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Image processing and Controller Based Game Play Using Hand Gestures

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***Abstract*—** Hand gesture is one of the most primitive ways of communication and is an area of dynamic examination for computer based vision and AI. This is a zone with numerous potential applications, giving clients a simpler and extra normal approach to speak with robots/system interfaces, without the need of any additional gadgets. In this way, the main objective of hand gesture recognition connected to Human-Computer Interaction (HCI) is to shape frameworks, which may decide explicit human motions and use them to pass on data and control gadgets. For that, vision-based hand gesture interfaces need fast signal acknowledgments continuously. This paper proposes the utilization of hand gestures and the utilization of three dimensional (3D) pivot of hand motions as the reason for clients to communicate with a computer. This paper presents strategies for Game Play utilizing both Image Processing strategy and Arduino combined with a sensor.

***Keywords*—** Gesture recognition, Image processing, Feature extraction, Human Computer Interaction, MATLAB, Controller, ADXL335 Accelerometer

I. INTRODUCTION

Human Computer Interaction (HCI) is the solution for our technically knowledgeable world. We need to style such a framework which may watch explicit hand signals and use them to pass on the learning. A client can demonstrate his/her hand playing out a particular motion before a web camera that is associated with a PC. At first, we catch the hand signal of a client and store it as input data. A hand motion acknowledgment framework gives a characteristic, nonverbal method for correspondence. The objective of signal acknowledgment [2] is to shape a framework that sees the human hand motions and use them to pass on the information. Constant vision-based hand signal acknowledgment is considered to encourage a great deal of conceivable advances for Human-Computer Interaction with the help of most recent development highlights of MATLAB, inside the field of PC vision and Artificial Intelligence.

1. Image processing

It is a method that is used to change a picture into input signals and perform activities on it to get an improved picture or attain some valuable data from it. Changes in pictures are generally performed consequently and depend on deliberately structured image processing calculations. Image processing provides additional functionalities to various parts of science including arithmetic, Material science, optical and electrical designing using Image processing techniques. Different steps concerned in image processing utilizes optical scanner or a photographic camera, to analyse and manipulate the image (data compression, image enhancement and filtering), and generate the desired output image.

The need to remove data from pictures and translate them been the driving variable in case of Image processing. Image processing has discovered use in various industries, including drug, military, and customer gadgets, etc. In medication, it is utilized for analytic imaging modalities like PET, CAT, MRI and functional-MRI. Mechanical applications have incorporated assembling frameworks, for example, security system, quality control and automated guided vehicle control. Complex image processing algorithms utilized in applications include Biometric methods like fingerprinting, face, iris and hand acknowledgment are being utilized widely in law enforcement and security. Digital cameras and camcorders, HD TVs, screens, DVD players, video recorders and mobile phones are some frequently used customer gadgets that utilize image processing.

2. MATLAB

MATLAB, a shortened form for â€˜matrix research facility, a stage for taking care of numerical and logical issues. It is a counterfeit language created by Math Works that permits network controls, capacities and information plotting, calculation execution, UI creation and interfacing with projects sent in programming dialects like C, C++, and Java, etc. In MATLAB, the IPT is an accumulation of capacities that broadens the ability of the MATLAB numeric figuring condition. It gives a far reaching set of reference-standard

calculations and work process applications for picture process, investigation, and perception and calculation advancement. It tends to be utilized to perform picture division, geometric changes, picture enlistment, picture upgrade, commotion decrease and 3D picture handling activities.

A large number of the IPT capacities bolster C/C++ code age for work area prototyping and implanted vision framework readiness.

II. RELATED WORK

We have analysed various image processing papers and methods where game play is achieved through various sensors. We have used accelerometer as the primary sensor while implementing our project. Also the implementation of both image processing and hardware based sensor has allowed us to analyse the difference in the response time of both the methods, thus helping us to find an efficient way to implement Game play using Hand Gestures. In [17] it introduced the static hand signal acknowledgment framework utilizing computerized picture preparing. For hand signal element vector SIFT calculation is utilized. The SIFT highlights have been registered at the edges which are invariant to scaling, pivot, expansion of commotion. In [18]: it displayed different technique for hand motion and communication through signing acknowledgment proposed in the past by different analysts. For people who find it difficult to hear and are unable to speak, Sign language is the main method for correspondence. With the assistance of communication through signing, these individuals can express their feelings and intentions to other individuals.
In [19] it displayed the ongoing innovative work of gesture based communication dependent on manual correspondence and non-verbal communication. Gesture based communication acknowledgment framework normally expand to three stages: Pre Handling, Extraction and Order. Grouping strategies utilized for acknowledgment are Neural Network (NN), Support Vector Machine (SVM), Hidden Markov Models (HMM) etc.

In [20] they used audit signal framework with its point just as they clarified focal points and drawbacks of framework. They additionally had given key issues its difficulties. Audit strategies for late stances and signals acknowledgment. In [21] they displayed strategy to distinguish hand motions dependent on PC vision methods, an execution works continuously six motions caught through a standard webcam. Strategy joins skin color sifting, edge identification, curved structure calculation.

In [22] hand signals are utilized to control the power point introduction. This framework doesn't require any database to store pictures of motions.

In [23] they present motions for controlling MS Power point and VLC media player. This application utilizes OpenCV in MS Visual Studio 2010.
In [24] they actualized framework with C++ with the utilization of OpenCV inbuilt libraries. Motions like punch, snatch, push ahead, and are utilized to control virtual diversion.

III. METHODOLOGY

We are using Image processing and also Arduino based hardware techniques to create a game play. This is used as an alternative for keyboards and mouse that are typically used to play games on a computer.
Image processing uses specific algorithms to help us communicate with the computer by converting a digital image into its corresponding input signal, which then is used to communicate with the system.

- ➔ Convert images into corresponding digital signals.
- ➔ Removes noise and other factors associated within the images.
- ➔ Extracts the topography, image size & scale, and also manipulates the number of objects in a scene.
- ➔ Compresses the images for displaying and communication across a network.

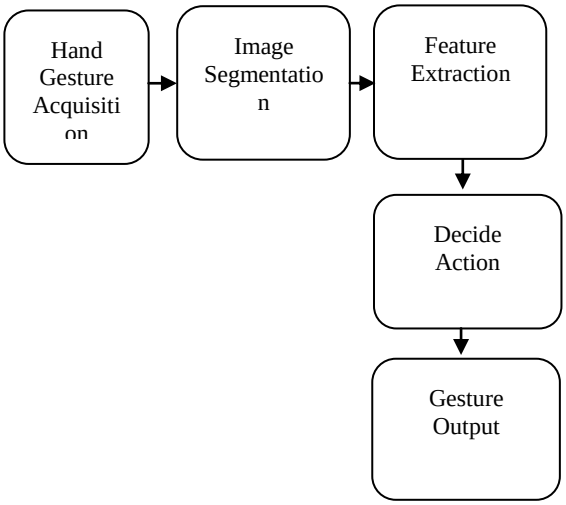

Figure 1: Flow Diagram of Image Processing

1. Hand image acquisition
Image acquisition is to acquire a digital image. It is typically finished with the assistance of image-frame grabber. An image-frame grabber can be portrayed as a GUI or interface which enables client to take previews by instating the camera equipment and trigger physically for taking snaps.

2. Hand gesture segmentation
In this progression, those regions in the picture which outlines the profile of the hand is isolated from the image background by applying diverse methodologies utilizing

distinctive shading models [3]. Utilizing diverse shading models helps in looking at the proficiency of division on premise of models separately.

3. Feature extraction

This is a dimensionality reduction method that shows a picture as a smaller component vector. This methodology can be utilized when picture sizes are substantial and a decreased component portrayal is required to finish assignments, for example, picture coordinating and recovery. Highlight identification, include extraction, and coordinating are frequently consolidated to tackle normal PC vision issues, for example, object discovery and acknowledgment, content-based picture recovery, face location and acknowledgment, and surface characterization.

The most fundamental step in hand gesture recognition is Feature Extraction. This step extracts important features after hand tracking and segmentation has been carried out successfully. This step helps in data dimensionality reduction. Feature extraction is very crucial to hand gesture recognition performance. The most significant decisions in the design of gesture recognition system is the selection of appropriate features and feature extraction methods. The feature vectors are obtained in this step. Various feature extraction techniques are Fourier descriptors [4], Hierarchical centroid [5], PCA, Hu Invariant Moment [6], Structural shape descriptors [6], etc. Point of this progression is to infer conceivable measure of highlights out of the fragmented hand outline, so as to separate the distinctive motions. The output of the previous stages is used to convert them into binary images and these are further used for image standardization.

4. Classification

By this progression we finish up analyzing the hand gesture and by applying appropriate coordinating strategy results, based on database pictures. For productive coordinating calculation we can actualize neural systems, chain coding, or can characterize calculation which is equipped for bringing best counterpart for the info one. Here fundamentally using the data provided we are able to classify the image into a certain category. Based on this categorization further action can be taken like processing the image or choosing the course of action that has to be taken for our desired output.

5. Gesture output

After the entire image processing data is acquired, we find a suitable course of action that has to be taken and then launch the application.

6. Hand Gesture using Controller and a sensor

In Controller based approach we use an Arduino Leonardo microcontroller board based on the ATmega32u4.the sensor used is ADXL335 Accelerometer.

7.Arduino Leonardo

The Arduino Leonardo is a microcontroller board. It has 20 I/O pins, a 16 MHz crystal oscillator, micro USB connection, power jack, ICSP header, and a reset button. It has everything that is needed to support the microcontroller, connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The board differs from all preceding boards in ways that the ATmega32u4 has built-in USB communication, eliminating the need for a secondary processor. This allows the Leonardo to connect to a computer as a mouse and keyboard, in addition to a virtual (CDC) serial / COM port. It also has other implications for the behaviour of the board.

8. ADXL335 Accelerometer

An accelerometer sensor measures the acceleration caused due to gravity. It is typically used in applications where the tilt action resulting from motions along the three dimensional axis is considered. This data is communicated via the accelerometer sensor.

- The O/P signals are proportional with respect to acceleration and analog voltages.

Circuit Diagram

Figure 2 is a circuit diagram for the ADXL335 and Figure 3 is Controller, based on the motion of hand it sends out values to controller, the controller assigns/classify based on the coordinates of the values obtained and passes the controller to keyboard. Which in turn control the Key movements for Arrow keys like UP, DOWN, RIGHT and LEFT. Which controls the racing car game whose controls depends on Arrow Keys.

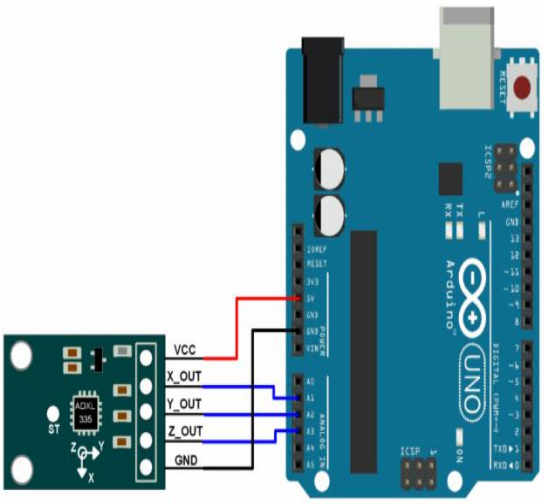

Figure 2: Circuit diagram for the ADXL335

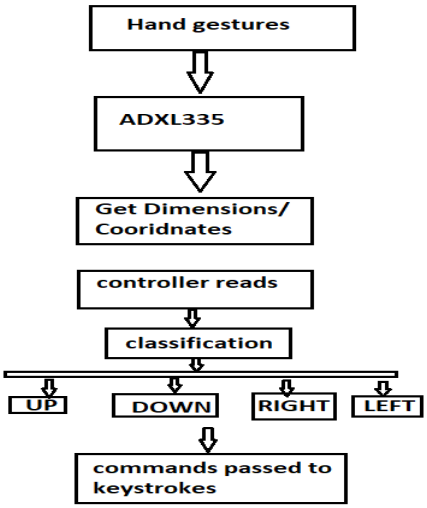

Figure 3: Controller

IV. RESULTS AND DISCUSSION

Following are the results snap shots of both MATLAB (Figure 4) and controller (Figure 5 and Figure 6):

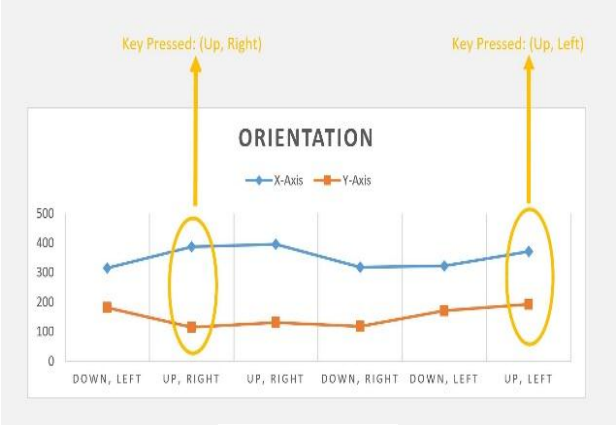

Figure 4: Matlab

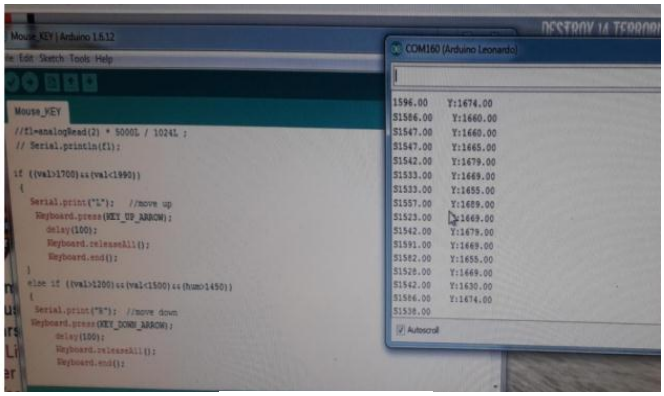

Figure 5: Controller

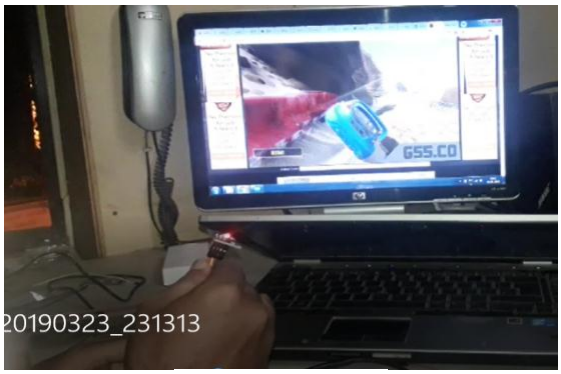

Figure 6: Gameplay

V. CONCLUSION AND FUTURE SCOPE

It was observed that in both methods i.e. Image processing and controller based we could achieve the hand movements and translated to different keystrokes using robotic libraries. We found that using sensor based the response was quicker compared to image processing based, the reason being it took time taken to process the image was more, where as in the sensor based he response was way better than image processing. Image processing technique of game play could be enhanced by using more optimised algorithms as computer vision based interactions are going to be the future in comparison to hardware sensor based.

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