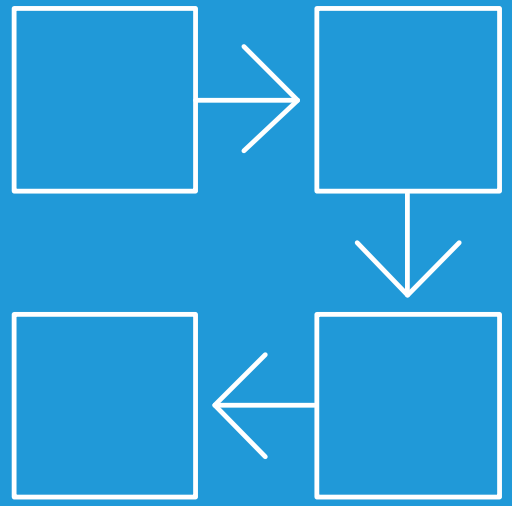

Welcome To Our Presentation

Design and Development of Robotic Arm to Print Objects Using Point Detection.

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Abstract

This paper discusses the design and realization of complex 3-axis Robotic Arm based on the microcontroller which combined with spindle drill. This machine can be used for Cutting, Engraving and Marking on wood, acrylic and PCB objects.

Robotic Arm has not been developed so that they are imported directly from another country. This has an impact on the industry that is difficult to develop because of the price of Robotic Arm still expensive. The challenge is how to make Robotic Arm with good performance but low cost so that it can contribute to the acceleration of domestic manufacture industry.

The software portion of a computer numerical control system must consist of at least of three major programs: a part program, a service program, and a control program. The part program contains the geometry description of the part being produced and the cutting conditions such as spindle speed and federate.

Design picture that has been made on the PC sent to the microcontroller using serial communication then Robotic Arm perform an execution on an object according to point coordinates. Drill spindles will create patterns on objects automatically according to the design drawings.

Abstract (Cont.)

After testing, the Robotic Arm can be used for cutting, engraving and marking on wood, acrylic, and PCB to 2D objects with 96% of carving accuracy and 100% of depth accuracy. This machine works on an object with a maximum size of 28cm x 21cm.

In this paper, we have used the concept of low cost mini Robotic Arm plotter machine, which is easily controlled by a computer and suddenly stop and paused by click action on the computer. By using this we have to make Difficult and Complex Design in the paper. This is a small machine which is easily Transportable and Assembled everywhere on Requirement of it. Stepper Motor will be run on in these criteria of bed size. If we have increased the size or length of the lead screw, it will be free to make the big size of design in the paper. We have used G-codes to give the command. G-codes are language to give the command to the machine to move right, left or up and down. On the successful work of this machine, we have some change on it and make it commercial used and applying tools for cutting, grinding of soft material etc.

Introduction

A robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm.

A Robotic arm whose Three principle axes of control are right angles to each other.

It is used to a computer numerical controlled or 2D printing, and also engraving and drawing 2D objects.

Objectives

- To develop a low-cost automatic computer numerical controlled Robotic Arm.
- To draw Printed Circuit Board (PCB) with point detection.
- To reduce the cost of the machine and increasing the flexibility.

Problem definition

- The fact that many devices whose are high implement cost.
- Point biased robotic arm is not available which is operate on only three motors.
- There many devices work only print or only engraving, but not both in at a time.

Challenges

- To reduce noise printing is so difficult for us.
- We will try to Accurate image print is more than 80% accuracy.
- Our device printer is slower printing. It more complicated faster printing.
- For This reason, this device is incapable to work properly.
  So it is a big challenge to design this device.

Tools used for Implementation

We developed an application using following tools:

Programming Language

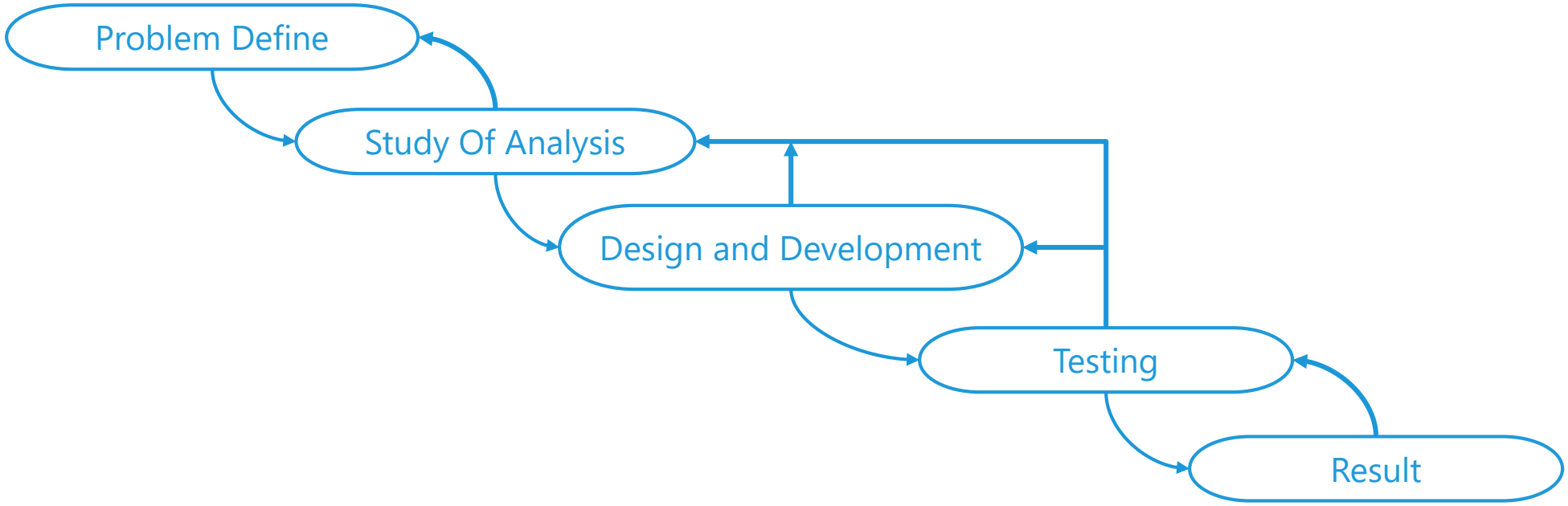
- C and C++
- Java
- G-Code.

Platform

- Processing v3.3.6.
- UI G4P GUI Builder.
- Arduino IDE v1.8.5.
- Mobile Platform(Android Studio).
- jViewer.

Methodology

This is the full steps to solve our problem.



Block Diagram (Windows)

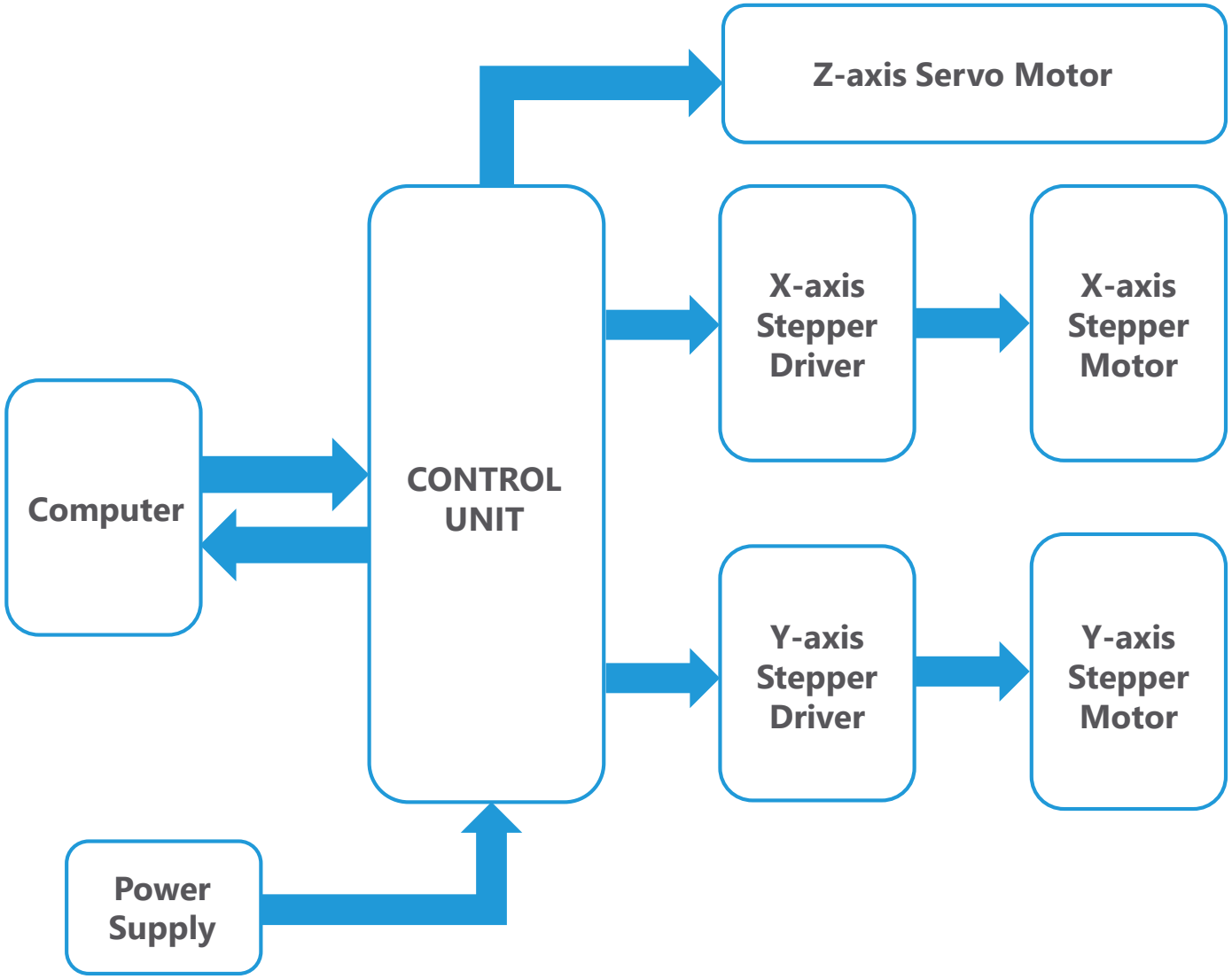


Fig: Block Diagram Windrows

Block Diagram (Android)

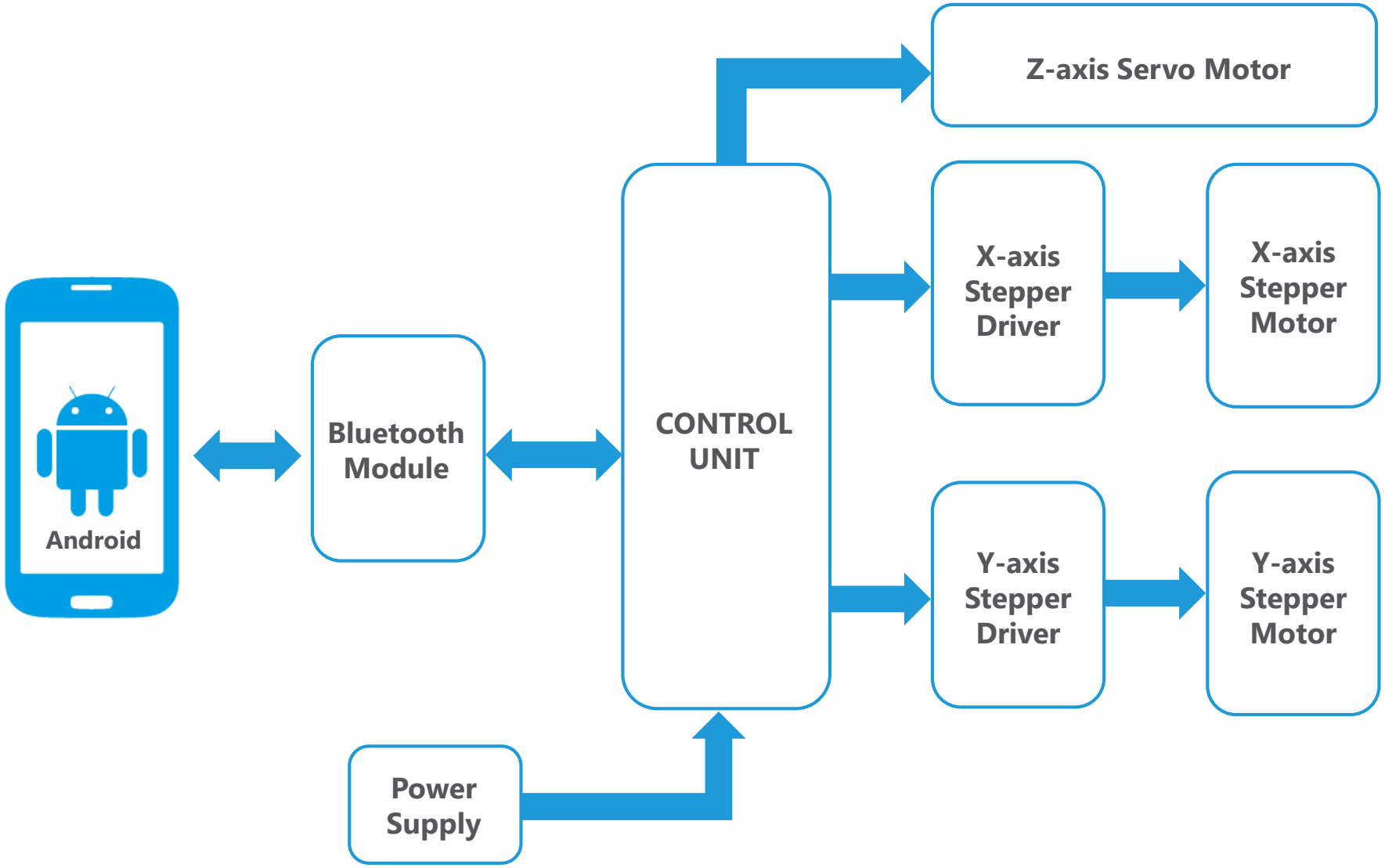
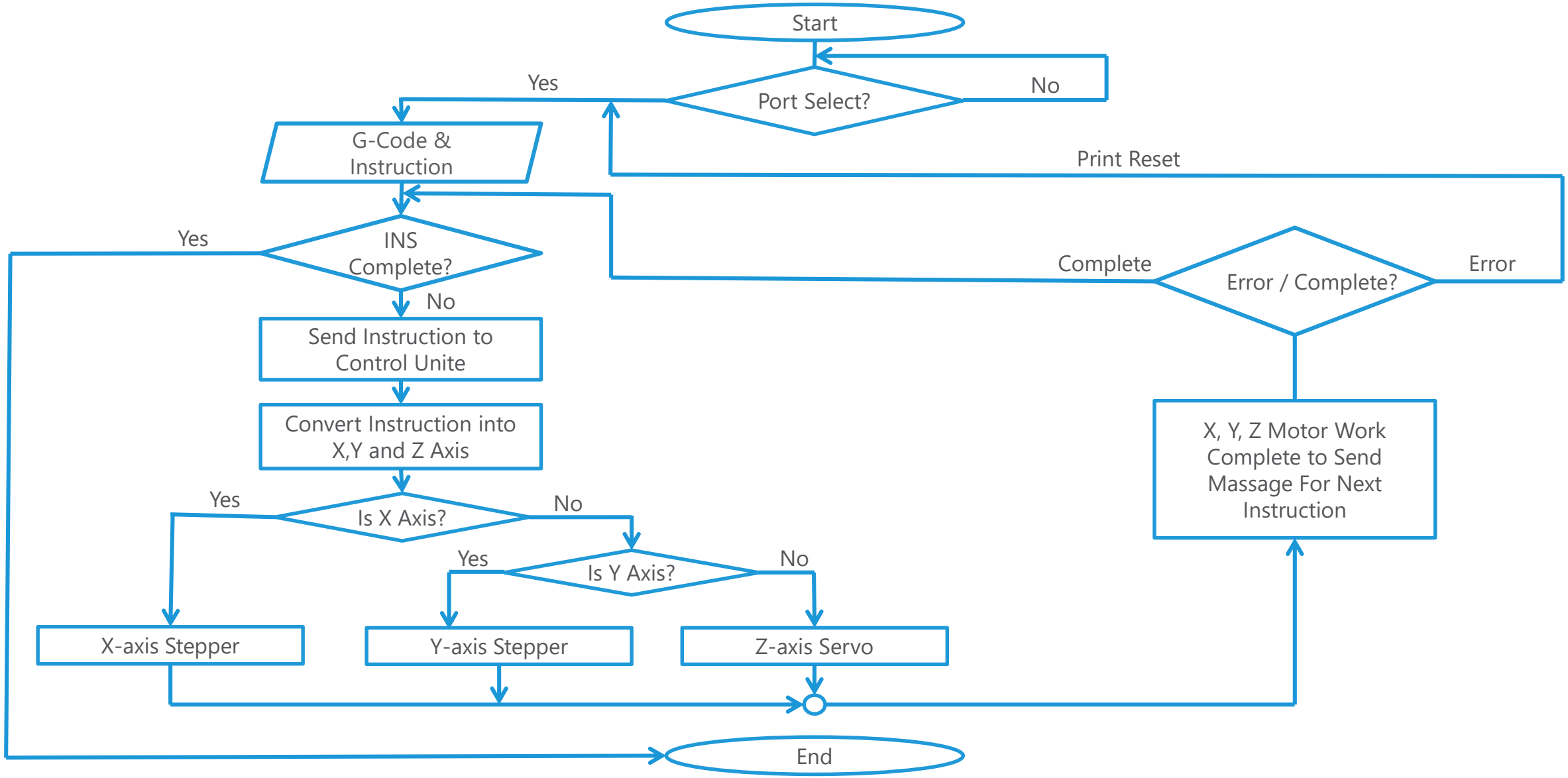


Fig: Block Diagram Android

Flow Chart


Start
Port Select?
Yes
No
G-Code & Instruction
Print Reset
INS Complete?
Yes
No
Send Instruction to Control Unite
Convert Instruction into X,Y and Z Axis
Is X Axis?
Yes
No
Is Y Axis?
Yes
No
X-axis Stepper
Y-axis Stepper
Z-axis Servo
Error / Complete?
Complete
Error
X, Y, Z Motor Work Complete to Send Massage For Next Instruction
End

Flow Chart (Algorithm)

Step 1: Start

Step 2: Port selection Yes or not?

If yes to Step 3 go to G-Code Instruction.

Else Step 1 again port selection.

Step 3: Send G-Code Instruction.

Step 4: Instruction complete or not?

If yes Printing End.

Else go to next Step 4 send the instruction to control Unite.

Step 5: Convert Instruction into X, Y and Z-Axis.

If yes Printing End.

Else go to next Step 4 send the instruction to control Unite.

Step 6: Is X axis?

If Yes Send Instruction Step 8 X-axis Stepper Motor.

Else to send Step 7 Is Y-Axis?

Step 7: Is Y-Axis?

If Yes Send Instruction Step 9 Y-axis Stepper Motor.

Else to Send Instruction Step 10 Z-axis Stepper Motor.

Step 8: X-axis Stepper motor work complete.

Step 9: Y-axis Stepper motor work complete.

Step 10: Z-axis Servo motor work complete.

Step 11: X, Y, Z Motor Work Complete to Send Massage for Next Instruction.

Step 12: Checking Instruction Error or Done?

If Done to request Next Instruction.

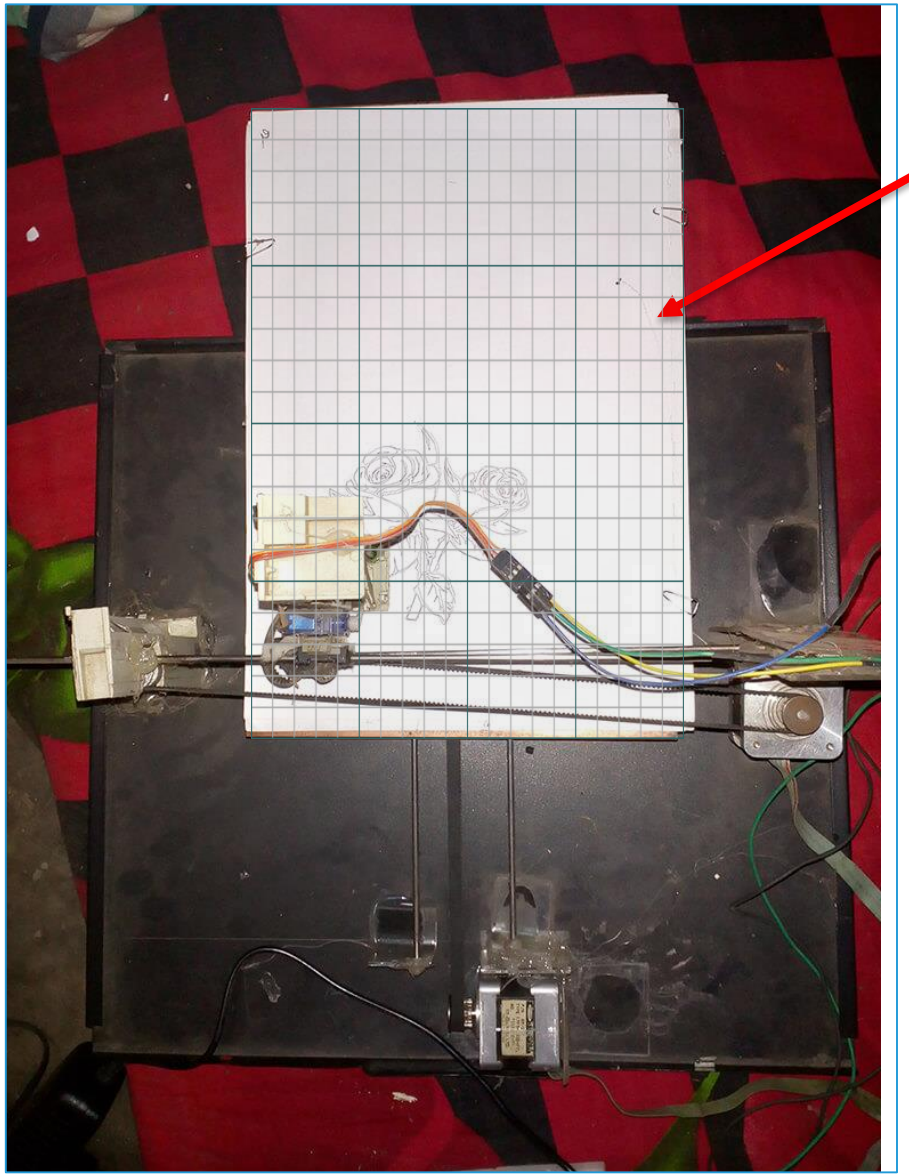
Else Error to Print Reset.

Step 13: When the All Instruction is complete?

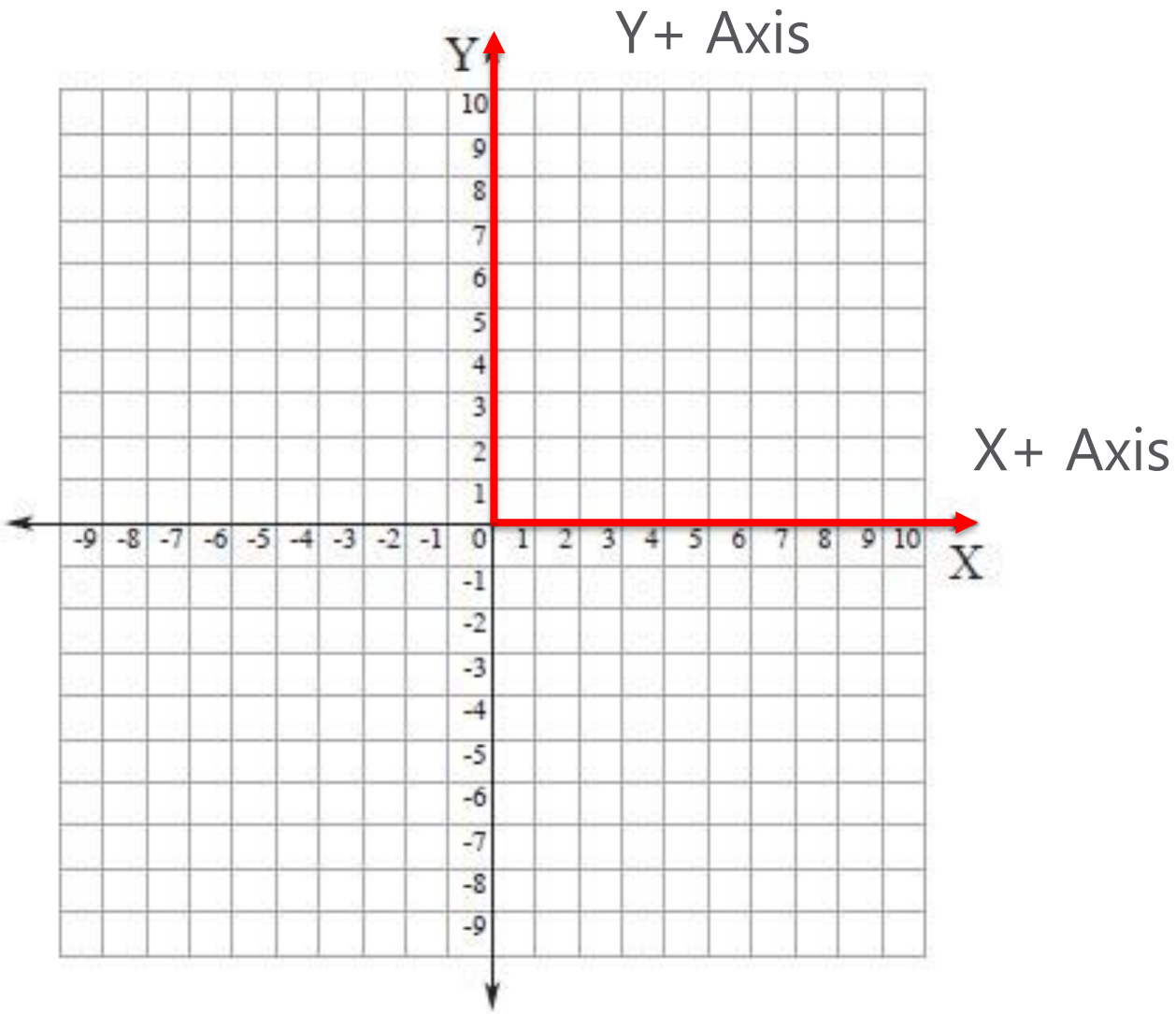
Yes, to Step 14 Print End.

Step 14: Print End.

How to Work Robotic Arm?



How To Work Robotic Arm?



How To Work Robotic Aram (Cont.)

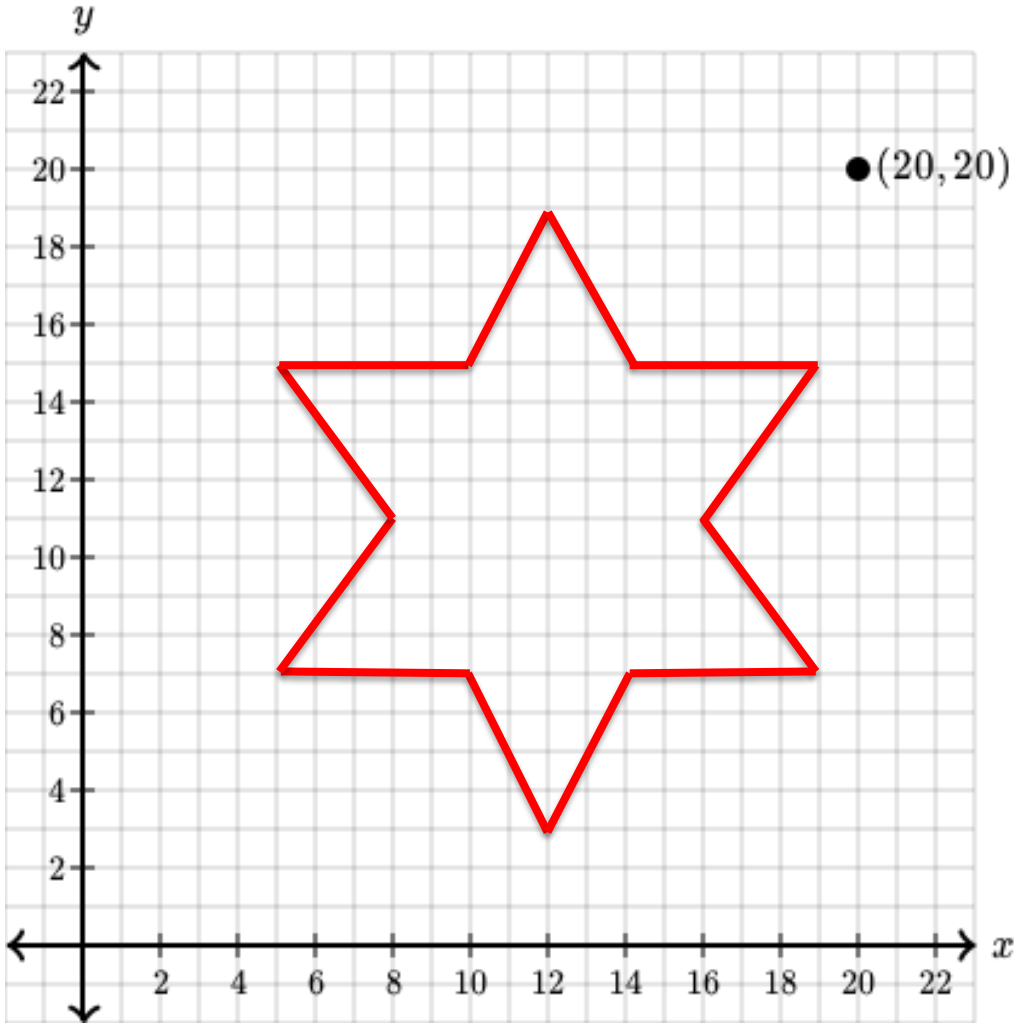


Fig: Graph paper X and Y Axis

X and Y Axis

- X=12, Y=3
- X=10, Y=7
- X=5, Y=7
- X=8, Y=11
- X=3, Y=15
- X=10, Y=15
- X=12, Y=19
- X=14, Y=15
- X=19, Y=15
- X=16, Y=11
- X=19, Y=7
- X=14, Y=7
- X=12, Y=3

How To Work Robotic Aram (Cont.)

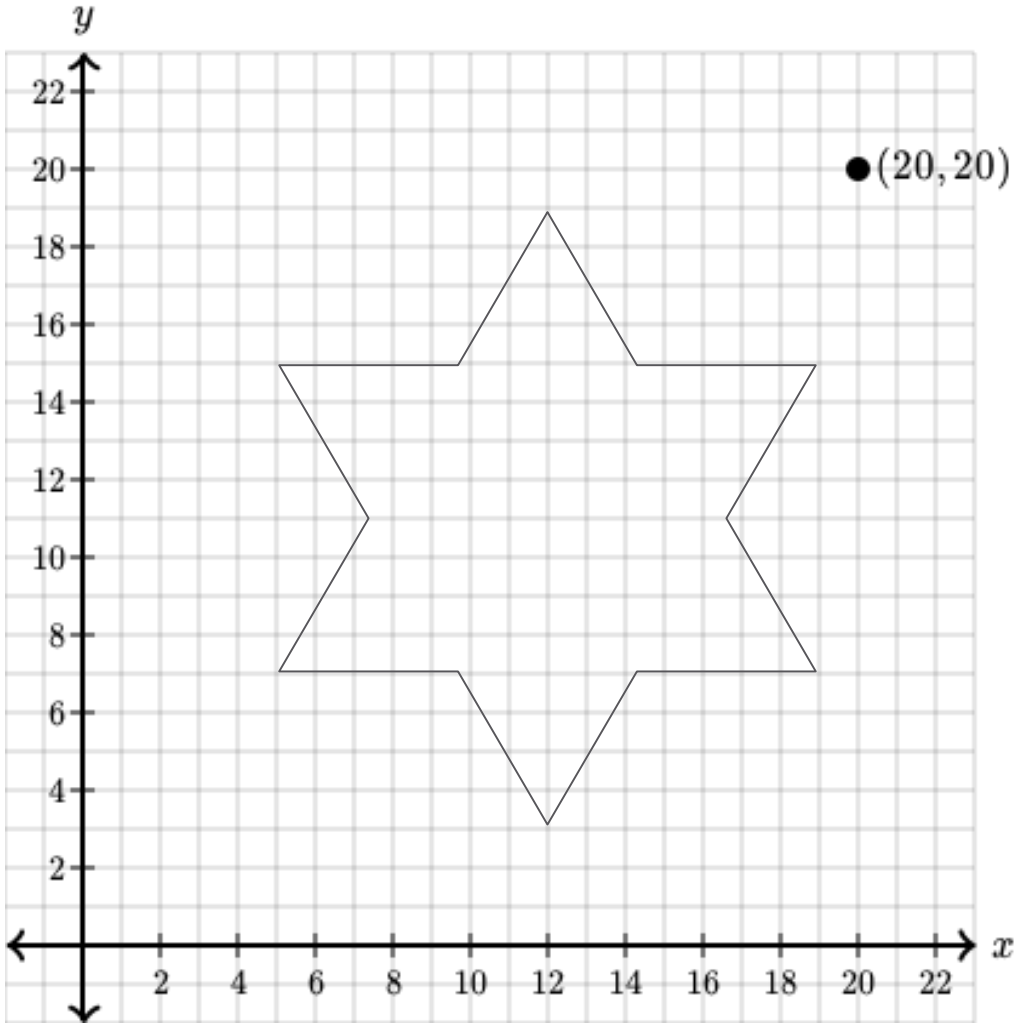


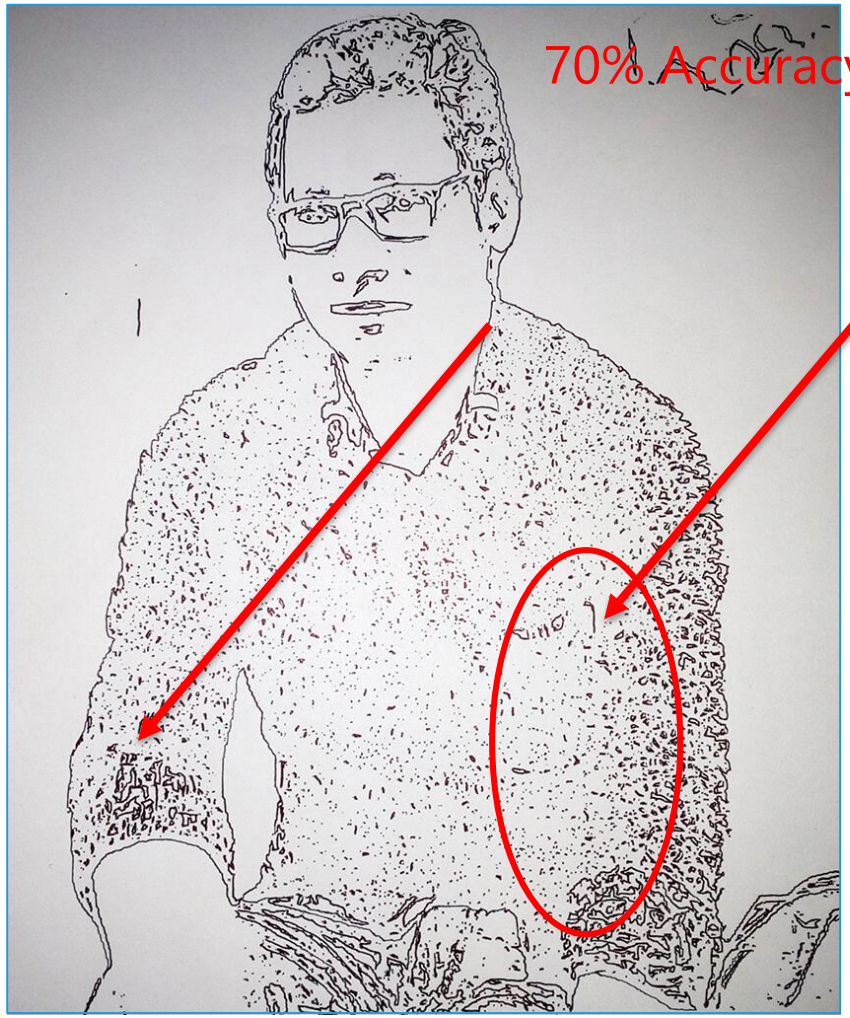
Fig: Graph paper X and Y Axis

Machine code (G-Code)

- G1 X12.00 Y3.00
- G1 X10.00 Y7.00
- G1 X5.00 Y7.00
- G1 X8.00 Y11.00
- G1 X3.00 Y15.00
- G1 X10.00 Y15.00
- G1 X12.00 Y19.00
- G1 X14.00 Y15.00
- G1 X19.00 Y15.00
- G1 X16.00 Y11.00
- G1 X19.00 Y7.00
- G1 X14.00 Y7.00
- G1 X12.00 Y3.00

Project Result and Screenshot

Original Image



Robotic Printed Image

Project Result and Screenshot (Cont.)

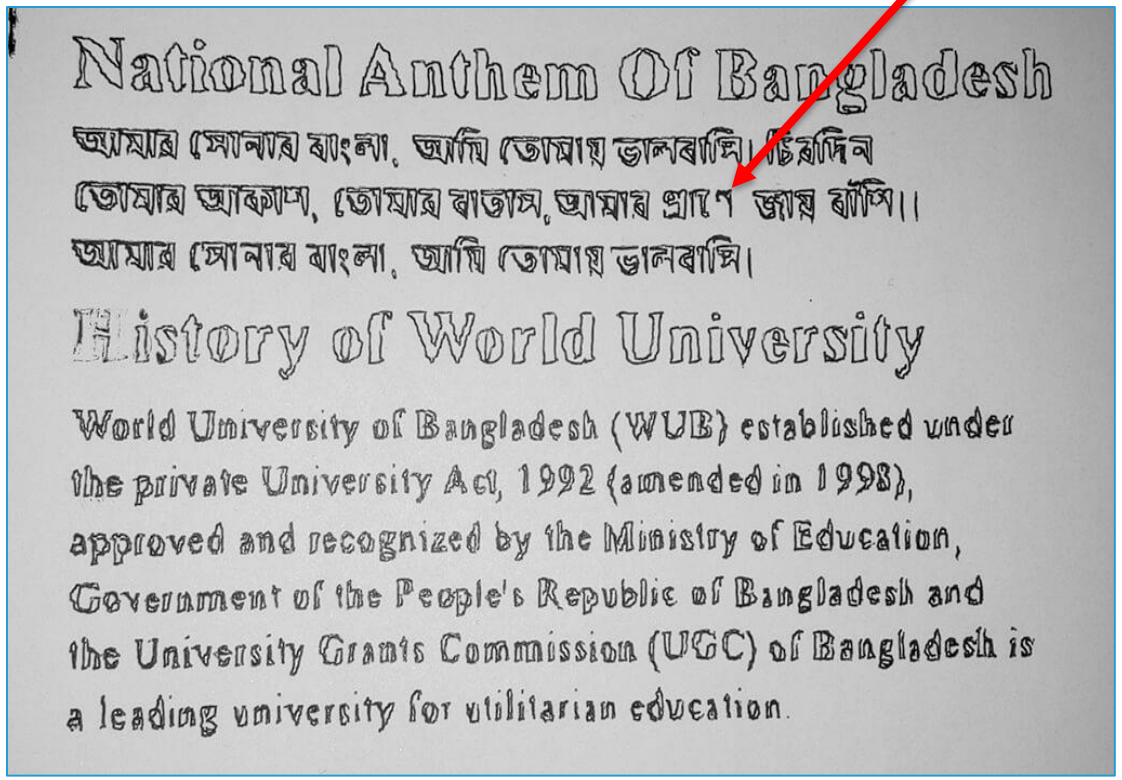
60% Accuracy Level

National Anthem Of Bangladesh

আমার সোনার বাংলা, আমি তোমায় ভালবাসি। চিরদিন
তোমার আকাশ, তোমার বাতাস,আমার প্রাণে বাজায় বাঁশি।
আমার সোনার বাংলা, আমি তোমায় ভালবাসি।

History of World University

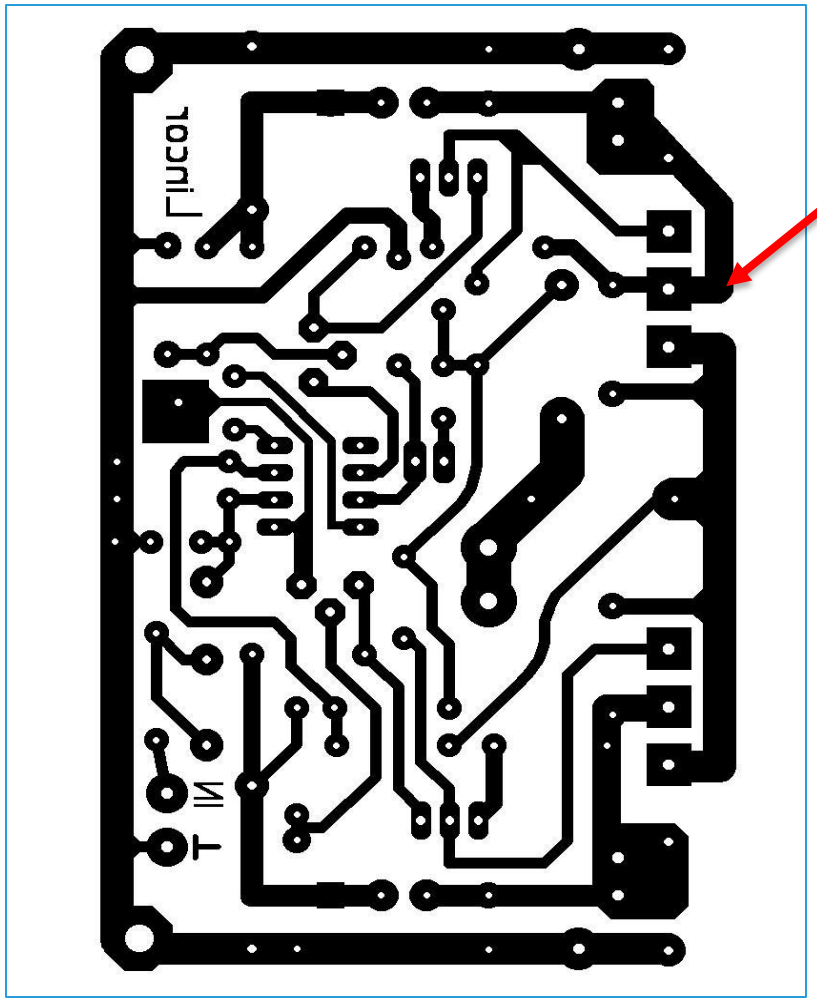
World University of Bangladesh (WUB) established under the private University Act, 1992 (amended in 1998), approved and recognized by the Ministry of Education, Government of the People's Republic of Bangladesh and the University Grants Commission (UGC) of Bangladesh is a leading university for utilitarian education.



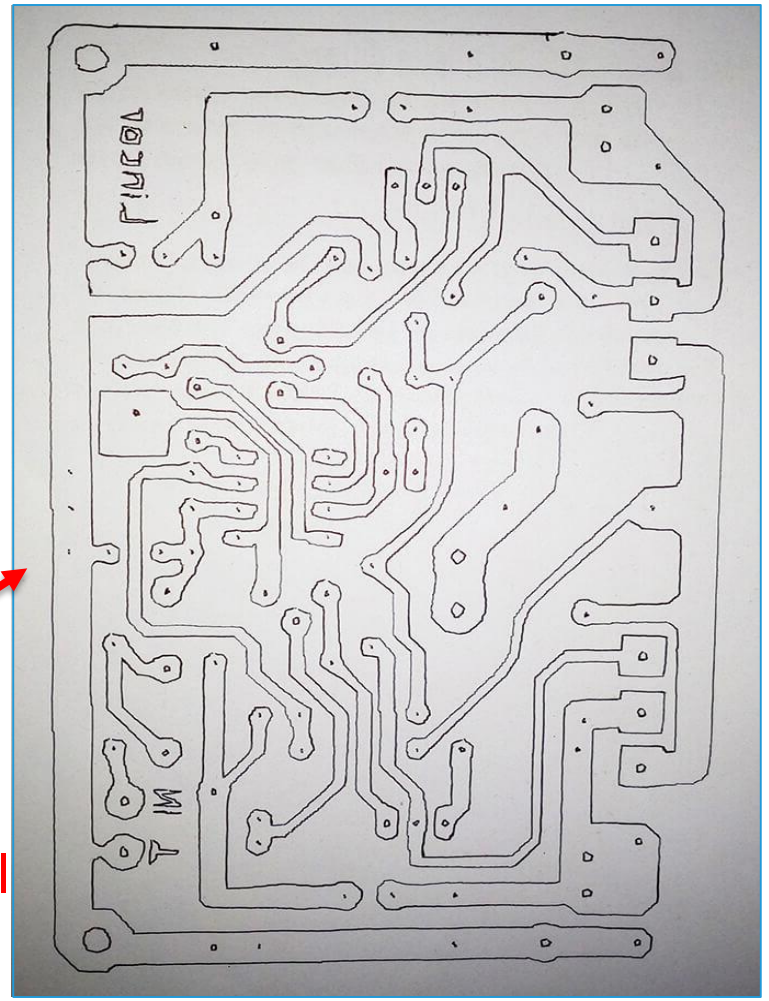
Original Texts

Robotic Printed Texts

Project Result and Screenshot (Cont.)



97% Accuracy Level



Original PCB Circuit

Robotic Printed PCB Circuit

Limitations of the Project

Our project has some limitations that we have faced this are-

- This Machine cannot print 3D objects.
- Our project printed image-Accuracy Level average 75% because of time limits.
- Cannot Engraving or mailing due to the time limit and high-cost devices that we cannot set these facilities.

Future Works

Although our Robotic Arm can print to 2D objects, we will develop a Robotic Arm that can print 3D or 4D objects. In future, we have an innovative idea that is Robotic Arms detect an image and it automatic prints this image.

We have implemented this idea, and also low-cost machine and mini Robotic Arm. To make 100% accuracy this Robotic Arm we will work and development and analysis our project.

Conclusion

This setup of hardware with a combination of G-code gives better accuracy and reduces the workload. G code make easy to find the information of locations of all stepper motor moving, as the status of our moving motor is directly seen on computer hence we can start or stop the machine whenever we are needed. Making a small machine brings a flexibility to do work.

The Robotic Arm can be used for cutting, engraving and marking on wood to form 2D or 3D objects with 98.5% carving accuracy and 100% depth accuracy. The process of synchronizing the stepper motors was controlled using GRBL library and Universal G-code Sender Software.

Thank You.