VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

An Internship Carried out at

"IGUS (INDIA) Pvt. Ltd."

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

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATIONS

by

SHUSHMITHA PS (1GD18EC039)

Under the support and guidance of

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GOPALAN COLLEGE OF ENGINEERING & MANAGEMENT

[Affiliated to VTU, Belagavi, Approved by AICTE, New Delhi]

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Department of Electronics and Communication Engineering

CERTIFICATE

This is to certify that Shushmitha PS (1GD18EC039) has undertaken the internship at IGUS(INDIA) Pvt. Ltd from 8-09-2021 to 8-10-2021 as per the syllabus prescribed by VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI, for the partial fulfilment of the requirements award of undergraduate of BACHELOR OF ENGINEERING in ELECTRONICS & COMMUNICATION ENGINEERING during the academic year 2021-2022.

Signature of HoD
Dr.S. Anantha Padmanabhan
HoD, Dept. ECE, GCEM

Signature of principal
Dr.N. Sengottaiyan
Principal,GCEM

EXTERNAL VIVA

Name of the Examiner: **Signature with Date:**

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2

DECLARATION

I Shushmitha PS (1GD18EC039) from the department of Electronics & Communication Engineering, Gopalan College of Engineering and Management, Bangalore, hereby declared that the internship work is entitled **"LOW-COST AUTOMATION OPERATIONS IN THE DESIGN OF FOR ROOM GANTRY, DELTA, AND ROBOLINK"** which has been submitted by me as partial fulfilment for the final year semester examination of Visvesvaraya Technological University, is an authentic record of my own work carried out in IGUS (INDIA) Private Limited, operation department, this internship work is submitted in partial fulfilment of the course requirement for the award of Degree in Bachelor of Engineering in Electronics & Communication Engineering.

Date:

Place:

SHUSHMITHA PS

1GD18EC039

CERTIFICATE OF INTERNSHIP

TO WHOMSOEVER IT MAY CONCERN

This is to certify that

Ms. Shushmitha P S

(USN- 1GD18EC039), a student of BE in Electronics and Communication Engineering in Gopalan College of Engineering & Management, Bangalore -48, India. As part of their curriculum activities, she has successfully completed her internship program in our organization from **8th September 2021 to 8th October 2021** in Operations Department under the guidance of Mr.Ragesh Kumar – Product Manager- Low Cost Automation.

She completed her internship on Programming Gantry systems using Arduino board in igus (India) Private. Limited.

During the time she took keen interest in the assigned work and performed well.

We wish her all success in academic endeavors and life.

For igus (India) Private. Limited
Authorized By,
RAGESH KUMAR
Product Manager- Low Cost Automation

ACKNOWLEGDEMENT

I would like to thank IGUS (INDIA) Pvt. Ltd, Bangalore for giving me this wonderful opportunity to carry out our internship program in their company which is in Bangalore.

I would also like to express a deep sense of gratitude to Mr. Ragesh Kumar, Product Manager LCA IGUS (INDIA) Pvt. Ltd, on the valuable guidance and moral support throughout the internship period.

I am obliged to staff members of IGUS (INDIA) Pvt. Ltd for the valuable information provided by them in their respective fields.

I express my gratitude and respect to Dr. N Sengottaiyan, Principal Gopalan College of Engineering and Management, for granting permission to carry out the internship.

I express my gratitude to Dr. S Anantha Padmanabhan, HOD Electronics & Communication Dept., Gopalan College of Engineering and Management for my work throughout the internship.

I express my gratitude to Dr. Kavitha, Asst. Prof. Electronics & Communication Dept., Gopalan College of Engineering and Management for guiding me throughout the internship.

I am thankful and fortunate enough to get constant encouragement, support and guidance from all the teaching staff of ECE department Gopalan College of Engineering and Management.

Last but not the least, I would like to thank my Parents and my Friends for their constant support.

SHUSHMITHA PS

(1GD18EC039)

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CHAPTER 1:

COMPANY PROFILE

More than five decades of experience with motion plastics®

IGUS has been in motion since the beginning of time. The technical progress is making IGUS machines faster and their movements more precise. This creates new challenges about the machine components. In 1964, Gunter Blase, who established IGUS, had the idea of developing motion products made of low-wear high-performance polymers. They are also known as Motion Plastics. Motion plastics products bring about improvements from environmental points of view as well. The life cycle assessment of the plastics produced is good. In the manufacturing process, 50% less mineral oil is used when compared to similar products made of steel and 70% less than those made of Aluminium. Given that 54.4 billion tons of lubricant that finds its way into the environment every year, lubrication-free polymers from IGUS make a further contribution to protection of the environment.

The different areas of the IGUS

- Iglidur plain bearings.
- E-chains energy supplies.
- Chain flex cables.
- Drylin linear technology.
- Robolink Low-Cost Automation.

CHAPTER 2:

INTRODUCTION

The requirements for motorized adjustments are becoming more and more demanding, installation spaces are reducing in size and customized solutions are sought for many systems. With automation on the rise, the case for linear robotics, has expanded. Linear robots are a type of industrial robot with two or three principal axes that move in a straight line rather than rotate, functioning at right angles to each-other. The three sliding joints correspond to moving the wrist: up and down, back and forth, as well as in and out. Linear robots with horizontal members supported at both ends are referred to as Gantry robots.

Because there is no rotating axis, linear robotics tend to have a higher degree of accuracy, making them the ideal automation solution for those mundane repetitive tasks. Unlike other automation machines, linear robotics systems can be reprogrammed to accommodate product changes quickly and are flexible to meet unique requirements. A linear robot can be more economical than other types of robots such as articulated arm or SCARA.

2.1 Room Gantry

Fig 2.1: Room Gantry

A Cartesian coordinate robot, also called linear robot which is an industrial robot whose three principal axes of control are linear (i.e., they move in a

straight line rather than rotate) and are at right angles to each other. Among other advantages, this mechanical arrangement simplifies the Robot control arm solution. It has high reliability and precision when operating in three-dimensional space. As a robot coordinate system, it is also effective for horizontal travel and for stacking bins.

Application Examples:

- Measurement and testing.
- Handling and assembly technology.
- Identification in microelectronics, medical technology.
- Tasks in the handling of small parts.
- Simple handling tasks.

Advantages:

- Easy installation.
- Proximity switch mounting by means of T slot along the entire length of the section.
- Ready-to-use modular kit with cantilever axis.
- Everything from one source.

2.2 Line Gantry

Fig 2.2: Line Gantry

With its two axes, the linear gantry robot LGR is ideal for loading and unloading machines and fixtures, as well as handling components between different stations. The system, made up of Aluminium and Steel axes.

Application:

- Pick and place.
- Labelling technology.
- Sorting systems.
- Identification in microelectronics, medical technology.

Advantages:

- Easy installation.
- Proximity switch mounting by means of T slot along the entire length of the section.
- Ready-to-use modular kit with cantilever axis.
- Everything from one source.

2.3 Surface Gantry

Fig 2.3: Surface Gantry

The XY Gantry stage is offered in travel lengths from 400mm to 1000mm. The lower stage of this XY Gantry has a cable management system and high torque NEMA 23 stepper motors. Cable management is available on the upper stage for payloads that have cables running to them.

The drive system on each axis utilizes a 10mm wide, steel reinforced timing belt to move the carriage. The carriage rides on 15mm linear guide bearings bolted to a stiff Aluminium extruded chassis.

All linear slides are machined from 6061 Aluminium alloy and black anodized.

Application:

- Measurement and testing.
- Labelling technology.
- Component marking.

Advantages:

- Easy installation.
- Proximity switch mounting by means of T slot along the entire length of the section.
- Ready-to-use modular kit with cantilever axis.
- Everything from one source.

3. Stepper Motor

3.1 NEMA 23

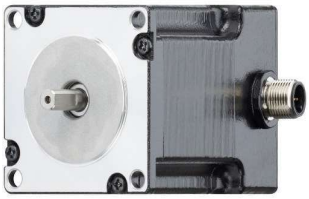


Fig 3.1: Stepper Motor NEMA 23

NEMA 23 is a high torque hybrid bipolar stepper motor with a 2.3*2.3-inch faceplate. This motor has a step angle of 1.8 deg., this means that it has 200 steps per revolution and for every step it will cover 1.8 degree. The motor has four colour coded wires (Black, Green, Red & Blue) terminated with bare leads. Black and Green wire relates to one coil; Red and Blue is considered with other.

3.2 NEMA 17

Fig 3.2: Stepper Motor NEMA 17

NEMA 17 Stepper motor is commonly used in CNC machines, hard drives and linear actuators. It can be operated at lower voltage, but torque will drop. These motors have a step angle of 1.8^0, this means that it has 200 steps per revolution for every step it will cover a 1.8^0 hence the level of control is also high. These motors provide high torque.

CHAPTER 4:

COMPONENTS USED

4.1 Arduino UNO

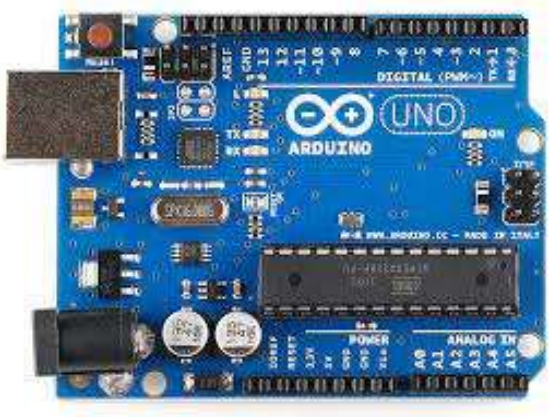


Fig 4.1: Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino .cc . The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. This board can be interfaced with other Arduino boards, Arduino shields, Raspberry Pi boards and can control Relays, LEDs, Servos and Motors as an output.

4.2 Drivers

4.2.1 Digital Stepper Motor Driver D7

Fig 4.2.1: Digital Stepper Motor Driver D7

- Can control stepper motor with up to 2.7A continuous current at supply voltage of up to 48V.
- Easy control.
- Exact positioning.

4.2.2 Digital Stepper Motor Driver D8

Fig 4.2.2: Digital Stepper Motor Driver D8

- Can control stepper motors with up to 4A continuous current at supply voltage of up to 48V.
- Easy control.
- Exact positioning.

4.3 Power Supply

Fig 4.3: Power Supply

A power supply is an electrical device that provides electrical power to a load. A power supply's principal job is to convert electric current from a source to the proper voltage, current, and frequency for powering a load.

4.4 MCB

Fig 4.4: Miniature Circuit Breaker

MCB stands for Miniature Circuit Breaker. It Automatically switches OFF electrical circuit during any abnormal condition in the electrical network such as overload and short circuit conditions.

4.5 Circuit Board Mounting

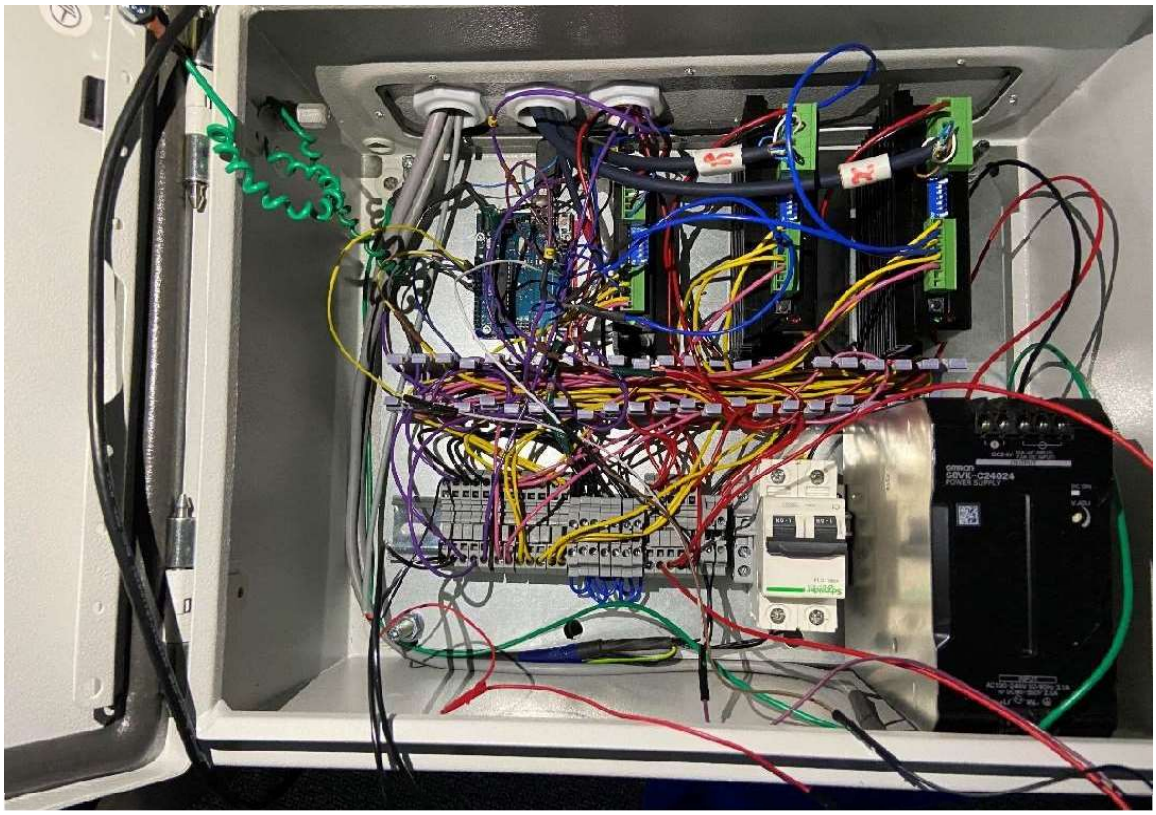


Fig 4.5: Circuit Board Mounting

The parts such as the Arduino UNO, MCB, Drivers, Power Supply and Relays were to be installed in the junction box. A junction box protects electrical connections from weather and keeps people safe from electric shocks. This is the circuit which allows the Room Gantry Robot to operate.

CHAPTER 5:

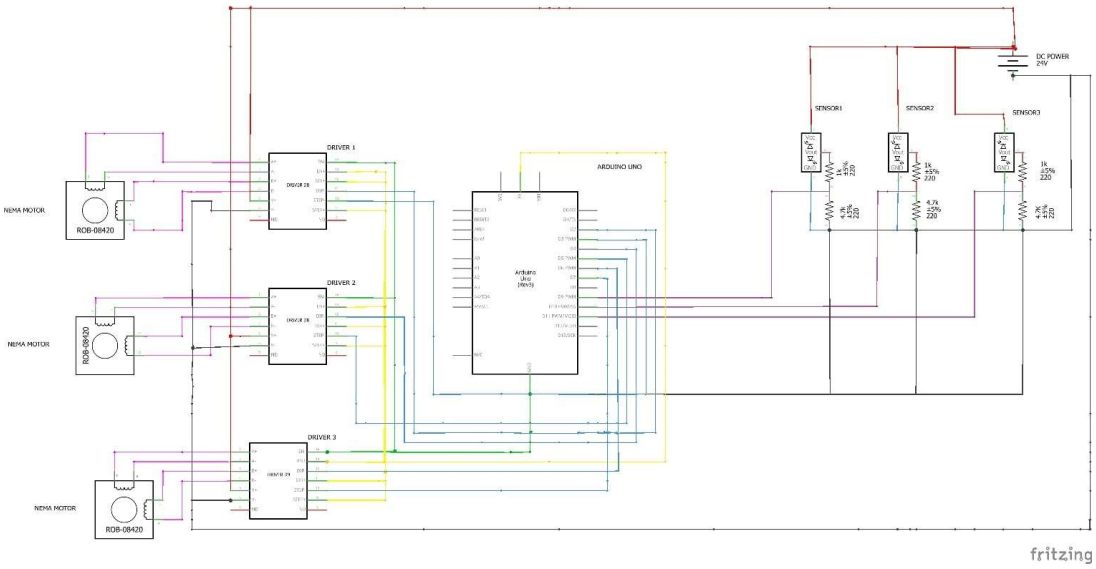
TASK PERFORMED

5.1 Construction

The Stepper Motor Connection with Driver D7, D8, D8 and Arduino as follows:

- The Coil 1(Red and Blue) of Stepper Motor is connected to A+, A- of Driver and Coil 2(Black and Green) of Stepper Motor is connected to B+, B- of Driver.
- V+ of Driver is connected to 24V DC and V- of Driver is Connected to Power Supply Ground.
- EN- of Driver is connected to Arduino GND.
- EN+, DIR+, Step+ of Driver is connected to 5V of Arduino.
- DIR- of Driver 7 is connected to pin D2 of Arduino, DIR- of Driver 8 is connected to pin D4 of Arduino, DIR- of Driver 8 is connected to pin D6 PWM of Arduino.
- Step- of Driver 7 is connected to pin D3 PMW of Arduino, Step- of Driver 8 is connected to pin D5 PWM of Arduino, Step- of Driver 8 is connected to pin D7 of Arduino.
- Pin D8 of Arduino is connected to one end of the Relay and other end is connected to one end of the Solenoid Valve.
- The other end of Solenoid Valve and one end of the Relay is connected to Power Supply Ground , the other two ends of Relay is connected to positive terminal of Power Supply.
- The other end of Relay is connected to 5V of Arduino.
- Pin D9 PWM of Arduino is connected to one end of Resistor 1 and the other end of the resistor 1 is connected to VOUT of Sensor 1.
- Pin D10 PWM/SS of Arduino is connected to one end of Resistor 1 of Sensor 2 and the other end of the resistor 1 is connected to VOUT of Sensor 2.
- Pin D11 PWM/MOSI of Arduino is connected to one end of Resistor 1 of Sensor 3 and the other end of the resistor 1 is connected to VOUT of Sensor 3.
- GND of all Sensors is connected to Power Supply GND , VCC of all Sensors is connected to positive terminal of Power Supply.
- One end of Resistor 2 is Connected to GND of Arduino and other end is connected to Resistor 1.

5.2 Circuit Diagram



5.3 Working

As we know, room gantry has variety of applications in many industries. Room gantry has 3 axes (namely x, y and z). Each axis has movable guideway (rectangular bar) and motors which are made to rotate alternatively to achieve the targeted location (where the object to be picked is placed). We constructed a circuit and programmed the Arduino uno to perform the above operation. The working is as follows,

We used proximity sensors, which are activated (turned on and LED goes off) when metal is detected and deactivated (turned on and LED goes off) when metal is not detected. This sensors data/information are collected by Arduino UNO to control the motors that is to rest the movable guideway in a desired location and to locate the home position in the room gantry. Drives are used to control the directions of rotation and number of steps per rotation as per the application. As discussed, these parameters of each motor on each axis can be controlled individually by the drives using Arduino data. We programmed Arduino in such away that any one axis (movable waveguide) moves at a time to achieve the smooth operation of gantry. This is very important operation to be considered because room gantry is a mechanical equipment.

When the power supply is turned on, x-axis guideway starts moving from its home position to the programmed position and stops, the y-axis guideway starts moving from its home position to the programmed position and stops and finally z-axis guideway moves from its home position to the targeted position and stops and gripper (vacuum tube) is activated to pick the object from its location. Now, the z-axis guideway moves from its targeted location

to home location. Similarly, y- axis moves from its programmed position to its home location and finally the x-axis guideway moves from its programmed position to its home location and drops the object in the container. This operation can be programmed as per the need of application.

5.4 Results

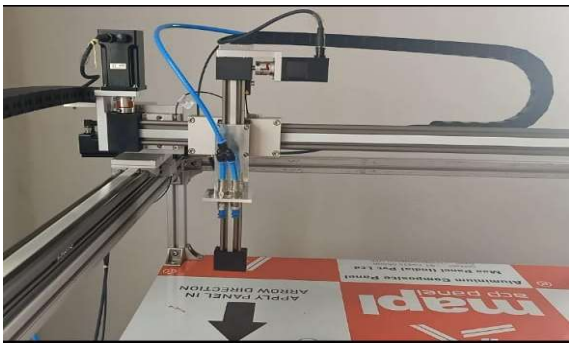


Fig 1

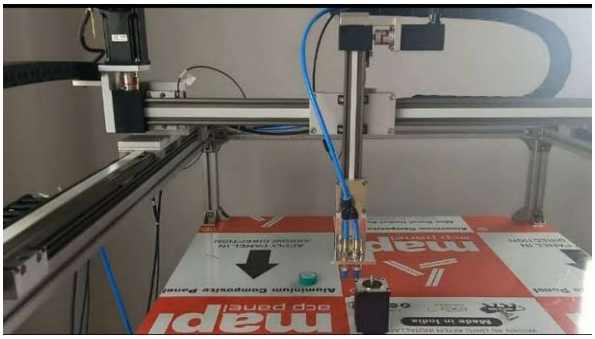


Fig 2

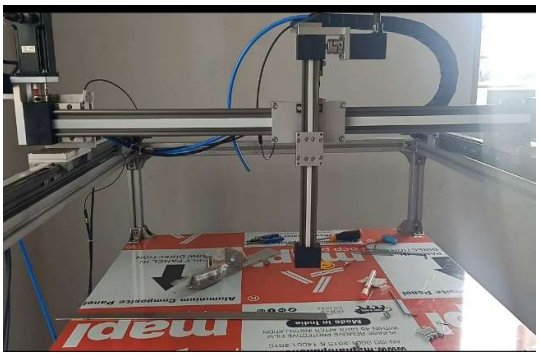


Fig 3

The working of the model can be viewed in the below mentioned link,

https://photos.app.goo.gl/mp3cH4jmFAsW7wRV9

CHAPTER 6:
CONCLUSION

In conclusion, this internship has been a very useful experience for me. I can safely say that my understanding of the work environment has increased greatly. However, I do think that there are some aspects of the work that I could have done better and that I need to work on. I need to build more confidence in applying accounting principles. I realized that I could have completed the work earlier than I did. Also, the technical parts of the job were a bit flawed and I was asked few times to correct it.

The two main things that I learned after my experience are the importance of time management and being self-motivated.