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ENERGY CONSERVATION USING PIR SENSORS

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ABSTRACT

The innovation addresses the conservation of energy using passive infrared sensors. Energy conservation has a pivotal role in sustainable development of resources. With the pace of growth of technology and electrical dependent gadgets increasing at an alarming rate, it is of utmost importance in today's world. This project aims to design a product that controls wastage and depletion of electrical energy. The product is designed to automate switching in and off of appliances. This product can be implemented in classrooms, study halls and seminar halls.This product has passive infrared sensors that sense the presence of humans and detect general movement. These sensors are connected to an Arduino board which is programmed to automate the electrical appliances in the absence and presence of humans within a period of time. Thereby it conserves electrical energy.

Keywords: Arduino UNO, Conservation, Electric energy, IoT, Modules, PIR sensors.

Introduction

The PIR sensors are placed in such a way that it covers the space to be monitored. The sensors cover the destined area and send the signal to the Arduino board which is programmed to switch off the appliances if none of the sensors around the focus area senses the presence of humans. The sensors overall are connected to the main supply through a Relay to maintain the voltage to prevent short circuiting.

Energy Conservation

Energy conservation using PIR sensors. Energy conservation is as important as its production and management. Wastage of energy is one of the concerning problems in today's world. Electricity is generated through so many means but all of those means when pushed to an extent are harmful to our planet and drain the other renewable energy sources in the process of its making, hence it is important that electricity is conserved even though it seems like abundant energy.[3] It starts with us acting upon it and helping create a sustainable future. Thus, the idea to implement in our surroundings by doing the bare minimum required from humanity.

IOT

The Internet of things is of great help in assisting humans. It increases efficiency and decreases the need for human assistance and helps us in real time. This helps connect various physical objects in this case sensors, connect through networks and share data to produce the desired result. IoT can be implemented in the concept of energy conservation.[2] The Passive infrared sensors form a network of its own and when connected to the Arduino board which is programmed, it therefore becomes an IoT device.

Energy Conservation and IOT

The Internet of things is efficient and as mentioned earlier it decreases the need of human assistance, which means it's less mistake prone and not likely to be faulty. IoT is a perfect fit when it comes to directing things and objects to perform its work in its loop. Energy wastage mostly occurs because of carelessness and the human nature of being absent minded in the case of household electricity waste, on a large scale the cause is different, and the solution needs to be large scale.[3][4] IoT devices when programmed tend to do their work in their routine unless disturbed by external causes or at times internal causes too. So, to replace the work of humans and not rely on their actions. In their stead IoT is implemented to switch off and on the appliances in the absence and presence of humans.

Overview of the Project

IoT based energy conservation using PIR sensors. The concept revolves around the functioning of the PIR sensors and that of the Arduino UNO board. The PIR sensors using the infrared rays emitted from the human body senses the presence or absence and send signals to the Arduino UNO in digital form. The board is programmed for the appliances in the monitored area to stay in its running state if the digital output from all the sensors or anyone of the sensor is high. And only if all the sensors send a low digital input the appliances turn off. DC step down converter is placed in between the sensors and the board to reduce the voltage supply to prevent a meltdown. The Arduino board is protected with a relay module shield to do the same. The sensors are coupled together in modules.

Components and Modules

PIR Sensors
Arduino UNO

Jumper wires

12V to 5V 1Amp DC step down converter circuit board

Generic 5V 10A Channel relay module shield

8 Channel Multi port power supply

ABS boxes

Software - Arduino IDE

PIR Sensors

- IR detectors in general descry the IR radiation emitted from an object.
- Passive infrared detectors use a brace of pyroelectric detectors to descry heat energy in the girding terrain. They work entirely by detecting IR emitted by or reflected from objects.[6]
- It has two modes H and I. They separate the working of detectors by its working mode i.e., the functioning of detectors and its active time.
- It has perceptivity control and off time control to acclimate its perceptivity and the break time.
- The term unresistant refers to the fact that PIR doesn't radiate energy for discovery purposes, unlike active infrared detectors. They've a discovery range of 25m.

Arduino UNO and Arduino IDE

Arduino is an open-source electronics platform, easy-to-use software.

The Arduino board receives signals from the sensor.

Arduino boards can read inputs – light from a sensor, a finger on a button and turn it into an output – cranking a motor, turning on an LED.

Arduino IDE platform allows us to program the board to our requirements. It can be run in online or offline mode.

Arduino IDE allows you to work in real-time.

Arduino IDE can be downloaded from Arduino's main website. It is compatible with Linux, Windows and MAC OS.[5]

System implementation

Sensor module

The product is complete with modules of sensors. Five sensors are placed inside a module. All the wires from the Vcc pin of the PIR sensors are soldered together. And similarly, the ground wires of the PIR sensors are soldered together with a ground from the Arduino UNO board.[1] The five wires from the High/Low output are left undisturbed and they flow out of the sensor module to the module with Arduino.

DC step down converter

A DC step down converter circuit board is placed in the sensor modules. The soldered wires from the Vcc and the ground are connected to the 5V side of the DC step down converter circuit board. The wires from Vcc are connected to the positive (OUT +ve) terminal of the DC converter. Similarly, the ground wires are connected to the negative terminal.

Relay

The Relay is placed in the Arduino module along with Arduino UNO. The output wires from the sensor module are connected to the Arduino UNO digital I/O pins. The ground of the relay is connected to the ground of the UNO board. The input channel wire from the relay is connected to one of the Arduino UNO digital I/O pins. The Vcc of the relay is connected to the 5V power pin of the Arduino. A pair of input output wires of the electrical appliances should be connected to the relay.

8-Channel multi-port power supply

The 12V side of the DC step down converter circuit board is connected to a 8 channel multi-port power supply. The positive terminal of the 12V side of the converter is connected to the positive terminal of the power supply and the negative terminal of the converter is connected to the negative terminal of the power source.

The power supply itself is to be connected to the main power supply of the desired room.

Hardware diagrams

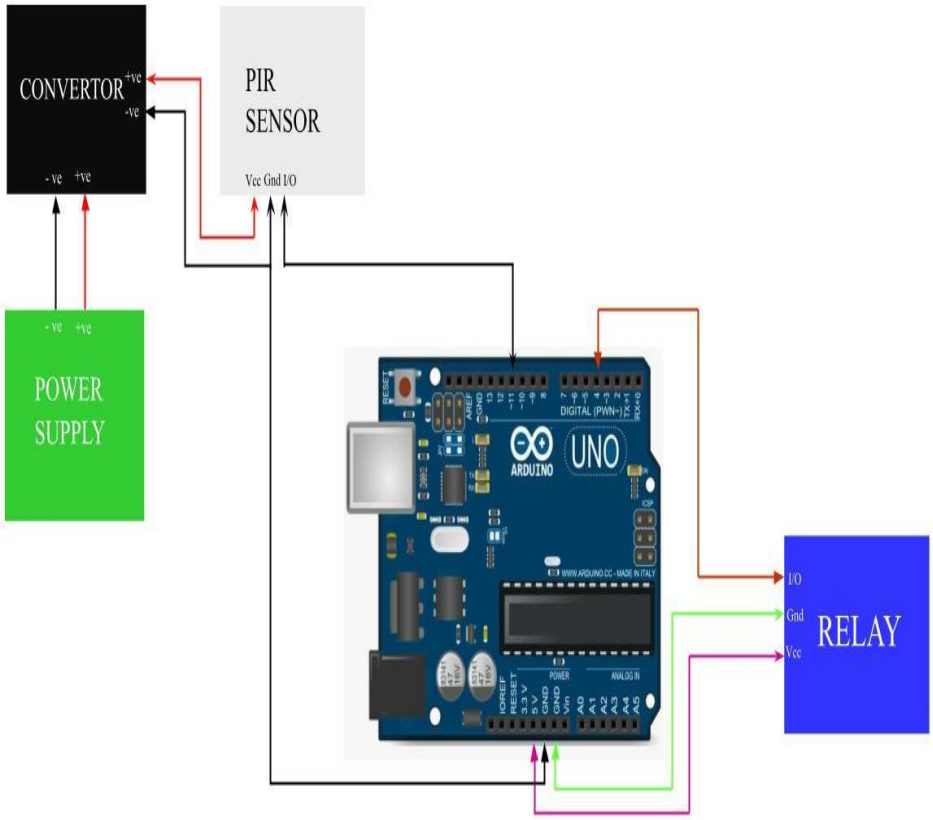


Figure 1 – Circuit connection of the modules and components.

Code Workflow

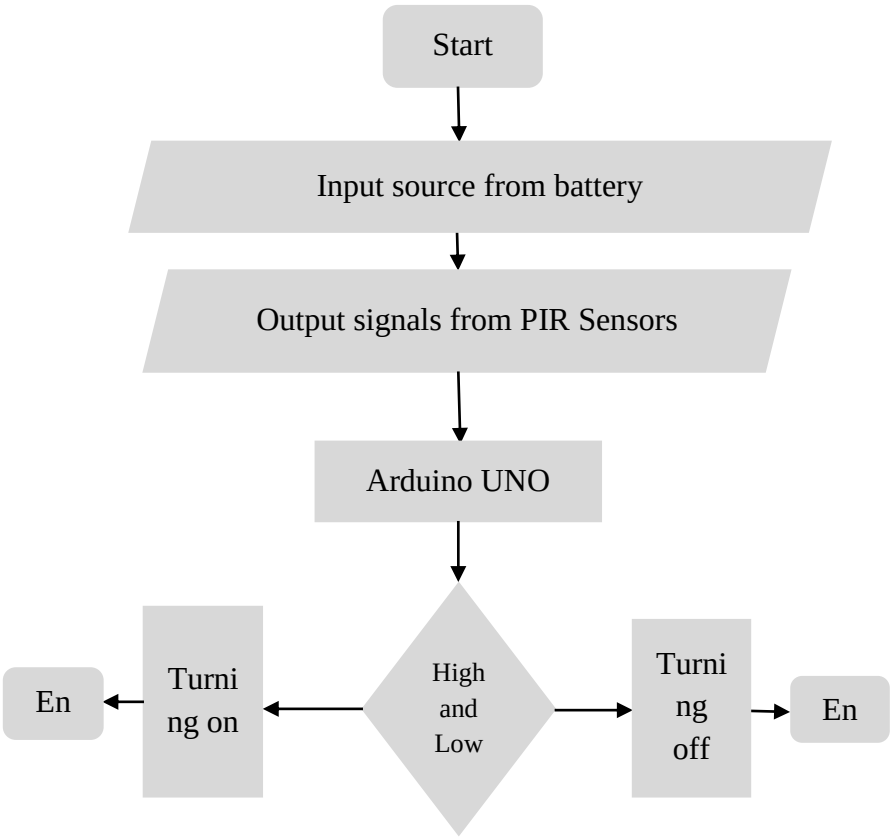


Figure 2 – Flowchart representation of working of the system.

System Design Algorithm

1. Open Arduino IDE.
2. Open New Project.
3. Declare integer variables.
4. The sensors is stored in these integer variables pirSensor_1, namely.
5. The value from These variables get their values using the read statement digitalRead(), as the value from the sensor is in the form of 0s and 1s i.e., either high or low.
6. A loop is defined for the functioning of the concept.
7. Else if condition statement is used, if all the sensors give out 1s i.e., high value the output signal is also 1 i.e., high, else if all the sensors give out 0s i.e., low the output signal is also 0 i.e., low else in case of any other signals i.e., some with 0s and some with 1s or another possibility also means the output signal is 1 i.e., high.
8. So, in real time this program commands the appliances to be switched on if any of the sensors senses a signal and to be switched off only if none of the sensors sense anything.
9. Save and upload the program to the Arduino UNO board.

Run the program.

Procedure

The PIR sensors detect the heat energy radiated from any matter i.e., infrared ray emission.[6] The sensor has an I/O pin and a ground pin. The input pin takes volts for its functioning, the output pin is for the transmission of signals detected and the ground pin to prevent power outburst.

The input to the sensors is through an 8 Multi channel power supply.

The input wires of all the sensors in a module are connected and sent through the DC converter and so are the ground wires. The output wires come out of the module without the connection of a converter. They are connected to the Arduino UNO board.

The Arduino UNO board has 16 I/O pins and the output from the sensors are fed as input to the Arduino board.

The Arduino has a Barrel jack which allows us to connect to our system and upload the program to make the sensors function in the desired manner.

The GND pin in the Arduino board is also connected to the power supply. This pin is used for grounding the circuit.

The Arduino has a relay shield for its protection from short circuiting or power outburst.

Through the Arduino Output pins a connection is established to the power supply to the electrical appliances, as in it turns on or off them.

Code

```
int pirSensor_1
int pirSensor_2
int pirSensor_3
int pirSensor_4
int pirSensor_5
int led
void setup() {
  pinMode(pirSensor_1, INPUT);
  pinMode(pirSensor_2, INPUT);
  pinMode(pirSensor_3, INPUT);
  pinMode(pirSensor_4, INPUT);
  pinMode(pirSensor_5, INPUT);
  pinMode(led, OUTPUT);
  Serial.begin(9600);
}
void loop() {
  int sensorValue1 = digitalRead(pirSensor_1);
  int sensorValue2 = digitalRead(pirSensor_2);
  int sensorValue3 = digitalRead(pirSensor_3);
  int sensorValue4 = digitalRead(pirSensor_4);
  int sensorValue5 = digitalRead(pirSensor_5);
  if (sensorValue1 == 1 && sensorValue2 == 1 && sensorValue3 == 1 && sensorValue4 == 1
&& sensorValue5 == 1)
  {
    digitalWrite(led,HIGH);
  }
  else if (sensorValue1 == 0 && sensorValue2 == 0 && sensorValue3 == 0 && sensorValue4 == 0 &&
sensorValue5 == 0)
  {
    digitalWrite(led,LOW);
  }
```

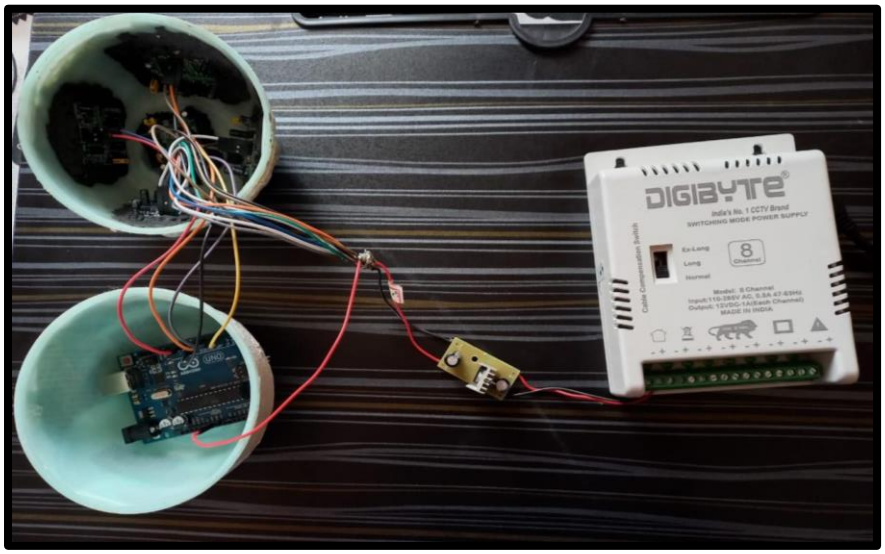
```
  else
  {
    digitalWrite(led,HIGH);
  }
  delay(1);
}
```

CONCLUSION AND FUTURE ENHANCEMENT

Thus, this product has been successfully created and implemented. The product works as expected. It successfully controls the supply of electrical energy to the desired appliances. The product has accomplished and serves its purpose of conserving electrical energy using PIR sensors with help the Arduino UNO. Thereby providing a time and cost-efficient solution to address the problem of conserving energy. Also, the project results in a IoT based product.

The product developed can be updated and modeled in such a way that it has complete control over the switching on and off appliances thereby overriding the control of manual switches. It can also be updated so that it can have control over more sophisticated appliances. With high involvement of IoT it can be automated to control the range of working too.

FIGURES



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