SMART DUSTBIN

ANUSHKA ARORA

Department of Computer Science and Engineering, Galgotias College of Engineering and Technology, Greater Noida, Uttar Pradesh, India

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.

1. INTRODUCTION

As India's population is rising day by day, the amount of waste generated is also increasing at a rapid rate. Therefore, the Waste Management Systems come into play. A dustbin is a container used to collect garbage or store recyclable or non-recyclable, degradable and non-degradable items. It is a common item which can be found in a small room to a very large industry. Everyone, usually has a habit to not close the lid after use and when it gets full, no one wants to empty it which leads to spilling out of trash and generates foul smell and produce bacteria and viruses that can cause life-threatening diseases. For these reasons we developed a Smart Dustbin equipped with Ultrasonic Sensors, Servo motors and ARDUINO UNO. It detects that someone is near the dustbin and wishes to throw trash into dustbin, hence it opens the lid of dustbin with help of motor, once the trash is inside, it automatically closes the lid. This is an IOT based project that brings new smart and clean way. It will be a very useful device for regular use as everyone soils and litters trash everywhere. It reduces human efforts to open and close lid too, which will attract and encourage everyone to throw trash in dustbin. Smart Dustbins are attractive and kid-friendly, that will help you to keep your home clean. It applies to various types of waste.

The dustbin opens the lid when someone is nearby, waits for a certain amount of time, and then closes automatically. Here, the lid is closed when not in use and opened only when needed.

2. LIERATURE REVIEW

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]

3. PROBLEM IDENTIFICATION

1. Our negligence resulted in the dustbin's lid being left open. As a result, it contributed to a variety of health issues and served as a host for numerous microorganisms.

2. Everyone is lazy enough to open lid and throw trash in dustbins rather they litter everywhere but not in dustbin.

4. METHODOLOGY

Smart Dustbin is an IOT [4] [5] [6] based project which uses Arduino. Here, for code execution and software things, we used Arduino. For distance and person sensing we used Ultrasonic Sensors. For opening and closing of lids we used Servo Motors. For connecting all the hardware components together, we used Jumper Wires. Assembling and integrating all hardware and software together a Smart Dustbin is made which will open lid and wait for few moments, after a person throws trash in it, it closes the lid automatically. With the use of technology, it will bring about significant changes in terms of cleanliness. Smart technology is making everything even better. With the aid of technology, this contributes to environmental preservation. Due to the fact that it is a sensor-based dustbin, anyone may use it with ease. Our goal is to make it affordable so that a large number of people can take use of it. And everybody should be able to use it and benefit from it.

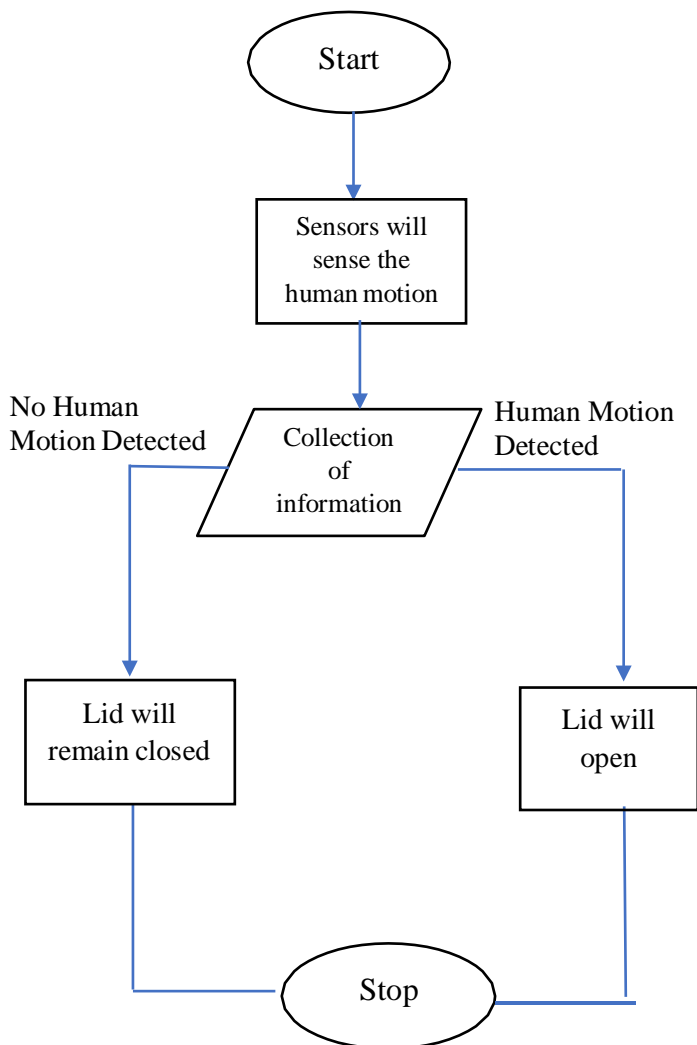For this project, the below mentioned Hardwares and Softwares are used.[7]

4.1 SOFTWARE USED

➢ Arduino IDE

4.2 HARDWARE USED

➢ Arduino UNO
➢ Ultrasonic Sensor
➢ Servo Motor
➢ Jumper Wires
➢ Dustbin
➢ 9V Battery

4.3 BLOCK DIAGRAM

```
                    ┌─────────┐
                    │  Start  │
                    └────┬────┘
                         │
                         ▼
                ┌──────────────────┐
                │ Sensors will     │
                │ sense the        │
                │ human motion     │
                └────────┬─────────┘
                         │
                         ▼
   No Human      ╱──────────────╲   Human Motion
   Motion Detected  Collection     Detected
                ╲   of           ╱
                 ╲ information  ╱
                  ╲──────────╱
         │                        │
         ▼                        ▼
  ┌─────────────┐          ┌─────────────┐
  │ Lid will    │          │ Lid will    │
  │ remain closed│         │ open        │
  └──────┬──────┘          └──────┬──────┘
         │                        │
         │       ┌─────────┐      │
         └──────▶│  Stop   │◀─────┘
                 └─────────┘
```

5. HARDWARE DESCRIPTION

5.1 ARDUINO

Arduino[8] is an open-source electronics platform built on simple hardware and software. Arduino boards have the ability to receive inputs, such as light from a sensor, a user pressing a button, or a tweet, and convert them into outputs, such as starting a motor, turning on an LED, or posting anything online. Sending a set of instructions to the board's microcontroller will instruct your board what to do. You achieve this by using the Arduino Software (IDE), which is based on Processing, and the Wiring-based Arduino programming language.
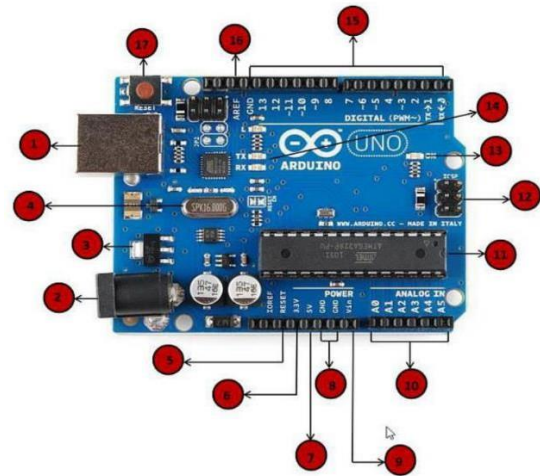

Fig 5.1 Arduino Uno Pin Diagram[16]

Pin Description[9]:-

 (i) Power USB

 (ii) Power (Barrel Jack)

 (iii) Voltage Regulator

 (iv) Crystal Oscillator

 (v, xvii) Arduino Reset

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

 (x) Analog pins

 (xi) Main microcontroller

 (xii) ICSP pin

 (xiii) Power LED indicator

 (xiv) TX and RX LEDs

 (xv) Digital I/O

 (xvi) AREF

5.2 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).A sender (using a piezoelectric crystal to emit sound)

and a receiver (encountering the sound after entering or exiting the target).

Ultrasonic sensors[11] are primarily used 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 manufacturing 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 5.2 Ultrasonic Sensor[17]

5.3 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[13] 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 5.3 Servo Motor[18]

5.4 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[14] is a wire with terminal pins at both ends. Used to connect two points in a circuit without soldering.

Jumper wires 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.

Jumper wires come[15] in three versions:

- 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 5.4 Jumper Wires[19]

6. SOFTWARE DESCRIPTION

6.1 ARDUINO IDE

- ➤ Arduino IDE is an open-source software that is mainly used for writing and compiling the code into the Arduino Module.
- ➤ It is an official Arduino software, making code compilation too easy that even a common person with no prior technical

knowledge can get their feet wet with the learning process.
- ➤ It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.
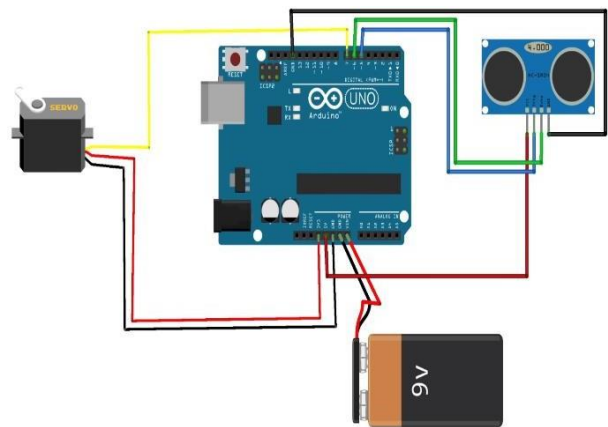- ➤ This environment supports both C and C++ languages.

Fig 6.1 Circuit Diagram

7. IMPLEMENTATION

Before connecting components with Arduino UNO, run the code on Arduino IDE and upload it on Arduino Uno.

Then connect all the hardware components correctly according to circuit diagram, with Arduino UNO.

Connect 9V battery to the Arduino UNO.

When system is powered ON, Arduino keeps monitoring for any things that come near the sensor at give range.

When Ultrasonic sensor detects an object, for example a hand etc, then Arduino calculates its distance and if the value is less than a certain predefined value then only servo motor will get activated and with the

support of the extended arm of the lid, opens the lid for the user to throw trash in them.

Lid will open for a given time only, then it will automatically close.

Fig 7.1 Working Model

8. ADVANTAGES

a) Maintains environmental hygiene.
b) Encourages people not to litter anywhere.
c) Makes everyone aware about the current technology.
d) Helpful for Physically Challenged persons.

e) Easy to use for people of any age.

9. 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 favour 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.

The project "SMART DUSTBIN" model has been assembled successfully to solve our problem statement and it is in working condition.

10. FUTURE WORK

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

Pollution is decreased through an automatic garbage loading warning system. Garbage cans are frequently overflowing, and several animals—including dogs and cows—enter or come close to them. Some birds even make an effort to empty the litter box of its contents. These situations can be avoided by this project. Messages can also be delivered straight to the cleaning vehicle rather than the contractor's headquarters.

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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