DESIGN AND DEVELOPMENT OF DUAL AXIS CONTROL ROBOT FOR WRITING ROBOT THROUGH SPEECH RECOGNITION

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ABSTRACT

The paper presents an approach to design rapid and fluid movements of a universal robot to perform robot writing tasks. The design of the proposed robot comprises both hardware and software. The hardware part consists of the mechanical design of the robot, the adequate choice of the motors, and the electronic devices to properly drive the robot joints. The software part contains the high level algorithms that convert the desired word to a sequence of target points, and the control algorithms that ultimately make the robot move according to the specifications. Here the writing mechanism is made by speech recognition technique. This speech recognition can be provided through either by using microphone or by using android applications. Thereby the robot can make the writing mechanism according to the user's input

KEYWORDS: Arduino Uno, stepper motor, servo motor, speech recognition.

I.   INTRODUCTION

Education system plays a major role in describing the innovative ideas to the students. In recent years, the definition of robot is generally used to mean an unmanned system or automation, as often seen in industrial applications. Generally, a robot is used to be shaped like humans, and referred to as machines and electric systems were capable of performing similar actions as humans. With the technological advancements in robotics field, efforts are being taken in researching, designing and development of robots for different practical purposes. Robots designed to assist human in their work and reduced human efforts. Nowadays, robots are designed to mimic human behaviour and perform tasks similar to human. Many research companies are developing robotic arm for performing basic functions like human arm. Among different functions, writing skills is one of function. The proposed robotic arm can be used by physically challenged person for writing operation. The main aim of developing the proposed system is to facilitate the physically challenged persons to write what they speak and also this design can be used in many other applications such as data accounting in industries can be done through wireless communication from one place to another. This reduces time and efforts of the workers.

II.   METHODOLOGY

a)   Existing System

The system will be divided into two sections one will be transmitter section and other will be receiver section. The transmitter section will consists of one Arduino Uno, one 3-axis accelerometer and one RF transmitter module. The receiver section consists of one RF receiver module, one motor driver IC, two PMDC motor, two wheels. Here we will require two separate 5 Volt power supply which will be applied to both the sections. The

robot moves forward, backward, right and left when there is tilt in the palm of user in forward, backward, right and left respectively directions. A gesture controlled robot can be controlled by using hand in place of any other method like buttons or joystick. Here one only needs to move hand to control the robot. A transmitting device is used in your hand which contains RF Transmitter and accelerometer. This will transmit command to robot so that it can do the required task like moving forward, reverse, turning left, turning right and stop. All these tasks will be performed by using hand gesture. Here the most important component is accelerometer.

b)   Disadvantages

- Time Consumption high
- Manual Work
- Mechanism little much difficult to implement.

c)   Proposed System

The writing robot makes the written prescription chit about the patients with the help of wireless communication. The movement G-Code file created by the help of Inkscape software then the processing software is used to send the G-Code file to the microcontroller. Then the CNC shield drive sends the controlling signals to the stepper motors and servo motor. Now the XY axis which operates as follows by the instructions given to the controller unit. The corresponding code is send the data to controller block is interfaced with motor driver unit along the DAC provides the pulse width signal to motor unit where it has been processed and final output is written and displayed on the paper from the output unit.
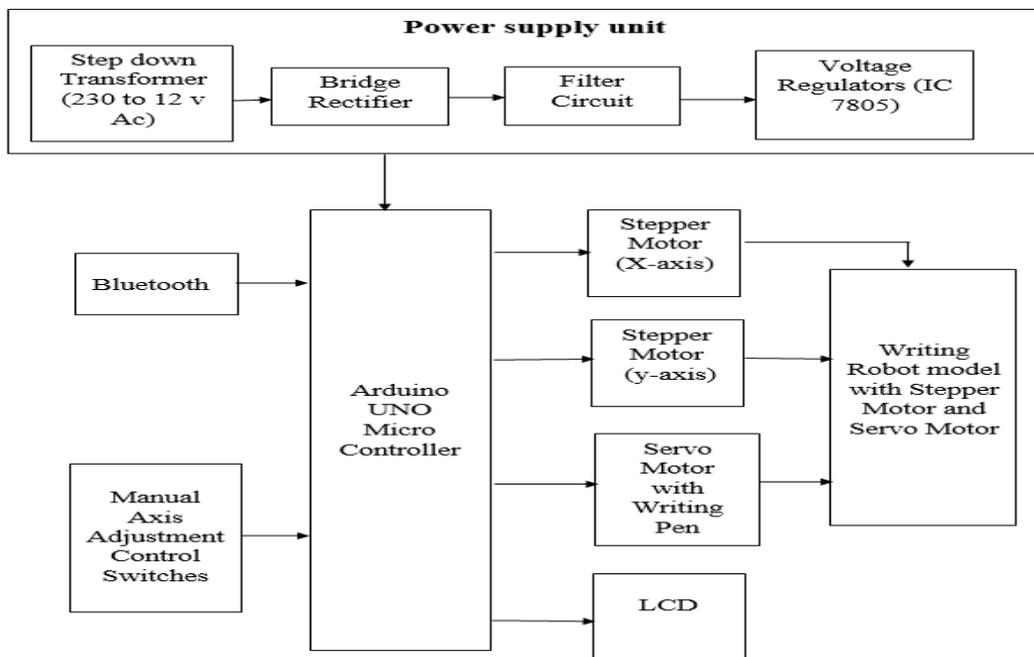

Fig-1: Block Diagram

d) Block Diagram Description

The power supply required for Arduino and stepper motor as well as servo motor is 5V and 12V.Hence stepdown transformer, bridge rectifier, filter and voltage regulators are used. The voice or speech is recognized by the Bluetooth module through android application or microphone. Then by using Inkscape software and Arduino IDE software the analog signal is converted into digital signal and then it is interfaced with the Arduino Uno. The Arduino Uno sends the signals to the respective x and y axis stepper motor and servo motor. According to the Arduino commands, the motors moves and rotates along the required axis. Finally, the writing operation is done according to the user's input.

e) Transmitter Section

Fig-2: Proposed System - Transmitter unit

The above figure determines the transmitter Unit of the proposed system. In this transmitter section the voice commands from the user is transmitted by using an android application or microphone. Then with the help of the Bluetooth module these commands are provided to the controller unit and thus the stepper motor and servo motor are moved in required direction.

III.   COMPONENTS AND ITS DESCRIPTION

Arduino Uno

Arduino's processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- Program memory and the data memory. The code is stored in the flash program memory, whereas the data is stored in the data memory. The Atmega328 has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader), 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16MHz.

Power Jack

Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on a external supply of 7 to 12V. Power can be applied externally through the pin Vin or by giving voltage reference through the IO Ref pin.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging.

Bluetooth

Bluetooth is a telecommunications industry specification that describes how mobile phones, computers, and personal digital assistants (PDAs) can be easily interconnected using a short-range wireless connection. Using this technology, users of phones, pagers, and personal digital assistants can buy a three-in-one phone that can double as a portable phone at home or in the office, get quickly synchronized with information in a desktop or notebook computer, initiate the sending or receiving of a fax, initiate a print-out, and, in general, have all mobile and fixed computer devices be totally coordinated

The maximum range is 10 meters. Data can be exchanged at a rate of 1 megabit per second (up to 2 Mbps in the second generation of the technology). A frequency hop scheme allows devices to communicate even in areas with a great deal of electromagnetic interference. Built-in encryption and verification is provided.

Servo Motor

A servo motor allows precise control of linear or angular position, speed. And it is a rotary actuator. It involves a sensor which is coupled to a motor for location feedback. It also requires a servo driver to send the feedback about the PWM signals.

It refers to a motor appropriate for use in a closed-loop control system. Applications of Servomotors are Metal Cutting and Metal Forming Machines and solar tracking system. When the beam of the motor at the preferred location, power supply to the motor is stopped. If not, the motor is twisted in the suitable direction.

Stepper Motor

Stepper motor (also called as step motor) is basically a brushless DC motor, whose rotor rotates through a fixed angular step in response to input current pulse. That means, the full rotation of the rotor is divided into equal number of steps, and rotor rotates through one step for each current pulse. Stepper motors are becoming very popular due to the fact that they can be controlled directly by computers, microprocessor.
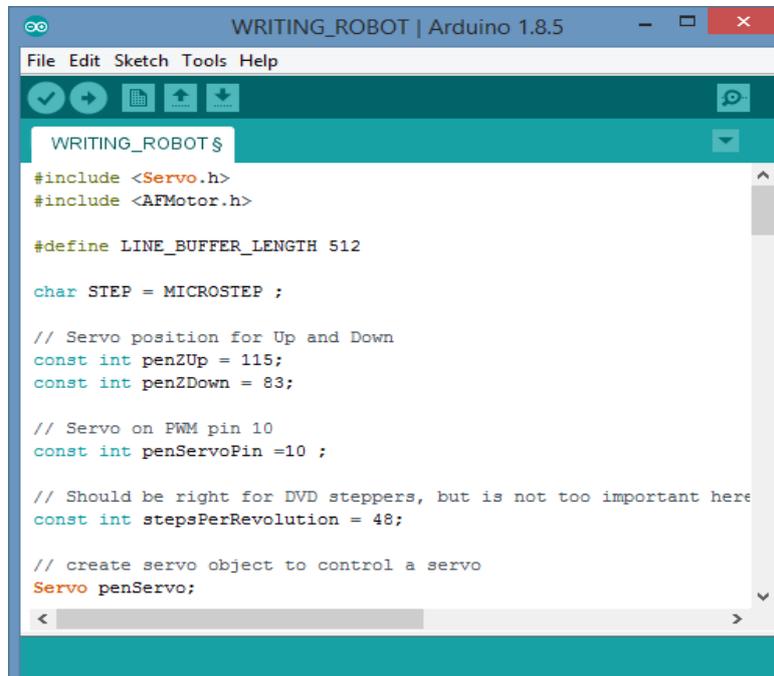
A stepper motor is a type of DC motor which has a full rotation divided in an equal number of *steps.* It is a type of actuator highly compatible with numerical control means, as it is essentially an electromechanical converter of digital impulses into proportional movement of its shaft, providing precise speed, position and direction control in an open-loop fashion, without requiring encoders, end-of-line switches or other types of sensors as conventional electric motors require.

IV.   RESULTS AND DISCUSSION

Simulation

Arduino Programming Control Logic

ATMEGA328P microcontroller is programmed using Arduino IDE software. Programming code in Arduino IDE for this project consists of a set of library files followed by the setup and loop codes. The input parameters from the user is acquired as the voice commands. Then these commands are provided to the microcontroller. The screenshot of the Arduino IDE containing program code of this proposed project is shown in Figure.

Fig-3: Arduino IDE Editor

Thus using Arduino IDE the programming code for the movement of the pen is provided to the designed system. After programming in Arduino IDE verify button is clicked to compile and generate an HEX file from the typed code. This hex file is later used for simulation in Proteus software.

Prototype Of The Writing Robot

The controller logic algorithm is programmed using Arduino IDE software and is implemented in real time using a simulation tool called Proteus. The prototype of the proposed system comprises of two parts which are given as follows:
- Transmitter section
- Main section

Transmitter Section

In the transmitter section, the android application is used to provide the voice commands to the main section. This application can be installed in the mobile phone. When user says the word or commands it is acquired by the application and it sends the corresponding signal to the main section.

Main Section

In the main section the Bluetooth receives the corresponding signal from the android application. Then it sends the commands to the Arduino board which is interfaced with the x and y axis Stepper motor and the servo motor. The prototype of the writing robot is shown in the figure
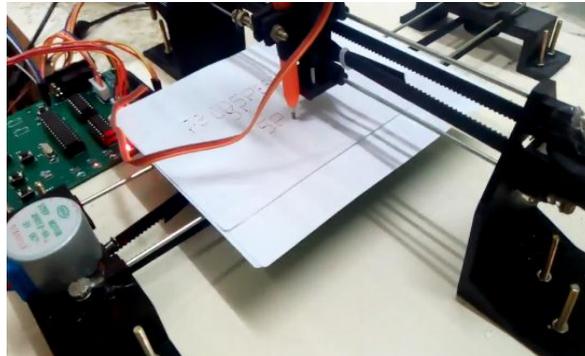
Fig-4: Prototype Of The Writing Robot

The written model of the writing robot is shown in the figure. In this figure it shows that it writes "YES" which is fed by the user when he says "YES" it is recognized by the android application. Then it transmits to the controller through the Bluetooth module. Thus when the user says any commands it starts the writing process. The manual adjustment switches are used to move the axis of the robot when there is a error.
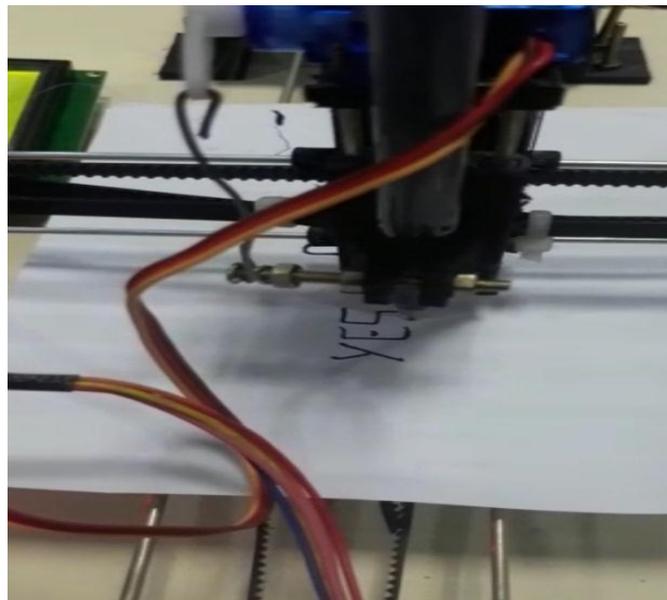

Fig-5: Working Prototype

The input commands from the user are transmitted through the android application or microphone. The power supply required for Arduino and stepper motor as well as servo motor is 5V and 12V. The voice or speech is recognized by the Bluetooth module through android application or microphone. Then by using Inkscape software and Arduino IDE software the analog signal is converted into digital signal and then it is interfaced with the Arduino Uno. The Arduino Uno sends the signals to the respective x and y axis stepper motor and servo motor. According to the Arduino commands, the motor moves and rotates along the required axis. Finally, the writing operation is done according to the user's input

V. CONCLUSION

In this paper, we present a method to design rapid and fluid movements of a universal robot to perform robot writing mimicking the kinematics and trajectory of human handwritten signatures. The handwriting specimen acquisition, writing specimen processing, robot writing and comparison of on-line human and robot signatures are the phases of the experimental research performed.

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