DECLARATION

This is to declare that the project entitled “Design and Development of Sophisticated Pneumatic Control Router System” submitted as part of requirement for completion of Bachelor of Science in Software Engineering in 2017 at the University of Dodoma under co-ordination of Mr. Ilakoze and supervision of Mr. A Mazoya.

This is our original work to the best of our knowledge.

Date: ……

Supervisor: Mr. Adam Mazoya.

Students Name:

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SUPERVISOR'S CERTIFICATION

This is to certify that the project report entitled "Design and Development of Sophisticated Pneumatic Control Router System" Submitted in partial fulfillment of the requirements for the course of Bachelor of Science in Software Engineering of College of Informatics and Virtual Education by Kimambo, Peter and Mussa Nzumbi N. They worked under my supervision and guidance and that no part of this report has been submitted for the award of any other degree, Diploma, Fellowship or other similar titles or prizes and that the work has not been published in any journal or Magazine.

SUPERVISOR'S NAME…….

SIGNATURE: .....

DATE: .....

ACKNOWLEDGEMENT

First, we would like to thank GOD for giving us health and strength to establish, perform and complete successfully this project.

We would also like to convey deepest gratitude to our Supervisor, Mr. A Mazoya for his sincere support, physically, mentally economically and advice on this project.

We would also like to thank the management of The University of Dodoma especially the College of Informatics and Virtual Education (CIVE) for this special opportunity to perform and show skills, talent and innovation through this project.

We are grateful to our fellow students who have been with us throughout this project for their support.

Special thanks to Ebrahim Yuni, and Rose George and the coordinator Mr Ilakoze for seeing the potential out of this project and for their encouragement throughout.

Last but not least is to extend special thanks to our beloved parents for their encouragements and support in all possible ways which really made it possible for us to accomplish this project.

ABSTRACT

This report has included in summary all works that have be done throughout the period that have being proposed for the final year project.

The report includes the project title together with the objectives, literatures that have been reviewed, the design and implementation of the project.

The project is all about the design and development of CNC router machine which explained in details to the part of this report.

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Chapter One

1.1 Introduction

This project is about design and development of a sophisticated neumatic control router that will be controlled and hosted by a computer program for better productivity, efficiency and precision that may be employed in large or local industries, used by individuals with creative mind and passion of creating or shaping objects.

1.2 Overview

Tanzania as one among many countries that strive into development of a better economy, has been observed to grow economically in different areas of production, especially in small enterprises and local industries despite of low technology that is being used in different areas of production.

Local and manual tools are being employed for creating various object designs needed in innovation places. This takes much time shifting materials from one tool location to another as well as taking higher labor efforts that can include more than one person to complete creating single shaped object.

The output of this project will help improve efficiency and performance of different enterprising industries on creating and manufacturing of different products that may require, precise cutting, drilling or engraving. This project is very important for our society not just because it increases productivity but because it also simplifies the work and the processes on manufacturing of products are going to be manufactured and achieve goals of development.

1.3 Objectives

This part is divided into two main parts of which the first is the general objective and the second is specific objective which states clearly what is to be done.

1.4.1 Main objective

The main objective of this project is to design and develop a sophisticated neumatic control router system.

1.4.2 Specific objective

i. Design and develop a desktop software application that will establish necessary communication between the hardware device and the computer for configuration purpose.

ii. Design and develop a Hardware based device with all its necessary components that will be a central part of the system.

iii. Design and develop a firmware software for the hardware part.

Chapter Two

2.1 Literature survey

2.1.1 Current system

[i]From small individual parts to large, heavy duty gang milling operations, there has been a milling machine which uses rotary cutters to remove materials from work piece by advancing in direction at an angle with the axis of the tool. Milling can be done with the wide range of machine tools.

The integration of milling begun with live tooling for lathes, rotates the work piece on its axis to perform various operations such as cutting, sanding, knurling, drilling, or deformation, facing, turning, with tools that are applied to the work piece to create an object with symmetry about an axis of rotation.

They are used in woodturning, metalworking, metal spinning, thermal spraying, parts reclamation, and glass-working.

2.1.2 Challenges posed by the current system

i. The cost of the milling machine is very high.
ii. As milling cutters cost high, the investment for procuring tools is more.
iii. The production cost will increase if we carry out the operations performed in a shaper or a drilling machine with a milling machine.
iv. Requires trained people/ professionals to operate the machine.
v. They use manual operations

2.1.3 Proposed system

The system proposed will use specific programmable software and will be automatic rather than being manual like the current available such as milling machine or lathe machine.

2.1.4 Significance

This system can be used continuously 24 hours a day, 365 days a year and only need to be switched off for occasional maintenance. They are programmed with a design which can then be manufactured hundreds or even thousands of times. Each manufactured product having the exact feature. Less skilled/trained people can operate this system unlike manual lathes / milling machines etc. which need skilled engineers.

They can be updated by improving the software used to drive the machines Modern design software allows the designer to simulate the manufacture of his/her idea. There is no need to make a prototype or a model. This saves time and money.

One person can supervise many NC machines as once they are programmed they can usually be left to work by themselves. Sometimes only the cutting tools need replacing occasionally.

With the help of this system the traditional manual machines will be replaced. The new advanced machine will be controlled by a software program that will carry out a wider variety of tasks with greater accuracy. It will allow automated control and improve productivity.

People from all variety of fields can be able use this new machine. Such as hobbyist and even military groups, students at all levels from primary to university, handy men people with start-ups business in the area that involve milling, cutting, lathing etc. can take advantage of the cost savings accrued by using this machine to turn raw materials into final products. The machine will be faster, more efficient and safer to use.

Chapter Three

3.1 Design

The design for this project involves two parts, which are the software and hardware. The software will be desktop software as it will involve positioning of objects virtually on an application main window win relation to the hardware working bed.

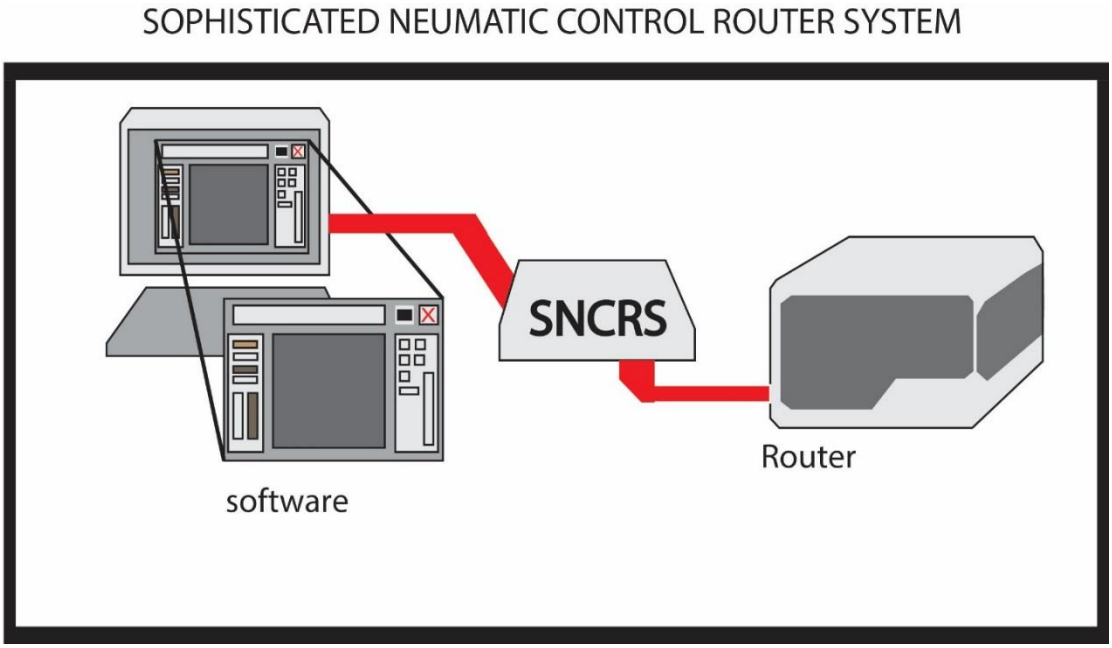

Figure 1: SNCR system

SNCRS USER INTERFACE

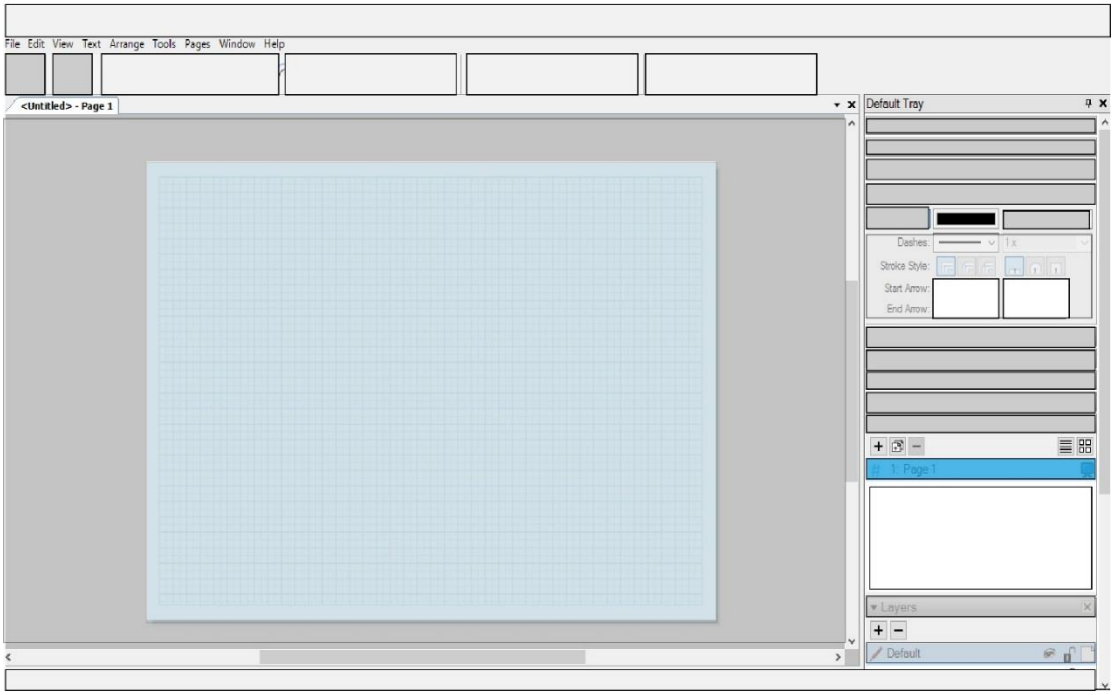

Figure 2: Expected software interface

Also, this part will be used to convert other CAD drawings into a format that is recognized by the hardware part. This will help end user to keep on using his/her preference CAD software, rather than limiting them into learning how to use the new developed software that comes with the system.

The second part is the hardware part which is comprised of microprocessor for interpretation of object designed earlier in the software, it also has a special program that is used create necessary communication between the software on the computer and the hardware system. It is used to provide necessary instruction to sensors and motors for specific movement and direction

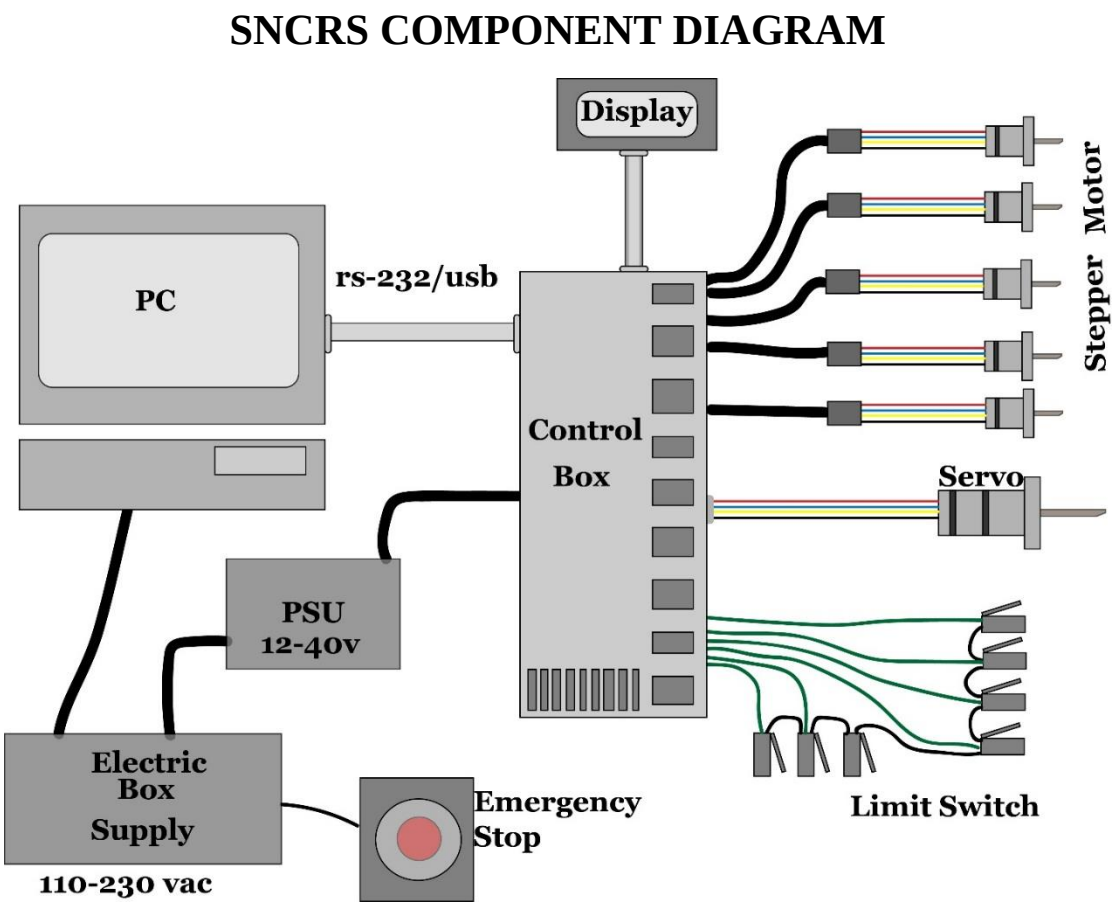

Figure 3: SNCRS component diagram

3.2 Implementation

3.2.1 Devices assembling

In this first phase of construction of the project, we have managed to organize, collect and purchase all equipment's concerned with the hardware component part such as step motor, steppers, Arduino, tires, Stanley steel rod, bolts and nuts, sliders, bearings and power supply as represented in the image below

Figure 4: project devices

3.1.2 Actual Hardware Implementation

At early stage of implementation of the project, the hardware component parts where designed and developed. The design of machine base is implemented that allows other corresponding units such as X-axis, Y-axis and Z-axis to be developed and settled on it.

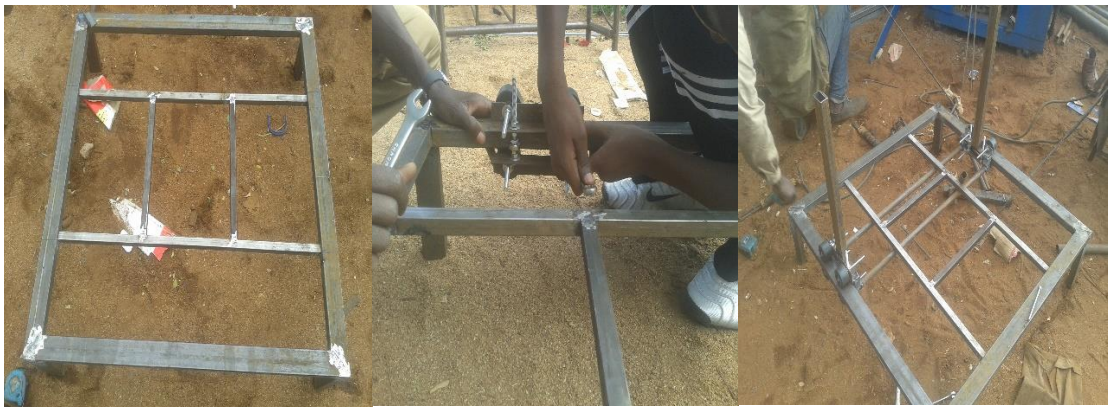

Figure 5: machine base

Each piece was not created separately, so it cost a lot of time and attention. The project continue to be developed to its unity and with close attention until all the relevant parts concerned with hardware where well designed and implemented. Good choice has been made to ensure the stepper motors have been placed onto a nice positions for the pushing its axis. Finally the machine in terms of hardware has been completed and now ready to be tested and mixed by side software which starts to be worked out now

Figure 6: A complete component

3.1.3 Actual Controller Implementation

The development of controller involved several processes such as etching of circuit boards, component placement on the circuit board, programming of the controller and then interfacing the controller to the main hardware machine.
The process of etching the circuit involved a UV Exposure machine, concentrated Sulphuric Acid and Acoustic soda. All of this process started with the design from the Proteus 8 professional software.

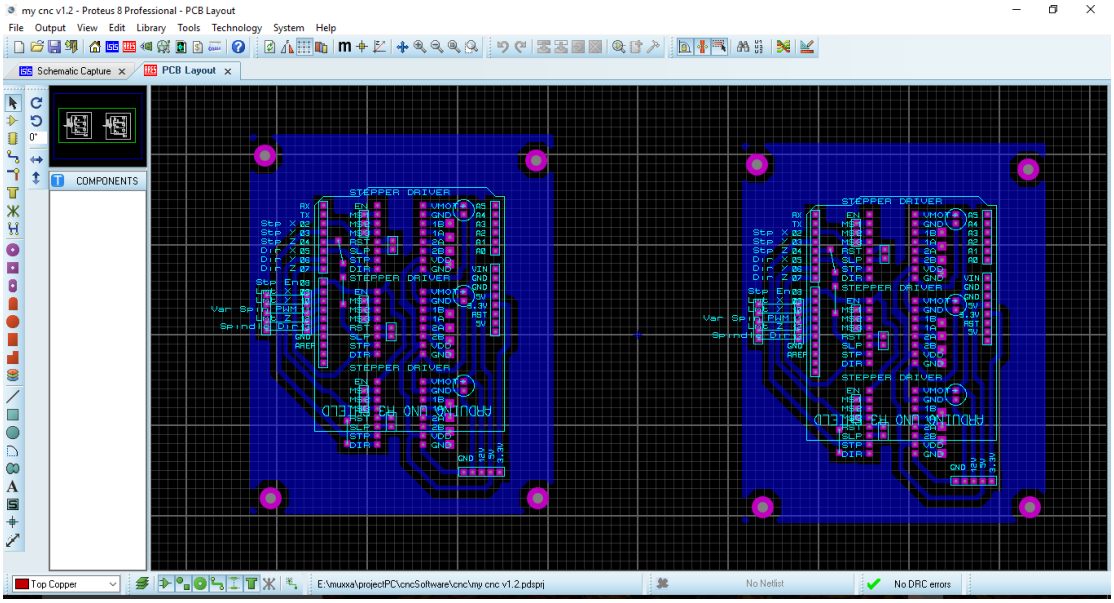

Figure 7: Circuit Board design on Proteus

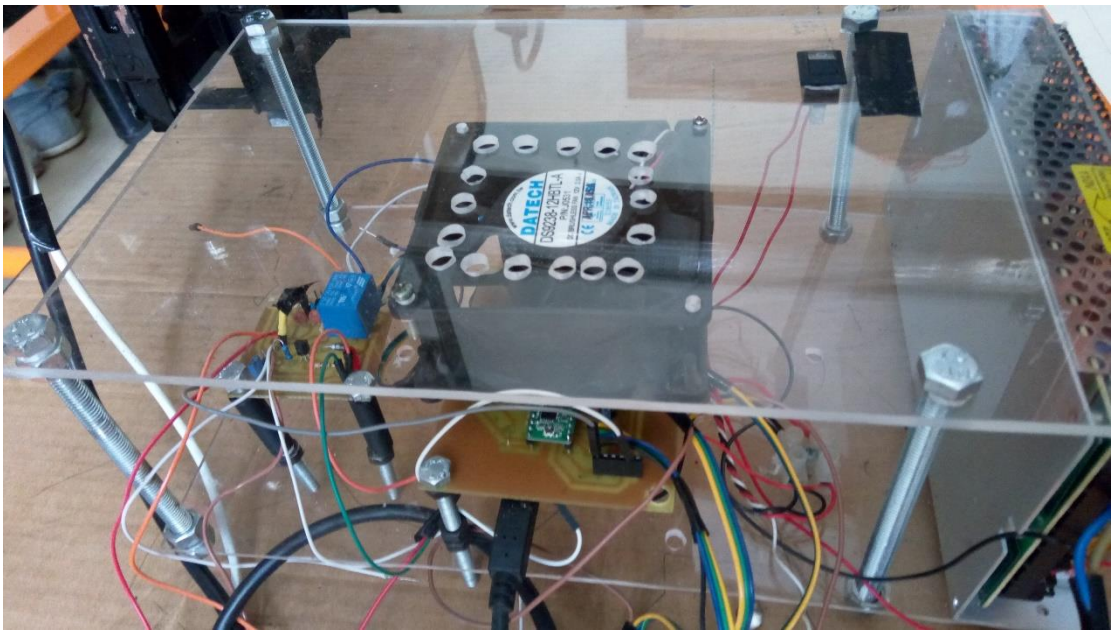

Figure 8: Control Board

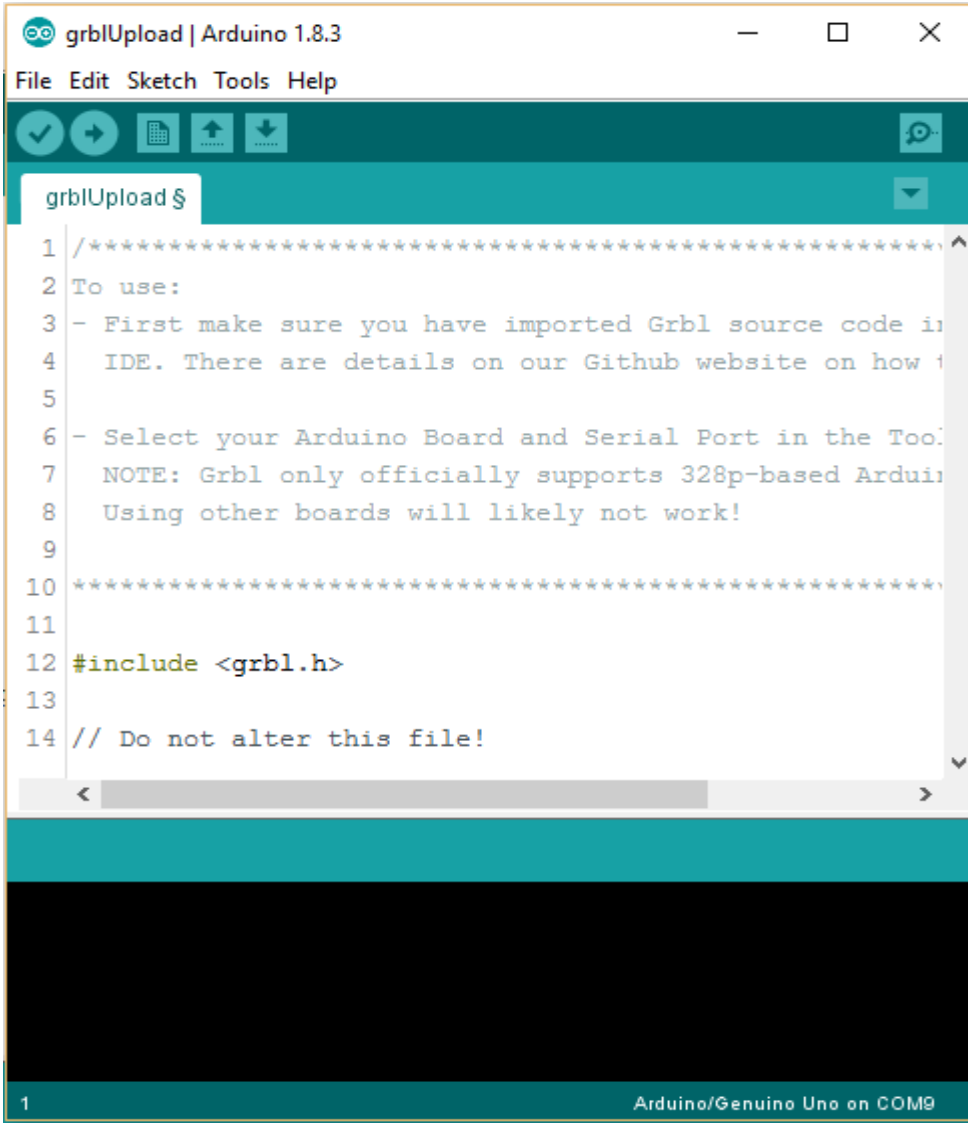

Figure 9: Loading Firmware

3.1.4 Implementation on the Software part

In this section, the desktop application was designed and coded specifically to control and do initial and advanced setup on the hardware machine.
This desktop main application is to act as a communication interface between the user and the hardware machine.
The software runs on windows operating system (86x or 64x bit). The main features are the buttons to move the z, x and y axis.
The button to assign communication port as the device communicate with the computer through USB Serial port 2.0

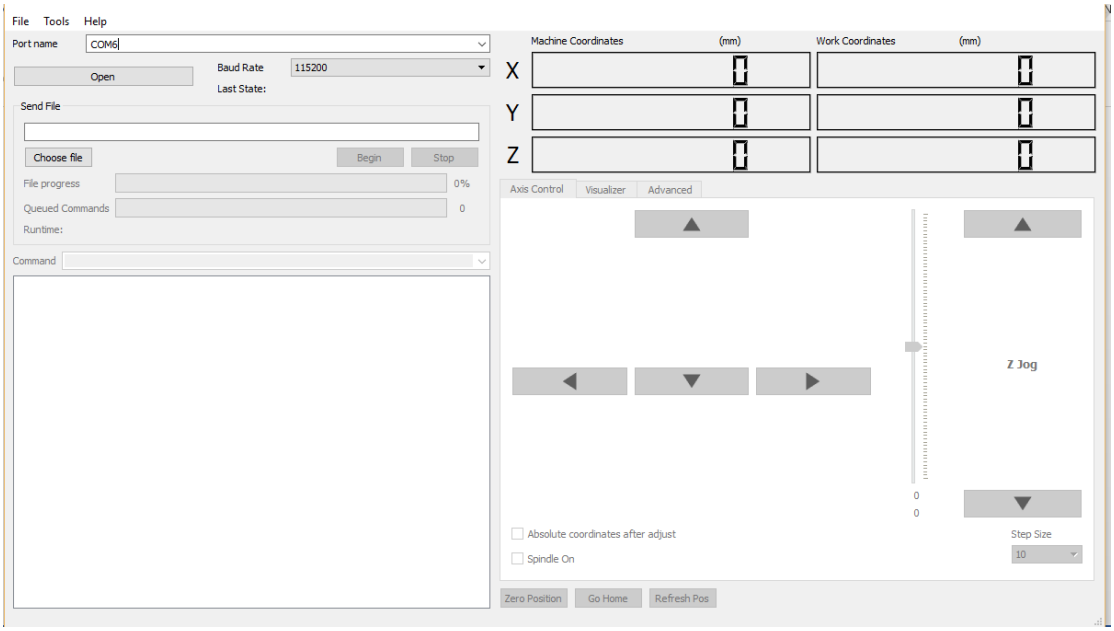

Figure 10: Desktop Software

The software offers a tab for help, where user can get more information on usage of the software.

3.3 Testing

3.3.1 Component Testing

Previously after buying devices such as power supply and stepper motors were tested each to ensure that they are all working correctly. This is because the project use the electronic waste devices (e-waste) instead of new one which were cost full that not affordable at this time.

After successful completion of the hardware part implementation section, the testing has been made to ensure that the component is working well and each axis move

correctly on its way and only some few adjustments where remained that supposed to be removed during the final integration of the software part.

3.3.2 Overall Testing

Later, all the component was generally collected and tested to ensure each part of the work was performed as intended. The test involved mechanical movement checking, motor testing, software testing.

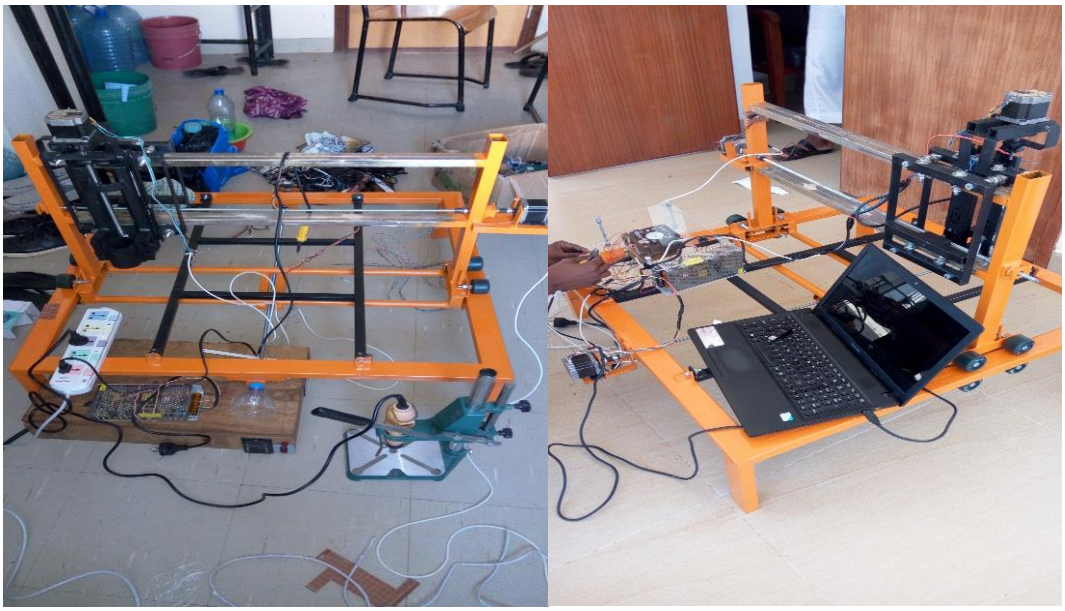

Figure 11: Integrated testing

Chapter 4

4.1 Conclusion and Recommendation

4.1.1 Recommendation:

A final year project is an opportunity to show and present brilliant innovative ideas about solutions or inventions to problems that faces the society or the globe as a whole. It's really exciting and promises to have allot of fun, knowledge gaining and increases awareness to students as they face or extract requirements for the implementation of the idea.

Despite that the feeling becomes so positive at the beginning yet there are challenges that should be addressed about the whole process from idea generation, defending titles, presentation and judgments from instructors.

From the experience throughout this project, some of the instructors seems to have a negative notation or perception that students can't come with brilliant and innovative ideas, even if they prove by being able to create brilliant projects, they face negative critics of which aren't going to help students.

This should change in a positive way, instructors should build positive perception to their students and should provide positive critics in a way to build out confidence to students.

The panel of instructors during presentation should not change at times, so that they could build a good relationship and get to understand fully student's ideas, so as they are able to help them mentally and technically.

4.1.2 Conclusion

This document presented the progression of this project from the start to the end. The key issues discussed in here are the literature review, requirement analysis and the design of the whole system by segmenting into units.

The design elaborates both static aspect and behavior aspect of the system through different types of unified modeling language diagrams (UML).

As the result the implementation of the system seems to be much easier and well understood. Since prototyping methodology was adopted, it created a possibility for some modification and changes for the sake of making the system perfect. From design perspective, data collection, analysis & design, the aim was to maintain the goal, which is to come up with cheaper design yet efficient and of high quality in order to reduce the overall development cost and the product cost at the end of the project.

As the world is developing so fast in different areas of production, energy, water, food, security, entertainment and so on, there is a need for generation of young creators and small start-ups entrepreneurs who may come up and add value in life through development activities. There is so much that can be done with this system, drawing, cutting, engraving of different materials or it can be used in agriculture to sow seeds. Therefore the only limitations would be user's imagination.

Up to this point, from the idea generation the crew we have learned a lot, by using advanced tools for product design, simulation and so on and acquire different kinds of knowledge, that we didn't get on the courses in a very short time.

Through this, the project has been able to motivate our colleagues in an amazing way.

4.2 Reference:

1. Lynch, M. (1993). Computer numerical control advanced techniques. New York: McGraw-Hill.
2. Lynch, M. (1994). Computer numerical control advanced techniques. New York: McGraw-Hill. Minasi, M (1994). Secrets of effective GUI design. San Francisco: Sybex.
3. Singh, N. (1996). System approach to computer integrated design and manufacturing. New York: Wiley

Appendix

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/**********************************************************************
To use:
- First make sure you have imported Grbl source code into your Arduino

- Select your Arduino Board and Serial Port in the Tools drop-down menu.
  NOTE: Grbl only officially supports 328p-based Arduinos, like the Uno.
  Using other boards will likely not work!

**********************************************************************/

#include <grbl.h>

// Do not alter this file!
```