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Monitoring System for Detecting Temperature Humidity and Automatic Lighting BSF Telegram Application

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Abstract: The life cycle of BSF to produce a good productive period, in conditions of warmer temperatures or above 30°C in these conditions adult flies become more active and productive. Likewise, the optimal temperature for larvae to grow and develop is at a temperature of 30°C, but at a temperature of 36°C, it has the effect that the pupae cannot maintain their life so that they are unable to hatch into adult flies. By monitoring the temperature and humidity in the area in the IoT-based BSF (Black Soldier Fly) fly cultivation cage which aims to monitor in real time with cellphones through the Telegram application. It is an attempt to condition the temperature and humidity conditions, which work automatically. Likewise, if there is a change in the light intensity variable, the process of maintaining the intensity value can be done automatically. By using NodeMCU 8266 as a microcontroller that has been programmed to monitor the temperature, humidity and lighting of the area in the drum, by utilizing the LDR sensor (Light Dependent Resistor) to determine the intensity value, and the DHT-22 sensor reading the temperature and humidity values of the area in the cage via placed in the cage, then the value obtained from the DHT-22 sensor and the LDR (Light Dependent Resistor) obtained will be sent to the Telegram application via NodeMCU 8266, then the humidity temperature value and the value obtained will be processed by the Microcontroller to carry out the watering process to reduce the temperature if there is an increase temperature above the specified threshold value and also lighting in the area inside the drum if the intensity value is below the threshold value. With this tool, it is hoped that it will make it easier for business actors to cultivate BSF (Black Soldier Fly) flies in terms of maintaining the temperature, humidity in the area in the cage to keep it stable and automation of lighting, using the Prototype method.

Keywords: Microcontroller, Black Soldier Fly, DHT-22 Sensor, LDR sensor, Internet Of Things, Prototype.

I. INTRODUCTION

The Black Soldier Fly (BSF) or black soldier fly (Hermetia illucens, Diptera: Stratiomyidae) is one of the most popular insects to be cultivated because of its nutrient content. This BSF maggot or caterpillar will later be used as animal and poultry feed because it has a high protein content of around 30-45% and is anti-fungal, environmentally friendly and more economical [1][2] This fly comes from America and subsequently spread to subtropical and tropical regions in the world [3]. Indonesia's tropical climate conditions are ideal for BSF cultivation. In terms of cultivation, BSF is very easy to develop on a mass production scale and does not require special equipment. The final stage of larvae (prepupa) can migrate on their own from the growth medium making it easier to harvest. In addition, this fly is not a pest fly and is not found in densely populated settlements, so it is relatively safe from a human health perspective [4][5].

Temperature is one of the factors that play a role in the BSF life cycle. Warmer temperatures or above 30°C cause adult flies to be more active and productive. The optimal temperature for larvae to grow and develop is 30°C, but at 36°C, the pupae cannot survive and are unable to hatch into adult flies. BSF larvae and pupae rearing at 27°C developed four days later than at 30°C [3]Temperature also affects the incubation period of eggs. Warm temperatures tend to trigger eggs to hatch faster than low temperatures. The intensity of light and temperature greatly affect the success of the mating activity of BSF flies [6][7]. Generally, adult flies require high light but still under intense sunlight. The minimum light intensity required for mating activity is 70 mol m-2 s-1 while the peak of mating activity occurs at lighting conditions of 100 mol m-2 s -1 or more than 200 mol m-2 s to 500 mol m-2 s -1 [8]. Therefore, to trigger BSF mating activity, artificial lighting is needed if the environment is cloudy or the lighting is lacking[9]states that the use of a 500 watt quartz-iodine lamp with a light intensity of 135 mol m-2 s-1 able to stimulate mating and egg-laying activities compared to conditions in the sun [4]. Previous studies have shown that the maintenance of BSF in a small-scale room with artificial light sources. The results will be adjusted in designing the small interior of the BSF maintenance system with further planning of the required light effects [10][11]. The highest temperature occurred around 13.00-14.00 WIB. The average daily sunlight intensity is 6069.8 lux, the fluctuation range is 4915.8-7755.8 lux, and the hourly sunshine intensity is 6158.6 lux, and the range is 436.8-13617.5 lux [12]. n general, BSF maggot breeders still use manual methods in maintaining the optimal temperature of the cage. This routine causes a problem, namely the breeder forgets to maintain the temperature in the

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cage, especially in the BSF maggot cage, causing death. Maggot BSF is very susceptible to changes in temperature and it can make Maggot BSF experience a decrease in body resistance so that it can cause death, therefore the optimal temperature for Maggot BSF is at a temperature of 30 ° – 36 ° C in the cage, the temperature is appropriate by standards required by Maggot BSF [6]. With the development of Internet Of Things technology which has a way of working[13], each object is given a unique identity (IP Address) so that it can be connected to the Internet so that it can be accessed anytime and anywhere.

Automation system or Smart system (also known as domotic) can be described as the introduction of technology in an environment to provide comfort, convenience, security, and energy efficiency for its users[14][13], With this connection, it can be collected and processed for certain purposes. Based on these problems, it is necessary to implement IOT, to monitor and control the variables of humidity, temperature and intensity which aims to help BSF maggot breeders facilitate activities in BSF maggot cultivation[9][2].

II. METHODOLOGY

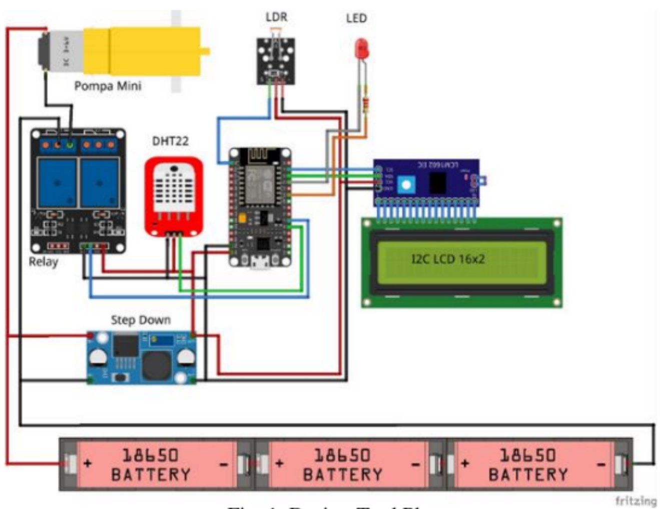

Fig. 1 Design Tool Plan

Fig. 1 is series of temperature detection systems, humidity and automatic lighting where the system works with NodeMCU 8266 as a microcontroller. NodeMCU 8266 is useful for controlling all activities that occur, starting from the initiation process to communication. This humidity and lighting temperature reduction system uses two sensors, namely the DHT22 temperature and humidity sensor which is used to detect temperature and humidity in the area inside the cage. Communication and data transfer is carried out via a WiFi network that is already connected to the NodeMCU8266 microcontroller.

In Fig II illustrates the flow for controlling temperature and humidity automatically using the DHT22 sensor. This activity starts from the temperature sensor reading the value in the area in the dark cage (insectarium) with a percentage of not more than 45℃ and the humidity in the area in the dark cage (insectarium) with a percentage of 65%RH. then the temperature and humidity values of the area in the cage are processed by the microcontroller according to what has been programmed. If the condition of the area in the dark cage (Insectarium) exceeds the programmed percentage limit, the Microcontroller will turn on the relay and then activate the water pump to immediately carry out the process of decreasing the temperature in the area in the dark cage (Insectarium) then the microcontroller will send data to Telegram.

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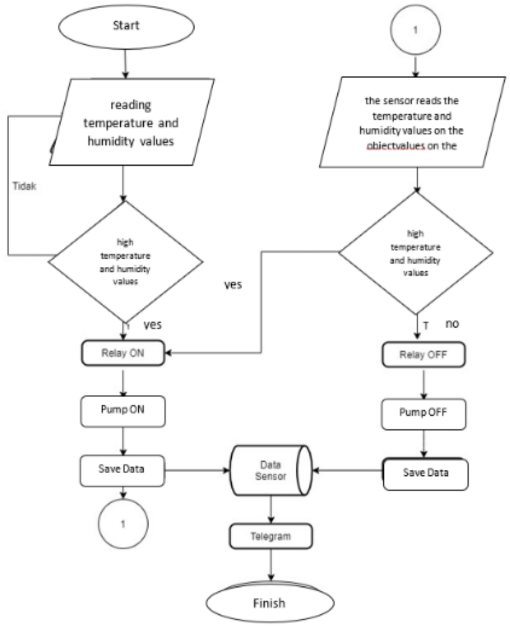

Fig. II Flow Tools

III. RESULT AND DISCUSSION

A. Design Hardware

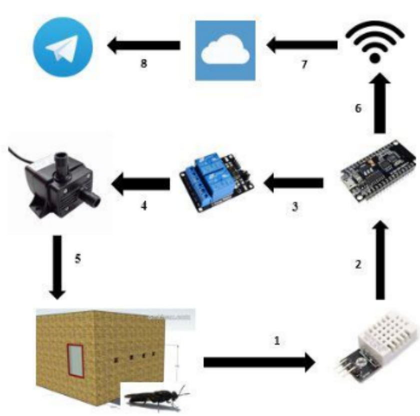

Fig. III DESIGN HARDWARE

Fig III is the process steps of the automatic humidity temperature detection system. the temperature and humidity sensor reads the temperature and humidity value of the drum, the temperature and humidity value of the cage which is read by the temperature and humidity sensor will be sent to the Microcontroller; the microcontroller receives the temperature and humidity values in the area in the cage. If the plant is in dry condition, then the Microcontroller orders the relay ON, the

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relay that receives the command from the Microcontroller will connect an electric current to immediately turn on the water pump, the water pump turns on and immediately performs watering via the Wi-Fi network. The microcontroller sends the temperature and humidity status via the WIFI network. then the temperature and humidity status is sent via Telegram. The Telegram application receives the temperature and humidity status and is then displayed in the application. Fig IV is the implementation of the tool.

Fig. IV Design Hardware

B. Testing Tool

Testing the temperature and humidity sensor is carried out to determine the status of temperature and humidity in a room sent by the room sprinkler system in accordance with predetermined coding rules, from the rules that have been made it can be seen the status of temperature and humidity based on the temperature and humidity sensor readings, in the process of testing this sensor using a temperature and humidity sensor DHT22. The results of testing the temperature and humidity sensors are shown in Table 1.

Table I shows the testing of temperature and humidity sensors on conditions in the room. In this test the sensor reads the temperature and humidity has returned to normal, this shows that the sensor has succeeded in lowering the room temperature.

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TABLE I TEMPERATURE AND HUMIDITY SENSOR TESTING

NO	High Temperature	Normal Temperature	Humidity	Spraying Time	Water discharge	Description
1.	36°C	32°C	74%	35 Second	24m^3	succeed
2.	38°C	33°C	68%	40 second	27m^3	Succeed
3.	45°C	40°C	62%	47 second	32m^3	Succeed
4.	35°C	31°C	74%	38 second	26m^3	Succeed
5.	39°C	35°C	68%	38 second	26m^3	succeed

The process of testing the use of the LDR sensor (Light Dependence Resistor), this sensor test is carried out to find out the input generated by the reading of the LDR sensor value which is read properly by the Microcontroller, then the coding rules that have been determined instruct the sensor to activate if the room is not light enough and stop automatically when the area in the cage is already get enough light. test results can be seen in Table II.

TABLE III LDR SENSOR TEST

No	Analog Sensor LDR	Light Condition	Description
1.	300 Cd	Off	Succeed
2.	893 Cd	On	Succeed
3.	143 Cd	Off	Succeed

The Test of Sending Commands and Receiving Data is a Test with a DHT-22 sensor and LDR (Light Dependent Resistor), which has been integrated with the internet and is connected via a WiFi network for data communication between NodeMCU 8266 and Telegram. Test result can be seen in Table III.

No	Number Test	Temperature Humidity and Lighting	
		Status	Sent Time
1.	Testing - 1	Delivered	16:33
2.	Testing - 2	Delivered	16:35
3.	Testing - 3	Delivered	16:37
4.	Testing - 4	Delivered	16:40
5.	Testing - 5	Delivered	16:44

The results of temperature readings on maggot live media by the DHT-22 sensor can be seen in the graph shown in Figure V.

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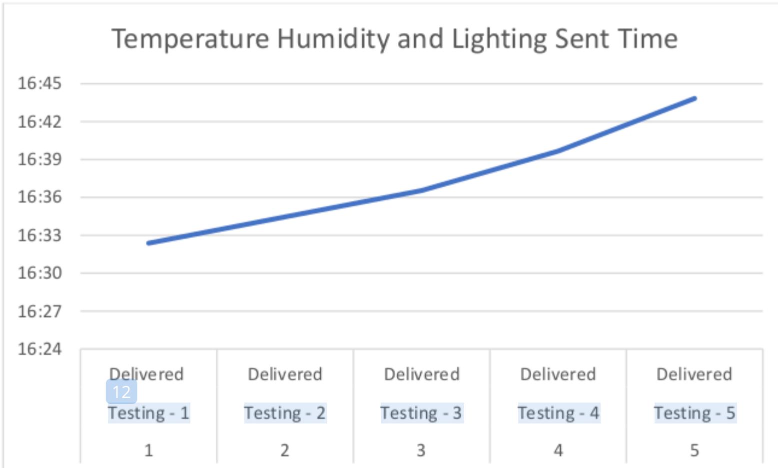

Fig. IV Design Hardware

IV. CONCLUSION

From the results of the research and implementation of a temperature, humidity and automatic lighting system that can be monitored through the telegram application described in previous chapters, the following conclusions can be drawn:

1. in the implementation stage of this automatic temperature, humidity and lighting detector, the Arduino IDE software successfully implements the tool's performance through the written source code command, so that the temperature reducing and automatic lighting device can execute all programmed commands;
2. the humidity and lighting temperature detection system can be done automatically based on the reading of the DHT-22 sensor value and the LDR (Light Dependent Resistor) sensor and can be easily monitored via the telegram application;
3. With this automatic plant sprinkler system, the author hopes to make it easier for business owners to cultivate BSF (Black Soldier Fly) flies in terms of maintaining temperature stability in the cage area..

REFERENCES

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