Microcontroller Based Remote Bill Board Control with SMS Access

Prof C.COkezie , Prof H.C Inyama, Engr. LotannaOnuchukwu

[*] Dept. of Electronic and Computer, NnamdiAzikiwe University, Awka, Nigeria

Abstract- Many state of the art and cutting edge universities in the world rely on wooden notice board hanging on the wall to display announcements. The overreliance of this practice in a university is still not enough to pass relevant information around as many problems are encountered. We consider the case study of professional Colleges, where information is a vital key for knowing the updates of the campus. This work presents an innovative and interesting manner of intimating the message to the people using a wireless electronic display board which was achieved using technology of GSM SMS. Designing such a digital notice board system with remote access requires a high reliability measure, more so when that display systems is used for real time information broadcasts then the system has to be always available an accurate. The work proposed here is Microcontroller based remote bill board control with SMS access. first off, a Microcontroller and a GSM modem were used to implement a digital notice board which can be accessed remotely through SMS. A method to increase the reliability of the proposed system was later developed and achieved using the web technology. Data performance test was conducted on the system to determine the reliability of GSM services for implementing such systems. The result of the test based on over 757 data transmissions shows that GSM services which is ubiquitous can be used as communication channel for controlling the system with 97% accuracy and the internet is a good back up for such system with 100% accuracy.

Index Terms- Personal Computer (PC), GSM, Internet, Modem, MySQL, AT Command, Connector, C-Language, C# Language, PHP

I. INTRODUCTION

The notice board is an indispensable part of many communities, found in neighborhoods, workplaces and other forms of social network. Thousands of notice boards exist on many offices and institutions providing a valuable opportunity for low expense, high visibility communication. Many of these displays are spontaneous and self-organizing; any surface can become a noticeboard and any window, a display case [1]. Large digital displays are now commonly seen in our everyday, with increasing need for information in modern times, Notice boards provides an easy way to broadcast important information across a group of people and ensure that it's read [2]. This paper is about the implementation of a digital notice boardfor colleges, offices, etc. it acts as a support system and improvement to the method by which information are being posted on notice boards. It is a digital display device that displays information that is fed to it through SMS or HTML. Thus, the challenge which this paper seeks to address, is on designing a public display board that delivers information timely, visibly clear, relevant and clear on action, such system can be used to deliver real time notices, in office and institutionsby using two communication channels which are GSM and Internet. Remote control of electronic billboard has been a subject of growing interest. In recent years, apart from voice calls on a mobile phone, sending of text messages using GSM has become very popular among mobile phone users, it is possible that we can use this SMS to control devices and to display data.This paper proposes an industrial application that will utilize the distinct advantages of the GSM.SMS system in controlling a message display board.

Conversely, With the growing popularity of internet and development of embeddedtechnology, Web technology has been extended to the development and application ofembedded system. The Internet is a global network of computer networks. Although thisbasic definition may seem rather simple, its implications are enormous. One of the mainfeatures of the Internet is its ability to allow dissimilar computer systems, and evennetworks of dissimilar systems, to communicate with each other by means of the common Transmission Control Protocol/Internet Protocol (TCP/IP). This technology is used here to control a notice board remotely. This channel acts as a backup for the GSM channel in case of failure of the GSM network. As these new proposed display models becomes available, older models become virtually worthless, with this in mind; this thesis seeks to design the remote billboard display with SIM 900 GSM modem, LPC2148 microcontroller and PC Server. In this research, SIM 900 GSM modem serves as the main receiver of the messages for the notice board, and LED dot matrix is used to display the received messages.

II. RELATED WORKS

The idea of using SMS to establish routes in commination networks between transmitters and receivers for the purposes of safety and guaranty of services is not new, but design method, the application, and reliability of the system varies, F. H. Fahmy el talin [3] presented and designed a textual display system, based on a light emitting diode (LED) dot matrix array powered by solar energy, A web based technology is deployed in [4] for the control of notice board. The works in [5], [6], [7], and [8] were all based on use of wireless sensor networks to control a public display board. Wireless Sensor Networks (WSN) is formed by a large number of networked sensing nodes. The main goal of a WSN is to produce meaningful information from raw local data collected by individual sensors. A similar work of WSN is the work in [8] in which proposed model consists of two

modules; one or more Transmitter and one Receiver module. The transmitter module consists of interfacing computer through serial interface to the Zigbee module. The receiver module placed at the remote end consists of Zigbee module interfaced with a microcontroller for displaying messages on LCD. All the works so far has been mainly focused on proffering methods on the design of a real time display board with little consideration of the reliability study. This work proposes the design of a real time display system with a high degree of reliability,the proposed system uses the technology of GSM SMS which is ubiquitous and easy to use. Thus, GSM is the defaultchannel for the proposed system and finally to increase the channel availability, the workdeveloped a backup channel for message update which is based on internet technology.

III.   DESIGN APPROACH

A good design methodology can help to verify the system for functionality thus, anaccurate design method must be chosen for the system. The block diagram of the systemis given in figure 3.1From the diagram a user types in a message using a mobile phone from any remotelocation in the world and the message is transmitted to the system through GSM network,the SIM 900 GSM Module in the system receives the message and the microcontrollerinterfaced to the SIM 900 module reads the message and writes it to the Dot Matrix which is the display board. A buzzer connected to the Microcontroller produces anaudible alarm whenever the message is to be displayed.The system sends an acknowledgement message which is an SMS to the user on successful display of the message. On failure to receive the acknowledgement message, the user resends the message using internet channel by login in to the web address of the web page and updating the same message, the PC server on the receiver side, monitors for the new message on the web and updates the board through the microcontroller interface. This redundant channel ensures that the system is always available. The diagram of the system is shown in fig 3.1
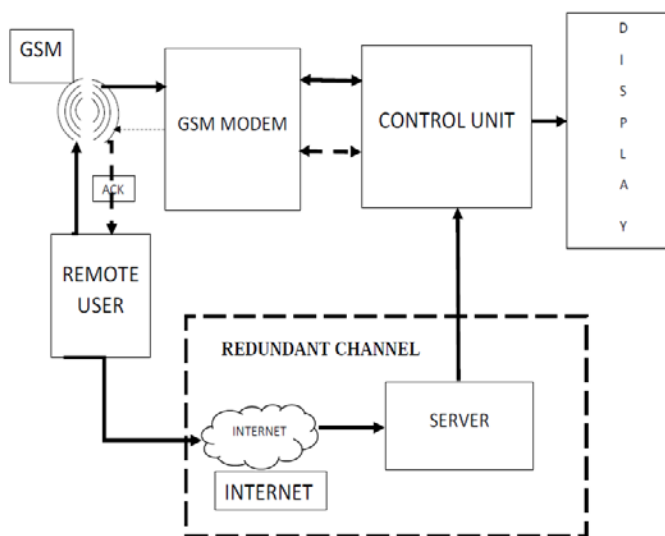
SIM 900 GSM Modem and LPC2148 Microcontroller is used to implement the system for the GSM channel while for the internet channel, a good windows PC can be used.

IV.   COMPONENT DESCRIPTION

A.   MICROCONTROLLER (LPC2148)

The LPC2148 microcontroller is based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine the microcontroller withembedded high-speed flash memory ranging from 32 kB to 512 kB. A 128-bit widememory interface and a unique accelerator architecture enable 32-bit code execution atthe maximum clock rate [9]. It has Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 Kbit/s), which is optimal for our work.

B   GSM MODULE (SIM 900)

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption [10]. SIM 900 has AT cellular command interface. Figure 4.1 shows the internal circuitry of SIM 900 GSM modem. Computers use AT commands to control modems. Both GSM modems and dial-up modems support a common set of standard AT commands. GSM modem can be used 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, various things can be done:

- 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.

Fig 4.1 SIM900 GSM Modem

C.   LED DISPLAY

Easy Matrix is used for the display. It is an easily cascadable 8×8 monochromatic LED dot matrix display module with onboard MAXIM's MAX7219 LED driver chip. The MAX7219 allows you to drive the LED matrix using only three I/O pins of any microcontroller. The LED matrix module used in Easy Matrix has a bigger dot size (5mm) and has the overall display dimensions of 60.2mm x 60.2mm (2.4″x2.4″). It is easily cascadable in series with the help of precisely aligned male and female header pairs located on the left and right sides of the display module. The Easy Matrix PCB dimensions are 60.5mm (2.4″) x 75.0mm (2.95″) and has 3.5mm mounting holes at its

four corners. It uses a male (J1) and female (J2) headers for cascading multiple modules in series.

V.   SOFTTWARES USED

A. KEIL μ vision 4 IDE

KeilμVision 4 IDE (integrated development environment) is the windows based front end for the C- Compiler and Assembler. KEIL μvision 4 is used for writing embedded C programs. The μVision IDE combines project management, run-time environment, build facilities, source code editing, and program debugging in a single powerful environment. μVision is easy-to-use and accelerates your embedded software development.

B.MySQL Connector

A Software is required to provide the API that the PHP application will use, and also handle the communication between the application and the database server, possibly using other intermediate libraries where necessary. This software is known generically as a Connector, as it allows your application to connect to a database server. MySQL provides standards based drivers for .Net enabling developers to build database applications in their language of choice. In addition, a native C library allows developers to embed MySQL directly into their applications.

VI.   IMPLEMENTATION

PROGRAM FLOW CHART

The system is based on two channels, the Internet and the GSM. When one channel goes down the traffic turn to the other channel. The basic communication media is the GSM the messages are transferred through GSM channel. When any failure is detected on the GSM communication media, the backup media will be activated to send the message through internet instead of GSM. The sender transmits the message and waits for the acknowledgement. After specified reasonable time, the transmitter creates a new connection if the acknowledgement not received. The transmitter repeats this loop until an acknowledgement is received by the receiver or until the user cancels the control message.

The first connection is initially the GSM by default, and the new connection will be the internet communication network. When a recognizable message received, the receiver will acknowledge the message and the message will be displayed. There are two Sections; The user side, and the controller side. Two flowcharts described the system operation; the sender flow chart and the receiver flowchart.
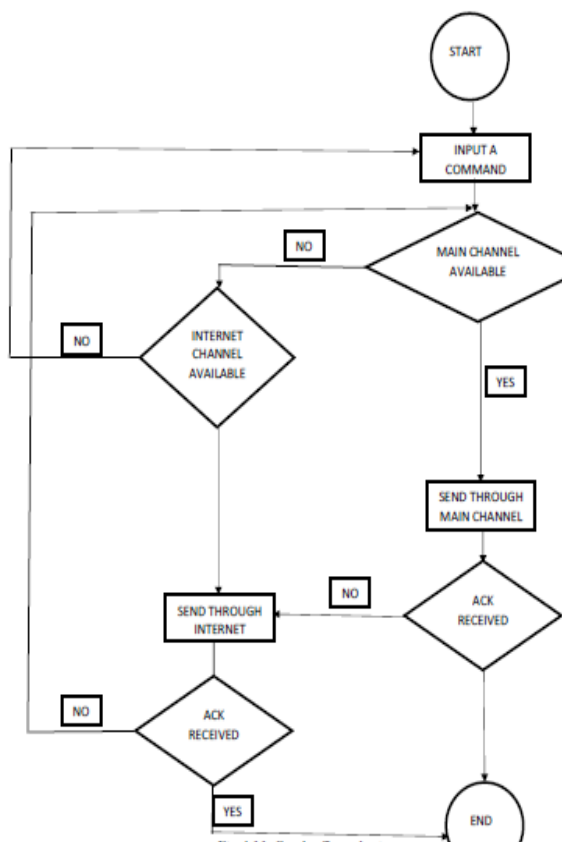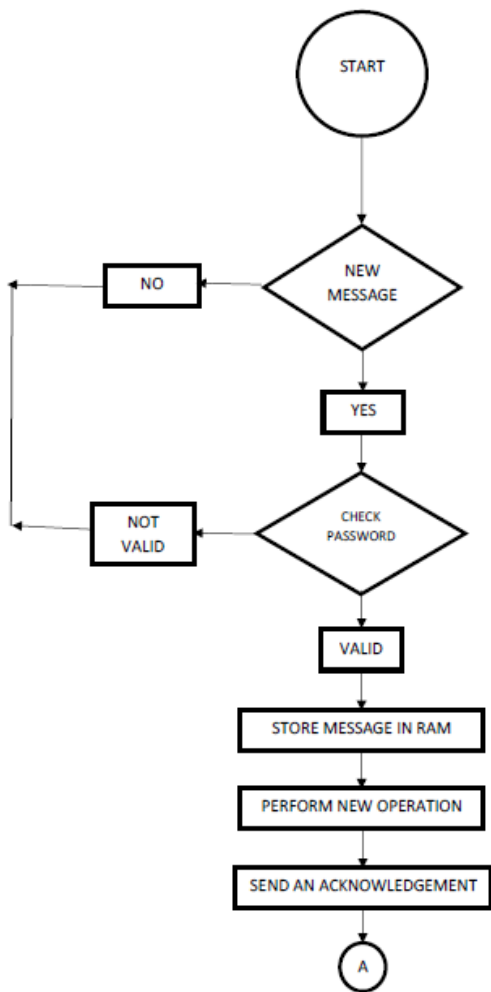

Fig 5.1   The Sender Flow Chart

Fig 5.2   The receiver flow chart

VII.   CONCLUSION

In summary, Microcontroller based remote billboard display with SMS access presents an improved method for using GSM mobile device to transmit SMS to public display board through a microcontroller and also implements a method to improve on the reliability of the system by introducing redundancy to the system. Based on the prototype system developed, it can be seen that GSM-SMS technology can be used to send data to the display system from any location and internet is a very good backup in case of GSM service down time with a very low latency as well, Since the transmission delays in these

channels are tolerable, we conclude that GSM–SMS and internet technology can be adopted as the backup communication channels to provide a flexible and remote means of updating the notice board system when integrated with the backend control systems for real time display of information.

REFERENCES

[1]   Nick Taylor, Keith Chervest and Jorg Muller, (2009). Affordances and Signifiers of Community, Computing Department, Lancaster University, LA1 4WA, UK and Institute for Geoinformatics, M¨unster University, Germany.

[2]   Miaosen Wang (2012) The Proxemics Peddler Framework: Designing a Public Display that Captures and Preserves the Attention of a Passerby, M.Sc thesis, April 2012.

[3]   F. H. Fahmy, S. M. Sadek, N. M. Ahamed, M. B. Zahran, and Abd El-Shafy A. Nafeh: "Microcontroller-based moving message display powered by photovoltaic Energy", International Conference on Renewable Energies and Power Quality (ICREPQ'10) Granada (Spain), 23rd to 25th March, 2010.

[4]   Wei C. and Bui. P. (2008) "Implementing a Web-Based Remote Control System for Led Dot Matrix Display". Department of Electrical Engineering Southern Taiwan University.

[5]   Hara. M. Williams, "Community Based Digital Bulletin Boards and Mobile Phone Interaction". Electrical Engineering and computer Science, Massachusetts Institute of technology (2009).

[6]   HuthaifaLuay M, "Design and implementation of wireless bulletin boards", Institute of graduate and research studies, department of Computer Engineering, July, 2012.

[7]   Hansal Shah, Zarna Parekh, AkshaySawant, ShivaniBhattacharjee" Wireless Display Using Zigbee" Electronics and Telecommunication Department, DJSCOE, Vile-Parle (W), Mumbai, Maharashtra, India International Journal of Electronics and Communication Engineering (IJECE) Vol. 2, Issue 4, Sep 2013, 49-58

[8]   Ajinkya Gaikwad, Tej Kapadia, Manan Lakhani & Deepak Karia "Wireless Electronics Notice Board", Department of Electronics and Telecommunication Sardar Patel Institute of Technology, Mumbai 400058, India, India International Journal of Electronics and Communication Engineering (IJECE), 2319 – 2526, Volume-2, Issue-3, 2013.

[9]   NXP B.V (August 12, 2011) LPC2141/42/44/46/48 product Data sheet

[10]   www.simcom.com/wm

AUTHORS

First Author – Prof C.COkezie, Dept. of Electronic and Computer, NnamdiAzikiwe University, Awka, Nigeria
Second Author – Prof H.C Inyama, Dept. of Electronic and Computer, NnamdiAzikiwe University, Awka, Nigeria
Third Author – Engr. LotannaOnuchukwu, Dept. of Electronic and Computer, NnamdiAzikiwe University, Awka, Nigeria