Gesture Recognition using Magic Ring Sensor

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Abstract*—In today's computer era, people used computers for communication purposes. Gesture is one of the most powerful and severe way of communication between computer and human. Gesture Recognition is one type of non-verbal Communication using fingers, palm, face, arms etc. There are multiple techniques for recognizing the gestures. This paper presents a hand gesture interface for executing the commands using dynamic time warping technique. But it is working on only two similar length sequences because of Accelerometer. For large number of gestures, this system does not work well. These limitations can be solved by proposed work.*

Keywords— Accelerometer, Dynamic Time Warping, Gesture Recognition, Magic Ring Sensor, Zigbee.

I. INTRODUCTION

Researchers are very active in the field of Gesture Recognition because people used computers for daily tasks. Gesture is the physical movements of the arms, face, fingers, hands or body to express the idea or meaning [1]. Gesture Recognition enables human to communicate with the machine and interact naturally without any mechanical devices. The main goal of gesture recognition is to create a system which can identify the human gestures to convey some meaningful information [1].

There are mainly three approach of the gesture recognition: Vision based approach, data glove approaches and colored marker approach [2]. In vision based approach, high resolution camera is needed to capture an image. There is no need to create a physical link between human and computer [4]. It is operated in limited range and it does not work well for lighting conditions [2]. In data glove approach, a sensor is used for capturing the image. It provides the exact coordinates of hand and fingers [5]. Range is also not limited. In color marker approach, a glove is worn by human in hand with different colors for tracking the hands. It consists of small region only.

Gesture recognition is widely used for emotion recognition, face recognition, robot control, sign language recognition, for controlling the electronic devices etc.

In the following, earlier works will be reviewed, in the next part proposed system with its flow chart is explained and finally the conclusion is presented.

II. RELATED WORK

In [3], Magic Ring Sensor is used for the capturing the gestures. In this work, five gestures are used: Up, Down, Left, Right and Centre. In magic ring sensor, there are two sensors fitted in it like accelerometer and Zigbee. Two microcontrollers are used in this work: Arduino Nano and PIC microcontroller. Arduino Nano is used at the Transmitter side and PIC Microcontroller is used at Receiver side. DTW algorithm is used for gesture recognition. The flow chart of the system is shown in Fig. 1.

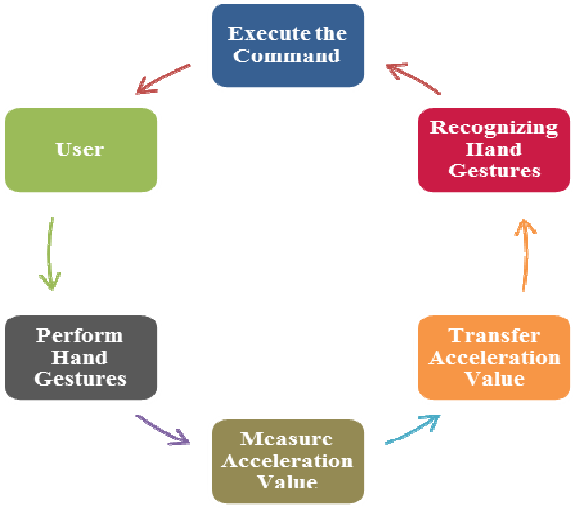

Fig.1: Flow chart of the system [3]

2.1 Steps of Above Flow Chart

In this section, steps of above flow chart are explained in detail.

Step 1: Capturing the Gesture: In [3], Magic Ring Sensor is used for capturing the gesture. In magic ring sensor, there are three devices named arduino nano, accelerometer and Zigbee as a wireless sensor. 9V battery is also connected with the MR sensor for power supply. Arduino Nano is a one type of Microcontroller which is used for serial communication. Arduino nano has much functionality for communicate with any other microcontroller.

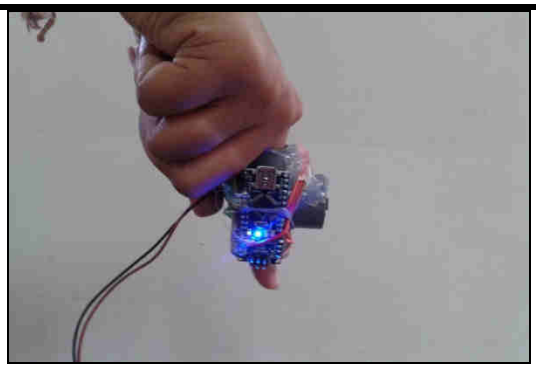

Fig.2: Down Gesture using MR sensor

Step 2: Measure the Acceleration value: for detecting the acceleration value of hands, accelerometer is used. It has two scales (±1.5g and ±6.0g). But ±1.5g is used because it can detect all predefined gestures with high resolution [6]. Movement of the hand is recognized by the accelerometer. X, Y, Z axis are measured by Accelerometer sensor. Exact Coordinates are measured by this sensor.

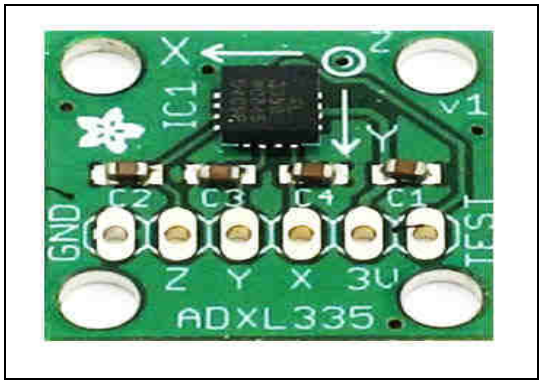

Fig.3: Accelerometer [6]

Step 3: Transmit the value using wireless sensor: As wireless sensor, Zigbee 1124 is used. It is used for the serial data communication and transmitting the acceleration value to the PC at a constant frequency. PIC chip is used at receiver side that receives data from Zigbee.

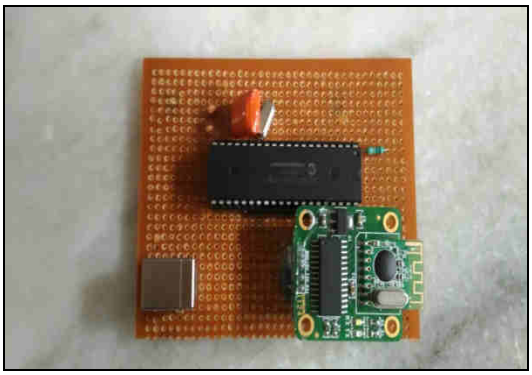

Fig.4: PIC Microcontroller

Step 4: Recognizing Hand Gestures: Acceleration value is used for recognizing the gestures which is already stored in PC [3]. DTW algorithm is used for command mapping. It works by creating a template time series for each gesture that needs to be recognized and then warping the real time signals to each of the templates to find the best match. It generates two different length sequences and then matching process is takes place. DTW distance for determining the gesture is calculated by following equation.

$DTWG(m,n)=DTWX(m,n)+DTWY(m,n)+\mathrm{DTWZ}(m,n)$

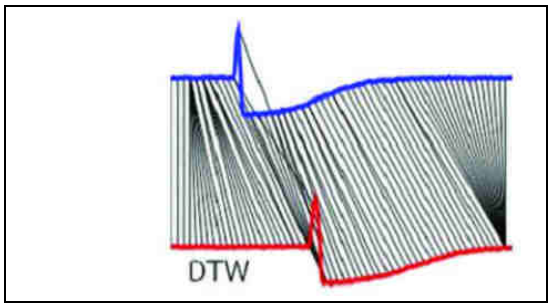

Fig.5: Working of DTW [3]

Step 5: Executing the command: DTW is used for similarity checking. Highest similarity in all results considered as output.Then operation is performed according to the command triggered.

2.2 Results

This part shows the results of the system. Figure shows as we perform the gesture, related command is triggered on the screen. For MR Sensor, ARDUINO software is used for codding and TERMINAL software is used for displaying output. Fig. 6 shows the output of MR sensor. Numeric data are given by MR Sensor as an output. For Gesture Recognition, MATLAB is used. Fig. 7 shows the output of command Execution.

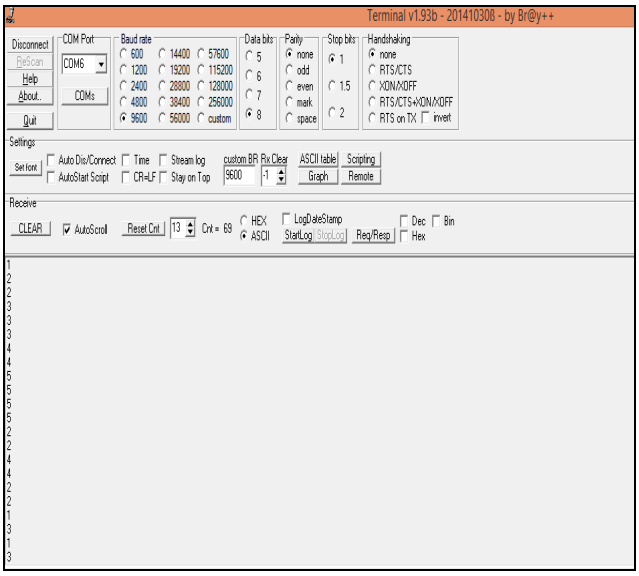

Fig. 6 Results from MR Sensor

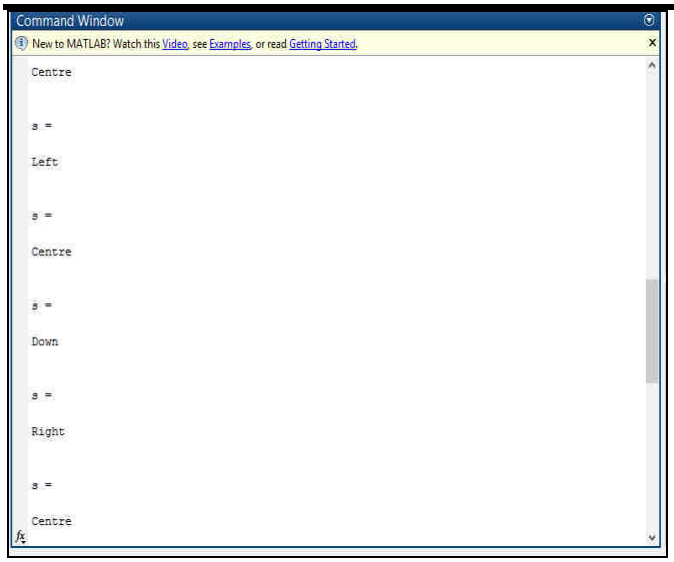

Fig. 7 Output of Command Execution

2.3 Advantages

DTW algorithm is used so the position and trajectories of hand is known to the system. Environment is not limited due to the use of sensor and external noise is opposed by this system. Serial communication is done by system so it has lower overhead and greater throughput. Zigbee is used so we can get the range of 30m for performing the gesture. If the door is closed and we are outside of that room, then also this system works.

2.4 Limitations

This system needs external hardware for capturing an image. It is suitable for only simple and static gestures. It is not work well for Complex gestures. It is expensive due to sensor. It is used for only small projects. Physical connectivity is needed in this system. Whole system is depends on the position of Accelerometer. If it is misplaced then system cannot work properly. Angle of gesture is important in this system.

III. PROPOSED WORK

Instead of sensor, camera is used for capturing an image. Because through sensor, we can work with only limited number of gestures and output is in numerical form. In Gesture Recognition, Feature Extraction is main step. SIFT method is color invariant. So, this work will improve that technique by combining modified SIFT and PCA by taking advantages of both the techniques. Trajectories are very important. So Dynamic Time Warping method is used for recognizing the Gestures. Its application is Sign Language. Blind people can hear the output in English and deaf people can see the output in three languages: Hindi, Gujarati and English. Fig. 8 shows the flow chart of the proposed system.

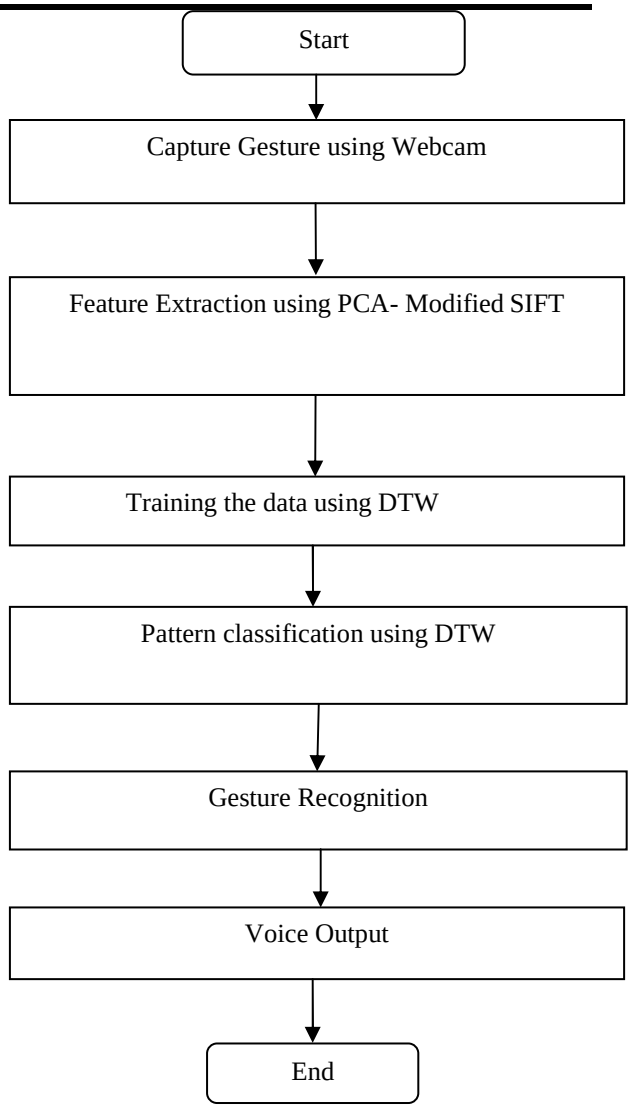

Fig.8: Flow Chart of Proposed System

IV. CONCLUSION

In today's computer era, people used computers for communication purposes. Gesture is one of the most powerful and severe way of communication between computer and human. In this proposed work, physical link is not required between Computer and Human. The main application of this proposed work is Sign Language. By this proposed work, dumb people can listen and deaf people can read output in three different languages: Gujarati, Hindi and English. We can extend this work by adding more languages like Urdu, Marathi etc.

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REFERENCES

[1] Tahani Bouchrika, Mourad Zaied, Olfa Jemai, Chokri Ben Amar, "Neural solutions to interact with computers by hand gesture recognition", Research Groups on Intelligent Machines, University of Sfax, Multimed Tools Appl, Springer, 2013.

[2] Anurag Ranjan, Jeevan M.M, Pankaj Chaudhary, Pavana Swaroopa S, S.KuzhalvaiMozhi, "Hand Gesture Recognition System Using Histogram And Neural Network", International Journal on Recent and Innovation Trends in Computing and Communication", ISSN: 2321-8169, Volume: 3, Issue: 4, 2377 –2382.

[3] Kaoru Yamagishi , Lei Jing , Zixue Cheng , "A System for Controlling Personal Computers by Hand Gestures using a Wireless Sensor Device", School of Computer Science and Engineering , The University of Aizu , Aizuwakamatsu , Japan , IEEE, 2014.

[4] Chetan Dhule, Trupti Nagrare, "Computer Vision Based Human- Computer Interaction Using Color Detection Techniques", 2014 Fourth International Conference on Communication Systems and Network Technologies, IEEE, 2014.

[5] Noor Adnan Ibraheem, RafiqulZaman Khan, "Survey on Various Gesture Recognition Technologies and Techniques", International Journal of Computer Applications (0975 –8887), Volume 50 – No.7, July 2012.

[6] https://www.sparkfun.com/datasheets/components/SMD/a dxl335.pdf