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DESIGN AND IMPLEMENTATION OF A MICROCONTROLLER BASED ELECTRONIC NOTICE BOARD WITH GSM CONTROL

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ABSTRACT
The primary aim of every notice board is to disseminate information to the appropriate persons. However, the methods used varies based on the type of information to be disseminated and the technology involved in the process of dissemination. This paper presents the design and implementation of a microcontroller based electronic

Introduction

Today, the world is becoming a global village day by day. This is due to the fact that people from different parts of the world are able to communicate with each other within fractions of seconds[1]. This is possible due to the advances in Electronic Engineering. With the increasing use of cellular technology, the use of mobile phones has increased drastically over the years. In today's world of technological advancements communications and control is necessary in any part of the world[2].

The primary aim of this paper is to design and implement a system capable of receiving message through mobile phones and sends it to Notice Board for display. This project is basically a microcontroller based design used to control remote notice board. PIC18F4520 is the heart of this project. Here, mobile phone is used as a message sender, sending messages to notice

notice board using PIC18F4520 Microcontroller with GSM Technology. Development of a standalone, electronic (matrix type Light Emitting Diode (LED)) notice board capable of controlling using GSM with short messaging service (SMS) is discussed in this paper. The size of the screen will permit the display of unlimited number of characters as a message due to the scrolling functionality. The message to be displayed is received as an SMS from an authorized transmitter (Mobile Phone). The GSM modem receives the SMS while the microcontroller (PIC18F4520) reads the SMS, validates the SMS and sends the SMS to the shift Register. The shift register stores the SMS which is then moved or shifted to the required position on each clock pulse to be displayed on the screen. The validation of the SMS is by the use of password which makes the Notice board to be controlled only by authorized personnel. When the GSM modem receives a predefined SMS (text message), the circuit automatically recognizes it as a command (Attention (AT) Command), and switches the output ports accordingly.

Keywords—Electronic Notice Board, GSM MODEM, Microcontroller, Wireless, LED.

board by sending appropriate SMS and receiving SMS whenever there is no network problem. The mobile used is GSM technology.

The primary benefits of GSM are seamless service, higher speech quality, widely available, reasonably priced mobile phones, digital convenience, and new services (Call waiting , Call forwarding, SMS). We can send and receive data to and from another GSM handset using the SMS GSM services. The message may be composed of letters, numbers, or a combination of both or even images. The fundamental benefit of SMS service is that people with speech or hearing impairments can use it as a communication tool. Additionally, if you get an SMS while outside the GSM coverage region, it will be kept and sent to you as soon as you

return to the network's coverage area. With this, you'll always be informed.

Because the electronic notice boards currently in use are programmable displays that need to be reprogrammed each time, it can be seen from the current trend of information dissemination in campuses, on major advertisement centers, commercial news displaying panel, and for security purposes that important notices take time to be displayed on the notice board. As a result, it is ineffective for frequent and immediate information flow, and the display becomes less significant[3].

Electronic message display has various applications; however, all are targeted to display different messages using GSM mobile phone as the input device. System using GSM includes only three applications. Notice Board is connected to the system just to show that, it is possible to control various notice boards using micro controller[4].

To send and receive messages, software was built for this project. An instruction is transmitted to the GSM modem whenever a message needs to be sent. The sending of the message to the intended recipient, however, is outside the purview of this project if there is no GSM service. The display unit in this case is designed to show up to eight alphabetic characters or 10 numerical characters at once and can also show 64 characters each cycle. The device may be used for advertising, as well as signs for hospitals, movie theaters, stores, notice boards in universities, and other commercial locations. However, the concept is limited to using a plastic assembly box that can be hung or placed in order to use the gadgets.

AIM

The primary goal of choosing this project is to gain experience and knowledge in creating real-time applications. Other goals include learning how to use a GSM modem and PIC18F4520 microcontroller to receive messages and display them on a notice board.

OBJECTIVES

• To investigate how GSM technology can be used to control Notice Board by wireless means.

• To write a fully functional machine level program that can control or coordinate the hardware;
• To establish a communication channel (Interface) between the PIC18F4520 Microcontroller, the GSM Modem, and the LED display Panel.

LITERATURE REVIEW

Wireless Electronic Display Board using GSM Technology was designed and implemented in [5]. The proposed system's main controller is the ARM-7, it is utilized to direct, monitor, and communicate with the networked sub-units. The GSM 900A serves as the ARM 7's trance-receiver component. It can be connected to the ARM-7 directly or via MAx232. The purpose of GSM is to receive messages from authorized individuals solely for notice-board display. Messages received using GSM technology were displayed on an LCD monitor. The ARM-7 can be connected to a temperature sensor. The temperature can be displayed on the notice board in the absence of any GSM technology messages. The proposed design is used by an authorized user to send messages to the noticeboard using any GSM smartphone, which is then displayed on the LCD screen.

The system was tested and was also functional according to specifications. However, the LCD used as a means of display gives the system lack of wider viewing angle, better contrast, and better colour accuracy.

The work in [6] discussed the design and construction of wireless digital notice board. The digital notice board designed enables the user to wirelessly display the notices. The system connects an Arduino board, a Wi-Fi module, and an LED screen display for communication purposes. The device comprises of a straightforward buzzer that may be used to receive alarm signals for fresh notices. The system uses webpage assigned with an IP address to remotely monitor the display. The IP address for the webpage that will display the notice was generated only when the network name and password were comparable and the user could access the webpage prior to delivering the notice. Embedded language had been used for all system-related programming. The wireless notice board was able to be monitored and or used through

internet web based resources. However, due to the limitation of 3G and 4G network in some places (mostly rural areas), the system may only be used in places with full 3G and 4G networks.

GSM base electronic notice board is implemented in [2]. The design used PIC18F2550 microcontroller as the central processing unit. The GSM MODEM SIM800L was interfaced with the microcontroller for proper reception, control and display of the message in the notice board. When message is sent to the system, the GSM MODEM receives the message, verify if the message is coming from an authorized user, and then sends it to the microcontroller. The PIC18F2550 microcontroller then sends the information to the LED for display. The display size used was 32cm x 16cm, 7 x 5 matrix (5 segment display). The system was implemented successfully and was able to display messages once sent to the notice board. When new message is sent, the old message will automatically be deleted.

The authors however, acknowledged that the implemented system has limitations of taking only 60 characters, while they equally suggested the use of high-end microcontrollers for the display of much longer characters. Also, the size of the screen (32cm x 16cm) is too small for proper viewing angle.

[7] Implement a wireless notice board based on a Wi-Fi transceiver which can connect mobile and embedded devices as well as a moving message display, which can serve as a digital notice board. The system operates similar to when a user wishes to update or display message on a notice board, but by electronic means. The system uses a Raspberry Pi chip which has been programmed in such a way that when the embedded system language coding receives any message, it will read the message from serial port. The WI-FI connected ARM cortex to the Display system and then receives the message and display on LCD in the notice board system. The input to the message is a PC. If a message is typed into any personal computer using a WI-FI transceiver, the display system will begin to show the information. This system uses personal computer (PC) to type in the message to be displayed, a Wi-Fi as a medium of communication between the PC and the notice board. This shows that the system can only be functional where there is Wi-Fi which has

limitation of range. Also, the use of PC to input the message means that one has to always be with a PC before he/she can send message.

[8] This article describes a project model for an electronic notice board that uses Bluetooth and GSM to show information on an LCD screen. The Microcontroller 8051 is the primary component here. GSM Modem and the microcontroller are connected via a MAX232 level convertor. It is employed to convert between RS232 voltage levels and TTL voltage levels. A 64K EEPROM is also part of the hardware. The timings and messages that will be displayed are stored in this EEPROM. The message is retrieved using Bluetooth technology, and the Bluetooth modem transfers it to the display board. GSM modules are employed when GSM technology is used. However, the use of Bluetooth technology as a channel of communication between the GSM MODEM and the LCD display limits the distance at which one can sends message to the display. This is because of the incapability of the Bluetooth technology to extend to a reasonable distance for proper communication.

IMPROVEMENT TO THE PREVIOUSLY DESIGNED SYSTEMS

The project employs GSM network, which makes it simple to communicate information from any area of the world as long as GSM network exists, as an enhancement over the reviewed projects and to overcome the complexities. The benefits of the chosen microcontroller, the PIC18F4520, over the prior scroll display are explained below;

1. Use of GSM mobile phone as input makes the system flexible; information wished to be displayed at any instance of time and from any network coverage area can be sent in with the mobile phone and it will display.
2. The display unit is constructed using LEDs; dot matrix technology is employed in its arrangement. LED display system is cast effective that is to say it is advantageous over LCD in terms of visibility especially in the night.
3. Use of 5x7 for a single character display; this arrangement allowed enough spacing between each letter allowing the user to easily read what is expected to be displayed.

4. The use of PIC18F4520 makes the whole system more efficient than using other microcontrollers or discrete components due to its response speed.

SYSTEM DESIGN REQUIREMENT AND METHODOLOGY

The requirements are splitted into hardware systems and software systems during the systems design phase. It establishes the general architecture of the system. Software design entails providing the functionality of the software system in a way that can be converted into one or more executable programs. The design include creating the necessary software and hardware for the project.

As shown in the block diagram and flow diagram in Figs. 1.1 and 1.2 below, the system is primarily composed of a mobile phone, a GSM (Global System for Mobile communication) modem, a PIC (Peripheral Interface Controller) microcontroller (PIC 18F4520), and an LED display panel, each of which has discrete functionalities to meet the system's major requirements;

The crucial requirements of the project are:

1. Power supply
2. Voltage regulators
3. Switch
4. Microcontroller
5. LED dot matrix display
6. Counters
7. Drivers

METHODOLOGY

Due to its compact size and tendency to take up less precious real space in a building or on a street, the streamlined scroll display type was selected for this design. Because of its distinctive form, it requires less power during installation, which results in significant energy savings. When power is provided by the ac mains, the microcontroller enters the active state. When this happens, the microcontroller uses the reset circuitry that is attached to it to clear the program counter. When a network signal is found, the GSM modem in the circuit first gets the message that the transmitter has broadcast (mobile phone). The GSM modem transforms the GSM voltage levels to the microcontroller voltage levels with the aid of the MAX-232 circuit, and then sends the

received message to the microcontroller. The received password for the message is first checked by the microcontroller, who then compares it to the source code-written password. The microcontroller transmits the message to the LED display board if this password matches the original password.

The warning will not be displayed but rather removed if this password does not match the original one entered in the software.

SYSTEM BLOCK DIAGRAM

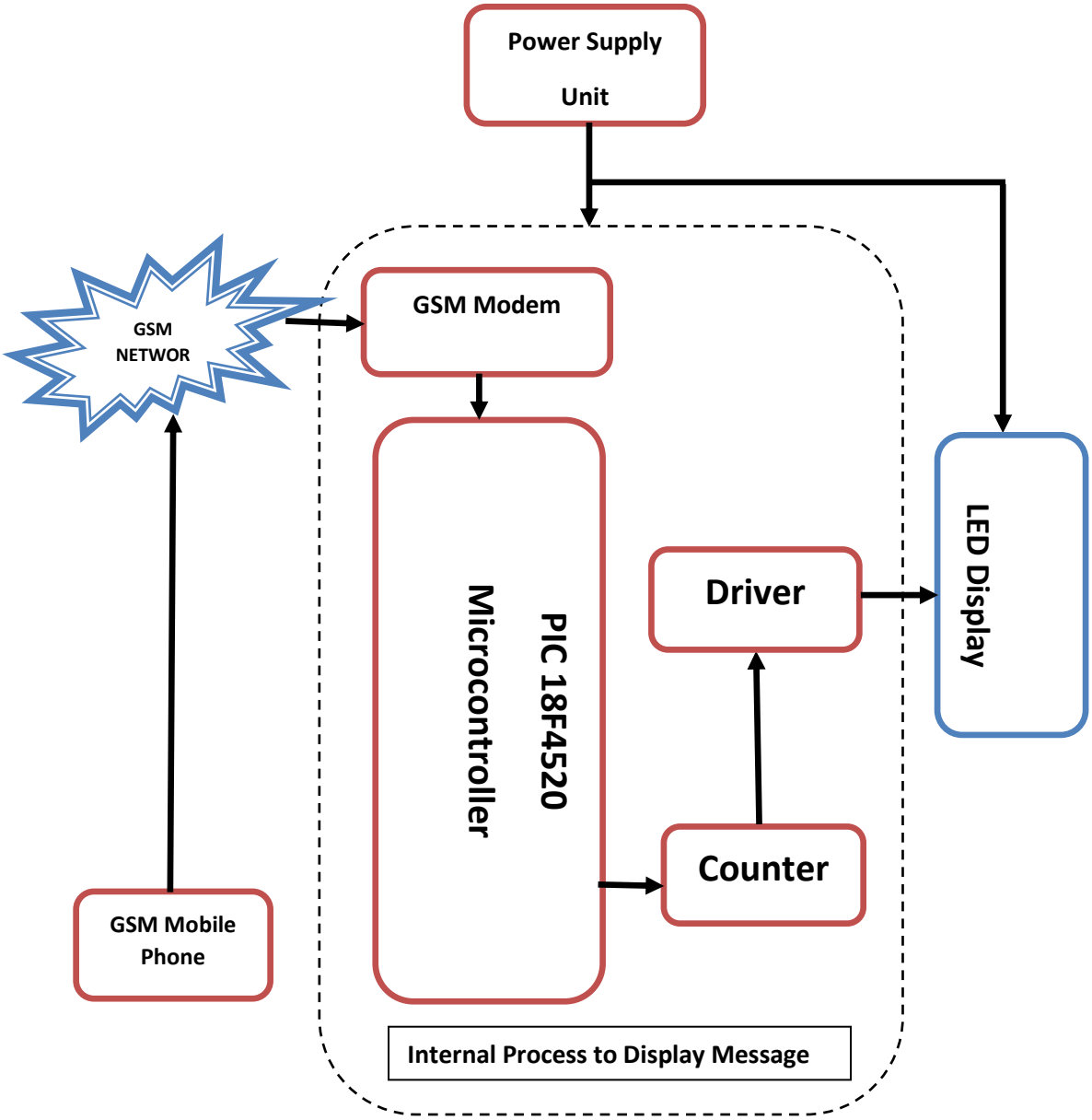


Fig. 1.1 Block Diagram of E-Notice Board

SYSTEM PROCESS FLOW DIAGRAM

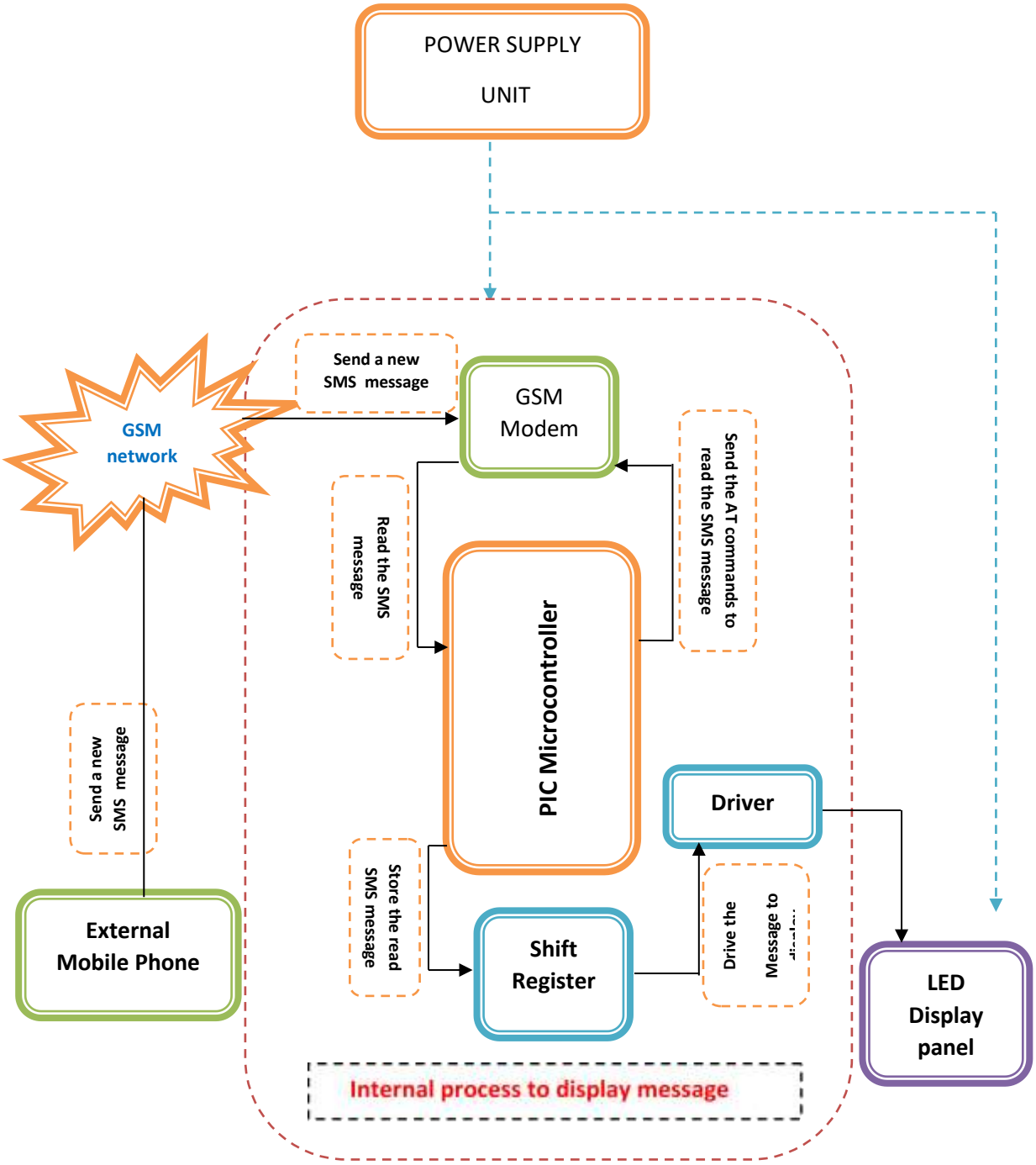


Fig. 1.2 Process Flow Diagram of E-Notice Board

Version 8.0 of the proteus professional program was used to create the simulation circuit. The parts were chosen from the library and properly attached. The simulation design is as shown in figure 2.1 and 2.2 below.

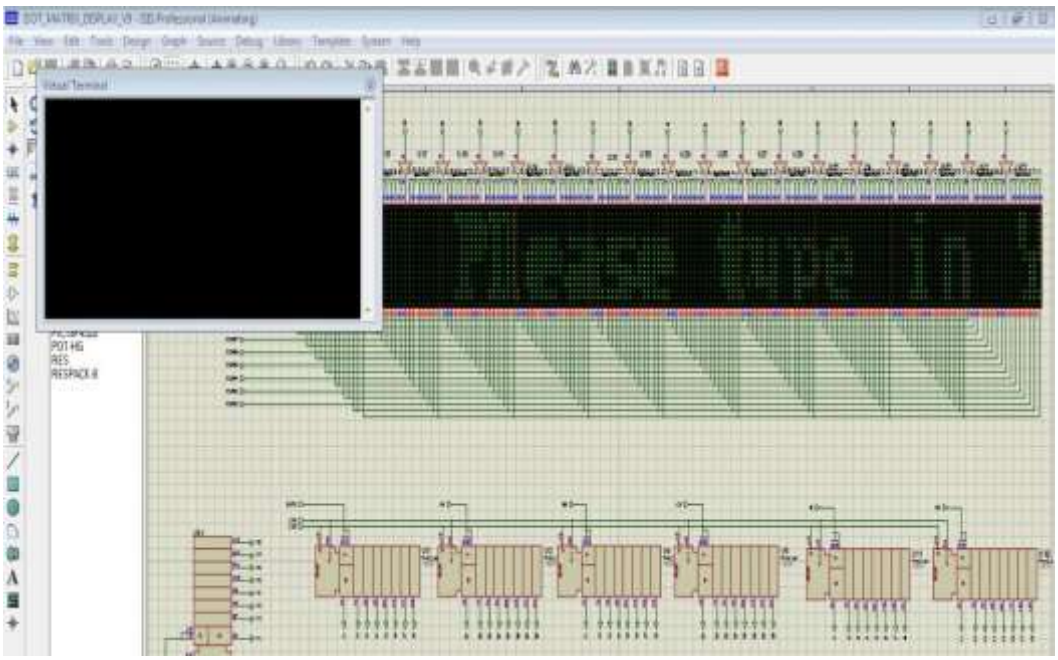


Fig. 2.1 Electronic Notice Board Simulation 1

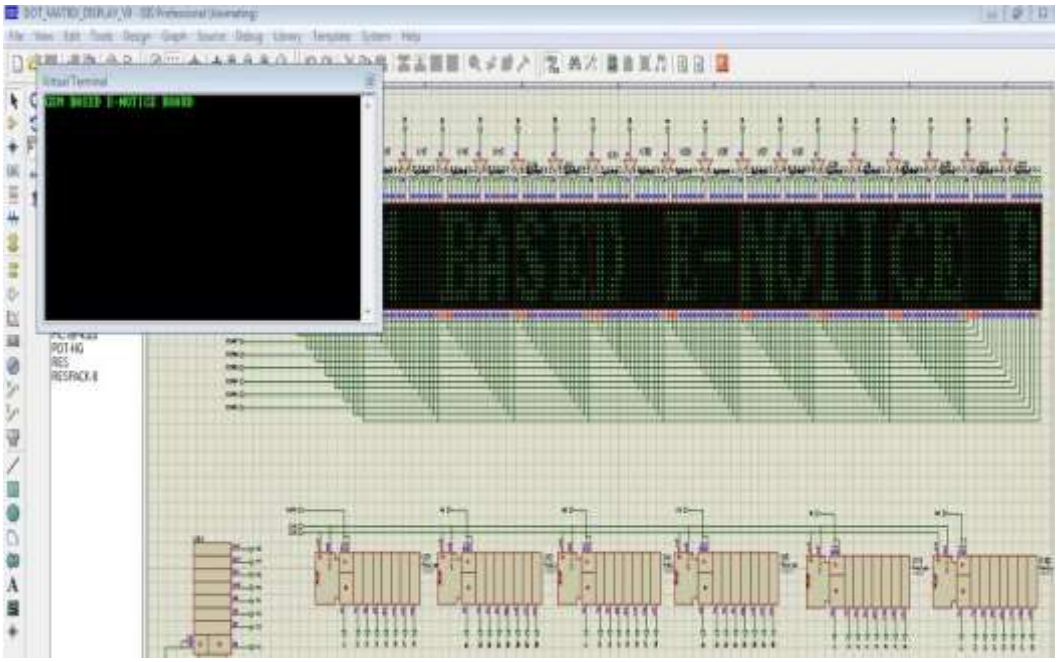
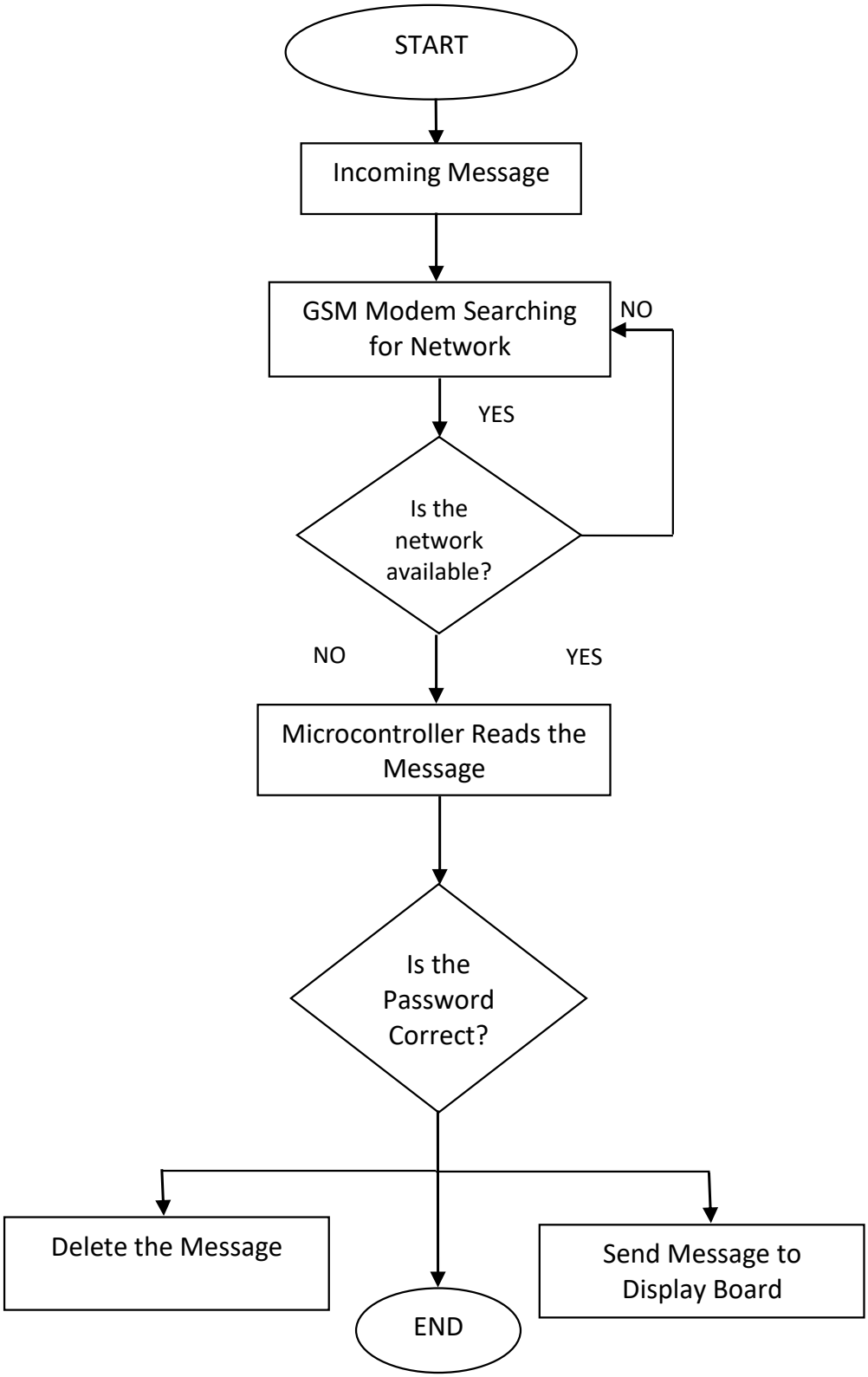


Fig. 2.2 Electronic Notice Board Simulation 2

SYSTEM DATA FLOW

The system's data flow and the process by which the output is created from the input through a series of functional transformations are both shown in the data flow diagram. Data flow diagrams display functional

transformations but do not offer implementation advice. The data flow



(Flow Chart) diagram is shown in Fig. 3.1.

Fig 3.1: Data Flow Diagram of Electronic Notice Board

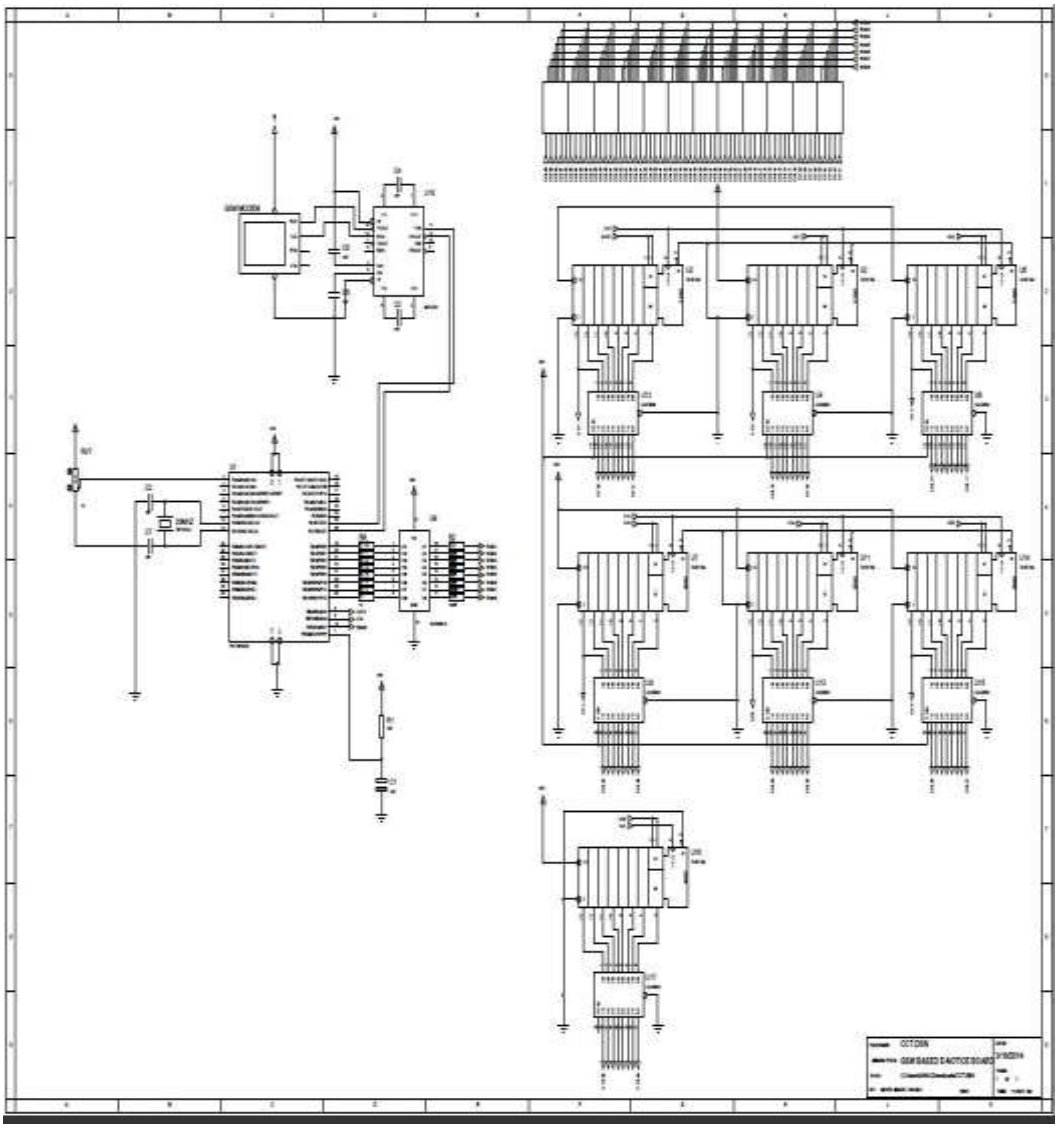


Fig 3.2: Complete Circuit Diagram of Electronic Notice Board

RESULTS AND DISCUSSION

The result obtained to determine the accuracy of the moving message is tabulated below: The timing for the message to respond and reappear in accordance with the program and the project is shown in the table below. Results of the delay time are shown in Table 1.1.

S/No.	DESIGNED TIME FOR MESSAGE TO RE-APPEAR AT DISPLAY (SECS)	TIME MESSAGE RE-APPEAR ON DISPLAY (SECS)	% Error
1	5	4.96	0.8
2	5	4.95	1.0

3	5	4.94	1.2
4	5	4.96	0.8
5	5	4.95	1.0

From the results above, the % Error is obtained as thus:

$$\%\ Error = \frac{5 - 4.96}{5} \times 100\%$$
$$= 0.8\%$$
$$\%Error = \frac{5 - 4.95}{5} \times 100\%$$
$$= 1.0\%$$
$$\%Error = \frac{5 - 4.94}{5} \times 100\%$$
$$= 1.2\%$$
$$\%Error = \frac{5 - 4.96}{5} \times 100\%$$
$$= 0.8\%$$
$$\%Error = \frac{5-4.95}{5} \times 100\% \quad = 1.0\%$$

$$Average\ \%Error = \frac{(0.8 + 1.0 + 1.2 + 0.8 + 1.0)\%}{5}$$
$$= 0.96\%$$
$$Accuracy = (100 - 0.96)\%$$
$$= 99\%.$$

According to the results found above, there was a small difference between the intended time for the moving message to resurface and the actual time the message reappeared in the created moving message. As a result, the project is roughly 99% accurate; the difference may be the result of data loss during the transfer from the main control to the display unit.

CONCLUSION

The client can control a notice board that may be remote or in a dangerous setting by using this application. The only prerequisite is that the system must be located within the service provider's network coverage region. Only when the client is operating within the service provider's network coverage area is it possible to control the linked

notice board. The user will still receive any messages from the system even if he is beyond the range of the network and unable to handle the notice board. The method is streamlined and time-saving because the user can send messages to be shown from a distance without being present where the display is located.

RECOMMENDATION

Satellite Communications has seen a significant advancement in wireless GSM communication. The GSM signals are detected and returned to the ground stations by reflection. These signals hold data on astronomical advances, geological surveys, and weather predictions. The design can be improved by incorporating GPS system to display time and temperature in real time. Along with secure appliance control, the current operating status of the appliances can be incorporated. We can also put in place message acknowledgment. A solar panel can also be incorporated to power the device for proper operations even in remote areas.

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345–347, 2015, doi: 10.17148/IJARCCE.2015.4974.

APPENDIX A: List of Components used:

	COMPONENT	QUANTITY
1.	PIC18F4520 Microcontroller	1
2.	SN74HC164 Shift Register	7
3.	ULN2803 Peripheral Driver Array	7
4.	UDN2981A Source Driver	1
5.	1uF Capacitor	3
6.	1nF Capacitor	4
7.	1K Ohm standard Resistor	8
8.	100 Ohm Standard Resistor	8
9.	20MHz Crystal Oscillator	1
10.	MAX232 Serial Interface IC	1
11.	Green LED's	392
12.	GSM Modem	1

APPENDIX B: Electronic Notice Board Models

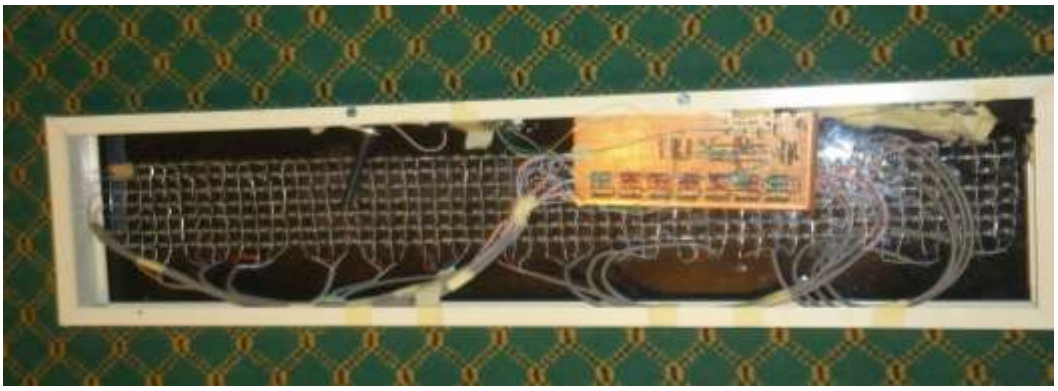

Plate 4.1: Electronic Notice Board Model 1

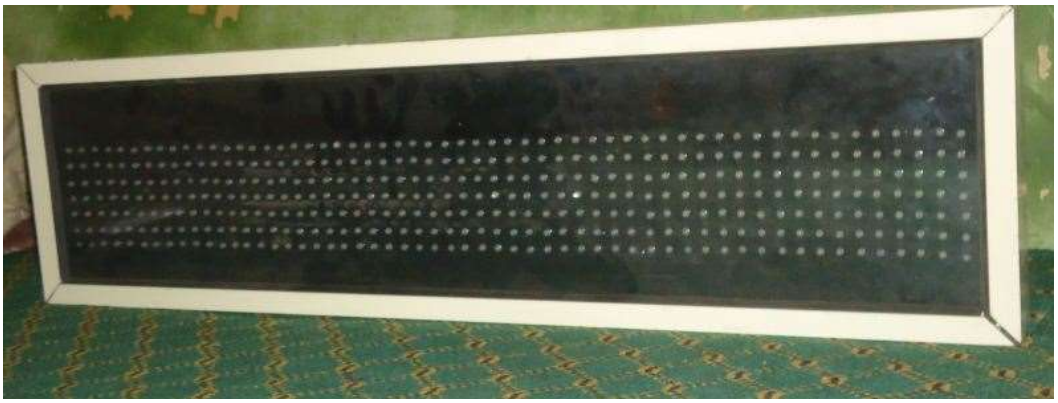

Plate 4.2: Electronic Notice Board Model 2

Plate 4.3: Electronic Notice Board Model 3

Platd 4.4: Electronic Notice Board Model 4

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