Journal of
Electronic Design Technology
https://journals.stmjournals.com/joedt
ISSN: 2229-6980 (Online)
ISSN: 2321-4228 (Print)
Volume 17, Issue 2, 2026
May–August
DOI (Journal): 10.37591/JoEDT
Review JoEDT

IR Laser Virtual Keyboard: A Review Paper

Payal Gupta[1], Sumit Kumar Gupta[2,*]

Abstract

Technology is evolving at an unprecedented pace, becoming faster, more compact, lightweight, and efficient. Continuous advancements in electronics, communication systems, and embedded technologies have led to the development of innovative devices that enhance convenience and improve user interaction with digital systems. One such innovation is the laser projection keyboard, a virtual input device that eliminates the need for a traditional physical keyboard. By projecting a full-sized keyboard onto any flat surface, this technology provides a portable and flexible alternative for data entry while maintaining the functionality of a conventional keyboard. A laser projection keyboard operates by using laser projection and infrared sensing technology. The laser projects the image of a standard QWERTY keyboard onto a flat surface, while infrared sensors detect the position of a user's finger when a virtual key is pressed. The detected keystrokes are processed by an embedded controller and transmitted to connected devices such as smartphones, tablets, laptops, or desktop computers through Bluetooth or USB communication. This enables accurate and efficient text input without requiring mechanical keys. The increasing demand for compact and portable computing devices has accelerated the adoption of virtual input technologies. Compared with conventional keyboards, laser keyboards occupy minimal space, are lightweight, and can be easily carried by users. Since they do not contain physical keys, they are also more hygienic, easier to clean, and less prone to mechanical wear and tears. These advantages make laser keyboards particularly suitable for business professionals, travelers, healthcare environments, educational institutions, and mobile computing applications. Although challenges such as typing accuracy under varying lighting conditions and the absence of tactile feedback remain, continuous improvements in sensing technology and embedded processing are enhancing their performance. Consequently, laser projection keyboards represent a significant advancement in human computer interaction, offering a modern, portable, and innovative solution for next-generation input technologies.

Keywords: Laser projection keyboard, technological innovation, keystroke, portability, space constraints, hygiene

INTRODUCTION

The infrared laser with the use of this innovative input device, users can type as they would on a conventional keyboard by projecting a virtual keyboard onto any flat surface. It uses visible keyboard layouts made possible by infrared laser beams rather than physical keys, and motion sensors or optical recognition technology are used to identify inputs. This cutting-edge technology has many benefits, including portability, device interoperability, and enhanced hygiene, as it does not have any physical parts that could collect dirt or bacteria. Owing to their small size, laser keyboards have become increasingly popular. This makes them ideal for professionals, business travelers, and mobile users who require a portable typing solution [1].

***Author for Correspondence**
Sumit Kumar Gupta
E-mail: er.guptasumit@gmail.com

[1]Student, Department of Electronics and Communication Engineering, Bansal Institute of Engineering and Technology, Lucknow, Uttar Pradesh, India
[2]Assistant Professor, Department of Electronics and Communication Engineering, Bansal Institute of Engineering and Technology, Lucknow, Uttar Pradesh, India

Received Date: July 20, 2026
Accepted Date: July 22, 2026
Published Date: July 27, 2026

Citation: Payal Gupta, Sumit Kumar Gupta. IR Laser Virtual Keyboard: A Review Paper. Journal of Electronic Design Technology. 2026; 17(2): 43–48p.

A laser projection keyboard is an advanced input device that utilizes sophisticated laser and optical sensing technology to project a full-sized virtual keyboard onto any flat opaque surface. Typically compact enough to fit in a pocket, the device is approximately the size of a fountain pen, making it highly portable and convenient for mobile use. It projects a bright red keyboard layout using laser beams, allowing users to type without physical keys. This innovative technology reduces the inconvenience of carrying bulky keyboards and offers a comfortable, space-saving solution for smartphones, tablets, laptops, and other portable computing devices [2]. To make the device function like a genuine one, users can tap on the projected keys using optical recognition. This new development will be quite helpful for people who use mobile computers, as they prefer in-touch typing to squinting at tiny keys.

DISCOVERY

In 1992, IBM developers created and patented an optical, virtual keyboard. It optically detects and analyzes human hand and finger motions and interprets them as operations on a physically non-existent input device, such as a surface with painted or projected keys. In this way, it can emulate unlimited types of manually operated input devices (such as mice, keyboards, and other devices). Mechanical input units can be replaced by such virtual devices, which can be potentially optimized for a specific application and user physiology, maintaining the speed, simplicity, and unambiguity of manual data input [3].

Canesta, a Startup company, created a projection keyboard in 2002 with their own. In the realm of technological innovation, laser keyboards stand out as remarkable advancements in input technology. Unlike traditional keyboards with physical keys, laser keyboards project a virtual keyboard onto any flat surface using infrared laser beams to detect and interpret the keystrokes. This revolutionary concept not only transforms the way we interact with digital devices but also addresses challenges related to portability, space constraints, and hygiene [4].

COMPONENTS

It consists of three primary parts. The Virtual Keyboard device has an Infrared Light Emitter at the bottom, a sensor in the middle, and a laser light emitter (pattern projector) at the top [5].

Laser Light Emitter

The Laser Light Emitter is a compact device that uses optical amplification to produce light. The light travels through Diffractive Optical Elements with a conventional keyboard layout microstructure before exiting this tiny device. Because it projects a keyboard pattern onto a smooth, opaque surface, the Laser Light Emitter is also known as a Pattern Projector.

Infrared Light Emitter

The keyboard layout is projected by the pattern projector onto a flat surface, and the Infrared Light Emitter produces infrared light just above and parallel to that surface. The user cannot see this infrared with their unaided eyes because it is not visible. It is typically positioned at the bottom of the keyboard to produce infrared light a few millimeters above the opaque, flat surface of the virtual keyboard [6].

Sensor

The sensor is a key component of the laser projection keyboard, which is responsible for detecting finger movements and identifying virtual key presses. It captures the reflected infrared light from the user's fingers and converts it into electronic signals for further processing by the controller. The processing unit analyzes these signals to determine the exact position of the finger and identifies the corresponding key that is pressed. The processed data are then transmitted to the connected device through a USB interface or wireless communication, such as Bluetooth, depending on the connectivity option supported by the laser projection keyboard [7].

Journal of Electronic Design Technology
Volume 17, Issue 2
ISSN: 2229-6980 (Online), ISSN: 2321-4228 (Print)

METHODOLOGY

A Visible Virtual keyboard is projected onto a flat surface using a beamer. This input device is contemporary in nature. The projector's sensor or camera detects finger motions. To determine actions or letters, the software translated the coordinates [8].

The reflected beam travels to the camera through an infrared filter. The angle of the incoming infrared light was captured by the camera. The location where the infrared beam was broken was determined using the sensor chip. The character or action to be generated is determined by the software. Figure 1 shows the operation of all three main components [9].

A second undetectable infrared beam is projected above the virtual keyboard using certain gadgets. A keystroke is made on the virtual keyboard by the user's finger. These bounces light back to the projector and disrupt the infrared beam. Figure 2 shows the dimensional keyboard layout with x and y-coordinates.

The projection is realized in four main steps and via three modules:

- Projection module,
- Sensor module and
- Illumination module.

The main devices and technologies used to project the image are:

- A diffractive optical element,
- Red laser diode,
- CMOS sensor chip and
- An infrared (IR) laser diode.

CONNECTIVITY

The Laser Projection Keyboard can be connected to computers, smartphones, tablets, and other digital devices using USB or Bluetooth communication. Bluetooth connectivity enables wireless point-to-multipoint communication, allowing keyboards to pair with multiple compatible devices, including personal computers (PCs), personal digital assistants (PDAs), and mobile phones. A Bluetooth dongle can be used to establish communication with devices that do not have built-in Bluetooth capability. The connection process depends on the operating system and hardware of the target devices. Once paired successfully, the laser keyboard provides a convenient, portable, and cable-free input solution for efficient text entry and device control [10].

DISPLAYING OUTPUT

The sensor detects reflected light, transmits signals to the computer, and the software interprets the reflected light coordinates to identify characters and actions, displaying the written characters on the screen. Figure 3 illustrates the basic workflow of this technique.

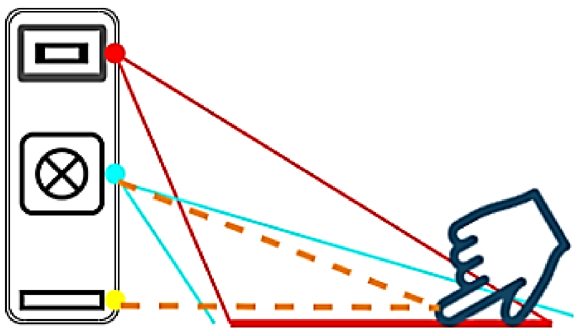

Figure 1. Working of all three main components.

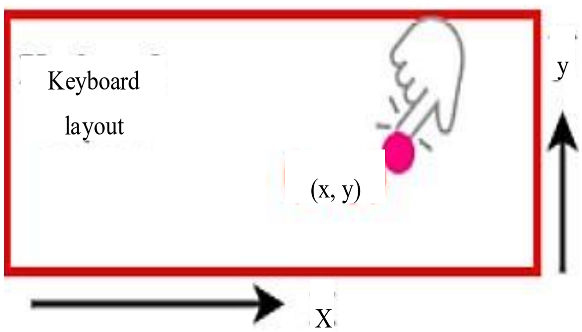

Figure 2. Dimensional keyboard layout with x and y coordinates.

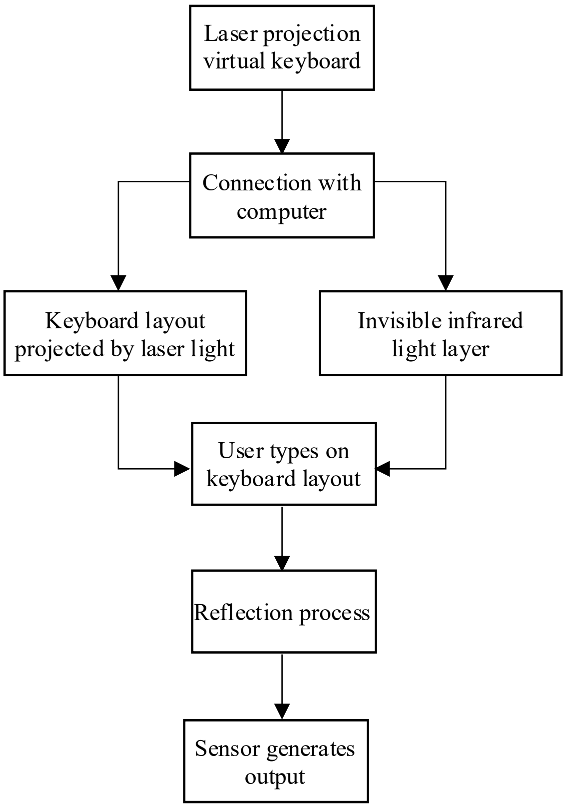

Figure 3. Workflow diagram.

MODIFICATIONS

Extra Utility Features

1. The Virtual laser keyboard device
2. It now has a speaker, enabling voice reporting and music playback [10].
3. For emergency situations, it can also be utilized as a power bank.
4. Users can utilize them as a virtual mouse by embedding a mouse mode function.
5. It has a mobile phone stand function that can be used to hold the phone firmly in place. It is located on the top surface of the keyboard.

User Comfort Features

1. A variety of keyboard layouts with varying key sizes and shapes are accessible. For example, consider rounded keystrokes.
2. Keyboards with an auto-sleep mode can automatically turn off to conserve battery life after a certain amount of inactivity.
3. Users may hear feedback as they hit keys on the keyboard, such as typewriter sounds or standard keyboard sounds.
4. A few Virtual laser keyboards have rechargeable batteries integrated into them.

CONCLUSION

Laser virtual keyboards represent a significant advancement in input technology by combining portability, wireless connectivity, hygienic operation, and innovative user experience. Unlike conventional keyboards, they eliminate the need for physical keys by projecting a virtual keyboard onto any flat surface, making them highly suitable for mobile computing and space-constrained environments such as aircraft cockpits. Their compact design and durability make them an attractive choice for professionals, students, and frequent travelers alike. However, challenges such as the lack of tactile feedback, reduced typing comfort, and sensitivity to ambient lighting conditions can affect typing accuracy and the overall user experience. Despite these limitations, continuous advancements in laser projection, infrared sensing, and embedded technologies have steadily improved their performance and reliability. As research and development continue, future laser keyboards are expected to provide enhanced accuracy, better responsiveness, and more natural user interactions. These improvements will further increase their adoption across various applications, making laser virtual keyboards a promising alternative to traditional input devices in next-generation computing systems.

FUTURE SCOPE

Integration of Tactile Feedback

One of the major limitations of the IR Laser Virtual Keyboard is the absence of tactile feedback. In the future, this technology can be improved by integrating haptic or tactile feedback mechanisms so that users can experience a physical key-press sensation similar to that of a conventional keyboard. This would improve typing comfort, satisfaction, and accuracy.

Improvement in Sensing Accuracy

The performance of the virtual keyboard can be further enhanced using advanced infrared sensors and high-precision optical tracking systems. Future improvements may reduce key detection errors and increase the accuracy of finger position recognition, making the device more reliable for regular and professional use [5].

Artificial Intelligence Based Typing Support

Artificial Intelligence (AI) can be incorporated into IR Laser Virtual Keyboards to provide predictive typing, automatic error correction, smart word suggestions, and adaptive typing assistance based on user behavior. This would make the typing experience more efficient, intelligent, and user friendly.

Gesture Recognition and Multi-function Control

Future versions of laser projection keyboard technology are expected to incorporate advanced gesture recognition capabilities, enabling users to perform functions such as scrolling, zooming, cursor navigation, and virtual mouse operations without the need for additional input devices. By integrating computer vision, infrared sensing, and artificial intelligence, these keyboards can recognize hand gestures and translate them into commands. This enhancement transforms the laser keyboard from a simple typing device into a multifunctional interactive interface. Such developments will improve user convenience, increase productivity, and expand applications in smart computing, presentations, gaming, healthcare, and human–computer interactions.

Better Visibility in Different Lighting Conditions

Currently, one of the practical issues with laser virtual keyboards is reduced visibility under strong ambient light or daylight conditions. In the future, brighter laser projection systems and adaptive light control techniques can be developed to improve visibility and usability in all environments.

Integration with Smart and Portable Devices

The IR Laser Virtual Keyboard has significant potential for integration with smartphones, tablets, laptops, desktop computers, and other portable smart devices through USB and Bluetooth connectivity. As mobile computing continues to grow, users increasingly require compact, lightweight, and portable input devices that provide convenience without compromising their functionality. The laser virtual keyboard meets these requirements by projecting a full-sized keyboard onto any flat surface, thereby eliminating the need for bulky physical keyboards. Its portability makes it particularly suitable for business professionals, students, travelers, and remote workers, offering an efficient, space-saving, and innovative input solution for portable computing applications.

REFERENCES

1. Gupta RG, Reddy RS, Parmar NN. Virtual keyboard using image processing. Int Res J Eng Technol. 2016;3(4):2009-13.

2. Jadhav K, Jagirdar F, Maine S, Shahabadi J. Virtual keyboard and virtual mouse. Int J Adv Res Comput Eng Technol. 2016;5(5):2278-1323.
3. Zhai S, Hunter M, Smith BA. The metropolis keyboard—an exploration of quantitative techniques for virtual keyboard design. In: Proceedings of the 13th Annual ACM Symposium on User Interface Software and Technology; 2000 Nov 1. p. 119-28.
4. Du H, Oggier T, Lustenberger F, Charbon E. A virtual keyboard based on true-3D optical ranging. In: Proceedings of the British Machine Vision Conference; 2005. Vol. 1. p. 220-9.
5. Roy S, Singh AK, Mittal A, Thakral K. Virtual wireless keyboard system with coordinate mapping. Int J Adv Eng Technol. 2014;7(3):1003.
6. Usakli AB, Gurkan S. Design of a novel efficient human-computer interface: an electrooculogram-based virtual keyboard. IEEE Trans Instrum Meas. 2009;59(8):2099-108.
7. Sabni T, Yavatkare JK, Yadav DS, Kakde V. Laser projection virtual keyboard: a laser and image processing based human-computer interaction device. Laser. 2017;6(3).
8. Su X, Zhang Y, Zhao Q, Gao L. Virtual keyboard: a human-computer interaction device based on laser and image processing. In: 2015 IEEE International Conference on Cyber Technology in Automation, Control, and Intelligent Systems (CYBER); 2015 Jun 8. p. 321-5.
9. Varcholik PD, LaViola JJ Jr, Hughes CE. Establishing a baseline for text entry for a multi-touch virtual keyboard. Int J Hum Comput Stud. 2012;70(10):657-72.
10. Bhaumik T, Bhaumik S, Paul S, Mitra S. A comparative study between different types of multilevel inverter. Int Res J Eng Technol. 2022;9(6).

