PROJECT REPORT ON
Laser Base Security System Project

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CERTIFICATE

This is to certify that Remlalnghaka , Ramdinmawia Zadeng and Rosangpuia Chhakchhuak have fully completed the project entitled “Laser Security System” to meet the requirement of the Mizoram University for the VI Semester Bachelor Application in the year 2024. It is to certify that all the corrections/suggestions indicated for internal assessment have been incorporated into the project. The project report has been approved as it satisfies the academic requirements in respect of the project. The project report has been approved as it satisfies the academic requirements in respect of the Project work prescribed for the BCA course.

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Name of Examiner Signature with date

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First, we would like to give thanks to God for guiding us throughout the process of our project, and giving us good health so that we can get this far. We would also like to give thanks to all our faculty members and our computer science department teacher, our Principal Mr.Vuansanga Vanchhawng, our head of Department K.Lalmuanpuia, and our Hostel Guide Sir H.Lalrinawma for giving us their full cooperation and support. We would also like to give thanks to all the people who helped us and involve in the making of this project, it's mainly because of them that we can complete it in time. We also would like to give a word of gratitude, especially to our project invigilator, Sir H.Lalruatkima for guiding us from the beginning till the end, providing us with all the necessities required for our project helping us in the completion of our project. Last but not the least; we thank our parents for their support and encouragement.

DECLERATION

A laser-based security system is designed to detect and deter unauthorized access to a restricted area by employing laser beams as a detection mechanism. Here's a detailed declaration for such a system:

Title: Laser-Based Security System

Objective:

The objective of this project is to create a security system that utilizes laser beams to detect and prevent unauthorized access to a designated area.

Components:

Laser Module: A laser emitter module is employed to generate a narrow beam of laser light. This module typically includes a laser diode and optics to focus the laser beam.

Laser Sensor: A laser sensor or detector is used to detect interruptions or disturbances in the laser beam caused by objects or individuals crossing its path.

Microcontroller: An Arduino or similar microcontroller board serves as the brain of the system, responsible for processing sensor data and controlling system behavior.

Buzzer or Alarm: An audible alert system, such as a buzzer or alarm, is activated upon detection of unauthorized access to alert nearby individuals.

User Interface: Optionally, a user interface such as an LCD display or LEDs can provide visual feedback on the system's status and any detected intrusions.

Power Supply: A stable power source, such as a battery or AC adapter, is required to power the system components.

Operation & Initialization:

Upon system startup, the microcontroller initializes the laser module and sensor, and enters a standby state awaiting detection events.

Laser Beam Emission: The laser module emits a continuous or pulsed beam of laser light, typically directed across the entry point or perimeter to be secured.

Detection: The laser sensor monitors the integrity of the laser beam. Any interruption or obstruction of the beam caused by an object or individual crossing its path is detected as a potential intrusion.

Intrusion Alert: Upon detecting an intrusion, the microcontroller triggers the alarm system to activate audible alerts, signaling the presence of an unauthorized access attempt.

User Feedback: Optionally, the system provides visual feedback via LEDs or a display to indicate the detected intrusion and current system status.

Reset and Recovery: After the intrusion event is resolved or acknowledged, the system resets to its initial state, ready to detect and respond to subsequent intrusion attempts.

Applications:

Home Security: Securing entry points such as doors and windows to deter burglary attempts.

Perimeter Protection: Monitoring fences, gates, and property boundaries to prevent unauthorized access.

Industrial Facilities: Safeguarding restricted areas within manufacturing plants, warehouses, and sensitive installations.

Outdoor Security: Protecting outdoor assets, equipment, and storage areas from theft or vandalism.

Conclusion:

A laser-based security system offers a reliable and effective means of detecting and deterring unauthorized access to secure areas. By leveraging laser technology for detection, the system provides a robust defense against intrusions while minimizing false alarms and ensuring rapid response to security threats.

ABSTRACTION

The Laser-Based Security System project aims to develop an advanced security solution using laser technology to detect and prevent unauthorized access to a designated area. The system comprises a laser emitter module, which produces a highly focused beam of light, and a corresponding laser sensor positioned to monitor the integrity of the laser beam. An Arduino microcontroller serves as the central processing unit, orchestrating the system's operation by analyzing sensor data and triggering the alarm system when an intrusion is detected.

The system provides robust real-time monitoring capabilities, enabling property owners to promptly respond to security breaches. With its ability to detect even subtle disruptions in the laser beam, the system offers enhanced reliability and accuracy compared to traditional security measures. Moreover, its modular design allows for easy integration with existing security infrastructure, making it an ideal choice for retrofitting or upgrading security systems in various environments.

Key features of the Laser-Based Security System include its scalability, adaptability, and low maintenance requirements. The system can be tailored to suit the specific needs of residential, commercial, and industrial settings, providing flexible solutions for perimeter protection and asset security. Furthermore, its low power consumption and efficient use of resources make it a cost-effective choice for long-term security applications.

By leveraging laser technology, the Laser-Based Security System offers a sophisticated yet accessible approach to safeguarding valuable assets and ensuring the safety of occupants. Its user-friendly interface and customizable features make it suitable for a wide range of security applications, from home security to industrial surveillance. With its emphasis on precision, reliability, and ease of use, the Laser-Based Security System represents a significant advancement in modern security technology.

CONTENT

INTRODECTION

In an era defined by technological advancement and unprecedented security challenges, the Laser Base Security Project emerges as a beacon of innovation and resilience. Traditional security systems are often vulnerable to circumvention and exploitation, rendering them ineffective against sophisticated threats. In response, our project endeavors to revolutionize security paradigms through the integration of cutting-edge laser technology.

The Laser Base Security Project aims to establish a robust defense mechanism capable of detecting and deterring intrusions with unparalleled precision and efficiency. By harnessing the power of laser beams, we create an invisible yet impenetrable barrier around protected assets. Intruders trigger the laser beams, instantly activating alarms and initiating response protocols. This swift detection and response capability ensure that potential threats are neutralized before they can inflict harm.

Our system prioritizes accuracy, reliability, and scalability, making it suitable for a wide range of security applications, from residential properties to high-security facilities. Furthermore, the non-invasive nature of laser technology minimizes the risk of false alarms and enhances overall security efficacy.

Join us on this transformative journey as we redefine security standards and fortify defenses against emerging threats. Together, let's pave the way for a safer and more secure future.

OVER VIEW OF THE PROJECT

The Laser-Based Security System project represents an innovative approach to enhancing security measures through the integration of laser technology. By leveraging the principles of light detection and intrusion detection, this project aims to create a robust and reliable security solution suitable for various applications.

At its core, the Laser-Based Security System consists of several key components, including a laser emitter module, a laser sensor (such as a Light Dependent Resistor or LDR), an Arduino microcontroller, and an alarm system (typically a buzzer). The laser emitter generates a focused beam of light, while the laser sensor detects disruptions or interruptions in the beam caused by intruders crossing its path. The Arduino microcontroller serves as the central processing unit, analyzing sensor data and activating the alarm system in case of a security breach.

Throughout the development of the project, the team has focused on several key objectives:

Precision: Ensuring accurate detection of intrusion attempts through the precise alignment and calibration of the laser emitter and sensor.

Reliability: Creating a robust system capable of operating effectively in various environmental conditions, while minimizing false alarms and ensuring timely response to security threats.

Accessibility: Designing a user-friendly interface that allows for easy installation, configuration, and operation of the security system, catering to both residential and commercial users.

Integration: Offering seamless integration with existing security infrastructure and IoT (Internet of Things) platforms, allowing for remote monitoring and control via mobile devices and web interfaces.

Scalability: Designing a modular system architecture that can be easily expanded or customized to meet the specific needs and requirements of different environments and applications.

The Laser-Based Security System project represents a significant advancement in modern security technology, offering a cost-effective and reliable solution for perimeter protection, asset security, and intrusion detection. With its emphasis on precision, reliability, and accessibility, this project has the potential to make a meaningful impact in enhancing safety and security in various settings, from residential homes to commercial establishments and industrial facilities

OBJECT OF THE PROJECT

Enhanced Perimeter Protection: Develop a security system that effectively detects and alerts against unauthorized entry or intrusion attempts within a designated perimeter.

Utilization of Laser Technology: Harness the capabilities of laser technology to create a precise and reliable detection mechanism for identifying intruders or obstacles within the secured area.

Real-time Monitoring and Alerting: Implement a system that provides real-time monitoring of the secured area and promptly notifies authorized personnel or stakeholders of any security breaches or anomalies.

Minimization of False Alarms: Design algorithms and mechanisms to minimize false alarms triggered by environmental factors such as wind, rain, or wildlife, ensuring accurate detection of genuine security threats.

Integration with Existing Infrastructure: Ensure compatibility and seamless integration with existing security infrastructure, including CCTV cameras, access control systems, and alarm monitoring stations, to enhance overall security effectiveness.

User-friendly Interface: Develop an intuitive and user-friendly interface for system configuration, monitoring, and management, catering to both technical and non-technical users.

Scalability and Flexibility: Design a modular and scalable system architecture that can accommodate future expansion, customization, and integration with emerging technologies or additional security features.

Remote Accessibility: Enable remote access and control of the security system via mobile devices, web interfaces, or cloud-based platforms, facilitating convenient monitoring and management from anywhere, anytime.

Compliance with Regulatory Standards: Ensure compliance with relevant regulatory standards and guidelines governing security systems, including data privacy, encryption, and access control protocols.

Cost-effectiveness and Affordability: Develop a cost-effective solution that delivers high-performance security capabilities without imposing prohibitive costs on end-users, making it accessible to a wide range of residential and commercial applications.

By addressing these objectives, the Laser-Based Security System project aims to deliver a comprehensive and reliable security solution that enhances safety, protects assets, and provides peace of mind to users in various environments and applications.

SYSTEM ANALYSIS

ER Diagram:

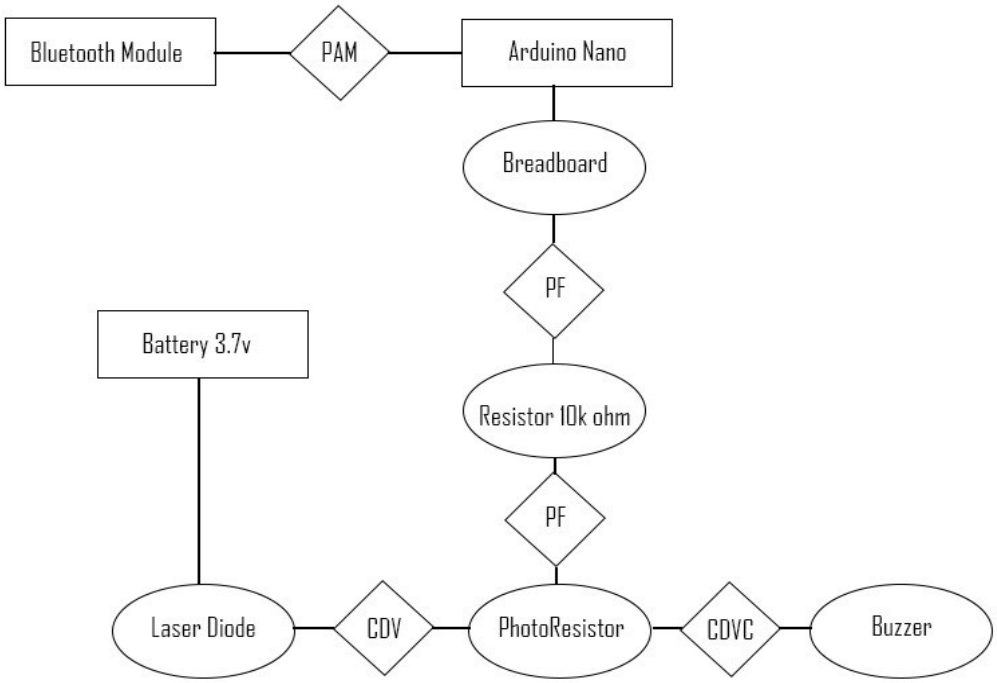

Figure 1 : ER Diagram

———	Connection between Object(Jumper wire)
▭	Attributes
◇	Relation
⬭	Entity
PAM	Tethering/Phone-as-modem
CDV	Conveying Digital Value
CDVC	Conveying Digital Value Condition
PF	Power Flow

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First and fore most , the arduino made handshake with the bluetooth module and which is all connected to the bread board . The power supply is form the battery 3.7 V .The power supply from the battery is control by the resistor 10K ohm . The photo resistor ,laser diode and buzzer ,which are all connected to the breadboard have digital value which is send to the arduino nano and from there the arduino nano convert the digital value into character value.

The breadboard distribute the power gave by the battery 3.7 V which are used by arduino nano,Bluetooth module,photo resistor and buzzer. The laser diode however used a different power supply which is the same as the previously mention battery i.e battery3.7V

The photo resistor with the help of the buzzer sends a numeric value o the arduino nano which is sonverted into a character value once it’s the arduino nano.The value change if the laser diode using the power supply given by the battery 3.7 V made contact wth the photoresisitor based on the numeric value send to the arduino nano , the coding inside the arduino nano send a signal to he buzzer making a sound equivalent to 1000 hertz that is delay by several second

HARDWARE DESGN

When setting up a laser security system using an Arduino Nano, in addition to the basic components like the Arduino Nano board itself, laser module, LDR, and buzzer, you may need the following external components and materials to create a fully functional system:

1. **Power Supply**: Provide power to the Arduino Nano and other components. You can use a USB cable connected to a computer or a USB power adapter, or a separate power source such as batteries or a DC power supply.
2. **Bluetooth Module**: For remote control and communication with the Arduino Nano via Bluetooth. Choose a Bluetooth module compatible with the Arduino Nano, such as HC-05 or HC-06.
3. **Enclosure**: Protect the electronic components and create a housing for the laser module, LDR, buzzer, and Arduino Nano. You can use a plastic project box or design and 3D print a custom enclosure.
4. **Laser Mounting Bracket**: Mount the laser module securely in place, ensuring proper alignment for effective detection. You can use 3D-printed brackets or customize a mounting solution based on the laser module's form factor.
5. **LDR Mounting Fixture**: Position the LDR sensor to detect interruptions in the laser beam accurately. A mounting fixture or bracket helps stabilize the LDR and align it with the laser beam path.

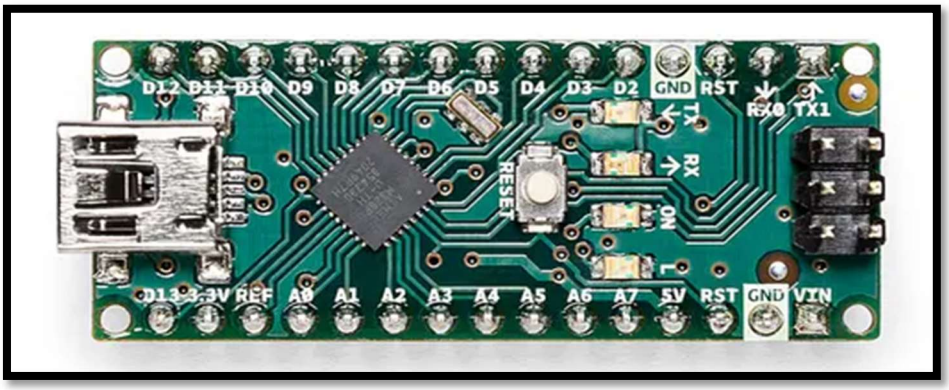
6. **Wiring and Connectors**: Use jumper wires, breadboards, and connectors to establish connections between the Arduino Nano, laser module, LDR, buzzer, and other electronic components. Ensure proper wiring and secure connections to prevent loose connections or short circuits.
7. **Optional Components**:
    - Resistors: Depending on the specific requirements of your circuit, you may need resistors to limit current or voltage.
    - LEDs: Add visual indicators to signal system status or alerts.
    - Switches: Include manual switches for power control or mode selection.
    - Capacitors: Stabilize voltage levels and reduce electrical noise in the circuit.
    - Voltage Regulator: Maintain a stable voltage supply for sensitive components.
    - Voltage Divider: Adjust signal levels or interface with components requiring different voltage levels.
8. **Tools**: Gather essential tools for assembly, such as soldering iron, wire strippers, pliers, screwdrivers, and a multimeter for testing and troubleshooting.
9. **Safety Equipment**: Wear appropriate safety gear, including safety glasses, when working with lasers and electronic components. Follow safety guidelines to prevent accidents and ensure safe operation of the laser security system.

By considering these external requirements and components, you can design and build a robust and functional laser security system using an Arduino Nano, tailored to your specific application and environment.

REQUIRED ITEMS

- ✓ Arduino nano
- ✓ Jumper wire
- ✓ Bluetooh module HC-05
- ✓ Bread board
- ✓ Battery
- ✓ Alarm buzzer
- ✓ Photo Resistor

ARDUINO NANO



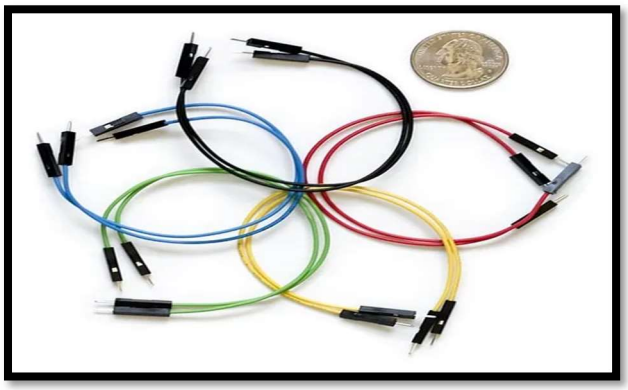
The Arduino Nano is a microcontroller board designed by Arduino.cc and based on the Microchip ATmega328P microcontroller.012 It is a small, flexible, and breadboard-friendly board with 30 male I/O headers configured in a DIP-30 style.02 It is similar to the Arduino Uno board but has replaced it due to its smaller size. Arduino boards are mainly used to build electronic projects such as embedded systems, robotics, and more.1 The Arduino Nano can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline

The Arduino Nano is one of the world's most popular and affordable digital control controllers. The Arduino Nano is a microcontroller-based device with 16 digital pins that can be used for various purposes. It can be used for almost every task, from minor to massive industrial-scale projects. It can also be used for prototyping and developing new applications. Let us look at how you can use the Arduino Nano to build custom software, applications, and devices

An external, programmable digital computer board contains all the necessary bits to create digital devices. The Arduino Nano, or "Muffin Track," as it has been called on the Internet, is programmable, and can be Used As IoT Controller For Many IoT Projects microcontroller-based computer https://www.towardsiot.com/can be used to create devices and applications. The Muffin Track features 16 digital pins that can be used for various functions. It can also be used as a prototyping board or a standalone development machine. The Muffin Track is often connected to the Internet by Ethernet cable and is therefore not tied to a specific home network. The Muffin Track

can also be a money-saving alternative to purchasing a dedicated development computer. This article will discuss using the Arduino Nano to build custom software, applications, and devices. The guide will cover the various parts of a custom application and how you can wire them up to create your own devices. Finally, you will learn how to connect devices with the included header and header-less header-port.

JUMPER WIRE



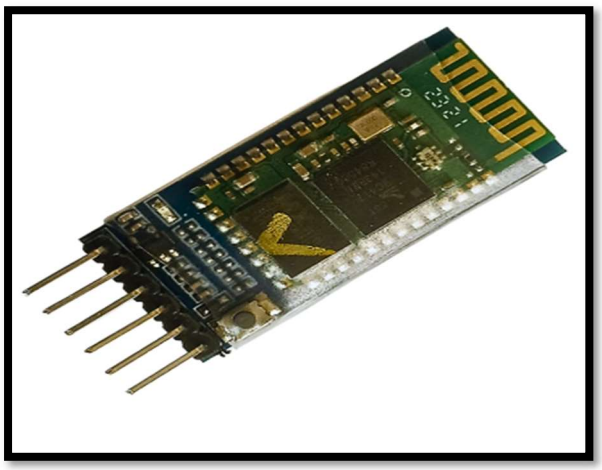
A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals.

A jump wire is an electrical wire or group of them in a cable with a connector or pin at each end. Wires are used to connect components to each other on the breadboard or other prototypes, internally or with other equipment or components, without soldering. Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering.

You can use jumper wires to modify a circuit or diagnose problems in a circuit. Further, they are best used to bypass a part of the circuit that does not contain a resistor and is suspected to be bad.

This includes a stretch of wire or a switch. Suppose all the fuses are good and the component is not receiving power; find the circuit switch. Then, bypass the switch with the jumper wire

BLUTOOH MODULE HC-05



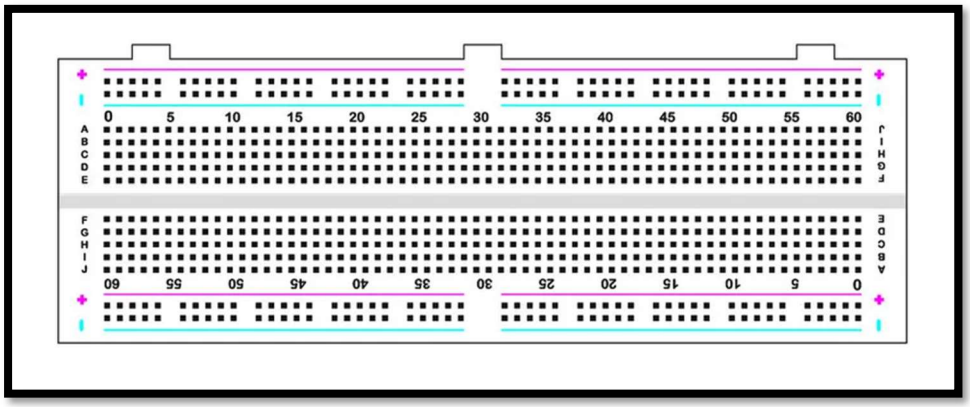
To communicate smartphone with HC-05 Bluetooth module, smartphone requires Bluetooth terminal application for transmitting and receiving data. You can find Bluetooth terminal applications for android and windows in respective app store.

- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard, and many more consumer applications.

- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART)

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration
HC-05 has red LED which indicates **connection status**, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner. When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.This module **works on 3.3V**. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has **3.3V level for RX/TX** and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 modulThe data transfer rate of HC-05 module can vary up to **1Mbps** is in the **range of 10 meters**.

BREAD BOARD



A Breadboard is simply a board for prototyping or building circuits on. It allows you to
place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board. The ease of use and speed are great for learning and quick prototyping of simple circuits. More complex circuits and high frequency circuits are less suited to breadboarding. Breadboard circuits are also not ideal for long term use like circuits built on perfboard (protoboard) or PCB (printed circuit board), but they also don't have the soldering (protoboard), or design and manufacturing costs (PCBs).

In the before times, boards used in the kitchen for cutting bread were used by young circuit designers to build circuits on with screws or nails driven into the board with wires wrapped around them to complete circuits. This was an improvement on 'deadbug' or direct solder connections, since the circuit could be nailed down and secure as well as easily modified if necessary for debugging or enhancements. The name has stuck through to today, even though placing circuits on boards for bread is only done for Instagram posts

As mentioned before, a breadboard is handy because you can set up circuits quickly and temporarily to test them and move on to a more permanent arrangement after investigating how it works on the breadboard. They are great for hobbyists and tinkerers to set up projects as a standalone device, or as a peripheral to an Arduino, Raspberry Pi, LaunchPad, BeagleBone, and many other development boards. They come in many sizes to fit projects large and small. Breadboards are also inexpensive, and the parts that work with them are also typically inexpensive too. If you want to make your project more permanent, moving from a design on a breadboard to protoboard or PCB will be easier than skipping to those harder to manipulate boards.

If you're just getting started, or are well down the path of electronic design, you'll run across breadboards. Getting to know their strengths of quick and easy circuit creation, and their weaknesses of impermanence and limitations in terms of power handling and RLC (resistance, inductance, capacitance) effects will help you create many fun and useful projects later

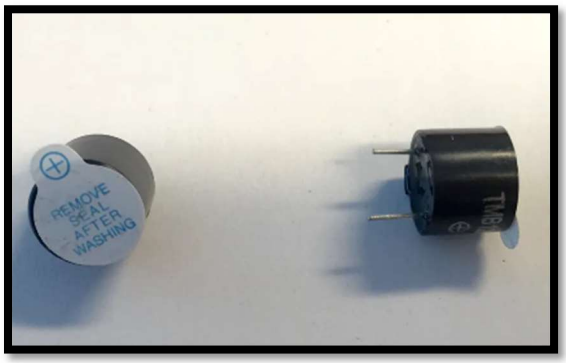
BATTERY

A battery is a device that converts chemical energy contained within its active materials directly into electric energy by means of an *electrochemical oxidation-reduction* (redox) reaction. This type of reaction involves the transfer of electrons from one material to another via an electric circuit. While the term battery is often used the cell is the actual electrochemical unit used to generate or store electric energy.

Batteries and similar devices accept, store, and release electricity on demand. Batteries use chemistry, in the form of chemical potential, to store energy, just like many other everyday energy sources. For example, logs and oxygen both store energy in their chemical bonds until burning converts some of that chemical energy to heat. Gasoline and oxygen mixtures have stored chemical potential energy until it is converted to mechanical energy in a car engine. Similarly, for batteries to work, electricity must be converted into a chemical potential form before it can be readily stored. Batteries consist of two electrical terminals called the cathode and the anode, separated by a chemical material called an electrolyte. To accept and release

energy, a battery is coupled to an external circuit. Electrons move through the circuit, while simultaneously ions (atoms or molecules with an electric charge) move through the electrolyte. In a rechargeable battery, electrons and ions can move either direction through the circuit and electrolyte. When the electrons move from the cathode to the anode, they increase the chemical potential energy, thus charging the battery; when they move the other direction, they convert this chemical potential energy to electricity in the circuit and discharge the battery. During charging or discharging, the oppositely charged ions move inside the battery through the electrolyte to balance the charge of the electrons moving through the external circuit and produce a sustainable, rechargeable system. Once charged, the battery can be disconnected from the circuit to store the chemical potential energy for later use as electricity

ALARM BUZZER



Buzzer is a kind of voice device that converts audio model into sound signal. It is mainly used to prompt or alarm. According to different design and application, it can produce music sound, flute sound, buzzer, alarm sound, electric bell and other different sounds.
Typical applications include siren, alarm device, fire alarm, air defense alarm, burglar alarm, timer, etc

Since the self-excited buzzer is driven by DC voltage, it does not need to use AC signal to drive. It only needs to output the driving level at the drive port and amplify the driving current through the triode to make the buzzer sound. It is very simple, and the self-excited buzzer is not explained here. This paper only explains the other excited buzzer which must be driven by 1/2-D square wave signal

ADVANTAGE OF ALARM BUZZER

1. Because there is no movable contact part, it has long service life and high reliability. It can be used continuously for more than 10000 hours. It is a semi permanent device.

2. No arcing or RF noise, no interference to other lines.

3. No large vibration due to loosening.

4. With electronic circuit control, so it can produce a variety of pleasant sound and analog sound, intermittent sound. The timbre is pure and not easy to be covered by noise.

5. It is excited by voltage, so the current consumption is small, generally less than 20mA, not more than 100mA.

6. Small and loud. The volume can reach 70 dB / 20 cm, and the thickness of the element is only less than 1 mm.

7. Wide operating temperature range

RESISTOR

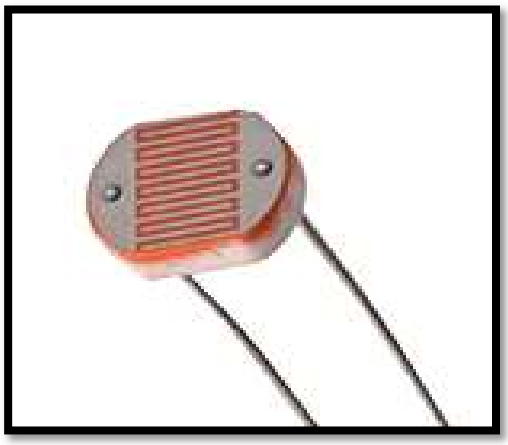
The resistor is a passive electrical component that creates resistance in the flow of electric current. In almost all electrical networks and electronic circuits they can be found. The resistance is measured in ohms.An ohm is the resistance that occurs when a current of one ampere (A) passes through a resistor with a one volt (V) drop across its terminals. The current is proportional to the voltage across the terminal ends.

Resistors are used for many purposes. A few examples include limiting electric current, voltage division, heat generation, matching and loading circuits, gain control, and setting time constants. They are commercially available with resistance values over a range of more than nine orders of magnitude. They can be used as electric brakes to dissipate kinetic energy from trains, or be smaller than a square millimeter for electronics.

A resistor is a little package of resistance: wire it into a circuit and you reduce the current by a precise amount. From the outside, all resistors look more or less the same. As you can see in the top photo on this page, and the one below, a resistor is a short, worm-like component with colored stripes on the side. It has two

connections, one on either side, so you can hook it into a circuit. What's going on inside a resistor? If you break one open, and scratch off the outer coating of insulating paint, you might see an insulating ceramic rod running through the middle with copper wire wrapped around the outside. The number of copper turns controls the resistance very precisely: the more copper turns, and the thinner the copper, the higher the resistance. In smaller-value resistors, designed for lower-power circuits, the copper winding is replaced by a spiral pattern of carbon. Resistors like this are much cheaper to make and are called **carbon-film**. Generally, wire-wound resistors are more precise and more stable at higher operating temperatures.

PHOTO RESISTOR



A photoresistor (also known as a photocell, or light-dependent resistor, LDR, or photo-conductive cell) is a passive component that decreases in resistance as a result of increasing luminosity (light) on its sensitive surface, in other words, it exhibits photoconductivity. A photoresistor can be used in light-sensitive detector circuits and light-activated and dark-activated switching circuits acting as a semiconductor resistance. In the dark, a photoresistor can have a resistance as high as several megaohms (MΩ), while in the light, it can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photoresistor can substantially differ among dissimilar devices. Moreover, unique photoresistors may react substantially differently to photons within certain wavelength bands.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor (such as silicon is). In

intrinsic devices, most of the available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction.

SOFTWARE REQUREMENT

ARDUINO IDE

The Arduino Integrated Development Environment (IDE) is a software platform used for writing, compiling, and uploading code to Arduino microcontroller boards. It provides a user-friendly interface and a set of tools designed to simplify the process of programming Arduino-based projects. Here's a brief overview of the Arduino IDE:

Code Editor: The IDE features a built-in code editor where users can write and edit their Arduino sketches (programs). The editor provides syntax highlighting, auto-indentation, and other features to assist with writing code.

Sketches: Arduino programs are commonly referred to as "sketches." Each sketch consists of two main functions: setup() and loop(). The setup() function is executed once when the Arduino board is powered on or reset, while the loop() function is executed continuously in a loop after setup() completes.

Library Manager: The IDE includes a Library Manager, which allows users to easily install and manage libraries (collections of pre-written code) for various sensors, actuators, communication protocols, and other functionalities. Libraries help simplify programming by providing ready-to-use code for common tasks.

Board Manager: Arduino supports a wide range of microcontroller boards, including Arduino Uno, Nano, Mega, and

many others. The Board Manager allows users to select the appropriate board from a list and install the necessary board drivers and software packages to enable programming for that specific board.

Serial Monitor: The IDE includes a Serial Monitor tool, which allows users to communicate with the Arduino board via the serial port. This tool is invaluable for debugging, testing, and monitoring the behavior of Arduino sketches by displaying data sent from the board and sending commands or messages to the board.

Upload Button: The IDE features an Upload button that compiles the current sketch and uploads it to the connected Arduino board via USB. This process is seamless and allows for quick iteration and testing of code.

Examples and Tutorials: The IDE comes with a variety of built-in examples and tutorials to help users get started with Arduino programming. These examples cover a range of topics, from basic digital and analog input/output to more advanced topics like communication protocols and sensor interfacing.

Cross-Platform Compatibility: The Arduino IDE is available for multiple operating systems, including Windows, macOS, and Linux, making it accessible to a wide range of users.

Overall, the Arduino IDE serves as a comprehensive development environment for beginners and experienced users alike, enabling the rapid prototyping and development of embedded systems and IoT projects using Arduino microcontroller boards.

ARDUINO BLUETOOTH CONTROLLER

Android apps available that allow you to control Arduino projects using Bluetooth communication. These apps typically provide a user-friendly interface for sending and receiving data wirelessly between an Android device and an Arduino board equipped with a Bluetooth module.

One popular app is the "Arduino Bluetooth Controller" app, which is available for download on the Google Play Store. This app allows you to create custom control interfaces with buttons, sliders, and other widgets to interact with your Arduino projects. You can configure the app to send specific commands or data to your Arduino board via Bluetooth communication.

Bluetooth Connectivity: The app should allow you to establish a Bluetooth connection between your Android device and your Arduino board equipped with a Bluetooth module.

Customizable Interface: You should be able to create custom control interfaces with buttons, sliders, switches, and other widgets to interact with your Arduino projects.

Data Transmission: The app should enable you to send data packets, commands, or control signals from your Android device to your Arduino board over the Bluetooth connection.

Feedback and Visualization: Some apps support receiving data from the Arduino board and displaying it on your Android device, allowing you to visualize sensor readings, monitor system status, or receive feedback from your Arduino projects in real-time.

Scripting or Automation: Advanced Arduino Bluetooth controller apps may offer scripting or automation features, allowing you to create custom scripts or sequences of actions to control your projects more efficiently.

HARDWARE REQUIREMENT

In a laser-based security system, several hardware components are essential to its operation. Here's a list of common hardware requirements for such a system:

1. Laser Module: The laser module emits a focused beam of light that serves as the detection line. It should be of sufficient power and precision for the application.

2. Light Dependent Resistor (LDR): The LDR detects changes in light intensity caused by interruptions in the laser beam. It converts these changes into electrical signals that the Arduino can process.

3. Arduino Board: The Arduino board serves as the central processing unit of the security system. It receives input from the LDR, processes it, and triggers the alarm if necessary.

4. Buzzer or Alarm: The buzzer or alarm is activated when the security system detects an intrusion. It serves as an audible alert to notify users of a potential security breach.

5. Power Supply: A stable power supply is necessary to power the Arduino board, laser module, LDR, and other components. This can be provided by batteries or a DC power adapter.

6. Enclosure: An enclosure houses the electronic components of the security system and protects them from environmental factors such as dust, moisture, and physical damage.

7. Wiring and Connectors: Wiring and connectors are used to establish electrical connections between the various components of the security system, including the Arduino board, laser module, LDR, and buzzer.

8. Mounting Hardware: Mounting hardware such as brackets, screws, and adhesive mounts may be needed to securely mount the laser module, LDR, buzzer, and other components in place.

9. Bluetooth Module (Optional): If remote monitoring and control capabilities are desired, a Bluetooth module can be added to the system to enable wireless communication with a smartphone or other Bluetooth-enabled device.

10. Computer : Which is compatible to operate the Arduino IDE software to maintain the code and functions for the arduino nano (microcontroller) at least to operate smoothly : processor i3 or ryzem 3, RAM-4GB is required.

SYSTEM DESIGN

Program structure

```
#include <SoftwareSerial.h>



char receivedChar;

bool alarmOn = false;

int BUZZER_PIN = 3;

int LDR_PIN = A0;
```

// This code snippet seems to be the beginning of an Arduino sketch. It includes the SoftwareSerial library and declares some variables. receivedChar is a character variable, alarmOn is a boolean variable initialized to false, BUZZER_PIN is set to pin 3, and LDR_PIN is set to the analog pin A0. The purpose or meaning of the code beyond these declarations would depend on the rest of the program

```
void setup()

{


  Serial.begin(9600);

  // Initialize serial communication for debugging
```

```
  Serial.begin(9600);
  // Initialize Bluetooth serial communication

  pinMode(BUZZER_PIN, OUTPUT);
  // Set buzzer pin as output

  pinMode(LDR_PIN, INPUT);
  // Set the photoresistor as input
}
```

//This setup() function initializes the Arduino board.

It begins serial communication twice, once for debugging via the USB connection (Serial.begin(9600)) and once for Bluetooth communication, presumably (Serial.begin(9600)).

It sets the BUZZER_PIN as an output pin using pinMode().

It also sets the LDR_PIN as an input pin, indicating it's likely connected to a photoresistor.

The setup prepares the board for further operations, like reading from sensors and controlling actuators.

```
void loop() {
  checkBluetooth();
  // Check for commands from Bluetooth
```

```
  checkLDR();
  // Check LDR status continuously
}
```

//This loop() function is the main part of the program, where the code executes continuously.

It calls the function checkBluetooth() to check for any commands received via Bluetooth.

It calls the function checkLDR() to continuously monitor the status of the light-dependent resistor (LDR).

This structure suggests that the program is designed to respond to commands received via Bluetooth while also monitoring the ambient light level using the LDR.

```
void checkBluetooth() {
  if (Serial.available())
  // Check if data is available to read
  {
    receivedChar = Serial.read();
    // Read the incoming byte

    if (receivedChar == 'A')
    {
      alarmOn = true;
```

```
      // Turn on the alarm

    } else if (receivedChar == 'B')
    {
      alarmOn = false;
      // Turn off the alarm

      noTone(BUZZER_PIN);
      // Stop the buzzer tone
    }
  }
}
```

//This checkBluetooth() function is responsible for handling commands received over Bluetooth.

It first checks if there is data available to read from the serial connection using Serial.available().

If there is data available, it reads the incoming byte using Serial.read() and stores it in the variable receivedChar.

If the received character is 'A', it sets the alarmOn variable to true, indicating that the alarm should be turned on.

If the received character is 'B', it sets the alarmOn variable to false, indicating that the alarm should be turned off. Additionally, it

stops any ongoing tone on the buzzer pin using noTone(BUZZER_PIN).

This function essentially allows the Arduino to receive commands ('A' for turning on the alarm and 'B' for turning it off) over Bluetooth and act accordingly.

```
void checkLDR() {
  int ldrValue = analogRead(LDR_PIN);
  // Read LDR value

  if (ldrValue < 300 && alarmOn) {
    tone(BUZZER_PIN, 1000);
    // Start the buzzer tone

    delay(6000);
    Serial.println("Alarm: Intruder detected!");
    // Send message to Bluetooth

  } else {
    noTone(BUZZER_PIN);
    // Stop the buzzer tone

  }
}
```

//The checkLDR() function is responsible for monitoring the light-dependent resistor (LDR) and triggering the alarm if certain conditions are met.

It first reads the analog value from the LDR using analogRead(LDR_PIN) and stores it in the variable ldrValue.

If the ldrValue falls below 300 (indicating low light conditions) and the alarmOn flag is true, indicating that the alarm is activated:

It starts a tone on the buzzer pin using tone(BUZZER_PIN, 1000) to produce a sound.

It introduces a delay of 6000 milliseconds (6 seconds) using delay(6000) to sound the alarm for a specific duration.

It sends a message "Alarm: Intruder detected!" over the Bluetooth serial connection using Serial.println("Alarm: Intruder detected!").

If the light level is above the threshold or if the alarm is not activated, it stops the tone on the buzzer pin using noTone(BUZZER_PIN).

This function essentially checks the light level sensed by the LDR and triggers the alarm if it falls below a certain threshold, provided that the alarm is activated

OVERALL DESIGN

Designing a laser security system involves several components and considerations. Here's a high-level system design for a laser security system:

1. **Requirements Analysis**:

    - Define the objectives of the security system.

        1. Laser
        2. Buzzer
        3. Photo-resistor
        4. Bluetooth module

    - Identify the areas to be protected.

      Determine the sensitivity of the system to detect intrusions accurately.

2. **Laser Emitters and Receivers**:

- Install laser emitters at strategic points to create a perimeter or detection zone.
- Position laser receivers opposite the emitters to detect interruptions in the laser beam.
- Use infrared lasers for invisible detection or visible lasers as a deterrent.

3. **Data Processing Unit**:
    - Incorporate a microcontroller or single-board computer to process data from the laser sensors.
    - Implement algorithms for detecting interruptions in the laser beams.
4. **Alarm System**:

- Integrate an alarm system to alert security personnel or property owners of intrusions.

- Options for alarms include sirens, lights, notifications to mobile devices, or automated alerts to a central monitoring station.

5. **User Interface**:

- Develop a user interface for system configuration, monitoring, and management.

6. **Power Supply and Backup**:

- Ensure a reliable power supply for continuous operation.

- Incorporate battery backup or uninterruptible power supply (UPS) to maintain functionality during power outages.

CODE

MICRO-CONTROLLER (Arduino nano)

```
 #include <SoftwareSerial.h>

#define RX_PIN 10 // Define pin for Bluetooth module RX
#define TX_PIN 11 // Define pin for Bluetooth module TX

SoftwareSerial BTSerial(RX_PIN, TX_PIN); // Create a SoftwareSerial object

void setup() {
  Serial.begin(9600); // Initialize serial communication for debugging
  BTSerial.begin(9600); // Initialize Bluetooth serial communication
}

void loop() {
  // Check if data is available to read from Bluetooth module
  if (BTSerial.available()) {
    char receivedChar = BTSerial.read(); // Read the incoming byte
    Serial.print("Received: ");
```

```
  Serial.println(receivedChar);
  // Add your logic here to process the received data
 }

 // Example: Sending data to Bluetooth module
 BTSerial.println("Hello from Arduino!"); // Send a message to Bluetooth module
 delay(1000); // Delay to prevent spamming messages
}
}

 if (Serial.available()) { // Check if data is available to read
  receivedChar = Serial.read(); // Read the incoming byte
  Serial.print("Received: ");
  Serial.println(receivedChar);

  if (receivedChar == 'A') {
   tone(BUZZER, 600); // Turn on the alarm (LED)
   Serial.println("Alarm turned ON");
  } else if (receivedChar == 'B') {
   noTone(BUZZER); // Turn off the alarm (LED)
   delay(60000);
   Serial.println("Alarm turned OFF");
  } else {
```

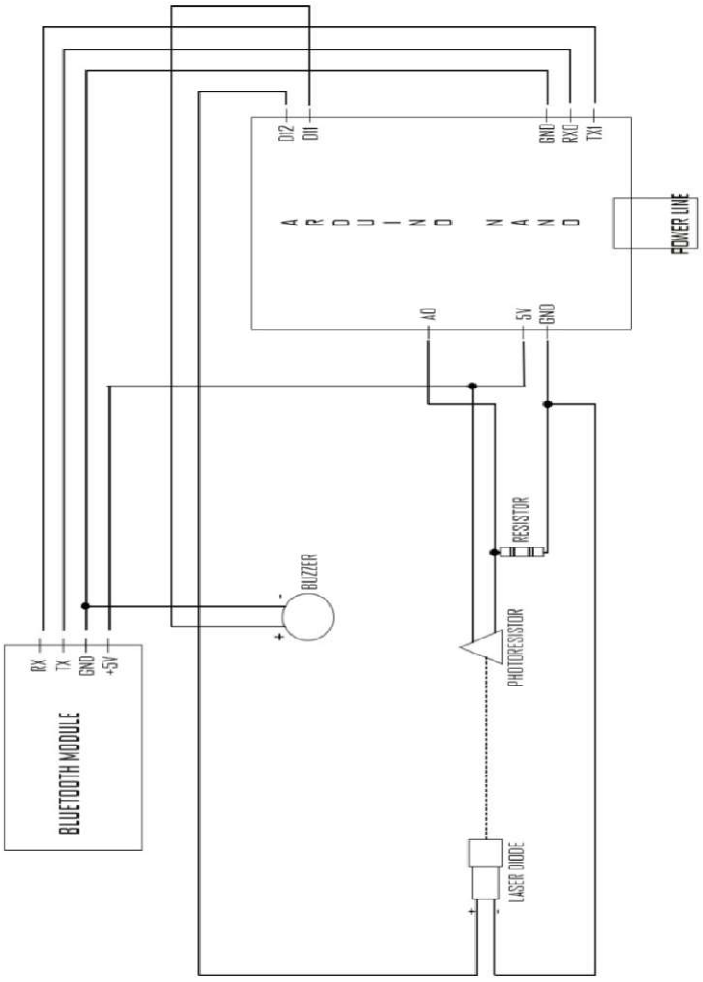
```
    Serial.println("Invalid command"); // Send back error message
for invalid command
   }
  }

  //delay(1000); // Delay to prevent continuous loop execution
}
```

BLUETOOTH MODULE ACTIVATION

```
 #include <SoftwareSerial.h>

#define RX_PIN 10 // Define pin for Bluetooth module RX
#define TX_PIN 11 // Define pin for Bluetooth module TX

SoftwareSerial BTSerial(RX_PIN, TX_PIN); // Create a SoftwareSerial object

void setup() {
  Serial.begin(9600); // Initialize serial communication for debugging
  BTSerial.begin(9600); // Initialize Bluetooth serial communication
}

void loop() {
  // Check if data is available to read from Bluetooth module
  if (BTSerial.available()) {
    char receivedChar = BTSerial.read(); // Read the incoming byte
    Serial.print("Received: ");
    Serial.println(receivedChar);
    // Add your logic here to process the received data
  }
```

```
  // Example: Sending data to Bluetooth module
  BTSerial.println("Hello from Arduino!"); // Send a message to Bluetooth module
  delay(1000); // Delay to prevent spamming messages
}
```

CIRCUIT DIAGRAM



As shown in the figure, the Arduino nano (Microcontroller) received power in range of 7-12 voltage that can power up the pic contained.

In Arduino nano(microcontroller) the GND(use as a common return path),RXO(serial communication use to receive data from one device to another) and TX1(serial communication use to transfer data from one device to another) pin which is used to connect with the Bluetooth module (HC-05) to enable to have serial communication with the Arduino Nano(microcontroller).(RxO Arduino pin to Tx1 Bluetooth, GND to GND both, Tx1 Arduino pin to Rx0 pin of Bluetooth module)

The Arduino nano also known as microcontroller D12 pin which is Digital pin mainly used as OUTPUT is connected to the positive line of the laser diode.And the negative line of the laser diode is connected to the GND pin(Ground).

The PhotoResistor doesn't have positive and negative side but have two side, one side connected the 5v to activate and the other side is passing through the resistor one leg, the combination of the PhotoResistor and resistor leg is connected to A0(analogue pin mainly used as INPUT for Arduino nano). The single leg of Resistor is connected to the GND(Ground).

The Buzzer, the main alarm for this system is operated by the Arduino nano with the combination of the PhotoResistor receiving value. Which is connected to the D11 pin (Digital pin mainly used as OUTPUT) to the buzzer positive leg and the negative leg is connected to the GND(ground) pin

CONCLUSON

As Group-1(Remlalnghaka, Rosangpuia Chhakchuak, Ramdinmawia Zadeng),we are immensely grateful to have successfully completed the Laser-Based Security Project. This endeavor has been a testament to our collective effort, teamwork, and perseverance.

The Laser-Based Security System represents a culmination of innovation, collaboration, and determination in the realm of modern security technology. Through meticulous planning, rigorous experimentation, and tireless effort, we have successfully developed a robust and effective solution for perimeter protection and intrusion detection.

First and foremost, we express our deepest gratitude to the Almighty for granting us the wisdom, guidance, and strength throughout this project. It is through His blessings that we were able to overcome challenges and achieve our objectives.

We extend our heartfelt thanks to our esteemed project guide and our Head of the Department, whose mentorship, expertise, and support have been invaluable. Your guidance steered us in the right direction, providing clarity and insight at every step of the journey. Your encouragement and feedback fueled our determination and inspired us to deliver our best, also extend our sincere appreciation to our respected principal for providing us with the opportunity to undertake this project. Your unwavering support and encouragement have motivated us to strive for excellence and exceed expectations.

Additionally, we acknowledge the contributions of our fellow classmates, teachers, and peers who supported us in various capacities throughout the project.

In conclusion, this project has been a rewarding and enriching experience for each member of Group-1(Remlalnghaka, Rosangpuia Chhakchuak, Ramdinmawia Zadeng). It has not only enhanced our technical skills but also fostered collaboration, problem-solving, and innovation. As we move forward, we are confident that the knowledge and lessons learned from this project will serve as a solid foundation for our future endeavors.

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