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## Short Messaging System Based Security Box Using Arduino and GSM Module

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### **Abstract**

*Nowadays security is a vital issue in our day to day life. In the current world, crime becomes increasing and people want to secure their asset at their house. In this situation, an owner wants an advance technology so that he doesn't worry about the assets when he doesn't present in his house. Using wireless technologies and a good user-friendly interface make the home safety system more attractive. This paper deliberates a simple but very effective technique which will be applied to home security. SMS (Short Messaging System) based security box reduce the rate of the crime and secure our assets. The box is designed in such a way that when someone except the owner opens the box it will send an SMS to the owner mobile using the GSM (Global System for Mobile Communication) module. Main motive about this paper is to make a low-cost security box but its benefit will be high.*

**Keywords:** Global System for Mobile Communication (GSM), Short Messaging System (SMS), Home security, Arduino Uno ATmega328 microcontroller.

### **1. Introduction**

In the modern age of digital technology, the security system is one among the necessary topics. First, what do we understand the word 'security system'? Security means the degree of defense against damages, risk, loss and crime [1]. It is a sort of protection formation and methods. A safety system provides us a sort of protection that ensures the safety and security of the assets when you are at the home or out of the home. A Safety system is a process for rising the standard of resident or working place life by facilitating pliable, pleasant and a safe environment [2].

Most of the security systems available in current, needed wiring, expensive, complex mechanism, bulky sized and many other problems [3]. Hence, an easy and comprehensive portable and simple security system should be advanced to fill up those loophole gaps. The implementation of this paper is to provide the user a security box which is cheap in price, low weight. The system alerts the user through SMS instantly when someone opens the box before the given time.

The key focuses of this security system are to providing security when the user is absent in the home or his working places. In GSM mobile technology SMS (Short Messaging Service) is a technique that can perform anywhere whenever it needed. As the message can send quickly, accurately and at a little cost, so here chose the GSM module. Reasons for choosing GSM module are, GSM technology takes input signal from machinery to output message on device [4]. That means that after discovery of any intrusion GSM module will active. In the system, SMS facility will be very effective, where information or alert message sent by the GSM module and those information or alert message received by the user. In home-based safety system is different types of sensor-related home security, keypad-based security, Figure print, Palmprint and so much [4]. But after so many research I chose GSM based home security because it is better than the other all as it is easy to install and having a very low cost. Besides wireless technology is used and very popular to control home security systems instead of wired topological connection and nowadays almost all the people using mobile phone so using this system user will not have to carry or buy any additional device to monitor their house. Also, as GSM module works via WSN (Wireless

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Sensor Network) it covers a good space that ensures remote monitoring and quickly and easily networks establishment with a reasonable cost [5].

When the owner of the box away from the home or industry, all the sensors are activated by switching on the Security system. Whenever an intruder tries to open the box before the time owner set then the LDR (Light Dependent Resistor) sensor will activate and make an alert sound using the buzzer and at the meantime send an SMS to the owner of that box using the GSM module. Seeing the SMS, the owner understand that someone tries to open her box. On the opposite hand, after the fixed time (user set the time before closing the box) the box will automatically open. Here, Arduino Uno controls all the system. The idea of the system is straightforward and also the security system is new, distinctive and additional consistent than other automatic security systems. Also, this system is transportable, easy to install, affordable value and may be used in any environment.

Remainder of the paper is planned as follows. Section-II gives a brief literature review of the existing system, Section-III describes the system and functional structure of the proposed system, Section-IV depicts the features are the present in the system, Section-V explains the algorithm, flowchart, circuit diagram and also the parts of the system, Section-VI gives explains the result of the system, Section-VII gives the total expenditure involved in the hardware components in the system and, finally, in Section-VIII conclusion of the system is presented.

## 2. Related Study

Here a number of related works that are connected to the security system using GSM module.

In [6] has developed a safety system where many sensors are used to detect fire, smoke, temperature etc. Here sensors send the info to the microcontroller, then the microcontroller takes further steps. It also works when the owner away from the house. If the user turns on the monitor sensor on when he goes outside the home, if the system notices a motion then it sends a signal to the microcontroller and microcontroller sends a particular message to the owner through the GSM module.

In [7] the work is done by mainly PIR (Passive Infra Red), GSM module and Arduino. Here 2 PIR sensors and 2 Arduino are used. If PIR sensor sense any obstacles in the fixed area then it captures an image through serial camera and saves the image. As well as it vigorous Buzzer alarm beside sends SMS to the owner. In [8] they developed a system when anyone tries to unlock the system except the owner, then the pressure sensors can active and also the controller can receive a pulse. Then the controller unit takes decision and activities according to the pulse result. Also, active the output devices which includes GSM module, LCD screen, Servo motor, Buzzer and LED. In [9] the key goal is to develop a system that integrates intrusion and smoke alarm systems. They developed the system for multi-home. They send a notification via GSM technology to the user if there any problem in the system.

In [10] GSM module, IR (infrared) sensor, ATMEGA16 board and a relay circuit are used. In this system, when an intruder cuts through the ultraviolet beam, an interrupt is sent to the microcontroller which is further interfaced with a GSM module. It sends an SMS to the homeowner to alert him.

In [11] microcontroller AT89C55 has been interfaced with GSM module with a communication procedure for contact between the user mobile phone and the safety system. In [12] the automation system in built by PIC16F887 microcontroller that was combined with GSM module.

## 3. Research Method

The proposed system includes both software and hardware. In the software part program has been uploaded within the Arduino Uno ATmega328 microcontroller. And in hardware part, servo motor, GSM module, Buzzer, LCD screen, LDR sensors are present.

### 3.1. System Diagram

The system diagram of proposed SMS based security box has been shown in Fig. 1. Generally, it consists three main parts. Input, control and processing and output sections. The input system contains LDR sensors. LDR is a very useful tool for calculating the light value. Control unit consists Arduino Uno. It is an open-source microcontroller. The Microcontroller which is present in the Arduino is based on ATmega328. The output system contains LCD Display, GSM

module, servo motor, buzzer and any mobile phone. Using the properties of light modulating properties in liquid display it consists sixteen columns and a couple of rows. SIM 900A GSM GPRS Module is a reliable wireless module and cellular network. It will send the message to the user mobile. Servo motor is one kind of motor which rotates 180°. Using this, the box will automatically open. The Piezo Buzzer is a magnetic buzzer. It will make sound loudly.

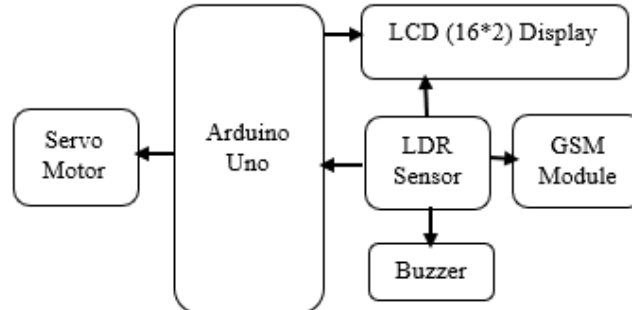


Figure 1. System diagram

**3.2. Functional Diagram**

The functional diagram of the system has been shown in Fig. 2. The LDR sensors situated in a place where the light will definitely fall in there. The box will automatically open (using Servo motor) after the time user input in the system. The user also sees a message “Now you can open the box” on the digital display. When someone opens the box before the time light will fall in the LDR sensors and also the sensors calculate the vary of the light and send the info to the Arduino to processing it. With this data Arduino active the buzzer, it will make an alert sound until the system will off and send an SMS to the user mobile phone using the SIM 900A GSM GPRS module and also show an aware message in the LCD display. LCD screen also shows the remaining time. Servo motor control the box lock system. When the time is finished servo motor rotates 90° and open the lock. The phone is for shown the message.

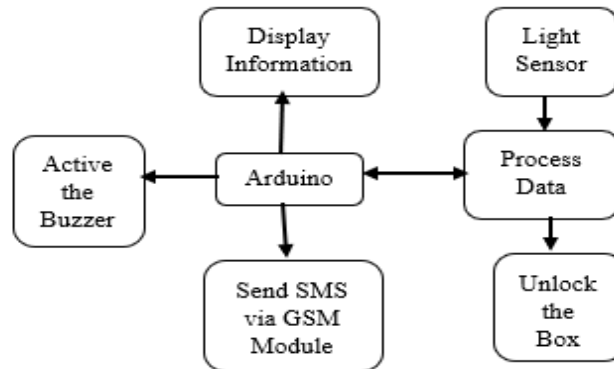


Figure 2. Functional diagram

**3.3. System Features**

The system has the subsequent features:

- 1) Low cost: The microcontroller that’s utilized in the Arduino Uno ATmega328 microcontroller. It is very low cost. The sensors, servo motor, LCD screen and buzzer are also inexpensive. The GSM module also in suitable price.
- 2) Small in size: The box which is used in here is very light weight and little in size. It will simply move one place to another.
- 3) User friendly: The system is very user-friendly. Anyone who doesn’t have any knowledge of Arduino or other elements utilized in this system they also used the systems in a proper way. The system starts only to start the power button and then the user set the time.
- 4) Quick response time: Ensure the proper security the user wants a system that aware him in a very short time. The system sends SMS to the user less than a second. Also, when the box is opened it sounds a noisy alarm instantaneously.

Wide area coverage: Now a day's GSM network is available in everywhere in the world. So, the system covers all the area where the GSM signal is available.

### **3.4. System Architecture**

#### **3.4.1. Hardware Components**

There are six main components to provide the total functionality of the security system.

1) Microcontroller

Arduino Uno which contains an 8-bit microcontroller called ATmega16 is used in this project. It ensures high performance at a low power consumption rate. It has an advanced RISC (Reduced Instruction Set Computing) architecture which helps it to execute 131 instructions in one machine cycle.

2) SIM 900A GPRS/GSM Module

SIM 900A has been used to send SMS. It is controlled by the microcontroller ATMeag16. It makes the development process easier and faster. It is very low power consumption. Its size is 24mm\*24mm\*3mm which helps to reduce the system size.

3) Servo Motor

It is very tiny (23mm\*12.2mm\*29mm) and lightweight (9g) with a very high output. Servo motor can rotate 0-180 degrees. In the system, it is used for open the lock automatically.

4) LCD (16\*2) Display

Liquid crystal display (LCD) uses the light controlling properties to display alphanumeric symbols. There are 16 columns and 2 rows. It can show up to 16 characters in 2 lines. [13]. In this system, the remaining period and the aware message is shown in here.

5) Piezo Buzzer

It is a sound producing device. It creates a loud and sharp sound. It can produce 2 to 4 kHz sound. In the system, it is used when somebody unlocks the box before the scheduled time.

6) LDR Sensor

Light Dependent Resistor (LDR) is mainly a resistor which resistance can be increasing or be decreasing depend on the amount of light intensity. In the system when somebody unlocks the box before the fixed time then the light will fall in the LDR and LDR will active. It sends a signal to microcontroller and microcontroller take the next steps.

#### **3.4.2. Algorithm**

Steps of the process in the proposed system are given below:

Step 1: Put Something in the box and lock the box.

Step 2: Set a suitable time.

Step 3: If the box is opened before the time?

Step 4: If Step 3 is NO, the box will open automatically after the time.

Step 5: If step 3 is YES, display an alert message.

Step 6: Send an SMS to the box owner.

Step 7: Active the alert sound.

#### **3.4.3. Flowchart**

The flow chart of the total system is shown in Fig. 3. Here we clearly show how the total system will run and the process of the security in step by step.

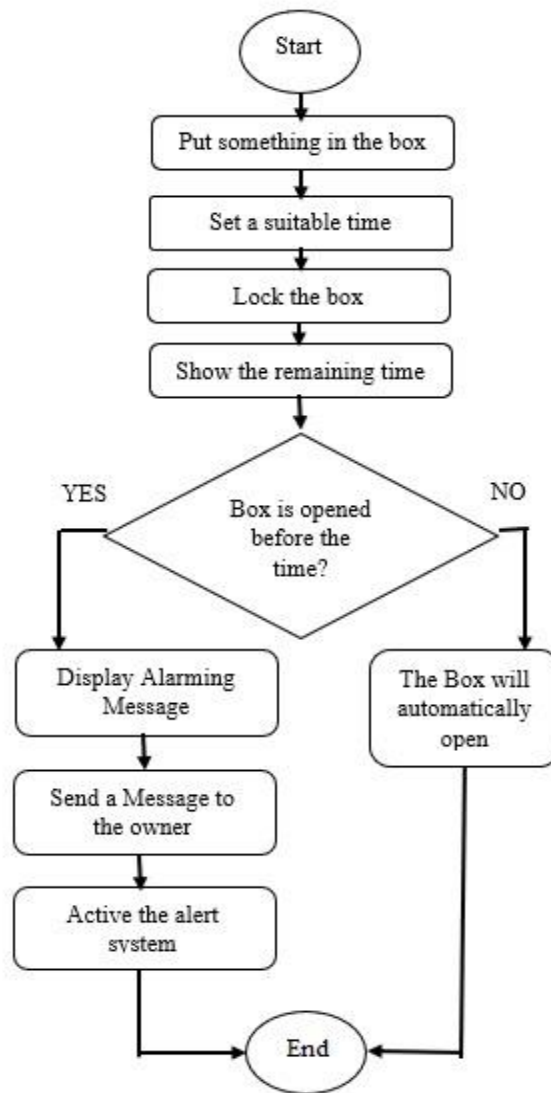


Figure 3. Flowchart of the total system

**3.4.4. Circuit Diagram**

Fig. 4, shows the circuit diagram of the SMS based security box. In the circuit, all the components are connected to the microcontroller (Arduino Uno). Here the power supply is 9v A.C. battery.

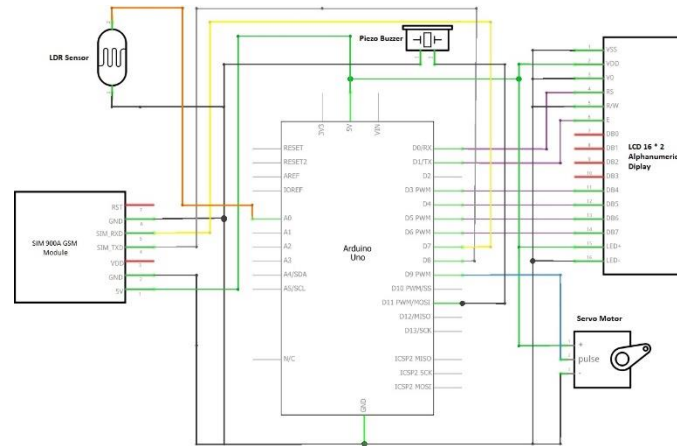


Figure 4. Circuit diagram of the proposed system

**4. Results and Analysis**

The prototype of the SMS based security box is designed and implemented successfully. The system is tested many times and get the accurate result all the time. The system gives a good response to the sensor and sends SMS when the box is opened before the scheduled time.

The Security box is shown in Fig. 5. Here in front of the box a lock and a display are present. In the display the remaining time to open the box, an aware message is displayed. The User opens the box and place something within the box and set a suitable time. Then the user closes the box and locks the box.

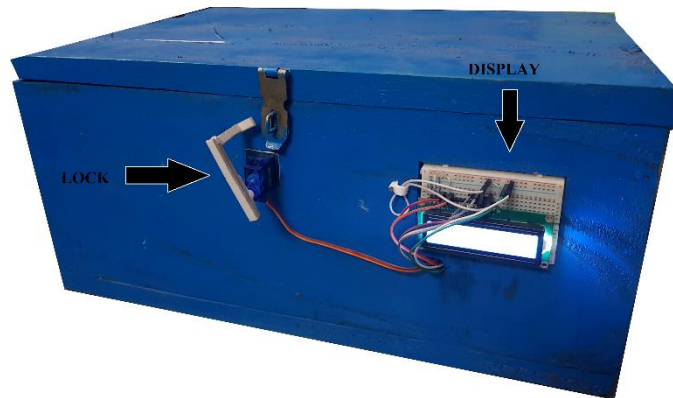


Figure 5. The main security box

When the given time is finished then the lock will automatically open and also show a message “Now you can open the box” in the display. Then the owner of the box safely opens the box. This case has been shown in Fig. 6.

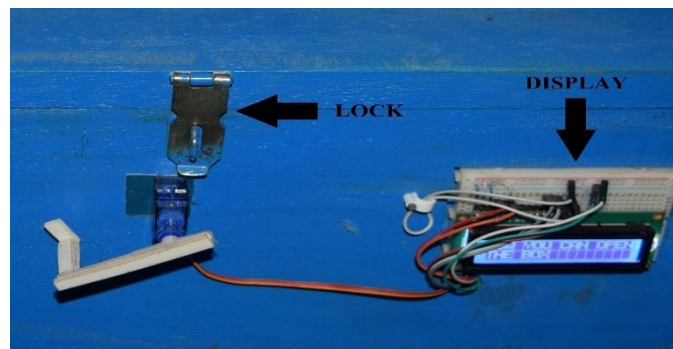


Figure 6. After the given time is finished the lock will open and show a message

When someone opens the box before the scheduled time then the LDR sensor are going to be activated. An aware message “WARNING” is shown on the display. Also, an alert alarm is activated. In Fig. 7, the message is displayed.



Figure 7. The warning message is shown

Also, a message is sent to the owner of the box when the box is opened before the scheduled time. The mobile number of the owner is given to the system. A user can change the number if he wants. As we use GSM module so we do not need any additional electronic equipment to transmit SMS. The cost of SMS is less and it reducing day by day. Time to receive the SMS to house owner depends on the signal strength range that we have got through the mobile tower. There must be some problem to send the SMS if the network signal is weak. In Fig. 8, the SMS is shown on the user mobile phone. Seeing the message, the owner will alert and take necessary steps further.

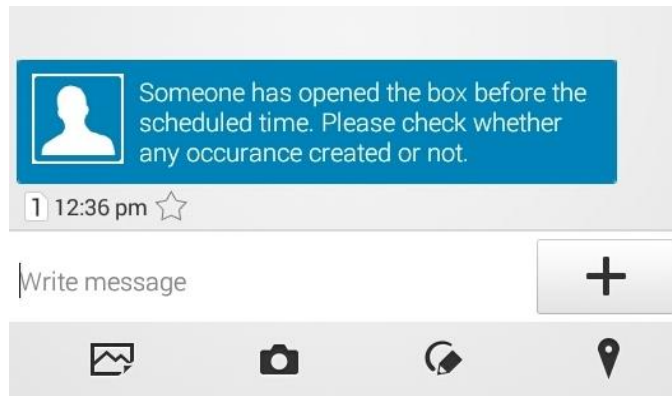


Figure 8. Send SMS to the box owner

**5. Cost**

The complete cost of the system is shown in Table 1. Here all the components are included that are used.

Table 1 Cost of the Full System

Sl. No.	Components Name	Quantity	Cost Per (\$)	Total (\$)
01.	Arduino Uno	1	8	8
02.	SIM 900A GSM Module	1	27	27
03.	LCD 16*2 Alphanumeric display	1	2	2
04.	LDR sensor	2	0.2	0.4
05.	Piezo Buzzer	1	0.2	0.2
06.	Servo motor	1	5	5
07.	Box	1	7	7
08.	Miscellaneous			5
Grand Total				54.6

## 6. Conclusion

A home protection system is needed for occupants, benefits, and safety. In the system all these properties are present. In the current situation, people getting more concerned to secure their house from unauthorized people. SMS based security system implemented in an easy method and is very easy to use in homes, offices and so on. It is possible to develop and implement the system in a limited budget, low power conception, compact in size and user-friendly. As the user can monitor premises from anywhere in real time it increases the safety of the private premises. As long as the mobile communication network is present user get an alert message through the GSM technology.

## References

- [1] Available at [https://en.wikipedia.org/wiki/Security\\_\(disambiguation\)](https://en.wikipedia.org/wiki/Security_(disambiguation))
- [2] G.M. Sultan Mahmud Rana, Abdullah Al Mamun Khan, Mohammad Nazmul Hoque, Abu Farzan Mitul, "Design and Implementation of a GSM Based remote home security and appliance control system," 2nd International Conference on Advances in Electrical Engineering, Dhaka, Bangladesh, pp. 291-295.
- [3] Mohamad Huzaiy Jusoh, Muhammad Firdaus Bin Jamali, Ahmed Faizal bin Zainal, Ahmed Asari Sulaiman and Mahamad Fahmi Hussin, "Wifi and GSM Based Motion Sensor for Home Security System Applications," 4<sup>th</sup> International Conference on Electronic Devices, Systems and Applications. 2015.
- [4] Abhishek S. Prarab and Amol Joglekar, "Implementation of Home Security System using GSM module and Microcontroller," International Journal of Computer Science and Information Technologies. 2015; 2950-2953.
- [5] Zheng Jungang, Wu Chengdong, Liu Daren and Xie Kun, "Study on Smart Home Network Technology Based on Wireless Sensor Network," Academic Journal of Shenyang Jianzhu University. 2005; 21: 753-756.
- [6] F. Shawki, M. El-Shahat. Dessouki, A. I. Elbasiouny, A.N. Almazroui and F. M. R. Albeladi, "Microcontroller Based Smart Home with Security Using Gsm Technology," International Journal of Research in Engineering and Technology. 2015; 4: 20-28.
- [7] Santoso Budijono, Jeffri Andrianto and Muhammad Axis Novradin Noor, "Design and implementation of modular home security system with short messaging system," EPJ Web of Conference 68, 2014.
- [8] Hasan, Raqibull and Khan, Mohammad Monirujjaman and Ashek, Asaduzzaman and Rumpa, Israt Jahan, "Microcontroller Based Home Security System with GSM Technology," Open Journal of Safety Science and Technology. 2015; 5(2):55-62.
- [9] Crystalynne D. Cortez, Jennifer L. Santos, Ken M. Alberto, Patrick O. Kua, Reynan C. Muncada, and Kevin R. Pontiveros, "Development of Multi-Home Alarm System Based on GSM Technology," International Journal of Electronics and Electrical Engineering. 2016; 4(4): 365-369.
- [10] Mehek Potnis, Ayesha Chimnani, Vishal Chawla and Mr. Amit Hatekar, "Home Security System Using Gsm Modem," Mehek Potnis et al. Int. Journal of Engineering Research and Applications. 2015; 5: 143-147.
- [11] H. Elkamchouchi and A. ElShafee, "Design and prototype implementation of SMS based home automation system," Electronics Design, System and Application, IEEE International conference. 2012; 162-167.
- [12] R. Teymourzadeh, S. Ahmed, K. W. Chan and M.V. Hoong, "Smart GSM based home automation system," Systems, Process Control, IEEE Conference. 2013; 306-309.
- [13] Available at <https://www.techshopbd.com/product-categories/lcd/254/lcd-display-16x2-techshop-bangladesh>.