Irrigation control system design for paddy field by means of internet of things

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Abstract. During this time the control of the water level that is done is still using manual tools in the form of floodgates placed between rice fields and irrigation. Given the importance of controlling and monitoring the level of irrigation water in rice fields, the authors get the idea to create a control system to close the irrigation floodgates on rice fields for farmers. In addition to notification in the form of a SMS (Short Message Service) reply to the telegram application, the open and close irrigation door system in paddy fields is a major alternative that is very useful for farmers to prevent crop failures if the water in the paddy fields exceeds the limit. In this system utilizing the work of ultrasonic sensors to measure any changes in water level in the paddy fields, then the data will be received and processed in the nodemcu and water level notifications will be sent to the telegram, to drive the irrigation door on the paddy using a servo motor that will open and close the irrigation door on rice fields automatically according to the conditions specified. if the water level is <2 cm, the irrigation door will open, the buzzer will not sound. And if the water level below> 2 cm, the irrigation door will be closed, the buzzer will sound as a sign that the water needs in the field are sufficient. While the notification in the form of an sms will be sent to the telegram.

1. Introduction

The design of this control system is a device that can help humans or facilitate humans in controlling the water level in the canal automatically and can prevent flooding and can facilitate irrigation in rice fields. In the modern era, an effective irrigation method is needed, so that not much energy and time is wasted in controlling the closing of the irrigation sluice on rice fields. Rice fields are agricultural businesses carried out on alkaline soils and require water for irrigation. The types of plants that are mainly used for rice farming are rice. In paddy field, land management is carried out intensively and is permanent agriculture. If the average irrigation needs is 1 liter/ second/ha with 100 days of rice age with an average rice yield of 3,000 kg / ha, the irrigation water requirement per 1 kg of rice is 2,880 liters in paddy fields.

2. Methods

2.1 Tools and Materials

2.1.1 Hardware. Electronic equipment used in this design includes:

a) Nodemcu;
b) Ultrasonic Sensor HC-SR04;  
c) Telegram;  
d) Servo Motor;  
e) Jumper Cable;  
f) Buzzer;  
g) 220 Volt Pump;  
h) Nodemcu adapter;  
i) 220 Volt Pump Socket;  
j) Miniature Rice Fields;  
k) Miniature Irrigation;  
l) Irrigation Door.

2.1.2 Software. The software used in the design of a prototype control system for irrigation floodgates in rice fields using an Internet-based telegram application of IOT is:  
   a) Fritzing.0.9.0b.32.pc;  
   b) Arduino 1.8.1 Windows.

2.2. Schematic design of a prototype control system for irrigation floodgates on rice fields using the internet-based telegram application of things (IOT)  
Schematic design of this tool is made to make it easier to do the prototype control system for irrigation floodgates on rice fields that use nodemcu as a controller of all components needed such as telegram applications, nodemcu, ultrasonic sensors, buzzers, and servo motors.  
Based on Figure 5 schematic design of the prototype of the rice paddy water gate shutter irrigation system using the internet-based telegram application of IOT, where the ultrasonic sensor VCC is connected to the VIN on the nodemcu which functions to flow positive currents, the GND on the ultrasonic sensor is connected to the GND nodemcu that functions to drain the negative current, the trig on the ultrasonic sensor is attached to the D6 nodemcu which functions to activate the ultrasonic trig pin and the echo on the ultrasonic sensor is connected to the D7 nodemcu which functions to activate the echo to the ultrasonic, positive buzzer is connected to D8 on the nodemcu which functions to connect the pin pin positive buzzer, and negative buzzer is connected to GND on the nodemcu which functions to connect the negative buzzer pin, the red wire on the servo is connected to pin 3v on the nodemcu which serves to connect positive current, brown cable is connected to GND on the nodemcu which functions to connect the negative current atif, and the yellow wire is connected to D2 on the node that serves to turn on the data.  
Schematic design of a prototype design for the control system of the irrigation floodgates on rice fields using the internet-based telegram application of things (IOT) to be made. The results of the schematic design of a prototype tool for control of the rice paddy floodgate irrigation system using the internet-based telegram application of IOT can be seen in Figure 1 below.
Figure 1. Schematic design of a prototype tool for the control system of rice flood gates by irrigation systems using the internet-based telegram application of things (IOT).

By using nodemcu as a set device to send messages to farmers using the telegram application when not in the location, where information obtained by the ultrasonic sensor is sent to the nodemcu to be processed according to the program that has been created and has been input to the Arduino board. As shown in Figure 2 below.

The sensor used in detecting water level is an ultrasonic sensor that detects accurately. This sensor can take a distance of water level with a minimum distance of 0 cm and a maximum of about 500 cm. As shown in Figure 2 below.

Figure 2. The physical form of node mcu.

The sensor used in detecting water level is an ultrasonic sensor that detects accurately. This sensor can take a distance of water level with a minimum distance of 0 cm and a maximum of about 500 cm. As shown in Figure 3 below.

Figure 3. The physical form of an ultrasonic sensor.

Open and close irrigation door systems in rice fields using servo motors. If the water level in the rice fields reaches <2 cm, the servo will open the buzzer will not sound, then the servo will close and the buzzer will sound when the water level reaches >2 cm.
2.3. Flowchart prototype design tool for control of irrigation floodgates on rice fields using an Internet-based telegram application of IOT.

The following is a flowchart of how the prototype of the irrigation floodgates control system works on rice fields using an Internet-based telegram application that will be made. As shown in Figure 8 below.

![Flowchart](image)

**Figure 4.** Flowchart prototype design tool for the control system of the closed irrigation floodgate paddy fields use the internet-based telegram application of things (IoT).

Based on the flowchart above, it can be explained when starting the nodemcu will automatically connect to the hotspot, if the water level in the rice field is still within <2 cm the servo will open, the buzzer will not sound. Furthermore, if the water level below > 2 cm then the servo will be closed, the buzzer will sound while a notification in the form of an SMS will be sent to the telegram.

3. Results and discussion

3.1. System work analysis

Testing and analysis of system work is a combination of software and hardware that has been realized. This testing tool gives accurate results, where information obtained by the ultrasonic sensor is sent to the
nodemcu to be processed in accordance with the program that has been made and has been input to the Arduino board. This tool works and reads any changes in water level in the rice fields. In the control system open and close the irrigation door on the rice fields automatically using a servo motor. This tool is made to notify that the rice paddy does not sink due to too much water storage in the fields and farmers do not experience crop failure.

By using nodemcu as a device that has been set to send messages to farmers using the telegram application when not in location. Servo will open if the irrigation water level is still in the range of 0-1 cm with a very good time of 9 seconds, with a network speed of 6.28 Mbps and a moderate time of 1.3 seconds with a network speed of 6.20 Mbps, the buzzer does not sound, if the water level is high Irrigation has reached 2 cm, with a time of 58.6 seconds with a network speed of 3.60 Mbps the servo will be closed, the buzzer will sound as a notification that the water needed for paddy is sufficient. While the notification in the form of ansms will be sent to the telegram.

3.2. The results of the prototype design of a control system to close the irrigation floodgate on rice fields using the internet-based telegram application of things (IOT)

The following is the result of a series of prototype design tools for the control system of the floodgates shut on the rice fields using the internet-based telegram application of things (IOT). As shown in Figure 9 below.

![Prototype Design Image](image)

**Figure 5.** The results of a prototype design of a control system to close the irrigation floodgate on rice fields using the internet-based telegram application of things (IOT).

The overall appearance of the design of the prototype control system of the irrigation sluice control system in the paddy fields above, where this tool works if the water is paddy with a height of <2 cm, the irrigation door will open, the buzzer does not sound. Furthermore, if the water level below> 2 cm, the irrigation door will be closed, the buzzer will sound as a sign that the water needs in the field are sufficient. The results of testing the prototype design of the control system to close the irrigation floodgate on rice fields using the internet-based telegram application of things (IOT) can be seen in Table 1 below.
Table 1. The results of testing the prototype design of the control system to close the irrigation floodgate on rice fields using the internet-based telegram application of things (IOT).

| high water in irrigation | paddy water conditions | Buzzer   | door  | time   | network speed |
|--------------------------|------------------------|----------|-------|--------|---------------|
| 0                        | no full                | not sound| open  | 00.00.09| 6,28 Mbps     |
| 1                        | no full                | not sound| open  | 00.01.03| 6,20 Mbps     |
| 2                        | full                   | sound    | closed| 00.56.08| 3,60 Mbps     |

Based on the test table above, it can be explained that the servo will open if the height of the irrigated water is still in the range of 0-1 cm with a very good time of 9 seconds with a network speed of 6.28 Mbps and a moderate time of 1.3 seconds with a network speed of 6.20 Mbps reads. Furthermore, if the irrigated water level has reached 2 cm with a time of 58.6 seconds with a network speed of 3.60 Mbps, the servo will be closed, the buzzer will sound as a notification that the water needed for paddy is sufficient, while a notification in the form of an SMS will be sent to the telegram.

4. Conclusions

After conducting the experimental phase and system development which is then continued with the results and discussion stages, conclusions can be drawn if the water level is still in the range of 0-1 cm with a very good time of 9 seconds, with a network speed of 6.28 Mbps and a moderate time of 1.3 seconds with a network speed of 6.20 Mbps, the buzzer does not sound, if the irrigation water level has reached 2 cm, with a time of 58.6 seconds and a network speed of 3.60 Mbps, the servo will be closed, the buzzer will sound as a notification that the water needed for rice is enough ricefields. While the notification in the form of an SMS will be sent to the telegram.

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