PANULAT-AN AUTOMATED PEN

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Abstract
Writing is nowadays one of the major form of communication. With all the emails, texts, tweets people have become prolific writers. It is one of the most powerful tools used to share our knowledge, emotions, beliefs and thoughts. Penmanship has become an old fashioned art with style and class to it. There are several difficulties encountered while recognizing unconstrained handwriting that are mainly caused by huge variations in writing styles and the overlapping and the connection with the neighboring characters. Furthermore, many applications require high accuracy and reliability. Panulat is a provision to recognize unconstrained handwriting an automated writing. It makes use of OCR to recognize the text.

It can help you with all sorts of paperwork, secure writing of certificates, accurate data entry and so on.
Keywords*: * Handwriting, OCR, Arduino programming, Python

I. INTRODUCTION

Handwriting recognition and emulation is the one among the challenging areas in the fields of image processing, pattern recognition and robotics. Though we have developed several alternatives to handwritten documents, people find it difficult to let go of the pen. Writing is a complex process which engages different levels of motion control. Data entry using pen is a natural convenient method but it arises a lot of problems. The large number of documents, different writing styles and the variability contributes to it. Similarly, the large number of documents that need to be digitalized need an accurate and reliable system.

Historical documents need to be preserved and documented as they represent our culture. Handwriting recognition is classified into two types offline and online recognition. In the offline method, the writing is usually captured by a camera or a scanner and the entire writing is available. In the online method the two dimensional coordinates of points are represented as a function of time. The online method is considered superior to the offline method. Many products are existing for conversion but the results are unsatisfactory.

Writing all the official documents may be tiresome. Earlier certificates were written by hand and it required excellent calligraphy and the focus on ensuring no misspelling takes place. To write a lot of documents can also take a lot time and money. Though alternatives such as computers and printers exist people prefer handwritten input over keyboard

In this paper, a prototype is developed which contributes to automation process and improves the interface between man and machine in numerous applications. The system writes automatically without any human aid and emulates handwritten notes. It can also recognize notes. It can also recognize the handwritten documents using the online character recognition method

II. LITERATURE SURVEY

The study done on the current state of the knowledge about this topic.

TABLE I: Literature Review

Reference Paper	Abstract
Improving OCR performance with background image elimination	In this paper OCR is used to detect the text characters from a document image. The brightness and distortion and chromaticity is used to enhance the contrast in each channel image. The method was tested using Tesseract and compared with ABYY Finereader and HAWRANG
Digital pen for paralyzed patient	This paper presents digital pen and gesture trajectory recognition for paralyzed patient. The pen consists of triaxial accelerometer, microcontroller and RF wireless transmission module. The trajectory recognition algorithm consists of acceleration acquisition, signal preprocessing, feature generation, feature selection, and feature extraction.
Handwritten OCR system for sindhi numerals	An OCR system which recognizes handwritten sindhi numerals without using common input devices such as keyboard and storage device memory. Keeping single template generated from computer is used for analysis and classification of handwritten numerals of different sizes and fonts
Neural network based handwritten character recognition system using without feature extraction	A neural network based offline handwritten character recognition system without feature extraction has been introduced in this paper for classifying and recognizing the 26 alphabets. The architecture with two hidden layers each having 100 neurons has been found to yield the highest accuracy of 90.19%
OCR program for images of printed text using a neural network	A simple method using self organizing map neural network (SOMNN) which is used for character recognition. The neural network is capable of distinguishing 62 characters of the English language. The program is also capable of recognizing characters in mages that are noisy, colored or rotated. For ideal images accuracy is 100% and for non-ideal images it is between 81% and 100%

III. DESIGN

A. Module Description

Design is a long evolving process with a series of inter- mediate stages, each one with its own significant importance towards a successful outcome.

Recognition: A critical procedure while scanning the text is to detect and recognize the text characters. The possible target text line is identified by using a geometric features and is fed to an OCR engine for character recognition. If the recognition result is confident enough, the target text line is accepted. If not recognized all the remaining text lines are fed to the OCR engine to verify whether an alternative target text line exists.

Two major difficulties in recognizing segmented, handwrit- ten characters are ambiguity and illegibility of the characters.

1) Writing: Writing is an influence of physical and biome- chanical process.
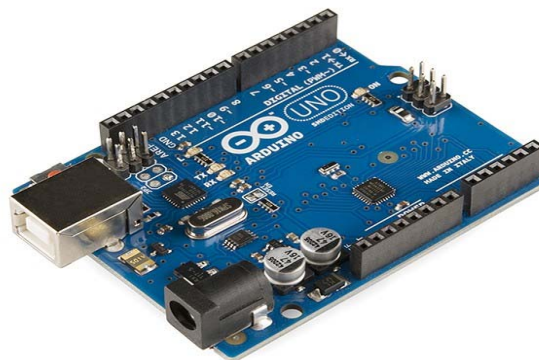
B. Implementation

1) Hardware:

Fig. 1: Arduino

a) Arduino: Arduino board designs uses a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output pins that can be interfaced to various expansion boards .The microcontrollers are controlled using the programming languages C and C++. In addition to this, the arduino provides an Integrated development environment (IDE) based on the processing language project.

b) CNC shield: CNC shield is used as drive expansion board for our machine. There are 4 slots in the board for the stepper motor driver module, each stepper motor needs 2 input/output. A control firmware need to be downloaded into Arduino to use the CNC board. GRBL is open source software that runs on an Arduino Uno that takes G-Code commands via Serial and turns the commands into motor signals. Grbl is a no-compromise, high performance, low cost alternative to parallel-port-based motion control for CNC machine. Arcs, circles and helical motion are fully supported, as well as, all other primary g- code commands.
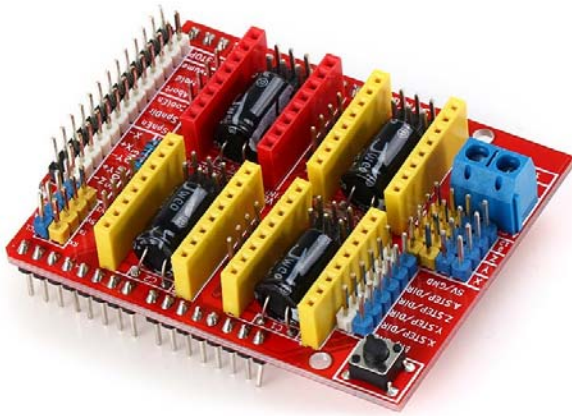
Fig. 2: CNC shield V3.0

c)   Servo Motor: A servomotor is a rotary or linear actuator that allows precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.

The motor is paired with some type of encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required,   an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.

2) Software:

a) Arduino IDE: A program for Arduino may be written in any programming language with compilers that produce binary machine code for the target processor. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and

pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus.

A program written with the IDE for Arduino is called a *sketch*. Sketches are saved on the development computer as text files with the file extension *.ino*. The Arduino IDE supports the languages C and C++ using   special rules of code structuring.

b) Inkscape: Inkscape is a free and open-source vector graphics editor; it can be used to create or edit vector graphics such as illustrations, diagrams, line arts, charts, logos and complex paintings. Inkscape's primary vector graphics format is Scalable Vector Graphics (SVG), however many other formats can be imported and exported.

Inkscape can render primitive vector shapes and text. These objects may be filled with solid colors, patterns, radial or linear color gradients and their borders may be stroked, both with adjustable transparency. Embedding and optional tracing of raster graphics is also supported, enabling the editor to create vector graphics from photos and other raster sources. Created shapes can be further manipulated with transformations, such as moving, rotating, scaling and skewing.

c) G-code: G-code is the most widely used numerical control (NC) programming language. It is used mainly in computer-aided manufacturing to control automated machine tools. G-code is sometimes called G programming language, not to be confused with LabVIEW's G programming language.

G-code is a language in which people tell computerized machine tools how to make something. The how is defined by g-code instructions provided to a machine controller (industrial computer) that tells the motors where to move, how fast to move, and what path to follow. The most common situation is that, within a machine tool, a cutting tool is moved according to these instructions through a toolpath and cuts away material to leave only the finished workpiece. The same concept also extends to noncutting tools such as forming or

burnishing tools, photoplotting, additive methods such as 3D printing, and measuring instruments. G-codes, also called preparatory codes, are any word in a CNC program that begins with the letter G. Generally it is a code telling the machine tool what type of action to perform.

d) Processing 3: Processing is a flexible software sketchbook and a language for learning how to code within the context of the visual arts. Since 2001, Processing has promoted software literacy within the visual arts and visual literacy within technology. The Processing language builds on the Java language, but uses a simplified syntax and a graphics user interface. Processing includes a *sketchbook*, a minimal alternative to an integrated development environment (IDE) for organizing projects. Every Processing sketch is actually a subclass of the PApplet Java class (formerly a subclass of Java's built-in Applet) which implements most of the Processing language's features. When programming in Processing, all additional classes defined will be treated as inner classes when the code is translated into pure Java before compiling. This means that the use of static variables and methods in classes is prohibited unless Processing is explicitly told to code in pure Java mode.Processing also allows for users to create their own classes within the PApplet sketch.

e) Python: Python is an interpreted high-level programming language for general-purpose programming. Python uses dynamic typing, and a combination of reference counting and a cycle-detecting garbage collector for memory management. It also features dynamic name resolution (late binding), which binds method and variable names during program execution. Python has a design philosophy that emphasizes cod readability, and a syntax that allows programmers to express concepts in fewer lines of code than might be used in languages such as C++ or Java. The language provides constructs intended to enable writing clear programs on both a small and large scale. Python features a dynamic type system and automatic memory management and supports multiple programming paradigms, including object-oriented, imperative, functional programming, and procedural styles. It has a large and comprehensive standard library.

IV. RESULTS AND DISCUSSION

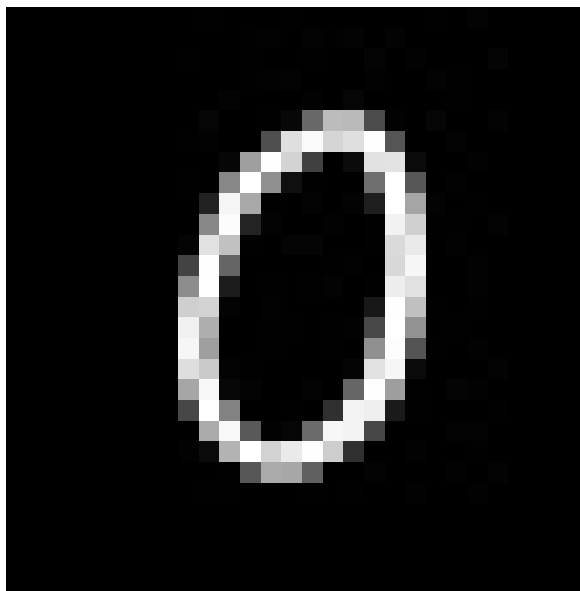Fig. 1: Data set for the OCR

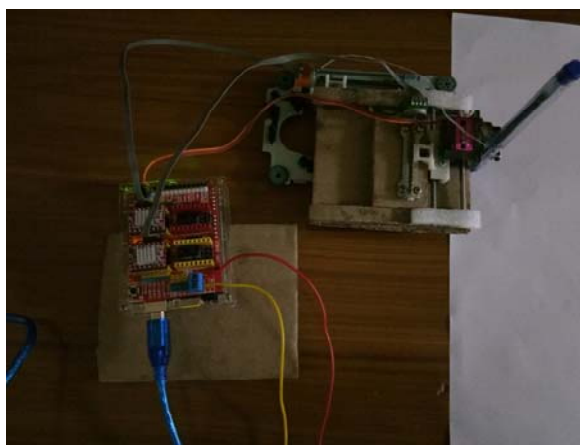
Fig. 2: Recognized Character

Fig. 3: Writing Machine

Fairly good recognition was obtained. No need to spend large amount of time, reliably remove the ambiguity between characters having same sequence of primitives, fairly good recognition

speed, can be easily extended to other projects. The robotic simulation of human handwriting presented in this paper can be used for teaching of handwriting skills, application in medical diagnostics, can help visuo-constructive deficits.

V. REFERENCES

1) Marius-Florin, Stefan Pretil, Lucian Alexandru, Valer Dolga,"Secure handwriting using a robot arm for educational purposes" IEEE (2014).

2) G. Vamvakas, B. Gatos, N. Stamatopoulous and S.J.Perantonis,"A complete optical character recognition methodology for historical documents", IEEE (2008).

3) Anwar Ali Sanjrani, Junaid Baber, Maheen Bakhtyar, Waheed Noor, Muhammed Khalid, "Handwritten optical charcter recognition system for sindhi numerals", IEEE (2016)

4) Narayan P.Kharaje, Kausar Pakir, Sushma Kodagali, "Digital pen for paralyzed patient", IEEE (2016)

5) Mande Shen and Hansheng Lei, "Improving OCR per- formance with background image elimination", IEEE (2011