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The Design of Microcontroller-Based Detection Tools and Rat Pest Repellent on Rice Seeds

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ABSTRACT

Keywords
Rat
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Camera
IoT

The control of rat pest in rice nurseries to obtain increased production continues to be done. In an effort to overcome the problem of rat pest various alternative controls have been carried out, both in technical culture, physical mechanics, and chemically. To reduce the undesirable effects of using chemicals to control rat pets, it is necessary to use other alternative rat pets control. Based on these problems, this study conducted various test to create a design that could be used to repel rat pests. The method used includes electrical and systematic design. The steps taken include the sate of literature study then designing, manufacturing hardware and software integrating the system and testing and analyzing the system. Considering these theories, it can find out the programming of microcontrollers, LDR sensors, Cameras, Internet Networks, NE555, Solar Panels, and Accu. This study uses several tests, including testing the LDR sensor, Camera, Internet Network, NE555, Solar Panel and Accu. LDR sensor is functions to detect rat objects, cameras to take video directly, internet network to send video from the microcontroller to the user, NE555 to emit ultrasonic soungd waves to repel rat pests, solar panels as a source of electrical energy, and accu as electrical energy storage that produced solar panels. From all of test above we get results when the LDR Sensor detects a rat then the NE555 will emit ultrasonic waves, then the camera sends video via iot to usser.

1. Introduction

Rat pests control on rice nurseries to gain an imporving production is constantly done [1]. In an effort to overcome the problem of rat pests various alternative controls have been carried out, both in technical culture, physical mechanics, and chemically [2]. Rat pests can be controlled chemically in an alternative way because in general the result can be immediately seen and are easily applied over large areas. However, the use of chemicals continuously in controlling vasious pests has caused various new problems, especially for the surrounding environment.

In reducing the undesirable effects of the use of chemicals to control rat pests, it is necessary to use alternative rat pests control. Farmer usually make a tool to control these rat pests with some plastic or used mosquito net stetched extending in the seeding area [3][4]. It was aimed at rat pests to not entering the seeding. Farmers usually check the seeding area twice a day in the morning and in the evening, and it turns out that many rice seeds come out of the ground also eat newly-grown stems, resulting in dead seedling and not optimal seeding. Rats are pests that are very damaging to rice plants in Indonesia. This pest must be specially controlled. Because farmers often lose money in the results of rice seeding due to rat pest attacks are very high [5][6].

The effort to control these rats have been done. But it is recognized, that the control method is not optimal, so that the hope to surppress the rat population is very difficult, therefore it is deemed necessary to the ease the burden of the farmers by making designs to detect a pest control device on rice seeding with a camera. The tool works automatically so that it can reduce losses on seeding area. This allows farmers to produce seed to be planted, so that they are sufficient for the needs of the land to be planted with rice.

2. The Proposed Method/Algorithm

In this study the methods used include electrical design, systematic in order to obtain accurate data and information [7]. In this design stats from collecting data, making design, making tools, testing and summarizing the results of the system. The following is a block diagram of an automated detection and repellent device system.

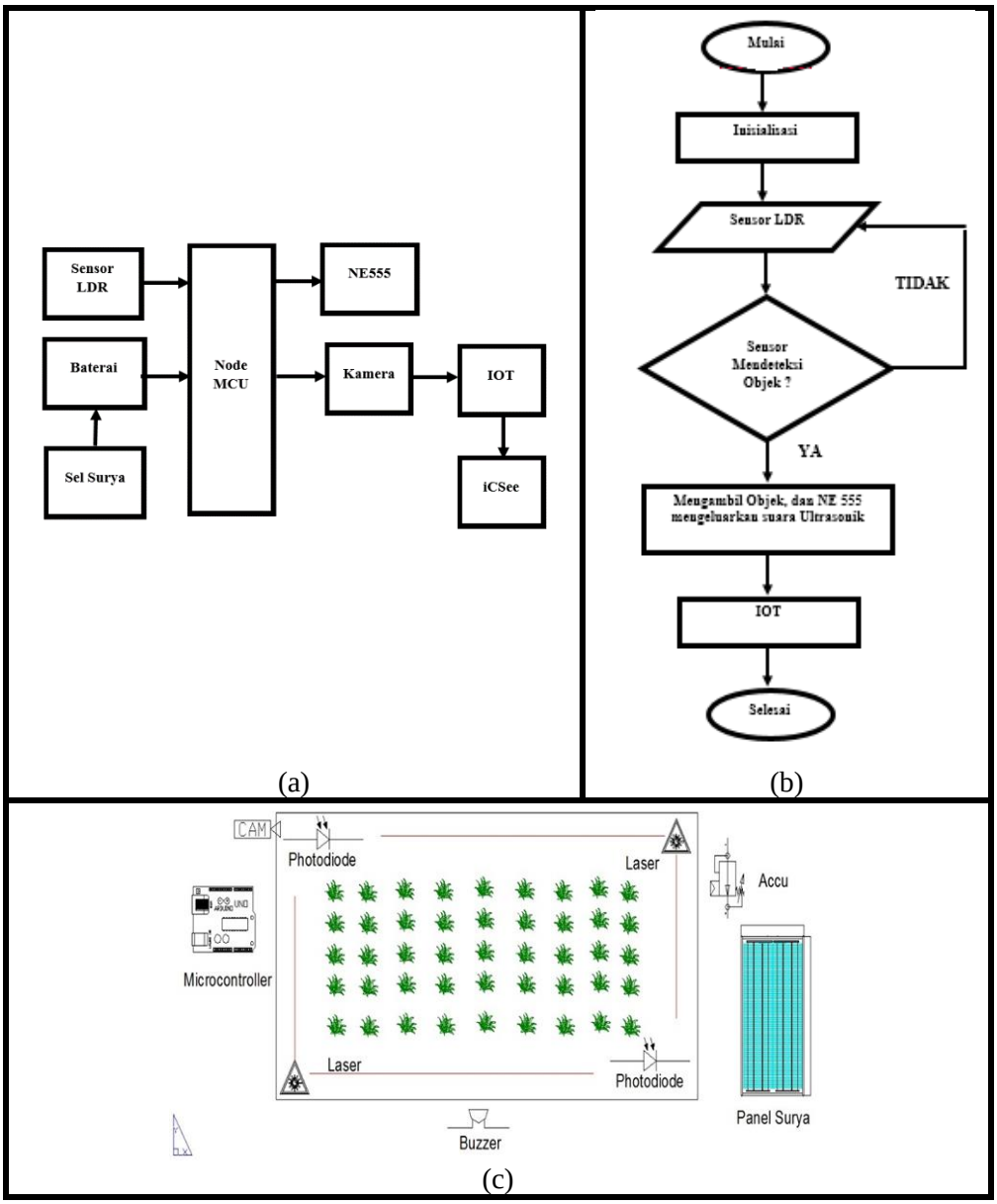

Fig. 1. (a) Diagram Block Planning Tool, (b) Sensor Reading Flowcart, (c) Plecement of Tools On The Seeding Field

From the block diagram figure this tool planning explains about the beginning of the process, which starts from the input of the LDR sensor which if the sensor is still exposed to the laser beam then the logic value will be Low (0), and vice versa if the laser beam is not about the LDR sensor or there is an object (Rat) that passes through the sensor, the logic value will be High (1).

1. Literature Study Stage
   On this literature study stage, several journals and reference books are used as a basic source for data processing. Literature study in this thesis includes the following matters:

   a. Study of a microcontroller operating system [8];
   b. Study of LDR sensors;
   c. Study of motion detection systems.

2. Hardware Design and Manufacturing Stage
   In this stage the design is adjusted to the function of the components that will be used, so that it can be realized and the system can run well.
3. Software Design and Manufacturing Stage
   At this stage Software testing has been made, before Hardware and Software are integrated into the whole system to run the system.
4. System Integration
   Integrate between Hardware and Software that has been compiled into a whole system to run well.
5. System Testing and Analysis Stage
   Test the system that has been integrated as a whole for further analysis according to its function. Flowchart system design software work as shown in Figure 1 (b).

   Placement of detection devices and rat repellent with a microcontroller-based camera in the seeding area, we must first adjust the tool to the length and width of the seeding area so that the results of this tool can work effectively. This following is an example drawing of a layout plan for tool placement on seeding area.

3. Result and Discussion

3.1. Testing result of LDR Sensor

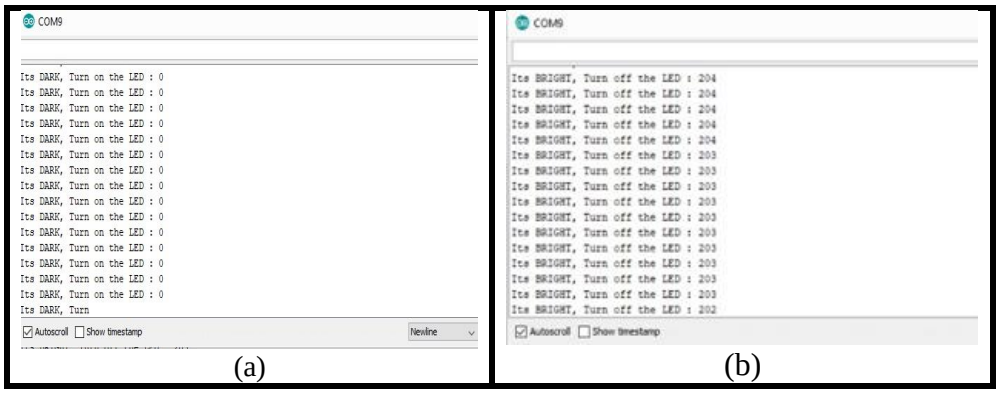

Fig. 2. (a) Serial Print LDR sensor readings when it's not detecting movement, (b) Serial Print LDR sensor readings when it's detecting movement

In the serial print results show a high voltage value, the laser beam received by the LDR sensor has been interrupted, so in this case indicates that the movement has cut off the laser beam received by the LDR sensor.

3.2. Camera Testing Result

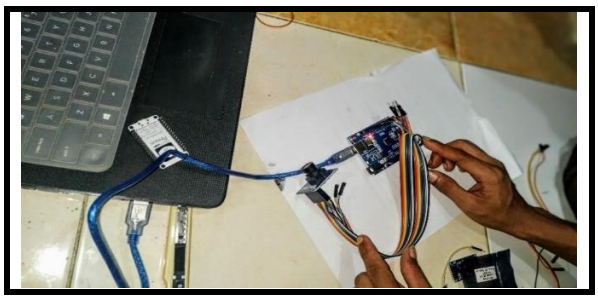

Fig. 3. Camera Test

On the results of this test send images resulting from the capture of objects by the camera, after capturing the image the results will be stored by a microSD Card which has been filled in by a microSD type memory. After that it will send to the microcontroller and will send to the iCSee application. In this case indicates that the camera is functioning properly.

3.3. Internet Network Testing Results

Fig. 4. Internet Network Testing

Internet network notification sends reports to the iCSee application which is an application for Android. Data sent in the form of images or video directly. If the application has received data that sent by the microcontroller, the internet network works well.

3.4. NE555 Test Results for Frequency Generating Module

In testing NE555 the Frequency Sound Generator Module is carried out to expel rat pests on rice seeding. The method used for NE555 testing is when there is a rat pest that passes on the LDR sensor, the microcontroller will automatically command the NE555 module to increase the frequency sound, so it is expected that the rat pest is disturbed with a frequency of 42.55 – 90.91 kHz [9][10].

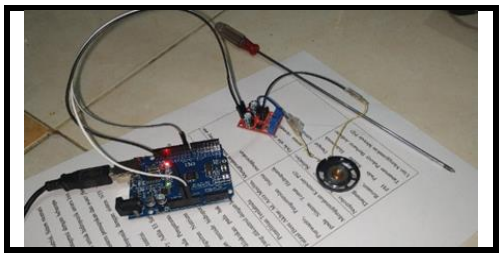

Fig. 5. NE555 Test Results for Frequency Generating Module

e. Solar panel testing is done to find out whether the solar panels are able to function properly. This test is done by giving light to the solar panel, then the solar panel output is checked using a digital multitester. Then after that it will be known how much voltage is generated.

To get good result in testing, the solar panle testing process is given light indoors and outdoors. If the digital multitester displays the voltage generated by the solar panel, the solar panel is functioning properly and is ready to use.

Fig. 6. Solar Panel Testing

Battery endurance testing is carried out to determine whether the battery is able to function properly. This test is done by checking using a digital multitester. Then it will be known how much voltage is generated.

To get good results in testing, the battery resistance testing process is charged first. If the digital multitester displays the voltage generated by the battery, the battery is functioning properly and is ready to use.

Fig. 7. Accu Endurance Testing

In this case, we will discuss the results of testing a series of devices, which include testing of LDR sensors, NodeMCU, cameras, LED, NE555, Accu, solar cells, and Solar charge controlle.

This test is done by providing input voltage to the whole system, then the microcontroller is programmed to activate the LDR sensor by providing voltage from the microcontroller. After being programmed, the microcontroller gives commands to the LED as lighting when the microcontroller gets a movement signal from the LDR sensor.

This test is done by providing input voltage to the whole system, then the microcontroller is programmed to activate the LDR sensor by providing voltage from microcontroller. After being programmed, the microcontroller gives commands to the LED as lighting when the microcontroller gets a movement signal from the LDR sensor.

In this system in addition to repelling rat pests can also take and transmit images in realtime through an attached camera. The method used in sending images to user is to use IOT received directly by the user on an android smartphone. The application that is connected to the IOT is iCSee which is available on the play store.

When observing the tool using mice directly, it was found that the results of rat testing were disturbed in the range of 4 to 7 meters. When rat are at a distance the rat looks confused and away from the source of sound. So it can be concluded rats are disturbed by ultrasonic sound waves of 90.91 kHz.

4. Conclusions

The design and detection of rat pest repellent on rice seeding with a microcontroller-based camera were designed using several components such as LDR sensor, NodeMCU, camera, LED, NE555, Accu, solar cells, and Solar charge controller that have been integrated. So that the LDR sensor can read rat pests object movements and cun turn on the LED, the speaker through the NE555 module, and the camera lights up to take pictures of the object which is then sent to the user via IOT.

The NE555 module will produce 82.9 kHz ultrasonic sound waves without speaker load. If given the load in the form of speakers, the ultrasonic sound waves become 42.55-90.91 kHz, the rat is disturbed at a distance of 4 to 7 meters. This aims to secure the rice seedlings from rat pests so that the rice seeding are not damaged or dear, and the camera functions when given voltage, then that's when the camera will send video in realtime via IoT, and users can receive input images or videos using the iCSee application that available on Android smartphones.

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