DESIGN AND CONSTRUCTION OF AN INTELLIGENT SYSTEM FOR AUTOMATIC ANIMAL FEEDING USING INTERNET OF THINGS TECHNOLOGY

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ABSTRACT

The method used in developing this system is the prototype method. The results of the study show that the IoT-based automatic feeding system works well according to the components used. This system uses servos, ultrasonic sensors, RTC sensors, and is equipped with an LCD to display information about the status of feed and remaining feed (on or off).

Keywords: Microcontroller, IOT, Blynk

INTRODUCTION

IoT technology systems have been implemented in several regions in Indonesia for feed automation. One of the main reasons is the lack of knowledge and skills of local farmers. There are many obstacles faced by farmers, especially in terms of feeding. [1]The problem is that when these farmers provide livestock feed, many are still accustomed to providing it as is with uncertain pellet feeding times in conventional ways such as when feeding. So to overcome this problem, a concrete solution is needed by adopting IoT technology from the side of automatic pellet feeding based on IoT[2]. With the existence of an automatic pellet feeding system based on IoT, it is hoped that chicken farmers can more easily provide feed without worrying about forgetting. This study raises the topic of an automatic feeding system based on IoT.

THEORETICAL BASIS

Microcontroller

A microcontroller is a complete microprocessor system contained within a chip. Microcontrollers generally contain only a CPU, as microcontrollers generally include a minimal system that supports microprocessor components, namely storage and E/A boundary areas.[3]

Internet of Things

Interaction between humans has been very common since ancient times. Finding technologies such as computers and other devices is also common, and human-machine interaction. If machines can interact with machines, it is called the Internet of Things. Under the Internet of Things or Abbreviation, this concept aims to do so. [4]

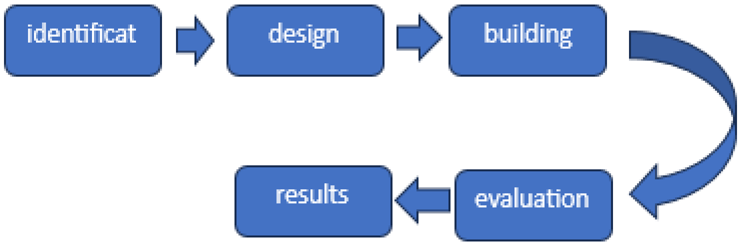
Expand the benefits of continuous connection to the internet. Regarding functions such as data exchange, remote control, and more, including real-world objects. Therefore, we can conclude that we build a machine-machine relationship between things so that machines can interact and work independently according to the data.[5]

The implementation of the Internet of Things itself usually always follows the wishes of the developer, in the development of applications created to monitor space, the implementation of the Internet itself must be a flow diagram for diagrams related to diagrams related to diagrams related to diagrams related to diagrams related to diagrams related to diagrams. numbers. Home sensors, distance and internet network speed that allows you to control the room. The development of network and internet technology such as the existence of IPv6, 4G, WiMAX helps implement it.[6]

The Internet of Things is more optimal and allows for distances that can be submitted, making it easier to control something.[7]

RESEARCH METHODOLOGY

This study uses the prototype method, an approach in software development where a prototype or initial model is created before the system is fully developed. This method is intended to describe a system consisting of several stages of development. In this study, the designed system includes monitoring humidity and irrigation in an automated factory, designing hardware and software, and using servo motors, actuators, NODEMCU ESP8266.[8]



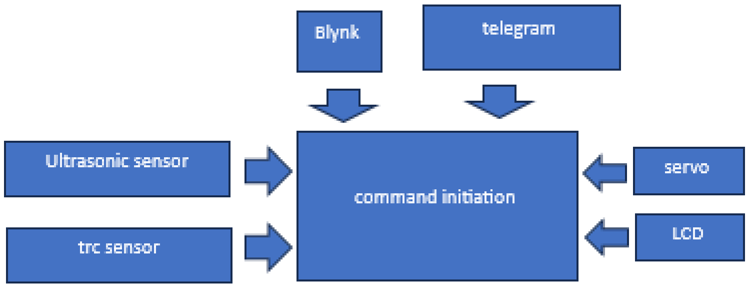
Picture 1. prototype diagram image

The image above is a flow diagram of system development, which in this context can be applied to an automatic feeding system based on the Internet of Things (IoT). The following is an explanation based on the stages in the diagram:

1. Needs Identification: In the initial stage, system needs are identified. In the case of an IoT-based automatic feeding system, this includes determining what the user needs, such as setting an automatic feeding schedule, monitoring the amount of feed, or remote control via a mobile application.
2. Design Process: Once the needs are identified, the system design process begins. This includes designing the necessary components, such as sensors to detect the amount of feed, actuators to control feeding, and an IoT interface for communication between the system and the user via the internet.
3. Building a Prototype: After the design is complete, a prototype of the system is created. At this stage, hardware and software are combined to create an initial version of the automatic feeding system. For example, assembling sensors, actuators, and microcontrollers (such as Arduino or Raspberry Pi) that will be connected to the IoT platform.
4. Evaluation and Improvement: The prototype that has been built is evaluated to ensure that its function is running well. Evaluation is carried out to find out whether the system is in accordance with the needs and is running efficiently. If there are deficiencies, improvements are made until the system functions properly. In the diagram, if the evaluation results show that the system is not adequate, then return to the design process for improvement.
5. Results: After evaluation and improvements are carried out until the system functions properly, the final result is an IoT-based automatic feeding system that is ready to use. This system allows automatic and remote control and monitoring via an IoT application or platform.

Hardware Design

In hardware design, in the automatic cattle feeding system based on the internet of things is an important thing before the assembly is done. NodeMCU ESP8266 as a microcontroller that processes data and sends signals to telegrams. The design used is as follows:



Picture 2. system diagram

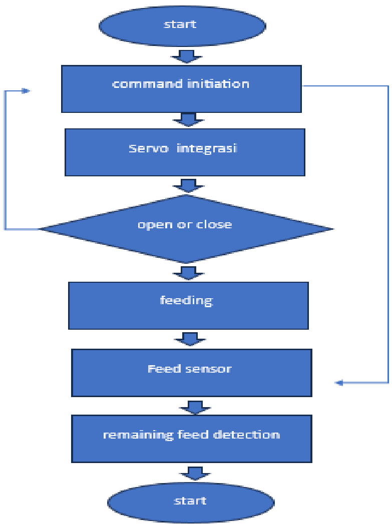
The image above is a block diagram of an Internet of Things (IoT) based automatic feeding system with the main components connected to the NodeMCU ESP8266. Here is the explanation based on the diagram:

1. NodeMCU ESP8266: This is a microcomputer or microcontroller that is the control center of the system. NodeMCU is equipped with a WiFi module, which allows the system to connect to the internet and interact with other devices through IoT platforms such as Blynk and messaging applications such as Telegram.
2. Servo: This servo is likely used to drive the feeding mechanism. When the system receives a signal from a sensor or from a user command via an app, the servo will move a component (such as a door or valve) that releases the feed.
3. Ultrasonic Sensor: This sensor is used to detect the distance or level of feed in the container. If the feed level drops below a certain threshold, the system can send a notification to the user or automatically add new feed if such a mechanism is implemented.
4. TRC D51302 Sensor: This sensor is an infrared or temperature sensor that may be used to monitor environmental conditions or detect the presence of animals around the feeding area. Data from this sensor can be used to trigger feeding.

5. 16x2 LCD: This screen is used to display real-time information on the spot, such as system status, amount of feed remaining, or other messages to the user located at the device location.
6. Micro USB: Used as a power source or for programming the NodeMCU. Micro USB allows charging from a power source such as an adapter or computer.
7. Blynk: Blynk is an IoT platform that allows remote control of devices via a smartphone app. In this system, Blynk is used to control or monitor the feeding system in real-time via the internet. Users can check the feed status, give manual commands to dispense feed, or receive notifications when there is a problem.
8. Telegram: Telegram is used as a communication channel to receive notifications or commands via messaging applications. For example, users can get notifications about feed levels, or even send commands via the Telegram bot to activate manual feeding.

Software Design

When creating software, the initial step involves coding the program in Arduino IDE (Integrated Development Environment). After the program in Arduino IDE is complete, the next step is to transfer the program from the laptop or PC to the NodeMCU module. To find out the flow of creating an Arduino program, a flowchart is made as shown below:



Picture 3. iot system flowcad

The image above is a flowchart of the workflow of an automatic feeding system based on the Internet of Things (IoT). The following is an explanation of the blocks in the image:

1. Start: The system is started either through a manual trigger from the user (via an application such as Blynk or Telegram) or automatically based on a predetermined schedule. This is the initiation stage of the feeding process.
2. Initiation or Command: At this stage, the system receives a command to start the feeding process. This command can come from the user via an IoT platform (such as the Blynk or Telegram application) or based on a schedule that has been set in the system.
3. Feed Integration Servo: After the command is received, the servo is activated to open or close the mechanical component that regulates the flow of feed. This servo acts as a driver to remove feed from the storage container.
4. Open or Close (Decision Point): At this stage, the system checks whether the servo has opened the mechanism to channel feed. If the system decides "Yes" (Y), the servo opens the mechanism to dispense feed, and feed is given. If "No" (T), the system returns to its initial state and no feed is given.
5. Feeding: After the decision to open the feeding mechanism is made, feed begins to be distributed to the animal feeder. The servo controls the amount of feed given according to the duration or amount of feed that has been set previously.
6. Ultrasonic Sensor Information: After the feed is given, the ultrasonic sensor detects the level of feed remaining in the feeder. This information is useful for knowing whether to refill the feed or not. This sensor can also be used to detect whether the feeder is still full or empty.
7. Detecting Remaining Feed: Based on data from the ultrasonic sensor, the system checks whether the amount of feed remaining is sufficient or needs to be refilled. If there is still feed left, the system will end the process. If not, a notification can be sent to the user via the IoT application to refill the feed.
8. Finished: The feeding process ends after the information from the sensor is analyzed. The system can return to standby until the next command or schedule arrives.

RESULTS AND DISCUSSION

This research successfully produced a prototype of an automatic feeding system for chicken coops. This system has been implemented by testing a prototype built on a small scale to test the function of each IoT device that will be developed in the system. The following is the result of the prototype

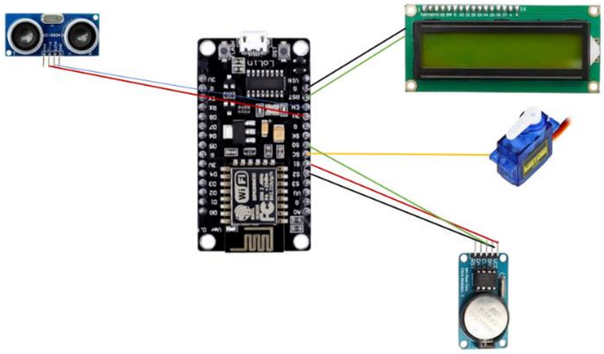
Picture 4. Cage design

System Design Results

This research has been carried out in accordance with the specified method, namely the prototype method. The initial stage begins with the design of hardware, software, and system miniatures. The following discussion will describe the results of the IoT-based automatic cattle feeding system, including hardware and software implementation, ending with system testing.

Hardware Design Results Design

The system used in building an IoT-based automatic cattle feeding system in Figure 5 below explains the system that has been created, where the servo sensor is integrated into the Arduino microcontroller to open the feed lid automatically. This system relies on several components such as servos, ultrasonic sensors for remaining feed, and RTC to set the feeding time. After the user sets the feeding time at 7 o'clock, the servo automatically opens for feed, the ultrasonic sensor will provide information on remaining feed. The following are some of the results of the kears device system design designed using fritzing as in Figure 4.3 below.



Picture 5. Device design results

The image above shows a series of automatic feeding systems based on the Internet of Things (IoT) using the NodeMCU ESP8266 as the central microcontroller. The following is an explanation of each component in the context of the system:

1. NodeMCU ESP8266: This is a microcontroller equipped with a WiFi module, allowing connection to the internet for long-distance communication. NodeMCU functions as a control center that receives input from sensors and sends commands to actuators such as servos.
2. LCD 16x2: The LCD screen is used to display system-related information directly, such as feeding status, remaining time, or other information such as the amount of feed in the container. This LCD helps users who are near the device to monitor the system visually.
3. Servo Motor: The servo is responsible for moving the feeding mechanism, for example opening the feed container door or moving the feed valve. When the feeding command is received from the system, the servo will move the physical mechanism to release feed into the feeding place.
4. Real-Time Clock (RTC) DS1302: This component functions as an accurate timer in the system. The RTC keeps the NodeMCU aware of the current time, which is important for running the system according to a predetermined schedule, such as a feeding schedule at a certain time.
5. Ultrasonic Sensor: This sensor is used to detect distance, which in this system may function to monitor the level of feed in the container. If the feed is almost gone, the sensor will signal the system to send a notification or take appropriate action, such as adding feed.

6. Breadboard: The breadboard is used to connect all components temporarily without the need for soldering. This makes it easier to design and test the system before making the final version or permanent prototype.
7. Power Supply: In the image, the electrical power to run the NodeMCU and all other components is supplied through the breadboard. This system usually uses a USB power source or external battery.

System Test Results

In this study, a prototype of a door security system using ultrasonic sensors and servos based on the Internet of Things (IoT) has been designed and tested, which aims to facilitate farmers in the feeding process by utilizing modern technology. Testing was carried out to evaluate servo performance, ultrasonic sensor accuracy, and RTC sensors. It is hoped that the results of this test can show the reliability and effectiveness of the system in increasing the efficiency of automatic feeding and become a basis for further development.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that the IoT-based automatic cattle feeding system functions well according to the components used. This system utilizes servo sensors, ultrasonic sensors, and RTC for the feeding process and measuring the remaining feed. In addition, the LCD is used to display information related to the remaining feed and the status of the on or off command. Thus, this system not only provides feed automatically, but is also able to detect the remaining feed in the tank, making it easier for farmers to manage feeding more efficiently.

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