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A MOBILE SYSTEM FOR INFORMATION DISSEMINATION VIA GSM-MICROCONTROLLER TECHNOLOGIES

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ABSTRACT
Mobile and Wireless dissemination of information is becoming big business and also becoming critical in the public places because of the convenience the system affords. This technology is useful in advertisements, stock market information dissemination and so on. Information has lifespan; therefore opportunities are wasted daily as a result of lack of timely dissemination of information and the convectional system of disseminating notices, of advertising to the general public or changing and managing information from time-to-time is a difficult and cumbersome process. There is therefore a need to develop a system that can be used to disseminate information on time anywhere the user is. A prototype of the system has been developed in the computer science department, Federal University of Technology Akure. The prototype aims at using microcontroller and Smartphone to wirelessly send information to a digital display board using GSM Technology. The hardware board at the heart of the system contains ATMEGA 328P microcontroller. The microcontroller is interfaced with GSM Modem via MAX232 level converter which is used to convert RS232voltage levels to TTL voltage levels and vice versa. A 16x2 Character LCD display and alphanumeric panel is attached to microcontroller for display. Microcontroller coding is done using Embedded C and MicroC software package. A test case carried out on the prototype developed performs excellently.

INTRODUCTION

Wireless communication has become more popular in the digital world today. Man wants to make virtually everything automated. This remote control of appliances is possible through an Embedded Systems. An embedded system is a combination of hardware and software to perform a specific function. The value of timely information is quite enormous Notice Board is a primary device in any institution, organization or public utility places like bus stations, railway stations and parks to display any text information.

In this paper, the convectional system of disseminating notices, of advertising to the general public or changing and managing information from time-to-time is a difficult and cumbersome process. Hence, advance wireless digital notice board system is proposed to display SMS messages in LCD connected to microcontroller using GSM facilities. This paper majorly focuses on transmission of textual data wirelessly by the use of GSM via asynchronous serial communication to a notice board where everyone can read the message.

RELATED WORKS

Adedayo (2016) worked on a mobile application system for controlling home appliances remotely via microcontroller. This can be used as a replacement of the existing switches in home which produces sparks and also results in fire accidents in few situations. So by considering the advantages of Wi-Fi, a Wi-Fi based automation system is the best to control the appliances in the house. The objective of this system is to design a cost effective, reliable and usable mobile application system for controlling domestic appliances remotely via microcontroller. So after setting up the development environment, the result of the above is implemented by designing the interface, that is, a website through which access to the microcontroller via Wi-Fi technology is achieved. This system can only be used to control home appliances remotely.

Ogunruku (2009) developed a digital billboard for textual information written in the board memory. It is also observed that the convectional system of advertisement is seen to have some shortcomings and therefore motivated the design of the system. For instance a billboard once designed cannot be rewritten unless redesigned. Also it was observed that 94% of people passing digital billboards can recall them while only 43% recall static, non-dynamic, billboards. Digital billboard advertising is proven to be six times more effective over static billboard advertising. It is also observed that, there is no need to pay for expensive printing, painting, shipping or the general application costs associated with traditional billboard advertising. Digital displays can provide a seamless and costless transaction of your messages to the LED sign format; it can adapt any artwork or existing advertisement for digital exposure. The aim of the project is to develop a suitable digital billboard, which is interactive and eye catching to replace the existing convectional billboards. The requirements for this research are in two folds, the hardware assembling and the microcontroller programming. The hardware requirements specify the type of electronic devices to be used while programming the integrated circuit (IC) simply gives the suitable programming language. The limitation of this system is that it is hard to change the text to another text for display.

Adamu (2014) presented Design and Implementation of a GSM-Based Scrolling Message Display Board was presented. 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 emerged) an authentic wireless communication could easily be developed between a mobile phone and a microcontroller using a GSM MODEM. The first objective is to enhance easy and quick dissemination of information to the general public. The other objective is to avoid wastage of material resources like papers for posting message on a conventional notice board. The main aim of this research will be to design a Short Message Service (SMS) driven automatic display notice board which can serve as a substitute for currently used programmable display board. It is proposed to design a receiver (GSM MODEM) display board which can be programmed from a dedicated mobile phone. The message that is desired to be displayed is sent through an SMS from a dedicated transmitter (mobile phone). The microcontroller receives the SMS from the authorized transmitter, validates the sending Mobile Identification Number (MIN) and displays the desired information on an LED array which serves as the display board started off as an instantaneous news display unit.

Sampath Kumar (2016) presented GSM Based Wireless Electronic Notice Board Display using ARM7 and LED. In a normal digital display board, 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.GSM technology aims to reduce the cumbersomeness in sending a message by using SMS (Short Message Service) technology. This technology can be put to use in public areas such as supermarkets hospitals, schools, multiplexes and buildings to enhance the security system and to spread awareness in an emergency. The project mainly focuses on transmission of textual data wirelessly 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 a

password. In addition to that address matching is done and data can be received only by the dedicated receiver. In this project it not only sends the data but send the data with password also, which enables us to prevent the unauthorized use of LED display board and only the person who has a password can have access to LED board.

Edget (2012) presented a Personal Computer controlled scrolling message display for college notice board. The research is motivated by the need to change a conventional notice board in colleges to a PC based scrolling message display board using parallel communication. One of the objectives is to enhance easy and quick dissemination of information to the general public. The other is to avoid wastage of material resources like papers for posting message on a conventional notice board. The PC is interfaced to microcontroller through MAX232 IC. An external memory is used to store the information. The information sent through the PC is displayed on an LCD (Liquid Crystal Display) interfaced with the microcontroller. This project is based on microcontroller from 8051 family. Embedded C language is used to program this microcontroller. The power supply consists of a step down transformer 220/12V, which steps down the voltage to 12V AC. This is converted to DC using a full-wave Bridge rectifier. The ripples are removed using a capacitive filter and it is then regulated to +5V using a voltage regulator 7805 which is required for the operation of the microcontroller and other components.

THE PROPOSED WIRELESS DIGITAL NOTICE BOARD

The control system consists of a hardware module and an application program for microcontroller unit developed in mikroC software package. The hardware module comprises of input stage, the display and the power supply unit. This discusses the stages involved in the design and construction of the hardware, the writing of the program and the *'burning'* process.

This system is basically divided into two part (i) Transmitter (ii) Receiver. Mobile phone acts as transmitter which is used to send SMS to the receiver part. Receiver part consists of GSM Modem, Microcontroller, MAX232, Buzzer, 16x2 LCD and Alphanumeric Display. In this paper LCD is interface with port A of controller, Alphanumeric Panel is interface with port C of the controller while buzzer, MAX232 and GSM modem are interfaced with port C of the controller. GSM modem operates on 12V power supply. The core part of receiver is Atmel microcontroller which is energized by 5V power supply. The SMS is received by microcontroller which is in the form of ASCII characters. The MAX232 circuit is used to level the voltage difference between GSM module and microcontroller. Arrived SMS is stored in EEPROM, after the authentication of the code by the microcontroller, SMS is finally displayed on Moving Display Board. The buzzer is connected to the microcontroller for indication of new message arrived for display. A 16x2 Character LCD display is attached in four bit mode to port C of microcontroller.

SYSTEM ARCHITECTURE

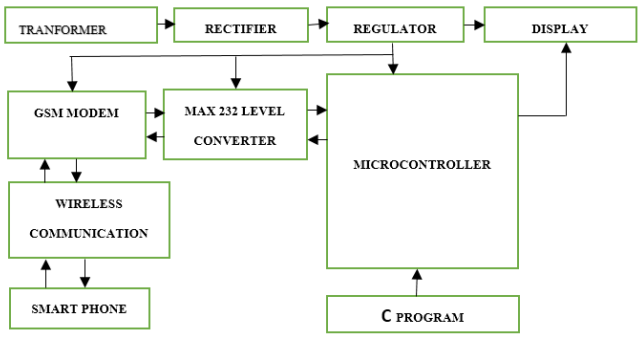

Fig. 1: The System Architectural Diagram

HARDWARE COMPONENTS

a) **Atmel AVR Microcontroller Development Board**

This is a development board manufactured by Atmel Company for programming various AVR microcontrollers and also used for testing and simulation of various microcontroller projects .

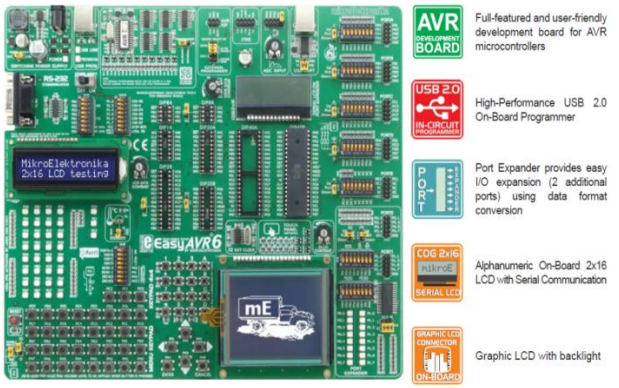

Fig. 2 AVR Microcontroller Development Board

b) **GSMMODEM**

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. The RS232 port of the modem can be used to communicate and develop embedded applications. Data transfer, remote control, SMS Control and logging are some of the applications that can be developed easily. The PC serial port or any microcontroller can be connected to the modem. The modem can be used to receive and send SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. This GSM modem is a highly flexible plug and play quad band GSM modem which can be connected directly and easily integrated to RS232 protocol.

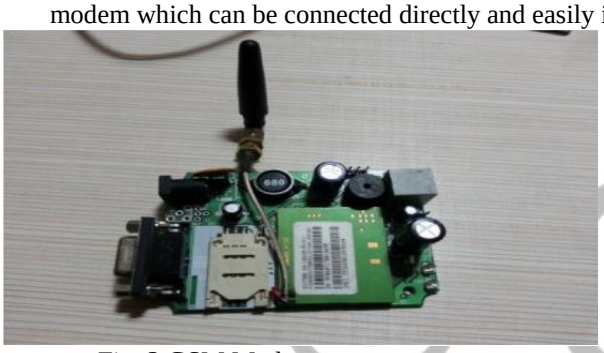
Fig. 3 GSM Modem

SIM 300 MODULE: SIM is an abbreviation for Subscriber Identity Module. It is a chip-on small card consisting of user's information as well as phone book. User can decide on which operator to use on the same handset as at when convenient. Dual SIM handsets are commonly available in the market today where we can use two operators on the same handset. The SIM cards are inserted into the slots available on the GSM Modem.

c) **LCD (Liquid Crystal Display)** is an electronic device for displaying alphanumeric texts. This project uses 14 pin LCD, 16*2 represents 16 characters and 2 line display. LCD's are easily programmable and economical and can easily display custom and special characters easily.

Fig. 4 LCD Module

d) **MICROCONTROLLER**

A microcontroller is a very small computer on a single integrated circuit containing a processor core, memory and programmable I/O peripherals. ATMEGA328P microcontroller is a high performance, low power, 8-bit AVR from Atmel Microcontroller Company. ATMEGA328P microcontroller is a RISC-based microcontroller (that is, Reduced Instructions Sets Computers) which combines 32KB ISP flash memory with read/write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface,

SPI serial port, a 6-channel 10-bit A/D converter (8-channels DIP packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8volts to 5.5volts.

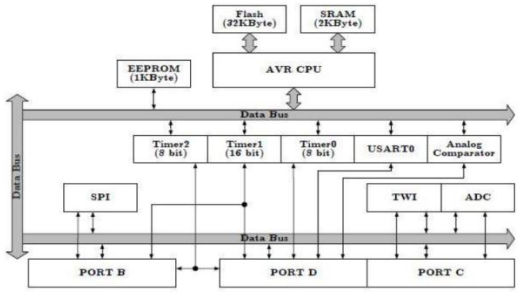

Fig. 5 Internal Architecture of ATMEGA 328P Microcontroller

e) **LEVEL SHIFTER OR SHIFT REGISTER:** The electronic MAX232 is an IC that converts signals from an RS-232 serial port to signals suitable for use in Transistor Transistor Logic (TTL) compatible digital logic circuits. The electronic MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The MAX232 drivers provide RS-232 voltage level outputs (which is approximation of: ± 7.5 V) from a single + 5 V supply through on-chip charge pumps. This makes it useful for implementing RS-232 protocol in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply designs do not need to be made more complex.

f) **VOLTAGE REGULATORS:** A Voltage regulator is a semiconductor device that maintains a constant voltage level automatically. A voltage regulator like 7805 produces a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. Electronic voltage regulators like 7805, 7808, 7809 etc are found in devices such as computer power supplies, microcontroller power supplies where they can stabilize the DC voltages used by the processor, microcontrollers and other elements. The LM7805 is a three terminal positive regulator available in theTO-220/D-PAK package. It employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible (Fairchild Semiconductor Corporation, 2001). If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulator, the device can be used with external components to obtain adjustable voltages and currents (Fairchild Semiconductor Corporation, 2001).

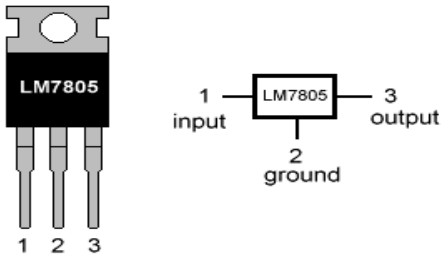

Fig. 6 LM7805 Voltage regulator pin configuration

SOFTWARE COMPONENTS

A software development process is a structure imposed on the development of a software product. Software consists of programs which enables a computer to perform specific tasks, as opposed to the physical components of the system (hardware). This includes all application software examples a word processor, which enables a user to perform a task and system software such as an operating system, which enables other software to run properly by interfacing with hardware and with other software or custom software made to user specifications. But for this project, much software have been used for programming and interfacing of the microcontroller to GSM modem SIM300 as well as LCD display. They are as follows: a) AT Commands b) HyperTerminal c) microC software package. For the embedded language, C was written and used to implement the program first then the language can be converted.

a) AT COMMANDS

AT abbreviates Attention, AT commands are instructions used to control a modem. Every command line starts with "AT" or "at". That is the reason modem commands are called AT commands. Commands that are used to control wired dial-up modems like ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), also support GSM/GPRS modems and mobile phones. Also, GSM/GPRS modems and mobile phones support an AT command set

that is unique to the GSM technology, like SMS-related commands such as AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

b) HYPERTERMINAL

HyperTerminal can be used to diagnose whether a connection problem is due to dial-up networking issue or modem/line issues. It is also capable of directing commands to the modem, thereby providing a means of collecting valuable information about the modem properties such as the chipset, BIOS and more. HyperTerminal can therefore be used instead of "More Info" or "Query Modem" on the Diagnostics table of the Modem Properties in Windows.

c) MICROC SOFTWARE PACKAGE

MikroC is a fully featured and Integrated Development Environment that provides smooth seamless access to all the tools in the professional developer's arsenal. From editing to debugging, MikroC can manage all aspects of product development for any member of Atmel microcontrollers.

SYSTEM FLOW CHART

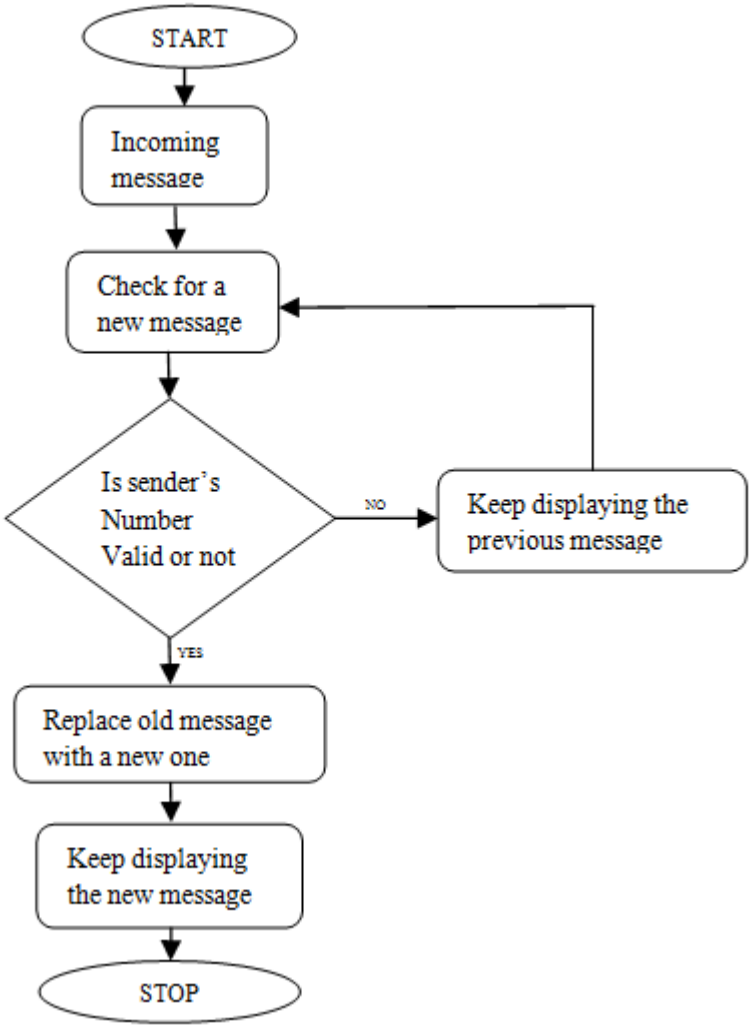

Fig. 7 Flow Chart of the System

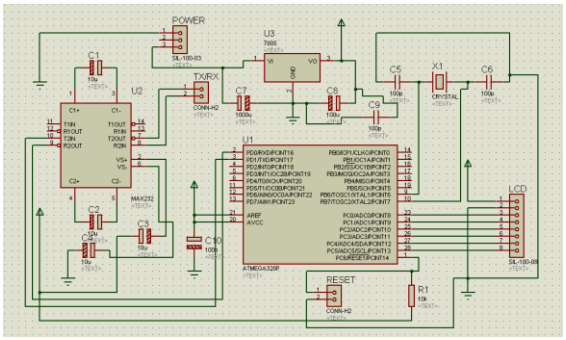

Fig. 8 Hardware Schematic Diagram

SYSTEM IMPLEMENTATION

A system is not useful unless implemented and tested to ensure that the system works fine and the functionalities are in place. The various requirements i.e the hardware and the software requirements are listed and the documentation spells out its usage. In this chapter, the full project is explained along with the experiments (Adebayo, 2016).

System Requirements

The following list gives an overview of the most important requirements of the proposed system:

i. **User friendly interface:** User can easily send information to the digital notice board wirelessly through a mobile phone.

ii. **Security and Authentication:** Only authorized user can have access to the digital notice board. If the system detects intruders it should deny access into the digital notice board.

iii. **Large area coverage:** GSM (Global System for Mobile Communication) is globally accessed by more than 212 countries and territories. It is one of the fastest growing telecommunication technologies of the world. Short Message Service is a most commonly used communication technique. Offers very much data security than any other wireless transmission.

iv. **System Usability:** Scalability is the ability of a system, network or process to handle growing amount of work in a capable manner or its ability to be enlarged to accommodate that growth. For example, system upgrade/downgrade by adding/removing hardware interface module should be easy and systematic task.

The implementation of this project went through the following stages.

- Printed Circuit Board (PCB) Design
- Components Soldering
- Assembly and Packaging
- Testing

PRINTED CIRCUIT BOARD DESIGN

Printed circuit board (PCB) was used to implement this project to reduce mistakes, damage to components and to ensure neat soldering. Tested circuit diagram of each stage was printed on a board as shown below. Components making up the circuit were then soldered on their respective positions.

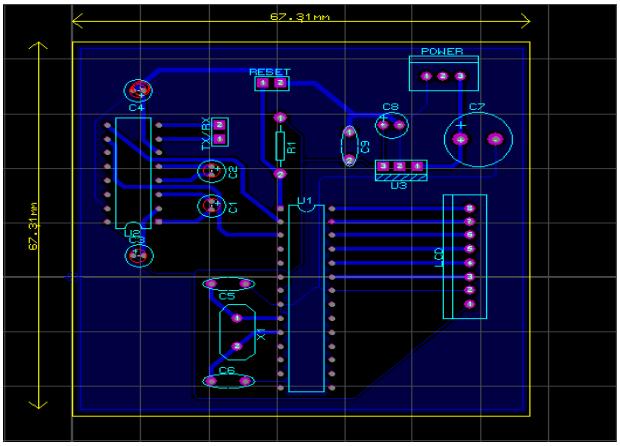

Fig.9 Printed Circuit Board from the System Schematic Diagram

COMPONENTS SOLDERING

The power supply stage was first soldered, and then all the other stages were soldered. Each stage was tested using the multi-meter to make sure it is working properly before the next stage is done. This helps to detect mistakes and faults easily. The soldering of the circuit was done on a Printed Circuit Board (PCB).

ASSEMBLY AND PACKAGING

The figure 12a shows how the system is connected internally. The microcontroller is connected to the GSM modem via the level converter i.e MAX232 using the RS232 protocol and figure 12b shows the final product or the system.

Fig. 10a: The system connectivity

Fig. 10b: The final product

CONCLUSION AND RECOMMENDATIONS

The display boards are one of the major communications medium for mass media. Local language can be added as a variation in this paper. This can be achieved by using graphics and other decoding techniques. Also, it is realized that this project saves time, energy and hence it is environmental friendly. Cost of printing and photocopying is also reduced as information can be given to a large number of people from our fingertips. Thus we can conclude that this project is an3 idea to make use of GSM in communications.

SMS controlled system has a better applications in security

SMS controlled system should be used to operate power plants which give electromagnetic radiations that is harmful to human body. Example: Switching on/off of a nuclear reactor

Reference

AdedayoI.O.(2016). The mobile application system for controlling home appliances remotely via microcontroller.B.Tech thesis, Department of Computer science, Federal university of Technology, Akure.

AdamuMurtalaZungeru, Gbenga Daniel Obikoya, Ochi FortunatusUche,Taidi Eli. THEDESIGN AND IMPLEMENTATION OF A GSM-BASED SCROLLING MESSAGE DISPLAY BOARD, International Journal of Computational Science, Information Technology and Control Engineering (IJCSITCE) Vol.1, No.3, October 2014

Bernard Sklar 2001. Digital Communications: Fundamentals and Application, Prentice Hall. ETS300 608, 1998. "Digital Cellular Telecommunication System (Phase 2); Specification of the Subscriber Identity Module- Mobile Equipment (SIM-ME) Interface", European Telecommunications Standards Institute, May 1998.

Bharat Kulkarni 2012. "GSM Based Automatic Meter Reading System Using ARM Controller", International Journal of Emerging Technology and Advanced Engineering, Website: www.ijetae.com(ISSN 2250-2459), Volume 2, Issue 5, pp 446-448.

D Dalwadi, N Trivedi and AKasundra 2011. Article in Nation conference on recent trends in engineering and technology, INDIAwww.atmel.com http://www.edgefxkits.in/wireless-electronic-notice-board-using-gsm

Edget 2012. The personal computer controlled scrolling message display for college notice board. M.Tech project. Available:https://www.mtechprojects.com/

OgunrukuA.(2009). The design and development of Digital Billboard.B.Tech thesis, Department of Computer science, Federal university of Technology, Akure.

Pawan Kumar, Vikas Bhardwaj, Narayan Sing Rathor, Amit Mishra, *GSM Based e-Notice Board:WirelessCommunication.* ISSN: 2231-2307, Volume-2, Issue-3, July 2012

Rahul Garg2013.SMS based voting machine.fromhttp://www.scribd.com/doc/136445446/SMSBASED-VOTING-MACHINE-Project Report UmeshKubde, Wardha& India, (2013), "SMS based security system", Available fromhttp://www.engineersgarage.com/ contribution/sms-based-security-system?

Simon 2009. "The development of an SMS-based teaching and learning system", Journal of Educational Technology Development and Exchange, 2(1), pp 113-124.