Alexandria University
Faculty of Engineering
Computer and Systems Engineering
Department

CS331: Microprocessor Systems

Project
Gesture controlled robot

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1. Project idea and description

Gesture controlled robot:

- It is controlled by using hand instead of buttons or joysticks.
- The robot is controlled by only moving the hand.
- A transmitting device is used in the hand which contains RF transmitter and accelerometer.
- This transmitting device will transmit commands to the robot.
- Commands are like: moving forward, moving backward, turning right or turning left.

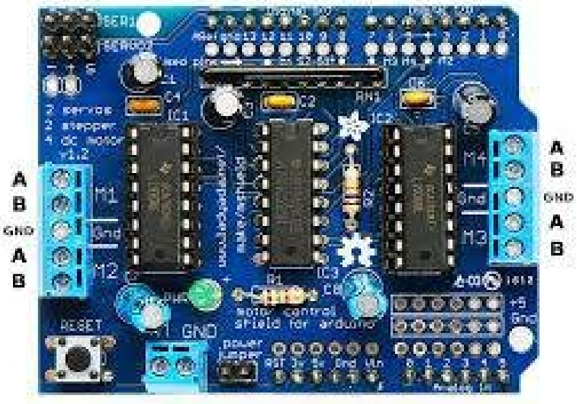
2. List of components used

- Arduino Uno
- Arduino Mega

- 2xTransceiver module (NRF24L01)

- MPU 6050
(Accelerometer)

- Motor shield (Adafruit l293d)

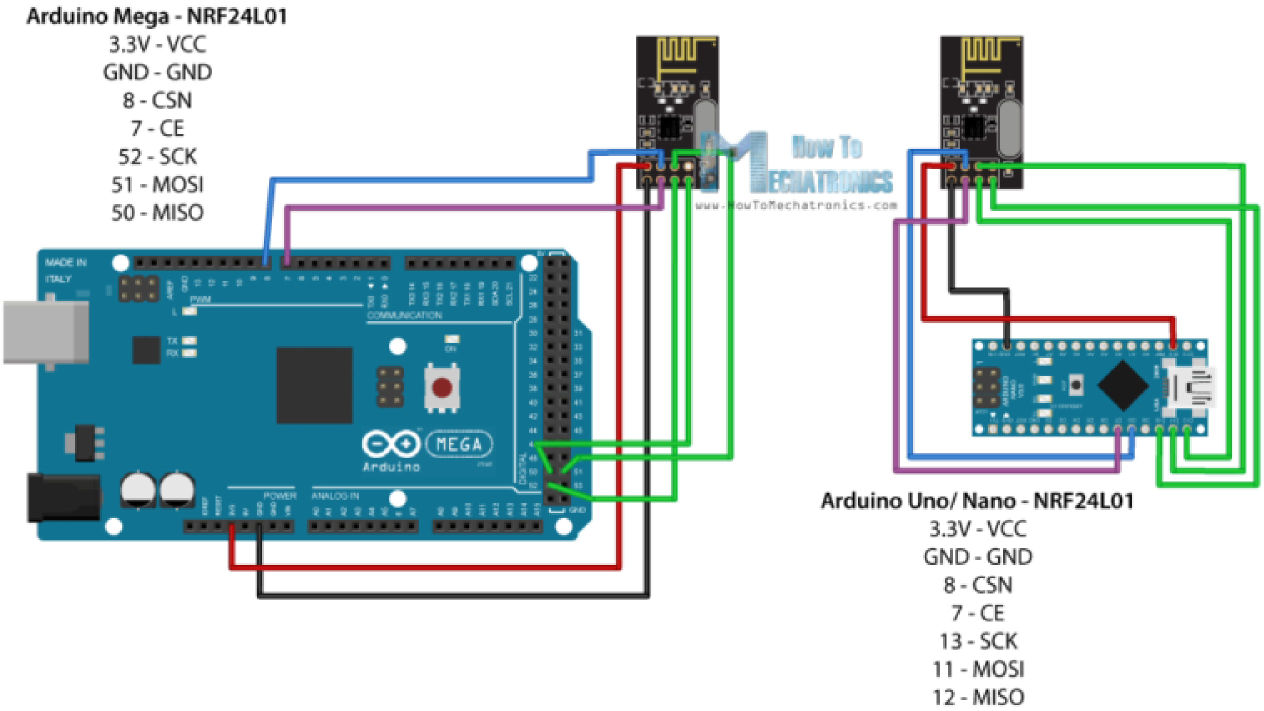


- Robot car frame
- Batteries
- Voltage regulator (lD1117)

- Wires

3. Circuit diagram and connections

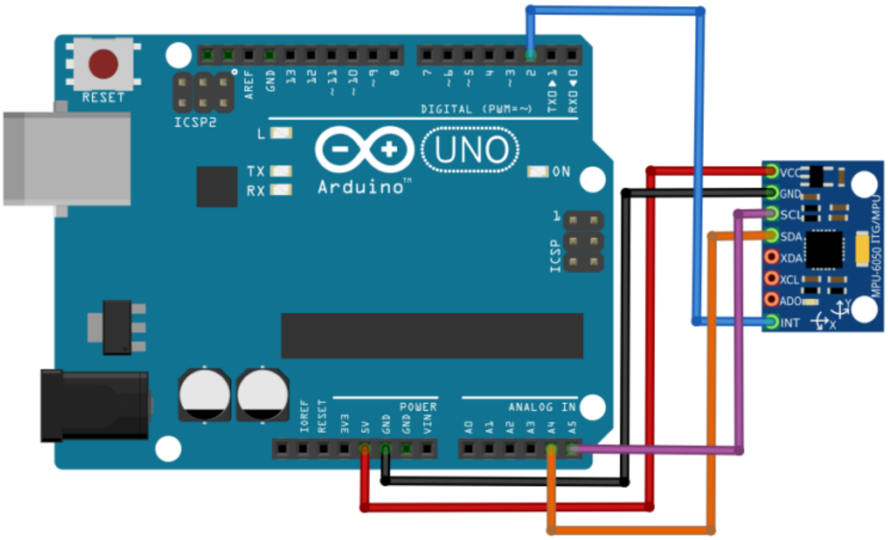
- Connecting the NRF24L01 module to the Arduino boards (Uno and Mega).



Arduino Mega - NRF24L01
3.3V - VCC
GND - GND
8 - CSN
7 - CE
52 - SCK
51 - MOSI
50 - MISO

Arduino Uno/ Nano - NRF24L01
3.3V - VCC
GND - GND
8 - CSN
7 - CE
13 - SCK
11 - MOSI
12 - MISO

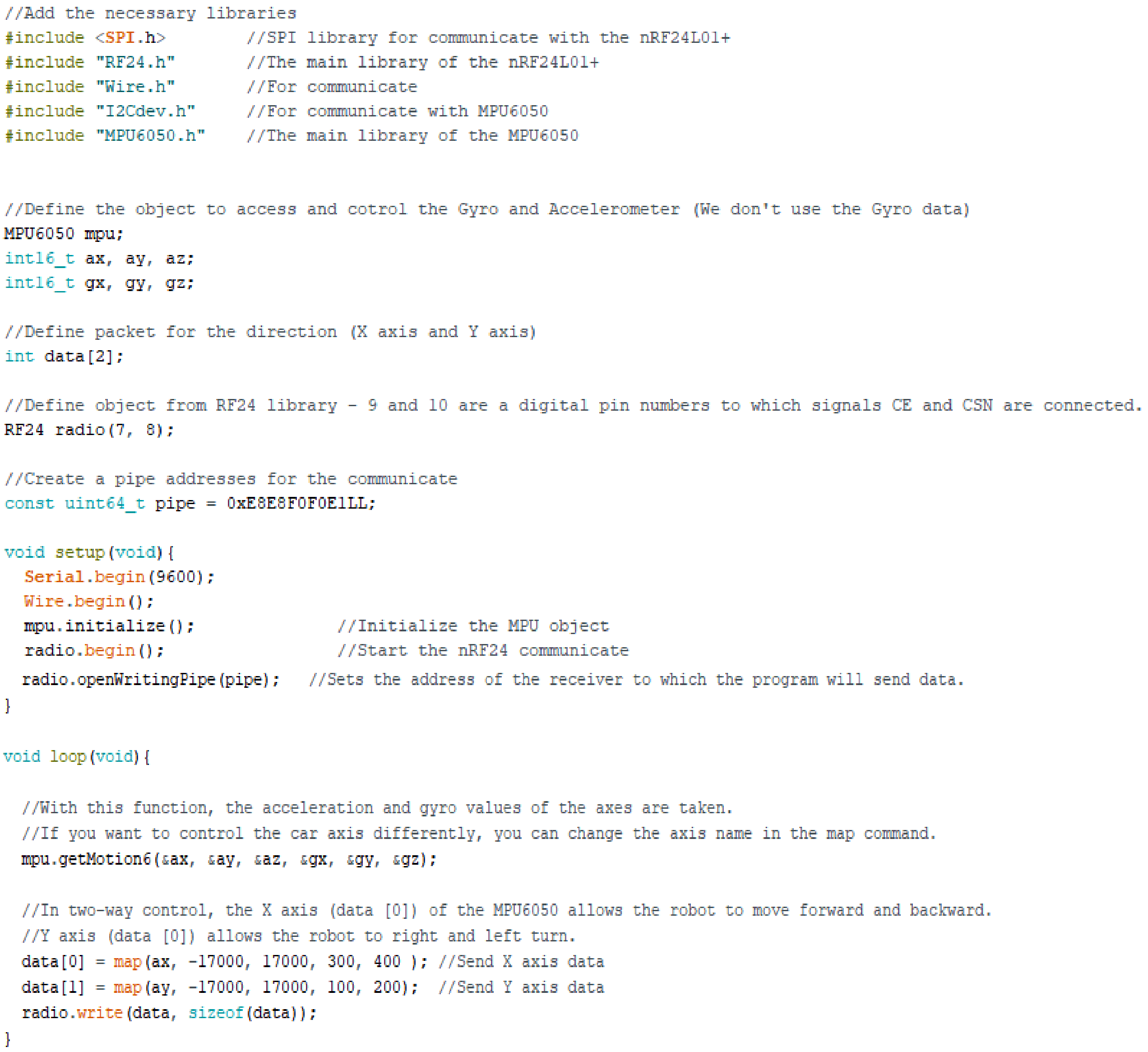
- Connecting the Arduino with the MPU 6050 Sensor.



- Connecting the motor driver shield L293D with the arduino mega.

4. Code

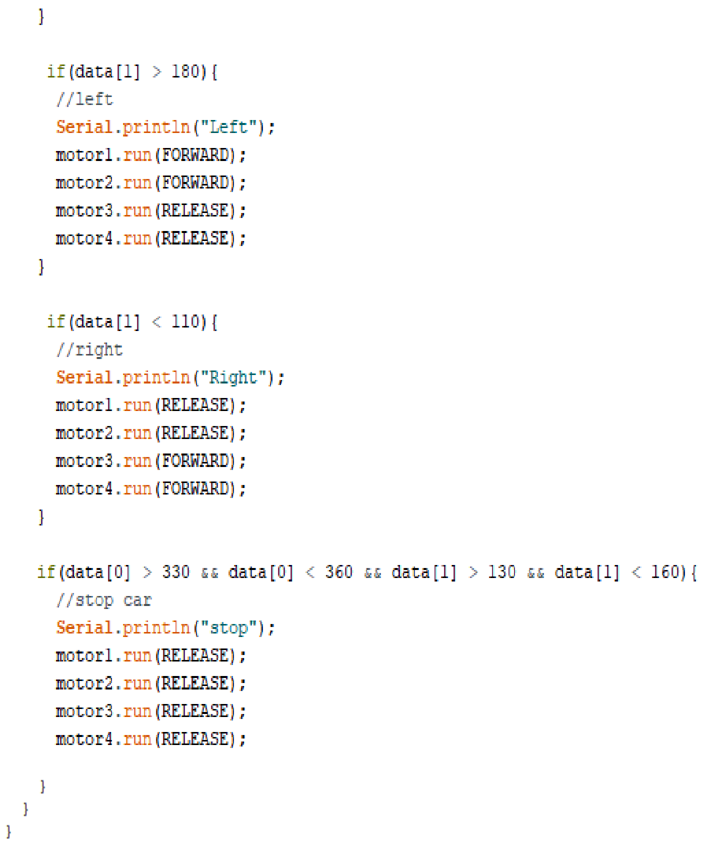
- Transmitter:



```
//Add the necessary libraries
#include <SPI.h>        //SPI library for communicate with the nRF24L01+
#include "RF24.h"       //The main library of the nRF24L01+
#include "Wire.h"       //For communicate
#include "I2Cdev.h"     //For communicate with MPU6050
#include "MPU6050.h"    //The main library of the MPU6050


//Define the object to access and cotrol the Gyro and Accelerometer (We don't use the Gyro data)
MPU6050 mpu;
int16_t ax, ay, az;
int16_t gx, gy, gz;

//Define packet for the direction (X axis and Y axis)
int data[2];

//Define object from RF24 library - 9 and 10 are a digital pin numbers to which signals CE and CSN are connected.
RF24 radio(7, 8);

//Create a pipe addresses for the communicate
const uint64_t pipe = 0xE8E8F0F0E1LL;

void setup(void){
  Serial.begin(9600);
  Wire.begin();
  mpu.initialize();              //Initialize the MPU object
  radio.begin();                 //Start the nRF24 communicate
  radio.openWritingPipe(pipe);   //Sets the address of the receiver to which the program will send data.
}

void loop(void){

  //With this function, the acceleration and gyro values of the axes are taken.
  //If you want to control the car axis differently, you can change the axis name in the map command.
  mpu.getMotion6(&ax, &ay, &az, &gx, &gy, &gz);

  //In two-way control, the X axis (data [0]) of the MPU6050 allows the robot to move forward and backward.
  //Y axis (data [0]) allows the robot to right and left turn.
  data[0] = map(ax, -17000, 17000, 300, 400 ); //Send X axis data
  data[1] = map(ay, -17000, 17000, 100, 200);  //Send Y axis data
  radio.write(data, sizeof(data));
}
```

- Reciever:

```
//Add the necessary libraries
#include <SPI.h>      //SPI library for communicate with the nRF24L01+
#include "RF24.h"     //The main library of the nRF24L01+
#include <AFMotor.h>

//Define packet for the direction (X axis and Y axis)
int data[2];

// motors
AF_DCMotor motor1(1, MOTOR12_64KHZ); // create motor #2, 64KHz pwm
AF_DCMotor motor2(2, MOTOR12_64KHZ); // create motor #2, 64KHz pwm
AF_DCMotor motor3(3, MOTOR12_64KHZ); // create motor #2, 64KHz pwm
AF_DCMotor motor4(4, MOTOR12_64KHZ); // create motor #2, 64KHz pwm

//Define object from RF24 library - 22 and 24 are a digital pin numbers to which signals CE and CSN are connected
RF24 radio(22,24);

//Create a pipe addresses for the communicate
const uint64_t pipe = 0xE8E8F0F0E1LL;

void setup(){

  Serial.begin(9600);
  radio.begin();                    //Start the nRF24 communicate
  radio.openReadingPipe(1, pipe);   //Sets the address of the transmitter to which the program will receive data.
  radio.startListening();
  motor1.setSpeed(255);
  motor2.setSpeed(255);
  motor3.setSpeed(255);
  motor4.setSpeed(255);

  }

void loop(){
  if (radio.available()){
    radio.read(data, sizeof(data));

    if(data[0] > 380){
      //forward
      Serial.println("Forward");
      motor1.run(FORWARD);
      motor2.run(FORWARD);
      motor3.run(FORWARD);
      motor4.run(FORWARD);

    }

     if(data[0] < 310){
      //backward
      Serial.println("Backward");
      motor1.run(BACKWARD);
      motor2.run(BACKWARD);
      motor3.run(BACKWARD);
      motor4.run(BACKWARD);
```



```
    }

     if(data[1] > 180){
      //left
      Serial.println("Left");
      motor1.run(FORWARD);
      motor2.run(FORWARD);
      motor3.run(RELEASE);
      motor4.run(RELEASE);
    }

     if(data[1] < 110){
      //right
      Serial.println("Right");
      motor1.run(RELEASE);
      motor2.run(RELEASE);
      motor3.run(FORWARD);
      motor4.run(FORWARD);
    }

    if(data[0] > 330 && data[0] < 360 && data[1] > 130 && data[1] < 160){
      //stop car
      Serial.println("stop");
      motor1.run(RELEASE);
      motor2.run(RELEASE);
      motor3.run(RELEASE);
      motor4.run(RELEASE);

    }
  }
}
```

5. Challenges faced and any notes

- The pins of the arduino uno weren't enough for both the shield and the transceiver, so arduino mega was used.
- A 3.3 volts were needed by the receiver, so a voltage regualtor was used from the 5 volts that are the output of the arduino mega to change them to 3.3 volts to be used by the reciever.

6. References and any libraries used

Libraries:
- RF24 library for the transceiver module
- I2Cdev library MPU6050 – library
- AF_Motor Arduino library

Resources:
- Learn.adafruit.com
- mertarduinotutorial.blogspot