

Software Requirements Specification

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1. INTRODUCTION

Human Machine Interface or HMI is a system comprising of hardware and software that helps in communication and exchange of information between the user (human operator) and the machine.

We normally use LED Indicators, Switches, Touch Screens and LCD Displays as a part of HMI devices. Another way to communicate with machines like Robots or Computers is with the help of Hand Gestures.

Instead of using a keyboard, mouse or joystick, we can use our hand gestures to control certain functions of a computer like play/pause a video, move left/right in a photo slide-show, scroll up/down in a web page and many more.

1.1 PURPOSE

The purpose of our project is to provide any easy interface between computer and human using hand gestures. We wish to make a windows based application for live motion gesture recognition using ultrasonic sensor and pyautogui library of python. In this project, we have implemented a simple Arduino based hand gesture control where you can control few functions of your web browser like switching between tabs, scrolling up and down in web pages, shift between tasks (applications), play or pause a video and increase or decrease the volume (in VLC Player) with the help of hand gestures.

1.2 SCOPE

The scope of this project are:

- Replace some functionality of mouse with hand gestures.
- Provide easy interface to interact with the computer.
- Provide easiness to the user at the time of power-point presentations.
- Gesture recognition can be used to provide more attractive gaming environment to truly immerse players in the game world like never before.

1.3 REFERENCES

References for the information gathered are hereby followed:

- [1] Nidhi Gupta, Ramandeep Singh, and Siddharth Bhatia. "Hand Gestures recognition using ultrasonic sensor" *International journal of research in engineering and technology*, 2014.
- [2] Mayuri S.Khasale, and prof. Aparna Gurjar " Computer Control with Hand Gestures using ultrasonic sensor " *International journal of innovation and advancement in computer science* , 2014.
- [3] Yu Sang, Laixi shi and Yimin Liu “Micro Hand Gesture recognition system using ultrasonic active sensing” *IEEE*, September 3, 2018

1.4 OVERVIEW

Computer technology has tremendously grown over the past decade and has become a necessary part of everyday live. The primary computer accessory for Human Computer Interaction (HCI) is the mouse. The mouse is not suitable for HCI in some real life situations, such as with Human Robot Interaction (HRI). There have been many researches on alternative methods to the computer mouse for HCI. The most natural and intuitive technique for HCI, that is a viable replacement for the computer mouse is with the use of hand gestures. This project is therefore aimed at investigating and developing a Computer Control (CC) system using hand gestures.

1.5 PRINCIPLE

The principle behind the Arduino based Hand Gesture Control of Computer is actually very simple. All you have to do is use two Ultrasonic Sensors with Arduino, place your hand in front of the Ultrasonic Sensor and calculate the distance between the hand and the sensor. Using this information, relevant actions in the computer can be performed.

The position of the Ultrasonic Sensors is very important. Place the two Ultrasonic Sensors on the top of a laptop screen at either end. The distance information from Arduino is collected by a Python Program and a special library called PyAutoGUI will convert the data into keyboard click actions.

2. GENERAL DESCRIPTION

Hand gesture recognition system has evolved tremendously in the recent few years because of its ability to interact with machine efficiently. Mankind tries to incorporate human gestures into modern technology by searching and finding a replacement of multi touch technology which does not require any touching movement on screen.

There are generally two approaches for hand gestures recognition, which are hardware based using sensors and other is vision based using webcam .

2.1 PRODUCT FUNCTION

The hand gestures in front of the Ultrasonic sensors can be calibrated so that they can perform five different tasks on your computer. Before taking a look at the gestures, let us first see the tasks that we can accomplish.

- Switch to Next Tab in a Web Browser
- Switch to Next Tab in a Web Browser
- Scroll Down in a Web Page
- Scroll Up in a Web Page
- Switch between two Tasks (Chrome and VLC Player)
- Play/Pause Video in VLC Player
- Increase Volume
- Decrease Volume

2.2 USER CHARACTERISTICS

- Get easy interface to interact with the computer.
- It will be easy for the user to change slides, scroll webpages and perform many more tasks without touching any physical components.
- Provide more interactive environment to game lovers.

2.3 GENERAL CONSTRAINTS

- The system needs an ultrasonic sensor for gesture detection.
- It can only perform only limited functionality.
- Hand distance should be proper from the screen.

3. SPECIFIC REQUIREMENTS

The Specific requirements of this project from the user point of view is -

1. Knowledge of hand distances from the screen to perform tasks properly.
2. Basic knowledge of gestures and their functionalities.
3. Knowledge about the position of sensors.
4. Arduino uno, ultrasonic sensor and some connecting wires.

The Specific requirements of this project from the developer point of view is -

1. He/she must have basic knowledge of sensors.
2. He/she should have knowledge of Python, arduino languages i.e. C/C++ etc.
3. A pc with internet connection.

3.1 FUNCTIONAL REQUIREMENTS

- **Browsing Gesture** - Control Mode The software shall allow the user to use the “Browsing Gesture Mode”. In this mode, user’s hand gesture will only be recognized for commands including previous page, next page, scroll up and scroll down.
- **Object Location** - Upon detection, the system shall be able to compute the location of the object using simple trigonometry math.
- **Hand Calibration** - Depending on user’s preferences, the system shall perform adjustments according to user’s dominant hand.

3.2 NON-FUNCTIONAL REQUIREMENTS

3.2.1 PERFORMANCE

This software shall minimize the number of calculations needed to perform image processing and hand gesture detection.

3.2.2 RELIABILITY

Regardless of the brightness level in user’s operating environment, the program shall always detect user’s hands.

3.2.3 USABILITY

This software shall be easy to use for all users with minimal instructions.

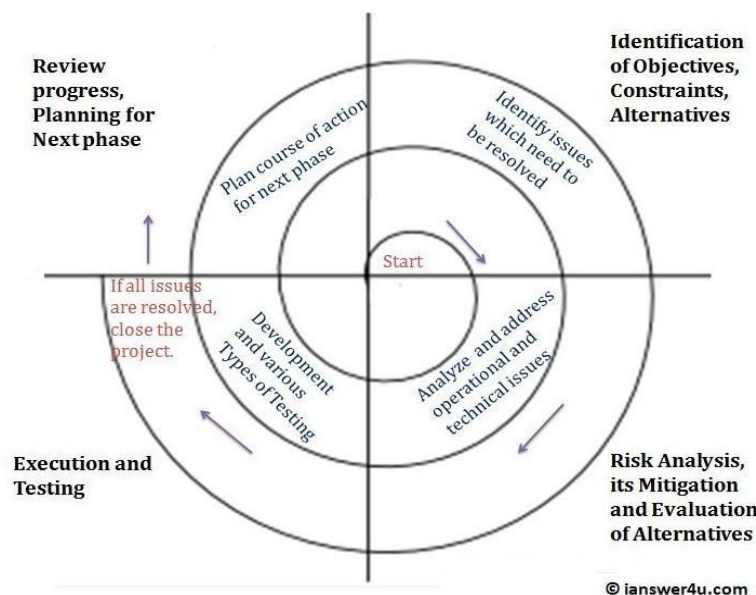
3.2.4 PORTABILITY

The pycharm software shall be 100% portable to all operating platforms that support python. Therefore, this software should not depend on the different operating systems.

4. SDLC MODEL

4.1 MODEL USED

The spiral model is a risk-driven process model generator for software projects. Based on the unique risk patterns of a given project, the spiral model guides a team to adopt elements of one or more process models, such as incremental, waterfall, or evolutionary prototyping. The spiral model combines the idea of iterative development with the systematic, controlled aspects of the waterfall model. This Spiral model is a combination of iterative development process model and sequential linear development model i.e. the waterfall model with a very high emphasis on risk analysis. It allows incremental releases of the product or incremental refinement through each iteration around the spiral.



Reason for use :-

The development team in Spiral-SDLC model starts with a small set of requirement and goes through each development phase for those set of requirements. The development team adds functionality for the additional requirement in every increasing spirals until the application is ready for the productions phase. The reason for using spiral model are:

- Additional functionality or changes can be done at a later stage
- Cost estimation becomes easy as the prototype building is done in small fragments
- Continuous or repeated development helps in risk management
- Development is fast and features are added in a systematic way
- There is always a space for customer feedback

4.2 TIMELINE CHART

