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Development of Prototype for Fetching Food to Livestock

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Abstract: This project aimed to develop a prototype for fetching food to livestock by using the IoT to control a servo motor as a food dispenser and a DC motor as a conveyor for serving food to livestock. The objective was to improve the efficiency and accuracy of feeding the food to livestock, reduce the time to feed food and enhance the overall health and productivity of the livestock. The system was integrated with sensors and a microcontroller to monitor food consumption and adjust the dispensing rate accordingly. A prototype was designed and tested. A prototype for fetching food systems to livestock has been developing on a small scale. This research highlights the potential of using servo motors and DC motors in feeding systems as a way to improve the feeding of food to livestock and increase their productivity.

Keywords: Prototype, DC Motor, Servo Motor, Livestock

1. Introduction

In general, animal feeding is one of the activities of the cattlemen. They need to feed animals in the farm according to their requirements. Part of the feeding amount is consumed by the animal to save its life and the other part is considered for instrumental milk production. An increase in productivity is intended to meet anticipated demand while reducing negative environmental effects [1-2]. Examples of strategies to increase productivity include better feeding and feed use efficiency [3]. Improving feeding and feed quality in any agricultural or animal farming operation often involves several tasks that require additional manpower, leading to increased costs. According to Agriculture 4.0, precision feeding implementation faces a lot of challenges [4]. Feeding animals can indeed be a time-consuming and labour-intensive process, especially if traditional or outdated methods are still in use. Some of the challenges that may contribute to inefficiencies include manual labour. Traditional feeding methods often involve manual labour, where cattlemen or animals must handle the entire feeding process. This can be time-consuming, particularly in large-scale operations, and may lead to inefficiencies.

The new technology allows us to reduce manpower and cost by its application [5]. So, in this project, it is proposed to utilise a microcontroller, which is ESP32, DC motor, servo motor and IR sensor

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obstacle avoidance to develop the automated cattle feeding system, which will not only reduce the manpower but also reduce the cost, even will be more efficient.

2. Materials and Methods

The materials and methods section, otherwise known as methodology, describes all the necessary information that is required to develop a prototype for feeding livestock.

2.1 Block diagram of project

Figure 1 shows the block diagram of an automated cattle feeding system. The block diagram will explain how the prototype works.

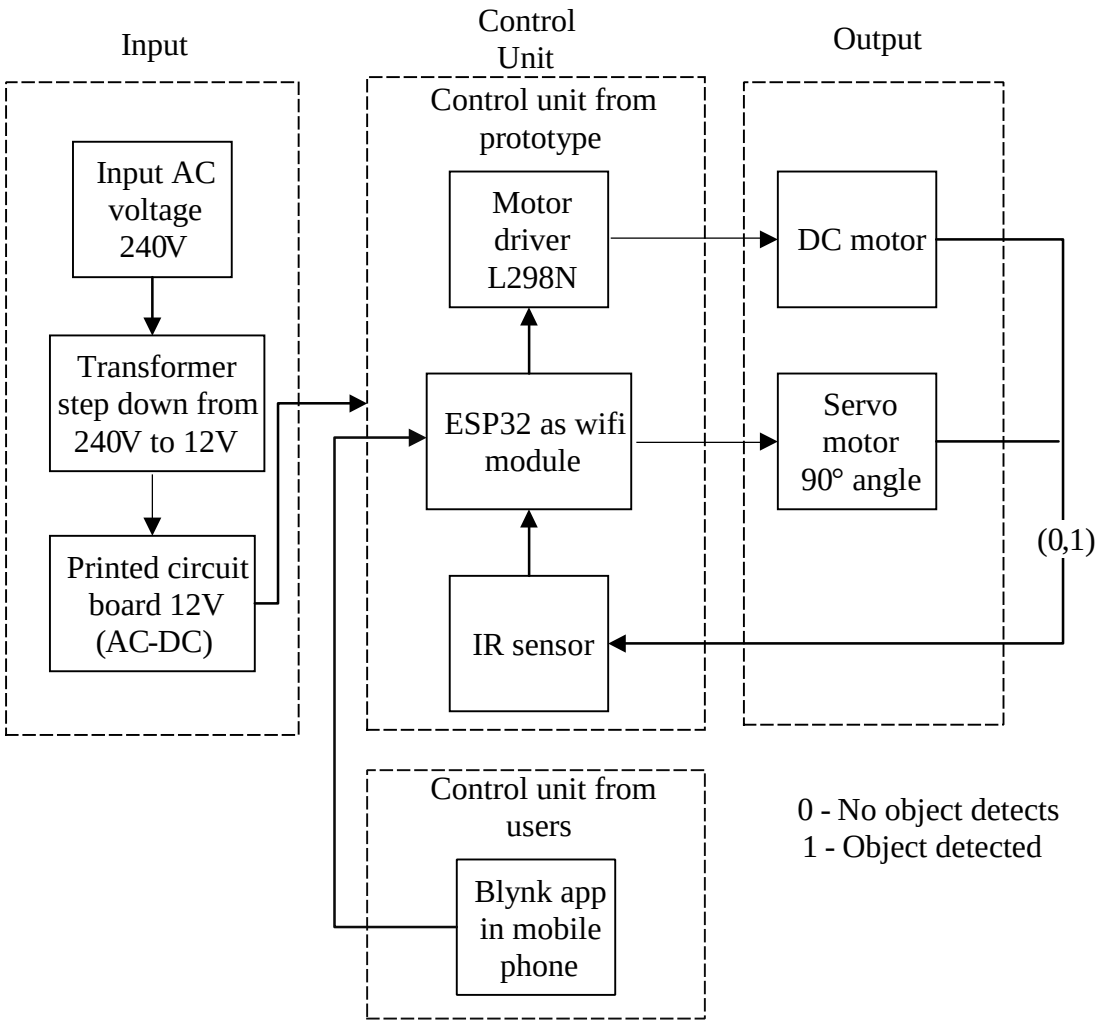


Figure 1: The block diagram of an automated cattle feeding system.

Firstly, the input voltage from the power source, socket plug, 240V will go through the transformer step down from 240V to 12V. Secondly, the PCB that uses the rectifier concept will convert from 12V AC to 12V DC. Thirdly, the power will flow to the motor driver to supply the DC motor and servo motor. The ESP32 is connected to the Blynk Cloud server via Wi-Fi. The ESP32 interacts with the components, including an ultrasonic sensor, a servo motor, and a motor driver. The ultrasonic sensor will monitor the quantity of food on the conveyor by giving a signal back to stop the motor from serving food.

2.2 Development C++ for controlling the motor to serve livestock

The programming language C++ will be used to create the motor-controlling algorithm. Defining the motor's parameters before diving into C++ code is an important first step in developing the algorithm. To get the conveyor up and running, first, the DC motor's settings need to be clarified. The next step is to define the angle and degree° of the servo motor rotation required to open and close a food dispenser. Finally, in order to detect when the food is on the conveyor and shut off the motor, the IR infrared sensor needs to be applied. Figure 2 shows the flowchart of coding to control both motors.

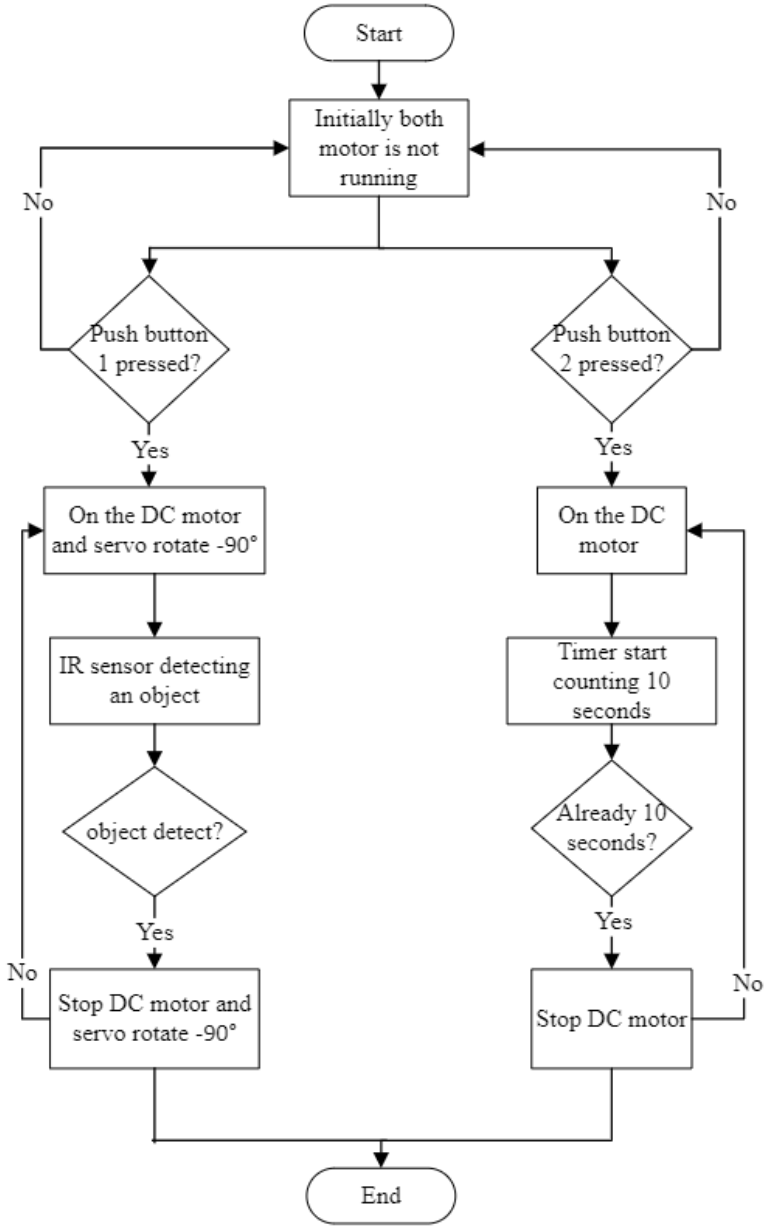


Figure 2: The flowchart of coding to control both motors.

The prototype is designed to automate livestock feeding through an ESP32 microcontroller and Blynk platform integration. Users interact with the system via the Blynk app, which offers two buttons linked to virtual pins. Pressing the first button activates the feeding process, setting the servo to a 90 angle and running the motor. The system monitors obstacles (food on the conveyor) using a sensor, immediately halting the feeding process if an obstruction is detected which is food on the conveyor is full by stopping the dc motor to run the conveyor and the servo motor will stop dispensing food. The

second button initiates a time to clear the conveyor which is the leftover food in 10 seconds. This setup leverages Wi-Fi connectivity, Blynk's real-time control, and servo motor operation to provide a streamlined, automated feeding solution for livestock management.

2.3 The schematic diagram in Proteus

Figure 3 shows the schematic diagram of the feeding system in proteus. The schematic diagram has been designed in Proteus software. This schematic diagram consists of all part components of hardware including the DC motor and servo motor for the fetching system of livestock. The objective of designing the circuit is for reference before implementing the circuit physically.

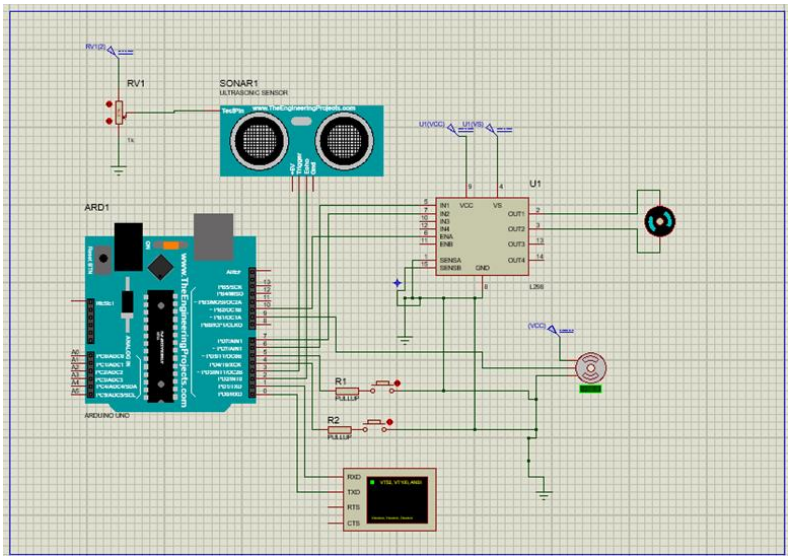


Figure 3: The schematic diagram of the feeding system in proteus.

3. Results and Discussion

3.1 The prototype for feeding food to livestock.

The prototype is developed on a small scale of feeding livestock. This project only shows and creates an idea to design the automation of feeding livestock using IoT before applying it to the real industry. To apply to real industry, need to change the hardware requirement to make it a more realistic product. Figure 4 and Figure 5 show the prototype of feeding livestock on a small scale and the connection of components.

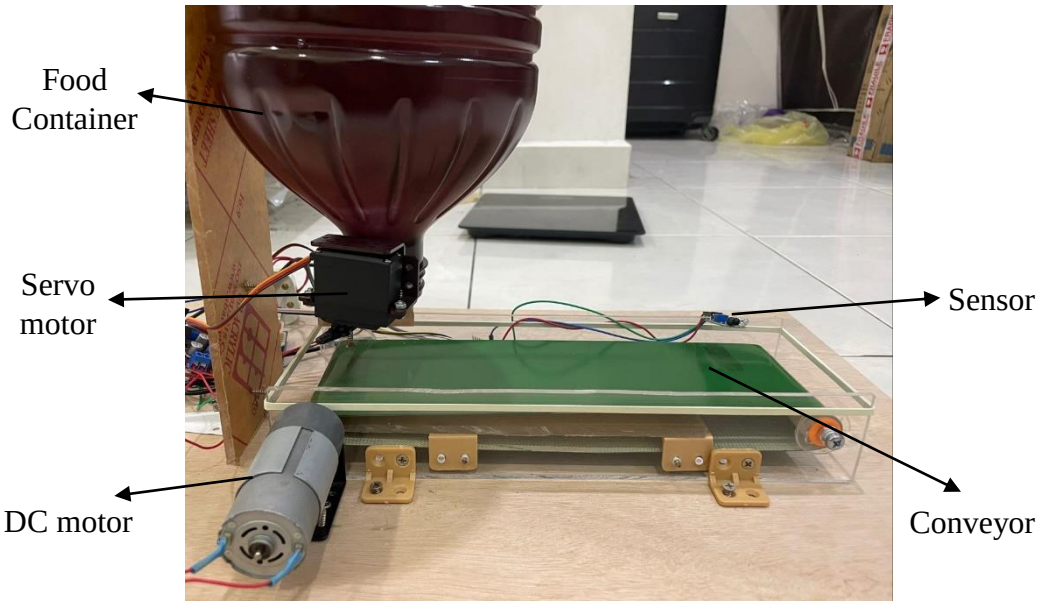


Figure 4: The prototype of feeding livestock in a small-scale

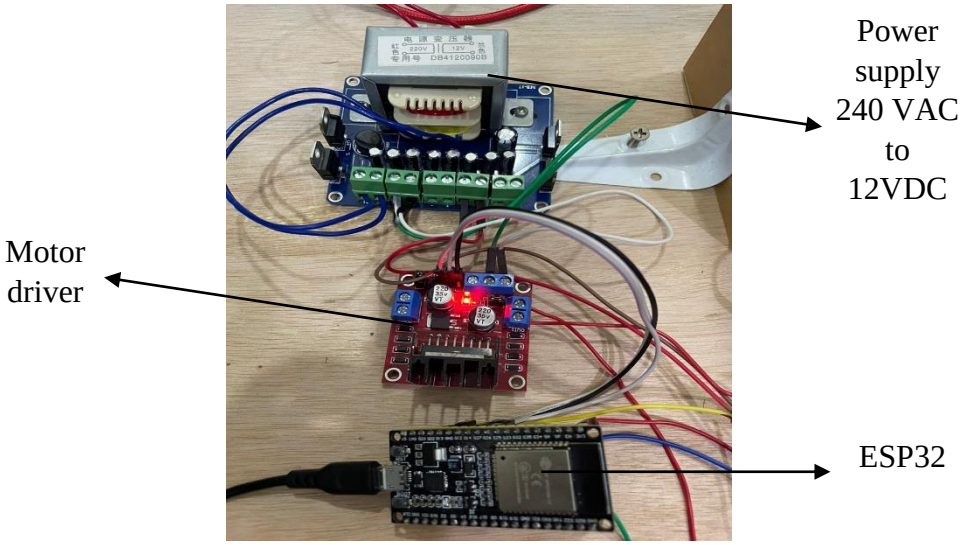


Figure 5: The connection of components.

3.2 System implementation

The Blynk created a mobile app interface to control the feeding system remotely for the users using a Wi-Fi signal which means the users can control this system of feeding food through mobile phones. The interface consists of two functions which are V0 the push button for feeding food and V1 is push button for clearing the conveyor. The figure shows the block diagram of V0 and V1.

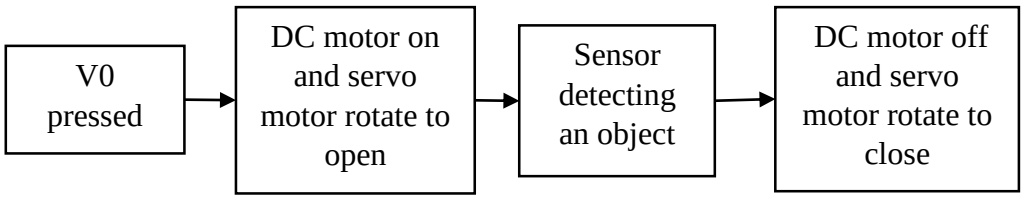


Figure 6: Shows the block diagram for V0

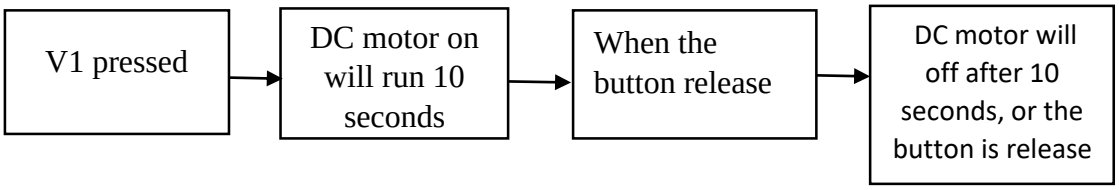


Figure 7: Shows the block diagram for V1.

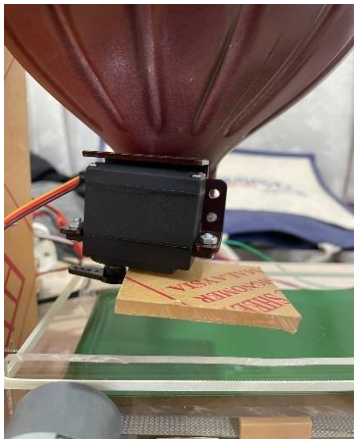
When the virtual pin V0 is pressed, the DC motor will be on the conveyor, and the servo motor will be rotated to a 90-degree angle to dispense the food. It will keep rotating until the infrared obstacle avoidance sensor detects an object. Upon detecting an object, the DC motor will stop, and the servo motor will be rotated to a 0-degree angle. When the virtual pin V1 is pressed, only the DC motor will be on for 10 seconds to clear the conveyor.

3.2 The rotation of the servo motor

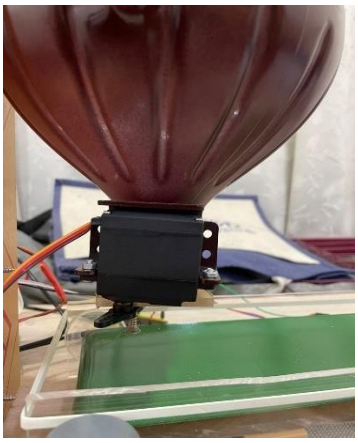
The servo will rotate according to the functions V0 and V1. Table 1 shows the rotation of the servo motor from the prototype. From this table, the position of the servo motor is rotated according to the conditions of V0 and V2. It shows that the prototype works by following the user's desired based on conditions of V0 and V2.

Table 1: Shows the rotation servo motor from the prototype

Condition of V0 and V2	Rotation of servo motor at prototype
V0 pressed	The servo motor will rotate to 90° open for dispensing the food and will stop dispensing when the sensor detects the food at the end of the conveyor.



V2 pressed	The servo motor will rotate 0° to close for not to dispense the food. Only the DC motor will run the conveyor to clear the conveyor.



4. Conclusion

In conclusion, the objective of developing a prototype for feeding food to livestock has been addressed through the design of a small-scale livestock feeding system. The system incorporates a servo motor as a food dispenser and a DC motor controlled by the L298N module to operate the conveyor. Additionally, innovation has been achieved by integrating IoT technology using a microcontroller for automation and data control, facilitated by the Blynk platform. These developments aim to improve efficiency and convenience in livestock feeding processes. By successfully implementing these objectives, the prototype provides a foundation for further enhancements and real-world applications in the industry.

Acknowledgement

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