Scientific Journal Impact Factor (SJIF): 1.711
e-ISSN: 2349-9745
p-ISSN: 2393-8161
International Journal of Modern Trends in Engineering and Research
www.ijmter.com

Review on Digital Writing Instrument using Gesture Recognition

Raste Madhura[1] ,Shivdas Shital[2], Patil Bhagyshri[3]
[1,2,3] *E&TC, ADCET Ashta*

ABSTRACT-This paper introduced an accelerometer based digital writing instruments like pen for handwritten digits as well as letters. This pen consists of triaxial accelerometer, a microcontroller and an RF wireless transmission module for the purpose of sensing and collecting gesture trajectories. The algorithm of trajectories recognition includes the various steps acceleration acquisition, signal preprocessing, feature generation, feature selection, and feature extraction. User can be use digital pen to make a hand gesture and the acceleration of hand motions collected by accelerometer and wirelessly transmitted for displaying the digit or letter. Probabilistic neural network is used to reduce feature set in algorithm.

Keywords -Accelerometer, gesture, linear discriminant analysis (LDA), probabilistic neural network (PNN), trajectories recognition algorithm.

I. INTRODUCTION

Traditionally the writing mechanism for a PC is supported by a keyboard or touch screen. Many a times it is difficult to use both the mechanisms in critical situations. A modification over the traditional approach is to switch to user's hand motion or gestures. Many methods can be adopted for gesture recognition. Traditionally an optical tracking system (OTS) was used to calibrate 3-D accelerations, angular velocities, and space attitude of handwriting motions. The OTS was developed to obtain accelerations of the ubiquitous digital writing instrument (UDWI) by calibrating 2-D trajectories and to obtain the accurate attitude angles by using the multiple camera calibration which increased its cost.

To minimize the expenditure, paper revised pen-style hardware and analysis software for the recognition of handwritten characters. For this implementation used triaxial accelerometer, a controller, and an RF wireless transmission module for sensing and collecting accelerations of hand writing and gesture trajectories. Triaxial accelerometer can be used to measure the accelerations of user's hand motions. Controller can be used for converting the analog signal into digital form. For displaying the motion, a PC is used through RF wireless Transceiver for long distance.

Digital pen can be utilized by the user's to write digits and make hand gestures at normal speed. The trajectory recognition algorithm can be used to recognize measured acceleration signals of these motions. The recognition procedure will be include the acceleration acquisition, signal preprocessing, feature generation, feature selection, and feature extraction. The acceleration signals of hand motions are measured by the pen-type portable device. [1]

II. RELEVANCE

Human Computer Interface and trajectory recognition applications have focused on the development of digital pens. There are mainly two existing types of gesture recognition methods, i.e., vision-based and accelerometer or gyroscope based. New wearable input device scurry implemented by Kim are based on the inertial sensors i.e. gyroscope and accelerometer. Using hand motion and finger clicking user can operate the system for selecting a specified character, which is used as a wearable keyboard, as well as a wearable mouse. It can be used as a device that interacts with the virtual environment like games. [2][3]

An inertial-measurement-unit-based pen with a trajectory reconstruction algorithm was implemented by Wang. The system is for the handwriting digit recognition application used one triaxial accelerometer,

one uniaxial angular rate gyroscope, and one biaxial angular rate gyroscope. This system was used to write numerals or draw simple symbols at normal speed. By using its trajectory reconstruction algorithm can reduce orientation and integral errors effectively and thus can reconstruct the trajectories of movements accurately. [4]

"Hand-written character recognition using MEMS motion sensing technology" [5] described by changing the position of Micro Electro Mechanical Systems (MEMS) can be able to show the alphabetical characters and numerical on the PC. "An optical-tracking calibration method for MEMS-based digital writing instrument"[6] describe a method to calibrate three-dimensional linear accelerations and angular velocities of human writing motions measured from MEMS sensors through optical tracking techniques.

III. HARDWARE DESIGN

The acceleration signal of user's hand motion can be generated with the help of accelerometer. The analog acceleration signals are converted to digital signal by an ADC and can be collected using controller. The wireless RF transceiver transmits the acceleration signals wirelessly to a personal computer (PC) shown in Fig.1

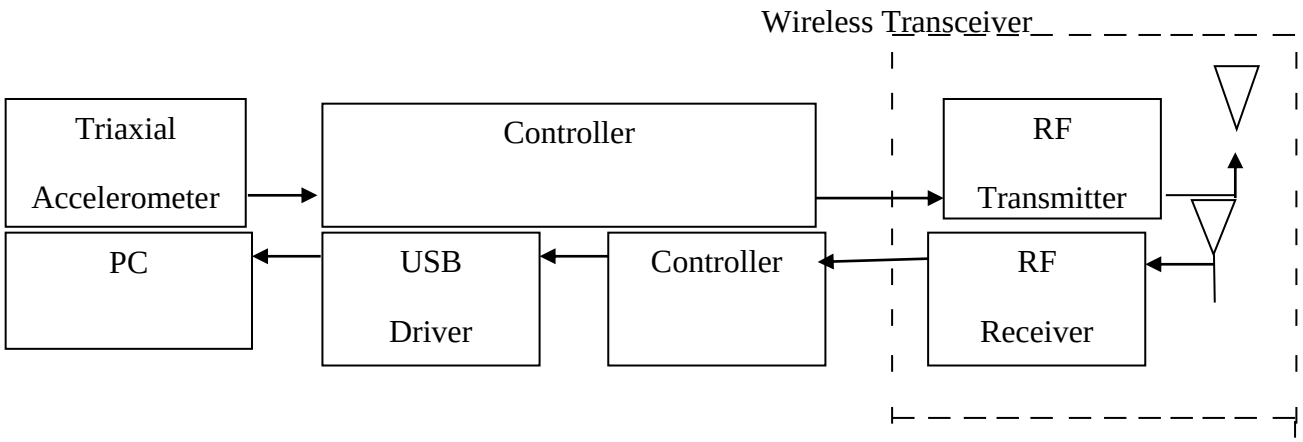

Fig.1 Block diagram of the digital pen module

IV. TRAJECTORY RECOGNITION ALGORITHM

The steps acceleration acquisition, signal preprocessing, feature generation, feature selection, and feature extraction used in trajectory recognition algorithm shown in Fig.2. Measured accelerated signal preprocessed by filtering and normalization.

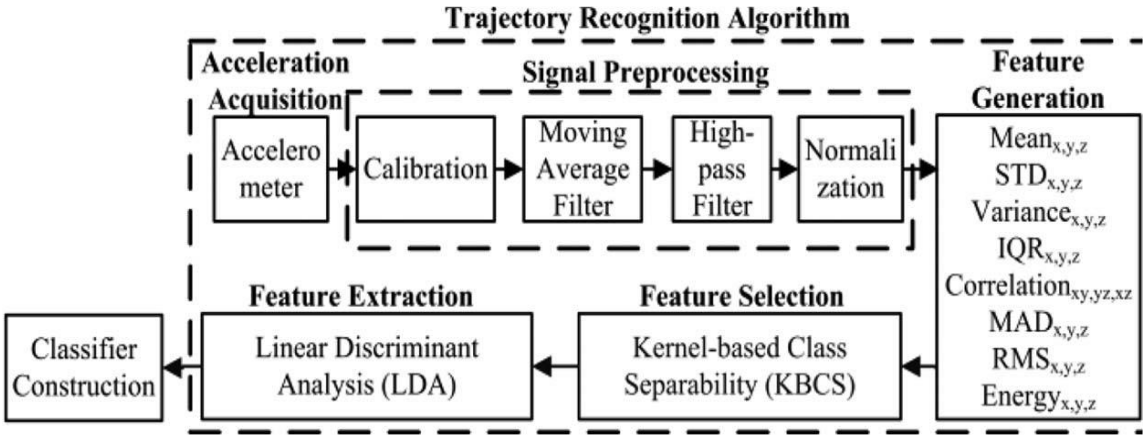

Fig.2 Block diagram of the trajectory recognition algorithm.

1) Signal Preprocessing-Filter out the high-frequency noise of the raw accelerations by the moving average filter and then remove the gravity from the filtered accelerations by a high-pass filter. Finally, normalize each segmented motion interval into equal sizes via interpolation.
2) Feature Generation-By extracting features from the preprocessed *x*-, *y*-, and *z*-axis signals can be obtained the characteristics of different hand movement signals, and we can extract eight features from the triaxial acceleration signals, including Mean, STD, VAR, IQR, Correlation between axes, MAD, RMS, and Energy.
3) Feature Selection- Kernel Based Class Separability (KBCS) can be used when the procedure of feature generation is done, 24 features are then generated. Because the amount of the extracted features is large, we adopt KBCS to select most useful features.
4) Feature Extraction-Linear Discriminant Analysis (LDA) is an effective feature extraction or dimensionality reduction method which uses a linear transformation to transform the original feature sets into a lower dimensional feature space.LDA is to divide data distribution in the different classes and minimize the data distribution of the same class in new space.
5) Classifier Construction-After feature extraction, these reduced features will be fed into the PNN classifier to recognize different hand movements.PNN includes different layer that are following.
5.1) Input layer for convey the input features to the neurons next layer.
5.2) Pattern generation is the next layer and it's divided into small equal parts.
5.3) Third layer is summation layer to produce vector possibilities.
5.4) Fourth layer is decision layer & it's based on the output of all neurons in the summation layer.
After applying the trajectory recognition algorithm, the recognized digit will be displayed on the PC.

V.SUMMARY

The trajectory algorithm can effectively recognize different hand trajectories that can be defined as various commands for Human Computer Interfaces, such as game controller, TV remote control and presentation pointer with motion recognition capability. To reduce the computational load and increase the recognition accuracy of the classifier, we utilize LDA to reduce the dimension of the selected features. The reduced feature vectors are fed into a PNN classifier to recognize the motion to which the feature vector belongs.

REFERENCES

[1]Jeen-Shing Wang and Fang-Chen Chuang, "An accelerometer-based digital pen with a trajectory recognition algorithm for handwritten Digit and gesture recognition", IEEE Trans. Ind. Electron., vol. 59, no.7, july 2012.
[2] Ruize Xu, Shengli Zhou, and Wen J. Li, Fellow, MEMS Accelerometer Based Nonspecific-User Hand Gesture Recognition, IEEE Sensors Journal, vol. 12, no. 5, May 2012.
[3] Y. S. Kim, B. S. Soh, and S.-G. Lee, A new wearable input device: SCURRY, IEEE Trans. Ind. Electron., vol. 52, no. 6, pp. 1490–1499, Dec. 2005.
[4]J. S. Wang, Y. L. Hsu, and J. N. Liu, An inertial-measurement-unit-based pen with a trajectory reconstruction algorithm and its applications, IEEE Trans. Ind. Electron., vol. 57, no. 10, pp. 3508–3521, Oct. 2010.
[5] S. Zhou, Z. Dong, W. J. Li, and C. P. Kwong, Hand-written character recognition using MEMS motion sensing technology, in Proc. IEEE/ASME Int. Conf. Adv. Intell. Mechatron., 2008, pp. 1418–1423.
[6]Z. Dong, U. C. Wejinya, and W. J. Li, An optical-tracking calibration method for MEMS-based digital writing instrument, IEEE Sens. J., vol. 10, no. 10, pp. 1543–1551, Oct. 2010.

