AUTOMATIC WASTEBIN

PROJECT REPORT 2022-2023

Submitted by

ABHINAV S RAJESH [REG NO: 2101132995]

ADITHYA KRISHNA C A [REG NO: 2101132996]

CYRIL POLY [REG NO: 2101132998]

HARIKRISHNAN K [REG NO: 2101133001]

CHITHRAPRIYA S [REG NO: 2101132065]

AKHINA T [REG NO: 2101132050]

SIXTH SEMSTER COMPUTER ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

GOVERNMENT POLYTECHNIC COLLEGE, CHELAKKARA

GOVERNMENT POLYTECHNIC COLLEGE, CHELAKKARA

DEPARTMENT OF COMPUTER ENGINEERING

CERTIFICATE

This is to certify that the project titled "AUTOMATIC WASTEBIN" done by ABHINAV S RAJESH [REG NO: 2101132995], ADITHYA KRISHNA C A [REG NO: 2101132996], CYRIL POLY [REG NO: 2101132998], HARIKRISHNAN K [REG NO: 2101133001], CHITHRAPRIYA S [REG NO: 2101132065], AKHINA T [REG NO:2101132050] Student 0f Computer Engineering partial fulfillment of the requirement for the award of Diploma in Computer Engineering under Directorate ofTechnical Education, Kerala State during the academic year 2022-2023.

Staff in Charge
Mrs. Midhun Mohan **Head of Department**

Place: Chelakkara

Date:

Internal Examiner **External Examiner**

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- **To impact quality engineering education through state-of-the-art methodologies and infrastructure**
- **To equip students with appropriate technical competency, professional ethics and relevant social values for leading a meaningful career**
- **To foster sustainable environment through various rural development initiatives**

DEPARTMENT VISSION

To be a centre of excellence in Computer Engineering by Moulding professionals with technical competence and social responsibility

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2. **To collaborate with other premier instructions and industries for academic excellence and to ensure employability.**

3. **To work with moral and ethical values emphasizing on sustainable development.**

DECLARATION

I/We here by state that project work submitted for the DIPLOMA in

COMPUTER ENGINEERING

On

"AUTOMATIC WASTEBIN"

It is my/our original work, and it has not previously from the basis for the award of any Diploma, degree, associate ship, fellow ship or any other similar site or mobile application.

Signature of the candidates(s)

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ABHINAV S RAJESH

ADITHYA KRISHNA C A

CYRIL POLY

HARIKRISHNAN K

CHITHRAPRIYA S

AKHINA T

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ABSTRACT

The "Automatic Wastebin" project presents an innovative solution for efficient waste management by combining automated lid operation, waste level sensing, and real-time monitoring through Blynk IoT. The system incorporates a sensor-based mechanism to automatically open the wastebin lid upon detecting an obstruction in front of the sensor, ensuring hands-free operation. After a programmed duration, the lid closes, maintaining hygiene and minimizing manual contact.

The system also features a waste level sensor inside the bin, providing accurate information about the current waste volume. This data is seamlessly transmitted to the Blynk IoT platform, enabling users to monitor waste levels remotely. The Blynk app displays real-time information, indicating when the wastebin opens and closes, facilitating convenient oversight and management.

Additionally, the project incorporates an alert system using a buzzer, which activates when the wastebin reaches its full capacity. This audible alert ensures timely emptying, preventing overflow and promoting efficient waste disposal practices.

The Automatic Wastebin aims to enhance user convenience, promote cleanliness, and contribute to smart waste management practices by seamlessly integrating automation, sensor technology, and IoT connectivity.

INTRODUCTION

In the wake of increasing environmental awareness and the pressing need for efficient waste management solutions, the development of the "Automatic Wastebin" project emerges as a significant innovation. This project represents a fusion of technology and sustainability, offering a solution to the challenges posed by traditional wastebins.

Traditional wastebins, while essential, often present hygiene concerns and require manual operation, leading to potential germ transmission and inconvenience. Moreover, monitoring waste levels manually can be cumbersome and prone to errors, resulting in inefficient waste disposal practices. Recognizing these challenges, our project endeavors to revolutionize waste management through automation, sensor technology, and IoT integration.

The Automatic Wastebin addresses these concerns by introducing an automated lid operation mechanism, triggered by the detection of an obstruction in front of the sensor. This feature ensures hands-free operation, enhancing hygiene and convenience, particularly in high-traffic areas such as public spaces, offices, and homes.

Furthermore, the integration of a waste level sensor inside the bin enables real-time monitoring of waste volume. By transmitting this data to the Blynk IoT platform, users gain remote access to information regarding waste levels, opening and closing times of the wastebin, and other pertinent details. This not only facilitates proactive waste management but also empowers users to make informed decisions regarding waste disposal and scheduling.

Additionally, the inclusion of a buzzer alert system serves as a proactive measure to notify users when the wastebin reaches full capacity. This feature aims to prevent overflow, minimize environmental impact, and streamline waste disposal processes.

In essence, the Automatic Wastebin project embodies innovation, efficiency, and sustainability. By leveraging technology to automate waste management processes and promote real-time monitoring, the project contributes to a cleaner, healthier environment while enhancing user convenience and promoting responsible waste disposal practices. Through this report, we delve into the design, development, and implementation of the Automatic Wastebin, highlighting its significance, functionality, and potential impact on waste management practices.

WHY WE CHOOSE THIS PROJECT?

Choosing to embark on the NodeMCU-Based Automatic Wastebin project represents a strategic decision that stems from a comprehensive evaluation of its multifaceted advantages and profound potential impact. At its core, this project embodies our collective commitment to addressing pressing societal and environmental challenges, particularly within the domain of waste management. In an era marked by escalating pollution levels, resource depletion, and environmental degradation, the imperative to adopt innovative solutions has never been more urgent. By undertaking the development of an automated wastebin system, we position ourselves as agents of change, actively contributing to the preservation and restoration of our planet's fragile ecological equilibrium.

Furthermore, the decision to pursue the NodeMCU-Based Automatic Wastebin project is underpinned by our unwavering dedication to innovation and technology integration. Recognizing the transformative potential of emerging technologies, particularly within the realm of the Internet of Things (IoT), we embrace the opportunity to harness the power of NodeMCU microcontrollers and sensor technologies to revolutionize traditional waste management practices. Through this endeavor, we not only showcase our technical prowess but also exemplify our capacity to adapt and thrive in an increasingly digitized world. By delving into the intricacies of IoT development, we expand our horizons, sharpen our problem-solving skills, and position ourselves at the vanguard of technological innovation.

Moreover, the NodeMCU-Based Automatic Wastebin project stands as a testament to our commitment to user convenience, hygiene, and operational efficiency. By implementing hands-free lid operation and real-time waste level monitoring, the system promises to enhance user experience and promote hygiene, particularly in densely populated urban environments where sanitation is of paramount importance. Additionally, by optimizing waste collection schedules and resource allocation, the system addresses critical inefficiencies inherent in traditional waste management practices, thereby mitigating overflow, minimizing littering, and conserving valuable resources. These tangible benefits underscore the project's potential to effect meaningful change and affirm its status as a transformative force in the field of waste management.

In essence, the decision to undertake the NodeMCU-Based Automatic Wastebin project transcends mere academic pursuit; it represents a bold declaration of our commitment to innovation, sustainability, and positive societal impact. As we embark on this journey of discovery and transformation, we do so with a profound sense of purpose and determination, fully cognizant of the profound implications of our endeavors. Armed with the requisite knowledge, skills, and passion, we stand poised to make a meaningful difference in the world, one wastebin at a time. Through our collective efforts, we aspire to create a future where waste management is not merely a challenge to be overcome but a beacon of hope for a cleaner, greener, and more sustainable world.

PURPOSE OF THIS SYSTEM

The purpose of the NodeMCU-Based Automatic Wastebin system is to revolutionize waste management practices by introducing automation, efficiency, and user convenience to the process of waste disposal. The system aims to address several key objectives:

1. **Hygiene and Sanitation**: By offering hands-free operation through automated lid opening and closing, the system promotes hygiene and sanitation, minimizing the risk of germ transmission and promoting cleanliness, particularly in public spaces and high-traffic areas.
2. **Efficient Waste Management**: The system facilitates efficient waste management by monitoring waste levels in real-time and triggering alerts or initiating lid closure when the wastebin approaches full capacity. This proactive approach prevents overflow, reduces littering, and optimizes waste disposal practices.
3. **Convenience and User Experience**: With remote monitoring and control capabilities via the Blynk app, users can conveniently monitor waste levels, receive alerts, and manage waste disposal processes from anywhere, at any time. This enhances user experience and engagement, making waste management more accessible and user-friendly.
4. **Resource Optimization**: By providing accurate data on waste levels and operational status, the system enables more efficient resource allocation, ensuring timely waste disposal and minimizing unnecessary waste collection trips. This optimization leads to cost savings, energy conservation, and reduced environmental impact.
5. **Sustainability and Environmental Impact**: The system promotes sustainability by encouraging responsible waste disposal practices, reducing littering and overflow, and facilitating recycling initiatives. By integrating smart sorting and recycling capabilities, the system further enhances its environmental impact, promoting a circular economy and reducing waste sent to landfills.

EXISTING SYSTEM

The current system of waste management relies heavily on manual processes and conventional wastebins devoid of automation or smart technology integration. In this traditional setup, wastebins necessitate manual operation for lid opening and closing, which not only poses inconvenience but also exposes users to hygiene risks, particularly in high-traffic areas such as public spaces, offices, and commercial establishments. The repetitive physical contact required for waste disposal increases the potential for germ transmission, raising concerns about public health and sanitation.

Moreover, the absence of waste level monitoring mechanisms exacerbates the inefficiencies of the current system. Without real-time monitoring capabilities, wastebins often reach full capacity without warning, leading to overflow and littering in the surrounding environment. This not only detracts from the aesthetic appeal of the area but also creates hazards such as tripping hazards and pest infestation. Furthermore, the lack of a proactive notification system means that waste management personnel must rely on fixed schedules for waste collection, regardless of the actual fill levels of the bins. This results in resource inefficiencies, as collection trips may be unnecessary or insufficient to meet demand, leading to either wasted resources or overflowing bins.

Additionally, the manual operation of wastebins poses challenges in terms of user engagement and empowerment. Individuals have limited visibility and control over the waste disposal process, with no means of monitoring the status of bins, receiving alerts about their fill levels, or providing feedback on the efficiency of waste collection services. This lack of transparency and interaction diminishes the overall user experience and hampers efforts to improve waste management practices through community involvement and awareness.

Furthermore, the absence of data collection and analysis capabilities in the current system impedes efforts to optimize waste management practices. Without insights into waste generation patterns, fill rates, and operational efficiency, decision-makers are unable to implement targeted interventions or allocate resources effectively. This hinders progress towards sustainability goals and environmental conservation efforts.

PROPOSE SYSTEM

The proposed system of waste management, embodied in the NodeMCU-Based Automatic Wastebin, presents a transformative approach to addressing the inefficiencies and challenges prevalent in the current waste disposal practices. By leveraging advanced IoT technology, automation, and real-time monitoring capabilities, this system aims to revolutionize waste management processes, enhance operational efficiency, promote hygiene, and empower users with greater control and engagement.

At the core of the proposed system is the integration of NodeMCU microcontroller technology, which serves as the central control unit orchestrating the various components and functionalities of the Automatic Wastebin. Through its compatibility with the Arduino IDE and Wi-Fi connectivity, the NodeMCU enables seamless communication with sensors, actuators, and IoT platforms, facilitating intelligent decision-making and remote management capabilities.

One of the key features of the proposed system is its automation of wastebin lid operation. By incorporating proximity sensors, the system can detect the presence of users or objects in front of the wastebin and trigger the automatic opening and closing of the lid accordingly. This hands-free operation not only enhances user convenience but also minimizes physical contact with the bin, thereby reducing the risk of germ transmission and promoting hygiene, especially in public settings.

Furthermore, the integration of waste level sensors enables real-time monitoring of the fill level inside the wastebin. This data-driven approach allows the system to proactively alert users or waste management personnel when the bin approaches full capacity, thereby mitigating the risk of overflow and littering. Additionally, by providing insights into waste generation patterns and fill rates, the system empowers decision-makers to optimize collection schedules, allocate resources efficiently, and implement targeted interventions to address specific waste management challenges.

Moreover, the proposed system enhances user engagement and transparency through its integration with the Blynk IoT platform. Through the Blynk app, users can remotely monitor the status of the wastebin, receive alerts about fill levels or system events, and even control the operation of the bin, thereby fostering a sense of ownership and responsibility towards waste management practices. This increased visibility and interaction not only improve the overall user experience but also promote community involvement and awareness, leading to more sustainable and environmentally conscious behaviors.

FEASIBILITY STUDY

1. **Technical Feasibility**:
   - Hardware: NodeMCU and required sensor and actuator modules are readily available and affordable. Integration with the Blynk IoT platform is feasible and well-documented.
   - Software: Arduino IDE and Blynk platform provide user-friendly development environments. Libraries and resources are available for sensor and actuator integration.
2. **Operational Feasibility**:
   - The system's automated lid operation and waste level monitoring enhance operational efficiency, reducing the need for manual intervention and optimizing waste disposal processes.
   - Integration with the Blynk IoT platform allows for remote monitoring and control, facilitating proactive waste management from anywhere, at any time.
3. **Economic Feasibility**:
   - Initial investment: NodeMCU, sensors, actuators, and other components are relatively affordable. However, costs may vary depending on project scale and customization.
   - Operating costs: Minimal ongoing costs, primarily associated with maintenance and occasional battery replacement for battery-powered applications.
4. **Environmental Feasibility**:
   - The project promotes sustainability by optimizing waste management practices, reducing littering, and facilitating efficient resource allocation.
   - Smart sorting and recycling capabilities could further enhance environmental impact by promoting recycling and reducing waste sent to landfills.
5. **Legal and Regulatory Feasibility**:
   - Compliance with waste management regulations: The project aligns with regulations promoting responsible waste disposal and environmental conservation.
   - Data privacy and security: Implementation of appropriate measures to ensure user data privacy and security is essential, considering the IoT nature of the project.
6. **Social Feasibility**:
   - User acceptance: The project's hands-free operation, remote monitoring capabilities, and environmental benefits are likely to be well-received by users, particularly in settings where cleanliness and hygiene are priorities.
   - Community engagement: Educational initiatives and outreach programs could further enhance social acceptance and promote widespread adoption of smart waste management practices.

Based on the feasibility study, the NodeMCU-Based Automatic Wastebin project demonstrates strong potential for success. With proper planning, implementation, and ongoing support, the project can offer significant benefits in terms of efficiency, sustainability, and user satisfaction, contributing to a cleaner and more sustainable environment.

MODULE WISE DESCRIPTION

Module 1: NodeMCU Controller Module

The NodeMCU Controller Module serves as the brain of the Automatic Wastebin system, orchestrating its various components and ensuring seamless operation. This module is vital for processing sensor data, controlling actuators, communicating with the Blynk IoT platform, and executing the system's logic. Its robust capabilities and flexibility make it an ideal choice for managing the complexities of the Automatic Wastebin project.

Key Features and Functions:

1. **Microcontroller Architecture**: The NodeMCU module integrates the ESP8266 Wi-Fi enabled microcontroller, offering a powerful yet compact solution for IoT applications. Its 32-bit architecture provides sufficient processing power to handle the system's tasks efficiently.
2. **Arduino Compatibility**: NodeMCU is compatible with the Arduino IDE, allowing developers to leverage the familiar Arduino programming environment and extensive library support. This compatibility simplifies the development process and facilitates rapid prototyping.
3. **Sensor Data Processing**: The NodeMCU module interfaces with various sensors, including proximity sensors and waste level sensors, to collect real-time data about the wastebin's environment. It processes this data to make informed decisions regarding lid operation and waste level monitoring.
4. **Actuator Control**: NodeMCU controls the servo motor actuator responsible for opening and closing the wastebin lid based on inputs from the proximity sensors and waste level sensors. It sends precise commands to the actuator to ensure smooth and reliable lid operation.
5. **Communication with Blynk IoT Platform**: NodeMCU communicates with the Blynk IoT platform over Wi-Fi, enabling remote monitoring and control of the Automatic Wastebin system. It sends data on waste levels, lid status, and system alerts to the Blynk app, allowing users to stay informed and take proactive actions.
6. **Event-Driven Programming**: The NodeMCU module utilizes event-driven programming to handle sensor inputs, actuator control, and communication tasks asynchronously. This programming paradigm ensures efficient resource utilization and responsiveness, enhancing the system's overall performance.
7. **Error Handling and Recovery**: NodeMCU implements robust error handling mechanisms to detect and recover from unexpected events, such as sensor failures or communication errors. It employs techniques such as error logging,

retry mechanisms, and fallback strategies to maintain system integrity and reliability.

8. **Scalability and Expandability**: NodeMCU offers scalability and expandability, allowing additional sensors, actuators, or features to be integrated into the system seamlessly. Its modular architecture and ample GPIO pins provide flexibility for future enhancements and customization

Module 2: Proximity Sensor Module

The Proximity Sensor Module is a critical component of the Automatic Wastebin system, responsible for detecting the presence of objects or users in front of the wastebin. These sensors play a pivotal role in triggering the automatic opening of the wastebin lid, thereby enhancing user convenience, hygiene, and operational efficiency.

Key Features and Functions:

1. **Detection Technology**: Proximity sensors utilize various detection technologies, including infrared (IR) sensors, ultrasonic sensors, or capacitive sensors, to detect the presence of objects within their detection range. Each sensor type offers unique advantages in terms of range, accuracy, and response time, allowing for flexible deployment based on specific project requirements.
2. **Mounting and Positioning**: Proximity sensors are strategically mounted around the wastebin, typically on the front or top surface, to ensure optimal detection coverage. Careful positioning and alignment are essential to maximize sensor effectiveness and minimize blind spots.
3. **Range Adjustment**: Many proximity sensors offer adjustable detection ranges, allowing users to fine-tune the sensor's sensitivity to suit the application environment. This feature enables customization to accommodate variations in wastebin size, user proximity, and ambient conditions.
4. **Triggering Lid Operation**: When an obstruction is detected within the sensor's detection range, the proximity sensor sends a signal to the NodeMCU controller, indicating the presence of a user or object in front of the wastebin. This signal serves as the trigger for initiating the automatic opening of the wastebin lid, facilitating hands-free operation and enhancing user convenience.
5. **Reliability and Accuracy**: Proximity sensors are designed to deliver reliable and accurate detection performance, ensuring consistent operation under various environmental conditions. Robust construction, quality components, and advanced signal processing algorithms contribute to the sensors' reliability and accuracy.
6. **Power Consumption**: Proximity sensors are typically designed for low power consumption, making them suitable for battery-powered or energy-efficient applications. This characteristic minimizes the overall power requirements of

the Automatic Wastebin system, contributing to longer battery life and reduced operating costs.

7. **Environmental Considerations**: Proximity sensors are engineered to withstand harsh environmental conditions, including temperature extremes, humidity,

   dust, and vibration. This rugged construction ensures long-term durability and reliable performance, even in challenging operating environments.

8. **Integration with NodeMCU**: Proximity sensors interface seamlessly with the NodeMCU controller module, exchanging signals and data to facilitate lid operation control. The NodeMCU module interprets sensor signals, processes them according to the system's logic, and coordinates the actuation of the servo motor actuator for opening and closing the wastebin lid.

Module 3: Waste Level Sensor Module

The Waste Level Sensor Module is a crucial component of the Automatic Wastebin system, responsible for accurately measuring the level of waste inside the bin. These sensors provide real-time data on waste accumulation, enabling timely waste disposal and preventing overflow, thereby enhancing operational efficiency and cleanliness.

Key Features and Functions:

1. **Sensor Technology**: Waste level sensors utilize various technologies, including ultrasonic sensors, infrared sensors, or capacitive sensors, to measure the distance from the sensor to the surface of the waste inside the bin. Each sensor type offers unique advantages in terms of accuracy, range, and response time, allowing for flexible deployment based on specific project requirements.
2. **Mounting and Positioning**: Waste level sensors are strategically positioned inside the wastebin, typically at the top or bottom of the bin, to ensure optimal measurement accuracy. Careful placement and alignment are essential to minimize measurement errors and ensure consistent performance.
3. **Measurement Range**: Waste level sensors offer adjustable measurement ranges, allowing users to customize the sensor's sensitivity to accommodate variations in wastebin size and waste accumulation rates. This feature enables precise measurement of waste levels across a wide range of bin capacities.
4. **Real-time Monitoring**: Waste level sensors continuously monitor the distance to the surface of the waste inside the bin, providing real-time data on the current fill level. This data is transmitted to the NodeMCU controller module, allowing users to monitor waste levels remotely via the Blynk app and receive alerts when the bin approaches full capacity.
5. **Threshold-based Operation**: The NodeMCU controller module processes data from the waste level sensors and triggers alerts or initiates lid closure when the waste level exceeds predefined thresholds. This proactive approach prevents

overflow, minimizes littering, and optimizes waste disposal practices, enhancing operational efficiency and cleanliness.

6. **Accuracy and Reliability**: Waste level sensors are designed to deliver accurate and reliable measurement performance, ensuring consistent operation under various environmental conditions. Advanced signal processing algorithms, robust construction, and quality components contribute to the sensors' accuracy and reliability.
7. **Power Consumption**: Waste level sensors are engineered for low power consumption, making them suitable for battery-powered or energy-efficient applications. This characteristic minimizes the overall power requirements of the Automatic Wastebin system, contributing to longer battery life and reduced operating costs.
8. **Integration with NodeMCU**: Waste level sensors interface seamlessly with the NodeMCU controller module, exchanging data and signals to facilitate real-time monitoring and control. The NodeMCU module interprets sensor data, analyzes it according to the system's logic, and triggers appropriate actions based on predefined thresholds, ensuring efficient waste management.

Module 4: Actuator Control Module (Servo Motor and Buzzer)

The Actuator Control Module is a pivotal component of the Automatic Wastebin system, responsible for controlling the physical movements of the wastebin lid and providing audible alerts to users when necessary. This module enhances the functionality, convenience, and user interaction of the system, ensuring seamless operation and effective waste management.

Key Features and Functions:

1. **Servo Motor Actuator**:
   - **Mechanical Movement Control**: The servo motor actuator controls the opening and closing of the wastebin lid in response to signals from the NodeMCU controller module. It translates electrical signals into precise mechanical movements, facilitating smooth and accurate lid operation.
   - **Angle Adjustment**: Servo motors offer precise angle control, allowing users to adjust the opening angle of the wastebin lid to suit specific requirements. This feature enables customization to accommodate different wastebin sizes, user preferences, and operational environments.
   - **Torque and Speed**: Servo motors provide sufficient torque and speed to operate the wastebin lid effectively, ensuring reliable performance under various load conditions. This capability ensures consistent lid operation and minimizes the risk of jams or malfunctions.
2. **Buzzer**:
   - **Audible Alert Generation**: The buzzer emits audible alerts when the wastebin reaches full capacity or when other system events require user attention. It generates distinctive sound patterns or tones to notify users of critical events, enhancing user awareness and responsiveness.

- **Volume Adjustment**: Buzzer modules often feature volume adjustment controls, allowing users to customize the alert volume to suit their preferences and environmental conditions. This feature ensures that alerts are audible without being disruptive or intrusive.
- **Alert Prioritization**: Buzzer alerts can be prioritized based on the severity and urgency of the event, ensuring that users are promptly notified of critical system conditions, such as full waste capacity or sensor malfunctions.

3. **Reliability and Durability**:

- **Robust Construction**: Servo motors and buzzers are designed with robust construction and high-quality components to withstand continuous operation and harsh environmental conditions. This durability ensures long-term reliability and reduces the risk of component failures or malfunctions.
- **Extended Lifespan**: Servo motors and buzzers are engineered for extended lifespan and minimal maintenance requirements, making them ideal for deployment in the Automatic Wastebin system. Their reliable performance contributes to the overall reliability and effectiveness of the system.

4. **Integration with NodeMCU**:

- **Control Signals**: The NodeMCU controller module sends control signals to the servo motor actuator to initiate lid opening and closing operations based on inputs from proximity sensors and waste level sensors. It also triggers the buzzer to emit audible alerts when necessary, based on predefined system events.
- **Feedback Mechanism**: The NodeMCU module receives feedback signals from the servo motor actuator and buzzer, confirming successful execution of commands and alerting the system of any errors or malfunctions. This bidirectional communication ensures accurate control and monitoring of actuator operations.

INTRODUCTION TO NODEMCU

NodeMCU, a versatile and powerful development board based on the ESP8266 Wi-Fi module, serves as the cornerstone for the implementation of the Automatic Wastebin project. This section provides an introduction to NodeMCU, highlighting its key features, capabilities, and relevance to the project's objectives.

NodeMCU emerged as a game-changer in the field of IoT (Internet of Things) and embedded systems, offering a compact yet powerful platform for building connected devices and applications. Developed on the Lua-based firmware, NodeMCU combines the capabilities of a microcontroller with built-in Wi-Fi connectivity, making it an ideal choice for projects requiring remote monitoring, control, and automation.

Key Features of NodeMCU include:

1. **ESP8266 Wi-Fi Module**: NodeMCU integrates the ESP8266 Wi-Fi module, providing seamless connectivity to Wi-Fi networks and enabling communication with IoT platforms, cloud services, and other devices over the internet.
2. **Arduino Compatibility**: NodeMCU is compatible with the Arduino IDE, allowing users to leverage the extensive Arduino ecosystem, libraries, and programming environment for rapid development and prototyping.
3. **GPIO Pins**: NodeMCU features a set of General Purpose Input/Output (GPIO) pins, which can be used to interface with sensors, actuators, displays, and other electronic components, facilitating the implementation of diverse projects and applications.
4. **Analog-to-Digital Converter (ADC)**: NodeMCU includes built-in ADC functionality, allowing analog sensors to be interfaced directly with the board for accurate sensing and measurement of physical quantities such as temperature, humidity, and light intensity.
5. **Low Power Consumption**: Despite its powerful capabilities, NodeMCU boasts low power consumption, making it suitable for battery-powered or energy-efficient applications where power efficiency is crucial.
6. **Lua Scripting Support**: NodeMCU firmware supports Lua scripting language, enabling users to develop code directly on the board using Lua scripts. This feature offers flexibility and simplicity for programming, particularly for users familiar with Lua.
7. **Community Support**: NodeMCU enjoys a vibrant and active community of developers, enthusiasts, and contributors who provide extensive documentation,

tutorials, and support forums, fostering collaboration and knowledge sharing among users.

In the context of the Automatic Wastebin project, NodeMCU serves as the central control unit, orchestrating the automation, sensor integration, IoT connectivity, and user interaction aspects of the system. Leveraging NodeMCU's capabilities, the project aims to create a smart, efficient, and connected wastebin solution that enhances waste management practices, promotes sustainability, and improves user convenience and engagement.

INTRODUCTION TO BLYNK IOT

Blynk IoT is a powerful platform that empowers individuals and organizations to build and deploy Internet of Things (IoT) applications quickly and easily. Designed with simplicity and versatility in mind, Blynk provides a user-friendly interface and a comprehensive suite of tools to streamline the development process and bring IoT projects to life. At its core, Blynk enables users to connect hardware devices, such as microcontrollers and sensors, to the cloud, allowing for seamless communication and data exchange over the internet.

One of the key features of Blynk is its drag-and-drop interface, which allows users to create custom dashboards and user interfaces for their IoT projects without the need for extensive coding or programming knowledge. Through the Blynk app, users can design interactive widgets, such as buttons, sliders, graphs, and gauges, to visualize data and control connected devices remotely. This intuitive interface empowers users to tailor their IoT applications to suit their specific needs and preferences, enabling greater flexibility and customization.

Furthermore, Blynk offers robust connectivity options, supporting a wide range of hardware platforms, including popular microcontrollers like Arduino, Raspberry Pi, ESP8266, and NodeMCU. With Blynk's extensive library of supported devices and protocols, users can seamlessly integrate their hardware components into the Blynk ecosystem, facilitating seamless communication and interoperability between devices.

Another distinguishing feature of Blynk is its cloud-based infrastructure, which provides users with secure and reliable access to their IoT projects from anywhere in the world. By leveraging Blynk's cloud services, users can remotely monitor and control their devices, receive real-time notifications and alerts, and analyze data collected from sensors and other sources. This remote accessibility enables users to stay connected to their IoT projects at all times, empowering them to respond to changing conditions and take action as needed.

In addition to its core features, Blynk offers a range of advanced functionalities and integrations to enhance the capabilities of IoT applications. These include support for third-party services and APIs, data logging and analytics tools, and integration with popular IoT platforms and services. Moreover, Blynk provides comprehensive documentation, tutorials, and community support to assist users at every stage of their IoT journey, from prototyping and development to deployment and maintenance.

Overall, Blynk IoT offers a comprehensive and user-friendly platform for building and deploying IoT applications quickly and easily. With its intuitive interface, robust connectivity options, cloud-based infrastructure, and extensive feature set, Blynk empowers users to unleash their creativity, innovate with IoT technology, and bring their ideas to life. Whether you're a hobbyist, maker, educator, or professional developer, Blynk provides the tools and resources you need to create impactful and successful IoT projects.

REQUIREMENTS

1. **NodeMCU Development Board**: Select a NodeMCU development board, which integrates the ESP8266 Wi-Fi module, for controlling the automatic wastebin system and facilitating IoT connectivity.
2. **Sensor Modules**:
   - Proximity Sensor: Required for detecting obstructions in front of the wastebin to trigger lid opening.
   - Waste Level Sensor: To measure the level of waste inside the bin accurately.
3. **Actuators**:
   - Servo Motor: Used for controlling the lid of the wastebin, enabling automatic opening and closing.
   - Buzzer: To provide audible alerts when the wastebin reaches full capacity.
4. **Blynk IoT Platform**:
   - Blynk Account: Sign up for a Blynk account to create an IoT project and access the Blynk app for monitoring waste level and receiving alerts.
   - Blynk Library: Install the Blynk library in the Arduino IDE to enable communication between the NodeMCU board and the Blynk app.
5. **Power Supply**:
   - Power Adapter: To provide the necessary power to the NodeMCU board and connected components.
   - Batteries (optional): For portable or wireless operation, consider using batteries as a power source.
6. **Printed Circuit Board (PCB)**:
   - Design Software: Utilize PCB design software to create a custom PCB layout for the project.
   - Fabrication Service: Choose a PCB fabrication service to manufacture the designed PCB according to specifications.
7. **Wastebin Container**:
   - Select a suitable wastebin container with a lid that can accommodate the servo motor mechanism for automatic opening and closing.
8. **Hardware Accessories**:
   - Jumper Wires: For connecting components and modules on the breadboard or circuit.
   - Mounting Hardware: Screws, nuts, and brackets for securing components and assembling the wastebin mechanism.
9. **Software**:
   - Arduino IDE: Download and install the Arduino Integrated Development Environment for writing, compiling, and uploading code to the NodeMCU board.

- Blynk App: Install the Blynk app on your smartphone to monitor waste level, receive alerts, and control the wastebin remotely.

10. **Miscellaneous**:
    - Resistors, capacitors, and other passive components: Depending on the specific sensor and actuator modules used in the project, additional passive components may be required for circuitry.
    - Enclosure (optional): Consider enclosing the electronics and wiring in a protective case to ensure durability and safety, especially for outdoor or commercial applications.

ADVANTAGES

1. **Hands-Free Operation**: The automatic lid operation triggered by proximity sensors enables hands-free operation, enhancing convenience and hygiene, particularly in public spaces or high-traffic areas.
2. **Efficient Waste Management**: Real-time monitoring of waste levels allows for timely emptying, preventing overflow and reducing the risk of littering. This promotes efficient waste management practices and ensures optimal use of resources.
3. **Remote Monitoring and Control**: Integration with the Blynk IoT platform enables remote monitoring of waste levels and operational status, as well as the ability to receive alerts and notifications. Users can manage the wastebin remotely, facilitating proactive waste management.
4. **Sustainability**: By promoting efficient waste disposal practices and preventing overflow, the project contributes to reducing environmental pollution and promoting sustainability. It encourages responsible waste management behavior among users.
5. **Customizability and Scalability**: The modular design of the project allows for customization and scalability to fit various waste management scenarios and requirements. Users can adapt the system to different bin sizes, sensor configurations, and operational preferences.
6. **Educational Value**: The project serves as an educational tool for learning about IoT integration, sensor technology, and programming with NodeMCU. It provides hands-on experience in prototyping and building practical solutions to real-world problems, fostering STEM skills among students and enthusiasts.
7. **Cost-Effectiveness**: NodeMCU offers a cost-effective solution compared to some other IoT microcontroller boards, making the project accessible to a wide range of users, including hobbyists, students, and small businesses.
8. **User Engagement**: Real-time monitoring, alerts, and remote control features enhance user engagement and awareness regarding waste management. Users are empowered to take proactive measures to optimize waste disposal practices and contribute to a cleaner environment.

DISADVANTAGES

1. **Complexity of Programming**: Programming NodeMCU for IoT applications can be more complex compared to traditional Arduino boards, especially for users unfamiliar with Lua scripting language or IoT protocols like MQTT.
2. **Limited Analog Pins**: NodeMCU typically provides fewer analog pins compared to traditional Arduino boards, which may limit the number of analog sensors that can be directly connected without additional multiplexers or analog-to-digital converters (ADCs).
3. **Power Consumption**: NodeMCU's Wi-Fi connectivity consumes more power compared to some Arduino boards, leading to increased power consumption and potentially shorter battery life in battery-powered applications.
4. **Compatibility Issues**: NodeMCU's form factor and pin layout may not be compatible with Arduino shields, limiting the ability to expand functionality using off-the-shelf shields designed for traditional Arduino boards.
5. **Network Dependency**: The IoT capabilities of NodeMCU rely on Wi-Fi connectivity for communication with IoT platforms like Blynk, making the system vulnerable to network outages or disruptions, particularly in areas with unreliable or congested Wi-Fi networks.
6. **Security Concerns**: Wi-Fi enabled devices like NodeMCU may be susceptible to security vulnerabilities if not properly configured or secured, potentially exposing the system to unauthorized access or data breaches.
7. **Resource Constraints**: NodeMCU has limited memory and processing power compared to some Arduino boards, which may constrain the complexity of the program and the number of features that can be implemented without compromising performance.
8. **Software Support and Documentation**: While NodeMCU enjoys a robust community and extensive documentation, users may encounter fewer resources and libraries compared to Arduino, requiring more effort and research to troubleshoot issues or find solutions.

INPUT DESIGN

Input design is a crucial aspect of system development, as it lays the foundation for effective data collection, processing, and analysis. A well-designed input system ensures that accurate, relevant, and timely data is captured from users or external sources, enabling the system to perform its intended functions efficiently. In the context of the NodeMCU-Based Automatic Wastebin project, input design encompasses various elements related to gathering information from users and sensors to facilitate automated waste management processes. Here's an overview of the input design considerations for the project:

1. Sensor Selection: The first step in input design is selecting appropriate sensors to monitor key parameters relevant to waste management, such as proximity sensors to detect obstructions in front of the wastebin and waste level sensors to measure the fill level inside the bin. Careful consideration should be given to sensor accuracy, reliability, and compatibility with the NodeMCU microcontroller.

2. Sensor Placement: Once sensors are selected, their placement on the wastebin should be strategically determined to ensure optimal performance and data accuracy. Proximity sensors, for example, should be positioned to detect obstructions in the path of the wastebin lid, while waste level sensors should be placed at appropriate heights inside the bin to measure fill levels accurately.

3. Data Acquisition: The NodeMCU microcontroller is responsible for acquiring data from the sensors at regular intervals. Input design should define the sampling frequency and data acquisition protocols to ensure timely and consistent data capture. This may involve configuring digital or analog input pins on the NodeMCU to interface with the sensors and reading sensor data using appropriate protocols such as I2C, SPI, or UART.

4. Signal Conditioning: Sensor data may require signal conditioning to improve accuracy and reliability. This could involve filtering out noise or smoothing sensor readings to reduce fluctuations. Signal conditioning techniques should be applied as part of the input design process to ensure that the data received by the NodeMCU is of sufficient quality for processing.

5. User Input Interface: In addition to sensor data, the system may also require input from users, such as commands to open or close the wastebin lid manually. Input design should define the user interface elements, such as buttons or touch sensors, and their integration with the NodeMCU to enable user interaction with the system.

6. Error Handling: Input design should include provisions for error handling to address potential issues such as sensor malfunctions, communication errors, or invalid user inputs. Error detection mechanisms and fallback strategies should

be implemented to ensure the system can gracefully handle unexpected situations and maintain reliability.

7. Data Validation and Verification: Before processing sensor data or user inputs, input design should incorporate mechanisms for data validation and verification to ensure data integrity and consistency. This may involve checking sensor readings for anomalies or validating user inputs against predefined criteria to prevent erroneous commands.

The NodeMCU-Based Automatic Wastebin project can establish a robust and reliable input system that effectively captures sensor data and user inputs, enabling the system to automate waste management processes with accuracy and efficiency.

OUTPUT DESIGN

Output design is a crucial aspect of system development, as it determines how information is presented to users and stakeholders. A well-designed output system ensures that users can easily understand and interpret system responses, alerts, and feedback, facilitating effective decision-making and interaction with the system. In the context of the NodeMCU-Based Automatic Wastebin project, output design encompasses various elements related to communicating information about waste levels, system status, and alerts to users through visual, auditory, and remote interfaces. Here's an overview of the output design considerations for the project:

1. Visual Feedback: The primary visual output of the system is the wastebin lid status, indicating whether it is open or closed. This feedback can be provided through LED indicators mounted on the wastebin or through a graphical user interface (GUI) on the Blynk app. LED indicators can be programmed to illuminate green when the lid is closed and red when it is open, providing users with immediate visual feedback on the status of the wastebin.

2. Waste Level Display: Another important visual output is the display of waste level information to users. This can be achieved through a graphical representation of the current fill level on the Blynk app dashboard, using gauge widgets or progress bars to indicate the percentage of waste in the bin. Users can monitor the fill level in real-time and take appropriate action, such as emptying the bin when it reaches a predetermined threshold.

3. Alerts and Notifications: The system should be able to generate alerts and notifications to inform users of important events, such as when the wastebin is full or when there is a malfunction in the system. These alerts can be displayed as pop-up messages on the Blynk app or sent as push notifications to users' mobile devices, ensuring that users are promptly notified of any issues requiring their attention.

4. Auditory Feedback: In addition to visual feedback, the system can also provide auditory feedback to users through a buzzer or speaker. For example, the system can emit a beeping sound when the wastebin lid opens or closes, providing an audible indication of system activity. Similarly, the buzzer can sound an alarm when the wastebin reaches full capacity, alerting users to take action.

5. Remote Monitoring and Control: The Blynk app serves as a remote interface for users to monitor wastebin status and control system operations from anywhere with an internet connection. Users can view real-time data, receive alerts, and issue commands to open or close the wastebin lid remotely,

enhancing convenience and user experience.

6. Data Logging and Reporting: The system can log sensor data and system events for later analysis and reporting. Data logs can be stored locally on the NodeMCU or uploaded to a cloud server for long-term storage and analysis. Users can access historical data and generate reports to track waste generation trends, monitor system performance, and identify areas for improvement.

The NodeMCU-Based Automatic Wastebin project can establish a comprehensive and user-friendly output system that effectively communicates information about waste levels, system status, and alerts to users, facilitating informed decision-making and interaction with the system.

DATA FLOW DIAGRAM

INTRODUCTION

Graphical descriptions of a system's data and how the processes transform the data is known as Data Flow Diagram (or DFD). This was first developed by Larry Constantine. This is also known as "bubble chart".

Data flow diagrams show the flow of data through a system. DFD's are commonly used during problem analysis. DFD's are useful in understanding a system and can be effectively used during analysis. The DFD aims to

Capture the transformation that takes with in a system to the input data, so that eventually the output data is used. A data flow diagram (DFD) illustrates how data is processed by a system in terms of inputs and outputs.

As its name indicates its focus is on the flow of information, where data comes from, where it goes and how it gets stored. Unlike details flowcharts DFDs do

Not supply detailed description of modules but graphically describe a system's data and flow and how the data interact with the system.

To construct data flow diagram, we use:

- Arrows
- Open Ended Boxes
- Squares

Data flow diagrams are widely used notation for specifying functions. They describe systems as collection of functions that manipulate data. They can be expressed by means of graphical notations that make them easy to use. A DFD describes control of flow of data through different levels. A DFD is easy to implement as well as one can easily understand the flow of execution of data.

The following are the basis elements of a DFD:

- Functions, represented by bubbles
- Data flows, represented by arrows

- Data stores represented by open boxes
- Input-output represented by special kind of IO boxes

The following seven rules govern construction of Data Flow Diagrams(DFD)

- Arrows should not cross each other
- Squares, Circles and files must bear names.
- Decomposed data flows must be balanced (all data flows on the decompose diagram must reflect flows in the original diagram).
- No two data flows squares or circle can have the same name.
- Draw all data flows around the outside of the diagram. Use strong verbs followed by nouns.

Choose meaningful names for data flows processes and data stores. Control information such as record contents, passwords and validations requirements is

Not pertinent to a data flow diagram.

BASIC DFD NOTATIONS

Data flow diagrams show the flows of data through a system. DFD's are commonly used during problem analysis. DFD's are useful in understanding a system and can be effectively used during analysis. The DFD aims to capture the transformation that takes with in a system to the input data, so that eventually the output data is used.

Process

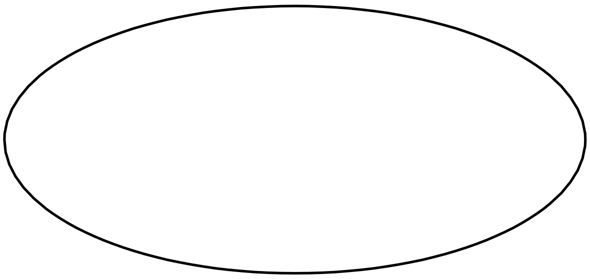
A process shows a transformation or manipulation of data flow within the system. A set of operations will be performed using the data in the database. The database may be updated after each operation.

External Entity

An external Entity is source of destination of data flow which is outside the area of study. Only those entities which originate or receive data are represented on a business process diagram. Usually this is an element from which the system inputs come or to which the system outputs go.

Data store

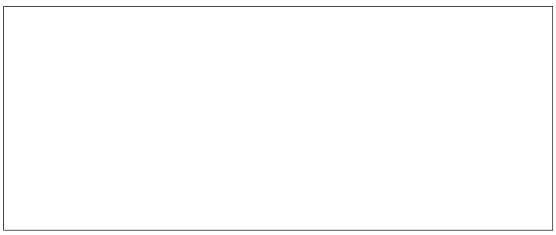
Data store is holding place for information with in the system.It is represented by an open ended narrow rectangle.Data stores May be long term files or short term accumulations. Each data store should be a reference followed by an arbitrary number.



Used to represent functions

Represent external entries

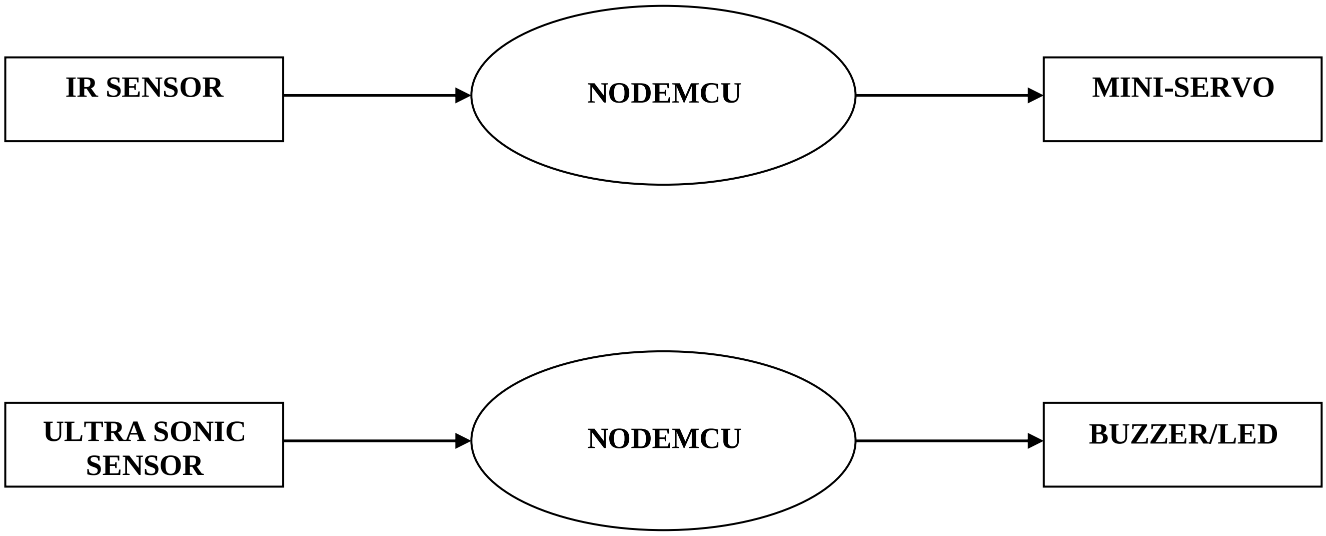
Direction of flow of information



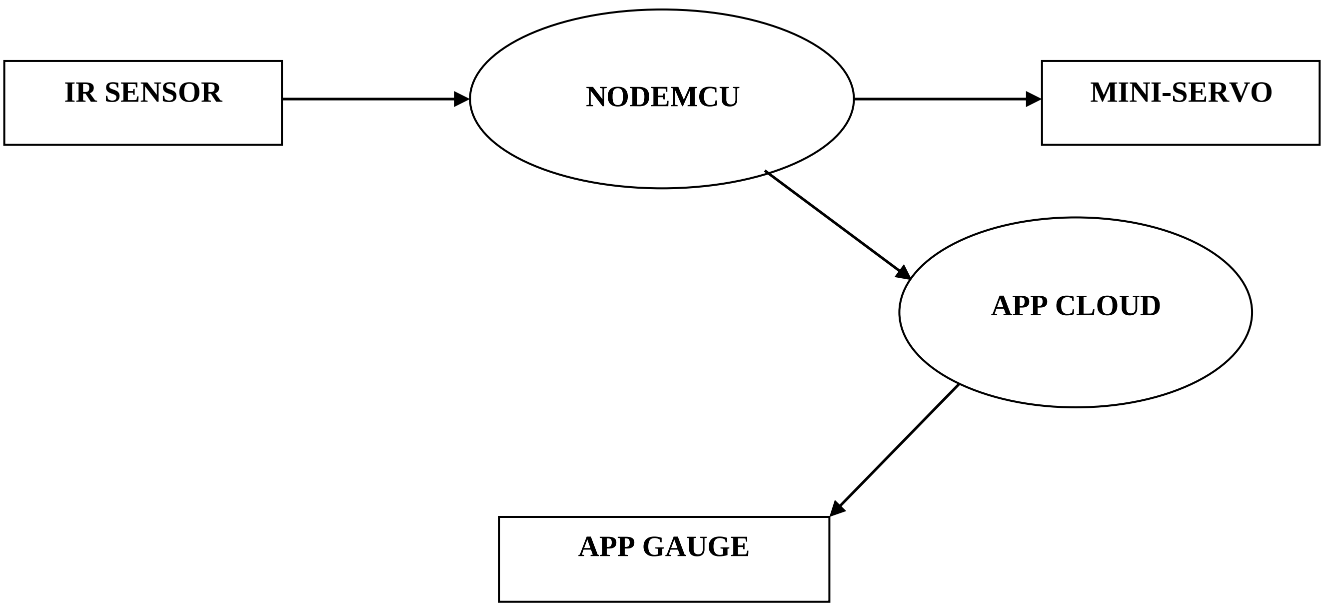
Stored information

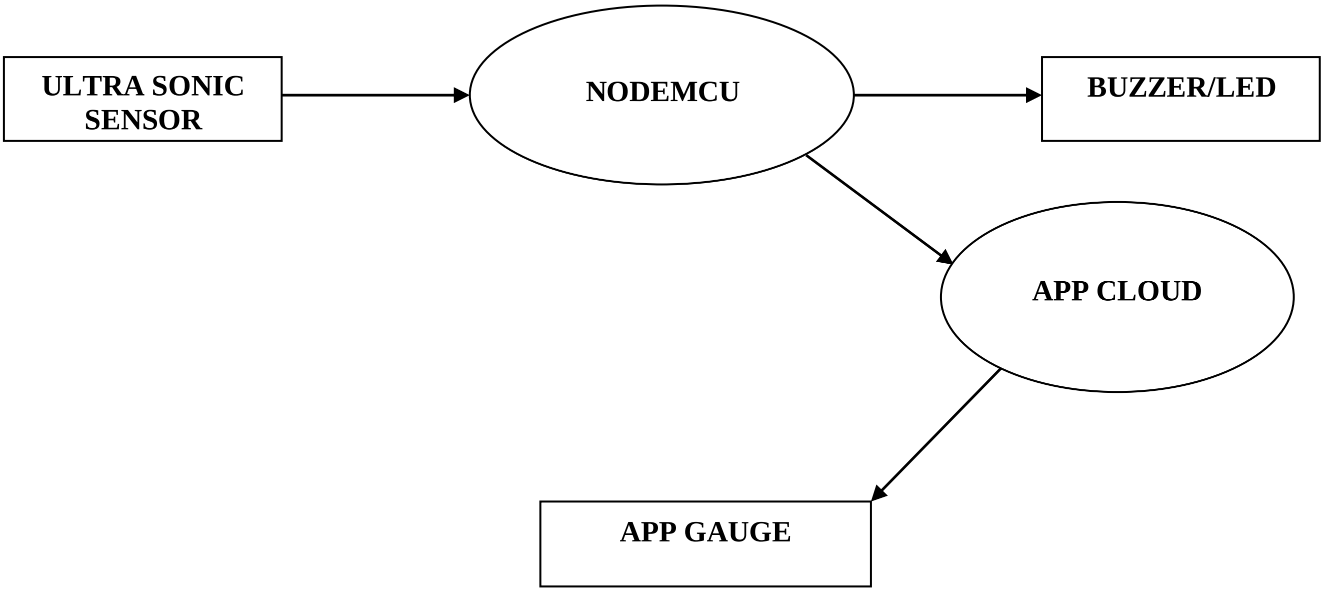
DATA FLOW DIAGRAMS

Level 0

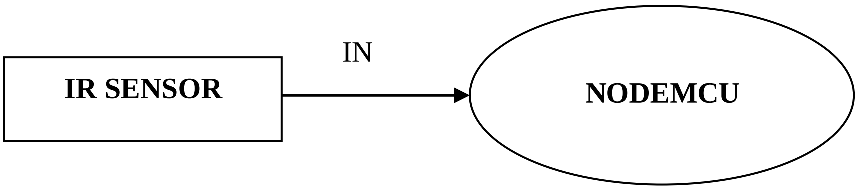


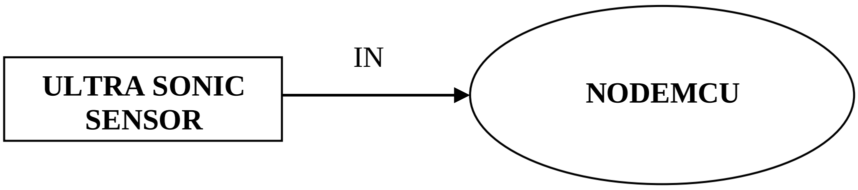
Level 1



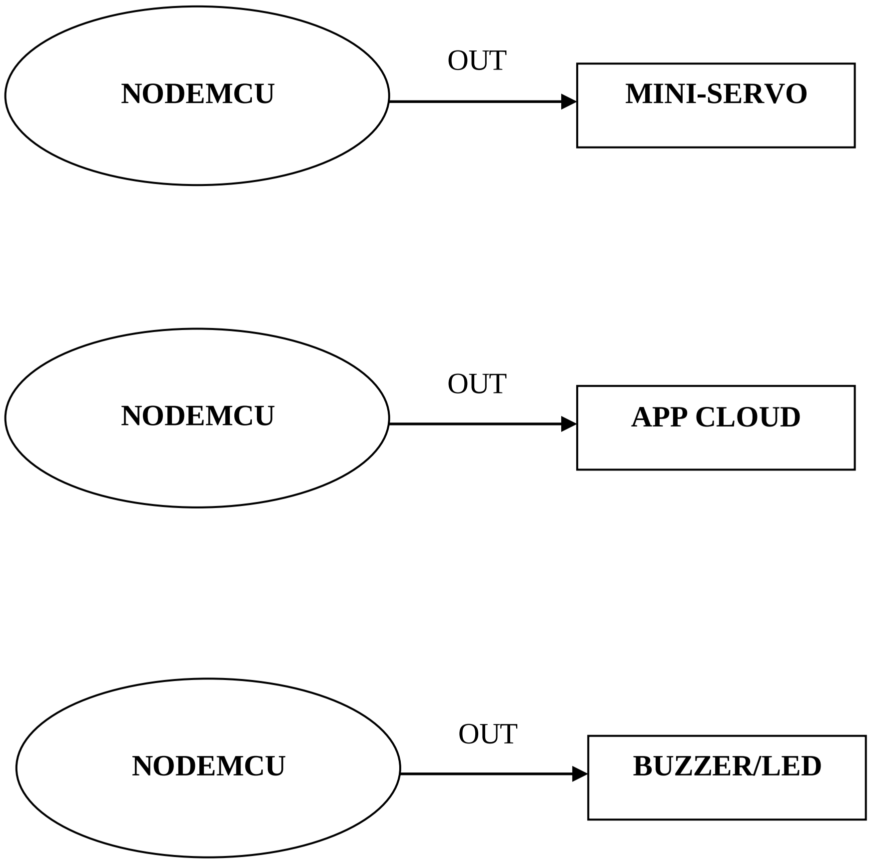


Level 2 (Input part)

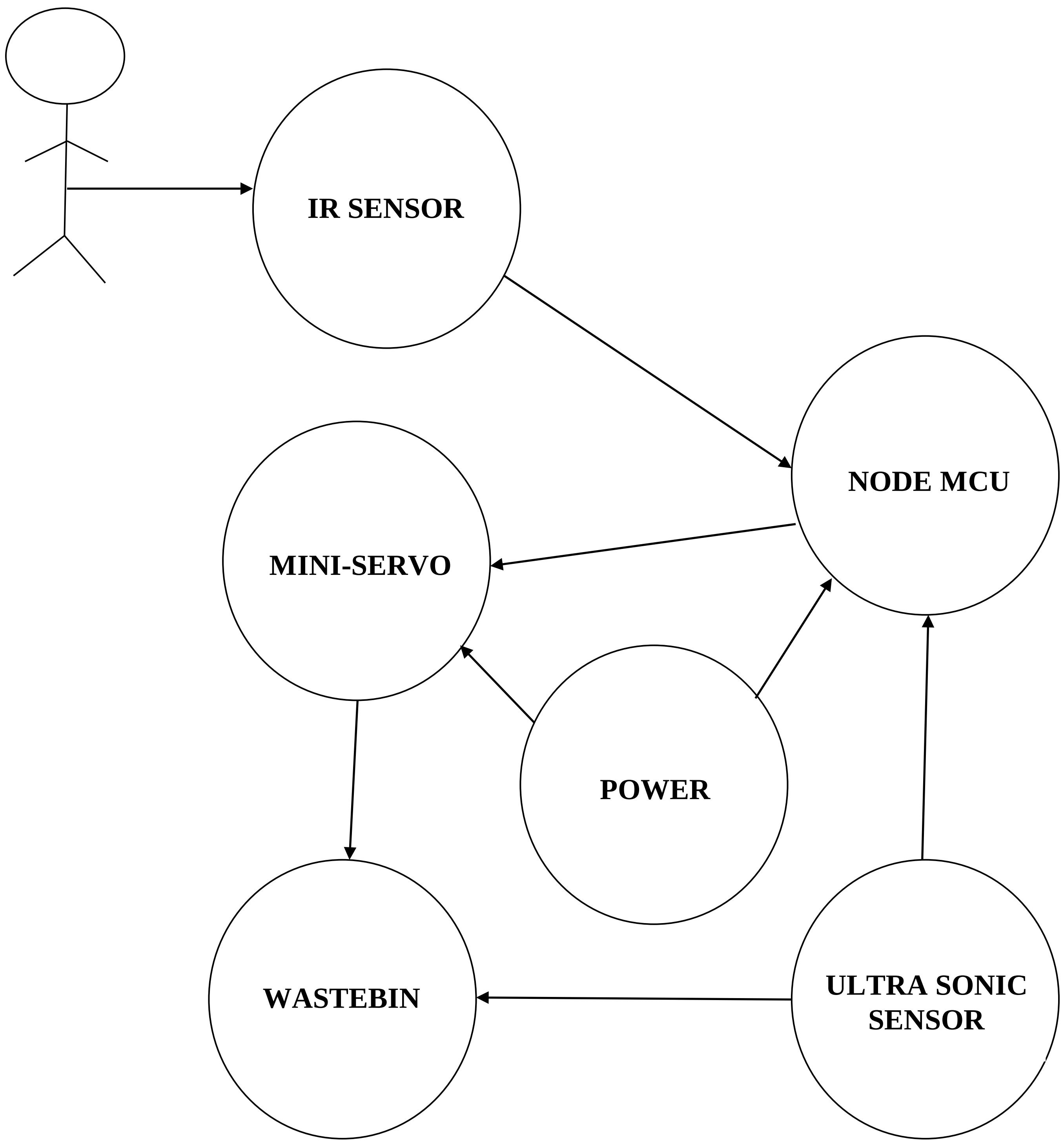




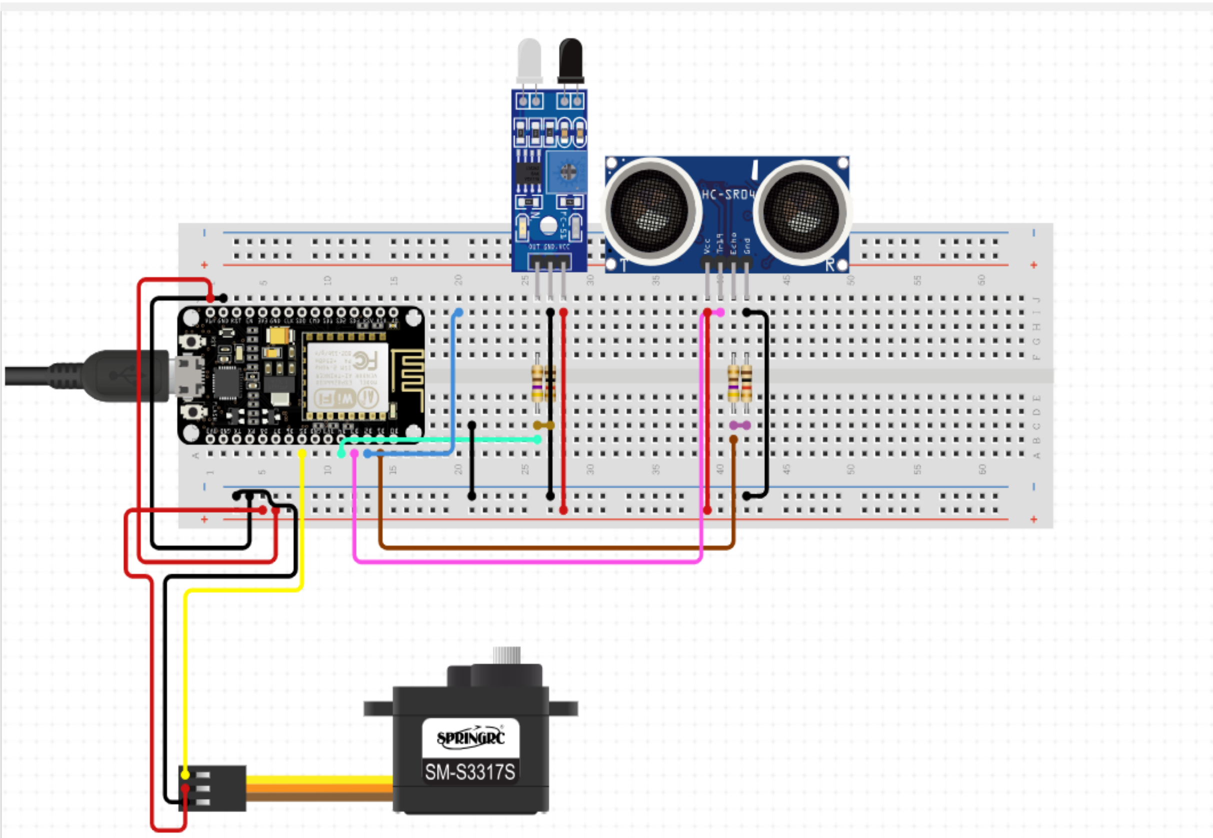
Level 2 (Output part)



USED CASE DIAGRAM



GRAPHICAL DIAGRAM



SAMPLE CODE

```
#define BLYNK_TEMPLATE_ID "TMPL3SFsOwGHb"
#define BLYNK_TEMPLATE_NAME "waste"
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266_SSL.h>
#include <Servo.h>

char auth[] = "V_cXPwt-ZkMsch-siste1TiJP9AOgn6q";
char ssid[] = "Wifi";
char pass[] = "matrix5005";

#define TRIGGER_PIN D1
#define ECHO_PIN D2
#define SERVO_PIN D3
#define IR_SENSOR_PIN D5
#define BUZZER_PIN D6
#define LIGHT_PIN D4

#define BIN_SIZE 25 // in centimeters
#define MAX_WASTE_LEVEL 90

Servo servo;
BlynkTimer timer;

void setup() {
```

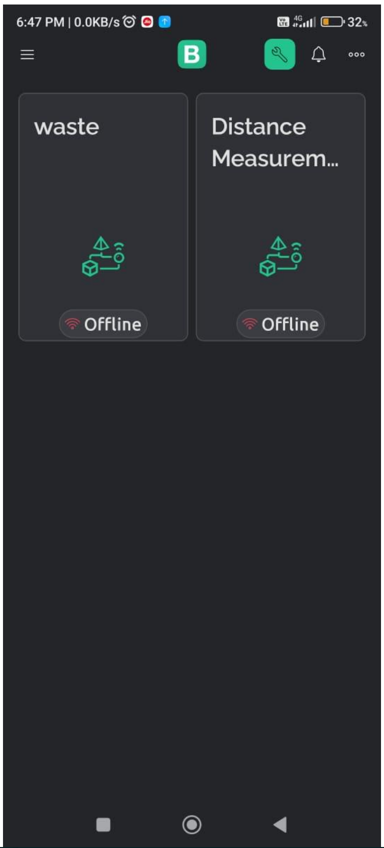
```
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
  pinMode(TRIGGER_PIN, OUTPUT);
  pinMode(ECHO_PIN, INPUT);
  pinMode(IR_SENSOR_PIN, INPUT);
  pinMode(BUZZER_PIN, OUTPUT);
  pinMode(LIGHT_PIN, OUTPUT);
  servo.attach(SERVO_PIN);
  servo.write(0); // Close the lid initially

  // Setup a function to be called every 1 second
  timer.setInterval(1000L, sendSensorData);
}

void loop() {
  Blynk.run();
  timer.run();
}

void sendSensorData() {
  long duration, distance;
  digitalWrite(TRIGGER_PIN, LOW);
  delayMicroseconds(2);
  digitalWrite(TRIGGER_PIN, HIGH);
  delayMicroseconds(10);
  digitalWrite(TRIGGER_PIN, LOW);
  duration = pulseIn(ECHO_PIN, HIGH);
  distance = (duration / 2) / 29.1; // Convert distance to cm
```

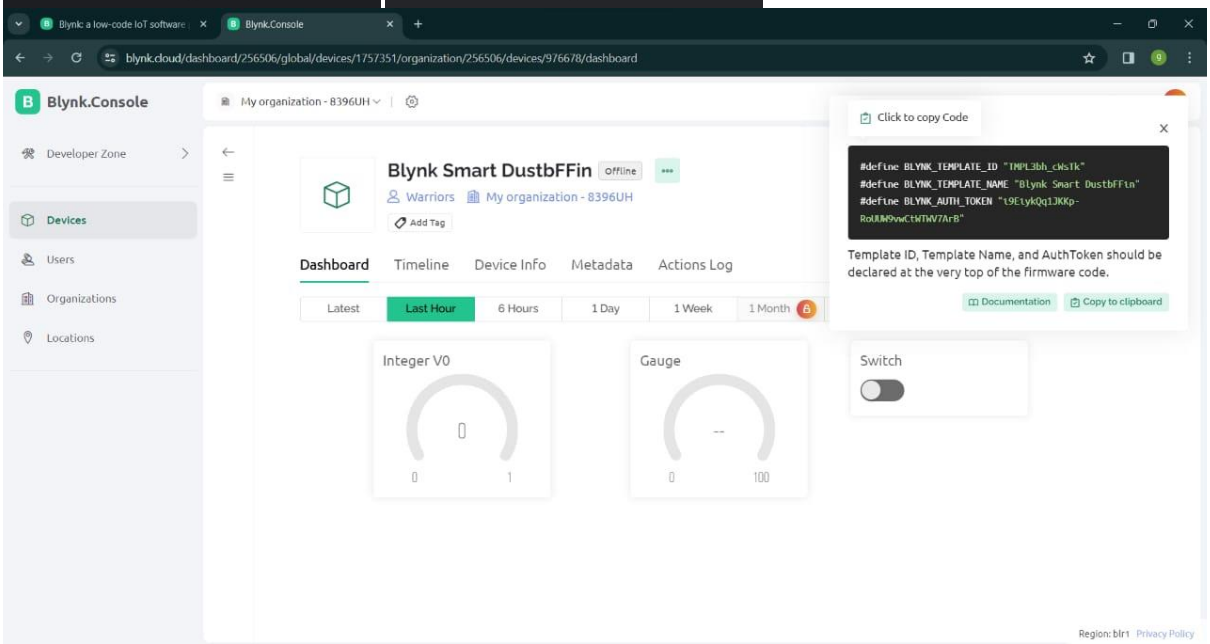
```
  // Update the waste level gauge
  Blynk.virtualWrite(V0, distance);

  // Update the lid position gauge
  int lidPosition = servo.read();
  Blynk.virtualWrite(V1, lidPosition);

  // Check if the bin is almost full and activate buzzer if needed
  if (distance <= 2) {
    digitalWrite(BUZZER_PIN, HIGH);
  } else {
    digitalWrite(BUZZER_PIN, LOW);
  }

  // Check if IR sensor detects presence and adjust lid position accordingly
  int irState = digitalRead(IR_SENSOR_PIN);
  if (irState == HIGH && distance < MAX_WASTE_LEVEL) {
    openLid();
  } else {
    closeLid();
  }
}


void openLid() {
  servo.write(90); // Open the lid
  Blynk.virtualWrite(V1, 90); // Update gauge value
```

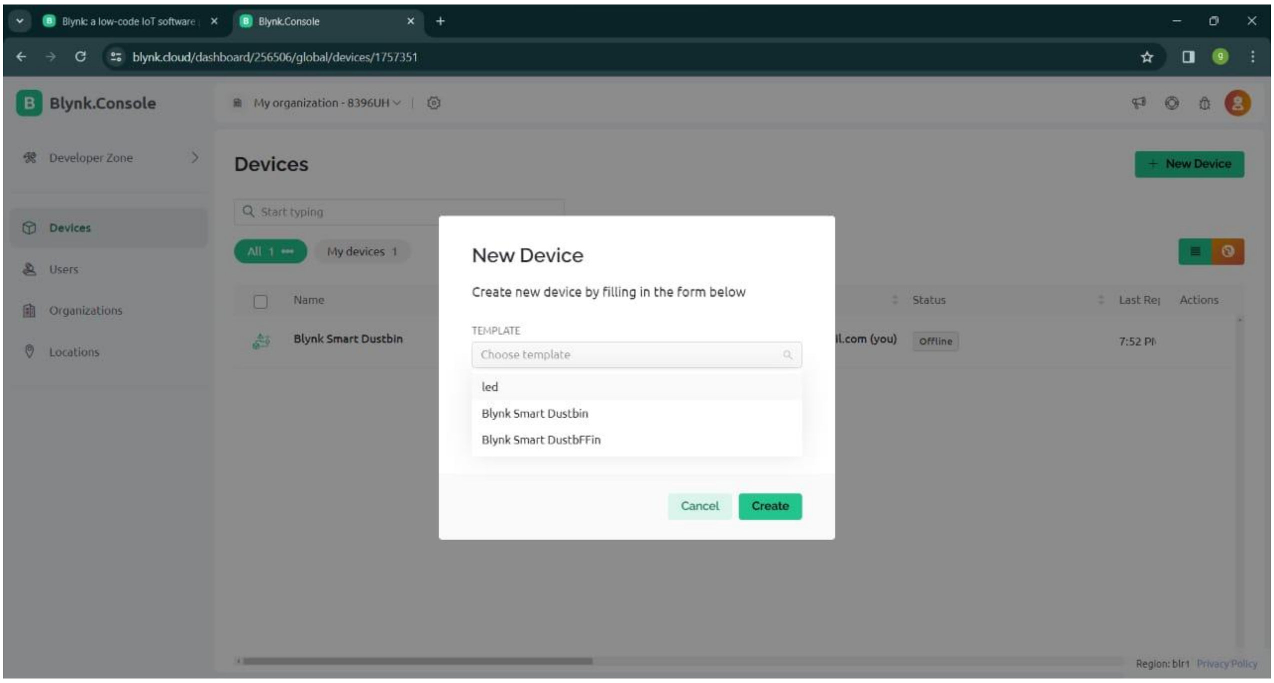
```
}

void closeLid() {
  servo.write(0); // Close the lid
  Blynk.virtualWrite(V1, 0); // Update gauge value
}
```

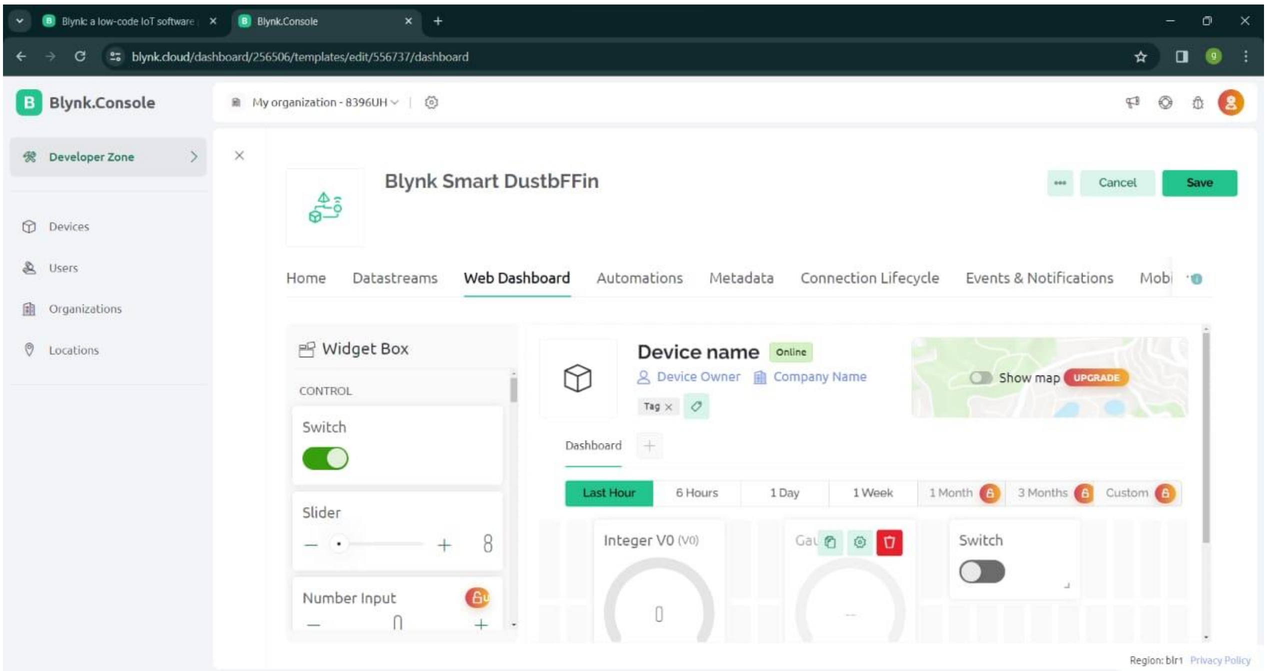
SCREENSHOT

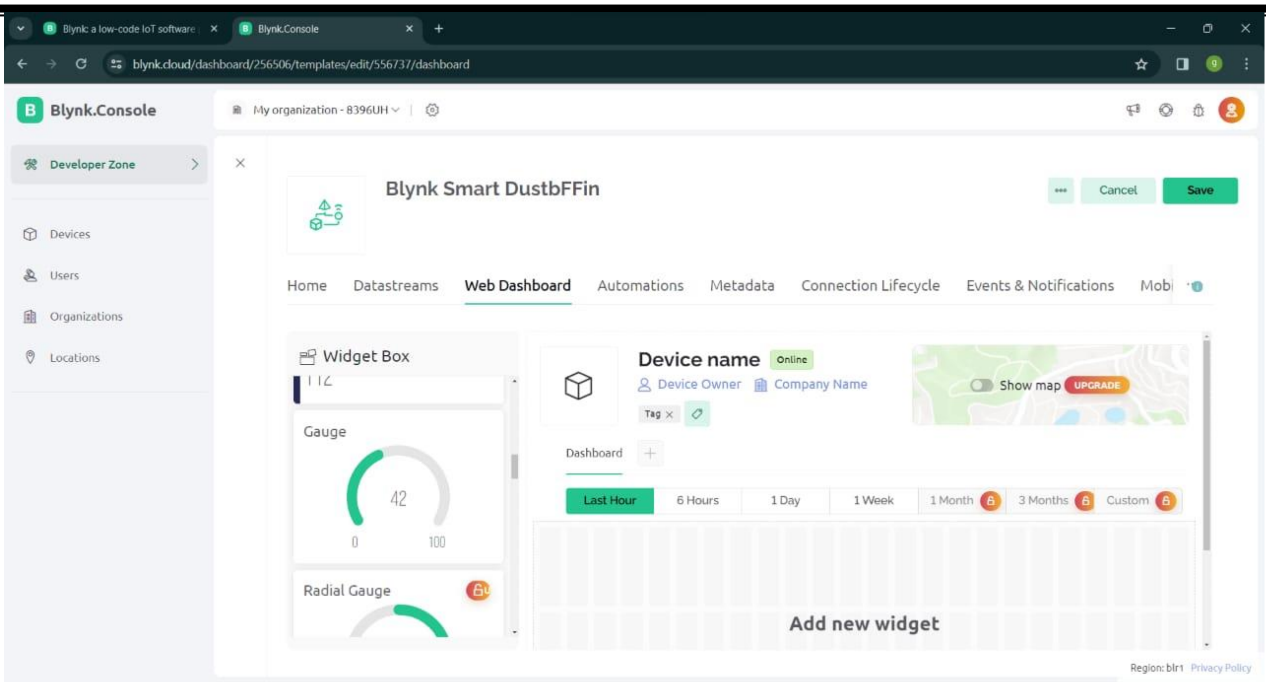

6:46 PM | 307KB/s
32
waste
25cm
0
25
90°
0
100
ALERT OFF

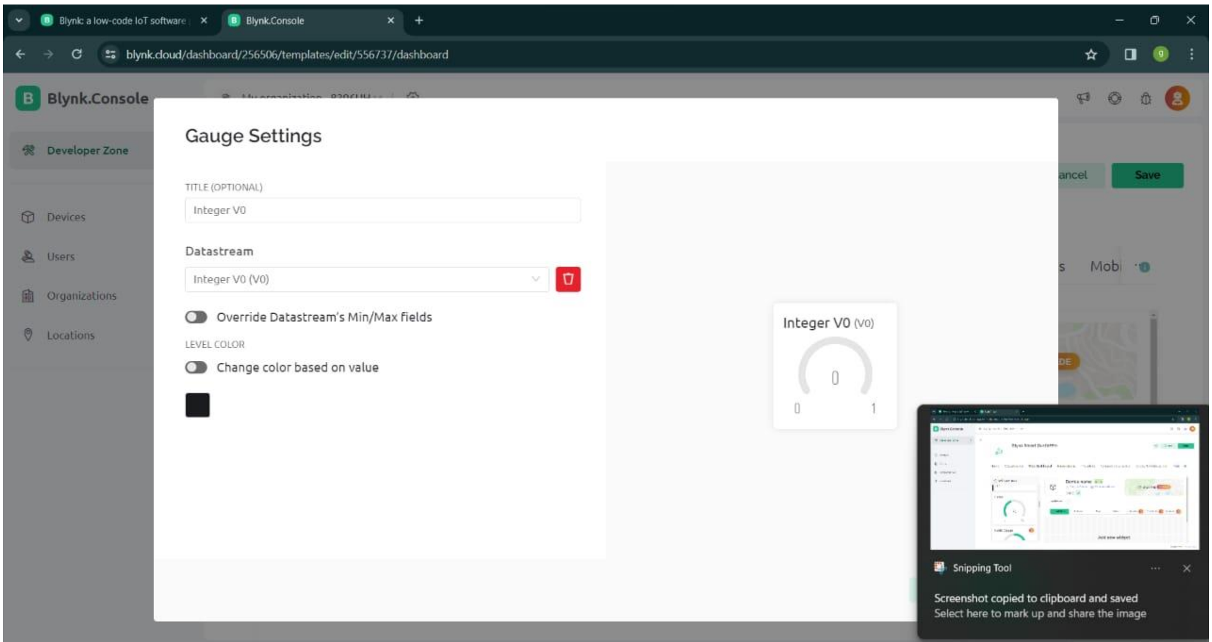

6:47 PM | 0.0KB/s
32
waste
Offline
Distance Measurem...
Offline

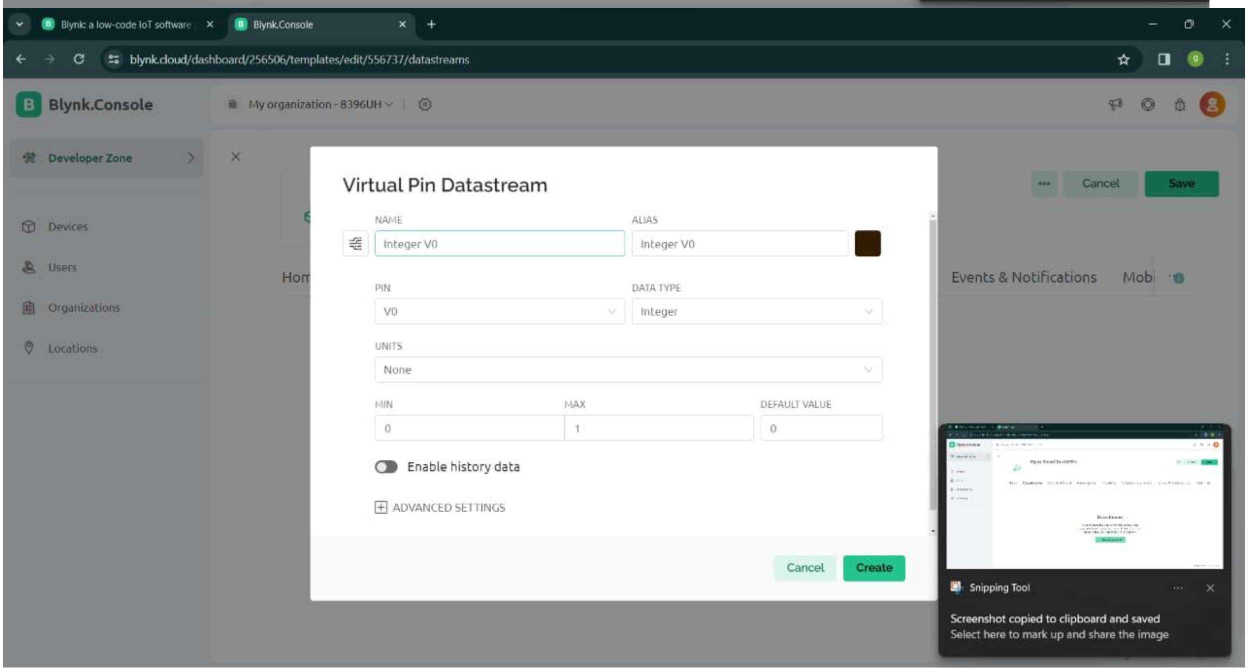

Blynk: a low-code IoT software
Blynk.Console
blynk.cloud/dashboard/256506/global/devices/1757351/organization/256506/devices/976678/dashboard
Blynk.Console
My organization - 8396UH
Developer Zone
Devices
Users
Organizations
Locations
Blynk Smart DustbFFin
Offline
Warriors
My organization - 8396UH
Add Tag
Dashboard
Timeline
Device Info
Metadata
Actions Log
Latest
Last Hour
6 Hours
1 Day
1 Week
1 Month
Integer V0
0
0
1
Gauge
--
0
100
Switch
Click to copy Code
#define BLYNK_TEMPLATE_ID "TMPL3bh_cWsTk"
#define BLYNK_TEMPLATE_NAME "Blynk Smart DustbFFin"
#define BLYNK_AUTH_TOKEN "t9EtykQq1JKKp-RoUUW9vwCtWTWV7ArB"
Template ID, Template Name, and AuthToken should be declared at the very top of the firmware code.
Documentation
Copy to clipboard
Region: blr1
Privacy Policy

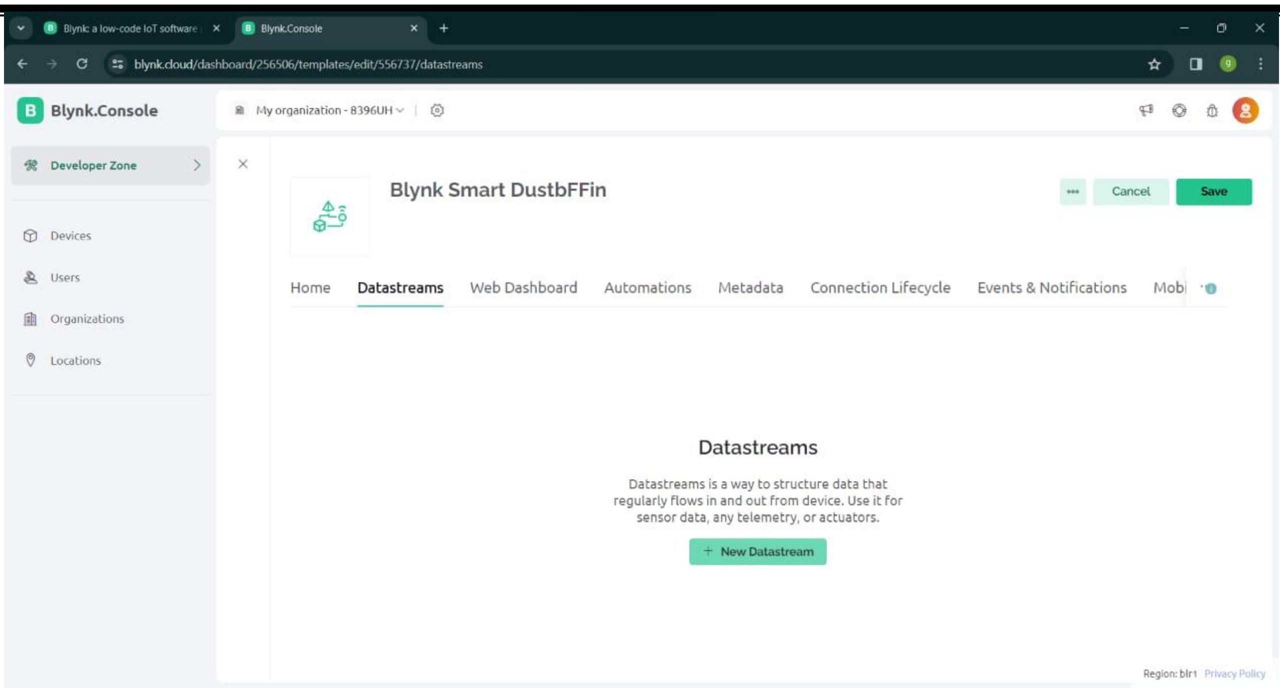

Blynk.Console
blynk.cloud/dashboard/256506/global/devices/1757351
My organization - 8396UH
Developer Zone
Devices
Users
Organizations
Locations
+ New Device
Start typing
Name
Blynk Smart Dustbin
Status
Offline
Actions
New Device
Create new device by filling in the form below
TEMPLATE
Choose template
led
Blynk Smart Dustbin
Blynk Smart DustbFFin
Cancel
Create
Region: blr1
Privacy Policy

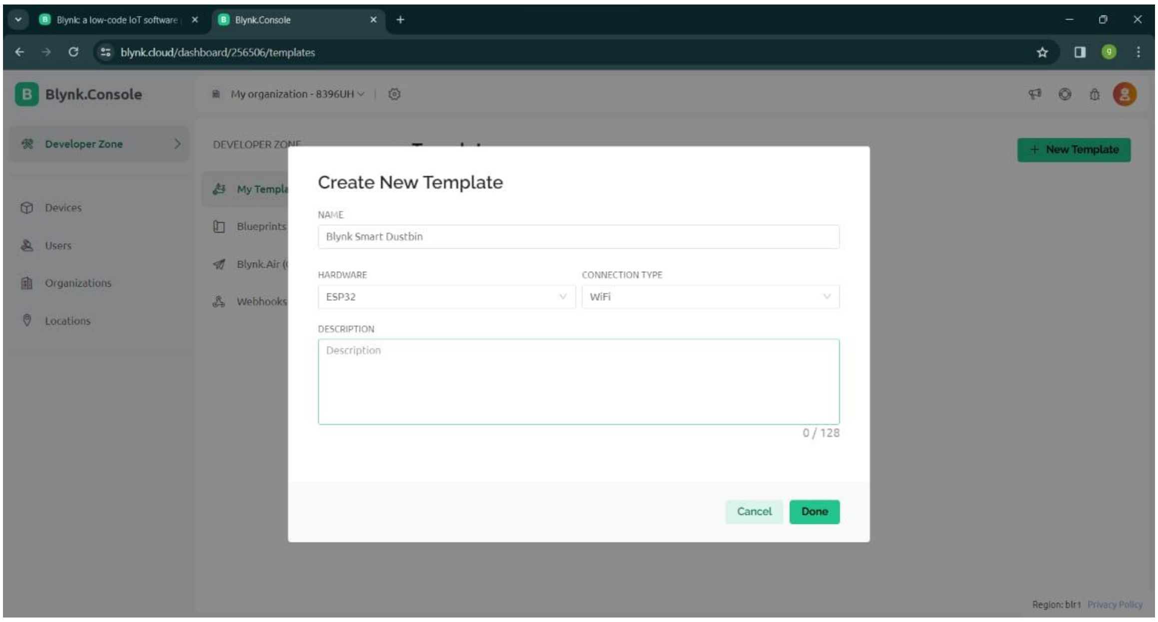

Blynk.Console
blynk.cloud/dashboard/256506/templates/edit/556737/dashboard
My organization - 8396UH
Developer Zone
Devices
Users
Organizations
Locations
Blynk Smart DustbFFin
Cancel
Save
Home
Datastreams
Web Dashboard
Automations
Metadata
Connection Lifecycle
Events & Notifications
Widget Box
CONTROL
Switch
Slider
Number Input
Device name
Online
Device Owner
Company Name
Show map
UPGRADE
Dashboard
Last Hour
6 Hours
1 Day
1 Week
1 Month
3 Months
Custom
Integer V0 (V0)
Switch
Region: blr1
Privacy Policy

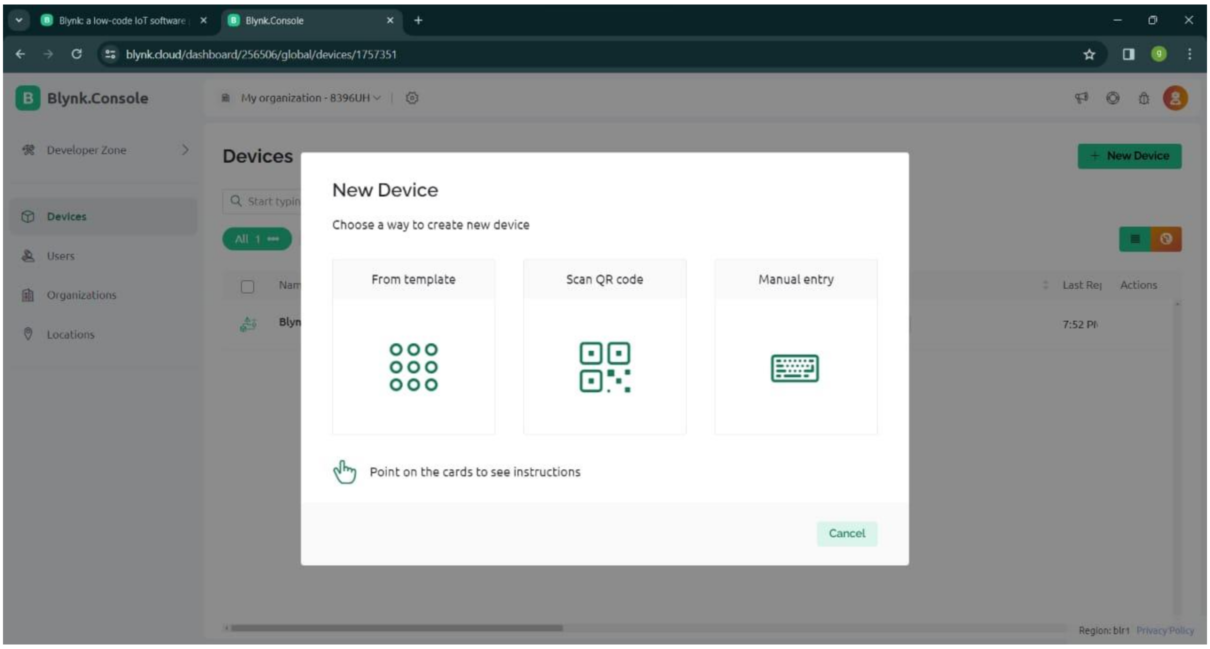

Blynk.Console
Developer Zone
Devices
Users
Organizations
Locations
Blynk Smart DustbFFin
Cancel
Save
Home
Datastreams
Web Dashboard
Automations
Metadata
Connection Lifecycle
Events & Notifications
Widget Box
Gauge
Radial Gauge
Device name
Online
Device Owner
Company Name
Show map
UPGRADE
Dashboard
Last Hour
6 Hours
1 Day
1 Week
1 Month
3 Months
Custom
Add new widget

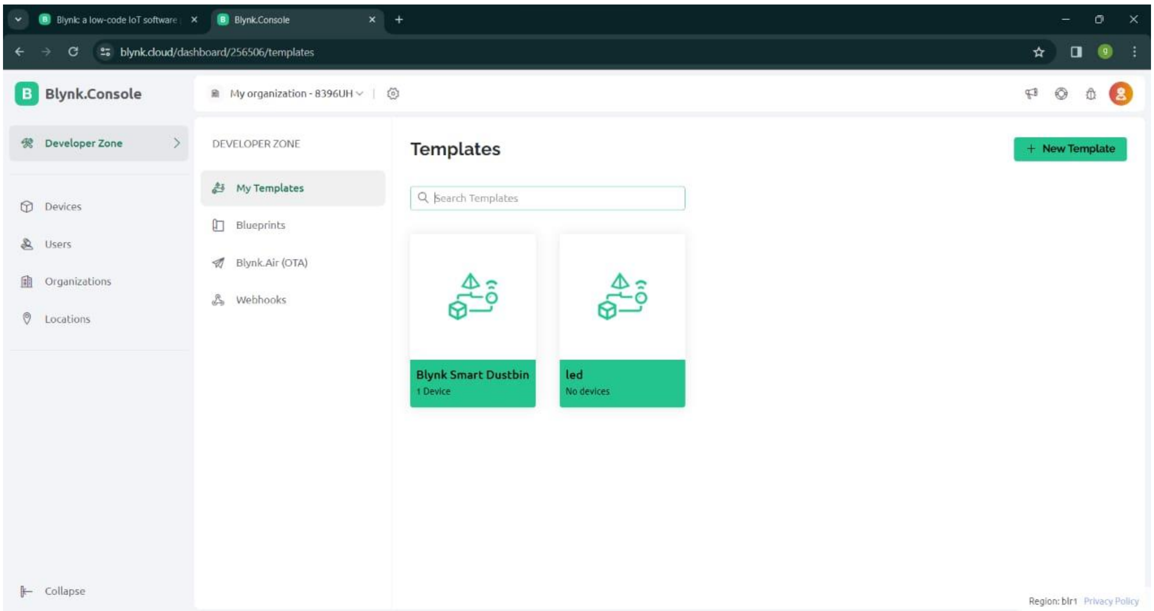

Gauge Settings
TITLE (OPTIONAL)
Integer V0
Datastream
Integer V0 (V0)
Override Datastream's Min/Max fields
LEVEL COLOR
Change color based on value
Integer V0 (V0)
Snipping Tool
Screenshot copied to clipboard and saved
Select here to mark up and share the image

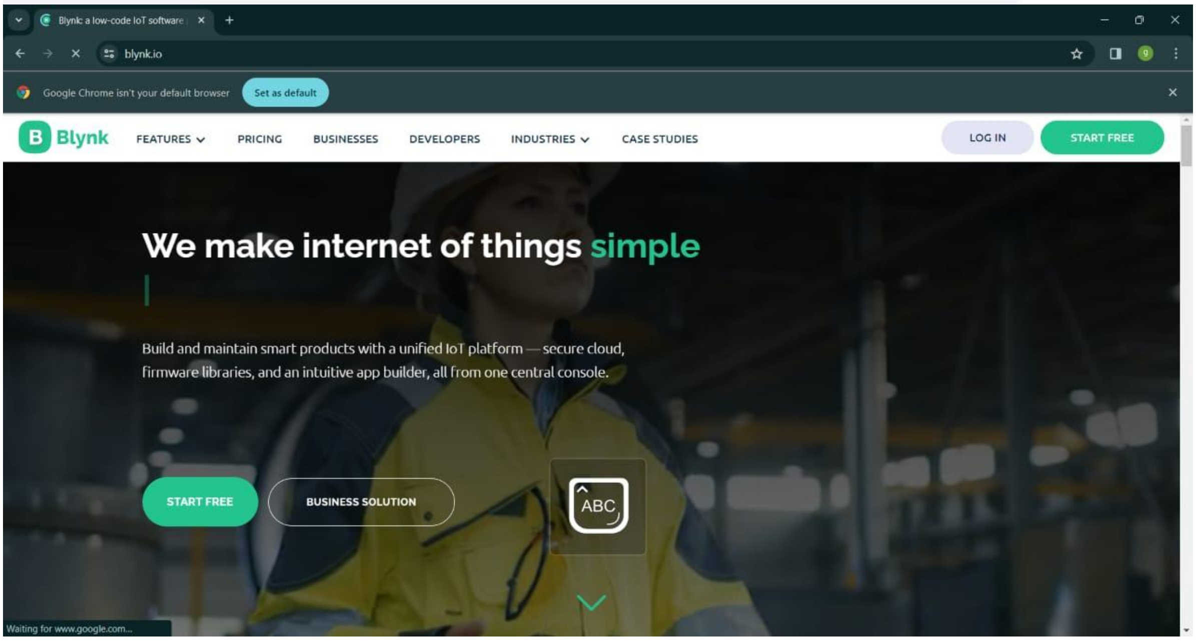

Virtual Pin Datastream
NAME
Integer V0
ALIAS
Integer V0
PIN
V0
DATA TYPE
Integer
UNITS
None
MIN
0
MAX
1
DEFAULT VALUE
0
Enable history data
ADVANCED SETTINGS
Cancel
Create
Snipping Tool
Screenshot copied to clipboard and saved
Select here to mark up and share the image

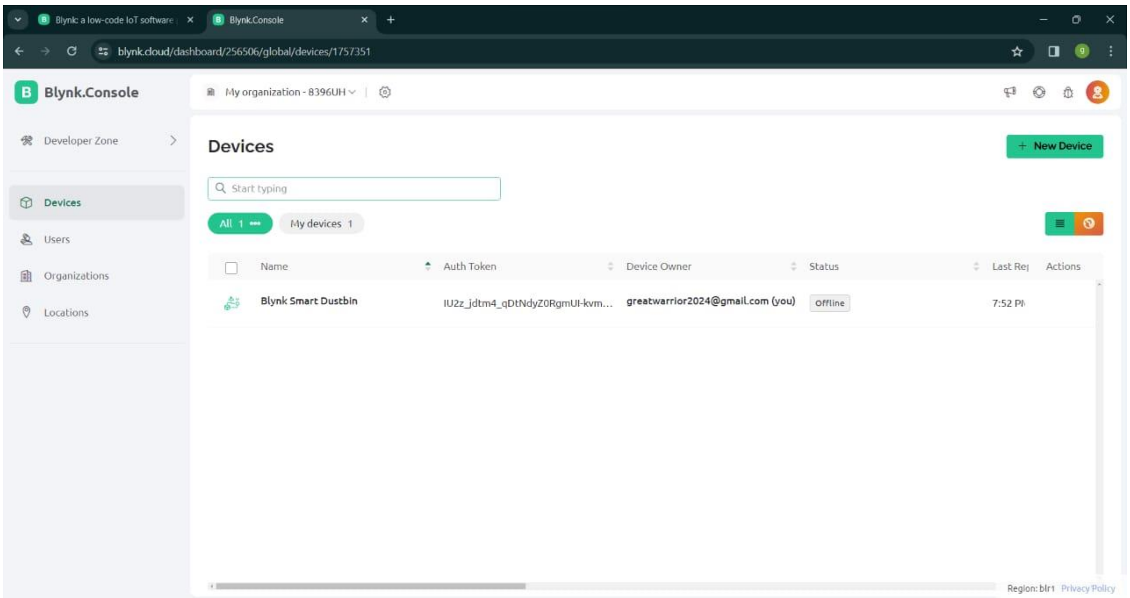

blynk.cloud/dashboard/256506/templates/edit/556737/datastreams
Blynk.Console
Developer Zone
Devices
Users
Organizations
Locations
My organization - 8396UH
Blynk Smart DustbFFin
Cancel
Save
Home
Datastreams
Web Dashboard
Automations
Metadata
Connection Lifecycle
Events & Notifications
Datastreams
Datastreams is a way to structure data that regularly flows in and out from device. Use it for sensor data, any telemetry, or actuators.
+ New Datastream
Region: blr1
Privacy Policy

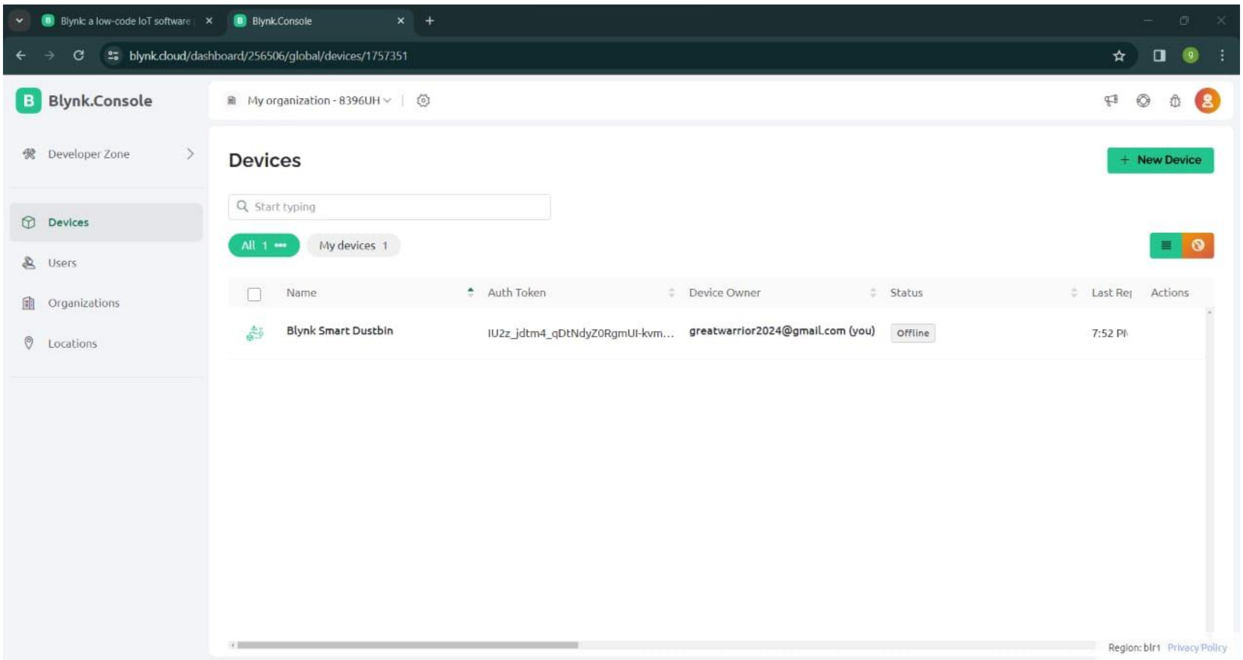

blynk.cloud/dashboard/256506/templates
Blynk.Console
Developer Zone
Devices
Users
Organizations
Locations
My organization - 8396UH
+ New Template
Create New Template
NAME
Blynk Smart Dustbin
HARDWARE
ESP32
CONNECTION TYPE
WiFi
DESCRIPTION
Description
0 / 128
Cancel
Done
Region: blr1
Privacy Policy

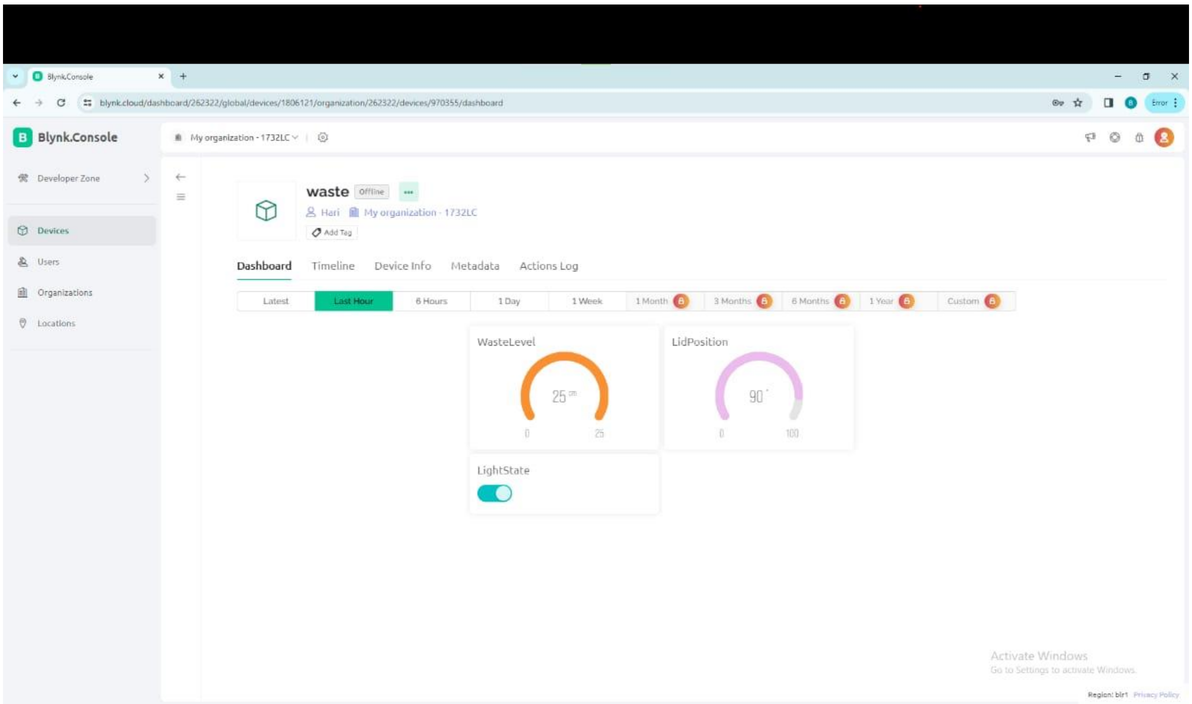

blynk.cloud/dashboard/256506/global/devices/1757351
Blynk.Console
Developer Zone
Devices
Users
Organizations
Locations
My organization - 8396UH
Devices
+ New Device
New Device
Choose a way to create new device
From template
Scan QR code
Manual entry
Point on the cards to see instructions
Cancel
Region: blr1
Privacy Policy


blynk.cloud/dashboard/256506/templates
Blynk.Console
My organization - 8396UH
Developer Zone
Devices
Users
Organizations
Locations
Collapse
DEVELOPER ZONE
My Templates
Blueprints
Blynk.Air (OTA)
Webhooks
Templates
New Template
Search Templates
Blynk Smart Dustbin
1 Device
led
No devices
Region: blr1 Privacy Policy


blynk.io
Google Chrome isn't your default browser
Set as default
Blynk
FEATURES
PRICING
BUSINESSES
DEVELOPERS
INDUSTRIES
CASE STUDIES
LOG IN
START FREE
We make internet of things simple
Build and maintain smart products with a unified IoT platform — secure cloud, firmware libraries, and an intuitive app builder, all from one central console.
START FREE
BUSINESS SOLUTION
ABC
Waiting for www.google.com...


blynk.cloud/dashboard/256506/global/devices/1757351
Blynk.Console
My organization - 8396UH
Developer Zone
Devices
Users
Organizations
Locations
Devices
New Device
Start typing
All 1
My devices 1
Name
Auth Token
Device Owner
Status
Last Rep
Actions
Blynk Smart Dustbin
IU2z_jdtm4_qDtNdyZ0RgmUI-kvm...
greatwarrior2024@gmail.com (you)
Offline
7:52 PM
Region: blr1 Privacy Policy


Blynk: a low-code IoT software
Blynk.Console
blynk.cloud/dashboard/256506/global/devices/1757351
Blynk.Console
My organization - 8396UH
Developer Zone
Devices
Users
Organizations
Locations
Devices
New Device
Start typing
All 1
My devices 1
Name
Auth Token
Device Owner
Status
Last Rep
Actions
Blynk Smart Dustbin
IU2z_jdtm4_qDtNdyZ0RgmUI-kvm...
greatwarrior2024@gmail.com (you)
Offline
7:52 PM
Region: blr1
Privacy Policy


Blynk.Console
blynk.cloud/dashboard/262322/global/devices/1806121/organization/262322/devices/970355/dashboard
Blynk.Console
My organization - 1732LC
Developer Zone
Devices
Users
Organizations
Locations
waste
Offline
Hari
My organization - 1732LC
Add Tag
Dashboard
Timeline
Device Info
Metadata
Actions Log
Latest
Last Hour
6 Hours
1 Day
1 Week
1 Month
3 Months
6 Months
1 Year
Custom
WasteLevel
25
0
25
LidPosition
90
0
100
LightState
Activate Windows
Go to Settings to activate Windows.
Region: blr1
Privacy Policy

FUTURE SCOPE

1. **Enhanced Sensor Integration**: Explore the integration of additional sensors, such as weight sensors or infrared sensors, to improve waste level detection accuracy and reliability, enabling more precise monitoring and management of waste levels.
2. **Optimization of Power Consumption**: Implement power-saving techniques and energy-efficient algorithms to minimize NodeMCU's power consumption, prolong battery life in battery-powered applications, and reduce overall energy consumption.
3. **Machine Learning and Predictive Analytics**: Investigate the use of machine learning algorithms and predictive analytics to analyze historical waste data, predict future waste generation patterns, and optimize waste management strategies, leading to more efficient resource allocation and waste disposal scheduling.
4. **Smart Sorting and Recycling**: Expand the project's scope to include smart sorting and recycling capabilities by integrating additional sensors and actuators for sorting different types of waste materials, promoting recycling, and reducing environmental impact.
5. **Community Engagement and Education**: Develop educational outreach programs and community engagement initiatives to raise awareness about waste management practices, IoT technology, and environmental sustainability, empowering individuals and communities to take proactive steps towards responsible waste disposal and conservation.
6. **Commercialization and Deployment**: Explore opportunities for commercialization and deployment of the Automatic Wastebin system in various settings, including commercial establishments, public spaces, and residential communities, to scale up impact and promote widespread adoption of smart waste management solutions.

CONCLUSION

The NodeMCU-Based Automatic Wastebin project stands as a testament to the potential of technology to revolutionize waste management practices. By harnessing the capabilities of NodeMCU, this project has successfully addressed critical challenges in waste disposal, offering a sophisticated yet accessible solution that enhances efficiency, cleanliness, and sustainability.

Through the implementation of automated lid operation triggered by proximity sensors and real-time monitoring of waste levels, the Automatic Wastebin project has introduced a new standard of convenience and hygiene to waste management. The system's hands-free operation not only minimizes the risk of germ transmission but also streamlines waste disposal processes, ensuring optimal use of resources and reducing the likelihood of littering and overflow.

Furthermore, the integration of the Blynk IoT platform enables remote monitoring and control, empowering users to manage waste levels, receive alerts, and optimize waste disposal practices from anywhere, at any time. This real-time connectivity not only enhances user convenience but also promotes proactive waste management, leading to more efficient resource allocation and environmental conservation.

Looking ahead, the project holds immense potential for further innovation and expansion. Enhancements such as enhanced sensor integration, optimization of power consumption, and the incorporation of machine learning algorithms for predictive analytics could further improve the system's effectiveness and efficiency. Additionally, exploring opportunities for smart sorting and recycling capabilities and engaging communities through educational initiatives could drive widespread adoption and positive environmental impact.

In conclusion, the NodeMCU-Based Automatic Wastebin project represents a significant step forward in the journey towards smarter, more sustainable waste management practices. By leveraging technology, innovation, and community engagement, this project paves the way for a cleaner, greener future, where waste is managed efficiently, responsibly, and with the utmost care for our environment and future generations.

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