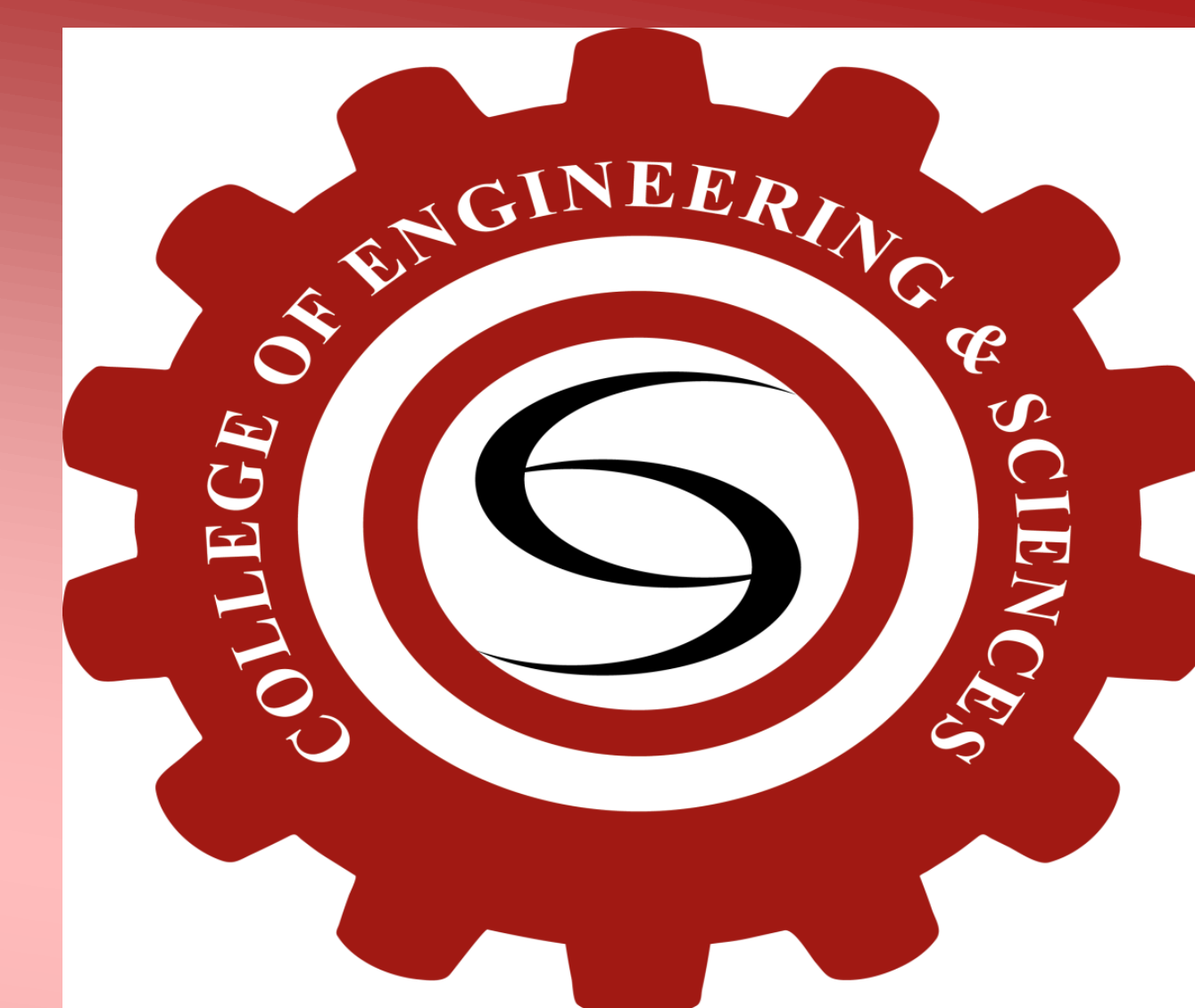




# ELECTRICAL ENGINEERING DEPARTMENT

## COLLEGE OF ENGINEERING AND SCIENCES

### FINAL YEAR PROJECT



**SUPERVISOR:**  
**Dr. Sayed Fayaz Ahmad**

**PROJECT:**  
**IOT-BASED WASTE MONITORING AND SORTING SYSTEM FOR SMART CITY**

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#### ABSTRACT

Since the development of an innovative standard known as the Internet of Things (IoT) and its fundamental technologies, the global industry is undergoing significant modifications. To benefit from this machinery using the Internet of Things (IoT), many business executives devote more time and resources to modernising their contributions. Despite that, it is challenging to offer an effective and real-time waste management system. But it is the responsibility of municipal waste management authority to provide an effective, sustainable waste management system. In this regard, this research will introduce a project that offers a complete waste management solution containing software, hardware, and communications parts. The system follows an IoT-based approach where the discarded waste from the smart bin is continuously monitored by sensors that inform the filling level of each compartment, in real-time. The technology that will be used is the Internet of Things (IoT) which allows for the Sorting, analysis and broadcast of data from sensors installed on waste bins. IoT-based waste monitoring can help city authorities monitor the fill-up level of the bins, in real time and adjust waste sorting routes leading to well-organized and cost-effective waste management.

#### INTRODUCTION

- Waste management is one of the key concerns of both developed and developing countries. With the development and economic growth, waste production is also increasing which increases the responsibility and accountability for a healthier and sustainable environment.
- The characteristics of solid wastes have changed as a result of the rapid development in developing countries' urban areas, and the amount of municipal solid waste (MSW) generated in the last ten years has dramatically increased. In cities and towns, there are many public areas with dustbins or garbage cans that are filled to the overflowing, creating hygiene issues and frustration in the surrounding area
- The proposed IoT-based waste management system will be a practical, economical, and clever way to handle waste Sorting, real-time remote monitoring problems, and disposal. In this way, we can contribute to our country to ensure a clean, green, healthy, and sustainable environment in our surroundings. It will be useful for the waste recycling process for the future development of nations.

#### PROBLEM STATEMENT

- There are several challenges faced by countries related to waste management systems. Because the existing waste management is not effective, Sustainable, and environment friendly. In addition, when smart cities do not have proper waste Sorting and monitoring systems the surrounding environment will be affected by increasing diseases like malaria, and dengue, and in the end it will lose fresh air which can create a harmful impact on the atmosphere, and builds a bad image of that city. Therefore, to overcome such problems the system will introduce an IoT-based waste management system with real-time monitoring, which offers an effective, healthy, and sustainable environment.

#### PROJECT COMPONENTS

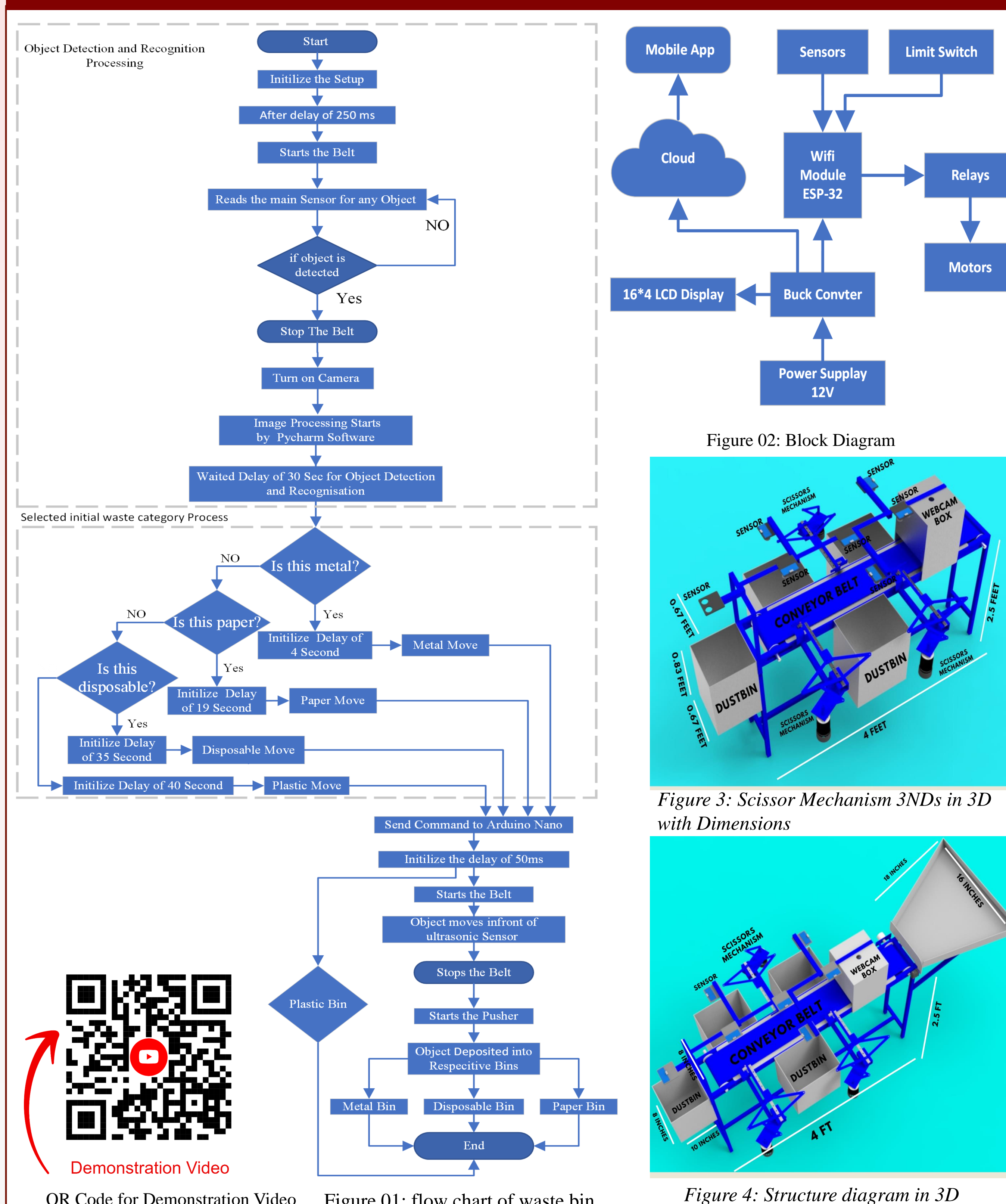
##### Hardware :

- Arduino Nano
- ESP32 (Controller)
- HC-SRO4 Ultrasonic Sensor
- Relay Module 4 Channel
- Buck Converter LM2596
- Webcam (Linux Compatible)
- Led Lights
- Limit Switches
- DC motor 1.5Ampere 24volt and one 3 Ampere
- Conveyer belt 4feet
- Roller set 2piece sets
- Scissor Mechanism 3NDs
- USB to Serial Board (FT232 RL)
- Metallic sensor (Iron)
- Metallic steel 19\*19 RHS structure

##### Software tools are used:

- Python: It is a coding compiler, in this project, it is used for coding apps, sensors, and webcams.
- Ubuntu: Operating system used to connect the hardware part with software.
- YOLO ( You Only Look Once) and TensorFlow: An algorithm and library that trains the system using deep learning and image processing techniques.

#### PROPOSED SYSTEM



#### CEPs AND SDGs

**Depth of Knowledge:** To design this system, many research studies about the existing waste management problems, types of waste, use of cloud-based systems, and deep learning. Moreover, to make an efficient and effective system object detection and recognition algorithms such as Yolo and Tensor-flow are used to train the system. And Open Cv Library, python programming, and Ubuntu operating system.

**Depth of analysis:** The sorting is done with the processing of project software and hardware interaction using the Ubuntu operating system and object detection algorithms. Due to the absence of reference points, it becomes difficult to identify the most effective way of waste sorting. However, after implementing some approaches it has been concluded that this is the design for an effective waste management system.

**Result:** Using this system waste Sorting and monitoring can be performed easily to make a clean, green, and sustainable environment. In addition, recycling of waste can be done on a large scale.

##### SDGs:

- SDG 3: Good Health and Well-Being
- SDG 9: Industry, Innovation and Infrastructure
- SDG 11: Sustainable Cities and Communities
- SDG 13: Climate Action
- This project is funded by PEC (The letter is attached as APPENDIX-VII in the report)

