California State University, San Bernardino

School of Computer Science and Engineering

Lab #7 Communication Protocols (I2C)

Submitted by

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Abstract

This lab requires the use of I2C communication to create a circuit that consist of two arduino uno's. The main function of this experiment is to create a solar panel that moves on a rotating servo according to the light intensity measured by a photoresistor. By using the Wire library in the arduino IDE, communication between two arduino uno's becomes possible and each arduino can be set as either a master or slave. In this case, the master arduino uno was used to measure the light intensity and the slave arduino uno was used to rotate the servo. The experimental result was successful.

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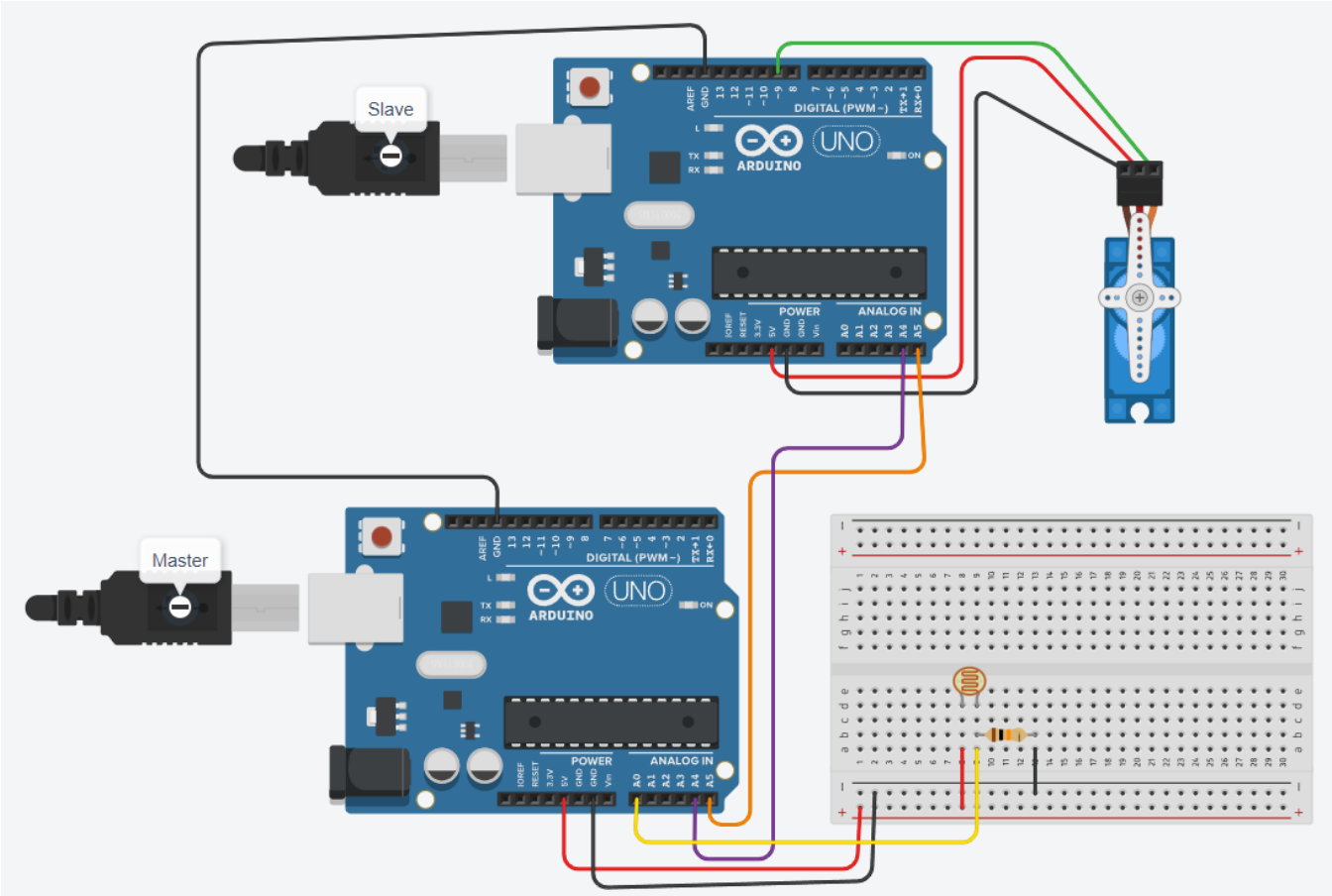
Grammar/English	/20
Report Format	/20
Results	/20
Simulation	/20
Disc./Analysis	/20
Total	/100

Introduction

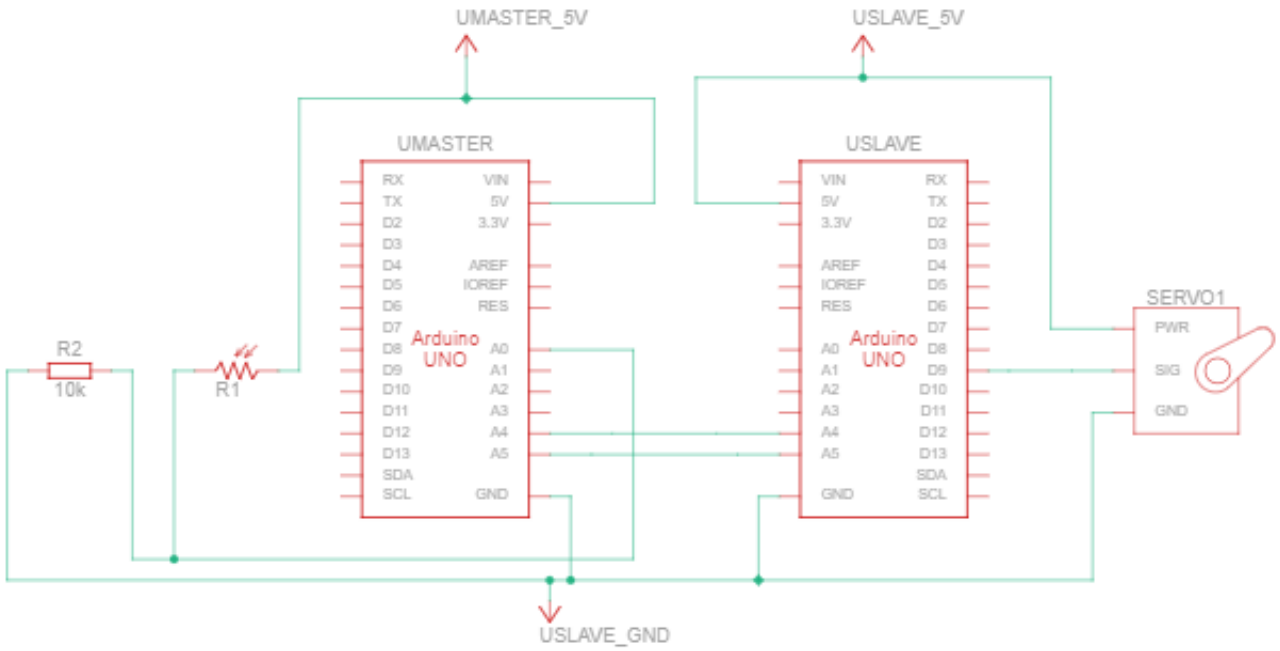
In this lab, I2C communication is used to build a circuit between two arduino uno's that have two key functions. The first function is to measure the light sensitivity using a photoresistor also known as an LDR(Light-dependent resistor). and the second function is to rotate a servo motor which presumably has a solar panel. By measuring where the light sensitivity is greatest, the servo motor can be used to rotate the solar panel in that direction. Components needed for this lab include two Arduino Uno's, a photoresistor, a servo motor, a 10k resistor, and jumper wires.

Experimental Results

Circuit Design:



Schematics:



Master Code:

```
#include <Wire.h> //I2C library

#define SLAVE_ADDR 9 //defines the other arduino as the slave

const int photocellPin = A0; //photoresistor attach to A0
int sensorValue = 0; //value read from the photoresistor


void setup()
{
  Wire.begin(); //initiates I2C communication
}

void loop()
{
  delay (50); //delay 50ms

  //read the value of A0 and map from 1 to 255
  sensorValue = map(analogRead(photocellPin), 0, 1023, 1, 255);

  //transmits data to the slave arduino
  Wire.beginTransmission(SLAVE_ADDR);
  Wire.write(sensorValue);
  Wire.endTransmission();
}
```

Slave Code:

```
#include <Servo.h> //servo library
#include <Wire.h> //I2C library

#define SLAVE_ADDR 9 //defines slave address

//initialized variables
int receivedData;
int pos = 0;

Servo servo_9; //attatches servo to pin 9 on slave


void setup()
{
  //servo initialization
  servo_9.attach(9, 500, 2500);
  servo_9.write(0);

  //intiates communication with master
  Wire.begin(SLAVE_ADDR);
  Wire.onReceive(receiveEvent);

  Serial.begin(9600); //sets buad rate to 9600

}

//recieves data from master through receivedData variable
void receiveEvent(int sensitivity)
{
  receivedData = Wire.read();
  Serial.println(receivedData);
}


void loop()
{
  //rotates servo according to the light sensitivity
  delay(50);

  if (receivedData <= 50)
  {
  servo_9.write(30);
  }

  else if (receivedData <= 155)
  {
  servo_9.write(60);
  }

  else if (receivedData <= 205)
  {
  servo_9.write(90);
  }

  else if (receivedData <= 235)
  {
  servo_9.write(120);
  }

  else if (receivedData >= 236)
  {
  servo_9.write(150);
  }
}
```

Using this circuit design and code, the servo rotates as it adjust to the light intensity measured from the photoresistor.

Discussion/Analysis of Results

Before getting into the results, lets discuss briefly about the components used in this experiment. The LDR resistance is directly affected by light intensity because of distance and light level. As the distance increases the LDR resistance increases and vice versa, however if light level increases the LDR resistance decreases. The servo motor uses gears to rotate a small shaft, by taking in code instructions from an arduino one can create a program that rotates the servo according to some parameters.

The expected outcome of this lab was to create a circuit that allows a solar panel to moved towards direct sunlight. Tinkercad only allows one to adjust the light measured by the photoresistor and not the direction or distance. Although my results are not one to one with the supposed outcome of this lab, I would say it's a fairly close result. The point of this lab was also to get a better understanding of I2C communication using two arduino uno's. I think I successfully created a circuit that uses I2C communication and does the two key functions as described in the introduction by making the master arduino uno provide the measured input of the photoresistor to the slave arduino uno which rotated the servo according that reading.

Conclusions

To conclude, this lab is made to experiment with I2C communication using two arduino uno's. By creating a code that allows two arduinos two communicate with eachother and perform task, we are able to get a better understanding of how I2C communication works. I2C is a half duplex from of communication which means it is able to support multiple masters and slaves, as opposed to SPI communication which only supports one master and multiple slaves.

References

1. Tinkercad. (2019). Tinkercad | From mind to design in minutes. Tinkercad. https://www.tinkercad.com/

2. I2C Part 1 - Using 2 Arduinos. (n.d.). Www.youtube.com. https://www.youtube.com/watch?v=PnG4fO5_vU4