Automated Writing Machine using Arduino and Robotics

Sri Anuradha Kuchibhotla[1], Kalyani Penke[2], Meka Siva Tejaswi[3], Poluparthi Yeshwanth Sai kowsik[4] Venkata Ramana Kammampati[5]
[1,2,3,4] *Department of ECE, Aditya college of Engineering & Technology, Surampalem, AP, India.*
[5] *Department of ECE, Aditya college of Engineering & Technology, Assistant Professor*

***Abstract*— We describe in this paper the design and implementation of an Arduino microcontroller-based Automated Writing Machine (AWM). The AWM is a multipurpose tool that can write or draw by hand on a variety of surfaces, including paper, whiteboards, and computer screens. The system's programmable control and mechanical components work together to provide precise and adaptable output. The Arduino microcontroller, writing mechanism, and user interface make up the three primary parts of the AWM. Pens and markers, along with motors and actuators, make up the writing mechanism, which enables precise pen strokes and controlled movement. The brains of the system are generated by the Arduino microcontroller, which follows user-defined instructions to produce the desired text or drawings. The user interface makes it easier for users to interact with the AWM by letting them enter text, choose fonts, change writing parameters, and start writing. AWM functionality is accomplished by combining software and hardware components. Pens or markers for writing, sensors for feedback and calibration, and motors and actuators for motion control are all included in the hardware. Arduino sketches that have been programmed to interpret user inputs, produce motion trajectories, and drive the writing mechanism in accordance with those trajectories make up the software. To further improve the AWM's capabilities, software libraries for text processing and font rendering may be integrated. To sum up, the Automated Writing Machine that is the subject of this paper shows that it is possible to use Arduino technology to create a flexible and programmable system that can generate handwritten text and drawings. Its wide range of applications, adaptable features, and modular design make it a useful tool for both professionals and enthusiasts.**

Keywords*—Automated Writing Machine, Arduino uno board, microcontrollers, mechanical components, motion controlling, sensors, software components, font reading, text processing

I. INTRODUCTION

Recent developments in microcontroller technology have opened the door for the creation of creative automation systems in a number of industries. The Automatic Writing Machine (AWM), a flexible tool that can efficiently and precisely produce handwritten text or drawings, is one example of such an application. The Arduino Writing Machine (AWM) is a programmable solution that uses Arduino microcontrollers to automate writing tasks in a variety of industries, including advertising and education. Handwriting using traditional methods is labor-intensive and prone to inconsistent alignment, spacing, and thickness of strokes. Due to these constraints, automated alternatives have been investigated, which has resulted in the development of the AWM. The AWM is a device that combines mechanical parts and programmable control to produce visually appealing output on a variety of surfaces, including paper, whiteboards, and digital screens, while also providing precise motion control.
The foundation of the AWM's operation is the incorporation of Arduino microcontroller technology. The open-source Arduino platform offers a versatile and user-friendly framework for creating unique control systems that are suited to particular needs. By interpreting user inputs, creating motion trajectories, and controlling actuators in response, Arduino enables the AWM to perform intricate writing tasks with ease. The core functionality of the AWM is based on the integration of Arduino microcontroller technology. An adaptable and user-friendly framework for creating unique control systems that are suited to particular needs is offered by the open-source Arduino platform. Arduino enables the AWM to perform intricate writing tasks with ease by interpreting user inputs, generating motion trajectories, and driving actuators accordingly.

The writing mechanism, Arduino microcontroller, and user interface are the three main parts of the AWM. Writing instruments, actuators, and motors make up the writing mechanism, which allows for precise pen strokes and controlled movement. The AWM is controlled by the Arduino microcontroller, which also performs user-defined instructions to generate the desired text or drawings. The user interface makes it easier for users to interact with the AWM by enabling them to easily input text, choose fonts, modify writing parameters, and start writing. In this paper, we examine the hardware and software components of the AWM, delving deeply into its design and implementation. We go over the Arduino sketches that program the AWM's behavior, the mechanical components in charge of motion control and writing accuracy, and the usability-enhancing features of the user interface.

II. LITERATURE REVIEW

Automated Writing Machines (AWMs) have become a novel way to automate handwriting tasks; they are powered by Arduino microcontroller technology. This review of the literature explores important facets of AWM technology, such as the role of Arduino in automation projects, mechanical design considerations, and the wide range of applications of AWMs in different fields. In order to achieve controlled movement and consistent writing quality, AWMs rely on precise mechanical components. Various mechanisms have been investigated in research to convert digital instructions into physical pen strokes, such as gantry systems, SCARA arms, and Cartesian robots. For writing implements to move precisely and consistently, actuators like linear actuators, servo motors, and stepper motors are essential. The core of an AWM is an Arduino microcontroller, which provides the processing power and control logic required to carry out writing tasks. Research has concentrated on creating Arduino-based control systems that can produce motion trajectories, comprehend user inputs, and synchronize the functioning of mechanical parts for accurate writing. To improve AWM accessibility and usability, user interface design is crucial.

Numerous methods of user interaction, such as physical buttons, touchscreen displays, and web-based interfaces, have been studied in research. Because user-friendly interfaces make it easier for users to input text, choose fonts, modify writing parameters, and preview output, they also increase the applicability of AWMs across a wider range of user demographics. There are still difficulties in maximizing AWMs' speed, accuracy, and adaptability despite tremendous advancements.

Prospective avenues for research could include enhancing writing quality via sophisticated motion control algorithms, incorporating machine learning for handwriting synthesis and recognition, and investigating innovative writing surfaces and materials.

III. SYSTEM DESIGN

A. Proposed Block Diagram

The proposed block diagram for automated writing machine using Arduino. Here all what are required is the stepper motors, rotors, pulleys, Arduino board, IDE and the regulators.

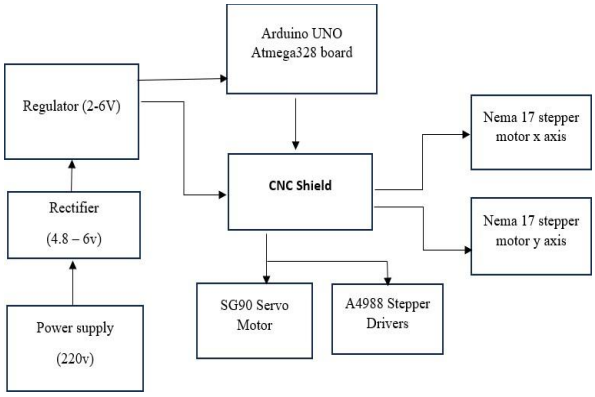


Fig. 1. Proposed system block diagram

B. Circuit Implementation

The circuit implementation of proposed system has been created and depicted in Fig.2.

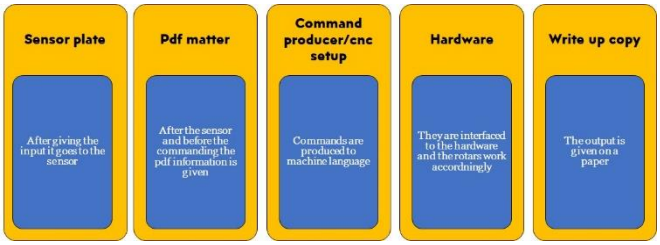


Fig. 2. Circuit implementation

C. Developed Hardware Prototype

The developed prototype (see Fig.3), has been verified for variety of movements for the arm as provided in the dataset.

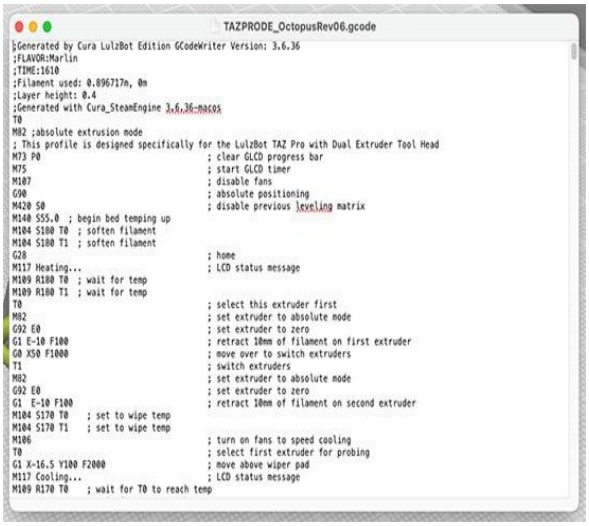
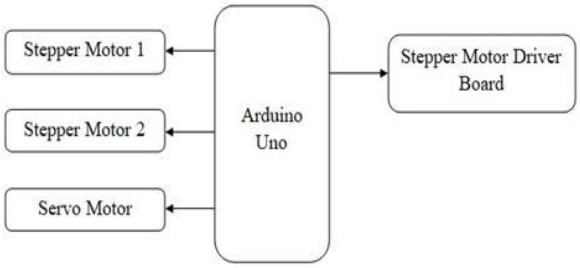


Fig. 3. Developed hardware prototype

D. Hardware implementation

The writing mechanism itself, which consists of the structure used to hold and control the writing instrument (pen or marker), is another essential piece of hardware. To produce readable text or drawings, the writing mechanism's design must guarantee stability, fluidity of motion, and even pressure on the writing surface. It might be necessary to include mechanisms that allow for the modification of pen height, pressure, and alignment during writing. Furthermore, to improve the AWM's longevity and usability, pen refill or replacement mechanisms might be taken into account.



E. Flow Diagram

A flow chart (see Fig.4) has been created for understanding the detailed operation of proposed system. Our project, "Automated Writing Machine based on Arduino and Robotics," aims to revolutionize the traditional writing process by leveraging the power of automation and robotics. By combining Arduino technology with innovative robotic mechanisms, we intend to create a system capable of producing written content efficiently and precisely. Through this project, we seek to streamline the writing process, enhance productivity, and explore the possibilities of integrating emerging technologies into everyday tasks. Our endeavor embodies the fusion of engineering, creativity, and practical application, promising to redefine the boundaries of conventional writing methods.

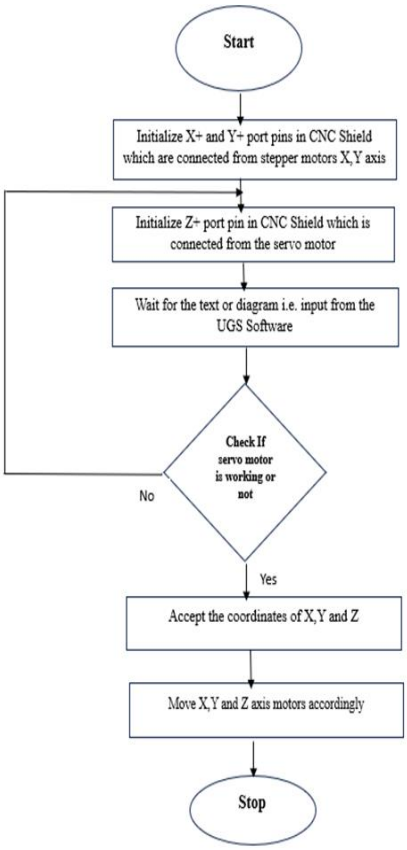


Fig. 4. Flow chart

IV. EXPERIMENTAL RESULTS

According to the findings, the text provided as input would generate a gcode from within and then provide an exact impression of the text provided as input. This could take a few minutes to generate because our internal ide software needs to convert it. The fundamental software needed for this automation is gcode and Inkscape. Since we're using the same Arduino Uno board for these purposes, the primary interface software is Arduino Ide. There is an accuracy of 90% and inaccuracy of 10% .This inaccuracy is because when some new scaling parameters are added to the ink panel then it takes time for upgradation and might loses its accuracy.

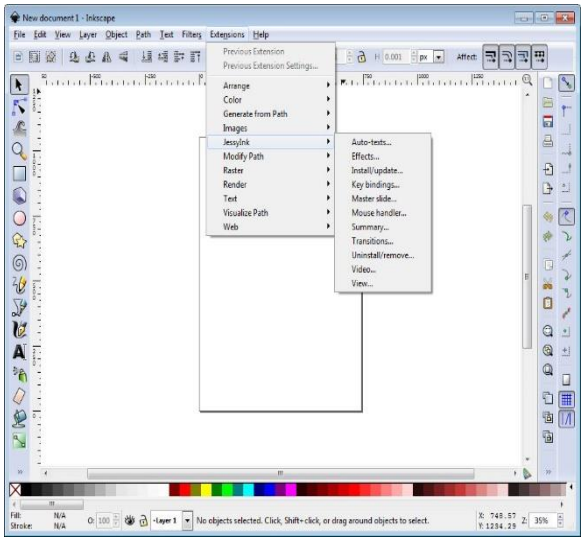


Fig. 5. The software implementation for text(Inkscape)

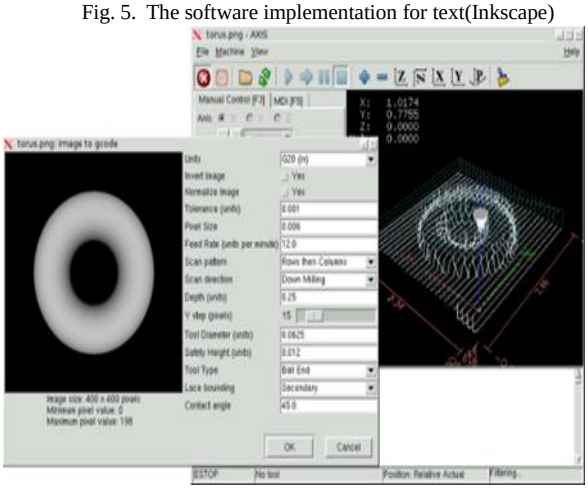


Fig. 6. Conversion of the internal gcode from text

It is observed form the Fig.7 and Fig. 8, the proposed system identifies multiple texts and input modes at a time but the accuracy of the device is normal.

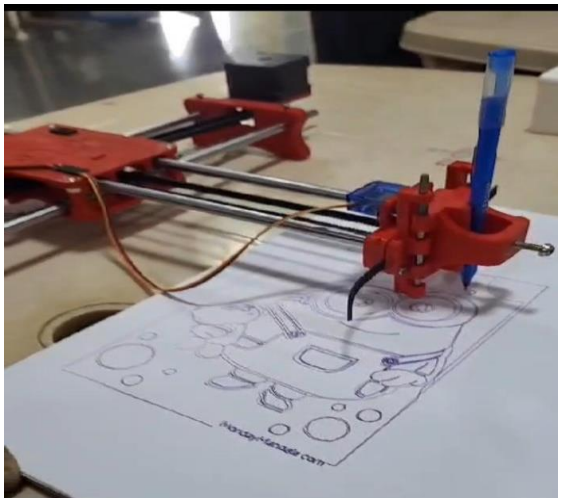


Fig. 7. Final output from the device

Fig. 8. Partial output occurred while testing the machine

V. CONCLUSION

An introduction to the exciting world of robotics and creative automation is provided by an Arduino-powered automated writing machine. In conclusion, this project demonstrates how creativity and technology can be combined to create individualized handwritten messages quickly and accurately. Utilizing the adaptability and programming powers of Arduino, this device showcases the potential for innovation across a range of industries, from design and art to marketing and communication. Projects such as these provide motivation as we push the limits of automation and robotics, showing us how technology can improve human capabilities and our daily lives.

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