Auto Bin for Bottle Cap Collection

Team Members

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Content

Introduction

The primary objective of this project was to create an innovative solution for efficiently collecting bottle caps while automating the process. This auto bin offers several advanced features, including automatic lid opening, weight measurement, and an indicator to determine when the bin is full.

By automating the lid opening mechanism, users no longer need to manually open the bin to deposit bottle caps. This not only enhances convenience but also encourages more people to participate in the recycling process, making it easier and more accessible.

Another significant feature of the auto bin is its weight measurement capability. Integrated sensors accurately measure the weight of the bottle caps deposited in the bin. This information can be used to track the quantity of collected caps, monitor recycling progress, and optimize collection and disposal processes.

To provide real-time feedback to users, the auto bin incorporates an indicator system. When the bin reaches its capacity or a predetermined threshold, the indicator signals that it is full and requires emptying. This feature eliminates the need for manual inspection and ensures timely maintenance.

The auto bin for bottle cap collection addresses the growing concern for environmental sustainability and waste management. By streamlining the process of collecting and recycling bottle caps, this project contributes to reducing plastic waste, conserving resources, and promoting a circular economy.

Instruction

Instructions for Using the Auto Bin for Bottle Cap Collection:

1. **Auto Lid Opening:**
    - Approach the auto bin with a bottle cap in hand.
    - As you reach the proximity sensor, the lid will automatically open.
    - Dispose of the bottle cap into the bin.
    - The lid will close automatically after 5 seconds if no one is in range.
2. **Monitoring Fullness and Weight Display:**
    - Download the Blynk app on your smartphone or access the Blynk website on your computer.
    - Create an account and log in to Blynk.
    - In the Blynk app or website, search for the auto bin device and add it to your dashboard.
    - The auto bin device will display real-time information on fullness and weight.
    - The fullness indicator will show the current status of the bin, indicating whether it is empty, partially full, or full.
    - The weight display will show the weight of the collected bottle caps in the bin.

Please note the following considerations:

- Regularly check the Blynk app or website to monitor the fullness and weight of the bin.
- When the fullness indicator shows that the bin is full, empty the bin by removing the collected bottle caps.

Requirement and Source Code

Repository for source code:

https://github.com/tham-ph/FinalProject-MBED-SamChanTodNumPla

Based on the project requirements, the following components and functionalities have been implemented:

1. **Communication and Processing:**
   - Two boards, an STM32 and NodeMCU, are utilized.
   - Three sensors are incorporated: a PIR sensor connected to a servo motor for detecting people and opening the lid, a load cell sensor for weight measurement, and an ultrasonic sensor for determining the bin's fullness.
   - All sensors are connected to the STM32 board, which manages the data processing.
2. **Internet and Cloud System Connectivity:**
   - The system is connected to the internet.
   - Data, including weight and fullness information, is transmitted from the STM32 board to the NodeMCU board.
   - The NodeMCU board sends the collected data to the Blynk cloud platform.
3. **Solving problems related to environment:**
   - **Plastic Waste Reduction**: The automated collection system encourages proper disposal and recycling of bottle caps, reducing plastic waste that would otherwise end up in landfills or harm the environment.
   - **Resource Conservation**: By facilitating recycling, the auto bin helps conserve valuable resources by promoting the reuse of materials, minimizing the need for new plastic production.
   - **Efficient Collection Management**: The load cell sensor for weight measurement and the ultrasonic sensor for fullness detection enable optimized collection scheduling, ensuring timely emptying of the bin and preventing overflow.

Roles and Responsibilities

Initially, all team members will collaborate and participate in the following steps together:

1. **Brainstorming and Project Topic Selection:**
    - Collaboratively generate project ideas related to waste management or recycling.
    - Discuss the feasibility, relevance, and potential impact of each idea.
    - Select a project topic that aligns with the objectives and interests of the team.
2. **Defining Project Requirements:**
    - Identify the specific functionalities and features the auto bin should have.
    - Determine the required components, such as the STM32 board, NodeMCU, sensors, and servo motor.
    - Define the desired capabilities, including automatic lid opening, weight measurement, and data transmission

After defining the project requirements and selecting the topic, each team member can contribute their work in the following areas:

Papon Kleubmongcol

1. **Bin Production:**
    - Proceed with the production of the bins by following the designed specifications.
2. **Writing Code for Ultrasonic Sensor:**
    - Develop the necessary code to effectively utilize the ultrasonic sensor. Ultrasonic requires a continuous clock which is logic HIGH for at least 10 us then followed by logic LOW for at least 50 us (We can use PWM Generation for implementation). Then, it will send back a pulse that has a logic HIGH as long as the time of the sound wave is sent from ultrasonic and reflects back to itself.
    - Implement algorithms and logic to accurately measure distances and detect the fullness of the bin.
    - Consider factors such as sensor calibration and error handling to ensure reliable and precise measurements.
    - Integrate the ultrasonic sensor code with the existing codebase, enabling it to work seamlessly with other sensors and components.
3. **Assembling All Sensor Code to Work Together:**
    - Combine and integrate the code for all the sensors, including the PIR sensor, load cell sensor, and ultrasonic sensor.
    - Ensure that the code effectively synchronizes the sensor functionalities, allowing for smooth coordination and operation.
    - Conduct thorough testing to verify that all sensors work together harmoniously and provide accurate data.

Thammarit Phiwton

1. **Writing and Testing Code for Servo Motor:**
    - Analyzed the servo motor's specifications and understand its control mechanism. It uses a timer of 50 Hz frequency or 20 ms pulse period.
    - Developed the code to control the servo motor, allowing for automatic lid opening and closing. We can control the turning degree of the servo (0 - 180 degree) by applying 2 - 12 % duty cycles.
2. **Writing and Testing Code for PIR Sensor:**
    - Developed the code to interface with the PIR sensor, enabling it to detect the presence of people near the bin. The code is very simple since the detection of motion will make the sensor send 1 from the OUT pin otherwise send 0.
    - Tested the code to ensure that the PIR sensor reliably detects people.
3. **Writing and Testing Code for HX711 Load Cell:**
    - Developed the code to read data from the HX711 load cell sensor and send calibrated weights to NodeMCU using UART. The data can be read by applying 25-27 positive clock pulses.
    - Implemented the necessary calculations and calibration to accurately measure the weight. It sends 24 bits data ranging around -800,000 to +800,000 in non-gram units so we need to map and calibrate the data.
    - Test the code to ensure that the load cell sensor provides precise and reliable weight measurements.
4. **Cleaning and maintaining the Code**
    - Performed a comprehensive code review to enhance readability, maintainability, and efficiency.
    - Maintaining the github repository.

Sataporn Kruatejah

1. **Equipment and Resource Procurement:**
    - Purchase necessary items that meet the project's specifications and requirements.
2. **Bin Production:**
    - Incorporate features like a lid mechanism that enables automatic opening and closing.
    - Assemble the bins, ensuring all components are securely attached and functional.
3. **Adapting Servo Code for Automatic Lid Opening:**
    - Modify the code from another team member and Implement the necessary commands and logic to ensure smooth and precise servo motor movements.
    - Test the code to verify that the servo motor operates as intended, accurately responding to sensor inputs and triggering the lid mechanism accordingly.
4. **Writing Code for NodeMCU to Receive Data from STM32:**
    - Understand the communication protocols and interfaces between the STM32 and NodeMCU.
    - Write code to establish a connection and data transfer between the two boards.
    - Ensure the NodeMCU can receive and process data from the STM32, including weight and fullness information.

Sarita Taveemunputtakarn

1. **Equipment and Resource Procurement:**
    - Acquire the required equipment and resources to support the implementation.
    - Research and source the necessary components, tools, or materials.
2. **Preparing the bin:**
    - Design the bins, taking into consideration factors such as their size and capacity.
    - Ensure that the bins are suitable for the intended purpose and meet the project requirements.
    - Procure or provide the necessary bins that align with the design specifications.
3. **Establishing connectivity between NodeMCU and Blynk IoT platform:**
    - Establish a connection between the NodeMCU microcontroller and the Blynk IoT platform.
    - Configure the required hardware and software settings, such as establishing Wi-Fi connectivity and integrating the Blynk library.
4. **Developing a Functional Blynk Application for User Interaction:**
    - Develop a user-friendly and functional Blynk application that allows for seamless interaction with the IoT system.
    - Design an intuitive interface, implementing the desired features and functionalities, and ensure the application is compatible with various devices and operating systems.

Conclusion

In conclusion, this project aimed to develop an auto bin for collecting bottle caps with features such as automatic lid opening, weight measurement, and indication of fullness. Through the course of the project, several important findings and considerations were made.

The PIR sensor, initially used for detecting people and triggering lid opening, was found to be overly sensitive and not suitable for accurately detecting when individuals wanted to dispose of bottle lids. It is recommended to explore alternative sensor options that are more appropriate for this specific task.

The ultrasonic sensor, while not ideal for measuring the height of an unstable surface, showed some improvement when using the average value. However, for future iterations or enhancements of the system, it is advisable to investigate other sensor options that can provide more accurate and reliable measurements.

Although this project focused on collecting bottle caps, it serves as a beta version that can be adapted for handling other types of waste in the future. By further refining and expanding the system, it has the potential to become a versatile waste management solution capable of accommodating various waste materials.

Overall, this project highlights the importance of sensor selection and continuous improvement in developing effective waste management solutions. By addressing the limitations identified and exploring alternative sensors, future iterations can enhance the functionality, accuracy, and adaptability of the auto bin system.