**1. Introduction**

The project was created with the aim of protecting valuables, and the model is made entirely of hand-cut wooden boards, which are then carefully painted black to give it an elegant and finished look. In order not to see any cables and to achieve the most clean and aesthetic look, I decided to hide them inside the columns of the mockup. The arduino and breadboard are cleverly placed at the top of the structure so that after opening the lid they can be easily seen and accessed conveniently.

The parts I have used in the mockup include various high-tech components such as laser modules, light receivers, ultrasonic sensors, LED strips, arduino mega and a buzzer. Each of these components plays a key role in ensuring the efficient operation of the system and in ensuring the protection of valuables.

For the project to function successfully, it is necessary to use specially written code that controls the operation of all components. This code is written in the C++ programming language, which provides the necessary flexibility and power to handle complex tasks. The integrated development tool (IDE) used to write and compile the code is the Arduino IDE, which offers a convenient and easy-to-use interface for programming the Arduino board.

**2. Effect of the product**

As we already understood, the project aims to protect gems, and for this purpose I use different methods for their protection. The laser modules and light receivers built into the columns communicate with each other continuously. In the event that any laser is interrupted, this interruption stops the signal to the receiver and the buzzer is immediately commanded to start sounding. This audible warning serves as a first line of defense and is intended to stop a would-be intruder.

However, if this initial warning does not stop the trespasser and he advances just a few centimeters, the ultrasonic sensors will be triggered. Their role is extremely important for the overall protection system. When the ultrasonic sensors measure a distance less than the preset critical distance, the light and sound signal are automatically activated. These signals serve as a secondary alarm designed to announce the presence of an intruder and the crime committed.

The entire system has been designed to provide maximum security for precious items using a combination of advanced technology and intelligent programming. Thus, the project offers reliable protection that can be useful in various scenarios and situations requiring a high degree of security.

**3. Hardware part**

The hardware part of the project includes the following components:

1. Laser modules: Used to create laser beams that are received by light receivers.

2. Light receivers: Detect the laser beams and signal to activate the buzzer when there is a break in the laser beam.

3. Ultrasonic sensors: Detect movement and send a signal to trigger the alarm when detecting a smaller distance than the preset one.

4. Led lights: Provide a visual signal when an intruder is detected.

5. Arduino Mega: Controls the operation of all components.

6. Buzzer: It emits a sound signal when the laser beam is interrupted or motion is detected by the ultrasonic sensors.

* The laser module is KY-008. It has the following parameters:
* **Voltage:** 5V, making it easily compatible with most electronic platforms.
* **Power:** 5mW, which means it is safe for general use and suitable for display, alignment or use as an indication point.
* **Size:** Small diameter (6mm), making it easy to incorporate into compact projects.
* **Output signal:** Constant laser beam when power is applied.
* **Control Output:** A digital output (high/low signal) that can be connected directly to a microcontroller**.**
* **Operating temperature:** Suitable for use in ordinary environmental conditions.
* **Mounting:** There are various ways of fastening, including with bolts or by integrating into specially designed holders.
* **Applications:** Widely used for distance measurement, liquid level, obstacle detection and other similar applications.
* **Wavelength:** 650 nm (red light)

The number of laser modules is sixteen, four on each side.

The receiver is TEMT6000. It has the following parameters:

* **Visible Light Sensitivity:** The TEMT6000 is designed to match the human visible light spectrum while having minimal infrared light sensitivity. This makes it suitable for applications where visible light measurement is essential.
* **Operating Voltage:** It typically operates at voltages between 2.7V and 5.5V, making it compatible with most microcontrollers and other electronic systems.
* **Output signal:** The output is analog, which allows precise measurements of light intensity. The output signal is proportional to the light intensity.
* **Easy to integrate:** Small size and easy to embed in different projects.
* **Wide measurement range:** The sensor can measure a wide range of light intensity, from low light to strong daylight.
* **Fast response:** The light response rate is fast, making it suitable for applications where changes in light need to be detected quickly.

The number of receivers is sixteen, four on each side.

The ultrasound is HC-SR04. It has the following parameters:

* **Measuring range:** HC-SR04 can measure distances from 2 cm to 400 cm, making it suitable for many different applications.

HC-SR04 is an ultrasonic distance measurement sensor widely used in electronic projects, robots and automation systems. It is characterized by accuracy, speed and low cost, making it a popular choice for many applications. Here's a detailed review of the HC-SR04 covering its features, how it works, uses and benefits.**Обхват на измерване:** Сензорът може да измерва разстояния от 2 cm до 400 cm, което го прави гъвкав за различни ситуации.

* **Accuracy:** The measurement accuracy is about 0.3 cm, which is sufficient for most applications.
* **Power Supply:** Operates at 5V, making it compatible with popular microcontrollers such as Arduino and Raspberry Pi.
* **Interface:** Uses two main pins – Trigger and Echo. Trigger is used to send an ultrasonic pulse and Echo to read its return.
* **Operating frequency:** The ultrasonic frequency of the sensor is 40 kHz, which is beyond the range of human hearing, making it silent.

The number of ultrasounds is ten, they are placed on the bottom of the box.

The led light is a WS2812 LED. It has the following parameters:

* **Addressable LEDs:** Each LED in the array is individually addressable, allowing precise control over color and brightness.
* **Integrated Controller:** The WS2812 has a built-in controller that controls the color of each LED using a serial communication protocol.
* **RGB LED:** Each LED contains red, green and blue elements that can be mixed to produce millions of colors.
* **Dimensions:** The 8x8 matrix measures approximately 68x68 mm, making it compact and easy to integrate.
* **Power Supply:** Operates on 5V, making it compatible with most microcontrollers and power supplies.
* **Communication Protocol:** Uses serial communication with a single wire interface, allowing easy connection and control.

The number of ice lights is two, which are placed on the top of the box.

The buzzer used is a 5V Buzzer. It has the following parameters:

* **Type:** Buzzers can be with an internal generator (active) or without a generator (passive). Active buzzers sound as soon as voltage is applied, while passive buzzers require an external frequency generator.
* **Supply voltage:** 5V is the standard supply voltage for this type of buzzer, making it compatible with most microcontrollers such as Arduino and Raspberry Pi.
* **Audio frequency:** The audio frequency varies but is usually between 1 kHz and 4 kHz. It's enough to be audible and attention-grabbing.
* **Size:** The compact size of the buzzer makes it suitable for various applications where space is limited.
* **Connection:** There are usually two terminals - positive and negative, which facilitates integration into electronic circuits.

The buzzer is one of a kind, which is placed on the top of the box.

The Arduino is an Arduino Mega 2560. It has the following parameters:

* **Microcontroller:** Arduino Mega 2560 uses ATmega2560 which is more powerful compared to ATmega328P used in Arduino Uno.
* **Inputs and outputs:** There are a total of 54 digital inputs/outputs, of which 15 can be used as PWM (Pulse Width Modulation) outputs, and 16 analog inputs.
* **Memory:** 256 KB program flash memory (8 KB for bootloader), 8 KB SRAM and 4 KB EEPROM.
* **Clock:** Operates on a 16 MHz crystal oscillator, which ensures stable operation and compatibility with other Arduino boards.
* **Communication Interfaces:** Arduino Mega 2560 has 4 serial ports (UART), I2C, SPI and USB interface for programming and communication.
* **Power supply:** It can be powered via USB or an external source with a voltage of 7 to 12V.
* **Compatibility:** Supports Arduino IDE (Integrated Development Environment) for easy programming and a wide range of Arduino libraries and Shields.

The arduino is one of a kind and is placed at the top of the box.

**4. Software part**

The software part of the project consists of code written in the C++ programming language that controls the functioning of the hardware components. The code was developed and compiled using the Arduino IDE. The software manages the communication between the laser modules and the light receivers, the activation of the buzzer and the LED strips, as well as the reactions of the ultrasonic sensors when motion is detected.

**Specification**

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| --- | --- | --- | --- |
| **№** | **Type of element** | **Meaning** | **Quantity** |
| **1.** | **Laser modules** | **KY-008** | **16** |
| **2.** | **Light receivers** | **TEMT6000** | **16** |
| **3.** | **Ultrasonic sensors** | **HC-SR04** | **10** |
| **4.** | **Led strips** | **WS2812 LED** | **2** |
| **5.** | **Buzzer** | **Buzzer** | **1** |
| **6.** | **Arduino Mega** | **Arduino Mega 2560** | **1** |

* Laser modules: Communication with light receivers.
* Light receivers: Detection of discontinuities in laser beams.
* Ultrasonic Sensors: Detect movement below setpoint.
* LED strips: Visual indication when an intruder is detected.
* Arduino Mega: Main System Controller.
* Buzzer: Audio signaling when laser beam breaks or motion is detected.