Industrial Automation Using 8051 Microcontroller

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Abstract **- This project mainly focuses on the controlling of home appliances remotely when the user is away from the place. The system is SMS based and user uses wireless technology (GSM). The system uses GSM technology thus providing universally access to the system for automated appliance control.8051 Micro Controller is the core component of this project. The objective of this project is to investigate a cost-effective solution that will provide controlling of home appliances remotely. The motivation was to facilitate the users to automate their homes having universal access. The home appliances control system with an affordable cost was thought to be built that should be mobile providing remote access to the appliances. This work includes the study of GSM modem using sensors. GSM network operators have roaming facilities; user can often continue to use the mobile phones when they travel to other countries etc.**

1.INTRODUCTION

"Industrial Automation using 8051microcontroller." 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 equipment via the mobile phone set by sending commands in the form of SMS messages and receiving the appliances status.[1] The main concept behind the project 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.[2] A microcontroller-based system has been proposed for our project. There are several terminologies that are used extensively throughout this project report. `

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).

2. MOTIVATION

The new age of technology has redefined communication. Most people nowadays have access to mobile phones and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted with the mobile phone. But the application of mobile phone cannot just be restricted to sending SMS or starting conversations. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red,

Bluetooth, etc. which has developed in recent years goes to show the very fact that improvements are in fact possible and these improvements have eased our life and the way we live. Remote management of several home and office appliances is a subject of growing interest and in recent years we have seen many systems providing such controls.

3. LITERATURE REVIEW

The literature related to the research topic has been reviewed for last twenty years in order to find out work carried out by various researchers. There are many systems for remote monitoring and control designed as commercial products or experimental research

platforms. It is noticed that most of the research carried out belongs to the following categories:

- Internet based Monitoring using Servers, GPRS.
- modems, etc. with different approaches.
- GSM-SMS protocols using GSM module individually or in combination with Internet technologies.
- monitoring using Wireless Sensor Networks.
- Wireless Monitoring using Bluetooth, Wi-Fi,
- ZigBee and RF (radio frequency).
- Applications have varied widely like Home.

Automation, Security Systems, Bio-medical applications, Agriculture, Environment, Reservoir, Bridge health monitoring, etc. [4]

4. PROBLEM IDENTIFICATION

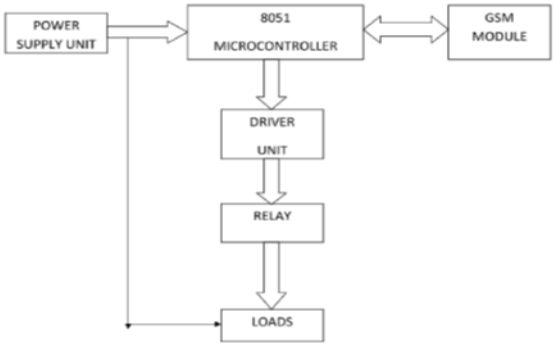
Technology has advanced so much in the last decade or two that it has made life more efficient and comfortable. The comfort of being able to take control of devices from one particular location has become imperative as it saves a lot of time and effort. Therefore, there arises a need to do so in a systematic manner which we have tried to implement with our system. The system we have proposed is an extended approach to automating a control system.[3]

5. WORKING PRINCIPLE

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.[1] A microcontroller-based system has been proposed for our project. The proposed approach for designing this system is to implement a microcontroller-based control module that receives its instructions and command from alular phone over the GSM network. The microcontroller then will carry out the issued commands and then communicate the status of a given appliance or device back to the cellular phone.[2]

ALGORITHM
Step 1: Start
Step 2: Phone initialization.
Step 3: Get Hardware Software
Step 4: Poll SMS from mobile phone
Step 5: If new SMS received go to step3 else, go to step1
Step 6: Receive SMS
Step 7: Check SMS pattern
Step 8: Control the device based on status
Step 9: Notify end user
Step 10: Go to step1

6.BLOCK DIAGRAM



COMPONENTS
Micro-Controller
An embedded microcontroller is a chip, which has a computer processor with all its support function (Clocking and reset), memory (both program storage and RAM), and I/O (including bus interfaces) built into the device. These built-in functions minimize the need for external circuits and devices to the designed in the final applications.[5] The improvements in microcontroller technology has meant that it is often more cost-effective, faster and more efficient to develop an application using a micro-controller rather than discrete logic. Creating applications for microcontrollers is completely different than any other development job in computing and electronics. In most other applications, number of subsystems and interfaces are available, but this is not the case for the Micro-controller where the following responsibilities have to be taken.

- Power distribution
- System clocking
- Interface design and wiring
- System Programming
- Application programming
- Device programming

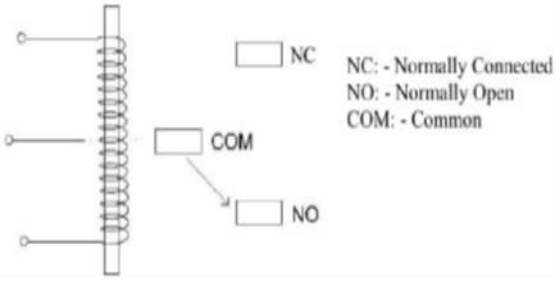
There are two types of micro-controller commonly in use. Embedded micro-controller is the microcontroller, which has the entire hardware requirement to run the application, provided on the chip. External memory micro-controller is the micro-controller that allows the connection of external memory when the program memory is insufficient for an application or during the work a separate ROM (or even RAM) will make the work simpler and sophisticated.[6]

ATMEL Micro-controller

The AT89C52 is a low power; high performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly flexible and cost-effective solution to many embedded control applications. The main features of this micro-controller are as follows.

- Compatible with MCS-51TM \Products
- 8K Bytes of In-system reprogrammable
- Flash Memory
- Endurance: 1,000 write/erase cycles
- Fully static operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 256 x 8-bit internal RAM
- 32 Programmable I/O lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Programmable Serial Channel

Relay



The relay driver is used to isolate both the controlling and the controlled device. The relay is an electromagnetic device, which consists of solenoid, moving contacts (switch) and restoring spring and consumes comparatively large amount of power. Hence it is possible for the interface IC to drive the relay satisfactorily. To enable this, a driver circuitry, which will act as a buffer circuit, is to be incorporated between them. The driver circuitry senses the presence of a "high" level at the input and drives the relay from another voltage source.[4] Hence the relay is used to switch the electrical supply to the appliances. From the figure when we connect the rated voltage across the coil the back emf opposes the current flow but after the short time the supplied voltage will overcome the back emf and the current flow through the coil increase. When the current is equal to the activating current of relay the core is magnetized and it attracts the moving contacts. Now the moving contact leaves from its initial position denoted (N/C)" normally closed terminal which is a fixed terminal.[2] The common contact or moving contact establishes the connection with a new terminal which is indicated as a normally open terminal "(N/O)". Whenever, the supply coil is withdrawn the magnetizing force is vanished. Now, the spring pulls the moving contact back to initial position, where it makes a connection makes with N/C terminal. However, it is also to be noted that at this time also a back emf is produced. The withdrawal time may be in microsecond, the back emf may be in the range of few kilovolts and in opposite polarity with the supplied terminals the voltage is known as surge voltage. It must be neutralized or else it may damage the system.

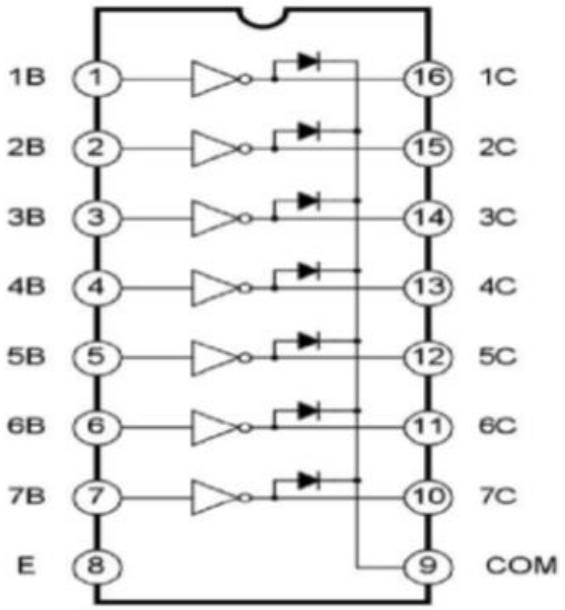
ULN2003 IC

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single Darlington pairs 500mA. The
Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas Discharge), line drivers, and logic buffers. The ULN2003 has a 2.7kW series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices.

Features:

- 500mA rated collector current (Single output)
- High-voltage outputs: 50V
- Inputs compatible with various types of logic.
- Relay driver application

Logical Diagram



7.GSM TECHNOLOGY

GSM is a global system for mobile communication GSM is an international digital cellular telecommunication. The GSM standard was released by ETSI (European Standard Telecommunication Standard) back in 1989. The first commercial services were launched in 1991 and after its early introduction in Europe; the standard went global in 1992. Since then, GSM has become the most widely adopted and fastest-growing digital cellular standard, and it is positioned to become the world's dominant cellular standard. Today's second-generation GSM networks deliver high quality and secure mobile voice and data services (such as SMS/ Text Messaging) with full roaming capabilities across the world.[3]

GSM platform is a hugely successful technology and as unprecedented story of global achievement. In less than ten years since the first GSM network was commercially launched, it become, the world's leading and fastest growing mobile standard, spanning over 173 countries. Today, GSM technology is in use by more than one in ten of the world's population and growth continues to sour with the number of subscribers worldwide expected to surpass one billion by through end of 2003.The Global System for Mobile Communication (GSM) network is a cellular telecommunication network with a versatile architecture complying with the ETSI GSM 900/GSM 1800 standard. Siemen's implementation is the digital cellular mobile communication system D900/1800/1900 that uses the very latest technology to meet every requirement of the standard.[4]

WORKING:

The block diagram 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 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. The relay driver (BUFFER ULN2003) is used to drive the relay circuits which switches the different appliances connected to the interface. The input from different sensors is feed to microcontroller and processed to operate respective task semi autonomously and autonomously. Assuming that the control unit is powered and operating properly, the process of controlling a device connected to the interface will proceed through the following steps:

- The remote user sends text messages including commands to the receiver.
- GSM receiver receives messages sent from the user cell phone.
- GSM receiver decodes the sent message and sends the commands to the microcontroller.
- Microcontroller issues commands to the appliances and the devices connected will switch ON/OFF.[5]

8.ADVANTAGES

1. It can be used in home security, offices and industries.
2. The range of device is very high.
3. Large no. of appliances can be connected.

4. Simple operation and easy to use.
5. We can also use this system for controlling heavy machineries in industries.[1]

9.LIMITATIONS

1. Sufficient balance or message pack required.
2. Network access required.[7]

10.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 equipment's and communication.

The extensive capabilities of this system are what make it so interesting. From the convenience of a simple cell phone, a user is able to control and monitor virtually any electrical devices. 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. The end product will have a simplistic design making it easy for users to interact with. This will be essential because of the wide range of technical knowledge that industries have.

REFERENCES

[1] K. Bromley, M. Perry, and G. Webb. "Trends in Smart Home Systems, Connectivity and Services", www.nextwave.org.uk, 2003.

[2] A. R. Al-Ali and M. Al-Rousan, "Java-based home automation system", IEEE Transactions on Consumer Electronics, vol. 50, no. 2, pp. 498-504, 2004.

[3] N. Sriskanthan, F. Tan and A. Karande, "Bluetooth based home automation system", Microprocessors and Microsystems, Vol. 26, no. 6, pp. 281-289, 2002.

[4] H. Ardam and I. Coskun, "A remote controller for home and office appliances by telephone", IEEE Transactions on Consumer Electronics, vol. 44, no. 4, pp. 1291- 1297, 1998.

[5] T. Baudel and M. Beaudouin-Lafon, "Charade: remote control of objects using free-hand gestures", Communications of the ACM, vol. 36, no. 7, pp. 8-35, 1993. 6. T. Saito, I. Tomoda, Y. Takabatake, J. Ami and K. Teramoto, "Home Gateway Architecture and Its Implementation", IEEE International Conference on Consumer Electronics, pp. 194-195, 2000.

[6] N. Kushiro, S. Suzuki, M. Nakata, H. Takahara and M. Inoue, "Integrated home gateway controller for home energy management system", IEEE International Conference on Consumer Electronics, pp. 386-387, 2003.