Chapter 1

Introduction

1.1 NEED OF MOBILE DEVICE CONTROLLER

The advances in the technologies related to wireless communication has led to the emergence of several engineering designs to aid the human requirements. Thus with the creeping interests in the wireless and GSM based projects, we came up with this idea of developing a simpler, multipurpose, cost-effective design to control the on-off mechanism of various devices in the field via short message service (SMS).[5]

According to connecting mode, university, college, departments, office, home network can be divided into two kinds: wireless network and non-wireless network. The wireless technology has some remarkable benefits comparing with non-wireless technology. For example, it makes the installation and maintenance easier and reduces the system cost. Bluetooth, Zigbee, and wireless USB are the most popular technologies in the field of home wireless network. This can be done via internet or GSM/GPRS. GSM/GPRS is more convenient than internet. The main reason is that the GSM/GPRS network has wide spread coverage making the whole system available for almost all the time. Furthermore, GSM/GPRS network has high security infrastructure which makes sure that the information sent or received cannot be monitored. The widespread availability of GSM network would allow the users to control the appliances from far places away from the appliances.[4]

1.2 AIM AND OPERATION

This project aims at integrating the expansiveness of a wireless cellular network and the ease of information transfer through the SMS with the coverage of public display boards. A modification could be allowing multiple users to display messages by giving them passwords so that only authorized persons can be able to send and display messages on the notice boards

1.2.1 BUILDING BLOCKS

1. Microcontroller ATMEGA 16A
2. GSM Module –SIM 300
3. LCD Display
4. Serial communication interface –RS232
5. MAX 232
6. SIM Card

1.2.2 OPERATION

This project consists of a mobile phone for displaying the text message in LCD screen as a notice board. This is done via Global System for Mobile Communication. The project also consists of a Microcontroller ATMEGA 32 based control system attached to the GSM kit. A GSM kit is a input device .GSM modem receive the message send to it by the authorized person and converts it into a four bit signal. This four bit data is then fed for further processing. Based on this the microcontroller sends information to LCD through a RS 232 serial cable interface .The same message will be displayed on LCD screen.

Chapter 2

Theory

2.1 EMBEDDED SYSTEM

An embedded system is a computer system with a dedicated function within a larger mechanical or electrical system, often with real time computing constraints. It is embedded as part of a complete device often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer (PC), is designed to be flexible and to meet a wide range of end-user needs. Embedded systems control many devices in common use today. Embedded systems contain processing cores that are either microcontroller, or digital signal processors (DSP). A processor is an important unit in the embedded system hardware. It is the heart of the embedded system

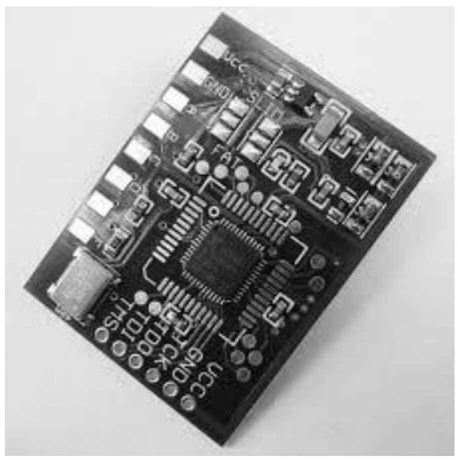

Fig. 2.1 .Embedded System

2.2 GSM TECHNOLOGY

2.2.1 Introduction

GSM stands for Global System for Mobile communication. It is a digital mobile telephony system that is widely used all across the world. This is a standard set developed by the European Telecommunications Standards Institute (ETSI) in the year 1989. Mobile services based on GSM technology were first launched in Finland in 1991. GSM supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS (Short Message Service). GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US. The 850MHz band is also used for GSM and 3G in Australia, Canada and many South American countries. Today more than 690 mobile networks provide GSM services across 218 countries and GSM represents 82.4% of all global mobile connections. There are now more than 2 billion GSM mobile phone users worldwide. A source references China as "the largest single GSM market, with more than 370 million users, followed by Russia with 145 million, India with 83 million and the USA with 78 million users."[5]

2.2.2 Architecture

The GSM network can be divided into three broad parts. The Mobile Station is carried by the subscriber; the Base Station Subsystem controls the radio link with the Mobile Station. The Network Subsystem, the main part of which is the Mobile services Switching Center, performs the switching of calls between the mobile and other fixed or mobile network users, as well as management of mobile services, such as authentication. Operations and Maintenance center oversees the proper operation and setup of the network. The Mobile Station and the Base Station Subsystem communicate across the air interface or radio link.

2.2.2.1 Mobile Station

Mobile Station consists of the physical equipment like radio transceiver, display and digital signal processors, and a smart card called the Subscriber Identity Module (SIM). The SIM provides mobility, so that the user can have access to all subscribed services irrespective of both the location of the terminal and the use of a specific terminal. By inserting the SIM card into another GSM cellular phone, the user is able to receive calls at that phone, make calls from that phone, or receive other subscribed services.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI). This is used for identifying the subscriber. It is also a secret key for authentication, and other user information. The IMEI and the IMSI are independent providing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.

2.2.2.2 Base Station Subsystem

The Base Station Subsystem is composed of two parts, 1) the Base Transceiver Station (BTS) and 2) the Base Station Controller (BSC). These communicate across the specified interface, allowing operation between components made by different suppliers.

The Base Transceiver Station houses the radio transceivers that define a mobile and handles the radio-link protocols with the Mobile Station. In a large urban area there will be a large number of BTSs deployed. The requirements for a BTS are ruggedness, reliability, portability, and minimum cost. The Base Station Controller manages the radio resources for one or more BTSs. It handles radio-channel setup, frequency hopping, and handovers. The BSC is the connection between the mobile and the Mobile service Switching Center. The BSC also translates the 13 kbps voice channel used over the radio link to the standard 64 kbps channel used by the Public Switched Telephone Network or ISDN.

2.2.3 Network Subsystem

The central component of the Network Subsystem is the Mobile services Switching Center (MSC). It acts like a normal switching node of the PSTN or ISDN, and in addition provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. The Mobile service Switching Center provides the connection to the public fixed network (PSTN or ISDN), and signaling between functional entities uses the Signaling System Number 7 (SS7), used in ISDN and widely used in current public networks.

The Home Location Register (HLR) and Visitor Location Register (VLR), together with the MSC, provide the calling routing and (possibly international) roaming capabilities of GSM. The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network. The current location of the mobile is in the form of a Mobile Station Roaming Number (MSRN) which is a regular ISDN number used to route a call to the MSC where the mobile is currently located. There is logically one HLR per GSM network, although it may be implemented as a distributed database. The Visitor Location Register contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographical area controlled by the VLR. .The other two registers are used for authentication and security purposes. The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where each mobile station is identified by its International Mobile Equipment Identity (IMEI). An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel. The other two registers are used for authentication and security purposes. The Equipment Identity Register (EIR) is a database that contains a list of all valid mobile equipment on the network, where each mobile station is identified by its International Mobile Equipment Identity (IMEI). An IMEI is marked as invalid if it has been reported stolen or is not type approved. The Authentication Center is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel**.**

2.2.4 SMS Services

SMS stands for short message service. The service allows for short text messages to be sent from one cell phone to another cell phone or from the Web to another cell phone. Short Message Service (SMS) is a text messaging service component of phone, web, or mobile communication systems, using standardized communications protocols that allow the exchange of short text messages between mobile phones. SMS text messaging is the most widely used data application in the world, with 2.4 billion active users, or 74% of all mobile phone subscribers. Global System for Mobile Communications (GSM) are standards as a means of sending messages of up to 160 characters to and from GSM mobile handsets. Most SMS messages are mobile-to-mobile text messages though the standard supports other types of broadcast messaging as well. Messages are sent to a Short message service center (SMSC) which provides a "store and forward" mechanism. It attempts to send messages to the SMSC's recipients. If a recipient is not reachable, the SMSC queues the message for later retry. Some SMSC also provide a "forward and forget" option where transmission is tried only once. Both mobile terminated (MT, for messages sent to a mobile handset) and mobile originating (MO, for those sent from the mobile handset) operations are supported. There are no guarantees that a message will actually be delivered to its recipient, but delay or complete loss of a message is uncommon, typically affecting less than 5% of messages.

2.3 SERIAL COMMUNICATION

2.3.1 Basics of Serial Communication

Computer transfers data in two ways these are

1. Parallel**:** Often 8 or more lines (wire conductors) are used to transfer data to a device that is only few feet away.

2. Serial**:** To transfer to a device located many meters away, the serial method is used. The data is sent one bit at a time.

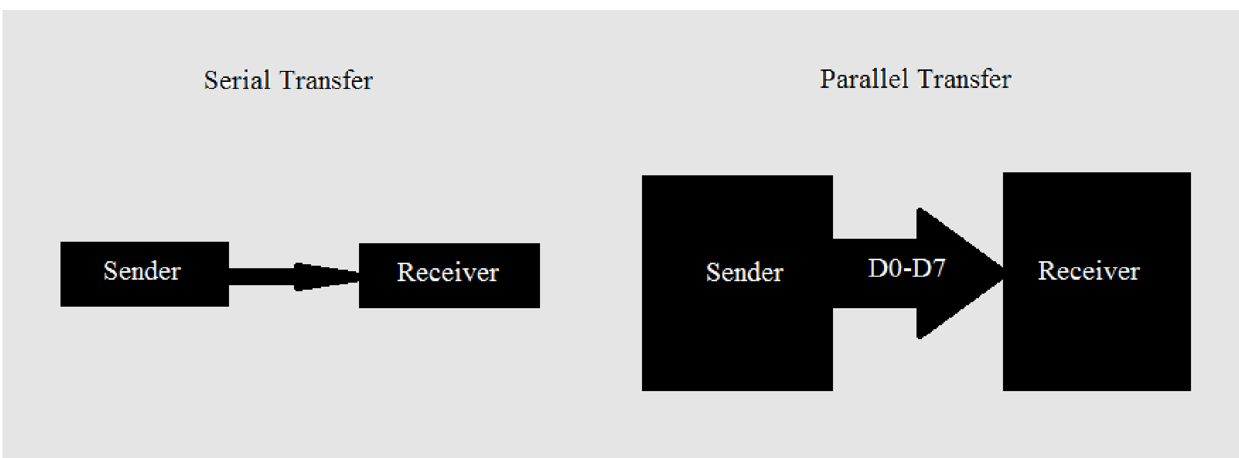

Fig 2.2: Modes of Communication

At the transmitting end, the byte of data must be converted to serial bits using parallel-in-serial-out shift register. At the receiving end, there is a serial-in-parallel-out shift register to receive the serial data and pack them into byte. When the distance is short, the digital signal can be transferred as it is on a simple wire and requires no modulation. If data is to be transferred on the telephone line, it must be converted from 0s and 1s to audio tones. This conversion is performed by a device called a modem, Modulator/demodulator".

Serial data communication uses two methods. First are synchronous method transfers a block of data at a time. Second is an asynchronous method transfer a single byte at a time.

It is possible to write software to use either of these methods, but the programs can be tedious and long. There are special IC chips made by many manufacturers for serial communications namely UART (universal asynchronous Receiver-transmitter) & USART (universal synchronous-asynchronous Receiver-transmitter).

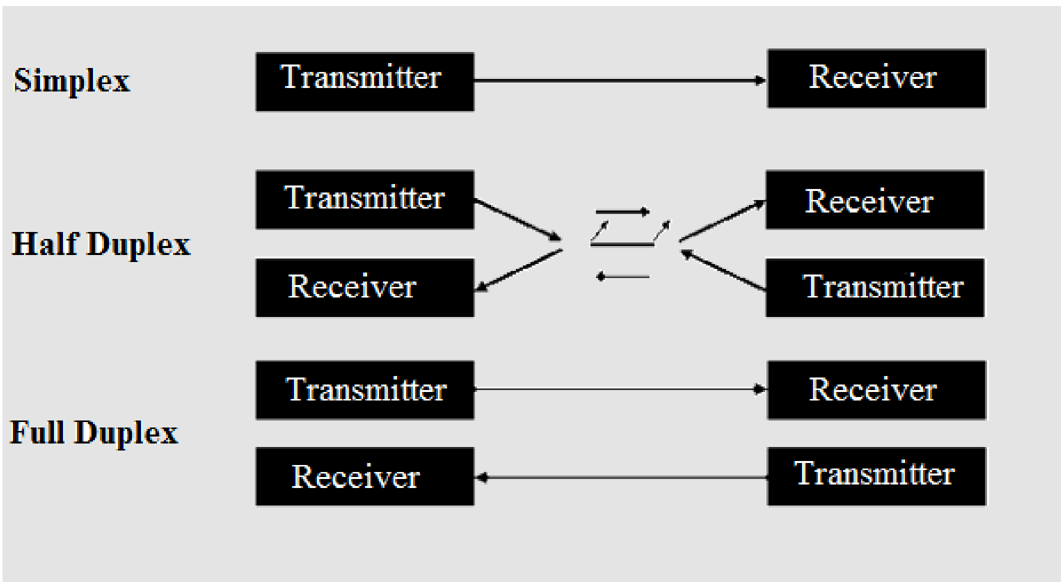

Fig 2.3: Diagrammatic Simplex & Duplex Transmission

A protocol is a set of rules agreed by both the sender and receiver. Asynchronous serial data communication is widely used for character-oriented transmissions where each character is placed in between start and stop bits, this is called framing and block-oriented data transfers use the synchronous method. The start bit is always one bit, but the stop bit can be one or two bits the start bit is always a 0 (low) and the stop bit(s) is 1 (high).

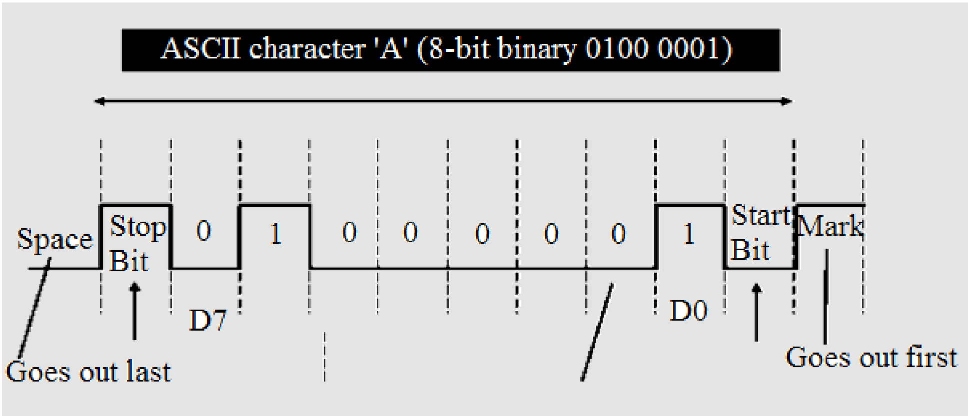

Fig 2.4: Transmissions of Data

Due to the extended ASCII characters, 8-bit ASCII data is common in modern PCs the use of one stop bit is standard. Assuming that we are transferring a text file of ASCII characters using 1 stop bit, we have a total of 10 bits for each character. In some systems in order to maintain data integrity, the parity bit of the character byte is included in the data frame. The rate of data transfer in serial data communication is stated in bps (bits per second).

Another widely used terminology for bps is baud rate. As far as the conductor wire is concerned, the baud rate and bps are the same, and we use the terms interchangeably. The data transfer rate of given computer system depends on communication ports incorporated into that system.

An interfacing standard RS232 was set by the Electronics Industries Association (EIA) in 1960. The standard was set long before the advent of the TTL logic family, its input and output voltage levels is not TTL compatible where a 1 is represented by -3 ~ -25 V, while a 0 bit is +3 ~ +25 V, making -3 to +3 undefined.

ATmega has two pins that are used specifically for transferring and receiving data serially. These two pins are called TxD and RxD and are part of port D. These pins are TTL compatible; therefore, they require a line driver to make them RS232 compatible. To allow data transfer between the PC and an ATmega system without any error, we must make sure that the baud rate of ATmega system matches the baud rate of the PC's COM port.

Chapter 3

Hardware Profile

3.1 GSM MODULE

3.1.1 Introduction

Full Type Approved Quad Band Embedded GSM Module (GSM 850/900 1800/1900) with AT command set and RS232 interface on CMOS level. This GSM wireless data module is the ready a solution for remote wireless applications, machine to machine or user to machine and remote data communications in all vertical market applications. The GSM Module included the following components:

- F35-A-2:TC35 MODULE / C55-2 with IMEI number.
- A2D/F35/C55-2/C2D Evaluation board PCB.
- GSM antenna and cable with coaxial plug (30cm).
- RS-232 9 pin serial cable.
- Wall mount power adapter.

3.1.2 GSM Module Specifications

Data services: 300-14000 bps, Asynchronous, Transparent and Non-transparent.[1][2]

Supply Voltage: 3.6 V – 5.0 V

RF characteristics:

- Receiver
  - ESGM Sensitivity : < -104 dBm
  - DCS Sensitivity : < -100 dBm
  - Dyanmic Range : 62 dB
- Transmitter
  - Maximum output power (EGSM): 33 dBm +/- 2 dB
  - Maximum output power (DCS) : 30 dBm +/- 2dB
  - Minimum output power (EGSM) : 5 dBm +/- 5dB
  - Minimum output power (DCS) : 0 dBm +/- 5dB

3.1.3 AT Commands

AT commands are instructions used to control a modem. AT is the abbreviation of Attention. Every command has the format either “ATxx or “AT+xxxx”. The starting “AT” is the prefix that informs the modem about the start of a command line. It is not part of the AT command name. These AT commands can be easily sent to a GSM modem/phone/module via serial port when communicating with PC or any other device.

The set of AT Commands used in our project are listed under:

Note: *<CR>* implies a non-printable ACII character Carriage Return (0x0D)
<LF> implies another non-printable ACII character Line Feed (0x0A)

1. AT:

Usage: Checking communication between the module and computer.

Syntax: AT *<CR><LF>*

Response (On success)**:** *<CR><LF>* OK *<CR><LF>*

Response (On failure)**:** *<CR><LF>* ERROR *<CR><LF>*

2. ATE:

Usage: Disables Command Echo in the response.

Syntax: ATE0 *<CR><LF>*

Response (On success)**:** *<CR><LF>* OK *<CR><LF>*

Response (On failure)**:** *<CR><LF>* ERROR *<CR><LF>*

3. AT+CNMI = 0,1:

Usage: Disables new message indication.

Syntax: AT+CNMI=,0, , , ,1 *<CR><LF>*

Response (On success)**:** *<CR><LF>* OK *<CR><LF>*

Response (On failure)**:** *<CR><LF>* +CMS ERROR: [Error Code] *<CR><LF>*

4. **AT+CPMS = “SM”, “SM”, “SM”:**

   Usage: Sets sent unread, sent read, received unread, received read messages memory as SIM memory.

   Syntax: AT+CPMS = “SM”, “SM”, “SM” *<CR><LF>*

   Response (On success)**:** *<CR><LF>* +CPMS: [used_space1], [max_space1], [used_space2], [max_space2], [used_space3], [max_space3] *<CR><LF>* OK *<CR><LF>*

   Response (On failure)**:** *<CR><LF>* +CMS ERROR: [Error Code] *<CR><LF>*

5. **AT+CMGD = [index], [flag]:**

   Usage: Deletes a particular or all received read/unread or all sent read/unread or all messages, according to value of index & flag.

   Syntax: AT+CMGD = [index], [flag]*<CR><LF>*

   Response (On success)**:** *<CR><LF>* OK *<CR><LF>*

   Response (On failure)**:** *<CR><LF>* +CMS ERROR: [Error Code] *<CR><LF>*

6. **AT+CMGR = [index]:**

   Usage: Disables new message indication.

   Syntax: AT+CMGR= [index] *<CR><LF>*

   Response (On success)**:** *<CR><LF>* +CMGR: “[msg_status]”, “[sender_no]”,”[date-time]+[TPDU Octet]” *<CR><LF>* [msg_body] *<CR><LF><CR><LF>*OK *<CR><LF>*

   Response (On failure)**:** *<CR><LF>* ERROR *<CR><LF>*

3.2 MICRO CONTROLLER

3.2.1 Introduction

The first microprocessor introduced in 1981/1971, was made possible by high levels of integration of digital circuits. Continued integration of peripherals and memory on the same integrated circuit as the microprocessor core led to the creation of micro controllers.

A micro controller is an integrated circuit composed of a CPU, various peripheral devices, and typically memory, all in one chip. Using one chip that contains all the necessary functions in place of a microprocessor and multiple peripheral chips has reduced the size and the power consumption of control oriented applications. A micro controller is different from a microprocessor both in hardware and software. In hardware it includes peripherals such as I/O, memory, and analog and digital interface. Micro controllers are more suited for small applications with specific control functions requiring specialized peripherals and interfaces. They are designed for process control and are required to interface to the real world processes.

Many of the peripheral devices integrated on a micro controller are for that specific purpose. Analog to digital converters perform the task of converting an analog signal to digital for use by the CPU, and digital to analog converters perform the task of converting digital data into analog value and waveforms to control analog functions.

In addition to the analog interface, micro controllers contain peripheral devices that enable them to communicate to other digital components within a system or to monitor and control digital functions. Communication interfaces, digital I/O and interrupt controllers fall into this category of peripheral devices. Other peripheral devices often included on the same chip include clocks and timers.

In terms of the software, micro controllers have a more compact set of instructions with commands more suited to process control such as input and output from. Single bit operations such as set and reset, bit-wise logical functions or branching instructions that depend on a single bit are commonly available as part of the instruction set to allow for reading input switch status or on/off control of an external event. Since in a given application the micro controller is programmed for one task, it only has one control program. [6]

In a microprocessor based system various programs are stored in a mass storage device and then loaded into the RAM for execution. In contrast the micro controller program is typically stored in a ROM or PROM and RAM is used for temporary storage of data, compared with discrete implementation of a system, the micro controller based approach provides shorter system development time, reduced implementation cost, lower power consumption, and higher reliability.

The only drawback, which is often not important, is the lower speed of execution. For example, for a micro controller system to perform a logical operation, several clock cycles are needed to read the inputs, perform the function and output the results. The same operation when implemented with discrete components will provide the results as soon as the signals have propagated through the logic gates.

Micro-controllers are used in a variety of process control applications, replacing complex digital circuits and sometimes-analog functions while providing more flexibility due to their programmability. Portable electronic devices such as personal audio devices (CD players, MP3 players), mobile telephones, digital cameras and video camcorders rely heavily on the reduced size and low power consumption of micro controller based electronics.

These features are crucial to applications like implantable medical devices such as pacemakers, or personal medical monitoring devices like gluco meters (electronic devices used for the measurement of blood glucose).

In other applications such as appliances, home audio and video, automotive, power management, and temperature control, using a micro controller results in reduced board level circuit complexity and consequently reduced cost. With the growing number of applications using micro controllers, it is not surprising that there are such a wide variety of these components. In addition to those commonly available, many manufacturers custom-design a micro controller to suit a specific application.[3]

3.2.2 Architecture

Architecturally all micro controllers share certain features. They all contain a CPU, memory and I/O on the same chip. Another common feature is the interrupt handling capability. What sets them apart from one another is the choice of CPU, the structure of memory, and choice of peripheral devices, I/O and interrupts handling hardware. The major distinguishing architectural characteristic of micro controllers is the word size. Micro-controllers are available in 4, 8, 16, or 32 bit wide words. The width of the data path impacts several features of the micro controller. The complexity of the instruction set (number of available instructions and addressing modes), program efficiency (code generation and storage space), execution speed, as well as chip implementation and interfacing complexity are all influenced by the width of the data path.

For simple control tasks 4-bit and for a vast number of control and measurement applications 8-bit micro controllers would be sufficient. For higher precision and speed applications like speech and video processing, or complex instrumentation, 16-bit and 32-bit micro controllers are more appropriate.

Another distinction between micro controllers is the instruction set. Micro-controllers with complex instruction set (CISC) provide capability to perform complex computations rapidly. The extensive set of instructions, allow complex operations to be performed with few instructions. On the other hand reduced instruction set computers (RISC) decrease program execution time by having fewer less complex instructions. Fewer available instructions results in faster execution due to smaller size of the op-code and less decoding time needed for each instruction.

The trade-off depends on the complexity of operations needed for a specific application. In simple control applications a RISC based micro controller is more suitable because of its lower overhead for each instruction. In more complex applications, the availability of a more diverse instruction set results in a more efficient and faster executing code because fewer instructions are needed to accomplish a complicated task. For micro controller applications the instruction set should include common computational instructions plus instructions optimized for the specific application at hand.

Just as in microprocessors, micro controllers are also differentiated according to their memory structure. Von Neumann architecture maps the data and program to same memory address space.

In the Harvard architecture the instructions are stored in a separate memory space than that used for data storage. Another memory related architectural characteristic of a processor is the addressing scheme. In linear addressing there is a one to one correspondence between an address and a memory location. So with an 8-bit address register, 2^8 distinct address locations can be accessed.

In segmented addressing a separate register is used to point to a segment in memory, and the address register is used to point to an offset from that segment's start point. This way if all of the program or data are in the same segment, in order to access them, only the address register need to be used and the segment register can remain pointing to the start point of that segment.[8]

3.2.3 ATmega16

The ATmega16 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

Features:

- 16K Bytes of In-System Self-programmable Flash program memory.
- 512 Bytes EEPROM
- 1K Byte Internal SRAM
- Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
- Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
- One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
- Real Time Counter with Separate Oscillator
- Four PWM Channels
- Operating Voltages
    - – 4.5 - 5.5V for ATmega16
    - – 2.7 - 5.5V for ATmega16L

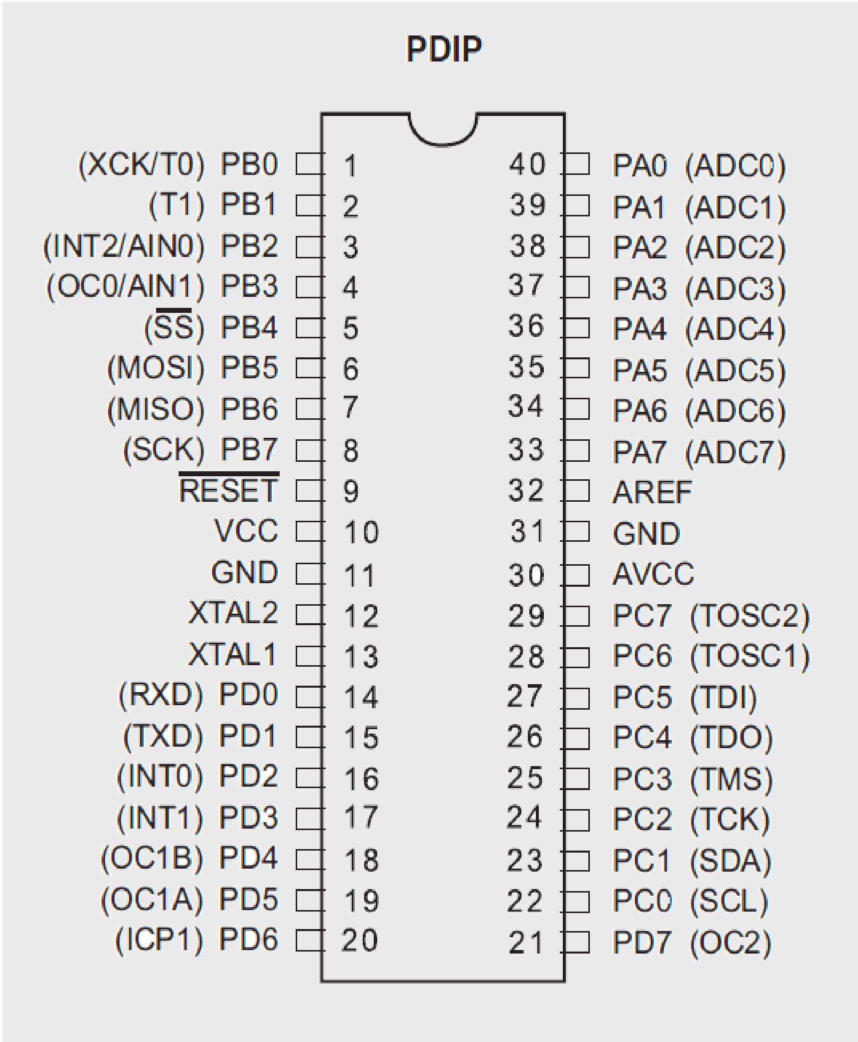

Fig 3.1: Pin diagram of ATmega16

3.3 MAX232:

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.

The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V. The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1 μF in place of the 1.0 μF capacitors used with the original device. The newer MAX3232 is also backwards compatible, but operates at a broader voltage range, from 3 to 5.5V. Voltage levels It is helpful to understand what occurs to the voltage levels. When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL.

This can be confusing when you realize that the RS232 Data Transmission voltages at a certain logic state are opposite from the RS232 Control Line voltages at the same logic state.

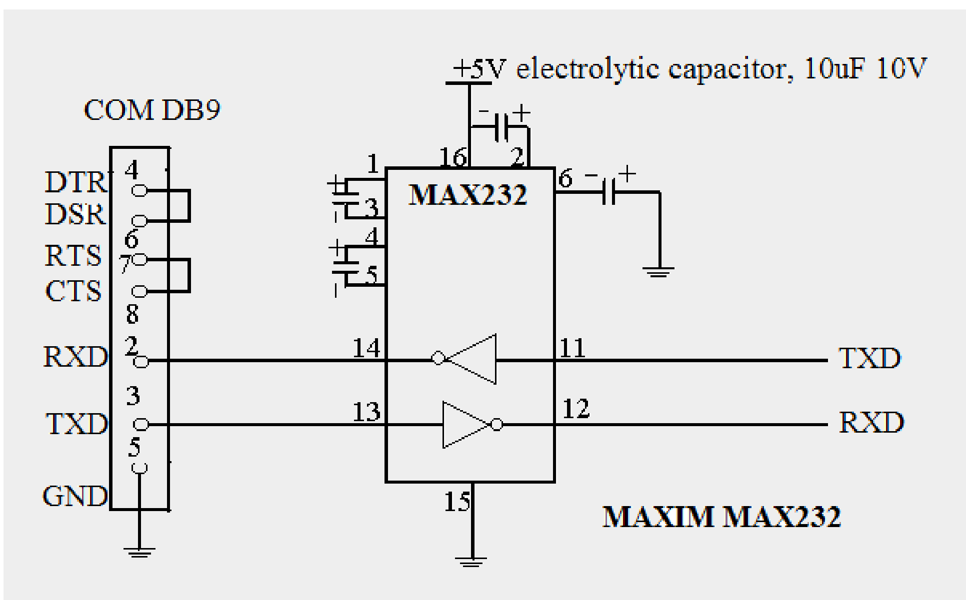

Fig 3.2: Connection between MAX232 and DB9 Connector.

RS232 Line Type & Logic Level	RS232 Voltage	TTL Voltage to/from MAX232
Data Transmission (Rx/Tx) Logic 0	+3V to +15V	0V
Data Transmission (Rx/Tx) Logic 1	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 0	-3V to -15V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 1	+3V to +15V	0V

Table 3.1: RS232 Line Logic levels

3.4 DB9 CONNECTOR:

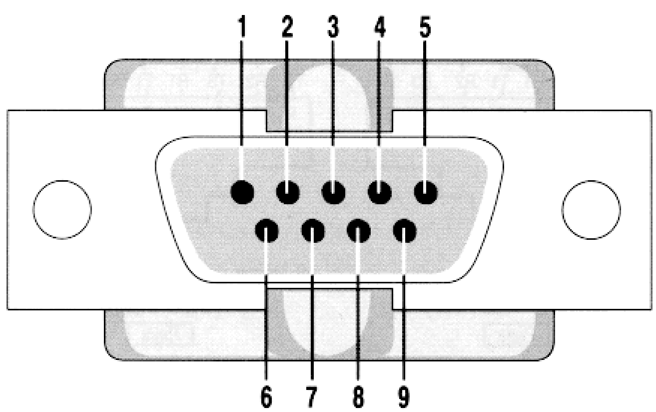

Fig.3.3: DB9 Connector

The DB9 (originally *DE-9*) connector is an analog 9-pin plug of the D-Subminiature connector family (D-Sub or Sub-D).

The DB9 connector is mainly used for serial connections, allowing for the asynchronous transmission of data as provided for by standard RS-232 (RS-232C).

Note that there are DB9-DB25 adapters for easily converting a DB9 plug into a DB25, and vice versa.

Pin number	Name
1	CD - Carrier Detect
2	RXD - Receive Data
3	TXD - Transmit Data
4	DTR - Data Terminal Ready
5	GND - Signal Ground
6	DSR - Data Set Ready
7	RTS - Request To Send
8	CTS - Clear To Send
9	RI - Ring Indicator Shield

Table 3.2: Pin Configuration of DB9 Connector

Chapter 4

Program & Hardware Design

4.1 CONTROL FLOW IN CODE

4.1.1. Initializations

The communication between the modem and the microcontroller was checked by using the command AT. The ECHO from the modem was turned off sending the command ATE0. For serial transmission and reception to be possible both the DTE (Data Terminal Equipment) and DCE (Data Communication Equipment) should have same operational baud rates. Hence we set the microcontroller at a baud rate of 9600bps. SIM memory was selected by sending the command AT+CPMS=”SM”,”SM”,”SM”. The system was then deemed to be ON.

4.1.2. Serial transfer using TI and RI flags

After setting the baud rates of the two devices both the devices are now ready to transmit and receive data in form of characters. Transmission is done when TI flag is set and similarly data is known to be received when the Rx flag is set. The microcontroller then sends an AT command to the modem in form of string of characters serially just when the TI flag is set. After reception of a character in the SBUF register of the microcontroller (response of MODEM with the read message in its default format or ERROR message or OK message), the RI flag is set and the received character is moved into the physical memory of the microcontroller.

4.1.3 Display

After validity check the control flow goes into the LCD program module to display the valid message stored in the memory. In case of multiple valid numbers all invalid stored messages are deleted by proper branching in the code to the “delete-message” module [6].

4.2 CIRCUIT DISCRIPTION

This project consists of GSM modem, microcontroller, led, and display. Admin/authority will send the message to the GSM module from his/her mobile, while the MODEM embedded with the system microcontroller receives SMS.

The DB 9 connecter is used to interface between the GSM modem and micro controller. GSM modem follows the USART protocol means it follows the serial communication protocol.
The output of the DB 9 connecter is given to the MAX232 IC to drive the micro controller and to convert the signal levels. The data received from the modem is converted to digital voltage levels which are converted by using MAX232 IC.

The output of the MAX232 is given to the port D of the micro controller. According to the message retrieved from the GSM modem next function will be performed. Commands given to the GSM modem are through the SMS, which is sent by the user or any GSM subscriber.

AT commands are sent to GSM modem to operate the devices and switch on and switch off the loads, devices etc.

According to the commands received from the modem to micro controller, the micro controller will read the SMS (message) which is in the memory of the micro controller, it follows the commands like switch on and switch off the devices which are connected to the micro controller.

Port A of the micro controller is connected to LCD display. Read, write, enable pins of micro controller are connected to the write, read, EA pins of the LCD display.

Along with displaying the message on LCD screen the GSM module will also forward the message to other users defined on the microcontroller

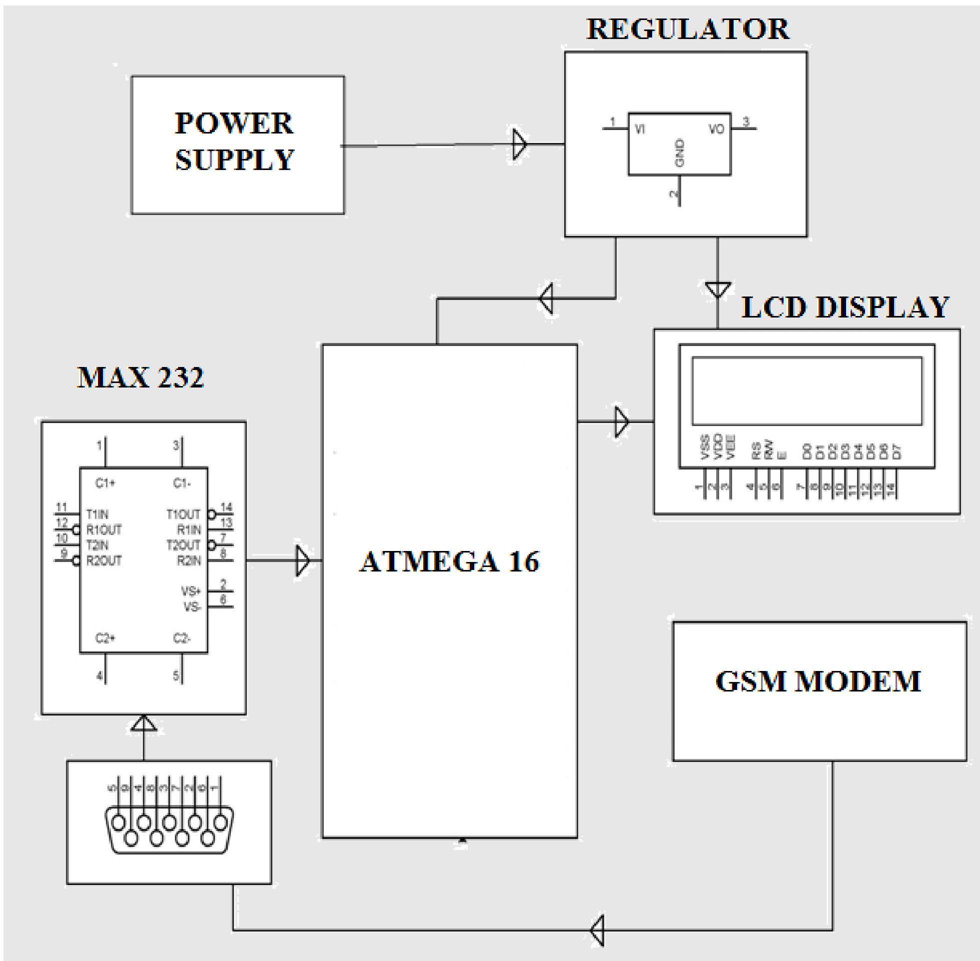

Fig 4.1 Circuit Schematic

Chapter 5

Conclusion

5.1 Conclusion

The prototype of the GSM based Appliance Control was efficiently designed. This prototype has facilities to be integrated with a number of peripheral devices thus making it truly mobile. The toolkit accepts the SMS, stores it, validates it, displays it in the LCD module and then runs the corresponding peripheral device. The SMS is deleted from the SIM each time it is read, thus making room for the next SMS. It will also forward the message to other users as per mentioned by the admin.

Wireless operations permit services, such as long-range communications, that are impossible or impractical to implement with the use of wires. It provides fast transfer of information and is cheaper to install and maintain. This project provides an efficient way of displaying messages on Notice Board using Wireless Technology. It also provides user authentication in order to avoid any misuse of proposed system.

5.2 Future Scope:

The use of microcontroller in place of a general purpose computer allows us to theorize on many further improvements on this project prototype. The ideal state of the microcontroller is when the indices or storage space in the SIM memory are empty and no new message is there to display. With proper use of interrupt routines the incoming message acts as an interrupt, the control flow jumps over to the specific interrupt service routine which first validates the sender's number and then displays the information field. It can also be used in Malls and Highways for Advertisement purpose. A moving display with variable speed can also be used in place of static display. Further development to this project can be done by providing message storage facility by non-volatile memory i.e. EEPROM attached to the microcontroller for retrieval of old messages if required. It can also be expanded to a bigger LCD screen.

Multilingual message display can be another variation in this model. The message can be first received, displayed in standard language. The same message can be converted to another language and the message can be displayed.

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