

GSM Based E-Notice Board: Wireless Communication

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Abstract: in this technical paper explains how a reliable and an authentic wireless communication could be easily developed between a mobile phone and microcontroller using GSM (Global System for Mobile Communication) MODEM (Modulator-Demodulator). This technical paper explains GSM based e-notice board which can be widely used for multitude of applications including educational sector, traffic control, banks, public advertisements, stock exchanges etc. Moreover we can also learn as well as modify some of the common applications of GSM MODEM as per the requirements and needs of the user. Here we will learn the hardware behind the picture. In addition to this I will tell you how to upgrade the software resulting low NRE (Non-Recurring Engineering) cost as well as low time-to-market. This technical paper plays a vital role in the state-of-the-art scenario where market window is relentlessly shrinking and really need pocket-friendly and authentic products.

Keywords: GSM, research, microcontroller, MODEM, software, mobile communication, 3G, 2G, LCD, bridge rectifier, transformer, interfacing, application, SIM, NRE, traffic control

I. INTRODUCTION

GSM – a digital mobile telephony system, which is globally accessed by more than 212 countries and territories. Global system for mobile communication is completely optimized for full duplex voice telephony. Initially developed for the replacement of first generation (1G) technology, now GSM is available with lots of salient features with the constant up gradation of third generation (3G) technology.

And now with the alliance of microcontroller, GSM MODEM could be further tailor-made for some of very innovative applications including GSM based DC motor controller, GSM based home security system, GSM based robot control, GSM based voting machine control, GSM based stepper motor controller etc.

II. MAIN FUNCTION OF GSM BASED E-NOTICE BOARD

- Sending message from any of the remote area to the distant located e-notice board using GSM mobile.
- For sending the text message from remote area we need to interface the mobile phone with GSM Modem.

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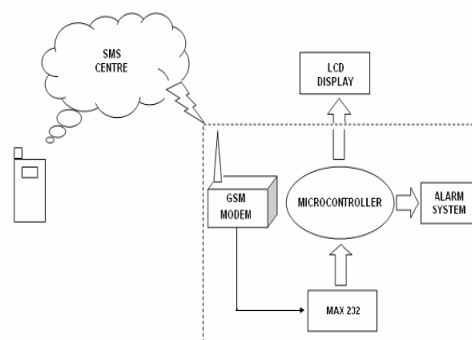
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- For developing some of GSM based applications we need to have some common peripherals including GSM MODEM, SIM, microcontroller, LCD (Liquid crystal display), power supply and also some connecting wires.

Moreover GSM based applications could be easily developed and enhanced due to easy accessibility of components in local markets at very pocket friendly prices. In section II we discuss main function of GSM based e-notice board.

A. BLOCK DIAGRAM OF GSM-BASED E-NOTICE BOARD

Here you can see the simple block diagram of GSM-based e-Notice board.



Essential components for assembling GSM based applications including:

1. GSM MODEM
2. Microcontroller
3. SIM
4. Power Supply or Power Adapter
5. Transformer
6. Bridge Rectifier
7. LCD

Let's start discussion one by one.

A) GSM MODEM: It is a wireless MODEM – just like dial-up MODEM, which works with GSM wireless network. But there is a difference between dial-up MODEM and wireless MODEM. Dial-up MODEM send and receives data through a fixed telephone line while wireless MODEM send and receive data through radio waves.

See fig 1.

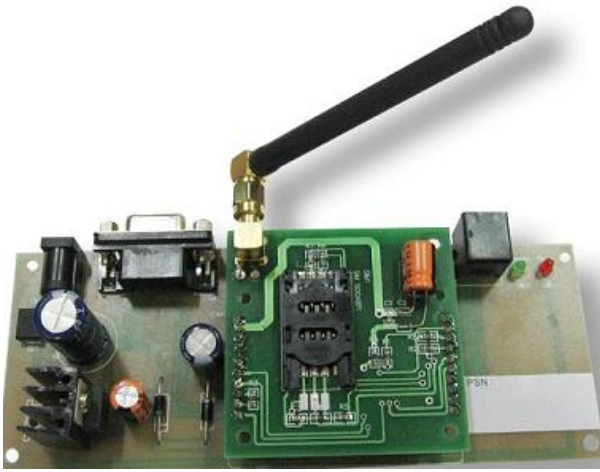


Fig 1: This is a picture of GSM MODEM which is easily available in local market.

B) *SIM*: Subscriber Identity Module is a clip-on small card consisting of user's information as well as phone book. As per convenient, user can alter the operator with retaining the same handset. Nowadays dual SIM handset is also available in the local market which brings the advantage of two different operators at the same time. See fig 2.



Fig 2: This is Mobile SIM Card. User can choose the SIM card as per need and requirement.

C) Power Supply/Power Adopter: Power supply is the source of electrical power. Normally we use +5V DC power for regular working of almost any electronic circuit. User can directly built +5V DC power supply using 4 diodes, filter capacitors and regulator IC - 7805 (Integrated Circuit) or can directly purchase a +5V DC power adopter from the local market. See fig 3.

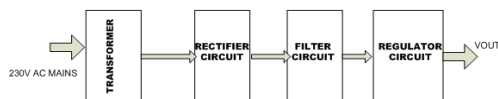


Fig 3: This is +5V DC Power Supply which is specially designed for providing +5V DC supply for microcontroller.

D) Transformer: Transformer is a static electrical device which transfers electrical energy from one circuit to another circuit. Depending upon winding, transformer could be easily understand with primary winding and secondary winding. See fig 4.



Fig 4: This is Step down Transformer which actually steps down the voltage level.

E) Bridge Rectifier: The main function of bridge rectifier in to convert AC (Alternating Current) into DC (Direct Current).A simple bridge rectifier consists of mainly 4 diodes. Normally we can use 1N4001 series of diodes. Additionally 1N4007 could also be used in place of 1N4001 series. See fig 5.

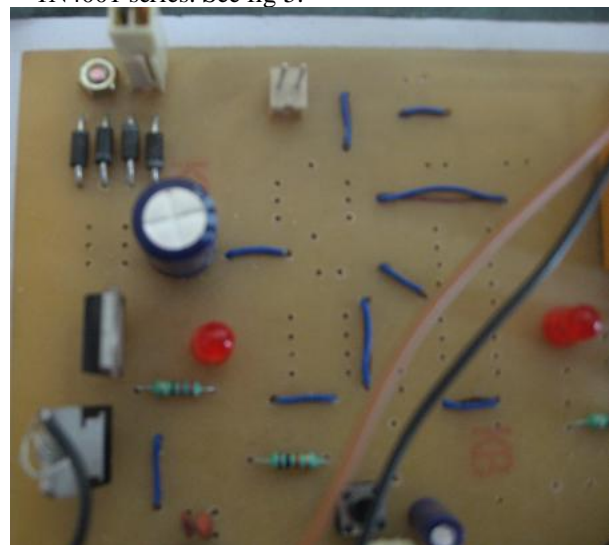


Fig 5: This is Simple Bridge Rectifier which converts AC into DC.

F) *LCD*: LCD - liquid crystal display, is a electronic device for displaying text or characters. We are using 14 pins LCD and the description is as follows:

- Pin 7 to Pin 14 – All 8 pins are responsible for the transfer of data.
- Pin 4 – This is RS i.e. register select pin.
- Pin 5 – This is R/W i.e. Read/Write pin.
- Pin 6 – This is E i.e. Enable pin.
- Pin 2 – This is VDD i.e. power supply pin.
- Pin 1 – This is VSS i.e. ground pin.
- Pin 3 – This is short pin.
- See fig 6.



Fig 6: This is Simple 16*2 LCD which is used for displaying alphabets.

G) Microcontroller:

- Microcontroller - specially designed for performing single task, is a computer-on-a-chip usually comprises of I/O ports, RAM, ROM and also CPU.
- Due to simplicity in design and pocket friendly prices, microcontroller is widely adopted for various fields including automobiles, medical science, defense, domestic applications, industrial use, energy management and lots more domains.
- In addition to this, microcontrollers are commonly built using CMOS (Complementary-Metal Oxide Semiconductor) technology resulting optimum performance with the least consumption of power.
- Due to performing only single dedicated task, latency of the task is fast and more reliable. See fig 7.

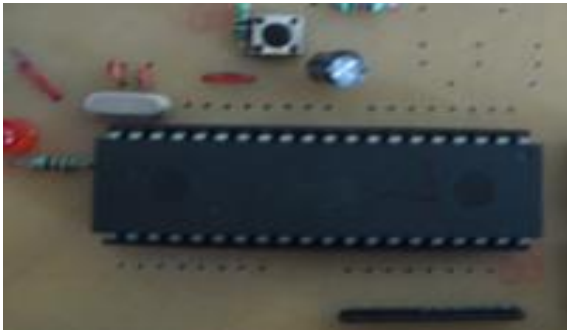
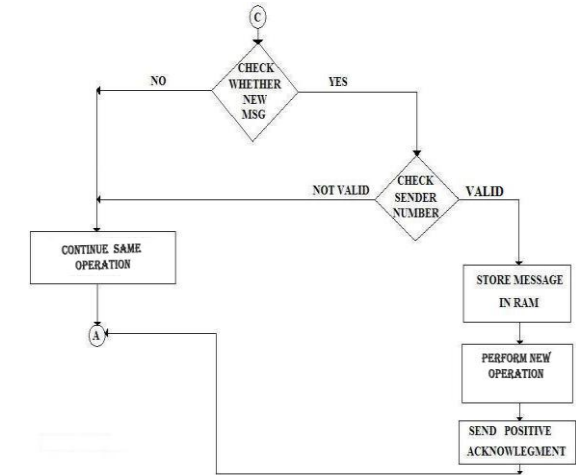
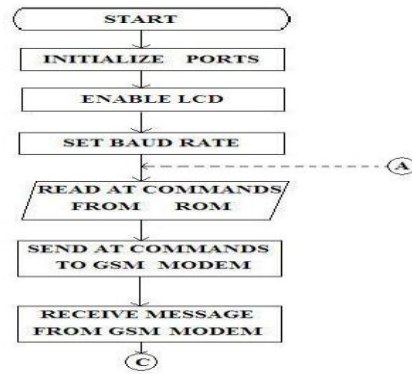


Fig 7: This is a 40 pin DIP (Dual in Line package) Microcontroller

III. FLOWCHART OF E-NOTICE BOARD

In section III we discuss the operational flowchart of GSM based e-notice board.



IV. SOME IMPORTANT INITIALIZING STEPS FOR GSM BASED E-NOTICE BOARD:

In the section IV we will learn some simple steps for the initialization of GSM based e-notice board.

How to access GSM MODEM using Microsoft Hyper Terminal:

- Before programming the application software we need to assure that our GSM MODEM as well as SIM is either correctly working or not.
- This status could be easily identified with the help of hyper terminal by sending AT (Attention) commands to the GSM MODEM.
- For windows users we can use “Hyper command Terminal” and for LINUX users we can use “Mincom” terminal.

Testing of GSM MODEM:

- After placing SIM card in GSM MODEM, we need to directly go to hyper terminal for further communication.
- Then type AT in main window. If a response OK is returned back to mobile phone then type AT-CMGR which is again a AT command which means read message from a given memory location.

How to initialize the microcontroller:

- For initializing the microcontroller with MODEM we need to use mainly 2 terms named as DTE and DCE.
- DTE – Data Terminal Equipment is a piece of hardware device for communication.
- DCE – Data Communication Equipment provides the path for communication.

How to interface microcontroller with LCD:

We are using 14 pins LCD and the description is as follows:

- Pin 7 to Pin 14 – All 8 pins are responsible for the transfer of data.
- Pin 4 – This is RS i.e. register select pin.
- Pin 5 – This is R/W i.e. Read/Write pin.
- Pin 6 – This is E i.e. Enable pin.
- Pin 2 – This is VDD i.e. power supply pin.
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- Pin 3 – This is short pin.

Software Environment:

KEIL Software for 8051Family: KEIL – founded in 1982, provides broad range of development tools including libraries, IDE (Integrated Development Environment), assemblers and also linkers.

HEX file: HEX file is a special file which is imported by a programmer into the target IC. Hex file is a kind of file which is actually not for user.

(a) First write your program either in C or in assembly language. In this paper I am writing the program of GSM based home automation system which is written in C language.

(b) Write your program (C or assembly language) in the KEIL software environment. See fig 8:

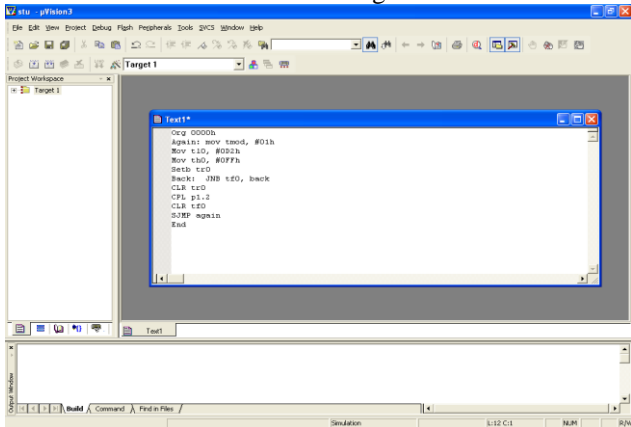


Fig 8 This is KEIL Development Environment for writing as well as debugging the program.

b) After writing your program in either c or assembly language, make sure of making HEX file. See fig 9 :

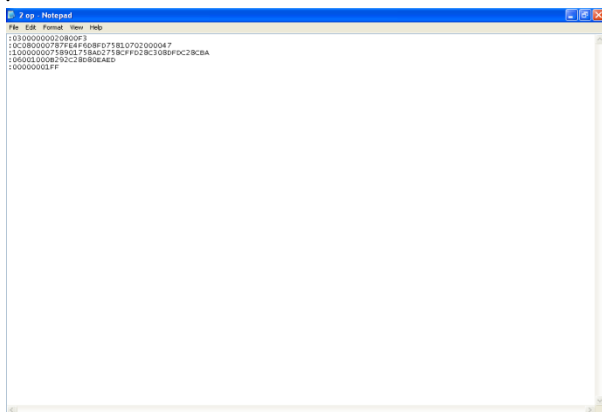


Fig 9 This is HEX File which is ready to move from computer to your target IC.

(c) Now we have a HEX file of the above program and this HEX file is ready to go at the target IC using PRO51 burner. See fig 10:

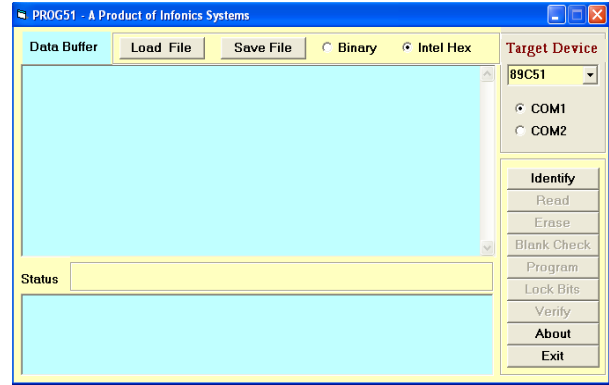


Fig 10: This is PRO51 Burner for burning your HEX code into the target IC.

PRO51 provides the facility of burning software for 8051 based microcontroller. Additionally we can also program ATMEGA microcontrollers.

Final Prototype looks like this: See fig 11.



Fig 11: This is simple prototype of GSM based application.

How to develop different applications using GSM Module: For developing different applications we need to follow some kind of sequence:

1. Write your program either in C or Assembly language. I am using C language.
2. Using KEIL software, compile as well as debug your program.
3. Again using KEIL software, make HEX file of your program.
4. After making HEX file of your program, shift the HEX file into target IC.
5. Shifting of HEX code into target IC is performed using PRO51 burner.
6. Now your GSM based application is ready to operate.
7. Depending upon the application, user needs to modify the program as per the need and requirement and rest of the steps are same.

V. CONCLUSIONS

The above technical paper explains how we can develop as well as modify GSM based e-notice board. In addition to this, for bringing new applications every time we need to only burn the HEX code of target program.

The target program could be GSM based home appliance, GSM based railway reservation, GSM based home security, GSM based robot control, and GSM based stepper motor controller and many more.



Make new HEX code and get completely new application without further modifying the hardware.

VI. FUTURE WORK

This technology could be further modified and more upgraded as per individual need and interest. We have discussed some basic ideas of this technology. And depending on innovative applications user can upgrade as per requirement.

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