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# " GARBAGE MANAGEMENT SYSTEM FOR SMART CITY "

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**Abstract** -This project presents an IoT-based smart dustbin using NodeMCU, MQ-135 gas sensor, ultrasonic sensors, a servo motor, and the Blynk platform. It features automatic lid operation via proximity detection and monitors fill level and gas concentration in real-time, displayed on the Blynk app. A custom PCB ensures reliable connections. If harmful gas levels are detected, the system triggers a buzzer and opens the lid for ventilation. This smart dustbin enhances hygiene and safety, demonstrating IoT's potential in improving waste management for households and public spaces

***Key Words*:** NodeMCU (ESP12E), Ultrasonic Sensor [2 units],7805 Voltage Regulator, MQ-135 Gas Sensor, Servo Motor 9g,Buzzer,DC Adapter (9 Volt),Soldering Iron, Solder Wire.

## .1. INTRODUCTION

In the contemporary world, the integration of smart technology into everyday objects has become increasingly prevalent, aiming to improve convenience, efficiency, and safety. This project focuses on the development of an IoT-based smart dustbin that leverages advanced sensors and a microcontroller to automate and enhance waste management processes. Utilizing a NodeMCU (ESP12E), the smart dustbin incorporates proximity detection, fill level monitoring, and gas concentration sensing to address hygiene and health concerns associated with traditional waste bins. By connecting to the Blynk IoT platform, the system allows real-time monitoring and control via a mobile app, providing users with immediate insights into the dustbin's status. This project not only exemplifies the practical application of IoT in everyday life but also highlights the potential for such innovations to contribute to cleaner and safer environments.

## 2. METHODOLOGY-

**1.Hardware Setup** :- Node MCU(ESP12E): Microcontroller for Wi-Fi and sensor integration.
Sensors:
- Ultrasonic sensor for proximity detection (lid control).
- Ultrasonic sensor for fill level monitoring.
- MQ-135 gas sensor for harmful gas detection.
- Actuators: Servo motor for lid operation and buzzer for gas alerts.
- Custom PCB: For reliable connections and streamlined assembly.

**2. System Integration**:
Component Connections: Wire sensors, servo motor, and buzzer to Node MCU.
Power Supply: Ensure stable power for all components.

**3. Firmware Development:**
- Programming: Write code to:
- Read sensor data.
- Control lid based on proximity.
- Trigger buzzer and ventilate on high gas levels.
- IoT Connectivity: Integrate with Blynk for real-time monitoring and control via a mobile app.

**4. User Interface Setup:**
- Blynk App: Configure to display fill level, gas concentration, and lid status. Enable alerts for high gas levels.

**5. Testing and Validation**:
- Functionality Testing: Ensure lid operation, fill level accuracy, and gas detection are working correctly.
- Performance Evaluation: Test system reliability and response under various conditions.

**6. Deployment and Documentation:**
- Installation: Deploy in real-world settings.
- User Guide: Document setup, operation, and troubleshooting.
- Feedback: Collect user feedback for improvements.

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## 3.SYSTEMDESIGN

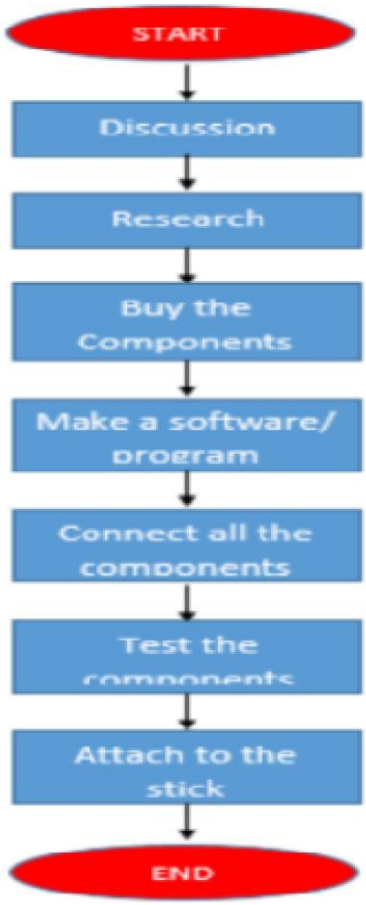


*Figure 1..FLOW CHART*

## *4.BLOCK DIAGRAM*

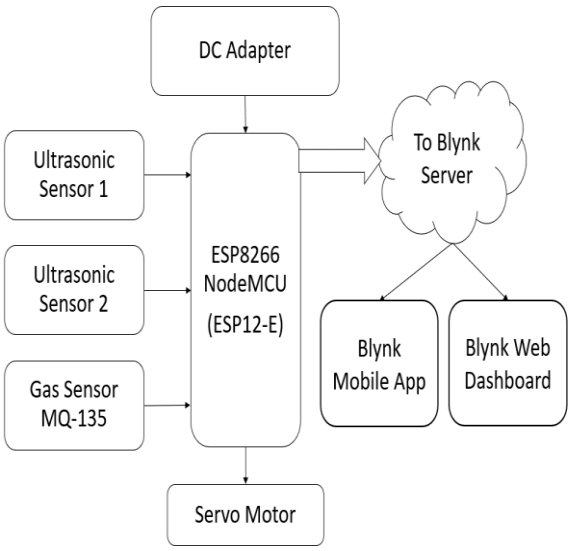


Figure 2. Block diagram

## 5.CIRCUIT DIAGRAM

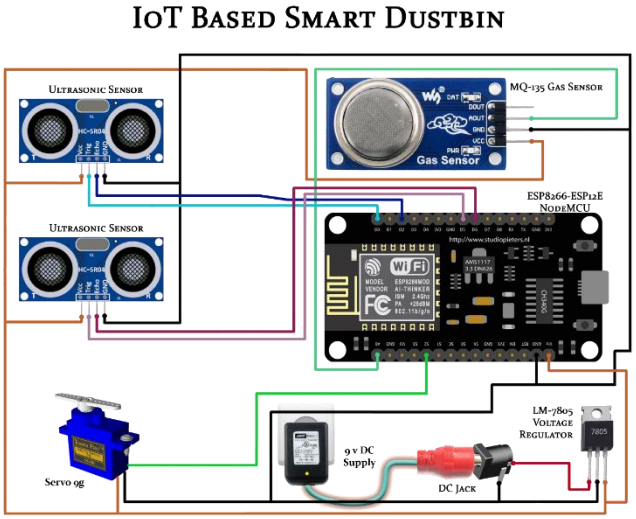


*Figure 3.Circuit Diagram*

## 6.WORKING

1. NodeMCU (ESP12E): A microcontroller with built-in Wi-Fi for integrating sensors and actuators, facilitating IoT capabilities.
2. Ultrasonic Sensor [2 units]: Sensors used for proximity detection (to control the lid) and fill level monitoring.
3. 7805 Voltage Regulator: Component used to step down voltage to a stable 5V for the NodeMCU and other components.
4. MQ-135 Gas Sensor: Sensor that detects harmful gas concentrations inside the dustbin.
5. Servo Motor 9g: Actuator for opening and closing the dustbin lid based on sensor inputs.
6. Buzzer: Alarm component triggered by high gas concentration levels.
7. DC Adapter (9 Volt): Power supply for the entire system, providing necessary voltage for components.
8. Soldering Iron: Tool for soldering electronic components and connections.
9. Solder Wire: Material used with the soldering iron to create electrical connections between components.

### 6.1 SYSTEM COMPONENET

### SOFTWARE:

### 1.Arduino IDE

The ATMega328p microcontroller IC with Arduino bootloader makes a lot of work easier in this project as Arduino code is written in C++ with an addition of special methods and functions, which we'll mention later on. C++ is a human-readable programming language. When you create a 'sketch' (the name given to Arduino code

files), it is processed and compiled to machine language.The Arduino Integrated Development Environment (IDE) is the main text editing program used for Arduino programming. It is where you'll be typing up your code before uploading it to the board you want to program. Arduino code is referred to as sketches.

**2 Blynk IoT: Android/Web App**

A scope of Arduino modules accessible including NodeMCU, Arduino Mega, Arduino Leonardo, Arduino Micro and some more with no earlier specialized information can consider going all in with the learning procedure.It is easily available for operating systems like MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and each of them contains a microcontroller on the board that is really modified and acknowledges the data as code.

Blynk is an IoT (Internet of Things) stage utilizing which you can without much of a stretch and distantly control equipment. Furthermore, you can likewise see sensor information, store the information, picture the information and so on everywhere. Talking about equipment, the Blynk stage bolsters a wide scope of sheets and MCUs like: here throughout the web.

- NodeMCU, Nano, Mini, Mega, etc'
- The Arduino-like sheets like ESP8266 and its variations, Blue Pill (STM32F103C), and so on.
- Texas Instruments' Tiva Boards, MSP432 Launchpad arrangement, and so forth.
- Raspberry Pi, BeagleBone Black, ordinary PC (Windows, Linux or Mac), and so forth.

## 4. CONCLUSIONS

The IoT-based smart dustbin project revolutionizes waste management by incorporating sensors, microcontrollers, and IoT platforms.

It brings significant benefits:

**1.Improved Hygiene:** Automatic lid operation and gas sensor alerts minimize direct contact and prevent the buildup of harmful substances, enhancing public health.

**2. Operational Efficiency**: Real-time waste monitoring enables optimized collection schedules, reducing resources and enhancing service efficiency.

**3. Environmental Impact:** By preventing overflows and detecting toxic gases, the system reduces litter and pollution, promoting environmental sustainability.

**4. User Convenience:** Automated lid operation and real-time notifications via the Blynk app enhance user experience, encouraging proper waste disposal practices and facilitating prompt maintenance actions.

**FUTURE WORK**

Future developments could focus on:

**Enhanced Security:** Implementing robust cybersecurity measures to protect data integrity and privacy.

**Cost Reduction:** Exploring cost-effective alternatives for sensors and components to make the system more affordable and scalable.

**Advanced Analytics:** Utilizing data analytics and machine learning to further optimize waste management processes and predict maintenance needs.

**Integration:** Expanding integration with other smart city infrastructure to create a more interconnected and efficient urban environment.

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