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GSM Based Wireless Electronic Notice Board Display through ARM7 and LED

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Abstract: This paper is developed a GSM based notice board display using ARM7 controller along with LED array. The microcontrollers provide all the functionality of the display notices and wireless control. The Display is obtained on a 7X96 Light Emitting Diode (LED) dot matrix display. A desired text message from a mobile phone is sent via a Global System for Mobile Communication (GSM) to the GSM module located at the receiving end. The GSM modem is connected, through MAX 232 Integrated Circuit (MAX 32 IC), to the ARM7 microcontroller. The message that is stored in the Electrically Erasable Programmable Read Only Memory (EEPROM) is then displayed on the LED dot matrix display. This hardware uses regulated 5V, 500mA power supply. A three-terminal LM7805 is employed for regulation of the voltage. A bridge type full-wave rectifier is used to rectify the AC output of the secondary of 230/12V step down transformer. The system was tested to work according to specification.

Keywords: Electronic Notice Board Display, ARM7, GSM, LED, EEPROM, MAX232.

I. INTRODUCTION

Communication devices such as mobile handsets and similar wireless innovations have become ubiquitous. Multiple domains in the field of Communication and Embedded devices are being increasingly explored. The use of cell phones has witnessed a rapid increase. Developments in communication technologies have led to the growth of dense networks. As a means of communication, notice boards are widely popular, with its applications ranging from schools, colleges, hospitals to major organizations. Notice boards effectively tackle the global problem of deforestation by conveying messages at large without the use of paper. Such innovative measures will go a long way in regulating the damage to the environment. Prior to the invention of microcontrollers and GSM MODEMs, a scrolling message display will only display the message loaded into its memory compartment and cannot or may never be modified except by totally rebuilding the system. In more recent times (after microcontrollers and GSM MODEMs had imaged), an authentic wireless communication could easily be developed between a mobile phone and a microcontroller using a GSM MODEM. This can be utilized to change or modify the message that is being displayed at any time and from anywhere within the reach of the wireless network signal. The message display is made of an array of Light Emitting Diodes (LED) arranged in a matrix configuration with a specific number or rows and columns.

The configuration allows each LED to be independently referred to and manipulated as desired. The simple tasks involved in displaying a message on a digital notice board may beterribly cumbersome and typically needs technical skills. Vast public companies like banks, airports and cinemas use digital scrolling message board in multitude applications [1]. However, if the message that is presently being displayed has got to be modified or changed, a Personal Computer (PC) or laptop computer has to be directly connected to the display (usually Crystal Display) and then a new message could be installed to the display board. These cumbersome processes can be totally eliminated by devising an alternative means of updating the message that would be displayed. Hence the need for a GSM based notice board. With this design, the notice board is simply updated by an SMS at any time and from anywhere with the desired message.GSM technology aims to reduce the complexity in sending a message by incorporating SMS (Short Message Service) technology. This technology can be put to use in public areas such as hospitals, schools, multiplexes and buildings to enhance the security system and also to spread awareness in an emergency. Wireless notice board using Zigbee is designed for applications such as displaying information at public places. In the current scenario the notice boards in a variety of institutions are managed manually. There is a long process to put up notices on a notice board.

This wastes a lot of resources like paper, printer ink, man power and also brings about loss of time. The importance of notice board in every academic is well known to us, every time the notices changes iteratively which have to be done manually. Also the importance of room light control is increasing day by day for same academic works. In this project we are proposing the work using ARM-7 LPC 2148 interfaced with graphical display and GSM modem to overcome the above drawbacks. In this paper a new design framework for notice board display was proposed based on

the GSM technology to overcome the problem of conventional approach. The proposed design displays the SMS send from a mobile to the GS model in the LED array. This reduces the manual effort and also the reduces the unnecessary expenditure as with conventional approach. The rest of paper is organized as follows: section II gives the details about the related work. Section III illustrates the complete details about the proposed system. section IV illustrates the details about the testing results and finally the conclusions are made in section V.

II. RELATED WORK

Several works have used GSM to monitor several application such as cell phone operated robot[2], SMS based voting system [3], SMS based security system [4], GSM based automatic meter reading system using ARM controller [5], SMS based teaching and learning system [6] and so on. Also, several researches have been done on GSM based e-notice board, where SMS sent from authorized mobile phones, via a GSM network, were displayed on a digital e-notice board. These several works have proven to be efficient and fast. With greater efficiency, messages were displayed with less error and less maintenance, though there is need for few modifications for better performance [7], [8], [9], [10], [11], [12], [13]. Nivetha, Puritha, Preethi and Yashvanthini (2013) designed an SMS driven automatic display using ARM-LPC2148 to interface multiple graphical display. With this technology, a single notice could be sent to several e-notice boards via ARM-LPC2148 [14]. Rahul Kamboj and Preeti Abrol (2013) designed and developed a GSM based multiple LED display boards using AT89S52 microcontroller, GSM module, LCD and several moving LED displays. Multiple moving LED displays were connected via different GSM modules at different geographical locations such that the same SMS sent was displayed on all the moving LED displays. Though with few limitations, this work proved to be cost-effective, secured and efficient as compared to previous works [15].Gowrishankar Kasilingam, Mritha Ramalingam and Chandra Sekar (2014) proposed development of GSM based digital notice board.

The complete system would have a dual system in terms of changing message display, dual power supply switchable between solar power system and alternating current (AC) from the utility supply, and inbuilt motion detector that could automatically switch OFF the whole system after working hours and would automatically switch ON if any motion is sensed by the motion detector after the programmed working hours. This work would probably prove highly efficient in terms of ensuring better communication and continuous power supply [16].Raj Hakani (2014) worked on GSM based alphanumeric scrolling display system using PIC16F877A microcontroller interface with GSM modem via MAX232 level convertor. Hardware also include DS1307 real time clock, alphanumerical panel and multiple 16×2 character LCD displays and microcontroller coding was done using Embedded C and MpLab. In this research, multiple users were authorized to update notices on the digital notice board. This design can only maximum of 60 characters on the board [17]. Mayur Bhoyar, Suraj Chavhan and Vaidehi Jaiswal(2014) also worked on the same research with little modification. Here, instead of coding the microcontroller with Embedded C and MpLab, microcontroller was coded with Embedded C and Kiel and the PC was coded with Visual Basic [18].

III. PROPOSED SYSTEM

In this project we have proposed a system which will enable people to wirelessly transmit notices on a notice board using GSM. The project mainly focuses on transmission of textual data through air interface by the use of GSM through asynchronous serial communication .The data will be processed by the microcontroller on both ends. The data will be displayed on LED only after entering unique pass key. In addition to that address matching is done and data can be received only by the dedicated receiver. Actually what happens is, sending SMS through phone has become very popular and if we can use this SMS to control devices and in displaying data. It is possible to receive or decode the SMS globally by using GSM, by the any part of world we can control and display data on LED board. In this project we not only send the data but send the data with pass code also. Which enables us to prevent the unauthorized use of LED display board and only the person who have pass code can have access to LED board . Important feature of thesis is we are using GSM network by which we can control LED display board by the any part of globe. If we must have the respected pass code. And the pass code is ok then the correct data is to be displayed on LED as shown in Fig.1.

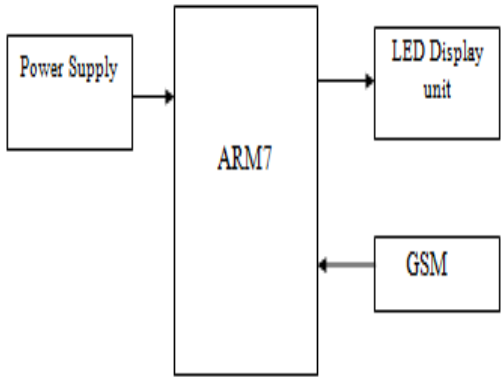

Fig.1. Block diagram.

In the block diagram the ARM7LPC2148 micro controller is interfaced with LED display unit and GSM. The LED display is interface on UART1 of ARM7LPC2148 micro controller. Similarly the GSM is interface on UART0.The message for this unit comes from an authorized mobile user will send the message containing information. Once the message is received by GSM it is processed by the ARM processor and display it on LED display through UART1. The data collected by the GSM MODEM is stored in the external memory which is fetch bit by bit by the control unit

and fed serially to the display driver (shift registers) and then finally displayed on the array of LEDs. For the purpose of this research, ARM7 processor was interconnected to increase the speed of processing and displaying a newly received message, i.e. to reduce the time lag between receiving a new message and displaying the message on the LED array as shown in Fig.2. The processor at the left is connected to a memory bank where the data to be displayed is stored. Also, ATMEL 24C01 EEPROM is connected to the ARM processor in order that, when data is received from the GSM modem to the microcontroller, it keeps it the EEPROM(electrically erasable programmable read only memory) until when it is needed. A colorless LED that emits red color type was chosen for this research because it is more obvious and captivating even in the day. An array of LEDs is arranged on a Vero board to form the display board of 7 X 96 array i.e. 7 rows and 96 columns of LEDs. MAX 232 serves to convert the signals from a DB9 serial port from a GSM MODEM to the signal suitable for an ATMEL AT89C52 microcontroller.

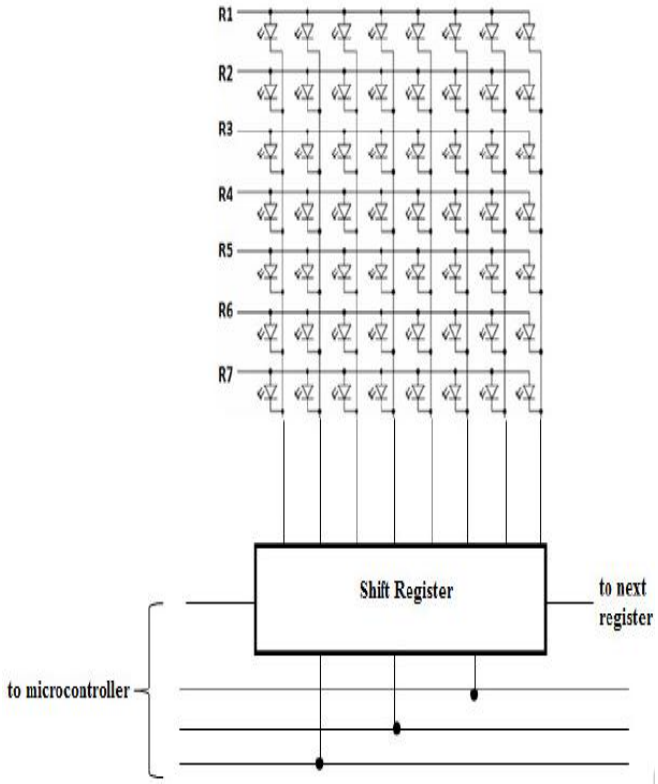

Fig. 2. Shift register interface with LED array.

The alarm is used in this work such that when a message has been successfully sent to the system, which is decoded by the GSM modem, the alarm sounds audibly to indicate the reception of anew message. The message is then updated on the notice board. Also, an 11.0592 crystaloscillator is used for this project to generate the required frequency. In this research work, twelve MM74HC595 shift registers are used to scroll the message across the display board. The display board sequentially displays 5×7 characters that move from left to right. Each shift register displays this character on 7 rows and 8 columns (7×8) and then shifts it to the next shift register making it a total of 7 rows and 96 columns. The shift register and the LED array display board are interfaced such that when data is received from the microcontroller, it is passed to the shift register through the shift register's data input(pin 14) and then passed to the internal register of the shift register by the shift register's serial clock (pin 11). The data are then output in a parallel format through pins 1, 2, 3, 4, 5, 6, 7 and 15(1 byte) by activating the latch clock (pin 12) of the shift register. This is demonstrated by the image shown in Fig2. AT (Attention) commands used in this research as stated in Table 1:

TABLE I: AT Commands and Respective Functions

AT COMMAND	FUNCTION
AT	Attention
ATEO	Echo off
AT+CMGS	Message format
AT+CMGS	Send message
AT+CMGR	Read message
AT+CMGD	Delete message

The entire system is powered by a DC supply, which it sources from an AC power adapter which serves to convert the AC supply to a suitable 12V DC that the system requires. The major components in the power supply unit are transformer, regulator (LM7805 IC), filter capacitor, rectifier and load.

IV. TESTING RESULTS

The design of the GSM-based scrolling message system was followed by construction of LED array display, control unit and shift register. After all the modules of the project (which includes the power system, the control unit, the GSM modem and the 7×96 matrix LED arrangement) has been constructed and tested independently, each module is connected appropriately to form the complete GSM based display board system as shown in Fig.3.

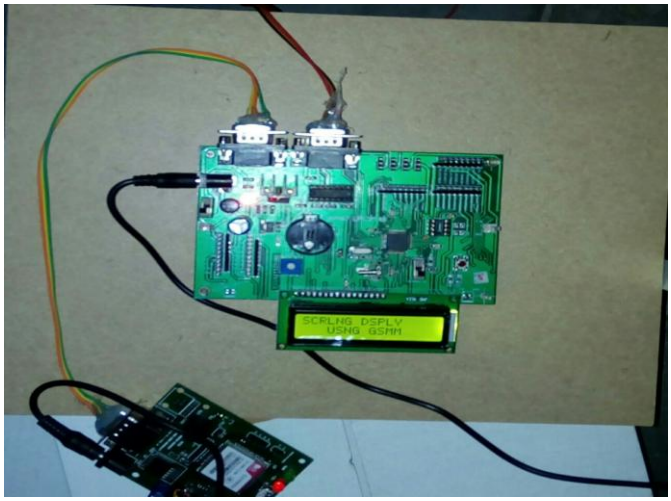

Fig.3. Implementation of a notice board display using GSM and LED.

The following steps were taken in connecting the GSM MODEM to the display board:

- A functional SIM card was installed into the GSM modem through the GSM modem SIM space.
- The female data bus 9 (DB9) of the GSM MODEM was connected to the male DB9 cable outlet from the display board
- The GSM MODEM was then plugged to the power supply, and a green light came up toindicate that the GSM MODEM is powered ON.
- The GSM MODEM automatically searched for the network of the inserted SIM via its antenna. This was observed from the change in the pattern of the blinking of the light on the GSM MODEM.
- The powered GSM MODEM was connected to the display board and the display board does not yet scroll any message because it was off.
- The 12V AC power adapter was plugged to an AC power source. This passed current to the AC power adapter, but not directly to the display board.

The display board was then switched ON and default message immediately begins to scroll from left to right on the board.

Fig.4. display on LED.

It should be noted that by default, when the display board is switched on for the very first time, a default message scroll across the board as shown in Fig.4. This message continues to scroll except it is changed by sending a text message to the SIM card in the GSM MODEM which has already been connected to the display board. In order for the message to be appropriately updated on the display board, the message was started with a 'hash' ('#') character in order to distinguish it from unwanted messages and consequently, prevented unwanted messages to be displayed on the board. The message was also in capital letters for the purpose of compatibility with the program burnt in the microcontroller IC. The display board was only able to display a maximum of 48 characters due to the size of the EEPROM which was only 1024 bits or 1 Kbyte. The following procedures were followed when updating a message on the display board:

- A 48 or less characters long text message was composed, starting with ('#') and capitalized letters. For example "#FOUR THINGS".
- The message was confirmed before being sent into the SIM card in the GSM MODEM
- The message was then sent to the SIM card in the GSM MODEM
- As the message got to the GSM MODEM, audible loud buzz from the alarm system sounds and the new message is immediately updated on the screen of the display board which contains exactly the message sent to the SIM card in the GSM MODEM. This message keeps scrolling on the display board until a new message is received by the MODEM.

V. CONCLUSION AND FUTURE SCOPE

The prototype of the GSM based display toolkit was efficiently designed. This prototype has facilities to be integrated with a display board thus making it truly mobile. The toolkit accepts the SMS, stores it, validates it and then displays it in the LCD module. The SMS is deleted from the SIM each time it is read, thus making room for the next SMS. The major constraints incorporated are the use of „*" as the termination character of the SMS and the display of one SMS as a time. These limitations can be removed by the use of higher end microcontrollers and extended RAM. The prototype can be implemented using commercial display boards. In this case, it can solve the problem of instant information transfer in the campus. Temperature and time (RTC)display during periods when no messages are to be displayed. Multilingual display in different areas as per the local language. This feature can be added by programming the microcontroller to use different encoding decoding schemes. The large LED scrolling display can replace small LCD panel in which multiple messages can be displayed. Graphical display**,** MMS technology with relatively high end microcontrollers to carry on the tasks of graphics encoding and decoding execute it. Use of multiple modems with displays with duplicate SIMs to increase degree of broadcasting.GSM based home security system, GSM based robot control, GSM based DC motor controller, GSM based stepper motor controller, GSM based voting machine control etc.

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