



Implementation of Home Automation System using GSM and Microcontroller Based

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ABSTRACT -This paper is to develop a system that allows for a user to remotely control and monitor multiple home/office appliances using a cellular phone. This system will be a powerful and flexible tool that will offer this service at any time, and from anywhere with the constraints of the technologies being applied. Possible target appliances include (but are not limited to) climate control system, security systems, lights, anything with an electrical interface. With this technology one can have an overview of the electrical usage of their appliances and can save much electrical power.

KEYWORDS- GSM (Global System for Mobile Communication), IVR (Interactive Voice Response), SMS (Short Messaging Service), UART (Universal Asynchronous Receiver & Transmitter), GSM Modem, CISC microcontrollers, PC (Personal Computer), JMS (Java Message Service), PHP (Hypertext Preprocessor).

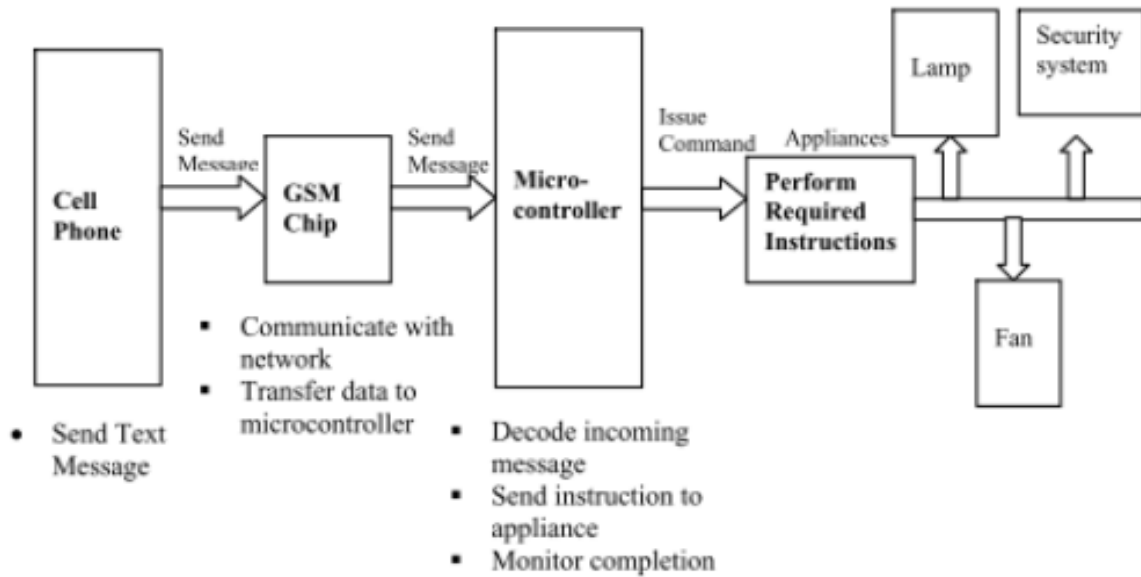
INTRODUCTION

GSM (Global System for Mobile Communications): It is a cellular communication standard. SMS (Short Message Service): It is a service available on most digital mobile phones that permit the sending of short messages (also known as text messaging service). "GSM based Control System" implements the emerging applications of the GSM technology. Using GSM networks, a control system has been proposed that will act as an embedded system which can monitor and control appliances and other devices locally using built-in input and output peripherals.

Remotely the system allows the user to effectively monitor and control the house/office appliances and equipments via the mobile phone set by sending commands in the form of SMS messages and receiving the appliances status. The main concept behind the system is receiving the sent SMS and processing it further as required to perform several operations. The type of the operation to be performed depends on the nature of the SMS sent. The principle in which the project is based is fairly simple. First, the sent SMS is stored and polled from the receiver mobile station and then the required control signal is generated and sent to the intermediate hardware that we have designed according to the command received in form of the sent message.

BLOCK DIAGRAM

It is a simple illustration of how we have implemented our project and the various parts involved in it. From the above representation, the first Mobile station is used as a transmitting section from which the subscriber sends text messages that contain commands and instructions to the second mobile station which is based on a specific area where our control system is located.



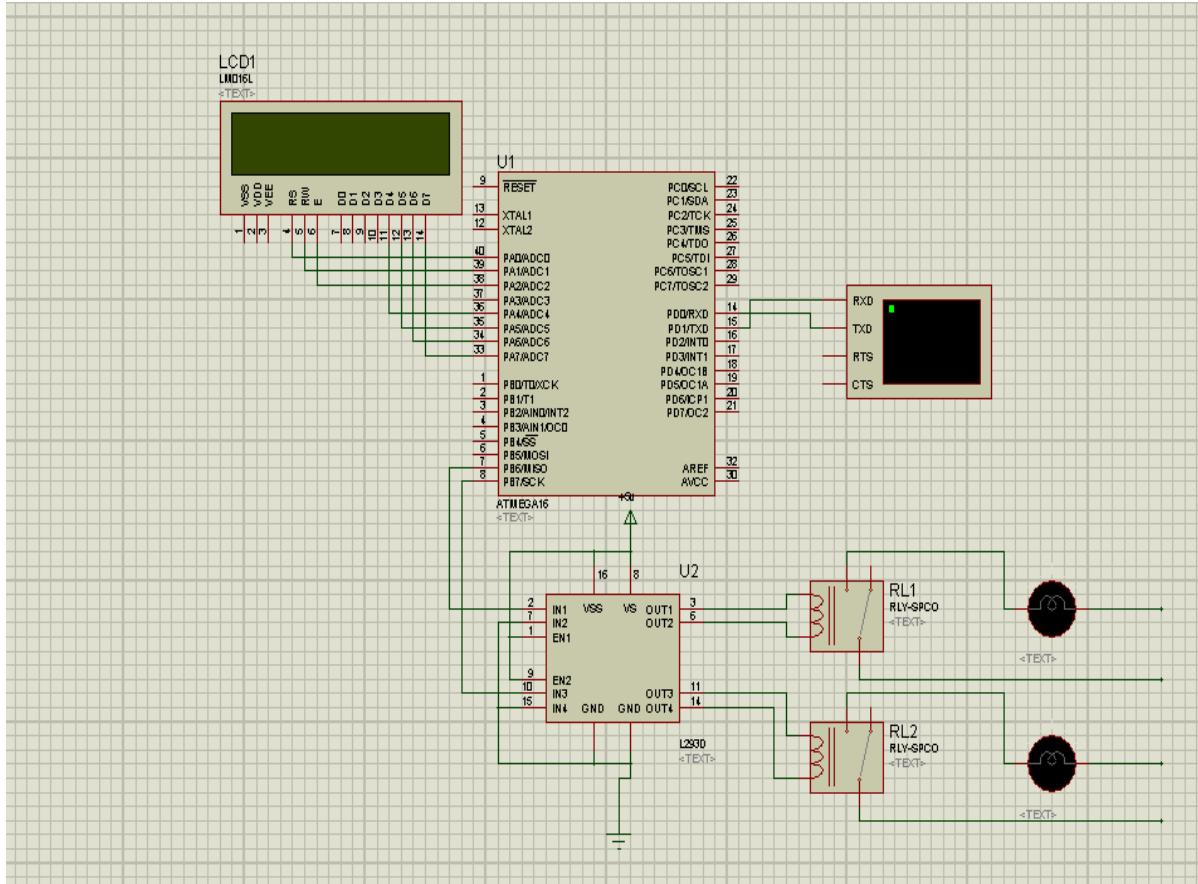
It is a simple illustration of how we have implemented our project and the various parts involved in it. From the above representation, the first Mobile station is used as a transmitting section from which the subscriber sends text messages that contain commands and instructions to the second mobile station which is based on a specific area where our control system is located. The cell phone indicated is a SIM900 RS232 GSM Module. The received SMS message is stored in the SIM memory of the phone and then extracted by the microcontroller and processed accordingly to carry out specific operations. In this project motor driver (L293D IC) is used to drive the relay circuits which switches the different appliances connected to the interface. The LCD is used to indicate the status of the operation performed by the microcontroller and also its inclusion makes the overall system user-friendly.

IMPLEMENTATION

In “GSM BASED ROOM AUTOMATION” system, LCD is connected with the PORTA of microcontroller in 4-bit mode. 4-MSB (Most Significant Bits) of PORTA are used for transfer data from controller to LCD and first three LSB (Least significant Bits) of controller are connected to RS, RW and EN pins of LCD respectively. PD0 and PD1 (Bit 0 of PORT D and Bit 1 of PORT D) are Rx and Tx (Receiver and Transmitter) pins of controller inbuilt UART circuitry which connected to the Tx and Rx pins of GSM Module respectively to establish the serial communication between controller and SIM900 module, Rx pin of controller is connected with Tx pin of module and Tx pin of controller is connected with Rx pin of module. PB6 and PB7 bits of PORTB are used for providing control logic to Driver IC.

L293D IC is used to drive the inductive loads of relays, both output of Driver IC is connected with the primary of SPDT relays and inputs are taken from the PB6 and PB7 bits of controller. +5v supply are connected with VSS, VS and Enable pins of both input.

Primary or Inputs of relays are connected with output of driver IC. NC and COM (Normally connected and common) terminals of SPDT relay are connected in series with the appliances circuit, relay in series are performing a switching action to ON of OFF the appliances.



TECHNICAL DETAILS
SIM900 RS232 GSM MODULE

This is a plug and play GSM Modem with a simple to interface serial interface. Use it to send SMS, make and receive calls, and do other GSM operations by controlling it through simple AT commands from micro controllers and computers. It uses the highly popular SIM900 module for all its operations. It comes with a standard RS232 interface which can be used to easily interface the modem to micro controllers and computers.





The modem consists of all the required external circuitry required to start experimenting with the SIM900 module like the power regulation, external antenna, SIM Holder, etc.

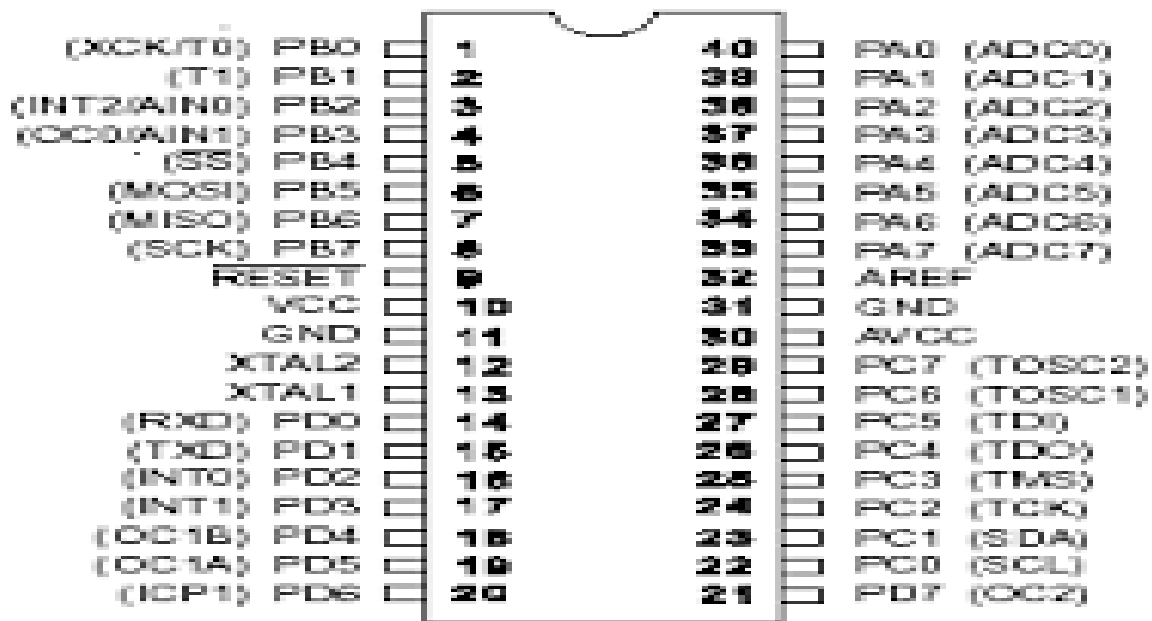
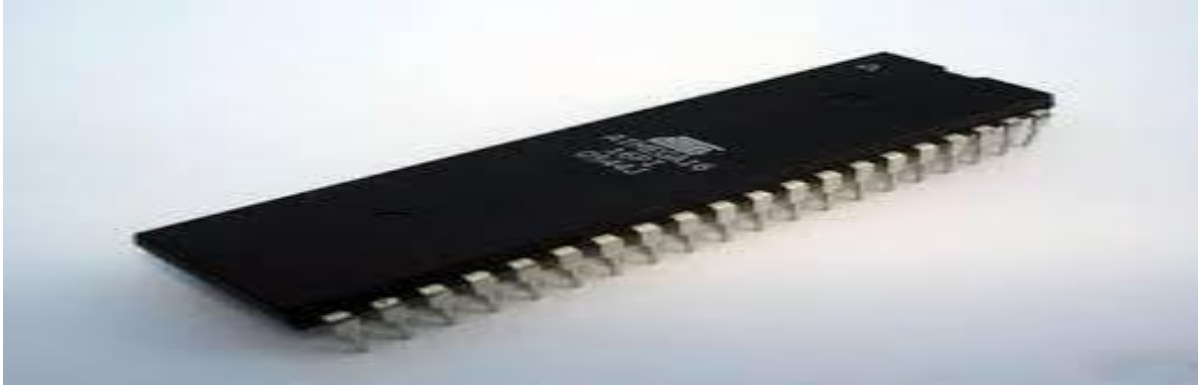
FEATURES

- Low operation cost of the system will make it suitable to own by personal or any agency that require remote control and monitor.
- Flash message mechanism is deployed to ease the user.
- Uses the extremely popular SIM900 GSM module
- Provides the industry standard serial RS232 interface for easy connection to computers and other devices
- Provides serial TTL interface for easy and direct interface to microcontrollers
- Power and Network LEDs for easy debugging
- Can be controlled through standard AT commands
- Comes with an onboard wire antenna for better reception.
- Board provides an option for adding an external antenna through an SMA connector
- The SIM300 allows an adjustable serial baud rate from 1200 to 115200 bps (9600 default)
- Modem a low power consumption of 0.25 A during normal operations and around 1 A during transmission
- Operating Voltage: 7 – 15V AC or DC (board has onboard rectifier).

ATMEL MICRO-CONTROLLER

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 designed to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.



The ATmega16 provides the following features: 16 Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 512 bytes EEPROM, 1 Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented

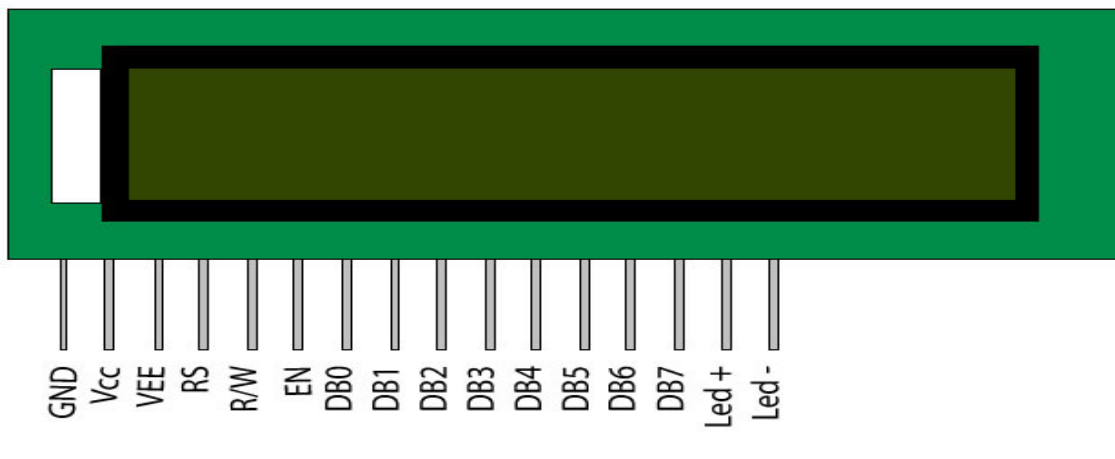
Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the

rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The device is manufactured using Atmel's high density nonvolatile memory technology. The On chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

The ATmega16 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

LIQUID CRYSTAL DISPLAY (LCD)



LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom character (unlike in seven segments), animations and so on.

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

LIST OF COMPONENTS

S No	Name of the component	Quantity required	Specification
1	GSM module	1	Sim900A
2	Controller	1	ATmega16
3	Display	1	16x2 Alphanumeric LCD
4	Relay Driver	1	L293D IC
5	Relay	2	SPDT Relay
6	Voltage Regulator	1	7805 IC
7	Capacitor	2	1000uF
8	Adopter	1	12v, 2A
9	Home Appliances	2	CFL

FUTURE ASPECTS

The scope of the paper “GSM Based control system” is immense. The future implications of the project are very great considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization, etc. The project itself can be modified to achieve a complete Home Automation system which will then create a platform for the user to interface between himself and the household.

LIMITATIONS

Our project has certain limitations and a list of such is mentioned below

- The receiver must reside in a location where a signal with sufficient strength can be received from a cellular phone network.
- Only devices with electrical controlling input ports will be possible targets for control.
- Operation of the controlling unit is only possible through a cell phone with SMS messaging capabilities.

CONCLUSION

The project we have undertaken has helped us gain a better perspective on various aspects related to our course of study as well as practical knowledge of electronic equipments and communication. We became familiar with software analysis, designing, implementation, testing and maintenance concerned with our project. This makes it possible for users to rest assured that their belongings are secure and that the television and other electrical appliances was not left running when they left the house to just list a few of the many uses of this system.

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