

# Advertising Display System using LED and Graphical LED

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*Abstract*—This paper explains the Use of “Embedded System in Communication” in very comfort way and how it makes easy human life and also how we can merge two different technologies like GSM (Global System for Mobile Communication) and LED (Light Emitting Diode) display by use of an Embedded System for different applications like advertising. This paper provides information about how a reliable and authentic wireless communication can be done between a mobile and microcontroller by using GSM MODEM. This paper gives you information about a SMS driven automatic Display which can replace currently used programmable electronic Display.

## I. INTRODUCTION

Now in Technology world, everything is going to be Digital. Advertisement is also one of the parts of that. In this competition days, Advertisement is also very important thing to attract the customers. Thus big shops and shopping malls use digital moving display for advertisement. Even on public places like railway stations, airport, bus stand are using digital moving display for everything like platform number, ticket information etc. but in those applications we want to change so have to go there and connect the display to PC or laptop. Suppose same message if the person wants to display in main centers of city so the person has to go there and it is also time consuming. I.e. Police wants to display about some crucial information within 5 minutes so it will not be possible so keeping this in mind we can design a display which can access remotely. Using of GSM technology to access the display is new technology to make communication between mobile and microcontroller.

Now a day's GSM (Global System for Mobile Communications) is the most famous mobile platform. It has lots of salient features. With use of microcontroller, GSM Modem is very useful to make many innovative applications like GSM Based Home Security System, GSM Based DC Motor Control, GSM Based Robot Control etc. It has many advantages like very high uptime with compared to Landline, multiple data collection points, large transaction in short period. Use of GSM technology makes the application wireless and so it saves a huge amount of cost of cabling.

LED (Light Emitting Diode) Dot - Matrix Display is widely used in advertising, traffic light and in many more display applications. It has more brightness than LCD and it is has very low cost. It is also easily available and low power consuming. The different patterns like scrolling the message etc. generated in LED Dot - Matrix attracts the customers. Its one advantage is that by making

different patterns we can display the message in many languages like English, Spanish, French, Hindi, Gujarati etc. It comes in different sizes like 128\*16 (Two Lined), 128\*32 (Four Lined), 128\*64 (Eight Lined) but most common size of Dot Matrix Display is 5\*7. If we want to display graphical image or any graphical data so we can use 128\*16 graphical LCD. A 5\*7 LED electronic display is shown in Figure 1.



Figure.1: A 5\*7 LED electronic Display

## II. BASIC CONCEPTS AND WORKING

The main aim to design SMS driven automatic electronic display is to replace the programmable electronic display and to save time. It is proposed to design receiver cum display board which can be programmed from an authorized mobile phone. The message to be displayed is sent through a SMS from an authorized transmitter. The microcontroller receives the SMS, validates the sending Mobile Identification Number (MIN) and displays the desired information. The electronics displays which are currently used are programmable displays which need to be reprogrammed each time. This makes it inefficient for immediate information transfer, and thus the display board loses its importance. The GSM based display board can be used as an add-on to these display boards and make it truly wireless. The display board programs itself with the help of the incoming SMS with proper validation. Such a system proves to be helpful for immediate information transfer.

Here in Advertising Display system Mobile is used as Transmitter which transmits SMS and from GSM Modem to LED Display Panel is used as Receiver. There are different components like GSM Modem, RS232, External Memory, Buzzer, Power Supply, LED Driver Circuits, LED Dot Matrix Display are being used. The Block Diagram of GSM Based Advertising display system is shown in Figure 2. System will work like when the user wants to display or update the notice board, the user has to send the message in his mobile defining the messages and then the password of the system to the number of the SIM which is inserted in the display system MODEM. Then the MODEM connected to the display system will receive the SMS, the microcontroller inside the system is programmed in such a way that when the modem receives any message the microcontroller will read the message form serial port.

The AT commands are serially transferred to the modem through RS 232 and verify for the password, if the pass word is correct then it will start displaying the messages in the display system.

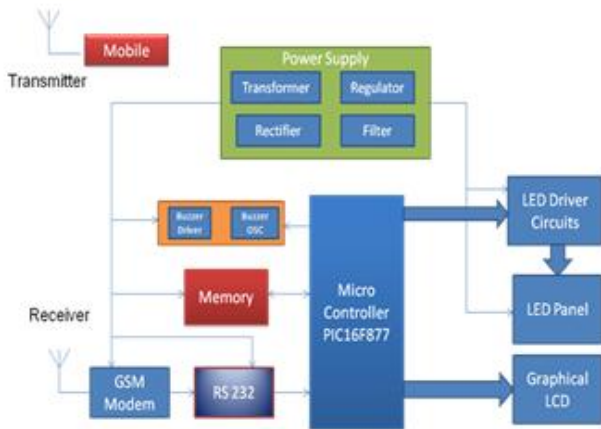


Figure.2: Block Diagram of Advertising System

### III. COMPONENTS DETAILS

#### A. Power Supply

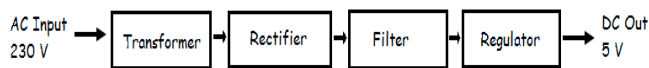


Figure.3: +5V DC Power Supply for Microcontroller

As Shown in Figure 3 Here in our application we need a 5V DC power supply for all electronics involved in the project. This requires step down transformer, rectifier, filter and voltage Regulator (7805) circuit for generation of 5V DC power. A Transformer is used to step-up or step-down (usually to step-down) the-supply voltage as per need of the solid-state electronic devices and circuits to be supplied by the DC power supply. A Rectifier is a device which converts the sinusoidal AC voltage into either positive or negative pulsating DC but it is unregulated. To reduce AC components (harmonics) from the rectifier output voltage a filter circuit is required. Voltage Regulator's main function is to maintain a constant DC output voltage.

#### B. RS-232 Converters

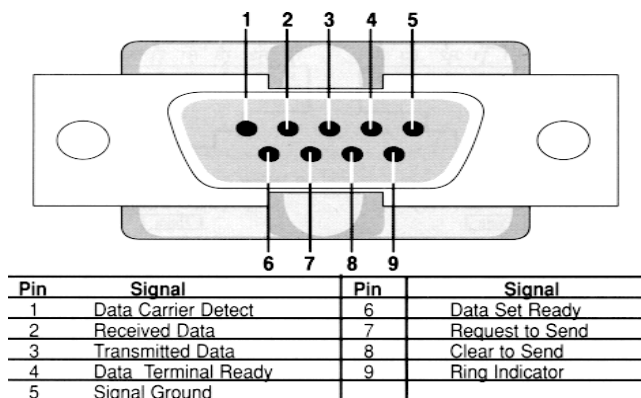


Figure.4: 9 pin RS-232 Connector

This is the device, which is used to convert TTL/RS232 vice versa. RS-232 was invented to connect Data Communications Equipment (DCE) and Data Terminal Equipment (DTE). It also employs serial binary data interchange. Thus as stated the DTE is used as terminal or computer and the DCE is used as modem or other communications device. RS-232 pin-outs for IBM compatible computers are shown below. A 9-pin connector and a 25-pin connector are two configurations which are widely used. A 9-pin connector is shown below in Figure 4.

The standard voltage range on RS-232 pins is -15V to +15V. This voltage range applies to all RS-232 signal pins. The total voltage swing during signal transmission can be as large as 30V. In many cases, RS-232 ports will operate with voltages as low as -5V to +5V. This wide range of voltages allows for better compatibility between different types of equipment and allows greater noise margin to avoid interference. Here GSM modem is communicated with the microcontroller using RS-232 serial data format Therefore to make compatible MODEM serial port with microcontroller serial port we are using the RS-232 converter.

#### C. GSM Modem

GSM Modem (Modulator Demodulator) is a wireless modem which works on GSM Wireless Network. Generally GSM Modem works on two frequencies. One is 900 MHz and the other is 1800 MHz. GSM Modem is a multi-functional, ready to use, rugged unit that can be embedded or plugged into any application. The GSM Modem can be controlled and customized to various levels by using the standard AT commands. It is connected to microcontroller through RS 232. We use SIM900 GSM Modem here and it supports some basic commands like AT+CMGR to read message, AT+CMGS to send message, AT+CMGW to write message to memory, AT+CMGD to delete message etc. i.e. to read a message received by GSM Modem command is AT+CMGR=1, can be sent from Microcontroller. Via RS 232, the message will be sent in ASCII code to Microcontroller, bit by bit.

#### D. Microcontroller (PIC16F877)

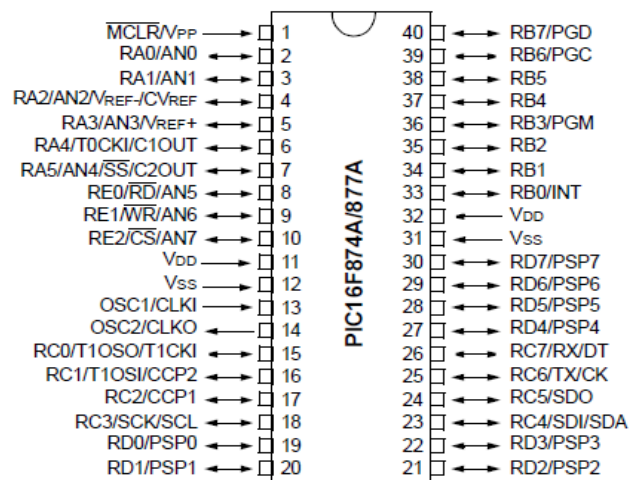


Figure.5: Pin Diagram of PIC16F877

The micro controller inside the system is programmed in such a way that when the modem receives any message the micro controller will read the message form serial port and verify for the password, if the pass word is correct then it will start displaying the messages in the display system. The microcontroller is used to display the display system with LED connected as rows and columns using high speed scanning technique. Here PIC16F877 has RISC Architecture and it is a 8 bit controller. PIC16F877 device comes in 28 pin package. This does not have a parallel slave implemented. Pin Diagram of PIC16F877 is as shown below.

PIC16F877 has following features.

- High Performance RISC CPU
- Operating Frequency: DC – 20 MHZ
- Flash Program Memory: 8K
- Data Memory: 368 bytes
- EEPROM Data Memory: 256 bytes
- Interrupts: 15
- I/O Ports: Ports A, B, C, D, E
- Timers: 3
- Capture/Compare/PWM Modules: 2
- Serial Communications: MSSP, USART
- Parallel Communications: PSP
- 10 bit Analog to Digital Module: 5 input channels
- Analog Comparators: 2
- Instruction Set: 35
- Package: 40 pin

E. *EEPROM Memory*

Electrically Erasable Programmable Read-Only Memory is an example of non-volatile memory. Non Volatile memory is used to store small amounts of data in many electronic devices to store the data when power is switched off. When static data is larger, data are to be stored in a specific type of EEPROM I.e. USB flash drives. A flash memory is more economical than other EEPROM devices. The EEPROM (AT24C64) provides 65,536 bits of serial EEPROM organized as 8192 words of 8 bits each. A AT24C64 is optimized for use in many industrial and commercial applications where low power and low voltage operation are essential. The AT24C64 is available in space saving 8-pin PDIP. The main application of memory here is to store the message coming from user mobile, the microcontroller is doing the operation of writing and reading to memory.

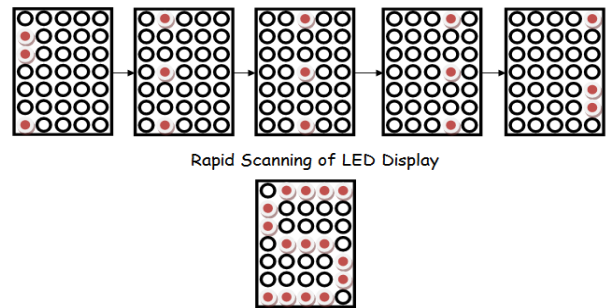
F. *Buzzer*

The buzzer subsystem produces a 2 KHz audible tone when powered. The buzzer will sound when the signal coming into the driver is high. It must be connected to a transistor. The buzzer is connected between the supply rail (positive V) and the input signal. This acts as load on the driver. When the input signal coming into the buzzer subsystem is low, a potential difference across the buzzer causes current to flow. It is this flow of current that causes the buzzer to sound. Buzzer is connected to microcontroller port pin, so microcontroller will give high or low to switch on/off

buzzer. Here it is used to define the normal/ abnormal/ active/ deactivate condition of system/ peripherals in sound form.

G. *LED Display*

The messages are displayed on the system using high speed techniques, the entire display column is connected to shift register output so that the characters are first shifting to each column and then the microcontroller will switch on the row one by one with small delay. This process is continuing in high speed so that the viewer will feel the display in a more brightness which is shown in below figure.



Observer's perception caused by visual persistence

Figure.6: Scanning of LED Display

H. *Graphical LCD:*

Here we are also display the message on Graphical LCD which contains 128 \*64 Dots. It works on +5 V Power Supply. It has 8 bit parallel interface.

No	Symbol	Level	Function
1	VSS		Ground
2	VDD		Power Supply For Logic Circuit
3	VO		Brightness Control
4	D / I	H / L	H : Data Input L : Instruction Code Input
5	R / W	H / L	H : Data Read (Lcd Module & Mpu) L : Data Write (Lcd Module & Mpu)
6	E		Enable
7-14	DB0-DB7	H / L	Data Bus Line
15	CS1	H	Chip Select For Ic1
16	CS2	H	Chip Select For Ic2
17	RST	L	Reset
18	VEE		Negative Voltage Output(-10v)
19	+Vled		Backlight
20	-Vled		Backlight

- Write Display Data

R	R/	DB	DB	DB	DB	DB	DB	DB	DB
S	W	7	6	5	4	3	2	1	0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

- Read Display Data

R	R/	DB	DB	DB	DB	DB	DB	DB	DB
S	W	7	6	5	4	3	2	1	0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

#### IV. CIRCUIT DIAGRAM, CONNECTIONS AND ALGORITHM

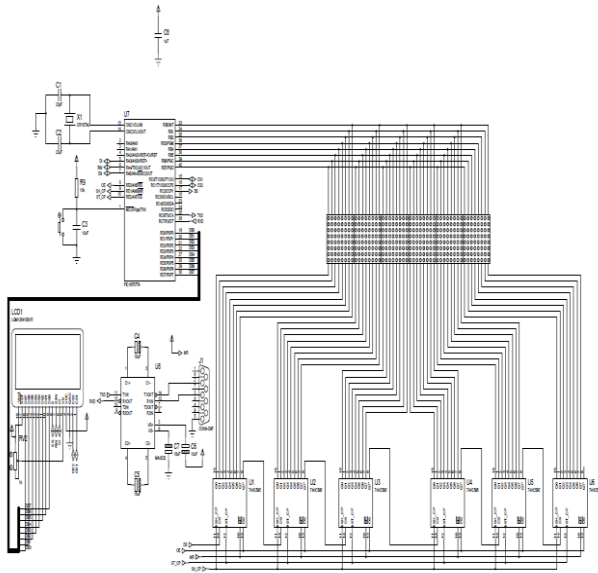


Figure. 7 Circuit Diagram

Here there is a circuit diagram whole system in figure 7 and a diagram of interfacing Microcontroller (PIC16F877) and 8\*8 LED Dot Matrix Display using Proteus software shown in Figure 8.

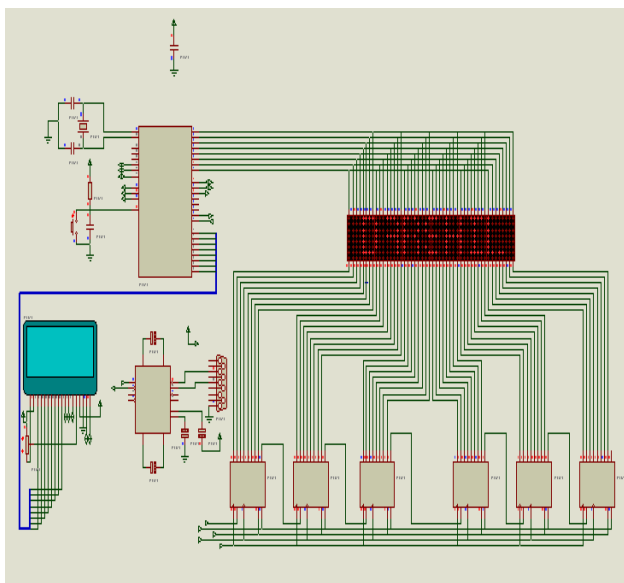


Figure.8: Interfacing between Microcontroller and LED Dot Matrix Display and Graphical LCD

As in above diagram, 74HC595 is used as LED

Driven Circuits. It is advanced high speed CMOS device fabricated with silicon gate CMOS Technology. It will maintain the CMOS low power dissipation and also can reach to speed operation almost near to bipolar schottky TTL. The 74HC595 is a high speed Serial In / Parallel out shift Register. A 2-input AND gate synchronous having the LOW-to-HIGH transition of the clock is used to enter Serial Data. The 74HC595 has an asynchronous Master Reset which clears the register and put all outputs LOW with independent of the clock. An input protection circuit insures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup.

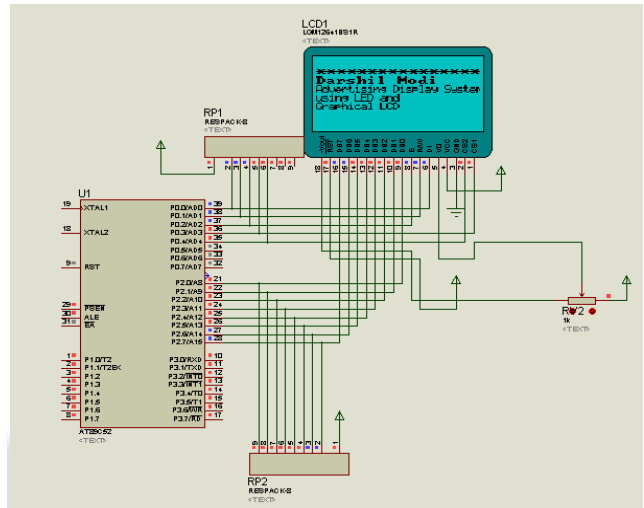


Figure.9: Interfacing of Microcontroller and Graphical LCD

This circuit prevents device destruction due to mismatched supply and input voltages. It is exceptionally useful when you need to expand your inputs. This allows you to convert 1 serial byte into 8 outputs. The 74HC595 also allows you to cascade these devices for more bits. You will need three pins, serial and serial clock. The 74HC595 does not have a latch so if you are using it to drive LEDs you will see led flickering as the bits are shifted. Its supply current is <80uA. Its max current output is in mA and output type is Tri state.

Here in figure 9, interfacing of Microcontroller and graphical LCD is shown.

In figure 10, connection of GSM Modem, Microcontroller and LED display is shown. Connection of GSM Modem to Microcontroller and Microcontroller to LED display should be cross connected. So Receiver of GSM Modem is connected to Transmitter of Microcontroller and Transmitter of GSM Modem is connected to Receiver of Microcontroller but ground pins of both sides must be connected together.

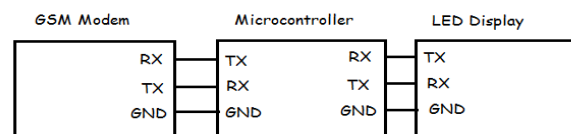


Figure.10: Transmitter, Receiver Connections

In Figure 11, Algorithm of the advertising display system is shown. As in figure if no new message is received so no process will be done but if message receives so it will check that it is from valid number. Then if message is from valid number then only it will display the new message and process ends otherwise it will keep displaying previous message.

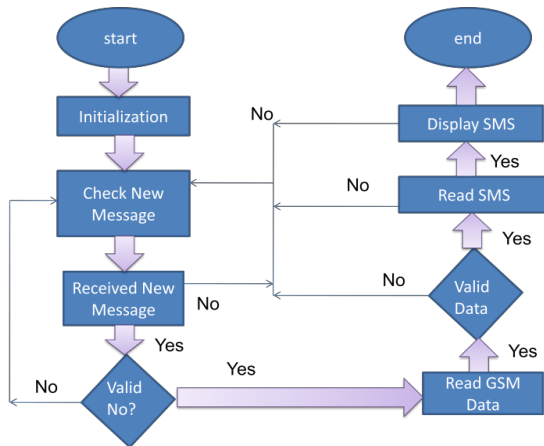


Figure.11: Algorithm of the system

Here in figure 12, hardware of the system is shown.

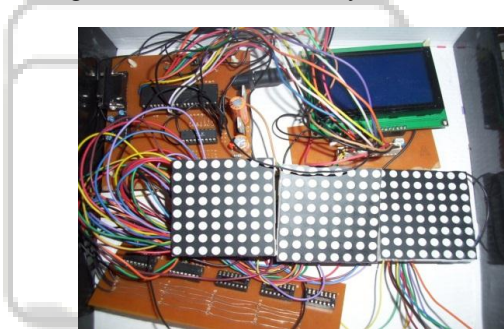


Figure.12: Hardware of the system

Here in Figure 13, output on LED Matrix display is shown which we are getting after implementation.

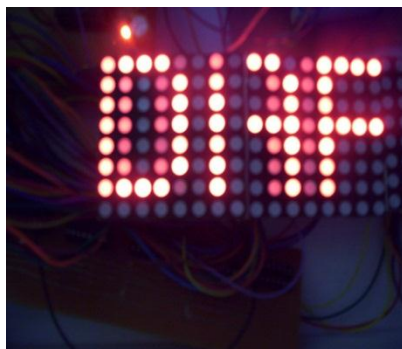


Figure. 13: output on LED Matrix Display

## V. CONCLUSION

This paper presents how we can make such innovative application with two different technologies like GSM and LED. This paper explains about introduction of advertising with use of LED, Basic Concepts of these two

technologies used in this application, Block Diagram, Components used in application and their working, Circuit Diagram and Algorithm of the system. Main Advantage of this application is time saving, cost effective and the person can send message remotely because of wireless communication. GSM is also user friendly and less power consuming and data will not be lost in case of power loss and here we are using Graphical LCD so that we can understand how can we enhance this project. If we want to make other GSM based applications so we just want to change HEX code not all the hardware. So we can modify it by our need and interest and can upgrade as per requirement.

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