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Writing Robot

[1]Asawari A. Landge,[2]Prajakta S. Mandavkar,[3]Pranali L. Bande,

[4]Rutuja V. Bhute,[5]Shraddha N. Jambhulkar

[1,2,3,4,5]Department of Computer Engineering, Cummins College of Engineering for Women, Nagpur, India,

Abstract: This project involves the creation of a robot capable of both writing text and drawing images on paper. The robot utilizes a combination of precise movements and writing/drawing tools to execute these tasks. The system is designed to accept input, convert it into readable text or drawable images, and then autonomously reproduce the input on paper. The project aims to explore the integration of robotics and artistic expression, providing a unique platform for automated creativity. The system accepts input in the form of text or image data. For text input, the robot utilizes natural language processing algorithms to interpret and understand the content. For image input, image recognition algorithms are employed to analyze and convert the visual information into a format suitable for drawing. This machine can draw both parallel and upstanding. Its single design structures a writing head that spreads beyond the machine, making it possible to draw on objects greater than the machine itself. The major benefit of the machine is that it can be located over the hardcover because the core XY extends the design of the machine. The purpose of this research paper is to present a comprehensive study on the design and development of a handwriting robot. The project aims to create a robotic system capable of accurately mimicking human handwriting, opening up possibilities for various applications in fields such as education, art, and automation. This paper explores the mechanical design, actuation mechanisms, control electronics, and sensors involved in building such a robot. By understanding the intricacies of these components and their interactions, we can achieve precise and fluid handwritten output. The research paper also delves into the challenges faced during the development process and proposes potential solutions for further improvement. Through this study, we hope to contribute to the advancement of robotics and its applications in the field of handwriting replication.

Keywords: writing machine, Servo motor

I. INTRODUCTION

Imagine having a robot friend that can write and draw on paper. This cool robot understands what you want it to write or draw. It uses smart tricks to figure out your words and even recognizes images. With its careful moves, it turns your ideas into beautiful writing or drawings on paper. This project is like having a creative sidekick, showing how robots and art can team up for some awesome creations. The main idea behind this project is to create a robot that's like a creative friend. It's not just about doing tasks but collaborating with you on art and writing projects. Whether you're looking for a writing assistant or an artistic companion, this robot is here to make the creative process more fun and interactive. The writing robot is a fascinating creation that combines robotics and handwriting to create beautiful handwritten content. It uses mechanical arms and precise movements to mimic the motions of a human hand, allowing it to write and draw with incredible accuracy. showcasing the capabilities of robotics in a creative and expensive way. By developing a writing robot, you'll be able to automate the process of handwriting and create unique pieces of art or personalized It's a project that requires a combination of programming, engineering, and artistic skills.

II. LITERATURE SURVEY

In their research, as described in [1], They are presenting a simple design for a 2D plotter. This plotter is based on the Arduino Uno microcontroller and utilizes the L293D motor driver for motor control. The plotter consists of three motors that implement the X, Y, and Z axes. The z-axis is manipulated by a servo motor to raise the pen for logic 0 and lower it for logic write. The drawing occurs along the X-Y plane, with stepper motors regulating the positioning. The x-axis is connected to two plastic components, while the y-axis is positioned directly on the base of the 2D plotter. The x-axis is connected to two plastic components, while the y-axis is positioned directly on the base of the 2D plotter. To create a surface for printing, a hard surface is attached to the Y-axis, where the programmed text or image can be printed. The printing area is 4cm x 4cm. To facilitate the communication between the microcontroller and the machine controller, a separate program is used to upload the coordinates to the machine

controller. The image file is transformed into G-code using software, and then the G-code is transferred to the microcontroller. The microcontroller, in turn, instructs the motor mechanism to draw the image based on the received G-code.

In [2], They discuss the basic principle of CNC machines, which involves controlling all the motors using computer software. Specifically, you have developed a machine with three motors: two stepper motors for the XY plane and one servo motor for precise pen adjustment. The stepper motors divide a full rotation into equal steps, while the servo motor allows for precise angle adjustments of the pen. To control the motion of the stepper motors, you use A4988 motor drivers, and a microcontroller is utilized to control the servo motor. The X-axis of your machine is attached to two wooden parts and operates in a vertical position for cutting and construction purposes. The Y-axis is placed horizontally on the plotter base. The pen is gripped by the servo motor, enabling it to move up and down along the Z-axis, which is free to move in the 2D plane (X-Y). To convert input text or images into G-code, you utilize Inkscape software and the 'G-code tools' extension. This allows you to generate the necessary instructions for the machine. The Universal G-code Sender is then used to transmit the G-code to the microcontroller, facilitating the control of the machine's movements. To get started with your plotter, you establish a connection between your laptop and the microcontroller. You upload the appropriate sketches to the Arduino board using the Arduino IDE software. Once the Universal G-code Sender is paired with the microcontroller, you can begin controlling the movements of the XY plotter. The flowchart illustrates the starting process of the plotter, depicting the laptop connection and the subsequent steps involved in preparing and transmitting the content to be written.

In the paper denoted as [3], the author discusses the design process of a plotter machine. They mention that the structure of the machine has been designed using SolidWorks software, and all the parts of the machine will be created before implementing the actual hardware. The initial design will be drawn after receiving approval. Before starting the design, the author emphasizes the importance of understanding the criteria and the linear movement of the stepper motors controlling the X, Y, and Z axes. The author explains that the X-axis stepper motor controls the left and right movement, the Y-axis stepper motor controls the front and back movement, and the Z-axis stepper motor controls the up and down movement of the pen. The travel length for the X-axis is 215 mm, for the Y-axis is 235 mm, and for the Z-axis is 1 mm.

The paper indexed as [4], The author discusses the importance of stepper motors in the context of a CNC plotter. It explains that stepper motors are DC electric motors that divide a full rotation into steps, making them ideal for precise control in the plotter. In this specific application, two stepper motors are utilized for the x and y axes to control the drawing pen, enabling accurate sketching of objects. The stepper motor drivers play a crucial role in driving the stepper motors. These drivers are specifically designed to provide continuous rotation with precise position control, even without a feedback system. They offer adjustable current control, multiple step resolutions, and built-in translators that simplify the control of stepper motors using step and direction inputs. The project mentioned in the research paper opts for using two drivers instead of two stepper motors. This decision allows for greater control and flexibility in achieving the desired precision and functionality of the CNC plotter.

In the paper denominated as [5], The author focuses on the creation of an XY plotter using a scanner mechanism and an Arduino microcontroller system. This plotter is designed to store and plot 2D data using a rectangular coordinate system. By utilizing the Arduino software, which is widely used in electrical parts, the connected computer or system can model and analyze data on the XY plotter. The selection of materials for the plotter mechanism takes into consideration factors such as cost and a wide range of applications, including the use of servo motors. The Arduino system is chosen due to its popularity and widespread use in the field. It offers benefits such as affordability, peak torque capacity, speed range, and compatibility with the core system. The XY plotter incorporates a special mechanism for raising and lowering the pen, controlled by two axes. Power and control for each axis are provided through the use of an L293D compact driver specifically designed for Arduino. This ensures efficient operation when saving or plotting two-dimensional data using a rectangular coordinate system. In order to interpret the 2-dimensional input image, it is converted into G-code. This allows computerized machine tools to understand and execute the commands. The G-code files are then sent from the user interface to the CNC plotter through the GTCRL processing program. G-code is a numerical control programming language that provides instructions on how to move, where to move, and the desired path.

The paper referenced as [6] research paper the CNC plotter machine works like a fancy drawing machine. Instead of you drawing by hand, it uses a computer to control a tool (like a pen or laser) to draw or write on things like paper or wood. It's really good at making accurate drawings because it uses special motors to control its movements very precisely. Plus, it doesn't use a lot of electricity, so it's efficient. Compared to other similar machines, this one isn't too expensive. So, even if you're on a tight budget, you might be able to afford it for different jobs.

In their research [7], the authors focused on designing and fabricating a 6-axis robotic arm with a gripper for the purpose of inventory control in supermarkets and retail stores. The gripper was equipped with real-time force sensors to ensure precise clamping force for different types of products, thereby preventing any potential damage caused by excessive pressure. The mechanical design of the system ensured uniform force distribution across the sensors, minimizing measurement inaccuracies. Additionally, the researchers implemented inverse kinematics coordinate conversion, which resulted in an error rate of less than 3.3% due to insufficient torque servomotor actuation. The robot's operation was facilitated by a user-friendly graphic user interface (GUI), and product recognition was achieved through barcode scanning. The authors believe that this innovative robotic solution has the potential to significantly enhance commodity management and streamline inventory processes in supermarkets and retail stores.
The paper cited as [8] the development of a geometric approach for solving the unknown joint angles of a robotic arm. This approach is aimed at achieving autonomous positioning of the arm. It relies on several key factors, including the known lengths of each arm joint, as well as the desired terminal position of the arm within its workable area in three-dimensional space. The analysis is based on a geometric representation of the arm and employs a strictly trigonometric approach. By utilizing trigonometry, the method allows for accurate calculations and precise positioning of the arm. The researchers have made certain assumptions about the functionality of the arm to develop this approach. These assumptions serve as the foundation for the analysis and ensure its effectiveness. To test the feasibility of the approach, the researchers retrofitted an iRobot Create mobile robot platform with a

robotic arm from lynx motion. This arm has five degrees of freedom, along with an end effector, which makes it suitable for comprehensive testing of the geometric method.

The paper designated as [9] the author describes the transformative impact of robotic arms in various industries. They discuss how robotic arms have made tasks easier and reduced errors, particularly in sectors like medicine and automation systems. The author also focuses on the development of a 4-axis moving robot arm controlled by a microcontroller and Bluetooth module using an Android application. They highlight the successful application of theoretical knowledge to practical implementation and the establishment of the necessary infrastructure for the project. Overall, the paper emphasizes the significance of robotic arms in revolutionizing industries and lays the foundation for future advancements in the field.

The paper [10], provide development of a plotter system using Arduino Nano and Proteus professional 8.6 for simulation. The researchers used the TX and RX pins of the Arduino Nano to establish serial communication between the computer and the Arduino board. To facilitate this communication, they utilized COMPIM in Proteus, which acts as a virtual serial port on the computer. This allowed them to receive data from external software such as Engraver master or UGS. The output pins of the Arduino Nano were connected to three sets of L297, which controlled the direction of the stepper motors in steps and the magnitude of the load current. By providing 5VDC to the ENABLE pin, the researchers activated the L297.To further control the stepper motors and provide over temperature protection, they connected the output of the L297 to the L298. The L298 not only controlled the drive power of the stepper motors but also ensured the safety of the motors. To establish the connection between the Engraver master or UGS software and Proteus, the researchers used VSPE as a connecting bridge. VSPE facilitated the communication between the external software and Proteus.

III. DISCUSSION

To turn the plotter into a writing robot, we would need to make a few adjustments. Instead of using a pen for drawing, we can replace it with a writing instrument, such as a marker or a pen that can be attached to the pen base controlled by the Z-axis servo motor. This way, the robot can write on paper or any other surface.

We would also need to modify the software to enable the robot to write text instead of drawing images. The software would need to convert the text into G-code, just like how it converts images, and send the instructions to the microcontroller. This would allow the robot to move the pen according to the G-code and write the desired text.

With these modifications, the plotter can be transformed into a writing robot that can create handwritten notes, drawings, or even calligraphy. It's a fascinating project that combines technology, creativity, and automation.

Modifying the plotter to create a writing robot opens up so many possibilities for creativity. By replacing the pen with a writing instrument and adjusting the software, we can make the robot write text instead of drawing images. It's like having a robot that can write handwritten notes, create beautiful drawings.

Collaboration between technologists, writers, businesses, and ethicists will be crucial in shaping the future of writing robots and their impact on society

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IV. FUTURE SCOPE

This proposed methodology has several areas for further research and development that can be identified such as :
for voice detection: Voice detection allows the robot to transcribe spoken text and write it with precision.

For fingerprint detection: The writing robot can utilize fingerprint detection to create personalized drawings or messages based on individual fingerprints.

For wireless connectivity: Adding wireless connectivity options such as Bluetooth or Wi-Fi would enable you to control the plotter remotely using a smartphone or computer, making it even more convenient to operate.

V. CONCLUSION

The writing robot project represents a significant advancement in content creation technology. By harnessing the power of automation and artificial intelligence, this project aims to streamline writing processes and enhance productivity. Through the implementation of sophisticated algorithms and natural language processing techniques, it can generate high-quality content quickly and efficiently. However, while the potential benefits of this project are substantial, there are also important considerations to address. These include ethical concerns surrounding the use of automated writing tools, the need to maintain authenticity and originality in content creation, and the potential impact on employment in the writing industry. the writing robot project holds immense promise for transforming the way we create and consume content. With careful consideration, responsible development, and collaborative effort, the writing robot project can usher in a new era of creativity, efficiency, and innovation in the field of writing.

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