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ARDUINO-BASED HUMAN SENSOR FAN ASSEMBLY AIMED TO SAVE ENERGY

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ABSTRACT

This research aims to develop an Arduino-based fan with a motion sensor that can detect the presence of people around it. Fans are often used to provide thermal comfort, but fans often work continuously without considering the presence of people in the room, resulting in wasted energy. In this research, an occupancy sensor is used to detect the presence of a person near the fan, and Arduino controls the fan speed based on this data. Experimental methods are used to test system performance that optimizes energy consumption and provides comfort to users. The research results show that an Arduino-based fan with an occupancy sensor can significantly reduce energy consumption and improve user experience by providing a fan that operates automatically based on demand. This research has the potential to reduce environmental impacts and energy costs while providing a solution for using fans that are more efficient and comfortable.

Keywords: *Fan, movement, human sensors, Arduino, human performance.*

INTRODUCTION

The use of indoor fans is commonly used to regulate temperature and increase the comfort of room occupants. However, traditional fans often operate independently without anyone present in the room, resulting in significant energy waste. Fans that cannot adapt to the presence of people can cause unnecessary movement and increased energy consumption. Increasing awareness of energy and environmental issues has increased the need to develop more efficient technology in the use of everyday electronic devices, including fans. Operation is done manually by pulling and lowering the operating lever. The fan operating system is inconvenient for humans and causes wasted power consumption. The fan continues to operate even if there are no users in the fan air circulation area. If the fan works from the left, center, and right even though the user is only on the left and center, then it is useless if the fan blows to the right if there is no user. Even if you forget to turn off the fan, it will still be on. Economically, fan systems also produce waste. Therefore, developing a fan with an ultrasonic sensor is an attractive solution, and ultrasonic sensors such as motion sensors can detect the presence of people near the fan. Using this information, you can set the fan to run automatically

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when someone is in the room and stop or reduce its speed when the room is empty (Anugrah & Jaya, 2019).

PrototypeThis human sensor fan can be developed using air conditioning which can be implemented by companies as an effort to support productivity. A hot and uncomfortable room will cause stress for employees. In companies that experience a decline in productivity, one of the causes is the level of stress in employees (Abdul Rahman & Habib Galih Siswoyo, 2023). According to (Paduloh & Purba, 2020) Productivity is an important factor that must be maintained by companies in carrying out the production process. Apart from that, according to(Intani, 2017)Productivity can be used as a measure of the success of an industry in producing products. This not only reduces wasteful energy consumption but also provides a more comfortable experience for users. Increasing electrical energy can be an indicator of increasing societal progress. However, excessive use of electricity can have a negative impact on us individually or on local communities(Harahap et al., 2019). Therefore, research and development of motion sensor fans using Arduino is a step forward in utilizing this technology to create indoor temperature control solutions that are more efficient, energy efficient, and environmentally friendly. This research aims to harness the potential of occupancy sensors and automation technology to bridge the gap between user comfort and energy sustainability. One user summarized the following statement: The use of indoor fans is a commonly used method to regulate temperature and increase the comfort of indoor occupants. However, traditional fans often operate without considering the presence of people in the room, which can waste a lot of energy. If the fan cannot adapt to the presence of people, unnecessary movement and high energy consumption can result. Increasing awareness of energy and environmental issues has increased the need to develop more efficient and environmentally friendly technology in the use of everyday electronic devices such as fans. Therefore, developing a fan with a presence sensor is an attractive solution.

Therefore, research and development of motion sensing fans using Arduino is a step forward in utilizing this technology to create indoor temperature control solutions that are more efficient, energy efficient, and environmentally friendly. This research aims to harness the potential of occupancy sensors and automation technology to bridge the gap between user comfort and energy sustainability.

Formulation of the problem

1. How to integrate a human sensor into a fan using Arduino to detect human presence in a room effectively?
2. How to test the performance of a human sensor fan that has been developed in various room situations and over a sufficient period of time, and analyze its impact on energy consumption and user experience compared to conventional fans?

RESEARCH METHODS

The methodology used in this project goes through several stages, including system design, manufacturing and testing. The project flow is as follows:

Electrical energy

House ladders need energy and electricity. Almost all activities may need energy. Shortage of energy electricity can bother activity human. Home ladders generally use more Lots of electricity. Two factors That influence the consumption of electricity in A House are the type of equipment And the amount of equipment used by residents' buildings. Because of That, availability And continuity energy

must still guarded. The need for electricity in Indonesia the more increasing along with the growth amount residents And progress in technology And information (Syam et al., 2022).

Fan

Fan wind is the Wrong One tool Which produces wind. The function of general fan wind is To cool, refresh, give ventilation (exhaust fans), And dry air (usually with component producer hot). A mechanism fan is something tool That changes energy electricity becomes energy kinetic. He uses motorcycle electricity Which changes energy electricity become energy kinetic. Motorcycle electricity This has coil iron Which moves And pairs magnet U on part anyway. When current flows through coil wire in coil iron, the process changes coil iron becomes a magnet. (Nadiansyah, 2018).

Arduino Uno

Arduino is kind of board circuit Which containing a microcontroller. With say other Arduino Also Can be called as board microcontroller. Wrong One board Arduino Which most famous is Arduino Uno. Board microcontroller This size card credit And own set pin Which used For communicate with device other(Barus et al., 2018). Simply connect the Arduino to your PC with a USB cable and run the Arduino software to program the ATmega328 chip. The Arduino Uno may be called an Arduino, but it is an electronics board with an ATmega328 microcontroller (So seeni et al., 2020). The Arduino UNO has 14 Input/Output pins (6 of which can be used as PWM outputs), a USB connection, six analog inputs, a 16MHz oscillator, an ICSP header, a power jack, and a reset button.(Paduloh & Muhendra, 2022).

SRF05 Ultrasonic Sensor

The SRF05 ultrasonic sensor is a sensor for the transmitter and receiver to record the reflection distance. The SRF05 ultrasonic sensor is an ultrasonic sensor that can measure distances from 3cm to 300cm. During the development of the parking guidance system prototype, the ultrasonic sensor acted as a distance sensor between the vehicle and other objects(Pindrayana et al., 2018). Ultrasonic sensors are sensors that utilize the working principle of ultrasonic waves. Ultrasonic sensors produce radio frequencies and receive echo (reflected) waves. This allows the sensor to calculate the time interval between transmission and reception of waves to determine the distance of an object.(Qomarrullah et al., 2016).

Relays

A relay is an electrically operated switch consisting of an electromagnet (coil) and a mechanical component (a pair of switch contacts), possible current small bring current on voltage more tall.(Kasrani & Widyanto, 2016). IC LM2596 is an integrated circuit that functions as a step-down DC converter. This IC series has many variations and can be divided into two groups: fixed voltage output versions or fixed variations and adjustable variations with adjustable output voltage. The LM2596 buck has advantages over resistor-based bucks. The advantage is that the output voltage is stable (does not change) even though the input voltage fluctuates(-Alfariski et al., 2022).

Jumper cables

Jumper cables are electrical cables used to connect components. Jumper cables usually have connectors or pins at each end to be connected male to male or female to female. (Fathulrohman & Asep Saepuloh, ST., 2018).

Research Stage

This research aims to describe or describe a situation clearly and in detail regarding the object under study. A research must be carried out systematically. Research methods must be explained so that the thinking framework and research direction can be understood. The research steps are depicted on a flow graph, namely a flowchart. The flowchart will describe the research from start to finish and the process carried out at each step. The research flowchart can be seen in Figure 1

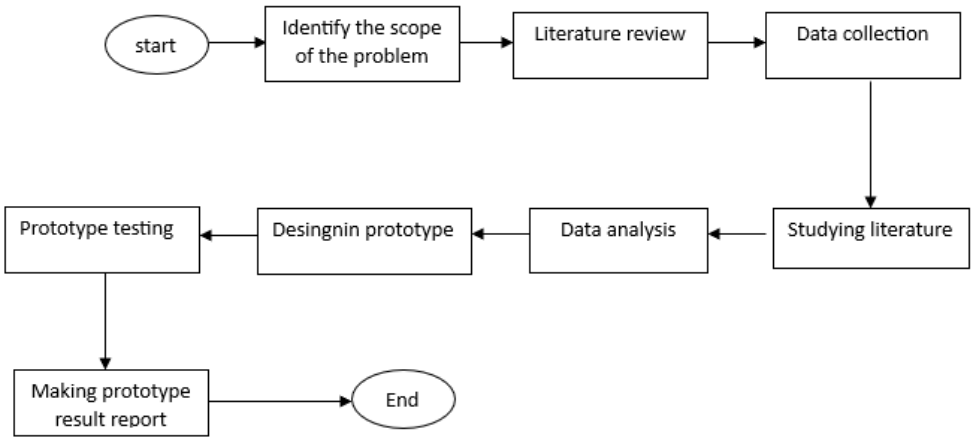

Figure 1 Prototype method flowchart

The research process begins with studying the literature and identifying the scope of the problem. Researchers study literature relevant to the problem to be researched to understand the problem in more depth. After understanding the problem, the researcher identifies the scope of the problem to be studied. The scope of this problem will determine the scope of the research to be carried out. The data that has been collected is then analyzed to answer research questions. This data analysis can be carried out using various methods, depending on the type of data and research objectives. After the data was analyzed, the researcher designed a prototype based on the results of the data analysis. This prototype can be a new product, service or system.

PRODUCT DESIGN

According to(Wiraghani & Prasnowo, 2017) Design is something activity That starts with idea innovative or ability create something work Which can represent the request market in a way accurate based on study And development technology. This product design is the first stage Of planning need a system product Which related to the diagram component. The installation done with connect cable jumper on Arduino, relays And sensors ultrasonic.

SYSTEM PROGRAMING

This is the stage for planning the control that will be created, namely by entering coding into the Arduino.

```
const int trigPin = 11;

const int echoPin = 10;

long duration;
int distance;

void setup() {
pinMode (2,OUTPUT);
pinMode (trigPin,OUTPUT);
pinMode (echoPin,INPUT);
Serial.begin(10000);
}
void loop() {

digitalWrite(trigPin,LOW);
delayMicroseconds (2);

digitalWrite(trigPin,HIGH);
delayMicroseconds (100
);
digitalWrite(trigPin,LOW);

duration = pulseIn(echoPin,HIGH);
digitalWrite(trigPin,HIGH);

distance = duration*0.034/2;

Serial.print("Distance:");
Serial.println(distance);

if (distance <=500)
{
digitalWrite(2,HIGH);
delay(500);
}
else
{
digitalWrite(2,LOW);
delay(500);
}
```

Figure 2 Data programing

WORK EFFECTIVENESS TEST

This stage is the final stage, namely product testing, by testing the product to maximize the response from the motion sensor and relay which automatically cuts off the electric current if the sensor detects movement.

Table and Figure

The following is data from experiments on an automatic fan. We tested it seven times at different distances and at different times. Of the seven trials, all of them were successful, which means that the automatic fan prototype was made successfully.

Tabel 2. 1 Test result data

Percobaan	Waktu	Jarak Benda	Hasil
1	10.00	10 cm	Menyala

2	10.30	15 cm	Menyala
3	11.00	20 cm	Menyala
4	11.45	50 cm	Menyala
5	12.15	70 cm	Menyala
6	12.50	100 cm	Menyala
7	13.20	150 cm	Menyala

DISCUSSION
Arduino circuit

Figure 3 Prototype assembly

The jumper cable is plugged into the middle socket then the male jumper cable is inserted by the Arduino into the first GND socket then the next jumper cable is plugged into the right socket relay then the second jumper cable is inserted into the 5 volt socket, after the jumper cable is inserted into the ultrasonic then the cable The male is inserted into the GND socket, the jumper cable is then inserted into number 10, after the jumper cable is inserted into the ultrasonic socket then the male cable is inserted into socket 11 on the Arduino, after the jumper cable is inserted into the relay then the male cable is inserted into socket number 2 on Arduino.

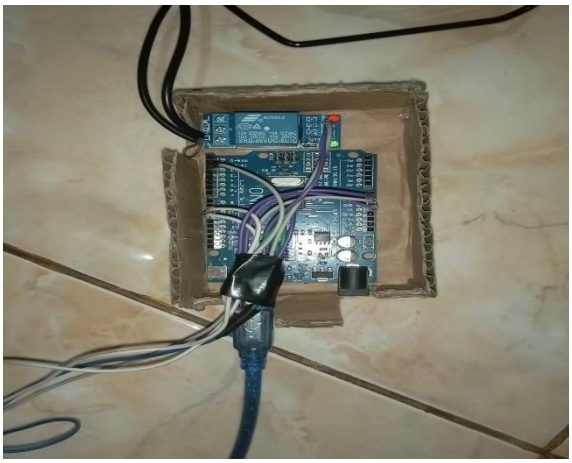

Figure 4 Prototype assembly

Prepare the relay then insert the jumper cable into the second socket, then connect it to the Arduino, then attach the jumper cable to the relay in the first socket, then insert the jumper cable into the third socket.

Figure 5 Prototype assembly

The jumper cable from the relay to the Arduino is in parallel then inserted into the first socket, then the jumper cable is inserted into the fourth socket after the jumper cable is inserted into the Arduino socket, after the next cable has been inserted into the Arduino then the female cable is inserted into the third ultrasonic socket, The cable is then inserted into the second socket.

DISCUSSION RESULT

Figure 6 Prototype assembly

The following are the results of assembling the motion sensor fan and testing it, by providing body movement or placing an object in front of the motion sensor. If the sensor that has been installed on the fan detects an object, the sensor will automatically give a signal to the Arduino to connect the current to the relay.

Figure 7 Assembly results

After testing by placing an object in front of the motion sensor, you can find out whether the programming on the Arduino Uno is working well. If the sensor connected to the Arduino with a fan is working well, the sensor will detect it and the fan will turn on.

CONCLUSION

The design of a human motion sensor fan prototype based on Arduino resulted in the conclusion that humans can reduce energy consumption by integrating the fan and Arduino. If this prototype is developed it will be able to be implemented in a company. It is important to test the performance of motion sensing fans in a variety of spatial situations and over long enough periods of time. This testing process should include an analysis of energy consumption and its impact on user experience. The test results provide insight into the efficiency of fans with occupancy sensors in increasing user comfort and optimizing energy consumption compared to traditional fans. In this way, technological developments can be promoted with the aim of more accuracy and maximum benefits in everyday use.

SUGGESTION

To consider several things in testing the performance of a human sensor fan:

1. Sufficient Testing Duration:
   Extend the test duration to gain a better understanding of long-term performance. This allows identification of potential issues or changes in performance over time.
2. Energy Consumption Monitoring
   During testing, continuously monitor energy consumption. Thus, it can be evaluated to what extent the human sensor fan can optimize energy use compared to conventional models.
3. User Experience Data Collection
   Include direct data collection from users regarding their experience using human sensor fans. Consider aspects such as comfort, noise level and ease of use.
4. Comparison with Conventional Fans
   Do a comprehensive comparison between human sensor fans and conventional fans. Focus on aspects of performance, energy efficiency, and user experience to evaluate the advantages of new technologies.

By taking these suggestions into account, testing human sensor fans can provide more in-depth and relevant results for the development of better technology.

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