AUTONOMOUS GRID SOLVER

Team Members:

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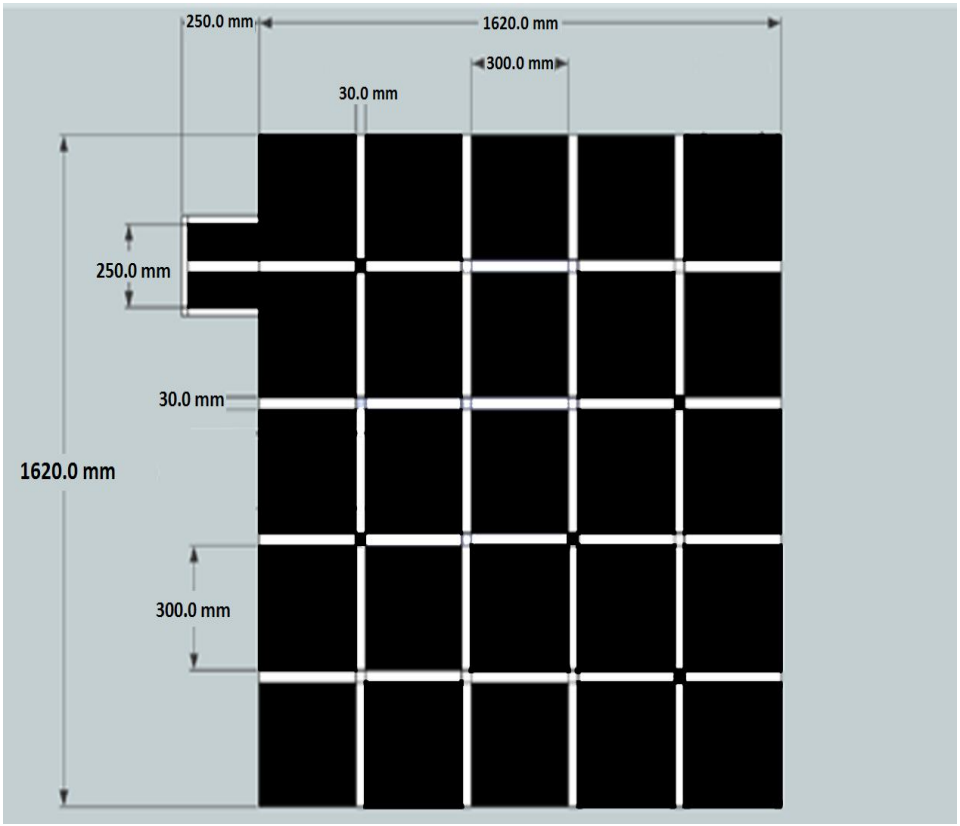
Event Name: ARCADE RUN (NVISION'13-IITH)

Task: *An autonomous bot has to detect and count the number of black nodes present in the 5x5 arena.*

Arena:



Robot Design:

Components Required:

1)LED's, Photo Diodes

2)ARDUINO UNO(Micro Controller board based on ATmega 328)

3) Integrated Circuits:

- L293D (Motor Controller)
- LM358N (Op-Amp)

4)LCD Display(JHD 162A)

5)2 Motors(100 rpm)

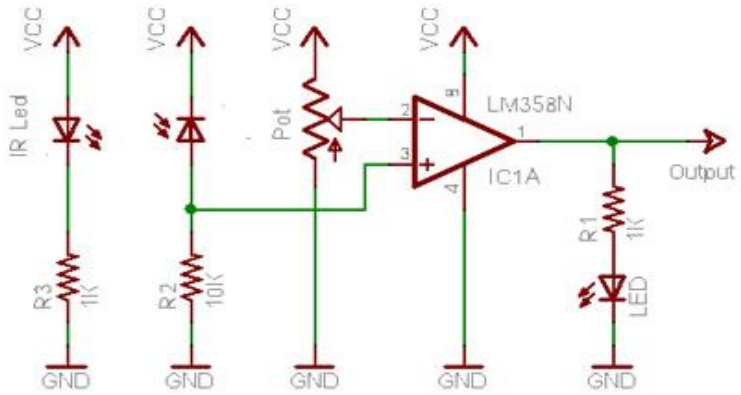
Construction & Design:

We had restricted the design to 20 cm*20 cm*20 cm. We had Sensor array of 6 IR sensors in front and 2 wheels in between and a support(instead of castor) at back of our robot. On the top, we mounted the programming board(Arduino) , LCD as well as L293D circuit board.

Sensor array:

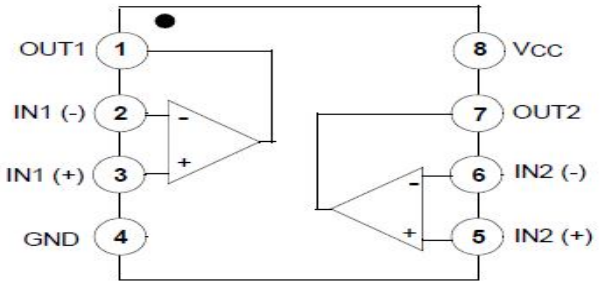
We used 6 IR sensors to follow the line and to detect the black & white nodes.

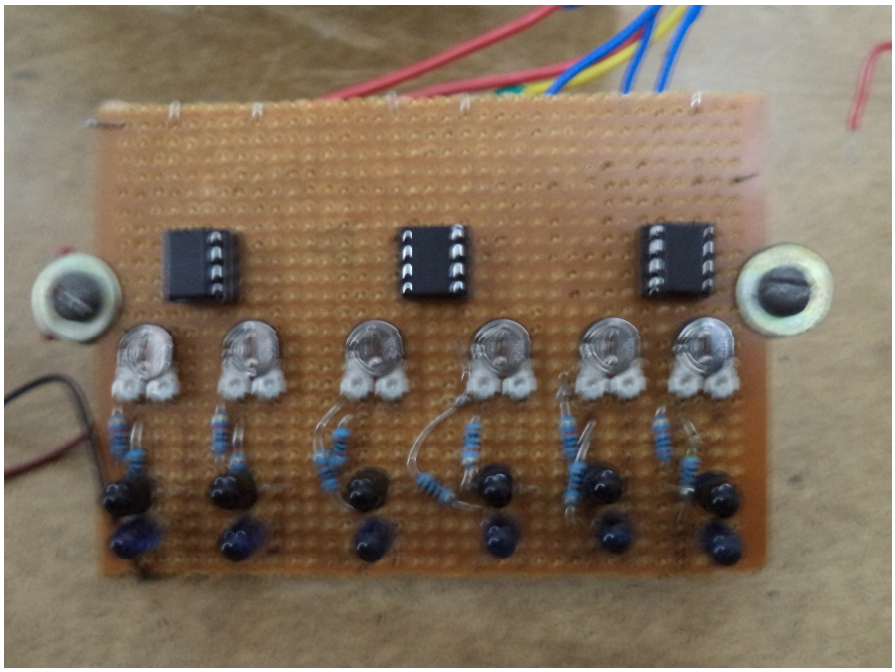
Sample Circuit:



We use LM358N as Voltage Comparator. It is an Op-amp.

Pin diagram of LM358N:





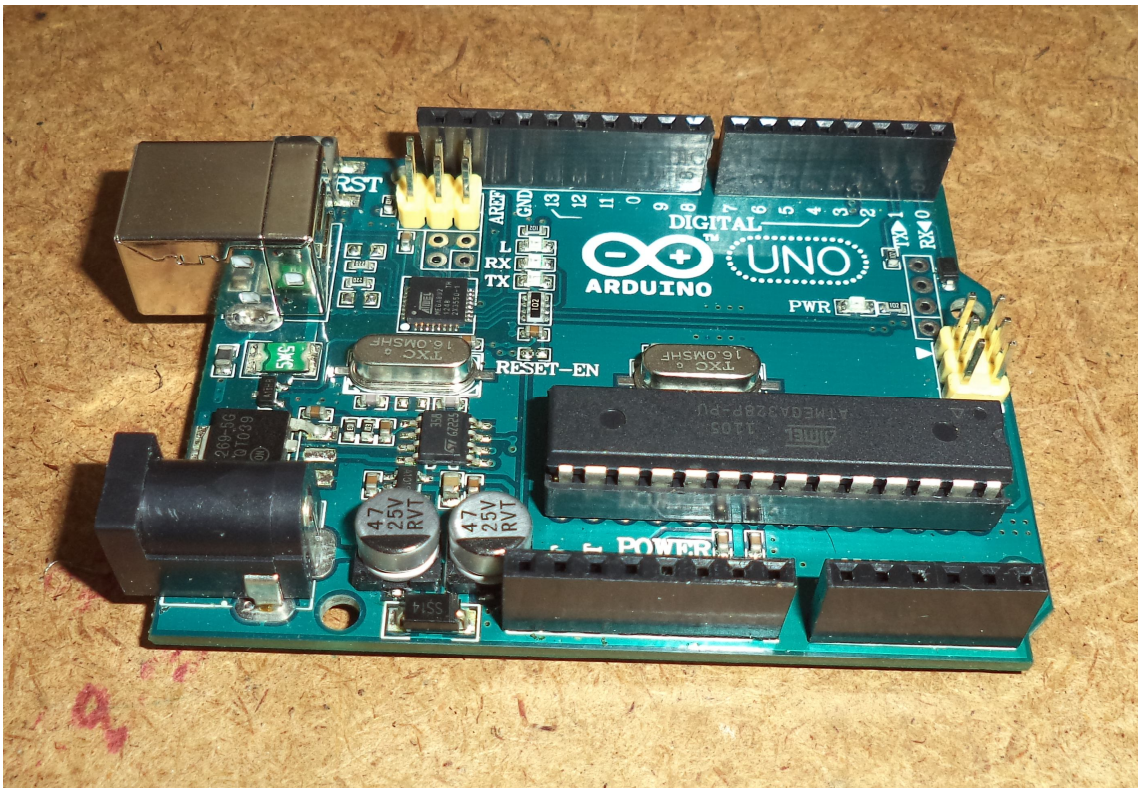
6-IR Sensor Module

Electronics:

Controlling of robot was done using a microcontroller. ATmega328p was chosen as it has required functionality. We used Arduino Uno(micro-controller board based on ATmega328p) to programme the microcontro-ller.

Summary:

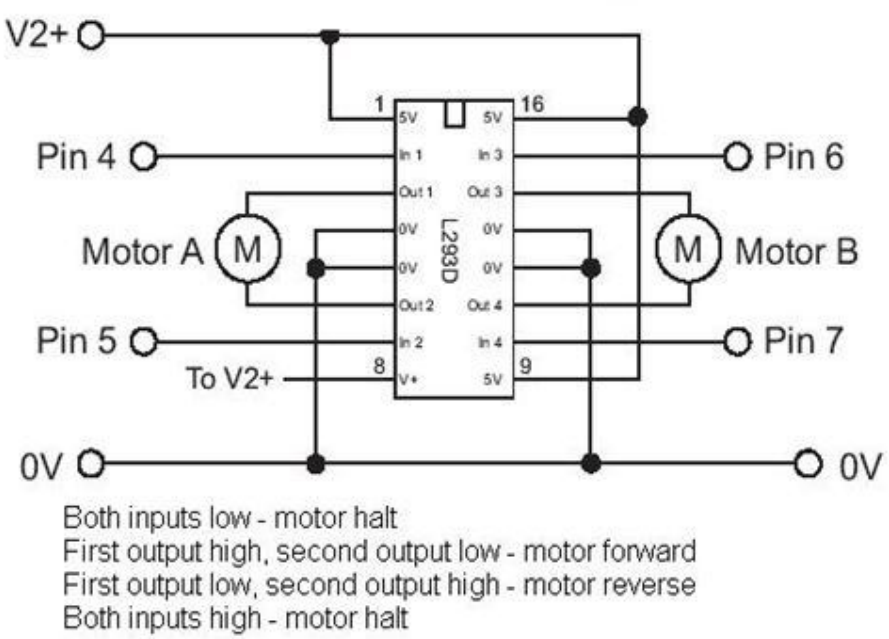
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-9V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) (0.5 KB used by bootloader)
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz



Arduino Uno programming board

Motor Controllers:

We used L293D to control the motors.



Programming:

The code is given below.

##

```
int count=0;
int gl=0,rl=0;
int rf=1;int maxturns=7;
int s1=2;int s2=3;int s3=4;int s4=7;int s5=8;int s6=10;//sensor intail
int mp1 = 9;int mn1 = 11;int mp2 = 5;int mn2 = 6;//motor intial
int totaljunctions=0;int exits=0;
int movetime=200;//for delay of move
int movetime2=500;
int gainmovetime=200;//for gain move delay
int rlop=13;int glop=12;//led pin o/p
int stops=0;
int exitnodes=0;
int pointprf=1;
#include <LiquidCrystal.h>
void setup()
{

pinMode(s1, INPUT);pinMode(s2, INPUT);pinMode(s3, INPUT);pinMode(s4, INPUT);pinMode(s5,
INPUT);pinMode(s6, INPUT);//sensor input itial
pinMode(mp1, OUTPUT);pinMode(mp2, OUTPUT);pinMode(mn1, OUTPUT);pinMode(mn2, OUTPUT);
pinMode(glop, OUTPUT);
  pinMode(rlop, OUTPUT);

//pinMode(enablePin1, OUTPUT);
//pinMode(enablePin2, OUTPUT);
}
void loop(){
  while(totaljunctions<16){
      sensordesicion();
  }
  while(exitnodes<3 &&totaljunctions>=16){
  if(totaljunctions==16 && stops !=0 && pointprf!=1){
    if(exitnodes<3){
    finaltraversal();}
    else{stops=1;}

  }
```

```
  else if(pointprf==1){
   drive(HIGH,LOW,HIGH,LOW,movetime2);
   pointprf=0;
}
 else if (stops==1){
    drive(HIGH,LOW,LOW,HIGH,500);drive(LOW,LOW,LOW,LOW,500);
    lcdcall();

  }

}
}
void lcdcall(){
  LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
  lcd.begin(16, 2);
  lcd.clear();
  // Print a message to the LCD.
  lcd.print("NO of black Nodes");
  lcd.setCursor(1,5);
  lcd.print(count);
  delay(10000);

}

void finaltraversal(){
if(digitalRead(s1)==HIGH && digitalRead(s2)==HIGH &&digitalRead(s4)==HIGH
&&digitalRead(s5)==HIGH &&digitalRead(s6)==HIGH){
  exitnodes=exitnodes+1;
  drive(HIGH,LOW,LOW,HIGH,movetime);
  gainposition();
}
else if(digitalRead(s1)==HIGH && digitalRead(s2)==HIGH &&digitalRead(s4)==LOW
&&digitalRead(s5)==HIGH &&digitalRead(s6)==HIGH){
  exitnodes=exitnodes+1;
  drive(HIGH,LOW,LOW,HIGH,movetime);gainposition();
}
}
void sensordesicion(){
if(digitalRead(s1)==HIGH && digitalRead(s2)==HIGH  &&digitalRead(s4)==HIGH
&&digitalRead(s5)==HIGH &&digitalRead(s6)==HIGH){
  totaljunctions=totaljunctions+1;
  turndesicion();

}
else if(digitalRead(s1)==HIGH && digitalRead(s2)==HIGH &&digitalRead(s4)==LOW
&&digitalRead(s5)==HIGH &&digitalRead(s6)==HIGH) {
  count=count+1;totaljunctions=totaljunctions+1;
  turndesicion();
  if(gl==0){digitalWrite(glop, HIGH);digitalWrite(rlop, LOW);}
  else if(gl==1){digitalWrite(glop, LOW);digitalWrite(rlop, HIGH);}
}
else if(digitalRead(s1)==LOW && digitalRead(s2)==LOW  &&digitalRead(s4)==LOW
&&digitalRead(s5)==LOW &&digitalRead(s6)==LOW){
  //totaljunctions=totaljunctions+1;
  //turndesicion();

   digitalWrite(mp1,LOW);
digitalWrite(mn1, LOW);
digitalWrite(mp2, LOW);
digitalWrite(mn2, LOW);
}
else{
  gainposition();

}


}
void gainposition(){
  if(digitalRead(s2)==HIGH &&digitalRead(s5)==LOW ){
```

```
  gainleftturn();

}
  else if(digitalRead(s2)==LOW &&digitalRead(s5)==HIGH ){
  gainrightturn();

}

}
void gainleftturn(){
  //code for left motor stops for miilli secs
  drive(HIGH,LOW,LOW,LOW,gainmovetime);

}
void gainrightturn(){
  //code for right motor stops for miilli secs
drive(LOW,LOW,LOW,HIGH,gainmovetime);

}
void turndesicion(){
if(totaljunctions%4==0 && rf==1){
      rightturn();
  }
   else if(totaljunctions%4==0 && rf==0){
      leftturn();
  }
  else if(totaljunctions%4==1 && rf==1 && totaljunctions!=1){
      rightturn(); rf=0;
  }
   else if(totaljunctions%4==1 && rf==0  && totaljunctions!=1){
      leftturn(); rf=1;
  }
  else{
   forwardmove();
  }

}
void forwardmove(){
  drive(HIGH,LOW,LOW,HIGH,movetime);gainposition();

}
void leftturn(){
  drive(HIGH,LOW,LOW,LOW,movetime2);gainposition();

}
void rightturn(){
  drive(LOW,LOW,LOW,HIGH,movetime2);gainposition();

}
void backwordmove(){
  drive(LOW,HIGH,HIGH,LOW,movetime);gainposition();

}
void drive(boolean mpd1,boolean mnd1,boolean mpd2,boolean mnd2,int time){
  digitalWrite(mp1,mpd1 );
digitalWrite(mn1, mnd1);
digitalWrite(mp2, mpd2);
digitalWrite(mn2, mnd2);
delay(time);

}
```

##

THANK YOU