DESIGN AND ANALYSIS OF LDR BASED LASER SECURITY SYSTEM

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Abstract - *The Laser Security Alarm System is an innovative and highly effective technology designed to enhance security in various applications. This system utilizes laser beams to create a protective perimeter and detect unauthorized intrusions. The fundamental concept revolves around the interruption of the laser beam, triggering an alarm or alert when an intrusion is detected. This abstract provides the gist knowledge of the key components and working of the Laser Security Alarm System. The core components include a laser emitter, a laser receiver, LDR and an alarm unit. The emitter projects an invisible laser beam, typically across a defined area or boundary. The receiver is responsible for continuously monitoring the laser beam. When an intrusion, such as a person or object, obstructs the laser path, the receiver sends a signal to the alarm unit, which then activates an alert mechanism. This alert can take various forms, including audible alarms, notifications to security personnel, or integrated surveillance system activation.*

Key Words: Laser Security Alarm, Photodector, Buzzer Alarm, Transistor, Resistor, Torch-LDR

1. INTRODUCTION

In an increasingly interconnected world, security has become a permanent concern for both individuals and businesses. To address this need, technological advancements have given rise to innovative security solutions, one of which is the Laser Security Alarm System [1]. For security systems, there are two essential components. Laser beam is a narrow beam that does not spread out like a lightbulb or flashlight does. Furthermore, laser light only has one colour. Laser light can be sent a long distance and still have enough energy in a limited area and can activate the photodetector security system because it does not spread out very much [2]. Due to its single wave length, the detector can be fitted with a blocking filter that allows laser light to pass through while keeping background light out of the detector. The path of the laser light is straight. This cutting-edge system combines the precision of laser technology with the effectiveness of alarms to create a robust and reliable security setup [3]. The Laser Security Alarm System is designed to detect unknown intrusions into a defined area by utilizing laser beams as a protective barrier [4]. When an intruder disrupts these laser beams, the system triggers

an alarm or alerts security or an alarm notification in system. Personal, ensuring that any potential threat is addressed promptly. This system is widely used in a variety of applications, including residential properties, commercial establishments, industrial facilities, and perimeter protection security areas. Homes can have these laser systems installed by a professional person or by you on your own. Technology advancements have significantly reduced the cost of security systems. Making laser systems is therefore among the least expensive security system options. It is capable of operating continually. A receiver module (laser receiver) is used to to receive the laser beam. With features like adjustable sensitivity, dual-beam technology, and real-time monitoring [5]. The laser security alarm stands at the forefront of modern perimeter protection, providing a robust defense for residential, commercial, and industrial environments [6]. With precise It is advanced home security system which can be accessed wireless by network system [7]. Laser beam is an advanced security system which is helpful in every field of defensing [8].

1.2 LITERATURE REVIEW:

A laser security system which is based on the principal voltage divider circuit and LDR. When laser beam falls on the LDR the voltage across it is low and resistance of LDR decreases. As soon as anyone interrupts the laser beam the alarm triggers in circuit [9]. Designed a laser light security which cover a large area. When any person or object cross the laser line the security alarm will ringing   and focus light will "ON" [10]. Home automation security with laser lights that interfaces with web pages and mobile apps. Passive infrared sensors are installed at a selected area to be protected. LED lights used because it consumes less energy [11]. Eco-friendly laser alarm system using LDR.It consists of two main circuit, the laser unit and LDR sensory alarm unit with rechargeable battery powered by solar energy. LDR is controlled by using Arduino [12]. Working principle and advantages of laser security alarm system. LDR is used as a sensor. It can be used for the water leakage over the cities [13]. Home automation security alert system that interfaces with windows 10 mobile application. It consists of laser, lights, alarm and python programmed which is connected to mobile through applications with triggering messages [14]. Intelligent theft detection alarm system based on laser fence and

wireless communication. If anyone disrupts the laser beam information like location (GPRS), etc will be shared to defender's mobile (SMS) [15]. Smart laser security alarm system in which a trap system is installed when a culprit enters the system traps the culprit motion. Fire sensor is also installed in a room if fire accident is detected immediately, it sends information to the fire station or user's mobile [16]. Multiple laser alarm system using Arduino Uno board to detect motion on the location. The device is coded is such a way that it will produce noise when all LDR receive zero light [17]. It is a home security system which monitored wireless/wireless sensors/accessed by the apps. The app is developed by using java on the client side and python programming language. A proprietary Raspberry pi camera is used for storing the pictures or videos of an intruder in environment in database [18].

2. DESIGN AND SIMULATION:

Designing a laser security alarm involves integrating a laser diode as the invisible light source and a photodiode or phototransistor as the receiver. A dependable beam path is ensured by precise laser and receiver alignment. The circuit has a comparator to set a triggering threshold in addition to amplification. When a beam is disrupted an alert system such a buzzer activates.
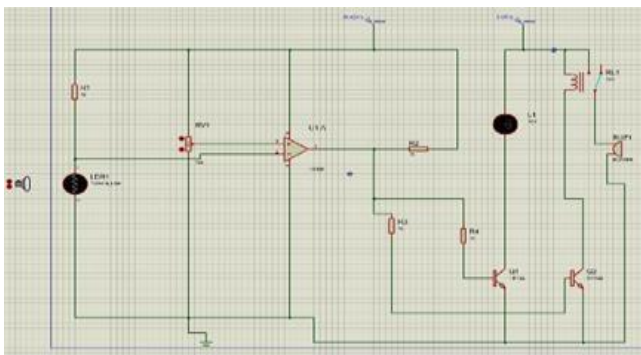

Fig.1 Circuit in Proteus

It indicates when the circuit is off the buzzer doesn't make any alerting sound and the LED doesn't glow.

A laser security alarm system is a device designed to detect intruders or unauthorized access by using lasers as a means of triggering an alarm. It works by creating a laser beam between a transmitter and a receiver. When an object crosses this beam, it interrupts the laser, causing the system to react and trigger an alarm. Here's how it works:

SL NO.	COMPONENET	VALUE
1.	RESISTOR(R1,R2,R3,R4)	1K
2.	VARIABLE RESISTOR(RV1)	1K
3.	TORCH_LDR	-
4.	LM393	-
5.	LAMP	-
6.	RELAY	12V
7.	TRANSISTOR(2N1711)	-
8.	BUZZER	-

WORKING:

Here the laser transmitter emits a continuous laser beam. Laser Receiver is positioned in such a way that it can detect the laser beam emitted by the transmitter. The alarm unit is responsible for activating the alarm when the laser beam is interrupted. The system is powered by electricity or batteries. The laser transmitter emits a narrow and focused laser beam, typically in the infrared spectrum, although visible red lasers can also be used. In most cases, the laser beam is colourless i.e., it is invisible to the naked eye.

The transmitter and receiver are aligned in a way that the laser beam travels from one to the other, forming a straight line or a predefined pattern. The receiver is set to receive the laser beam without interference. The Interruption Detector detects hen an intruder or an object crosses the path of the laser beam, it interrupts the beam. This interruption is detected by the receiver. The system can be set to trigger an alarm under various conditions:

• When the laser beam is completely blocked.

• When the beam is partially obstructed (for example, by a person walking through).

• When the beam is reflected off a surface (in some systems).

Alarm Activation: Once the laser receiver detects an interruption in the beam, it sends a signal to the alarm unit. The alarm unit can produce an audible alarm (such as sirens or bells), activate lights, or send a notification to a security system. Resetting the System: After the alarm is triggered, the system needs to be reset manually or automatically. This typically involves ensuring that the laser beam path is clear again. Security Monitoring: Laser security systems can be used in a variety of applications, such as protecting valuable assets, securing perimeters, or monitoring high-security areas. Key advantages of laser security alarm systems include their accuracy, reliability,

and the capability to cover long distances with a single laser system. They are commonly used in combination with other security measures to enhance overall security.

3. RESULT ANALYSIS:

According to the analysis's findings, the Laser Security Alarm System is a trustworthy and efficient security measure. It is a great tool for security applications due to its high detection accuracy, low false positive rate, quick response time, and overall dependability. It is crucial to keep in mind that realworld deployment may introduce extra difficulties not apparent during controlled testing, such as the need for maintenance a presence of natural factors.
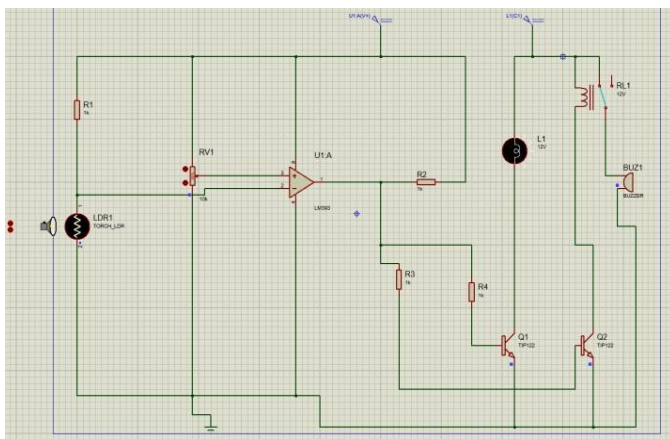

Fig 2: - When someone crosses the torch beam light the LED glows and the switch get closed, gives an alerting sound.

4. CONCLUSIONS

A laser security alarm system provides an efficient way to secure a space by utilizing laser beams to identify intrusions, according to the study's findings. It might be influenced by environmental conditions like fog or dust but offers benefits like precision and quick response time. For reliable operation, regular maintenance and accurate calibration are necessary. It can also improve general security when combined with other security measures. When putting a laser security alarm system into place, it's critical to take certain criteria and potential restrictions into account.

5.REFERENCES:

[1]. Thodupunoori, Rahul, Laser Alarm Security Systems (July 24, 2021). Available at SSRN: https://ssrn.com/abstract=3919037 or http://dx.doi.org/10.2139/ssrn.3919037

[2]. "Design and IoT Implementation of a Long-Range laser Based Intrusion Detection System for Perimeter Surveillance," 2022 International Interdisciplinary Conference on Mathematics, Engineering and Science (MESIICON), Durgapur, India, 2022, pp. 1-6, doi: 10.1109/MESIICON55227.2022.10093464. A. Chakraborty, A. Mallick, P. Saha, S. R. K. Vadali, S. Aruchamy, and V. S. Nageli.

[3]. Will G. J. M. Hospel, "Application of laser technology to introduce security features on security documents in order to reduce counterfeiting," Proc. SPIE 3314, Optical Security and Counterfeit Deterrence Techniques II, (1 April 1998); https://doi.org/10.1117/12.304704

[4].Hung-Jen Liao, Chun-Hung Richard Lin, Ying-Chih Lin, Kuang-Yuan Tung,Intrusion detection system: A comprehensive review, Journal of Network and Computer Applications,Volume 36, Issue 1,2013,Pages 16-24,ISSN 1084-8045,https://doi.org/10.1016/j.jnca.2012.09.00

[5].M. Kezmah, D. Donlagic and B. Lenardic, "Low cost security perimeter based on a Michelson interferometer," SENSORS, 2008 IEEE, Lecce, Italy, 2008, pp. 1139-1142, doi: 10.1109/ICSENS.2008.4716642.

[6]. Raju A Nadafa, S.M. Hatturea, Vasudha M Bonala, Susen P Naikb,Home Security against Human Intrusion using Raspberry Pi,Procedia Computer Science, Volume 167,2020,Pages 1811-1820,ISSN 1877 0509, https://doi.org/10.1016/j.procs.2020.03.200.

[7]. Chunjuan Wei, Junjie Yang, Wu Zhu, and Jian Lv, "A design of alarm system for substation perimeter based on laser fence and wireless communication," 2010 International Conference on Computer Application and System Modeling (ICCASM 2010), Taiyuan, 2010, pp. V3-543-V3-546, doi: 10.1109/ICCASM.2010.5620690

[8]. T. Sahani and V. P. Vishwakarma, "Intruder Laser Turret Defence System with Facial Recognition," 2022 4th International Conference on Circuits, Control, Communication and Computing (I4C), Bangalore, India, 2022, pp. 397-400, doi: 10.1109/I4C57141.2022.10057637.

[9]. K. Raviraj, M.Lithin siva swamy Naidu, A.Bilva naga Veera Vara prasad, N.Phaneendra, K.Brahma Siva ganesh, "LASER SECURITY ALARM SYSTEM", IJRAR - International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348-1269, P- ISSN 2349-5138, Volume.7, Issue 2, Page No pp.629-632, April 2020, Available at : http://www.ijrar.org/IJRAR2004223.pdf

[10]. P. Hosmer, "Use of laser scanning technology for perimeter protection," in IEEE Aerospace and Electronic Systems Magazine, vol. 19, no. 8, pp. 13-17, Aug. 2004, doi: 10.1109/MAES.2004.1346890.

[11].M. A. Zainal Arifin, M. Kassim, A. R. Mahmud and S. Izwan Suliman, "Automation Security System with Laser

Lights Alarm on Web Pages and Mobile Apps," 2019 IEEE 9th Symposium on Computer Applications & Industrial Electronics (ISCAIE), Malaysia, 2019, pp. 287-292, doi: 10.1109/ISCAIE.2019.8743998.

[12]. Hashim, H. M. B. ., & Hussain, D. M. A. . (2018). Security System via LDR . Journal of Applied Engineering & Technology (JAET), 2(2), 20–30.

[13]. A. Rai, M. Rai, N. Jogi, B. Rai, S. Rai and D. Rasaily, "Low Cost Laser Light Security System in Smart Home," 2019 International Conference on Innovative Sustainable Computational Technologies (CISCT), Dehradun, India, 2019, pp. 1-4, doi: 10.1109/CISCT46613.2019.9008141.

[14]. A. Jaafar, M. Kassim, C. K. Haroswati and C. K. Yahya, "Dynamic home automation security (DyHAS) alert system with laser interfaces on webpages and windows mobile using rasberry PI," 2016 7th IEEE Control and System Graduate Research Colloquium (ICSGRC), Shah Alam, Malaysia, 2016, pp. 153-158, doi: 10.1109/ICSGRC.2016.7813319.

[15]. Chunjuan Wei, Junjie Yang, Wu Zhu and Jian Lv, "A design of alarm system for substation perimeter based on laser fence and wireless communication," 2010 International Conference on Computer Application and System Modeling (ICCASM 2010), Taiyuan, 2010, pp. V3-543-V3-546, doi: 10.1109/ICCASM.2010.5620690.

[16]. P. Gunasekaran, K. Suresh Kumar, R. Hari Priya and V. Balaji, "Laser Based Smart Security Monitoring System Using Nodemcu and React.Js with Improved Storage Efficiency," 2021 International Conference on System, Computation, Automation and Networking (ICSCAN), Puducherry, India, 2021, pp. 1-4, doi: 10.1109/ICSCAN53069.2021.9526425.

[17]. Mohammed, Ayad. (2015). Design and Construction of a Smart Security System by Laser Fence Technique. FONDAZIONE GIORGIO RONCHI. 6. 699-713.

[18]. Sanjay Satam, S., El-Ocla, H. Home Security System Using Wireless Sensors Network. Wireless Pers Commun 125, 1185–1201 (2022). https://doi.org/10.1007/s11277-022-09596-z