

FRUIT FLY REPELLENT USING SMS GATEWAY AS A MONITORING SYSTEM

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Abstract – Pests are one of the main obstacles for farmers that can cause a decrease in the amount of crop production. One of the pests that often disturb farmers, especially for chili farmers or other horticultural crops, is the fruit fly. This pest is very disturbing harvests because their numbers are increasing quite rapidly. This problem underlies the development of this pest repellent. The working principle of this tool is to repel fruit flies using ultrasonic waves without using pesticide drugs that can damage the environment if used continuously. This tool is designed using Arduino Uno as the main controller. Ultrasonic waves are generated and regulated using piezoelectric at a certain frequency as a fruit fly repellent. Then the tool is rotated using a servo motor to reach all corners of the land. For control and monitoring, this tool uses the GSM SIM800L version 2 module for sending short messages. From the results of the overall evaluation, this fruit fly repellent can work according to its function. This can be proven by testing when not using a fruit fly repellent, there are a lot of flies trapped in the bait bottle totaling 30, while when given a repellent, the flies trapped in the bait bottle are reduced to 15 with the information that the buzzer can emit sound, and servo motor moving condition, as well as GSM SIM800L, can send messages to the sender.

Keywords: Arduino UNO, Pest Repellent, Agricultural Technology.

I. INTRODUCTION

Technological developments are currently changing, technology can be adopted for agriculture [1], technology changes the process of agricultural activities [2], human needs in agriculture are increasing and diverse [3], not only agriculture and fertilizers are needed by farmers, but farmers need tools that can help and assist work such as insect repellent, to do this can use natural ingredients [4], and technology. Tools are tools that can repel pests that damage crops or crops [4].

The impact that occurs as a result of pest attacks is that it can cause disease in plants, resulting in losses to the value of production, growth, and plant growth [5]. Farmers take several ways to prevent these impacts, including using fertilizers that have chemicals in them, namely chemical pesticides. The use of chemicals used by farmers continuously will cause damage to the plants themselves and can cause pollution which will result in environmental pollution, including damage to soil nutrients.

Several technologies have been applied to overcome pests, the technology applied does not pollute the environment such as the use of pesticides, one example is the detection and monitoring of pests [6]. In this study, we produced a fruit fly repellent using voice and SMS gateway-based monitoring. This tool uses the sound emitted by the buzzer to repel pests that will interfere with plants. The buzzer will sound if the tool is active and this tool will rotate for optimal pest repelling.

II. METHODS

Figure 1 shows the block diagram of the system. There is a voltage source that is used as a voltage source for Arduino and other electronic components, Arduino is an electronic circuit board that has the main advantage of fast processing and easy interface [7] [8]. Some other electronic components are RTC, piezoelectric buzzer, servo motor, GSM SIM800L module which has been connected to the LM2596, and also a Smartphone that functions as a monitor of the device by sending and receiving notifications. Arduino uno function on this tool is used to receive and send data to and from other electronics modules. In addition, there is an RTC that is connected to the Arduino which functions as a timer for the device used to drive other components in real-time. The driving component used is a servo motor, the servo motor functions to move the tool so that it can rotate, including the buzzer component. The piezoelectric buzzer functions as an electronic component that is used as a sound source, every sound that is emitted will be informed to the device. The module used so that the device can communicate with the device is the GSM module.

A. Hardware Design

The previously designed electronic circuit can be seen in Figure 2, it can be explained that this fruit fly repellent is composed of a microcontroller board, namely Arduino Uno which acts as a data processor from RTC, GSM and to the buzzer, the buzzer component will produce sound and a servo motor used as an actuator in the tool. This circuit requires a 12 VDC voltage source as voltage source to activate all the components contained in this tool. Because the voltage is still too high, the voltage is lowered using the LM2596 module which functions as a voltage reducer from DC to DC. The LM2596 is connected to the GSM SIM800L version 2 module which functions to send notifications to users in the form of SMS text messages. In addition to the GSM module, the LM2596 is also connected to a servo motor, this servo motor has a function that is to move the tool in a rotating 60 degree continuously. Then there are also 3 piezoelectric buzzers, this buzzer works to produce sound. the frequency of this buzzer has been changed, which is 25 kHz – 30 kHz. In this series of tools, there is also an RTC that serves to provide time for the servo to rotate and stop.

B. Software Design

Figure 3 describes the workflow of the tool from start to finish. In the flowchart, the first thing to do is to initialize the microcontroller pins. After that, the piezoelectric buzzer will be active, then the GSM module will provide information to the user via SMS whose destination number has been previously set. Furthermore, when the time has shown 05.00 then the servo rotates until 06.00 and at that time GSM will be active which then sends a message that the servo is active. Then, when the time shows 06.00 and the servo motor is not rotating, the GSM module sends a message if the servo motor has stopped rotating. Then when the time shows 16.00, the tool rotates again until 17.00 in the afternoon and the GSM module sends a message that the tool is rotating. when the time is showing at 17.00 then the servo does not rotate and the tool is not active so GSM sends a message that the tool is no longer active, and at that time the buzzer is also not active.

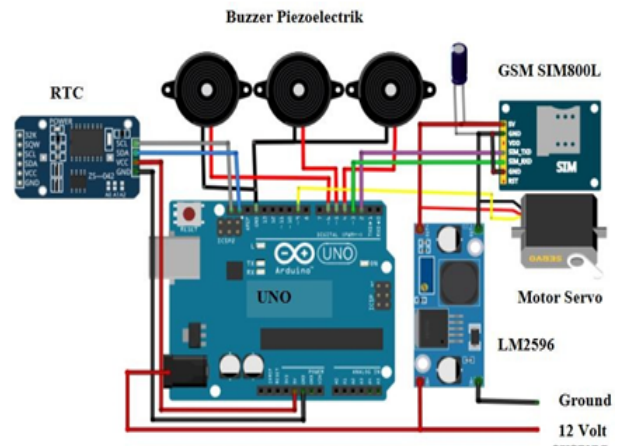


Figure 2. Electronic Circuit

III. RESULT AND DISCUSSION

Testing of fruit fly repellent with a monitoring system via SMS has been carried out. Figure 4 shows the upper part of the system, where the cover is used as a place for attaching the funnel and buzzer which is useful for making sound so that it will cause flies to be disturbed and leave. While the funnel is used as a protector from the piezoelectric buzzer so that the sound emitted sounds louder.

Figure 5 shows a picture of the system inside, this tool uses an Arduino which is on the left side of the wall of the tool, above it there is a PCB that is connected to the LM2595 circuit and has a function to lower the power supply voltage, while beside it there is a GSM SIM800L module which functions as a notification sender in the form of SMS. In addition to the GSM module, there is an RTC which serves to provide the time required for the device. Then it can be seen on the basic parts of the tool that there is a servo motor that functions as a driving force for the tool, which rotates at an angle of 60 degrees back and forth. And some bearings and shafts are useful for helping the servo motor to move more easily.

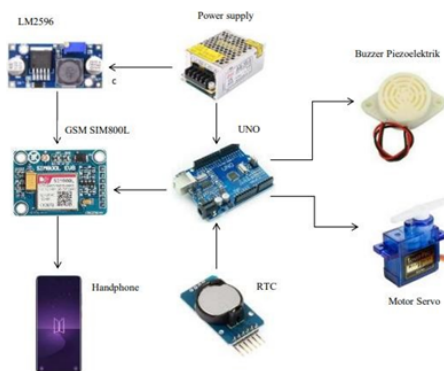


Figure 1. Block Diagram

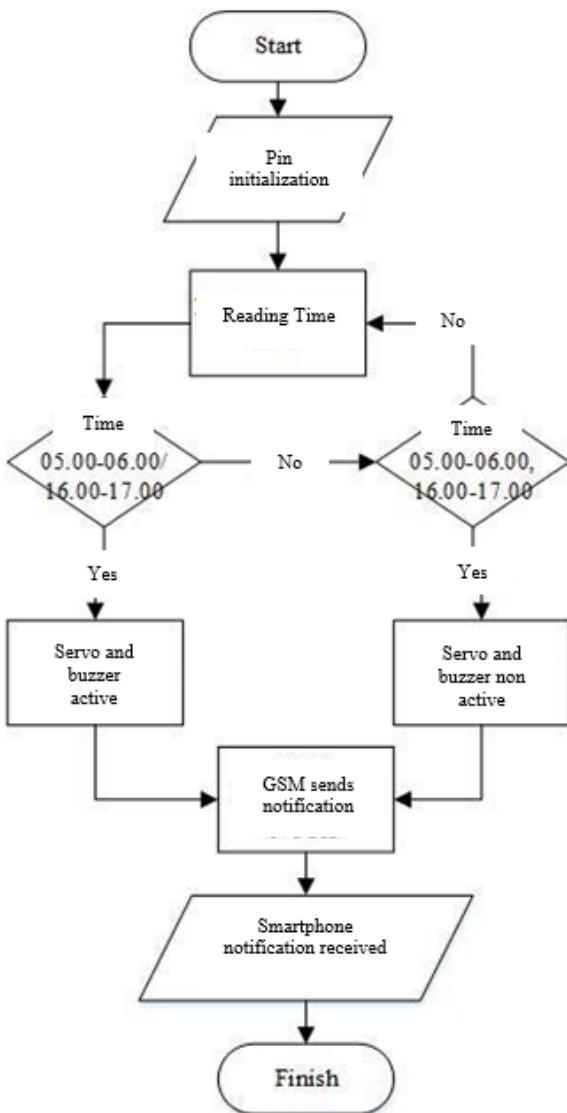


Figure 3. Flowchart



Figure 4. Hardware Result



Figure 5. System Inside

A. Testing Buzzer Sounds on Flies

This test aims to determine how effectively the piezoelectric buzzer works and how many flies are trapped in mineral bottles, with or without fruit fly repellent. Next, we will see a comparison between bottles that are placed without a repellent and those with a repellent. In this tool this piezoelectric buzzer is used as a sound transmitter whose frequency value has been changed to 30KHz which can disturb fruit flies.

Table 1. Buzzer Test Results for Flies

No	Testing Time	Buzzer Test for Flies	Trapped Flies	
			Amount	Picture
1	First day	Not using tools	Approximately 30	
2	The Second day	Not using tools	Approximately 20	
3	The Third day	Using tools	Approximately 15	
4	The fourth day	Using tools	Approximately 9	

In this buzzer test using a comparison of tools or without tools, previously that the piezoelectric buzzer had been changed the frequency value to 30KHz. As can be seen in the buzzer test, on the first day of testing, when the fruit fly trap was placed without the midges, so what happened was that in a day there were approximately 30 fruit flies trapped, this is a small number because the fruit still a few are ripe because fruit flies like fruit that will ripen. On the second day of testing, it

remained the same without using midges, so there were approximately 20 fruit flies trapped. In the third test on the fifth day, when given a pest control device, there were less than 15 trapped fruit flies. This happens because the sound from the frequency waves emitted causes fruit flies to be disturbed so that not many enter the trap, even though prior to conducting the experiment, hormone withdrawal drugs had been added first. In the fourth test, on the sixth day, the pest flies were still used and the fruit flies trapped were less than 9 fruit flies slightly less than the previous day.

B. Overall System Test

In testing the tool as a whole has a goal, namely to find out the performance of this tool can work well as expected. In testing this tool, there are several components, including a piezoelectric buzzer, GSM SIM800L Module, RTC, and a servo motor which are combined to form a tool. The first way to do this is to activate this tool by connecting it to the power supply, then the RTC is given a different test time so that it will automatically turn on the piezoelectric buzzer and the servo will also turn on and rotate for 1 hour when the tool is active, the module will turn on. GSM will send a notification in the form of SMS on the smartphone. This test is repeated at different times. The test results can be seen in Table 2.

The previous test table shows that when the time that has been inputted into the RTC is read, all tools will work. It can be explained in the first data collection, namely, when the RTC is set at 07:40:45 the servo will also be active, and the Piezoelectric buzzer will make a sound so that the tool will be inactive mode, then GSM will send SMS to smartphone users. In the second data collection, when the RTC is given a time of 09:15:42, the servo will also move back and forth accompanied by a sounding piezoelectric buzzer so that the buzzer is active and the GSM module will send an SMS to the Smartphone. In the third data collection, the RTC is given a time of 12:45:00 so that the servo will move back and forth and accompanied by a piezoelectric buzzer that makes a sound so that the buzzer is active, then the GSM module will send an SMS to the smartphone users. In the fourth test, by giving the RTC a time of 14:00:35 so that the servo will move for one hour back and forth with an angle of 60 degrees accompanied by a piezoelectric buzzer that sounds, and the

Table 2. System Test Results

No	Time	Servo	Buzzer	Description	
				Call	SMS
1	07:40:45	Enabled	Enabled	✓	✓
2	09:15:42	Enabled	Enabled	✓	✓
3	12:45:00	Enabled	Enabled	✓	✓
4	14:00:35	Enabled	Enabled	✓	X
5	16:00:15	Enabled	Enabled	✓	✓

GSM module will send a message to mobile phone users, but in this experiment, GSM is unable to send messages because the signal on the module suddenly disappears due to conditions when data collection is in heavy rain. The last data collection is when the RTC is given a time of 16:00:15 so that it will cause the servo to move back and forth for 1 hour and is accompanied by a piezoelectric buzzer that will emit a sound of 35 kHz and the GSM module will send a notification in the form of SMS to the user Smartphones.

IV. CONCLUSION

Based on the results of the tests that have been carried out, it can be concluded that:

1. Fruit flies can be expelled using ultrasonic waves with a frequency of 30 kHz. The waves are generated from piezoelectric vibrations which are arranged to have a suitable output. From the tests that have been carried out, it is found that the fruit flies that come to the bait are much reduced when the designed tool is installed. Can be seen in table 1 for more complete results.
2. This fruit fly repellent is appropriate and can work well, this can be seen in table 2, namely in the overall test where when the tool is active, the GSM module will give notification as a sign that the tool can be used. Then when the servo is given the command to rotate and work well, it is already active and when the buzzer gets a command to make a sound, the buzzer will also be active then when the two tools work, the GSM module will send a notification in the form of SMS.

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