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Smart Event Desk with Mini Photovoltaic and Air Purifier FP-F30

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ABSTRACT

At an event booth, there will undoubtedly be many visitors who will come to see the event and go around from one Booth to another. In a situation like this, the air in the booth environment will mix with visitors, from cigarette smoke to pollution outside the booth event so the air quality will be less good. Therefore, it is necessary to *create an intelligent booth system to overcome pollution problems by equipping the Air Purifier at the event booth accompanied by lights, ultrasonic sensors, and mini photovoltaic. Mini photovoltaic serves as an alternative source of electrical power, supporting sensors such as ultrasonics to detect people around the Booth, humidity sensors, BH1750 light intensity sensors, voltage sensors, and lamps function as alternative lighting. Air Purifier will filter air pulsions around the event booth. This system works automatically, so it is more effective in its use*

Keywords: *Arduino, Air Purifier, Mini Photovoltaic, Smart Booth, Ultrasonic Sensor, BH1750 Sensor*

Introduction

Along with the rapid advancement of modern technology, the need for electrical energy is increasing, while the sources of electrical energy used still use non-renewable energy [1]. Photovoltaic is one of the new renewable energy where the energy source comes from the sun, although there are still few people who use it as a source of electrical energy. Therefore, the application of photovoltaic cells as an alternative energy source [2].

The application of photovoltaic (PV) can be used as an alternative energy source to produce electrical energy as will be studied, namely the use of event desks using photovoltaic as a backup power source and resources from PLN [3]. In this case, the event desk is usually placed at events that are full of visitors and can affect the surrounding air quality. In addition to being equipped with photovoltaic (PV), the event desk will add an air purifier to filter the air around the event desk [4]. An air purifier is clinically proven to be able to purify, and filtration of air through its HEPA (High-Efficiency Particulate Air) filter can significantly inhibit the development of viruses[5][6][6]. Air pollution occurs indoors or outdoors. An unhealthy room environment can cause indoor pollution. With the hope that this tool can be used as an intelligent event desk that can help save PLN's electricity usage while helping filter the surrounding air so that it is free from viruses and bacteria that cause disease [7].

Research Methods

The method used to solve this problem can be seen in the flowchart of figure 1.

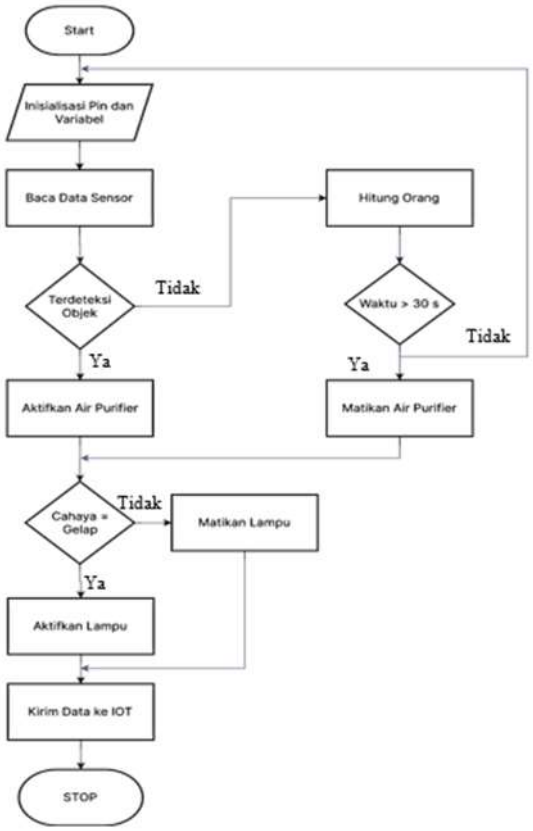

Figure 1 Flowchart system

Based on the flowchart that has been made before, the system's processes can be seen running from when the system is turned on until the cessation of system work [8]. The workings of this tool run systematically, from entering sensor data and processing to producing output. The system detects pins connected between the microcontroller and the sensors when the device is turned on. So that the data taken from the sensor as input is stored in a variable. When the HCSR 04 ultrasonic sensor detects an object/person in front of the event booth, it will send data to the microcontroller and then process it to produce output by turning on the Air Purifier. The Air cleaner will continue to turn on if an object/person passes through the ultrasonic sensor [10]. If, for 30 seconds, no one passes in front of the event booth, in other words, no object passes through the ultrasonic sensor. The microcontroller will command the relay driver so that the Air Purifier turns / off. After the Air Purifier control command, proceed to the light control system at the event booth. Like the Air Purifier, the lamp uses a relay driver as the controlling driver [11]. When the BH1750 sensor, which functions as a lighting sensor, detects that the lighting around the Booth is dark, the sensor will send data to the microcontroller then the data is processed and produce the relay driver control output so that the lights will turn on when the lighting conditions around the Booth are dark, and will turn off again when the lighting conditions are bright [12].

Here is a block diagram of systems and schematics to see the relationships related to the system shown in figure 2.

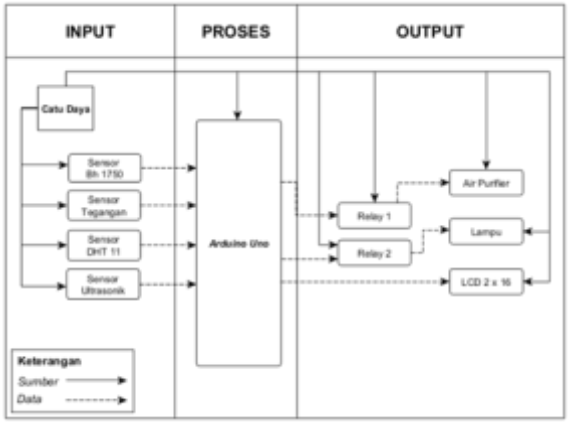

Figure 2 Block diagram system

From the block diagram above, it can be seen that this system has four sensors, one processor, and three outputs that we will do testing to finally be able to answer the problems that have occurred [13]–[17].

Results and Discussion

Network Schematic

The circuit schematic is an arrangement of wiring or wiring sensor inputs – sensors connected to the controller and from the controller connected to the output of the device. The schematic of this circuit is arranged based on the needs of electronic components used by the tools to be designed and shown in figure 3.

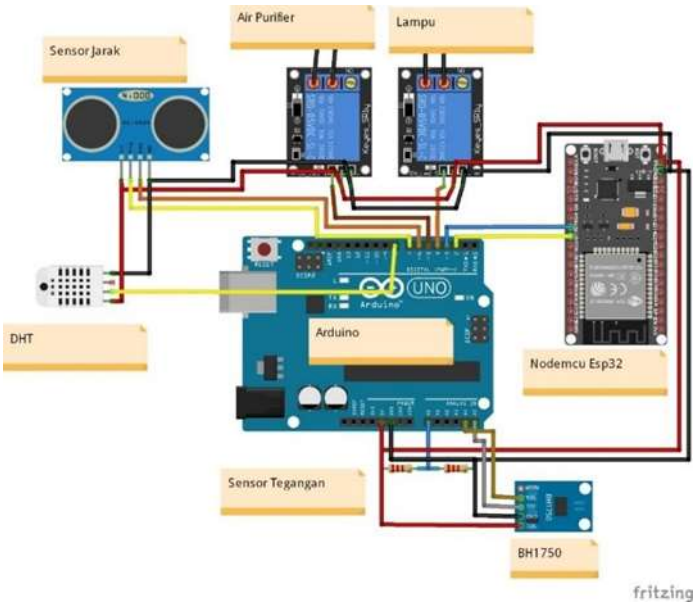

Figure 3 Circuit Schematic Design

How the Tool Works

The design of the tool "Smart Event Desk With Mini Photovoltaic and Air Purifier FP-F30" uses an automatic system and several components as support, such as sensors that function as sensors that act as senses placed on this event booth tool. The sensors used in this tool are DHT 22 sensors that serve as air humidity sensors, voltage sensors, Bh1750 sensors that can determine the amount of sunlight intensity, and ultrasonic sensors for crowd detection. At the same time, the microcontrollers used are ESP 32 and Arduino. This microcontroller functions as a controller or control system in this tool.

The way this tool works runs systematically from the process of entering data – sensor data is then processed to produce output. The system detects pins connected between the microcontroller and the sensors when the device is turned on. So that the data taken from sensors as input is stored in a variable. When the HCSR-04 ultrasonic sensor detects an object/person in front of the event booth, the ultrasonic sensor will send

data to the microcontroller and then process to produce output in the form of turning on the Air Purifier. The Air cleaner will continue to turn on if some objects/people pass through the ultrasonic sensor. If, for 30 seconds, no person passes in front of the event booth, in other words, no object passes through the ultrasonic sensor. The microcontroller will command the relay driver so that the Air Purifier turns / off. After the Air Purifier control command, proceed to the light control system at the event booth. Like the Air Purifier, the lamp uses a relay driver as a controlling driver. When the BH1750 sensor, which functions as a lighting sensor, detects that the lighting around the Booth is dark, the sensor will send data to the microcontroller then the data is processed and produce the relay driver control output so that the lights will turn on when the lighting conditions around the Booth are dark, and will turn off again when the lighting conditions are bright.

The working system of this tool is controlled and monitored using an IoT (Internet Of Things) system so that sensor data such as humidity, lighting sensors, and monitoring using applications installed into mobile phones. This booth event uses mini photovoltaics as a backup energy source. The electrical energy is stored in a battery using SCC (Solar Charge Controller) to control the electrical energy produced by mini photovoltaic derived from solar power so that it can be stored in a battery (battery). DC electrical energy produced by mini photovoltaic in the converter uses an inverter to become AC voltage to be used as an energy source to turn on lights and Air Purifier through the control system.

Proximity sensor testing

This test aims to determine the amount of error produced by the proximity sensor following the results of the difficulties that have been carried out, shown in table 1.

Table 1. Proximity sensor testing

No	Sensor Results	Readings of measuring instruments	Ket
1	.6cm	0cm	6 cm difference
2	.8cm	.8cm	No difference
3	34cm	34cm	No difference
4	27cm	27cm	No difference
5	19cm	19cm	No difference

The results obtained from 5 proximity sensor tests are excellent sensor readings where the error produced is the highest is 6 cm because the sensor is too ticking. At the same time, for other distances, all are pretty precise.

Light sensor testing

In this test, prepare a light measuring instrument that we will use to reference the fair value, then put it in place with enough light and run the system. The following are the results of the appropriate sensor test

Table 2. Light sensor test results

No	Sensor Results	Readings of measuring instruments	Ket
1	3.33 LX	3 LX	Difference 0.33 lx
2	28.33 LX	26 LX	Difference 2.33 lx
3	441.67 LX	468 LX	Difference 26.33 lx
4	235.83 LX	214 LX	Difference 21.83 lx

From the results above, it can be concluded that the tool has difference from the highest measuring instrument is 26 lx when the light is high, the error is also high

Temperature Sensor Testing

In this test, a tool is needed that can measure air temperature. In this test, the author uses two types of measuring devices. The following are the results of the reduction that the author has done.

Table 3. Temperature sensor test results

No	Sensor Results	Readings of measuring instruments	Ket
1	32 ºC	30.9 ºC	Difference 1.1 ºc
2	33 ºC	32 ºC	1 ºC difference
3	33 ºC	33 ºC	No difference
4	32 ºC	31 ºC	1 ºC difference

After conducting experiments in obtaining the alliance results of the highest measuring instrument is 1.1 ºC and the smallest is the same or no difference from here means that the sensor can work properly.

System-wide testing
After conducting experiments from each sensor currently testing all systems to determine whether the system can work properly, several experimental scenarios follow the table of experimental results run.

Table 4 System-wide testing

Light	Distance	Temperature	Lamp	Purifire
124 LX	31 ºC	10 CM	OFF	ON
20 LX	31 ºC	10 CM	ON	ON
20 LX	31 ºC	60 CM	ON	OFF
534 LX	33 ºC	100 CM	OFF	OFF
214 LX	33 ºC	29 CM	OFF	ON

From testing the system above, it can be concluded that it has worked well. When the light is less than 50 lx, the lights will turn on, and then when the distance is detected to be less than 30 cm, the system will activate the air purifier. After surviving 30 seconds from testing, everything was done and succeeded according to the program that had been made.

Analysis
From the results of measurements, calculations, and tests that have been carried out, the analysis of the following results is obtained:

1. The transformer output voltage obtained from the measurement results is 12.22 V. The voltage is still within its tolerance. The transformer output voltage is influenced by the number of windings in the transformer and the transformer input voltage.
2. From the measurements and calculations in this design, satisfying results are obtained where the error percentage is still below 2%, meaning the results are promising.
3. Proximity sensor testing is quite good, almost 90% accurate for sensor detection. The sensor difference is only 1 – 2 cm, which has little effect on the system.
4. If the sensor is closed or less than 2cm, then its value will not be accurate anymore
5. Likewise, the light sensor has a significant enough error of up to 26 lx but does not affect the system's work, which only needs data when this is in fair or dark conditions; if it is dark, it will activate the backup light.
6. The temperature sensor works well, having an error of 1 – 2 ºC.
7. When someone passes by the Booth, the system immediately activates the air purifier.
8. When it detects dark to light, the system automatically activates it, which will be exciting when used daily.

Conclusion

From the measurements and calculations carried out in this design, satisfactory results were obtained because all error percentages were below 2%. The bh-1750 light sensor has a relatively high error of 26 lx, but the sensor can be used for cases that do not require precision. The dht11 temperature sensor works well and has an error of 1 ºC. The system works well and can activate the lights and cleaner to the instructions that have been designed before.

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