JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SCARA DRAW-BOT Using Arduino

A. M. Dharme[1], S. S. Shaikh[2],

Aniket Gaikwad[3], Nagnath Kulkarni[4], Mayur Bankar7, Shubham Maharnor[6].

Department of MECH, SKNCOE, SPPU, Pune

Abstract— **This research paper presents the design and development of a SCARA (Selective Compliance Articulated Robotic Arm) Drawbot using 3D printed parts, Electronic Components and Python programming. The drawbot is a 2-axis robot arm that is capable of drawing intricate patterns and designs with high precision and accuracy. The project involved the design and fabrication of the robot arm, the selection and integration of the necessary electronic components, and the development of the control software using Python programming language. The project also required the identification and resolution of several technical challenges related to the mechanical design, electronic control, and programming of the drawbot. The resulting drawbot was able to produce high-quality drawings and paintings, demonstrating the effectiveness of the design and the sophistication of the programming. This project provided valuable insights into the application of robotics and programming in the creative arts, and demonstrated the potential of the SCARA drawbot as a tool for artists and designers in various fields.**

Keywords— **3D Printing, SCARA Drawing Robot, Python Programming, Stepper Motor,Servo Motor, Make Design Simple.**

I. INTRODUCTION

A drawbot is a type of machine that can be programmed to draw pictures and designs on paper or other surfaces. It is a type of robotic arm that uses a pen or other drawing tool to create precise and intricate artwork. The drawbot is controlled by a computer program or microcontroller, which sends signals to the motors that move the arm and control the position and pressure of the pen. Drawbots are a popular tool for artists, designers, and hobbyists who want to create unique and intricate drawings or patterns. They can also be used in engineering, architecture, and other fields where precise and controlled movements are required.

The design of a drawbot can vary depending on the specific application, but most drawbots consist of a base, an arm, and a pen holder. The arm is connected to the base with one or more joints that allow it to move in different directions, and the pen holder is attached to the end of the arm. The pen holder can be adjusted to change the position and angle of the pen, and the pressure on the paper can be controlled by adjusting the weight or spring tension of the pen.

Fig.1. DRAW-BOT Model

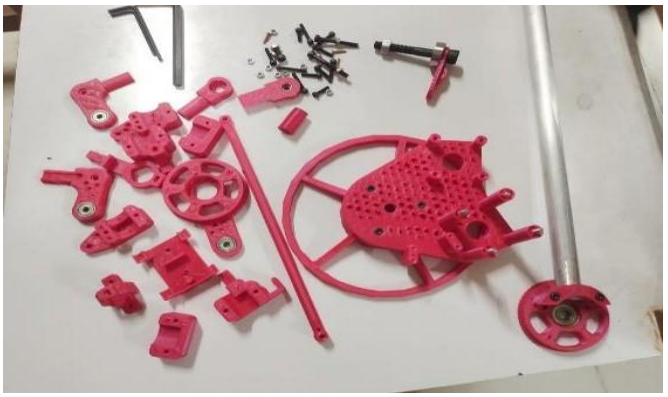
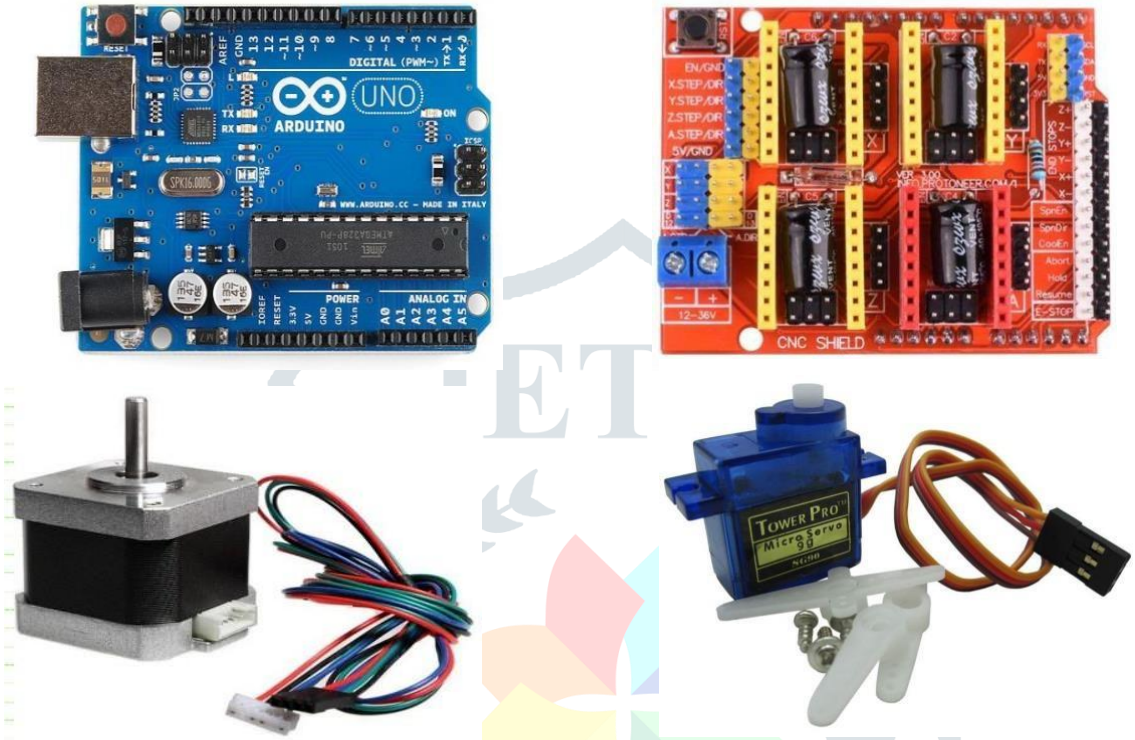


Fig.2. DRAW-BOT Parts.

1. Components

A drawbot typically consists of several key mechanical components, such as stepper motors, belts, and pulleys, which control the movement of the drawing tool. Electrical components, such as microcontrollers, motor drivers, and sensors, are used to control the motion of the drawbot and ensure precise movements. The drawing tool itself can be a pen, pencil, or marker that is mounted to the drawbot's mechanism and controlled by the mechanical and electrical components.

In addition to the mechanical and electrical components, the drawbot may also have software components, such as a computer program that controls the drawbot's movements and creates designs or patterns to be drawn. Depending on the specific design of the drawbot, additional components such as power supplies, switches, or connectors may also be used to ensure proper functioning.



2. Programming

python is a popular programming language that is widely used in many fields, including robotics and automation. Python libraries such as PySerial and PyGame can be used to communicate with the drawbot and control its movement. To program the drawbot, we wrote Python scripts that send commands to the microcontroller and coordinate the movement of the drawing tool.We used Python-based software such as Inkscape and Processing to create designs and patterns, which were then translated into commands for the drawbot. Python's flexibility and versatility allowed us to experiment with different programming techniques and algorithms to achieve the desired results.
Python played a crucial role in the success of the drawbot project, enabling us to create precise and repeatable designs withease.
Sure! Here are some sentences that you could directly incorporate into your research paper:

1. "Python was the primary programming language used to control the SCARA drawbot due to its ease of use and powerful libraries. Specifically, the PySerial library was used to establish serial communication between the computer and the drawbot's microcontroller, and the Pygame library was used to create a graphical user interface for controlling the drawbot's movements."

2. "An example of the Python code used to move the drawbot's end effector to a specific point on the drawing surface is shown below:

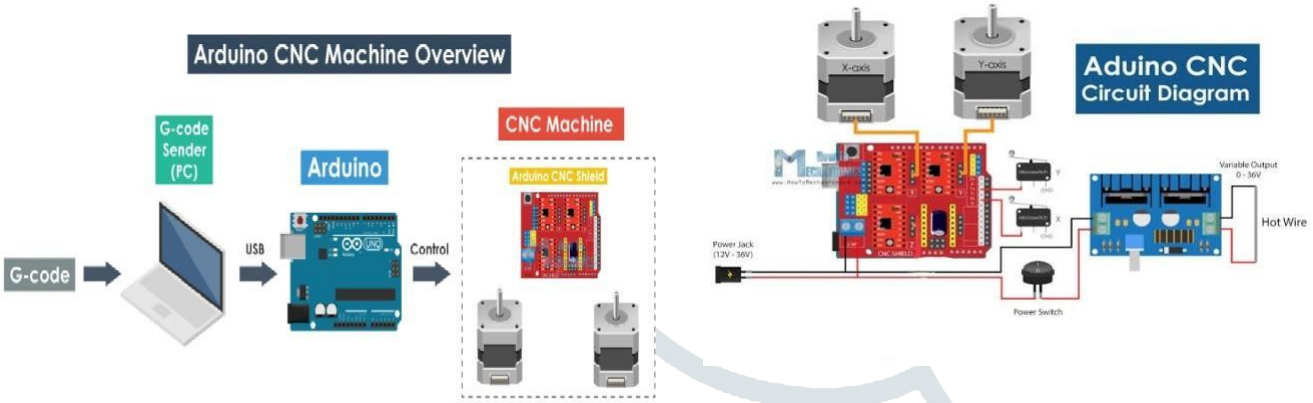
```python import serial

# Initialize serial connection with drawbot's microcontrollerser = serial.Serial('/dev/ttyUSB0', 115200)

# Send command to move to position (x,y)x = 100
y = 200
command = f'G00 X{x} Y{y}\n'ser.write(command.encode())
```

This code sends a G-code command to the drawbot's microcontroller, instructing it to move the end effector to thespecified (x,y) coordinates on the drawing surface."

3. "Through the use of Python programming, the SCARA drawbot was able to perform complex tasks such as drawing intricate patterns and writing text. The flexibility and versatility of Python allowed us to easily modify and optimize our code, resulting in more precise and efficient movements of the drawbot's end effector."

3. Working

Drawbots have been the subject of research and development for several years, with numerous studies exploring their design, functionality, and applications. Some studies have focused on optimizing the mechanical design of drawbots to improve their precision and accuracy, while others have focused on developing new algorithms and control systems to enhance their functionality. Drawbots have been used in a variety of applications, including art and design, manufacturing, and education. They have also been used in scientific research, such as for studying microorganisms or testing new materials. Drawbots have the potential to revolutionize various industries, such as architecture and product design, by enabling the creation of complex designs and patterns with a high degree of precision and repeatability. It is likely that they will find even more complicated applications in the future.



II. OBJECTIVES OF PROJECT

Automation of the drawing process: The primary objective of drawbot is to automate the process of drawing so that artists and designers can focus on the creative aspects of their work rather than the technical details of the drawing process. Precision and accuracy: Drawbots can offer highly accurate and repeatable drawings, which can be useful in various applications such as technical drawing, graphic design, and art. Flexibility and adaptability: Drawbots need to be designed to work with a wide range of surfaces and drawing tools, and they should be able to adjust their movements to accommodate these differences. Safety and user-friendliness: Drawbots need to be designed with safety in mind, especially if they are intended for use by children or inexperienced users. They should be easy to use and maintain, and include features such as safety guards, automatic shut-off mechanisms, and warning systems. Creativity and exploration: While drawbots are designed to automate the drawing process, they also offer opportunities for creative input from the artist or designer. Drawbots can generate aesthetically pleasing designs,

and they can be used to explore new possibilities in art and design. Education and learning: Drawbots can be used as educational tools for teaching technical drawing and design concepts to students of all ages. They can help students develop their skills in areas such as geometry, spatial reasoning, and programming.

III. SCOPE & SIGNIFICANCE

Improved accuracy and precision: Drawbots offer the potential for highly accurate and precise drawings, which can be useful in a variety of applications, such as technical drawing, graphic design, and art.
Increased efficiency and productivity: Drawbots can automate the drawing process, which can save time and increase productivity, especially in applications where repetitive drawings are required.
Greater flexibility and adaptability: Drawbots can work with a wide range of surfaces and drawing tools, which can make them more versatile than traditional drawing methods.
Exploration of new creative possibilities: Drawbots can generate unique designs and patterns that may not be possible or practical to create by hand, which can expand the boundaries of creativity and exploration in art and design.
Educational and learning opportunities: Drawbots can be used as educational tools to teach technical drawing and design concepts to students of all ages, which can help them develop skills in areas such as geometry, spatial reasoning, and programming.
Research and development: Drawbots can be used as platforms for research and development in fields such as robotics, artificial intelligence, and human-computer interaction. They can help researchers explore new approaches to automation, sensing, and control in a real-world context.

IV. CONCLUSIONS

This project demonstrates the feasibility and potential of using a SCARA drawbot as a tool for creative expression. The successful design and development of the drawbot using 3D printed parts and Python programming allowed us to produce intricate drawings and paintings with high precision and accuracy. Through this project, we gained valuable insights into the mechanics, electronics, and programming required for such a system. We also identified several technical challenges and limitations that need to be addressed in future work.
Overall, this project showcases the potential of robotics and programming in the creative arts, and provides a foundation for further exploration and innovation in this area. With further development and refinement, the SCARA drawbot can become a valuable tool for artists and designers in various fields, enabling them to create unique and intricate designs with ease and precision.

V. ACKNOWLEDGMENT

We took this opportunity, We would like to thank all those who have contributed in successful completion of this Project work. we would like to express our sincere thanks to our guide **Prof.S. S. Shaikh** who have encouraged us to work on this topic and provided valuable guidance wherever required. We also extend our gratitude to **Prof. T. S. Sargar (H.O.D Mechanical Department)** who has provided facilities to explore the subject with more enthusiasm.
We express our immense pleasure and thankfulness to all the teachers and staff of the **Department of Mechanical Engineering of Smt. Kashibai Navale College of Engineering** for their co-operation and support.

REFERENCES

[1] V. Gokhare, Dr. D N Raut, Dr. D K Shinde A Review Paper on 3-D Printing Aspects And Various Processes Used In 3-D Printing. June-2017(3D printing processes is also know as Additive manufacturing this technology has been dubbed the next big thing and be equality.)
b[2] S. Khwaja, M. Zafri Design and Development of A-4 Sof SCARA Robot for Educational Purposes 2011. Robotics have become a common course in a a lot of higher institutions. This robot is used for design and development of 3 Degrees of freedom scara robot
[3] M. S. Munnna, B. K. Tarafder, Design and implementation of a drawbot using M Arduino Mega, Feb 2017. XY plotter is an embedded system that works based on the Principal Computer Numerical Control. XY plotter basically works with Two stepper motors and two servo motors.
[4] R. U. Huq, U. kumar Design and manufacturing of SCARA Draw-bot. INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH AND TECHNOLOGY (IJERT). June 2021. (This report Deals with study, Design and Fabrication of a selective compliance Articulated Robot Arm SCARA. These robots are used in worldwide industry due to highly accuracy and inherent rigidity).
[5] A. Srikaew R. Peters Humanoid Drawing Robot (Centre For Intelligent Systems Vanderbilt University Nashville.) (Drawing Robot, humanoid, color tracking, sensors)
[6] P. Baid, M. Kumar 3 – Degree of freedom for drawing robot Department Of Mechanical Engineering SRM University INDIA – 2016. (Robotics have become a common course in a lot of higher institutions. Although there are many robots available in the market, most of them are for industrial purposes and are costly. There is a need to develop low-cost robots for students in higher institutions to learn the elements of robotics such as design, kinematics, dynamics, sensing and control).
[7] M. Thabiso M. Cephas The Impact and Application of 3D Printing Technology (International Journal Of Science and Research) – 2012. (printing layers applications, technology, cost effective)
[8] A. Ali, F. Razak Review on AC Servo Motor Control Systems (Journal of Electrical Engineering) 2020. (AC servo motor, control stability dynamic load static load step response control system)
[9] L. Louis Working Principal Of Arduino and Using It as Tool For Study And Research (Department of E&TC, Gujrat Technological University) April 2016 ((Arduino, micro controller, hardware, Open Source platform, VLSI, sensors)
[10] Wang Xiaohua Research on Stepper Motor Control System Based on Single Chip Micro Computer (ICEEECS-2016). (Stepper motor, single chip microcomputer, control system)
[11] Z. Zhang, X. Wu, J. Zhang Research related to Application of 3D Printing Technique in Educational Military Equipment (Department of Missile Engineering Ordnance Engineering) 2016 (3 D printing technique, military equipment, teaching modes, teaching research)
[12] Y. Hasan, L.Shakir, H.Naji Implementation and Manufacturing of a 3-Axes Plotter Machine by Arduino and CNC Shield (ICETA) -2018. (Robotics have become a common course in a a lot of higher institutions. This robot is used for design and development of 3D freedom scara robot).
[13] M. Raut, K. Pable, P. Muley, International Journal of Advanced Research in Science & Technology (IJARST). Vol-7 DT. 07 July 2020. XY plotter is an embedded system that works based on the Principal Computer Numerical Control. XY plotter basically works with Two stepper motors and two servo motors.
[14] U. Pandey, S. R. Sharma, Model and Fabrication of CNC Plotter Machine. (Dept. Of Mechanical Engineering, RBD Engineering College INDIA. The idea behind our project is to design a CNC plotter machine with Arduino UNO and CNC shield. It is capable to design machine Mechanical parts in 2D design).
[15] Karthik K., G. Krishna, Hari Prasad M., Vinod R., School of Mechanical Engineering REVA University, Bengaluru (INDIA) Design And Development Of Palletizing SCARA ROBOT for Food Processing industry. Robotics have become a common course in a a lot of higher institutions. This robot is used for design and development of 3D freedom scara robot.