IEEE SJCE STUDENT BRANCH

Amaze and Fury Road

Instruction Manual

I. AMAZE: Event Date- 20th and 22nd March 2019

Amaze is the line follower competition where your robot has to follow the black path. The sensor that is going to be useful here is IR Sensor.

IR Sensor has usually 2 entities. Transmitter and the receiver.

The main principle of working of the line follower robot is that, **Black color absorbs more and reflects less. White color absorbs less and reflects more.**

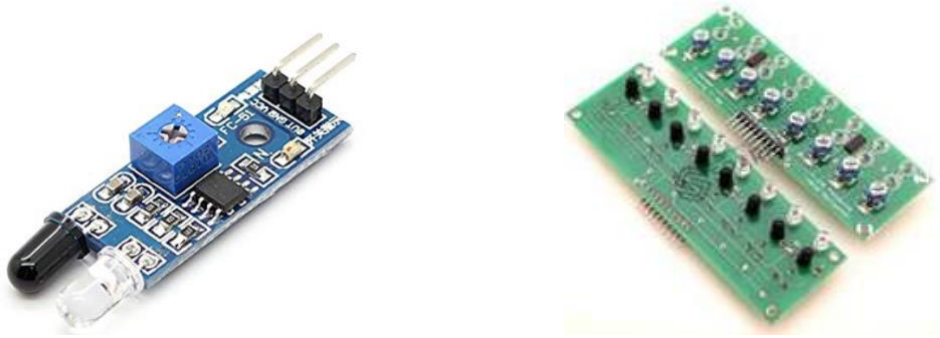
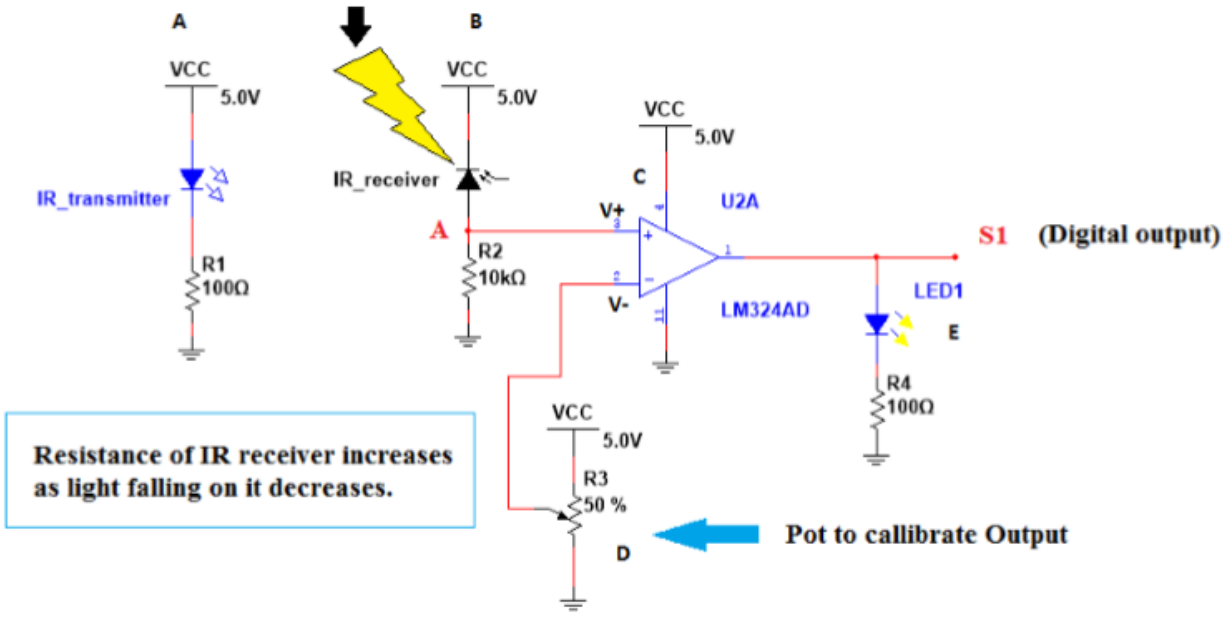


Figure 1(a) IR module, (b) IR array

Figure 1(a) shows an IR module and figure 1(b) shows IR array. The IR array has 8 IR pairs.

The darker one is the receiver and the transparent one is the transmitter.
From now on the convention is that**: 1 transmitter + 1 receiver =1 IR sensor or 1 IR pair.**

When the IR transmitter transmits the light, if the sensor is on black line, most of it will be absorbed by the black color of the line. So, the receiver receives less radiation. Lesser the radiation received, more will be the voltage across the receiver.



If the sensor is on white line, when the transmitter transmits the IR radiation, most of it will be reflected by the white color. So, the receiver receives more part of the radiation. Larger part of radiation the radiation receives, less will be will be the voltage across the receiver.

The above diagram shows the circuit for single sensor. The **IR array** consists of 8 such circuits. It has **10 pins**. And the sensors are named as S1, S2, S3, S4, S5, S6, S7, S8. Rest 2 pins are GND and VCC.

In the circuit shown above A is transmitter part, R1 is current limiting resistor. B is the receiver part.
By increasing R2, you can increase the sensitivity of the receiver. C is the comparator part. D is the potentiometer. E is the output part given as input to Arduino.

Function of comparator part:

Usually sensor gives out the analog output. If this is given to ADC, and if ADC is 10 bits, then the total values range from 0 to 1023. It will be difficult to monitor 1024 values.
Thus, there is a **comparator that reduces the 1024 values to only 2 values i.e. HIGH OR LOW (1 OR 0) digital which will be helpful for the calibration.**

Working of comparator:

Comparator compares 2 values of voltages. If V+ is greater than V-, output will be 5V.
If V-is greater that V+, output will be 0V. Thus, if output is high LED1 will be ON else it will be OFF. This LED helps you out to check if the sensor is calibrated or not.

What is calibration?

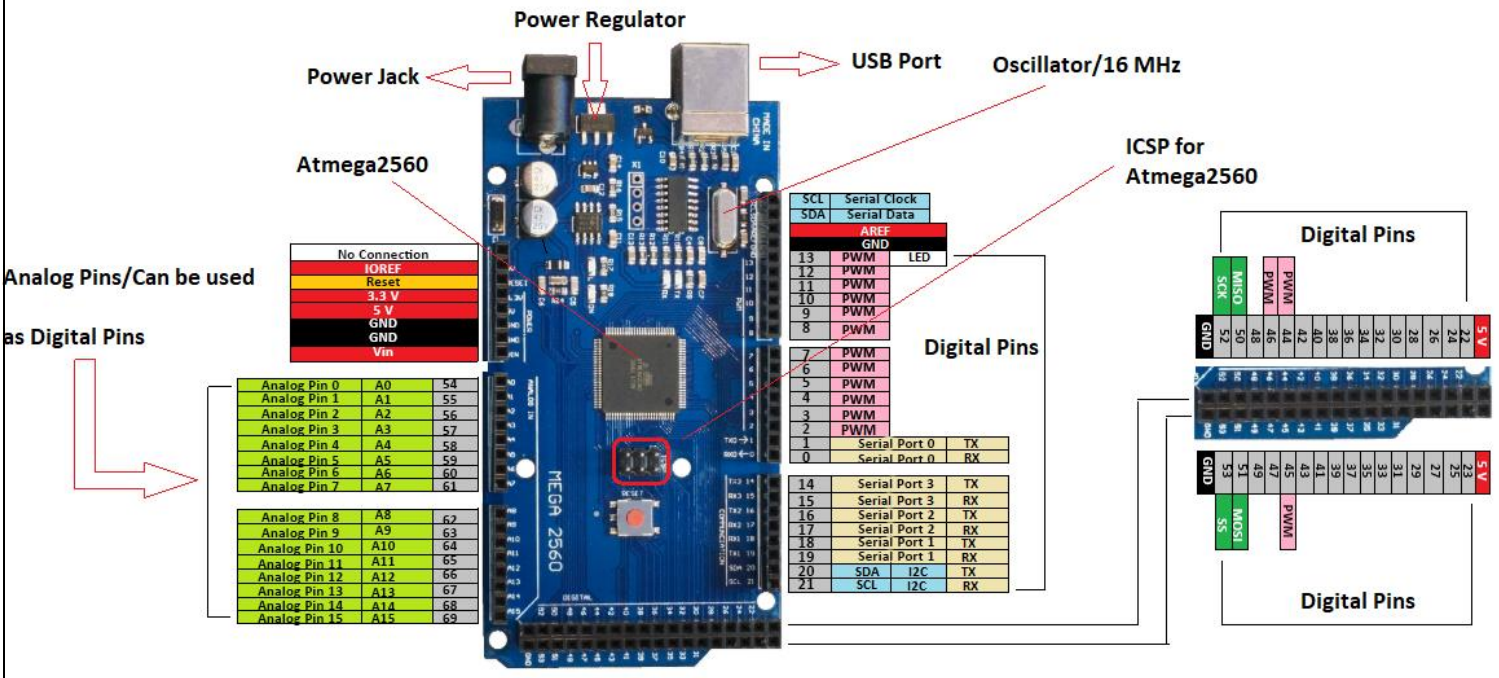
Adjusting the sensitivity of the sensor by turning the potentiometer on the sensor module. Calibrating the sensor before the competition is very important as there will be different light conditions in different places.

How is it done?

You have to calibrate the IR sensor in such a way that when the sensor is on white part LED must be ON and LED must be OFF when the sensor is in black track.
Now you know if the sensor is giving high output, it is on white part and if it is giving the low output, it is on the black track. You can code accordingly.
By turning the potentiometer, you can vary the voltage at V- there by it helps you to calibrate the sensor according to the light conditions at the spot of competition.

Connection of IR module to Arduino

As you know that the output of comparator (Point E in the circuit diagram) is digital, the output of



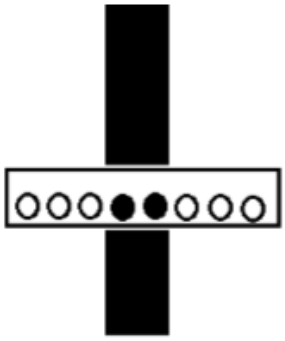
Arduino Mega 2560 Pinout

the comparator (pins S1 TO S8) can be connected to **any Digital PINS** of the Arduino. Make sure that **Ground of Arduino and IR Module are shorted and the IR module powers only with 5V not 3.3 V.**

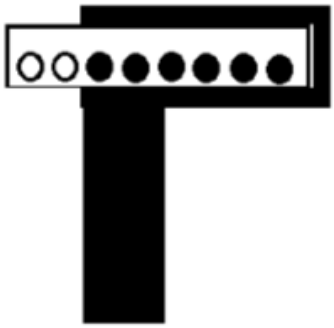
Motor inputs on motor driver module should be connected to the any of the **Digital pins** of Arduino.

CODING part:

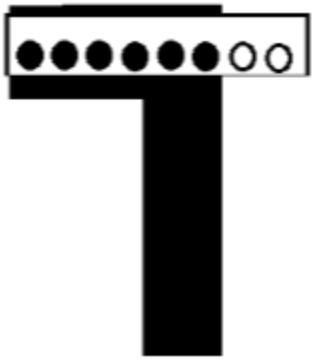
Now you know that the sensor's output is connected to the Arduino. Using 8 sensor IR array some of the simple cases that might be encountered are mentioned below,



When middle 2 sensors are OFF, make the motors to move fwd.



When 6 sensors on right are OFF make the robot to move right.



When left 6 sensors are off, make the robot to move left.

As simple as that. Just digital read the input Pins from the IR array and give the output to the motors to drive them. Thus, using simple if-else cases, you can write the code.

Example:
S1, S2 …. S8 are INPUTS.
leftmotorfwd, leftmotorbkwd, rightmotorfwd, rightmotorbkwd are OUTPUTS functions for turning motors.

```
S1=digitalRead(Some digital pin);
S2=digitalRead(Some digital pin);
S3=digitalRead(Some digital pin);
S4=digitalRead(Some digital pin);
S5=digitalRead(Some digital pin);
S6=digitalRead(Some digital pin);
S7=digitalRead(Some digital pin);
S8=digitalRead(Some digital pin);

if(S1==HIGH && S2==HIGH && S3==HIGH && S4==LOW && S5==LOW &&
S6==HIGH && S7==HIGH && S8==HIGH)
{
digitalWrite(leftmotorfwd,HIGH);
digitalWrite(rightmotorfwd,HIGH);
digitalWrite(leftmotorbkwd,LOW);
digitalWrite(leftmotorbkwd,LOW);
}//To move forward
```

NOTE:

1. You can make the LED to be OFF on black line and ON against the white part if you do the calibration of the sensors accordingly on the spot. (Calibration can be done by varying the potentiometer
   To check, just connect the IR module to 5V and GND and then turn potentiometer with the screwdriver you can observe the turning ON and OFF of the LED of corresponding sensor.

2. The track may contain different and many more cases in addition these 3 above cases. The 3 cases mentioned above are just to give a fair idea. i.e. **If middle sensors are LOW, make the robot to move forward. You can write the code for remaining left, right, T junctions etc.**

II. FURY ROAD: Event date – 24th March 2019

Fury Road is competition in which a bot has to run on a muddy terrain full of various curves and obstacles.

The robot can be of 2 types wired and wireless:

Wired Robot:

Things You Need..

- **1 x Chassis with 4 x L-clamp**
- **4 x Geared DC motor (300 RPM used)**
- **4 x Wheels**
- **Battery 12v (Lead acid or LIPO)**
- **Ribbon cable**
- **2 x DPDT switches with box**
- **Insulation Tape**
- **Soldering iron and solder**

Robot Assembly:

Structure of DPDT switches:

For the working of DPDT switches, you can refer
https://www.youtube.com/watch?v=SE9wQns8sjU

Connections:

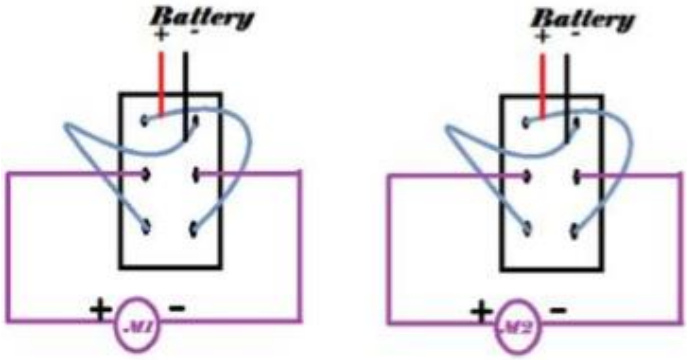
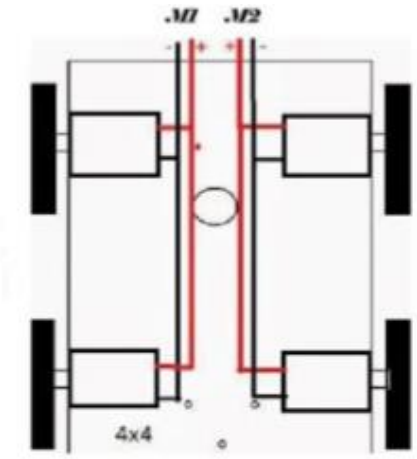


Fig (a). 2 x DPDT Switch



Fig(b).Top view of chassis

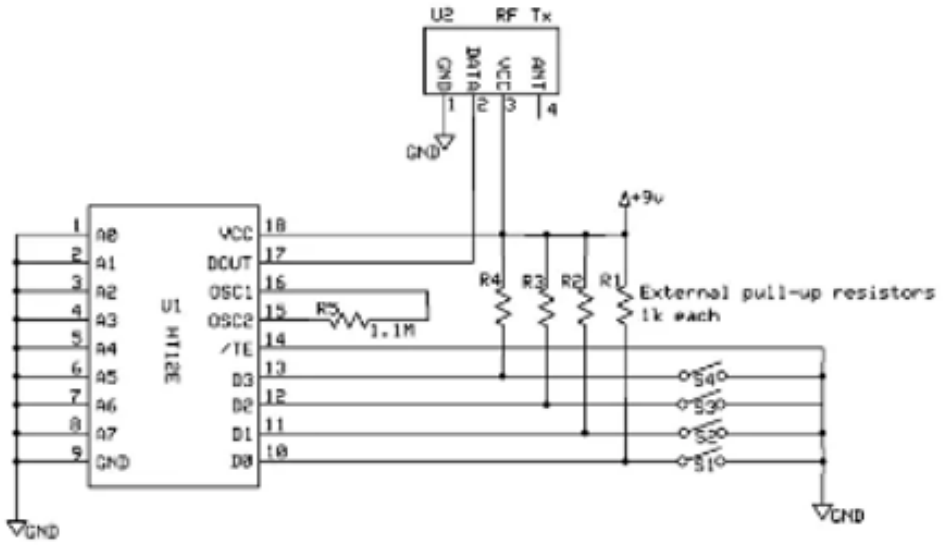
http://www.amazon.in/Switch-Dpdt-Switches-Robot-Control/dp/B00TJHZD16/ref=sr_1_1?ie=UTF8&qid=1489339692&sr=8-1&keywords=dpdt+switch+box

Always purchase center OFF DPDT switches

Wireless Robot:

To make the wireless robot, you need to use the RF transmitter and RF receiver.

Thus, data sent by the RF transmitter can be used to transmit through wireless media and is received by the receiver. You can prepare your own Remote.
Remote has 2 parts. Transmitter and the receiver.

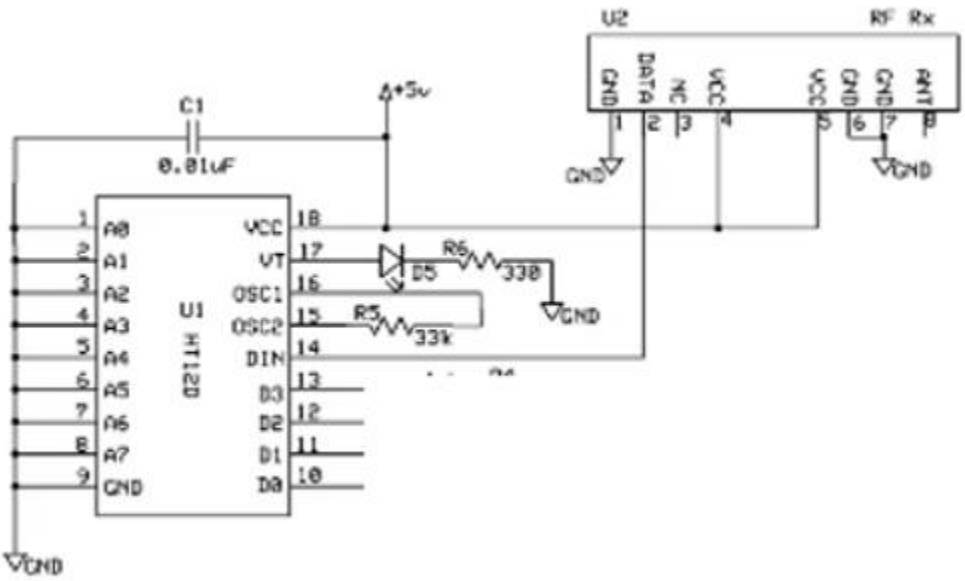


(c) maxEmbedded 2011
maxEmbedded.wordpress.com

maxEmbedded		
RF Transmitter Schematics		
Mayank Prasad	Rev 1.0 04-09-2011	RF # 1

Switches S1, S2, S3, S4 in the above diagram can be used to control the robot.

The data sent by S1, S2, S3, S4 is by pulldown mechanism. The same data is received by the receiver.



(c) maxEmbedded 2011
maxEmbedded.wordpress.com

maxEmbedded		
RF Receiver Schematics		
Mayank Prasad	Rev 1.0 05-09-2011	RF # 2

A good explanation about the RF remote is given at
http://maxembedded.com/2011/09/rf-module-interfacing-without-microcontrollers/
It is up to you whether you do wired or wireless robots. No constraints upon that.

Guidelines for building the bot:

Bot Specification for AMAZE:

- The autonomous bot must fit into the box of dimension 220 mm X 220 mm X 220 mm(l x b x h)
- The code used to program the bots will be checked by the organizers before run to ensure no **hardcoding** has been done . If any team is found of such malpractices they will be disqualified.
- Bot must be started individually by only one switch. However, a team may have onboard switch for restart. This switch has to be shown to the organizer before the run.
- During the run, the autonomous bot must not damage the arena in any way. It is not allowed to leave anything behind or make any marks while traversing the arena. Any bot found damaging the arena will be immediately disqualified. The final decision is at the discretion of the organizers.
- Bot must have on board power supply.
- When using the electric power supply, the potential difference between any 2 points must not exceed 24 V at any point of time during the game.
- The autonomous bot should not separate or split into two or more units. All bots/units which are touching each other or are in the starting point will be considered as one bot.
- Machine cannot be constructed using readymade 'Lego kits' or any readymade mechanism. But they can make use of readymade gear assemblies. Violating this clause will lead to disqualification of the team.

Track width of Amaze will be 2 cm to 2.5 cm. Middle 2 sensors will be on straight black line.

Bot Specification for FURY ROAD:

- The bot should be powered by electric energy only (Those found to be using IC engines will not be allowed to participate).
- The bot dimensions should not exceed 25 cm * 20 cm. An allowance of 1cm will be allowed.
- The bot can be either wired or wireless. In case of wired bots make sure that the wire length is minimum of 8m.
- Batteries should be sealed. Batteries such as LiPo, NiCd, dry cell etc. can be used

General Guidelines for Fury Road

- Since the track will involve all kind of possibilities such as inclinations, hair-pin curves etc. build your bot wisely.
- Its better if you use 4 wheeled Robot with all wheels connected with a motor to get a good speed.
- Choose a motor with a decent speed (300 RPM at least) and good torque.
- Preferred wheel diameter is 7 • 10 cm.
- Make sure your bot has a good ground clearance.

SCORING CRITERION, DISCIPLINARY RULES AND OTHER COMPETITION RULES WILL BE UPDATED SOON.
THE ABOVE RULES ARE ONLY TO HELP YOU TO BUILD THE ROBOT.

FAQs

- **Who can participate?**
  - **Student from any college or university can participate.**
  - **Students from 3rd and 4th year B.E. of SJCE are not eligible to participate.**
- **How many participants in a team?**
  - **Maximum of 4 participants in a team.**
- **Can students from different colleges form a team?**
  - **Yes.**

For other queries,

contact:

Raghavendra: 8277544356

Shashwath : 7760732108