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Design and Development of Writing Robot Using Speech Processing

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Abstract

Modern society heavily relies on robotics as a technology. The use of robots in manufacturing and warehouse automation is well-established. For example, they can move goods to and from storage racks for Internet mail orders as well as assemble cars or washing machines. More recently, robots have entered homes and hospitals for the first time and achieved amazing success in planetary exploration. Robots, however, have fallen short of the expectations set forth in the 1950s and 1960s, when it was widely believed - by scientists, engineers, and the general public - that by the turn of the 21st century we would have intelligent robots serving as butlers, companions, or co-workers. Robotics, a subfield of mechanical engineering, electrical engineering, and computer science, is the study of robot design, construction, operation, and application, as well as the use of computer systems for their control, sensory feedback, and information processing. These technologies are concerned with automated devices that can take the place of humans in dangerous environments or during production processes or that resemble humans in terms of appearance, behavior, and/or cognition. The use of natural inspiration in many of today's robots has benefited the field of bio-inspired robotics. Although the concept of creating autonomous machines dates back to the classical era, it wasn't until the 20th century that real progress was made in understanding their functionality and potential uses. Creativity can only be fostered with effective teamwork and communication. The majority of patients and some pharmacists have trouble deciphering a doctor's handwritten prescription, which can occasionally lead to negative outcomes because the prescription is incorrectly interpreted. Understanding doctor's prescriptions can be challenging due to the frequent use of Latin abbreviations and medical terminology that most people are unfamiliar with. Prior to performing this task, standards for online human signing are first developed. After that, robot writing tasks are completed in accordance with these standards to produce robot signatures. Finally, recommendations are made to enhance robot motion.

Keywords: *Writing Robot, Bluetooth, Artificial Intelligence, Robotics.*

1. Introduction

Every field has a significant role for robotics. Robotics combines a wide range of engineering specialties and abilities. The body can be made of metal. The wheels' mounting on the axles, their connection to the motors, and the maintenance of the body's balance all require mechanics. To run the motors and link the sensors to the controllers, we need electronics. Finally, we require the software to control the robot and comprehend the sensors. Throughout history, robotics has frequently been seen to imitate human behavior and complete tasks in

a similar manner. The field of robotics is currently growing quickly as technology advances. Whether for domestic, commercial, or military use, developing new robots serves a variety of useful purposes.

For humans, many robots carry out risky tasks like disarming mines and bombs and exploring shipwrecks. The zenith of technological advancement at the moment might be characterized as robotics. Robotics is a field of study that combines advanced algorithms, manufacturing techniques, sensor fabrication, mechanical engineering, and material science.

An amateur or professional will be exposed to hundreds of different fields of study through the study and practice of robotics. Some people's almost magical curiosity of the world is sparked by the romanticism of robotics, which leads to the development of incredible machines. Robotics promises to be a life changing experience. The science or study of technology that is primarily concerned with the design, development, theory, and application of robots can be summed up as robotics.

In this project, robotic arms are programmed with robot manipulators that perform tasks akin to those of a human arm. The basic functions of a human arm can be carried out by a variety of high-tech prostheses. The objective of our project is to develop a robotic arm that will allow individuals with physical disabilities to write. The patient's amputee hand will be fitted to the robotic arm, which will then record the words the patient says into the microphone. This writing robot's unique feature is that it is equipped with a pen that writes according to spoken commands. The user must send the command to the system using an Android application. After receiving the order. Its motors will complete the required writing task.

2. Literature Survey

Anil and Abhishek discuss the development of a CNC machine that can move in the X, Y, and Z directions.. Stepper motors, linear DVD driver movements, and Arduino controllers were used to build and operate the device. A stepper motor driver is also used for each motor to control the movement effectively because Arduino struggles to control the motors on its own.

In this paper, Prachi Khilari aims to review and compare various speech recognition systems and methods for converting speech to text. The paper also discusses the different types of speech, speaker models, and vocabulary to develop a speech-to-text conversion system. Explains how people with disabilities and people who are blind can use this technology in their daily lives.

Rajesh Mehra and Suraj Malik's paper outlines the general design and implementation of a DSP-based speech recognition and text conversion system. This paper demonstrates voice-oriented text conversion commands. They intended to carry out all calculations related to speech processing in real time. This involves simultaneously accepting user input and using software filters to analyse the data. After that, correlational and law commanding methods were to be used to compare the results.. In this paper, MATLAB is used to implement voice recognition. A person is sovereign when they use voice command. The function keys are used to store the voice command in the database.

The speech recognition system processes real-time speech input, extracting the desired feature from the spoken words, filtering it out, and comparing it to the sample already present in the system. The required MATLAB operations are then completed in order to convert the received data into text form. A voice recognition programme was created and implemented. The system uses speech recognition technology to control numerous and extensive appliances. It can be used for many different things, including voice-activated wheelchairs and robotic appliances.

In this paper, Manoj Kumar and Riyaz Ahmed outline the design of robotic arm control using MATLAB.

The system aims to develop a MATLAB programme capable of operating a robotic arm. Two servo motors are used at joints to move the robotic arm. The system is interfaced with and the Arduino Uno is programmed in accordance with the necessary instructions to control the servo motor. The robotic arm programme is developed

using this suggested technique using the MATLAB software. This paper prototyped a human gesture method for writing on a white board.

There are systems which has utilized all 26 English letter shapes in this method. The ability to recognise human gestures is provided by a vision-based system, which typically resembles a web camera. The entire setup demonstrates how easily hand gesture movement trajectories can be tracked. Following the identified path, a robot arm moves to produce the written English alphabet as the result.

The interactive system created by Muskan Mathur and Vidisha Bhat in this paper allows students to hear the questions and speak out the answers in a logical order. The entire transcript is then mailed to the teacher and is then inscribed by a robotic arm on paper. The student's answer sheet is made available in both hardcopy and softcopy at the end of the test. We used a software unit that makes use of the Python speech recognition library and a hardware unit that makes use of an Arduino Uno and CNC shield to implement the proposed work. The word error rate for the suggested system is 21%.

3. Methodology

Using wireless communication, a writing robot creates written prescription paperwork for patients. The G-Code file is sent to the microcontroller using the processing software after being created with the aid of the Inkscape programme. The stepper motors and servo motor are then given control signals by the CNC shield drive. Now the XY axis, which functions in accordance with the commands given to the controller unit. The data is sent to the appropriate code, which, along with the DAC, connects the controller block to the motor driver unit and sends the pulse width signal to the motor unit. The motor unit processes the data, and the output unit writes and displays the final output on paper.

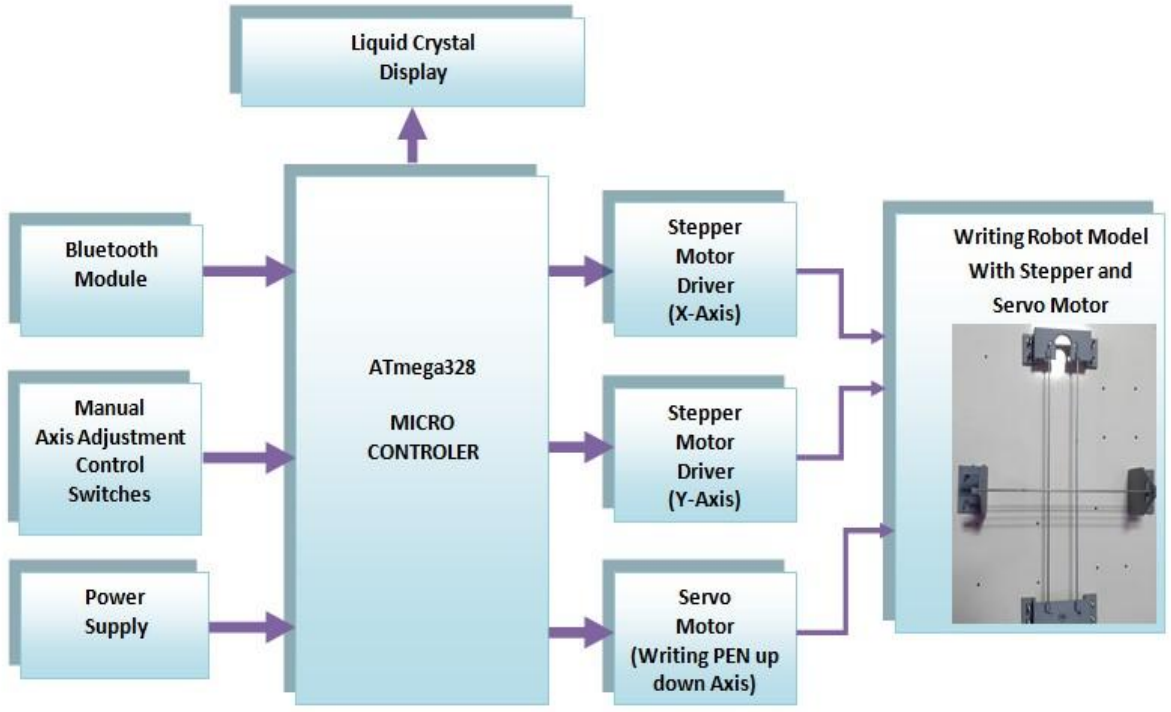

Figure 1 Block Diagram

In the Figure 1, it is clear that a Bluetooth module is being used to collect speech data, which will then be transmitted to an ATmega 328 board for speech synthesis and data reading. The command will be sent to the motor section after the data has been read. In addition, we are manually controlling the motor by means of the axis adjustment switches. We have a section for the power supply, which will give the system power. We are

using the Atmega 328 controller, in which programming is done in accordance with the concept, to control and operate all the data. We are using a servo motor to create the writing robot, and a stepper motor to move the x and y axes.

The ATMEGA328P-PN is a well-known microcontroller that serves as a crucial element of Arduino board products. The ATMEGA328P-PN, an 8-bit RISC processor with a 20MHz maximum clock speed, 32KB of program FLASH, and 2KB of RAM, is what drives the Arduino Uno and Nano. A lot of onboard peripherals, such as UART, SPI, timers, ADC, comparators, and a watchdog, are available on the ATMEGA328P-PN, which is housed in a 28-DIP package. This enables designers to quickly prototype their designs before committing to surface mount technology. With a temperature range of -40°C to 105°C and a voltage range of 1.8V to 5.5V, the ATMEGA328 is a versatile microcontroller that is reasonably priced.

The HC-05 Bluetooth module was developed for wireless communication. You can configure this module as either a master or a slave. Bluetooth serial modules allow all serialcapable devices to communicate with one another over Bluetooth. Since the HC-05 Bluetooth module has a 3.3V level for RX/TX and the microcontroller can detect that level, there is no need to change the transmit level. However, we must adjust the transmit voltage level of the microcontroller to the RX of the HC-05 module. The HC-05 module can transfer data at a rate of up to 1Mbps over a distance of ten meters.

Liquid crystals are primarily used in the operation of the LCD (Liquid Crystal Display) type of flat panel display. LEDs have many uses for both consumers and businesses because they are frequently used in smartphones, televisions, computers, and instrument panels. LCDs represented a significant improvement over the technologies they replaced, such as light-emitting diode (LED) and gas-plasma displays. Displays could be made much thinner using LCD technology than they could have using cathode ray tube (CRT) technology. LCDs operate on the principle of blocking light rather than emitting it, which results in a significant reduction in power consumption compared to LED and gas-display displays. An image is produced by an LCD's liquid crystals using a backlight where an LED emits light.

An electric motor known as a stepper has a shaft that rotates in steps or by shifting by a predetermined number of degrees. By counting the number of steps that have been completed, this feature, which is made possible by the motor's internal design, allows users to determine the exact angular position of the shaft. This feature makes it suitable for a range of applications as well.

A type of motor with incredibly accurate rotational capabilities is a servo motor. A control circuit that provides feedback on the motor shaft's current position is typically present in this type of motor. The servo motors can rotate very precisely thanks to this feedback. An object can be rotated at predetermined angles or distances using a servo motor. It only consists of a simple motor that powers a servo mechanism. If a motor is powered by a DC power source, it is referred to as a DC servo motor, and if it is powered by an AC power source, it is referred to as an AC servo motor. In this tutorial, we will only discuss how the DC servo motor works. In addition to these major divisions, there are many other servo motor types based on the kind of gear arrangement and operating characteristics. The gear configuration of a servo motor allows us to get a very high torque servo motor in small and light packages. They can be used for a variety of applications, such as toy cars, RC helicopters and planes, robotics, etc. thanks to these qualities.

4. Results and Discussion

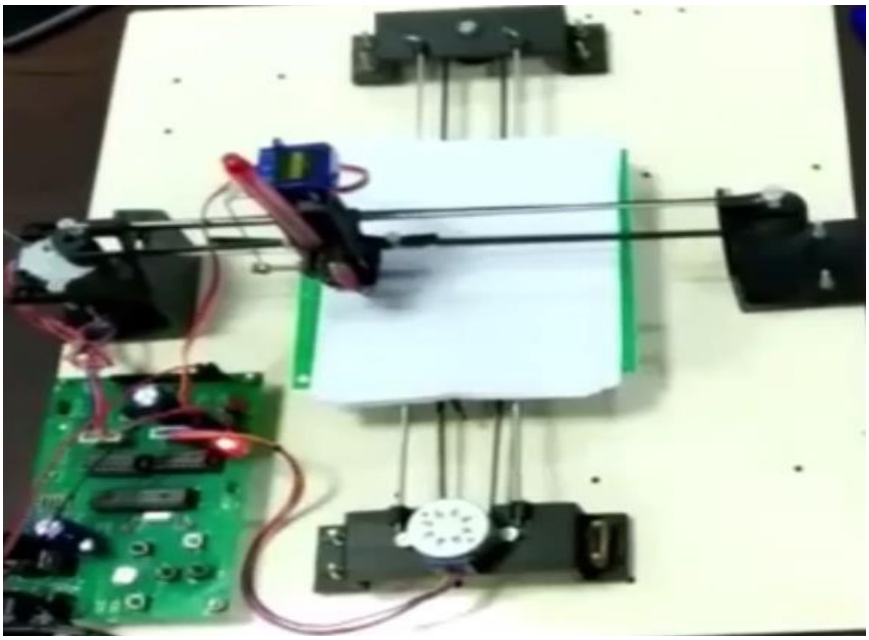

Figure 2 Robot writing

Here in the board we are using an Arduino controller to receive the speech data through Bluetooth and the same will be converted into the action using the motors in the device. The conditions will be provided in form of code in the Arduino microcontroller in Figure 2.

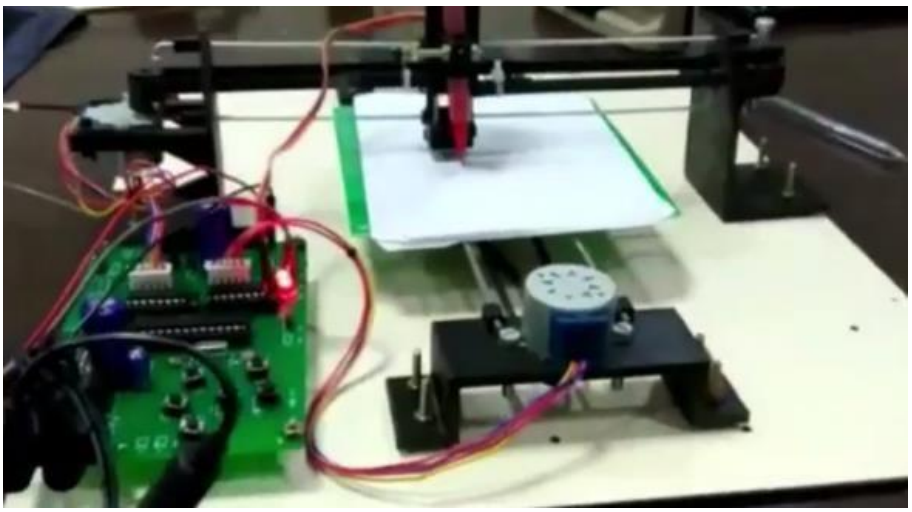

Figure 3 Robot Writing using Speech Processing

Here in this figure 3, we can see that the robot is writing using the motors. We have attached a pen by creating a suitable setup. The setup is moved as per the lines and the robot start writing the content provided to it through the speech. Apart from writing, the robot will also shift the line automatically. In this pic the content provided using the speech is being printed on the paper. Which can be verified.

5. Conclusion

The design of a writing robot using speech recognition was suggested in this paper. The system's goal of creating a robot that uses speech recognition to demonstrate writing abilities has been accomplished. The created system can be beneficial for a variety of individuals, especially those who struggle with writing due to physical limitations and those who have dysgraphia. With the development of new technology, it is also possible to integrate additional features like pick and place.

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