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Digital Pen For Handicapped And Old Age People

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Abstract : *This paper presents digital pen for handwritten digit and gesture trajectory recognition for Handicapped person. The accelerometer based digital pen for handicapped and old age people consists of basically three main parts i.e triaxial accelerometer, microcontroller and RF wireless transmission module. This parts used for sensing and collecting accelerations of handwriting and gesture trajectories of hand motions of paralyzed patient. The minimized features are passed to a neural network for recognition. The main important experimental results have successfully validated the effectiveness of the trajectory recognition algorithm utilized in Digital Pen proposed in this paper.*

Keywords *- KNN classifier, MEMS, Wireless transmitting module, Voice module.*

I. Introduction

The increase of different technologies in daily human life and price of electronic components has rapidly decreased the dimension and weight of customer electronic products. A significant advantage of inertial sensors like accelerometers for purpose of motion sensing is that they can be operated without any external reference and limitation in working conditions. The motion trajectory recognition is challenging task as different users have different speed and different ways to perform particular motion. This problem is resolved by scientists by enhancing the accuracy of the motion recognition system. Many different scientists try to focus of that signals to increase the recognition rate of that acceleration signals of the Paralyzed patient.

The rest of the paper is organized as follows: Section II illustrate trajectory recognition algorithm Section III elucidates hardware design of digital pen illustrate MEMS microcontroller, Bluetooth communication. Finally conclusions are drawn in Section IV.

II. Trajectory Algorithm

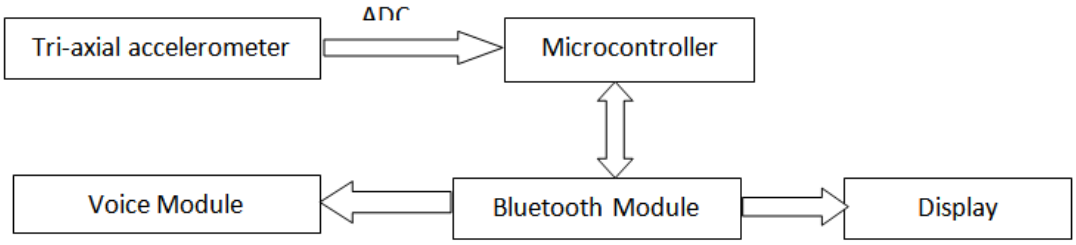

Fig1. Block diagram

The block diagram of trajectory recognition algorithm is shown in following Fig. 2. It consists of five different blocks first is acceleration acquisition which consists of an accelerometer device, second is signal preprocessing which performs preprocessing of data from accelerometer, third is feature generation, feature selection is fourth and last is feature extraction.

The feature vectors which are minimized are given as input to the classifier to recognize the different motions of the hand of paralyzed patient. The classifier detects the particular motion which is represented by that feature vector. The step wise procedure of the five different trajectory recognition algorithms of the different acceleration signals is explained below [4].

2.1 Signal Preprocessing:

The different acceleration signals i.e. different motions of the hand of the paralyzed patient are read through the accelerometer and stored by the microcontroller. The signal preprocessing of the acceleration

signals block consists of the four different processes i.e. calibration, a moving average filter, high pass filter and normalization.

2.2 Feature Generation:

The different characteristics of hand movement acceleration signals of the paralyzed patient can be obtained by separately extracting features from the preprocessed three axis signals from the triaxial acceleration signals of hand motions viz. 1. Mean, 2. STD, 3. VAR, 4. IQR, 5. Correlation between axes, 6. MAD, 7. rms and 8. Energy. When this generation procedure is completed, 24 different features are then obtained.

2.3 Feature Selection

The scientist Wang originally developed the adopted selec- tion criteria of the different features in the KBCS .

2.4 Feature Extraction

After completing the feature extraction, these minimized features will be fed into the classifier device to recognize different hand movements of the paralyzed patient.

2.5 Classifier Construction

K Nearest Neighbor (KNN from now on) is one of those algorithms that are very simple to understand but works incredibly well in practice. Also it is surprisingly versatile and its applications range from vision to proteins to computational geometry to graphs and so on. KNN is an non parametric lazy learning algorithm. When you say a technique is non parametric , it means that it does not make any assumptions on the underlying data distribution. This is pretty useful , as in the real world , most of the practical data does not obey the typical theoretical assumptions made (eg gaussian mixtures, linearly separable etc) . Non parametric algorithms like KNN come to the rescue here.

KNN can be used for both classification and regression predictive problems. However, it is more widely used in classification problems in the industry. To evaluate any technique we generally look at 3 important aspects:

2.5.1 Ease to interpret output

2.5.2 Calculation time

2.5.3 Predictive Power

III. Hardware

3.1 Micro-Electro-Mechanical Systems

Micro-Electro-Mechanical Systems (MEMS) is the integra- tion of mechanical elements, sensors, actuators, and electronics. The accelerometers sensitivity is fixed for this work from -3g to +3 g.

Fig3.1. Micro-Electromechanical System

Micro-Electro-Mechanical Systems having the features like RoHS Compliant, Dual axis accelerometer,Monolithic CMOS construction, On-chip mixed mode signal processing, Resolution better than 2 mg etc.

3.2 Bluetooth Module:

The HC-05 is based on the EGBT-045MS Bluetooth module. It can operate as either a slave device or a master device. As a slave it can only accept connections. As a master it can initiate a connection.HC-05 module

is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.

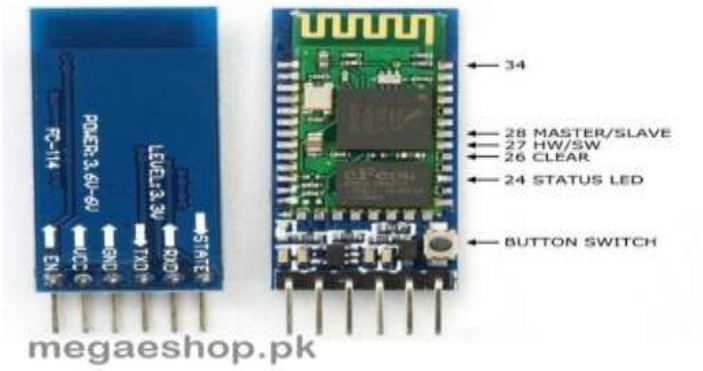

Fig3.2. Bluetooth Module

IV. Advantages, Disadvantages and Application

4.1 **Advantages**

- Portable
- Reduce human effort.
- Moderate range
- Low maintenance.
- Does not lose information.

4.2 **Disadvantage**

- Range of transfer is limited (upto 100 meter).
- Device should be handle properly.

4.3 **Applications**

- Alternate for keyboard
- Helpful for people with speech disorder and impairment.
- For teaching purpose.
- Efforts of making the concept of pen and paper redundant.
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V. Conclusion

This project will present a gesture recognition system for digits from 0-9. The wireless sensing device designe will be fitted with a three dimensional accelerometer. The accelerometer data filteres and divide into frames. Temporal features will extracted from each frame to form a feature vector which was given as input to the classifier. KNN is used for pattern recognition. The KNN classifier achieved a comparable accuracy. Since temporal features can be calculated easily with minimal computational cost, this method of gesture recognition can be employed in real time applications. They may also see social benefits and can be proved to be a great assistance in interacting and conveying messages to the people around them thus making the extra efforts of learning sign language redundant. The result will be displayed on the screen and voice module will call the command assigned for particular gesture.

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