GSM Based Wireless Electronic Notice Board using PIC18F2550 Microcontroller

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Abstract -- Notice board is primary thing in any institution or organization or public utility places like bus stops, railway stations or parks. But sending various notices day to day is a tedious process. This paper deals with advanced notice board. It presents an SMS based notice board incorporating microcontroller PIC18F2550. A GSM module SIM 800L is interfaced to the ports of the microcontroller PIC18F2550. When the user sends a SMS via a registered number from his mobile phone, it is received by a SIM loaded GSM modem at the receiver unit. The GSM modem is interface to the control unit to receive messages from the user. The message received is sent to the microcontroller that further displays it on electronic notice board which is equipped with a display unit interfaced to a microcontroller. It is further displayed on an electronic notice board which equipped with 7 X 5 (5 Segment Display) light emitting diodes display interfaced to the dot matrix controller which converts instructions from a processor into signals which turns on or off lights in the matrix so that the required display is produced. As this paper aims to replace the passing of information with wooden notice board and the likes, the problem of not properly disseminating message is greatly reduced.

Indexed Terms -- Notice board, Electronic, GSM, Wireless, Bluetooth, Microcontroller, LED.

I. INTRODUCTION

The importance of placing notice boards in institutions or organizations and public utility places like airports, bus stations and railway stations to display and pass information can never be overemphasized. However, day-to-day changing of notices in these places is a difficult task. Wireless Electronic Notice Board is used for transmission of text data through wireless GSM interfaced with microcontroller [11]. It displays online message on public places. The system consists of a GSM receiver and a display unit which can be programmed from an authorized mobile phone. The GSM receiver receives the information to be displayed as SMS which is then displayed on the display unit (LED or LCD) [6]. Being a wireless electronic board, it is easily expandable and allows the user to add more display unit at any time and place which allows instantaneously display of important messages [3].

GSM Based Wireless Electronic Board helps in passing messages almost immediately by sending SMS which is better and more reliable than the old traditional way of pasting messages on notice board. It is used in enhancing the security system and also to make awareness of the emergency situations and avoid many dangers in industries.

The main aim of this paper is to design SMS driven automatic display board which can replace the currently used conventional wooden notice boards in most universities. The notice board displays messages sent from the user's mobile. When a user sends a message from his mobile phone, it is received by a SIM loaded GSM modem at the receiver unit. The GSM modem is interfaced to the control unit to receive messages from the user. The message received is sent to the microcontroller that further displays it on electronic notice board which is equipped with a display unit interfaced to a microcontroller.

This paper is within the scope of wireless communication (GSM wireless communication). Global System for Mobile communication (GSM) is a digital mobile telephony system which is widely used in many parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) which is the most widely used of the three digital wireless telephony technologies (TDMA, GSM and CDMA) [13]. GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band [1].

This model is applicable in;

- Public utility places like bus stations, railway stations, parks, airports etc.
- Educational institutions and organizations
- Traffic management
- Advertisements
- Stadia

Wireless electronic notice board can also be Android-Bluetooth based or PC based.

In Android-Bluetooth Based Wireless Electronic Notice Board, an electronic display notice board is interfaced to an android device through Bluetooth connectivity. While the user sends the message from the android application device, it is received by the Bluetooth device at the display unit. It is then sent to the microcontroller that further displays the notice sent from the user on to the LCD or LED display of the notice board [2].

In PC Based Wireless Electronic Notice Board, the message sent from the computer's keyboard is transmitted through radio frequency (RF) transmitter. RF receiver is fixed to the display panel at the receiving unit. The receiver receives the data coming from the transmitter and the same data will be received by the microcontroller at the receiver end. The microcontroller sends this data to the display unit and thus the message given by the user at the transmitter end will be displayed [1].

GSM and Android-Bluetooth based notice boards are more portable than PC based but GSM based is better than the rest because of its portability and ability to send messages over long distances of wireless network coverage [6].

II. SYSTEM REQUIREMENTS AND ARCHITECTURE

The operation is simple. The information to be displayed is sent as a message from the authorized mobile phone. The GSM modem receives the message. This message is then extracted by the microcontroller from the GSM modem. The message is then displayed on the LED display board.

Serial communication is used for the entire process from GSM module to Microcontroller and from microcontroller to the LED display. The three devices are powered by the same power supply.

The main components of this research work include;

- GSM modem
- Microcontroller
- Power supply or power adapter
- Display unit

III. METHODOLOGY

The system was designed with figure 1 as the block diagram and figure 2 as the circuit diagram. +5v is required to power the microcontroller and the P10 dot matrix display. +4v is sufficient for the GSM module. An adapter supplies the needed power for the design. PIC18F2550 acts as the central processing unit for this project. Ideal for low power (nanoWatt) and connectivity applications that benefit from the availability of three serial ports: FS-USB (12 Mbit/s), I²C™ and SPI™ (up to 10Mbit/s) and an asynchronous (LIN capable) serial port (EUSART) [7].

Large amounts of RAM memory for buffering and Enhanced FLASH program memory make it ideal for embedded control and monitoring applications that require periodic connection with a (legacy free) Personal Computer via USB for data upload/download and/or firmware updates. While operating up to 48MHz, the PIC18F2550 is also mostly software and hardware compatible with the PIC16C745 Low-Speed USB OTP devices [9].

Its special features include memory endurance, self-programmability, extended instruction set, enhanced addressable USART, 10-bit A/D converter and dedicated ICD/ICSP port.

PIC18F2550 microcontroller requires some extra supporting hardware like +5volts power supply, Power on RESET (POR), as well as manual RESET, Clock generator and pull up resisters.

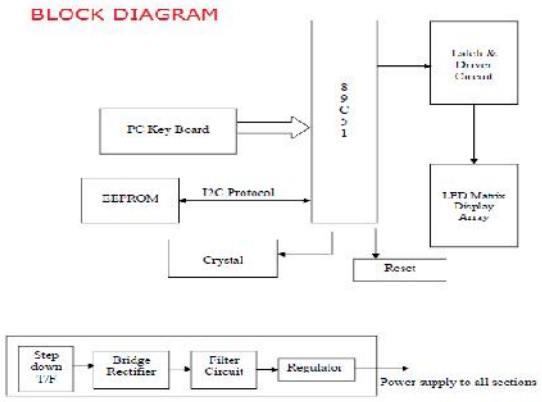

Fig. 1: - Block diagram

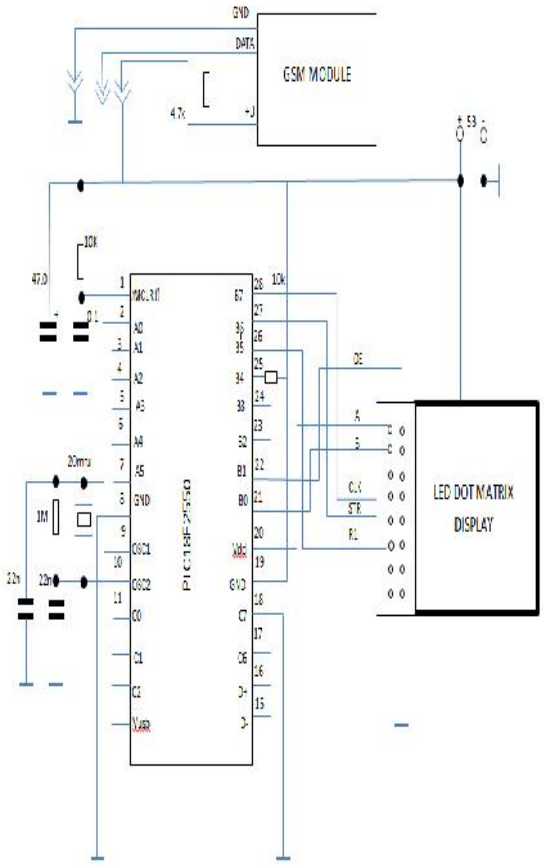

Fig. 2: - Circuit diagram

When the power supply of the CPU board is switched ON, the microcontroller must be RESET to start the program execution from 0000H memory location.

In microcontroller, port 0 does not have internal pull up resistor therefore, external pull up resistor has to be used at port 0. At other ports external pull up resistor is optional; however external pull up resistors is already connected for the other ports [12].

PIC16F876A microcontroller connected with transistor level converter interfaces the GSM module with the PIC18F2550 microcontroller.

IV. GSM MODEM INTERFACING

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves [5].

Fig. 3: - GSM modem

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer [2]. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer.

Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

A SIM card is a subscriber identity module application on a smartcard that stores data for GSM/CDMA Cellular telephone subscribers. Such data includes user identity, network authorization

data, personal security keys, contact lists and stored text messages [14].

Security features include authentication and encryption to protect data and prevent eavesdropping. The smartcard with Subscriber identity module application is generally known as SIM CARD [4]. But, in reality, the SIM is effectively a mass-market smartcard.

When the SIM is viewed as a smartcard, it opens up security possibilities that resonate far beyond the mobile world.

Computers use AT commands to control modems, where both GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, one can do things like:

- Reading, writing and deleting SMS messages
- Sending SMS messages
- Monitoring the signal strength
- Monitoring the charging status and charge level of the battery
- Reading, writing and searching phone book entries.

The number of SMS messages that can be processed by a GSM modem per minute is very low -- only about six to ten SMS messages per minute [8]

V. DOT MATRIX DISPLAY (DMD) INTERFACING

The PIC18F2550 microcontroller is also interfaced with the dot matrix display. A dot-matrix display is a display device used to display information on machines, clocks, railway departure indicators and many other devices requiring a simple display device of limited resolution [10].

The display consists of a dot matrix of lights or mechanical indicators arranged in a rectangular configuration (other shapes are also possible, although not common) such that by switching on or off selected lights, text or graphics can be displayed [7]. A dot matrix controller converts instructions from a processor into signals which turns on or off lights in the matrix so that the required display is produced.

In this research paper, 32 x 16 cm, 7 x 5 matrix (5 segment display) LED (green) is used to display the message or notice.

VI. DESIGN ALGORITHM

The algorithm for the designed system is as follow;

1) Start:

In this step after switching on the power supply the circuit gets on and LED glows showing that the circuit is properly working.

2) Initialize the microcontroller:

In this step the microcontroller gets initialized and waits for the notice.

3) Send message through the mobile phone:

This step includes the sending of message through any general mobile phone.

4) Wait for the message to be received:

The modem of the circuit waits for the message to be arrived for displaying it.

5) Display the message on the LED:

After receiving the message n proper code conversion, the message is displayed on both the LED screen.

6) Wait for the new notice to be arrived:

In this step the old notice is displayed on LED and it waits for the new notice [12].

VII. RESULTS AND DISCUSSION

This section describes the overall process of the implemented system. Several testing were performed to ensure proper execution and assembly of the intended result. The diagrams below show the various outputs of the designed system.

Fig. 4: - Interior view of the system

Fig. 5: - Exterior view of the system

Fig. 6: - Display implementation of the word “Note Hello”

When the notice board is plugged to a power outlet, the display comes on and begins to display the last message that is received. When a new message is sent, it automatically overrides the last message on the display and begins to display the new message.

VIII. CONCLUSION AND FUTURE RESEARCH

Wireless communications are the fastest growing segment of the communications industry.

Wireless Local Area Networks (WLAN) currently supplements or replaces wired networks in many homes, businesses, and campuses. Many new applications, including wireless sensor networks, automated highways and factories, smart homes and appliances, and remote telemedicine, are emerging from research ideas to concrete systems. The explosive growth of wireless systems coupled with the proliferation of laptop and palmtop computers indicate a bright future for wireless networks, both as stand-alone systems and as part of the larger networking infrastructure.

This paper is based on GSM wireless technology. The main objective was to replace the constant display of notices with sheets of paper with a faster, efficient and convenient display board. This objective has been achieved by the designed system (GSM Based Wireless Electronic Notice Board). This can be used widely in schools, public utility places like roadside for traffic control and in emergency situations. It is cost efficient system and very easy to handle. Latency involved in using of papers in displaying of notices is avoided and the information can be updated by the authorized persons. However, this notice board designed cannot take more than 60 characters. It has limited functions which are; to display previous notice and to override old notice with new one. No dedicated LED to indicate power ON or OFF; the only way to know if there is enough power to the system is when the display board itself comes on.

In the future, external memory like RAM and higher end microcontrollers can be used to display much longer characters so that longer messages can be conveyed by the system.

Adding more functions like “No New Notice”, “Getting New Notice Ready” etc. will only make the system flexible and sophisticated for industrial use.

Typical red LED could be used as power indicator. Problem with not really knowing if the system is properly plugged to a power outlet or system not powering up would be known with the LED ON and OFF indicator.

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