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Smart IOT Dustbin

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Submitted to: Mr. Sugat Man Shakya
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I confirm that I understand my coursework needs to be submitted online via Google Classroom under the relevant module page before the deadline in order for my assignment to be accepted and marked. I am fully aware that late submissions will be treated as non-submission and a mark of zero will be awarded.

Acknowledgement

First and foremost, we would like to express module leader Mr. Sugat Man Shakya and Mr Shishir Subedi for providing us with their assistance in helping us construct this IOT project of a smart dustbin by sharing their knowledge and offering advice. The support they provided has been invaluable for our group and we are grateful to them for providing us with the time and effort which motivated us to complete our work.

Secondly, we also want to express our gratitude to our colleagues and seniors for their help and suggestions, which allowed us to collaborate effectively as a team and gain new concepts and ideas that allowed us to finalize this project within the limited time frame.

Abstract

Our project ‘Smart IOT Dustbin’ aims to create a system that is capable to monitor the trash level in a dustbin and notify the users when it gets full. In this smart system, two ultrasonic sensors have been used where one detects the physical movements and another one monitors the level of trash collected. The use of cloud computing facilitates the storage, analysis and visualization of data in real-time. Furthermore, the system is well configured to send notifications to users when the dustbin reaches its capacity and, thus, ensures proper waste management. Overall, this project brings an effective and innovative solution for the management of trash in a dustbin.

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1. Introduction

1.1 Current Scenario

Waste management is a critical aspect of modern society, and as the world's population grows, the volume of waste generated continues to rise. To tackle this issue, new technologies are being developed to streamline waste management processes, one of which is the Smart Dustbin IoT project. This project aims to use cloud computing technology to create a more efficient and effective waste management system.

1.2 Problem Statement and Project as a Solution

Smart dustbins are an innovative solution that incorporates the Internet of Things (IoT) technology to provide real-time waste management data. They are equipped with sensors that can detect the level of waste in the bin, and this data is transmitted to a cloud-based platform for analysis. This data can then be used to optimize waste collection schedules and routes, reduce waste overflow, and improve overall waste management efficiency.

This project focuses on the use of cloud computing to store and analyse the data collected by the smart dustbins. Cloud computing offers a scalable and cost-effective solution for managing large amounts of data. By using cloud-based analytics, the waste management system can quickly and efficiently process the data collected by the smart dustbins to generate insights and optimize waste management processes.

Overall, the Smart Dustbin IoT project has the potential to revolutionize waste management by providing real-time data and insights that can help optimize waste collection and reduce environmental impact.

2. Aims and Objectives

2.1 Aim

The aim of this project is to create a system that can monitor the level of trash inside a dustbin and notify accordingly.

2.2 Objectives

The objectives of this project are as follows:

- To detect the external, physical movements using ultrasonic sensor.
- To facilitate the opening and closing of dustbin's lid using servo motor.
- To monitor the trash amount inside a dustbin via ultrasonic sensor.
- To implement a certain cloud computing technology in order to store, visualize and analyse data in real-time.
- To configure the system in a way that it notifies users if the dustbin is filled.

3. Background

3.1 Expected Outcomes & Deliveries

Our project aims to develop a smart dustbin with the use of 'Arduino UNO' microcontroller (controlling unit), ultrasonic sensors (sensor) and servo motor (actuator). In real-time scenario, this prototype enables a user to monitor and visualize the amount of trash stored in the dustbin without needing to manually open the dustbin's lid.

It is crucial to have a stable internet connection for this purpose. The combination of an external sensor and servo motor will automate the process of opening and closing of the lid, and another sensor inside the dustbin will track if the dustbin reaches the full capacity and notifies the user via email. This project brings an easy and efficient way to dispose the human waste with minimum human intervention.

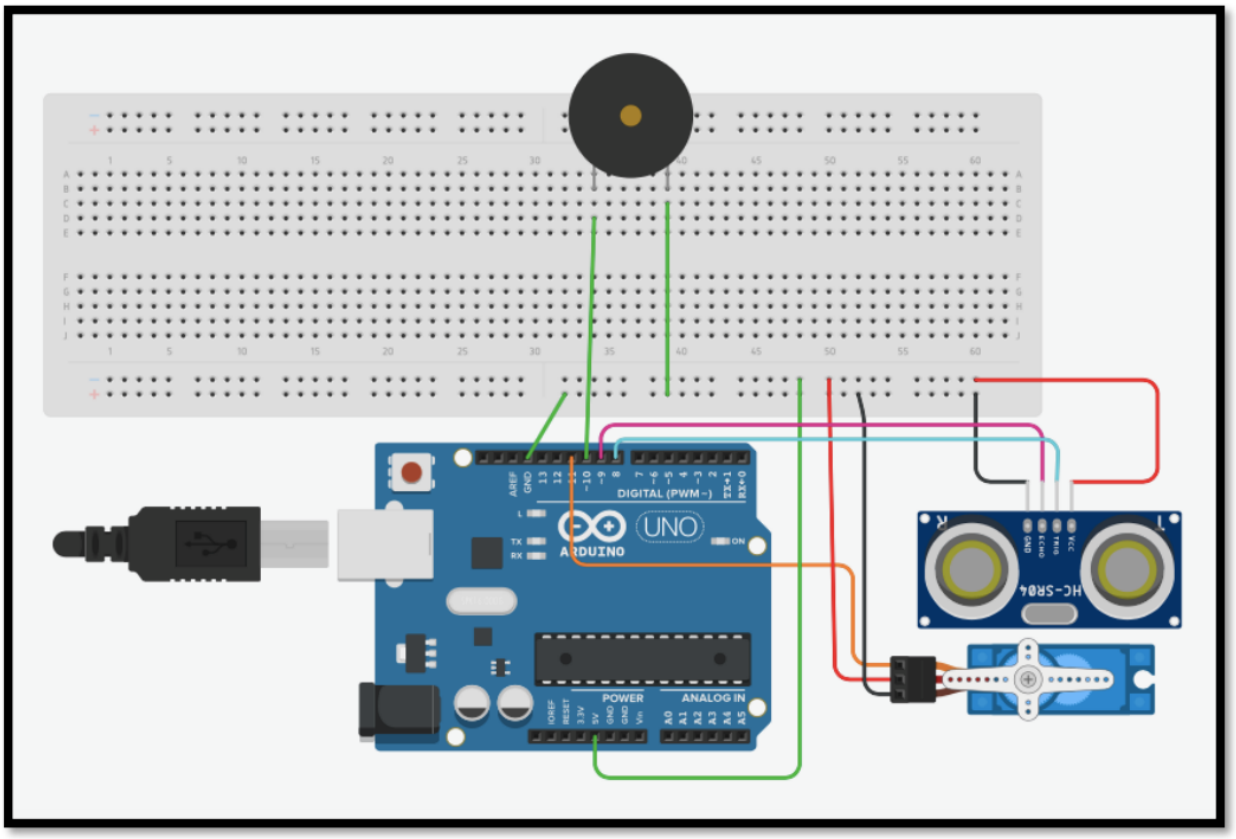

Figure 1: Circuit Diagram of IOT Dustbin

3.2 Requirement Analysis

- **Arduino UNO:** It is an open-source board that consist of a microcontroller (a programmable circuit board) and IDE (Integrated Development Environment) i.e., a software. These are used to write and upload computer code to the Arduino board (Arduino, 2015). The board consists of various input/output pins and can be programmed using IDE via type-B USB cable.
- **Ultrasonic sensor:** It determines the distance of an object from its position using SONAR. It offers high accuracy in an easy-to-use package from 1 to 13 feet in distance. It consists of ultrasonic transmitter and receiver module. (Gabriel & Kuria, 2020)
- **Servo motor:** It is a rotary actuator, mainly used for applications that require accurate rotation angle. Generally, when sensors take input, it forwards it to the controlling unit, later sends the processed data to the actuator (i.e., servo motor) to perform physical operation. (Bhargaca & Kumar, 2017)
- **Buzzer:** This device generates simple beep sounds. It uses a special crystal that changes its shape whenever voltage is applied to it at varying frequency. (Gabriel & Kuria, 2020)
- **Draw.io:** It is a software used to make flowcharts, diagrams, and various other charts.
- **MS-Word:** It is a word processing program that aids to create and process simple to complex documents.

4. Individual Contribution Plan

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Name	Role	Contribution

Table 1: Table of Contribution of Individual.

5. Conclusion

To conclude, Smart dustbin is a reliable and effective solution for the proper management of waste in a more efficient and sustainable manner. By implementing IoT sensors and cloud computing technologies, the project enables real-time monitoring of waste levels, optimizes waste collection schedules, reduces waste overflow, and ultimately contributes to a cleaner and healthier environment. The benefits of this project include the reduction of human intervention required for waste management, better utilization of resources, and improved public health. Additionally, the use of cloud computing provides scalability, reliability, and cost- effectiveness to the project.

Therefore, the implementation of a smart dustbin IoT project using cloud computing is a step towards building a smarter and more sustainable world.

6. References

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7. Appendix

- **Arduino UNO**

The Arduino Uno is a microcontroller board that utilizes the ATmega328P chip. It is designed to make it easy for anyone to start experimenting with electronics and programming. The board features 14 digital input/output pins, six of which can be used as pulse-width modulation (PWM) outputs. Additionally, there are six analog input pins, a 16 MHz ceramic resonator, a USB connection, a power jack, an in-circuit serial programming (ICSP) header, and a reset button.

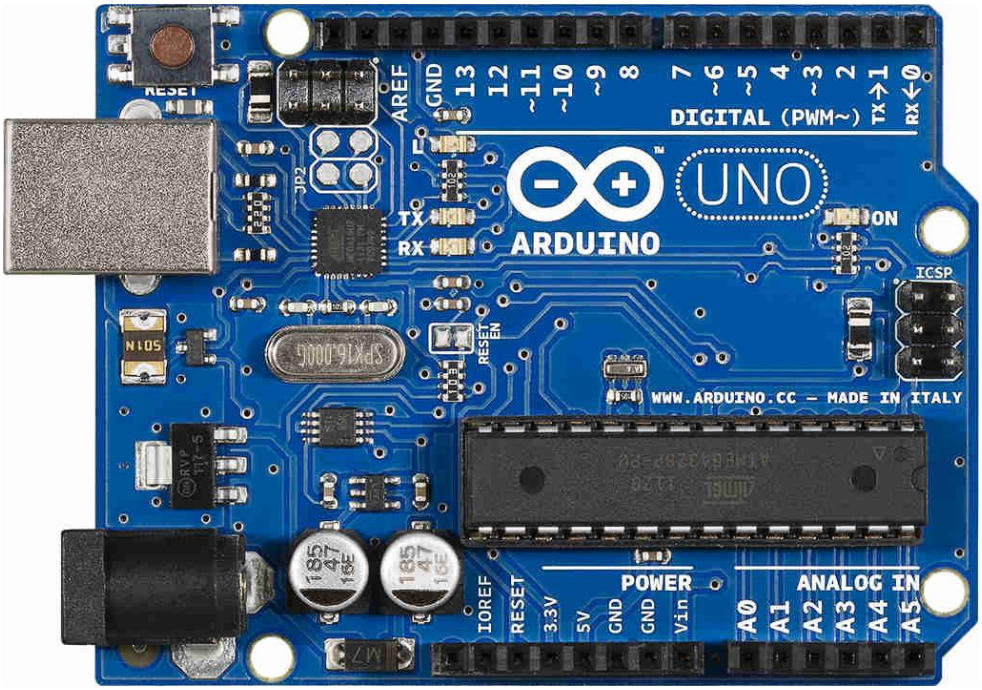

Figure 2: Figure of Arduino UNO Board.

The Uno board includes everything you need to get started with the microcontroller. Simply connect it to a computer using a USB cable or power it with an AC-to-DC adapter or battery, and you are ready to begin tinkering with the board. Even if you make mistakes, the board is designed to be user-friendly, and worst-case scenarios involve only replacing the chip, which is inexpensive and straightforward.

The name "Uno" was chosen because it means "one" in Italian and signifies the release of Arduino Software (IDE) 1.0. This board was the reference model for the

Arduino platform, and it is the first in a series of USB Arduino boards. As the Arduino platform has evolved, newer releases have been introduced, and there is now an extensive list of current, past, and outdated boards available. Regardless of the board, the Arduino platform remains a popular choice for both hobbyists and professionals looking to experiment with electronics and programming. (arduino.cc, 2023)

- **Jumper Wire**

Jumper wires are basic cables with connector pins on each end, used to connect two points without the need for soldering. They are commonly used in electronics prototyping with breadboards and other tools for easy circuit changes. Jumper wires are essential for anyone interested in electronics experimentation and can be found in various lengths and colors for organizing complex circuits. They are a cost-effective and widely available option, allowing engineers and hobbyists to build and test circuits quickly and efficiently. Jumper wires are a simple yet crucial component in the electronics industry, providing flexibility and convenience in circuit-building. (Vuyyuru, 2023)

Figure 3: Figure of Jumper Wire.

- **Ultrasonic Sensor**

The ultrasonic sensor is an electronic device utilized for measuring distances, which is a crucial factor in various applications such as robotic control and vehicle detection. Optical and sound sensors are among the most useful types for measuring distances, with ultrasonic sensors commonly used as proximity sensors in parking technology and anti-collision safety systems. In robotic obstacle detection systems and manufacturing engineering, ultrasonic sensors are also frequently used. Compared to infrared sensors, ultrasonic sensors are less prone to interference from smoke, gases, and other airborne particles. Ultrasonic sensors are also utilized as level sensors to monitor liquid levels in closed vessels, including chemical plant drums. Additionally, the medical industry has benefited from ultrasound technology for imaging internal organs, identifying tumors, and ensuring the health of fetuses in the womb. (Anon., 2023)

Figure 4: Figure of Ultrasonic Senor.

- **Servo Motor**

  A servo motor is an actuator that rotates and precisely controls the position of its output shaft using a closed-loop control system. It is made up of a small DC motor and a set of gears that drive the output shaft. The motor's speed and direction are controlled by a feedback mechanism that compares the actual position of the shaft to the desired position and makes necessary adjustments. The use of servo motors is prevalent in industries that require precise motion control, such as robotics, manufacturing, and aerospace. In addition, hobbyist projects such as drones and radio-controlled vehicles often utilize servo motors for accurate and controlled movement.