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Low-Cost Speech to Text Translation Handwriting Robot using Arduino and Google API

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***Abstract*—Among all forms of communication, writing is the most popular and universally recognised. Writing proficiency is thus crucial for reaching professional and corporate objectives. Unfortunately, it could be difficult in unique situations involving persons with varied abilities. The solution is to carry out the writing job utilising a robotic arm (SCARA). Writing an alphabet in both English and a regional language will be made possible by automation. The hardware and software requirements for building a robot that can do a task that is typically completed by a portable pen are covered in this paper.**

***Index Terms*— Handwriting Robot, Arduino, Speech recognition, Google API, CNC plotter.**

I. INTRODUCTION

The Oxford dictionary gives the definitions of writing and text composition as marking cohesive words on paper. Writing has a big role in documentation. According to survey data, we complete around 30% of our job via written communication! As a result, writing abilities are crucial for reaching professional and corporate objectives. Writing is crucial in a variety of fields, including business, journalism, research, and education.

Novelist Anais Nin, a French-Cuban, once said, "We write to taste life twice, in the moment and in retrospect." One of the abilities that one learns throughout the formative years is writing. Unfortunately, learning this talent is not stressed sufficiently. This places a person in a challenging circumstance. Even if someone can speak a language fluently, being unable to write it makes them feel less confident. It has an impact on their businesses and careers.

A handwriting robot is the answer to this problem. The handwriting robot is a robot that provides the quickest method for producing extremely huge writings. The hand writing robot, which is essentially a Selective Compliance Articulated Robot Arm (SCARA), has been constructed in the present study. Using an Arduino open-source physical computing platform and an ATMEGA 8 microprocessor, the robot writes the input on a drawing board. A unique mechanism is used to lift and descend the pen on the handwriting robot, which is controlled on two axes. Each axis is driven by a separate servo motor.

A servo is used for pen control. An autonomous robotic arm with three degrees of freedom (DOF) and two flexible joints along the X-Y axis but fixed joints along the Z axis is known as a SCARA. With this configuration, the arm can do jobs more quickly and accurately.

Writing problems are common among people with learning disabilities, Parkinson's disease, and dyslexia. For children with dyslexia, following a writing model that relies on strong transcribing abilities, working memory,

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and executive function may be challenging and lead to bad spelling and poor writing quality overall. By using this handwriting machine, this may be simply avoided. It is common for villages, daily wage employees, and immigrants who are skilled orators but poor writers to be illiterate. The handwriting robot is thus a blessing for these folks. The fact that this robot operates in real-time and produces effective writing at a conversational tempo makes it a simple task to replace stenographers. This makes it feasible to document in one's own handwriting. Additionally, it may assist students in taking notes while on the road. This might simplify and streamline the newspaper reporting industry.

This works major goal is to provide assistance to many individuals in carrying out their routine manuscripting activities. It has a chance of attaining the following goals:

- To create an affordable, effective, and user-friendly writing bot.
- To save costs by doing away with stenographers and scribes.
- Objective To make writing easier for humans and take less time.
- To make tests easier for those who are blind or have other disabilities.
- To provide documentation that is error-free in the fields of media, research, and education

II. Recent Works

A. Computer Numeric Control (CNC) plotter

The Mini CNC Plotter is an embedded device that utilises the Computer Numeric Control (CNC) principle. This approach lessens the need for human labour and lowers the likelihood of mistakes [1]. The system becomes more effective via appropriate circuit alignment, software use, and component installation and mounting. The inspiration came from utilising a CNC plotter for tasks like glass cutting [5], PCB drilling [3], and wood engraving. The same method has been refined throughout time by using pens instead of pinheads in engraving machines. The most basic design used previously entered data. Most of the prototypes even had an issue with overheating that had to be resolved using a heat sink, which increased the project's volume and expense.

B. Computer Numeric Control (CNC) plotter

Interaction between a person and a machine is crucial for the error-free and effective operation of a CNC machine using voice input. Voice Controlled Robots (VCRs) have been utilised in earlier studies to record and transport voice [13]. A database of voice inputs was sometimes developed for this purpose [14]. Large databases are required for better outcomes, which is a difficult process.

C. Speech-to-text translation

Different speech-to-text conversion methods are already in use [18]. For this, modern software like Matlab is often employed. The project loses portability, which is a disadvantage of this strategy. Recent designs have completely automated real-time handwriting tasks by integrating hardware, Text-To-Speech (TTS) synthesis, and automatic speech recognition (ASR) [19].

III. Methodology

The block diagram in Figure 1 represents the structural aspect of a handwriting robot block diagram, which is separated into two parts: hardware and software. The handwriting robot's software is in charge of detecting and recognising the speaker's speech collected by a microphone using the Python API. The translator API in Python handles the translation. The translated output is saved to a file before being delivered to a GBRL controller.

The robot's circuitry interprets the GBRL controller's output as the information to be written. The Aurdi controls the servo motor, which in turn controls the arm of the robot to move along several axes. Thus, using this integrated approach of operating both software and hardware, the writing process with voice as input is accomplished.

The user's voice signal will be entered into the system in the project's first phase using a microphone. Analogue voice signals will be converted to a suitable digital form for further processing by a PC sound cable included into the microphone. By utilising a Python programme that leverages Google API to isolate words, this voice signal is transformed into text. It is possible to create images from the text that has thus been collected. The PC microphone picks up the user's speech signal, which Google Speech to Voice API transforms to text. This text may then be translated into various language scripts using the Language Translator Library. The resulting script is then translated to an image file and fed into the Benbox programme. By using stepper motors to write the necessary script on paper, this programme delivers the angular momentum necessary to control them.

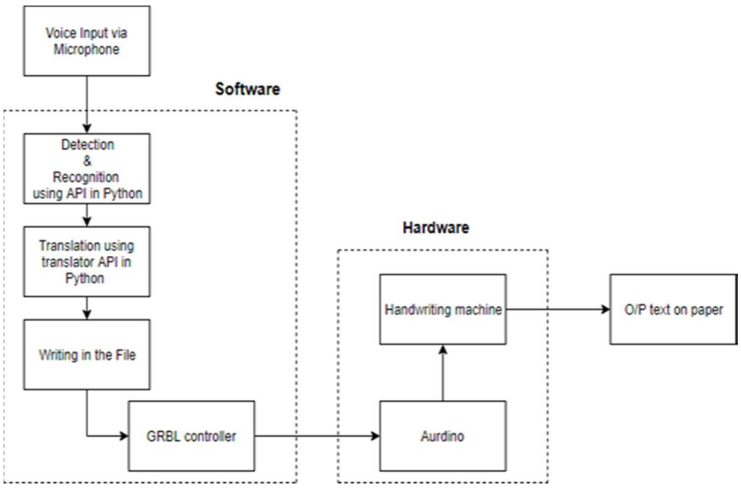


Figure 1. Block diagram of the proposed system

III. Results and Discussions

The outcome of speech to text conversion and translation into the given language—in this example, English, Hindi, and Kannada—is shown in Figure 2. The code begins by asking us to "Say something," at which point voice is recognised, processed, and translated into text in the chosen language.

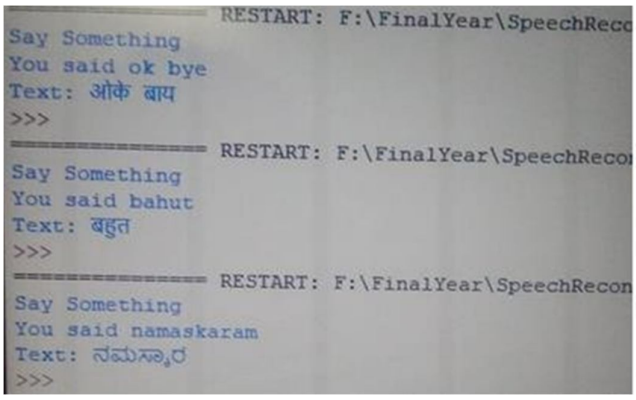


Figure 2. Output of the speech to text conversion for three different languages

The suggested work's hardware integrated model is shown in the picture in Figure 3. Writing is done by this robot, which uses an Arduino microcontroller as well as a stepper motor for data gathering and control.Figures 4a and 4b below illustrate the texts written by the developed handwriting robot in English and Kannada.

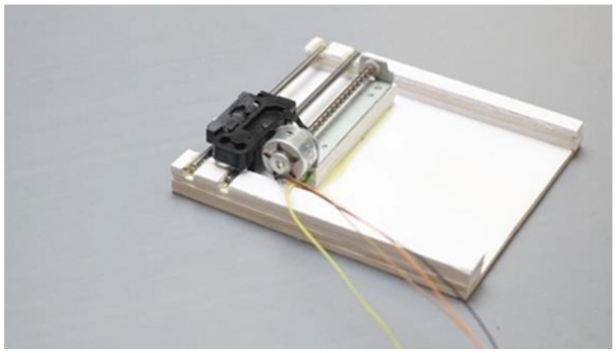
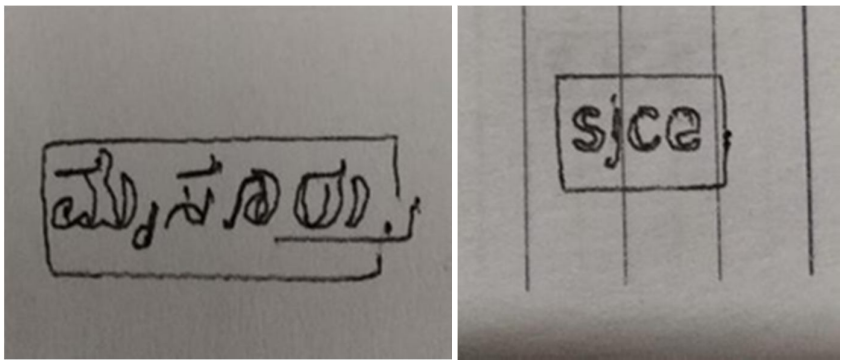


Figure 3. Hardware model of the proposed work



a) b)

Figure 9. a) Kannada text (left) and b) English text (right) as obtained from the proposed system

The project is capable of functioning as long as Google API, which in turn requires a persistent internet connection, is used. In poor network locations, continuous internet access is not always assured. The degrees of freedom in the X, Y, and Z axes determine how flexible the robotic arm can be. It is not feasible to move between the project's supported languages instantly. The processing of the dictation may take a moment, which will show as the arm writes the information.

IV. CONCLUSIONS

This handwriting robot is a useful tool and a benefit to many of individuals from different societal groups. The project integrates numerous technological ideas, including robots, CNC machines, and translators, to provide the required result in textual form. As long as the information from the translator is accurate, the project may write a word or a short phrase.

The goal of the project to create a handwriting robot is to enhance the functionality of current CNC machines by making them smarter, more compact, and efficient. The project's primary goal is to enable functionally illiterate people and people with disabilities to use it widely and affordably. The arm may be made even more user-friendly by adding a graphical user interface, and a web interface can be created so that the robot can be accessed remotely. Users of this handwriting robot will be able to converse in a variety of languages thanks to its translation idea.

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