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CONTROLLING OF SYSTEM APPLICATIONS USING TOUCHLESS INTERFACE MODULE

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ABSTRACT

In recent days the automation in the domain of robotics motivates the researchers to develop more flexible and simple operable machines. In the present work, the operations of the computer or laptop's desktop functionalities controlled through various hand gestures of human. In this system, a Human Machine Interface (HMI) system plays key role in exchanging the data between computer and human. The current design mainly involved with HMI system that is able to control the system applications such as volume offsetting, scroll vertical and horizontal, tab shifting etc., without using any mouse, keyboard, or joystick. This would be a great help for paralyzed people if they able to control the system without any electronic gadget specified above. The paralyzed people can easily operate their laptops with simple hand gestures using current design. The system control with simple unique gestures of hands reduces the space between user and machine. In the present paper basic Arduino Uno is used to support the hand gesture-based system control.

Gesture based interaction systems are becoming very popular both at workplace and home. This work intends to develop a system which can recognize hand gestures which can be used as an input command to interact with the PC or laptop. One of the key areas which need to be looked at while developing such systems is the code implementation stage. In order to manage the work, we shall be using Python for the implementation of the code. We feel that if we successfully meet our goals then we shall have contributed towards the future of natural gesture-based interfaces, if only in a minimal way.

Keywords: *Human Machine Interface, Hand gestures, Arduino-uno, Ultrasonic sensors, Python.*

INTRODUCTION

In today's world of automation, hand gesture technology is not just limited to gaming application but also in various areas such as medical application, industry application, IT hubs, Banking sectors, etc. This project is based on a similar concept of hand gesture control-based laptop or computer. Human

Machine Interface (HMI) is a system that consists of hardware and software which helps to initiate a communication and information exchange between the user and the machine. We generally use various indicators such as LED's, Switches, Touch Screens and LCDs as a part of HMI devices. Another unique way of communicating with machines like Robots or computers is with the help of Hand Gestures. Instead of using various equipment like keyboards, mouse, joystick, etc, now simply we can use hand moments/hand gesture to control the functions of the computer/laptop. In this project, we have implemented Arduino based hand gesture control where one can control music, video, browser, documents, gaming, navigation and many others tasks. We have used two ultrasonic sensors and attached to Arduino. The ultrasonic sensors are attached at the top of the computer on either side which is used to calculate the distance between the hand and the sensor. Using the following information of the distance between the hand and the sensors, the above operations are executed. Python Pyautogui library is used to perform mentioned tasks on our laptop/computer. From Arduino, the commands are sent to the computer via a serial port. Python reads this incoming data which is running on the computer/laptop and finally based on these incoming read data, the following tasks and operations are executed.

LITERATURE REVIEW

In 2010, Jinda-Apiraksa A, Pongstiensak W, Kondo T[1] proposed that the current overall design is classified into parts. One is hardware and the second one is software. The hardware section contains Laptop, Arduino Uno Microcontroller, and an Ultrasonic senor. Similarly, in the software section Arduino IDE and Python 3.7.1 IDLE with PyAutoGUI module are used to control the data communication. The basic working of detecting hand gestures is depending on the ultrasound sensors. At a specified distance of hand, the sensor will detect the hand and allows to functions as per the user requirement. At the specified distance, the gesture of the hands will recognize by the webcam inbuilt in the laptop. The gestures of the hand will convert into respective keywords. The respective keywords decoded from the hand gestures will sent to windows.

At the background, the python script used to process the keywords. Based on these keywords the corresponding virtual functions of hot keys will implement in the operating system. It is observed that two ultrasonic sensors are interfaced with the Arduino Uno board GPIO pins. The Arduino board connected with the Laptop through USB port. The ultrasonic sensors have two sensors, one is acts as a transmitter and the second one is a receiver. The transmitter emits ultrasonic waves and travels until it bombards with the user hands. When the ultrasonic waves hit a surface of user hand and the reflected waves travelled back and received by the receiver part of the sensor. The time gap between transmission and receiving calculated to measure the distance of hand in front of the laptop.

In 2018 Li C, Xie C, Zhang B, Chen C, Han J ,[4] proposed that the operating system of the computer is not able to recognize the commands produced by the Arduino. Therefore, a background program is written in python to detect the Arduino codes and produces the respective virtual hotkeys to run the applications. Python programming decode the virtual keystrokes and respective hotkeys pre-programmed to execute the computer applications. The hardware implementation interfacing sensors with Arduino as shown in figure. The reliability and response time do optimize with multiple sensor nodes. When multiple sensors are interfaced with the microcontroller then there exists an array of parameters with which multiple number of gestures can be recognized. The processor may not be ready to receive multiple parameters at a time. In that case a digital pipeline can propose to synchronize the speed between sensor node and processor.

EXISTING METHOD

There are several techniques to control a computer utilising hand gesture approach. Each method has its advantages and disadvantages. Let's look into different methods in brief.

1) Controlling computer web cameras Using web camera technology, we need a projector which projects the display on a clear wall or any other plain surface. User can interact with the projected screen using his fingertips which are tracked in the air by the camera using ‘camshaft’ tracker. A related study of distinct methods of hand gesture detection has been made. Here an efficient technique is employed to identify the hand gestures which are transformed into relevant actions.

2) Controlling computer using IR sensors When we are working with IR sensors the user is equipped with a glove which was fitted with IR sensors that acts as a bridge between user and computer. The gloves are used to recognize the hand gestures of the disabled people and convert those gestures into meaningful messages in real time. With the amount of bend made by the fingers continuous data stream is obtained as output from Infrared (IR) sensor. IR sensors change the output voltage depending on the strength of the received signal. Change in bend is converted to change in the electrical voltage by IR sensors. The output from IR sensors is processed by a microcontroller and a corresponding message is displayed.

3) Limitations in existing system

• Controlling the computer with hand gestures using projectors is only used for gamming applications and this will not sense the objects exactly when the lighting was changed.

• When controlling the computer with hand gestures using web cameras, it is difficult to interact with system using camshaft in the air and this is time taken thing to project on the plain surface and as it needs extra plain surface along with the requirements of the project to project, we demonstrate that the fast and portable hand gesture computers.

• While controlling the system with hand gestures using IR sensors, it is difficult to always bend the fingers and is expensive to buy IR sensors and also these sensors will not work in lighting. So, we demonstrate the easy and cost-effective gesture controlling of computer by using ultrasonic sensors instead of using IR sensors, color bands, web cameras, projectors. As ultrasonic sensors are portable to move, cost effective and easy to operate we implemented the project by using ultrasonic sensors. Hence it is easily affordable by anyone and also easy to operate with the hand just by waving in front of the sensors.

PROPOSED METHOD

This article proposes a simple hand motion control based on Arduino. This system helps us to control various functions of a computer using hand signals. As a replacement of using a keyboard, mouse or joystick, our hand motion can be used to direct few computer tasks such as playing/pausing a clip, moving left/right in a picture slide show, scrolling up/down on a Web page, and more. It is cheaper than the existing system as it contains two Ultrasonic sensors and an ARDUINO board which are available at very low cost. As shown in Figure 1, the different hand

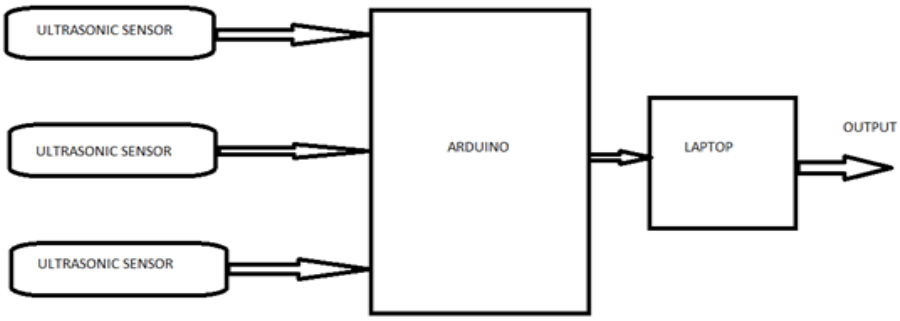

Fig.1: BLOCK DIAGRAM OF PROPOSED SYSTEM

gestures of user are going to be given as input to the sensors fixed in the particular computer. The ultrasonic sensor receives the inputs and converts those into different operations need to perform on the computer.

METHODS OR TECHNIQUES USED

Arduino IDE and Python 3.7.1 IDLE with PyAutoGUI module are used to control the data communication. The circuit design is very simple but the setup of the sensors is important. The positioning of Ultrasonic sensors is done in such a way that the two ultrasonic sensors are placed at

either ends of a computer screen. The respective distance information is collected by the Arduino UNO, using Python programming and a library called PyAutoGUI which converts the data into click action. Hand gesture recognition system can be used for many different functionalities, such as video control, music player control, Microsoft application control, and chrome handling. All these interactions are real-time gesture recognition. By using the ultrasonic sensor, the distance of hand acts as an input. Depending on the respective distances of hand, particular functions are performed in the system.

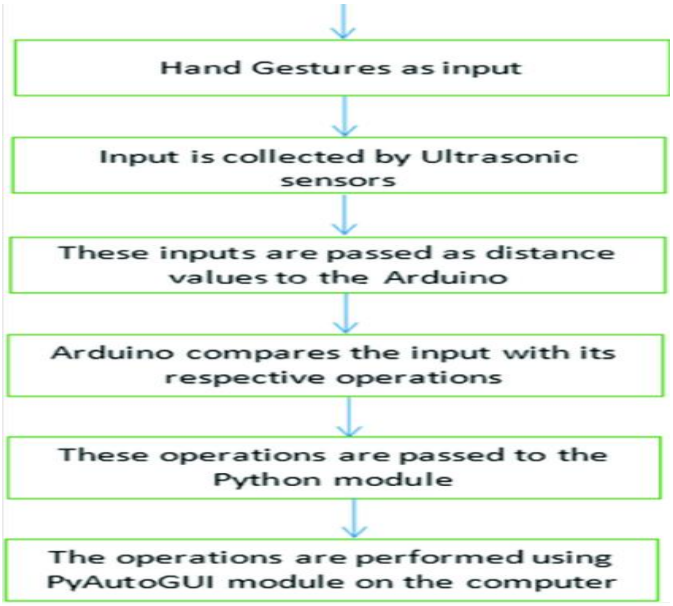

Fig.2: METHODOLOGY USED IN PROPOSED SYSTEM

RESULT

Run the python code, when the hardware setup completely done. Then the output appears on the python IDE as shown in figure (3). It is showing the description of operation such as window up, down, previous, next.

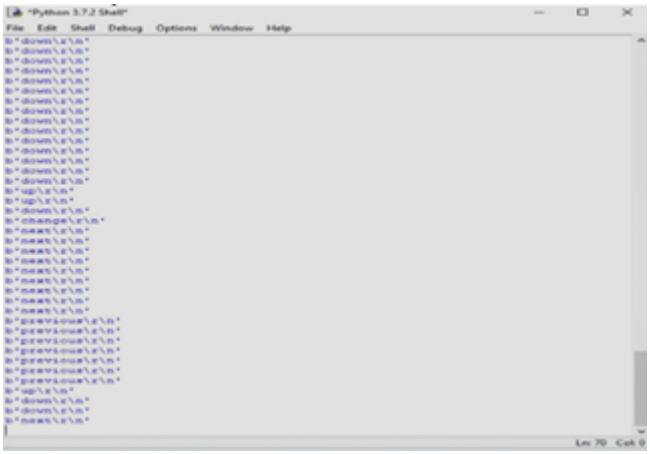

Fig.3: Showing comments of operations done with applications

Fig.4: Showing VLC Application

Fig.5: Showing Web Pages

1. When we place our hand at 1st sensor in the range between 3cm-15cm then output be next. When we place our hand in the range between 15cm-30cm then output be Page Up. When we place our hand in the range between 30cm-100cm then output be Page Down.
2. When we place our hand at 2st sensor in the range between 15cm-30cm then output be Volume down. When we place our hand in the range between 30cm-100cm then output be Volume Up.
3. When we place our hand at 3rd sensor in the range between 3cm-15cm then output be play/pause. When we place our hand in the range between 15cm-30cm then output be Forward. When we place our hand in the range between 15cm-30cm then output be Backward.

ADVANTAGES

1. The given system is handy and portable, and thus can be easily carried from one place to another.
2. The circuitry is not that complicated and thus can be easily troubleshooted.
3. There is no direct contact between the user and the device, so there is no hygiene problem.
4. This system would be designed to be those that seem natural to users, thereby decreasing the learning time required.

APPLICATIONS

1. This project can be used in gesture control gaming in gaming industry.
2. This system can be used for making touch less displays at low cost.
3. This project can be implemented in medical area for making gesture control displays.

CONCLUSION

The presented approach proves that it is possible to use inexpensive ultrasonic rangefinders for gesture recognition to control the video. This fact seems to be important because these sensors are

easily available and no additional ultrasonic system is needed to be constructed. Unfortunately, a set of gestures which can be recognize in this way is very limited. Nevertheless they are useful for extension of communication channel between a human and a machine. In this context the obtained results are preliminary and show that recognition of some class of gestures is possible by using very simple range-finders.

FUTURE SCOPE

1. This project can be further implemented on platform like AVR, ARM microcontroller etc.
2. We can add many video controlling features just by modifying the python code.
3. We can integrate this type of module for many applications like browsers, designing and editing applications.

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