

GSM Based Smart Digital Wireless Electronic Notice Board

Arun Agarwal¹, Kishan Ray², Biplab Kumar Pradhan³, Vishaka Kumari⁴

Department of ECE, ITER, Siksha O Anusandhan Deemed to be University, Bhubaneswar, Odisha, India

E-mail: ¹arunagrawal@soa.ac.in

Abstract

Traditional notice boards are very difficult to maintain and involves very tedious process to change notice every time. This also is accompanied by waste of paper, ink, time, and manpower as well. This research work presents a low-cost new concept of digital wireless electronic notice board based on Global System for Mobile communications (GSM) modem whereby the required notice to be displayed will be sent through Short Message Service (SMS). This transmission of information is done by Radio Frequency wireless technique. In this device, a message or notice is sent to the display device like Liquid Crystal Display (LCD), and this message can be easily modified and sent from any part of the world, just by using the SMS facility in GSM cellular devices. Whatever notice to be displayed on the board is sent using suffix and prefix, and the message sent is displayed on the 16*2 display built on the wireless notice board. This work is very useful in schools, cinema halls, railway stations, colleges, offices etc. where the notice can be changed from anywhere, at any moment and as many times it needs to be modified.

Keywords: Wireless Communication, LCD, SMS, GSM, cellular service, electronic, digital

1. Introduction

Currently, almost all electronic bulletin boards are designed as wired systems. One of the drawbacks of this design is that the system is inflexible in terms of placement. A generic pinboard can't be placed anywhere because of the clutter of cables. Earlier, people used paper as a medium to convey messages, and printed paper was displayed on the bulletin. Changing the message displayed on traditional billboards is not easy. It requires a lot of time, resources and workers. Bulletin boards are one of the most commonly used boards to

communicate information from elementary schools to large organizations [1-5]. People using wireless bulletin boards can connect easily and quickly. It uses a Wi-Fi network to provide a wide area network, allowing information to be sent in text messages to an LED display that acts as a bulletin board. This work belongs to the area of Global System for Mobile Communication (GSM) wireless communications. GSM is a digital mobile phone system that is widely used in many parts of the world. GSM uses a variant of Time Division Multiple Access (TDMA). It is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA) [6-10]. GSM digitizes and compresses the data and transmits it over the channel along with two other streams of user data, each in its own time slot. It works with in the 900MHz or 1800MHz frequency bands [12-18].

In this work, a device which can display any message within limits of 32 characters in the notice board digitally has been designed. This device is operated digitally, and anyone can have access the device using a GSM sim validate number. Message can be sent across any corner of the world using any cellular device. This work is designed to promote wireless means of communication and automation the in modern world.

1.1 Motivation

This topic is selected as communication as our primary specialization and this work is purely based upon the working procedure of communication combined with devices. This work is not a wire complicated system and replicates a pure model of wireless establishment. This is the reason behind choosing this work design, as it could be implemented in a small configuration as well as large configuration.

1.2 Design Goals

1.2.1 Purpose

To make wireless communication more purposeful by implementing this work in hardware in real time, so that future work developments can keep aspects of this current work is the purpose of this project. Clarification of older concepts using modern devices, to make wireless communication more useful for future aspects can be accomplished.

1.2.2 Scope

This work contains research, documentation and validation of the communication process and its establishment in real time. It is produced as a primary design so that more

modification as well as development could be done regarding the topic in mere future. It will also help future aspirants to know and cultivate more about the product.

1.2.3 Applicability

1. Used in public places such as railway stations, bus stands, malls etc. to display any update.
2. This work can also be used in colleges and organizations to make announcements.

1.3 Problem Statement

To design a product, this will help to understand the linking of wireless communication and devices. This work shows how devices can be manipulated or operated using communication from any corner of the world. The electronic board can be accessed using GSM service without using any physical wires to communicate.

2. Literature Survey

Currently, bulletin board is managed manually using a keyboard or other device. This is an hour task to post a notice on the bulletin board. Moreover, it wastes a lot of resources such as paper, printer ink, manpower and time. There are existing systems based on GSM technology, wherein a SIM card is required to send messages to the board. It also includes GSM international roaming capabilities, so the messages can be sent to the recipients from anywhere in the world but will incur additional charges. The drawbacks of such systems are that with no password, anyone can send and view the messages, and if there is a problem with the network, GSM will not work. Moreover, paper consumption is a major contributor to deforestation, and awareness is essential if public places and organizations can engage and communicate with people using any other mode of communication rather than bulletin way. A wireless electronic signal system that replaces the need for paper signs using any of the many easy-to-configure, low-power wireless technologies available (Wi-Fi, Bluetooth, Radio Frequency (RF), XBEE, GSM, etc.) can be easily achieved. As the world moves towards digitization, wireless digital billboards are a requisite. Wireless electronic notice boards are a perfect replacement for paper memo boards and are easy to maintain, portable and accessible [8].

To solve this problem, this paper proposes a SMS-based pin board with extensive GSM integrated to facilitate communication of pin board message display via user's mobile

phone. Its operation is based on the microcontroller ATMEGA32 assembly language program. ASIM900 GSM modem with SIM card is connected to the port of the microcontroller using the attention command. When a user sends a SMS from a registered mobile number, it will be received by a SIM900 GSM modem on the receiving end.

3. Proposed Model

The main components of this research work include:

- GSM modem
- Microcontroller
- Power supply
- Display unit

3.1 System Design

1. Testing each component – Each electronic component must be tested if they are working or not, because misbehavior of any electronic device may cause the whole device to not work properly.

2. Assembling of components – After testing, the components must be implemented in a single board to check the accessibility of components.

3. Burning of the program – The program or code can be written and developed using software like Keil vision to the Arduino.

4. Display – After completion of implementation of components and burning of code, checking of measured value on the display is performed.

3.2 Architecture

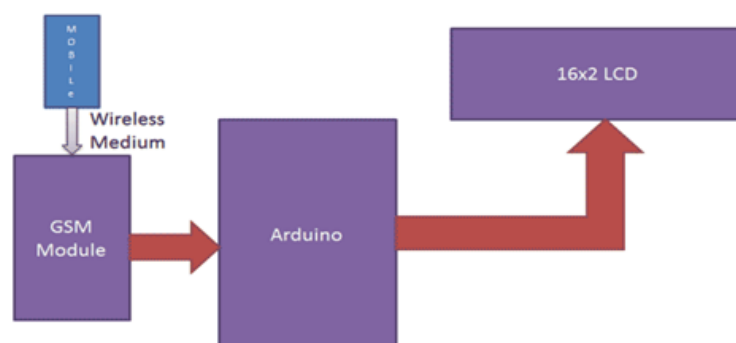


Figure 1. Proposed Model

3.3 Component Design

3.3.1 GSM SIM900A

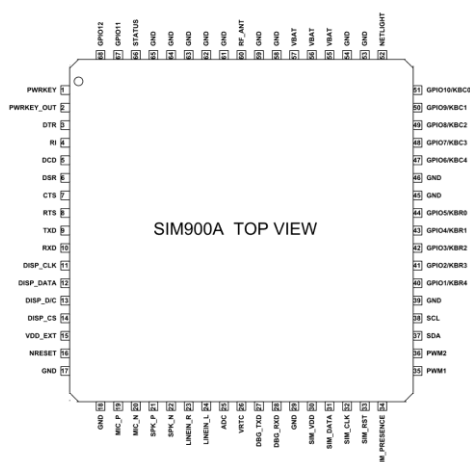


Figure 2. GSM SIM900A module

Devices available with GSM and GPRS services are available for all mobile phones and PDAs. This module can also be used for developing IoT and embedded applications. SIM900A is a dual band GSM and GPRS engine operating on different frequencies ESGM 900MHz and DCS 1800MHz respectively. SIM900A features GPRS multi-slot class 10/8 and supports GPRS code scheme.

3.3.2 LCD

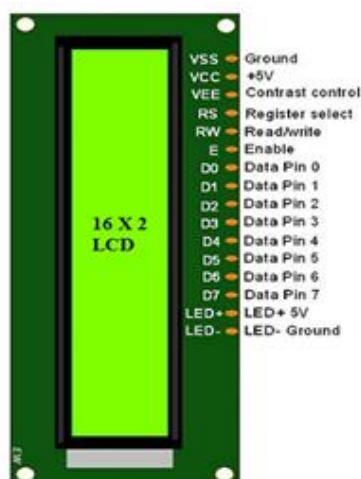


Figure 3. LCD display

The Liquid Crystal Display (LCD) is one of the display modules used for various applications of various electronic circuits and devices such as mobile phones and calculators.

3.3.3 Arduino Uno

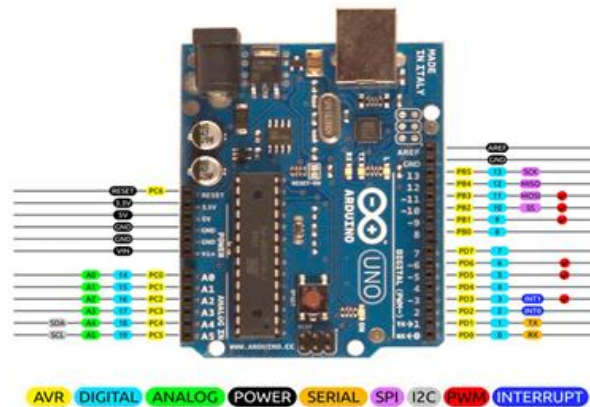


Figure 4. Arduino Uno pin diagram

This is a microcontroller used in a wide range of devices. It consists of other components like crystal oscillator, serial communication, voltage regulator etc. It has 14 pins in it, to which other devices could be connected.

3.4 Implementation

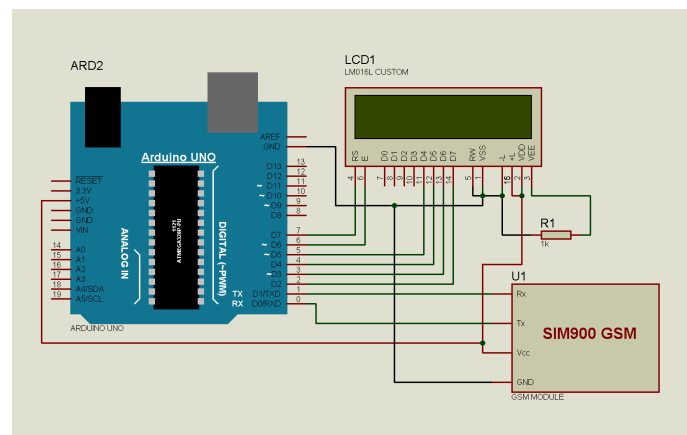


Figure 5. Schematic diagram of the proposed model

The electronic board circuit is implemented using a GSM module consisting of an 8051 microcontroller, a GSM module and a 16*2 display. The LCD is directly connected to the microcontroller because the logic levels of both the GSM module and the microcontroller are already aligned on the GSM module board.

3.5 Methodology/Design Evolution

After implementation of the circuit, the circuit is tested by burning the code to the Arduino Uno. The entire circuit after implementation is given a shape of electronic notice

board. The design will contain a solid box of plastic or wood which will make the design more conventional to use and handle. There are huge sign boards and digital banners present in public places. This prototype is a simple implementation of electronic boards which can be manipulated using digital signals without any use of predefined codes to execute each time the change of displayed information. It is wireless and only requires a power cord to operate in any conditions. The small design and mobility of the prototype makes it more convenient for using in places where there is a requirement of minimum wire mesh and to be updated frequently within a span of time. The portability of the device makes it easier to put up in any place without any hesitation. Either it is desk or a dashboard, it can fit easily to any small space.

4. Testing, Analysis and Evaluation

Testing Criteria: Effectiveness

This work is effective in terms of software and hardware.

Engineering tools used in this work:

- Keil Vision
- Arduino IDE
- MS Office
- Hardware tools

5. Problems, Faults, Challenges, and Limitations

Network issues always remain a problem due to multipath fading and deep fade in critical situations.

5.1 Faults

- Do not work in the absence of network.
- Cannot send Gif and audio to the board.

5.2 Challenges and Limitations

These are related to the fact that the proposed system is a SMS based system, therefore limitations with respect to the number of characters is present. Further, it cannot display audio and video, and scheduling announcements cannot be made.

6. Conclusion and Future Work

This paper presents a detailed design and development of a digital wireless electronic notice board. The implementation of wireless communication using microcontroller development board, educates about the use of GSM module, about their use and their working manuals. This work develops a keen interest in the whole process of communication and how it is implemented in day-to-day life. The complexity of the work defines the complications and work architecture enhancement to take place in large scale implements of industrial works and devices. Future work is directed towards large screen notice boards based on Internet of Things (IoT) technology. Further, use of Bluetooth and ZigBee technology can be a good research area. Using GSM modem, limits the application to text messaging. However, the Raspberry Pi can display images and play video/audio files. The source of this multimedia content can be a server such that the Raspberry Pi can communicate with, over the internet.

References

- [1] <https://www.electronicshub.org/wireless-electronic-notice-board-using-gsm/>
- [2] <https://components101.com/microcontrollers/arduino-uno>
- [3] <https://www.elprocus.com/lcd-16x2-pin-configuration-and-its-working/>
- [4] [4.https://components101.com/wireless/sim900a-gsm-module#:~:text=The%20SIM900A%20is%20a%20readily,EGSM%20900MHz%20and%20DCS%201800MHz.](https://components101.com/wireless/sim900a-gsm-module#:~:text=The%20SIM900A%20is%20a%20readily,EGSM%20900MHz%20and%20DCS%201800MHz.)
- [5] D. G. Rangani and N. V. Tahilramani, "Smart notice board system," 2017 3rd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT), 2017, pp. 209-214, doi: 10.1109/ICATCCT.2017.8389135.
- [6] Y. Teckchandani, G. S. Perumal, R. Mujumdar and S. Lokanathan, "Large screen wireless notice display system," 2015 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), 2015, pp. 1-5, doi: 10.1109/ICCIC.2015.7435697.
- [7] V. Sharma, S. Bansal, N. Verma, A. Jain, L. Jain and T. Jain, "Wireless Notice Board Using GSM," 2019 2nd International Conference on Power Energy, Environment and Intelligent Control (PEEIC), 2019, pp. 12-17, doi: 10.1109/PEEIC47157.2019.8976569.
- [8] D. K. Sharma, V. Tiwari, K. Kumar, B. A. Botre and S. A. Akbar, "Small and medium range wireless electronic notice board using Bluetooth and ZigBee," 2015 Annual IEEE India Conference (INDICON), 2015, pp. 1-5, doi: 10.1109/INDICON.2015.7443394.

- [9] "Wireless data transmission over GSM Short Message Service", June 2014, [online] Available: <http://www.eacomm.com/downloads/products/textbox/wdtgsm.pdf>.
- [10] Ajinkya Gaykwad, Tej Kapadia, Maan Lakhani and Deepak Karia, "Wireless electronics notice board", International journal on advance communication theory and engineering, February 2013.
- [11] R. Anandan, "Wireless home and industrial automation security system using GSM", Journal of Global Research in Computer Science, vol. 4, no. 4, pp. 126-132, 2013.
- [12] K. Mr. Ramchandra and Mr. Rohit Jagtap Guravl, "Wireless Digital Notice Board Using GSM Technology", International Research Journal of Engineering and Technology (IRJET), vol. 2, no. 9, December 2015.
- [13] Shraddha J. Tupe and A.R Salunke, "Multifunction smart display using Raspberry pi", International journal of advance foundation and research in computer, January 2015.
- [14] Ajinkya Gaykwad, Tej Kapadia, Maan Lakhani and Deepak Karia, "Wireless electronics notice board", International journal on advance communication theory and engineering, February 2013.
- [15] Prachee U. Ketkar, Kunal P. Tayade, Akash P. Kulkarni and Rajkishor M. Tugnayat, "GSM Mobile Phone Based LED Scrolling Message Display System", International Journal of Scientific Engineering and Technology, vol. 2, no. 3, July 2012.
- [16] A. Sachan, "Microcontroller based Substation Monitoring and Control System with GSM Modem", IOSR Journal of Electrical and Electronics Engineering (IOSRJEEE), pp. 2278-1676, 2012.
- [17] Weihua Pan, Fucai Luo and Lei Xu, "Research and design of chatting room system based on Android Bluetooth", Consumer Electronics Communications and Networks (CECNet) 2012 2nd International Conference, pp. 3390-3393, 21–23 April 2012.
- [18] Zafft and E. Agu, "Malicious WiFi networks: A first look", Local Computer Networks Workshops (LCN Workshops) 2012 IEEE 37th Conference, pp. 1038-1043, 22-25 Oct. 2012.