Smart Lights

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Abstract

Smart light is one of the best possible ways to save electricity wasted due to the unnecessary use of street lights at night when there is no passage of vehicles at night on the streets. Smart street lights are being installed as a solution to this problem, which turns on only when there is a passage of vehicles or trespassers. This can be done by installing sensors that would be programmed so that when they sense any vehicle or trespasser, the street lights will be turned on simultaneously. Moreover, the smart light system in this paper behaves like usual street lights that turn on all night. The ideal behaviour of the smart street light system is that no one needs to the turn-off of street lights at night. Whenever someone sees street lights, they turn them on, and whenever no one sees street lights at night, they turn them off. The smart street light system consists of LED lights, brightness sensors and motion sensors. The light turns on before pedestrians and vehicles come and turn off or reduce brightness when there is no one. It will be difficult for pedestrians and vehicles to distinguish our smart street lights and the conventional street lights because our streetlights all turn on before they come.

Keywords: - *Arduino UNO, PIR Sensor, Automatic Control, Accelerated Use of LED Lights, LDR Sensors, Central Monitoring Station, and Interconnecting Cables*

INTRODUCTION

Lights have always been the fundamental necessity, whether in rural or urban areas, used since the 18th century. It has also been used as an alternative during nighttime and during bad weather conditions for safety purposes. All these lights were continuously being operated manually. Still, in this modern era where everyone is turning towards Eco-friendly systems, it is essential to turn towards the same for lights too as they are being used daily and are a massive part of our power consumption system. It was a simple task to manage and control them back in those days, but the increasing demand and installation of them in every lane has made its management difficult. This project can be considered an initiative towards decreasing the wastage of electricity being done on empty roads at night when there is no necessity.

The government can adopt this whole system for their street lights and by housing or co-operative

societies who can install these lights there, which means that it can be used commercially or personally.

This system works on a simple phenomenon, i.e., when there is any movement sensed near the lights, the sensor sends the acknowledgement of a movement near it, and the system turns on the lights connected to that sensor.

The project comprises two main modules, i.e. the Adruino Uno and PIR sensors. The Arduino would be programmed so that whenever the PIR sensor sends a signal to it, it will send supply to the light, and it will be turned on. In this way, it will only light up when there's someone around, and on an empty street, it will be kept turned off or at a low frequency.

Our main purpose in proposing the system is to provide a convenient environment for pedestrians, drivers, cyclists, etc., to have a better sight during the night by lighting up the lights when they are around and saving the electricity when no one is around.

OBJECTIVE AND SCOPE OF THE STUDY

This study aims to develop an environment that is no different from the current scenario except the fact that it works only when someone's around and consumes electricity. It would be not consuming any excess of it when not in use(i.e. when no one is around). It reduces electricity consumption, and automatic control of the lights when the environment gets darker are the critical features of this project.

In concluding this study, it can be stated that this project, if implemented in real life, would be a great thing to work with as it is an efficient project which saves electricity, which requires no manual control and once installed, is of no worries if it is being serviced regularly. It can be stated that this is relatively cost-efficient as a one-time investment that is also not high.

If this implementation is successful, a further upgrade can be added by converting the power supply to solar power. The lights would be in the daylight (i.e. the sun) for the maximum time, giving it an excellent reason to add solar energy. Thus, it can be an amazing project to work on, and more implementation can help us convert any city to a smart city.

REFERENCE TEST SPECIMENS

Several works have been done in this area regarding the usage of automatic lighting and other motion sensor-based systems.

Automatic lighting[I]: this could be a perfect project except for the one fact that it works on a timer-based system where the lights would be switched on at a particular time and off at a specific time. This also means that it would work for hours even when not in use. Apart from the excess usage of electricity, the fixed timings were a part of its drawback. The daylight timings change season to season, which means that the daylight time in winters is shorter and in summer is long and unpredictable in monsoons. So just setting a timer for the same is not the solution, which is a drawback because it has not been a successful model.

Other projects worked on the motion sensors, which failed due to their less durability and tendency to get damaged in a bad situation. Such project references are available at the end of the document [II][III][IV][V]

HARDWARE AND SOFTWARE

- Arduino Uno
- PIR Sensors
- LDR Sensors
- Lights
- Arduino IDLE

Table 1 Requirements

	Hardware Requirements	Software Requirements
Developer Requirements	-Arduino Uno board -PIR Sensors - Connecting wires -Lights -LDR	Arduino IDLE working in Windows 7-10

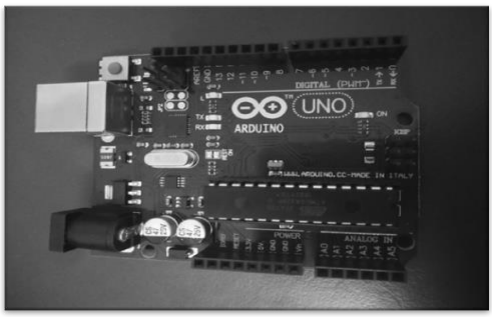
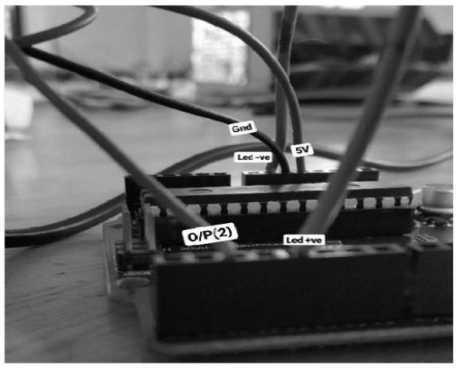


Figure 1 Arduino Uno



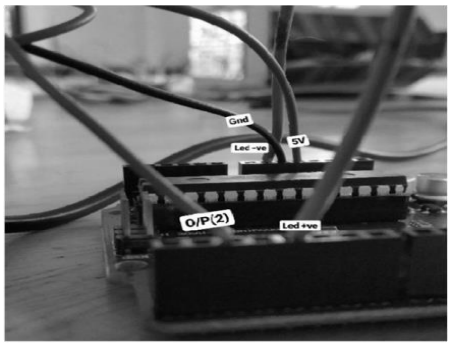


Figure 2 Connections used in the prototype

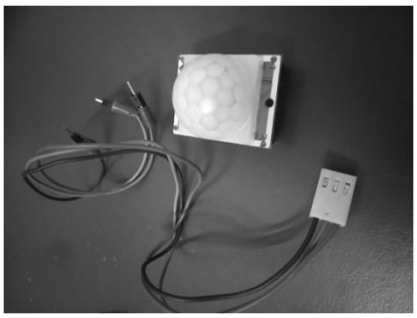


Figure 3 PIR Sensor

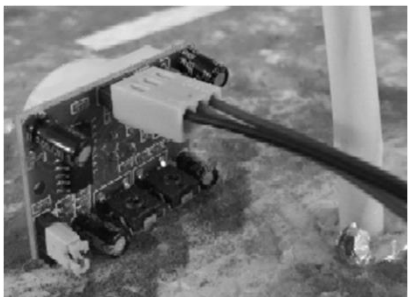


Figure 4 PIR Sensor Connections

How does it work?

The LDR would be installed at a certain open area where the system is to be installed and connected to the Arduino board. And when the daylight intensity decreases and crosses the decided threshold, the system would be turned on. The lights might be turned on at low power and light up whenever the system sensors detect motion.

The Arduino Uno will be programmed by adding a loop that keeps checking/reading the digital input coming from the sensor. When the input is high, it will call a function digital Write() which will turn the lights on, and there will be a delay of around 30 seconds, after which the lights will go off. And this would continue till the system is given the input from LDR about the daylight, and the system would go off when it is morning again.

The sensors would be installed at the side of the road by turning its motion-sensing knob's range up to 5 meters or according to the width of the road and by connecting it to the system, as shown in the figure.

Also, it is noted that 3 street lights would be turned on as soon as motion is detected, and as the vehicle or the pedestrian crosses these 3 street lights and reaches the next sensor, the other street lights would be turned on. And the time delay can be set as per the consumer's requirements. In short, 3-3 street lights would light up simultaneously as soon as motion is detected.

Hence by integrating all these components it can make an efficient domain to work with.

SAMPLE PROGRAM FOR ARDUINO

```
int led=4;
int pir_inp=2;
int pirState = LOW;
int val=0;
void setup() {
  pinMode(led,OUTPUT);
  pinMode(pir_inp,INPUT);
  Serial.begin(9600);
}
void loop() {
  val = digitalRead(pir_inp);
  Serial.println(val);
  if(val == HIGH) {
    digitalWrite(led,HIGH);
    /*if(pirState==LOW) {
      Serial.println("LED ON");
      pirState=HIGH;
    }
    */
    delay(3000);
  }
  else {
    digitalWrite(led,LOW);
    /*if(pirState==HIGH) {
      Serial.println("LED Off");
      pirState=LOW;
    }*/
  }
  delay(500);
}
```

PERFORMANCE OF SMART LIGHTS

Once installed, this system might reflect its results in the electricity bill just in a short period when one starts using it.

The performance depends upon the project's durability, whether it works for an extended period or not. It also will depend on the quality of the components used in the project.

The overall system could make an excellent way to reduce energy consumption if implemented correctly and provide time to time service to it like every two to four weeks.

CONCLUSION

Thus, by using this domain, we can save energy and conserve it for other projects that lag because of no power supply, which is being used unnecessarily. On the other hand, it is also cost-effective, practically possible, eco-friendly, and safe to save energy. Although it seems to be a simple project, its simplicity is the most potent point of this domain. Hence, this project is flexible to all the street lamps and can be installed at every possible streetlight and by housing and co-operative societies for their compounds and lanes. For further future work, it would be like to including some more features like including same lighting technique in parking system, dimming the lights in the parking and even on streets using a dimmer switch which senses the people and vehicles around, this system can also be implemented on public bus stops at night. On roads, poles can be installed, indicating that cars

from the other side are coming to avoid accidents at night and even in the fog.

REFERENCES

The below-given references were used to get closer to the problems being faced in them and try to come up with a new and slightly better idea.

1. Automatic Lighting : https://www.electronicshub.org/automatic-street-light-controller-circuit-using-relays-and-ldr/
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5. The e-JIKEI Network Promotion Institute, et al. Smart street light system with communication means. Published unexamined patent application in Japan P2011-165573A (in Japanese).