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Contactless Gesture Recognition System Using Proximity Sensors

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Abstract- A gesture recognition system is such a system that recognizes and differentiates between gestures'. These gestures can be any type of facial or body gestures. Various facial expressions constitute facial gestures. Similarly the various gestures that can be made using our hand, or the palm to be more specific are called 'HAND GESTURES'. In this project , we aim to develop such a system that is able to recognize some of such 'hand gestures' and differentiate between them, thus triggering a certain event corresponding to the gesture. It is propose to develop a system that can successfully recognize hand two dimensional hand gestures, using an IRsensor matrix for the purpose of recognition.It is also plan to connect the recognition system to a computer keyboard emulation system so that appropriate gestures can cause corresponding keyboard events like pressing and releasing of a key.

Keywords: Facial Gesture, IR Sensor ,Hand Gesture, Body Gesture

I. INTRODUCTION

As mentioned in abstract, we plan to develop a contactless gesture recognition system that will successfully recognize and differentiate between various hand gestures over the two dimensional plane.

Gesture Recognition systems are broadly classified into two types:

- Gesture Recognition over Two Dimensional Plane
- Gesture Recognition over Three Dimensional Plane

1.1 Gesture Recognition over two dimensional plane*:*

Here, any gesture, be it a hand gesture or facial gestures, or any other gestures, they are detected using sensors that return information over only two dimensions of plane. Eg.X and Y.

Consider the Trackpad on a Laptop. It sensors your finger, and tracks it movement. However sensing is done only to gather the movements of your finger over the X Y plane such that it can be reflected on the X Y plane on the screen. In simple words, as your fingers move over the trackpad, the X and Y co ordinates are gathered, and the cursor on the screen is appropriately moved over the X Y plane on the screen.

Considering another example, any touch-screen device is also a gesture recognition system over a 2D plane. A mobile phone that is operated using the touch interface is actually a sensing device gathering data about the movements and touch gestures that you make on the touch-screen surface, while it is translated into appropriate actions and events on the device. Operation such as scroll, zoom in and zoom out, draw, etc. can be performed on the device using their corresponding gestures.

1.2 Gesture recognition system over a three Dimensional plane:

On the other hand, there are such systems that allow sensing of gestures on a three dimensional plane. That is, here, information is gathered about the gesture on all axis of X, Y and Z.

A doctor performing a procedure on a patient from a remote location using a robot and a gesture recognition glove is a good example of such systems. It must be noted that such systems are relatively more complex to create, more expensive and require highly sophisticated and complex algorithms for the purpose of recognition of gestures over three dimensions.

1.3 Gesture Recognition Using IR proximity sensors

We used here multiple IR sensors[1]are combined into a specific arrangement and then data from them is combined and processed by specifically designed to translate the data into meaningful gestures. Gesture-based interfaces provide an

intuitive way for users to specify commands and interact with computer. As mobile phones and tablets become ubiquitous, there is an increasing need of an intuitive user interfaces for small-sized, resource-limited mobile devices.

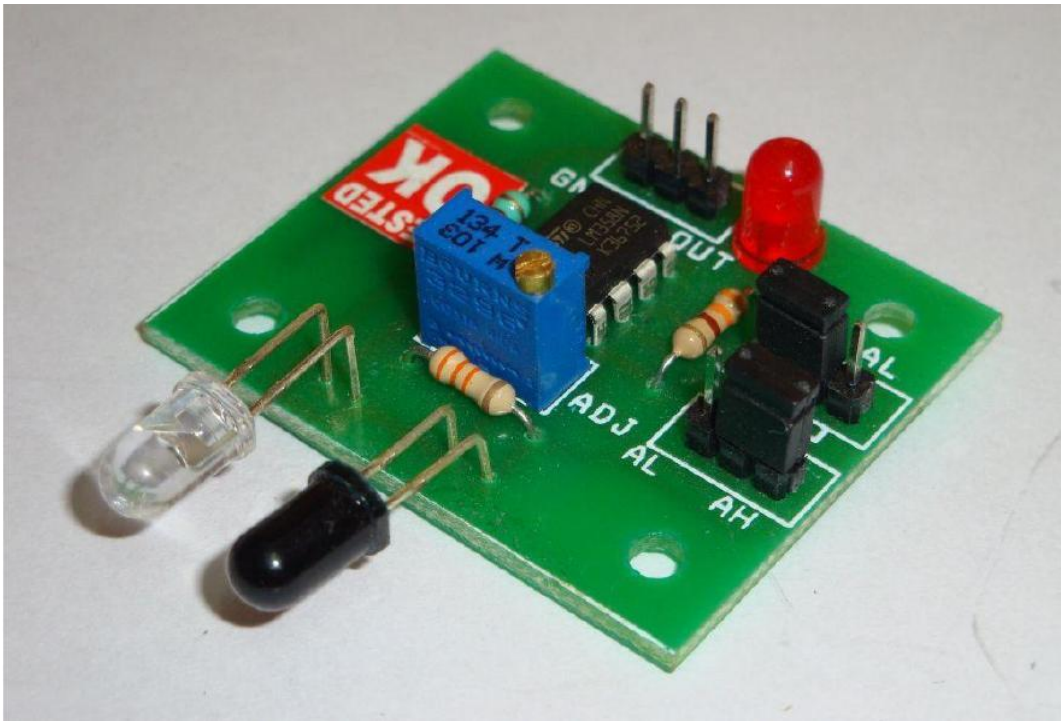

Fig 1.3.a IR Proximity sensor

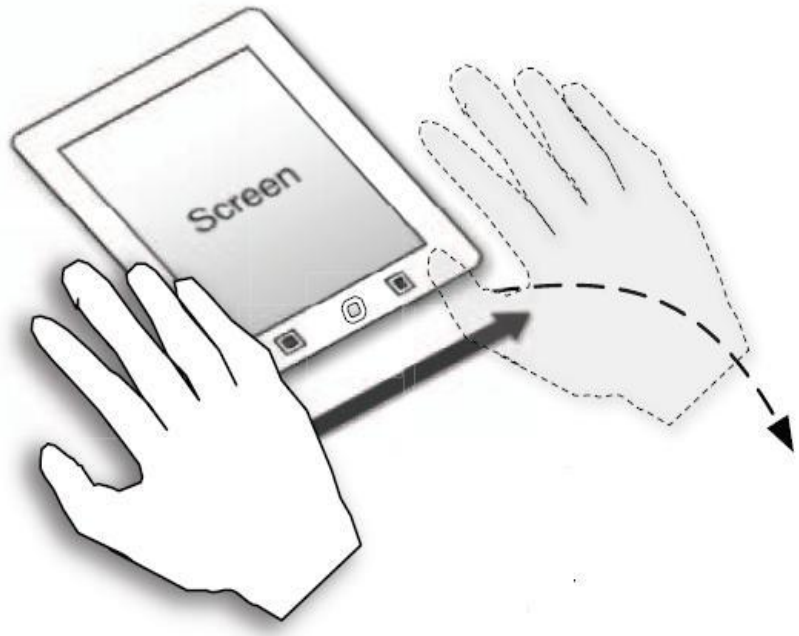

Fig1.3.b: 2D gesture using IR Proximity Sensor

Most existing gesture recognition systems can be classified into three types: motion-based, touch-based, and vision-based systems. For motion-based systems user cannot make gestures unless holding a mobile device or an external controller. Touch-based systems can accurately map the finger/pen positions and moving directions on the touch-screen to different commands. However, 3D gestures are not supported because all possible gestures are confined within the 2D screen surface. While the first two types of system require users to make contact with devices, vision-based systems using camera and computer vision techniques allow users to make intuitive gestures without touching the device. However, most vision-based systems are computationally expensive and power-consuming, which is undesirable for resource-limited mobile devices like tablets or mobile phones.

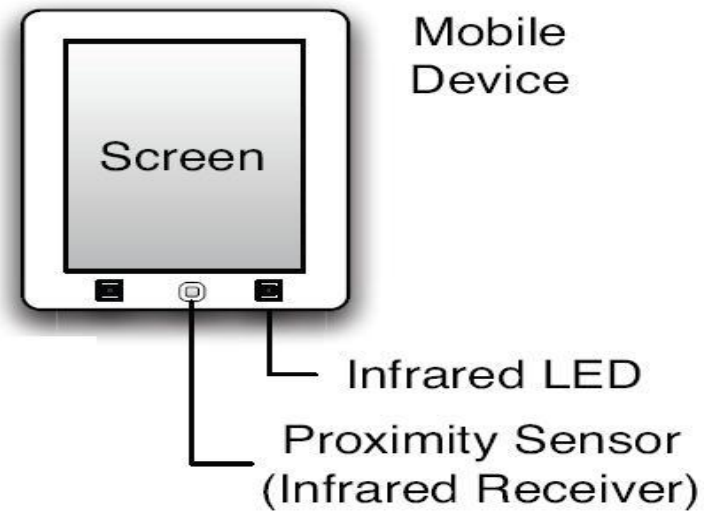

Fig1.3.C: 3D Gesture using IR Proximity Sensor

To solve the existing challenges, we present a contactless gesture recognition system using only two infrared proximity sensors. We propose a set of infrared feature extraction and gesture classification algorithms. Using the system as a gesture interface, a user can flip e-book pages, scroll web pages, zoom in/out, and play games on mobile devices using intuitive hand gestures, without touching, wearing, or holding any additional devices. The design also reduces the frequency of users' contact with devices, alleviating the wear and tear to screen surfaces.

II. *REVIEW OF LITERATURE*

2.1 Computer Interfacing

2.1. a) Vision Based Gesture

There has been extensive research on vision-based gesture recognition, mostly focusing on the detection of hand trajectory. Although they can recognize complex gestures, they can be sensitive to background objects, color, and lighting. Robustness can be improved by adding color markers on the user's hand with a tradeoff of the inconvenience to wear additional gears. Moreover, continuous video recording of a user can make one feel like under surveillance and pose a threat on user privacy. Another related work, used six IR sensors facing the user to capture IR image maps, and then classify gestures using DTW. In this work, we reduce the number of the required IR sensors to two and thus reduce the power consumption, which is mentioned as a critical issue in Even using the limited information from only two IR sensors, our system can achieve accurate gesture recognition using the proposed IR feature set and the classifier. For motion-based system, one of the recent work Wave match accelerometer data with gesture templates using DTW. 98.6% and 93.5% accuracy was achieved with and without template adaptation, respectively, for user-dependent gesture recognition. However, a user needs to hold a device with accelerometer, and press a button to indicate start and end of a gesture. In this work, we eliminate these limitations with contactless gesture recognition. EMG-based system [3] is another novel way to recognize gesture patterns using electrical activity produced by skeletal muscles. However, a user must wear EMG sensors on the wrist at all times to perform gestures, which can be inconvenient and not suitable for mobile device interfaces.

2.1.b) Computer Keyboard

Fig2.1.b: Computer keyboard as a Input

*The **keyboard** is a input device which uses an arrangement of buttons or key which act as mechanical or electronic switches. the decline of punch card and paper tape , interaction via tele-printer keyboards, the main input device for computer. A keyboard typically has characters printed the keys and each press of a key typically corresponds to a single written symbol, to produce some symbols requires pressing and holding several keys*

simultaneously or in sequence. While most keyboard keys produce letters , numbers or signs or signs Despite the development of alternative input devices, such as the mouse, touch-screen, pen-drive , voice recognition the keyboard remains the most commonly used and most versatile device used for direct (human) input into computers.

In normal usage, the keyboard is used to type text and numbers into a word processor, text editor or other programs. In a modern computer, the interpretation of key presses is generally left to the software. A computer keyboard distinguishes each physical key from every other and reports all key presses to the controlling software. Keyboards are also used for computer gaming, either with regular keyboards or by using keyboards with special gaming features, which can expedite frequently used keystroke combinations. A keyboard is also used to give commands to the operating system of a computer, such as windows alt + ctrl +del combination, which brings up a task window or shuts down the machine. Keyboards are the only way to enter commands on a command- line interface.

2.2 TOUCH-LESS

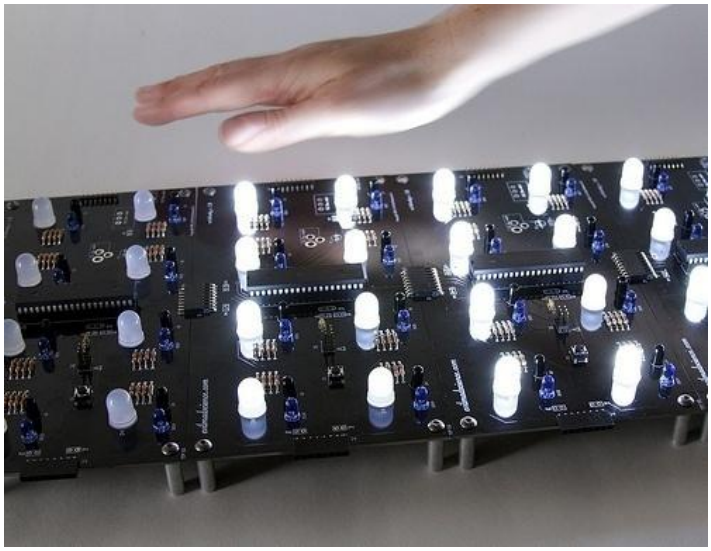

Fig2.2: Touch-less operation Using IR Proximity sensor

Multiple IR sensors are combined into a specific arrangement and then data from them is combined and processed by an algorithm specifically designed to translate the data into meaningful gestures. Hand Gesture-based interfaces [4] provide an intuitive way for users to specify commands and interact with computers. To solve the existing challenges, we present a contactless gesture recognition system using only two infrared proximity sensors. We propose a set of infrared feature extraction and gesture classification algorithms. Using the system as a gesture interface, a user can flip e-book pages, scroll web pages, zoom in/out, and play games on mobile devices using intuitive hand gestures, without touching, wearing, or holding any additional devices. The design also reduces the frequency of users' contact with devices, alleviating the wear and tear to screen surfaces

.III. *CONCLUSION*

1. It is a contactless gesture recognition system that allows users to make use of gesture inputs without touching, holding, or wearing any device.
2. Using the proposed IR feature set and classifier, the system can recognize gestures with 98% precision and 88% recall rate.
3. The low power consumption and high accuracy make the system particularly desirable for deployment on resource-limited mobile consumer devices.

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