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# Design and Development of a Smart Wireless Electronic Notice Board System

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**ABSTRACT**:For a long time, paper-based notice boards have been widely used in the government and private organizations, school areas to share information among the customer. However, using traditional (paper-based) techniques is a wastage of paper and paper-ink and human power. As a result, it is a time-consuming method and also it is not cost-effective. Therefore, to mitigate the aforementioned drawback, in this paper the design and development of a smart wireless electronic notice board are presented. The system is designed using a GSM module, Bluetooth module, ardiuno microcontroller, LCD, Buzzer, and LED. The circuit diagram and its functionality has been validated using the Proteus simulator. Based on the distance, the user of the proposed system can select one of the two approaches, are GSM modem-based and Bluetooth module-based approaches. The simulation and the hardware implementation of the proposed system are successfully achieved. From the result it has been realized that the proposed system is only accessed by authenticated users, it isa cost-effective system and very easy to handle. Besides, the latency involved in using papers in displaying notices is avoided. Therefore, the proposed system has many upcoming applications, as it can be set up at educational institutions and organizations, public transport places like railways, bus stations, airports, at the roadside for traffic control, and advertisements purpose.

**KEYWORDS:**ATmega328Microcontroller, Bluetooth module, GSM module, Liquid crystal display, MAX232, Notice Board.

## I. INTRODUCTION

A notice board is a place where people can leave public messages to advertise things, announce events or provide updated information in any organization [1]. For a long time, manual (paper-based) notice boards have been used by posting the paper on building walls or the prepared board made from wood. However, using these techniques is; (1) wastage of paper and paper ink and human power due to posting thus, it is not cost-effective, (2) it minimizes the appearances of the building wall and then it harms the environment since the papers will be discarded after use, lastly, (3) it takes much time to reach the receiver because of the process of printing and posting paper hence it is not time effective [2].

Therefore, all these limitations are very serious issues because there may be information loss as well as time and energy. Nowadays people from different parts of the globe need to communicate with one another in fractions of seconds using wireless communication. Therefore, replacing those manual notices boards using wireless notice boards is currently required. A wireless electronic notice board is possible through embedded systems. Being a wireless-based system offers flexibility to display flash news or announcements faster than the manual or traditional system [3].

In general, intending to improve overall system performance and limitation of manual notice board, various works have employed GSM-based wireless display systems such as SMS voting system, mobile operated robot, SMS based education system, and SMS based security system, which can be summarized as follows. The authors

of the study cited in [4] proposed sending a message to a Digital Monitor through a Raspberry Pi card from an authenticated PC. Wi-Fi is used for data transfer in the article. We can add, remove, or change the wording at any moment to meet our needs. For sending notices, a transmitter-authorized PC is used. The Wi-Fi is connected to the Raspberry Pi on the receiving end. The notice is received by the receiver when it is sent by an authorized user from his system. Wireless is a common technology that allows an electronic device to send and receive data via a computer network, including high-speed wireless connections. The information comes from a verified user.

Using a liquid crystal display (LCD), a receiver, decoder, microcontroller, and dot matrix, a wireless electronic notice board was established at University Malaysia Pahang in [5]. Paper cited in [6] describes the design and implementation of multiple LED display boards using an AT89S52 microcontroller, a GSM module, an LCD, and many moving LED displays.The authors of [7] built a wireless electronic display board utilizing GSM technology and displayed the message on the display board using various AT instructions. The GSM technology was utilized in the article to control the display board and to transmit information via a message sent from an authenticated source.

Likewise, [8] built an SMS-based wireless notice board display utilizing a GSM phone. [9] describes the hardware implementations of a GSM-based scrolling message display board with 7X96 Light Emitting Diode (LED) and dot matrix. In [10s] also shows a smart notice board that uses GSM communication to display messages on the notice board from the user's cell phone.In [11] Bluetooth-based electronic notice board has been proposed. In the paper, the system has been designed using GSM and Bluetooth, LCD, regulator, and rectifier. Similarly, in [12] a system through wireless transmit announcements on a notice board using Wi-Fi has been proposed. The Wi-Fi can pass information for about a hundred-meter distance Wi-Fi data rate has 1 or 2Mbps. It accesses several points and to care network interfaces. It also makes the system well-matched with more than one cellular technology.

In general, it can be realized from the above literature, various design of a wireless notice board system have been proposed. However, in most of the paper, they have used GSM and Bluetooth modules separately to provide access for far and near the user. Besides, the security of the system is not yet considered in the system. Especially, GSM module-based by developing android applications. Therefore, in this paper, the design and implementation of an integrated GSM modem and Bluetooth module-based wireless electronics notice board has been proposed, which is the novelty of this work.

Therefore, the main aim of this article is to design and implement a wireless electronic notice board that is suitable for both far and near the user. Besides, to increase the system security of wireless notice board by developing android applications for GSM and Bluetooth modules. In general to mitigated manual notice board performance limitation. Another part of the document is organized as follows. Sections present the proposed design and working principle. The simulation results and discussion is given in section three. Section four describes the result of the hardware implementations. Finally, the conclusion is presented in section five.

## II. PROPOSED DESIGN AND WORKING PRINCIPLE

The designed system has two sections (i.e. transmitting and receiving Sections) as indicated in Figure 1. The transmitting section is composed of a mobile phone which has inbuilt by GSM and Bluetooth module. The receiver section consists of a GSM module, HC-05 Bluetooth module, Arduino Microcontroller, Buzzer, LED, and LCD. As far as the time is concerned with technology, the designed project is implemented to fulfill the safety requirements of the users. In this system, the authorized user can send an SMS message to notify the user without any physical movement. These can be done using GSM modem-based approaches for far users and Bluetooth modem-based approaches for near users.

In the first approach, The GSM modem is first properly initialized and then it checks for modem connectivity. The Arduino microcontroller is programmed to send a fixed AT command to the module. The AT commands are used to check the communication with the module. It returns a result code OK if the module and the controller are connected properly. Then the user can send an SMS message to notify the user. The developed android application is to authorize the user of the system and for the security of SIM card in the GSM modem. The operation of this application is that at the initial moment all authorized user passcode is stored in the database of the system. For example, when an authorized user wants to send an SMS text message; first, the android application checks the passcode of the user by getting the necessary information from the database

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of the system. Then if the user's passcode is registered in the database of the system, he/she can send an SMS text message to the system by using this android application. Otherwise, if the user's passcode is not registered in the database of the system, the application closes the system by saying access is denied for this passcode.

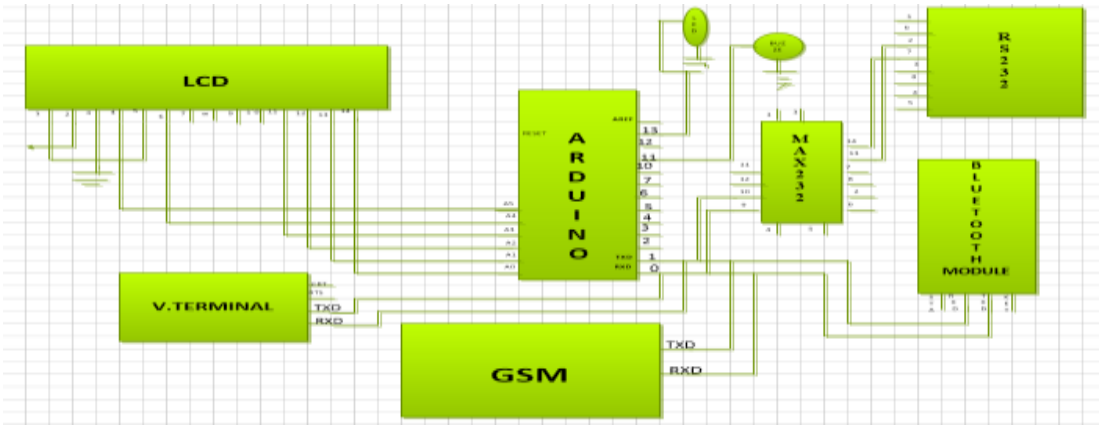


Figure 1. Circuit Diagram of the Overall System.

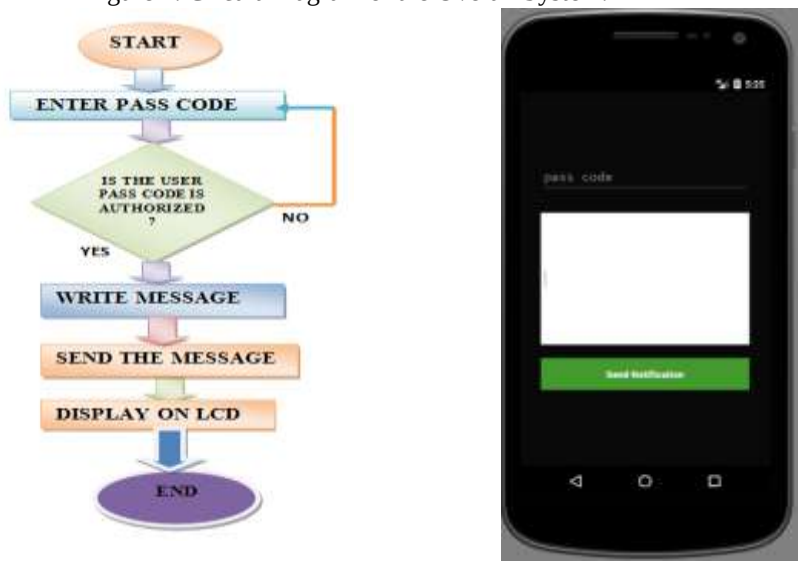


Figure 2. Block Diagram along with Developed an Android Application for GSM Security.

In the Bluetooth module approach, the user enters the user name and password of the developed android application. If the user name and password of the application are correct, the text field is open for the user to write an SMS text message to be sent to the Bluetooth module in which the module forward received message to Arduino microcontroller and then to display unit to notify the user. If the user name and password are not correct, the application never opens the text field to allow the user to enter the message.

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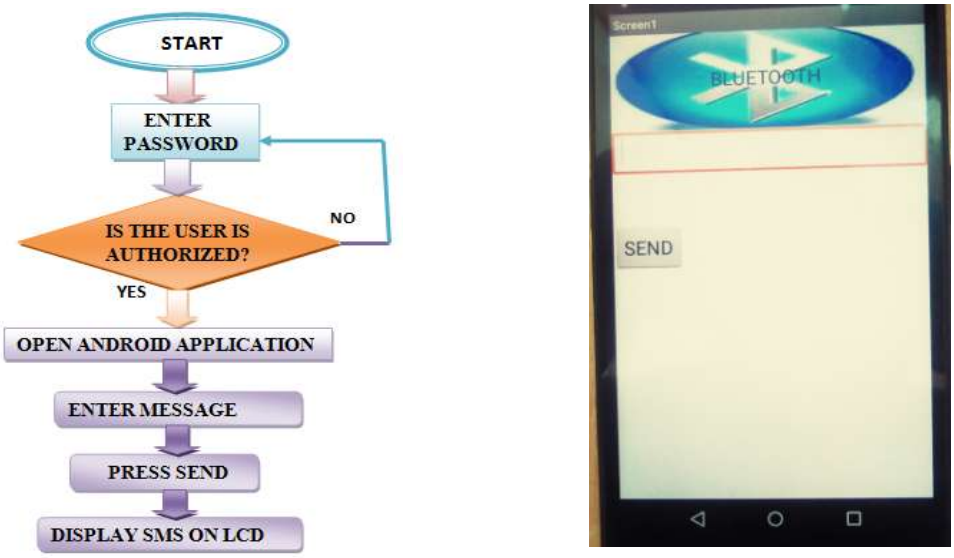


Figure 3. Block Diagram along with Developed Android Application for the Bluetooth Module.

## III. SIMULATION RESULTS AND DISCUSSION

In this section, simulation results and discussion is explained. Therefore, to implement the hardware of the proposed system, the system performance has been verified using a proteus simulator. Figure 4 shows the primary condition of the system on proteus software. Initially, when power is switched on and all the modules are kept ready, as there is no message is sent to the GSM modem or Bluetooth module from the sender, the board displays the default message. In this case, it is "**sending SMS to notice board**". From this it can be observed that transmitters and receiver ports of GSM, Bluetooth modules, and LCDs are in the active state i.e., the GSM and the Bluetooth modules can transmit and receive a text from the authorized user. This status occurs after the HEX file of the Arduino microcontroller and GSM modem is loaded to the system. The black screen on the left side is a virtual terminal, which is used to show the status of the overall system.

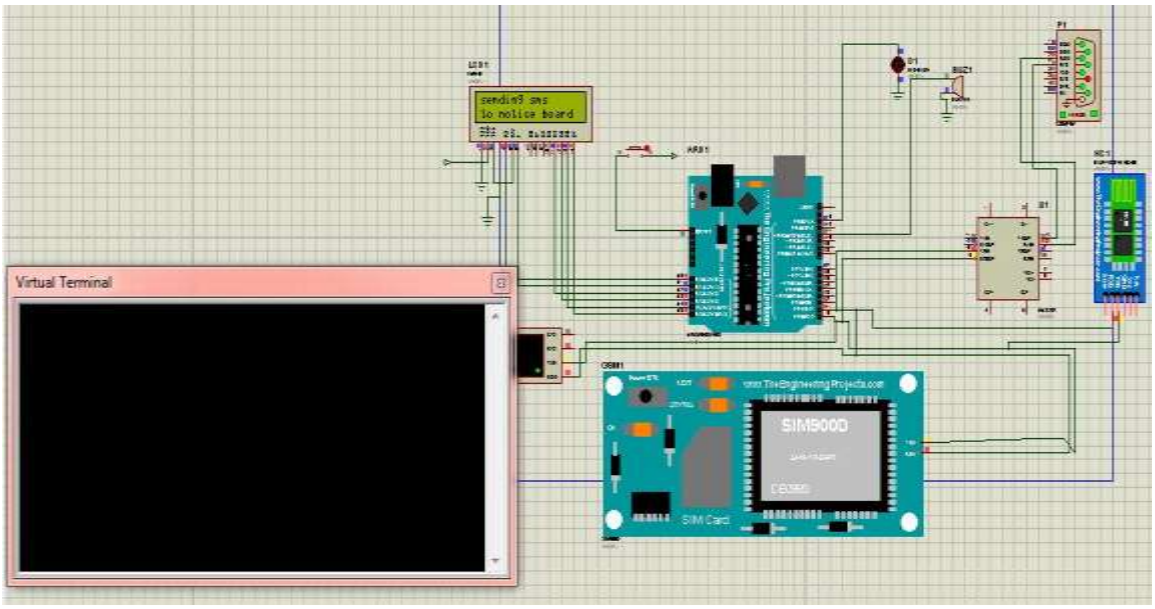


Figure 4. The Initial Status of Simulation.

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Immediately, after the AT+CMGR command is executed (see Figure 5), the AT command is displayed on the virtual terminal. Afterward, the command AT+CMGR is executed in the GSM module the message is transferred to the arduino microcontroller serially. The GSM is connected to an arduino microcontroller board through TX and RX pins. The LCD board is connected to the arduino microcontroller board by its output pins directly. The virtual terminal windows on the left side show the commands executed in the GSM and the commands executed in the arduino microcontroller are passed into the display board. Now, the entire system waiting for the condition to receive a new message from the transmitter. Thus, the authorized users can send SMS text messages to be displayed on board wirelessly. However, depending on the distance between the user and displaying unit the user can select GSM or Bluetooth module-based methods of displaying messages.

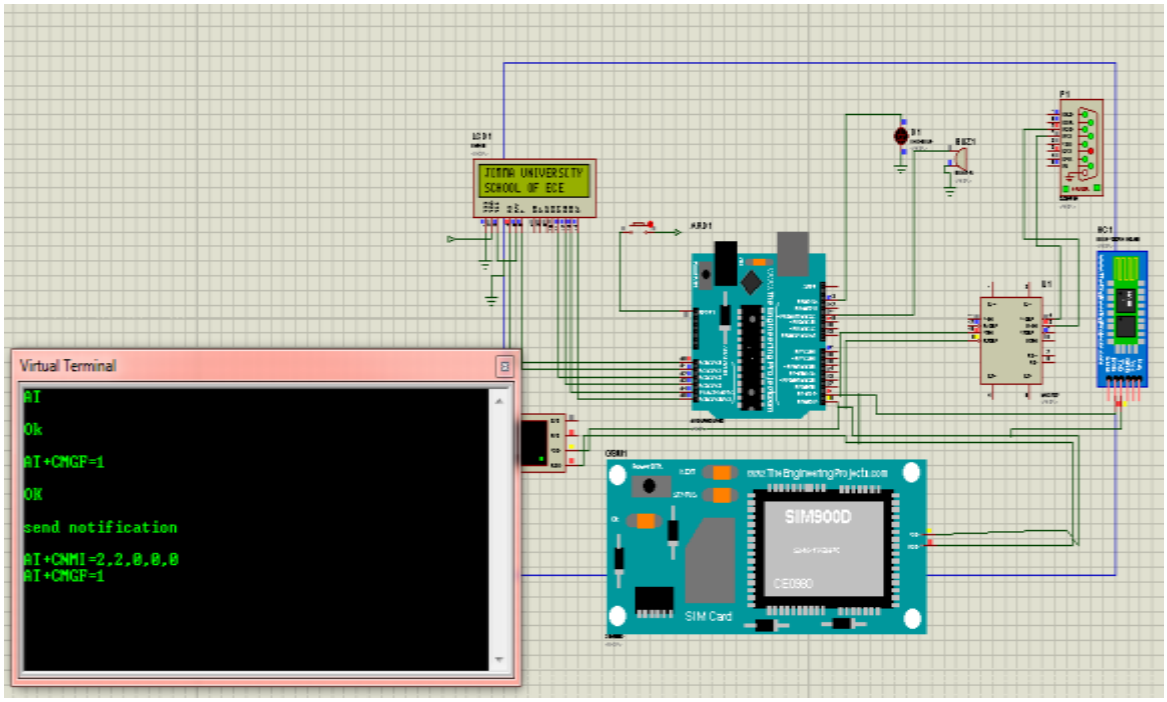


Figure 5. Virtual terminals displaying AT command.

## IV. RESULT OF HARDWARE IMPLEMENTATIONS

This section presents the hardware implementation of the proposed system design based on the system circuit revealed in Figure 1. The developed wireless electronic notice board can be viewed strictly without any specific locations. For the fact that the notice board program runs on a mobile phone connected by cellular networks and Bluetooth module to send the test message from an authenticated user. The procedure for implementing the wireless electronics notice board in this paper has two approaches which have been given below.

### 4.1. Bluetooth Module Based Wireless Notice Board

To implement this technique, first, the developed android application is installed on the chosen user devices. The Phone number of the selected user is registered and the passcode is assigned to the individual user. If the user passcode is correct, the text field is opened and allows the user to type the text to be displayed. When the transmitter clicks on send button the SMS text is received by the Bluetooth module. On the next, the microcontroller read the text message serially from the module, then forward it to LCD to notify the concerning body. For instance, if the authorized (after all process is checked) person wants to send a text message which is "**we are group 3**", all the above steps are checked and verified, the SMS of the authorized personis received by Bluetooth module, and forwarded to microcontroller then displayed on LCD which is the same as a sent message from a mobile phone by using Bluetooth application.

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Figure 6. Received and Sent Message Using Bluetooth Module Display System.

**4.2. GSM Modem Based Wireless Notice Board**

The step to use this approach can be stated as, first the presence of the user phone number will be checked in the database using a developed android application, if the number is registered, the user can send the SMS text to the GSM. Next, the arduino microcontroller reads the text serially from the GSM and then forwards the text to the LCD for display. At this time the Buzzer starts sounding to notify the user arrival of the new message. Therefore, after the system is initialized and ready to receive an SMS text, the LCD displays the default message in the setting in this case it is "**JIMMA UNIVERSITY SCHOOL OF ECE"** as indicated in Figure 7 (left side). For instance, the authorized person wants to display a text message "**we have meeting**" the user writes an SMS message on the text field.After all process of the system is completed, the sent is displayed on LCD at receiver side which is the same as the message sent from mobile phone see right side of Figure 7.


Figure 7. Default Message on LCD (top) and Received and Transmitted Message (bottom).

## V. CONCLUSION

In this paper, the design and hardware implementation of a wireless electronic notice board has been successfully presented. From the hardware implementation, it has been realized that the proposed system is a cost-effective system and very easy to handle, the cost of printing and photocopying is also reduced. Besides, the latency involved in using papers in displaying notices is avoided and the information can be updated by the authorized persons. Therefore, the proposed system has many upcoming applications, as it can be set up at educational institutions and organizations, public transport places like railways, bus stations, airports, at the roadside for traffic control, and advertisements purpose.

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