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HOME SECURITY BASED ON LASER LIGHTING SYSTEM

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ABSTRACT: *Security is a most important factor today. Technology develops day by day in the world. The crime gang also improves their technology to perform their operation. So technology of security should be modern with time to protect the crime works. We decide to make a security project as our project. In this project we have used laser light to cover a large area. We know laser light goes through long distance without scattering effect. It's also visible only at source and incident point, otherwise invisible. These two properties help us to build up a modern security system, which may name as "laser security". LASER-Ray goes through long distance without scattering effect and the Ray is almost invisible. Only the radiation point and incident point is visible. So by this security project we can make an invisible boundary of a sensitive area. There are two parts of the system. One is transmitter and other is receiver. The transmitter part is built with a LASER radiator, a pair of dry cell batteries, an on-off switch and a stand to hold it. The receiver side, there is a focusing LDR (Light depending Resistor) sensor to sense the LASER continuously. The LDR sensor also holds with a stand and it connected with the main driver circuit. When anybody crossover the invisible ray the main circuit sense the discontinuity by sensor and turn on the alarm circuit. If once the alarm zcircuit is on it will still ringing until push the reset button. The system has built with low cost and high performance. The power consumption of the system is very low. Wi-Fi (Short for Wireless Fidelity) is a wireless technology that uses radio frequency to transmit data through the air. Wi-Fi has initial speeds of 1mbps to 2mbps. Wi-Fi transmits data in the frequency band of 2.4 GHz. It implements the concept of frequency division multiplexing technology. Range of Wi-Fi technology is 40-300 feet.*

1. INTRODUCTION

In general security systems are used for protection and in the project this is designed with Laser and an optical sensor LDR. The main aim of the project is to construct a simple and cheap laser security system using 555 timer with wireless transmission of the information and explore its uses in all aspects. A LASER ray or beam goes through long distance without scattering effect and it is almost invisible. Only the radiation point and incident point is visible. So by this security project we can make an invisible boundary of a sensitive area. The transmitter part is built with a LASER radiator, a pair of dry cell batteries, an onoff switch and a stand to hold it. And to receive this laser beam, there is a focusing LDR (Light depending Resistor) sensor that senses the LASER continuously. The LDR sensor is connected with the trigger circuit designed using 555 timer chip that provides input to the controller when any intruder is sensed. When anybody crossover the invisible ray the main circuit sense the discontinuity by sensor and turn on the alarm circuit by transmitting the information to android mobile through IoT module Wi-Fi interface. The system has built with low cost and high performance. The power consumption of the system is very low.

When the laser light falls on the LDR, it causes low resistance in it. Due to low resistance of the LDR it does not activate the alarming circuit. If anybody tries to trespass inside the secure place or cut the Laser beam by denying the continuous striking of Laser to LDR, the alarm will be activated by the controller and also transmits this information through the WiFi module to the android device, which lead the circuit to make effective notification in terms of making sound. This entire project work is designed using microcontroller which falls under the embedded technology. So it is necessary to have knowledge about the microcontrollers.

2. LITERATURE SURVEY

A Literature survey on Home security based on laser lighting system conducted

[1] Laser security system by Debarati Dutta [2013]. This paper on a laser-based security system presented a detailed approach to improving security using laser beams as invisible barriers. The system is designed to continuously monitor the path of the laser beam, and when an intruder crosses or disrupts the beam, it immediately triggers an alarm. This method ensures a high level of security for both residential and commercial properties. Additionally, the system is relatively cost-effective, simple to install, and offers continuous monitoring without requiring physical guards. It is particularly suited for areas where traditional security measures may be inadequate or too expensive.

[2] Laser based security system using Arduino UNO by Paramitha Mondal, Madhusree Mondal [2014]. This paper proposed a laser-based security system using Arduino to enhance protection for homes and offices. Their system utilized laser beams and light-dependent resistors (LDR) to create invisible security barriers. When an object or person interrupted the laser beam, the LDR detected the change in light intensity and triggered an alert through the Arduino microcontroller. The system aimed to provide an efficient, low-cost security solution with minimal maintenance. It could be easily installed in various settings and offered reliable detection of unauthorized entry, making it suitable for residential, commercial, and industrial applications.

[3] Laser security alarm system by A.B.N.V. Prasad, K. Ravi Raj, K. Siva Ganesh, M. Lithin Siva swamy Naidu, N. Phaneendra [2017]. In this paper proposed a laser security alarm system designed to offer a low-cost yet effective security solution. The system used a laser beam and a light-dependent resistor (LDR) to form an invisible security boundary. Upon interruption of the laser beam, the LDR detected the change in light intensity, sending a signal to an Arduino microcontroller, which then triggered an alarm.

[4] Laser based security system for home by Harshal Hemane, Debarati Sen [2018]. It employs laser beams and light-dependent resistors (LDRs) to create invisible barriers around a property. When the laser beam is disrupted, the LDR detects the change in light and triggers a signal to a microcontroller, activating an alarm or notification. This system is designed to provide reliable, continuous surveillance, ensuring home protection by detecting unauthorized entry. It emphasizes affordability, ease of installation, and low maintenance, making it an efficient solution for residential security.

3. FUNCTIONAL DESCRIPTION

The functional description of the project work is explained in this chapter. For better understanding, the total module is divided into various blocks and each block explanation is provided here. The diagrams (block diagram and circuit diagram) of this project work are provided in the next chapter. The following is the description of the overall function or operation of the project work.

3.1 LASER

A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation. The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation". A laser differs from other sources of light in that it emits light coherently. Spatial coherence allows a laser to be focused to a tight spot, enabling applications such as laser cutting and lithography. Spatial coherence also allows a laser beam to stay narrow over great distances (collimation), enabling applications such as laser pointers. Lasers can also have high temporal coherence, which allows them to emit light with a very narrow spectrum, i.e., they can emit a single colour of light. Temporal coherence can be used to produce ultrashort pulses of light with a broad spectrum but durations as short as a femtosecond.

Fig 3.1 Laser Pointer

Semiconductor lasers in the blue to near-UV have also been used in place of light-emitting diodes (LEDs) to excite fluorescence as a white light source, this permits a much smaller emitting area due to the much greater radiance of a laser and avoids the droop suffered by LEDs such devices are already used in some car headlamps.

3.2 LDR (LIGHT DEPENDENT RESISTOR)

A photo resistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity, in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

Fig 3.2 Light Dependent Resistor

Photo resistors work based off of the principle of photoconductivity. Photoconductivity is an optical phenomenon in which the material's conductivity is increased when light is absorbed by the material. When light falls i.e. when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in a large number of charge carriers. The result of this process is more and more current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased.

3.3 PIR SENSOR (PASSIVE INFRARED)

Sensor is an electronic sensor that measures infrared light radiating from objects. PIR sensors mostly used in PIR-based motion detectors. Also, it used in security alarms and automatic lighting applications. The below image shows a typical pin configuration of the PIR sensor, which is quite simple to understand the pinouts. The PIR sensor consist of 3 pins.

FIG.3.3 PIR Sensor

- Pin1 corresponds to the drain terminal of the device, which connected to the positive supply 5V DC.
- Pin2 corresponds to the source terminal of the device, which connects to the ground terminal via a 100K or 47K resistor. The Pin2 is the output pin of the sensor. The pin 2 of the sensor carries the detected IR signal to an amplifier from the
- Pin3 of the sensor connected to the ground.

WORKING PRINCIPLE

The passive infrared sensor does not radiate energy to space. It receives the infrared radiation from the human body to make an alarm. Any object with temperature is constantly radiating infrared rays to the outside world. The surface temperature of the human body is between 36°C - 27 ° C and most of its radiant energy concentrated in the wavelength range of 8 um-12 um.

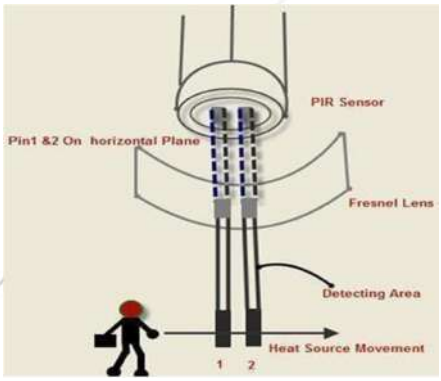

FIG.3.3.1 PIR Working Principle

Passive infrared alarms classified into infrared detectors (infrared probes) and alarm control sections. The most widely used infrared detector is a pyroelectric detector. It uses as a sensor for converting human infrared radiation into electricity. If the human infrared radiation is directly irradiated on the detector, it will, of course, cause a temperature change to output a signal. But in doing all this, the detection distance will not be more. In order to lengthen the detection distance of the detector, an optical system must be added to collect the infrared radiation. Usually, plastic optical reflection system or plastic Fresnel lens used as a focusing system for infrared radiation.

- Indoor passive infrared: Detection distances range from 25 cm to 20 m.

- Indoor curtain type: The detection distance ranges from 25 cm to 20 m.
- Outdoor passive infrared: The detection distance ranges from 10 meters to 150 meters.
- Outdoor passive infrared curtain detector: distance from 10 meters to 150 meters

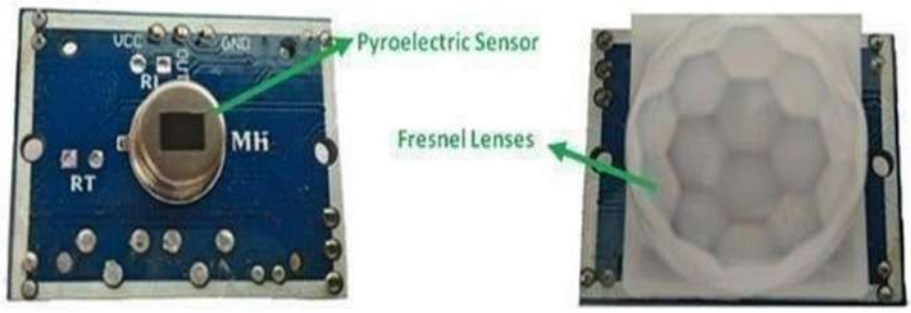

FIG.3.3.2 Pyroelectric Sensor

In the detection area, the lens of the detector receives the infrared radiation energy of the human body through the clothing and focused on the pyroelectric sensor. When the human body moves in this surveillance mode, it enters a certain field of view in sequence and then walks out of the field of view. The pyroelectric sensor sees the moving human body for a while and then does not see it, so the infrared radiation of human body constantly changes the temperature of the pyroelectric material. So that it outputs a corresponding signal, which is the alarm signal.

4. HARDWARE COMPONENTS

ARDUINO UNO

Android is a Linux based operating system designed primarily for touch screen mobile devices and it is a open source. There are so many applications already developed on Android and many applications are being developed at free of cost for its users. We can also develop our own customized applications with free of cost or with minimum cost according to our requirements. In this project we will use an application in the android device to read the information that is transmitted from the Bluetooth module. In recent years, an open-source platform Android has been widely used in smart phones. Android has complete software package consisting of an operating system, middleware layer and core applications. Different from other existing platform like iOS (iPhone OS), it comes with software development kit (SDK), which provides essential tools and Application.

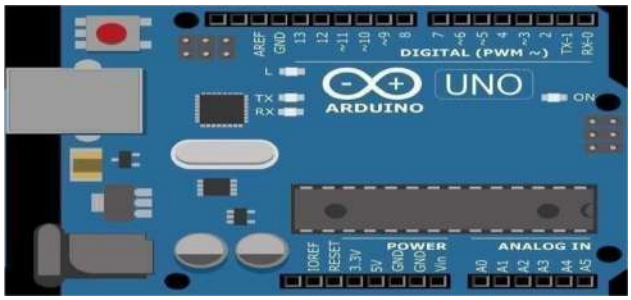

Fig.4.1 Arduino

Using a Smartphone as the "brain" of equipment is already an active research field with several open opportunities and promising possibilities. In our work, the home appliances are controlled to either switch ON or switch OFF using voice commands through the android device. Android is an operating system based on the Linux kernel, and designed primarily for touch screen mobile devices such as smart phones and tablet computers. Initially developed by Android, Inc., which Google backed financially and later bought in 2005, Android was unveiled in 2007 along with the founding of the Open Handset Alliancea consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices.

The first publicly available smart phone running Android, the HTC Dream, was released on

October 22, 2008. The user interface of Android is based on direct manipulation, using touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching and reverse pinching to manipulate on-screen objects. Internal hardware such as accelerometers, gyroscopes and proximity sensors are used by some applications to respond to additional user actions, for example adjusting the screen from portrait to landscape depending on how the device is oriented. Android allows users to customize their home screens with shortcuts to applications and widgets, which allow users to display live content, such as emails and weather information, directly on the home screen. Applications can further send notifications to the user to inform them of relevant information, such as new emails and text messages.

5. SOFTWARE REQUIREMENTS

EMBEDDED C LANGUAGE

Embedded C is a crucial programming language in the field of embedded systems. These systems are at the heart of numerous modern devices, from smartphones and home appliances to automotive control systems and industrial machinery.

Embedded C is specifically designed for embedded systems, and its importance lies in its efficiency, portability, and close-to-the-hardware capabilities. Embedded systems often have limited processing power and memory, making efficiency paramount. Embedded C allows developers to write compact and optimized code, ensuring these systems operate smoothly while conserving resources.

Portability is another key aspect. Embedded C code can be written to be platform-independent, enabling the same code to run on various microcontrollers and processors, enhancing reusability and minimizing development time.

Moreover, Embedded C provides low-level access to hardware components, making it ideal for tasks like controlling sensors, motors, and communication interfaces. Its ability to work at a hardware level ensures precise control and real-time responsiveness, crucial for safety-critical applications.

In safety-critical industries like healthcare and automotive, Embedded C's reliability and determinism are invaluable. It allows for the development of robust and predictable systems, reducing the risk of failures.

6.TECHNICAL ARCHITECTURE

BLOCK DIAGRAM

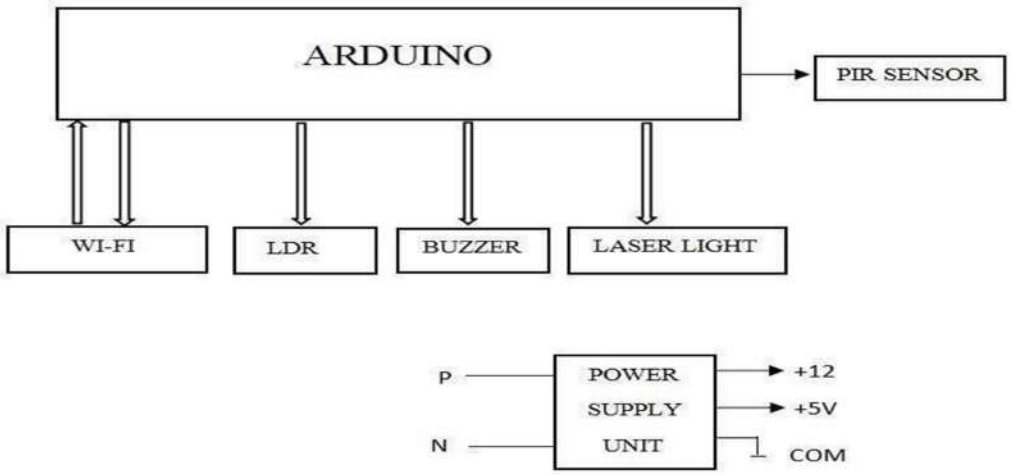

Fig.6.1 BLOCK DAIGRAM

7. TESTING RESULTS

HARDWARE MODULE

The figure below shows the complete hardware module. The hardware module consists of the Arduino UNO, PIR Sensor, LED, LDR, Buzzer, WI-FI, Laser Light, Transformer, Mirror, Voltage Regulator and Power Supply.

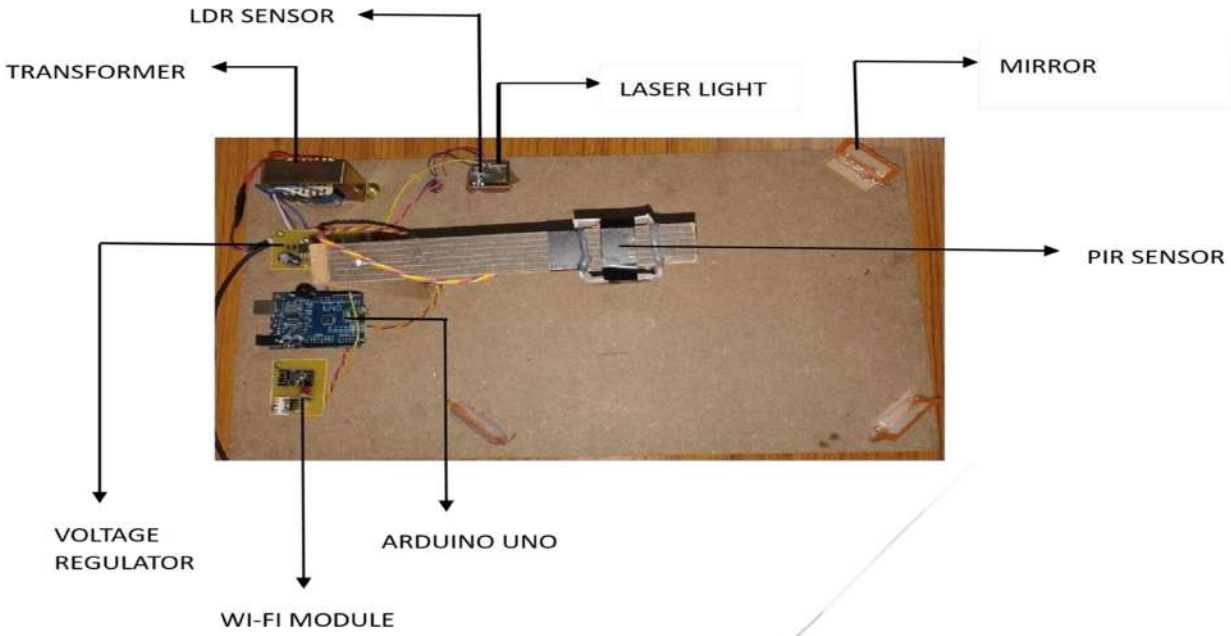

FIG.7.1 Hardware module

TESTING AND RESULTS

CASE 1: When a person enters from the right side, the system detects the intrusion, triggering the buzzer and sending an SMS alert to the homeowner via a Wi-Fi-connected app. Although the LDR (Light Dependent Resistor) sensor does not register any significant change in light in this case, the buzzer serves as an audible alert, and the SMS ensures the homeowner is immediately informed of the potential breach.

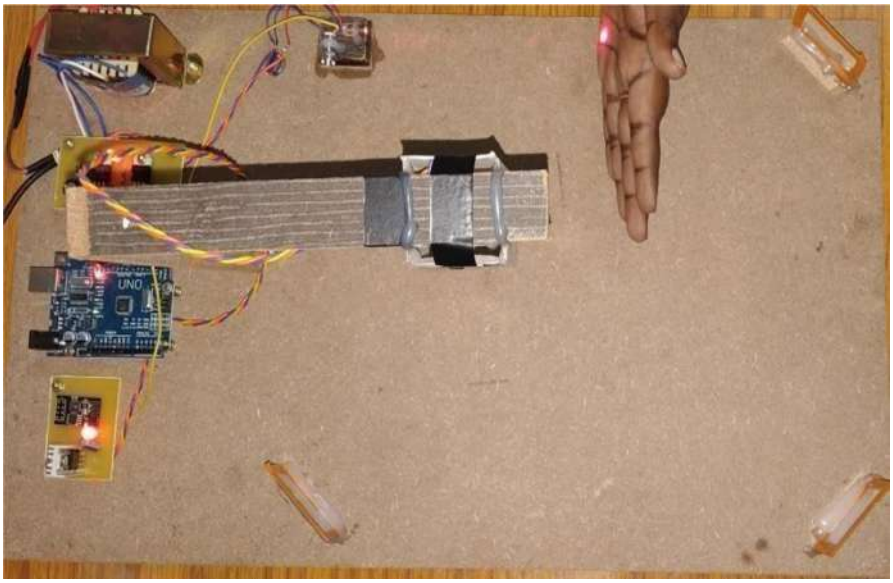

FIG.7.2.1(a) Case 1 Right side direction

Fig 7.2.1(b) Alert Message

CASE 2: Similarly, the system also monitors the front side of the house. If someone approaches from this direction, the buzzer is once again activated, and an SMS alert is sent to the homeowner, just as it does for the right-side entry. Despite the LDR sensor not detecting any light variation, the system's combination of an audio alert and wireless notification provides comprehensive coverage, keeping the homeowner aware of all entry attempts.

CASE 3: The left side of the house is also under constant surveillance by the system. When an entry is detected from this side, the system behaves consistently by activating the buzzer and sending an alert through the Wi-Fi app. The LDR sensor remains off, as the intrusion doesn't seem to affect the ambient light significantly. Nevertheless, the system ensures that any entry attempt from the left is met with immediate alerts to the homeowner.

CASE 4: In addition to these directional alerts, the system employs a PIR (Passive Infrared) sensor for detecting objects based on their body temperature, particularly for human detection (around 37°C). This sensor enhances the system's ability to detect living entities that may not cause significant changes in light but emit heat. In this scenario, both the LDR sensor and the PIR sensor are activated, providing more comprehensive detection. The buzzer is triggered as an audible alert, and the SMS alert is sent to the homeowner through the Wi-Fi app, ensuring a multilayered response to potential intrusions, whether by light disturbance or body heat detection.

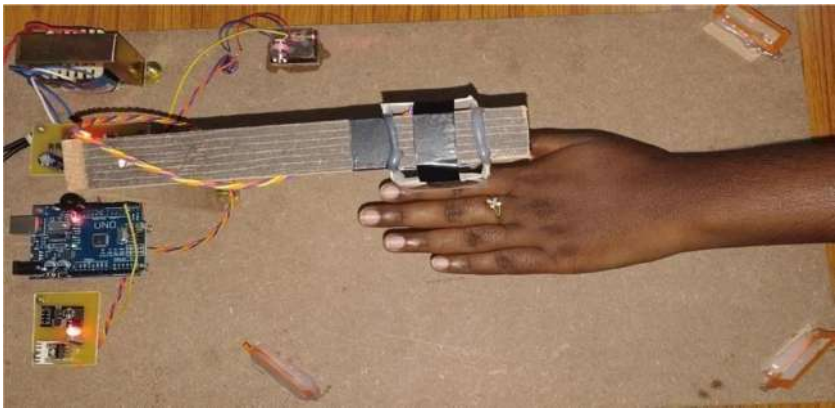

FIG.7.2.4(a) PIR Human detect

FIG.7.2.4(b) Alert Message

8.CONCLUSION

Laser security system provides us the security against any crime, theft in our day-to-day life and so people are installing them in order to stay safe, secure and sound. Various electronic security systems can be used at home and other important working places for security and safety purposes. It is a great opportunity and source of saving man power contributing no wastage of electricity. The "Laser Security System" is an important helping system. Using this system robbery, thefts & crime can be avoided to large extend. Avoiding thieves results in the safety of our financial assets and thereby this system provides us protection against all.

The Laser & LDR system is highly sensitive with a great range of working. The system senses the light emitted by the Laser falling over the LDR connected with the circuit. Whenever the beam of light is interrupted by any means, it triggers the alarm or siren. This highly reactive approach has low computational requirement; therefore, it is well suited to surveillance, industrial application and smart environments.

FUTURE SCOPE

- In the future, laser security systems could incorporate face recognition and fingerprint scanning.
- Using multiple lasers and LDRs could make the system more effective.
- The system could send a photo of the burglar to a registered email address.

- Laser security systems could be used to protect expensive or antique items, in high security areas, or in industries.
- create ultra-fast communication networks, perform advanced medical procedures, and create more precise manufacturing processes.

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