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Photonics Lab Summary

Using Optic Fibers to Tell Time

Purpose

The purpose of this project was to explore the usage of optic fibers in telling time.

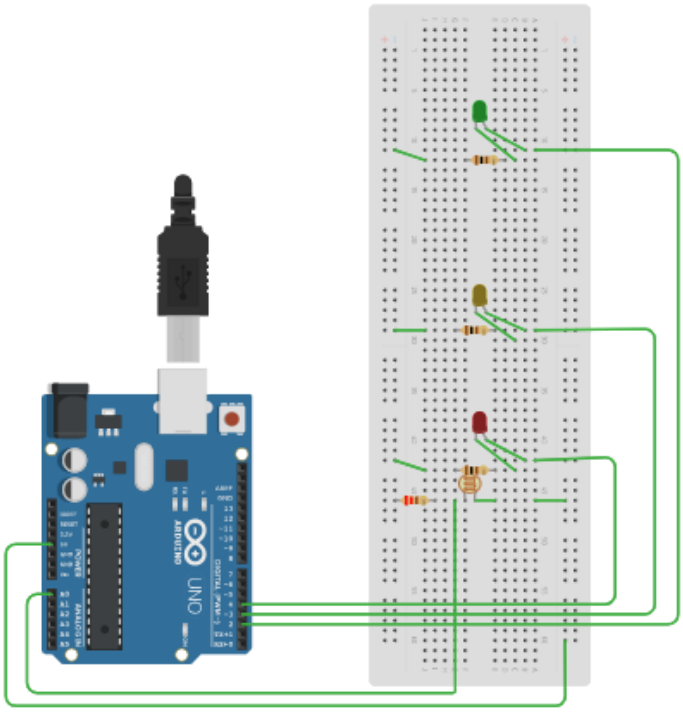
Materials

- Computer
- Optic Fiber - preferably 5 feet long(enough to stick out window)
- Arduino Uno
- Photoresistor
- 220 ohm Resistor
- Breadboard - preferably 8in by 5 in
- Breadboard wire(at least 10, including space connectors)
- 3x 100 ohm Resistors
- Red LED
- Green LED
- Yellow LED

Procedure

1. Put a wire from the 5V place on the Arduino to the positive rail on the breadboard
2. Put the ground wire on the ground rail(can be any wire)
3. Place the photoresistor anywhere on the breadboard(preferably not absolute top/bottom)
4. Hook a wire from one end to the positive rail.
5. On the other end have a wire go back to A0 (analog).
6. Finally, on the other side of the wire add a 220-ohm resistor that goes to the ground rail
7. Place the 3 LED onto the breadboard
8. On each of the LED's, add a 100 ohm resistor to the ground rail.
9. Connect the Red LED to Arduino pin 4, yellow to pin 3, and green to pin 2

10. It should look like this:



11. Then, upload this code to the Arduino:

```
int greenLedPin = 2;
int yellowLedPin = 3;
int redLedPin = 4;

int lightSensorPin = A0;
int analogValue = 0;


void setup() {
  pinMode(greenLedPin, OUTPUT);
  pinMode(yellowLedPin,OUTPUT);
  pinMode(redLedPin,OUTPUT);
}

void loop(){
  analogValue = analogRead(lightSensorPin);
  if(analogValue < 50){
    digitalWrite(redLedPin, HIGH);
  }
  else if(analogValue >= 50 && analogValue <= 100){
```

```
    digitalWrite(yellowLedPin, HIGH);
  }
  else{
    digitalWrite(greenLedPin, HIGH);
  }
  delay(200);
  digitalWrite(greenLedPin, LOW);
  digitalWrite(yellowLedPin, LOW);
  digitalWrite(redLedPin, LOW);
}
```

12. Finally, take your 5 foot long optical wire and connect it to outside the window(facing the sun) and hover the other end above the photoresistor
13. If the red LED lights up, it is dark outside, probably early morning or late night.
14. If the green LED lights up, it is very bright outside. It is probably noontime.
15. If the yellow LED lights up, it is shady. Probably getting to night time or late morning.

Results & Conclusions

Fiber optics work by utilizing total internal reflection(T.I.R), a process in which photons are reflected inside an object. In an optic fiber, there is a long clear strand of either glass or plastic, which by using T.I.R is able to transport the light. Fiber optics are able to provide light if one end has a light source to gain light. Some optic fibers can even show entire images of what the other side is seeing. In my project, having one optic fiber leading from outside allowed me to measure the intensity of the light on the photoresistor, which would then activate a red, green, or yellow light based on the intensity. My creation uses T.I.R to reflect light from the sun through the optic fiber and project it onto the photoresistor. Based on the resistance(a photoresistor resists different amounts of electricity based on the brightness/intensity of light hitting it), the Arduino will determine approximately what time it could be : morning, noon, or evening. Lastly, my project shows sustainability; optic fibers last for a long time and 1 single strand can last 25 years. Thus, my system can work for a much longer time than normal clocks and it provides a reliable way to approximate time. However, one drawback of my system is the weather. Optic fibers are unaffected by rain, but the cloudiness could influence the light levels and give a darker or lighter reading than supposed to. Thus, using optic fibers to tell time is reliable only when it is sunny and there are no/little clouds.