J. Bangladesh Electron. 11 (1-2); 51-56, 2011

Design and Development of a Cost Effective Laser Ray Touch Screen Technology

Md. Ariful Islam[1], A. K. M Fazlul Haque[1], M. Shahjahan Ali[2] and Moheuddin Ahmed[1]

Department of Electronics and Telecommunication Engineering[1], Daffodil International University

Department of Applied Physics, Electronics and Communication Engineering[2]

Islamic University, Kustia, Bangladesh

Abstract

This paper presents the new laser ray cost effective touch screen technology is to create a touch screen that is easily operated by the users without training the touch screen can be portable and movable without display system. A touch screen technology has been developed which is used to operate a computer for opening all folder by only a single touch on the screen. This work is divided into two main sections. One is hardware section which consists of a personal computer, voltage divider circuit, LDR, and Laser light source. And the other is the program control unit. This program has been written with visual basic language. Laser light has been used as the light source and LDR has been use as sensor. In its inactive mode laser light falls directly on the LDR which intern produces low voltage (logic 0) and when some obstacles (egg, human finger or stick etc) are in front of the light source , no light or very small light falls on the LDR which then produces high voltage (logic 1). In other words, this circuit gives a Low voltage when the LDR is in the light and a high voltage when the LDR is in the shade. The voltage divider circuit gives an output voltage which changes with illumination. In this way, eight LDRs produced an 8 bit signal such as 10001111, 11001111 etc. The voltage across LDRs is directly connected to the printer port (10, 11, 12, 13and 15) of the CPU. Finally, it is found that the proposed technology is better than the other existing technique.

Keywords: Laser, LDR, Visual Basic, Touch Screen

1. INTRODUCTION

The ability to directly touch and manipulate data on the screen without using any intermediary devices has a very strong appeal to users. In particular, novices benefit most from the directness of touch screen displays. A fast learning curve and inherent robustness makes touch screens an ideal interface for interacting with public installations, such as information kiosks, automated teller machines, ticketing machines, or gambling devices [1]. While touch screen use is widespread in special purpose applications, the slow adoption of touch screens into more general computing devices has be attributed to known issues of relatively high error rates, arm fatigue, and lack of precision . Due to technical restrictions, most commercially available touch screen devices in use today are only capable of tracking a single point on the surface of the device. However, with the recent emergence of many multi-touch prototype devices, research on multi-finger and multi-hand touch interactions has increased. Today's WIMP (windows, icons, menus and pointing) user interfaces require frequent selection of very small targets. For example, window resize handles are often just 4 pixels wide. Noisy input, lower tracking resolution, and large potential touch area of a finger now become a problem. Furthermore, fingertips can occlude small targets depriving users of visual feedback during target acquisition.

Touch screens are a popular method of interaction with information systems embedded in public kiosks. Typical information systems are used on desktop PCs and therefore restricted to having a mouse as the selection device used to interact with the system. Today, users of information systems on desktop personal computers are limited in their method of interaction with the system. Most information systems are designed to be used with a keyboard and mouse.

Although the keyboard and mouse is the accepted method of interaction it doesn't necessarily suit all information systems. Information systems with limited data entry may be more usable through the use of a keyboard and touch screen. Touch screens require less physical space and thus the workstation environment in an office setting could be improved, allocating more space to the employee and less to the computer.

2. RELATED WORKS

Touch screens are effective interaction devices. It is found that they can be comparable to a mouse in selecting targets as small as four pixels per side and were significantly faster for larger targets. There is a large body of research that demonstrates the value of touch screens. Most of this work, however, investigated large desktop-size devices. It gave less attention to small touch screens often used in handheld mobile devices, as well as implications of user mobility on touch screen interaction. It is believed that touch screen can be an important enhancement for mobile applications with many indirect indications supporting this suggestion. Indeed, despite evidence that touch screen keyboards are faster and more accurate for text entry, handwriting techniques still prevail on mobile devices. This may be attributed to better kinesthetic feedback in writing: it may simply feel more natural to the user to write than to poke on a soft keyboard. Consumer electronics designers have known this problem for quite some time. Although there is a history of consumer electronic devices utilizing the touch screen, there has always been dissatisfaction with them as users can not feel the response of graphical buttons. Without tactile feedback, the user can only rely on audio and visual senses, which have many disadvantages. First, a mobile individual must focus on real-world activities. However, because visual display demands uninterrupted user attention, it is difficult to control the device while attending to other tasks. Second, as displays become smaller, GUI widgets become less visible and are easily obstructed by a touching finger, making visual feedback less effective. A pen may help, but it would occupy the second hand, can be easily lost, and is inappropriate for many devices, such as digital cameras. Third, street noise hinders audio feedback, and during a meeting it becomes inappropriate and a nuisance. Finally, the lack of tactile feedback destroys the metaphor of directness and physicality of interaction with touch screens. The earlier research on tactile displays for mobile devices has been limited to vibrating the entire device body. For example, in reported design of "full body" tactile displays those were used to enhance gestural interaction with mobile devices and to provide expressive tactile notifications for mobile users. In this paper a novel tactile actuator, Touch Engine have been used to communicate the tactile feeling to the hand holding the device or, when the device was tacked away in a pocket, to the user's body, via vibrating the entire device.

More recently, Albinsson, P. Zhai [2] explored several on screen widgets for increasing precision while selecting small targets on a touch screen. Their interactions were designed to be used with touch screens capable of reporting only a single contact point and therefore the users were required to execute multiple discrete steps before selecting the target. These steps were delimited by the user lifting their finger from the screen, thus impeding the overall interaction performance. Interestingly, they observed that even though their baseline zooming technique (Zoom Pointing) performed best out of the four techniques compared, its main drawback of losing overview or context can be a significant problem in many applications. Some research by Kabbash [3] points in the opposite direction, claiming that requiring the user to coordinate actions of their hands in order to perform two handed interactions may complicate the overall task and slow performance.

Buxton [4] identified that most current user interfaces require an interaction model consisting of at least 3 different states (out-of-range, tracking, and dragging). However, many touch sensitive devices can only reliably sense location in one state thus making it hard to disambiguate between dragging and tracking (hover).

3. TECHNOLOGIES OF THE TOUCH SCREEN

There are several types of touch screen technologies offered by various worldwide manufacturers [5]. Each technology has its own set of characteristics and depending on our touch application, these differences may be viewed as benefits or disadvantages. Most touch solutions have a touch screen attached to a video display unit. The touch screen works with a controller and a software device driver to sense a touch, determine its location, and transmit the information to the computer's operating system. Touch solutions primarily use one of six technologies, each with characteristics that make it best suited for specific application. These technologies are:

- Resistive Technology
- Capacitive Technology
- Near Field Imaging Technology
- Acoustic Wave Technology
- Infrared Touch Screen Technology
- Visible ray Touch Screen Technology

4. WORKING METHODS AND RESULTS

The main circuit of the touch screen is given in the figure 2. The circuit uses voltage divider rule to produce the output voltage that is either 3-8 volt or less than 2 volt. In the circuit I supplied 5 voltages to the circuit as an input voltage from the data pin (2) of the parallel port. The circuit has designed using 8 Light Depended Resisters (LDR) and 8 Laser light as a light source. Each LDR makes a voltage divider circuit with a resistor. The voltage across LDRs is the signal voltage which is directly connected to the printer port (10, 11, 12, 13 and 15) of the CPU. The LDRs are organized in the x and y edges of the monitor and the Laser lights are also organized corresponding to the LDRs. When the light falls on the LDR, the output of the LDR becomes less than 2 volt which has been treated as logic 0. And when the light does not falls on the LDR, the output of the LDR becomes 3-8 volt which been treated as logic 1. In the circuit below R (top) is a 10 KΩ resistor, and an LDR is used as R bottom:

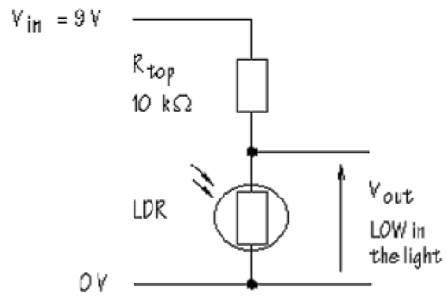

Figure 1: The voltage divider rule using Resistor and LDR

Suppose the LDR has a resistance of 0.5 Ω in bright light, and 200Ω in the shade (these values are reasonable). When the LDR is in the light, V_{out} will be:

$$V_{out} = \frac{R_{bottom}}{R_{bottom} + R_{top}} \times V_{in} \quad \text{.........(4.1)}$$

$$V_{out} = \frac{0.5}{0.5 + 10} \times 9 = 0.43\text{V}$$

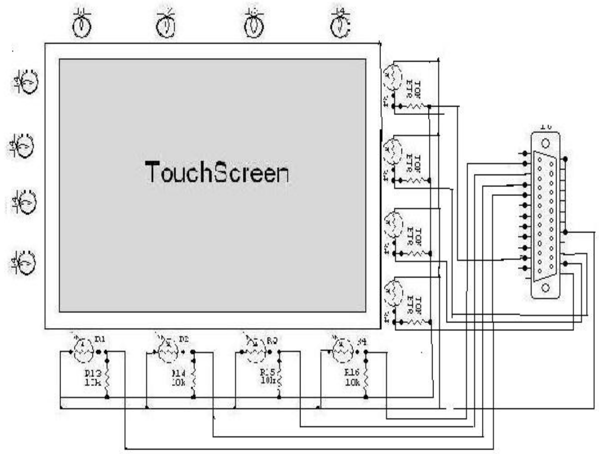

Figure 2: The Main Circuit of the Touch Screen

In the shade, V_{out} will be:

$$V_{out} = \frac{200}{200+10} \times 9 = 8.57 \text{ V}$$

In other words, this circuit gives a Low voltage when the LDR is in the light and a High voltage when the LDR is in the shade. The voltage divider circuit gives an output voltage which changes with illumination. In this way, eight LDRs produced an 8 bit signal such as 10001111, 11001111 etc. Bases on these 8 bit signal a program is written using Visual Basic language. And finally, the desired output for each touch has been found. The Main Circuit of the Laser ray Touch Screen system is shown in Fig-2

Table 1: Signal generated for each touch.

Touch on	Create Signal 8 bit	Corresponding Decimal Value
Folder(C)	11001111	207
Folder(D)	00001111	15
Folder(E)	10101111	175
Folder(F)	10011111	159
Exit	10010111	151

The flow chart of the working principle has been given in the figure 2. Consider 'I' as an integer. When the screen is touched an 8 bit signal and corresponding a decimal value is obtained. If the decimal value is 207 that is i=207, then folder (c) is opened otherwise CPU check the other value. If the decimal value is 15 i.e i=15, then folder (D) is opened otherwise CPU check the others value. If i=175, then in a same procedure (F) folder is open or CPU check the other value. On the other hand if i=159. Then folder (D) is opened otherwise CPU check the last value i=151 when CPU get the value i=151, CPU exit the program.

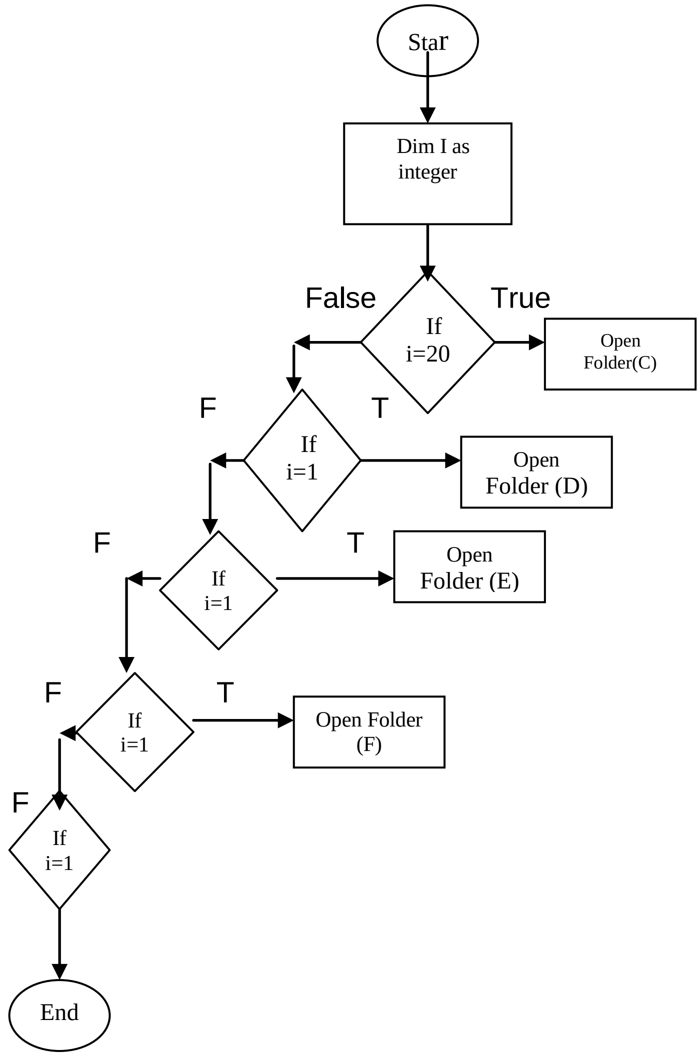

Figure 2: Flow chart of the working principle of laser ray touch screen technology.

CONCLUSION

The touch screen that is developed in this work is used to access buttons. When the button is selected by the finger or stylus that prevent the light to reflect on the LDRs but light is reflected on other LDRs that are not covered by the finger. When the button is selected it will be opening a folder on the display system. In this paper, only the control named button is used and check box, radio button and other controls are not used. The touch screen can be created manually and this type of touch screen can be used with any type of computer system. The touch screen may be appeared error if the light sources do not produce the desired level of light. To produce the touch screen four sensors have been used in horizontal and four sensors in vertical. So it can not cover all area of the monitor. So if the location is selected where no signal is sensed by the sensor then it will be not work properly. It is the limitation of this work. If this touch screen can be produced industrially it is possible to minimize this limitation. Now-a-days all touch screens are built with the display system. Here is the different of the proposed touch screen. It is in reality differed than the traditional touch screen because it is movable without its display system.

REFERENCES

[1]. Shneiderman, B., Touch screens now offer compelling uses. IEEE Software, 1991. 8(2): p. 93-94, 107.

[2]. Albinsson, P. Zhai, S. (2003). High precision touch screen interaction. In Proc. Of CHI' 2003, 105-112.

[3] Research by Kabbash. (2006). Precise selection techniques for multi- touch screens. Proc. of CHI' 06, 1263-1272.

[4] Buxton, W.Hill, R. & Rowley, P. (1985). Issues and techniques in touch sensitive tablet input, Computer Graphics, 19(3), Proceedings of SIGGRAPH'85, 215-223.

[5] Comparative Study of Various Touch screen Technologies, International Journal of Computer Applications (0975 – 8887), Volume 6– No.8, September 2010