2016

Smart Street Lighting System

Project Report-cs207

The idea of the project is to save energy from the streetlights consuming useful power. It is a step forward to allot the power generated in a much better and systematic fashion across the roads.

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Introduction

This paper documents the design and scale modeling of an intelligent public lighting system. It is a control system of artificial lighting, which has the purpose of providing lighting automatically when necessary, instead of spending energy by staying on. In this way we achieve a much more efficient energy consumption, since the lights will only stay on if necessary, and once they are not required, they will be turned off.

Its operation is based on photosensitivity of the photoresistor, which must be located in a place where natural lighting does not reach. When it receives artificial light, the electric circuit is activated. In the absence of brightness, the circuit will close. There are two ways to achieve the demands that are trending in relation to alternative sources of energy:

• Finding an alternative source to supply the power.

• Reducing the energy consumption of the present resources available.

Our project supports the second statement.

Inspiration

The driving force behind choosing the smart lightening system as our project is to offer better, more specialized services which can improve the quality of life of the citizens while promoting sustainability. Approximately the 20% of the world's electrical energy is consumed by light, as street-lighting systems. Public lightning also consumes a big part of economical resources, as electrical bills are paid by people's taxes. With the rising costs of energy, combined with increased environmental and regulatory pressures toward energy efficiency, reducing power consumption becomes the sole purpose of this project.

Designing Process

The original design we had for our project proposal involved the following hardware:

- Microcontroller
- IR transmitter-receiver pair
- LDR circuit
- LM 324 assembly
- Power LED

Afterwards, the design was changed due to different reasons, which resulted in us using the following hardware in our project:

- 1x Arduino
- 1x Breadboard
- 3x 220 Ohm Resistors
- 1x 10K Ohm Resistor
- 3x LED's
- Wires

Refer to Appendix A to look at our hardware.

Building Process

We decided to change some parts of the original proposal, and we chose PIR sensors, which are sensors that detect infrared movement. We ordered these sensors online and after two weeks said sensors never arrived. When we saw ourselves with little time in hand, we had to restructure our project, so that we could use materials that we already had so that it would give us time to have the functional project by the due date.

Hardware:

On our hardware we have the photoresistor connected to the analog pin 0 (A0) and to 5V, then through a 10K ohm resistor to our three LEDs, which are connecter in series to the ground. Our digital pin 3 (D3) is connected through the 220 ohm resistors to our LEDs. *Refer to Appendix B and Appendix C*. We connected the LEDs and the photoresistor with wire extensions so we could fit them into the model. *Refer to Appendix D*.

Our model was made out of cardboard so we could hide the wires and makes it look like streetlights. *Refer to Appendix E*.

Software:

The sketch used to make this work is quite simple; *please refer to Appendix F*. First we declared our digital pin 3 (D3) as an output on our setup, this is the pin that is connected to the LEDs and lets us control them. Then, we declared an integer on our loop, this is to get a value from our analog pin 0 (A0), which is the pin connected to the photoresistor, the photoresistor gives a value to our A0 pin, which is

read and if the value is smaller than 400 we send an order to our D3 pin to keep the lights off; if the value is higher than 400 then D3 pin will turn the lights on.

Reflection

The biggest challenge we faced during the development of the project was having to do it all over a weekend. We had ordered three PIR sensors online, which we would use to detect movement. The sensors did not arrive in time, so in the end we had to restructure our project and use material that we already had to be able to have the project ready by the due date.

Once we solved another way of doing our project without the PIR sensors everything went very fast. We chose to use photoresistors because of its practicality and adaptability to our project. The other problem we had was that we only had one photoresistor, so we had to make the model smaller and use only three LEDs.

Conclusion

The idea of this project can be implemented in a large scale on highways like while we are going from Regina to Saskatoon,there is not much traffic on road at night still the lights are ON.Similarly in all parking lots,lights are working during whole night,whether there is any movement of traffic or not.In this endeavour,a province can prosper with its energy efficiency and proper allotment to the required loads.This project was challenging and very educational for us. We were forced to deal with a lot of stress, not knowing if the parts we ordered would arrive on time. We had to use our creativity to solve the problems and restructure the project over one weekend when we saw that the PIR sensors we ordered would not arrive in time.This is a sincere effort in managing the traffic flow at night and reducing the amount of energy wasted in the procedure.

Sincere thanks to our professor Mr.Trevor Tomesh,who gave us ideas ,to complete our project at last moment, like to ise photo resistor,ultra-sonic sensors etc.A special thank to our lab instructor Mr. Alex who was always there to provide his full support via demonstration of various instruments using aurdino.

References

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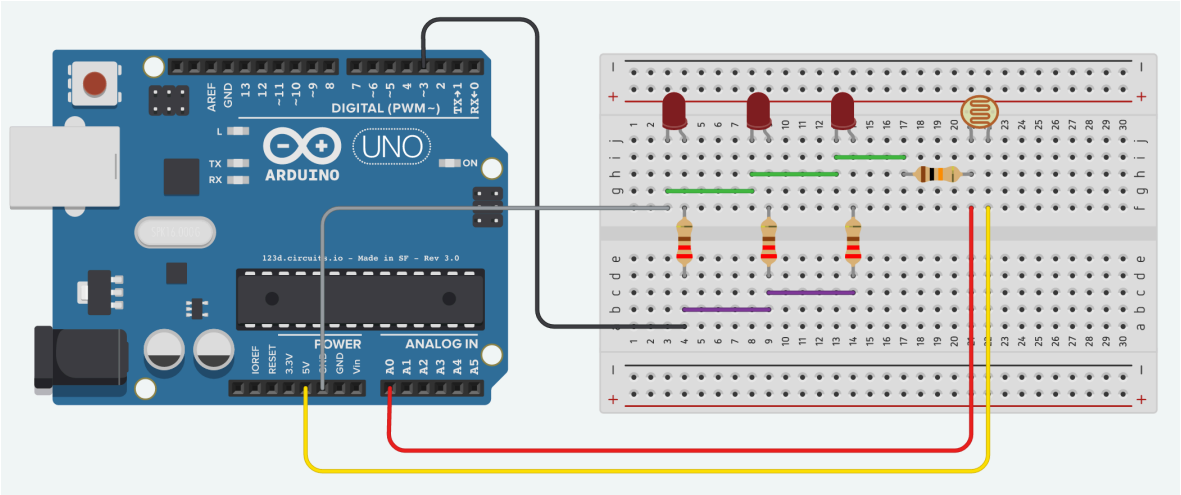
- http://bibdigital.epn.edu.ec/bitstream/15000/4083/1/CD-3848.pdf

Appendix

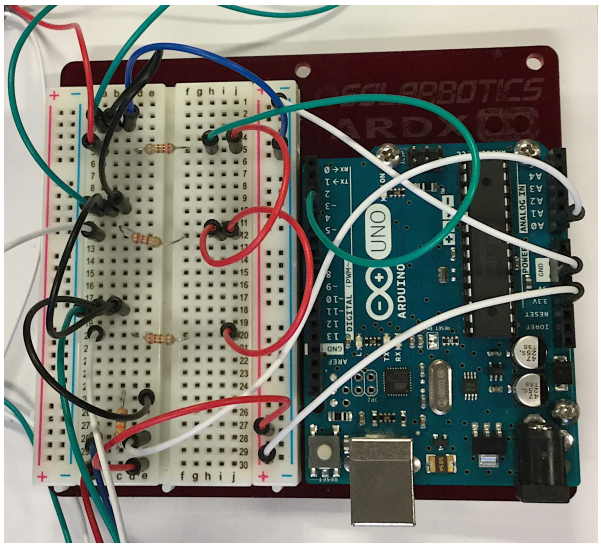
Appendix A

3x LEDs | Photoresistor | 10KΩ resistor | 3 x 220Ω resistor

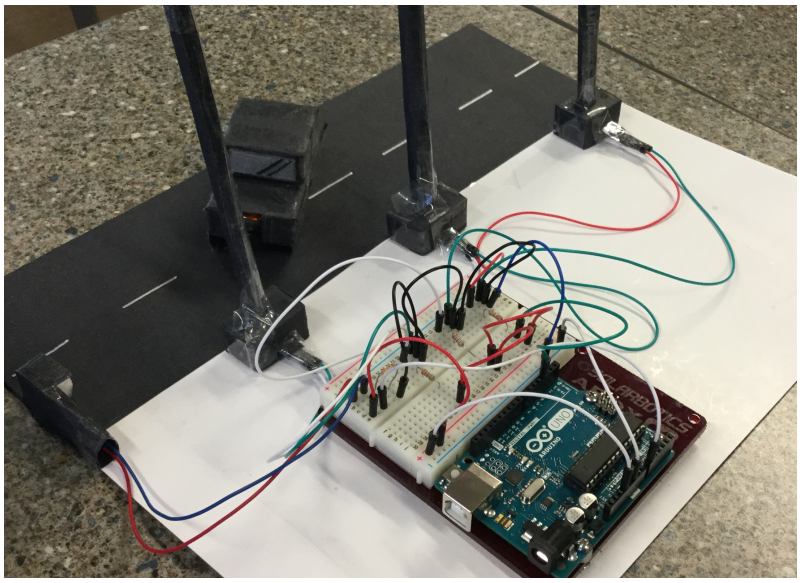
Appendix B



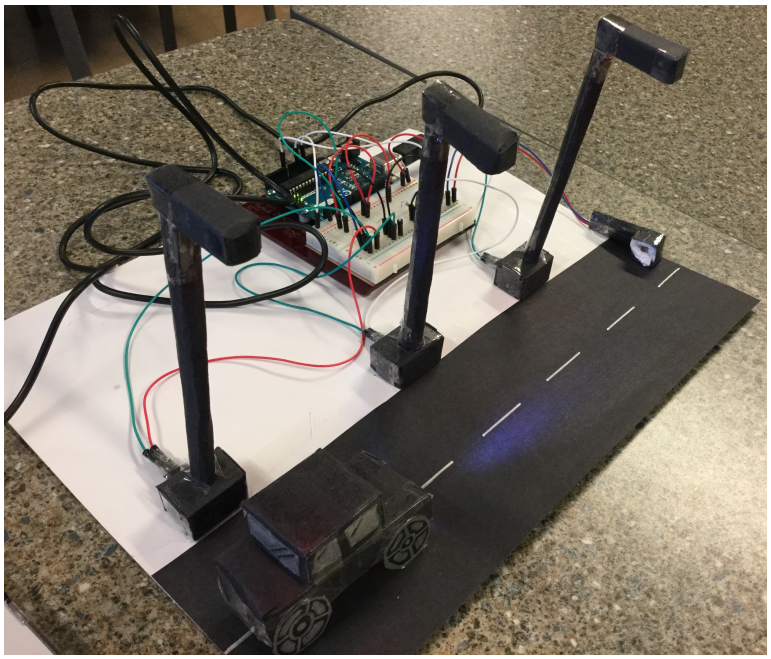
Appendix C



Appendix D



Appendix E



Appendix F

```
void setup() {
    Serial.begin(9600);
    pinMode(3, OUTPUT);
}
void loop() {
    int sensorValue = analogRead(A0);
    if (sensorValue < 400) {
```