Design and Development of Automated Writing Machine

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Abstract: **The changes in the recent industry trends have given rise to a technological evolution, which is leading to the development of Industry 4.0 with highly automated industries through human-machine interaction. As the process gets more complex and cumbersome, automation becomes more vital for the growth and efficiency of a system. Automated machines are more accurate, versatile and timely and reduce the probability of error significantly. In recent years, numerous systems were proposed to operate as a writing machine that can give output in predefined fonts. The system proposed in this paper deals with recognizing the text in the document and then giving the output in the user's font. Using this method Additionally, the weight of the entire system is made relatively lower than the other commercially available writing machine.**

Keywords: **Optical character recognition, text extraction, writing machine.**

1. Introduction

As the world is entering the dawn of a new era, manufacturing is undergoing an evolution, which has been termed Industry 4.0 or Smart Manufacturing. The speed with which industries are moving towards digital technologies like industrial robotics, 3D printing, machine learning, optical character recognition, cloud computing, augmented reality and sensors can make the industry 4.0 revolution more realistic.

The human race is turning to robots to do the work and reduce human effort. In this society which is undergoing rapid change, time and manpower are the major critical constraints in the completion of any tasks on large scales and with efficiency. Therefore, automation is playing a significant role in saving a lot of human efforts in most of the regularly carried out works like welding, painting, assembly, container filling, writing, etc. As far as writing is concerned, the time and effort taken in typing the keys on a keyboard which is time-consuming and requires a lot of skills and human effort can be avoided with the help of automation.

Some technologies such as automated voice-to-text converters are used to write only the inbuilt fonts like Roman, Calibri, Arial, Impact, Georgia, etc. The paper aims to design and develop a system that is capable of writing on a page with the help of a pen in the user's specific handwriting or any of the predefined fonts if needed.

This initiates the concept of CNC machines which are computer numerical control machines as a unique and versatile form of soft automation. Initially, it had been advanced to regulate the motion and also the operation of device tools. By using concepts like CNC machines, an automated machine can be implemented for writing purposes also the overall hardware setup of the proposed system.
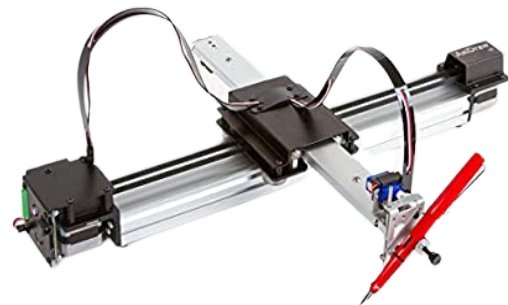

Fig. 1. Writing machine

As humans can interpret the contents of an image by looking at it and can read the text on the image, computers on the other hand need a more organized way of understanding. Computers use to read images. Optical Character Recognition involves the detection and recognition of text present in digital images and converting this text in the images to an encoded form that is understood by computers with ease. Some applications that have been used are recognition of car number plates from a camera, or scanning of a hand-written document to convert it into a digital copy.

2. Existing System

The present technologies like printers and scanners are that they only write in predefined fonts present in the computer. It is handled through a blackboard presentation or PowerPoint presentation Blackboard presentation is the process held from the ancient days which is defined as boring by children. To improve PowerPoint presentation is used which is more interesting and easier to understand than blackboard teaching.

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A. Drawbacks

The major drawback of this paper is the same process of teaching leads to a boring environment for neither teacher nor the student. This system leads to reduce the interest in a student's observing capacity.
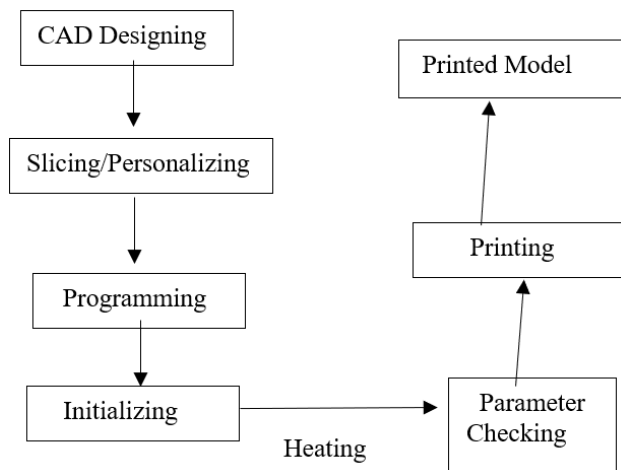

Fig. 2. Procedure

3. Literature Survey

A. Polygraph

The first signature duplicating machines were developed by John Isaac Haw kins in the year 1803, Known as polygraphs, and are a little similar to today's autopen in design and operation. The Polygraph was used to generate a copy of a document using pen and ink.

B. Typewriter

The first typewriter for commercial use was introduced in 1874. It was a machine used for writing characters with the help of an array of keys.

C. Telautograph

It is attributed to Elisha Gray in the year 1888. It transmits Electrical impulses generated by the potentiometer at the sending end to the receiving end. At the receiver a pen attacher with a servomechanism.

D. Autopen

An autopen also known as a signing machine or robot pen is a device used for signing automatically. Developed in 1980, It was used as a storage unit device to record signert signatures.

E. Long pen

The long pen is another variation of autopen which is a remote signing device inverted by writer Margaret at the wood in 2004, It allows the user to write in int from some remote location via PC, Internet, and a Robotic hand.

F. Axi draw

The axi draw project was introduced in 2014 by Dr. Linsay Robert Wilson. This works as an adaptable pen plotter that works with a variety of writing instruments like Permanent makers, Fountain Pen, etc.

4. Tools Required

A. Hardware

Stepper Motor: Stepper can be changed over the computerized beat into the development of pen as for pivot X, Y, Z heading. A stepper engine is a brushless engine that partitions a full turn into various equivalent advances, the stepper engine is known by its property to change over various driving forces into a characterized increase in the shaft position. Each heartbeat moves them through a proper point. We have utilized 3 stepper engines with a lead screw. The engine result will be as the pivot of the lead screw.

Fig. 3. Stepper motor

1) Servo motor

A servo engine is a unique story the servo can get a control signal that addresses an ideal result position of the servo shift and apply capacity to its Dc engine until its shaft goes to that position.

Fig. 4. Servo motor

2) Arduino

Arduino will be characterized as it is gotten the order or information from the PC with the assistance of a USB link. It is mounted on n CNC safeguard; it will move information from Arduino to the CNC safeguard by utilizing a stepper driver. Arduino UNO is a microcontroller board, it contains everything expected to help the microcontroller, basically interface it to a PC with a USB link and a power source. It controls the place of the stepper engine with h assistance of a program. It is an open-source stage given simple to-utilize equipment and programming. T has advanced and simple information/yield pins which might connect into different extensions at any point board and different circuits and microcontrollers with corresponding parts that aides in programming and joining into different circuits. The current provided 5 volts with a USB link.

B. Software

1) Inkscape 0.48.5

Inkscape is used to design the plotted diagram or text. In this

project by using this software G-code file of a selected image or text is created G-code is a commonly used numerical control programming language that includes X, Y, and Z coordinates. Creating G-Code File Using Inkscape:-The CNC plotter of our project will work within 20cm×20cm area So we choose the document properties of the Inkscape 40cmx40cm (Width × Height) which is four times the working area of the plotter because the plotter can draw only in the first quadrant. So we have initially kept the axes at the nearest end of the motors which is considered as an origin to easily modify the design. In Fig. 3 the working area the of CNC plotter is shown with the text written in the pre-defined area. The text is selected using the cursor and then select "object to path" from the drop-down window to save the G code form of the selected text. To create the G-code of an image, the file must have a transparent background. The image should be dragged into the selected area then select "trace bitmap" from the from drop-down window to create a transparent image. Scans are selected as 8 and "Edge detection" is selected to create black & white images. After adding this transparent image in the predefined area we've used the "object to path" command to create the G-code file of the selected image by following the steps described earlier.

2) G – Coder

This is presented by "G". G codes are predefining Functions associated with the Movement of the Machine Axis. It has Two Digits, Ex- G00, G81, and G90. It is possible to include more than one G address in one block. Provided these Functions are not mutually Exclusive. Ex- G02 and G03 are together in one block is not Permissible. The g function defines the path to be followed in a complete design. ExG00- positioning.

G01- Linear interpolation
G02- Clockwise Circular interpolation

C. Working

Firstly, the Installation of Arduino software in the system.

The programming code will be uploaded to the Arduino Uno board once the devices are fixed.

The sensors used recognize the user and fetch user input with stored documents and return the result and start writing on paper.

The sensor is more efficient than speech independent system. Speaker-independent speech recognition has been proven to be very difficult because pattern matching would fail to handle, including accents and the varying speed of delivery, pitch, volume, and inflection.

One more use of this invention is if the user wants a fresh document that doesn't exist on the hard disk or plates then the automatic pen allows this by sensing and then writing

It stores the new document on the hard disk for later use.

Advantages:

- CNC machines can be used continuously 24×7 throughout the year and only need to be switched off for occasional maintenance.
- CNC machines are programmed with a design that can then be manufactured hundreds or even thousands of times. Each manufactured product will be the same.

- Less skilled/trained people can operate CNC machines unlike manual lathes/milling machines etc. which need skilled engineers.
- CNC machines can be updated by improving the software used to drive the machines
- Training for the correct use of CNC machines is available through the use of 'virtual software'. This software is like a computer game that allows the operator to practice using the CNC machine on the screen of a computer.
- 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 CNC machines as once they are programmed they can usually be left to work by themselves. Only the cutting tools need replacement occasionally.

Disadvantages:

The machine runs at a slow pace and generates excess heat which causes the heat sink to be heated quickly. A slight error may remain on the image file after it has been plotted due to one side of the Y-axis being fixed to the moving mechanism and the other end being free to move. The Z-axis is not very rigid so it causes slight vibration.

Applications:

- Compact CNC/3D Printer by Brijesh Sondarva
- Mini CNC Foam Cutter by Jonahmarrs
- Mini Arduino CNC by me_ zain
- CD/DVD Bipolar Motor Driver W/o Microcontroller by Samiran
- CNC Stomp Pad Project
- CNC Programming
- G-Code Programming
- CNC Plasma Cutting by ivan irons
- L293D driver board for CNC by Brijesh Sondarva

Table 1
Comparison of the proposed system with others

Parameters	Existing Method	Proposed Method
Cost (Rupees)	8090	6003
Converter	OCR	CNC
Font Converter	Possible	Possible
Weight (KGS)	1	0.88
Speed (WPM)	5-10	5-15
Origin	INDIA	INDIA

5. Result

This paper proposes another sort of computerized composition machine which integrates optical person acknowledgment. The source code will remove the text from the info picture and afterward this extricated text is changed over into any of the predefined text styles put away in the PC or to the client's penmanship. The info picture which is a bit of a checked record in a predefined text style - "Arial" the removed text switched over completely to the client's text style.
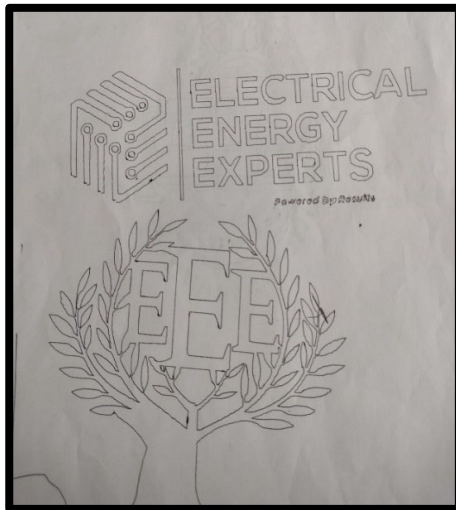
Fig. 5.   Input image

Fig. 6.   Output image

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> Amazon, the multinational e-commerce grant, has done the impassible and reached a staggering 18 trillion dollars market cap in the past few years, and is expected to reach over 18 Trillion in revenues by the year 2025.

Fig. 7.   Input in predefined text

Fig. 8.   Output text

The textual style transformation is finished with the assistance of a web application. Here the client's sequential information is transferred and it is working to utilize this textual style.

The fundamental benefit of this framework lies in the expense of creation. Taking into account two monetarily accessible comparable frameworks with the end goal of examination.

One more significant highlight to remember is the precision of the optical person. CNC of text in predefined textual styles is moderately more precise than that in human penmanship, roughly above 95% more often than not relying upon which textual style is utilized. The exactness of CNC if there should arise an occurrence of human penmanship acknowledgment is reliant upon how ratty or flawless the individual's penmanship is. The composing velocity of the machine is practically equivalent to that of a typical human which is 13wpm (words each moment).

One of the limits of this venture is that the result would be able just to be written in block letters because of the laser etching programming utilized. This issue might potentially be tackled by utilizing different programming.

6. Conclusion

In these developing times, humans are turning towards robots to do their work to save time and manpower and to have an efficient output. The basic problem with the already existing technologies like automated speech writing machines, speech-to-text converters, printers, and scanners, is that they only write in predefined fonts present in the computer. The proposed system works as an automated writing machine that is capable of writing in any predefined font or the user's handwriting style. After integrating the software with hardware, the resultant mechanical system makes up a user-friendly and cost-effective automated writing machine with minimum human interruption, reducing the requirement of manual effort and time. To summarize, the automated writing machine will be able to contribute to our daily life challenges and hence improve our quality of life.

7. Future Scope

The proposed system can be used as a baseline setup for many future modifications. One such modification can be to increase the speed of writing compared to the speed achieved currently. Additionally, the inclusion of voice-to-text modules in the already proposed system will be beneficial for differently abled people. Another modification can be to make a real-time system, where the user can send the text to be written remotely and the machine should be capable of writing it down. This can be achieved by incorporating the use of the internet and cloud services into the process. This particular application can be useful to notify a family member whose phone battery might have run out and hence the phone would have switched off. Currently, the optical character recognition of the proposed system is not as accurate for shabby handwriting as it is for predefined handwriting style. Hence, by achieving better text

recognition, the system can be extended to read doctors' prescriptions which in turn can be converted to the user's language using a language translation model.

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