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Virtual Keyboard

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Abstract—**This paper presents a virtual keyboard technology based on ultrasonic sound technique. Virtual Keyboard can be defined as touch typing device which enhances and enables the communications through virtual interface technology. It doesn't have a physical appearance like conventional keyboard. Instead it uses a laser projection module to display the layout of keyboard. It is actually a key-in device, which can be implemented in space saving situations and as well as in hostile environments as the utilization of conventional keyboard is limited there. When system is powered ultrasonic sensor continuously emits signals, which then used to identifying the characters. The corresponding character will then displayed using arduino and Bluetooth module.**

Keywords: Virtual Keyboard, ultrasonic sensor, Arduino UNO and Bluetooth module

I . INTRODUCTION

Virtual Keyboard has no physical appearance. Although other forms of Virtual Keyboards exist; they provide solutions using specialized devices such as 3D cameras. Due to this, a practical implementation of such keyboards is not feasible. The utilization of virtual keyboard appears in space saving situations or requirement in soft programmability of systems or keys to avoiding mechanical failures or in movement situations where usability of conventional keyboard is limited utilization of virtual keyboards in space situations are enormous. These kind of keyboards are utilized in hostile environment. Virtual keyboards find their position in transport environments. Example rail, plane or automotive. Various type of virtual keyboard are available in the market, such as laser projected, on screen type and one which operates on the basis of image processing.

A virtual keyboard can be defined as a touch typing device that enhances and enables communication through virtualy interfaced sensing areas. The sensing area can be realized with sensors, finger tracing methods, or using touch pad. In this paper we will develop a virtual keyboard that can be projected on any surface. This system mainly uses ultrasonic sensors to operate the system. It has both hardware part as well as software part. The hardware equipment is mainly consists of ultrasonic sensors, arduino, Bluetooth module, and display. These are utilized for establishing the overall connections. For getting an accurate and precise readings the connection should be made properly. The coding is also needed for arduino in order to get accurate reading from ultrasonic sensor. We have to record the readings observed from sensor to make a dimensional layout for developing a virtual keyboard. The distance is measured using ultrasonic sound sensors and will sense/detect the word typed by the user. This device is very reliable and easy to operate by the user as well to develop also.

Here we are designing something new which will help the user to reduce effort while doing work. Projection keyboard is nothing but the image of keyboard is projected from projector and ultrasonic sensors are placed at bottom of device. If someone place his/her finger on the image, with the help ultrasonic sensor it is able to calculate the distance towards the character present. Using this keyboard users are able to do their work sitting conveniently. To make the keyboard touch sensitive, one has to touch any portion of the projection keyboard then it will display the result. For example, suppose if we placed finger on a character 'q', the software should able to recognize the input given is 'q'. This will done by calculating the distance towards hand or finger and according to that device will understood what to display.

For the efficient performance of the system we use a small projector to project the layout of the keyboard. Projector will project the image of the keyboard. Humans are able to adjust the brightness of keyboard. We need multiple ultrasonic sensors for efficient detection of characters. Using the signals obtained from ultrasonic sensor microcontroller will calculate the distance and identifies which word is pressed. The device explained here is highly efficient since it uses sound waves which are not harmful to humans. As sound waves are independent of temperature

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this system can be used in high and low temperature. Hence this keyboard is better than other existing ones.

II. LITERATURE REVIEW

The world has been developing day by day and most of the devices and gadgets are also developing and becoming smaller. But one thing that remained for long time is traditional keyboard. As the demand for computing environments increases new techniques has been introduced to provide multiform interactions between users and machines. But the basis for most human to computer interactions remains the keyboard or mouse. So we are presenting a technology that will be helpful for the next generation and it is Virtual Keyboard. As the name suggests the virtual keyboard has no physical appearance. It acts as an application that virtualises the hardware keyboard with different layouts. There were several techniques implemented as a substitute for keyboard.

One of the proposed concept of virtual keyboard is based on camera calibration. Camera based virtual keyboards can be implemented using a single or multiple cameras. The major challenges of this technique is to determine touching of finger on the surface. This touch detection based real three-dimensional (3D) model which built from stereoscopic camera based systems is more accurate than single camera based solutions. However, as stereoscopic cameras are not common in mobile phones, this method is less applicable to mobile solutions. Also the challenge of accurate touch detection is even greater when using a single camera on almost any surface. The set-up of system is like this- first the camera is positioned accordance with the paper which acts as the keyboard and then a microphone will be attached to the paper. And it is interfaced with the PC with the help of microcontroller. When user starts typing in front of the camera and touches the paper, there will be a sound generated due to the tap of finger on keyboard. It is detected by controller and input is sent to PC by serial communication. Once the input is received the Matlab code triggers the camera and the photo of corresponding character is captured. Then by applying different image processing operations like segmentation, thresholding etc, required character is determined and displayed on the text editor. In this system, the keyboard layout can be a paper and it need not be projected. An image processing application will detect the key press events and process them accordingly. As it uses image processing technology it take more time for processing each characters, hence it is more time consuming.

In another method Laser Powered Virtual Events based on java application is used to detect the laser point stroke on any flat surface. The surface is divided into nine segments. The layout can be generated on any flat surface such as wall or book as virtual events and a press of laser light acts as key press on keyboard. This method uses webcam to monitor the segmentation area. Key press is detected when laser light comes to any segment and then it is equivalent to pressing of a specified keyboard key. Laser Control will acts as an application to control keyboard using a laser pointer by pointing defined areas on a wall. This application monitors the wall for the presence of a small spot using a webcam. When the spot appears somewhere on wall, if it is inside a defined hotspot, the appropriate command or keystroke is executed. The hotspots can be set by the user as well as the actions taken. It is possible to enhance the system to take complete keyboard keys in form of grids and at the time of projector presentation, it can be used for changing slides remotely or firing any other events.

The above methods of the existing virtual keyboards are based on camera calibration techniques or based on laser powered events. To avoid the complexities of these methods we introduce a keyboard technique based on ultrasonic signal.

III. PROPOSED METHODOLOGY

In this method we are introducing a technology using echo signal. For that we uses ultrasonic sensor which continuously emits ultrasonic signal and a Bluetooth module to transmit the data. The ultrasonic sensor is used to detect the finger movement and corresponding distance towards a key. Once the sensor detects the finger movement, it will understand by the arduino and it will send required character to the serial monitor via Bluetooth module. The surface can either a laser projected one or we can use single piece of paper which contain the layout of keyboard.

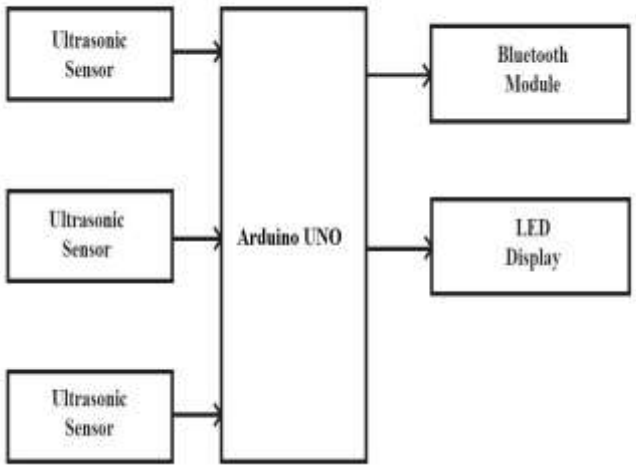

Figure 1. BLOCK DIAGRAM

Figure 1 shows the block diagram of proposed technology. It essentially consists of a keyboard projector, ultrasonic sensors, microcontrollers, Bluetooth modules and a display. The keyboard Pattern Projector projects the image

of the keyboard of the system. This image can be projected on any flat surface. The projected image can be similar to standard QWERTY keyboard or it can be one with essential keys. When the layout is displayed ultrasonic sensor starts emitting ultrasonic signals. Ultrasonic sensors are essentially sound sensors, which operate at a frequency greater than human hearing. These devices work on a principle of echo sound, which evaluate attributes of a target by interpreting the echoes from radio or sound waves, respectively. Ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object. When it detects a key press, for determining the character, Arduino UNO is used. For easy programming and processing microcontroller used is ATMEGA328. It is embedded inside Arduino UNO board. Arduino act as a computing platform with combination of micro-controller and software development environments. Most of the Arduino programs can be written in C or C++. It can run in all operating systems. Once Arduino determines the required character it has to be displayed. In order to display the character a serial monitor can be used or it can be displayed on a mobile screen or personal computer. The input to the display is send via Bluetooth module. The Bluetooth module used here is HC-05. It is a master- slave module. This module enables us to transmit and receive serial data in a wireless manner This Bluetooth module allows us to transfer the binary codes to the mobile unit.

IV. HARDWARE AND SOFTWARE IMPLEMENTATION

The virtual keyboard implementation requires both hardware and software implementation. The hardware implementation mainly consists of ultrasonic sensors, micro-controllers, Bluetooth module and projection module. The projection module is used for displaying the layout of keyboard. The projection module is a laser light projected using convex lens and hologram of keyboard. For the efficient performance the projection module is made adjustable, so that its brightness can be controlled. There are multiple ultrasonic sensors which are placed at certain distance apart. These sensors are used to detect the key press. When the system is powered it starts emitting the ultrasonic signals, whenever there is a key press occurs the sensor detects it by calculating the distance towards key. The distance calculating capability of sensor is utilized for this purpose. Arduino uno is used as microcontroller board. It is used to calculate the distance. Once the character is determined it is transmitted to the display or serial monitor via Bluetooth module. The display can be of a mobile or of a personal computer.

The software implementation mainly requires algorithm for character determination. It is done with the help of arduino programming. Since the arduino programs are written in C or C++. It is more easier to program via arduino.

A. ALGORITHM FOR VIRTUAL KEYBOARD

1. START
2. Switch on the power supply
3. If keyboard layout is projected, Switch on the ultrasonic sensors
4. If ultrasonic sensors are on, go to step 5 else move to step 3
5. Once the ultrasonic sensor is turned on, pair the Bluetooth module with mobile phone
6. Place the finger on required character.
7. Determine the word pressed with help of distance measurement calculations
8. If pressed character displays, move to step 6 until typing completes
9. If typing completes, move to next step, else move to step 6
10. Switch off the system
11. END

V. FORMULAE AND CALCULATIONS

The calculations can be formulated using following equations. Time duration is calculated for measuring distance towards each word. The following formula can be used for this purpose.

Time = Width of Echo pulse, in uS (microsecond)

Distance in centimeters = Time / 58

Distance in inches = Time / 148

VI. CONCLUSION

The main aim of our project was to reduce the complexities of currently existing virtual keyboards based on image processing techniques. For achieving this our virtual keyboard was implemented using ultrasonic sensor, arduino and Bluetooth module. Implementing this system gave us better understanding of the working of arduino and keyboard system. Main challenge in implementing this project was unavailability of a low cost projection module in the Indian market. To overcome this we used a keyboard drawn on paper. Also virtual keyboard is hard to get used to. Since it involves typing in plain surface, it requires little practice. The device can function in many ways ranging from its use in Smart phone, PDAs, e-mails, word processing, and spread sheet task. It can also be used in Gaming control application and in High-tech industrial sectors. Also it can be used in places where less space is available for placing keyboard as it requires less space.

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