VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Gnana Sangam, Belgaum – 590002, Karnataka

A

PROJECT WORK ON

"IOT BASED CAMOUFLAGE ARMY ROBOT"

Carried out

by

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Submitted in partial fulfillment for the award of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Under the guidance of

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CERTIFICATE

This is to certify that the project work entitled

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is a work carried out by

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is a bonafide work carried out at K.S. institute of Technology, Bangalore in partial fulfillment for the award of Bachelor of Engineering Degree in Electronics and Communication from Visvesvaraya Technological University, Belgaum during the year 2018-2019. It is certified that all corrections and suggestions indicated during internal assessment have been incorporated in the report deposited in the department library. The project report has been approved as it satisfies the academic requirements in respect of Project Work prescribed for Bachelor of Engineering Degree.

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DECLARATION

We Skanda H N USN: 1KS15EC094, Smitha S Karanth USN: 1KS15EC095, Suvijith S USN: 1KS15EC100 and Swathi K S USN: 1KS15EC101 students of 8th semester B.E., Department of Electronics and Communication Engg., K.S. Institute of Technology, Bengaluru declare that the project entitled "IOT BASED CAMOUFLAGE ARMY ROBOT" has been carried out by us and submitted in partial fulfillment of the course requirements for the award of degree in B.E. in Electronics and Communication, Visvesvaraya Technology University, Belgaum during the academic year 2018-2019. Further, the matter embodied in dissertation has not been submitted previously by anybody for the award of any Degree or Diploma to any other University.

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The successful project is culmination of efforts of many people who have rendered their unconditional support. I would be dishonest without acknowledging these people.

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Last but not the least the project would not have been a success without the grace of **God** and support of my **parents** and **friends**.

ABSTRACT

The most primitive and natural method for avoiding detection is camouflaging, exhibited by many flora and fauna. Implementing this ability in the field of robotics is the main objective. The use of a multifunctional army robot associated with various sensors is described. The use of LEDs and color sensor plays the vital role for camouflaging. A cloud based IOT interface with Blynk app and Wi-Fi module is used for retrieving, storing and recovering information. Application of other sensors for various parameter detection and usage of wireless camera for live streaming surveillance is also featured here. The effective use of all the methods and devices, produces an efficient camouflaged combat robot that serves numerous purposes.

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ACRONYMS

BAE	:	British Aerospace Engineering
RGB	:	Red, Green and Blue
LO	:	Low Observable Technology
LED	:	Light Emitting Diode
EDGE	:	Enhanced Data Rate for GSM Evolution
GPRS	:	General Packet Radio Services
LIDAR	:	Light Detection and Ranging
SIFT	:	Scale Invariant Feature Transform
HOG	:	Histogram of Oriented Gradients
IDE	:	Integrated Development Environment

CHAPTER 1

INTRODUCTION

INTRODUCTION

A robot is an automatic mechanical device often resembling a human or an animal. Modern robots are usually guided by a computer program or electronic circuitry. Robots have replaced humans in performing repetitive and dangerous tasks. Basically Army Robot is capable of performing tasks such as locomotion, metal detection, sensing the harmful gas and humans beneath the surface. Army Robot is an autonomous robot comprising of wireless camera which can be used as a spy. The main aim is to implement a Camouflaged technology based Wireless multifunctional Army Robot which can be controlled via mobile.

1.1 IoT

IoT stands for "Internet of Things". In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society". IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

1.2 Camouflage Technology

Active camouflage or adaptive camouflage is camouflage that adapts, often rapidly, to the surroundings of an object such as an animal or a military vehicle. In theory, active camouflage could provide perfect concealment from visual detection. Active camouflage is used in several groups of animals, including reptiles on land, and flatfish in the sea. Animals achieve active camouflage both by color change and by counter illumination (among marine animals)[1].

This camouflage technology had began with United States Air Force program which placed low-intensity blue lights on aircraft as counter illumination camouflage. As night skies are not pitch black, a 100 percent black-colored aircraft might be rendered visible. By emitting a small amount of blue light, the aircraft blends more effectively into the night sky.

Active camouflage may now develop using organic light-emitting diodes (OLEDs) and other technologies which allow for images to be projected onto irregularly shaped surfaces. Using visual data from a camera, an object could perhaps be camouflaged well

enough to avoid detection by the human eye and optical sensors when stationary. Active camouflage could make moving targets more difficult to see. However, active camouflage works best in one direction at a time, requiring knowledge of the relative positions of the observer and the concealed object.

The BAE Systems[1] announced their Adaptive infrared camouflage technology which uses about 1000 hexagonal panels to cover the sides of a tank. The panels are rapidly heated and cooled to match either the temperature of the vehicle's surroundings, or one of the objects in the thermal cloaking system's "library" such as a truck, car or large rock.

To achieve the feat of 'cloaking' an object, metamaterials are used. Some of which can bend electromagnetic radiation, such as light, around an object, giving the appearance that it isn't there at all. Invisibility cloaks rely on metamaterials, which are a class of material engineered to produce properties that don't occur naturally. Light is electromagnetic radiation, made up of perpendicular vibrations of electric and magnetic fields. Natural materials usually only affect the electric component but metamaterials can affect the magnetic component too, expanding the range of interactions that are possible. The metamaterials used in attempts to make invisibility cloaks are made up of a lattice with the spacing between elements less than the wavelength of the light we wish to 'bend'. The figure 1.1 shows how metamaterials bend the light rays around them, and makes the material inside invisible. Thus achieving absolute invisibility.

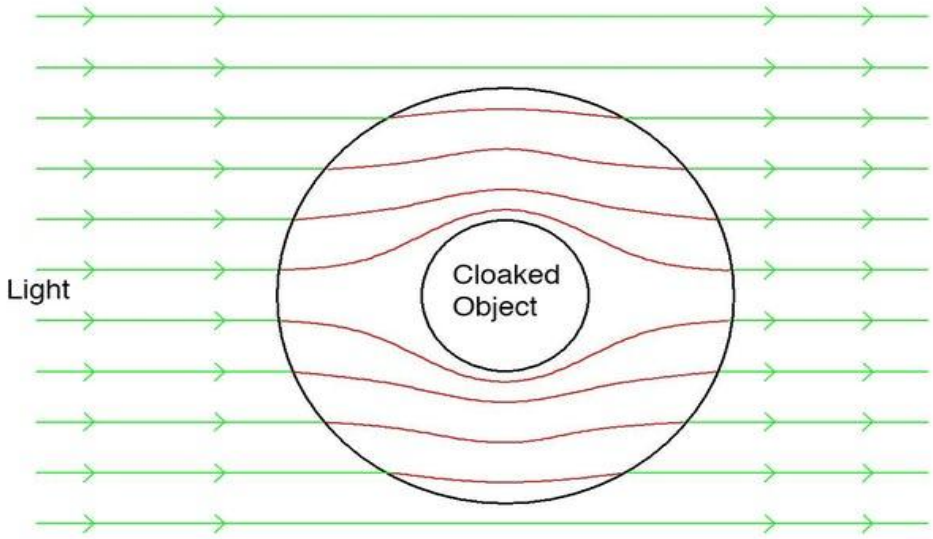

Fig 1.1: Cloaking system

1.3 Stealth Technology

Stealth technology also termed LO technology (low observable technology) is a sub-discipline of military tactics and passive electronic countermeasures, which cover a range of techniques used with personnel, aircraft, ships, submarines, missiles and satellites to make them less visible (ideally invisible) to radar, infrared, sonar and other detection methods. It corresponds to camouflage for these parts of the electromagnetic spectrum.

The main motive behind Camouflage Robot is to reduce human losses in military operations or terrorist attacks. Camouflage Robot acts as a virtual spy and can be sent into the strategic locations of military importance for observation and warfare purpose. Since it's very hard to detect it by a naked human eye, the Camouflage robot can be also used to test the various security systems developed in the market and act as a measure to evaluate its efficiency. The idea of the Camouflage Robot is based on the chameleon's camouflage techniques. The aim of the project is to design, manufacture and operate a robot via PC, used as remote control device, a small mobile robot which can duplicate the colors where it moves on, hence being camouflaged to the outside world. To achieve these goals, we used a LED matrix (RGB) which can diffuse uniform colors. Initially, the robot can camouflage itself in red, green and blue color.

CHAPTER 2

LITERATURE SURVEY

LITERATURE SURVEY

The paper[1] describes about BAE Systems announcing Adaptive infrared camouflage technology. It uses about 1000 hexagonal panels to cover the sides of a tank. The panels are rapidly heated and cooled to match either the temperature of the vehicle's surroundings, or one of the objects in the thermal cloaking system's "library" such as a truck, car or large rock. Stealth technology also termed LO technology (low observable technology) is a sub-discipline of military tactics and passive electronic countermeasures, which cover a range of techniques used with personnel, aircraft, ships, submarines, missiles and satellites to make them less visible (ideally invisible) to radar, infrared, sonar and other detection methods. To achieve the feat of 'cloaking' an object, they have developed what are known as meta materials, some of which can bend electromagnetic radiation, such as light, around an object, giving the appearance that is not there.

The paper[2] proposes bio-inspiration work based on chromatic behaviour change with respect to multiple predators. Here the robot exhibits similar concept showcasing difference in colour response on detecting multiple predators. Dwarf chameleons alter their detection ability by encompassing difference in its exposure values with that of the surroundings. The exposure values are said to be maximum detectable on encountering species of their own kind and minimum detectable on encountering its predators. A simple example to this can be noticed by the camouflage feature of a chameleon exhibiting a brighter exposure contrast as stealth in presence of a snake and a lower exposure in presence of a bird respectively. This chromatic behavioural changes are incorporated to our cylindrical based prototype which basically involves many stages as described further. The robot can be controlled automatically or by tele-operation. In the tele-operation the controlling is by mobile device noticing the changes through a visual streaming camera onboard. The robot is initially free to roam, if and only if it encounters a hostile or friendly agents the next phase starts. Here in the next phase on detecting its predators it changes itself to a significant colour and also is programmed to remain still in stealth for exhibiting effective camouflaging. If the robot encounters species of its own then it changes to a detectable colour. Here the colour changing is exhibited based on the visual characteristics of the surrounding terrain.

The paper[3] describes about the basic functionalities that takes place in the following phases- (1) Kinect camera at the back of LCD, captures the BG scene of the

camouflage object and then sends the captured images to the computer for real time processing. (2) Kinect camera mounted on the display, tracks the observer's eyes and his skeleton, and then sends the 3D location of his eyes in real time. (3) The occluded region behind the object depends on its size and its location with respect to the location of the observer's eyes, i.e. LCD that covers the camouflaged object. (4) The computer processes the RGB and depth images received from back camera and the tracking information from front camera, which are the tracking status, face features, 2D tracked points, 3D tracked head joint point, and head pose (pitch, roll, and yaw, with working range of 20° ,90°, 45° respectively). (5) The camouflaged image with appropriate scale and location sends to the LCD display.

The paper[4] is concerned with the development of a cognitive robot-ant for inspection of real environments such as riverside, seaside, river/channel orifices, canalization vicinity, etc. The primary task of the robot is to acquire data on the condition of the ecology system and to do some simple cleaning tasks. The robot is provided with on board cameras and a wide array of different specialized sensors. The data and images are sent to the corresponding supervision centre. Here they are processed and connected to geographical information which is collected from a web of sources. Thus providing the high-level commands for the robot operation. The robot navigates autonomously, following the high-level instructions obtained from the surveillance centre. It is off-the-shelf, robust wheel-based robot capable of operating on regular as well as irregular terrains. The robot has following modules : (1) versatile perception , (2) artificial brain (intelligence), (3) locomotion system (4) arm(s). Heterogeneous system consists of sensors for detection(such as LIDAR, GPS), Visual sensors and non visual perception sensors. TCP/IP communication with the remote surveillance centre enabled over GPRS/EDGE/3G services is used.

The paper[5] deals with a webcam which is used for receiving images and sending them to the notebook or a computer with a central processing unit which is used to display images. A router wireless LAN on the automatic robot is used for transmitting the image data to display on the notebook. Four Motors are utilized for driving four wheels of the automatic robot controlled by relay circuits. They receive signals from infrared sensor circuits which are used for detecting objects and sending signals through the relay circuits to the notebook. Strength of the transmitted signals on the air is measured in terms of distances depending on the received data. Delay time of transmitting and receiving images is considered from the robot to display on the notebook. Distances of the detected signals can be received from four

infrared sensors which are displayed on screen. The automatic robot testing will be tested in three patterns of obstacles.

The paper[6] describes about an intelligent detection process which is divided into two phases: Learning phase including in the offline process and Test phase which is a part of the online process. The former includes the preparation of the database files. SIFT and HOG features are the inputs of the AdaBoost algorithm learning and the decision person or not is the output of the network. The second phase of our human detection algorithm identifies if humans exist in the extracted image and where they are in the video sequences. For that AdaBoost is trained to recognize the shape of a human. The trained AdaBoost is then used to identify which of the connected components are human or not. The main advantages of this method are its high speed and performance. It is based on the combination of several weak classifiers which, in average, have a moderate precision and create a strong classifier. The AdaBoost provides both learning and classification operators. In order to implement both algorithms, we have used GML AdaBoost Matlab Toolbox 1 with AdaBoost algorithm implementation. The detection of people is done by sliding a search window through the frame image and checking whether an image region at a certain location is classified as human or non-human. The system can detect standing individuals at different positions, orientations, and with different backgrounds.

The paper[7] describes about the technique for object detection in two sections: (1) Scanning & filtering algorithm (2) Object detection algorithm. The different stages of operation include colour based image thresholding, scanning and filtering, object detection, segmentation and saving to the data base. Image thresholding in an image is converting an RGB scale to binary or BW Scale. The proposed object scanning and filtering algorithm can identify the objects distinctly from each other, irrespective of shape and size. Here the object identification does not affect the system accuracy even when the image background is complex. Window based image scanning is chosen to identify the indexes of non-zero values and the windows having more than 50 percent of non-zero values are only considered for object detection. This condition in scanning, inherently acts as a noise filter. The proposed algorithm for object detection needs no prior information of size or shape of the object. Object detection algorithm figures out the boundaries of the objects by scanning non-zero values.

The paper[8] explains the concept of cloud, which majorly provides interconnection between virtual computers facilitating resources. It also has a private cloud providing IaaS using open stack method. With this it uses Amazon configuration settings for storage at cloud which can be altered in real time. Here Amazon web services is used for different applications to communicate. When the system is turned on, camera starts recording and at real time the data is sent to cloud by using a Wi-Fi adapter, where the communication from the module to the cloud takes place. This can be depicted as a server-client based operational model. Based on the IP address, streaming can be done from any part of the world by operating on the web page.

In paper[9], the segmentation technique used here is motivated by the observation that for most of the domains of interest here changes in illumination lead to small changes in colour value and that these changes are relatively uniform across all colours. So, with modern cameras with automatic shutters and gain control red pixels may vary in colour but will stay in the same region of colour space. The different methods used for colour recognition are: (1) Pixel Classification : To label pixels according to which symbolic class they belong to, we use a soft-labelling scheme followed by a hard decision based on adaptive thresholds. The pixel is assigned to the highest priority colour class for which its likelihood is above the threshold for that colour class. (2) Threshold Adaptation : A histogram based approach is used to adapt the threshold from frame to frame. the key assumption here is that pixels in the image are drawn from two different underlying distributions: pixels that belong to the colour class of interest and pixels that do not. the key assumption translates to a histogram of likelihood values consisting of two, clearly distinguishable Gaussian peaks centered around likelihood values of 1, and 0, respectively. The peak with the highest likelihood value corresponds to the pixels of interest. (3) Region Extraction : Once the image has been segmented, regions of similarly labelled pixels are found using connected component analysis. CM Vision provides fast connected components using a combination of run length encoding and run conglomeration.(4) Object Recognition : Once an image has been segmented and coloured regions extracted, high-level vision must attempt to detect and recognize relevant objects in the image if any are present.

In paper[10] SAR is used as imaging radar. SAR is a kind of high-resolution microwave imaging radar. Due to its all-weather, day/night, and penetration capability, airborne and spaceborne SAR are now widely used in target recognition. Passive ground

camouflage target which include camouflage tank, camouflage armored vehicle and camouflage aircraft is a simple and effective approach. The different techniques used for target recognition in SAR radar is as follows: (1) Image segmentation. (2) Feature extraction of SAR images. (3) K-means algorithm. In image segmentations there are many sub methods to segment the obtained image. They are: (1) Image binarization. (2) Canny edge detection. There are two ways in feature extraction as well. They are: (1) Gray feature extraction. (2) Texture feature extraction. All the above techniques are used to recognise the target from the images obtained from SAR radars.

In paper[11] Camouflage robot is used as a solution for reducing human losses in military operations or terrorist attacks. They play major role in saving human lives. The proposed system consists of one colour sensor camera as part of camouflaging feature and other camera for surveillance purpose. Colour sensor camera senses the colour of surface and according to that robot will change its colour. Because of this feature this robot cannot be easily detected by enemies. We have used Wireless transceiver for communication between transmitter and receiver. This robot can quietly enter into enemy area and send us the information via camera. The movement of this robot is wirelessly controlled by a computer. Since human life is always valuable, these robots are the substitution of soldiers in war areas.

CHAPTER 3

OBJECTIVES

OBJECTIVES

Human lives being invaluable need to be protected from risky tasks or operations that are usually carried out in military domains of any country. The main motive of this robot is to avert the danger the soldiers and military personnel has to go through in unfavorable conditions. One of the major operations in the army is to infiltrate the enemy campsite and gather vital information such as enemy camp layout or any other strategies, without being detected by the opposition. Hence this robot acts as a virtual spy by utilizing color sensor and RGB LEDs to camouflage itself and retrieve information.

The objective of using a color sensor is highlighted in this project which can virtually differentiate between the 3 primary colors red, blue and green and glow the respective LEDs. The LED strips that are fixed around the robot take the color of the shade sensed by the color sensor and work as a cloaking device.

Retrieving information needs to be uninterrupted and clear and hence the robot uses a wireless camera with live steaming and night vision. The camera's ability to rotate 360 degrees and transfer message through audio increases its efficiency. The use of IOT platform to store the retrieved information is also justified by the robot.

Using Arduino mega as the core processor meets the objectives and advantages that any other version of microcontrollers lack. Node MCU is used in order to meet both the controller and 2 way communication link purposes. The existing system uses various complex components that not only increase the price but the durability of the robot. Hence using economically suitable components meets the objectives of an inexpensive virtual spy robot.

The robot tackles various other requirements that play a key role in avoiding human participation and reduces human loss. Detection of any enemy vehicle or personnel at a distance alerts the operator of the danger that may lie ahead. Also the detection of any soldier or victim under the debris of an explosion or accident is vital for the rescue team. This robot fulfills both these requirements by using ultrasonic sensors and PIR sensors respectively. The main aim is to use Wi-Fi communication to relay the information from these sensors to the

operators rather than using zigbee or Bluetooth as used in the existing systems.

Harmful gases is a common entity in the war field as a byproduct of explosives and its property to be invisible to naked eyes makes it highly harmful. Hence the robot uses a gas sensor installed to detect the harmful gases and its contents to alert the rescue operators.

Most of the bombs and detonators used in the present world are usually made up of some sort of metal or alloys. To use a metal detector to detect these explosives based on their metal content is one of the objectives of the robot.

Locomotion of the army robot in various terrains is essential for flawless working. Hence the robot incorporates DC motors for their motion to cancel out any disadvantages in stepper motors used in the existing systems. A system which can receive and decipher information received from the Smart phone using IOT to further pilot motors which in turn drive the robot in any required direction is established.

The objectives of reduced cost and creating a multifunctional camouflaging army robot are met by this proposed system.

CHAPTER 4

IMPLEMENTATION METHODOLOGY

IMPLEMENTATION METHODOLOGY

The idea of the Army Robot is based on the camouflage techniques . The aim of the project is to design, manufacture and operate via a Smart phone which is used as a remote control device. The use of RGB LEDs is used to induce primary colors to achieve the concealment. This robot is designed in such a way that it can reproduce the color independently at various areas with specific spots of the ground surface which allows the robot to mock up as a checkerboard of multiple colors i.e the various colors it drives over. A system which can receive and decipher information received from the Smart phone using IOT to further pilot motors, which in turn drives the robot in any required direction is implemented.

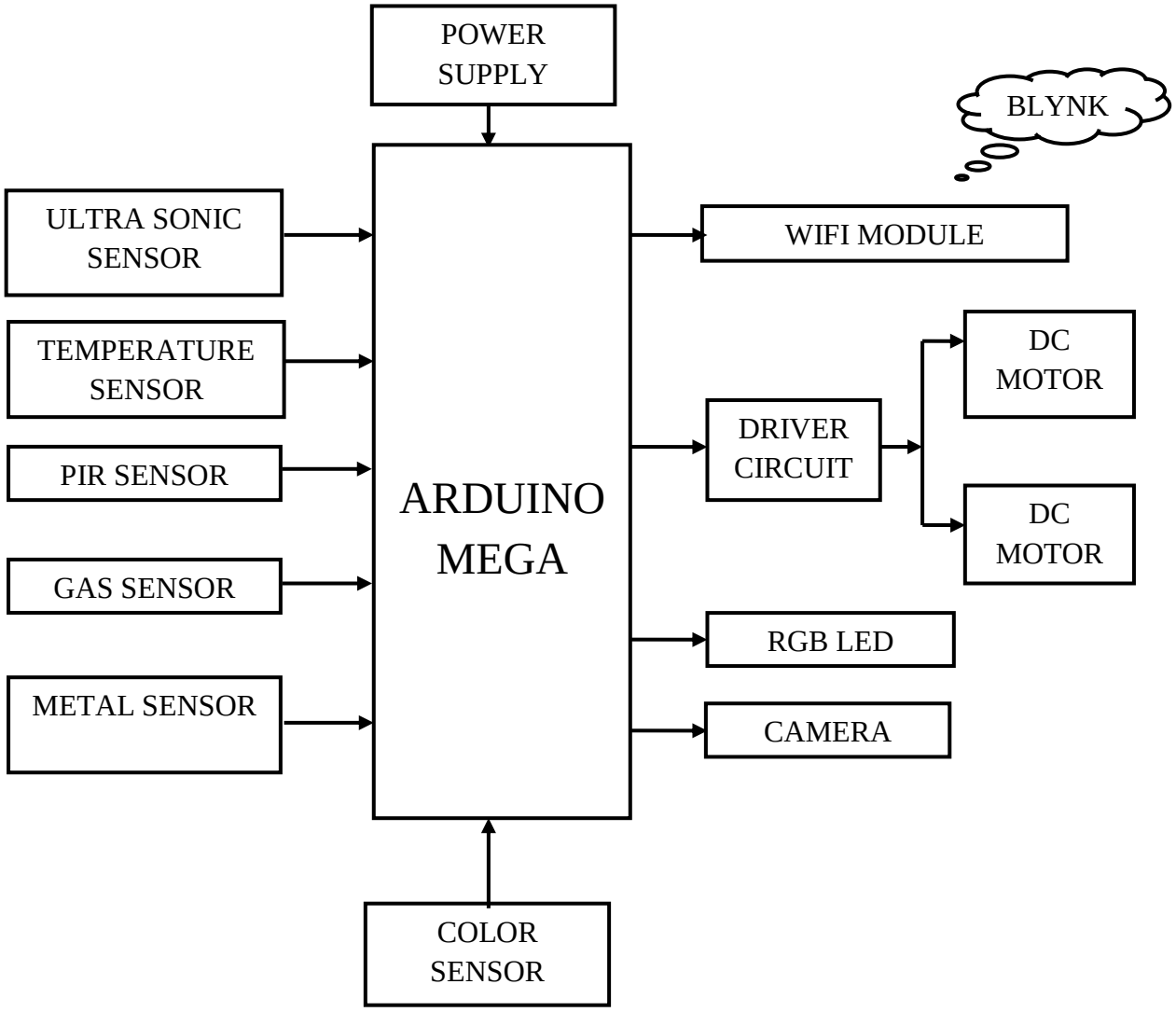

Fig 4.1: Transreceiver Block Diagram of Camouflage Army Robot

Fig 4.2: Transreceiver Block Diagram of Camouflage Army Robot Control Unit

The main processor used is Arduino Mega which is a microcontroller board based on the ATmega2560. The ATmega series is much more advanced as it has many more peripherals which can be programmed easily when compared to the 8051 Microcontroller.

An ultrasonic sensor is a device which can measure the distance to an object by using sound waves. Hence this device is employed which helps in detecting the obstacles.

Here a PIR (passive infrared sensor) or PID (passive infrared detector) is used which measures infrared light radiating from objects in its field of view. They are referred as passive as they do not radiate energy. They entirely work on radiation and reflection properties.

The LM35 temperature sensor is used which measures the temperature through an electrical signal with the help of thermocouple or RTD(resistance temperature detector). Its operating temperature range is from -55°C to 150°C.

A MQ3 Gas sensor is used for detecting leakage of gas. It has high sensitivity and fast response time. This sensor provides an analog resistive output based on the contents in the gas and their concentration. It is suitable for detecting Alcohol, Benzine, CH4, Hexane, LPG, CO (carbon monoxide). Its sensitivity can be adjusted by using the potentiometer.

Here a metal detector is used for detecting the presence of nearby metal, and also for finding metal inclusions hidden within objects or metal objects buried underground.

The color sensor employed detects the color of the surface, usually in the RGB scale. Color is the result of interaction between a light source, an object and an observer.

A DC motor is a class of rotatory electrical machine that converts direct current to mechanical energy. Here 2 DC motors are employed for the movement of the robot which is controlled by an android application. A typical L293D motor driver circuit is used. The motor driver IC allows two DC motors to drive simultaneously in any direction.

Node MCU esp8266 is used as a Wi-Fi module which is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC.

The android application used here is BLYNK, which is an internet based tool used for mapping hardware circuitry onto android phones. It is a platform with iOs which is used to control for Arduino, Rassberry Pi and similar microcontroller boards over internet. Here the robot movement and other sensor data values are displayed in the Blynk application.

CHAPTER 5

INTERFACING

EXPLANATION

INTERFACING EXPLANATION

System design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. System architecture is a conceptual model that defines the structure and behaviour of the system. It comprises of the system components and the relationships describing how they work together to implement the overall system.

Modular design, or "modularity in design", is a design approach that subdivides a system into smaller parts called modules or skids, that can be independently created and then used in different systems.

5.1 Arduino Mega

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller.

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vcc/Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The Mega2560 differs from all preceding boards as it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

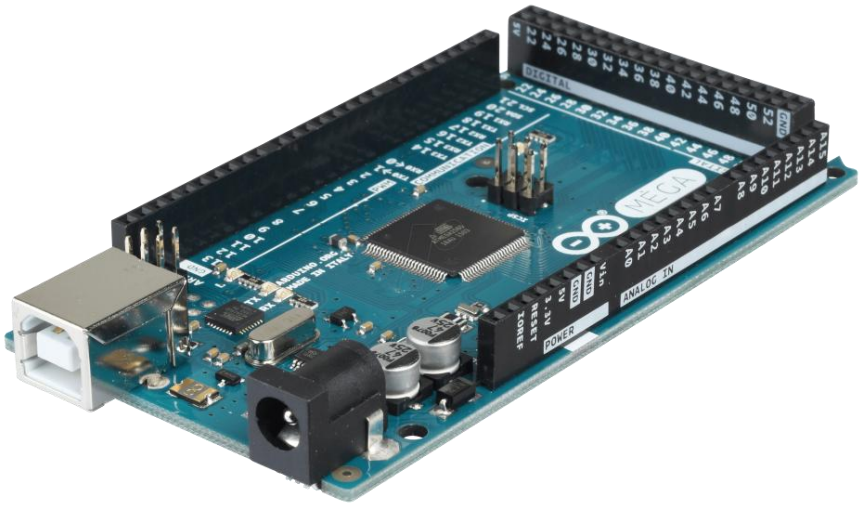

Fig 5.1: Arduino Mega Board (Courtesy : Google Image)

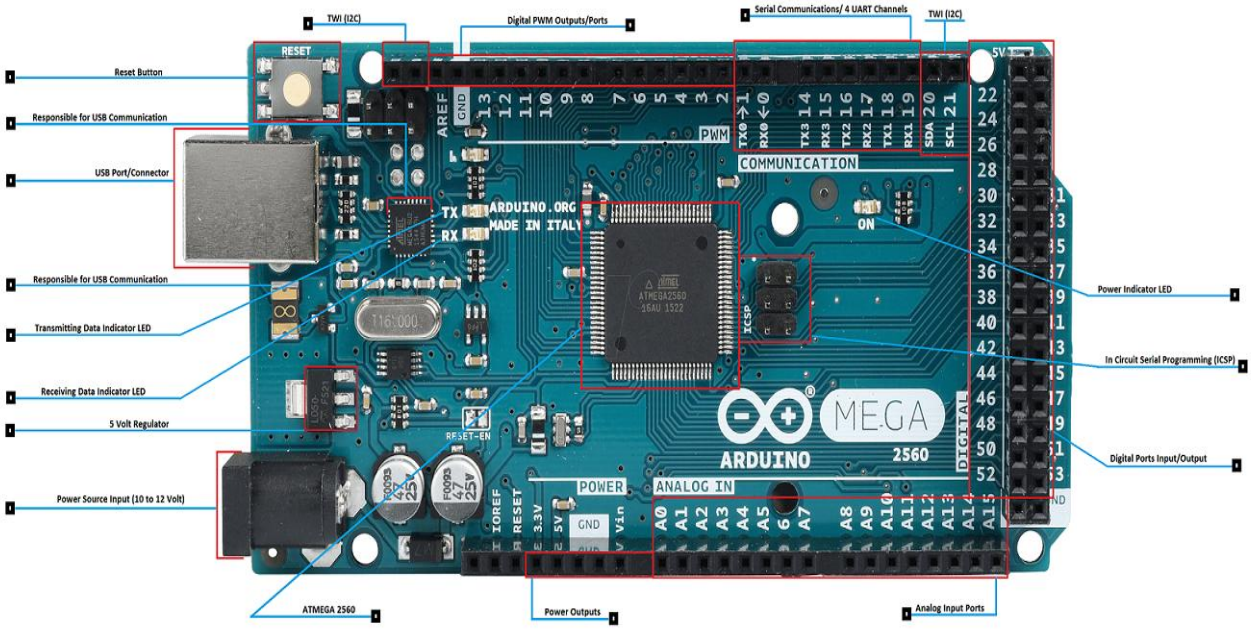

Fig 5.2: Components of Arduino Mega Board (Courtesy : Google Image)

The detailed specifications are as follows:

V_{IN}: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND: Ground pins.

Memory : The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output : Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms.

External Interrupts : 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.

PWM: 0 to 13. Provide 8-bit PWM output with the analogWrite() function.

SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS). These pins support SPI communication using the SPI library. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Uno, Duemilanove and Diecimila.

LED 13: There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it is off.

I2C: 20 (SDA) and 21 (SCL). Support I2C (TWI) communication.

AREF: Reference voltage for the analog inputs. Used with analogReference().

Reset: Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Communication : The Arduino Mega2560 has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial communication. An ATmega8U2 on the board channels one of these over USB and provides a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being

transmitted via the ATmega8U2 chip and USB connection to the computer (but not for serial communication on pins 0 and 1). A SoftwareSerial library allows for serial communication on any of the Mega2560's digital pins. The ATmega2560 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus and SPI library for SPI communication.

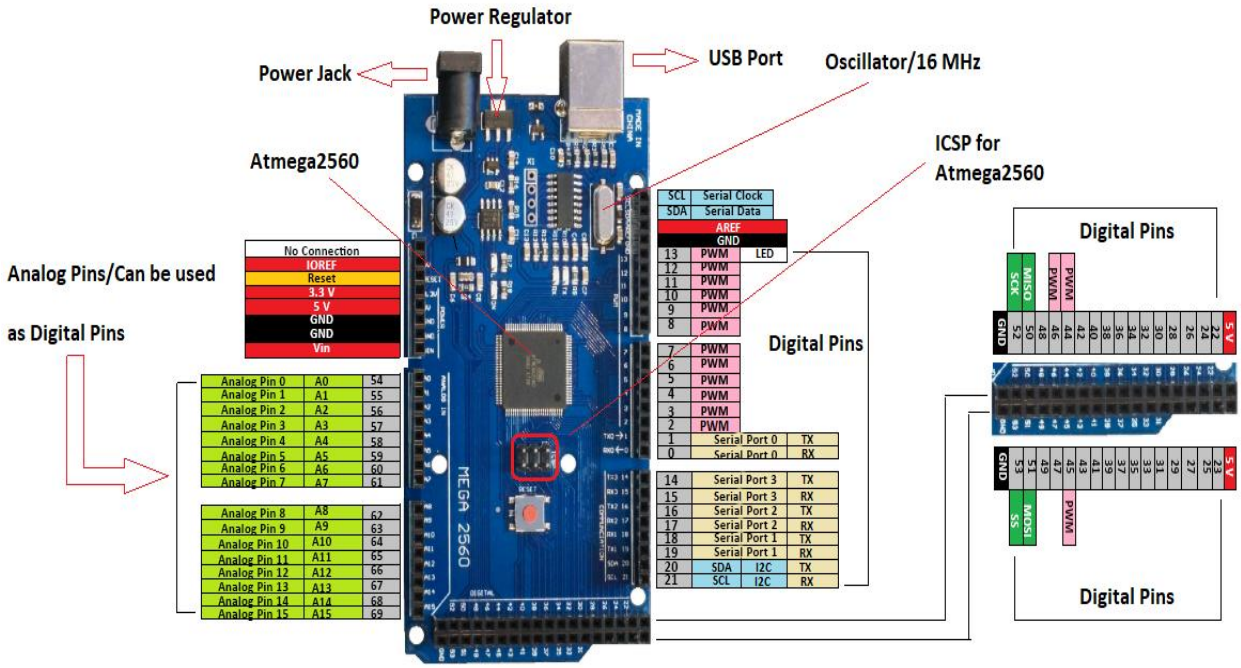

Fig 5.3: Pin Details and Communication (Arduino Mega) (Courtesy : Google Image)

Programming : The Arduino Mega can be programmed with the Arduino software. The ATmega2560 on the Arduino Mega comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files). We can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header.

Automatic (Software) Reset : Rather than requiring a physical press of the reset button before an upload, the Arduino Mega2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply

pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Mega2560 is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB).

USB Overcurrent Protection : The Arduino Mega2560 has a resettable polyfuse that protects your computer's USB ports from shorts and over current. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

5.2 PIR SENSOR

The passive infrared or electrolytic or IP motion sensor (PIR) are basically made of a electrolytic sensor that can detects the level of infrared radiation. It detects (infrared energy) heat energy radiated or emitted by an object like a body of a person moving across a field of view of a heat sensor of the motion detection system.

Fundamentally, pyroelectric sensors that detect the levels of infrared radiation are used to make PIR sensors. There are different types of PIR sensor circuits used in numerous electronics applications which are used to discover a human being entering or leaving the particular area or room. These passive infrared sensors are flat control, consists of a wide range of lens, and PIR sensors can be easily interfaced with electronic circuits. The PIR sensor circuit consists of three pins, power supply pin, output signal pin, and ground pin. The PIR sensor circuit is having ceramic substrate and filter window as shown in the figure and also having dome like structure called as Fresnel lens.

Generally, the PIR sensor power is up to 5V, but, the large size PIR modules operate a relay instead of direct output. It is very simple and easy to interface the sensor with a microcontroller. The output of the PIR is (usually digital output) either low or high. Whenever, human being (even a warm body or object with some temperature) passes through the field of view of PIR sensor, it detects the infrared radiation emitted by a hot body motion.

Thus, the infrared radiation detected by the sensor generates an electrical signal that can be used to activate an alert system or buzzer or alarm sound.

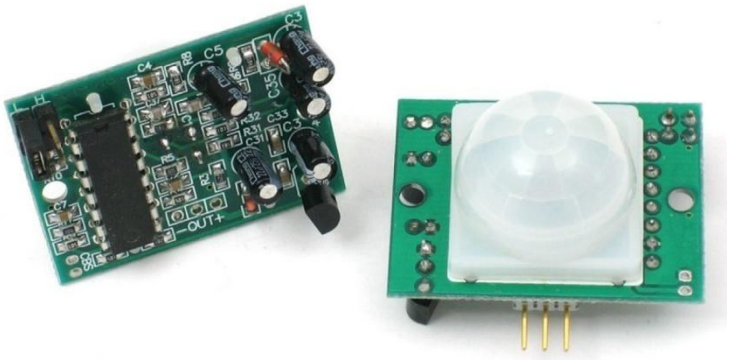

Fig 5.4: PIR Sensor (Courtesy : Google Image)

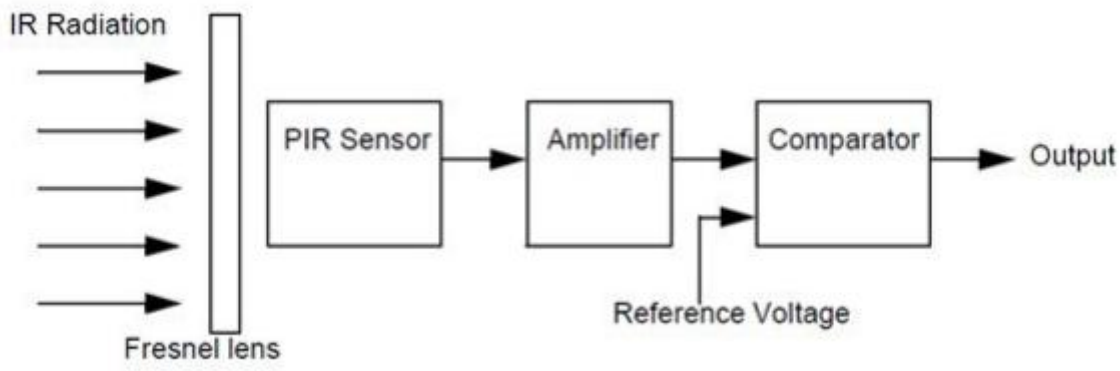

Fig 5.5: Block diagram of PIR Sensor (Courtesy : Google Image)

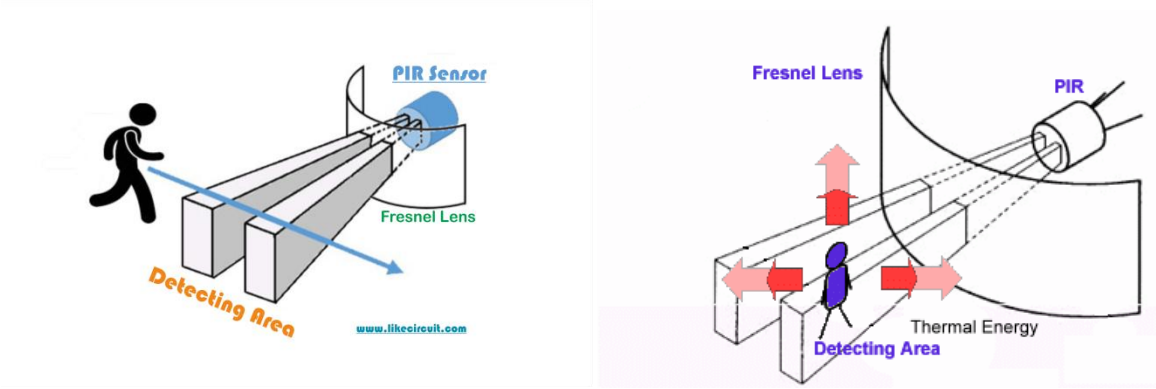

Fig 5.6: Working Demonstration of PIR Sensor (Courtesy : Google Image)

The PIR sensor internally is split into two halves, one half is positive and the other is considered as negative. Thus, one half generates one signal by detecting the motion of a hot body and other half generates another signal. The difference between these two signals is generated as output signal. Primarily, this sensor consists of Fresnel lens which are bifurcated

to detect the infrared radiation produced by the motion of hot body over a wide range or specific area. If once the sensor gets warmed up, then the output remains low until it detects motion. If once it detects the motion, then the output goes high for a couple of seconds and then returns to a normal state or low. This sensor requires settling time, which is characteristically in the range of 10 to 60 seconds. Some of the applications of these PIR sensors are as follows :

- PIR Sensor based Automatic Door Opening System
- PIR Sensor based Security Alarm System
- They are able to sense the detection of people and other objects
- PIR sensors are also used in automatic lightening systems. In these type of systems, when a person comes in the vicinity of the sensor then, the lights are automatically turned ON.
- They are used in outdoor lightening systems and also in some lift lobbies.

5.3 GAS SENSOR

This gas sensor is suitable for detecting different types of gases. It is suitable for detecting Alcohol, Benzine, CH4, Hexane, LPG, CO (carbon monoxide) gases. It has a high sensitivity and fast response time. This module is made using Alcohol Gas Sensor MQ3. It is a low cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L.

The sensitive material used for this sensor is SnO2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and has a good resistance to disturbances due to smoke, vapor and gasoline. This module provides both digital and analog outputs. MQ3 alcohol sensor module can be easily interfaced with Microcontrollers, Arduino Boards, Raspberry Pi etc. This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer.

It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration. The drive circuit is very simple, all it needs is one resistor. A simple interface could be a 0-3.3V ADC.

Fig 5.7: Gas Sensor (Courtesy : Waveshare Image)

Pin Out

- VCC – Input Power Supply
- GND – Supply Ground
- DO – Digital Output
- AO – Analog Output

Technical Data

- Concentration : 0.05 mg/L ~ 10 mg/L Alcohol
- Operating Voltage : 5V ±0.1
- Current Consumption : 150mA
- Operation Temperature : -10°C ~ 70°C

Features

- 5V operation, Simple to use
- LEDs for output and power, Output sensitivity adjustable
- Analog output 0V to 5V & Digital output 0V or 5V Low Cost
- Fast Response
- Good Sensitivity to Alcohol Gas
- Both Digital and Analog Outputs
- On-board LED Indicator

Applications

- Vehicle Alcohol Detector
- Portable Alcohol Detector

5.4 Metal Detector

Nowadays, the metal detector is used to identify metallic devices such as bombs, guns for security purpose. To avoid any illegal or unauthorized entry of metallic objects, bombs, knives, guns within the luggage bags of the person carrying them in public places like theatres, shopping malls, parks, airports, hotels, railway stations. A security system is developed by using proximity sensor which is named as a metal detector. So, a metal detector is used in many robotic or electronics projects to detect any present metals which are nearby or the existence of hidden items within objects.

Fig 5.8: Metal Detector

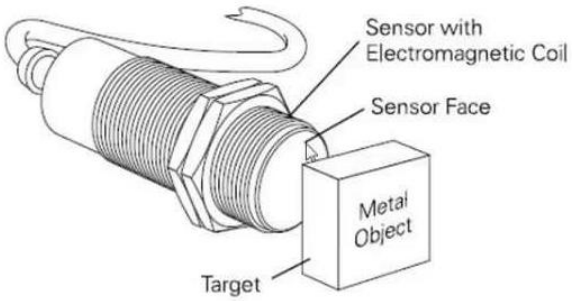

Fig 5.9: Parts of Metal Detector (Courtesy : Google Image)

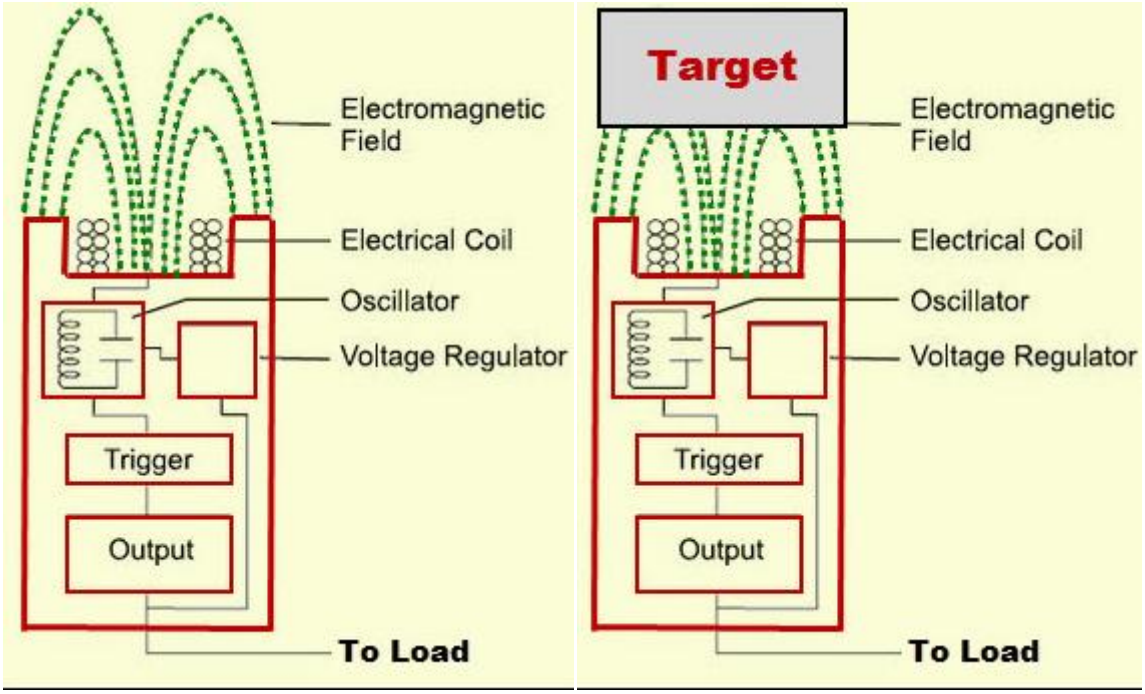

Fig 5.10: Working of Metal Detector (Courtesy : Google Image)

In the year 1960, the first metal detector was established and was used in industrial applications and mineral prospecting. A metal detector is an electronic device that comprises of an oscillator which generates an AC current that passes via a coil generating an alternating magnetic field. When a part of the metal is nearby to the coil, eddy current will be induced in the metal object & this generates a magnetic field of its own. If an extra coil is used to measure the magnetic field, the magnetic field can be changed and sensed due to the metal object. The metal detectors are used to sense the weapons and also used in the construction industry to identify the steel reinforcing bars in pipes, concrete, wires, pipes buried in walls & floors.

Metal detector types are classified into three types such as BFO (Beat Frequency Oscillation), TR (Transmitter or Receiver) and VLF (Very Low frequency). The metal detector working is, when the electromagnetic field is transmitted from the search coil into the earth. Metals in the electromagnetic field will become strengthened & resend an electromagnetic of their own. The metal detector comprises of a search coil which receives the retransmitted field & alarms the user by generating a response of the metal. Minelab

metal detectors are accomplished by discriminating between dissimilar types of targets and can be fixed to ignore unwanted metal objects.

The main purpose of the battery is to provide the power to the detector. The control box comprises of the electronics of the detector. When the transmit signal is generated, the receive signal is processed and transformed into a target response. The electromagnetic field can be transferred by the search coil of the detector into the ground & receives the electromagnetic field return from a metal object. The transmitted electromagnetic field energizes metal objects to allow them to be sensed. Here, a target is a metal object that can be sensed by a metal detector. In this, the target is treasure which is sensed and that is a good target. These metal objects are generally attracted to a magnet like nails and also non-ferrous like bottle tops. If the metal detector is fixed to discard unwanted targets, then the response of the target will not be generated for those targets. The receive electromagnetic field is produced from energized targets & it is received by the search coil.

The metal detector circuit built with an LC circuit, buzzer and simple proximity sensor. In LC circuit, capacitor and inductor are connected in parallel. When the circuit detects any metal near to it, then the circuit activates the proximity sensor and its glow the LED and makes a buzzer.

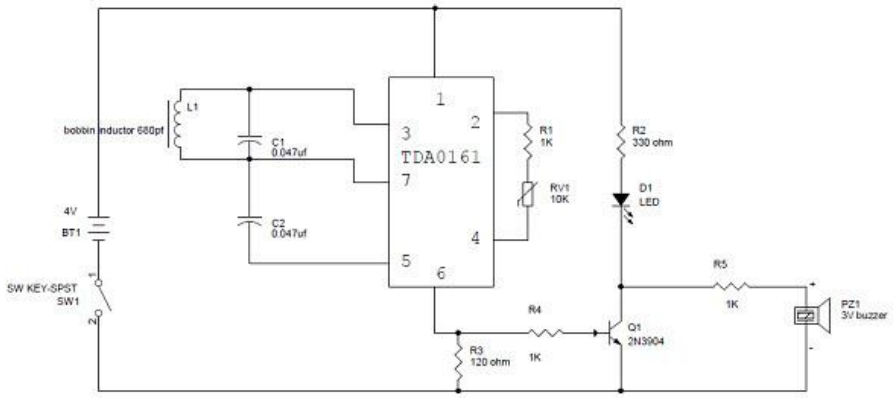

Fig 5.11: Circuit Diagram of Metal Detector (Courtesy : Google Image)

When this circuit has any resonating frequency from any target which is near to it, then the electric field will be created, which will lead to induce current in the coil and change the S/L in the flow of the S/L through the coil. The value of the sensor can be changed by using a variable resistor, that is equal to the LC circuit. When the metal is detected, the circuit will have new signal and respond accordingly. When the metal object is sensed by the coil, the sensor's output will be of 1mA. When the coil is close to the target, then the output of the

sensor will be around 10mA. When the output pin is high, the resistor R3 will offer a positive voltage to the Q1 transistor to turn ON the LED, which will glow and generate a buzzer sound. Here, resistor R2 is mainly used to restrict the current flow.

5.5 Color Sensor

The TCS230 senses color light with the help of an 8 x 8 array of photodiodes. Then using a Current-to-Frequency Converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. Finally, using the Arduino Board we can read the square wave output and get the results for the color.

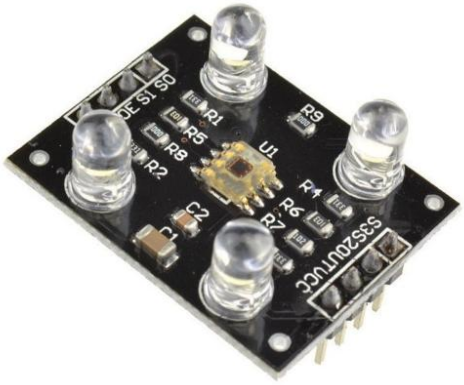

Fig 5.12 : Color Sensors (Courtesy : Google Image)

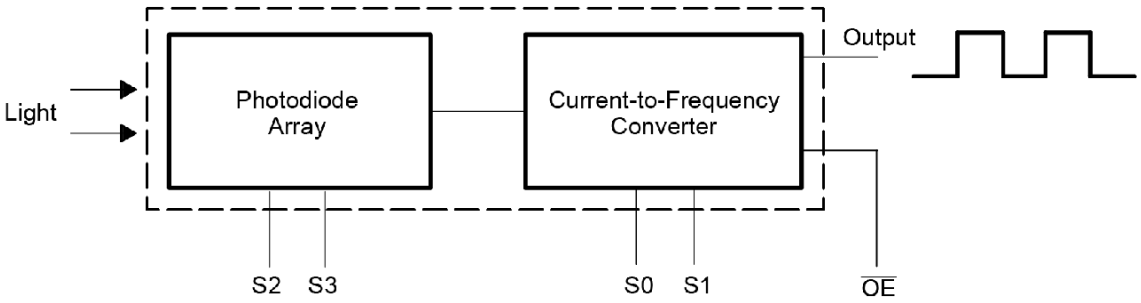

Fig 5.13 : Interfacing of Color Sensor (Courtesy Google Image)

If we take a closer look at the sensor we can see how it detects various colors. The photodiodes have three different color filters. Sixteen of them have red filters, another 16

have green filters, another 16 have blue filters and the other 16 photodiodes are clear with no filters.

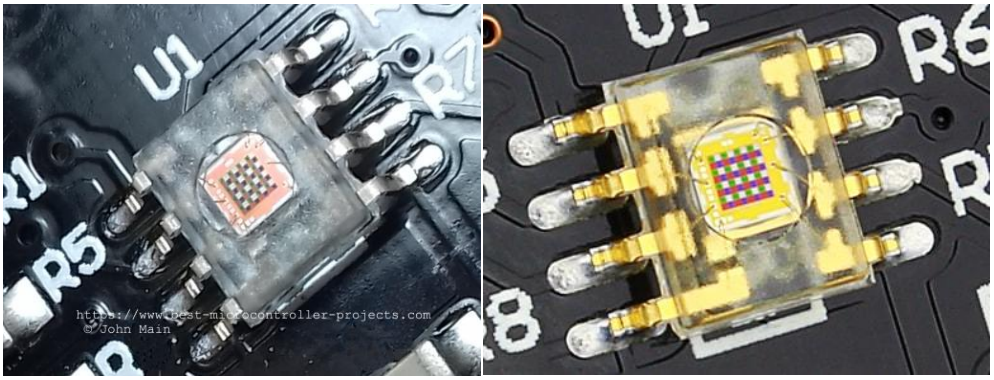

Fig 5.14 : Detailed view of color Sensor (Courtesy : Google Image)

Each 16 photodiodes are connected in parallel, so using the two control pins S2 and S3 we can select which of them will be read. So for example, if we want to detect red color, we can just use the 16 red filtered photodiodes by setting the two pins to low logic level according to the table 5.1.

Table 5.1 : Output frequency scaling and color display representation

S0	*S1*	*Output Frequency Scaling*
L	L	Power down
L	H	2%
H	L	20%
H	H	100%

S2	*S3*	*Photodiode Type*
L	L	Red
L	H	Blue
H	L	Clear (no filter)
H	H	Green

The sensor has two more control pins, S0 and S1 which are used for scaling the output frequency. The frequency can be scaled to three different preset values of 100 %, 20 % or 2%. This frequency-scaling function allows the output of the sensor to be optimized for various frequency counters or microcontrollers. The connection of color sensor to Arduino board is represented by a schematic below.

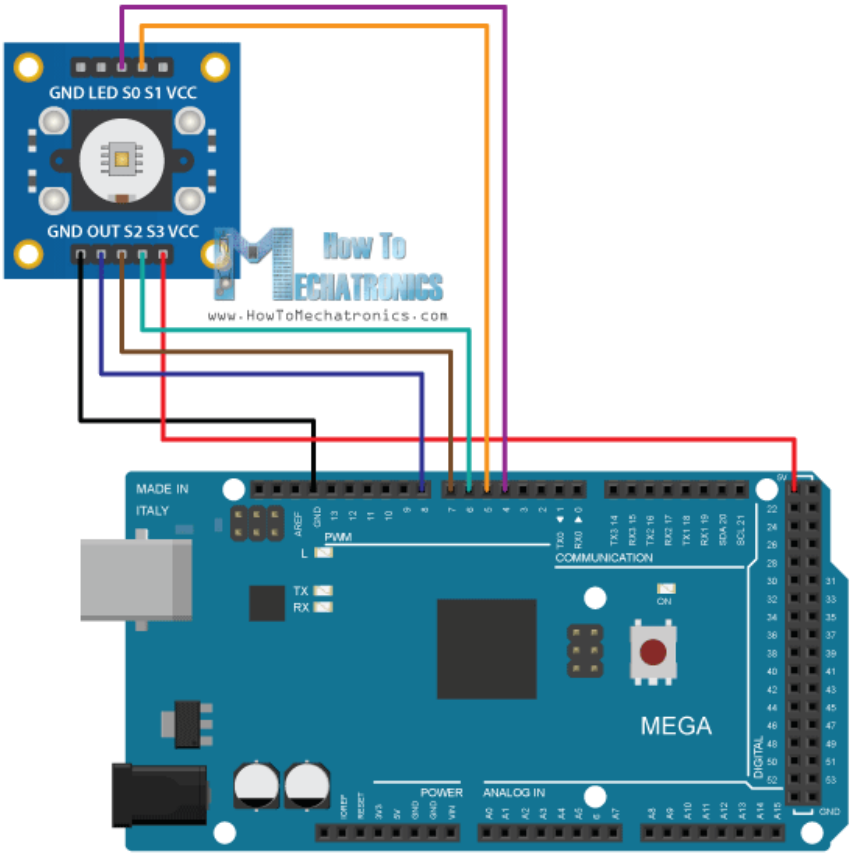

Fig 5.15 : Interfacing of Color Sensor to Arduino Mega (Courtesy:howtomechatronics Image)

5.6 DC motor

DC motor is used to provide locomotion to the robot. It is driven by the power supply circuit with 12V. DC motor used is compatible with the micro-controller. Common DC gear head motors need current above 250mA. There are many integrated circuits like ATmega16 Microcontroller, 555 timer IC. But, IC 74 series cannot supply this amount of current. When the motor is directly connected to the output of the above ICs then, they might damaged. To overcome this problem, a motor control circuit is required, which can act as a bridge between the above motors and ICs (integrated circuits). There are various ways of making H-bridge motor control circuit such as using transistor, relays and using L293D/L298.

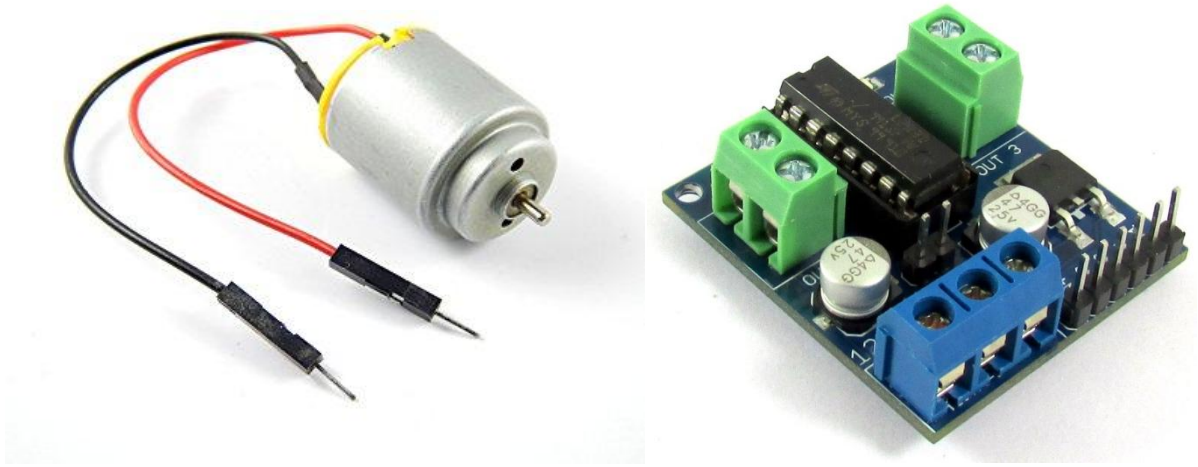

Fig 5.16 : DC Motor (Courtesy : Google Image)

Pin Diagram of a L293D Motor Driver IC Controller

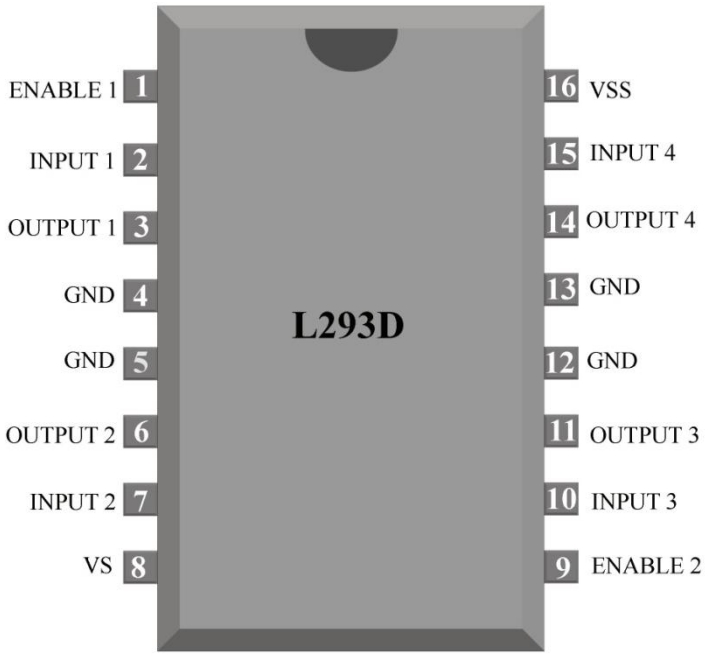

Fig 5.17 : Pin Details of L293D IC (Courtesy : Google Image)

Pin-1(Enable 1-2): When the enable pin is high, then the left part of the IC will work otherwise it won't work. This pin is also called as a master control pin.

Pin-2 (Input-1): When the input pin is high, then the flow of current will be through output 1

Pin-3 (Output-1): This output-1 pin must be connected to one of the terminals of the motor

Pin4 &5: These pins are ground pins

Pin-6 (Output-2): This pin must be connected to one of the terminals of the motor.

Pin-7 (Input-2): When this pin is HIGH then the flow of current will be though output 2

Pin-8 (Vcc2): This is the voltage pin which is used to supply the voltage to the motor.

Pin-16 (Vss): This pin is the power source to the integrated circuit.

Pin-15 (Input-4): When this pin is high, then the flow of current will be through output-4.

Pin-14 (Output-4): This pin must be connected to one of the terminals of the motor

Pin-12 & 13: These pins are ground pins

Pin-11 (Output-3): This pin must be connected to one of the terminals of the motor.

Pin-10 (Input-3): When this pin is high, then the flow of current will through output-3

Pin-9 (Enable3-4): When this pin is high, then the right part of the IC will work & when it is low the right part of the IC won't work. This pin is also called as a master control pin for the right part of the IC.

A H bridge is an electronic circuit that allows a voltage to be applied across a load in any direction. H-bridge circuits are frequently used in robotics and many other applications to allow DC motors to run forward & backward. These motor control circuits are mostly used in different converters like DC-DC, DC-AC, AC-AC converters and many other types of power electronic converters. In specific, a bipolar stepper motor is always driven by a motor controller having two H-bridges.

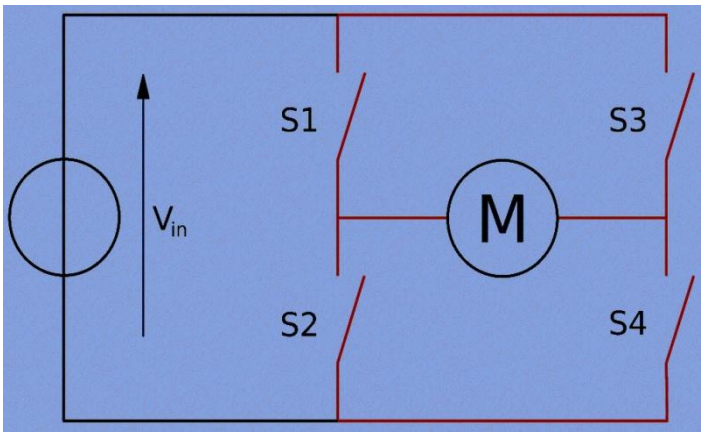

Fig 5.18 : H - Bridge Connection (Courtesy : Wikipedia Image)

A H-bridge is fabricated with four switches like S1, S2, S3 and S4. When the S1 and S4 switches are closed, then a +ve voltage will be applied across the motor. By opening the switches S1 and S4 and closing the switches S2 and S3, this voltage is inverted, allowing invert operation of the motor. Generally, the H-bridge motor driver circuit is used to reverse the direction of the motor and also to break the motor. When the motor comes to a sudden stop, as the terminals of the motor are shorted. Or let the motor run free to a stop, when the

motor is detached from the circuit. The table below gives the different operations with the four switches corresponding to the above circuit.

Table 5.2 : Motor control operation

S1	S2	S3	S4	Operation
1	0	0	1	Motor moves right
0	1	1	0	Motor moves left
0	0	0	0	Motor free runs
0	1	0	1	Motor brakes
1	0	1	0	Motor brakes
1	1	0	0	Short Power Supply
0	0	1	1	Short Power Supply
1	1	1	1	Short Power Supply

The IC L293D consists of 4-input pins where, pin2 and 7 on the left side of the IC and Pin 10 and 15 on the right side of the IC. Left input pins on the IC will control the rotation of a motor. Here, the motor is connected across side and right input for the motor on the right hand side. This motor rotates based on the inputs we provided across the input pins as Logic 0 and Logic 1.

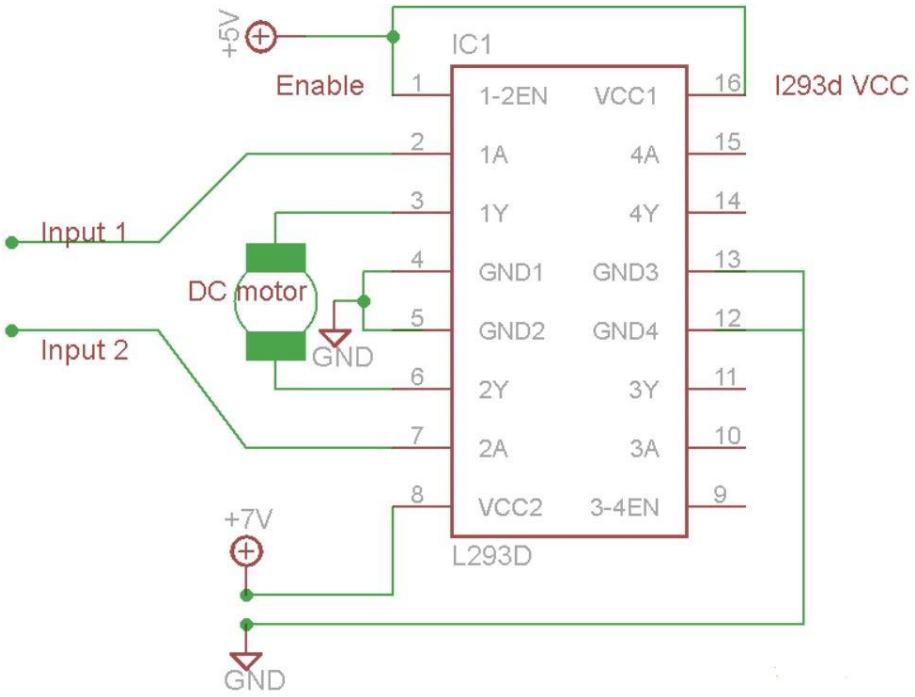

Fig 5.19 : Driver Circuit [L293D] Connection (Courtesy : Google Image)

Let's consider, when a motor is connected to the o/p pins 3 and 6 on the left side of the IC. For rotating of the motor in clockwise direction, then the i/p pins have to be provided with Logic 0 and Logic 1.

When

Pin-2= logic 1 & pin-7=logic 0, then it rotates in clockwise direction.
Pin-2= logic 0 & Pin7=logic 1, then it rotates in anti clock direction
Pin-2= logic 0 & Pin7=logic 0, then it is idle (high impedance state)
Pin-2= logic 1 & Pin7 = logic 1, then it is idle

In a similar way the motor can also operate across input pin-15 and pin-10 for the motor on the right hand side. The L293D motor driver IC deals with huge currents, due to this reason, this circuit uses a heat sink to decrease the heat. Therefore, there are 4-ground pins on the L293D IC. When we solder these pins on the PCB (printed circuit board), then we can get a huge metallic area between the ground pins where the heat can be produced.

5.7 Ultrasonic sensor

Ultrasonic sensor sends out pulses of ultrasonic waves and measures the reflection off a moving object. The ultrasonic transducers are the sensors that are used in ultrasonic motion detector as it can even detect motion in areas where there are not supposed to be any moving object. The ultrasonic motion detectors have two transducers : one that emits an ultrasonic wave and the other that picks up reflections from the different objects in the area. The reflected waves arrive at the receiver in constant phase if none of the objects in the area are moving. If something moves then the received signal will be shifted in phase hence the phase comparable detects the shifted phase and sends a triggering pulse to the output. A system employing ultrasonic sensors per each observed area with three node sensor cluster can be established whereby each sensor node mounts an ultrasonic sensor. Nodes in each cluster communicate the sensor readings to the cluster's coordinator node. The latter contributes its own sensor measurements.

Fig 5.20 : Ultrasonic Sensor (Courtesy : Google Image)

Advantages

- It is very sensitive and extremely fast in action
- It can also be used to detect people since they are inexpensive and can operate with a narrow beam widths.

5.8 Node MCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits.

ESP8266 Wi-Fi module is a low cost standalone wireless transceiver that can be used for end-point IOT developments. Its Wi-Fi module enables internet connectivity to embedded applications. It uses TCP/UDP communication protocol to connect with server/client.

To communicate with the ESP8266 Wi-Fi module, Microcontroller needs to use set of AT commands. Microcontroller communicates with ESP8266-01 Wi-Fi module using UART having specified Baud rate.

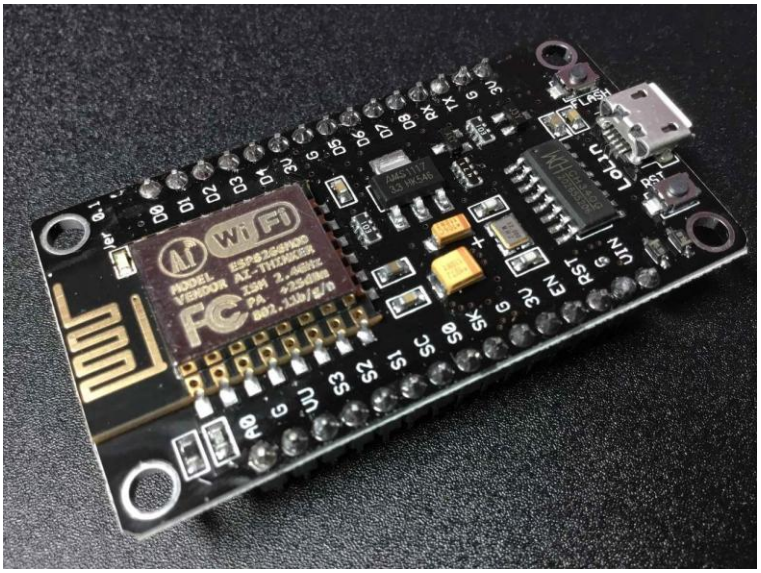

Fig 5.21 : Node MCU (Courtesy : Google Image)

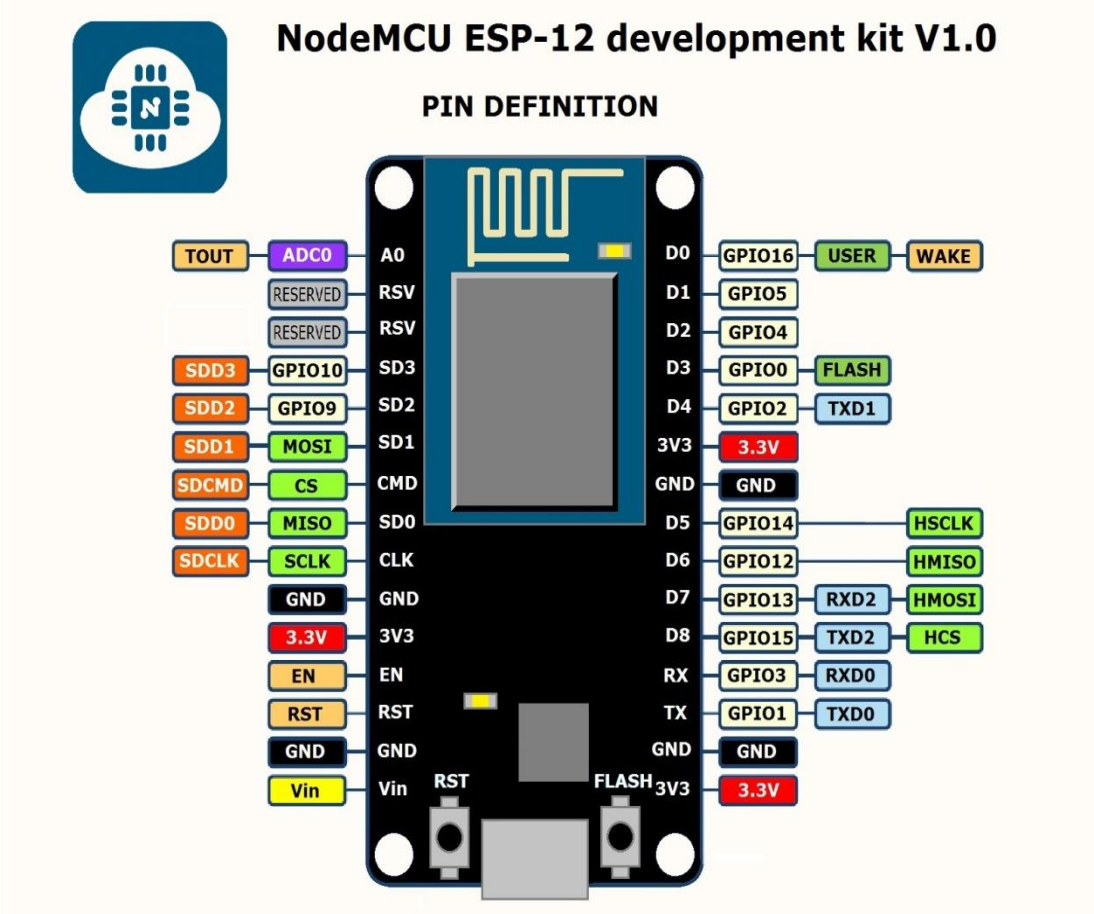

Fig 5.22: Pin Details of NodeMCU (Courtesy : Google Image)

5.9 Temperature sensor

LM35 is a precision IC temperature sensor with its output proportional to the temperature (in ^{o}C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 ^{o}C temperature rise in still air. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.

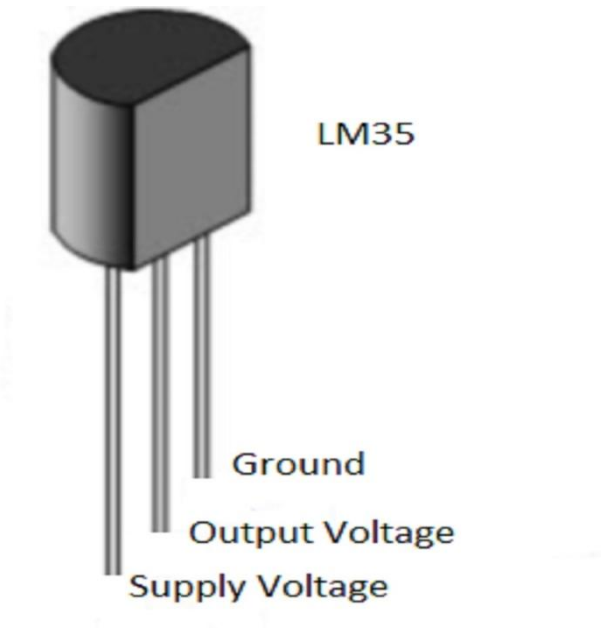

Fig 5.23 : Temperature Sensor (Courtesy : Wikipedia Image)

Operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ^{o}C rise/fall in ambient temperature, *i.e.*, its scale factor is 0.01V/ ^{o}C.

5.10 Wi-Fi Camera

An Internet Protocol Camera, commonly referred to as an IP camera, is a digital video camera much like a webcam, which transmits and receives data over a network or the internet. Unlike an ordinary webcam it is a standalone unit with its own IP address that

requires nothing more than a network connection in order to transfer images. The IP camera connects to a network in exactly the same way as any other standard network device such as a laptop, tablet or printer.

IP cameras may be used with a wired network connected via ethernet cable to a broadband modem or router, or wirelessly via a WiFi router. Setting up an IP Camera is relatively simple, requiring nothing more than a network connection and a little patience to site and configure the camera. The majority of IP Cameras on the market can be configured to provide live viewing, continuous recording, operate at a scheduled time or be triggered by a specific event.

The images captured by an IP camera may be viewed from anywhere in the world via the internet, whether via pc, laptop or mobile phone. In many cases, as well as being able to view video footage and listen to audio streaming, the camera may also be controlled remotely.

Fig 5.24 : Wireless Camera (Courtesy : Google Image)

IP Cameras acts as a versatile security solution, requiring nothing more than a network connection. There is no need for co axial cables, a computer station or even wired electricity. They can be used as a temporary or permanent solution, and relocated as and when required. IP cameras are available for both indoor and outdoor use, with both day and night functionality, and with the ability to pan or zoom either remotely or via operator command. Whether you require overt or covert security, there is an IP camera to suit.

CHAPTER 6

SOFTWARE DESCRIPTION AND FLOW CHART

SOFTWARE DESCRIPTION AND FLOW CHART

This chapter describes about the software used in this project to meet our needs. In the proposed system we have used Arduino IDE to program the Arduino mega board. The software description is as explained below :

6.1 Arduino IDE

An integrated development environment (IDE) is a software application that provides comprehensive facilities to computer programmers for software development. An IDE normally consists of a source code editor, build automation tools and a debugger. Most modern IDEs have intelligent code completion. Some IDEs such as NetBeans and Eclipse contain a compiler, interpreter, or both; others such as SharpDevelop and Lazarus do not. The boundary between an integrated development environment and other parts of the boarder software development environment is not well defined. Sometimes a vision control system, or various tools to simplify the construction of a graphical user interface (GUI), are integrated. Many modern IDEs have a class browser, an object browser and a class hierarchy diagram, for use in object oriented software development.

Fig 6.1 : Logo of Arduino (Courtesy : Arduino.cc Image)

6.1.1 Overview

Integrated development environments are designed to maximize programmer productivity by providing tight-knit components with similar user interface. IDEs present a single program in which all development is done. This program typically provides many features for authoring, modifying, compiling, deploying and debugging software. This contrasts with software development using unrelated tools, such as vi. GCC.

One aim of IDE is to reduce the configuration necessary to piece together multiple development utilities, instead of providing the same set of capabilities as a cohesive unit. Reducing that setup time can increase developer productivity, in cases where learning to use IDE is faster than manually integrating all the individual tools. Tighter integration of all development tasks has the potential to improve overall productivity beyond just helping with setup task. For example, code can be continuously parsed while it is being edited, providing instant feedback when sytax errors are introduced. That can speed learning a new programming language and its associated libraries.

Some IDEs are dedicated to a specific programming language, allowing a feature set that most closely matches the programming paradigms of the language. However there are multiple language IDEs.

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop(), that are compiled and linked with a program main() into a executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program to convert the executable code to a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

6.1.2 Sketch

A program written with the Arduino IDE is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino .Arduino software IDE pre1.0 saved sketches with extension .pde.

A minimal Arduino C/C++ program consists of only two functions 1) setup() : This function is called once when a sketch starts after power up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch. 2) loop() : After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is power off or reset.

While most IDEs are graphical, text based IDEs such as turbo pascal were in popular use before the wide spread availability of windowing systems like Microsoft Windows and X

Windows System(X11). They commonly use function keys or hotkeys to execute frequently used commands or macros.

6.1.3 Getting started with Arduino

1) Getting an Arduino board and USB cable
2) Download the Arduino IDE software
3) Connect the board
4) Install the drivers
5) Laucnh the Arduino application

Arduino also simplifies the process of working with microcontrollers and it offers some advantage such as :

1) Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50.
2) Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
3) Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well.
4) Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it is based.
5) Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it.

6.2 Blynk

Blynk is a toolset for all makers, designers, teachers, and geeks who use their smart phones to control electronics like Arduino, RaspberryPi and similar ones. With Blynk, we can snap with amazing interfaces with different gadgets. It works perfectly and saves tons of time.

Blynk will work with all popular boards and shields. Blynk Cloud is much more convenient which is free and an open-source platform helping in creating projects. Blynk is very powerful and simple where drag and drop of controllers (buttons, timers), displays (Value display, LCD), notifications and other functional widgets makes our work less cumbersome. Blynk is not an app that works only with a particular shield. Instead, it is been designed to support the boards and shields we are already using. And it works on iOS and Android.

Blynk also works over USB. This means you can tinker with the app by connecting it to your laptop or desktop while waiting for some internet shield to arrive. Blynk works over the Internet. So the one and only requirement is that your hardware can talk to the Internet. No matter what type of connection we choose - Ethernet, Wi-Fi or maybe this new ESP8266 Blynk libraries and sketches will be connected to Blynk Server and pair up with our smartphone.

Blynk libraries work with :

- USB
- Ethernet shield
- WiFi shield
- Arduino with Ethernet
- Raspberry Pi (Blynk will communicate with Pi's GPIOs)

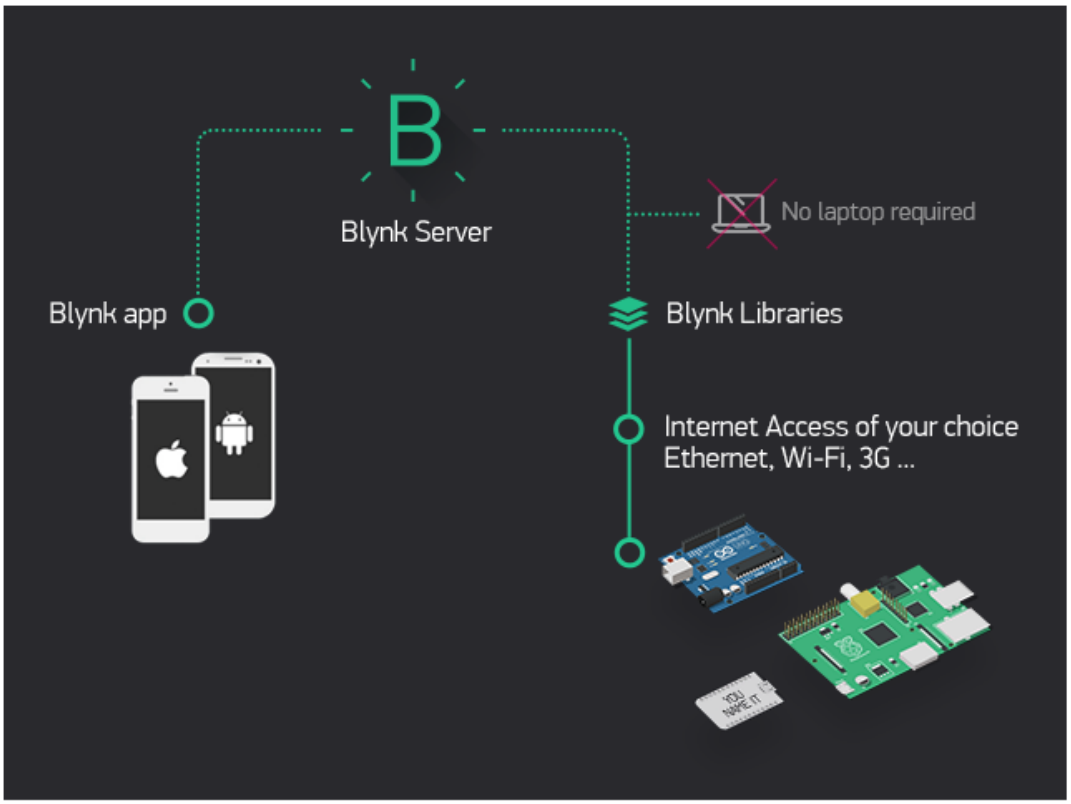

Fig 6.2 : Pairing up of Blynk Server with Smart Phone (Courtesy : docs.blynk.cc Image)

It's not that easy to take Arduino out of your home network, so we've built a Blynk server. It handles all the authentication and communication, and also keeps an eye on the board while the smart phone is offline. Blynk server runs on Java and is open-source. Messaging between mobile apps , Blynk Server and Arduino is based on a simple, lightweight and fast binary protocol over TCP/IP sockets.

There are three major components in the platform:

1) Blynk App : It allows you to create amazing interfaces for your projects using various widgets which are provided.
2) Blynk Server : It is responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It’s opensource, could easily handle thousands of devices and can even be launched on a Raspberry Pi.
3) Blynk Libraries : It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands.

6.2.1 Creating a project using Blynk app

A smart phone, IoT hardware and an internet connection are the basic modules for Blynk application. Blynk can run on over 400 hardware modules. The most popular are ESP8266, ESP32, NodeMCU, Arduino (any model), Raspberry Pi (any model) etc.. To connect our hardware to the Internet, we can choose almost any module either built-in, or external shields. Initially we need to download Blynk app for iOS or Android devices which is the easiest way to build our own mobile application that work with the hardware of our choice. Next we need to install the Blynk libraries which is an extension that runs on top of our hardware application. It handles all the connection routines and data exchange between our hardware, Blynk Cloud, and our application project. After this we need to create an account and we need to login by proving valid credentials. In order to get our hardware online and connect it to Blynk Cloud, we would need a device Authentication Token. After our hardware is connected to Blynk we are ready and we get a message saying " Welcome to Blynk ".

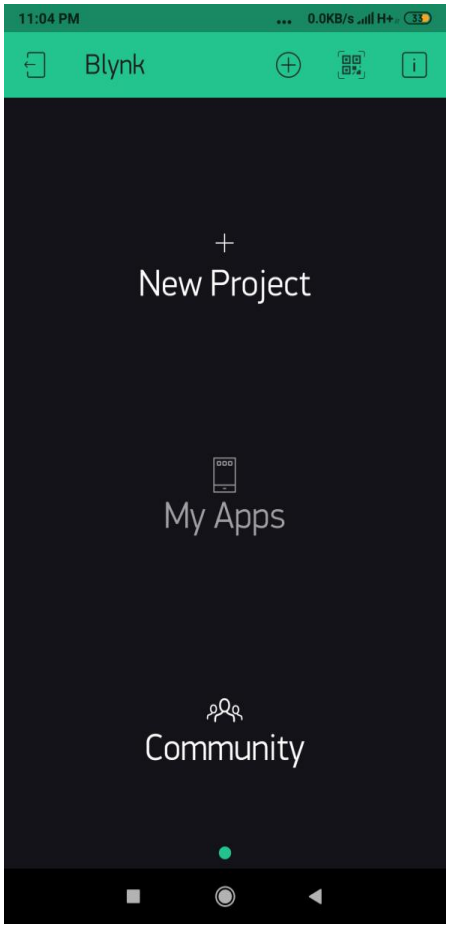

Fig 6.3 : Creating a new project in Blynk App

Create a Blynk Project

Inorder to create a new project application in Blynk, we need to first click on " New Project " in the app. Then enter the project name " CAMOUFLAGE ARMY ROBOT " and make sure the " Hardware Model " is set to ESP8266 as represented in the figure below.

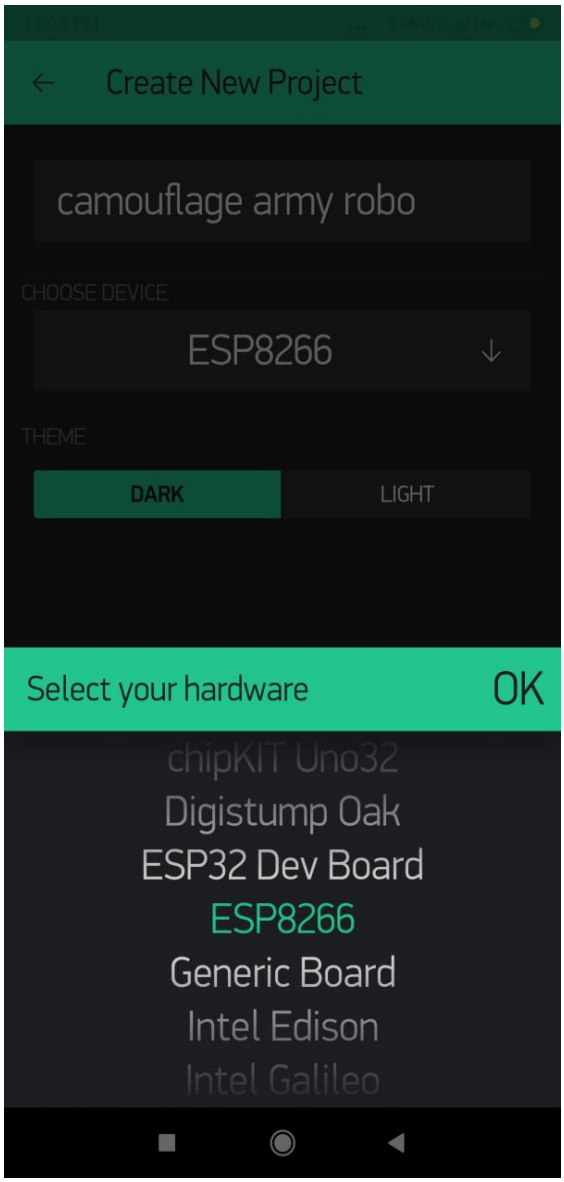

Fig 6.4 : Selecting ESP8266 Hardware Model after creating Camouflage Project

Once after the confirmation of selection of hardware to ESP8266 and project title, the Blynk app asks for validation. Here we need to enter out valid credentials and login with the Blynk server. Once after the verification of details entered we obtain an Authentication token for the registered mail Id. After these validations we are now authorized to use the Blynk

application. The authentication token is very important as it registers the ESP8266 module to your application.

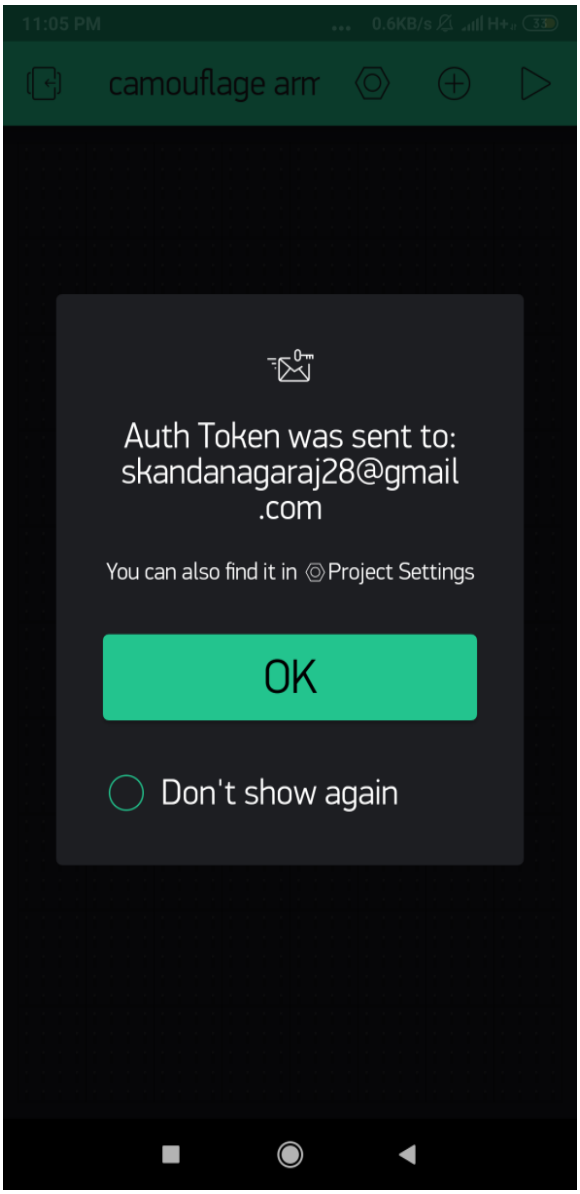

Fig 6.5 : Generation of Authentication code which helps in registering ESP8266 Module to application

After this, various functional widgets are accessible. We can use the widgets based on the energy level present. Here in Blynk application each and every widget that may be a LCD display, button, GPS stream etc... consumes some amount of energy. Based on the energy left out we are liable to choose widgets of our interest. The different functional widgets available are represented in the figure given below.

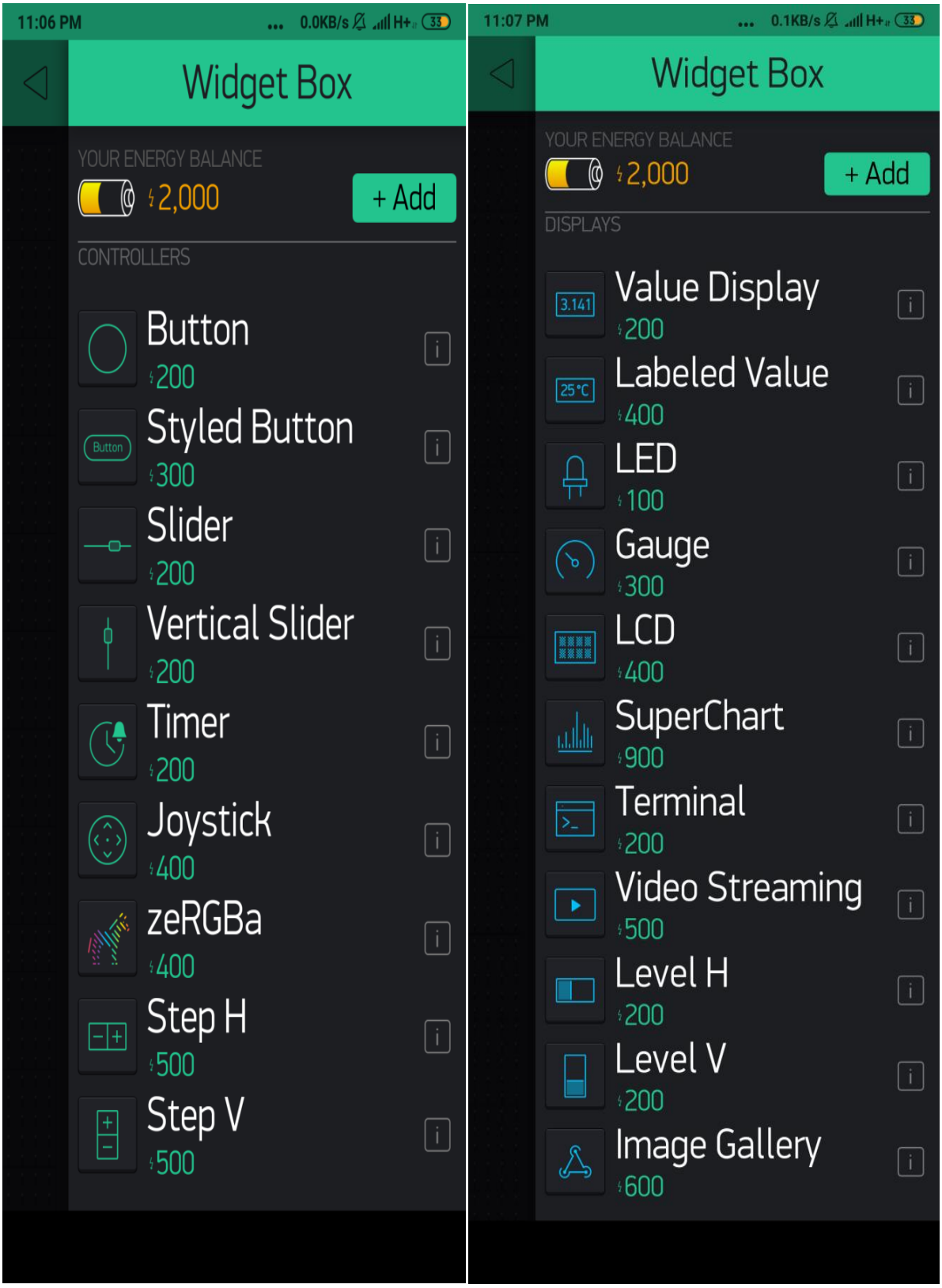

Fig 6.6 : Available Functional Widgets (Set 1)

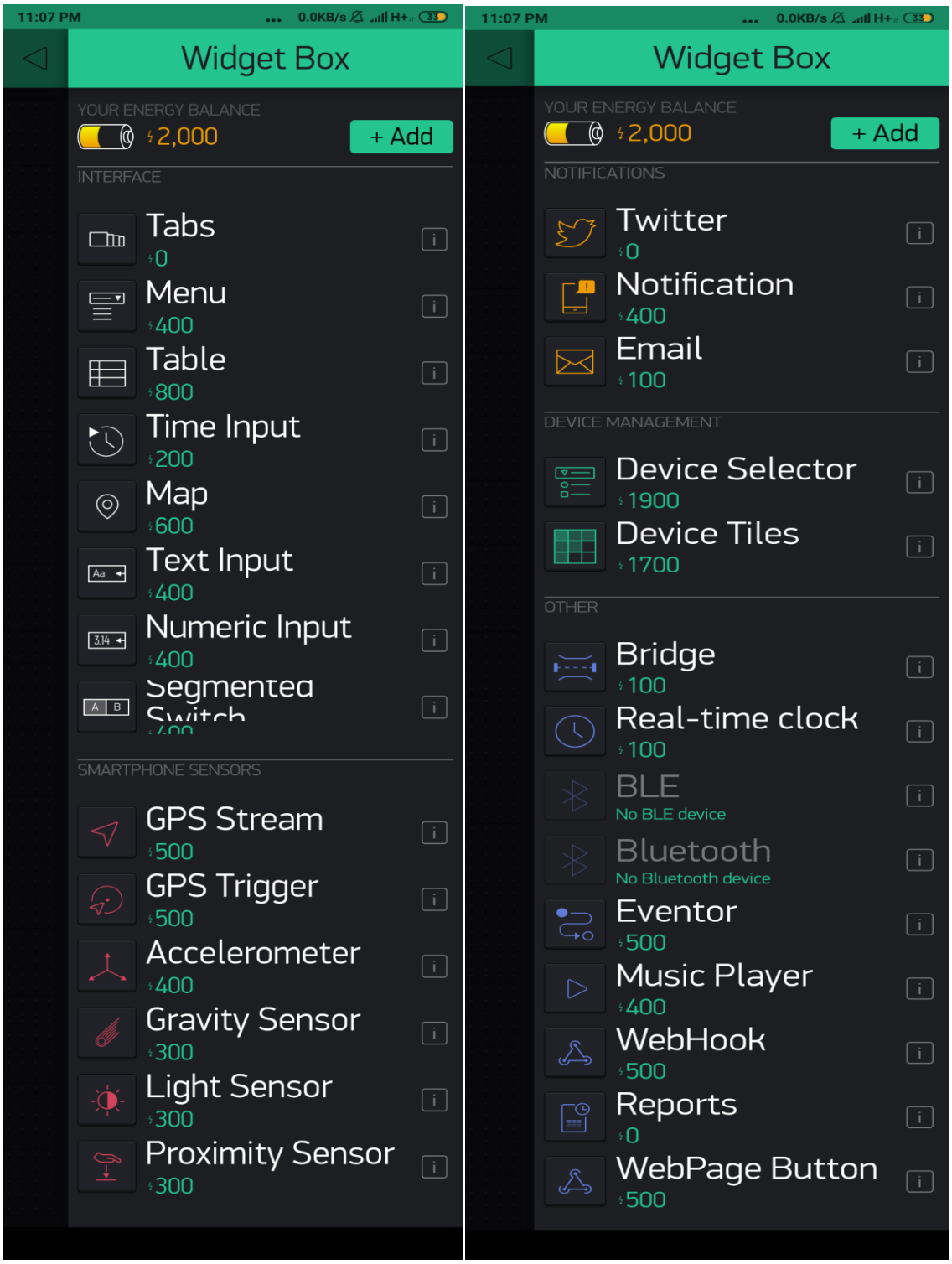

Fig 6.7 : Available Functional Widgets (Set 2)

Upload the Blynk Firmware

Now that our Blynk project is set up, open Arduino and add the Blynk libraries which are required for communicating with the Arduino. With addition to including of required

libraries we also have to make sure to paste our authorization token into the auth[] variable. Also make sure to load your Wi-Fi network settings into the Blynk.begin(auth, "ssid", "pass") function. Then the upload process is said to be completed.

Run the Project

After the app has uploaded, open the serial monitor, setting the baud rate to 9600. Wait for the “Ready” message. Then click the “Run” button in the top right corner of the Blynk app. Press the button and watch the LED. Once the Blynk application is connected via your smart phone hotspot, it shows that we are online and the controlling can be done successfully.

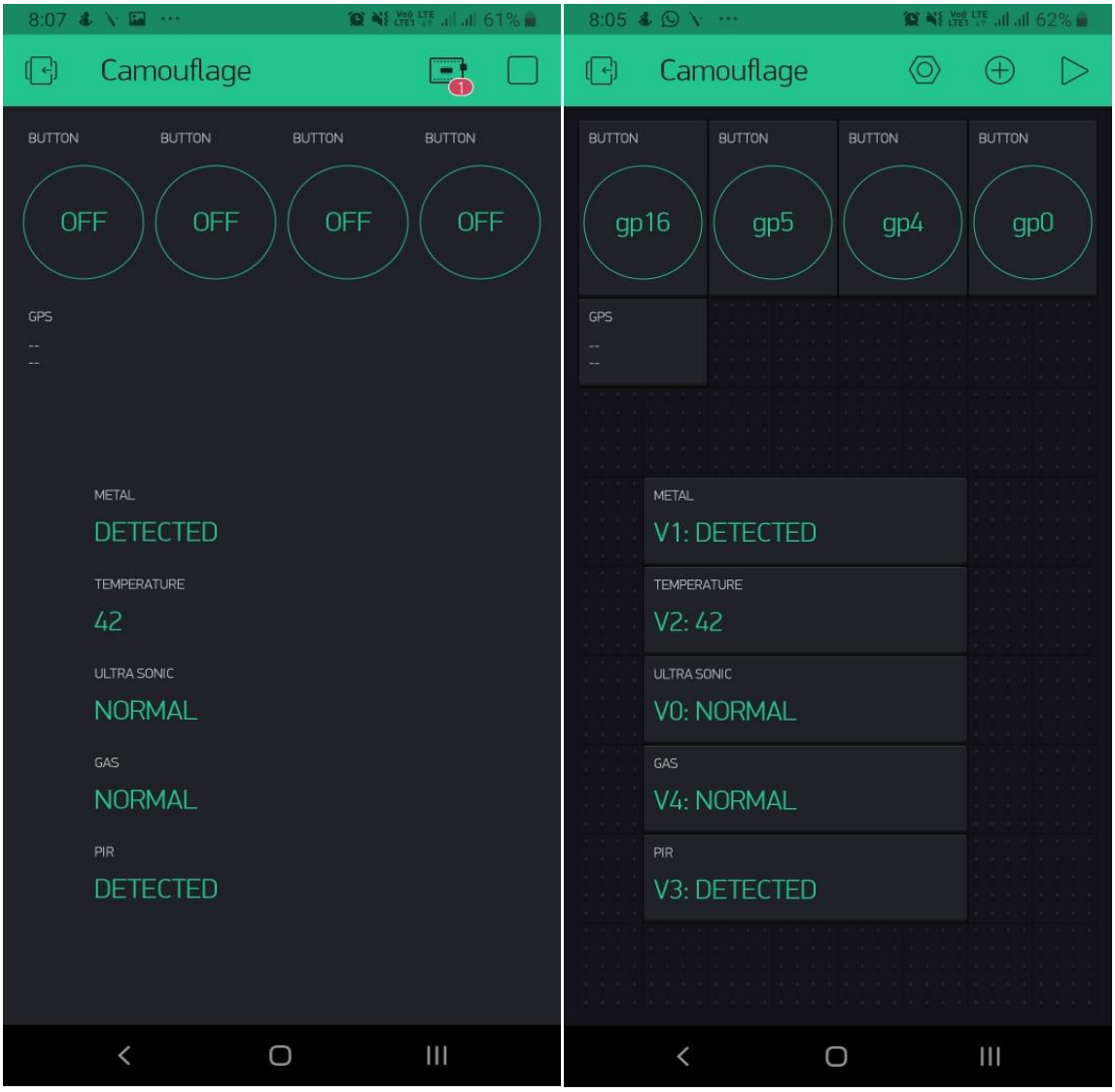

Fig 6.8 : Controlling the motion of robot through mobile hotspot and Snapshot of the output of various sensors.

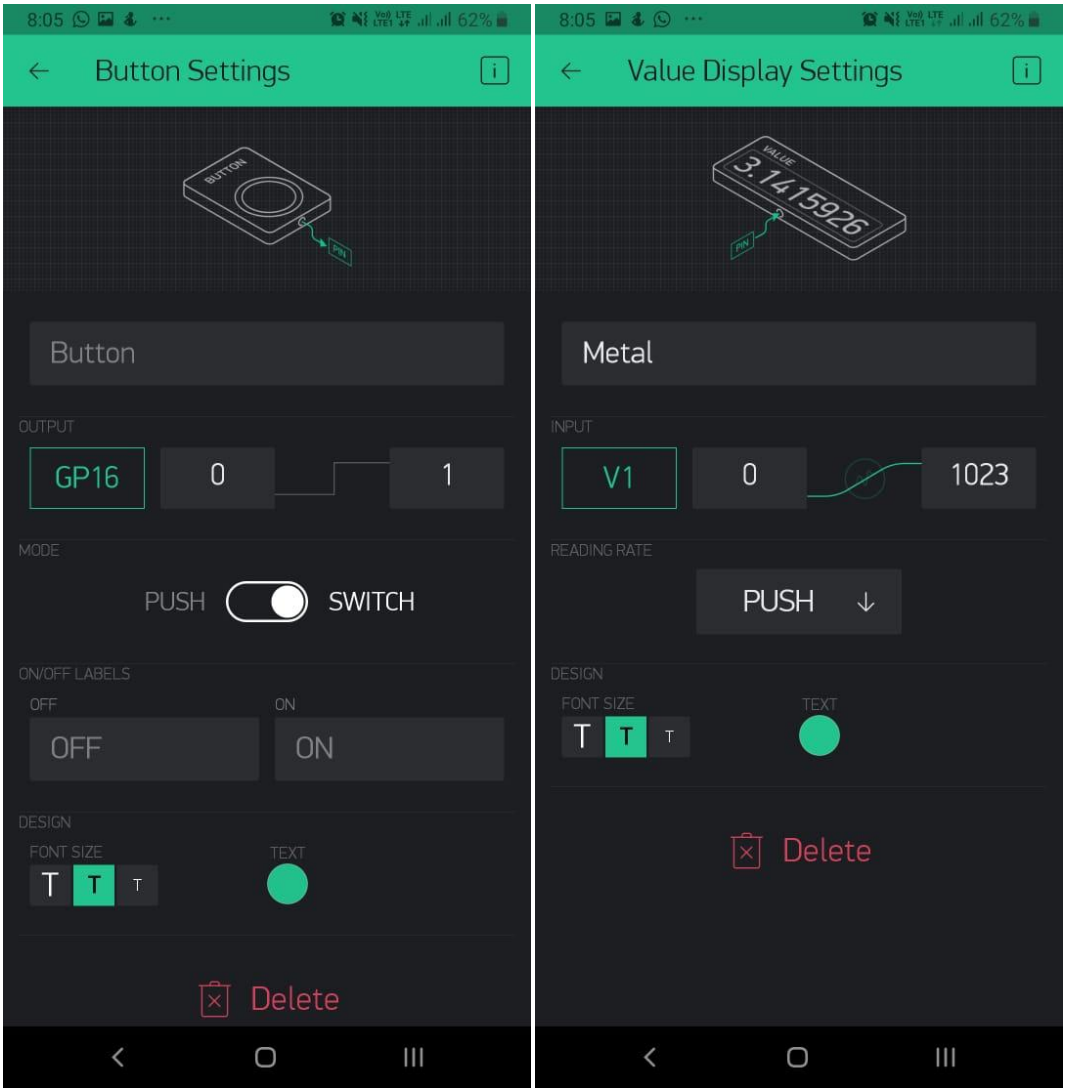

Fig 6.9 : Snapshot of Button and Value Display settings

We can add more widgets to the project based on our requirement and feasibility. They should immediately work on the ESP8266 without uploading any new firmware. In this way Blynk application which is a drag-n-drop application constructor packed with IoT features such as visualizing and plotting data from any sensor, controlling relays, motors, and getting push notifications and so on, acts as a promising tool to work with in the upcoming era.

6.3 Live video streaming

For video live streaming, a Wi-Fi camera based on IP address is used. The live video streaming can be viewed in the mobile by using an android application named V380S.

The V380S is a new generation intelligent household cloud camera which can easily realize the remote video monitoring and management. By this software, the process of real-time video can be viewed anytime and anywhere. It supports the remote PLZ control. The camera direction can be controlled in this mobile application. The added advantage in this application is that the audio commands can be sent for the surveillance purpose. Intelligent cloud streaming transmission technology with 720p million high-definition public network real-time transport is used. The V380S application increases cloud storage services where the video can be uploaded to the server with enhanced data security.

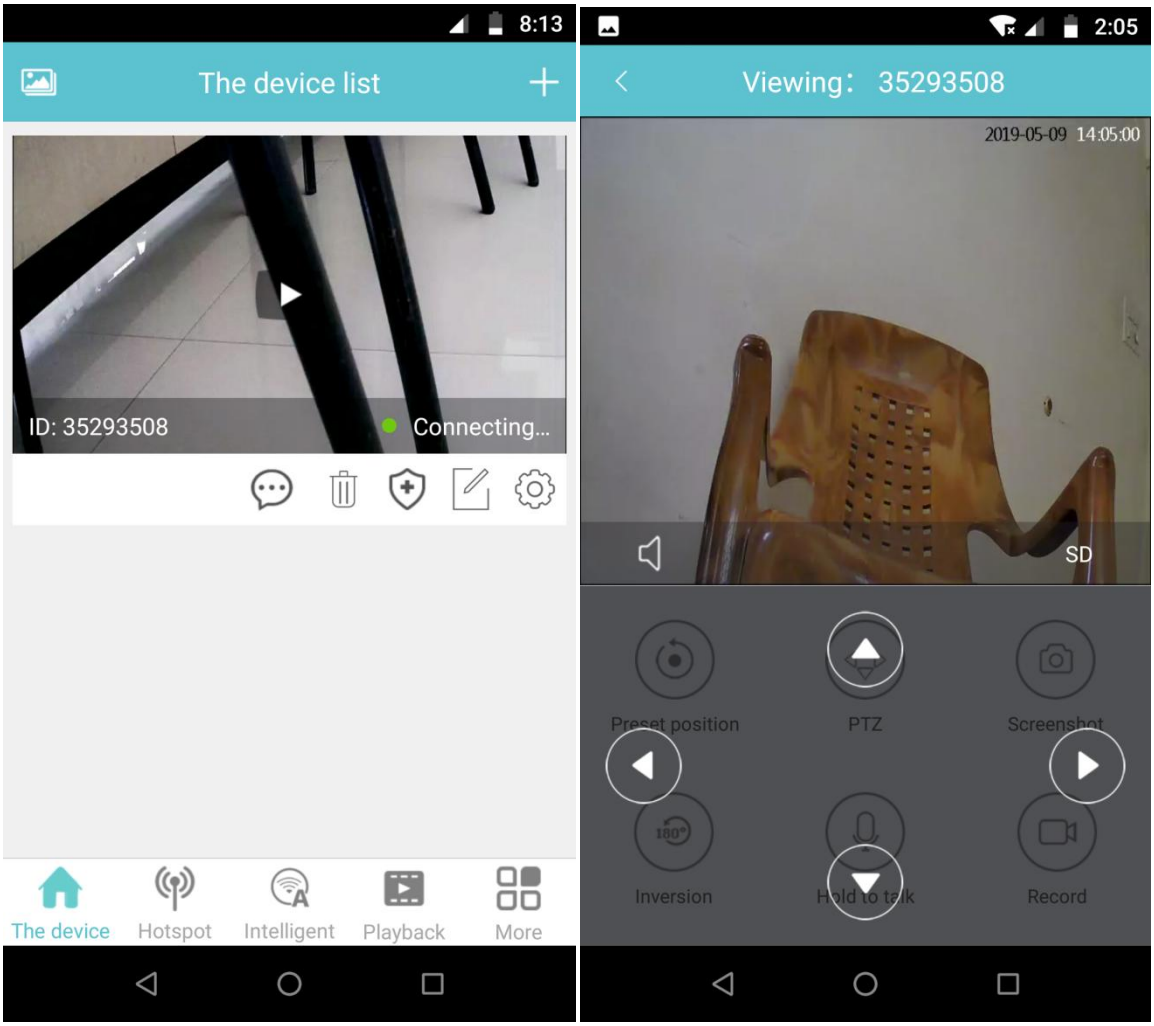

Fig 6.10 : Snapshot of Video streaming Display settings

6.4 Flow chart

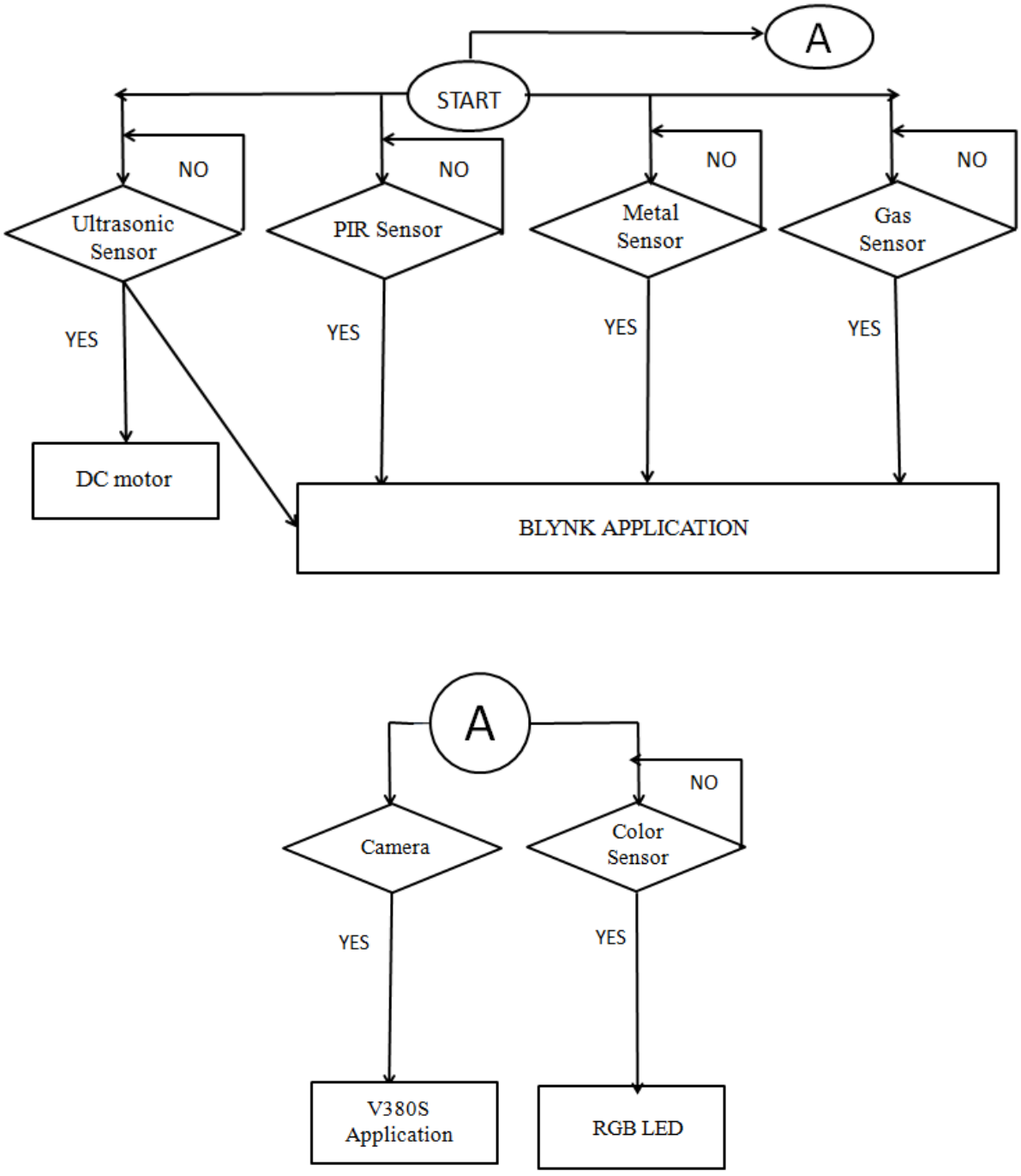

Fig 6.11: Flowchart of Working of Camouflage Army Robot

CHAPTER 7

RESULTS

RESULTS

A low cost Army Robot with Camouflaging feature is designed and manufactured as shown in figures (Fig 7.1 - 7.4). The movement of the robot is controlled using Blynk app and also the output of the all the sensors is displayed on the mobile screen as shown in Fig 7.5.

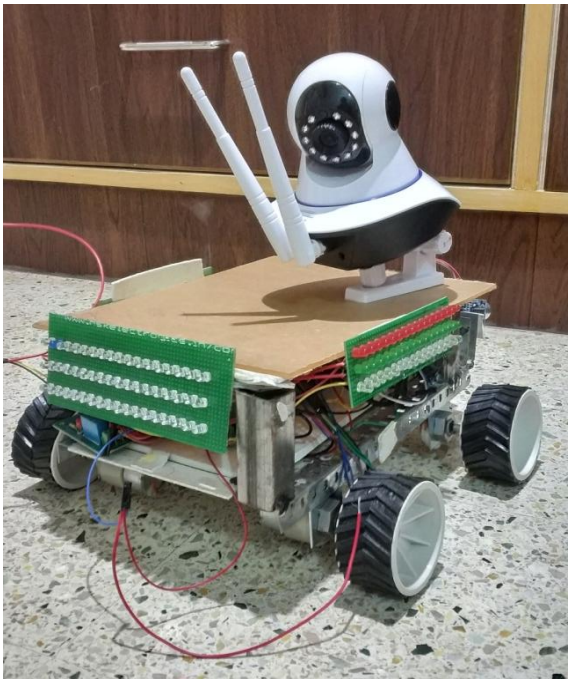

Fig 7.1 : Front View of Designed Robot

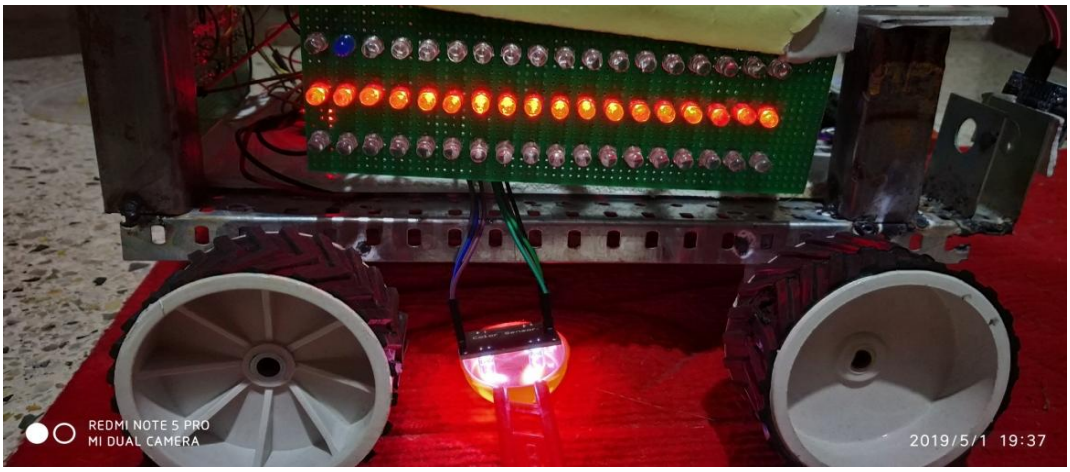

Fig 7.2 : Red Color Detection

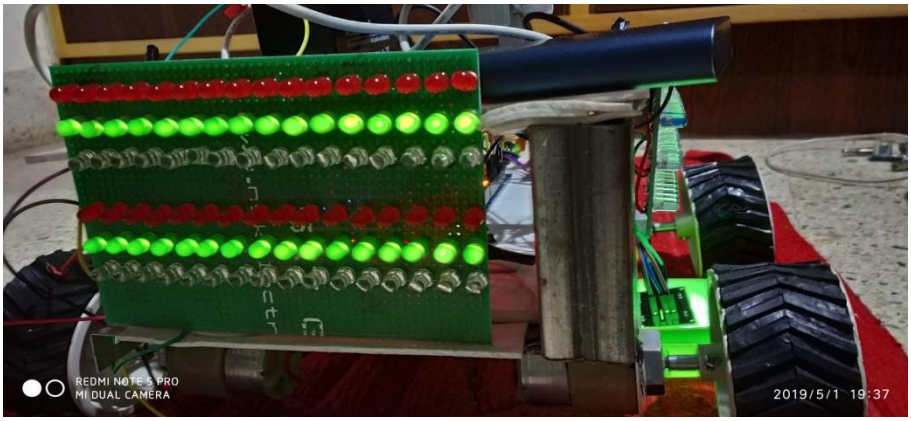

Fig 7.3 : Green Color Detection

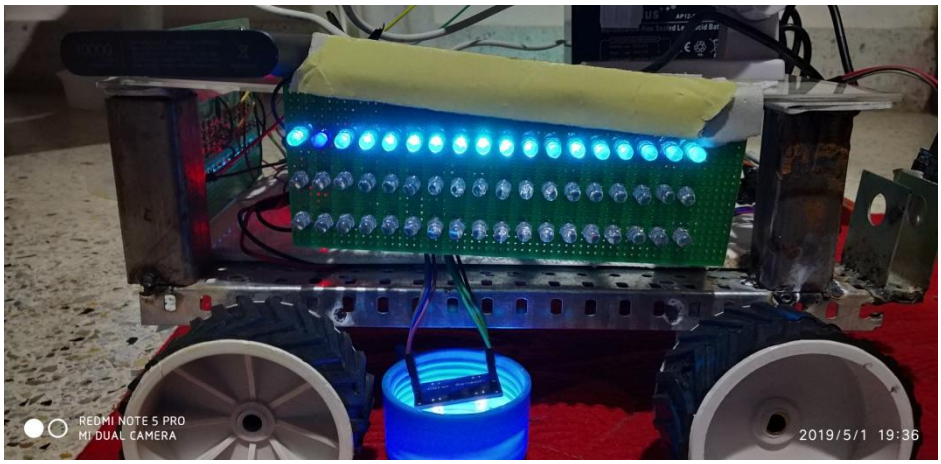

Fig 7.4 : Blue Color Detection

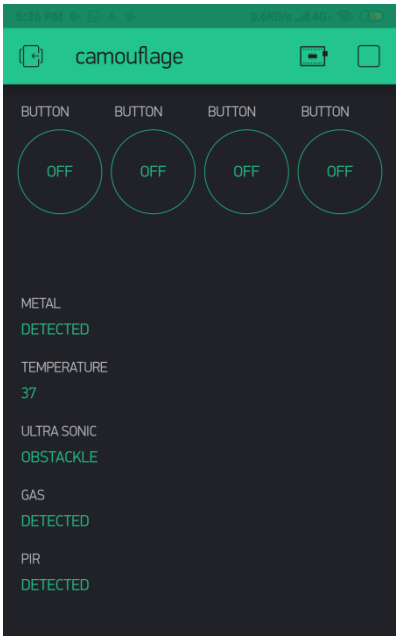

Fig 7.5 : BLYNK APP

CHAPTER 8

APPLICATION AND FUTURE WORKS

APPLICATIONS AND FUTURE WORKS

7.1 Applications

- This project can be used for performing multi-tasks .
- Further this robot can be extended to perform stealth and ability to maneuver in inaccessible areas.
- Various sensors like ultrasonic, PIR, gas sensor, color sensor, metal detector etc. make this vehicle more effective.
- In military application, this robot can be used to detect the presence of human being.
- It can be used in rescue operation where human reach is not possible.
- This camouflage robot can be utilised in the tracking systems.
- Army Robot is an autonomous robot comprising of wireless camera which can be used as a spy (surveillance purpose).
- Robot can further be equipped with speaker or recorder to interact with survivor and assure them of nearby help.

7.2 Future scope

The proposed system provides a helping hand to our security forces in detection of intruders. The robot can also be used in high altitude areas where human cannot survive. Moreover, the camouflaging feature makes it difficult to detect the robot by naked human eye. There is scope to improve the system by configuring it with multicolor camouflaging. It can also be incorporated with the Amazon Kindle which is basically predominant for readers allowing them not strain their eyes in any lighting conditions. Displaying an opposite side image on it makes it camouflaged and with the help of its zero reflecting screen it can be more predominant.

CHAPTER 9

CONCLUSION

CONCLUSION

Military warfare has seen a decreased fatality rate in their personnel over the recent years in this modern world. The crust of the reason being the advancement in technologies that enable designing and development of unmanned robots to function in unfavorable areas for humans. The evolution of various forms of robots from rovers to humanoids has dealt with the crisis of human loss especially in covert missions and spy operations. The proposed system specifications that mainly relies on a concealment technique to avoid detection resonates with these advancements in military unit.

The implementation of various sensors has proven to have a high success rate. Starting with the color sensor which is the primary device used for cloaking, has been implemented along with RGB lights to give the desired camouflaging technique. This methodology can be a stepping stone for further advancements in the spy surveillance of the enemy territory. This efficiently helps the armies to send in rovers to recover information and infiltrate enemy campsite. The use of a camera with dual properties of daytime and night vision recording further boosts the efficiency of the live streaming and recoding which is the main mode of surveillance.

The use of applications such as BLYNK has improved the scope of maneuvering the robot as the DC motors have been easily linked with the application. Use of IOT and wifi module has proven advantageous and helped in the easy 2 way communication between user and the unmanned robot.

The importance of having various other sensors and features to claim the multi funtionality of the robot is tested and proved. The use of metal sensors to detect metals can be used as a bomb detector. The implementation of a temperature sensors to record the surrounding fluctuation in the area can give a deep knowledge about the terrain. The gas sensors used can be modified further to detect the harmful gases that are naked to the human eye. The ultrasonic and PIR sensors help in the detection of obstacles and humans which can be used to alert the operator and also used in rescue missions.

The overall composure of the proposed system not only satisfies the above criteria but also provides a cost effective and efficient multifunctional prototype. Further implementation

of the system in real time with more advanced technologies can prove more worthy of its blueprint that's depicted by this system. There is scope to improve the system by configuring it with multi-color camouflaging.

CHAPTER 10

PAPER PRESENTATION DETAILS

PAPER PRESENTATION DETAILS

1. SURVEY PAPER

2. IMPLEMENTATION PAPER

IOT BASED CAMOUFLAGE ROBOT

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*Abstract :*The most primitive and natural method for avoiding detection is camouflaging, exhibited by many flora and fauna. Implementing this concept in the field of robotics is the main objective of this paper. The use of a multifunctional army robot associated with various sensors is discussed. The use of LEDs and colour sensor plays a vital role for camouflaging. A cloud based IOT interface with Blynk app and WiFi module is used for retrieving, storing and recovering information. Applications of various sensors for detecting parameters are discussed. The usage of wireless camera for live streaming surveillance is also featured in this paper. The various methods discussed are used to design an efficient camouflaged combat robot that serves numerous purposes.

***IndexTerms* -WiFi, AdaBoost,IOT**

I. INTRODUCTION

Over millions of years, natural evolution of living creatures has evident reports with very high adaptive environment blending capability. Some of them being, salamanders, snakes, cockroaches, cuttlefish, golden tortoise, beetle, north pacific giant octopus, chameleons and so on. These gave rise as solutions to traditional problems pertaining locomotion, mechanism design and perception. To accomplish these techniques in real time, camouflage technology can be employed. The camouflage problem is defined as concealing a 2D object located between an observer and a background scene/screen which may be static or dynamic. Active camouflage or adaptive camouflage is a method that adapts, often rapidly, to the surroundings of an object. In theory, active camouflage could provide perfect concealment from visual detection. With the advancement of technology in various domains especially in military, the application of camouflage for infiltration and for primitive security measures to protect the border from the trespassers has played a prominent role. Some organizations working in risky inaccessible areas take the help of robot which are otherwise not feasible by human efforts. The robotic technology has entered into many domains in which they can interact and cooperate closely with human beings; they can incorporate additional features such as autonomy and robustness, through building of a versatile perception and recording various parameters using a multi-sensor platform. The interfacing module is accomplished by using IOT (Internet Of Things) which allows objects to be sensed remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world. The main aim of the paper is to implement a Camouflaged technology based Wireless multifunctional Army Robot which can be controlled through Blynk application using WiFi module.

II. METHODOLOGY

The paper [1] describes about BAE Systems announcing Adaptive infrared camouflage technology. It uses about 1000 hexagonal panels to cover the sides of a tank. The panels are rapidly heated and cooled to match either the temperature of the vehicle's surroundings, or one of the objects in the thermal cloaking system's "library" such as a truck, car or large rock. Stealth technology also termed LO technology (low observable technology) is a sub-discipline of military tactics and passive electronic countermeasures, which cover a range of techniques used with personnel, aircraft, ships, submarines, missiles and satellites to make them less visible (ideally invisible) to radar, infrared, sonar and other detection methods. To achieve the feat of 'cloaking' an object, they have developed a material known as meta materials, some of which can bend electromagnetic radiation, such as light, around an object, giving the appearance that is not there.

The paper [2] proposes bio-inspiration work based on chromatic behavior change with respect to multiple predators. Here the robot exhibits similar concept of showcasing difference in color response on detecting multiple predators. Dwarf chameleons alter their detection ability by encompassing difference in its exposure values with that of the surroundings. The exposure values are said to be maximum detectable on encountering species of their own kind and minimum detectable on encountering its predators. A simple example to this can be noticed by the camouflage feature of a chameleon exhibiting a brighter exposure contrast as stealth in presence of a snake and a lower exposure in presence of a bird respectively. These chromatic behavioral changes are incorporated to our cylindrical based prototype which basically involves many stages as described further. The robot can be controlled automatically or by tele-operation. In the tele-operation the controlling is done mobile device noticing the changes through a visual streaming camera onboard. The robot is initially free to roam; if and only if it encounters a hostile or friendly agents the next phase starts. Here in the next phase on detecting its predators it changes itself to a significant color and also is programmed to remain still in stealth for exhibiting effective camouflaging. If the robot encounters species of its own then it changes to a detectable color. Here the color changing is exhibited based on the visual characteristics of the surrounding terrain.

The paper [3] describes about the basic functionalities that takes place in the following phases- [i] Kinect camera at the back of LCD, captures the BG scene of the camouflage object and then sends the captured images to the computer for real time processing. [ii] Kinect camera mounted on the display, tracks the observer's eyes and his skeleton, and then sends the 3D location of his eyes in real time. [iii] The occluded region behind the object depends on its size and its location with respect to the location of the observer's eyes, i.e. LCD that covers the camouflaged object. [iv] The computer processes the RGB and depth images received from back camera and the tracking information from front camera, which are the tracking status, face features, 2D tracked points, 3D tracked head joint point, and head pose (pitch, roll, and yaw, with working range of 20° ,90°, 45° respectively). [v] The camouflaged image with appropriate scale and location sends to the LCD display.

The paper [4] is concerned with the development of a cognitive robot-ant for inspection of real environments such as riverside, seaside, river/channel orifices, canalization vicinity, etc. The primary task of the robot is to acquire data on the condition of the ecology system and to do some simple cleaning tasks. The robot is provided with on board cameras and a wide array of different specialized sensors. The data and images are sent to the corresponding supervision centre. Here they are processed and connected to geographical information which is collected from a web of sources. Hence initiating the operation of the robot. The robot navigates autonomously, following the high-level instructions obtained from the surveillance centre. It is off-the-shelf, robust wheel-based robot capable of operating on regular as well as irregular terrains. The robot has following modules: (i) versatile perception (ii) artificial brain (intelligence) (iii) locomotion system (iv) arm(s). Heterogeneous system consists of sensors for detection (such as LIDAR, GPS), Visual sensors and non visual perception sensors. TCP/IP communication with the remote surveillance centre enabled over GPRS/EDGE/3G services is used.

The paper [5] deals with a webcam which is used for receiving images and sending them to the notebook or a computer with a central processing unit which is used to display images. A router wireless LAN on the automatic robot is used for transmitting the image data to display on the notebook. Four Motors are utilized for driving four wheels of the automatic robot controlled by relay circuits. They receive signals from infrared sensor circuits which are used for detecting objects and sending signals through the relay circuits to the notebook. Strength of the transmitted signals on the air is measured in terms of distances depending on the received data. Delay time of transmitting and receiving images is considered from the robot to display on the notebook. Distances of the detected signals can be received from four infrared sensors which are displayed on screen. The automatic robot testing will be tested in three patterns of obstacles.

The paper [6] describes about an intelligent detection process which is divided into two phases: Learning phase including in the offline process and Test phase which is a part of the online process. The former includes the preparation of the database files. SIFT and HOG features are the inputs of the AdaBoost algorithm learning and the decision person or not are the output of the network. The second phase of our human detection algorithm identifies if humans exist in the extracted image and where they are in the video sequences. For that AdaBoost is trained to recognize the shape of a human. The trained AdaBoost is then used to identify which of the connected components are human or not. The main advantages of this method are its high speed and performance. It is based on the combination of several weak classifiers which, in average, have a moderate precision and create a strong classifier. The AdaBoost provides both learning and classification operators. In order to implement both algorithms, we have used GML AdaBoost Matlab Toolbox 1 with AdaBoost algorithm implementation. The detection of people is done by sliding a search window through the frame image and checking whether an image region at a certain location is classified as human or non-human. The system can detect standing individuals at different positions, orientations, and with different backgrounds.

The paper [7] describes about the technique for object detection in two sections: (1) Scanning & filtering algorithm (2) Object detection algorithm. The different stages of operation include colour based image thresholding, scanning and filtering, object detection, segmentation and saving to the data base. Image thresholding in an image is converting an RGB scale to binary or BW Scale. The proposed object scanning and filtering algorithm can identify the objects distinctly from each other, irrespective of shape and size. Here the object identification does not affect the system accuracy even when the image background is complex. Window based image scanning is chosen to identify the indexes of non-zero values and the windows having more than 50 percent of non-zero values are only considered for object detection. This condition in scanning, inherently acts as a noise filter. The proposed algorithm for object detection needs no prior information of size or shape of the object. Object detection algorithm figures out the boundaries of the objects by scanning non-zero values.

The paper 8] explains the concept of cloud, which majorly provides interconnection between virtual computers facilitating resources. It also has a private cloud providing IaaS using open stack method. With this it uses Amazon configuration settings for storage at cloud which can be altered in real time. Here Amazon web services are used for different applications to communicate. When the system is turned on, camera starts recording and at real time the data is sent to cloud by using a Wi-Fi adapter, where the communication from the module to the cloud takes place. This can be depicted as a server-client based operational model. Based on the IP address, streaming can be done from any part of the world by operating on the web page.

In paper [9] The segmentation technique used here is motivated by the observation that for most of the domains of interest here changes in illumination lead to small changes in colour value and that these changes are relatively uniform across all colours. So, with modern cameras with automatic shutters and gain control red pixels may vary in colour but will stay in the same region of colour space. The different methods used for colour recognition are: (1) Pixel Classification : To label pixels according to which symbolic class they belong to, we use a soft-labeling scheme followed by a hard decision based on adaptive thresholds. The pixel

is assigned to the highest priority colour class for which its likelihood is above the threshold for that colour class. (2) Threshold Adaptation: A histogram based approach is used to adapt the threshold from frame to frame. the key assumption here is that pixels in the image are drawn from two different underlying distributions: pixels that belong to the colour class of interest and pixels that do not. The key assumption translates to a histogram of likelihood values consisting of two, clearly distinguishable Gaussian peaks centered around likelihood values of 1, and 0, respectively. The peak with the highest likelihood value corresponds to the pixels of interest. (3) Region Extraction: Once the image has been segmented, regions of similarly labeled pixels are found using connected component analysis. CM Vision provides fast connected components using a combination of run length encoding and run conglomeration.(4) Object Recognition : Once an image has been segmented and colored regions extracted, high-level vision must attempt to detect and recognize relevant objects in the image if any are present.

In paper [10] SAR is used as imaging radar. SAR is a kind of high-resolution microwave imaging radar. Due to its all-weather, day/night, and penetration capability, airborne and spaceborne SAR is now widely used in target recognition. Passive ground camouflage target which include camouflage tank, camouflage armored vehicle and camouflage aircraft is a simple and effective approach. The different techniques used for target recognition in SAR radar is as follows: (1) Image segmentation. (2) Feature extraction of SAR images. (3) K-means algorithm. In image segmentations there are many sub methods to segment the obtained image. They are: (1) Image binarization. (2) Canny edge detection. There are two ways in feature extraction as well. They are: (1) Gray feature extraction. (2) Texture feature extraction. All the above techniques are used to recognise the target from the images obtained from SAR radars

III. CONCLUSION

The human detecting robot is highly favourable on circumstances where it's impossible for human beings to reach or monitor during unfortunate events. The implementation of this design is purely driven by usage of PIR sensors, IR sensors, Dc motors and cameras etc. Overall, this robot is a highly functional device that reduces the strain on humans during calamities. The camouflage robot system provides a helping hand to our security forces in detection of intruders. The robot can also be used in high altitude areas where human cannot survive. Moreover, the camouflaging feature makes it difficult to detect the robot by naked human eye. There is scope to improve the system by configuring it with multi-colour camouflaging.

REFERENCES

[1] Akash Ravindran, Akshay Premkumar, "CAMOUFLAGE TECHNOLOGY", Department of Electronics & Communication Engineering, IJETCSE, 2014.

[2] K. S. Kumar, M. R. Elara, E. A. Martinez and R. C. Ambrosio, "Designing and experimenting bio-inspired chromatic behaviours in surveillance robot," 2015 10th International Conference on Information, Communications and Signal Processing (ICICS), Singapore, 2015.

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[4] A. Rodic, D. Katie and G. Mester, "Ambient intelligent robot-sensor networks for environmental surveillance and remote sensing," 7th International Symposium on Intelligent Systems and Informatics, Subotica, 2009, pp. 39-44, 2009.

[5] A. Leelasantitham and P. Chaiprapa, "A study of performances on an automatic IEEE 802.11g wireless-standard robot using infrared sensors," 2008 IEEE International Conference on Robotics and Biomimetics, Bangkok, pp. 1556-1560, 2009.

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[9] Brett Browning and Manuela Veloso "Real-Time, Adaptive Colour-based Robot Vision" August 2005, Conf.loc. Edmonton, Alta., Canada, 2005.

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IOT BASED CAMOUFLAGE ARMY ROBOT

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REFERENCES

[1] Akash Ravindran, Akshay Premkumar, "CAMOUFLAGE TECHNOLOGY", Department of Electronics & Communication Engineering, IJETCSE , 2014.

[2] K. S. Kumar, M. R. Elara, E. A. Martinez and R. C. Ambrosio, "Designing and experimenting bio-inspired chromatic behaviours in surveillance robot," *2015 10th International Conference on Information, Communications and Signal Processing (ICICS)*, Singapore, 2015.

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[9] Brett Browning and Manuela Veloso " Real-Time,Adaptive Colour-based Robot Vision" August 2005, Conf.loc. Edmonton, Alta., Canada, 2005.

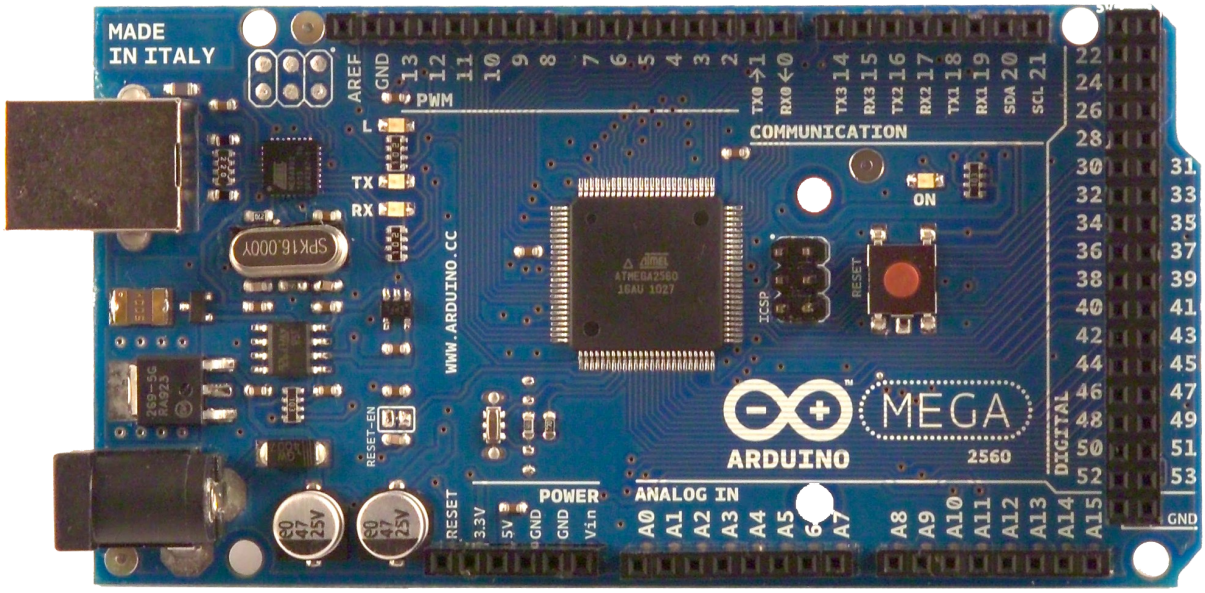
[10] Minling Huang, Weijie Xia, Linlin Huang, Ying Zhou, Yanjun Pan, "Passive Ground Camouflage Target Recognition based on Gray Feature and Texture Feature In SAR Images" October 2016 Conf.loc: Guangzhou, China, 2016.

[11]Shinde, Hitesh, Kirti Sonawane, Pranit Rane, Atharva Pathak, Sumita Chandak, "Camouflage Color Changing Robot For Military Purpose", International Journal for Research in Applied Science and Engineering Technology, 6. 4314-4316. 10.22214/ijraset, 2018.

[12] Skanda H. N, Smitha S Karanth, Suvijith S, Swathi K. S, "IOT Based Camouflage Army Robot," survey paper, Department of Electronics & Communication Engineering, KSIT, JETIR, 2019.

APPENDIX A

Arduino MEGA 2560



Product Overview

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

Index

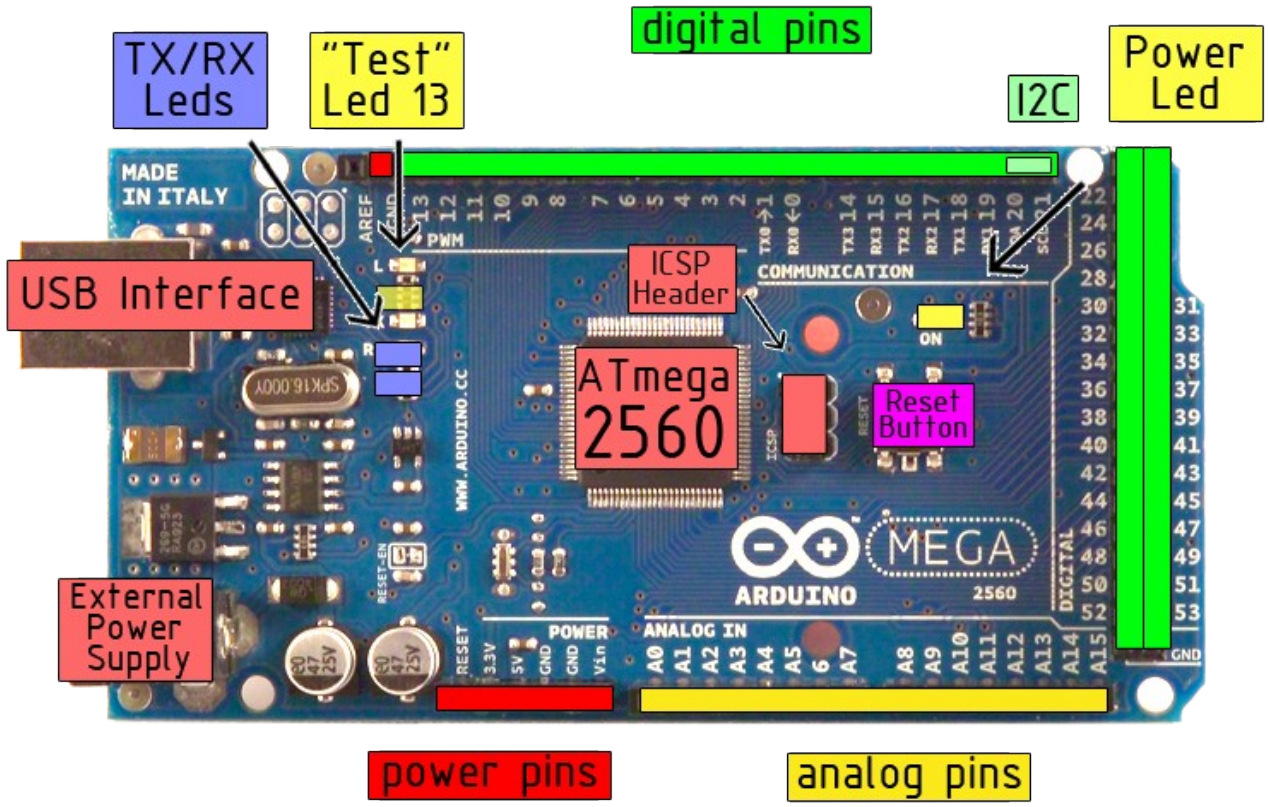
Technical Specification

EAGLE files: arduino-mega2560-reference-design.zip Schematic: arduino-mega2560-schematic.pdf

Summary

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

the board



Power

The Arduino Mega2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

The power pins are as follows:

- **VIN.** The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V.** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3.** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND.** Ground pins.

Memory

The ATmega2560 has 256 KB of flash memory for storing code (of which 8 KB is used for the bootloader), 8 KB of SRAM and 4 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- **Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .
- **External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19 (interrupt 4), 20 (interrupt 3), and 21 (interrupt 2).** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- **PWM: 0 to 13.** Provide 8-bit PWM output with the analogWrite() function.
- **SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS).** These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Duemilanove and Diecimila.
- **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- **I^2C: 20 (SDA) and 21 (SCL).** Support I^2C (TWI) communication using the Wire library (documentation on the Wiring website). Note that these pins are not in the same location as the I^2C pins on the Duemilanove.

The Mega2560 has 16 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and analogReference() function.

There are a couple of other pins on the board:

- **AREF.** Reference voltage for the analog inputs. Used with analogReference().
- **Reset.** Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

Communication

The Arduino Mega2560 has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial communication. An ATmega8U2 on the board channels one of these over USB and provides a virtual com port to software on the computer (Windows machines will need a .inf file, but OSX and Linux machines will recognize the board as a COM port automatically. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the ATmega8U2 chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A SoftwareSerial library allows for serial communication on any of the Mega's digital pins.

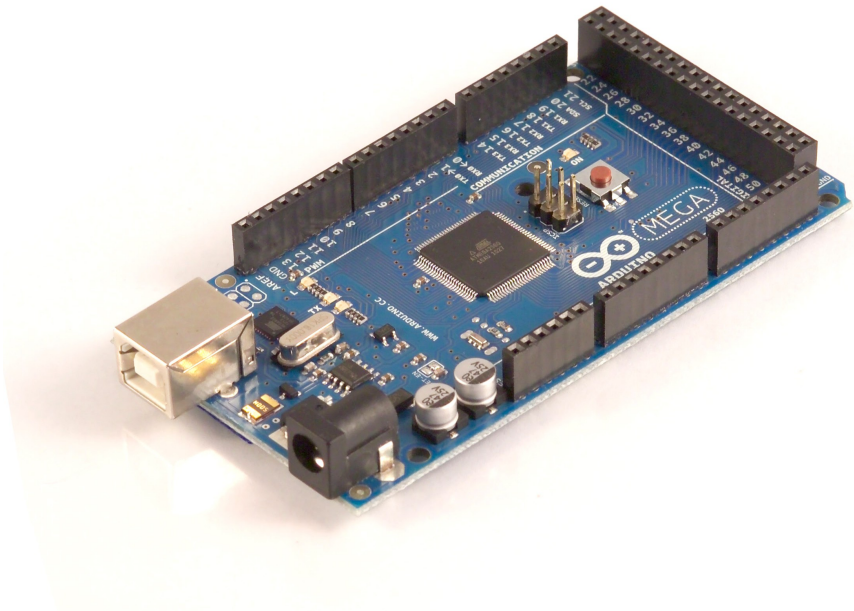
The ATmega2560 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation on the Wiring website for details. To use the SPI communication, please see the ATmega2560 datasheet.

Programming

The Arduino Mega2560 can be programmed with the Arduino software (download). For details, see the reference and tutorials.

The Atmega2560 on the Arduino Mega comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.



Automatic (Software) Reset

Rather then requiring a physical press of the reset button before an upload, the Arduino Mega2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Mega2560 is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Mega2560. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Mega contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

USB Overcurrent Protection

The Arduino Mega has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Physical Characteristics and Shield Compatibility

The maximum length and width of the Mega PCB are 4 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Three screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

The Mega is designed to be compatible with most shields designed for the Diecimila or Duemilanove. Digital pins 0 to 13 (and the adjacent AREF and GND pins), analog inputs 0 to 5, the power header, and ICSP header are all in equivalent locations. Further the main UART (serial port) is located on the same pins (0 and 1), as are external interrupts 0 and 1 (pins 2 and 3 respectively). SPI is available through the ICSP header on both the Mega and Duemilanove / Diecimila. **Please note that I^2C is not located on the same pins on the Mega (20 and 21) as the Duemilanove / Diecimila (analog inputs 4 and 5).**

How to use Arduino

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software on running on a computer (e.g. Flash, Processing, MaxMSP).

Arduino is a cross-platoform program. You'll have to follow different instructions for your personal OS. Check on the Arduino site for the latest instructions. *http://arduino.cc/en/Guide/HomePage*

Linux Install

Windows Install

Mac Install

Once you have downloaded/unzipped the arduino IDE, you can Plug the Arduino to your PC via USB cable.

Blink led

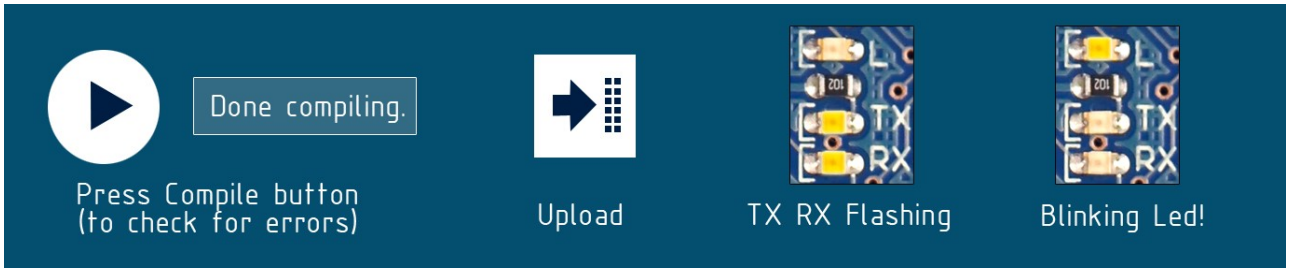
Now you're actually ready to "burn" your first program on the arduino board. To select "blink led", the physical translation of the well known programming "hello world", select

File>Sketchbook>
Arduino-0017>Examples>
Digital>Blink

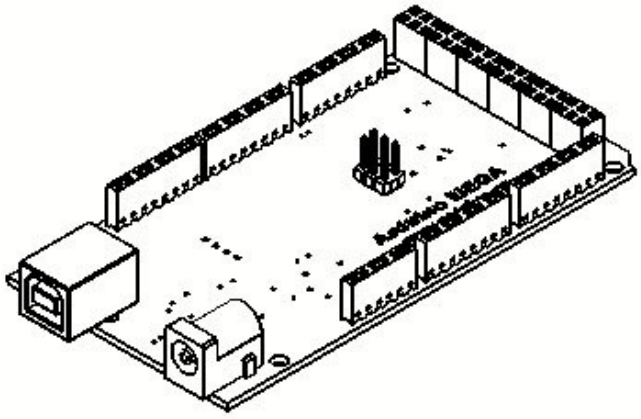
Once you have your skecth you'll see something very close to the screenshot on the right.

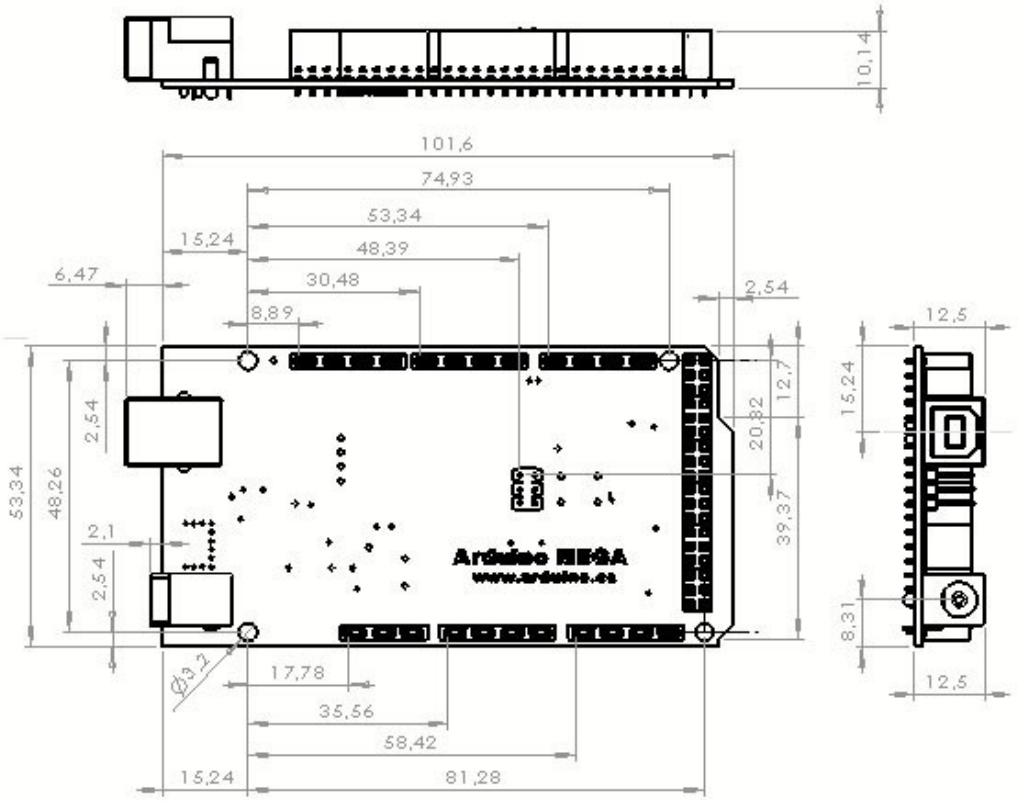
In **Tools>Board** select MEGA

Now you have to go to
Tools>SerialPort
and select the right serial port, the one arduino is attached to.



Dimensioned Drawing





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1.5 The Arduino™ products are not authorized for use in safety-critical applications where a failure of the product would reasonably be expected to cause severe personal injury or death. Safety-Critical Applications include, without limitation, life support devices and systems, equipment or systems for the operation of nuclear facilities and weapons systems. Arduino™ products are neither designed nor intended for use in military or aerospace applications or environments and for automotive applications or environment. Customer acknowledges and agrees that any such use of Arduino™ products which is solely at the Customer's risk, and that Customer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

1.6 Customer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products and any use of Arduino™ products in Customer's applications, notwithstanding any applications-related information or support that may be provided by the producer.

2. Indemnification

The Customer acknowledges and agrees to defend, indemnify and hold harmless the producer from and against any and all third-party losses, damages, liabilities and expenses it incurs to the extent directly caused by: (i) an actual breach by a Customer of the representation and warranties made under this terms and conditions or (ii) the gross negligence or willful misconduct by the Customer.

3. Consequential Damages Waiver

In no event the producer shall be liable to the Customer or any third parties for any special, collateral, indirect, punitive, incidental, consequential or exemplary damages in connection with or arising out of the products provided hereunder, regardless of whether the producer has been advised of the possibility of such damages. This section will survive the termination of the warranty period.

4. Changes to specifications

The producer may make changes to specifications and product descriptions at any time, without notice. The Customer must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." The producer reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The product information on the Web Site or Materials is subject to change without notice. Do not finalize a design with this information.

Enviromental Policies

The producer of Arduino™ has joined the Impatto Zero® policy of LifeGate.it. For each Arduino board produced is created / looked after half squared Km of Costa Rica's forest's.

HC-SR501 PIR MOTION DETECTOR

Product Discription

HC-SR501 is based on infrared technology, automatic control module, using Germany imported LHI778 probe design, high sensitivity, high reliability, ultra-low-voltage operating mode, widely used in various auto-sensing electrical equipment, especially for battery-powered automatic controlled products.

Specification:

- Voltage: 5V – 20V
- Power Consumption: 65mA
- TTL output: 3.3V, 0V
- Delay time: Adjustable (.3->5min)
- Lock time: 0.2 sec
- Trigger methods: L – disable repeat trigger, H enable repeat trigger
- Sensing range: less than 120 degree, within 7 meters
- Temperature: – 15 ~ +70
- Dimension: 32*24 mm, distance between screw 28mm, M2, Lens dimension in diameter: 23mm

Application:

Automatically sensing light for Floor, bathroom, basement, porch, warehouse, Garage, etc, ventilator, alarm, etc.

Features:

- Automatic induction: to enter the sensing range of the output is high, the person leaves the sensing range of the automatic delay off high, output low.
- Photosensitive control (optional, not factory-set) can be set photosensitive control, day or light intensity without induction.
- Temperature compensation (optional, factory reset): In the summer when the ambient temperature rises to 30 ° C to 32 ° C, the detection distance is slightly shorter, temperature compensation can be used for performance compensation.
- Triggered in two ways: (jumper selectable)
  - non-repeatable trigger: the sensor output high, the delay time is over, the output is automatically changed from high level to low level;
  - repeatable trigger: the sensor output high, the delay period, if there is human activity in its sensing range, the output will always remain high until the people left after the delay will be high level goes low (sensor module detects a time delay period will be automatically extended every human activity, and the starting point for the delay time to the last event of the time).
- With induction blocking time (the default setting: 2.5s blocked time): sensor module after each sensor output (high into low), followed by a blockade set period of time, during this time period sensor does not accept any sensor signal. This feature can be achieved sensor output time “and” blocking time “interval between the work can be applied to interval detection products; This function can inhibit a variety of interference in the process of load switching. (This time can be set at zero seconds – a few tens of seconds).
- Wide operating voltage range: default voltage DC4.5V-20V.
- Micropower consumption: static current <50 microamps, particularly suitable for battery-powered automatic control products.
- Output high signal: easy to achieve docking with the various types of circuit.

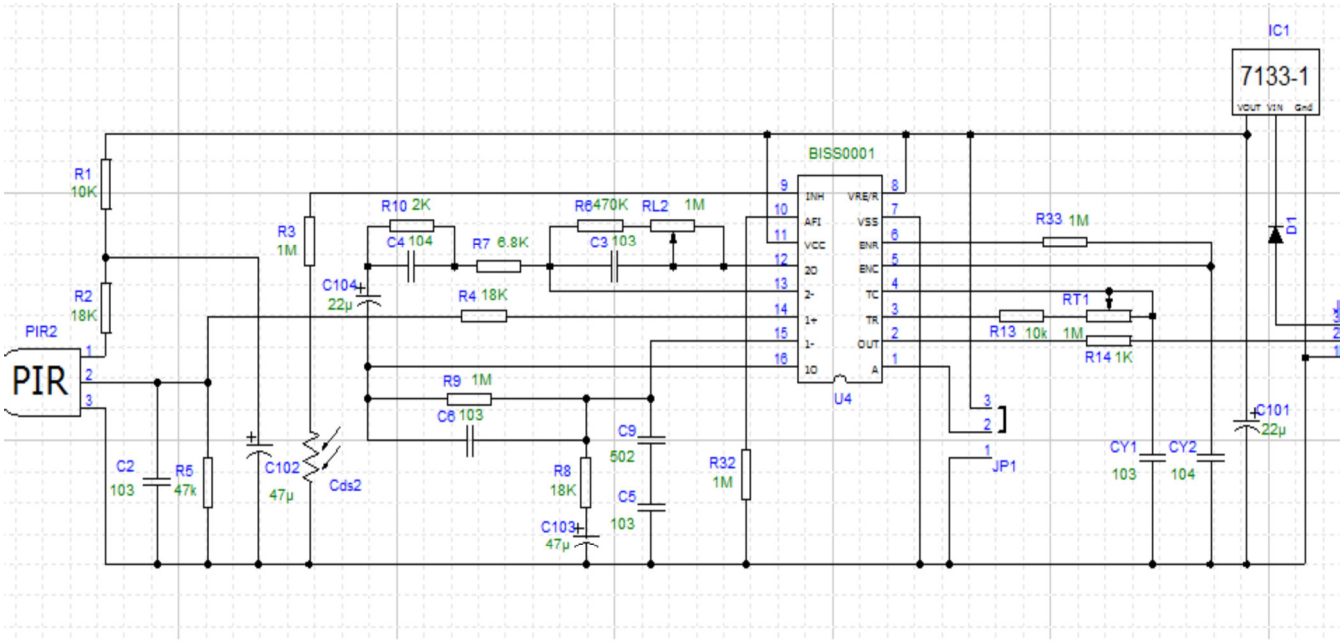
Adjustment:

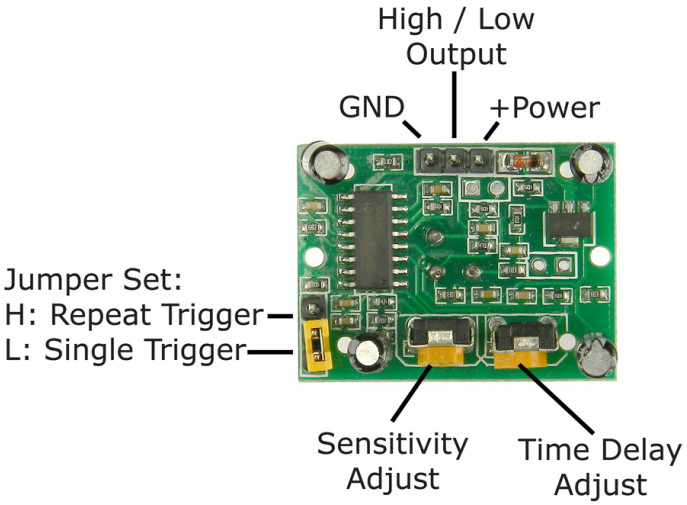
- Adjust the distance potentiometer clockwise rotation, increased sensing distance (about 7 meters), on the contrary, the sensing distance decreases (about 3 meters).
- Adjust the delay potentiometer clockwise rotation sensor the delay lengthened (300S), on the contrary, shorten the induction delay (5S).

Instructions for use:

- Sensor module is powered up after a minute, in this initialization time intervals during this module will output 0-3 times, a minute later enters the standby state.
- Should try to avoid the lights and other sources of interference close direct module surface of the lens, in order to avoid the introduction of interference signal malfunction; environment should avoid the wind flow, the wind will cause interference on the sensor.
- Sensor module with dual probe, the probe window is rectangular, dual (A B) in both ends of the longitudinal direction
  - so when the human body from left to right or right to left through the infrared spectrum to reach dual time, distance difference, the greater the difference, the more sensitive the sensor,
  - when the human body from the front to the probe or from top to bottom or from bottom to top on the direction traveled, double detects changes in the distance of less than infrared spectroscopy, no difference value the sensor insensitive or does not work;
- The dual direction of sensor should be installed parallel as far as possible in inline with human movement. In order to increase the sensor angle range, the module using a circular lens also makes the probe surrounded induction, but the left and right sides still up and down in both directions sensing range, sensitivity, still need to try to install the above requirements.

HC-SR501 PIR MOTION DETECTOR





1 working voltage range :DC 4.5-20V

2 Quiescent Current :50uA

3 high output level 3.3 V / Low 0V

4. Trigger L trigger can not be repeated / H repeated trigger

5. circuit board dimensions :32 * 24 mm

6. maximum 110 ° angle sensor

7. 7 m maximum sensing distance

Product Type	HC--SR501 Body Sensor Module
Operating Voltage Range	5-20VDC
Quiescent Current	<50uA
Level output	High 3.3 V /Low 0V
Trigger	L can not be repeated trigger/H can be repeated trigger(Default repeated trigger)
Delay time	5-300S(adjustable) Range (approximately .3Sec -5Min)
Block time	2.5S(default)Can be made a range(0.xx to tens of seconds
Board Dimensions	32mm*24mm
Angle Sensor	<110 ° cone angle
Operation Temp.	-15-+70 degrees
Lens size sensor	Diameter:23mm(Default)

Application scope
•Security products
•Body induction toys
•Body induction lamps
•Industrial automation control etc
Pyroelectric infrared switch is a passive infrared switch which consists of BISS0001 ,pyroelectric infrared sensors and a few external components. It can au
open all kinds of equipments, inculding incandescent lamp, fluorescent lamp, intercom, automatic, electric fan, dryer and automatic washing machine, etc.
It is widely used in enterprises, hotels, stores, and corridor and other sensitive area for automatical lamplight, lighting and alarm system.

Instructions

Induction module needs a minute or so to initialize. During initializing time, it will output 0-3 times. One minute later it comes into standby.
Keep the surface of the lens from close lighting source and wind, which will introduce interference.
Induction module has double -probe whose window is rectangle. The two sub-probe (A and B) is located at the two ends of rectangle. When human body r
to right, or from right to left, Time for IR to reach to reach the two sub-probes differs.The lager the time diffference is, the more sensitive this module is. Wh
body moves face-to probe, or up to down, or down to up, there is no time difference. So it does not work. So instal the module in the direction in which mos
activities behaves, to guarantee the induction of human by dual sub-probes. In order to increase the induction range, this module uses round lens which ca
from all direction. However, induction from right or left is more sensitivity than from up or down.

TECHNICAL DATA MQ-3 GAS SENSOR

FEATURES

* High sensitivity to alcohol and small sensitivity to Benzine .
* Fast response and High sensitivity
* Stable and long life
* Simple drive circuit

APPLICATION

They are suitable for alcohol checker, Breathalyser.

SPECIFICATIONS

A. Standard work condition

Symbol	Parameter name	Technical condition	Remarks
Vc	Circuit voltage	5V±0.1	AC OR DC
V_H	Heating voltage	5V±0.1	ACOR DC
R_L	Load resistance	200KΩ	
R_H	Heater resistance	33Ω ±5%	Room Tem
P_H	Heating consumption	less than 750mw	

B. Environment condition

Symbol	Parameter name	Technical condition	Remarks
Tao	Using Tem	-10℃-50℃	
Tas	Storage Tem	-20℃-70℃	
R_H	Related humidity	less than 95%Rh	
O_2	Oxygen concentration	21%(standard condition)Oxygen concentration can affect sensitivity	minimum value is over 2%

C. Sensitivity characteristic

Symbol	Parameter name	Technical parameter	Remarks
Rs	Sensing Resistance	1MΩ - 8 MΩ (0.4mg/L alcohol)	Detecting concentration scope: 0.05mg/L—10mg/L Alcohol
α (0.4/1 mg/L)	Concentration slope rate	≤0.6	
Standard detecting condition	Temp: 20℃±2℃ Humidity: 65%±5%	Vc:5V±0.1 Vh: 5V±0.1	
Preheat time	Over 24 hour		

D. Structure and configuration, basic measuring circuit

	Parts	Materials
1	Gas sensing layer	SnO_2
2	Electrode	Au
3	Electrode line	Pt
4	Heater coil	Ni-Cr alloy
5	Tubular ceramic	Al_2O_3
6	Anti-explosion network	Stainless steel gauze (SUS316 100-mesh)
7	Clamp ring	Copper plating Ni
8	Resin base	Bakelite
9	Tube Pin	Copper plating Ni

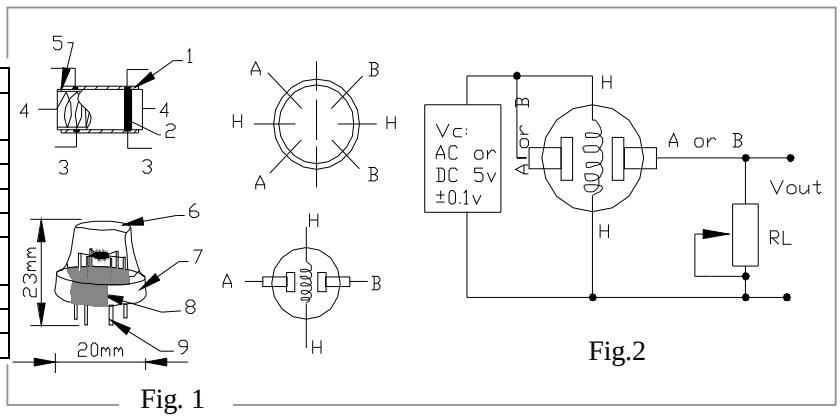
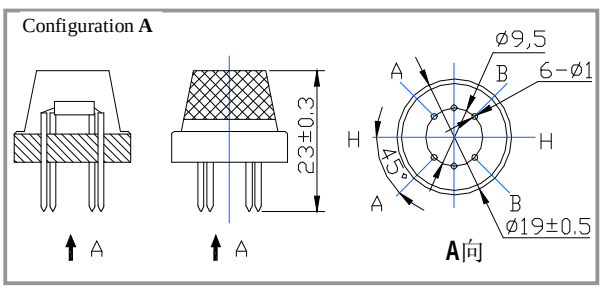
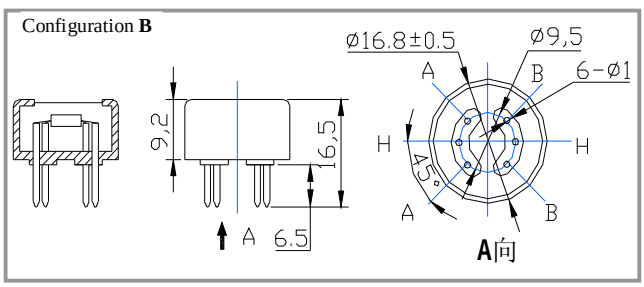


Fig. 1 Fig.2





Structure and configuration of MQ-3 gas sensor is shown as Fig. 1 (Configuration A or B), sensor composed by micro AL_2O_3 ceramic tube, Tin Dioxide (SnO_2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-3 have 6 pin ,4 of them are used to fetch signals, and other 2 are used for providing heating current.

Electric parameter measurement circuit is shown as Fig.2

E. Sensitivity characteristic curve

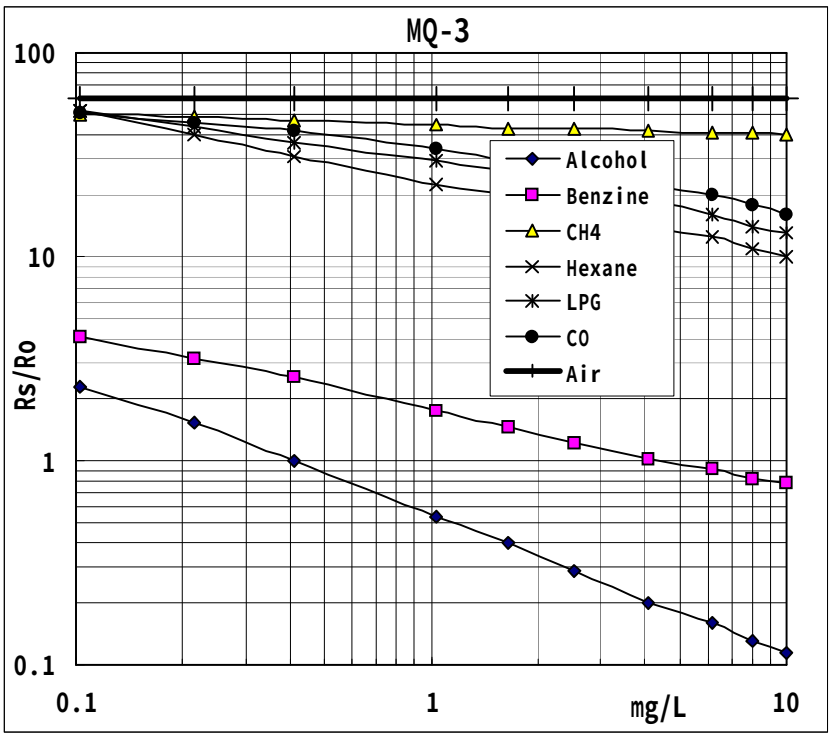


Fig.2 sensitivity characteristics of the MQ-3

Fig.3 is shows the typical sensitivity characteristics of the MQ-3 for several gases.
in their: Temp: 20℃、
Humidity: 65%、
O_2 concentration 21%
RL=200kΩ
Ro: sensor resistance at 0.4mg/L of Alcohol in the clean air.
Rs:sensor resistance at various concentrations of gases.

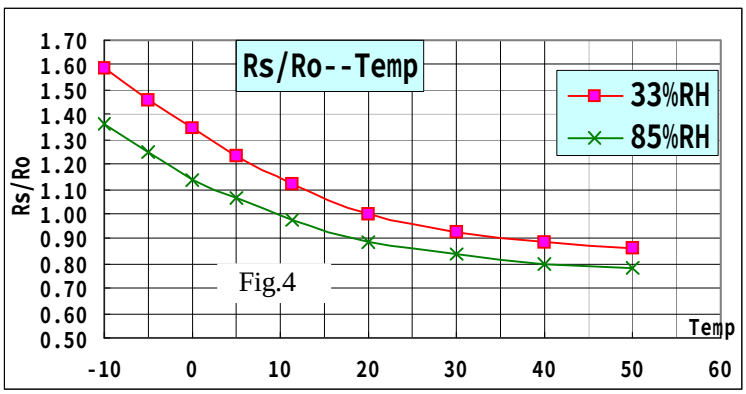


Fig.4

Fig.4 is shows the typical dependence of the MQ-3 on temperature and humidity.
Ro: sensor resistance at 0.4mg/L of Alcohol in air at 33%RH and 20 ℃
Rs: sensor resistance at 0.4mg/L of Alcohol at different temperatures and humidities.

SENSITVITY ADJUSTMENT

Resistance value of MQ-3 is difference to various kinds and various concentration gases. So,When using this components, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 0.4mg/L (approximately 200ppm) of Alcohol concentration in air and use value of Load resistancethat(R_L) about 200 KΩ (100KΩ to 470 KΩ).

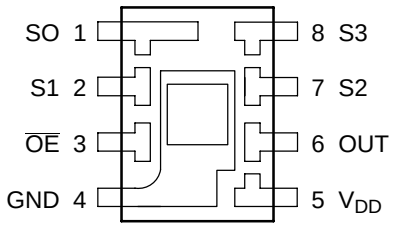
When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

TCS230
PROGRAMMABLE
COLOR LIGHT-TO-FREQUENCY CONVERTER

TAOS046 - FEBRUARY 2003

- **High-Resolution Conversion of Light Intensity to Frequency**
- **Programmable Color and Full-Scale Output Frequency**
- **Communicates Directly With a Microcontroller**
- **Single-Supply Operation (2.7 V to 5.5 V)**
- **Power Down Feature**
- **Nonlinearity Error Typically 0.2% at 50 kHz**
- **Stable 200 ppm/°C Temperature Coefficient**
- **Low-Profile Surface-Mount Package**

SOIC PACKAGE
(TOP VIEW)

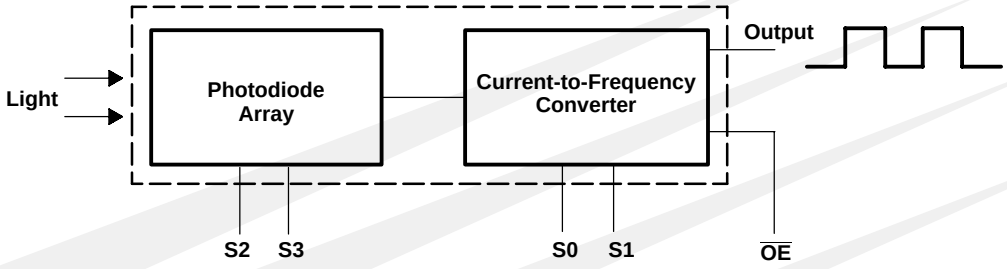


Description

The TCS230 programmable color light-to-frequency converter combines configurable silicon photodiodes and a current-to-frequency converter on single monolithic CMOS integrated circuit. The output is a square wave (50% duty cycle) with frequency directly proportional to light intensity (irradiance). The full-scale output frequency can be scaled by one of three preset values via two control input pins. Digital inputs and digital output allow direct interface to a microcontroller or other logic circuitry. Output enable ($\overline{OE}$) places the output in the high-impedance state for multiple-unit sharing of a microcontroller input line.

The light-to-frequency converter reads an 8 x 8 array of photodiodes. Sixteen photodiodes have blue filters, 16 photodiodes have green filters, 16 photodiodes have red filters, and 16 photodiodes are clear with no filters. The four types (colors) of photodiodes are interdigitated to minimize the effect of non-uniformity of incident irradiance. All 16 photodiodes of the same color are connected in parallel and which type of photodiode the device uses during operation is pin-selectable. Photodiodes are 120 µm x 120 µm in size and are on 144-µm centers.

Functional Block Diagram



Texas Advanced Optoelectronic Solutions Inc.
800 Jupiter Road, Suite 205 • Plano, TX 75074 • (972) 673-0759
www.taosinc.com

Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
GND	4		Power supply ground. All voltages are referenced to GND.
$\overline{OE}$	3	I	Enable for f_o (active low).
OUT	6	O	Output frequency (f_o).
S0, S1	1, 2	I	Output frequency scaling selection inputs.
S2, S3	7, 8	I	Photodiode type selection inputs.
V_{DD}	5		Supply voltage

Table 1. Selectable Options

S0	S1	OUTPUT FREQUENCY SCALING (f_o)		S2	S3	PHOTODIODE TYPE
L	L	Power down		L	L	Red
L	H	2%		L	H	Blue
H	L	20%		H	L	Clear (no filter)
H	H	100%		H	H	Green

Available Options

DEVICE	T_A	PACKAGE - LEADS	PACKAGE DESIGNATOR	ORDERING NUMBER
TCS230	- 25°C to 85° C	SOIC-8	D	TCS230D

Absolute Maximum Ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V_{DD} (see Note 1) . . . . . 6 V
Input voltage range, all inputs, V_I . . . . . - 0.3 V to V_{DD} + 0.3 V
Operating free-air temperature range, T_A . . . . . 0°C to 70°C
Storage temperature range . . . . . - 25°C to 85°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values are with respect to GND.

Recommended Operating Conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{DD}		2.7	5	5.5	V
High-level input voltage, V_{IH}	V_{DD} = 2.7 V to 5.5 V	2		V_{DD}	V
Low-level input voltage, V_{IL}	V_{DD} = 2.7 V to 5.5 V	0		0.8	V
Operating free-air temperature range, T_A		0		70	°C

Electrical Characteristics at T_A = 25°C, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	I_{OH} = -4 mA	4	4.5		V
V_{OL}	Low-level output voltage	I_{OL} = 4 mA		0.25	0.40	V
I_{IH}	High-level input current				5	µA
I_{IL}	Low-level input current				5	µA
I_{DD}	Supply current	Power-on mode		2	3	mA
		Power-down mode		7	15	µA
	Full-scale frequency (See Note 2)	S0 = H, S1 = H	500	600		kHz
		S0 = H, S1 = L	100	120		kHz
		S0 = L, S1 = H	10	12		kHz
	Temperature coefficient of output frequency	$\lambda \leq$ 700 nm, -25°C $\leq T_A \leq$ 70°C		±200		ppm/°C
k_{SVS}	Supply voltage sensitivity	V_{DD} = 5 V ±10%		±0.5		%/V

NOTE 2: Full-scale frequency is the maximum operating frequency of the device without saturation.

Operating Characteristics at V_{DD} = 5 V, T_A = 25°C, S0 = H, S1 = H (unless otherwise noted) (See Notes 3, 4, 5, 6, and 7).

PARAMETER		TEST CONDITIONS	CLEAR PHOTODIODE S2 = H, S3 = L			BLUE PHOTODIODE S2 = L, S3 = H			GREEN PHOTODIODE S2 = H, S3 = H			RED PHOTODIODE S2 = L, S3 = L			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
f_O	Output frequency	E_e = 45.6 µW/cm^2, λ_p = 470 nm	16	20	24	11.2	16.4	21.6							kHz
		E_e = 39.2 µW/cm^2, λ_p = 524 nm	16	20	24				8	13.6	19.2				kHz
		E_e = 32.8 µW/cm^2, λ_p = 635 nm	16	20	24							14	19	24	kHz
		E_e = 0		2	12		2	12		2	12		2	12	Hz
R_e	Irradiance responsivity (Note 8)	λ_p = 470 nm		439			360			88			31		Hz/ (µW/ cm^2)
		λ_p = 524 nm		510			189			347			46		
		λ_p = 565 nm		548			49			318			110		
		λ_p = 635 nm		610			30			37			579		
	Saturation Irradiance (Note 9)	λ_p = 470 nm		1370			1670								µW/ cm^2
		λ_p = 524 nm		1180						1730					
		λ_p = 565 nm		1090						1890					
		λ_p = 635 nm		980									1040		
R_v	Illuminance responsivity (Note 10)	λ_p = 470 nm		585			480			117			41		Hz/ lx
		λ_p = 524 nm		98			36			67			9		
		λ_p = 565 nm		92			8			53			18		
		λ_p = 635 nm		407			20			25			386		
	Nonlinearity (Note 11)	f_O = 0 to 5 kHz		±0.1 %			±0.1 %			±0.1 %			±0.1 %		% F.S.
		f_O = 0 to 50 kHz		±0.2 %			±0.2 %			±0.2 %			±0.2 %		% F.S.
		f_O = 0 to 500 kHz		±0.5 %			±0.5 %			±0.5 %			±0.5 %		% F.S.
	Recovery from power down			100			100			100			100		µs
	Response time to output enable ($\overline{OE}$)			100			100			100			100		ns

NOTES: 3. Optical measurements are made using small-angle incident radiation from a light-emitting diode (LED) optical source.
4. The 470 nm input irradiance is supplied by an InGaN light-emitting diode with the following characteristics: peak wavelength λ_p = 470 nm, spectral halfwidth $\Delta\lambda_{1/2}$ = 35 nm, and luminous efficacy = 75 lm/W.
5. The 524 nm input irradiance is supplied by an InGaN light-emitting diode with the following characteristics: peak wavelength λ_p = 524 nm, spectral halfwidth $\Delta\lambda_{1/2}$ = 47 nm, and luminous efficacy = 520 lm/W.
6. The 565 nm input irradiance is supplied by a GaP light-emitting diode with the following characteristics: peak wavelength λ_p = 565 nm, spectral halfwidth $\Delta\lambda_{1/2}$ = 28 nm, and luminous efficacy = 595 lm/W.
7. The 635 nm input irradiance is supplied by a AlInGaP light-emitting diode with the following characteristics: peak wavelength λ_p = 635 nm, spectral halfwidth $\Delta\lambda_{1/2}$ = 17 nm, and luminous efficacy = 150 lm/W.
8. Irradiance responsivity R_e is characterized over the range from zero to 5 kHz.
9. Saturation irradiance = (full-scale frequency)/(irradiance responsivity).
10. Illuminance responsivity Rv is calculated from the irradiance responsivity by using the LED luminous efficacy values stated in notes 4, 5, and 6 and using 1 lx = 1 lm/m^2.
11. Nonlinearity is defined as the deviation of f_O from a straight line between zero and full scale, expressed as a percent of full scale.

TYPICAL CHARACTERISTICS

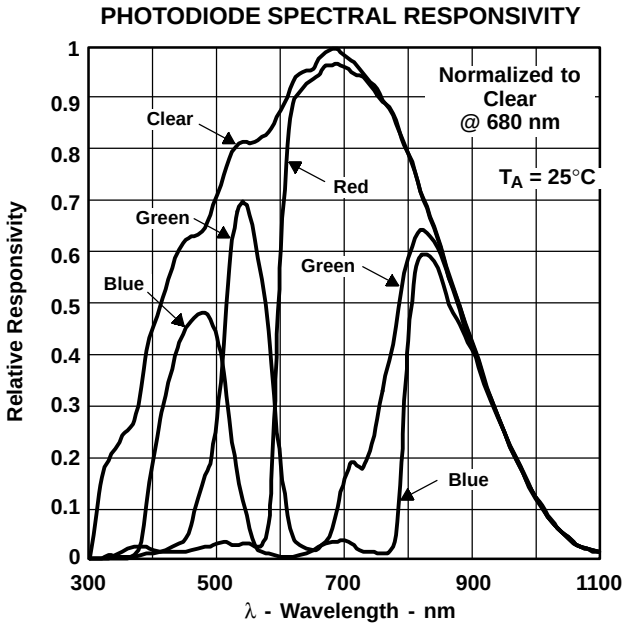


Figure 1

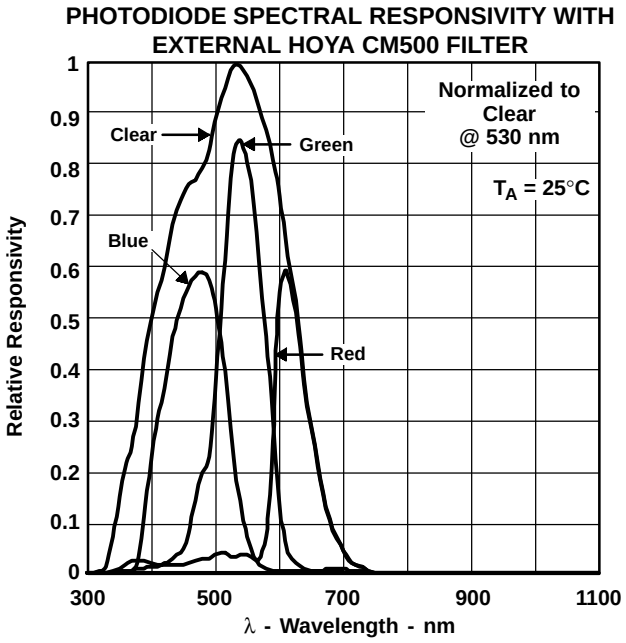


Figure 2

APPLICATION INFORMATION

Power supply considerations

Power-supply lines must be decoupled by a 0.01-μF to 0.1-μF capacitor with short leads mounted close to the device package.

Input interface

A low-impedance electrical connection between the device $\overline{OE}$ pin and the device GND pin is required for improved noise immunity.

Output interface

The output of the device is designed to drive a standard TTL or CMOS logic input over short distances. If lines greater than 12 inches are used on the output, a buffer or line driver is recommended.

Photodiode type (color) selection

The type of photodiode (blue, green, red, or clear) used by the device is controlled by two logic inputs, S2 and S3 (see Table 1).

Output frequency scaling

Output-frequency scaling is controlled by two logic inputs, S0 and S1. The internal light-to-frequency converter generates a fixed-pulsewidth pulse train. Scaling is accomplished by internally connecting the pulse-train output of the converter to a series of frequency dividers. Divided outputs are 50%-duty cycle square waves with relative frequency values of 100%, 20%, and 2%. Because division of the output frequency is accomplished by counting pulses of the principal internal frequency, the final-output period represents an average of the multiple periods of the principle frequency.

The output-scaling counter registers are cleared upon the next pulse of the principal frequency after any transition of the S0, S1, S2, S3, and $\overline{OE}$ lines. The output goes high upon the next subsequent pulse of the principal frequency, beginning a new valid period. This minimizes the time delay between a change on the input lines and the resulting new output period. The response time to an input programming change or to an irradiance step change is one period of new frequency plus 1 μS. The scaled output changes both the full-scale frequency and the dark frequency by the selected scale factor.

The frequency-scaling function allows the output range to be optimized for a variety of measurement techniques. The scaled-down outputs may be used where only a slower frequency counter is available, such as low-cost microcontroller, or where period measurement techniques are used.

Measuring the frequency

The choice of interface and measurement technique depends on the desired resolution and data acquisition rate. For maximum data-acquisition rate, period-measurement techniques are used.

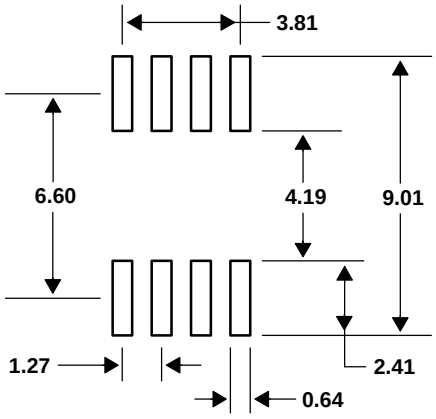
Output data can be collected at a rate of twice the output frequency or one data point every microsecond for full-scale output. Period measurement requires the use of a fast reference clock with available resolution directly related to reference clock rate. Output scaling can be used to increase the resolution for a given clock rate or to maximize resolution as the light input changes. Period measurement is used to measure rapidly varying light levels or to make a very fast measurement of a constant light source.

Maximum resolution and accuracy may be obtained using frequency-measurement, pulse-accumulation, or integration techniques. Frequency measurements provide the added benefit of averaging out random- or high-frequency variations (jitter) resulting from noise in the light signal. Resolution is limited mainly by available counter registers and allowable measurement time. Frequency measurement is well suited for slowly varying or constant light levels and for reading average light levels over short periods of time. Integration (the accumulation of pulses over a very long period of time) can be used to measure exposure, the amount of light present in an area over a given time period.

APPLICATION INFORMATION

PCB pad layout

Suggested PCB pad layout guidelines for the D package are shown in Figure 3.

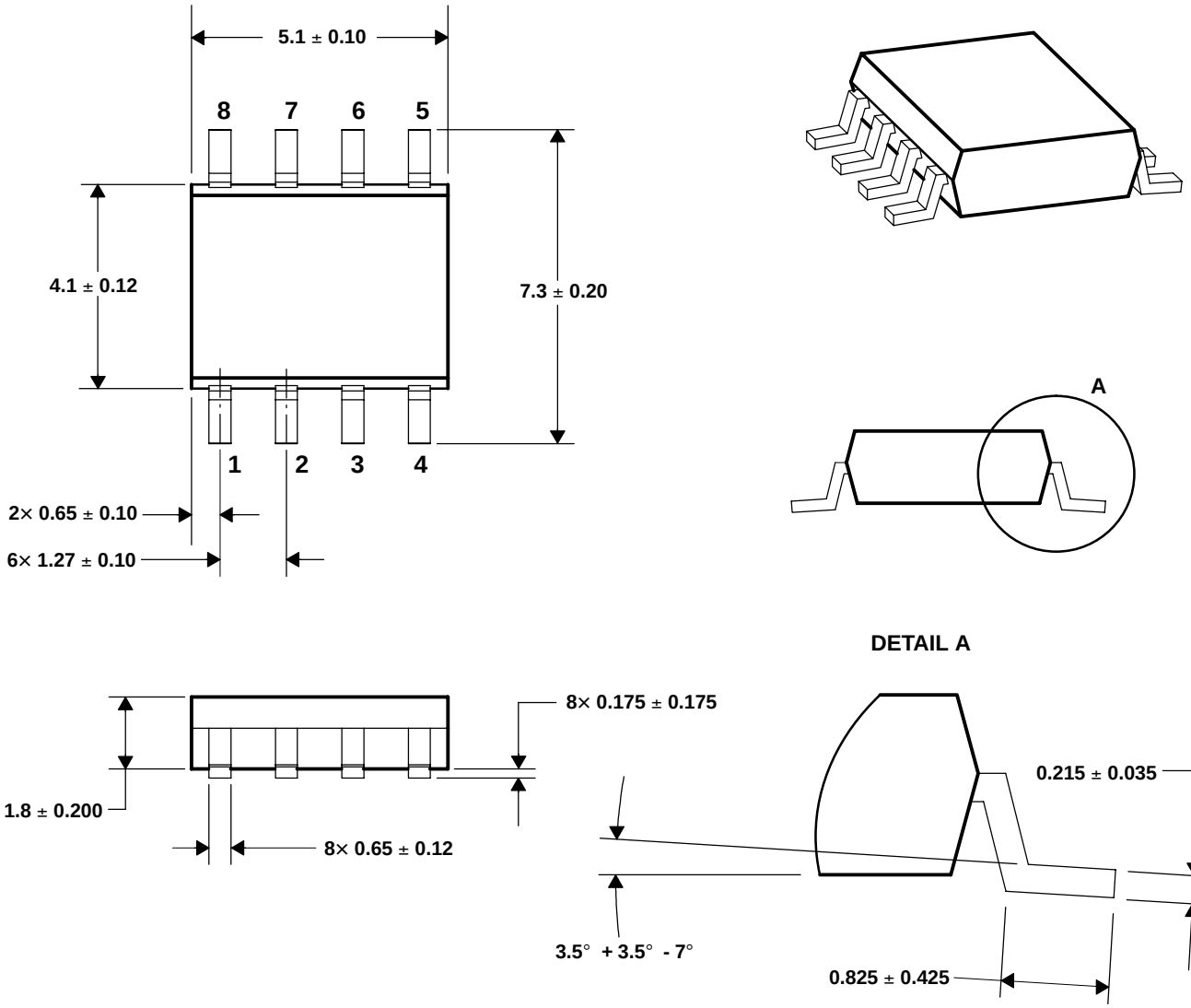


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

Figure 3. Suggested *D* Package PCB Layout

MECHANICAL INFORMATION

PACKAGE D **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. Package is molded with an electrically nonconductive clear plastic compound having an index of refraction of 1.55.
C. Actual product will vary within the mechanical tolerances shown on this specification. Designs for use of this product MUST allow for the data sheet tolerances.
D. Pin 4 (GND) is mechanically connected to the die mount pad.
E. The 8 × 8 photodiode array area is 1.15 mm × 1.15 mm (1.33 sq. mm).
F. This drawing is subject to change without notice.

Figure 4. TCS230 Mechanical Specifications

PRODUCTION DATA — information in this document is current at publication date. Products conform to specifications in accordance with the terms of Texas Advanced Optoelectronic Solutions, Inc. standard warranty. Production processing does not necessarily include testing of all parameters.

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Ultrasonic Ranging Module HC - SR04

Product features:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:
(1) Using IO trigger for at least 10us high level signal,
(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
(3) IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning.
Test distance = (high level time×velocity of sound (340M/S) / 2,

Wire connecting direct as following:

- 5V Supply
- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground

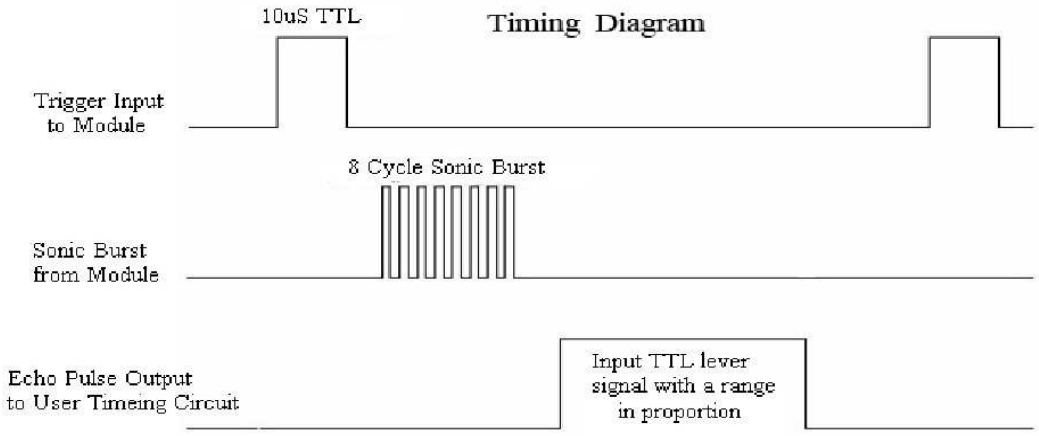
Electric Parameter

Working Voltage	**DC 5 V**
Working Current	**15mA**
Working Frequency	**40Hz**
Max Range	**4m**
Min Range	**2cm**
MeasuringAngle	**15 degree**
Trigger Input Signal	**10uS TTL pulse**
Echo Output Signal	**Input TTL lever signal and the range in proportion**
Dimension	**45*20*15mm**

Vcc Trig Echo GND

Timing diagram

The Timing diagram is shown below. You only need to supply a short 10uS pulse to the trigger input to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. The Echo is a distance object that is pulse width and the range in proportion .You can calculate the range through the time interval between sending trigger signal and receiving echo signal. Formula: uS / 58 = centimeters or uS / 148 =inch; or: the range = high level time * velocity (340M/S) / 2; we suggest to use over 60ms measurement cycle, in order to prevent trigger signal to the echo signal.



Attention:

- The module is not suggested to connect directly to electric, if connected electric, the GND terminal should be connected the module first, otherwise, it will affect the normal work of the module.
- When tested objects, the range of area is not less than 0.5 square meters and the plane requests as smooth as possible, otherwise ,it will affect the results of measuring.

EINSTRONIC
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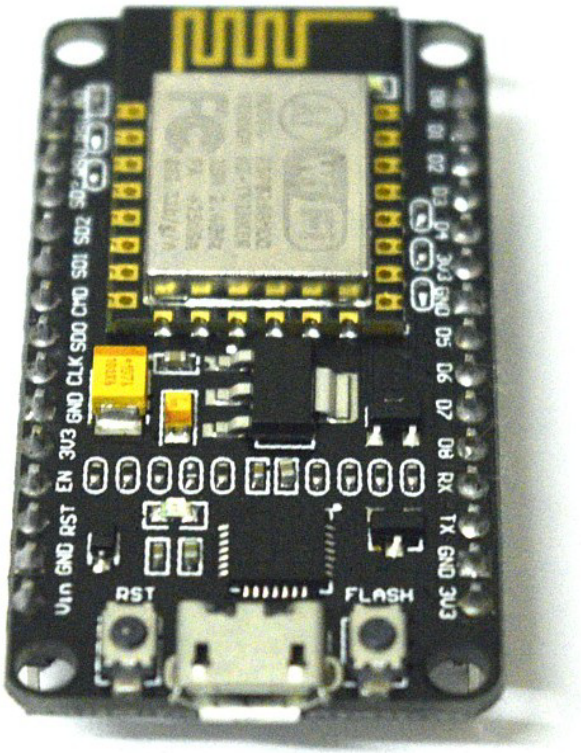
INTRODUCTION TO

NodeMCU ESP8266

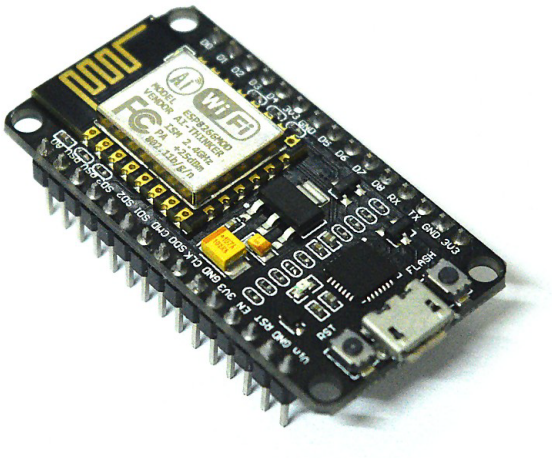
DEVKIT v1.0 **JULY 2017**



www.einstronic.com

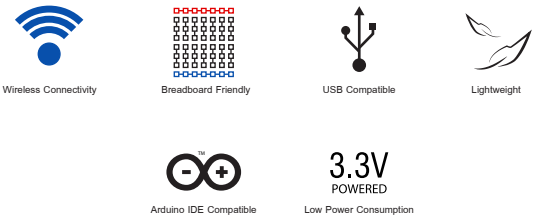
NodeMCU ESP8266 ESP-12E WiFi Development Board

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term “NodeMCU” by default refers to the firmware rather than the DevKit. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.



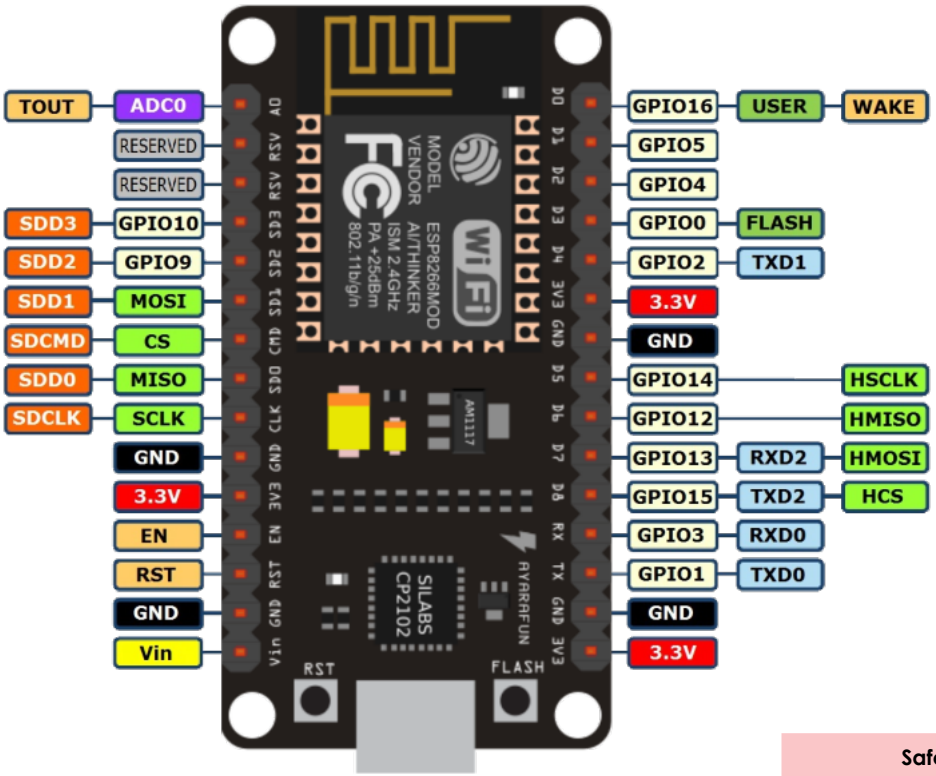
Features

- Version : DevKit v1.0
- Breadboard Friendly
- Light Weight and small size.
- 3.3V operated, can be USB powered.
- Uses wireless protocol 802.11b/g/n.
- Built-in wireless connectivity capabilities.
- Built-in PCB antenna on the ESP-12E chip.
- Capable of PWM, I2C, SPI, UART, 1-wire, 1 analog pin.
- Uses CP2102 USB Serial Communication interface module.
- Arduino IDE compatible (extension board manager required).
- Supports Lua (alike node.js) and Arduino C programming language.



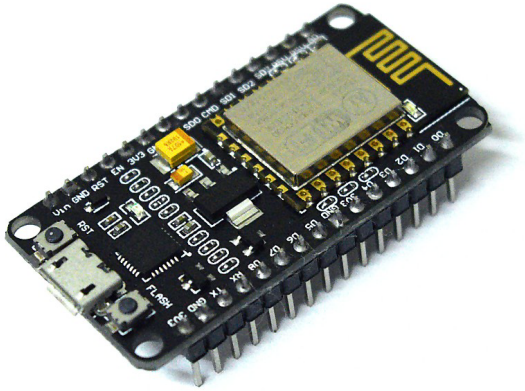
PINOUT DIAGRAM

NodeMCU ESP8266 v1.0

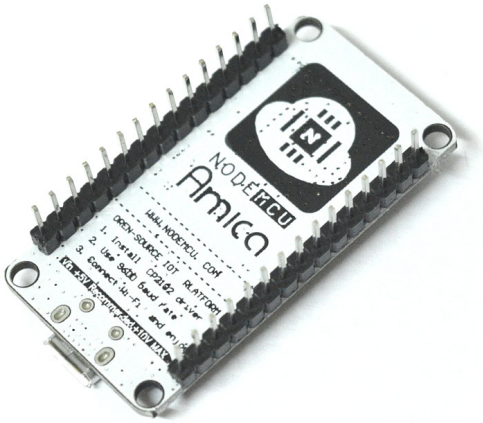


Source
https://iotbytes.wordpress.com/nodemcu-pinout/

Safety Precaution
All GPIO runs at 3.3V !!



Front View



Front View

Specifications of ESP-12E WiFi Module

Wireless Standard	IEEE 802.11 b/g/n
Frequency Range	2.412 - 2.484 GHz
Power Transmission	802.11b : +16 ± 2 dBm (at 11 Mbps) 802.11g : +14 ± 2 dBm (at 54 Mbps) 802.11n : +13 ± 2 dBM (at HT20, MCS7)
Receiving Sensitivity	802.11b : -93 dBm (at 11 Mbps, CCK) 802.11g : -85 dBm (at 54 Mbps, OFDM) 802.11n : -82 dBm (at HT20, MCS7)
Wireless Form	On-board PCB Antenna
IO Capability	UART, I2C, PWM, GPIO, 1 ADC
Electrical Characteristic	3.3 V Operated 15 mA output current per GPIO pin 12 - 200 mA working current Less than 200 uA standby current
Operating Temperature	-40 to +125 ºC
Serial Transmission	110 - 921600 bps, TCP Client 5
Wireless Network Type	STA / AP / STA + AP
Security Type	WEP / WPA-PSK / WPA2-PSK
Encryption Type	WEP64 / WEP128 / TKIP / AES
Firmware Upgrade	Local Serial Port, OTA Remote Upgrade
Network Protocol	IPv4, TCP / UDP / FTP / HTTP
User Configuration	AT + Order Set, Web Android / iOS, Smart Link APP

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Related Sites

NodeMCU official site
http://nodemcu.com/index_en.html

NodeMCU Documentation
https://nodemcu.readthedocs.io/en/master/

NodeMCU Firmware (GitHub)
https://github.com/nodemcu/nodemcu-firmware

Project tagged with NodeMCU, HACKADAY.IO
https://hackaday.io/projects?tag=NodeMCU

ESP8266 Getting started, by ACROBOTIC industries
http://learn.acrobotic.com/tutorials/post/esp8266-getting-started

Quick Start to Nodemcu (ESP8266) on Arduino IDE
by Magesh Jayakumar
http://www.instructables.com/id/Quick-Start-to-Nodemcu-ESP8266-on-Arduino-IDE/

GETTING STARTED WITH PLATFORMIO AND ESP8266 NODEMCU
by Brandon Cannaday
https://www.losant.com/blog/getting-started-with-platformio-esp8266-nodemcu

Programming ESP8266 ESP-12E NodeMCU V1.0 With Arduino IDE
Into Wireless Temperature Logger
by Shin Teo
http://www.instructables.com/id/ESP8266-NodeMCU-v10-ESP12-E-with-Arduino-IDE/

For more details, we can be reached at the addresses below.
Terms & Condition apply.

CONTACT INFORMATION

www.einstronic.com
010 - 2181014 (Henry - Owner)
einstronics@gmail.com
facebook.com/einstronic

V380 IP Camera User Manual

1. Download the APP “V380”, install and register.

Register an account by phone number or Email. We recommend using mobile phone registration, sometimes the mailbox can not receive verification information.

2. Add and Delete a New Device

1). Add a new device
Press "+" to add a new device. V380 helps new starters to connect the camera to WIFI easily. Power on the new camera, enter WIFI SSID & password (the same WIFI as your smartphone has connectedto). Wait for connection.

After hearing a ding sound from the camera, its net indicator lightturns on. The camera connects to WIFI successfully.

Name the camera whatever you like, for example “V380123”, enter its password”123456” (default). Press. The camera is online.

2). Add a new device by QR code.
More →Add camera by QR Code →Enter WIFI SSID & password →Next, a QR
Code emerges, scan the QR code →Heard, wait for connection → Connected
(NET indicator light on), enter the password of the camera(default 123456)
→Save the device→It is online.

3). Manual Add
This is used to add a new camera that is already on line. (Which means the camera has already been connected

to WIFI, and you know the ID and password of the camera .)

4). Delete a device
Android - - - - - - Long - press the camera that is to be deleted, a prompt comes out, press OK.
IOS - - - - - - Choose the camera , slide to left to delete.

3. Live - view and its settings

Click to live view
Attention: Position preset is a very practical function.
【DO NOT hand-rotate the head of the camera!!】
Rotate the camera on phone app to the place you want ,then press button 1, press OK. A camera can support 5 positions preset.

4. Alarm Settings

1). Defence Area Learn code with other alarm detectors The camera can support max. 64 channels of wireless alarm detectors. All the external detectors must learn code with the camera before normal use.
For example, to set up a door sensor as the first detector of the hall, choose the hall, click button “1”, press“OK” to code. Trigger the door sensor, the camera will remember the code and learning is successful. There is a blue left to button “1”. Binding preset can be done here. Press “OK” and make the doors ensor in position 1. It means the door sensor is set to be in position 1 preset.
2). Alarm Settings
3). Alarm pushing settings
4). If you set the right alarm pushing but can not receive alarm messages, try to check here.
Set alarm in terval (default 10s)。Check if you blo cked the camera. If yes, just delete it, then you can receive alarm messages.

5. Record Settings

Plug in the SD card when the camera is power off. Normally the SD card is with capacity 8-32GB, max 128GB (If the SD card capacity is above 32GB, please format the SD card on PC as FAT32 first.) SD card in and working well------ record indicator lights on Recording ------record indicator flickers.

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Project Work Review RUBRICS

Continuous Internal Evaluation (CIE) - 100 Marks				
Review-1 Evaluation Criteria (25 Marks)				
	Total Marks	**Good**	**Average**	**Poor**
1.Project Understanding	5	4 to 5 Marks	3 Marks	0 to 2 Marks
2'Presentation	5	4 to 5 Marks	3 Marks	0 to 2 Marks
3.Progress Made	5	4 to 5 Marks	3 Marks	0 to 2 Marks
4. Literature Survey	5	4 to 5 Marks	3 Marks	0 to 2 Marks
5. Punctuality	5	4 to 5 Marks	3 Marks	0 to 2 Marks
Review-2 Evaluation Criteria (25 Marks)				
Review-2 Items	**Total Marks**	**Good**	**Average**	**Poor**
1.Presentation	5	4 to 5 Marks	3 Marks	0 to 2 Marks
2.Progress Made	5	4 to 5 Marks	3 Marks	0 to 2 Marks
3.Chapter status in Project Report	5	4 to 5 Marks	3 Marks	0 to 2 Marks
4.Literature Survey completed paper	5	4 to 5 Marks	3 Marks	0 to 2 Marks
5. Punctuality	5	4 to 5 Marks	3 Marks	0 to 2 Marks
Review-3 Evaluation Criteria (50 Marks)				
Review-3 Items	**Total Marks**	**Good**	**Average**	**Poor**
1. Presentation	5	4 to 5 Marks	3 Marks	0 to 2 Marks
2.Project Completion	10	8 to 10 Marks	5 to 7 Marks	0 to 4 Marks
3.Implementation paper status	5	4 to 5 Marks	3 Marks	0 to 2 Marks
4. Punctuality	5	4 to 5 Marks	3 Marks	0 to 2 Marks
5 . Project Report Completion	25	16 to 25 Marks	11-15 Marks	0 to 10 Marks

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Dept. of Electronics & Communication Engg
K.S. Institute of Technology
Bengaluru - 560 109

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGG.

8th SEMESTER PROJECT REVIEW - 1

2018-19

Project Group No	17
Project Title	IOT Based Camouflage Army Robot
Guide Name	Dr. P N Sudha

Sl No	USN	Student Name	5 Project Understanding(5)	5 Presentation(5)	5 Progress Made(5)	5 Literature Survey(5)	5 Punctuality(5)	Total (25)
1	1KS15EC094	SKANDA H N	4	5	5	5	5	24
2	1KS15EC095	SMITHA S KARANTH	5	5	5	5	4	24
3	1KS15EC100	SUVIJITH S	5	5	4	5	5	24
4	1KS15EC101	SWATHI K S	5	4	5	5	5	24

Evaluator Name **Mr.Saleem.S**evaramani SST

Project Coordin **Dr. B Sudarshan**
Mrs. Lakshmi H R

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2	1KS15EC095	SMITHA S KARANTH	5	4	5	5	5	24
3	1KS15EC100	SUVIJITH S	5	5	5	5	5	24
4	1KS15EC101	SWATHI K S	5	4	5	5	5	24

Evaluator Name **Mr.Santhosh Kumar.B.R**

Project Coordin **Dr. B Sudarshan**
Mrs. Lakshmi H R

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2	1KS15EC095	SMITHA S KARANTH	4	5	5	5	5	24
3	1KS15EC100	SUVIJITH S	5	4	5	5	5	24
4	1KS15EC101	SWATHI K S	5	5	5	5	5	24

Evaluator Name **Dr.P.N.Sudha**

Project Coordin **Dr. B Sudarshan**
Mrs. Lakshmi H R

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8th SEMESTER PROJECT REVIEW - 2
2018-19

Project Group No	17
Project Title	IOT Based Camouflage Army Robot
Guide Name	Dr. P N Sudha

			Presentation(5)	Progress Made(5)	Chapter Status in Project Report(5)	Literature Survey Completed Paper(5)	Punctuality(5)	Total (25)
1	1KS15EC094	SKANDA H N	5	5	5	5	5	25
2	1KS15EC095	SMITHA S KARANTH	5	5	5	5	4	24
3	1KS15EC100	SUVIJITH S	4	5	5	5	5	24
4	1KS15EC101	SWATHI K S	5	5	5	5	5	25

Evaluator Name **Dr.P.Joy Prabhakaran**

Project Coordinat **Dr. B Sudarshan**
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8th SEMESTER PROJECT REVIEW - 2

2018-19

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Project Title	IOT Based Camouflage Army Robot
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1	1KS15EC094	SKANDA H N	5	5	4	5	5	24
2	1KS15EC095	SMITHA S KARANTH	5	5	5	5	5	25
3	1KS15EC100	SUVIJITH S	5	5	5	5	5	25
4	1KS15EC101	SWATHI K S	5	5	4	5	5	24

Evaluator Name **Dr.P.N.Sudha**

Project Coordinat **Dr. B Sudarshan**
Mrs. Lakshmi H R

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1	1KS15EC094	SKANDA H N	4	5	5	5	5	24
2	1KS15EC095	SMITHA S KARANTH	4	5	5	5	5	24
3	1KS15EC100	SUVIJITH S	5	5	5	5	5	25
4	1KS15EC101	SWATHI K S	5	5	5	5	5	25

Evaluator Name **Dr.Surekha.B**

Project Coordinat **Dr. B Sudarshan**
Mrs. Lakshmi H R

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8th SEMESTER PROJECT REVIEW - 3

2018-19

Project Group No	17
Project Title	IOT Based Camouflage Army Robot
Guide Name	Dr. P N Sudha

			Presentation(5)	Project Completion(10)	Implementation Paper Status(5)	Project Report Completion(25)	Punctuality(5)	Total (50)
1	1KS15EC094	SKANDA H N	4	10	5	25	5	49
2	1KS15EC095	SMITHA S KARANTH	4	10	5	25	5	49
3	1KS15EC100	SUVIJITH S	5	10	5	25	5	50
4	1KS15EC101	SWATHI K S	5	10	5	25	5	50

Evaluator Name **Dr.P.N.Sudha**

Project Coordinat **Dr. B Sudarshan**
Mrs. Lakshmi H R

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8th SEMESTER PROJECT REVIEW - 3

2018-19

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2	1KS15EC095	SMITHA S KARANTH	5	10	5	25	5	50
3	1KS15EC100	SUVIJITH S	5	10	5	25	5	50
4	1KS15EC101	SWATHI K S	5	10	5	25	5	50

Evaluator Name **Mrs.Jayasudha.B.S.K**

Project Coordinat **Dr. B Sudarshan**
Mrs. Lakshmi H R

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2	1KS15EC095	SMITHA S KARANTH	5	10	5	25	5	50
3	1KS15EC100	SUVIJITH S	4	10	5	25	5	49
4	1KS15EC101	SWATHI K S	4	10	5	25	5	49

Evaluator Name **Dr.B.Sudharshan**

Project Coordinat **Dr. B Sudarshan**
Mrs. Lakshmi H R

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Branch : EC Scheme : 2015 Semester : 8

Sl NO.	USN	15EC81	15EC82	15EC833	15EC834	15EC84	15ECP85	15ECS86	STUDENT SIGNATURE
1	1KS14EC106	12	12	13	-	35	80	95	
2	1KS15EC001	15	17	17	-	47	99	97	
3	1KS15EC002	17	19	18	-	46	96	99	
4	1KS15EC003	19	18	16	-	46	99	99	
5	1KS15EC004	17	15	19	-	50	99	98	
6	1KS15EC005	17	17	18	-	50	99	98	
7	1KS15EC006	20	17	20	-	50	97	98	
8	1KS15EC008	19	18	20	-	48	99	99	Ankita A Kaikar
9	1KS15EC009	16	18	19	-	48	99	97	
10	1KS15EC010	20	19	20	-	50	99	98	
11	1KS15EC011	18	16	17	-	47	97	97	
12	1KS15EC012	15	17	17	-	45	99	99	
13	1KS15EC014	16	18	17	-	43	99	98	
14	1KS15EC016	19	17	19	-	44	99	97	
15	1KS15EC017	20	20	20	-	47	99	99	
16	1KS15EC018	12	15	16	-	46	99	97	
17	1KS15EC019	19	17	16	-	46	97	99	
18	1KS15EC020	17	18	-	17	48	99	98	
19	1KS15EC021	19	17	19	-	50	99	98	Chandana.G
20	1KS15EC022	14	15	17	-	45	99	96	
21	1KS15EC023	17	17	18	-	45	99	97	
22	1KS15EC024	20	18	19	-	46	97	97	
23	1KS15EC025	17	18	18	-	43	99	98	
24	1KS15EC027	12	14	14	-	40	97	96	
25	1KS15EC028	16	17	17	-	42	91	96	
26	1KS15EC029	19	17	19	-	43	95	99	
27	1KS15EC030	17	16	17	-	40	96	99	
28	1KS15EC032	17	17	16	-	41	95	96	
29	1KS15EC033	19	16	19	-	44	99	97	
30	1KS15EC034	12	13	14	-	42	99	96	
31	1KS15EC035	20	17	20	-	46	99	99	
32	1KS15EC036	20	17	19	-	48	97	97	
33	1KS15EC037	20	17	20	-	50	99	99	
34	1KS15EC038	16	16	14	-	41	99	96	
35	1KS15EC039	20	18	-	18	49	99	99	

Sl NO.	USN	15EC81	15EC82	15EC833	15EC834	15EC84	15ECP85	15ECS86	STUDENT SIGNATURE
36	1KS15EC040	20	18	19	-	45	99	97	Karya.N.
37	1KS15EC042	17	12	16	-	44	96	96	
38	1KS15EC043	20	18	20	-	47	93	97	K. Rohini
39	1KS15EC044	20	17	17	-	43	93	97	
40	1KS15EC045	15	14	14	-	40	78	96	
41	1KS15EC046	18	17	15	-	48	98	99	Sanjay
42	1KS15EC047	17	17	16	-	43	96	98	
43	1KS15EC048	17	17	19	-	41	93	96	
44	1KS15EC049	19	17	17	-	45	98	97	
45	1KS15EC050	19	18	-	19	49	99	97	Mayankshingh
46	1KS15EC051	16	16	18	-	43	98	97	
47	1KS15EC052	16	16	16	-	46	99	98	Nishashetty
48	1KS15EC053	19	17	-	19	44	99	98	Megha V.
49	1KS15EC054	18	17	17	-	40	98	97	Meghana K V
50	1KS15EC055	13	18	16	-	46	99	97	
51	1KS15EC056	15	17	18	-	48	99	98	
52	1KS15EC057	16	17	16	-	44	98	96	
53	1KS15EC058	17	16	16	-	40	89	95	N. Priya
54	1KS15EC059	14	14	19	-	48	97	96	
55	1KS15EC060	20	15	18	-	39	90	97	
56	1KS15EC061	16	18	16	-	48	99	99	
57	1KS15EC062	17	18	17	-	41	92	97	
58	1KS15EC064	12	14	-	16	45	95	99	
59	1KS15EC065	16	12	17	-	40	90	96	
60	1KS15EC066	20	20	-	20	50	99	98	Pooja M.
61	1KS15EC067	20	19	20	-	50	99	98	Pragathi V.
62	1KS15EC068	17	16	-	18	50	99	98	
63	1KS15EC069	18	18	20	-	46	99	98	
64	1KS15EC070	16	17	-	18	49	99	99	
65	1KS15EC072	17	17	-	17	47	98	97	
66	1KS15EC074	20	20	-	20	50	99	98	
67	1KS15EC076	16	15	17	-	45	93	96	Shreyas N
68	1KS15EC077	20	19	20	-	50	99	99	Rashmi
69	1KS15EC078	17	15	16	-	44	89	95	
70	1KS15EC079	17	18	15	-	45	94	97	
71	1KS15EC080	19	16	17	-	39	98	97	
72	1KS15EC081	13	16	-	14	50	99	97	Saanvi Shastry.
73	1KS15EC082	18	16	-	17	49	99	99	Sangeeta
74	1KS15EC083	16	16	-	17	45	98	97	Sanjana
75	1KS15EC084	15	13	17	-	43	97	96	
76	1KS15EC085	20	20	20	-	50	99	99	Sanjana.
77	1KS15EC086	17	14	-	16	47	99	98	

Sl NO	USN	15EC81	15EC82	15EC833	15EC834	15EC84	15ECP85	15ECS86	STUDENT SIGNATURE
78	1KS15EC087	18	16	-	18	50	99	98	
79	1KS15EC088	16	15	-	16	38	90	96	
80	1KS15EC089	12	12	13	-	42	96	95	
81	1KS15EC090	20	18	-	16	50	97	98	
82	1KS15EC091	16	18	19	-	47	96	98	
83	1KS15EC092	20	20	19	-	46	99	98	
84	1KS15EC093	16	14	19	-	42	92	98	
85	1KS15EC094	20	19	-	20	50	99	99	
86	1KS15EC095	20	19	20	-	50	99	99	
87	1KS15EC096	16	15	17	-	41	99	98	
88	1KS15EC097	17	17	-	18	43	90	96	
89	1KS15EC100	20	19	20	-	50	99	99	
90	1KS15EC101	20	20	20	-	50	99	99	
91	1KS15EC102	14	15	20	-	45	87	98	
92	1KS15EC103	14	12	-	16	42	95	97	
93	1KS15EC104	14	12	14	-	39	96	95	
94	1KS15EC105	12	12	-	12	41	94	96	
95	1KS15EC106	15	17	20	-	43	99	99	
96	1KS15EC107	16	15	-	14	43	99	98	
97	1KS15EC108	18	16	-	18	43	96	98	
98	1KS15EC109	14	13	-	14	42	92	97	
99	1KS16EC400	15	16	18	-	40	87	95	
100	1KS16EC402	14	16	14	-	43	90	95	
101	1KS16EC403	18	16	16	-	43	93	96	
102	1KS16EC405	15	14	14	-	41	94	95	
103	1KS16EC409	20	16	17	-	40	90	96	
104	1KS16EC410	16	13	17	-	41	85	95	
105	1KS16EC411	19	19	16	-	42	94	96	
106	1KS16EC413	20	18	20	-	43	99	96	
107	1KS16EC414	18	16	18	-	43	96	96	
108	1KS16EC415	18	15	15	-	43	90	95	
109	1KS16EC417	19	15	16	-	44	92	96	
110	1KS16EC418	17	17	17	-	43	95	95	
111	1KS16EC420	17	16	18	-	38	99	96	
112	1KS16EC423	15	17	18	-	38	99	95	
113	1KS16EC424	18	14	18	-	39	80	95	
114	1KS16EC426	13	13	17	-	40	90	95	
115	1KS16EC427	16	14	20	-	40	90	95	
116	1KS16EC432	20	20	20	-	48	95	97	
117	1KS16EC433	17	15	20	-	46	99	97	
118	1KS16EC434	14	12	15	-	45	93	96	
119	1KS16EC436	15	13	16	-	40	90	96	

Sl NO.	USN	15EC81	15EC82	15EC833	15EC834	15EC84	15ECP85	15ECS86	STUDENT SIGNATURE
120	1KS16EC439	12	13	17	-	41	94	96	
121	1KS16EC440	16	17	20	-	41	99	97	
--x--	Faculty Signature								----xxxxxxx----

* - values are either optional subjects or the faculty has not yet entered the marks

HOD

Seal and Signature

HEAD OF THE DEPARTMENT
Dept. of Electronics & Communication Engg
K.S. Institute of Technology
Bengaluru - 560 109

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