International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06 | June 2021 www.irjet.net p-ISSN: 2395-0072

Laser Projection Virtual Keyboard

Mehul Bhargava[1], Shruti Singh[2], Madhuri Sharma[3]

[1,2]Student, Dept. of Computer Science and Engineering, SRM Institute of Science and Technology, U.P., India
[3]Assistant Professor, Dept. of Computer Science and Engineering, SRM Institute of Science and Technology, U.P., India

---

Abstract - *When computers were invented, they were massive and caused many problems because of their humongous size and weight. With the advancement in technology, almost every component of a computer got improved with the reduction in size, better performance, fast response, and addition of new advanced features. But the keyboard is the only component that remained nearly the same over the years. The traditional keyboard has a miniaturization problem, and there is a need for upgradation, so we choose an option for a virtual keyboard. In this novel approach, when the typist types, finger movements will be tracked by the camera to obtain the keystroke and send the typed characters to the computer. A Laser Projection Virtual Keyboard is a keyboard having the component of the software that the user uses by virtually pressing on the area using a wireless or optical detectable surface rather than by depressing physical keys.*

***Key Words*: Virtual Keyboard, Laser light, Infrared light, Sensor, Projection and Ultrasonic Sensor.**

1.INTRODUCTION

A virtual keyboard is a computer input device that is operated by typing (depressing motion of fingers) on a wireless or optical-detectable surface or area instead of pressing physical keys. The user virtually depresses or touches keys displayed in the image of the keyboard, which is projected by the virtual keyboard device. An optical device detects the stroke which is pressed by the user and sends it to the computer. A Projection keyboard establishes a connection to other devices using Bluetooth Technology or by USB. It can be connected to various devices such as smartphones, Personal Computers & mini-PC devices with iOS, Windows, or Android platforms [1].

This device is actually a key-in device based on highly advanced laser technology; approximately a size of a fountain pen, a keyboard of full size is projected onto a flat surface. This is the latest technology to eliminate finger cramping. Through the use of laser technology, a device such as a handheld device, is used to project a brick red image of keyboard. The concept of optical recognition is used to detect & allows users to tap on the projected keys by the device so that it behaves like a real one. This new invention will become a boon in the field of mobile computers who do prefer in-touch typing rather than cramping over tiny keys [2]. Laser Keyboard systems will now in further to do the functioning of Mouse as well.

We have self-implemented and built Laser Projection Virtual Keyboard using a technology that includes echo sounds and general techniques that are used for the execution and construction of this keyboard. We inferred some ways to improve this keyboard and some valid modifications.

2. DEVELOPMENT

A Virtual Keyboard was devised and patented by IBM engineers in 1992. In 2002, start-up company Canesta invented a projection keyboard using their exclusive "electronic perception technology". The company afterward licensed the technology to Celluon of Korea [3]. Canesta has added click sounds that imitate real typing, to help users with better and improved usage. Now, this device is available in various versions and manufactured by different companies like Serafim, Gangxun, Microwave, Tobo, and PremiumAV.

3. APPROACH

3.1 Connecting the Keyboard

The Virtual Keyboard can be connected to a computer either by wire mode like USB cables or by wireless modes like Bluetooth.

3.2 Light Emission

When the Keyboard is properly connected to a computer, the laser light emitter projects a layout of the keyboard on the surface along with infrared light on the same area of keyboard projection. This infrared light is not visible to the user and drifts a very few distances over the surface [4]. This plane is placed just parallel to and above the surface of the keyboard layout projection.

3.3 Reflection Process

When the user touches the key's position on the interface, the light gets reflected from the user's fingers & surroundings of the key. This reflected light is directed towards the sensor.

3.4 Displaying Output

After receiving the reflected light, the sensor sends the signals to the computer and a software converts the coordinates of reflected light to identify actions and characters, thereby displays the typed characters on the screen [5].

The basic approach workflow is shown in Fig -1.

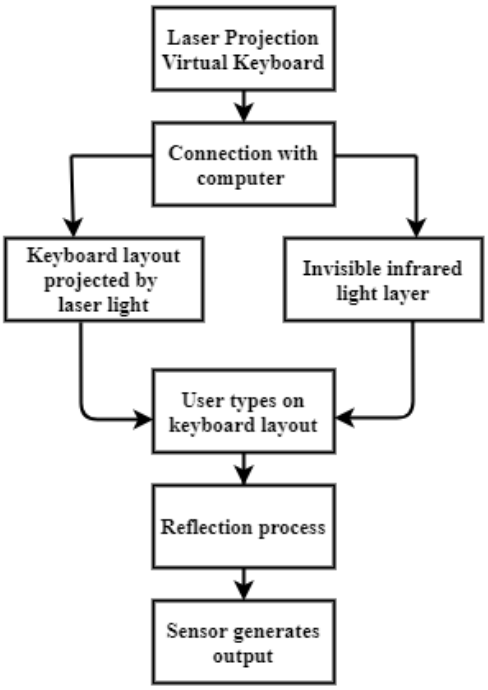

Fig -1: Workflow Diagram

4. DESIGN

The Virtual keyboard is generally cuboidal in shape, with one front surface projecting the laser light on the opaque flat surface. The general dimensions are 8 cm height, 5 cm length, and 3 cm width and it is a lightweight device with a weight of around 70 grams only, which makes it portable.

4.1 Components

It has three main components Laser Light Emitter (pattern projector) which is located at the top, Sensor in the middle, and an Infrared Light Emitter at the bottom of the Virtual Keyboard device [6].

4.1.1 Laser Light Emitter

The Laser Light Emitter is a small device that emits light through the process of optical amplification. Before the light comes out of this tiny device, it passes through a Diffractive Optical Element that has a microstructure of a standard keyboard layout. Laser Light Emitter is also called a pattern projector as it gives a keyboard pattern on a flat and opaque surface.

4.1.2 Infrared Light Emitter

The Infrared Light Emitter emits infrared light just above and parallel to the flat surface, where the keyboard layout is projected by the pattern projector. This infrared is not visible and cannot be seen with naked eyes by the user. It is usually placed at the bottom of the virtual keyboard, which allows it to emit infrared light a few millimeters above the flat and opaque surface.

4.1.3 Sensor

The sensor converts the reflected light into electronic data and sends the data for further processing. It is the component responsible for tracking the finger movements and guessing the pressed key.

It also has a USB port or other ports based on the connectivity options. The design is shown in Fig -2 below.

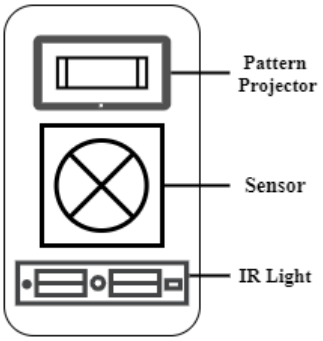

Fig -2: Virtual Keyboard Design

5. WORKING

The Laser Light Emitter or Patter Projector has a Diffractive Optical Element which is having a complex microstructure that spreads the laser light and projects the layout of the keyboard on the flat opaque surface.

The Infrared Light Emitter creates a thin layer of Infrared light a few millimetres above the flat surface. Whenever we touch any key on the projected keyboard the Infrared Light gets reflected from our finger and goes back to the keyboard's sensor and the sensor detects the location (coordinates of a 2-dimensional plane) of our finger and tells which key we have touched [7].

It can detect multiple keys at a time. The detected signals are sent to the computer and the output characters are displayed on the computer screen.

Fig -3 shows the working of all three main components, that are Laser Light Emitter, Sensor, and Infrared Light Emitter.

Fig -4 shows how the keyboard layout is based on a 2-dimensional plain with x and y coordinates, that are used by the sensor to detect the location of finger strokes.

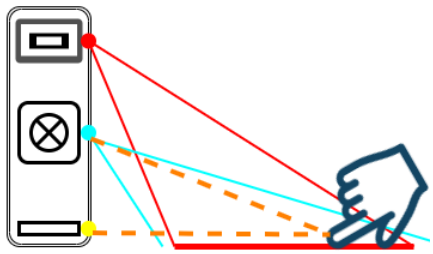

Fig -3: Working of All Three Main Components

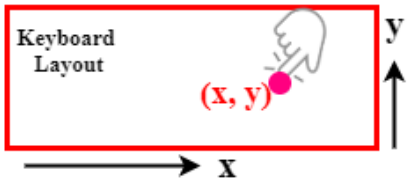

Fig -4: 2-Dimensional Keyboard Layout with x and y coordinates

6. SELF IMPLEMENTATION

We have implemented the Laser Projection Virtual Keyboard using a methodology that includes echo signals. We have used an Ultrasonic Sensor, a Bluetooth module (HC-05), Keyboard Layout Projection Laser, a monitor (display), and most importantly Beaglebone Black Rev C. Beaglebone Black Rev C is a low powered single board computer. It measures approximately 75 by 75mm. It has 512 MB DDR3 RAM, the processor clock speed is 1 GHz, HDMI, and 4 GB of eMMC flash memory. Beaglebone Black Rev C has various applications and is commonly used in electronic and robotic projects.

6.1 Hardware and Software Setup

The hardware implementation includes the setting of Ultrasonic Sensors, Bluetooth module, microcontrollers, and Projection module. The Projection module uses laser light to project the keyboard layout using a convex lens and hologram of the keyboard. Its brightness can be controlled for efficient performance. All of the other components here are already set and ready to use. After switching on the system, they automatically start performing their desired tasks.

The software setup mainly requires an algorithm for character recognition. It is implemented by the Beaglebone Black Rev C programming in the Python programming language.

6.2 Proposed Methodology

The Keyboard Projection Laser projects the layout of the keyboard on a flat and opaque surface. After this, the Ultrasonic Sensor begins emitting ultrasonic signals. The ultrasonic sensor is basically a sound sensor, that operates at a frequency higher than the hearing ability of humans. These devices perform on a concept of echo sound, which evaluates the characteristics of a target by elucidating the echoes from sound waves. These sensors determine the distance of an object by producing high-frequency sound waves which get reflected by the object as an echo and measure the time gap between sending the high-frequency sound signals and receiving the echo. For this purpose, the following calculations and formulas are used:

Time = Span of Echo movements (microseconds)
Distance (centimeters) = Time / 58
Distance (inches) = Time / 148

After detecting the pressed key, for determining the character, Beaglebone Black Rev C is used. Beaglebone Black Rev C acts as an evaluation platform with a combination of software development and microcontroller environments. Most of the Beaglebone Black Rev C programs are written in Python Programming Language and they can be run in all operating systems. After this, the typed character needs to be displayed. To display the character, a monitor is used and the input to be displayed is sent through the Bluetooth module. This module allows us to send and receive data through wireless means. Finally, the typed key or the entered characters are displayed. The proposed methodology flow diagram is shown in Fig -5.

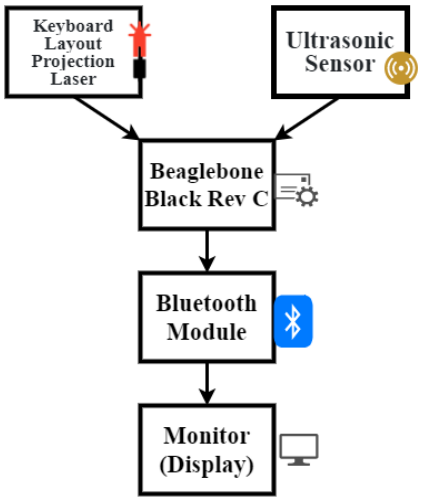

Fig -5: Proposed Methodology Flow Diagram

7. ADVANTAGES

a) Virtual Keyboards are portable and can be carried in pockets. They take small space in bags or on computer tables.
b) They have the ability to reduce the risk from repetitive strain injuries.
c) It provides the different alternative layouts of a keyboard.
d) They come with a built-in rechargeable battery.
e) It does not need a large tying space.
f) It can be used in no or dim lighting, usually at night.
g) They can be used as a virtual mouse, power bank, speaker, or cell phone stand.
h) They are handheld devices, which makes them unique and different from other keyboards.

8. DISADVANTAGES

a) It is not recommended for users with fast typing speed.
b) Its accuracy is slightly less than standard keyboards.
c) There is a lack of sense of typing to a user.
d) If the surroundings are too bright, then the keyboard is not clearly visible.

9. MODIFICATONS

9.1 Extra Utility Features

a) A speaker is added to the Virtual Keyboard device, which supports voice reporting and music playing.
b) It can also be used as a power bank for emergent uses.
c) They can be embedded with a mouse mode feature, which enables the users to use it as a virtual mouse [8].
d) It can be used as a cell phone stand which is located at the top surface of the keyboard which holds a cell phone with a strong grip.

9.2 User Comfort Features

a) Multiple keyboard layouts are available with different shapes and sizes of keys. For instance, round keystrokes.
b) After a certain time period of inactivity, keyboards can switch off on their own to save battery, and this feature is called Auto Sleep mode [9].
c) While typing, users can experience different key pressing sound feedbacks like typewriter sounds or normal keyboard key-pressing sounds [10].
d) Some Virtual Keyboards come up with built-in rechargeable batteries.

10. CONCLUSION

Laser Projection Virtual Keyboards is a competent invention, the idea and technology used behind its designing and working are really prominent. Though, it doesn't get much success. It can be improved if its accuracy is improved and it is very useful for many users and not for others. In the future, when there is a need for minimized gadgets, this keyboard will gain much more importance.

REFERENCES

[1] Prof. R. G. Gupta,RaguruShrikanth Reddy, Nakul Navnit Parmar, "Virtual Keyboard Using Image Processing", International Research Journal of Engineering and Technology (IRJET),Vol. 03, pp. 2009- 2013, April 2016.

[2] Krutika Jadhav, Fahad Jagirdar, Sayali Mane, Jahangir Shahabadi, "VIRTUAL KEYBOARD AND VIRTUAL MOUSE", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Vol. 05, pp. 1471-1474, May 2016.

[3] Nikhil Koul, Pranav Nawathe, Pranav Tulpule, "Virtual Keyboard", International Journal of Scientific & Engineering Research, Vol. 05, pp. 650-653, April-2014.

[4] Rupali Pandey, Amit Kumar Jha, "Virtual Keyboard", National Conference on Smart Computation and Technology in Conjunction with The Smart City Convergence 2018, Vol. 04, pp. 91-95, March 2018.

[5] Souvik Roy, Ajay Kumar Singh, Aman Mittal, Kunal Thakral, "Virtual Wireless Keyboard System with Coordinate Mapping", International Journal of Advances in Engineering & Technology (IJAET) 2014, Vol. 07, pp. 1003-1008, July 2014.

[6] Shaicy P Shaji, Leo Pius, Maritta Simon P, Tressa Francis,Vishnu Babu K, Vineeth Francis, "Virtual Keyboard", International Journal Of Engineering And Computer Science, Vol. 06, pp. 20797-20800, March 2017.

[7] Toshan Sabni, Jayant K Yavatkare, Divyanand S. Yadav, Prof. Vinit Kakde, "Laser Projection Virtual Keyboard: A Laser and Image Processing based Human-Computer Interaction Device", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 06, pp. 346-348, March 2017.

[8] Vidyut Agarwal, Shivam Mishra, Manoj Nehriya, Rupali Satpute, "Virtual Laser Keyboard", International Conference of Innovative Research in Science and Engineering, Vol. 02, pp. 411-414, March 2016.

[9] Paul D. Varcholik, Joseph J. LaViola, Charles E. Hughes, "Establishing a baseline for text entry for a multi-touch virtual keyboard", International Journal of Human-Computer Studies, Volume 70, pp. 657-652, 2012.

[10] Tushar Naykodi, Abhilash Patil, Kiran Sase, Sitesh Singh, "Reconfigurable Virtual Keyboard based on Image processing", International Journal of Engineering Research & Technology (IJERT), Vol. 03, pp. 1-3, 2015.