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Gnana Sangama, Belgaum – 590002, Karnataka

A

Report on the project work titled

"Automatic Segregation of waste using Robotic ARM"

To be undertaken

By

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Certificate

This is to certify that the project work entitled "Automatic Segregation of waste using Robotic ARM" is a bonafide work carried out by Ms. Bhoomika P M, Ms. Sonika V, Ms. Suma B S and Ms. Vismitha Sonna Sathyanarayana bearing USN 1KS16EC017, 1KS16EC094, 1KS16EC099 and 1KS16EC115 respectively for the award of Bachelor of Engineering Degree in Electronics and Communication from Visvesvaraya Technological University, Belgaum during the year 2019-2020.

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DECLARATION

We, Bhoomika P.M USN:1KS16EC017, Sonika V USN:1KS16EC094, Suma B. S USN:1KS16EC099 and Vismitha Sonna Sathyanarayana USN:1KS16EC115, students of 8th semester B.E, Department of Electronics and Communication Engg., K.S. Institute of Technology, Bengaluru declare that the project entitled "Automatic Segregation of Waste using Robotic ARM" has been carried out by us and submitted in partial fulfilment of the course requirements for the award of degree in B.E. in Electronics and Communication, Visvesvaraya Technology University, Belgaum during the academic year 2019- 2020. 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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ABSTRACT

As the world is in the stage of up gradations, there is one stinking problem we have to deal with Garbage. Waste segregation and recycling are effective ways of reducing dumped trash. Recycling is done manually by sorting the waste by the human interface. To reduce human interface and to make system smarter. We implemented a system for collecting and segregating waste into dry and wet with no human interface. The system designed with inbuilt sensors to detect and segregate the waste, along with an arm to pick and place the waste into separate bins designed for dry and wet waste.

Key Words: Arduino, Ultrasonic Sensor, Wi-Fi Module, IR Sensor.

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CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

As the world is in a stage of up-gradation, there is one stinking problem that is to deal with Garbage. In today's life, the pictures of garbage bins being overfull and the garbage spill outs are seen everywhere. This leads to a number of diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management not only in India but for most of the countries in the world. Hence, such a system has to be built which can eradicate this problem or at least reduce it to the minimum level. The project provides one of the most efficient ways to keep our environment clean and green.

Based on estimates, the world cities generated 1.3 billion tons of waste annually with Asia accountable for 1 million tons per day. With current urbanization and population growth rate, the global waste generation is estimated to rise to 2.2 billion tons by 2025. More than half the world's population does not have access to regular trash collections which have caused troubles, are at a crisis level.

The smart city concept is still new in India, although it has received a lot of attention in a few years when our present prime minister gave the idea of building 100 smart cities throughout India. Now, with the upcoming large number of smart cities, large numbers of responsibilities are also required to be fulfilled. The prime need of a smart lifestyle begins with cleanliness, and cleanliness begins with dustbin. Society will get its waste dispatched properly only if the dustbins are placed well and collected well. The main problem in the current waste management system in most of the Indian cities is the unhealthy status of dustbins. In this project we have tried to upgrade the trivial but vital component of the urban waste management system, i.e. dustbin.

This project proposes an Automated Waste Segregator (AWS) which is a cheap, easy to use solution for a segregation system at households, so that it can be sent directly for processing. It is designed to sort the refuse into wet waste and dry waste. The AWS employs different sensors to distinguish between wet and dry waste. Experimental results show that the segregation of waste into wet and dry has been successfully implemented using the AWS.

The system uses different sensors to perform the required actions. Along with this a robot system is integrated to deliver the process of collecting the waste that is to be sorted by the AWS,

to minimize the human interference. The Robot Arm System is composed of dc motors and gear drivers that are able to mechanically pick up the waste and dump the waste. Wi-Fi module is incorporated to send a message once the bin is full.

1.1 BACKGROUND

Waste segregation and recycling are effective ways of reducing dumped trash. Unfortunately, these practices are not widely implemented in the country. People have been negligent when it comes to proper waste disposal, ignoring labels and throwing recyclables that can still be reused. Most of the people are unaware or ignore the fact the waste segregation and recycling can reduce cost, reduce drain in our resources, and lessen the waste being produced. Typical composition of garbage people throw in are 5.8% metals, 3.5% glass, 1.6% plastic,12.9% papers, 1.8% textiles and 53.7% biodegradables which means only the remaining 20.7% of the wastes should really be going to our landfills. In our country, recycling centers do manual process of sorting wastes so it increases human interface. For this we implement a system which minimizes human interference in the waste collecting and segregation process. Materials such as paper, glass and metals are the wastes that need to be segregated in this project.

CHAPTER 2

LITERATURE SURVEY

In [1] An Automated Waste Control Management System (AWCMS) has been designed which includes an electronic waste detection device and a central control unit. An infrared sensor is used for sensing waste levels, GPS is used for location identification, Arduino Board having a microcontroller and GSM Module is used for sending the message which contains the information regarding the status of the bin. The central control unit consists of a receiving device which receives a message through GSM Module and sends it to the computer software using Arduino Board's microcontroller. The software has a proficiently designed GUI which helps the user to perform and monitor all the required actions for waste monitoring and detection of waste bins placed in an area or a city. All the information is displayed in the GUI of the software in the event of a waste-bin getting full and then being emptied by municipal waste trucks or field workers. So that all the components in this entire system work in an efficient manner to make waste management automation possible so the waste is collected and disposed to the landfill at proper time.

In [2] the paper detects the wastes in the dustbins with the help of sensor devices and as soon as the waste is detected, it will be segregated and right away information is transferred to cloud via IOT. Microcontroller is used between the sensors and IOT module. Ultra-sonic sensor is used to detect the nearness of the waste material. The moisture sensor is used to analyze and report the moisture content in the waste, and if there is moisture content available then the waste cannot be put in the dustbin. Image processing algorithm is used to identify the plastics and degradable items and is separated to another Separate sections. The dustbin data are uploaded to the cloud in real time.

In [3] In last few decades garbage management has become a perilous matter in the developing country along with the rapid growth in the population and pollution. In most of the areas it is revealed that overflowed garbage bins are not emptied on time thus creating disease ridden environment and infirm countries. Collection of garbage in bins faces daily variation in quantity according to time as well. Waste picking vehicles of Municipal Corporation which are at fixed intervals has dwindling reliability and unmonitored collection system. The proposed model makes

an IOT based smart garbage monitoring system which can detect the garbage level of the dustbin and via Wi-Fi and GSM the status and location of bins can be displayed on web server. This system will improve the coordination between the transportation process and garbage collection.

In [4] this research aimed to design and develop an autonomous robot to feasibly address waste disposal issues in common indoor places. The researchers found a path to improve plan by using Fuzzy Logic Control (FLC). And also, they utilized the Microcontroller unit to control sound, input proximity and IR sensors, and output geared DC motors through machine learning and electromechanical interface. They simulated an adaptive algorithm using Mamdani-type FLC model, implemented this algorithm using C programming language, then downloaded as machine code to a real prototype. Based on test results, the waste robot accurately detects human involvement, a feature that would be pivotal in overcoming individual indifferences on waste management. This research chronicled how a waste management robot prototype was designed and developed as feasible solution to address waste disposal issues in strategic locate the locations such as households, offices.

In [5], we have demonstrated a promising approach to manage the waste with increased efficiency so that the huge sums of money involved in the waste collection systems are minimized and the process is eased for both, the citizens and the government. Moreover, the problem related to the spilling of the waste due to overfilling of the trucks is also solved. These bins, use RFID tags for tracking of the wastes linked with a web-based online system and according to the weight of waste added, host server calculates the points and updates in the database of virtual wallet. Also, it measures the fullness of the dustbins and updates the status of each dustbin on the municipal server. It notifies them when the dustbin is full and provides the shortest route to empty all the dustbins based on the capacity of the municipal waste loading vehicles. The Capacity of trucks is calculated and updated each time according to the number of dustbins serviced by the trucks, as soon as it completes a route assigned to it. Furthermore, the user is assisted in material waste classification through our application and also the smart bin knows its content and can report back to the rest of the recycling chain about its contents. Our system, target two crucial problems, cost efficiency in waste sorting and waste collection processes. This system that we have proposed improves the current scenario, by bringing all the data on the internet so that systems operate more

efficiently. Primarily, there is level sensor and toxicity sensor that will be sending the data collected at intervals of 15 minutes each. With the following data, we have a decision taking system that will decide whether to include the dustbin in the list of collection and mark it on the map of the municipal application. This will in fact save a lot of efforts and fuel wasted in collection process as real-time monitoring of bins is done.

In [8] Waste management, both indoor and outdoor, is almost done manually. This is unhygienic, and requires significant amount of valuable human resource to get it done. Outdoor waste management is automated to an extent. Therefore, a proposal to fully automate indoor waste management, by making the existing disposal outlets more intelligent and using a movable waste collecting robot, is discussed in this paper. The filling of the dustbin is monitored by ultrasonic sensors and if it is filled to the brim, the Arduino Nano controller transmits the data to the robot with the aid of wireless Zig bee 802.15.4 protocol. The robot is designed in such a way that it effectively tracks the location of the filled dustbin and collects the waste in its storage part. The RSSI (Received Signal Strength Indicator) value from the message received is used to identify which dustbin is full and its location based on Wave Front Algorithm. In comparison with the existing systems, the proposed system exhibits appreciable efficiency in power consumption and making it an ideal candidate for waste management.

In [9], The Paper contains the Objective of the project is to enhance practicality of IoT based solid. Waste collection and management system for smart city. As soon as dustbin has reached its maximum level, Waste management department gets alert via SMS via GSM module placed at dustbin so department can send waste collector vehicle to respective location to collect garbage. Two ultrasonic sensors are settled at the highest point of the dustbin to avoid inaccurate level measurement and is interfaced with PIC microcontroller. Weight sensor is placed at the base ofthe dustbin and is additionally interfaced with controller to recognize over weight of the junk filled in the dustbin. The RF-transmitter encode the information originating from PIC and send to Arduino unit which acts as receiver, it sends the information to RF-collector which is associated with the Arduino Ethernet shield. Arduino collects information received by the collector and transfer on website page through the Ethernet shield. The weight estimation of the waste inside a bin is based on the principle of an electrical conductor whose resistance changes when its length changes due to

stress and it is virtually proportional to the applied strain. A Wheatstone Bridge Networkis formed by using four strain gauges with four separate resistors. Waste inside the bin causes a variation in value of one or more resistors due to the generated strain. Thus, the bridge output voltage is changed with this variation in resistance which is proportional to the weight of the waste. Dust bin used for experiment is having cross section 12 X 12 X 25cm, weight 380 gm and capacity of 3 liters. To avoid inaccurate and misleading level measurements we have installed two ultrasonic sensors (HC-SR04) at the top of dust bin. . 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. Using input trigger for at least 10us high level signal, the module automatically sends eight 40 kHz and detect whether there is a pulse signal back. If the signal back, through high level, time of high output duration is the time from sending ultrasonic to returning. On the other side load cell (TAL220) is installed at bottom of dustbin. TAL220 is straight bar load cell made up from an aluminum-alloy and has four strain gauges that are hooked up in a Wheatstone bridge formation. It is capable of reading a capacity of 10kg. We have also developed web page which allows us remote monitoring of the real time bin status. HTML code was written to design graphical user interface (GUI). Web page provides information regarding location of dustbin placed, its status, name and contact details of the coordinator in that respective area. Full or empty is shown on the web page and if it is full SMS is sent via GSM module to coordinator.

In [10], main objective of this paper is effective and efficient methods of waste collection and segregation at domestic level based on their nature of composition i.e. metal, plastic and biodegradable, the waste is stored accordingly in their respective segments of the dustbin. The Collection and segregation of waste is the major challenge faced by all metropolitan cities worldwide, this is due to the rapid increase in population, industrialization and urbanization. There is lack of knowledge about segregation of waste at the domestic level. The major problems faced due to improper waste management include health hazards to human kind, environmental issue etc. Therefore leading to an unhealthy atmosphere to survive. Segregation of wastes at junk yards is a tedious and time consuming process hence recycling of wastes is not effectual. These drawbacks can be overcome by proper waste management at domestic level.

In [13] Rapid increase in volume and types of solid and hazardous waste due to continuous economic growth. It is estimated that in 2005-06 total amount of municipal solid waste generated

globally reached 2.02 billion tones, representing a 7% annual increase since 2003. The segregation, transport, handling, and disposal of waste needs to be properly managed to minimize the risk to the health and safety of patients, the public, and the environment. This paper proposes an Automated Waste Segregator (AWS) which is a cheap as well as easy to use solution for a segregation system for household use, so that it can be sent directly for processing. It is designed to sort the refuse into dry and wet waste. The AWS employs capacitive sensors to distinguish between wet and dry waste. Experimental results show that the segregation of waste into wet and dry waste has been successfully implemented using the AWS.

In [15], Proposed system is an automated alert based smart bin or garbage collection system and to alert the authorities like corporation or local waste disposal team. Using this, we can monitor the complete waste disposal in an efficient way. This is a prototype developed for two bins. This system can be easily extended to any number of bins. All dustbins present in a city can be connected together through a system for totally automating the process of the wastage collection once the bins are full. Additional controls like closing the lid when the bin is full and closing the bin when it rains. The main focus is on the dustbins placed outside every corner in the streets in order to keep the environment clean. Road side dustbins are not monitored and cleaned properly most of the times. In this paper we propose a new system for managing garbage within Smart Cities.

2.1 GAPS IN LITERATURE SURVEY

In [1] paper human intervention still exists i.e., for segregating the collected garbage whether it is a wet or dry waste.

In [2] paper they have used Microcontroller which cannot perform many functions at the same time. The data is uploaded to the cloud which requires network to send files and to retrieve them. Image processing is used to detect wet or dry waste which is very costly and time consuming.

In [3] status and location of bins can be displayed on web server that can sit down because the server can be overwhelmed at times. By using IOT there is a huge risk of leakage data when sent over a network which can mix up two data. Due to the complex network, a single loophole can put the entire system down.

In [4] Fuzzy Logic Control (FLC) is used which requires lot of data to be applied. Accuracy depends on human knowledge and expertise and needs regular updates with time. They have utilized MCU that can't interface high power devices and it performs limited number of executions at a time.

In [8] The Arduino Nano controller transmits the data to the robot with the aid of wireless Zig bee protocol, which is includes short range and low data speed. Replacement of Zig bee complaint appliances is costly. To identify which dustbin is full and its location Wave Front Algorithm is used which is time consuming and expensive and it is possible that two or more nodes have same value.

In [13] The AWS employs capacitive sensors to distinguish between wet and dry waste. Capacitive sensors very much sensitive to changes in environment conditions such as temperature, humidity. This sensor is not so accurate which will affect performance.

CHAPTER 3

PROBLEM STATEMENT

- The environment is highly polluted by untreated waste.
- No smart system is present in developing countries.
- Prevent diseases from rag pickers as it decreases human labor.
- Recycling efforts are generally done partially, not in an integrated system.
- An astounding 0.1 million tons of waste is generated each day in India. Only 5% of this colossal amount of waste is recycled.
- One possible solution for this problem could be segregating the waste at the disposal level itself.
- In India, the collection, transportation and disposal of MSW are unscientific and chaotic.
- Uncontrolled dumping of waste on outskirts of towns and cities has created overflowing landfills.
- This has found to reduce the average life span of the manual segregators.
- The manure useful for agriculture derived from household domestic waste is not efficiently utilized due to improper segregation of dry and wet waste.

CHAPTER 4

OBJECTIVE

In daily life, segregating and disposing of waste is a big task. It is difficult to manage the waste and dumping it into the dump yard. In order to overcome the problem waste segregation using robotic arm which identifies and disposes the waste into separate the bins is designed.

The objectives of the project are:-

- The main aim of the project is to segregate waste at source level to wet and dry by reducing human intervention.
- Dispose the waste into separate waste bins.
- Identify and separate the waste to take proper measures for waste handling and to preparing for reuse, recycling, another recovery, and disposal
- To provide smart and efficient way of waste management.
- To control the pollution of environment and alert the waste management authority.
- To focus on various options available for the disposal of the waste for a bright and more sustainable future.
- To protect health, well-being and environment through effective waste management techniques.
- To reduce human intervention as much as possible in waste disposal and handling.

CHAPTER 5

IMPLEMENTATION AND METHODOLOGY

5.1 BLOCK DIAGRAM

The system at first has the IR sensor used to detect the waste in front of the smart bin. Along with this system it is integrated to deliver the process of collecting the waste that is to be sorted by the AWS, to minimize the human interference

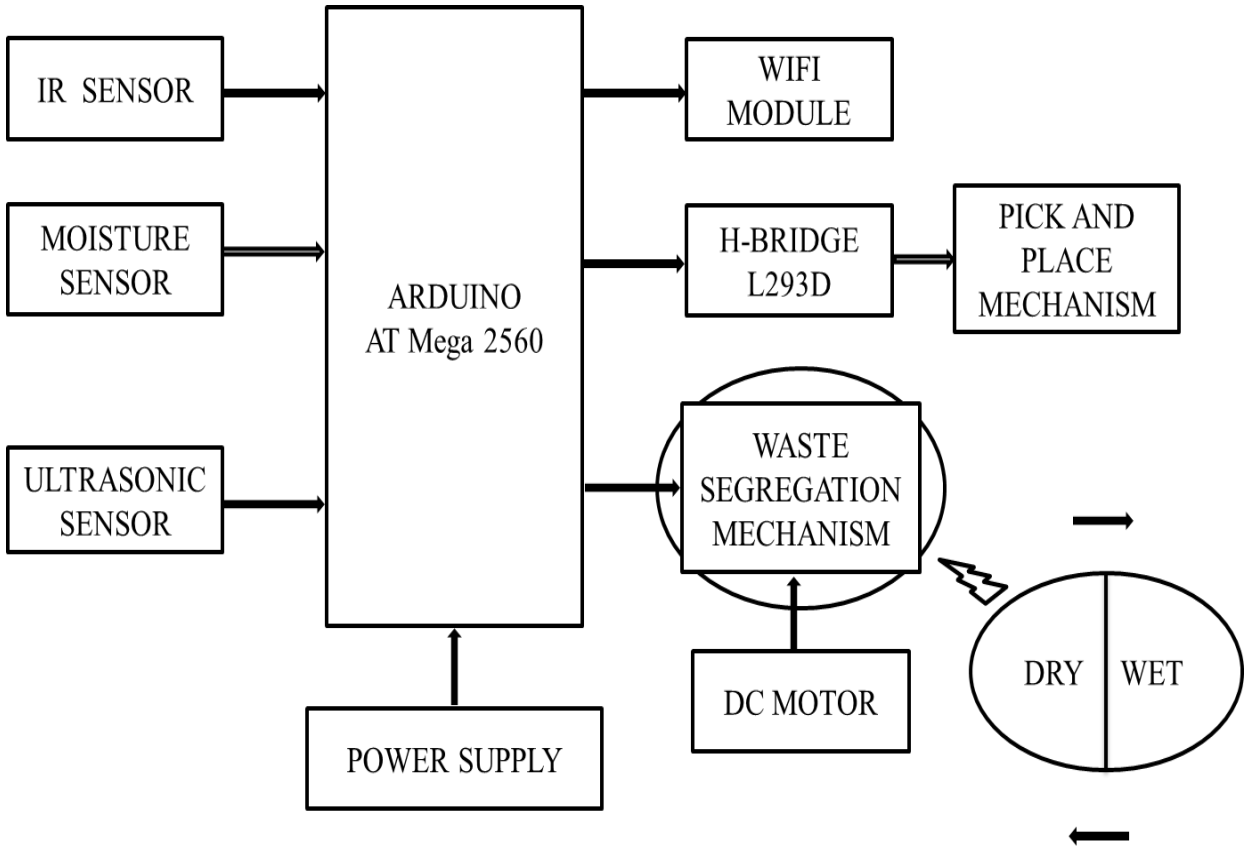

Fig 5.1: Block diagram

The Robot Arm System is composed of dc motors and gear drivers that is able to mechanically pick up the waste and put it at a platform which consists of sensors like moisture sensor to detect dry and wet waste and based on coding it rotates the slotted bin to dump. Also ultrasonic sensor placed at lid of bin detects the level of waste inside bin and sends notifications to empty it once it is full via Wi-Fi module. IR Sensor is used to detect the obstacle that comes in its way. Ultrasonic Sensor is

used to detect the level of waste in dustbin. Moisture Sensor is used to detect the moisture content in waste and distinguish between dry and wet waste. Wi-Fi is used for communication purpose by transmitting signals. H-BRIDGE (L293D) is a motor driver which allows DC motor to drive on either direction. Two power supplies are incorporated in the system to run the different parts of the system involved in picking, segregating and dumping of dry and wet waste.

The ROBOT is designed using DC Motors and Motor Drivers. The ROBOT will sense the presence of waste on conveyor using IR Sensors. After that the ARM will pick the waste and drop it on the collector bin, at the bin there is soil moisture sensor. The Soil Moisture sensors are used to sense the agriculture or wet waste. As the sensors sense the waste the bin placed at vehicle will move accordingly. ARM will drop the waste in the collector bin, which drops the waste further into the proper section of bin. WIFI module used here to send the intimation to concerned authority once the separation is over and even when the bin is completely full. The Block diagram shows the different components used in the Smart Dust bin System. It includes Power Supply, IR Sensor, Moisture Sensor, Ultrasonic sensor and ARM. Sensor is connected in dustbin it is used to detect the level of dustbin where dustbin is full or empty. With the help of sensors the system can segregate the waste collected in collection Point. In turn Controller initiates Robotic arm to collect the waste and segregate accordingly. Two Separate storage based dustbins are designed for automatic waste collection and segregation. As soon as the ultrasonic sensor senses that garbage container reached its maximum capacity. The WIFI sends the message to the trash management personnel that trash box is filled completely, so that they schedule there trash collection based on this information.

The complete flow of the system designed is shown below. The moving system stops when an obstacle is present and the arm picks up the waste and places it on the collector plate and comes back to original position. The collector plate tilts and the waste id dropped into the bin. If wet waste is detected the bin rotates and then the waste is dumped in to the other part of the bin. Then the process continues. Notifications are sent respectively which includes level of the dustbin each time.

5.2 FLOW CHART

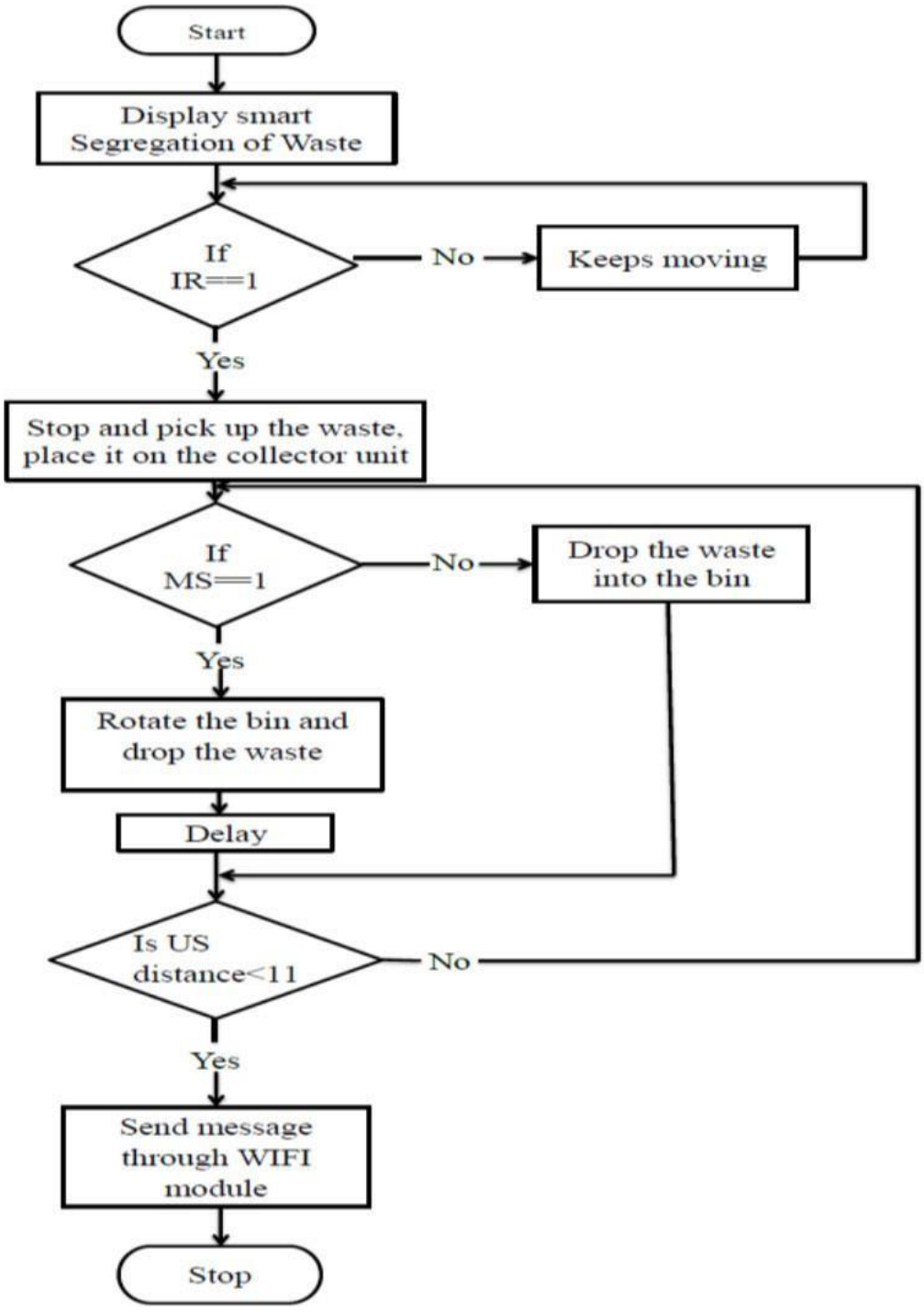

Fig. 5.2: Flow chart of system

CHAPTER 6

HARDWARE & SOFTWARE DESCRIPTION

HARDWARE USED:

6.1 ARDUINO (ATMEGA 2560)

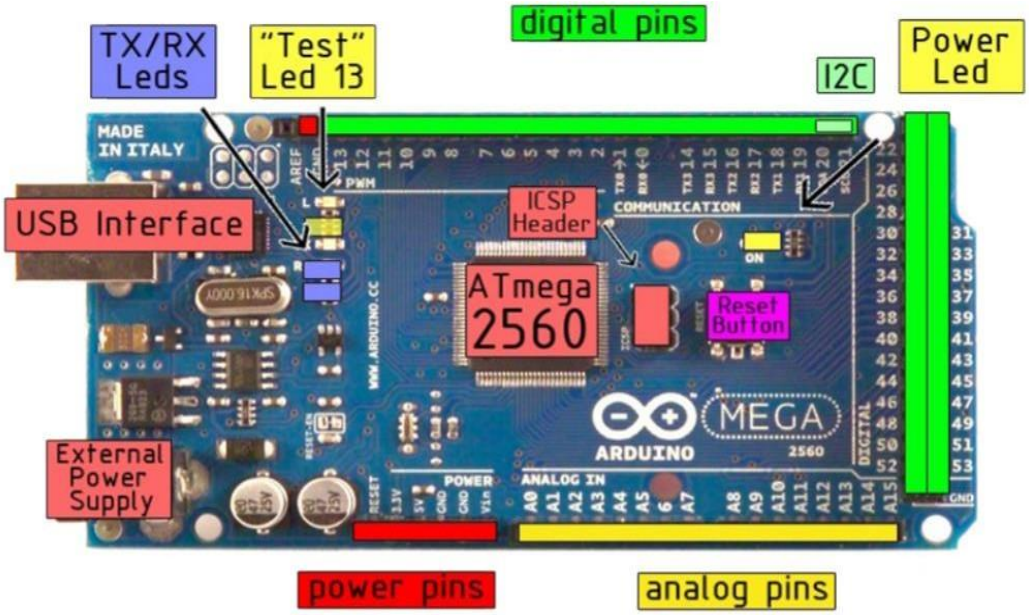

Fig. 6.1: Arduino ATmega2560

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes pre-

programmed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol.[1] The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 programmed as a USB-to-serial converter.

6.1.1 Specifications

- Arduino board- mega2560
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by boot loader
- SRAM: 2 KB
- EEPROM 4 KB
- Clock Speed 16 MHz
- Power: The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically.

6.1.2 Arduino Hardware

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. The boards use single or double-row pins or female headers that facilitate connections for programming and incorporation into other circuits. These may connect with add-on modules termed shields. Multiple and possibly stacked shields may be individually addressable via an I²C serial bus. Most boards include a 5 V linear regulator and a 16 MHz crystal oscillator or ceramic resonator. Some designs, such as the

Lily Pad, run at 8 MHz and dispense with the onboard voltage regulator due tospecific form-factor restrictions. Most Arduino boards consist of an Atmel 8-bit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, ATmega2560) with varying amounts of flash memory, pins, and features.

Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino UNO is the optiboot bootloader. Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor–transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB-to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used.

The Arduino board exposes most of the microcontroller's I/O pins for use by other circuits. Uno provide 14 digital I/O pins, six of which can produce pulse-width modulated signals, and six analog inputs, which can also be used as six digital I/O pins. These pins are on the top of the board, via female 0.1-inch (2.54 mm) headers. Several plug-in application shields are also commercially available. The Arduino Nano, and Arduino-compatible Bare Bones Board and Boarduino boards may provide male header pins on the underside of the board that can plug into solderless breadboards.

There are several I/O digital and analog pins placed on the board which operates at 5V. These pins come with standard operating ratings ranging between 20mA to 40mA. Internal pullup resistors are used in the board that limits the current exceeding fromthe given operating conditions. However, too much increase in current makes these resisters useless and damages the device.

6.1.3 Arduino Pin Configuration

- **LED-** Arduino Uno comes with built-in LED which is connected through pin 13. Providing HIGH value to the pin will turn it ON and LOW will turn it OFF.
- **Vin-** It is the input voltage provided to the Arduino Board. It is different than 5 V supplied through a USB port. This pin is used to supply voltage. If a voltage is provided through power jack, it can be accessed through this pin.
- **5V-** This board comes with the ability to provide voltage regulation. 5V pin is used to provide output regulated voltage. The board is powered up using three ways i.e. USB, Vin pin of the board or DC power jack.
- **GND-**These are ground pins. More than one ground pins are provided on the board which can be used as per requirement.
- **RESET-** This pin is incorporated on the board which resets the program running on the board. Instead of physical reset on the board, IDE comes with a feature of resetting the board through programming.
- **IOREF-**This pin is very useful for providing voltage reference to the board. A shield is used to read the voltage across this pin which then select the proper power source.
- **PWM-** PWM is provided by 3, 5, 6, 9, 10, 11pins. These pins are configured to provide 8-bit output PWM.
- **SP-** It is known as Serial Peripheral Interface. Four pins 10(SS), 11(MOSI), 12(MISO), 13(SCK) provide SPI communication with the help of SPI library.
- **AREF-** It is called Analog Reference. This pin is used for providing a reference voltage to the analog inputs.
- **TW-** It is called Two-wire Interface. TWI communication is accessed through Wire Library. A4 and A5 pins are used for this purpose.
- **Serial Communication-** Serial communication is carried out through two pins called Pin 0 (Rx) and Pin 1 (Tx). Rx pin is used to receive data while Tx pin is used to transmit data.
- **External Interrupts-** Pin 2 and 3 are used for providing external interrupts. An interrupt is called by providing LOW or changing value.

USB supports voltage around 5V while Vin and Power Jack support a voltage range between 7V to 20V. It is recommended to operate the board on 5V. It is important to note that, if a voltage is supplied through 5V or 3.3V pins, they result in bypassing the voltage regulation that can damage the board if voltage surpasses from its limit.

6.2 IR SENSOR

Fig. 6.2: IR Sensor

Basically an IR sensor is used for detecting an obstacle, there are some areas where valuable things are placed, an IR transmitter and receiver is placed there, an infrared path is established and if any person comes into that path the buzzer gets on which gives out a long beep Similarly a firesensor is used to detect fire. The sensed data is given to the microcontroller, processing is done according to the logic in the microcontroller and then writes onto Wi-Fi which will further send sms to the mobile at the user. A buzzer is interfaced to microcontroller to give out a beep sound whenever an obstacle and fire is detected.

An Infrared sensor or commonly known as IR Sensor is an electronic device, used to sense the heat of an object and motion of an object. Basically, an IR Sensor can detect Infrared radiation that is not visible with naked eyes. A body when heated radiates infrared light which can be detected by IR Sensor. When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the sensor is defined.

6.2.1 Features

- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Built-in Ambient Light Sensor
- 20mA supply current
- 5VDC Operating voltage
- VCC: External 3.3V-5V voltage (can be directly connected to 5v MCU and 3.3v MCU)
- GND: GND External
- OUT: Small board digital output interfaces (0 and 1)

6.2.2 Applications

- It can detect the obstacle.
- If the obstacle can be detected accurately it can be avoided as well.
- It can measure the distance from the obstacle.

6.3 ULTRASONIC SENSOR

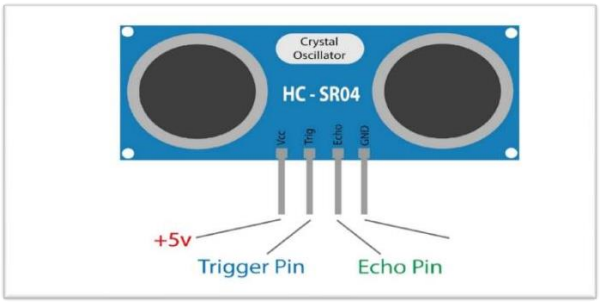

Fig.6.3: HC-SR04 Ultrasonic Sensor

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module. It emits an ultrasound at 40000Hz which travels through the air and if there is an object or obstacle on its path it will bounce

back to the module. Considering travel time and the speed of the sound you can calculate the distance. The HC-SR04 Ultrasonic Module has 4 pins, Ground, VCC, Trig and Echo. The Ground and the VCC pins of the module needs to be connected to the Ground and the 5 volts pins on the Arduino Board respectively and the trig and echo pins to any Digital I/O pin on the Arduino Board.

6.3.1 Specification

- Quiescent Current: <2mA Effectual Angle: <15°
- Ranging Distance: 2cm – 500 cm/1" - 16ft
- Resolution: 0.3 cm

6.3.2 Applications

- Applications ranging occasions
- Measuring the distance between objects
- Programmable car obstacle avoidance
- Robot obstacle avoidance
- Teaching apparatus
- Security, industrial control

6.4 DC MOTOR

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of Electric vehicles, and in drives for steel rolling mills.

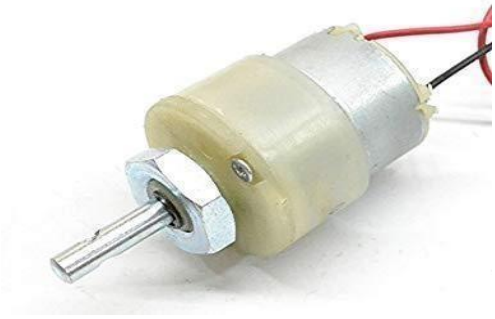

Fig. 6.4: DC Motor

6.5 MOISTURE SENSOR

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content. The relation between the measured property and soil moisture must be calibrated and may vary depending on environmental factors such as soil type, temperature, or electric conductivity. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing in hydrology and agriculture. Portable probe instruments can be used by farmers or gardeners.

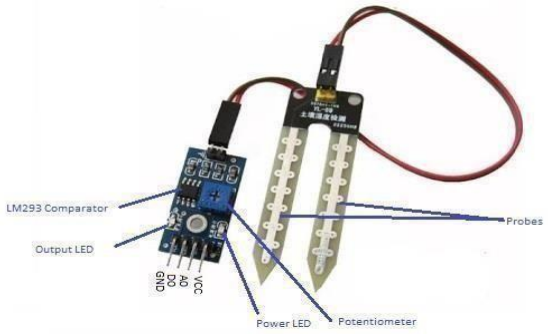

Fig.6.5: Moisture Sensor

The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. When there is more water, the soil will conduct more electricity which means that there will be less resistance. In this project moisture sensor is used to detect the content

of moisture present in the waste and moisture sensor is placed at the top of the plate. Whenever the waste is dumped in the plate the moisture sensor detects the waste whether it contents the moisture or not. If the waste is wet that means it contains moisture then it will place at the slots. If the waste is dry then it is placed at another slot.

6.5.1 Features

- VCC pin is used for power
- A0 pin is an analog output
- D0 pin is a digital output
- GND pin is a Ground
- The required voltage for working is 5V
- The required current for working is <20mA
- Type of interface is analog
- The required working temperature of this sensor is 10°C~30°C

6.5.2 Applications

- Agriculture
- Landscape irrigation
- Research
- Simple sensors for gardeners

6.6 H-BRIDGE

An H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards. Most DC-to-AC converters (power inverters), most AC/AC converters, the DC-to-DC push–pull converter, most motor controllers, and many other kinds of power electronics use H-bridges. In particular, a bipolar stepper motor is almost invariably driven by a motor controller containing two H Bridges.

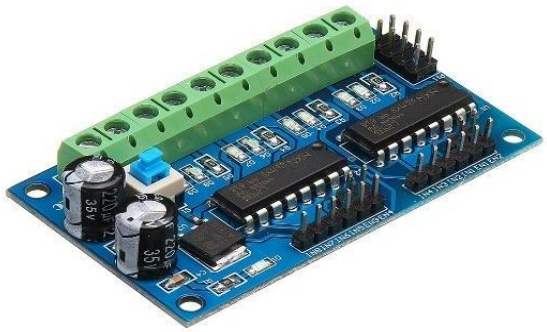

Fig. 6.6: L293D IC

6.6.1 Specification

- Total number of pins = 16
- IC Operating voltage = 5 – 7 v
- Input voltage = 4.5 – 36 v
- Output voltage = 4.5 – 36 v

6.6.2 H-Bridge motor control circuit using L293D IC

The IC LM293D consists of 4-i/p 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 i/p for the motor on the right hand side. This motor rotates based on the IPS we provided across the input pins as Logic 0 and Logic 1.

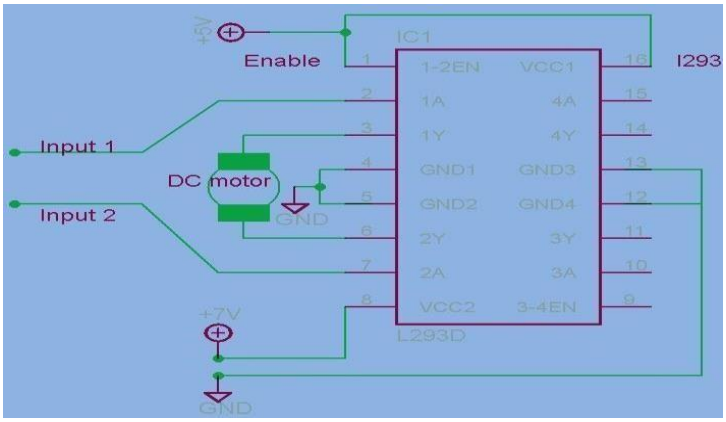

Fig. 6.7: Pin connection with motor

Let‘s consider, hen 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 L4293D 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 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.

SOFTWARE USED:

6.7 ARDUINO IDE

The Arduino Integrated Development Environment (IDE) is a cross platform application (for Windows, MacOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards. 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. A sketch is the name that Arduino uses for a program. It is the unit of code that is uploaded to and run on an Arduino board.

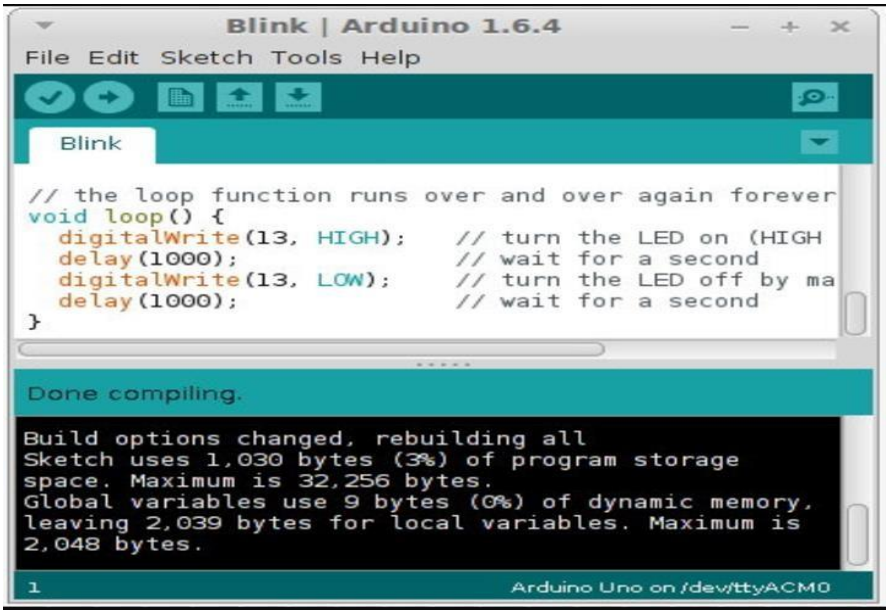

Fig.6.8: Arduino Sketch.

- The pinMode() function configures a pin as either an input or an output. To use it you pass it the number of the pin to configure and the constant INPUT or OUTPUT. When configured as an input, a pin can detect the state of a sensor like a pushbutton.
- The digitalWrite() functions outputs a value on a pin. For example, the line: digitalWrite(led Pin, HIGH); set the ledPin (Pin 13) to HIGH, or 5 volts. Writing a LOW to Pin connects it to ground, or 0 volts.
- The delay() function causes the Arduino to wait for the specified number of Milliseconds before continuing on to the next line. There are 1000 milliseconds in a Second, so the line delay(1000); creates a delay of one second.

CHAPTER 7
RESULTS AND FUTURE WORK

7.1 RESULTS

The proposed methodology provides a Robotic solution for Garbage segregation. A pick and place mechanism is used for separation. Uses Moisture sensor for Waste separation such as wet, dry. Planning for enabling collection of garbage generation data. This checks the waste level over the dustbins by using Sensor. Once it detected immediately the system alert will be sent to concerned authority through WI-FI Module.

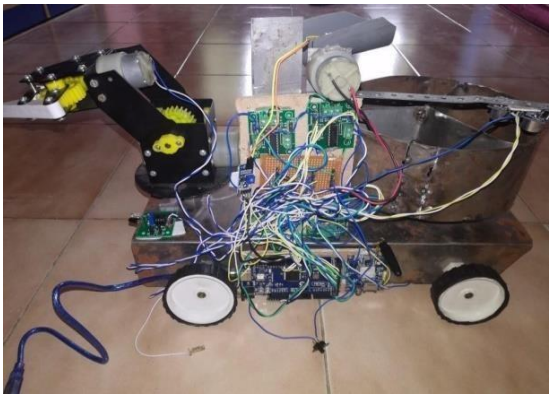

Fig. 7.1: Smart Robotic Bin

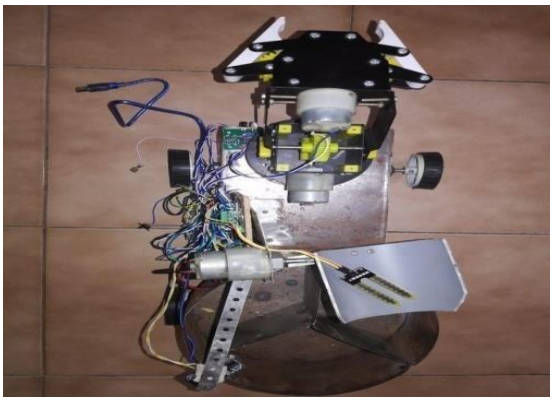

Fig. 7.2: Smart View of Robotic Bin

This implementation of smart garbage Bin indicator receptacle, gives a solution for unsanitary environmental condition in a city. This system assures to send notification and status on dashboard of dustbins when the garbage level reaches its maximum. In our project seven Dc Motors are used. Four Dc motors are used at the wheels to move the system. Two Dc motors are used to rotate the Robotic Arm here, one motor to rotate from right to left and vice-versa, another one to rotate from top to bottom and vice-versa. Lastly one Dc motor is used to rotate the slots i.e. two different slots are used to segregate the waste into dry and wet.

In our project IR sensor is placed at the front side of the system to detect the waste present in front of the system. When the waste is detected using IR sensor the system stops and pick the waste using Robotic arm and then it willplace the waste at the plate.

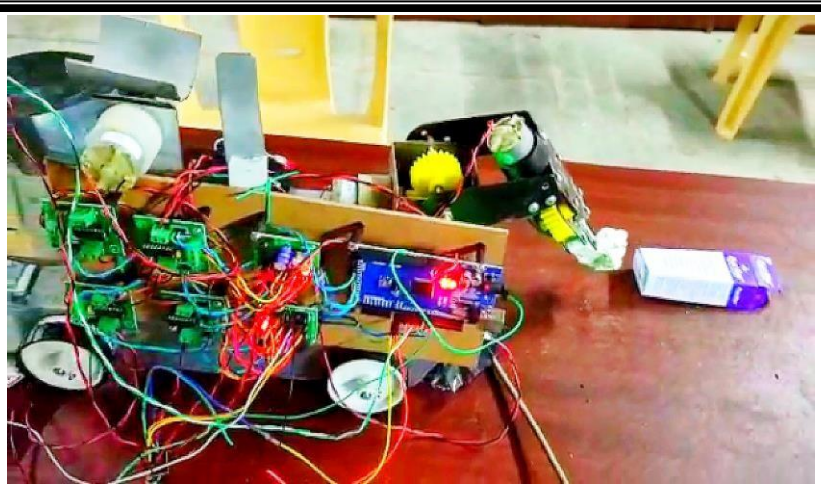

Fig 7.3: Once the sensor detects the waste, robot stops and arm picks the waste.

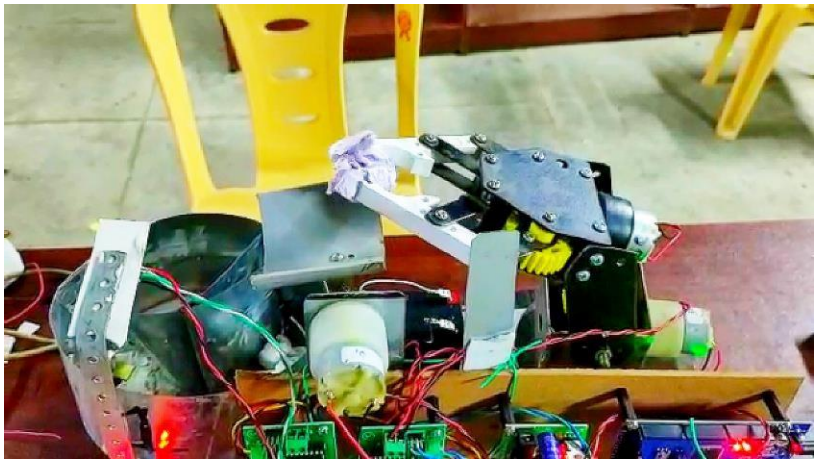

Fig 7.4: After picking the waste the arm places it on the collector unit.

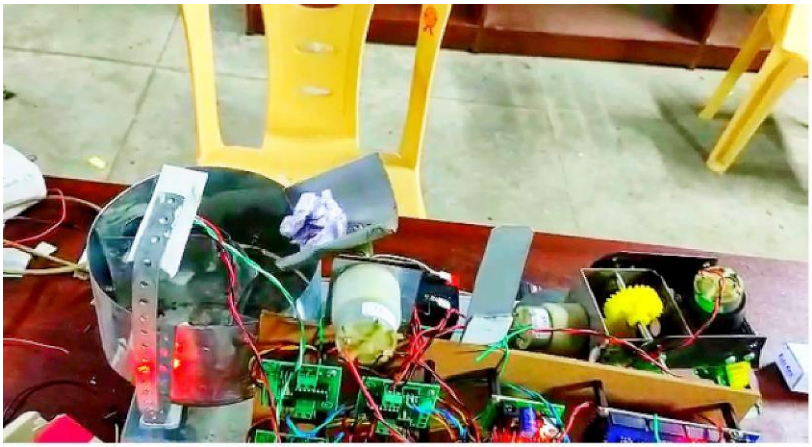

Fig 7.5: The collector unit detects the waste as wet and dry, and then drops it into the bin accordingly.

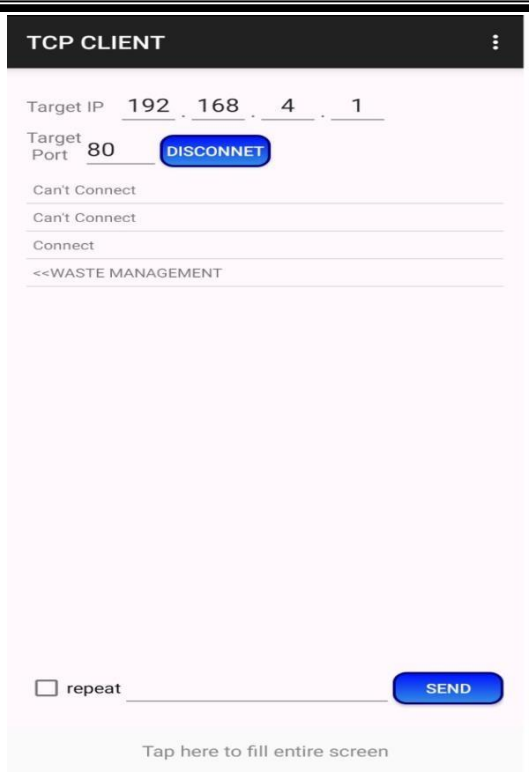

Fig. 7.6: Wi-Fi module gets connected "WASTE MANAGEMENT" message will be displayed.

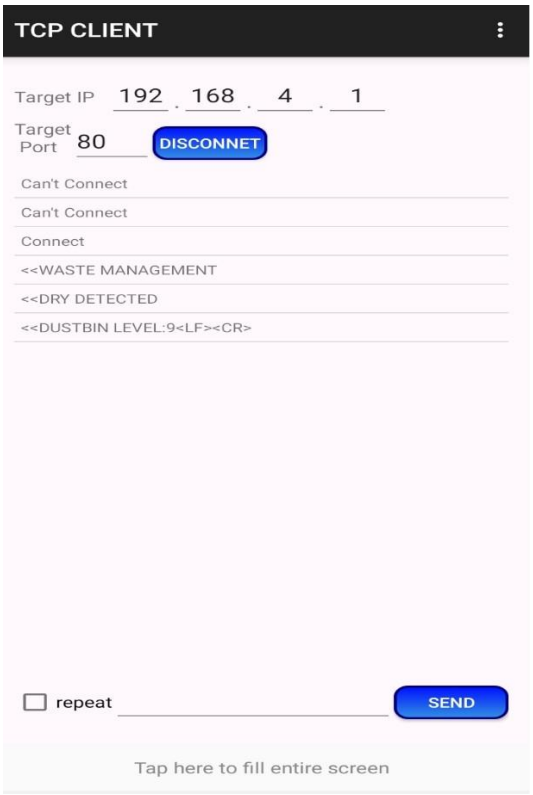

Fig.7.7: Type of waste and bin level will be displayed.

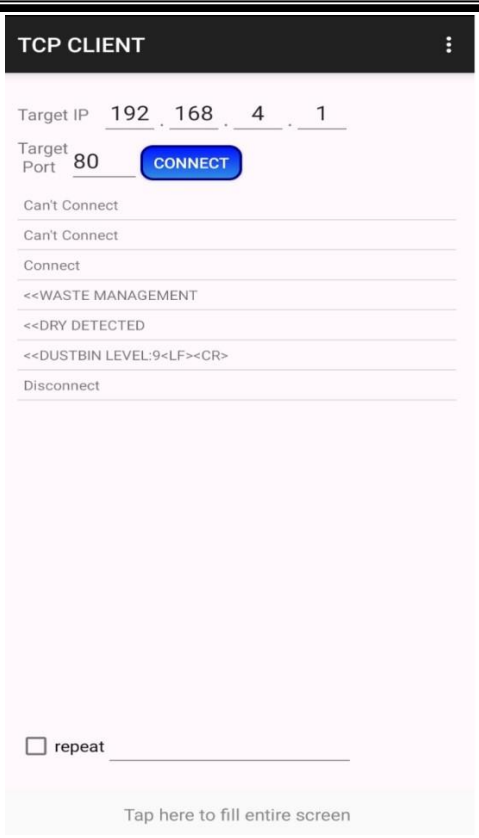

Fig.7.8: Wi-Fi module gets disconnected “Disconnected” message will be displayed

7.2 FUTURE WORK

In this project, implementation is done only for a single bin. Integration of many bins each with a unique ID can be done by implementing the principles of IOT and creating database for each bin which can be maintained by using SQL technology and a login webpage is created to ensure authorized entries. One more modification can be done, that this dustbin may be user free, i.e. if the waste in the dustbin gets filled then it follows a path where it will dump all the waste. Apart from this, differentiation can be made between dry trash bin and wet trash bin collecting plastic dry waste and biodegradable waste respectively. GPS module can be interfaced to each dustbin which sends the status and location of the dustbin, which can be displayed on the GUI maintained by the respective authority of the city. Further the whole system can be made water resistant. Once someone puts a hand in front of the dustbin it will initiate command to stop the dustbin first then it will display the various messages regarding putting garbage inside dustbin. If garbage is full and still someone stops the dustbin it will display the message -garbage is full. If garbage is not full it will take the garbage from user wait for few seconds to ensure proper entry of garbage and then

start moving based on whichever mode is selected. Smart e dustbin has wide entry in parking zones, big corporate areas, hospitals, gardens and parks. It was initially developed by SK robotics Bengaluru based company but due to some issues regarding its safety the project was not successful at that time. After that many people tried to convince the government authority about publishing use of such robotics dustbins in park or garden areas.

CHAPTER 8

CONCLUSION

The project reports on Wastes segregation using robotic arm. The robotic arm will be able to sort out into dry and wet waste. When the sensors are triggered the motor-powered arm is actuated and the materials are dispensed onto its proper bins. The Trash management system is a step forward to make the manual collection and detection of wastes automated in nature. It would pioneer work for solid waste collection, monitoring and management processes. This project for the management of wastes is efficient and time saving process than the currently employing method in which concerned municipal employee has to look for the filled waste bins manually across different spots in an area/street for checking regularly whether the waste bin is filled or not. Automatic Waste Segregator Bin using Robotic Arm performs the segregation into dry and wet waste. The waste around the bin is detected and the robotic arm is used to place the waste in the bin. This system is more innovative as it includes an automated system and a robotic arm, making it a more effective and efficient system.

REFERENCES

[1] Agha Muhammad Furqan Durrani, Ateeq Ur Rehman2, Arslan Farooq, Jehangir Arshad Meo et al "An Automated Waste Control Management System (AWCMS) by using Arduino" 2019 International Conference on Engineering and Emerging Technologies (ICEET).

[2] Hamin N, P Mohamed Fathimal, Raghavendran R, et al "Smart Garbage Segregation & Management System Using Internet of Things(IOT) & Machine Learning (ML)" 2019 1st International Conference on Innovations in Information and Communication Technology (ICIICT).

[3] Smita S Pawar, Shivani Pise, Kranti Walke, Renuka Mohite "Smart Garbage Monitoring System Using AVR Microcontroller" 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)

[4] Ralph Sherwin A. Corpuz, John Clifford R. Orquiza "Utilization of Fuzzy Logic Control in a Waste Robot" 2018 Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM).

[5] Murugaanandam. S, Ganapathy. V and Balaji. R ―Efficient IOT Based Smart Bin for Clean Environment‖ 2018 International Conference on Communication and Signal Processing.

[6] Jia-Wei Lu1, Ni-Bin Chang2, Feng Zhu1, Jing Hai1, Li Liao3 ―Smart and Green wastes Urban Solid Waste Collection System for Differentiated Collection with Integrated Sensor Networks‖ 15th International Conference on Networking, Sensing and Control (ICNSC), 2018 IEEE

[7]R.Mukesh Assistant Professor, International Conference on Inventive Systems and Control (ICISC 2018) IEEE Xplore Compliant - Part Number: CFP18J06-ART.

[8] Poorani Ravindhiran, Pradeep Gopal, Joseph Gladwin S, Rajavel R ". Automated Indoor Waste Management System Employing Wave Front Algorithm and Received Signal Strength Indicator Values-based Mobile Robot" 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC).

[9] Krishna Nirde , Prashant S. Mulay, Uttam M.Chaskar ―IoT based solid waste management system for smart city‖ 2017 International Conference on Intelligent Computing and Control Systems (ICICCS).

[10] Santhosh Kumar B R, Varalakshmi N , Soundarya S Lokeshwari , Rohit K, Manjunath,Sahana D N ―Eco-Friendly IoT Based Waste Segregation and Management‘‘2017 International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT).

[11] Trushali S. Vasagade, Shabanam S. Tamboli, Archana D. Shinde ―Dynamic Solid Waste Collection and Management System Based On Sensors, Elevator and GSM‖ International Conference on Inventive Communication and Computational Technologies (ICICCT), 2017 IEEE.

[12] Amrutha Chandramohan, Joyal Mendonca, Nikhil Ravi Shankar, et al “Automated Waste Segregator” 2014 Texas Instruments India Educators' Conference (TIIEC).

[13] Waikhom Reshmi , RamKumar Sundaram , M.Rajeev Kumar ―Sensor Unit for the Wastes Management: A Better Method for Frequent Data Updating System‖ International Conference on Science, Engineering and Management Research (ICSEMR 2014), 2014 IEEE.

[14] Sahil Mirchandani , Sagar Wadhwa, Preeti Wadhwa, Richard Joseph ―IoT internet of things Enabled Dustbins‖ MIXDES 2013, 20th International Conference "Mixed Design of Integrated Circuits and Systems" , June 20-22, 2013, Gdynia, Poland, June 2013.

[15] Abel Avitesh Chandra, Yeonwoo Lee, Beom Mu Kim, Se Yeong Maeng, Sang Hyeoking Park and Seong Ro Lee ―Review on Sensor Cloud and its Integration with Arduino based Sensor Network International Conference on Sensor and Updating Technologies (ICSUT), 2013 IEEE.

[16] A. W. Larsen, ―Survey on existing technologies and methods for plastic waste sorting and collection, July 2012.

[17] Stephane Gervais-Ducouret ―Next Smart Sensors Generation‖ International Conference on Sensor and some popular technologies (ICSPT), 2011.

[18] A. B. Jan Baeyens and R. Dewil, ―Recovery and recycling of postconsumer waste metal in CHEMICAL ENGINEERING AND CHEMICAL PROCESS TECHNOLOGY.

[19] K. Dhayalini& A. Durgadevi, - IoT based design and analysis of robotic vehicle movement in military applications, International journal of innovations and advancement in CS.

[20] L. E. Parker, ―Alliance: An Architecture for Fault Tolerant Multirobot Cooperation‖, IEEE Transactions on Robotics and Automation, pp. 220-240.

APPENDIX

```
//#include <SoftwareSerial.h>

#include<String.h>

//#include<Timer.h>

//Timer t;

//#include <SoftwareSerial.h>

//SoftwareSerial gsmSerial(8,9);//rx,tx

//SoftwareSerial Serial1_WIFI(6, 7);

//#define heart 13

//void SendSms( char *num1, char * str1 );

//int METAL_SENSOR = 2;

int IR_SENSOR = 8;

int WET_SENSOR =9;

int IN_1=32; //ROBOT

int IN_2=34;

int IN_3=36;

int IN_4=38;

int DUST_1 =6;     //rotate bin

int DUST_2 =7;

int WASTE_MOVE_1 =48;

int WASTE_MOVE_2 =50;

int OPEN_CLOSE_ARM_1 =3;

int OPEN_CLOSE_ARM_2 =2;

int ARM_ROTATE_1 =46;
```

```
int ARM_ROTATE_2 =44;

int UP_DOWN_ARM_1 =42;

int UP_DOWN_ARM_2 =40;

const int trigPin = 5;

const int echoPin = 4;

long duration;

int distance;

//#define count 50

//#define delay for(i=0;i<65000;i++);

//void ultrasonic(void);

void FORWORD(void);

void REVERSE(void);

void RIGHT(void);

void LEFT(void);

void STOP(void);

void ARM_UP(void);

void ARM_DOWN(void);

void ARM_OPEN(void);

void ARM_CL0SE(void);

void ARM_STOP(void);

void ARM_1_STOP(void);

void SENSOR_MONITOR(void);

void ROBO_MOVEMENT();
```

```
void ROBO_FUNCTION();
void CHECKING_WASTE();
void ARM_ROTATE();
void ARM_1_ROTATE();
void ARM_ROTATE_STOP();
void DUSTBIN_ROTATE_WET();
void DUSTBIN_ROTATE_WET_1();
void DUSTBIN_ROTATE_METAL();
void DUSTBIN_ROTATE_METAL_1();
void WASTE_DROP();
//void send2server();
//void connect_wifi(String cmd, int t);
//
//char *api_key="64O68CP3K3E53E5E";     // Enter your Write API key from ThingSpeak
//static char postUrl[150];
//void httpGet(String ip, String path, int port=80);
int z,A,W,M,U,D;
void setup ()
{
    pinMode(IN_1,OUTPUT)
    ;
    pinMode(IN_2,OUTPUT)
    ;
```

```
pinMode(IN_3,OUTPUT)

;

pinMode(IN_4,OUTPUT)

;
```

```
      pinMode(DUST_1,OUTPUT);
      pinMode(DUST_2,OUTPUT);
      pinMode(OPEN_CLOSE_ARM_1,OUTPUT);
      pinMode(OPEN_CLOSE_ARM_2,OUTPUT);
      pinMode(WASTE_MOVE_1,OUTPUT);
      pinMode(WASTE_MOVE_2,OUTPUT);
      pinMode(ARM_ROTATE_1,OUTPUT);
      pinMode(ARM_ROTATE_2,OUTPUT);
      pinMode(IR_SENSOR,INPUT);
      pinMode(WET_SENSOR,INPUT);
//    pinMode(METAL_SENSOR,INPUT);
    pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
    pinMode(echoPin, INPUT);
    Serial.begin(9600);
    Serial.println("WASTE MANAGEMENT AND SEPARATION ");
// Serial1.begin(9600);
    Serial.println("WASTE MANAGEMENT AND SEPARATION ");
    delay(3000);
    // SendSms("6362604810","WASTE MANAGEMENT AND SEPARATION");
     Serial.begin(9600);
     Serial.println("Connecting Wifi .. ");
// connect_wifi("AT",1000);
// connect_wifi("AT+CWMODE=1",1000);
```

```
// connect_wifi("AT+CWQAP",1000);
// connect_wifi("AT+RST",5000);
// connect_wifi("AT+CWJAP=\"Technofly1\",\"786786123450\"",10000);
 Serial.println("Wifi Connected");
// pinMode(heart, OUTPUT);
// delay(2000);
// t.oscillate(heart, 1000, LOW);
// t.every(20000, send2server);
//
//ROBO_FUNCTION();
 WIFI();
 Serial.write("AT+CIPSEND=0,16\r\n"); // MULTIPLE MODE SELECTION
        delay(50);
        Serial.print("WASTE MANAGEMENT");
        delay(50);
//        Serial.write("\n\r\r"); // MULTIPLE MODE SELECTION
      Serial.write("\r\n"); // MULTIPLE MODE SELECTION
      delay(1000);
//ARM_CL0SE();
//    delay(2000);
//    ARM_1_STOP();
//    delay(2000);
//ARM_OPEN();
```

```
//    delay(2000);
//    ARM_1_STOP();
//    delay(3000);
//     ARM_UP();
//    delay(3000);
//    ARM_STOP();
//    delay(1000);
// ARM_1_ROTATE();
//    delay(1000);
//    ARM_ROTATE_STOP();
//    delay(3000);
//    ARM_DOWN();
//     delay(2000);
//    ARM_STOP();
// delay(2000);
// FORWORD();
//ARM_ROTATE();
//    delay(1000);
//    ARM_ROTATE_STOP();
//    delay(3000);
//UV_SENSOR();
//   while(1);
//digitalWrite(DUST_1,HIGH);
```

```
// digitalWrite(DUST_2,LOW);
// delay(2500);
// digitalWrite(DUST_1,LOW);
// digitalWrite(DUST_2,LOW);
// digitalWrite(WASTE_MOVE_1,LOW);
// digitalWrite(WASTE_MOVE_2,HIGH);
// delay(1000);
//
//  digitalWrite(WASTE_MOVE_1,LOW);
//  digitalWrite(WASTE_MOVE_2,LOW);
//// UV_SENSOR();
// delay(1000);
//digitalWrite(WASTE_MOVE_1,HIGH);
// digitalWrite(WASTE_MOVE_2,LOW);
// delay(1000);
//
//  digitalWrite(WASTE_MOVE_1,LOW);
//  digitalWrite(WASTE_MOVE_2,LOW);
//digitalWrite(OPEN_CLOSE_ARM_1,HIGH);
//delay(3000);
// digitalWrite(OPEN_CLOSE_ARM_2,LOW);
// delay(3000);
// digitalWrite(OPEN_CLOSE_ARM_1,LOW);
```

```
// delay(3000);
// digitalWrite(OPEN_CLOSE_ARM_2,HIGH);
// delay(3000);
// while(1);
  }
char Serial_read(void)
{
    char ch;
    while(Serial.available() == 0);
    ch = Serial.read();
    return ch;
}
void WIFI(void)
{
  String BUFF, buff_1;
  char ch;
  Serial.print('A');
  delay(10);
  Serial.print('T');
  delay(10);
  Serial.print('E');
  delay(10);
  Serial.print('0');
```

```
delay(10);
  Serial.print("\r\n");
  Serial.print("1");
  Serial.print(Serial.readString());
  delay(50);
  Serial.write("AT\r\n");
  Serial.print("2");
  Serial.print(Serial.readString());
  delay(50);
  Serial.write("AT+CWMODE=2\r\n");
  Serial.print("3");
  Serial.print(Serial.readString());
  delay(50);
// Serial.write("AT+CWJAP=\"iPhone\",\"123456789\"\r\n");
// Serial.print("4");
// Serial.print(Serial.readString());
// delay(50);
//
// Serial.print(Serial.readString());
// delay(50);
// Serial.print("6");
// Serial.print(Serial.readString());
// delay(50);
```

```
// Serial.print("7");
// Serial.print(Serial.readString());
// delay(50);
// Serial.print(Serial.readString());
// delay(50);
  Serial.write("AT+CIPMUX=1\r\n");
  Serial.print("8");
  Serial.print(Serial.readString());
  delay(50);
  Serial.write("AT+CIPSERVER=1,80\r\n");
 Serial.print("9");
 Serial.print(Serial.readString());
  delay(50);
  Serial.write("AT+CIFSR\r\n");
  Serial.print("10");
  Serial.print(Serial.readString());
  delay(50);
}
void loop()
  {
    ROBO_MOVEMENT();
}
void UV_SENSOR()
```

```
{
  digitalWrite(trigPin, LOW);
delayMicroseconds(2);
// Sets the trigPin on HIGH state for 10 micro seconds
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
// Reads the echoPin, returns the sound wave travel time in microseconds
duration = pulseIn(echoPin, HIGH);
// Calculating the distance
distance= duration*0.034/2;
// Prints the distance on the Serial Monitor
Serial.print("DUSTBIN LEVEL: ");
Serial.println(distance);
String one = "DUSTBIN LEVEL:";
   // String two = ',' ;
     String message = one + distance;
     String str = "C";
     String all = str + message;
     // Convert String to char array
     int str_len = message.length() + 1;
     char textmessage[str_len];
     message.toCharArray(textmessage,str_len);
```

```
// Serial.println(textmessage);
      Serial.write("AT+CIPSEND=0,17\r\n"); // MULTIPLE MODE SELECTION
     delay(50);
     Serial.write(textmessage);
     delay(50);
     Serial.write("\n\r\r"); // MULTIPLE MODE SELECTION
     delay(1000);
if(distance<5)
{
  Serial.print("DUSTBIN IS FULL");
  Serial.write("AT+CIPSEND=0,15\r\n"); // MULTIPLE MODE SELECTION
        delay(50);
        Serial.write("DUSTBIN IS FULL");
        delay(50);
        Serial.write("\n\r\r"); // MULTIPLE MODE SELECTION
        delay(1000);
//    SendSms("6362604810","DUSTBIN IS FULL");
   delay(2000);
 }
}
//void SendSms( char *num1, char * str1 )
//{
//    char buff[10],i=0;
```

```
//    Serial1.write('A');
//    delay(100);
//    Serial1.write('T');
//    delay(100);
//    Serial1.write('E');
//    delay(100);
//    Serial1.write('0');
//    delay(100);
//    Serial1.write('\r');
//    Serial1.write("AT+CMGF=1\r"); //Initialize GSM For mobile
//    delay(2000);
// Serial1.write("AT+CMGS=\"");
//    delay(2000);
//    Serial1.write(num1);
//    delay(2000);
//    Serial1.write("\"\r");
//    Serial1.write(str1);
//    delay(2000);
//    Serial1.write(26);
//    delay(2000);
//    Serial1.print("sms sent");
//}
void ROBO_MOVEMENT()
```

```
{
  Serial.println("ROBO MOVEMENT...");
  FORWORD();
  delay(5000);
  STOP();
  delay(1000);
  LEFT();
  delay(5000);
  STOP();
  delay(1000);
  FORWORD();
  delay(5000);
  STOP();
  delay(1000);
  LEFT();
  delay(5000);
  STOP();
  delay(1000);
  FORWORD();
  delay(5000);
  STOP();
  delay(1000);
}void FORWORD(void)
```

```
{
  Serial.println("FORWORD" );
  digitalWrite(IN_1,LOW);
  digitalWrite(IN_2,HIGH);
  digitalWrite(IN_3,HIGH);
  digitalWrite(IN_4,LOW);
}
void SENSOR_MONITOR(void)
{
   if(digitalRead(IR_SENSOR)==LOW)
   {
     ROBO_FUNCTION();
   }
}
void ROBO_FUNCTION()
{
     Serial.println("WASTE DETECTED..\r\n") ;
    // delay(3000);
      //CHECKING_WASTE();
     ARM_CL0SE();
     delay(4000);
     ARM_1_STOP();
     delay(2000);
```

```
ARM_UP();
    delay(18300);
    ARM_STOP();
    delay(3000);
    ARM_ROTATE();
    delay(1000);
    ARM_ROTATE_STOP();
    delay(3000);
    ARM_DOWN();
    delay(4000);
    ARM_STOP();
    delay(3000);
    ARM_OPEN();
    delay(2000);
    ARM_1_STOP();
    delay(3000);
    ARM_UP();
    delay(4000);
    ARM_STOP();
    delay(3000);
    ARM_1_ROTATE();
    delay(1000);
    ARM_ROTATE_STOP();
```

```
 delay(3000);
    ARM_DOWN();
    delay(18300);
    ARM_STOP();
    delay(3000);
    CHECKING_WASTE();
}
void CHECKING_WASTE()
{
  while(1)
  {
    if(digitalRead(WET_SENSOR)==LOW)
    {
      Serial.println("WET DETECTED..\r\n") ;
      delay(1000);
       Serial.write("AT+CIPSEND=0,12\r\n"); // MULTIPLE MODE SELECTION
        delay(50);
        Serial.print("WET DETECTED");
        delay(50);
//        Serial.write("\n\r\r"); // MULTIPLE MODE SELECTION
      Serial.write("\r\n"); // MULTIPLE MODE SELECTION
      delay(1000);
      DUSTBIN_ROTATE_WET();
```

```
WASTE_DROP();
      DUSTBIN_ROTATE_WET_1();
    }
//      if(digitalRead(METAL_SENSOR)==LOW)
//    {
//       Serial.println("METAL DETECTED..\r\n") ;
//      delay(1000);
//       Serial.write("AT+CIPSEND=0,14\r\n"); // MULTIPLE MODE SELECTION
//        delay(50);
//        Serial.write("METAL DETECTED");
//        delay(50);
//        Serial.write("\n\r\r"); // MULTIPLE MODE SELECTION
//        delay(1000);
//       DUSTBIN_ROTATE_METAL();
//       WASTE_DROP();
//        DUSTBIN_ROTATE_METAL_1();
// }
    else
    {
      Serial.println("DRY DETECTED..\r\n") ;
     delay(1000);
      Serial.write("AT+CIPSEND=0,12\r\n"); // MULTIPLE MODE SELECTION
       delay(50);
```

```
 Serial.print("DRY DETECTED");
        delay(50);
//        Serial.write("\n\r\r"); // MULTIPLE MODE SELECTION
       Serial.write("\r\n"); // MULTIPLE MODE SELECTION
       delay(1000);
       WASTE_DROP();
        delay(5000);
       ROBO_MOVEMENT();
     }
  }
}
void REVERSE(void)
{
   Serial.println("REVERSE") ;
// delay(10000)
 digitalWrite(IN_1,LOW);
 digitalWrite(IN_2,HIGH);
 digitalWrite(IN_3,LOW);
 digitalWrite(IN_4,HIGH);
}
void RIGHT(void)
{
   Serial.println(" RIGHT") ;
```

```
 digitalWrite(IN_1,HIGH);
  digitalWrite(IN_2,LOW);
  digitalWrite(IN_3,LOW);
  digitalWrite(IN_4,HIGH);
}
void LEFT(void)
{
   Serial.println(" LEFT ") ;
 digitalWrite(IN_1,LOW);
 digitalWrite(IN_2,HIGH);
 digitalWrite(IN_3,HIGH);
 digitalWrite(IN_4,LOW);
}
void STOP(void)
{
  Serial.println(" STOP ") ;
  digitalWrite(IN_1,LOW);
  digitalWrite(IN_2,LOW);
  digitalWrite(IN_3,LOW);
  digitalWrite(IN_4,LOW);
  for(z=0;z<20;z++)
  {
    SENSOR_MONITOR();
```

```
delay(500);
  }}
void ARM_UP(void)
{
  Serial.println(" UP ") ;
  digitalWrite(UP_DOWN_ARM_1,LOW);
  digitalWrite(UP_DOWN_ARM_2,HIGH);
}
void ARM_DOWN(void)
{
    Serial.println(" DOWN ") ;
  digitalWrite(UP_DOWN_ARM_1,HIGH);
  digitalWrite(UP_DOWN_ARM_2,LOW);
// ARM_STOP();
}
void ARM_STOP(void)
{
    digitalWrite(UP_DOWN_ARM_1,LOW);
  digitalWrite(UP_DOWN_ARM_2,LOW);
  //delay(10000);
}
void ARM_OPEN(void)
{
```

```
 digitalWrite(OPEN_CLOSE_ARM_1,HIGH);
   //delay(5000);
  digitalWrite(OPEN_CLOSE_ARM_2,LOW);
   //delay(10000);
// ARM_1_STOP();
}
void ARM_CL0SE(void)
{
    digitalWrite(OPEN_CLOSE_ARM_1,LOW);
    //delay(10000);
  digitalWrite(OPEN_CLOSE_ARM_2,HIGH);
   // delay(5000);
// ARM_1_STOP();
}
void ARM_1_STOP(void)
{
   digitalWrite(OPEN_CLOSE_ARM_1,LOW);
  digitalWrite(OPEN_CLOSE_ARM_2,LOW);
 // delay(10000);
}
void ARM_ROTATE()
{
   digitalWrite(ARM_ROTATE_1,HIGH);
```

```
digitalWrite(ARM_ROTATE_2,LOW);
}
void ARM_1_ROTATE()
{
   digitalWrite(ARM_ROTATE_1,LOW);
  digitalWrite(ARM_ROTATE_2,HIGH);
}
void ARM_ROTATE_STOP()
{
    digitalWrite(ARM_ROTATE_1,LOW);
  digitalWrite(ARM_ROTATE_2,LOW);
}
void DUSTBIN_ROTATE_WET()
{
  digitalWrite(DUST_1,HIGH);
  digitalWrite(DUST_2,LOW);
  delay(10500);
  digitalWrite(DUST_1,LOW);
  digitalWrite(DUST_2,LOW);
  delay(3000);
}
void DUSTBIN_ROTATE_WET_1()
{
```

```
digitalWrite(DUST_1,LOW);
  digitalWrite(DUST_2,HIGH);
  delay(10500);
  digitalWrite(DUST_1,LOW);
  digitalWrite(DUST_2,LOW);
  delay(3000);
  ROBO_MOVEMENT();
}
//void DUSTBIN_ROTATE_METAL()
//{
// digitalWrite(DUST_1,HIGH);
//  digitalWrite(DUST_2,LOW);
// delay(8500);
// digitalWrite(DUST_1,LOW);
// digitalWrite(DUST_2,LOW);
// delay(3000);
//}
//void DUSTBIN_ROTATE_METAL_1()
//{
// digitalWrite(DUST_1,LOW);
// digitalWrite(DUST_2,HIGH);
// delay(8500);
// digitalWrite(DUST_1,LOW);
```

```
// digitalWrite(DUST_2,LOW);
// delay(3000);
// ROBO_MOVEMENT();
//}
void WASTE_DROP()
{
  digitalWrite(WASTE_MOVE_1,LOW);
  digitalWrite(WASTE_MOVE_2,HIGH);
  delay(600);
  digitalWrite(WASTE_MOVE_1,LOW);
  digitalWrite(WASTE_MOVE_2,LOW);
// UV_SENSOR();
  delay(1000);
digitalWrite(WASTE_MOVE_1,HIGH);
digitalWrite(WASTE_MOVE_2,LOW);
delay(600);
digitalWrite(WASTE_MOVE_1,LOW);
digitalWrite(WASTE_MOVE_2,LOW);
UV_SENSOR();
  delay(200);
  //ROBO_MOVEMENT();
}
 void connect_wifi(String cmd, int t)
```

```
{
  int temp=0,i=0;
  while(1)
  {
//    lcd.clear();
//    lcd.print(cmd);
    Serial.println(cmd);
    Serial1.println(cmd);
    while(Serial1.available())
    {
      if(Serial1.find("OK"))
      i=8;
    }
    delay(t);
    if(i>5)
    break;
    i++;
  }
  if(i==8)
  {
   Serial.println("OK");
// lcd.clear();
//        lcd.setCursor(0,1);
```

```
//      lcd.print("OK");
  }
  else
  {
   Serial.println("Error");
//        lcd.setCursor(0,1);
//      lcd.print("Error");
  }
}
```

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SEGREGATION OF WASTE-A SURVEY

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Abstract - *Waste segregation and recycling are effective ways of reducing trash. In our country, recycling centers do manual process of sorting wastes so it increases human interface. For this we implement a system which minimizes human interference in the waste collecting and segregation process. The main objective of this project is to design a system using Arduino UNO for automatic segregating of waste at source and capable of cleaning. It is based on the principle of EM induction. Ultrasonic sensor estimates the distance and the status of the bin will be send through GSM. This bin can be used at places like offices, apartments, shopping malls etc. This system will be useful in making Waste Management in smart cities automated without the human intervention.*

***Key Words*: Arduino UNO, GSM, Ultrasonic sensor, IR sensor, L293D H-Bridge, Moisture sensor.**

1. INTRODUCTION

As the world is in a stage of up gradation, there is one stinking problem. We have to deal with Garbage! In our day to day life, we see the pictures of garbage bins being overfull and all the garbage spills out. This leads to many diseases as large number of insects and mosquitoes breed on it. A big challenge in the urban cities is solid waste management not only in India and also in many parts of the world. Hence, such a system has to be built which can eradicate this problem or at least reduce it to the minimum level. Based on estimates, the world cities generated 1.3 billion tons of waste annually with Asia accountable for 1 million tons per day.

More than half the world's population does not have access to regular trash collections which have caused troubles, are at a crisis level. With the upcoming smart cities, large numbers of responsibilities need to be fulfilled. A smart lifestyle begins with cleanliness, and cleanliness begins with waste management in proper way. A society will get its waste dispatched properly only if the dustbins are placed well and disposed well. The main problem in the current waste management system is the unhealthy status of dustbins.

2. LITERATURE SURVEY AND SUMMARY

In [1] Rapid increase in volume and types of solid and hazardous waste due to continuous economic growth. It is estimated that in 2005-06 the total amount of municipal solid waste generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003. The segregation, transport, handling, and disposal of waste needs to be properly managed to minimize the risk to the health and safety of patients, the public, and the environment. This paper proposes an Automated Waste Segregator (AWS) which is a cheap as well as easy to use solution for a segregation system for household use, so that it can be sent directly for processing. It is designed to sort the refuse into dry and wet waste. The AWS employs capacitive sensors to distinguish between wet and dry waste. Experimental results show that the segregation of waste into wet and dry waste has been successfully implemented using the AWS.

In [2] Waste management, both indoor and outdoor, is almost done manually. This is unhygienic, and requires significant amount of valuable human resource to get it done. Outdoor waste management is automated to an extent. Therefore, a proposal to fully automate indoor waste management, by making the existing disposal outlets more intelligent and using a movable waste collecting robot, is discussed in this paper. The filling of the dustbin is monitored by ultrasonic sensors and if it is filled to the brim, the Arduino Nano controller transmits the data to the robot with the aid of wireless Zig bee 802.15.4 protocol. The robot is designed in such a way that it effectively tracks the location of the filled dustbin and collects the waste in its storage part. The RSSI (Received Signal Strength Indicator) value from the message received is used to identify which dustbin is full and its location based on Wave Front Algorithm. In comparison with the existing systems, the proposed system exhibits appreciable efficiency in power consumption and making it an ideal candidate for waste management.

In [3] In last few decades garbage management has become a perilous matter in the developing country along with the rapid growth in the population and pollution. In most of the areas it is revealed that overflowed garbage bins are not emptied on time thus creating disease ridden environment and infirm countries. Collection of garbage in bins faces daily variation in quantity according to time as well. Waste picking vehicles of Municipal Corporation which are at fixed intervals has dwindling reliability and unmonitored collection system. The proposed model makes an IOT based smart garbage monitoring system which can detect the garbage level of the dustbin and via Wi-Fi and GSM the status and location of bins can be displayed on web server. This system will improve the coordination between the transportation process and garbage collection.

In [4] This research aimed to design and develop an autonomous robot to feasibly address waste disposal issues in common indoor places. The researchers found a path to

improve plan by using Fuzzy Logic Control (FLC). And also, they utilized the Microcontroller unit to control sound, input proximity and IR sensors, and output geared DC motors through machine learning and electromechanical interface. They simulated an adaptive algorithm using Mamdani-type FLC model, implemented this algorithm using C programming language, then downloaded as machine code to a real prototype. Based on test results, the waste robot accurately detects human involvement, a feature that would be pivotal in overcoming individual indifferences on waste management. This research chronicled how a waste management robot prototype was designed and developed as feasible solution to address waste disposal issues in strategic locations such as households, offices.

In [5] An Automated Waste Control Management System (AWCMS) has been designed which includes an electronic waste detection device and a central control unit. An infrared sensor is used for sensing waste levels, GPS is used for location identification, Arduino Board having a microcontroller and GSM Module is used for sending the message which contains the information regarding the status of the bin. The central control unit consists of a receiving device which receives a message through GSM Module and sends it to the computer software using Arduino Board's microcontroller. The software has a proficiently designed GUI which helps the user to perform and monitor all the required actions for waste monitoring and detection of waste bins placed in an area or a city. All the information is displayed in the GUI of the software in the event of a waste-bin getting full and then being emptied by municipal waste trucks or field workers. So that all the components in this entire system work in an efficient manner to make waste management automation possible so the waste is collected and disposed to the landfill at proper time.

In [6] This paper detects the wastes in the dustbins with the help of sensor devices and as soon as the waste is detected, it will be segregated and right away information is transferred to cloud via IOT. Microcontroller is used between the sensors and IOT module. Ultra-sonic sensor is used to detect the nearness of the waste material. The moisture sensor is used to analyze and report the moisture content in the waste, and if there is moisture content available then the waste cannot be put in the dustbin. Image processing algorithm is used to identify the plastics and degradable items and is separated to another separate sections. The dustbin data are uploaded to the cloud in real time.

3. GAPS IN LITERATURE SURVEY

In [1] The AWS employs capacitive sensors to distinguish between wet and dry waste. Capacitive sensors very much sensitive to changes in environment conditions such as temperature, humidity. And this sensor is not so accurate. This will affect the performances.

In [2] The Arduino Nano controller transmits the data to the robot with the aid of wireless Zig bee protocol, which is includes short range and low data speed. Replacement of Zig bee complaint appliances is costly. To identify which dustbin is full and its location Wave Front Algorithm is used which is time consuming and expensive and it is possible that two or more nodes have same value.

In [3] The status and location of bins can be displayed on web server that can site down because the server can be overwhelmed at times. By using IOT there is a huge risk of leakage data when sent over a network which can mix up two data. Due to the complex network, a single loophole can put the entire system down.

In [4] Fuzzy Logic Control (FLC) is used which requires lot of data to be applied. The accuracy depends on human knowledge and expertise and needs regular updates with time. They have utilized MCU that can't interface high power devices and it performs limited number of executions simultaneously.

In [5] In this paper human intervention still exists i.e., for segregating the collected garbage whether it is a wet or dry waste.

In [6] In this paper they have used Microcontroller which cannot perform many functions at the same time. The data is uploaded to the cloud which requires network to send files and to retrieve them. Image processing is used to detect wet or dry waste which is very costly and time consuming.

4. DESIGN METHODOLOGY

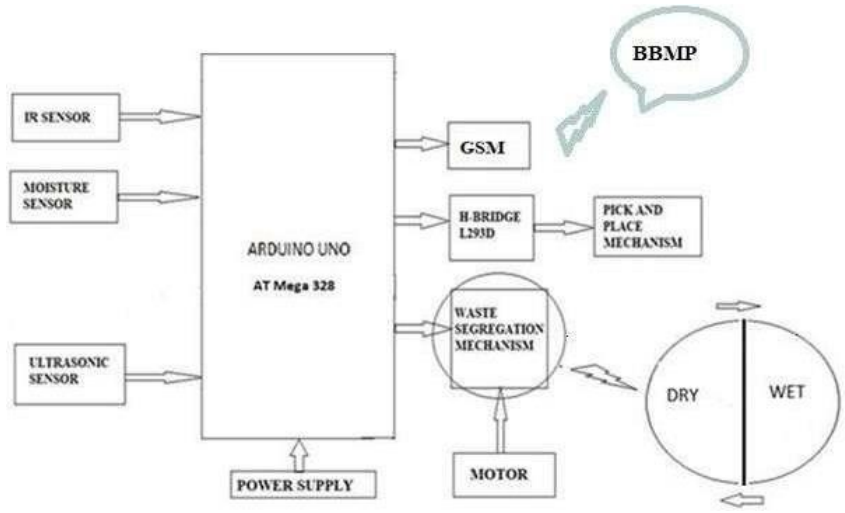

Fig -1: Block diagram of AWS

5. CONCLUSION

The above reviews give out different methods and strategies used for serving the purpose of waste management. Our project provides one of the most efficient ways to keep our environment clean and green. In this project we have tried to upgrade the trivial but vital component of the urban waste management system, i.e. dustbin.

REFERENCES

1. Amrutha Chandramohan, Joyal Mendonca, Nikhil Ravi Shankar, et al "Automated Waste Segregator" 2014 Texas Instruments India Educators' Conference (TIIEC).

2. Poorani Ravindhiran, Pradeep Gopal, Joseph Gladwin S, Rajavel R ". Automated Indoor Waste Management System Employing Wave Front Algorithm and Received Signal

3. Strength Indicator Values-based Mobile Robot" 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC).

4. Smita S Pawar, Shivani Pise, Kranti Walke, Renuka Mohite "Smart Garbage Monitoring System Using AVR Microcontroller" 2018 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)

5. Ralph Sherwin A. Corpuz, John Clifford R. Orquiza "Utilization of Fuzzy Logic Control in a Waste Robot" 2018 Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM).

6. Agha Muhammad Furqan Durrani, Ateeq Ur Rehman2, Arslan Farooq, Jehangir Arshad

7. Meo et al "An Automated Waste Control Management System (AWCMS) by using Arduino" 2019 International Conference on Engineering and Emerging Technologies (ICEET).

8. Shamin N, P Mohamed Fathimal, Raghavendran R, et al "Smart Garbage Segregation & Management System Using Internet of Things (IOT) & Machine Learning (ML)" 2019 1st International Conference on Innovations in Information and Communication Technology (ICIICT).

9. Balagugan, Raja S Maheswaran T, Savitha S "Implementation of Automated Waste Segregator at Household Level" -IJIRSET 2017.

10. "Smart Garbage Monitoring and Clearance System using Internet of Things" S. Vinoth Kumar, A. Krishna Kumar and Mahantesh Mathapati, et al-2017 IEEE International Conference.

11. Shashika lokuliyana, Anuradha Jayakody, G.B.S Dabarera, et al "Location Based Garbage Management System with IOT for Smart city"- 2018 IEEE International Conference.

12. Jayashree Ghorpade-Aher, Anagha Wadkar, et al "Smart Dustbin: An efficient Garbage Management Approach for a Healthy Soceity"-2018 IEEE International Conference.

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AUTOMATIC SEGREGATION OF WASTE USING ROBOTIC ARM

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Abstract - *As the world is in the stage of upgradations, there is one stinking problem we have to deal with Garbage. Waste segregation and recycling are effective ways ofreducing dumped trash. Recycling is done manually by sorting the waste by the human interface. To reduce human interface and to make systems smarter. We implemented a system for collecting and segregating waste into dry and wet with no human interface. The system designed with inbuilt sensors to detect and segregate the waste, along with an arm to pick and place the waste into separate bins designed for dry and wet waste.*

Key Words: **Arduino, Ultrasonic Sensor, Wi-Fi Module, IR Sensor.**

1. INTRODUCTION

A rapid increase in volume and types of solid and hazardous waste as a result of continuous economic growth, urbanization, and industrialization, is becoming a burgeoning problem for national and local governments to ensure effective and sustainable management of waste. It is estimated that in 2006 the total amount of municipal solid waste generated globally reached 2.02 billion tones, representing a 7% annual increase since 2003 (Global Waste Management Market Report 2007). The segregation, handling, transport, and disposal of waste are to be properly managed to minimize therisks to thehealthandsafety of patients, the public, and the environment. The economic value of waste is best realized when it is segregated. Currently, there is no such system for the segregation of dry and wet waste.

This paper proposes an Automated Waste Segregator (AWS) which is a cheap, easy to usesolution fora segregationsystem at householdssothat it can be sent directly for processing. It is designed to sort the refuse into wet waste and dry waste. The AWS employs capacitive sensors to distinguish between wet and dry waste. Experimental results show that the segregationofwaste into wetanddrywaste has been successfullyimplemented usingtheAWS. This system employs an IR sensor moisture sensor and an ultrasonic sensor to perform the various operations. It consists of dc motors to drive the system. A Wi-Fi module is incorporated to get the notifications respectively when a certain action is performed.

2. LITERATURE SURVEY AND SUMMARY

In [1], the basic idea behind this project is to implement a smart way of handling the garbage which is done by using the IoT protocol for the dustbin status wirelessly, through email to notify the concerned persons that the system is filled with garbage and need to be replaced. The Espresso chip which is a NodeMCU ESP8266 platform is selected along with ultrasonic sensor and LCD interfacing for current status display. This system is based on IoT protocol. The working is based on the Arduino platform. This microcontroller controls the movement of Dustbin on a specific path defined by a line or the path can be pre-programmed in the device. The LCD, Ultrasonic Sensor, Proximity Sensor, Wi-Fi module (ESP8266), and Motor Driver (L293D) are interfaced with the Arduino UNO board. If someone wants to put the garbage in it, then the person can stop the dustbin by

Keeping a hand in front of it. Notification is displayed on LCD and also transfers the message through the Wi-Fi module– ESP8266. This module transmits and receives data on a web server. It collects information from proximity sensors, ultrasonic sensors and also controls the movement of a dustbin.

In [2], the system aims to schedule trucks by finding the shortest path for waste collection. This system sets up smart waste bins/ trash cans per society, which will be IoT enabled. It transmits information about dustbin fill status and harmful gas levels. It finds an efficient route to collect maximum waste with less cost and fuel. The system provides estimated dates for collection of waste, Real-time bin status, expected fill updates for the bins, and optimized the shortest path for waste collection. This is a bin monitoring system for waste collection. The trucks landing at our doorstep irregularly for waste collection discard their further path if they get filled at some point. Eventually delaying the collection of waste in some regions. This leads to waste accumulation in such regions. To avoid such condition this system is introduced for scheduling trucks for waste collection.

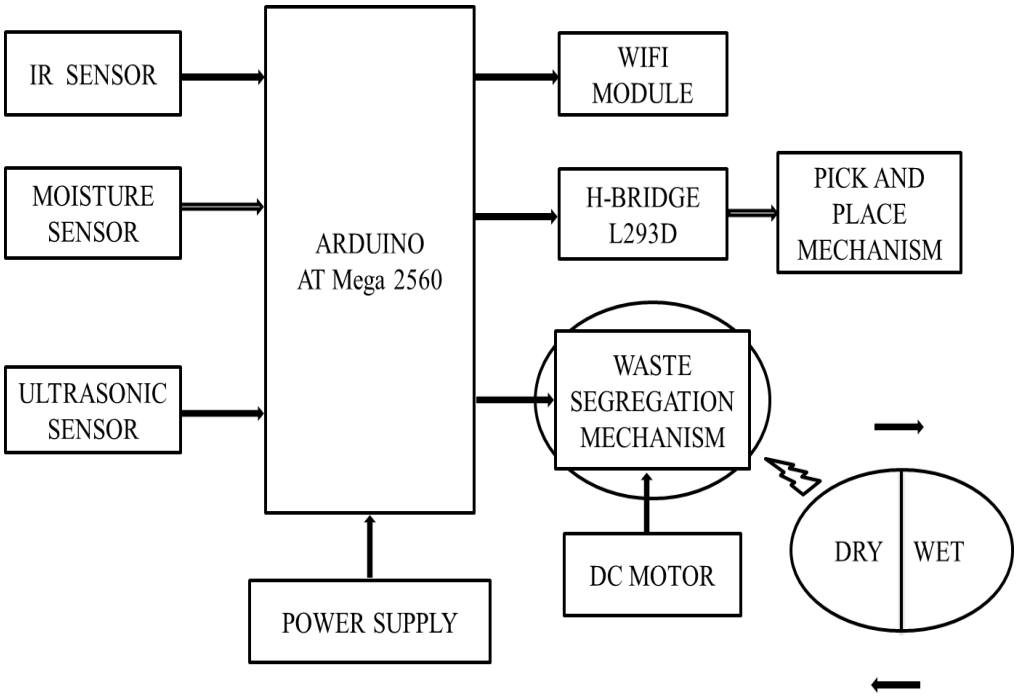
The waste which generates harmful gases needs to be collected earliest so that harmful gas levels intheatmospherecan be reduced. Bins are composed of sensors and communication technology which senses the level of waste in bins and measures toxic gases. It sends information through GSM/GPRS communication from the bin to the server, which includes GSM/GPRS connectivity to each bin causing a large increase in operating cost. The data sent are received and stored by workstation, then the shortest distance is calculated and also pick- up dates are estimated.

In [3], this paper describes the application of —Solar Smart Bin in managing the waste collection system of an entire city. A smart city is incomplete without a smart waste management system, as they playa vital role in keeping thecities/towns clean & hygienic and also provide a better public image for the tourists coming from all around the world. This Solar Smart Bins proposed to manage the waste collection system of the entire city. The module consists of two bins, one for crushing the biodegradable waste such as plastic/paper cups and glasses, and various other materials and the other bin is used for storing the bottles, tins, etc. It is being designed in such a way that, energy-efficient data aggregation from a large number of bins even under the harsh environmental conditions can operate significantly and is reliable andaccurate. Theprincipleusedfor measurement is locating the level ofobject bythe reflected sound waves so-called echo sounding. GSM module consists of SIM800A. It requires 5V DC voltage and current consumption of 500mA.

In [4], the proposed model has two dustbins (named as Dustbin Aand Dustbin B) which will be kept at public places mostly. Dustbin A can be used but Dustbin B cannot be used until Dustbin A is full. Dustbin B can only be used once Dustbin A is full and then Dustbin A will not open until the waste is cleared in the Dustbin A. Whenever any dustbin is filled up, a message is sent to the concerned authority. This will avoid the overflow of waste in the bin. Dustbins have automatically closedandopen features depending on the presence of an obstacle. The proposed system consists of double dustbins, where second Dustbin B cannot be used until and unless Dustbin A is filled. Dustbin B can only be used once Dustbin A is full and then Dustbin A will not open until the waste is cleared in the dustbin A. Two IR sensors are placed in the front of the bins so that whenever any person comes in front of dustbin it opens and closes automatically using a servo motor. An ultrasonic sensor is used to measure the level of waste inside bins. Once the Dustbin A or B gets filled up a message is sent to the concerned authority via GSM module.

3. METHODOLOGY

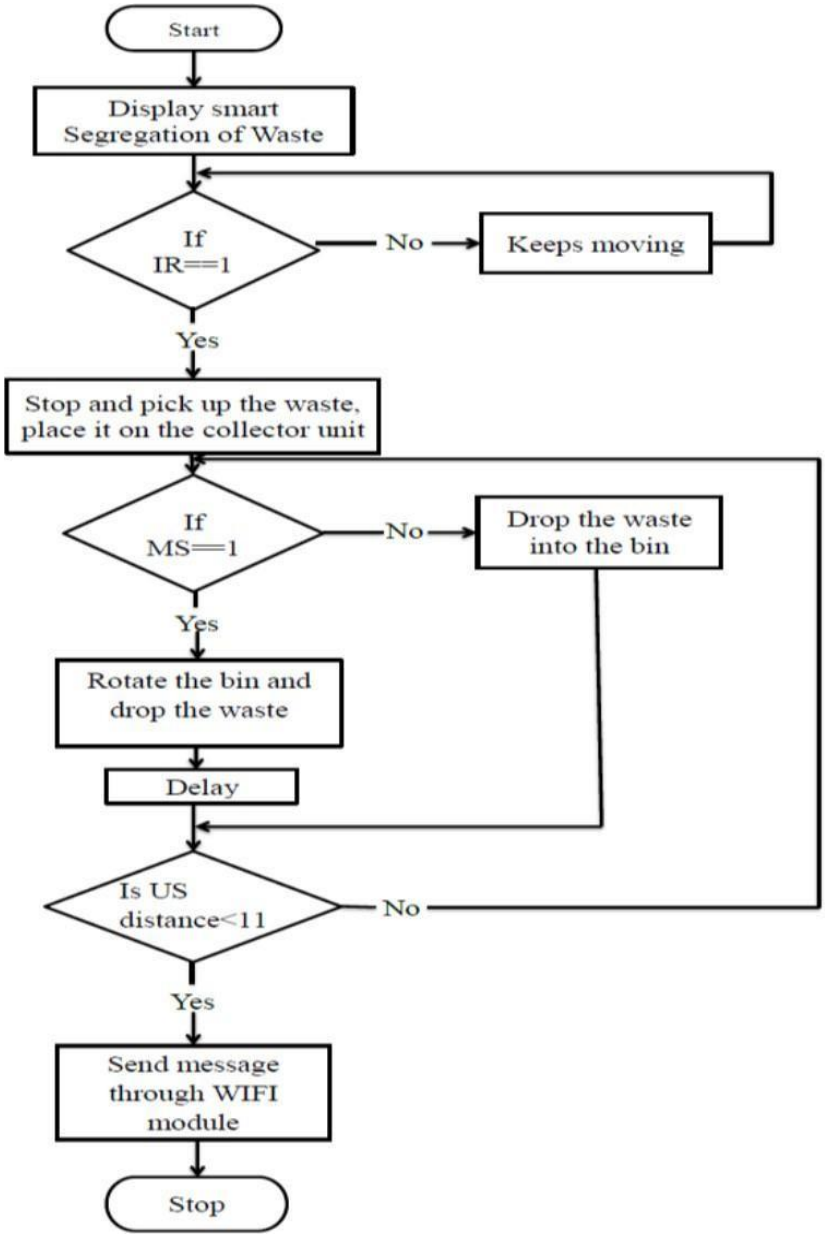
3.1. Proposed Block Diagram



In this project, the ROBOT is designed using DC Motors and Motor Drivers. The ROBOT will sense the presenceofwasteona conveyor using IR Sensors. After that,the gripper will pick thewasteand at thegripper, therearetwotypes of sensors. Thesensors are Moisture, metal proximity, and limit switch. The metal proximity sensorsare used to sense the metal type waste and the limit switch is used to sense the other waste except for the metal. Soil Moisture sensors are used to sense agriculture or wet waste. As the sensors sense the waste the bin placed at the vehicle will move accordingly. ARM will drop the waste in the proper section of the bin. WI-FI module used here to send the intimation to concerned authority once the separation is over andevenwhenthebin is full. The Block diagram shows the different components used in the Smart Dust bin System is Power Supply, IR Sensor, Metal Sensor, and Moisture Sensor ARM. The sensor is connected in dustbin it is used to detect the level of dustbinwheredustbin is full or empty.

With the help of sensors, the system can segregate the waste collected in collection Point. In turn, the Controller initiates Robotic arm to collect the waste and segregate accordingly. Three Separate storage based dustbin is designed for automatic waste collection and segregation. As soon as the ultrasonic sensor senses that the garbage container reached its maximum capacity.

3.2. Flow Chart



4. RESULTS

This system provides a Robotic solution for Garbage segregation. A pick and Place mechanism is used for separation. Use of Sensors like Moisture for Waste separation such as wet and dry. Planning for enabling the collection of garbage generation data. This checks the waste level over the dustbins by using the Sensor. Once it detected immediately this system alert to concern authority through the WIFI module. The below figures shows the snapshots of the results obtained.

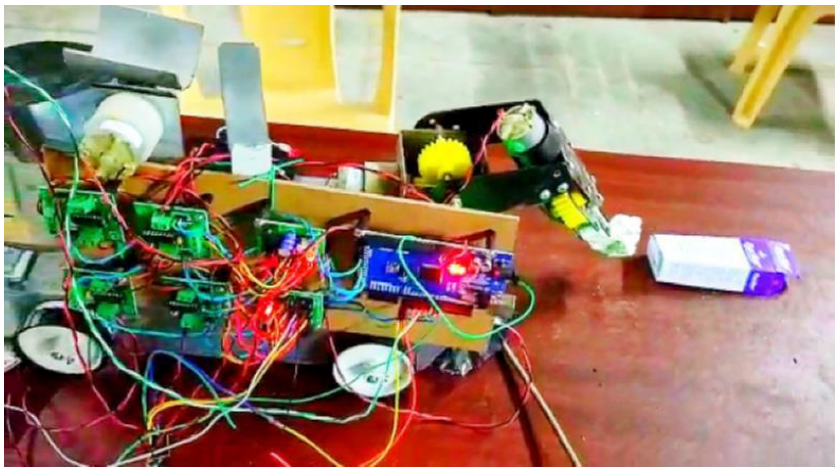


Fig-1: Once the sensor detects the waste, robot stops and arm picks the waste.

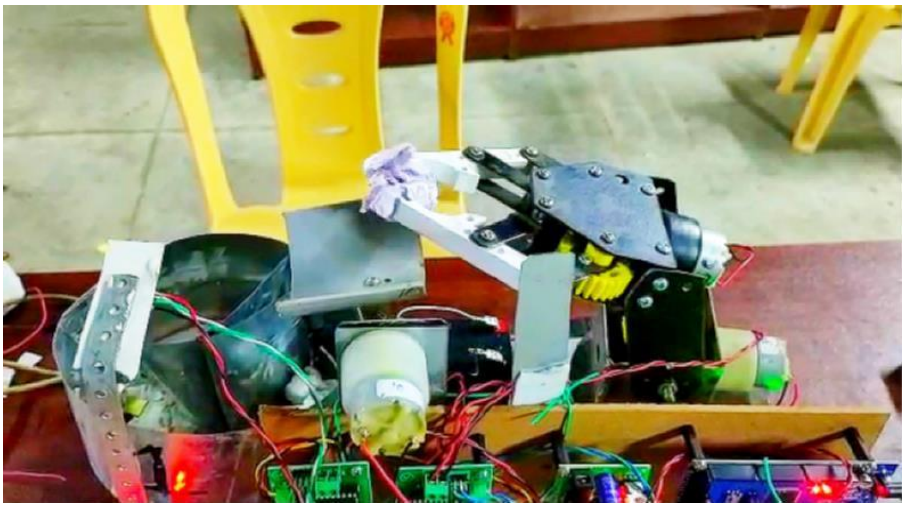


Fig-2: After picking the waste the arm place it on the collector unit.

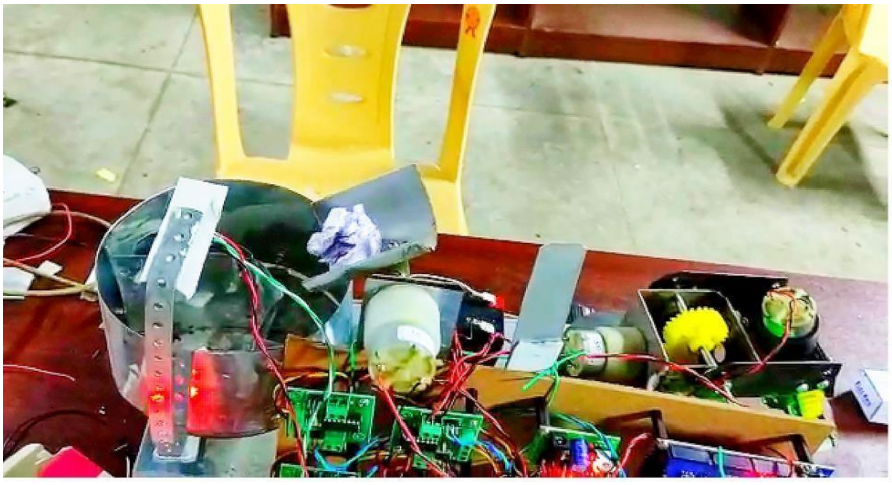


Fig-3: The collector unit detects the waste as wet and dry, and then drops it into the bin accordingly.

5. CONCLUSION AND FUTURE SCOPE

Automatic Waste Segregator Bin using the Robotic Arm performs the segregation into dry and wet waste. The waste around the bin is detected and the robotic arm is usedto place the waste in the bin. This system is more innovative as it includes an automated system and a robotic arm, making it a more effective and efficient system. This research takes a step forward in contributing towards the cleanliness of our society, thereby supporting the idea "SWACHH BHARAT ABHIYAN" proposed by our humble Prime Minister. This system can be made more advanced and efficient by using a crusher and artificial intelligence in the future.

6. REFERENCES

1. Amrutha Chandramohan, Joyal Mendonca, Nikhil Ravi Shankar, et al "Automated Waste Segregator" 2014 Texas Instruments India Educators' Conference (TIIEC).
2. Poorani Ravindhiran, Pradeep Gopal, Joseph Gladwin S, Rajavel R ". Automated Indoor Waste Management System Employing WaveFront Algorithm and Received Signal Strength Indicator Values-based Mobile Robot" 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC).
3. Smita S Pawar, Shivani Pise, Kranti Walke, Renuka Mohite "Smart Garbage Monitoring System Using AVRMicrocontroller" 2018 Fourth InternationalConference onComputing Communication Control and Automation(ICCUBEA) Ralph Sherwin A. Corpuz, John Clifford R. Orquiza "Utilization of Fuzzy Logic Control in a Waste Robot" 2018 Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment and Management (HNICEM).
4. Agha Muhammad Furqan Durrani, Ateeq Ur Rehman2, Arslan Farooq, Jehangir Arshad Meo et al "An Automated Waste Control Management System (AWCMS) by using Arduino" 2019 International Conference on Engineering and Emerging Technologies (ICEET).
5. Shamin N, P Mohamed Fathimal, Raghavendran R, et al "Smart Garbage Segregation & Management System Using Internet of Things (IOT) & Machine Learning (ML)" 2019 1st International Conference on Innovations in Information and Communication Technology (ICIICT).
6. Balagugan, Raja S Maheswaran T, Savitha S "Implementation of Automated Waste Segregator at Household Level" -IJIRSET 2017.
7. "Smart Garbage Monitoring and Clearance System using Internet of Things" S. Vinoth Kumar, A. Krishna Kumar and Mahantesh Mathapati, et al-2017 IEEE International Conference.
8. Shashika lokuliyana, Anuradha Jayakody, G.B.S Dabarera, et al "Location Based Garbage Management System with IOT for Smart city"- 2018 IEEE International Conference.
9. Jayashree Ghorpade-Aher, Anagha Wadkar, et al "Smart Dustbin: Anefficient Garbage Management Approach for a Healthy Soceity"-2018 IEEE International Conference.

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office.kscst@iisc.ac.in

Mr. H. Hemanth Kumar
Executive Secretary

16th March 2020

Ref: 7.1.01/SPP/953

The Principal,
K.S. Institute of Technology,
Bengaluru - 560 062.

Dear Sir/Madam,

Sub : Sanction of Student Project - 43rd Series: Year 2019-2020
Your Project Proposal Reference No. : ***43S_BE_1303***

Ref : Your Project Proposal entitled " ***AUTOMATIC SEGREGATION OF WASTE USING ROBOTIC ARM***

We are pleased to inform that your student project proposal referred above, has been approved by the Council under "Student Project Programme - 43rd Series" with a budgetary break-up as detailed below:

Student / s	Ms. Bhoomika P M	**Budget**	
	Ms. Sonika V	**Particulars**	**Amount (Rs.)**
	Ms. Suma B S	Materials/Consumables	4,000.00
	Ms. Vismitha Sonna	Labour	-
Guide/s	Mrs. V Sangeetha	Travel	-
	-	Miscellaneous	-
Department	Electronics And Communication Engineering	Report	500.00
		Total	**4,500.00**
	Four Thousand Five Hundred Rupees Only		

The following are the guidelines to carryout the project work :

a) The project should be performed based on the objectives of the proposal sent by you.

b) The project should be completed in all respects and one copy of the hardbound report along with softcopy of the full report in a CD (.pdf format) should be submitted to KSCST.

c) Any change in the project title and objectives, etc., or students is liable to rejection of the project and the amount sanctioned needs to be returned to KSCST.

d) Please quote your **project reference number printed above** in all your future correspondences.

e) **Important:** After completing the project, 2 to 3 page write-up (synopsis) needs to be sent by e-mail [spp@kscst.iisc.ernet.in] and should include following :

1) Title of the project
2) Name of the College & Department
3) Name of the students & Guide(s)
4) Keywords

6) Introduction / background
(with specific reference to the project, work done earlier, etc) - about 20 lines
6) Objectives (about 10 lines)
7) Methodology (about 20 lines)
(materials, methods, details of work carried out, including drawings, diagrams etc)
8) Results and Conclusions
(about 20 lines with specific reference to work carried out)
9) Scope for future work (about 20 lines).

(Note: The write-up (Synopsis) should be sent with the approval of project guide. The softcopy of the write-up, in MS Word format, should be sent by e-mail (spp@kscst.iisc.ernet.in). In your e-mail, please also include project proposal reference number and title of the project.)

e) Projects selected for Seminar / Exhibition will be awarded.

The sanctioned amount will be sent through crossed cheque to the Principal. Please furnish the bank account details as per the format enclosed with this letter.

The sponsored projects evaluation will be held in the Nodal Centre and the details of the nodal centre will be intimated shortly by e-mail / Website announcement.

Please visit our website for further announcements / information and for any clarifications please email to spp@kscst.iisc.ernet.in

Thanking you and with best regards,

Yours sincerely,

(H. Hemanth Kumar)

Copy to:

1) The Head of the Department of
Electronics And Communication Engineering
K.S. Institute Of Technology,
Bengaluru - 560 062.

2) Mrs. V Sangeetha
Department of Electronics And Communication Engineering
K.S. Institute Of Technology,
Bengaluru - 560 062.

3) The Finance Officer, KSCST, Bengaluru

Encl: As Above

K S INSTITUTE OF TECHNOLOGY, BENGALURU

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RUBRICS for Evaluation of Project work

Review-1 : Total Marks 15			
Design Readiness (Component procurement, Project plan & set up of environment)	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	Component procurement, Project plan & set up of environment is done as required	Component procurement, Project plan & set up of environment is done partially	Component procurement, Project plan & set up of environment is poorly done
	8 to 10 marks	**5 to 7 marks**	**0 to 4 marks**
Comparison with similar work	**Evaluation criteria**		
	Good	**Average**	**Poor**
5 marks	Comparison of the work is good against similar work	Comparison of the work is average against similar work	Comparison of the work is poor against similar work
	4 to 5 marks	**3 marks**	**0 to 2 marks**

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RUBRICS for Evaluation of Project work

Review-2 : Total Marks 40			
Partial Demo	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	Partial demonstration of project work is satisfactory	Partial demonstration of project work is average	Partial demonstration of project work is poor
	8 to 10 marks	**5 to 7 marks**	**0 to 4 marks**
Tool learning	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	Tool learning is satisfactory	Tool learning is partially satisfactory	Tool learning is poor
	8 to 10 marks	**5 to 7 marks**	**0 to 4 marks**
Project Report draft	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	The contents of the Draft project report is good	The contents of the Draft project report is average	Draft project report is poorly written.
	8 to 10 marks	**5 to 7 marks**	**0 to 4 marks**
Consistency Team work	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	Demonstration of consistency in work progress and team work if good.	Demonstration of consistency in work progress and team work if average.	Demonstration of consistency in work progress and team work if poor.
	8 to 10 marks	**5 to 7 marks**	**0 to 4 marks**

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RUBRICS for Evaluation of Project work

Review-3 : Total Marks 45			
Functional demo	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	Functional demonstration of project work is satisfactory	Functional demonstration of project work is average	Functional demonstration of project work is poor
	8 to 10 marks	**5 yo 7 marks**	**0 to 4 marks**
Results vs Requirements Further work	**Evaluation criteria**		
	Good	**Average**	**Poor**
5 marks	Results vs requirements of the project is satisfactory	Results vs requirements of the project is partially satisfactory	Results vs requirements of the project is poor
	4 to 5 marks	**3 marks**	**0 to 2 marks**
UGC approved State level or above	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	The work is published in UGC Journal + one in state level or above	Both papers are published in statel level or above	Only one paper is published
	6+4 marks	**4 +4 marks**	**4 to 6 marks other wise 0 marks**
Final Project report	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	Project report is complete and correct in all respects	Project report is complete and correct partially.	Project report's completeness and correctness is poor
	8 to 10 marks	**5 to 7 marks**	**0 to 4 marks**
Presentation & PPT quality	**Evaluation criteria**		
	Good	**Average**	**Poor**
10 marks	Presentation and PPT quality is good	Presentation and PPT quality is average	Presentation and PPT quality is poor
	8 to 10 marks	**5 yo 7 marks**	**0 to 4 marks**

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8th SEMESTER PROJECT REVIEW - 1

2019-20

Project Group No	3
Project Title	Automatic segregation of waste using Robotic arm
Guide Name	Mrs Sangeetha V

Sl No	USN	Student Name	CO1(10)	CO3(5)	Total (15)
			Design Readiness (Component procurement, Project plan & set up of environment)(10)	Comparison with similar work(5)	
1	1KS16EC017	BHOOMIKA.P.M	10	5	15
2	1KS16EC094	SONIKA.V	10	5	15
3	1KS16EC099	SUMA.B.S	10	5	15
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	5	15

Evaluator Name **Dr.Surekha.B**

Project Coordinators **Dr. B Sudarshan**
Mrs.Sahana Salgere

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4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	5	15

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

Project Coordinators **Dr. B Sudarshan**
Mrs.Sahana Salgere

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2	1KS16EC094	SONIKA.V	10	5	15
3	1KS16EC099	SUMA.B.S	10	5	15
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	5	15

Evaluator Name **Mrs Sangeetha V**

Project Coordinators **Dr. B Sudarshan**
Mrs.Sahana Salgere

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8th SEMESTER PROJECT REVIEW - 2
2019-20

Project Group No	3
Project Title	Automatic segregation of waste using Robotic arm
Guide Name	Mrs Sangeetha V

Sl No	USN	Student Name	CO2 (10)	CO3 (10)	CO4 (10)	CO5 (10)	Total (40)
			Partial Demo (10)	Tool learning (10)	Project Report draft(10)	Consistency Team work (10)	
1	1KS16EC017	BHOOMIKA.P.M	10	10	10	9	39
2	1KS16EC094	SONIKA.V	10	10	9	10	39
3	1KS16EC099	SUMA.B.S	10	10	8	8	36
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	10	9	8	37.

Evaluator Name **Mrs.Sangeetha.V**

Project Coordinators **Dr. B Sudarshan**
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2019-20

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2	1KS16EC094	SONIKA.V	10	10	9	10	39
3	1KS16EC099	SUMA.B.S	10	10	9	10	39
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	10	9	10	39

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

Project Coordinators **Dr. B Sudarshan**
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3	1KS16EC099	SUMA.B.S	10	10	9	8	37
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	10	9	8	37

Evaluator Name **Dr.Surekha.B**

Project Coordinators **Dr. B Sudarshan**
Mrs. Sahana Salagere

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGG.
8th SEMESTER PROJECT REVIEW - 3
2019-20

Project Group No	3
Project Title	Automatic segregation of waste using Robotic arm
Guide Name	Mrs.Sangeetha.V

Sl No	USN	Student Name	CO2(10)	CO3(5)	CO4(10)	CO4(10)	CO5(10)	Total (45)
			Functional demo10)	Results vs Requirements Further work (5)	UGC approved (6) State level or above (4)	Final Project report(10)	Presentation (5) PPT quality (5)	
1	1KS16EC017	BHOOMIKA.P.M	10	5	10	10	10	45
2	1KS16EC094	SONIKA.V	10	5	10	10	10	45
3	1KS16EC099	SUMA.B.S	10	5	10	10	10	45
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	5	10	10	10	45

Evaluator Nan **Mrs.Sageetha.V**

Project Coord **Dr. B Sudarshan**
Mrs. Sahana Salagere

HOD

K.S. INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGG.
8th SEMESTER PROJECT REVIEW - 3
2019-20

Project Group No	3
Project Title	Automatic segregation of waste using Robotic arm
Guide Name	Mrs.Sangeetha.V

Sl No	USN	Student Name	CO2(10)	CO3(5)	CO4(10)	CO4(10)	CO5(10)	Total (45)
			Functional demo10)	Results vs Requirements Further work (5)	UGC approved (6) State level or above (4)	Final Project report(10)	Presentation (5) PPT quality (5)	
1	1KS16EC017	BHOOMIKA.P.M	10	5	10	10	10	45
2	1KS16EC094	SONIKA.V	10	5	10	10	10	45
3	1KS16EC099	SUMA.B.S	10	5	10	10	10	45
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	5	10	10	10	45

Evaluator Nan **Dr.Surekha.B**

Project Coord **Dr. B Sudarshan**
Mrs. Sahana Salagere

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K.S. INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGG.

8th SEMESTER PROJECT REVIEW - 3

2019-20

Project Group No	3
Project Title	Automatic segregation of waste using Robotic arm
Guide Name	Mrs.Sangeetha.V

Sl No	USN	Student Name	CO2(10)	CO3(5)	CO4(10)	CO4(10)	CO5(10)	Total (45)
			Functional demo10)	Results vs Requirements Further work (5)	UGC approved (6) State level or above (4)	Final Project report(10)	Presentation (5) PPT quality (5)	
1	1KS16EC017	BHOOMIKA.P.M	10	5	10	10	10	45
2	1KS16EC094	SONIKA.V	10	5	10	10	10	45
3	1KS16EC099	SUMA.B.S	10	5	10	10	10	45
4	1KS16EC115	VISMITHA SONNA SATHYANARAYANA	10	5	10	10	10	45

Evaluator Nan **Dr.P.Joy Prabhakaran**

Project Coord **Dr. B Sudarshan**
Mrs. Sahana Salagere

HOD

Visvesvaraya Technological University

K.S. INSTITUTE OF TECHNOLOGY, BANGALORE

Branch : EC Scheme : 2015 Semester : 8

Sl NO.	USN	15EC81	15EC82	15EC833	15EC84	15ECP85	15ECS86	STUDENT SIGNATURE
1	1KS14EC068	19	19	16	42	91	90	
2	1KS14EC085	18	14	12	44	80	85	
3	1KS14EC107	15	18	16	35	91	88	
4	1KS14EC117	15	18	16	45	91	88	
5	1KS15EC071	18	19	19	44	87	90	
6	1KS16EC002	20	20	20	50	98	88	
7	1KS16EC003	19	19	18	45	98	85	
8	1KS16EC004	19	20	20	50	98	90	
9	1KS16EC006	19	20	18	49	89	88	
10	1KS16EC009	20	20	20	50	98	88	
11	1KS16EC010	18	20	16	49	88	90	
12	1KS16EC011	19	20	20	48	94	88	
13	1KS16EC013	20	20	20	50	99	99	
14	1KS16EC014	18	18	19	48	88	85	
15	1KS16EC015	20	20	20	50	99	94	
16	1KS16EC016	19	20	20	46	91	90	
17	1KS16EC017	20	20	20	50	99	99	
18	1KS16EC018	20	20	20	47	93	98	
19	1KS16EC019	20	20	19	50	92	99	
20	1KS16EC020	20	20	20	48	88	85	
21	1KS16EC022	20	20	20	48	92	94	
22	1KS16EC023	20	20	19	48	90	99	
23	1KS16EC024	18	20	19	47	94	85	
24	1KS16EC025	19	20	20	46	95	94	
25	1KS16EC026	19	20	20	47	96	99	
26	1KS16EC028	20	20	20	44	95	99	
27	1KS16EC031	20	20	20	49	94	94	
28	1KS16EC032	20	20	20	50	99	99	
29	1KS16EC034	20	20	20	50	99	98	
30	1KS16EC035	19	20	20	50	98	90	
31	1KS16EC036	20	20	20	49	94	98	
32	1KS16EC037	19	20	20	47	92	90	
33	1KS16EC039	20	20	20	45	93	85	
34	1KS16EC040	20	20	20	50	96	98	
35	1KS16EC041	20	20	20	48	99	99	

Sl NO.	USN	15EC81	15EC82	15EC833	15EC84	15ECP85	15ECS86	STUDENT SIGNATURE
36	1KS16EC042	20	20	20	48	94	98	
37	1KS16EC043	19	20	19	46	91	85	
38	1KS16EC044	19	20	19	45	90	98	
39	1KS16EC045	20	20	20	48	90	94	
40	1KS16EC047	20	20	20	49	98	88	
41	1KS16EC048	19	19	18	43	90	85	
42	1KS16EC049	20	20	20	50	98	94	
43	1KS16EC050	20	20	20	50	95	90	
44	1KS16EC051	19	19	20	45	91	90	
45	1KS16EC052	20	20	20	50	92	98	
46	1KS16EC053	20	20	20	50	95	90	
47	1KS16EC054	20	20	20	50	95	98	
48	1KS16EC055	19	20	18	48	95	90	
49	1KS16EC056	18	20	19	45	89	90	
50	1KS16EC057	20	20	20	50	98	90	
51	1KS16EC058	20	20	20	50	99	90	
52	1KS16EC059	19	20	20	49	95	90	
53	1KS16EC060	20	20	16	46	90	85	
54	1KS16EC061	20	20	20	50	98	99	
55	1KS16EC062	18	20	18	43	89	85	
56	1KS16EC063	20	20	20	50	98	99	
57	1KS16EC064	20	20	20	50	95	99	
58	1KS16EC065	16	18	18	45	90	85	
59	1KS16EC067	19	20	20	49	95	99	
60	1KS16EC070	17	18	18	47	87	85	
61	1KS16EC071	20	20	20	50	97	94	
62	1KS16EC072	20	20	20	50	98	99	
63	1KS16EC073	20	20	19	50	95	99	
64	1KS16EC074	16	18	18	48	94	90	
65	1KS16EC076	20	20	20	50	97	99	
66	1KS16EC077	19	20	19	45	94	98	
67	1KS16EC078	20	20	20	50	99	99	
68	1KS16EC079	20	20	20	50	90	98	
69	1KS16EC080	20	20	20	48	90	98	
70	1KS16EC081	19	19	19	45	98	94	
71	1KS16EC082	19	18	20	50	94	90	
72	1KS16EC083	17	20	20	45	92	90	
73	1KS16EC084	20	19	19	45	90	85	
74	1KS16EC085	20	20	20	50	95	98	
75	1KS16EC087	20	20	19	47	93	90	
76	1KS16EC088	20	20	19	48	95	90	
77	1KS16EC089	20	20	20	49	92	90	

Sl NO.	USN	15EC81	15EC82	15EC833	15EC84	15ECP85	15ECS86	STUDENT SIGNATURE
78	1KS16EC090	17	20	19	48	96	90	
79	1KS16EC091	18	20	19	49	95	94	
80	1KS16EC092	17	19	19	45	93	90	
81	1KS16EC094	20	20	20	50	99	99	
82	1KS16EC095	20	20	20	49	91	94	
83	1KS16EC096	20	20	19	48	99	85	
84	1KS16EC097	18	19	16	47	90	94	
85	1KS16EC098	20	19	19	49	92	98	
86	1KS16EC099	20	20	20	49	98	90	
87	1KS16EC102	20	20	20	50	95	99	-
88	1KS16EC103	19	20	18	45	92	98	
89	1KS16EC105	20	20	20	48	95	85	
90	1KS16EC106	19	19	19	45	91	94	
91	1KS16EC108	20	20	20	50	96	94	
92	1KS16EC109	20	20	20	50	96	98	
93	1KS16EC111	19	19	18	45	91	98	
94	1KS16EC112	20	20	19	46	90	94	
95	1KS16EC114	19	19	18	48	65	90	
96	1KS16EC115	20	20	20	50	98	94	
97	1KS16EC116	19	20	20	50	98	98	
98	1KS16EC117	20	20	20	47	90	90	
99	1KS16EC118	20	20	20	45	90	94	-
100	1KS16EC119	20	20	19	48	96	94	
101	1KS16EC120	20	20	20	47	90	90	
102	1KS16EC401	16	18	16	35	90	85	
103	1KS16EC406	19	19	18	44	90	94	
104	1KS16EC416	17	19	17	35	75	85	
105	1KS16EC419	19	19	18	35	75	90	
106	1KS16EC430	18	19	18	44	90	90	
107	1KS17EC400	19	20	20	44	92	90	
108	1KS17EC402	18	20	18	41	87	85	
109	1KS17EC404	19	20	20	46	92	94	
110	1KS17EC406	20	20	20	46	95	85	
111	1KS17EC407	19	19	17	45	92	85	
112	1KS17EC408	19	19	17	42	65	94	
113	1KS17EC409	19	20	20	45	80	94	
114	1KS17EC413	20	20	20	48	80	90	
--x--	Faculty Signature			SSTy				----XXXXXXX----

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

8/9/2020

HOD
Seal and Signature

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