VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELAGAVI – 590018, KARNATAKA INDIA

An Internship Report

"*ROBOTICS*"

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

BACHELOR OF ENGINEERING

In

ELECTRONICS AND COMMUNICATION

Submitted by

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1PE17EC122

Internship carried out

at

PINWHEEL ROBOTICS (formerly Idea Fires)

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Certificate

This is to certify that the Internship work entitled **"*ROBOTICS*"** carried out by ***Saurabh Suman*** bearing USN **1PE17EC122** a bona fide student of **PESIT Bangalore South Campus**, Bengaluru in fulfillment for the award of Degree of **Bachelor of Engineering in Electronics and Communication** of **Visvesvaraya Technological University, Belagavi** during the academic year **2020-2021**. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the department library. The Internship report has been approved as it satisfies the academic requirements in respect of Internship work prescribed for the said degree.

Signature of the guide

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DECLARATION

I, **Saurabh Suman** bearing USN **1PE17EC122** student of **8th semester, BE of the Department of Electronics and communication Engineering, PESIT-BSC,** would hereby declare that the Internship entitled **"ROBOTICS "** has been carried out by me and submitted in fulfillment of the course requirement for the aware degree of **Bachelors of Engineering in Electronics and Communication Engineering of Visvesvaraya Technological University, Belagavi during the academic year 2020-2021.** I further declare that the work embodied in this report has not been submitted to any other university or Institution for the award of any degree.

Place: Bengaluru

Date: 4th April 2021

Signature of Student

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ACKNOWLEDGEMENT

This Internship would be incomplete without the able of guidance of the people who made it possible. Without such encouragement, support and guidance from them, this internship would not have been possible.

I am very grateful to my external guide**, Technical Manager and Proprietor** for his constant technical and moral support that has been of immense help in realizing this Internship work.

I am very grateful to my internal guide **Mr. Vinay Reddy N, Assistant Professor, Department of Electronics and Communication Engineering, PESIT BSC,** for his constant technical and moral support that has been of immense help in realizing this Internship work. His support was indeed a motivating factor which drove me to work towards completion of the Internship with determination and dedication.

I would also like to thank **Dr. Subhash Kulkarni, Professor and Head, Department of Electronics and Communication Engineering, PESIT BSC**.

My sincere thanks to my internship co-ordinate **Mr. Vinay Reddy N** Assistant Professor, Dept. of ECE, PESIT-BSC, for his valuable suggestions and guidance.

My sincere thanks to **Dr. Subhash Kulkarni, Principal, PESIT BSC**, for providing the necessary facilities required to accomplish this Internship.

I am grateful to my parents and my friends who indirectly helped me and stood by me as a pillar of support in times of need during this Internship

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1.PINWHEEL ROBOTICS

1.1 ABOUT THE COMPANY

Pinwheel Robotics is a Robotics Research & Development Company. They take up R&D projects on Robotics and build prototype. They have in-house team of designers , circuit designers , sensor designer and programmer who can program micro-controller.
Pinwheel Robotics is a startup conceptualized by Mr Prateek Kumar Baishkhiyar. The company focuses on imparting technical knowledge to students of middle school and high school with a sole aim to make the technology ready. The venture is progressing and is run by young engineers and interns. The company targets school and education centers to showcase the DIY kits. The company organises workshops wherein hands-on activities are conducted for school children. Recently the company is also involved in developing industry grade robotics. The company is planning to expand in the PCB design and IOT. Most of the projects of the organization are based on Arduino UNO and ESP32.

To develop a community of avid Electronics engineers, the company is planning to impart skills to college students in an effort to grow the Robotics societies in colleges in and around Bengaluru. The company also assists other startups with robotics projects and technology demonstrations. Aid in the form of structural design is also provided.

Pinwheel Robotics brings the most novel and practical way of learning the concepts of Science, Technology, Engineering and Mathematics(STEM) to the Future Scientists and Engineers of the nations. Pinwheel imparts the concept of Science Engineering by way of making things, learning while doing. Pinwheel brings Joy to the Student community by way of introducing and designing the most novel and brilliant DIY Robotic kits.

Website: www.pinwheel.in
Headquarters: HSR layout, Bengaluru.
Year of Establishment : Oct,2018
Service ,Product and Design Organization
Type: Sole Proprietorship
Specialties: Creative, Innovative, and Rapid Prototyping

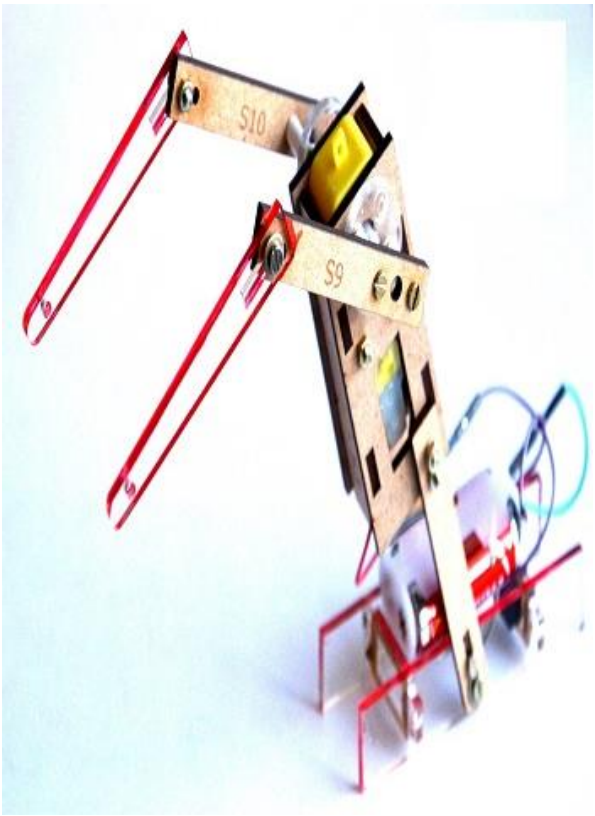
1.2 OUR FEATURES

- Easy to assemble modular DIY kit.
- Durable and long lasting.
- Reusable components and switch control.
- Up-gradable.
- Customer centric
- Timeliness
- User friendly

1.3 PRODUCTS

- Walking robot

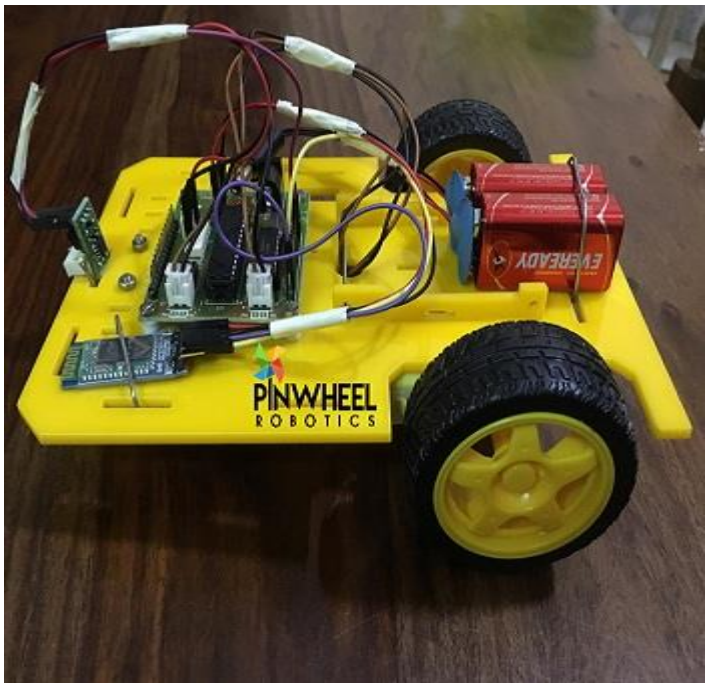
- Wired remote car



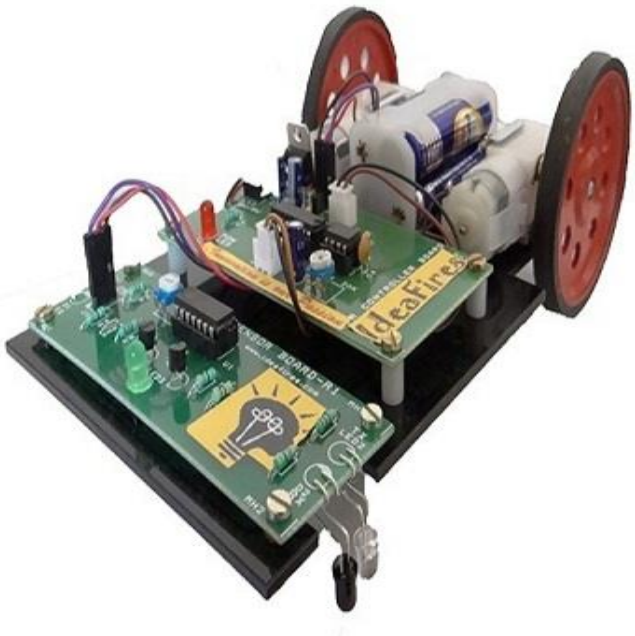
- Generic crawling robot

- Triangle robot

- Mini car



- Edge detector car



- Light chasers

The company is also active on blogging portals on sharing innovative ideas and inculcating interest among aspiring engineers. Recent trends shared have been appreciated by youth and attracted industries to provide us with opportunities.

2. ABSTRACT

With the growing capabilities of robotics, the need for human aid in repetitive tasks has been minimized to a great extent. Modern industries are moving towards automated approaches as these consume much less time and are more accurate and efficient. The market is experiencing a significant transformation, with robots growing beyond the workhorses of industrial shop floors and beginning to adopt the roles of personal assistants, surgical assistants, delivery vehicles, autonomous vehicles, exoskeletons, crewless aerial vehicles and among many other uses. The use of robotics will increase productivity and has the potential to bring more manufacturing production work back to developed countries. As productivity increases, labor is likely to receive a significant share of the benefits.

3. TASK ASSIGNED

3.1 INTRODUCTION

As an intern at Pinwheel robotics I along with my team was assigned with the task of creating a technology demonstration of industrial two axis fabric punching machine. This was followed by assembly of a war combat robot for educational purposes. For performing these tasks we were assigned to study about two axis CNC machine and their control using Stepper motors. I worked on the assembly part of the task and learnt different simulation tools for performing the same. Software implementation and manual testing was done, which helped understand the modifications which could be done. The purpose of a fabric punch is to make holes in a fabric. Traditionally a punch is hammered over the fabric and a hole is formed. To carry out the work very efficiently with very minimal spacing left, this work required a hell lot of concentration and time. This is a very inefficient method, hence with the use of electronics and concepts derived from a CNC machine a two axis industrial punch can be used to automate the task. We were assigned to device a technology demonstration of an industrial fabric punch. The model was tasked to perform various functionalities.

Computer Numerical machine: The term CNC stands for 'computer numerical control', and the CNC machining definition is that it is a subtractive manufacturing process which typically employs computerized controls and machine tools to remove layers of material from a stock piece. CNC machining is a manufacturing process which utilizes computerized controls to operate.

Proteus Simulation tool The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards. It was developed in Yorkshire, England by Labcenter Electronics Ltd. The microcontroller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control

- **Stepper motor in two axis**

Two stepper motors are implanted on two axis of a CNC (computer numerical control) rail that was required to perform specific tasks in both directions

- **War combat robot**

A robot was built for war combat situations where it is used for bombarding as well as it detects the things and picks it up on other side.

4. FABRIC PUNCH MODEL

4.1 DISCRIPTION ON STEPPER MOTOR FOR TWO AXIS

4.1.1 WORKING PRINCIPLE

Dual-axis planar linear stepper motors are ideal for open loop positioning applications with light payloads. Linear stepper motors are capable of very precise position, velocity and acceleration control when coupled with a micro stepping drive and indexer. The moving assembly is called the “forcer”. The two axis step and direction signal from a micro stepping drive, to the 2 or 4 phase forcer is supplied via a power cable.

CIRCUIT DIAGRAM

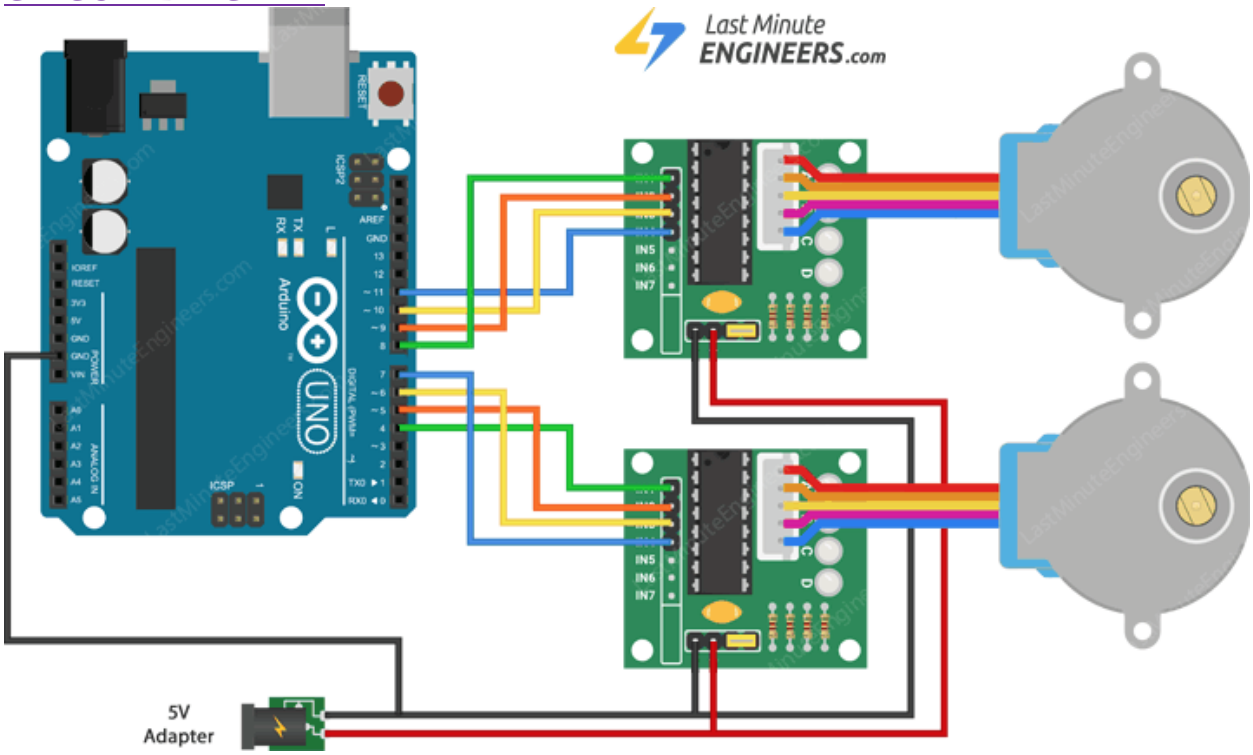


FIG.1

PROTEUS SOFTWARE IMPLEMENTATION

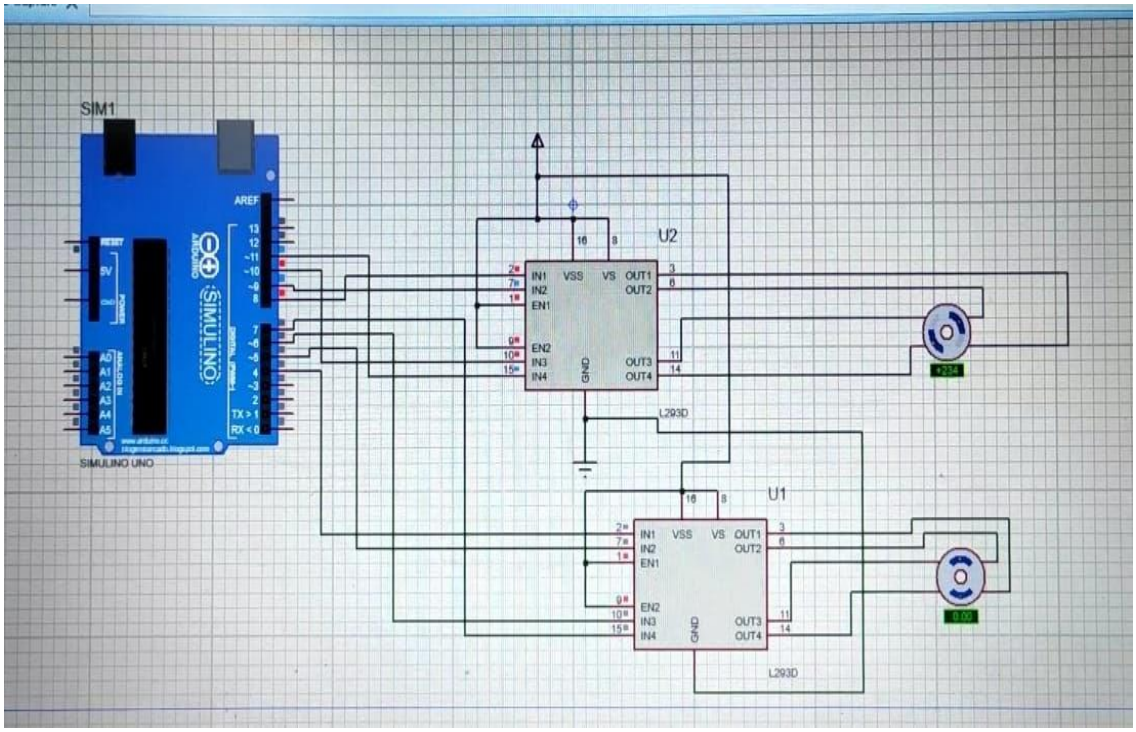


FIG. 2.

WORK DONE

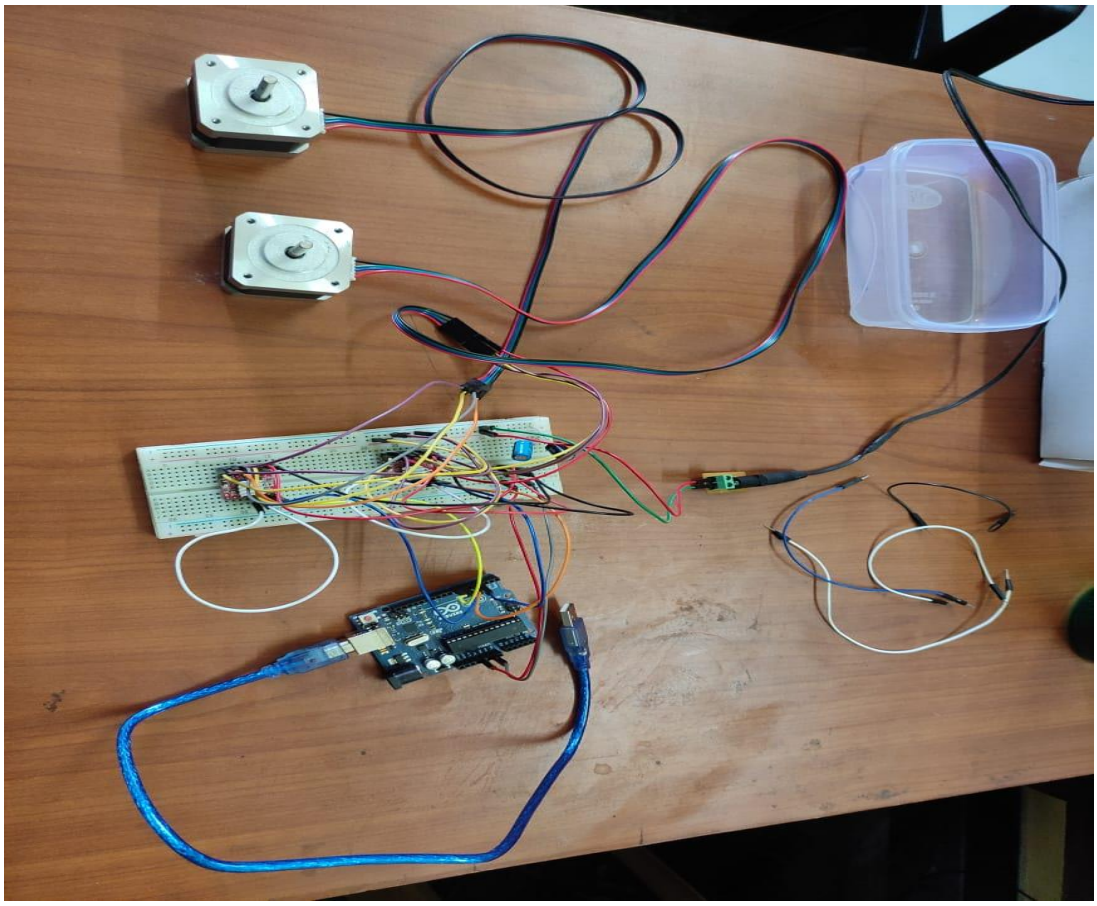


FIG.3.

PROPOSED MODEL TO BE DONE

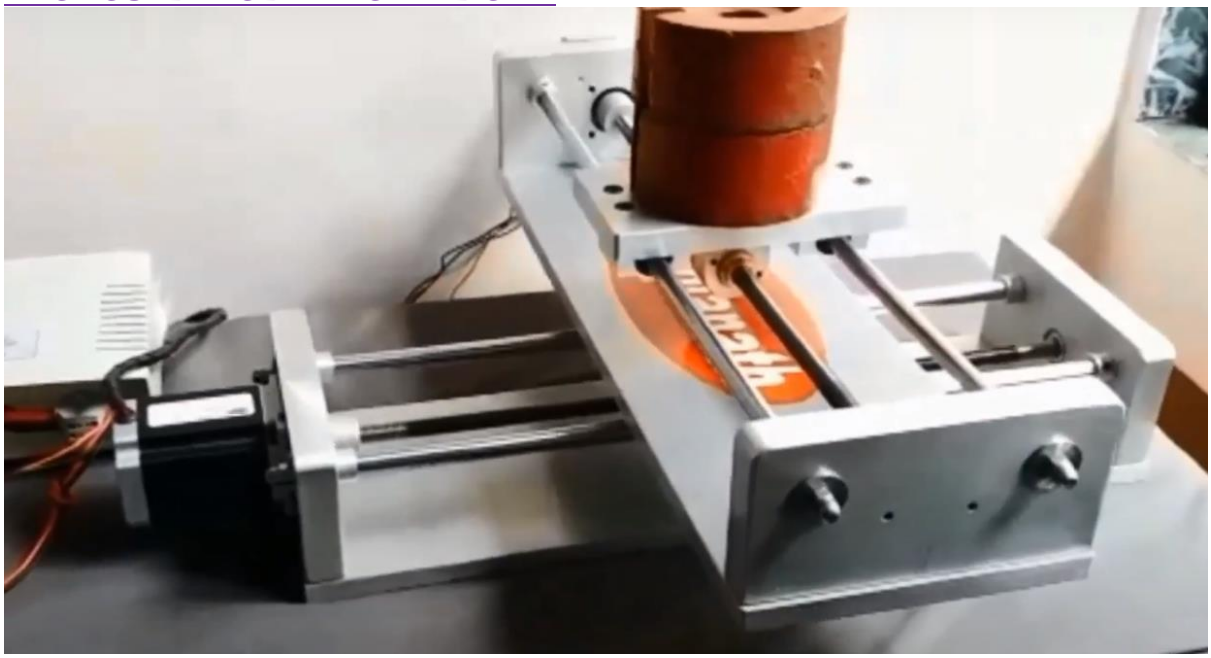


FIG. 4.

The design, simulation and circuitry for a two axis motor driven CNC model had been carried out. Research based on stepper motor, CNC was done to understand the implementation of the desired model. We looked upon calculations related to stepper motor step angle and the desired length that is needed to be covered in an axis.
Firstly before implementing the model on the hardware part, a small simulation was performed on the Proteus software based on which complete circuitry was to be made. The Hardware part was then implemented.

4.2 COMPONENTS REQUIRED

Sl. No.	Component	Quantity
1	Stepper Motor	2
2	A4988 stepper motor driver	2
3	Arduino Uno	1
4	Bread board	1
5	Power adapter for motor driver	1
6	Jumper Wires	

4.3 ADVANTAGES

- Low profile and small cross section
- High Speed
- Low cost positioning stage solution
- No servo tuning required
- Multiple forces on a single platen

4.4 APPLICATIONS

- Pick and Place
- Wire bonders
- Parts transfer
- Fiber optic

AIM TO BE ACHIEVED USING 2 STEPPER MOTOR

4.5 WORKING

Firstly we started with the software implementation of the work that is needed to be done. We built a simulation on Proteus software of rotating two stepper motor in two different axis with one is a particular direction and other the reverse of it.

Moving on we first did all the connections required according to the circuit diagram shown in fig.1. Both the motors were connected to their respective drivers.

To drive the stepper motor as per our need, we used the help of Arduino Uno that was connected to these drivers with the help of breadboard.

The code that was put inside the Arduino Uno had the following functionalities:

(a) It was used to rotate both the stepper motor in both the axis in two different directions.
(b) It had a back and forth motion in x direction and a linear 1D motion in y axis.
(c) There was a controlled rotation in both the axes. Like, what distance to be covered in x direction and what should be the step angle for covering that distance. Again moving down 1 unit in y direction and again going in x direction.
(d) It can also stop and resume from that particular instant and not going always to the beginning and start.

4.6 MATHEMATICAL CALCULATIONS

Suppose a cloth of length = 50cm
Radius of circle to be cut out = 1cm
For most efficient cut,
The stepper in x direction cuts a circle at (1,1) of radius 1cm.
Movement of 2cm along the x axis. New coordinate (3,1).
Moves till the end.
Total steps moved= (50-2)/2=24 steps
Subtraction of 2 is done because it starts from (1,1) and ends at (49,1).
So, the motor moves by 24 steps
Now movement of y by 2 cm and the motor in x axis moves from (49,3) to (1,3).
Process repeats till y reaches end

4.7 ARDUINO CODE FOR STEPPER MOTOR IN TWO AXES

```
//X axis
// stepPin 3
// dirPin 4
// 0 is clockwise
// 1 is anticlockwise
//Y axis
// stepPin 5
// dirPin 7
// Press P for Pause
// Press R for Resume
#include <avr/interrupt.h>
#include <avr/sleep.h>

const byte interruptPin = 2;
const int stepPin_x = 3;
const int dirPin_x = 4;
```

```
const int stepPin_y = 5;
const int dirPin_y = 7;
int repeat=1;

// Define the step for movement
const int x_steps=50;
const int y_steps=100;
const int s_x=200;// The number of steps to traverse along the entire row
int count_x;// The number of steps for 1 movement in x direction

int nstep_x, ndelay_x, nrepeat_x, direct_x;
int nstep_y, ndelay_y, nrepeat_y, direct_y;

void setup() {
//Setting the baud rate
Serial.begin(9600);
pinMode(stepPin_x,OUTPUT);
pinMode(dirPin_x,OUTPUT);
pinMode(stepPin_y,OUTPUT);
pinMode(dirPin_y,OUTPUT);
step1(0,1,2000,1);
step2(0,1,2000,1);
Serial.println("Ready");

/*
Serial.println(" For motion in horizontal direction");
Serial.println(" Enter the number of steps");
while (Serial.available() == 0);
nstep_x = Serial.parseInt();

Serial.println(" Enter associated delay");
while (Serial.available() == 1);
ndelay_x = Serial.parseInt();

Serial.println(" Enter the number of times to repeat");
while (Serial.available() == 1);
nrepeat_x = Serial.parseInt();

Serial.println(" Enter the direction");
while (Serial.available() == 1);
direct_x = Serial.parseInt();

// Serial.println(nstep_x);
// Serial.println(ndelay_x);
```

```
// Serial.println(nrepeat_x);
// Serial.println(direct_x);

Serial.println(" For motion in vertical direction");

Serial.println(" Enter the number of steps");

while (Serial.available() == 1);
nstep_y = Serial.parseInt();
Serial.println(" Enter associated delay");
while (Serial.available() == 1);
ndelay_y = Serial.parseInt();
Serial.println(" Enter the number of times to repeat");
while (Serial.available() == 1);
nrepeat_y = Serial.parseInt();
Serial.println(" Enter the direction");
while (Serial.available() == 1);
direct_y = Serial.parseInt();

// Serial.println(nstep_y);
// Serial.println(ndelay_y);
// Serial.println(nrepeat_y);
// Serial.println(direct_y);
*/

// Sets the two pins as Outputs
count_x=s_x/x_steps;
Serial.println("Initialized");
//Serial.println(count_x);
delay(1000);
}
void loop() {
if(repeat>0) {
        // step1(nstep_x,direct_x,ndelay_x,nrepeat_x);
        // step1(100,0,3000,1);
        // step2(200,1,3000,1);
        // step2(nstep_y,direct_y,ndelay_y,nrepeat_y);

cut(5);// Function to start the process

// inc_x();
// delay(1000);
// inc_x();
// delay(1000);
```

```
// dec_x();
// delay(1000);
// inc_y();
// delay(1000);
// inc_y();
// delay(1000);
// dec_y();
// delay(1000);
}
repeat--;
// step1(0,1,2000,1);
// step2(0,1,2000,1);
delay(1000);
}

void sleepNow()
{
Serial.println("going to sleep");
delay(15);
sleep_enable();
attachInterrupt(digitalPinToInterrupt(interruptPin),wakeUpNow, LOW);
//detachInterrupt(digitalPinToInterrupt(interruptPin));
Serial.println("going to sleep");

while(1)
{
        if(Serial.read()=='R')
        {
                Serial.println("Waking up");
                digitalWrite (interruptPin, LOW);
                break;
        }
}
}

void wakeUpNow() //This is the code that runs when the interrupt button is pressed and
interrupts are enabled
{
digitalWrite(interruptPin, HIGH);
}
void inc_x()
{
step1(x_steps,1,6000,1);
}
```

```
void dec_x()
{
step1(x_steps,0,6000,1);
}

void inc_y()
{
step2(y_steps,1,6000,1);
}

void dec_y()
{
step2(y_steps,0,6000,1);
}

void cut(int rows)
{
 for(int i=0;i<rows;i++)
 {
  if(i!=0)
  {
   step2(y_steps,1,6000,1);
  }
  int z=0;
  if(i%2==0)
  {
   for(int z=0;z<count_x;z++)
   {
        if(Serial.read()=='P')
        {
         Serial.println("In The interrupt pause");
         delay(2000);
         sleepNow();
         //attachInterrupt(digitalPinToInterrupt(interruptPin), halt, LOW);
        }
        step1(x_steps,1,6000,1);
        delay(2000);
   }
  }
  else
  {
   for(int z=0;z<count_x;z++)
   {
        if(Serial.read()=='P')
```

```
          {
          Serial.println("In The interrupt pause");
          delay(2000);
          // attachInterrupt(digitalPinToInterrupt(interruptPin), halt, LOW);
          sleepNow();
          }
          step1(x_steps,0,6000,1);
          delay(2000);
      }
    }
  }
}

void step1(int steps,int dir,int delay1,int repeat1)
{
  bool t;
  int i=0;
  if(dir==1) {
  t=HIGH;
  }
  else {
  t=LOW;
  }
  while(i<repeat1)
  {
    digitalWrite(dirPin_x,t);
    for(int x = 0; x < steps; x++)
   {
     digitalWrite(stepPin_x,HIGH);
     delayMicroseconds(delay1);
     digitalWrite(stepPin_x,LOW);
     delayMicroseconds(delay1);
    }
    i++;
   }
}
void step2(int steps,int dir,int delay1,int repeat1)
{
  bool t1;
  int i=0;
  if(dir==1) {
    t1=HIGH;
  }
  else
```

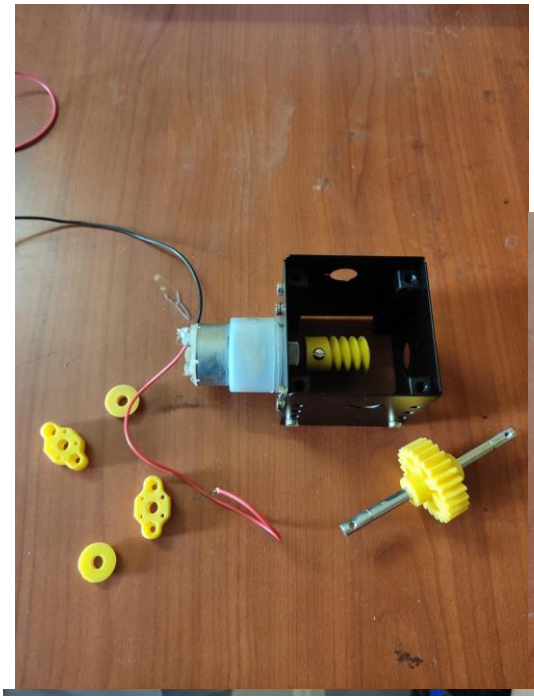
```
 {
  t1=LOW;
 }
 while(i<repeat1)
 {
  digitalWrite(dirPin_y,t1);
  for(int x = 0; x < steps; x++)
  {
        digitalWrite(stepPin_y,HIGH);
        delayMicroseconds(delay1);
        digitalWrite(stepPin_y,LOW);
        delayMicroseconds(delay1);
  }
  i++;
 }
}
```

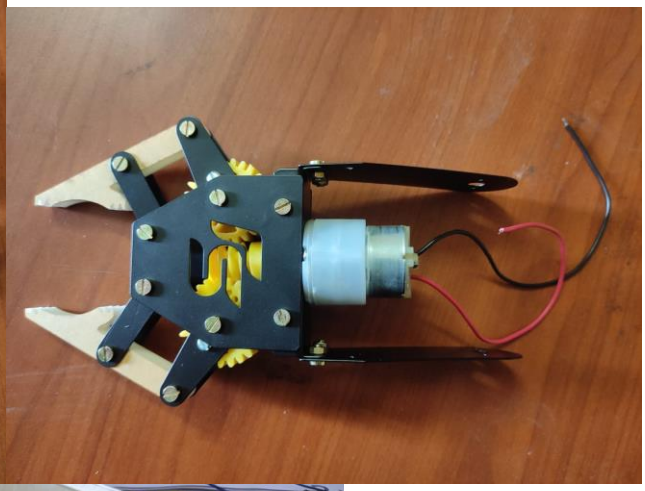
Description:

This Code has all the functionalities as mentioned:
(i) It shows zigzag motion(i.e. rotates both clockwise and anticlockwise in 2 different axes).
(ii) Can increment and Decrement based on code.
(iii) Steps of rotation can be varied according to length to be achieved.
(iv) Able to pause and resume at any instant we wish to.

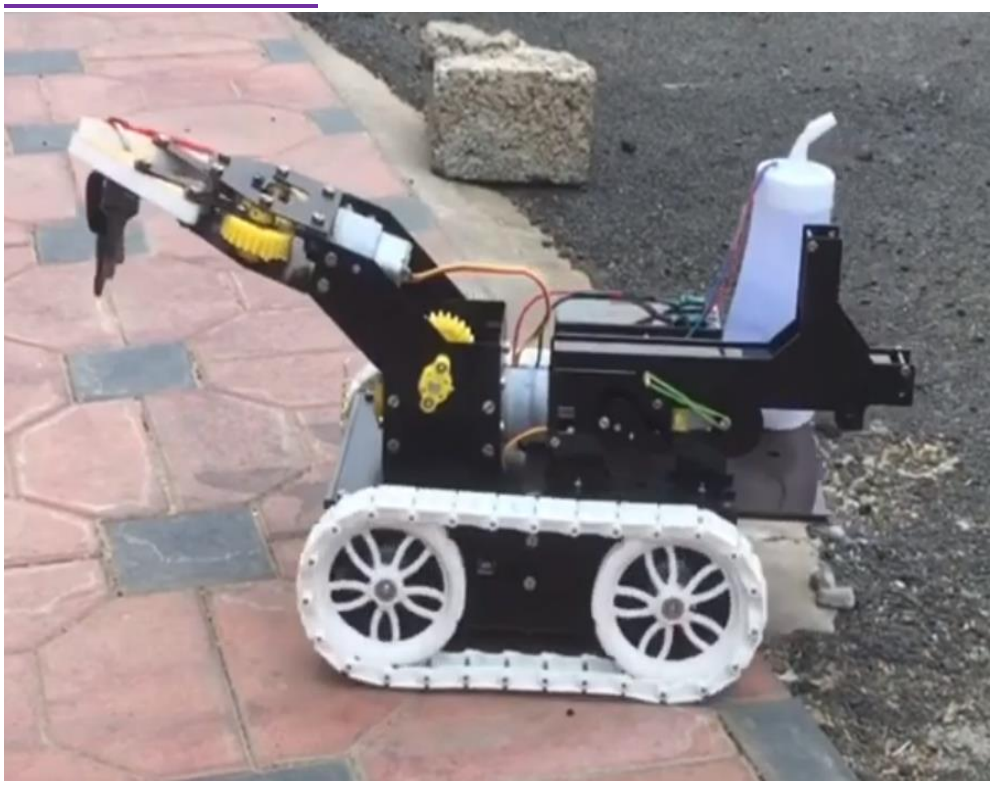
5. WAR COMBAT ROBOT

INBETWEEN PHASES OF WORK:





FINAL MODEL:



5.1 FEATURES

- Ignite your passion for robotics by building a robotic arm with this kit from Robosoft Systems. The kit includes components to build a robotic arm that can pick and place things.
- Manually controlled platform
- The robotic arm is a manually controlled platform that uses caterpillar-type track belt for movement.
- The gear box of the robotic arm is a mechanical assembly which uses worm gear assembly to lift heavy loads.
- By assembling this robotic arm, you will be able to learn about the different mechanical and electronic components that make a robot work. You can adopt these combinations to experiment and create one on your own.
- Modifications can be made to the robot to increase the capabilities of the bot and interface various other sensors.

6. OUTCOME

Joining a company can be an intimidating task, especially when you have no initial experience of working in a professional set up. The internship will definitely ease this transition. Not only was I able to interact with people having varied experience, but also I was able to learn how a company works.

6.1 Technical Outcome

The major technical learnings were with respect to interfacing Arduino with different sensors, using Proteus and Error handling. Moreover to understand the coordination of the backend and the frontend, and how the documentation must be done for smoother project flow.

6.2 Non-Technical Outcome

1. **Teamwork** – I learned and even gained experience on what it is to work with the team. One learns that everyone has a different style of working and a different approach to problem solving. Now, not everyone need to know about everything that is required for the project but yes, one can do a part in which he/she is good at. By this one can finish the job within the deadline and also enjoy their part of doing. Later one can understand others work to have an overall knowledge of the work.
2. **Inventory** - One of the most important things you can gain from an internship is newfound knowledge. This can include knowing how to fulfil tasks that are relevant to your desired career path and sharpening the skills that you already possess. An internship is an opportunity to test out all the skills that you developed in college and see how they work in the real world. You will get an idea of what your biggest strengths are, as well as areas of improvement you should work on.
3. **Work space** - Working in a professional setting for the first time can be difficult to get used to. But it is the best way to learn how the things work in real-life, hands-on experience. One of the most valuable skills you will gain from an internship is the ability to speak with people in a professional setting. Discussions with bosses or co-workers are different from discussions with lecturers or fellow students, after the internship, one will have a better idea of the appropriate way to behave as a professional.
4. **Networking** - This is probably one of the most undermined and underused advantages of an internship. Networking will help you develop and improve your skill set, stay on top of the latest trends in your industry, keep a pulse on the job market, meet prospective mentors, partners, and clients, and gain access to the necessary resources that will foster your career development. Getting to know people at your workplace means that you are ultimately creating a healthy environment to work and learn in.

5. **Positive attitude towards constructive criticism** - You will probably make a few mistakes and receive constructive criticism about your work from both your colleagues and your boss. I learnt that it is for your own good and growth and it will improve the quality of your work. Making use of it to improve upon your skills is the wisest thing to do.
6. **Time management** - Work ahead when you can-In college, it's easy to fall into the habit of postponing, but in the office, things are different. You have deadlines to meet. One learns that the best way to manage this is to work ahead when you can. You might not always meet your deadlines. Although deadlines are important, they cannot always be met. In those cases, one must remember to power through because good quality work trumps anything at the end of the day. However, even though you might have flexible deadlines, you should always feel the pressure to get it done. This will prevent your work from piling up. Flexible deadlines give you more time to get the task done, but it might also set you back on other projects. So being aware of the time on hand and the amount of work is paramount.
7. **Priority** - When the amount of workload is overwhelming, one must follow a top down approach of doing tasks based on their importance to the company. This will help you break down your work, and how much time you should spend on each task.

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