Project Report

On

DEVICE CONTROL THROUGH HAND GESTURES

In partial fulfillment of requirements for the degree

Of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE & ENGINEERING

Submitted by:

AKASHDEEP SINGH KHANUJA [17100BTIT01419]

JAYANT GAWALI [17100BTCSE01231]

HEMANT BHATI [17100BTCSE01226]

MIHIR SONI [17100BTCSE01237]

Under the guidance of

DR. ABHISHEK SINGH RATHORE

SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE

SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

JULY-DEC 2020

SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE
SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

DECLARATION

We here declare that work which is being presented in the project entitled "**DEVICE CONTROL THROUGH HAND GESTURES**" in partial fulfillment of degree of **Bachelor of Technology in Computer Science & Engineering** is an authentic record of our work carried out under the supervision and guidance of **DR. ABHISHEK SINGH RATHORE** Department of Computer Science & Engineering. The matter embodied in this project has not been submitted for the award of any other degree.

Akashdeep Singh Khanuja

Jayant Gawali

Hemant Bhati

Mihir Soni

Date : 10/12/2020

SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE
SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

PROJECT APPROVAL SHEET

Following team has done the appropriate work related to the "**Device Control Through Hand Gestures**" in partial fulfillment for the award of **Bachelor of Technology in Computer Science & Engineering** of "SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY" and is being submitted to SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE.

Team:
1. Akashdeep Singh Khanuja
2. Jayant Gawali
3. Hemant Bhati
4. Mihir Soni

Internal Examiner **External Examiner**

Date: 10/12/2020

SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE
SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CERTIFICATE

This is to certify that **Mr. Akashdeep Singh Khanuja**, **Mr. Hemant Bhati**, **Mr. Jayant Gawali and Mr. Mihir Soni** working in a team have satisfactorily completed the project entitled "**DEVICE CONTROL THROUGH HAND GESTURES**" under the guidance of Dr. **ABHISHEK SINGH RATHORE** in the partial fulfillment of the degree of **Bachelor of Technology in Computer Science & Engineering** awarded by SHRI VAISHNAV INSTITUTE OF INFORMATION TECHNOLOGY affiliated to SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE during the academic year **July 2020-Dec 2020**.

DR. ABHISHEK SINGH RATHORE
(Project Guide)

Prof. Chetan Chauhan
(Project Coordinator)

Dr. Anand Rajavat
(Director & Head, Department of Computer Science & Engineering)

ACKNOWLEDGEMENT

We are grateful to a number of persons for their advice and support during the time of complete our project work. First and foremost our thanks goes to **Dr. Anand Rajavat** Head of the Department of Computer Science & Engineering and **Mr. Abhishek Singh Rathore** the mentor of our project for providing us valuable support and necessary help whenever required and also helping us explore new technologies by the help of their technical expertise. His direction, supervision and constructive criticism were indeed the source of inspiration for us.

We would also like to express our sincere gratitude towards our Director **Dr. Anand Rajavat** for providing us valuable support.

We are really indebted to **Prof. Chetan Chauhan,** project coordinator for helping us in each aspect of our academics activities. We also owe our sincere thanks to all the **faculty members** of the Computer Science & Engineering Department who have always been helpful.

We forward our sincere thanks to all **teaching and non-teaching staff** of the Computer Science & Engineering department, SVVV Indore for providing necessary information and their kind cooperation.

We would like to thanks our parents and family members, our classmates and our friends for their motivation and there valuable suggestions during the project. Last, but not the least, we thank all those people, who have helped us directly or indirectly in accomplishing this work. It has been a privilege to study at SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE.

ABSTRACT

There are many hardware devices used today for controlling system operations (like mouse, keyboard etc.). This project is made to change the idea of system control that is to bring a change in conventional way of controlling the systems. This will be done by introducing a new way of controlling systems through hand gestures.

These hand gestures will be recognized by camera and will be stored in a dataset and accordingly operations that are to be performed will be linked with it. That is there will be a particular gesture for each and every action that is to be taken. After this we will train the systems as per the data stored. During the time of implementation, the system will detect the gestures through the camera and will act accordingly.

The main aim of the project is to give a better user experience by providing him a new way of controlling the system by hand gestures. This will improve his experience in many domains like gaming, presentations, watching movies, listening music, reading text etc. Experience in each of these domains can be improved like in gaming if one can control using his hands instead of a mouse then it will make the came more interactive than before. Similarly if one needs to watch movies or listen to music it is more convenient for him/her to perform operations like forwarding the video, increasing volume, pause the video through hand gestures then through mouse or keyboard as it will be more easy and continental.

TABLE OF CONTENTS

CHAPTER 1 – INTRODUCTION

1.1 Introduction

Sometimes it is very inconvenient to deal with physical controls of devices and most of the time we are in such a situation where we can't able to access device controls physically. Also users feel less emerging experience while playing game using basic device controls. In this situation, to improve user experience with device, there should be functionality which enables users to control device without interactive with physical hardware.

There is always a need and a scope of growth in every domain. Similarly, there is a scope of improvement in domain of system controls. This improvement can be done by replacing the systems like mouse and keyboard with something like camera which could recognize the hand gestures to perform basic operations

Hence, controlling device using Hand Gestures, kind of such solutions we are creating, under which we going to design a model which is used to control the device screen through hand gestures which provides user ease access or interaction to device screen.

1.2 Problem Statement

Sometimes it is very inconvenient to deal with physical controls of device and most of the time we are in such a situation where we can't able to access device controls physically. Also users feel less emerging experience while playing game using basic device controls.

In this situation, to improve user experience with device, there should be functionality which enables users to control device without interactive with physical hardware. Hence, controlling device using Hand Gestures, kind of such solutions we are creating, under which we going to design a model which is used to control the device screen through hand gestures which provides user ease access or interaction to device screen. For example

1) In Gaming area user can control the game movements through hand gestures which indirectly provide the practical experience of game.

2) When a user is giving presentation, he can control the device through its hand gestures and continue its presentation without movement from its place or without touching its device, etc.

1.3 Need for the proper System

There is always a need and a scope of growth in every domain. Similarly, there is a scope of improvement in domain of system controls. This improvement can be done by replacing thesystems like mouse and keyboard with something like camera which could recognize the handgestures to perform basic operations.Bringing change in this domain is important as there are some of the problems with usingcontrols like mouse which can be resolved by our project For example-

• They need a flat space close to the computer:

As we all know mouse require a flat surface or a mouse pad to work efficiently absence of which can ruin your experience. For example- if you are playing a game that require mouse control and you do not have flat base under your mouse then you may not get a good experience. If we use hand gestures instead of mouse then we do not require a mouse pad or a flat surface along with this controlling the game with hands will make the game more interactive and real.

• If the battery wears out in a wireless mouse, it cannot be used until it has been replaced:

It is a frustrating situation if your mouse stops working due to any physical damage or a battery wear out. This may become even more frustrating when you are giving an important presentation and your controls are not working properly. Also the mouse that are connected with the systems through cables also cause problems if they are not connected properly or if the cable breaks. This problem can also be solved as the integrated webcam in laptops do not require any extra battery and also it is internally connected with the systems. The web cam used in the desktops are also efficient as they are fixed at one place and need not to move while giving commands this will prevent it from damage and getting disconnected. We will proceed in project in following way-We will first specify hand gestures corresponding to operations performed in system .These hand gestures will be recognized by camera and will be stored in a dataset and accordingly operations that are to be performed will be linked with it. That is there will be a particular gesture for each and every action that is to be taken .After this we will train the systems as per the data stored. During the time of implementation the system will detect the gestures through camera and will act accordingly.

1.4 Objective

To improve user experience with devices, there should be functionality which enables users to control devices without interacting with physical hardware. Hence, controlling devices using Hand Gestures, kind of such solutions we are creating, under which we are going to design a model which is used to control the device screen through hand gestures which provides user ease access or interaction to device screen.

1.5 Modules of the system

1. Data set generation module.

This module is dedicated to generate required patterns and datasets for training models. This model is based on convolutional neural networks, and requires different datasets (images) of hand gestures from different angles. This module is completely responsible for producing the required number of datasets.

2. Training module.

In this module, our deep learning model is getting trained by given datasets. This training module make sure to train model in a way that it should give accurate and quick results.

3. Testing module.

This module is basically to test different models generate by training module. In this testing model which is giving accurate and quick results will be select to integrate in the tool.

4. Main module.

This module is main, i.e. in this module, tool execution will be live and it is going to be completely deployed. This module is responsible for the fundamental workflow of the tool. This is again generalized in some sub-modules –

- **Frame Input module**

  This module is to handle frames from the camera and apply some filters and suitable operations on the frame for the next module.

- **Gesture prediction module/Identification.**

  In this module the input frame will be predicted and gesture will be identified from the given frame.

- **Device Control Module**

  According to the input gesture Device Control Module handles the control corresponding to the gesture.

1.6 Scope

It facilitates the user to give command for performing simple operations like moving the mouse pointer, dragging and dropping files, and controlling device through hand gestures. Especially in the field of :-

1. Gaming: It gives real time experience of gaming without the use of external input controls and only hands and fingers , with a working Camera are enough.

2. Presentation: Many times we need to switch ppt and we have to go to laptop/pc and change it here this project comes to the rescue.

3. All control based utilities: It would be able to take control over all types of device activities which is being done by physical controls.

CHAPTER 2 - LITERATURE SURVEY

2.1 Existing System

In recent decades, due to computer software and hardware technologies of continuous innovation and breakthrough, social life and information technology have a very close relationship in the twenty-first century. In the future, especially the interfaces of consumer electronics products (e.g. smartphones, games and infotainment systems) will have more and more functions and be complex. How to develop a convenient human-machineInterface (HumanMachine Interaction/Interface, HMI) for each consumer electronics product has become an important issue. The traditional electronic input devices, such as mouse, keyboard, and joystick are still the most common interaction way. However, it does not mean that these devices are the most convenient and natural input devices for most users. Since ancient times, gestures are a major way for communication and interaction between people. People can easily express the idea by gestures before the invention of language. Nowadays, gestures still are naturally used by many people and especially are the most major and nature interaction way for deaf people

In recent years, the gesture control technique has become a new developmental trend for many human based electronics products, such as computers, televisions, and games. The objective of this model is to develop a real time hand gesture recognition system based on adaptive color HSV model and motion history image (MHI). By adaptive skin color model, the effects from lighting, environment, and camera can be greatly reduced, and the robustness of hand gesture recognition could be greatly improved.

2.2 Proposed System

Most gesture recognition methods usually contain three major stages. The first stage is the object detection. The target of this stage is to detect hand objects in the digital images or videos. Many environment and image problems are needed to solve at this stage to ensure that the hand contours or regions can be extracted precisely to enhance the recognition accuracy. Common image problems contain unstable brightness, noise, poor resolution and contrast. The better environment and camera devices can effectively improve these problems. However, it is hard to control when the gesture recognition system is working in the real environment or is become a product. Hence, the image processing method is a better solution to solve these image problems to construct an adaptive and robust gesture recognition system. The second stage is object recognition. The detected hand objects are recognized to identify the gestures. At this stage,

differentiated features and effective classifiers selection are a major issue in most researches. The third stage is to analyze sequential gestures to identify users' instructs or behaviors.

2.3 Feasibility Study

Feasibility Study in Software Engineering is a study to evaluate feasibility of a proposed project or system. Feasibility study is one of the four stages of Software Project Management Process. As the name suggests feasibility study is the feasibility analysis or it is a measure of the software product in terms of how much beneficial product development will be for the organization in a practical point of view. Feasibility study is carried out based on many purposes to analyze whether software products will be right in terms of development, implantation, contribution of project to the organization etc.

2.3.1 Technical Feasibility

- Since this project is being developed under technology that is stable and established.
- The technology chosen for software development has a large number of users because it uses only cameras and some well known libraries which are easily available.

2.3.2 Economical Feasibility

- This project require working camera for its functioning, which is affordable by almost every user which uses software.
- This project uses open-source APIs and libraries, so it is completely economically affordable.

2.3.3 Operational Feasibility

As this project is based on machine learning and deep learning, so there is no other operation demands that aren't feasible. We have all resources available to accomplish this project's requirements.

CHAPTER 3 – REQUIREMENTS ANALYSIS

3.1 Method used for Requirement analysis

Requirements convey the expectations of users from the software product. The requirements can be obvious or hidden, known or unknown, expected or unexpected from client's point of view.
Requirements Elicitation is the process to find out the requirements for an intended software system or a product/model by communicating with client, end users, system users and others who have a stake in the software system development.

There are various requirement methods like Interviews, Surveys , Questionnaires, Task analysis, Domain Analysis, Brainstorming, Prototyping,etc which are used to take the requirements or do requirement analysis from user or client.

Methods which are used to do requirement analysis in our model are –

1. Story Telling –

The Participants tend to tell stories rather than requirements; it is human nature. For most people, storytelling implies sharing their own experiences and allowing others to be enlightened through them or sharing what they have learned. Story is the most powerful means of communicating a message. People tell stories because it is a part of human nature; we like to tell stories, read books, dramatize TV, cinema, etc.

Stories are factual and a great source of information; however, they are unstructured. The narrative aspect of the story sometimes makes it long. However, people have different storytelling styles; for example, some will get right to the point of the story, making the life of a business analyst easy, while others may go on unendingly.

Stakeholders prefer telling stories rather than coming straight to the point. This is because we relish the opportunity to be acknowledged and understood.
In the requirements elicitation context, business users tell stories because they like to be heard and understood. They also try to detail out the things that they do as a part of their daily routine, which may at times involve sharing of vivid experiences, their pain, highs and lows in life, etc. Story, they believe, is the most suitable medium to make one understand their plight.

2. Brainstorming -

An informal debate is held among various stakeholders and all their inputs are recorded for further requirements analysis.

- It is a group technique
- It is intended to generate lots of new ideas hence providing a platform to share views
- A highly trained facilitator is required to handle group bias and group conflicts.

- Every idea is documented so that everyone can see it.
- Finally a document is prepared which consists of the list of requirements and their priority if possible.

3. Pen and Paper

In this technique with the help of pen and paper all the requirements are taken from user and written on paper with the help of pen for future changes and needs. According to user need if some requirement we have to change or update then we can do that easily with pen and paper but in this we have to maintain pen and paper to keep user requirements safe.

3.2 Data Requirements

The experiments on the data set of images show that our method performs well and is highly efficient. Initially to train this project's model and test we require some images of hand gestures.

3.3 Functional Requirements

The functional requirements of this project are as follows:

1) When user want to control the device screen through Hand Gesture then user should be able to start the application. When user want to control the device screen through hand gesture then user should be able to do that.

2) Our model should control the device screen by proper tracking through hand gesture. Model should be create in a way that by moving our hand in front of camera our model should be able to capture that hand or track that hand properly which controls the device screen.

3) Our model should be able to move the cursor or track the mouse pointer through hand properly.With the help of hand gesture we should be able to track the mouse pointer so that wherever we want us to go on screen we can go with the help of our hand gesture over device screen.

4) Our model should be able to perform clicks on screen after tracking our hand properly. Our model should be able to perform clicks like left click , right click, and double click on screen through hand gestures.

Left Click:- Just like the mouse left click works similarly with the help of hand gesture we should be able to perform left click on device screen through our hand gesture.

Right Click:- Just like the mouse right click works similarly with the help of hand gesture we should be able to perform right click on device screen through our hand gesture.

Double Click:- Just like the mouse double click works similarly with the help of hand gesture we should be able to perform left click on device screen through our hand gesture.

5) Our model should be able to perform cut-copy-paste operation on screen through hand properly. Our model should be able to perform cut-copy-paste operation with the help of hand gesture. Just with the single gesture our model should be able to do copy operation and wherever we want to do paste operation we should be able to do it by proper maintaining of our hand gesture over screen.

6) We should be able to control the model/application by exiting the application. A hand gesture should be maintained or created properly so that user can exit from the application after this no hand gesture should be recognized.

3.4 Non Functional Requirements

1) Scalability:-

Software scalability is an attribute of a tool or a system to increase its capacity and functionalities based on its user's demand. Scalable software can remain stable while adapting to changes, upgrades, overhauls, and resource reduction.

2) Security:-

Software security is an idea implemented to protect software against malicious attack and other hacker risks so that the software continues to function correctly under such potential risks.

3) Usability:-

Usability is the degree to which a software can be used by specified consumers to achieve quantified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use.

4) Availability:-

Availability is defined as the probability that the system is operating properly when it is requested for use. In other words, availability is the probability that a system is not failed or undergoing a repair action when it needs to be used.

5) Reliability:-

Reliability is the probability of failure-free software operation for a specified period of time in a specified environment. Software Reliability is also an important factor affecting system reliability.

6) Usability:-

Usability is the degree to which a software can be used by specified consumers to achieve quantified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use.

3.5 System Specification

3.5.1 Hardware specification

The hardware environment in this system will use computer systems along with camera which will record the hand gesture first and then will use it in performing operations. We are not using any kind of sensors in this project due to following reasons-

- It will increase the cost of project.
- Scanners are difficult to handle and can't be controlled by everyone.

3.5.2 Software Specification

The system will use:

1) Webcam Based Scanner.:

The system must have a working webcam so that system able to detect hand gestures and perform action according to hand gesture on system.

2) Anaconda(Jupyter Notebook):

Anaconda is a conditional free and open-source distribution of the Python and R programming languages for scientific computing, that aims to simplify package management and deployment.

The Jupyter Notebook application allows you to create and edit documents that display the input and output of a Python or R language script. Once saved, you can share these files with others.

3) Python.

Python is an interpreted, high-level and general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace.

Python is a general-purpose coding language—which means that, unlike HTML, CSS, and JavaScript, it can be used for other types of programming and software development besides web development. That includes back end development, software development, data science and writing system scripts among other things.

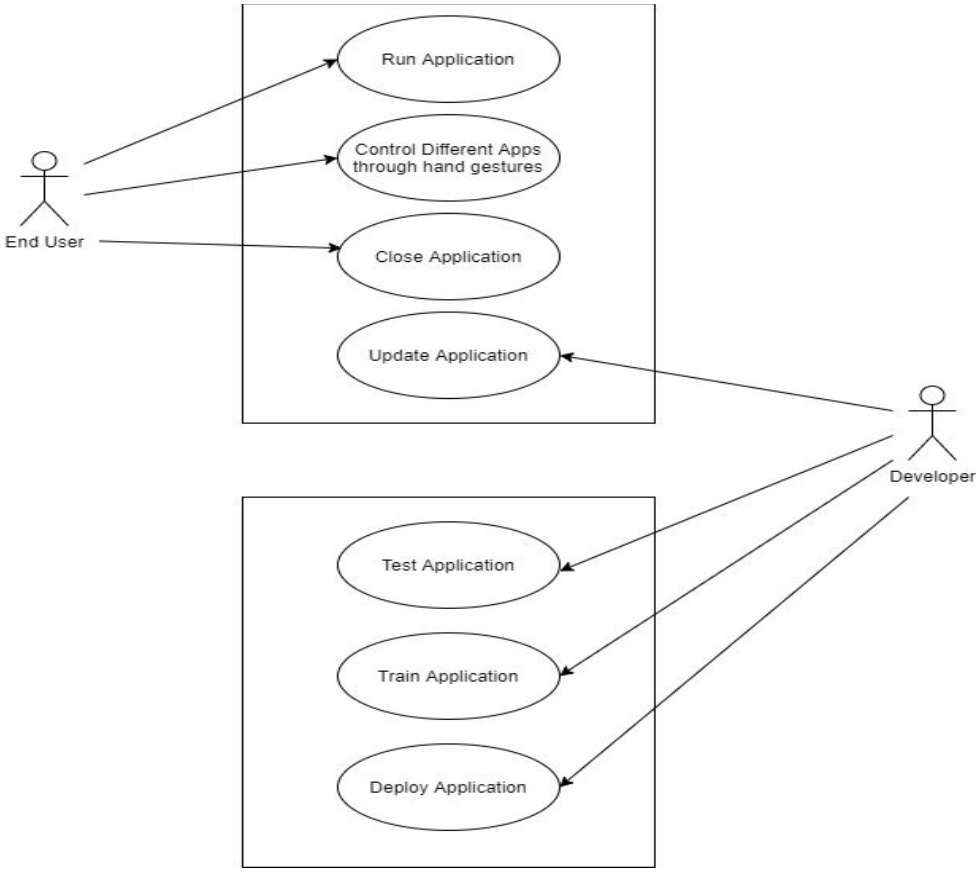
4) Open CV

OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez. The library is cross-platform and free for use under the open-source Apache 2 License.

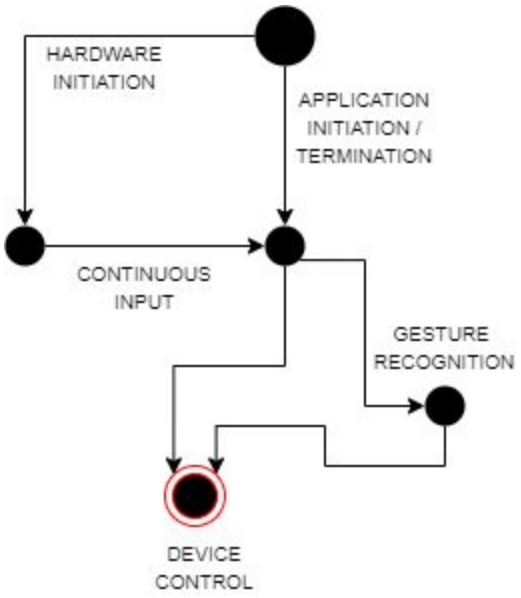
CHAPTER 4 – DESIGN

4.1 Software Requirements Specification

4.1.1 Use Case Model

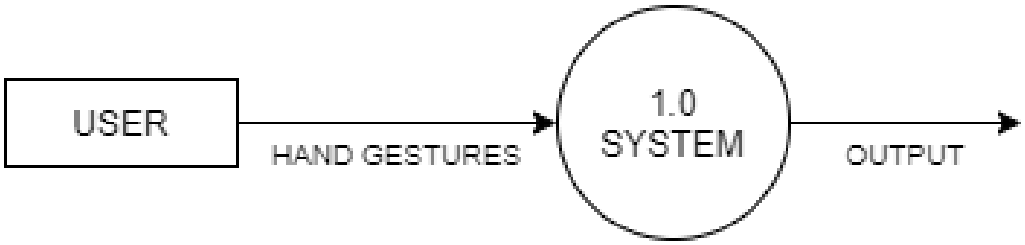


4.2 Conceptual level activity diagram



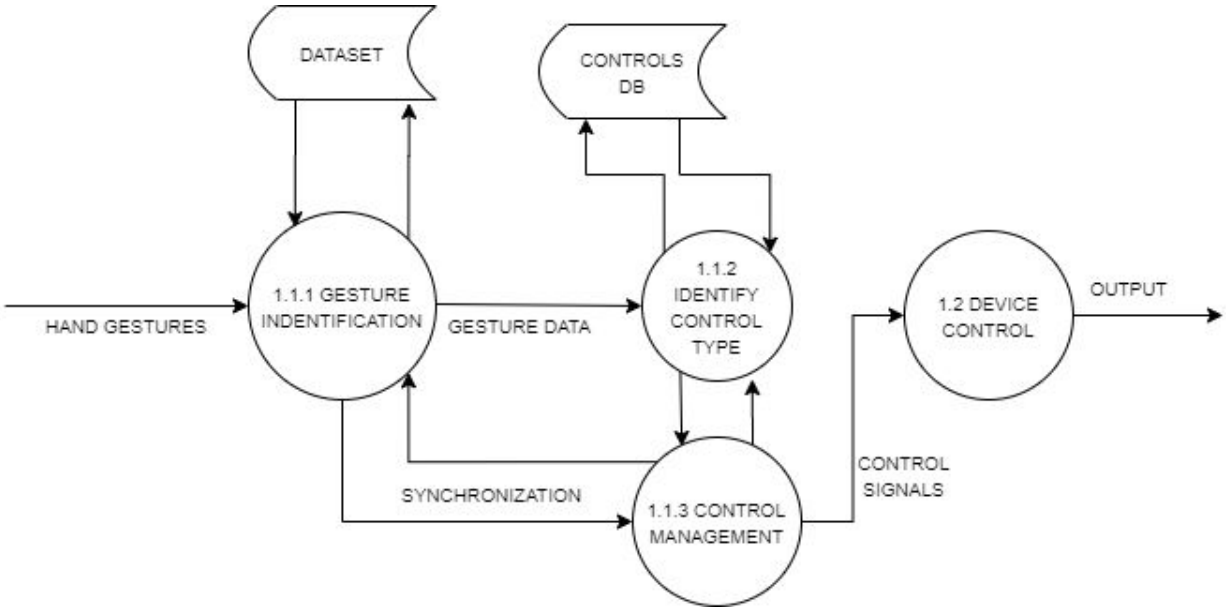
4.3 Data flow Diagram(Level 0,1,2)

Level 0



Level 1

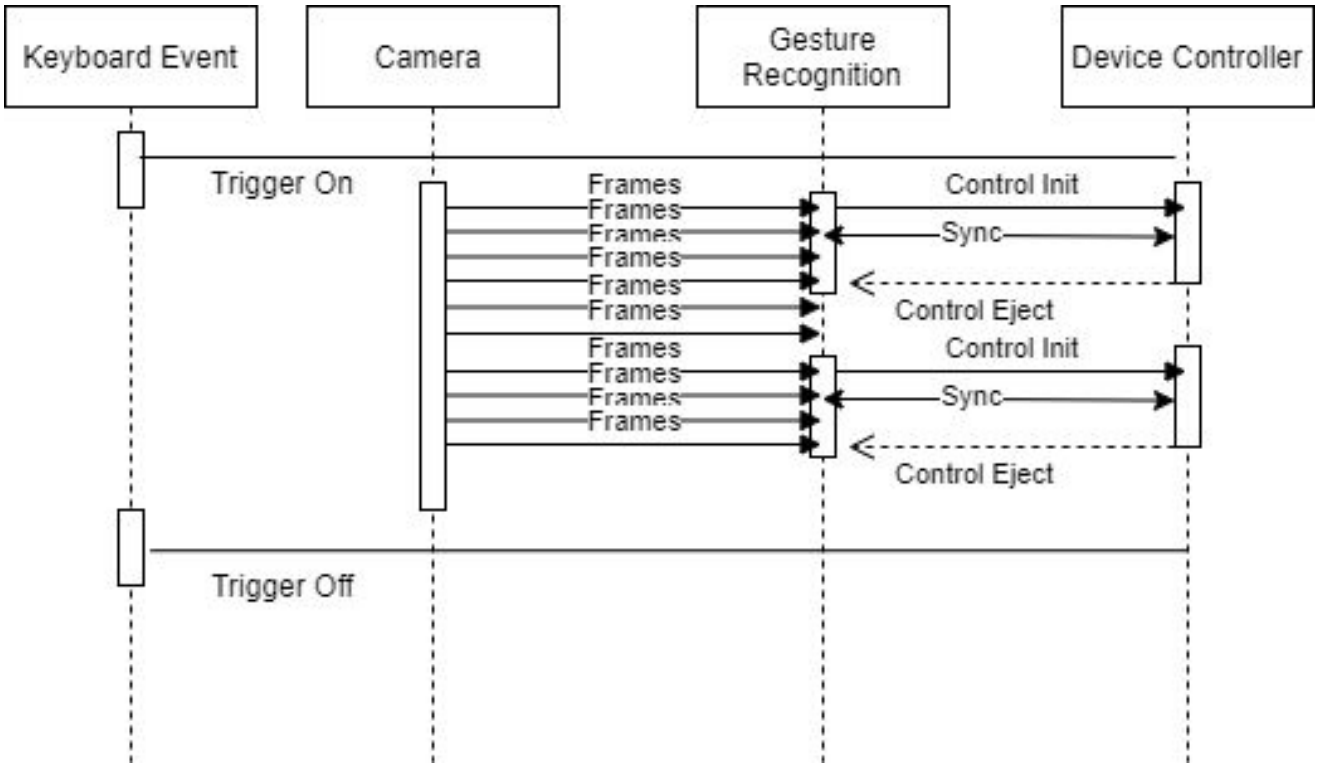
Level 2 :-


DATASET
CONTROLS DB
HAND GESTURES
1.1.1 GESTURE INDENTIFICATION
GESTURE DATA
1.1.2 IDENTIFY CONTROL TYPE
1.2 DEVICE CONTROL
OUTPUT
SYNCHRONIZATION
1.1.3 CONTROL MANAGEMENT
CONTROL SIGNALS

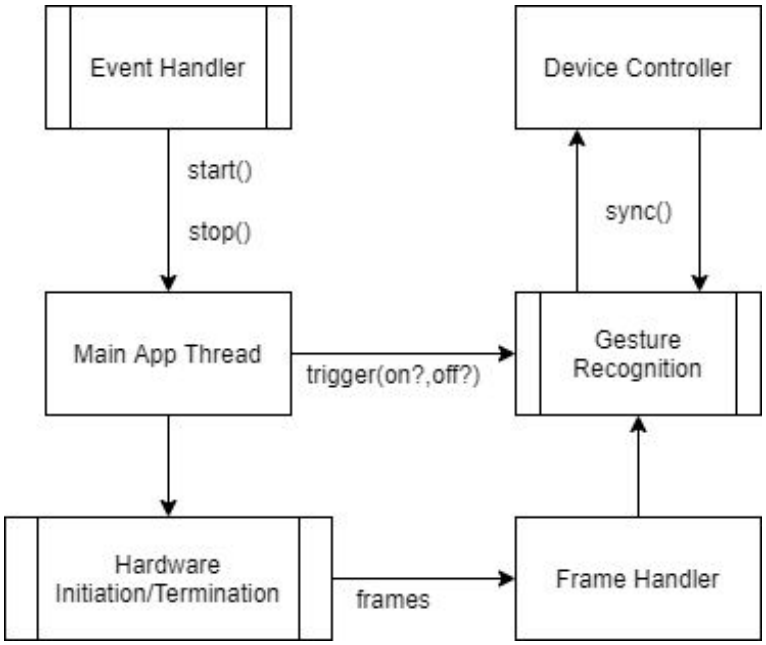
CHAPTER 5 – SYSTEM MODELING

5.1 Interaction Diagram

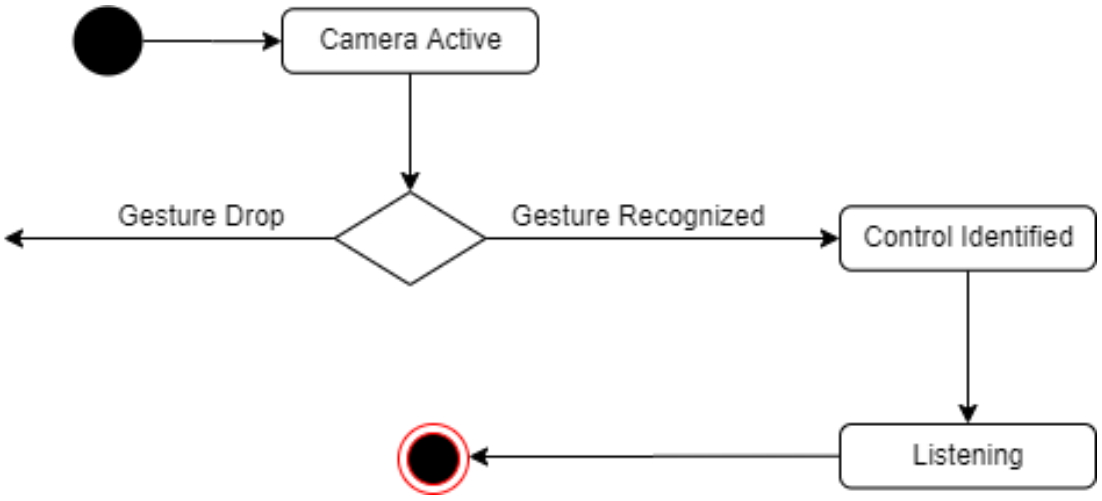
5.1.1 Sequence Diagram



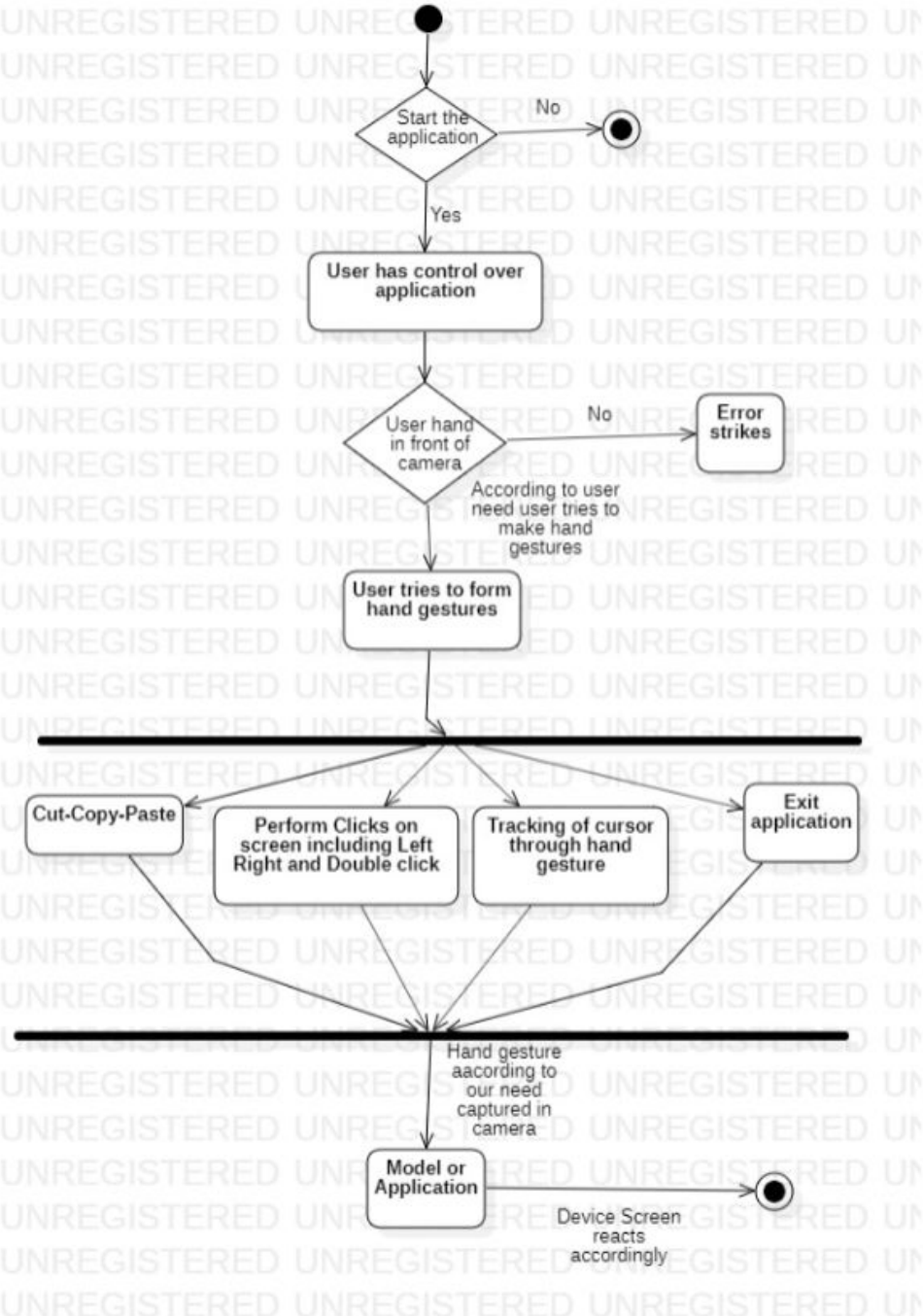
5.1.2 Collaboration Diagram



5.2 State Diagram



5.3 Activity Diagram



5.4 Testing

Software testing is a process, to evaluate the functionality of a software application with an intent to find whether the developed software met the specified requirements or not and to identify the defects to ensure that the product is defect-free in order to produce a quality product.

Software Testing is Important because if there are any bugs or errors in the software, it can be identified early and can be solved before delivery of the software product. Properly tested software product ensures reliability, security and high performance which further results in time saving, cost effectiveness and customer satisfaction.

Unit Testing

Unit testing is the first level of testing and is often performed by the developers themselves. It is the process of ensuring individual components of a piece of software at the code level are functional and work as they were designed to.

In this project unit testing is done at the time of implementation. Some actions and events are tested while writing code.

Integration Testing

After each unit is thoroughly tested, it is integrated with other units to create modules or components that are designed to perform specific tasks or activities. These are then tested as group through integration testing to ensure whole segments of an application behave as expected (i.e, the interactions between units are seamless).

As described there are many modules in the system taking there own functionality and tasks, to work them in proper and synchronized manner, some testing with and after integrations has been done.

System Testing

System testing is a black box testing method used to evaluate the completed and integrated system, as a whole, to ensure it meets specified requirements. The functionality of the software is

tested from end-to-end and is typically conducted by a separate testing team than the development team before the product is pushed into production.

To this project system testing, accepts final goal to create a gesture controlled functionality, system is capable to handle input and performing given functionalities with the best performance.

CHAPTER 6 – CONCLUSION & FUTURE WORK

6.1 Limitation of Project

1) Device should have working webcams/cameras.

2) Hand gestures in front of the camera should be formed properly to perform action on the device.

3) Try not to take any other body part or other object in front of the camera while forming hand gestures.

4) The background in which hand gestures are formed should have bright light so that the hand gestures should be properly recognised.

5) Try to take the background wall of light colour mostly preferred white background so that the hand gestures should be properly visible and easily recognised.

6) The background wall should be whole empty without any postures,images etc. so that only the hand is visible and the device performs accordingly.

6.2 Future Enhancement

As our model able to control VLC player with hand gestures similarly we are willing to control other applications like power point , Gaming application ,Microsoft Office Word etc. by integrating our model or tool with this applications by interacting with their API by forming hand gestures in front of camera to provide ease access to user.

We are planning to integrate our model or tool with the Windows Operating System, Linux Operating System etc. so that every user can use our model or tool to get ease access to control their device .

CHAPTER 7 - BIBLIOGRAPHY & REFERENCES

7.1 References and Books

- **Book - Deep Learning**
  Book by Aaron Courville, Ian Goodfellow, and Yoshua Bengi.
  An introduction to a broad range of topics in deep learning, covering mathematical and conceptual background, deep learning techniques used in industry, and research perspectives.

  Originally published: 2015
  Authors: Ian Goodfellow, Yoshua Bengio, Aaron Courville

  Concept Covered – CNN (Convolutional Neural Networks)

- **Image processing with opencv.**
  https://likegeeks.com/python-image-processing/

- **Machine learning project reference**
  https://machinelearningmastery.com/tutorial-first-neural-network-python-keras/

- **Getting start with Pyautogui**
  https://stackabuse.com/getting-started-with-python-pyautogui/

- **Machine Learning Basics with tensorflow.**
  https://www.tensorflow.org/resources/learn-ml/basics-of-machine-learning

7.2 Other Resources and documentation

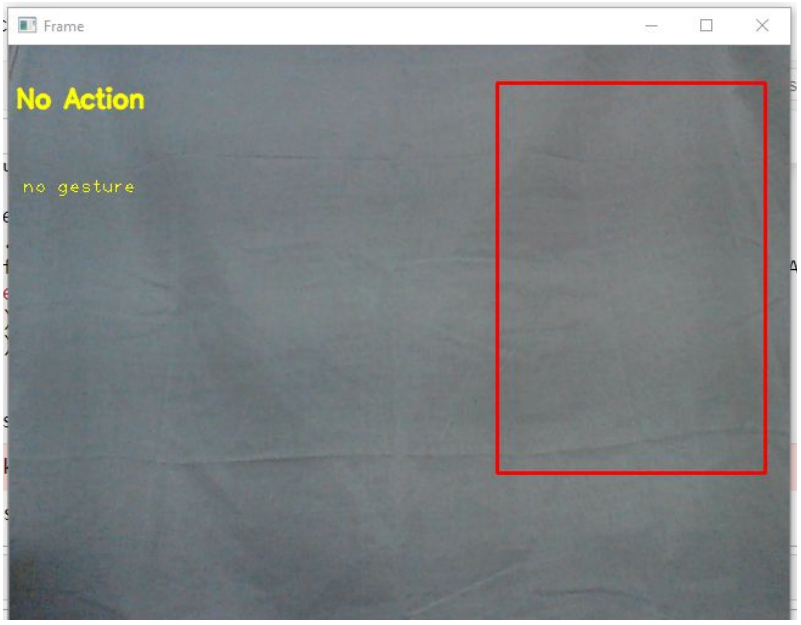
- **Documentation: OpenCV**
  https://docs.opencv.org/master/

- **Documentation: Keras**
  https://keras.io/getting_started/

- **Documentation Pyautogui**
  https://pyautogui.readthedocs.io/en/latest/

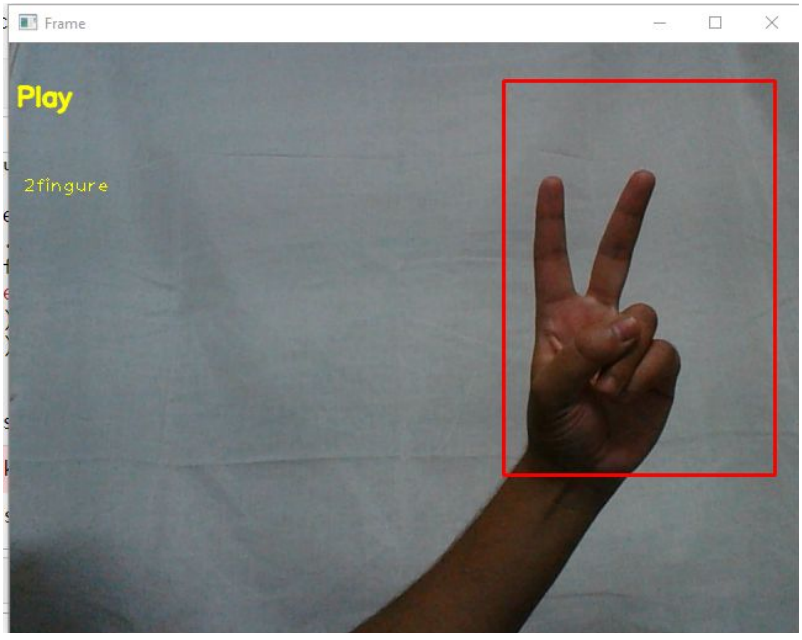
7.3 Snapshots (with description)

1. When there is no gesture.



In this case no control operation will perform. This is a neutral condition.

2. Two Finger Gesture – Play

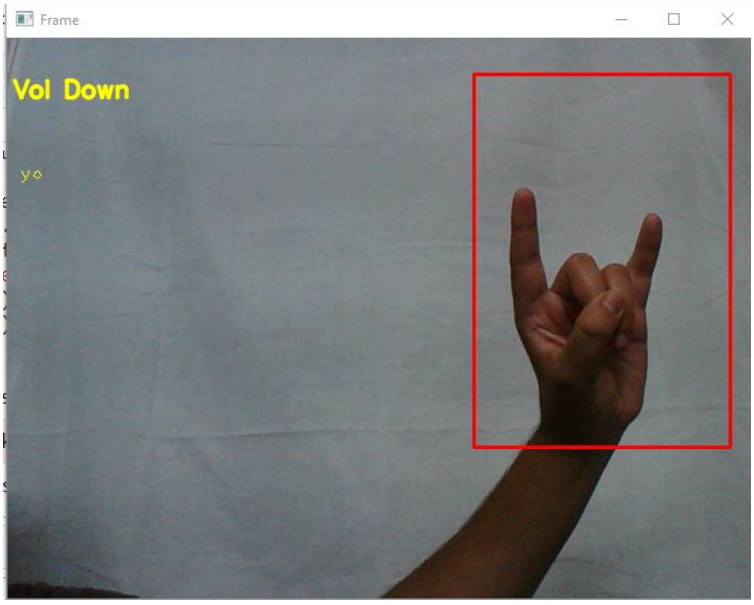


This gesture will start the music in media player.

3. Palm – Volume Up

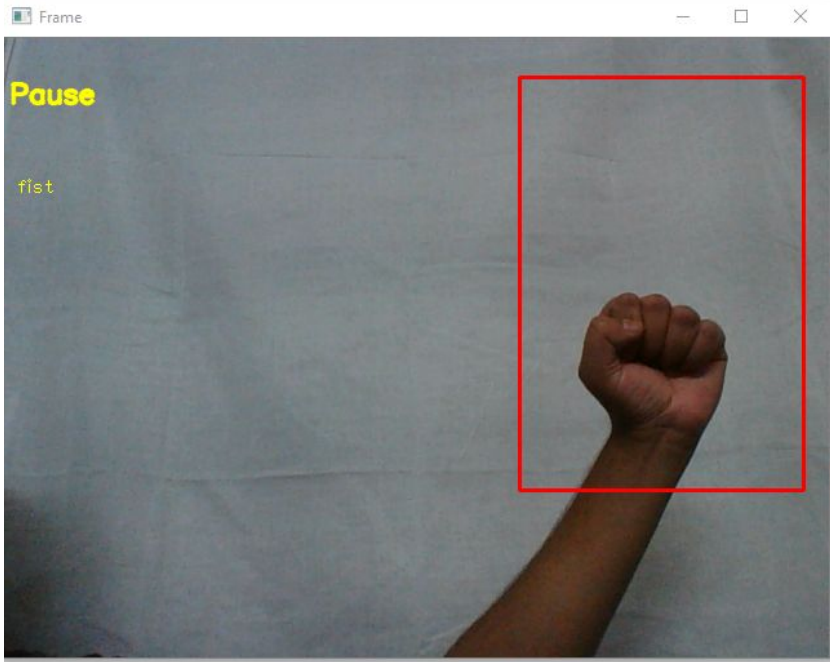
Open hand (palm) to increase volume.

4. Yo Gesture – Volume Down



To decrease the volume of media player.

5. Fist – Pause



This gesture will pause the media player.