CMR UNIVERSITY

Private University Established in Karnataka State by Act No. 45 of 2013

SCHOOL OF ENGINEERING AND TECHNOLOGY

An Internship Report

On

"VIRTUAL ROBOTICS INTERNSHIP"

Submitted in partial fulfillment of the requirements for the award of degree in

Bachelor of Technology

in

Computer and Communication Engineering

Of CMR University, Bangalore

Submitted by:

SHESHADRI M O

21BBTCC015

Internship Carried out at
Scientific Platforms
And Cosmic
Explorations
BANGALORE

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Prof. Bibi Ameena
Assistant Professor
Dept. of CCE, SOET

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2022-2023

CMR UNIVERSITY

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Department of Computer and Communication Engineering

CERTIFICATE

This is to certify that the Internship work entitled "Virtual Robotics Internship", submitted to the CMR University, Bangalore, in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer and Communication Engineering is a record of work done by Mr. **Sheshadri M O** bearing university register number **21BBTCCO15** during the academic year 2022-23 at School of Engineering and Technology, CMR University, Bangalore under my supervision and guidance. The Internship report has been approved as it satisfies the academic requirement in respect of internship work prescribed for the said degree.

Internal Guide:
Prof. Bibi Ameena
Assistant Professor
Dept. of CCE
SOET, Bangalore

External Guide:
KODACY
Educational Platform

Signature of the HOD
(Dr. Saravana Kumar)

Signature of the Dean

Examiners Signature with date

(1) _____ _____
Name Signature

(2) _____ _____
Name Signature

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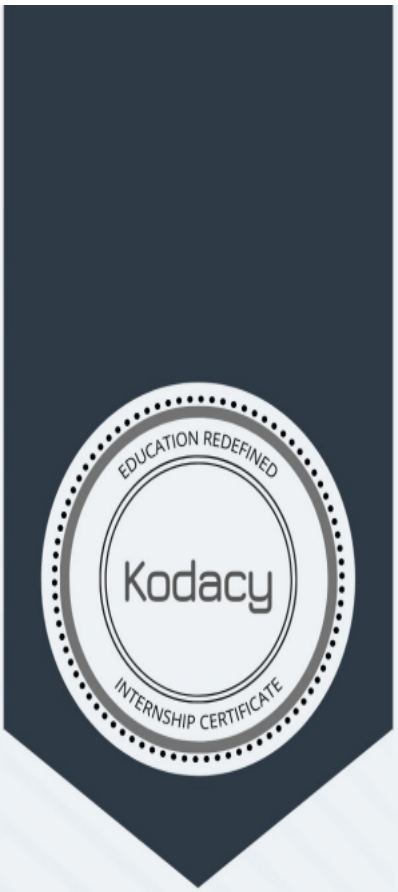
Certificate
OF INTERNSHIP



This certificate is presented to :

Sheshadri M O

for successfully participating in the 15 day online internship program on "ROBOTICS" conducted by KODACY in association with Scientific Platforms And Cosmic Explorations (SPACE).

Date Of Completion : 07/02/2023
Certificate ID : SVRI2021R5761
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AKASH JOSEPH
Chief Executive Officer (CEO)

ABSTRACT

Kodacy is an educational platform under the parent company SPACE (Scientific Platforms And Cosmic Explorations. Kodacy aims to provide affordable and accessible education to everyone, anywhere across the world. Space is government registered and ISO 2020 certified company.

Robotics tests ideas and steers continuing research. Finally, robotics is the proof. The heart of robotics is motion – controlled programmable motion – which brings us to the present text. Modern Robotics imparts the most important insights of robotics: the nature of motion, the motions available to rigid bodies, the use of kinematic constraint to organize motions, the mechanisms that enable general programmable motion, the static and dynamic character of mechanisms, and the challenges and approaches to control, programming, and planning motions.

The evolution of the technical necessities of society and the technological advances achieved have helped the strong growth of new applications in recent years, such as surgery assistance, rehabilitation, automatic refuelling, etc. With the rapid modernization of the First World, new types of services are being required to maintain a certain quality of life.

The robotics internship comes with lessons and projects for you to learn, build, code and simulate virtually using our platform. It's a certified internship program.

ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of this project would be incomplete without the mention of the people who made it possible, without whose constant guidance and encouragement would have made efforts go in vain.

I consider myself privileged to express gratitude and respect towards all those who guided me through the completion of the project. I express my thanks to my Internal Internship Guide, Department of Computer and Communication Engineering, School of Engineering and Technology, CMR University for his constant support.

I express my sincere gratitude to my internship external guide or platform Kodacy collaboration with Scientific Platforms And Cosmic Exploration for guiding me throughout this internship and making it successful.

I would like to express my thanks to Dr. Saravana Kumar, Associate Professor and Head, Department of Computer and Communication Engineering, School of Engineering and Technology, CMR University, Bangalore, for his encouragement that motivated me for the successful completion of internship work.

I express my heartfelt sincere gratitude to Dr. V. R. Manjunath, Dean, School of Engineering and Technology, CMR University for his support. I would like to express my sincere thanks and gratitude to our internship coordinator.

Prof. Bibi Ameena for his support, invaluable guidance and encouragement throughout the tenure of this internship.

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SHESHADRI M O

DECLARATION

I, SHESHADRI M O bearing USN 21BBTCC015, student of Bachelor of Technology, Computer and Communication Engineering, CMR University, Bengaluru, hereby declare that the internship work entitled "VIRTUAL ROBOTICS INTERNSHIP" submitted by me, for the award of the Bachelor's degree in Computer and Communication Engineering to CMR University is a record of bonafide work carried out independently by me under the supervision and guidance of Prof. Bibi Ameena, Assistant Professor, CCE Dept., CMR University.

I further declare that the work reported in this internship work has not been submitted and will not be submitted, either in part or in full, for the award of any other degree in this university or any other institute or University.

Place: Bengaluru SHESHADRI M O

Date: 21BBTCC015

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Chapter 1

1. INTRODUCTION

The robotics internship comes with lessons and projects for you to learn, build, code and simulate virtually using our platform. It's a certified internship program. Robotics involves the design, construction, operation, and use of robots. The goal of robotics is to design machines that can help and assist humans. Robotics develops machines that can substitute for humans and replicate human actions. Robots can be used in many situations for many purposes, but today they are used in dangerous environments (including inspection of radioactive materials, bomb detection and deactivation), manufacturing processes, or wherever humans cannot survive (e.g., in space, underwater, in high heat and radioactive conditions). Robots can take any form, but some are made to resemble humans in appearance. This is claimed to help in the acceptance of robots in certain replicative behaviors which are usually performed by people. Such robots attempt to replicate walking, lifting, speech, cognition, or any other human activity. The word robotics was derived from the word robot, which was introduced to the public by Czech writer Karel Capek in his play R.U.R. (Rossum's Universal Robots), which was published in 1920. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Robotics is also used in STEM (science, technology, engineering, and mathematic) as a teaching aid.

In this particular internship given by SPACE, we are going to learn about following topics;

- Types of Robots
- Introduction to Robo chip
- Playing With LED and code
- Ultrasonic Sensor and code
- Motor Driver

1. Obstacle avoidance robot and code
2. Line following robot and code
3. Joystick controlled robot and code

Chapter 2

4. LITERATURE SURVEY

Murphy, Robin R. Introduction to AI robotics. MIT press, 2019
Niku, Saeed B. Introduction to robotics: analysis, control, applications, John Wiley & Sons, 2020.

Robotics is about turning ideas into action. Somehow, robots turn abstract goals into physical action: sending power to motors, monitoring motions, and guiding things towards the goal. Robotics is the gathering place of these ideas. Robotics provides motivation. Robotics tests ideas and steers continuing research. Finally, robotics is the proof. The heart of robotics is motion – controlled programmable motion – which brings us to the present text. Modern Robotics imparts the most important insights of robotics: the nature of motion, the motions available to rigid bodies, the use of kinematic constraint to organize motions, the mechanisms that enable general programmable motion, the static and dynamic character of mechanisms, and the challenges and approaches to control, programming, and planning motions. Modern Robotics presents this material with a clarity that makes it accessible to undergraduate students.

During the last 45 years, robotics research has been aimed at finding solutions to the technical necessities of applied robotics. The evolution of application fields and their sophistication have influenced research topics in the robotics community. This evolution has been dominated by human necessities. As a response to the evolution of human social needs, from the industrial robotics that released the human operator from dangerous or risky tasks to the recent explosion of field and service robotics to assist the human. The later incorporation of industrial robots into other types of production processes added new requirements that called for more flexibility and intelligence in industrial robots.

As a first step, we introduce a 3×3 matrix representation for describing a frame's orientation; such a matrix is referred to as a rotation matrix. It was around 1960 when industrial robots were first introduced in the production process, and until the 1990s industrial robots dominated robotics research. In the beginning, the automotive industry dictated the specifications industrial robots had to meet, mainly due to the industry's market clout and clear technical necessities. One such area was kinematic calibration, which is a necessary process due to the inaccuracy of kinematic models based on manufacturing parameters. The calibration process is carried out in four stages. The first stage is mathematical modeling, where the Denavit-Hartenberg (DH) method and the product-of-exponential (POE) formulation lead the large family of methods. A robot manipulator, also known as a robot arm, is a serial chain of rigid limbs designed to perform a task with its end effector.

The evolution of the technical necessities of society and the technological advances achieved have helped the strong growth of new applications in recent years, such as surgery assistance, rehabilitation, automatic refuelling, etc. With the rapid modernization of the First World, new types of services are being required to maintain a certain quality of life. Research in humanoid robotics is currently shifting from locomotion issues to interaction between humans and robots.

Definitely robotics research is moving from industrial to field and the way the field is evolving is the controversy set off by Prof. Engel berger, the creator of the first robotics company, at the 2005 International Robot Exhibition in Tokyo, Japan. Since the introduction of industrial robots in the automotive industry, robotics research has evolved over time towards the development of robotic systems to help the human in dangerous, risky or unpleasant tasks. As the complexity of tasks has increased, flexibility has been demanded in industrial robots, and robotics research has veered towards adaptive and intelligent systems.

CHAPTER 3

TYPES OF ROBOTS

Robotics is the intersection of science, engineering and technology that produces machines called robots that substitute or replicate human actions.
Types of robots are:

- Pre-programmed Robots
- Humanoid Robots
- Autonomous Robots
- Teleoperated Robots
- Augmenting Robots

3.1. PRE-PROGRAMMED ROBOTS:

Pre- programmed robots operate in a controlled environment where they do simple and monotonous tasks. An example of a preprogrammed robot would be a mechanical arm on an automotive assembly line.

3.2. HUMANOID ROBOTS:

A humanoid robot is a robot with its body shape built to resemble the human body. The design may be for functional purposes, such as interacting with human tools and environments, for experimental purposes, such as the study of bipedal locomotion. Some humanoid robots also have heads designed to replicate human facial features such as eyes and mouths.

3.3. AUTONOMOUS ROBOTS:

An autonomous robot is a robot that is designed and engineered to deal with its environment on its own, and work for extended periods of time without human intervention. A truly autonomous robot is one that can perceive its environment, make decisions based on what it perceives and/or has been programmed to recognize conditions and then actuate a movement or manipulation within that environment.

3.4. TELEOPERATED ROBOTS:

Tele-operated robots are remotely controlled robots. they might have some sort of intelligence, but normally they take their command from a human operator and execute exactly as instructed. Right now, tele-operated robots are mostly used in medical surgeries and military operations.

3.5. AUGMENTING ROBOTS:

Tele-operated robots are remotely controlled robots. they might have some sort of intelligence, but normally they take their command from a human operator and execute exactly as instructed. Right now, tele-operated robots are mostly used in medical surgeries and military operations.

Fig (3.1.1)

Fig (3.2.1)

Fig (3.3.1)

Fig (3.4.1)

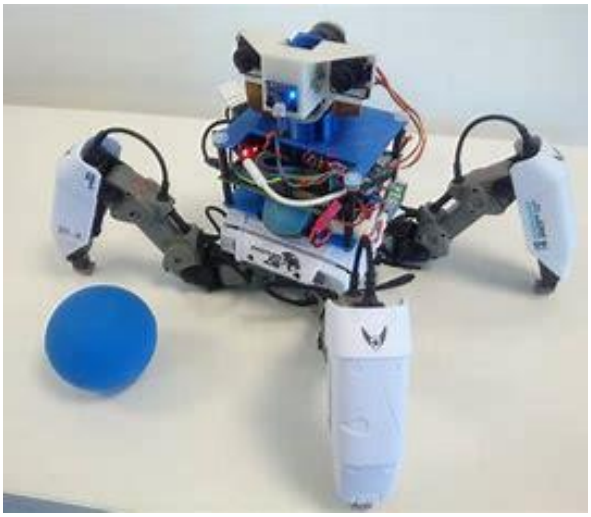

Fig (3.5.1)

CHAPTER 4

INTRODUCTION TO ROBOCHIP

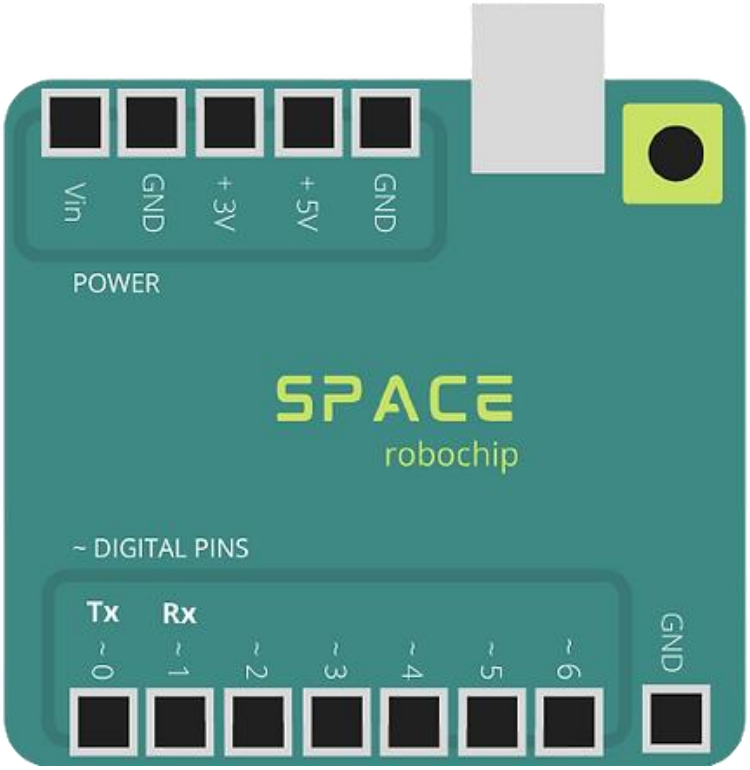

Fig (4.1)

This is SPACE Robo chip. You will be learning to code and build robots virtually using this chip in our internship program. The Space Robo chip is a microcontroller which has 7 digital pins. The Pin 0 is also considered as the transmitter pin (Tx) and Pin 1 is also considered as receiver pin (Rx).

CHAPTER 5

PLAYING WITH LED (LIGHT EMIITING DIODE)

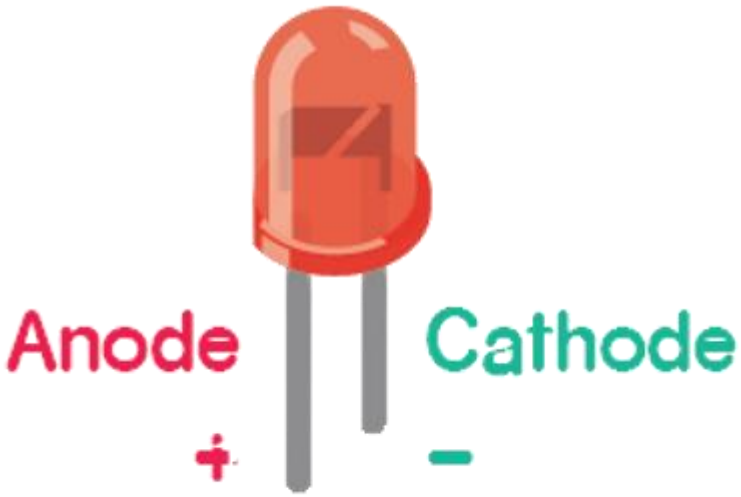

Fig (5.1)

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current is passed through it. In this experiment we will connect the positive end to digital pin 6 of our microcontroller board. As well as we will connect the negative pin of LED to GND of our microcontroller board.

Positive (+) to Digital Pin 6

Negative (-) to GND

CODE:

```
void setup() {
pinMode(6, OUTPUT);
}
void loop(){
digitalWrite(6, HIGH);
delay(100);
digitalWrite(6, LOW);
delay(100);
}
```

CHAPTER 6

ULTRASONIC SENSOR

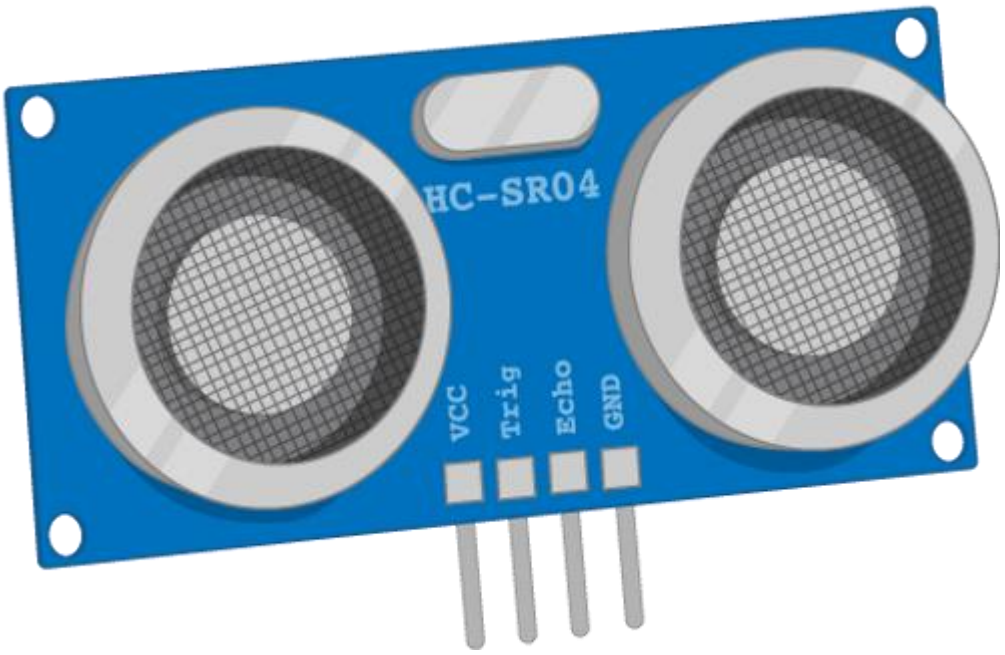

Fig (6.1)

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves. Usually a normal ultrasonic sensor will have 4 pins. In order to generate the ultrasound we need to set the Trigger Pin on a High State for 10 microseconds. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo Pin. The Echo Pin will output the time in microseconds the sound wave travelled

EXPERIMENTAL CONNECTIONS:

- VCC to 5V of Space Robo chip
- Trig to Digital Pin 5 of Space Robo chip
- Echo to Digital Pin 6 of Space Robo chip
- GND to GND of Space Robo chip

CODE:

```
const int trigPin = 5;
const int echoPin = 6;

float duration, distance;

 void setup() {
   pinMode(trigPin, OUTPUT);
   pinMode(echoPin, INPUT);
   Serial.begin(9600);
 }

 void loop() {
   digitalWrite(trigPin, LOW);
   delayMicroseconds(2);
   digitalWrite(trigPin, HIGH);
   delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

   duration = pulseIn(echoPin, HIGH);
   distance = (duration*.0343)/2;
   Serial.print("Distance: ");
   Serial.println(distance);
   delay(100);
 }
```

CHAPTER 7

MOTOR DRIVER

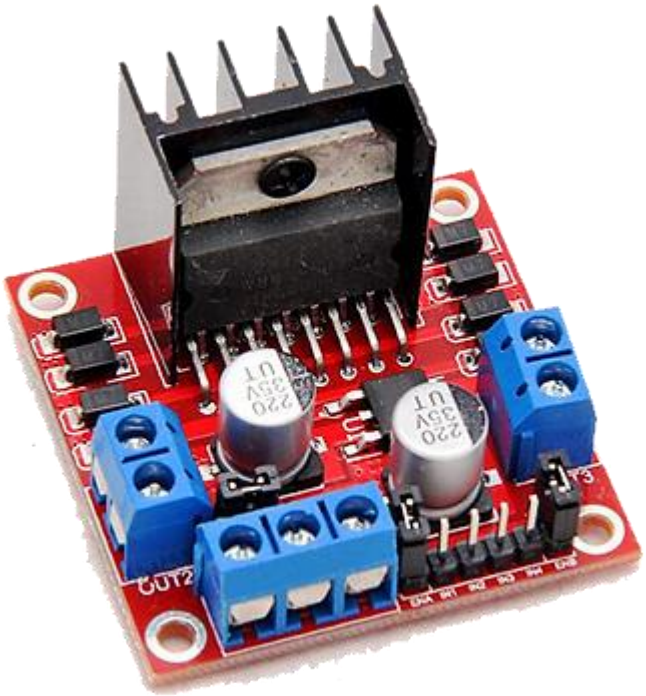

Fig (7.1)

As the name suggest a motor driver IC or module is used to drive the motors of a robot. We are using it as a kind of protection from high voltages which would damage our microcontroller board which in this case is our Space Robo chip. Its because our microcontroller board only require maximum of 5v to run but for motors we need more voltage for its proper working. So we use this driver as a link to carry out both the jobs together, which is the proper working of microcontroller board as well as the motors.

7.1 Obstacle Avoiding Robot

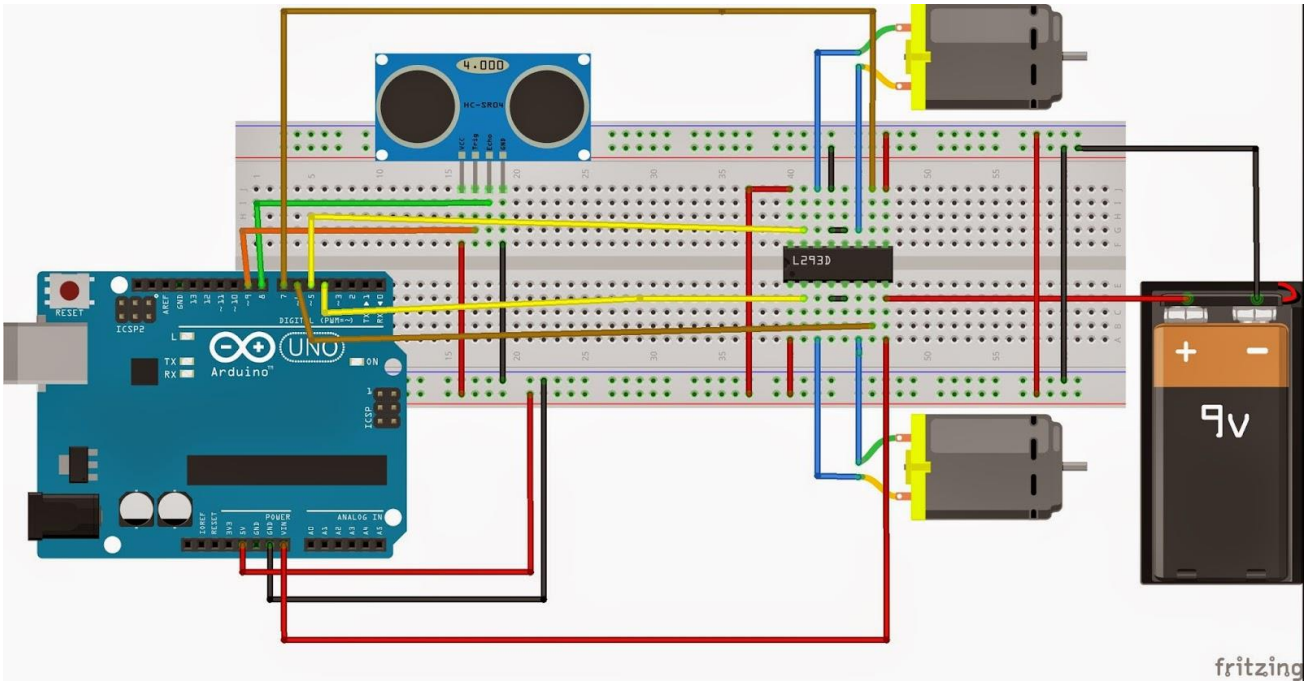

Fig (7.1.1)

An obstacle avoiding robot is a fully autonomous robot which can be able to avoid any obstacle which it face when it move. Simply, when it met an obstacle while it moving forward, automatically stop moving forward and makes a step back. In robotics, obstacle avoidance is the task of satisfying some control objective subject to non-intersection or non-collision position constraints. What is critical about obstacle avoidance concept in this area is the growing need of usage of unmanned aerial vehicles in urban areas for especially military applications where it can be very useful in city wars. Normally obstacle avoidance is considered to be distinct from path planning in that one is usually implemented as a reactive control law while the other involves the pre-computation of an obstacle-free path which a controller will then guide a robot along. With recent advanced in the autonomous vehicles sector, a good and dependable obstacle avoidance feature of a driverless platform is also required to have a robust obstacle detection module.

CODE:

```
#define echo 5
#define trig 6
#define led 13
void setup()
{
```

```
pinMode(trig, OUTPUT);
pinMode(echo,INPUT);
pinMode(1,OUTPUT);


pinMode(2,OUTPUT);
pinMode(3,OUTPUT);
pinMode(4,OUTPUT);
Serial.begin(9600);
}
void loop()
{
long time,dist;
digitalWrite(trig,LOW);
delayMicroseconds(2);
digitalWrite(trig,HIGH);
delayMicroseconds(10);
digitalWrite(trig,LOW);
time = pulseIn(echo,HIGH);
dist = time/2/29.1;
Serial.println(dist);
delay(1000);
if (dist<100)
{
digitalWrite(1,LOW);
digitalWrite(2,LOW);
digitalWrite(3,LOW);
digitalWrite(4,LOW);
}
else
{
digitalWrite(1,HIGH);
digitalWrite(2,LOW);
digitalWrite(3,LOW);
digitalWrite(4,HIGH);
}
}
```

7.2 Line Following Robot

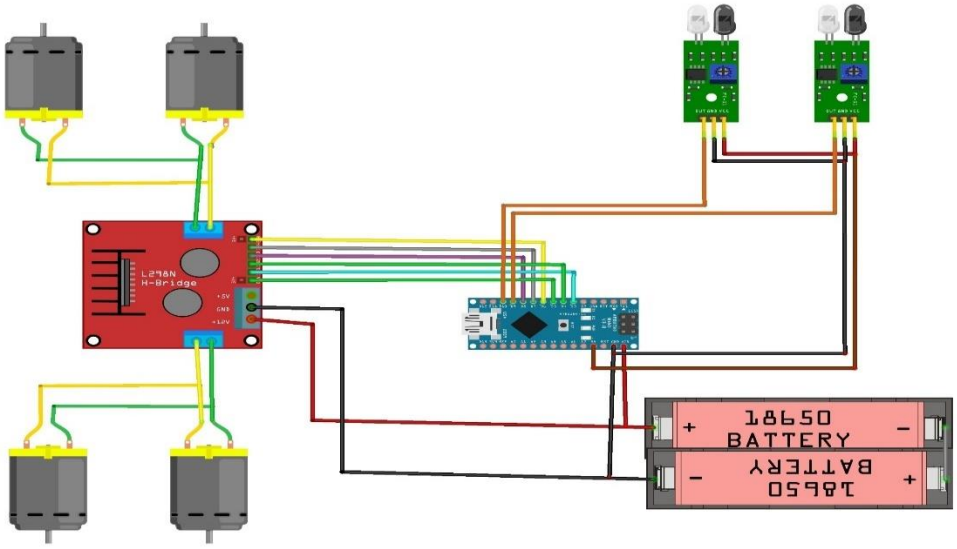

Fig (7.2.1)

Line follower robot is an autonomous machine that can follow a path. The path can be seen like a white line on a black surface (or vice-versa) or it can be invisible as magnetic field. The robot consists of two sensors that are installed at the front end of the robot body and two wheels that are driven by DC motors. The circuit board present in the robot controls the wheel speed based on the input signal from the sensors. The controlling of the robot is done like that when the robot sees a black line it stops.

CODE:

```
const int r1=1, r2=2, l1=3, l2=4;
const int LS = 6;
const int RS = 5;
int L,R;
void setup()
{
pinMode(LS, INPUT);
pinMode(RS, INPUT);
pinMode(r1, OUTPUT);
pinMode(r2, OUTPUT);
pinMode(l1, OUTPUT);
pinMode(l2, OUTPUT);
digitalWrite(r2,LOW);
digitalWrite(l2,LOW);
}
void loop()
{
L = digitalRead(LS);
R = digitalRead(RS);
digitalWrite(r1, !R);


digitalWrite(l1, !L);
}
```

7.3 Joystick Robot

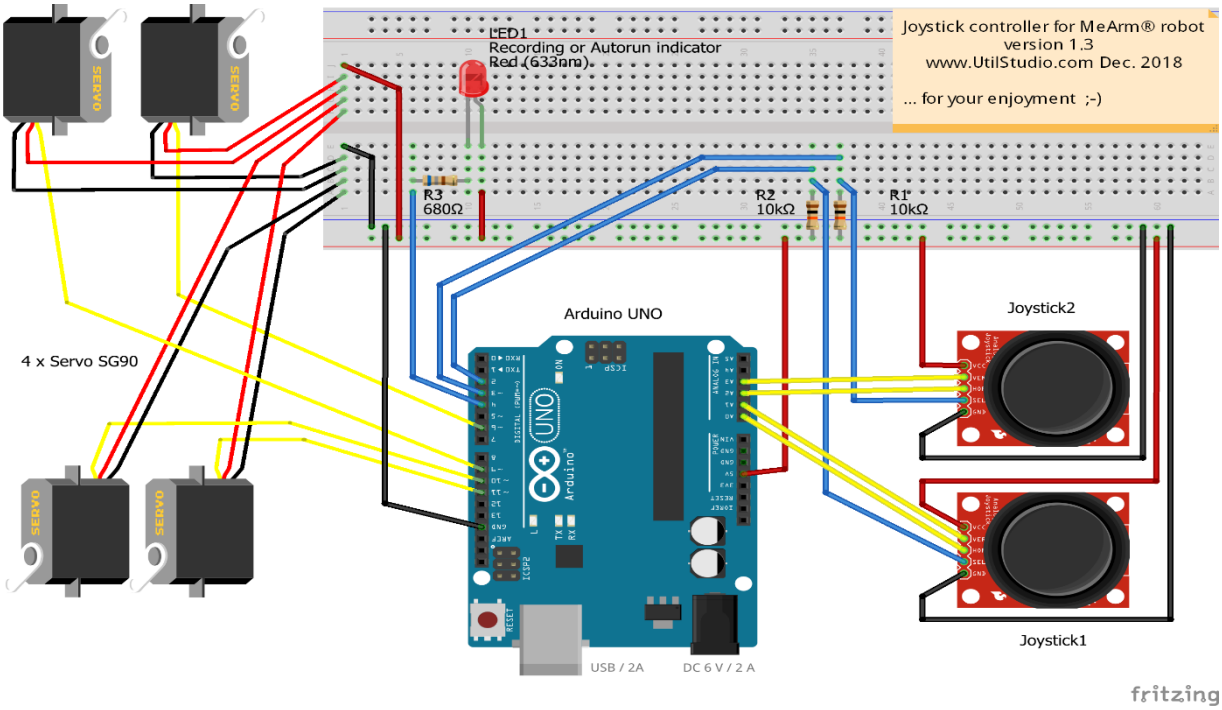

Fig (7.3.1)

A joystick, sometimes called a flight stick, is an input device consisting of a stick that pivots on a base and reports its angle or direction to the device it is controlling. A joystick, also known as the control column, is the principal control device in the cockpit of many civilian and military aircraft, either as a centre stick or side-stick. Joysticks are often used to control video games, and usually have one or more push-buttons whose state can also be read by the computer. A popular variation of the joystick used on modern video game console is the analog stick. Joysticks are also used for controlling machines such as cranes, trucks, underwater unmanned vehicles, wheelchairs, surveillance cameras, and zero turning radius lawn mowers. Miniature finger-operated joysticks have been adopted as input devices for smaller electronic equipment such as mobile phones or gadgets.

CODE:

```
 char t;
const int r1=2,r2=3,l1=4,l2=5;

void setup() {
Serial.begin(9600);
pinMode(r1,OUTPUT);
pinMode(r2,OUTPUT);
pinMode(l1,OUTPUT);
pinMode(l2,OUTPUT);
}

void loop() {
if(Serial.available()){
t = Serial.read();
}

if(t == 'F'){
digitalWrite(r1,HIGH);
digitalWrite(r2,LOW);
digitalWrite(l1,HIGH);
digitalWrite(l2,LOW);
}

else if(t == 'B'){
digitalWrite(r1,LOW);
digitalWrite(r2,HIGH);
digitalWrite(l1,LOW);
digitalWrite(l2,HIGH);
}

else if(t == 'L'){
digitalWrite(r1,HIGH);
digitalWrite(r2,LOW);
digitalWrite(l1,LOW);
digitalWrite(l2,HIGH);
delay(100);
t = 'S';
}

else if(t == 'R'){
digitalWrite(r1,LOW);
digitalWrite(r2,HIGH);
digitalWrite(l1,HIGH);
digitalWrite(l2,LOW);
delay(100);
t = 'S';
}
}
```

CHAPTER 8

8. CONCLUSION

The virtual robotic internship gave me the knowledge about how the robots are designed, implemented, controlled. Robotics is the gathering place of these ideas. Robotics provides motivation. Robotics tests ideas and steers continuing research. Finally, robotics is the proof. The heart of robotics is motion – controlled programmable motion – which brings us to the present text. Modern Robotics imparts the most important insights of robotics: the nature of motion, the motions available to rigid bodies, the use of kinematic constraint to organize motions, the mechanisms that enable general programmable motion, the static and dynamic character of mechanisms, and the challenges and approaches to control, programming, and planning motions.

CHAPTER 9

REFERENCE

[1] https://www.kodacy.com/roboticsinternshipdoc
[2] https://www.kodacy.com/post/code-doc
[3] https://en.wikipedia.org/wiki/Joystick
[4] https://en.wikipedia.org/wiki/Robots