A

Mini-Project Report

on

SMART DUSTBIN

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CERTIFICATE

This is to certify that the mini-project report entitled "**SMART DUSTBIN**" submitted by **Mr. SHUBHAM SRIVASTAVA (Roll.No:114), Ms. UNNATI AGARWAL (Roll.No:126),** to the Galgotias College of Engineering & Technology, Greater Noida, Utter Pradesh, affiliated to Dr. A.P.J. Abdul Kalam Technical University Lucknow, Uttar Pradesh in partial fulfillment for the award of Degree of Bachelor of Technology in Computer science & Engineering is a bonafide record of the project work carried out by them under my supervision during the year 2022-2023.

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SHUBHAM SRIVASTAVA
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ABSTRACT

The main aim to create our project “Smart Dustbin” is to contribute towards Swacch Bharat Abhiyan started by our Hon’ble Prime Minister Shri. Narendra Modi ji. Today, with advancement and enhancement our emerging technologies, we tried to implement it on Waste(Garbage) and dustbins containing them. We used Internet of Things(IOT) to create a smart system on dustbin which is a fully functional working model. Here, in our working model we used ARDUINO to implement IOT to design a Dustbin which cleans the environment. This intelligent dustbin is based on a microcontroller-based(Arduino) system with ultrasonic sensors and motors in dustbins. If dustbins are not maintained, they can lead to an unhealthy environment and cause pollutants that affect our health. This proposed technology uses ultrasonic sensors, servo motors and battery jumper cables. Once all hardware and software connections are complete, the smart dustbin program will run.

The dustbin lid waits for the user to come near dustbin to throw trash into it. The Ultrasonic Sensors sense the user is infront of it and wants to throw in some trash, therefore it rotates the Servo Motor opening the lid of the dustbin. Once user throws in the trash it automatically closes the lid. From a social viewpoint, it contributes to health and hygiene, and from a business point of view, it strives to be affordable for as many people as possible. So that everyone can benefit from it, from the common people to the rich.

Keywords: Arduino UNO, Dustbins, Ultrasonic Sensors, Servo Motors, Jumper Wires, IoT, Circuit etc.

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CHAPTER 1: INTRODUCTION

1. INTRODUCTION

India's population growth rate is rising rapidly, garbage is increasing, and environmental problems are increasing. A dustbin is a container used to collect garbage or store recyclable or non-recyclable, degradable and non-degradable items. It is usually used in homes and offices, but when it is full, there will be no one to clean it, and garbage will spill out. Areas surrounding litter can also contribute to elevated pollution levels. Air pollution from dustbin produce bacteria and viruses that can cause life-threatening diseases in humans. For this reason, we have developed a smart dustbin equipped with the ultrasonic sensor ARDUINO UNO. It detects objects thrown into the dustbin and opens the lid with the help of a motor. This is an IOT[4] [5] based project that brings new smart and clean way.

It's a good device to clean your home, as nearly every descendant of the house has soiled it and littered it on a large scale via electronics, wrappers, and other things. And intelligent dustbins are attractive and kid-friendly, helping you keep your home clean. Applies to different types of waste. The dustbin opens the lid when someone/object is nearby, waits a certain amount of time, and then closes automatically. Here, the lid is closed when not in use and opened only when needed.

1.1 MOTIVATION

As the population grows, the clean scenario for waste disposal gets significantly worse. There are many public places in the city that are overflowing with bins and bins installed. This leads to unsanitary conditions in the surrounding area. It also causes ugliness and some serious illnesses, and at the same time it stinks and devalues the area.[7]

To avoid this situation, we are developing a project called "Smart Dustbin", a GSM-based garbage and waste collection bin overflow indication system for smart cities. The main motivation behind this project is the ongoing Swachh Bharat Abhiyan (Clean India Movement) campaign launched by Prime Minister Narendra Modi of India on October 2,

2014 in Rajghat, New Delhi. Roads and infrastructure in his 4,041 municipalities in the country.

1.2 DESCRIPTION

As people get smarter, things get smarter. As smart city ideas emerge, so does the need for smart waste management. The smart dustbin idea is for smart buildings, universities, hospitals and bus stations.

A smart dustbin is a new implementation idea that uses an infrared sensor to make a regular dustbin intelligent and automatically open the lid when a person approaches. your hands.

The lid won't open until the dustbin is empty, so you don't throw away the trash and make a mess.

1.3 DEFINITIONS

- It is important to dispose of garbage properly. It is a responsibility that everyone should bear. In times of Covid-19, people are trying to innovate and keep things as contactless as possible. The smart dustbin is one of his innovative ideas.
- The smart dustbin uses ultrasonic sensors to detect objects in front of it.
- Then send the signal to the Arduino Uno. The Arduino understands the signals and sends them to the servo motors. This will open the flap at the top of the dustbin.
- Here we have programmed the race to open for only 5 seconds. The flap will automatically close after he has 5 seconds. This time, we can change it by making a small change to the code in the Arduino IDE.

1.4 CHAPTER OVERVIEW

Chapter 2 - Literature Review - This chapter provides an introduction to the model and data on the theory behind model development. It also includes a detailed analysis of how the ideas

for this were sourced and collected. Then, when we get to work decisions, we need to complete a literature review.

Chapter 3 - Problem Formulation - Chapter 3 talked about how to come up with a problem. and the problem and its presentation

Chapter 4 – Methodology – This describes the survey design, survey tools, or data collection. This also inculcates information about data analysis and ethics for projects that do not harm society. After that, we finally came to a conclusion about how we did our research and analysis.

Chapter 5 - Implementation - This part contains the actual material of the project. It contains a running image of the app and gives an overview of what it will look like later. Also includes data flow diagrams (DFDs), flow charts and schematics.

Chapter 6 - Project Relevance - This is the final part comparing the model's data analysis with the old model. Chapter 7 – Conclusions and Future Outlook – This part provides an overview of the findings and conclusions.

In it, we will also inform you about our contributions and an overview of our team. Then there is the future projection of our project, how it will benefit our society in the future, and the associated ethics.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

SMART DUSTBIN USING ARDUINO IS AN IOT BASED PROJECT.

Here we used Arduino for code execution and ultrasonic sensor for sensing, servo motor for opening the lid and after waiting for a while, it closes automaticallyp. With the help of technology, it makes a dramatic difference in terms of cleanliness. For the benefit of man, everything is realized with intelligent technology. So this helps keep the environment clean with the help of technology. Being a sensor-based dustbin, it can be easily accessed/used by all ages. We also aim to keep the price low so that more people can use it. And it should be convenient and helpful for everyone.

2.1.1 WHAT IS A DUSTBIN?

A dustbin, also known as a dustbin, dustbin, or dustbin, is a type of container that is usually made of metal or plastic. The words "garbage", "basket" and "bin" are more common in British English. "trash" and "can" are more common in American English. "Waste" may specifically refer to food waste (as distinguished from "garbage") or general municipal solid waste.

2.1.2 WHAT IS INTERNET OF THINGS (IOT)?

The Internet of Things (IoT) [6] refers to physical objects (or group of such objects). The Internet of Things has been viewed as a misnomer because devices do not need to be connected to the public Internet, they just need to be networked and individually addressable.

The field has evolved due to the convergence of multiple technologies, including ubiquitous computing, commodity sensors, increasingly powerful embedded systems, and machine learning. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), independently and collectively enable the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", including devices and appliances (such as lighting fixtures, thermostats, home security systems, cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers. IoT is also used in healthcare systems.

There are a number of concerns about the risks in the growth of IoT technologies and products, especially in the areas of privacy and security, and consequently, industry and governmental moves to address these concerns have begun, including the development of international and local standards, guidelines, and regulatory frameworks.

2.1.3 WHAT IS ARDUINO?

Arduino is an open source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. The hardware product is licensed under the CC BY-SA license, but the software is licensed under the GNU Lesser General Public License (LGPL) or GNU General Public License (GPL) and may not be used by authorized persons for Arduino It restricts board manufacturing and software distribution. Arduino boards are commercially available through official websites or authorized distributors.

Various microprocessors and controllers are used in Arduino board designs. The board is equipped with a set of digital and analog input/output (I/O) pins that can be connected to various expansion boards (“shields”) or breadboards (for prototyping) and other circuitry. The card has a serial communication interface, such as Universal Serial Bus (USB) on some models, and is also used to load programs. Microcontrollers can be programmed in the C and C++ programming languages using standard APIs, also

known as the Arduino language. The Arduino language is inspired by the Processing language and used in a modified version of the Processing IDE. In addition to using a traditional compiler toolchain, the Arduino project provides an integrated development environment (IDE) and command line tools developed in Go.

2.2 BACKGROUND INFORMATION

1. "Bhatt, M. C., and all (2019). Smart Dustbin for Efficient Waste Management. *International Research Journal Of Engineering And Technologi*, *6*(07), 967-969." proposed the problems people faced while throwing the garbage where lids are closed and their hands are full. Through this paper we have took the idea to tackle the traditional method or the normal use of Dustbin in our daily life. Each and every person in the world disposes the waste in the dustbin and if the dustbin becomes full, he empties the waste inside the bin and again uses the same Dustbin. So, we have got an idea to replace this traditional method and come up with some IOT based work. [1]

2. "Suryawanshi, S., and all (2018). Waste management system based on IoT. *Waste Management*, *5*(03), 1-3." proposed how Arduino will be helpful in building the effective solution for a smart dustbin. It gathered data about Arduino Uno and other technicalities which will be used thereafter in the project. [2]

3. "Pandey, M., and all (2020). Smart dustbin using Arduino. *International Journal of Scientific Research in Engineering and Management (IJSREM)*, *4*(08)." In this paper, details for making the model have been mentioned. The whole idea of Smart Dustbin using electronic components like Arduino, Servo Motor, Ultrasonic Sensor is mentioned is this paper. Smart dustbin is an effective and efficient one when compared with the traditional dustbins. The smart dustbin works in the following manner: The ultrasonic sensor is present at the front side of the dustbin and this sensor is linked to the lid of the dustbin and the ultrasonic sensor to Arduino. The ultrasonic sensor detects human hand and waste when the hand and the waste are placed in front of that sensor and the lid of that dustbin opens and the waste is put into it.

This is how the model with full functionality is ready. [3]

2.3 CONCLUSION

Basically, this project is about replacing the old regular dustbin with an improved working model. It has many great features that make our lives easier and solve the problem of waste collection and management.

CHAPTER 3: PROBLEM FORMULATION

3.1 INTRODUCTION

Problem formulation is the study and analysis of the problem from which the project was initiated. This chapter consists of a problem domain description (so you can see why you need a smart dustbin), a problem description, a block diagram, project goals, and project goals and how to do it. This is a list of issues to resolve as described in the issue description.

3.2 PROBLEM STATEMENT

- There are millions of public trash bins used by people and emptied within days by authorities. The problem is that not all bins fill at the same rate and the dump truck wastes time checking all bins. This translates into more fuel consumption, effort and costs.
- Developing a real-time waste management system to check bin levels whether the bins are full or not.
- Due to our carelessness, the lid of the dustbin was opened and not closed. Therefore, it caused various health problems and acted as a host for various bacteria, etc.

3.3 OBJECTIVES

The main goal of this project is to implement a SMART DUSTBIN that solves all the problems faced by the previous system by including all these features in the newly implemented smart dustbin.

Its main purpose is to:

- Development of easy-to-use and durable dustbins.
- Use IoT to deploy efficient, automated and intelligent dustbins.
- Issue an alarm to instruct public authorities to empty the bin when the bin is full.
- Creating an automatic lid system that closes when out of reach of the user.

3.4 CONCLUSIONS

In this chapter, we learned about the needs of this project and the problems it solves to make the application more effective. We examined the main problems of the old app to provide results and some new features of the new app that improve the old app to meet other needs of society.

CHAPTER 4: METHODOLOGY

SMART DUSTBIN USING ARDUINO IS AN IOT BASED PROJECT. Here we use Arduino for code execution and ultrasonic sensor for sensing, open the lid and wait for a while. With the help of technology, it makes a dramatic difference in terms of cleanliness. For the benefit of man, everything is realized with intelligent technology. So this helps keep the environment clean with the help of technology. A sensor-type dustbin that can be easily taken out and used by people of all ages. We also aim to keep the price low so that more people can use it. And it should be convenient and helpful for everyone. Both software and hardware are required to complete the project.

- **Required Software:**
  - ARDUINO IDE
- **Required Hardware:**
  - ARDUINO UNO
  - ULTRASONIC SENSOR
  - SERVO MOTOR
  - 9V BATTERY
  - DUSTBIN

4.1 PROPOSED WORK AND SPECIFICATIONS

4.1.1 ARDUINO

Arduino[8] is an open-source computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. . Project products are distributed as open-source hardware and software licensed under the GNU Lesser General Public License (LGPL) or GNU General Public License (GPL). The GPL restricts the manufacture of Arduino boards and the distribution of software to anyone with permission. Arduino boards are available in pre-assembled form or as DIY kits. Various microprocessors and controllers are used in Arduino board designs. The board is equipped with a set of digital and analog input/output (I/O) pins that can be connected to various

expansion boards (shields) and another circuitry. The board has a serial communication interface, including Universal Serial Bus (USB) on some models, which is also used to load programs from a PC. The Arduino/Genuino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital I/O pins (6 of which can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal, a USB connector, a power jack, an ICSP header, and a reset button. Contains everything needed to support the microcontroller. Simply plug it into your computer with a USB cable, or power it up with an AC-DC adapter or battery to get started. You can play around with UNO without worrying too much about doing something wrong. Worst case, you can replace the chip for a few bucks and start over. "Uno" means 1 in Italian and was chosen for the release of the Arduino Software (IDE) 1.0. The Uno board and Arduino software (IDE) version 1.0 was the reference version of his Arduino that evolved into newer versions. The Uno board is the first in a series of USB Arduino boards and is a reference model for the Arduino platform.

See the Arduino Board Index[9] for an extensive list of current, past, and obsolete boards.

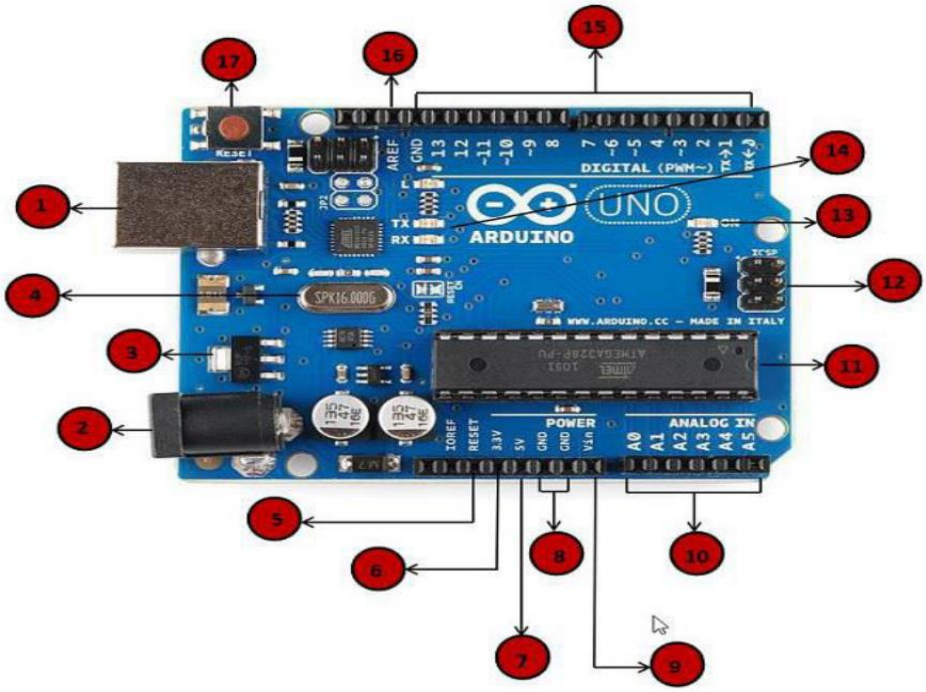

Fig 1 Arduino Uno Pin Diagram[16]

(i) Power USB- Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection.

(ii) Power (Barrel Jack) Arduino boards can be powered directly from the AC mains power supply by connecting it to the Barrel Jack.

(iii) Voltage Regulator The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

(iv) Crystal Oscillator The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.

(v, xvii) Arduino Reset You can reset your Arduino board, i.e., start your program from the beginning. You can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labelled RESET (5).

(vi, vii, viii, ix) Pins (3.3, 5, GND, Vin)

- 3.3V (6) − Supply 3.3 output volt
- 5V (7) − Supply 5 output volt
- Most of the components used with Arduino board works fine with 3.3 volt and 5 volts.
- GND (8)(Ground) − There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- Vin (9) − This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.

(x) Analog pins- The Arduino UNO board has five analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

(xi) Main microcontroller- Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from

the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet.

(xii) ICSP pin- Mostly, ICSP (12) is an AVR, a tiny programming header for the Arduino consisting of MOSI, MISO, SCK, RESET, VCC, and GND. It is often referred to as an SPI (Serial Peripheral Interface), which could be considered as an "expansion" of the output. Actually, you are slaving the output device to the master of the SPI bus.

(xiii) Power LED indicator- This LED should light up when you plug your Arduino into a power source to indicate that your board is powered up correctly. If this light does not turn on, then there is something wrong with the connection.

(xiv) TX and RX LEDs- On your board, you will find two labels: TX (transmit) and RX (receive). They appear in two places on the Arduino UNO board. First, at the digital pins 0 and 1, to indicate the pins responsible for serial communication. Second, the TX and RX led (13). The TX led flashes with different speed while sending the serial data. The speed of flashing depends on the baud rate used by the board. RX flashes during the receiving process.

(xv) Digital I/O- The Arduino UNO board has 14 digital I/O pins (15) (of which 6 provide PWM (Pulse Width Modulation) output. These pins can be configured to work as input digital pins to read logic values (0 or 1) or as digital output pins to drive different modules like LEDs, relays, etc. The pins labelled can be used to generate PWM.

(xvi) AREF- AREF stands for Analog Reference. It is sometimes, used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

- Microcontroller- ATmega2560
- Operating Voltage -5V
- Input Voltage (recommended)- 7-12V
- Input Voltage (limit)- 6-20V
- Digital I/O Pins-54 (of which 15 provide PWM output)
- Analog Input-16

4.1.2 ULTRASONIC SENSOR

An ultrasonic sensor[10] is an electronic device that measures the distance to an object by emitting ultrasonic waves and converting the reflected sound into electrical signals.

Ultrasound travels faster than audible sound (that is, sound that humans can hear). The ultrasonic sensor consists of two main components:

A sender (using a piezoelectric crystal to emit sound) and a receiver (encountering the sound after entering or exiting the target).

To calculate the distance between the sensor and the object, the sensor measures the elapsed time between the transmitter's sound emission and contact with the receiver. The formula for this is D = ½ T x C (where D is distance, T is time, and C is the speed of sound ~ 343 meters/second). For example, if a scientist points an ultrasonic sensor at a box and the sound takes 0.025 seconds to bounce back, the distance between the ultrasonic sensor and the box is: **D = 0.5 x 0.025 x 343[17]** or about 4.2875 meters.

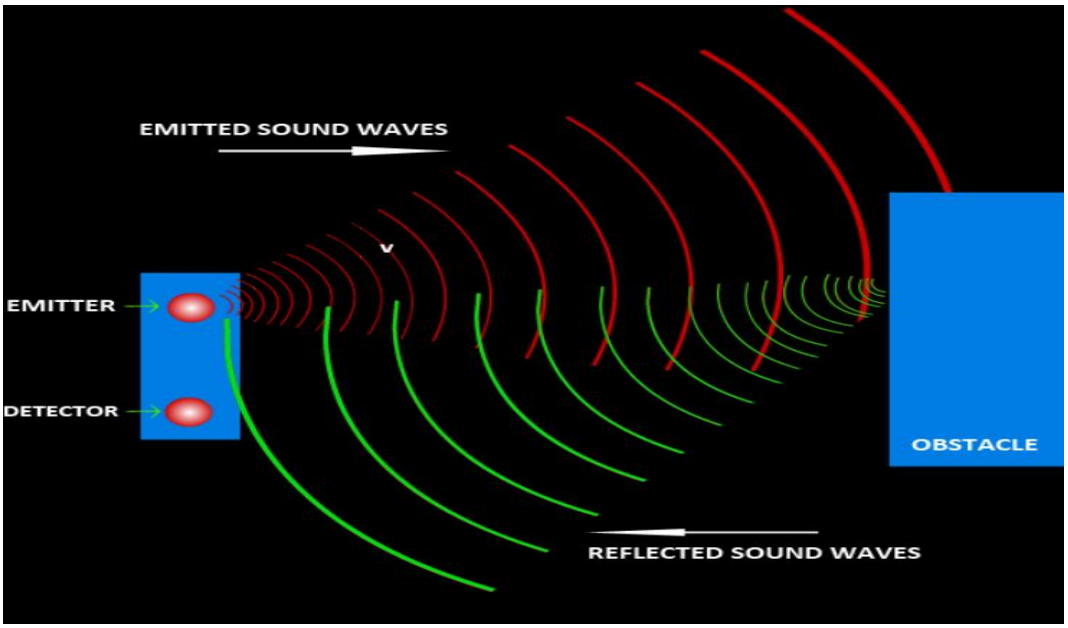

Fig 2 Ultrasonic Sensor Working[17]

Ultrasonic sensors are primarily used[11] as proximity sensors. They can be found in parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems and manu0facturing engineering. Compared to infrared (IR) sensors in proximity sensing applications, ultrasonic sensors are less susceptible to interference from smoke, gases, and other airborne particles (although the physical component is subject to variables such as heat).

Ultrasonic sensors are also used as level sensors to detect, monitor, and control liquid levels in closed vessels (such as chemical plant drums). Most notably, ultrasound technology has enabled the medical industry to image internal organs, identify tumors, and ensure the health of babies in the womb.

Fig 3 Ultrasonic Sensor[18]

Technical Specifications:-

- Power Supply − +5V DC
- Quiescent Current – <2mA
- Working Current − 15mA
- Effectual Angle – <15 degree
- Ranging Distance − 2cm – 400 cm/1″ – 13ft
- Resolution − 0.3 cm
- Measuring Angle − 30 degree

4.1.3 SERVO MOTOR

A servo motor[12] is a small device with an output shaft. This shaft can be positioned at a specific angular position by sending a coded signal to the servo. As long as the encoded signal is present on the input line, the servo will maintain the angular position of the shaft. As the encoded signal changes, the angular position of the shaft changes. [8] In practice, servos are

used in his RC planes to position control surfaces such as elevators and rudders. It is also used in remote control cars, dolls and of course robots.

Servos are very useful in robotics. The motor is small, has a built-in control circuit, and is very powerful for its size. A standard servo like the Futaba S-148 has 42 ounces/inch of torque, which is powerful for its size. It also draws a current proportional to the mechanical load. So lightly loaded servos don't consume much energy. The inside of a servo motor is shown in the following diagram. You can see the control circuit, motor, gear set, and case. You can also see his three wires leading to the outside world. One is for power (+5 volts), ground and the white wire is the control wire.

Fig 4 Servo Motor [19]

Working of a Servo Motor:-

A servo motor has some control circuitry and a potentiometer (variable resistor aka pot) connected to the output shaft. In the photo above you can see the potentiometer on the right side of the circuit board. This potentiometer allows the control circuit to monitor the current angle of the servo motor. If the shaft is square, the motor will be off. If the circuit determines that the angle is incorrect, it rotates the motor until the desired angle is reached. The servo output shaft can move anywhere in 180 degrees. Usually he is in the range of 210 degrees, but it depends on the manufacturer. Uses regular servos to control angular movement from 0 to 180 degrees. A mechanical stop built into the main driven gear mechanically prevents further rotation. The power applied to the motor is proportional to the distance the motor travels. So when the shaft needs to be rotated a long distance, the motor will spin at full speed. If less rotation is required, the engine will rev slower. This is called proportional control.

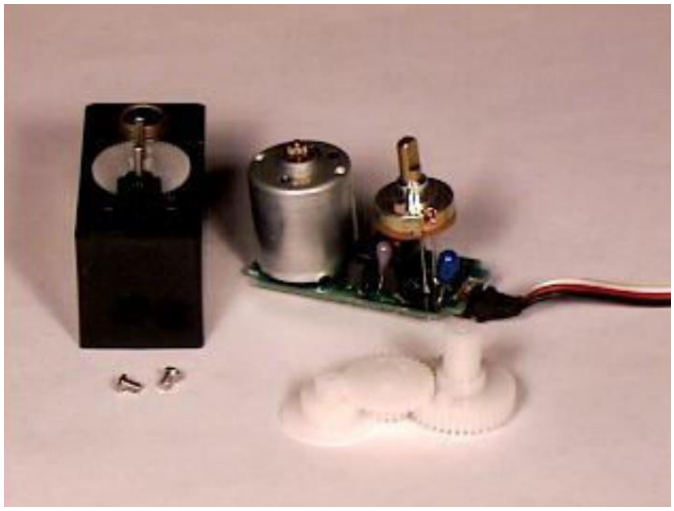

Fig 5 Servo Motor Components[20]

How Do You Communicate the Angle[13] at Which the Servo Should Turn?

A control wire is used to transmit the angle. The angle is determined by the duration of the pulse applied to the control wire. This is called pulse-coded modulation. The servo expects a pulse every 20 milliseconds (0.02 seconds). The length of the pulse determines how far the motor will rotate. 1.5 ms pulse. B. Rotate the motor to the 90 degree position (often called the neutral position). If the pulse is less than 1.5 milliseconds, the motor will rotate the shaft closer to 0 degrees. If the pulse is longer than 1.5 ms, the shaft will rotate nearly 180 degrees..

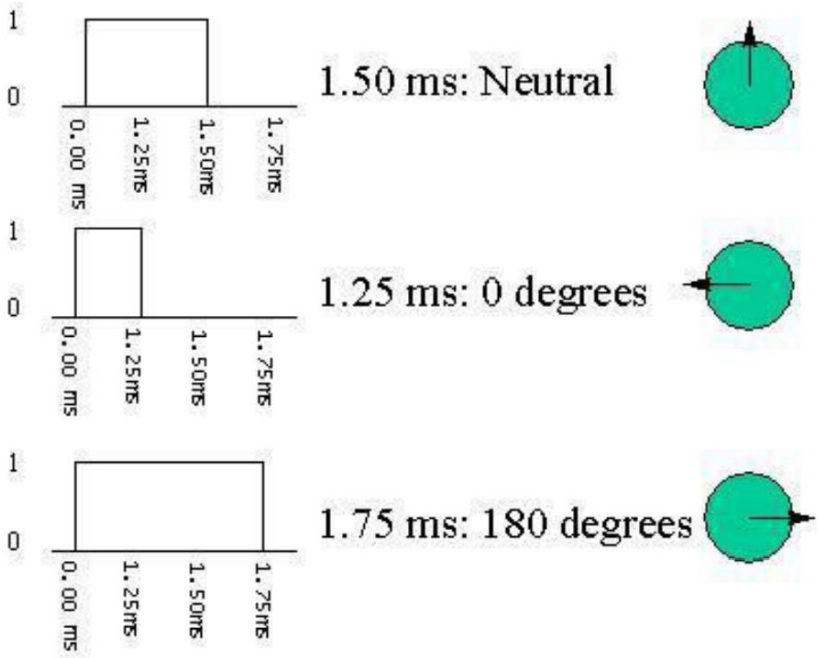

Fig 6 Servo Motor Angles[21]

4.1.4 JUMPER WIRES

Generally, jumpers are small metal connectors used to close or open parts of a circuit. They have two or more connection points that coordinate the electrical circuit board.

Their function is to configure settings for computer peripherals such as the motherboard. Assuming your motherboard supports intrusion detection. You can set a jumper to enable or disable it. A jumper wire is a wire with terminal pins at both ends. Used to connect two points in a circuit without soldering.

Jumper wires[14] can be used to modify circuits or diagnose circuit problems. It also contains no resistors and is best used to bypass parts of the circuit that are suspected of being defective.

This includes wiring harnesses or switches. Suppose all fuses are good and the component has no power. Find the circuit switch. Then bridge the switch with jumper wires.

How much current (I) and voltage (V) can jumper wires handle?

The I and V rating will depend on the copper or aluminium content present in the wire.

For an *Arduino application* is no more than 2A and 250V. We also recommend using solid-core wire, ideally 22 American Wire Gauge (AWG).

Types of Jumper Wires:-

Jumper wires come in three versions[15]:

- Male-to-male jumper
- Male-to-female jumper
- Female-to-female jumper

And two types of head shapes: **square head** and **round head**.

The difference between the two lies in the endpoints of the wire. The male end has a pin sticking out and can be plugged into things, while the female end does not, but it is also used for plugging.

A plug is also called a plug and has a solid pin on the centerline. Sockets, on the other hand, are called sockets and have a center conductor with a hole to accommodate the male pin.

Male-to-male jumper wires are the most common and probably the most commonly used. For example, connecting two connectors on a breadboard requires a connector-to-connector cable.

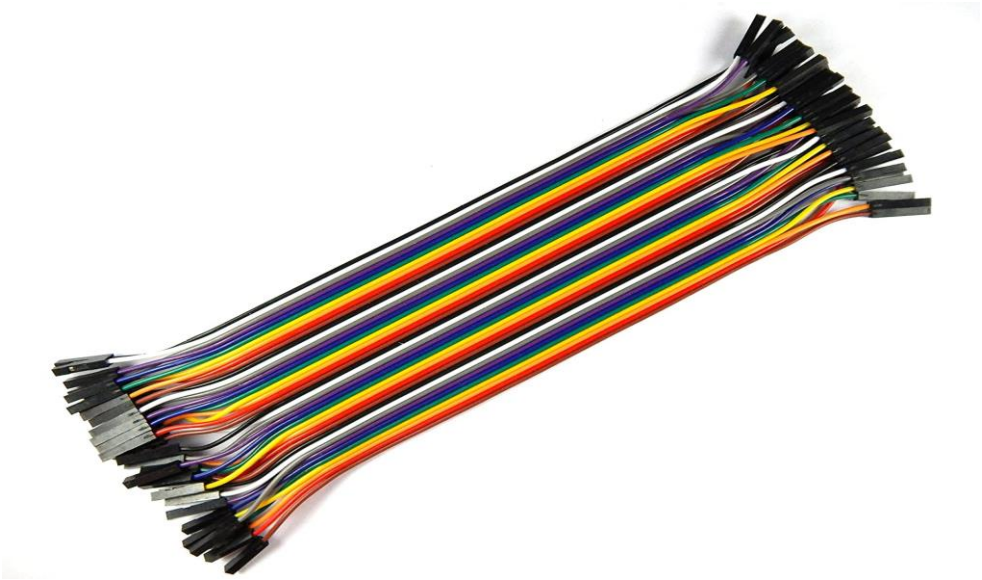

Fig 7 Jumper Wires [22]

CHAPTER 5: IMPLEMENTATION

5.1 MODEL IMAGES

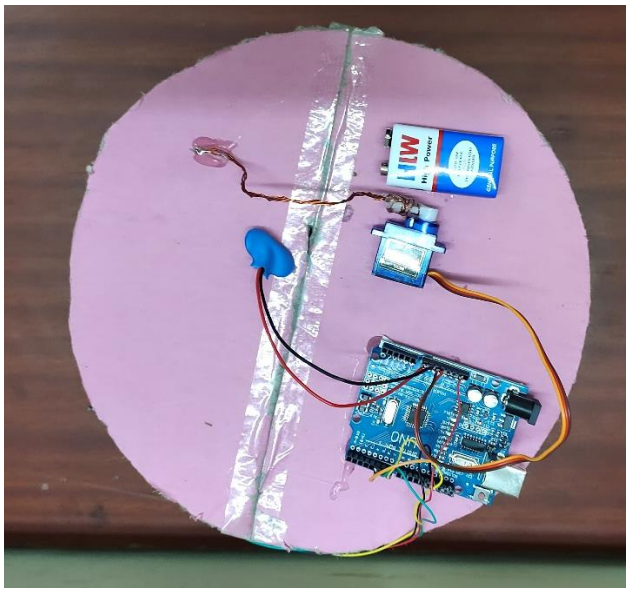

Fig 8(a) Top View

Fig 8(b) Front View

5.2 DATA FLOW DIAGRAM (DFD)

A data flow diagram is a graphical representation of data flow through an informed system. DFD scans are also used to visualize the structured design of data processing. In a DFD, data items flow from external data sources or internal data stores through internal processes to internal data or external data sinks.

5.2.1 LEVEL 0

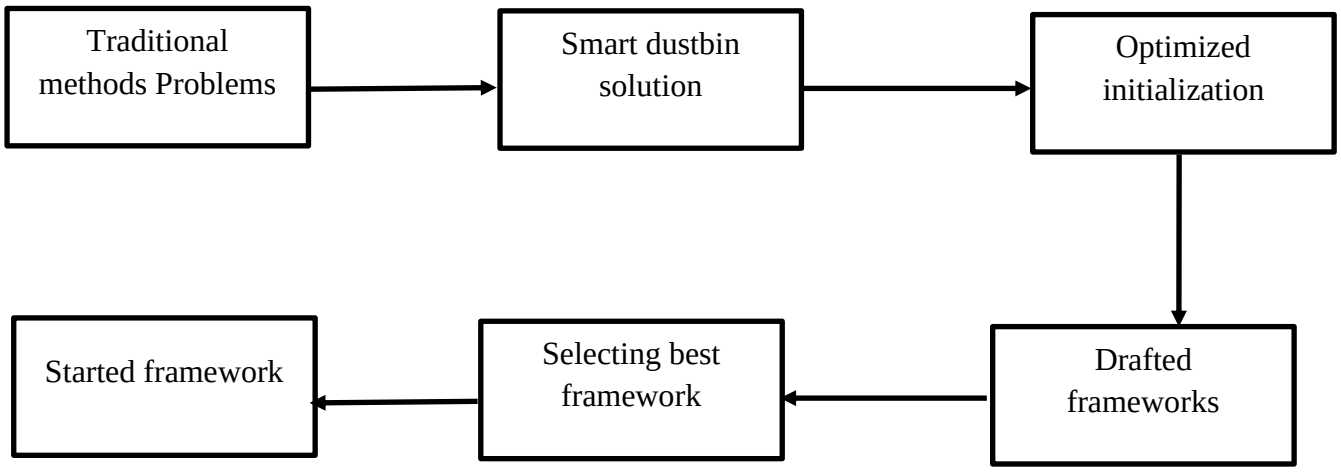

Fig 9 Level 0 data flow diagram shows how system is divided into sub system

5.2.2 LEVEL 1

A Level 1 DFD shows how the system is divided into subsystems. Each subsystem handles one or more data flows to and from external agents, providing all the functionality of the system as a whole.

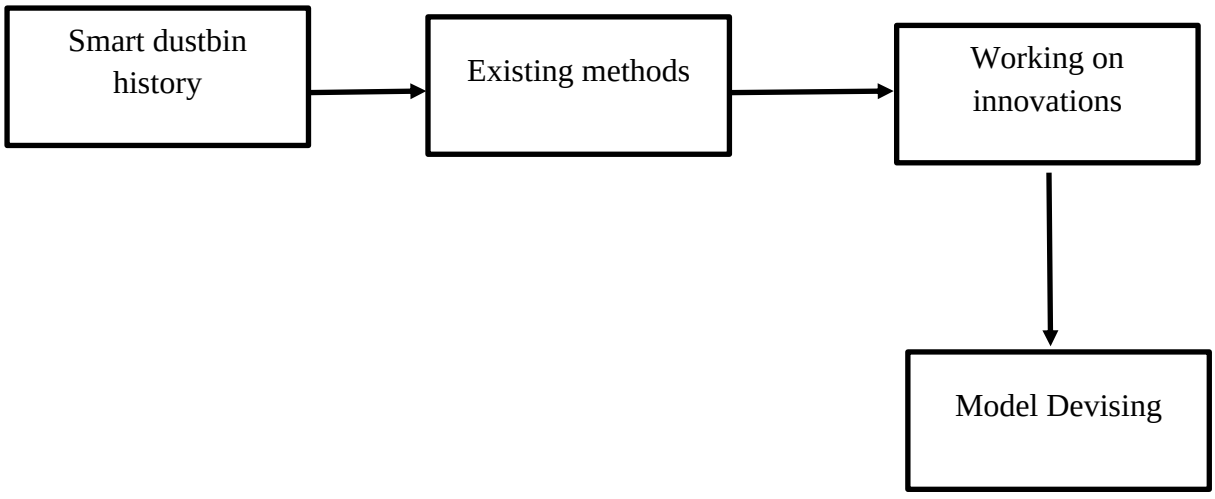

Fig 10 Level 1 data flow diagram shows the sub process of first main process

5.3 FLOWCHART

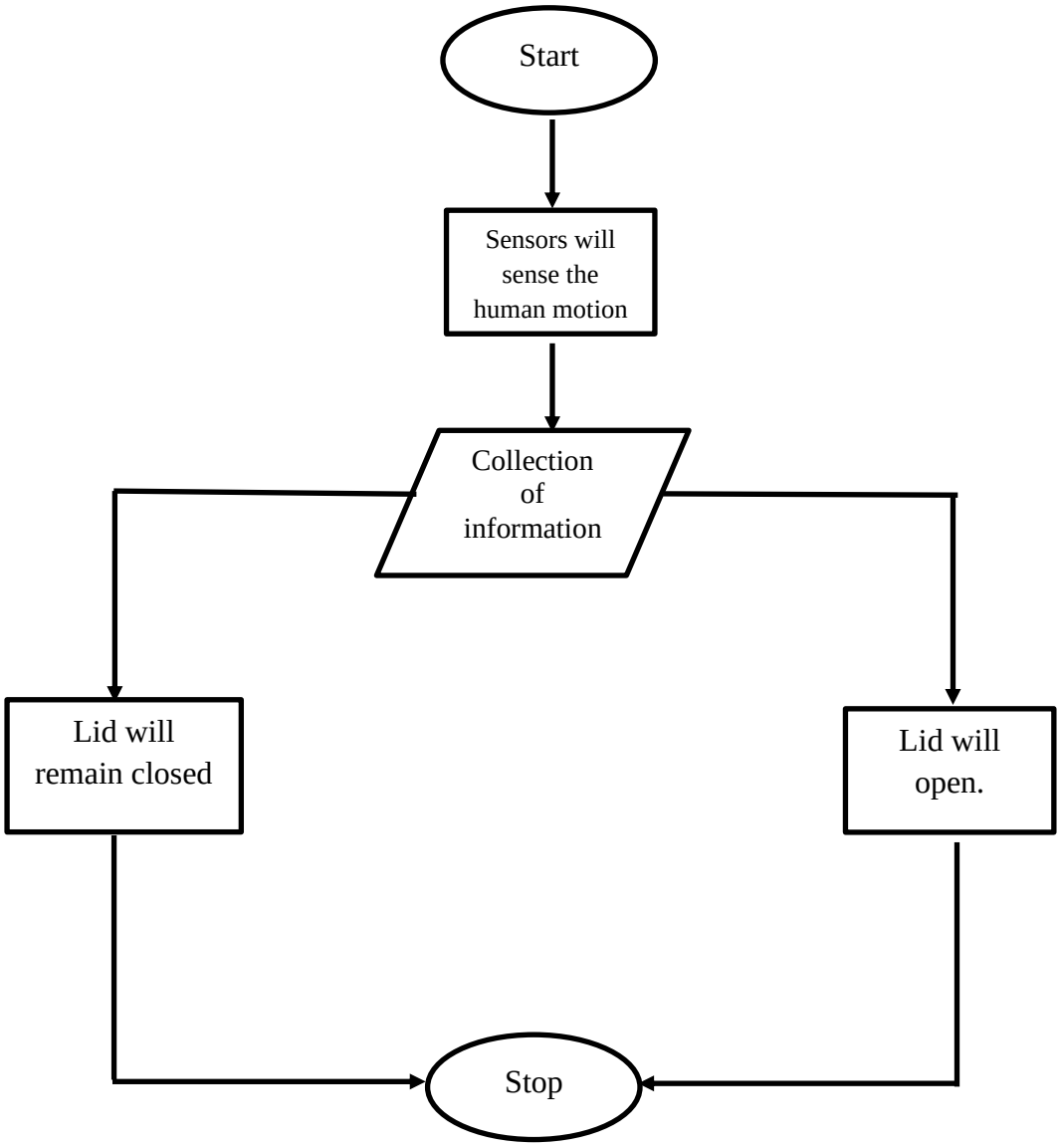

Fig 11 Flowchart

5.4 CIRCUIT DIAGRAM

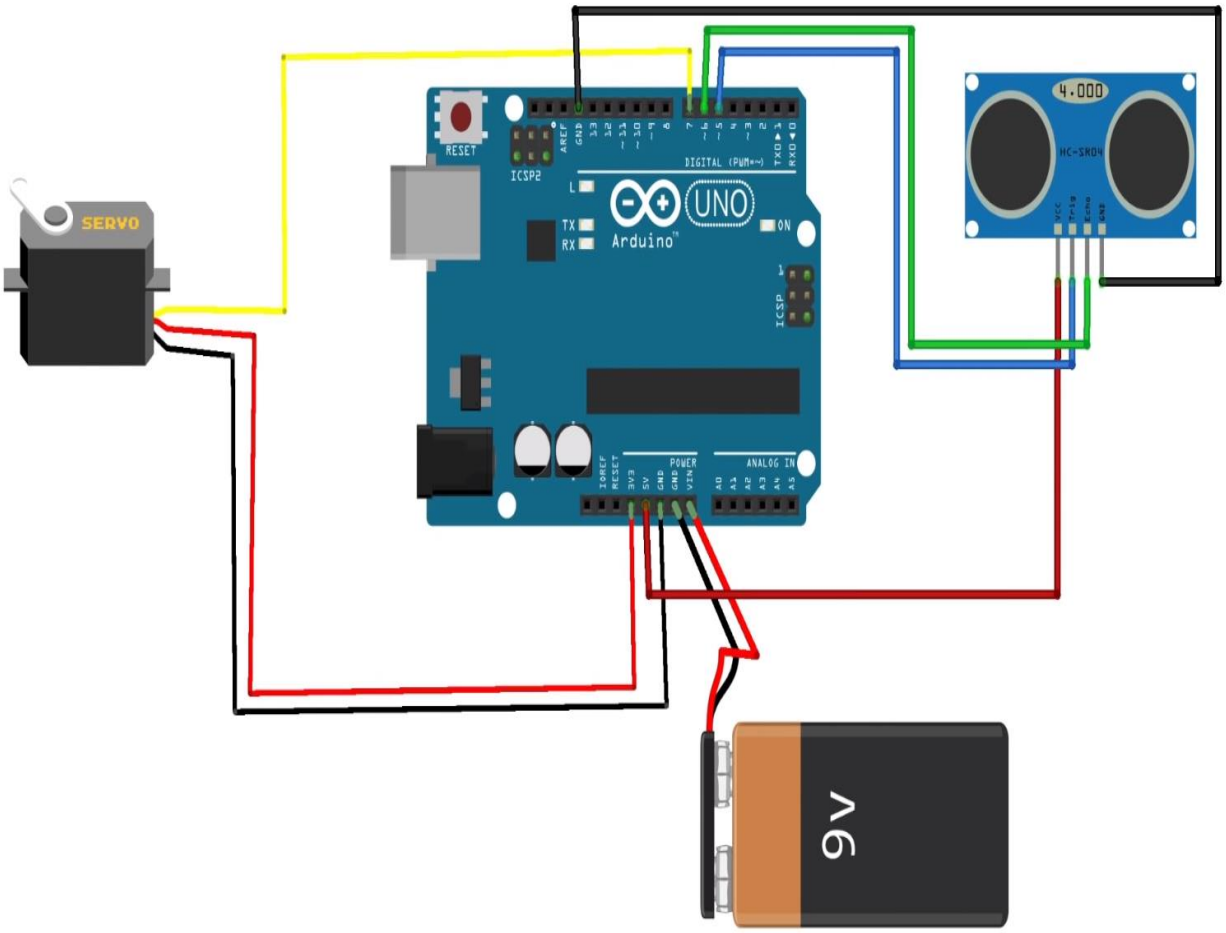

Fig 12 Circuit Diagram

CHAPTER 6: PROJECT RELEVANCE

6.1 CONTRIBUTION OF PROJECT TO THE SOCIETY

In this new world, urbanization is highly advanced. At the same time, the amount of waste is also increasing. Waste management was an important issue to consider. This report is another way to reach this legitimate goal.

In this report, Smart Bin is built on his microcontroller-based Arduino Uno platform board connected to an ultrasonic sensor. Real-time management of smart trash bins prevents overflow of trash bins on roadsides and other locations.

When implemented at scale to replace traditional dustbins, these smart bins will avoid unwanted roadside clumps, thus quickly reducing trash to efficient levels.

The stench from rotting waste can be left untreated for long periods of time due to the neglect of authorities and the neglect of the public, leading to long-term problems. Insect and mosquito breeding can lead to nuisances associated with promoting unsanitary environments. This can even lead to terrible illnesses. The purpose of this project is to keep our environment clean. We also aim to create a clean and green environment.

Below are the benefits of using the smart dustbin.

- Reduces the number of waste collections required by up to 80%, resulting in less manpower, emissions, fuel consumption and traffic congestion.
- Reduced number of waste containers required.
- Maintaining environmental hygiene (i.e. no waste spills, less unpleasant odors).
- Helps drive progress through technology in terms of cleanliness.
- Maintains environmental hygiene.
- Encourages people not to litter anywhere.
- Makes everyone aware about the current technology.
- Helpful for Physically Challenged persons.
- Easy to use for people of any age.

6.2. ETHICS AND CONCLUSION

- After much research and knowledge, we have come to the conclusion that our project does not harm society and follows all norms and guidelines of computer software systems.
- Ethics is the study of value concepts such as 'good', 'bad', 'right', 'wrong' and 'should' applied to behaviour in relation to group norms and rules. As such, it addresses many issues essential to practical decision-making (Veatch, 1977). Computer software systems are at the heart of modern decision-making, including data/information storage and manipulation, data availability, and "alternative" formulation and selection.
- In fact, the use of computer systems often determines the types of questions asked and the likelihood of their answers. This becomes especially clear when software systems are included in knowledge management methods (Schmoldt and Rauscher, 1994). Software systems play an integral role in an organization's memory. The ubiquity of software systems across all facets of public and private institutions means that the environments they create must be considered critically when developing and deploying them. Two major ethical questions must be answered when it comes to software systems.
- First, can these systems reflect the different ethical codes of groups affected by decisions made through software? Second, what are the ethical considerations that should guide the design and development of the software itself? is it? Therefore, in the first question, we did not use unethical code that could harm society and communities. As for the second part of the question, it does no harm to society, it benefits everyone and helps in every possible way.

CHAPTER 7: CONCLUSION AND FUTURE PROJECTIONS

7.1 CONCLUSION

This project examines in detail the "SMART DUSTBIN" utilizing IoT. This report describes the construction, work and implementation of the project. This model fully meets the expectations of everyone. Using Arduino UNO, servo motors, ultrasonic sensors, and jumper wires, the project is well built and working. The results of our project work support our hypothesis that the smart dustbin solves the problem of the old regular dustbin.

The final conclusion of our project is that the system is highly efficient and can be used on a small budget.

Here, we want to shift the evolution in favor of cleanliness. The smart dustbin outperforms conventional dustbins because it combines garbage compaction and smart trashcan monitoring technologies. integrating cutting-edge technology, like Arduino. The lid of the dustbin automatically opens when something approaches it and closes after a predetermined amount of time.

From a social perspective, we want to promote health and cleanliness, and from a commercial perspective, we aim to make it as accessible as possible for as many people as possible, so that everyone—from the poor to the rich—can take use of it. This, in my opinion, will result in some modifications in both technology and cleanliness.

So our next task is to add another sensor to detect if the bin is full. Also, an indicator is added so that the user can tell if the trash is full.

7.2 FUTURE PROJECTIONS

The above methods are just a stepping stone to introduce IOT. Many improvements can be made to this prototype that could represent a revolutionary change in maintaining a clean and healthy environment.

Here are some things that could be improved:

- Implementation of multiple side-by-side collection bins where type and waste are automatically recognized and placed in the correct bin color associated with that type. These dustbins can be located using a GPS tracker that allows you to easily locate the dustbin at a specific location and empty the trash. This method could lead to smart waste monitoring systems
- Automatic garbage filling warning system helps reduce pollution. Garbage bins are often crowded –and many animals, such as dogs and cows, enter or near them. Some birds even try to remove the litter from the litter box. This project can avoid such situations. Also, messages can be sent directly to the cleaning vehicle instead of the contractor's office.
- Apart from that, a distinction can be made between dry and wet bins that collect dry plastic waste and biodegradable waste respectively. Methane and odor sensors are available for implementation. This facilitates waste separation at the source and reduces manpower requirements. To make it even better, an automated system can be developed that can pick up the trash in and around the bins, sort them, and dispose of them in their respective bins.

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CONTRIBUTION OF EACH MEMBER

1. SHUBHAM SRIVASTAVA:- Managed the Assembly, Report, and technical parts of the model.
2. UNNATI AGARWAL:- Managed the circuit connections, Assembly and coding part of the model.

ANNEXURE

```
#include <Servo.h>   //servo library
Servo servo;
int trigPin = 5;
int echoPin = 6;
int servoPin = 7;
int led= 10;
long duration, dist, average;
long aver[3];   //array for average


void setup() {
   Serial.begin(9600);
   servo.attach(servoPin);
   pinMode(trigPin, OUTPUT);
   pinMode(echoPin, INPUT);
   servo.write(0);         //close cap on power on
   delay(100);
   servo.detach();
}

void measure() {
 digitalWrite(10,HIGH);
digitalWrite(trigPin, LOW);
delayMicroseconds(5);
digitalWrite(trigPin, HIGH);
delayMicroseconds(15);
digitalWrite(trigPin, LOW);
pinMode(echoPin, INPUT);
duration = pulseIn(echoPin, HIGH);
dist = (duration/2) / 29.1;    //obtain distance
}
void loop() {
  for (int i=0;i<=2;i++) {   //average distance
    measure();
   aver[i]=dist;
    delay(10);              //delay between measurements
  }
 dist=(aver[0]+aver[1]+aver[2])/3;

if ( dist<50 ) {
//Change distance as per your need
 servo.attach(servoPin);
  delay(1);
 servo.write(0);
 delay(3000);
 servo.write(150);
 delay(1000);
 servo.detach();
```

```
}
Serial.print(dist);
}
```