WIRELESS ELECTRONIC DISPLAY BOARD USING GSM TECHNOLOGY

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Abstract-This paper deals with an innovative rather an interesting manner of intimating the message to the people using a wireless electronic display board which is synchronized using the GSM technology. This will help us in passing any message almost immediately without any delay just by sending a SMS which is better and more reliable than the old traditional way of pasting the message on notice board. This proposed technology can be used in many public places, malls or big buildings to enhance the security system and also make awareness of the emergency situations and avoid many dangers. Using various AT commands is used to display the message onto the display board. GSM technology is used to control the display board and for conveying the information through a message sent from authenticated user.

Keywords: GSM modem, LED Display, Microcontroller

I. INTRODUCTION

In this modern world Mobile Phones and the related technologies are becoming more and more prevalent. Various technical arenas in the field of Telecommunication and Embedded Systems are becoming omnipresent in the people. The use of cell phones has rapidly increased over the last decade and a half. Upgradation in networking technologies has encouraged the development and growth of very dense networks. Now-a-days the general mass prefer communicating while on the move therefore landlines usage has been drastically reduced [1,2]. Notice boards are one of the widely used ones ranging from primary schools to major organizations to convey messages at large. A lot of paper is been used and which is later wasted by the organizations. This in turn leads to a lot of deforestation thus leading to global warming. Small innovative steps in making use of technology for regular purposes would have an adverse effect on the environment issues which we are presently concerned about. The main aim of this paper is to design a SMS driven automatic display Board which can replace the currently used programmable electronic display and conventional notice boards. It is proposed to design receive cum display toolkit which can be programmed and later be used from an authorized mobile phone. The whole process can be described from the block diagram in Figure 1. The GSM modem receives a message from the authorized mobile phone and the message is extracted by the microcontroller from the GSM modem and is 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 [1-9]. This proposed system in this paper has many upcoming applications in educational institutions and organizations, crime prevention, traffic management, railways, advertisements etc. Been user friendly, long range and faster means of conveying information are major bolsters for this application. By using this proposed methodology we can enhance the security system and also make awareness of the emergency situations and avoid many dangers.
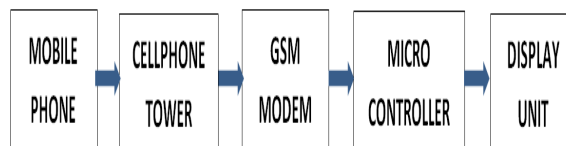

Figure 1: Block Diagram

II. LITERATURE REVIEW

With the development of cellular networks in the 1970's for increasing the lack of frequencies in the radiotelephone services which in turn lead to introduction of AMPS (Advanced Mobile Phone System) where the transmission was analog based. This was known to be the first generation in cellular networks. The second generation was based on digital transmission and was called with various abbreviations as GSM (Global System for Mobile communications), ERMES (European Radio Messaging System). Various Cordless telephone standards were also introduced during this time only. The third generation has risen with the unification of different technologies; some of them which are popularly known are FPLMTS (Future Public Land Mobile Telecommunications System), UMTS (Universal Mobile Telecommunication System), and IMT-2000(Internationa Mobile elecommunication)[1-9].

III.   OVERVIEW

To realize the proposed wireless GSM Based Display unit the following prototype model has been developed in the laboratory. It consists of Micro controller, GSM Modem, One cellphone and LED display board. LED display board is used for testing the proposed methodology. The interfacing of a GSM modem with a normal PC is quite easy with help of the AT commands sent to it from the HyperTerminal window. But we must take into fact that the modem requires a wired connection at one end and wireless at the other. As it is too expensive to use a dedicated general purpose computer at each and every site of the display boards, the possibility of performing the objective with a dedicated computer is not feasible practically on cost factors. Hence we employ Atmel ATmega32 microcontroller with 1024 bytes EEROM storage memory. The complexity of coding considerably intensifies as compared with PC, but once programmed the micro controller works at its best since it is a committed embedded system. The design procedure involves identifying the different components and assembling all of them and ensuring safe interfacing between all these components. Then coding process has to be done, which has to take care of the deferrals between two successive communications and most importantly the authentication of the sender's number. The number of authenticated mobile numbers can be more than one. This enables the multiple users can operate the digital display. The main limiting constraint is the RAM of the microcontroller.

IV.   PROPOSED METHOD

A.   Features and description of various hardware and software components

The AT89S52 is a low-power, high-performance CMOS 8-bit microcomputer with 4k bytes of flash programmable and erasable read only memory (EPROM).By combining a versatile 8-bit CPU with flash on a monolithic chip, the Atmel AT89S52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications and pin out. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The idle mode stops the CPU while allowing the ram, timer/counters, serial port and interrupt system to continue functioning. The power-down mode saves the ram contents but freezes the oscillator disabling all other chip functions [1-9].

We also are using SIM300 GSM module with following features

• TTL UART interface for connection to microcontroller

• RS232 interface for connection to PC/Laptop
• 12V power supply option
• 5V power supply option
• LED indicating network status

In this paper we have interfaced microcontroller with GSM Modem to decode the received message and do the required action. The protocol used for the communication between the two is AT command. RS-232 standards are used for the serial communication of binary bits. Various AT commands of call control, data card control, phone control, computer data interface, service, network communication parameter, SMS text mode and SMS PDU mode are used for the communication purpose from microcontroller to the GSM module. Raisonance 8051 Integrated Development Environment (RIDE) is the software used from editing to compiling, linking and debugging along with a simulator which conveniently manages all aspects of the embedded systems development with a single user interface.

B.   Operation

The unit can be operated with PS2 keyboard or serial port.

B.1 Operation with PS2 keyboard:

Initially the PS2 keyboard is connected to the display unit and power is supplied to the display unit. Then five different options of creating a new message (F1), viewing a message (F3), formatting (F4), setting time and date (F6) and exit (ESC) options will be displayed. (Corresponding keys are pressed to choose various options). On choosing F1 we are choosing to create a new message. The message looks in the following format: <M message><DEF 1><S 5><D L2>

The characters enclosed in brackets <> are parametric commands which control the display styles of the message. The parametric commands should be typed in capital letters only. These commands can be inserted only in specified areas only (some on beginning rest ending that also in specified order). The parametric commands are visible only when message is viewed or at the time of creating message. During the execution of messages these characters are not displayed

Parametric Command set:

< M>   command for creating message.

<DEF 1>   message number (1 to 99)

<S 5>   command for defining speed.(1 to 9). 1 is slow, 9 is fast

<D L2/R2/U2/D2>   Display begins from mentioned side that is from left/right/up or down and moves in opposite direction. Last digit defines number of times to display. (1 to 99)

Illustration:

<M Hello world><DEF 1><S 4><D R2> enter.

In the above format <M defines that this is message, Hello world is the message<DEF 1> defines the message number, <S 4> defines the speed is 4,<D R2> defines the message should scroll from left to right 2 times. After pressing enter the message is saved in the memory.

F3 View is selected when there is a requirement to view the message saved in the memory. The message is displayed by choosing the number of message from 1 to 99 which is stored in the memory .Similarly, on choosing F4 it is designed so that all the messages in the memory is lost as it is used for formatting. There is also an option to set the time and date according to its time zone which is accessed by choosing F6 access button.

B.2 Operation with serial port:

The unit is connected to the display and hyper terminal settings are configured. Shift# is typed to enter the menu mode where you will be asked to choose to view message (type 1), format (type 2), set time (type 3) and exit (type 4).

On choosing 1 the message is displayed on the board. The message has the following format:

<M message><DEF 1><S 5><D L2>

on choosing 2 the memory is formatted and 3 can be used to set the time and date accordingly.

Sending messages through serial port:

Connect the unit to serial port and configure hyper terminal to default settings and Press Shift * to feed the new messages. Then the display unit will print ********.

Illustration:

<M Hello world><DEF 1><S 4><D R2>

In the above format <M defines that this is message, Hello world is the message<DEF 1> defines the message number, <S 4> defines the speed is 4, <D R2> defines the message should scroll from left to right 2 times. After pressing enter the message saved in the memory.

The microcontroller, GSM module and display board are powered by AC to DC adapter with input 100-240V AC, 50/60Hz and Output 12V DC, 1A.

V.   DESCRIPTION OF THE PROPOSED METHOD

Figure 2 shows the GSM module used in our paper; it consists of a SIM card of MIN "8686400268". The message transmitted by any number to this MIN is received and saved in the memory of the SIM card. This module works with the AT-Commands set as mentioned in earlier sections. The RxD and TxD pins of this GSM module are connected to the TxD and RxD of the microcontroller respectively so that the information (here message) is transmitted through a serial port[1-9].   The RxD and TxD pins of the microcontroller board are the 2nd and 3rd pins of the DB9 port given in the board (which are connected to the P3.0 and P3.1 ports of microcontroller). The message received by GSM module is retrieved by the microcontroller by using suitable AT-command. The display board is also connected to this board through serial port pins (P3.0 and P3.1). The message is transferred to the display board when the AT command "AT+CMGR" is executed.
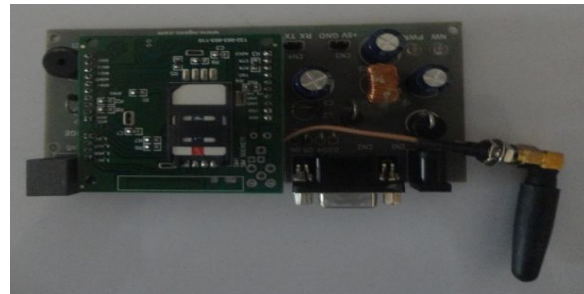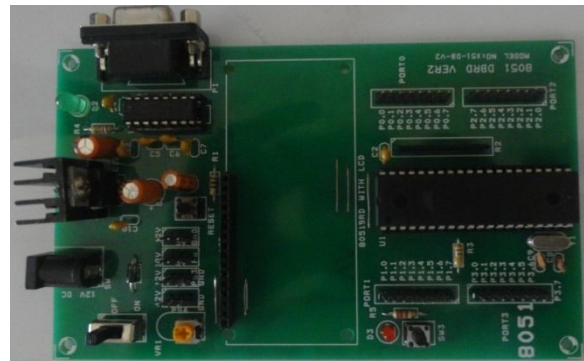

Figure 2: GSM Module

Figure 3: 8051 development board VER 2

Till the command AT+CMGR is executed the board displays the default message saved in it. When the AT+CMGR=1 command is executed, then the message is transferred to the Display board through serial communication and "=1" designates the message, storage location 1 in the board and then the message is displayed. Figure 4 shows the total hardware of the paper including the GSM module, 8051 development board, and the relay circuit (optional). All the connections are shown in this figure which is made as explained previously in the paper.
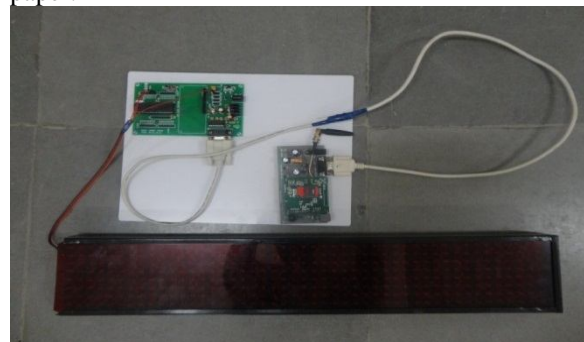

Figure 4: Hardware components connected together

VI. SIMULATION RESULTS

Before going on to the proposed design practically, the results were verified in 8051 simulator. Using this simulator various modules of the project are constructed with the tools available in the simulator. And then by making the appropriate circuit connections as discussed earlier using the virtual wires and then writing the hex code onto the virtual microcontroller we can observe the results of the proposed method. The process of simulation of the project is as follows.
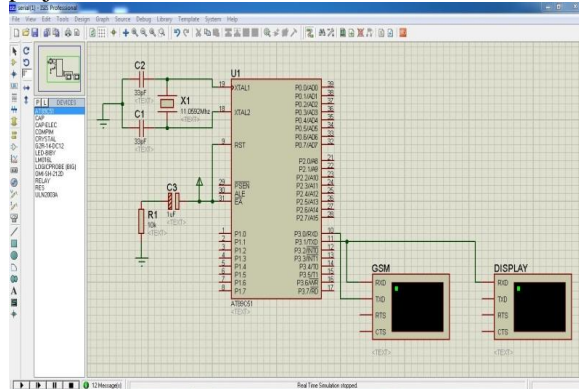

Figure 5: The schematic diagram or the virtual project

Figure 5 shows the schematic diagram built using the tools available in the simulator. It shows all the components of the project such as GSM module, Microcontroller and Display board and the connections between them.
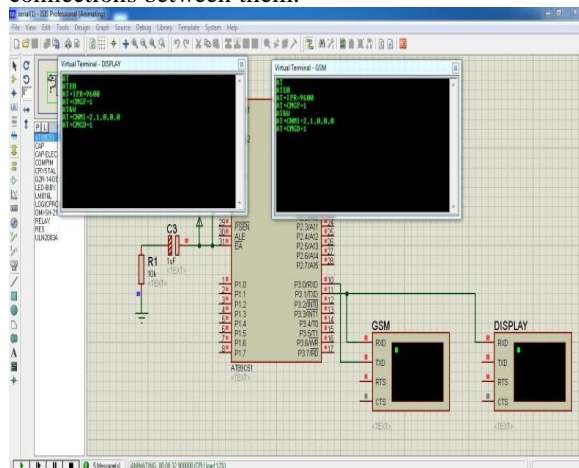

Figure 6: Initialization of GSM module and the Microcontroller

Figure 6 shows the initialization process of GSM module and microcontroller using AT commands. The two virtual terminal windows in above figure shows the commands executed in the GSM and the commands executed in the microcontroller that are passed onto the display board. Now the entire system waits for a new message to the provided MIN.

In figure 7 the GSM terminal shows a new message and notification as "+CMTI" and a command "AT+CMGR" is executed to read the message through microcontroller.
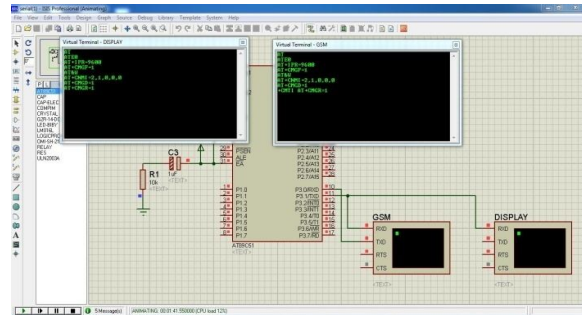

Figure 7: Displaying the notification of new message

Figure 8 shows the displaying of the message in the Display terminal immediately after the AT+ CMGR command is executed.
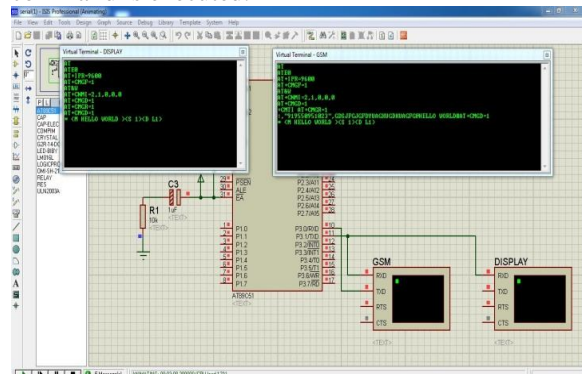

Figure 8: Terminals displaying the sent message

VII. RESULTS

As shown in figure 9 the message is sent as "@hello cbit#" because when @ is received the message reading starts and when # is received the message reading stops so whatever the message we want to display is kept in between @ and #. The message is received by the GSM module and is passed onto the microcontroller using serial communication. The GSM module uses the AT commands presented in a proper syntax. The GSM module receives the message and stores in the memory available in the SIM card. When the command AT+CMGR is executed in the microcontroller the message is transferred to the microcontroller. The GSM is connected to microcontroller board through serial communication using RS232 cable (DB9 pins). The LED display board is connected to microcontroller board by pins directly as shown in figure 4. The TxD and RxD of display board are connected to P3.0 and P3.1 of microcontroller board.

Initially when power is switched on and all the modules are kept ready, as there is no message is sent to the GSM module, the board displays the default message fed into it as shown in figure 10.
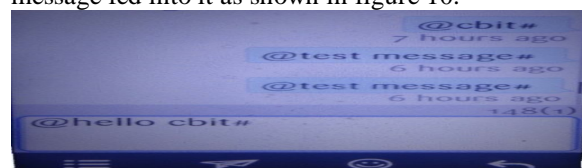

Figure 9: A mobile user sending the message in specified format

Figure 10: LED board displaying the default message

Then as in figure 9 when a message is sent in the specified format, then a series of commands are executed which can be seen in a HyperTerminal when the kit is connected to the COM PORT of PC as in figure 11.
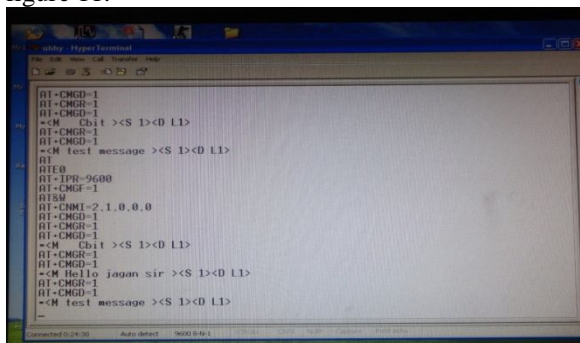

Figure 11: HyperTerminal window showing the sequence of commands executed

After these commands are executed the icrocontroller retrieves the message from GSM module and displays on the LED board as shown in figure 12.

Figure 12 LED board displaying the message sent

Thus from figure 12 we can see that the message sent is displayed on the LED board. Hence our papers aim is achieved successfully.

CONCLUSION

As the technology is advancing every day the display board systems are moving from Normal hand writing display to digital display. Further to Wireless display units. This paper develops a photo type laboratory model wireless notice board system with GSM modem connected to it, which displays the desired message of the user through an SMS in a most populated or crowded places. This proposed system has many upcoming applications in educational institutions and organizations, crime prevention, traffic management, railways, advertisements etc. Been user friendly, long range and faster means of conveying information are major bolsters for this application. By using this proposed methodology we can enhance the security system and also make awareness of the emergency situations and avoid many dangers.

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