International Journal of Innovative Research in Computerand Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | Impact Factor: 7.488|

||Volume 8, Issue 5, May 2020||

Character Recognition in 3D Space through Gestures

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ABSTRACT: The objective of this paper is to develop a system to make computers capable of learning and recognizing gestures made in the air (3d space) via a handheld remote. The system can be programmed specifically by binding a gesture to a task/automated function and execute it on successful recognition. The MPU-6050 accelerometer sensor installed in the remote with an Arduino board sends a stream of acceleration values recorded in 6 degrees of freedom to the computer via a Bluetooth module when a gesture is drawn. This data is processed using the SVM machine learning algorithm in the computer to learn and recognize the gestures. Throughout ages across many cultures' gestures have been a central feature of human development, non-verbal communication, knowledge etcetera. The role of gesture can have a huge impact on designing and evaluating learning environments, communicating, interacting (for the visually impaired) with computers, and other limitations.

KEYWORDS: Arduino, HC- Bluetooth Module- HC-06, Accelerometer, LED, Switch.

I. INTRODUCTION

The project focuses on Human-Computer interaction which can be channeled using the proposed gesture recognition system to carry out day to day life activities, limitations.

The gesture recognition systems can be broadly classified into two main types viz. Device-based and Vision-based. Device-based systems acquire gestures directly via a physical device that measures the data and characteristics of the gestures and processes it meanwhile Vision-based GRS uses a camera to capture the gestures. The major disadvantage of Vision-based GRS is its high complexity of processing and cost of implementing which makes it economically unsuitable for small scale use. Many Device-based GRS available have a major drawback of flexibility and portability as the majority of them have a constraint of wearing glove which is physically connected to the computer through wires. Hence the proposed system incorporates a Bluetooth device (HC-06) to feed the gesture data directly to the computer over-the-air. The system uses the SVM classifier, a supervised algorithm from the 'scikit learn' python library for the classification of the data collected during the training process, and stores it in all files as predefined gestures. The system accepts and identifies the predefined gestures with similarity matching with the stored data set collected during the training process.

For the scope of the system, it can be implemented for 'slow learners' described as a student with a debility to learn and understand basic and necessary academic skills at a significantly lower rate and depth than the norm of his/her age. Weak comprehensive and contemplating ability with delayed reasoning skills creates difficulty in learning new concepts which creates a huge challenge for the parents and teachers to narrow this gap. Although they have the ability to perform but at a low average level for which they require special teaching techniques.

The proposed technique can be a solution to overcome such challenges of the kids by engaging them into an interactive learning process which will train their poor visual decoding, general coordination deficits (balance, eye-hand)poor auditory memory (difficulty following sequence of directions)attention deficit mixed dominance, lack of adequate eye movement control.

The prototype system is a gesture-recognition based application with on-screen GUI which will display some random alphabetic/numeric characters and the user has to recreate the same i.e. to draw gestures in the air(3-Dimensions) with a handheld remote which will be assessed as per the accuracy. By engaging them to repetitively use their hand, eye, and brain in co-ordination, there will be increased chances of them adapting to the new as well as basic concepts, and with all this being done in an entertaining way will also aid to their attention and concentration skill development.

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II. RELATED WORK

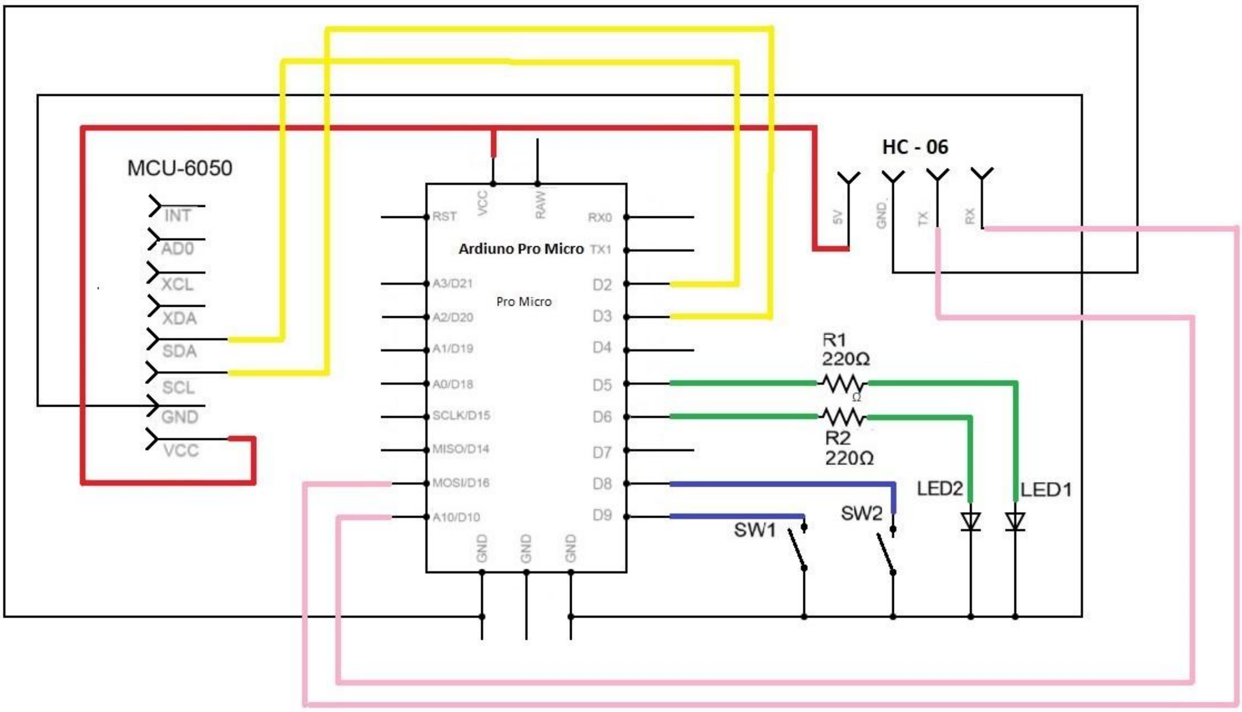

Fig.2.1.Circuit Diagram

Arduino Pro Micro:

Arduino Pro Micro is a microcontroller board based on the ATmega32U4 and it has 20 digital input/output pins of which 7 pins can be used as PWM outputs and 12 pins as analog inputs, a 16 MHz crystal oscillator, a micro USB connection, an ICSP header, and a reset button.
Simply connect it to a computer with a micro USB cable to get started and it is coded to form a gesture database.

Bluetooth Module – HC-05/06:

The Bluetooth module HC-06 has 4 pins, 2 for power and 2 to establish a connection. In this VCC power supply is typically hooked up to 5V pin of the Arduino. Then GND Ground is hooked up to the GND pin of the Arduino and RX reception pin to transmission pin (TX) of the Arduino and TX transmission pin to reception pin (RX) of the Arduino.

Accelerometer – MPU 6050:

The MPU-6050 combines a 3-axis accelerometer and 3-axis gyroscope with an onboard Digital Motion Processor (DMP) packaged in a low-cost GY-521 module. The MPU-6050 is a low-cost accelerometer & gyroscope option for use in applications such as gesture recognition in gaming, self-balancing robots, toys, cell phones, vehicle navigation, fitness monitoring, and similar applications where movement direction can be detected.

Switch:

The switches are used to control device operation and is used for the toggling activation of the sensor and to enable Bluetooth transmission.

III. PROPOSED ALGORITHM

Sci-kit Learn Library:

Scikit-learn is a useful library for machine learning in Python. The Scikit-learn library contains a lot of tools for machine learning and statistical modeling including classification, regression, and clustering.
Scikit-learn is used to build machine learning models and it is not used for reading the data, manipulating, and summarizing it. There are better libraries for that (e.g. NumPy, Pandas, etc.)

Components of sci-kit-learn:

Scikit-learn comes loaded with the following features:
Supervised learning algorithms: If we go into a supervised machine learning algorithm there is a very high chance that it is part of sci-kit-learn. Starting from Generalized linear models (e.g. Linear Regression), Support Vector Machines (SVM), Decision Trees to Bayesian methods – all of them are part of the scikit-learn. The spread of machine learning algorithms is one of the big reasons for the high usage of sci-kit-learn.
Cross-validation: There are various methods to check the accuracy of supervised models on unseen data using sklearn library.
Unsupervised learning algorithms:There is a large spread of machine learning algorithms in the offering – starting from clustering, principal component analysis to unsupervised neural networks.
Feature extraction: Scikit-learn for extracting features from images and text.

Flow Chart:

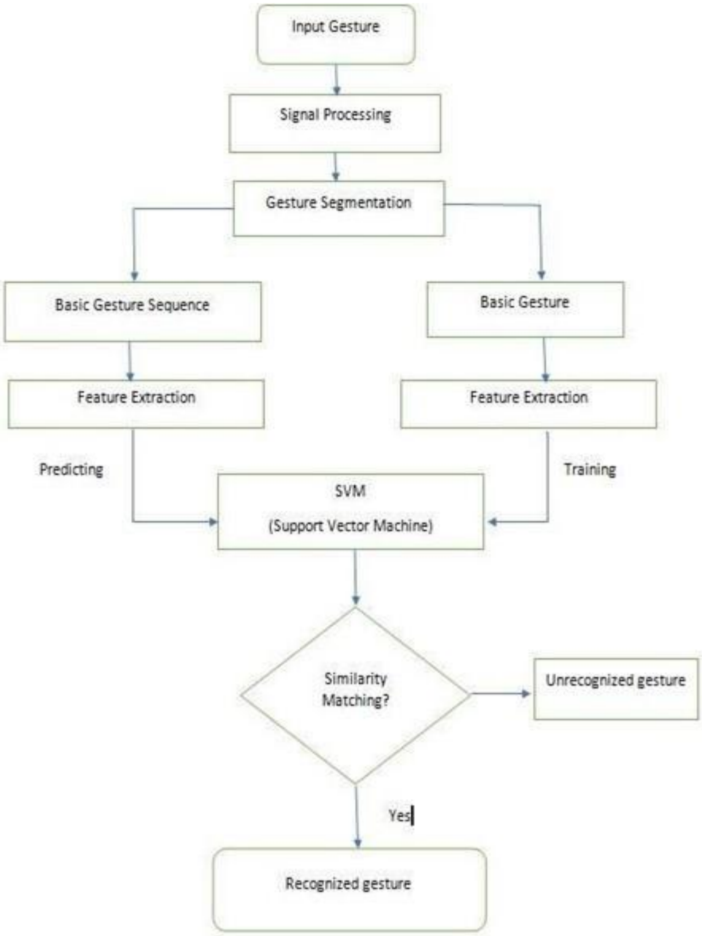

Fig.3.1.Flow Chart

IV. METHODOLOGY

1. Send the Sensor data over serial communication to computer using Bluetooth Module HC- 05 & Interpret the sensors values from serial monitor usingpython
2. Now, Train theData.
3. If the data is not trained then train the databy,

a. Add the sensor values to thedataset

b. Add SVM Classifier to classify sensor values according togestures and Create a Classifier Model and dump in a file.

4. If the data is trainedthen,

a. Load the classifier model from file.

b. Predict the gesture using predict functionclassifier.

c. Convert the predicted number into correspondingcharacter.

d. Display the output on screen using PythonTkinter

V. RESULTS

Initially, the machine won't be knowing anything. The machine has to read the gestures which are made by the device. The gestures are read through the sensor attached to the Arduino and it provides the values. A combination of the sensor values will be used to estimate the path taken by the device while making the gesture. The sensor values will be used to form a data-set. The sensor values will be mapped to the corresponding character which was specified by the user while training the machine and it will be used to predict the character from the gesture made in thin air.
For example, making a 'C' in the air with the device can be mapped to print the letter 'C' on the computer screen. Initially, the user has to train the machine by testing it continuously. Thus, the machine comes to know the gestures required for a particular operation.

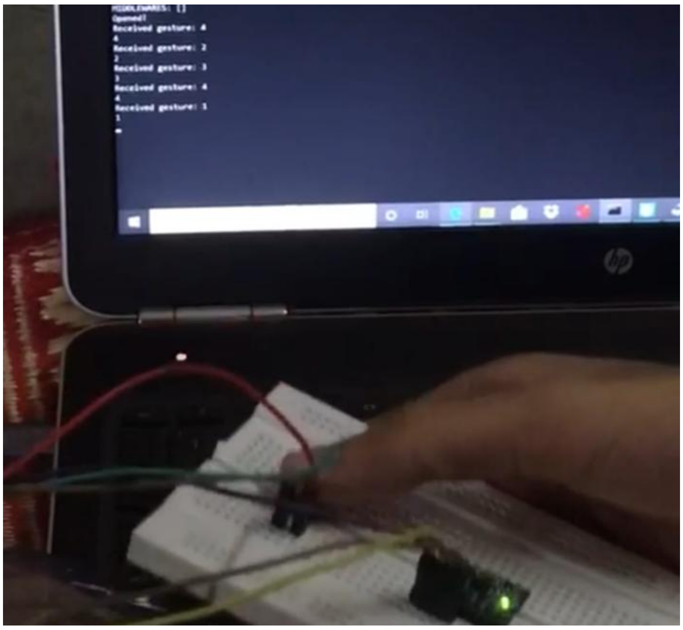

Fig.5.1.Final Output

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VI. CONCLUSION

In this paper, we have portrayed a framework to successfully implement a device-based gesture recognition system. The system has the ability to identify the gestures drawn in the air (3d space) through a motion-sensing handheld device and can be programmed for a lot of applications as discussed above. If the system is to be programmed for a large number of gestures altogether, thorough training will be required to improve the accuracy of the system respectively.

REFERENCES

[1] Zimmerman, T. G., Lanier, J., Blanchard, C., Bryson, S., and Harvill, Y. A hand gesture interface device. SIGCHI Bull. 17,SI (1987),189–192.
[2] R. Cipolla and A. Pentland, Computer Vision for Human-Machine Interaction, Cambridge University Press, 1998, ISBN 978- 0521622530.
[3] Perng, J., Fisher, B., Hollar, S., and Pister, K. Acceleration sensing glove (asg). In Wearable Computers, 1999. Digest of Papers. The Third International Symposium on (1999), pp.178–180.
[4] J. Kela, et al., “Accelerometer-Based Gesture Control for a Design Environment,” Personal and Ubiquitous Computing, Vol. 10, No. 5, 2005, pp.285-299.
[5] Juha K., Panu K., Jani M., Sanna K., Giuseppe S., Luca J. and Sergio D. M. Accelerometer-based gesture control for a design environment, Springer, Finland,2005.
[6] Matthias Rehm, Nikolaus Bee, Elisabeth André, Wave Like an Egyptian - Accelerometer Based Gesture Recognition for Culture Specific Interactions, British Computer Society,2007.
[7] Chen, Q., Georganas, N., and Petriu, E. Real-time vision-based hand gesture recognition using haar-like features. In Instrumentation and Measurement Technology Conference Proceedings, 2007. IMTC 2007. IEEE (May 2007), pp.1–6.
[8] H.Lee,etal.,“Select-and-Point:ANovelInterfaceforMulti-Device Connection and Control Based on Simple Hand Gestures,” CHI 2008, Florence, 5-10 April2008.
[9] T.ShiratoriandJ.K.Hodgins,“Accelerometer-based userinterfacesforthecontrolofaphysicallysimulatedcharacter”, ACM Transactions on Graphics, vol. 27, no. 5, (2008), pp.1–9
[10] S. P. Priyal, P. K. Bora, “A study on static hand gesture recognition using moments”, In Proceedings of International Conference on Signal Processing and Communications (SPCOM), (2010), pp.1-5
[11] Hand gesture computing, Gaurav Pradhan, Balakirshnan Prabhakaran, IEEE Conference ,2011
[12] *Gyro-Accelerometer based control of a robotic Arm using AVR Microcontroller*-The 9th International Forum on Strategic Technology (IFOST), October 21-23, 2014, Cox’s Bazar,Bangladesh.
[13] Accelerometer based Wireless Air Mouse using Arduino Micro-controller Board - Proceedings of 2015 Global Conferenceon Communication Technologies(GCCT 2015).
[14] Cost-effective hand gesture computer control interface7th IEEE International Conference on Cognitive Infocommunications (CogInfoCom 2016) • October 16- 18, 2016 • Wrocław,Poland.