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DIGITAL PEN FOR HANDICAPPED AND OLD AGE PEOPLE

Harsh Patel[1], Ratnesh More[2], Siddharth Mishra[3], Parth Mistry[4], Prof. Sandip Zade[5]

[1,2,3,4,5]*Dept. of Electronic Engineering, Atharva College of Engineering Mumbai, India.*

Abstract - *This paper presents a digital pen for and gesture trajectory recognition for Handicapped persons and old age persons using the tri-axis accelerometer. The accelerometer-based digital pen for handicapped and old age people consists of basically three main parts i.e., tri-axial accelerometer, microcontroller, and GSM transmission module. This parts used for sensing and collecting accelerations of gesture trajectories of motion of pen by paralyzed patient. A neural network is used for recognizing the minimized features. Also using GSM module the given command can be sent directly to a mobile phone from which urgent help can be provided to desired patient. The effectiveness of the trajectory recognition algorithm utilized in this paper have successfully validated from the main important experiments.*

Key Words: Bluetooth module, GSM module, MEMS, voice module

1. INTRODUCTION

The increase in different technologies in daily human life and the 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're going to be operated with none external reference and limitation in working conditions. The motion trajectory recognition is a challenging task as different users have different speeds and different ways to perform a particular motion. This problem is resolved by scientists by enhancing the accuracy of the motion recognition system. Many different scientists try to focus on that signals to extend the popularity rate of that acceleration signals of the Paralysed patient.

The increase in human-machine interactions in our daily lives has made user interface technology progressively, more important. Physical gestures as intuitive expressions will greatly ease the interaction process and enable humans to more naturally command computers or machines. For example, in telerobotics slave robots have demonstrated to follow his master's hand motions remotely [1]. Other proposed applications of recognizing hand gestures include character-recognition in 3-D space using inertial sensors [2], [3], gesture recognition to control a television set remotely [4], enabling a hand asa3-Dmouse[5], and using hand gestures as an impact mechanism in the computer games [6]. Moreover, gesture recognition has also been proposed to understand the actions of a musical conductor[7].In our work, a miniature MEMS accelerometer-based recognition system which can recognize even hand gestures in 3-D space is built. The system has potential uses like a remote controller for visual and audio equipment, or as an impact mechanism to command machines and intelligent systems in offices and factories. There are mainly two existing sorts of gesture recognition methods, i.e., vision-based and accelerometer and /or gyroscope based. Due to the limitations such as unexpected ambient optical noise, slower dynamic response, and relatively large data collections/processing of vision-based method [9],our recognition system is implemented based on an inertial measurement unit based on MEMS acceleration sensors. The acceleration patterns are not mapped into velocity, displacement or transformed into the frequency domain, but are directly segmented and recognized in the time domain. By extracting an easy feature supported sign sequence of acceleration, the recognition system achieves high accuracy and efficiency.

The remainder 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 followed by the benefits , disadvantages, and applications in section IV. Finally conclusions are drawn in Section V.

2. Trajectory Algorithm

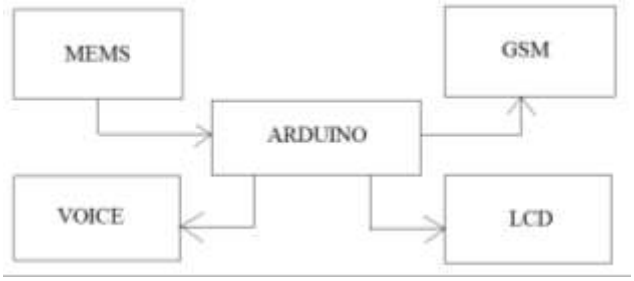

Fig 2: Block Diagram

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 extraction is fourth and last is the feature selection. The feature vectors which are minimized are given as input to the classifier to acknowledge the varied motions of the hand of a paralyzed patient. The classifier detects the actual movement which is represented by that feature vector. The step-wise procedure of the five different trajectory recognition algorithms of the various acceleration signals is explained below.

2.1 Signal Processing

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data from accelerometer, third is feature generation, feature extraction is fourth and last is the feature selection. The feature vectors which are minimized are given as input to the classifier to acknowledge the varied motions of the hand of a paralyzed patient. The classifier detects the actual movement which is represented by that feature vector. The step-wise procedure of the five different trajectory recognition algorithms of the various acceleration signals is explained below.

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 pre-processed three-axis signals from the tri-axial 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.

3. Gesture Motion Analysis

After completing the feature extraction, these minimized features are going to be fed into the classifier device to acknowledge the various hand movements of the paralyzed patient. Gesture motions are within the vertical plane (as defined by the x-z plane in Fig.1 (a)) or the projection of the motions is especially. For example, an easy up gesture is often decomposed into several acceleration and deceleration periods. As shown in Fig. 1(b), an up gesture actually consists of motion from point 1 to point 2, and then back to point 1. The velocity at the starting point 1, midpoint 2 and endpoint 1 are all zeros. For the convenience of the study , point 3 is that the point between point 1 and point 2 where acceleration changes sign and point 4 is that the point between point 2 and point 1 where acceleration changes sign. Then the acceleration changes are often described as acceleration on the z-axis is negative (since positive z-direction is downward); velocity changes from zero to a maximum value at 3; acceleration at point 3 is zero. : acceleration on the z-axis is positive; velocity changes from negative to positive and is maximum at point 4, where acceleration becomes zero. acceleration on the z-axis is negative; velocity changes from positive to zero. Also, acceleration and velocity become zero at point 1.

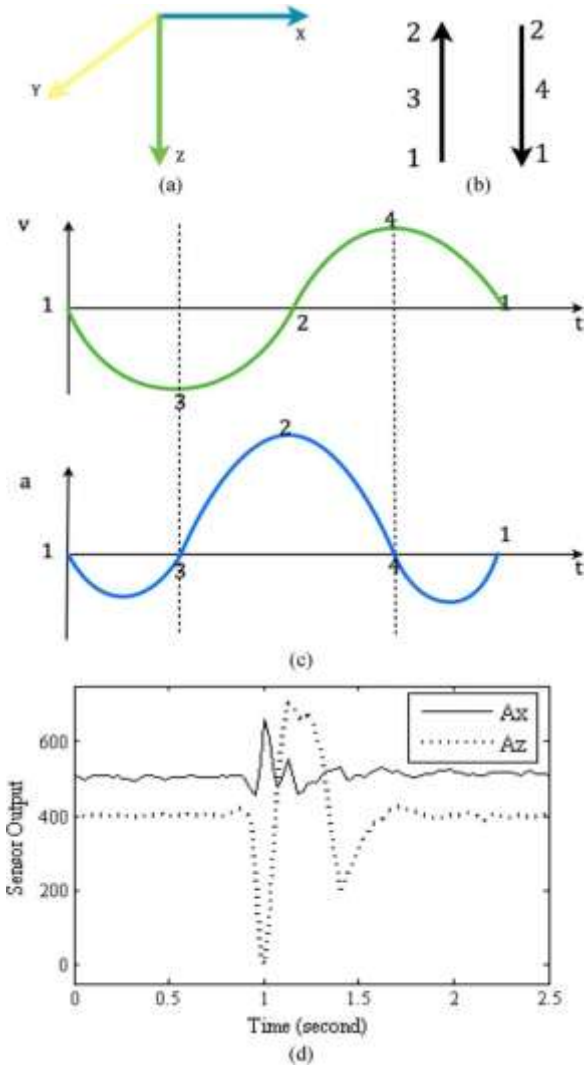

Fig 3: graph

4. Hardware

4. 1 Micro-Electro-Mechanical System(MEMS)

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

Fig 4.1: MEMS

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

4. 2Bluetooth Module

The HC-05 is predicated on the EGBT-045MS Bluetooth module. It can operate as u want it lika 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.

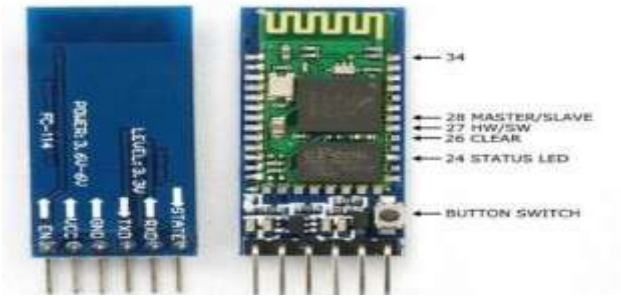

Fig 4.2: Bluetooth Module

4. 3GSM Module

GSM may be a mobile communication modem; it stands for global system for mobile communication. The original idea of GSM was discovered at Bell Laboratories in 1970. It is widely used mobile communication system within the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operate at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands, communication purpose.

Fig 4.3: GSM Module

A GSM digitizes and reduces the info , then sends it down through a channel with two different streams of client data, each in its own particular slot. The digital system has the capability to hold 64 kbps to 120 Mbps of knowledge rates. There are various cell sizes during a GSM system like macro, micro, pico and umbrella cells. Each cell varies as per the implementation domain. There are five different cell sizes during a GSM network macro, micro, pico and umbrella cells. The coverage area of every cell varies consistent with the implementation environment.

GSM networks operate on all most quite varied carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating within the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and therefore the United States). In rare cases, the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems.

5. System Work Flow

The gesture motion data then undergo a segmentation program which automatically identifies the beginning and end of every gesture in order that only the info between these terminal points will be processed to extract feature. Subsequently, the processed data are recognized by a comparison program to figure out the presented gestures.

To collect proper hand gesture data for the sensing system, the experimental subject should follow proper guidelines and which are compulsory below during the info acquisition stage: The sensing devices would be held horizontally during the entire data collection process (i.e., the x-y plane of the sensor chip. The time interval between two gestures should be no less than 0.2 seconds so that the segmentation program can separate each one of the gestures in sequential order.

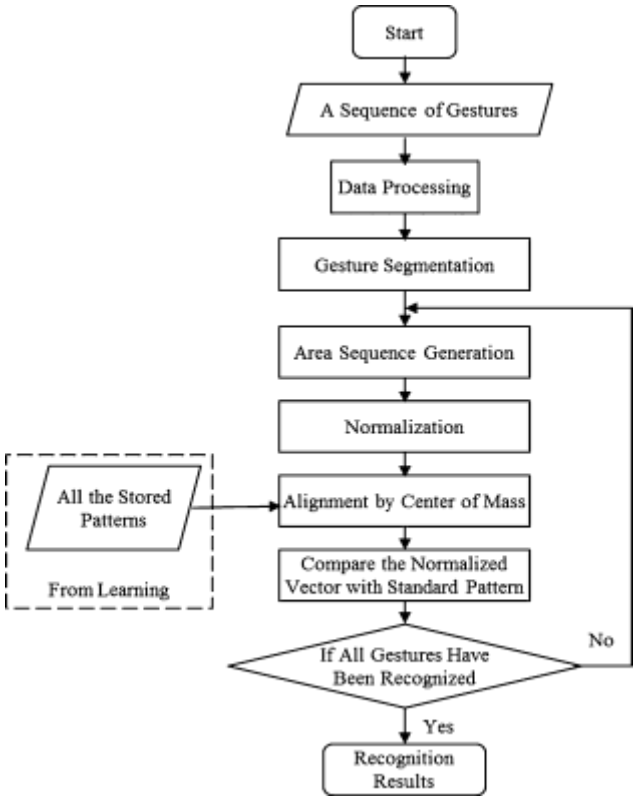

Fig 5: Flowchart

6. Advantages, Disadvantages and Application

6.1 Advantages

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

6.2 disadvantages

- Range of transfer is restricted (upto one hundred meter).
- Device ought to be handle properly

6.3 Application

- Alternate for keyboard.
- Helpful for folks with speech disorder and impairment.
- For teaching purpose.
- Efforts of constructing the conception of pen and paper redundant.

7. CONCLUSION

This paper describes a nonspecific person gesture recognition system by using MEMS accelerometers. the popularity system consists of sensor data collection, segmentation and recognition. After receiving acceleration data from the sensing device, a segmentation algorithm is applied to work out the starting and end points of each input gesture automatically. The sign sequence of a gesture is extracted because the classifying feature, i.e., a gesture code. Finally, the gesture code is compared with the stored standard patterns to work out the foremost likely gesture This project will present a gesture recognition system in several axis. Since temporal features are often calculated easily with minimal computational cost, this method of gesture recognition are often employed in real time applications. they'll also see social benefits and may be proved to be an excellent assistance in interacting and conveying messages to the people around them thus making the additional efforts of learning signing redundant. The result are going to be displayed on the screen and voice module will call the command assigned for particular gesture.

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