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Embedded based Industrial Monitoring System Implementation through ARM and GSM

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***Abstract*— Monitoring of industry is needed for present fastest growing world. Because everyone expects to achieve scalable result and safety measurement. In general to do this, there are many techniques available in present scenario. This paper explains how the machines in industry are monitored and controlled by user with GSM. We explained arm and GSM techniques to achieve better result in automation. The system what we proposed has microcontroller ARM and relays. Here microcontroller is the main unit among whole system and which accept the information from GSM communication. The user can automatically control the respective machine by switching relays and actuators. The microcontroller is instructed by embedded c language. KEIL and PROTUES Software's are used to simulate the result**

***Index Terms*— ARM7microcontroller, GSM, KEILsoftware, Monitoring, PROTUESsoftware and Relays**

I. INTRODUCTION

Monitoring or controlled by automation is very essential part in industry. The need of control industrial machinery and processes is to reducing the human interference. Now days The technology is growing very fast so that the automated technology also growing rapidly and which is used for tracking and display the information of machine with using wireless technology. The examples for wireless technology are *Zigbee, GSM and GPRS*. Present using technology are not correct automatic system, these technology are need to control time to time . Presently some technology like SCADA is used for monitoring. Here the major problem is that system cannot be use in remote places. In some industry completely monitored. Once the process started it runs continuously for month. From remote area we have to control some parameters like gas leakage, temperature, pressure, speed of the motor and need to observe fire safety also. Though the technology exist in industry need some skilled man power observing or monitoring parameters like leakage, temperature, pressure, speed of the motor and fire safety.

So here we present and implementing a automation system that works even if concerned person is not present at field, he can become aware, update and control the status of that particular plant with the help of GSM communication.

Here sensors are used to collect the date from machine or plant in industry environment. These sensor signals are transferred to the ARM controller. Based on this information user can control the respective machine that means the signals from user can transfer to ARM device through GSM wireless technology. These control signals will transfer from ARM device to sensor or relays to control the operation. In this way we controlled and monitored two or more tasks by user with using GSM.

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II. HARDWARE DESCRIPTION

Implementation of the monitoring industry is shown in the figure1 consists of microcontroller LPC2148 ARM7, GSM modem, different appliances, relays and power supply.

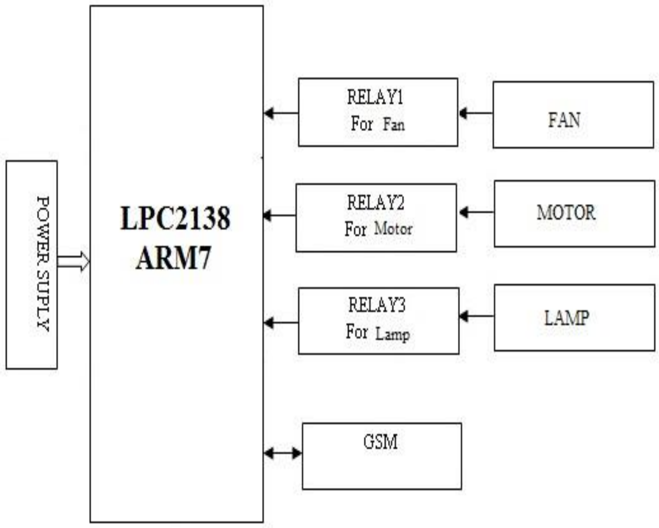

Fig1: Block Diagram

A. *LPC2148 ARM7 Microcontroller*

The LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory of 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces the code by more than 30% with minimal performance penalty.

Due to their tiny size and low power consumption, LPC2148 microcontrollers are ideal for the applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

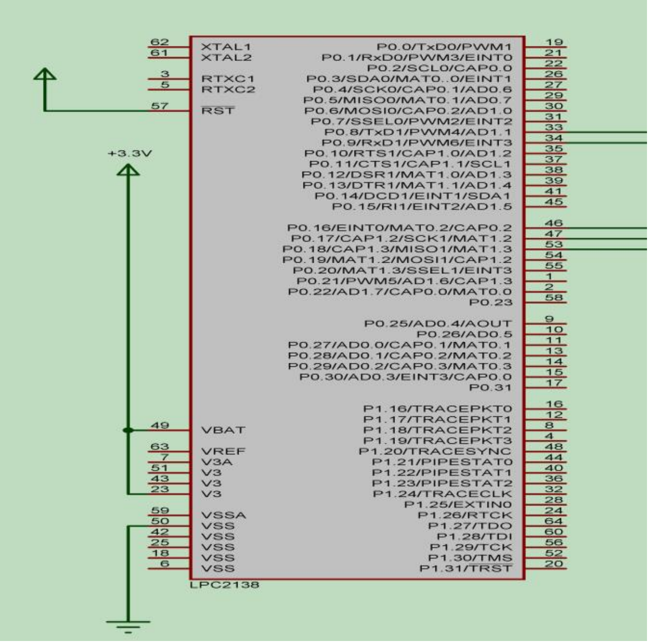

Fig2: LPC2138

B. GSM Modem

GSM (Global System for Mobile communications) used to transfer data or voice from one mobile to another mobile. In generally three wireless mobile techniques which are TDMA, CDMA and GSM. The microcontroller accepts the data from sensors and this same information is sent to GSM modem. Through this modem SMS (Short Message Service). Sent to user.

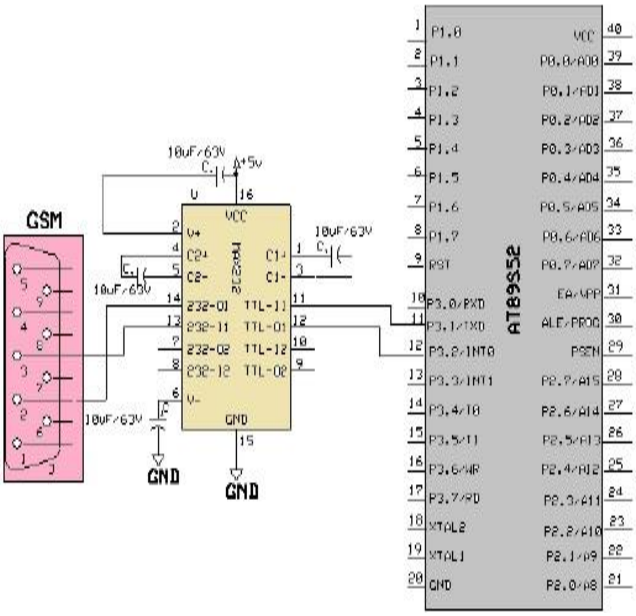

Fig3: GSM

AT command syntax:

The "AT" or "at" prefix must be set at the beginning of each command line. To terminate a command line enter <CR>. Commands are usually followed by a response that includes. "<CR><LF><response><CR><LF>". Throughout this document, only the responses are presented, <CR><LF> are omitted intentionally.

S.NO	The AT Command	Description of Commands
1	AT	Check if serial interface and GSM modem is working.
2	ATE0	Turn echo off, less traffic on serial line.
3	AT+CNMI	Display of new incoming SMS.
4	AT+CPMS	Selection of SMS memory.
5	AT+CMGF	SMS string format, how they are compressed.
6	AT+CMGR	Read new message from a given memory location.
7	AT+CMGS	Send message to a given recipient.
8	AT+CMGD	Delete message.

TABLE I: AT-Command set overview

C. MAX232 IC

Max 232 is a one of the communication device which is used for serial communication. The main use of Max 232 device is to convert signal from RS-232 to signals suitable for use in TTL compatible digital logic devices. It is dual receiver or transmitter and is used to convert RX, TX, CTS and RTS signals. It provide RS-232 voltage level outputs from a single +5V SUPPLY via on-chip charge pumps and external capacitors.

Voltage levels:

TTL Devices	RS232
Logic 0	+3 to+25v
Logic 1	-3 to -25v

TABLE2: Voltage levels

The internal structure of MAX232 device is shown in below

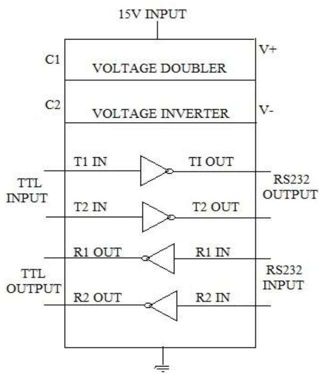

Fig4: max232

D. Relays

Relay is an electromagnetic switch which is used to drive high voltage loads depending on the logic values of microcontroller. Relay coil is connected to the collector of a transistor through 12V Vcc. Emitter of the transistor is grounded. a biasing resistor is connected to the base of the transistor. This value can be varies between 220Ω to 1.5kΩ.

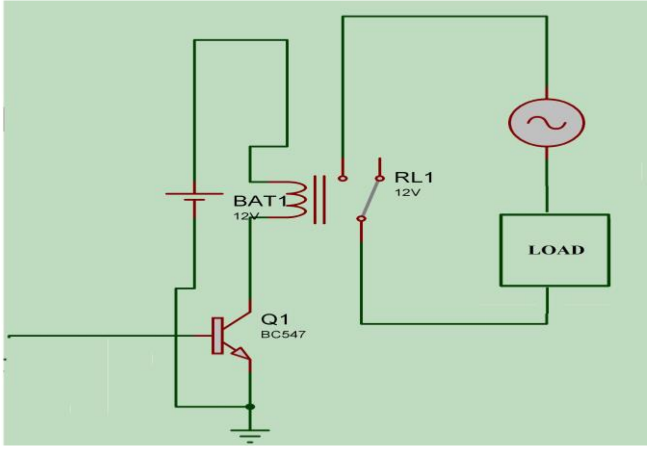

Fig3: RELAY

Inside the relay there are three terminals namely common, normally connected, normally open. By default the common terminal is connected to the normally connected terminal with a spring tension. Whenever we apply logic to the base of the transistor, the transistor acts as closed switch and makes the coil energized in to an electromagnet. This in turn attracts the small iron strip of the common terminal, which makes a connection between common and normally opened terminal. A load can be connected between these two terminals and a source as shown in the figure3.

E. Supply Unit:

As the microcontroller LPC2148 operating voltage is +5V DC. Through this power supply circuit we have to create a +5V DC which is given to the micro controller. The below components are used to create the power supply.

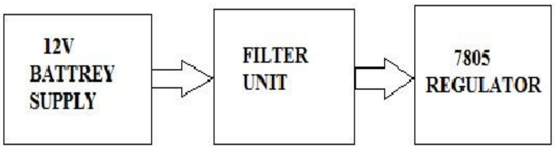

Fig4: Block diagram of power supply

Description:

12v dc power supply is given to filter unit That output DC Voltage is given to the positive voltage regulator LM7805 (i.e., 78 represents the positive series and 5 represent the output voltage it can provide). So the output of the regulator will be the regulated +5V DC. To indicate the condition of the circuit we place a LED at the end of the circuit.

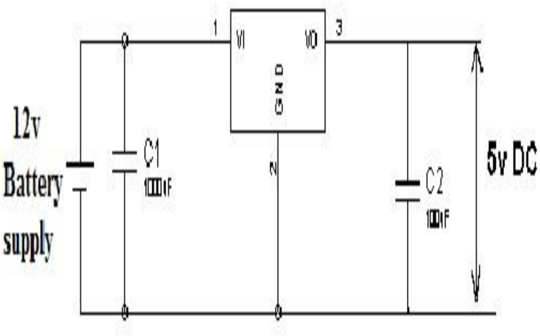

Fig5: Power supply unit circuit diagram

III. CIRCUIT DESCRIPTION

The circuit description of Embedded based Industrial Monitoring System Implementation through ARM and GSM is explained based on following schematic diagram. Port 0 (pin33& pin34) of microcontroller arm7 lpc2148 is connected to GSM modem (RXD&TXD). Here the circuit consist three loads which are fan, motor and lamp. The port 0 (pin46) is connected to transistor Q1 (BC547), The collector of the transistor is connected to rely1 and then connected to FAN. Base should be ground. The port 0 (pin47) is connected to transistor Q2(BC547), The collector of the transistor is connected to rely2 and then connected to MOTOR. Base should be ground. The port 0 (pin53) is connected to transistor Q3(BC547), The collector of the transistor is connected to rely3 and then connected to LAMP. Base should be ground. The supply voltage is +3v which is connected to pin49 and vss should be ground.

IV. SOFTWARE DESCRIPTION

This project is totally depends on embedded system so that it could be developed by using micro vision keil which is used to complied debugged and test by writing embedded –c . So here we use two software’s those are micro vision keil software and proteus software. First one is used to control the execution of embedded c program. The second one is used to simulate the circuit.

A. Micro vision Kiel software

It is possible to create the source files in a text editor such as Notepad, run the compiler on each C source file, specifying a list of controls, and run the Assembler on each Assembler source file, specifying another list of controls, run either the Library Manager or Linker (again specifying a list of controls) and finally running the Object-HEX .converter to convert the Linker output file to an Intel HEX file. Once that has been completed the HEX file can be downloaded to the target hardware and debugged. Alternatively KEIL can be used to create source file automatically compile, link and convert using options set with an easy to use user interface and finally simulate or perform debugging on the hardware with access to C variables and memory. Unless you have to use the tools on the command line, the choice is clear. KEIL greatly simplifies the process of creating and testing an embedded application

B. Proteus software

Proteus is a fully functional, procedural programming language created in 1998 by Simone Zanella. Proteus incorporates many functions derived from several other languages: C, BASIC and Assembly. it is especially versatile in dealing with strings, having hundreds of dedicated functions; this makes it one of the richest languages for text manipulation.

Proteus owes its name to a Greek god of the sea (Proteus), who took care of Neptune's crowd and gave responses; he was renowned for being able to transform himself, assuming different shapes. Transforming data from one form to another is the main usage of this language.

Proteus was initially created as a multiplatform (DOS, Windows, Unix) system utility, to manipulate text and binary files and to create CGI scripts. The language was later focused on Windows, by adding hundreds of specialized functions for: network and serial communication, database interrogation, system service creation, console applications, keyboard emulation, ISAPI scripting (for IIS). Most of these additional functions are only available in the Windows flavor of the interpreter, even though a Linux version is still available. Proteus was designed to be practical (easy to use, efficient, complete), readable and consistent. Its strongest points are:

Powerful string manipulation, comprehensibility of Proteus scripts, availability of advanced data structures: arrays, queues (single or double), stacks, bitmaps, sets, AVL trees. The language can be extended by adding user functions written in Proteus or DLLs created in C/C++.

V. WORKING PROCEDURE

The heart of the project is controller to control desire signal. We proposed the controller is LPC2148-ARM7 which is from ARM family. Embedded based Industrial Monitoring System Implementation through ARM and GSM system is used to the concerned person who is not present in the plant can monitor the industry appliance using his mobile. It is possible with microcontroller *ARM7 LPC2148.* So the working procedure is the microcontroller *LPC2148 ARM7* receives instruction from *GSM MODEM.* And transfers instruction to respective loads. As per instruction the loads are worked. These commands are sent by user .these commands are transferred to *GSM MODEM*. It shown in Fig9.

For example if press 1 or 2, the fan will be ON/OFF, if press 3or4, the motor will be ON/OFF and if press 5or6, the lamp Will be ON/OFF. If we want to operate all devices then press

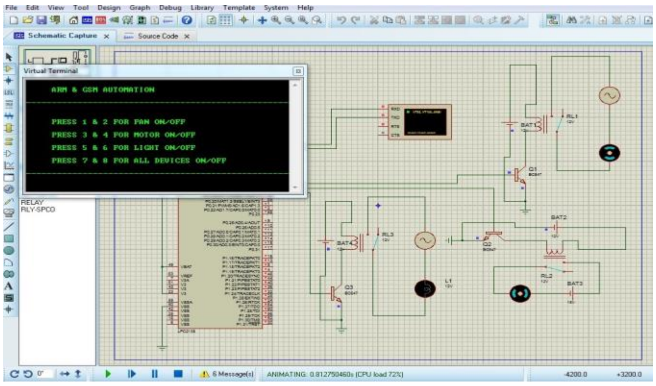

Fig6: Step 1

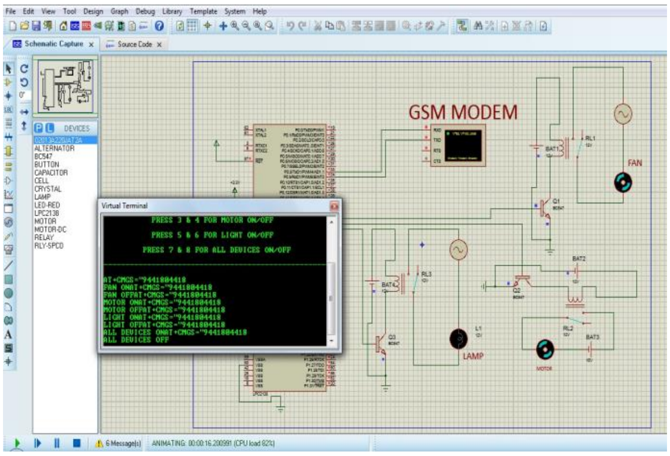

Fig7: Remaining steps

7or8 for all devices are ON/OFF. Above shown Feg6&7 is working procedure of embedded based Industrial Monitoring System Implementation through ARM and GSM system

When we run on proteus software the following fig8 will be generated

Fig8: Virtual Terminal1

The relays are used for controlling the action as ON or OFF. This total information will be forward to user through SMS. User can control the working of machine in industry plant by sending instruction through SMS. These are possible with GSM modem

The working procedure can be controlled by using relay switching. For real-time execution use *KEIL* software and the instruction dumped into microcontroller LPC2148-ARM7

VI. CONCLUSION

Implementation of this project is helped me to gain few unknown things related to our branch and also could study the practical knowledge of embedded systems. In this project can be implemented in huge plants like nuclear plants and power plants. The GSM network used helps in monitoring the system from a distant area. The microcontroller used helps in connecting many input/output devices at a time. These 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.

Finally we have successfully implemented the scalable industrial monitoring system through GSM and Lpc2148 arm7. In this the arm collects the date from sensors and sends to user through the GSM modem. The user can monitor the respective parameter via short message service.

VII. RESULT

Here the project of scalable industrial monitoring system is totally depends on microcontroller, Lpc2148-arm7. In INDIA, so many industries have been using following technologies to communicate the information from one end to the other end of the company. Bluetooth, limited to short range. Zigbee/IEEE802.15.4, range is up to only few kilometers maximum. Wi-Fi, it requires costly equipment setup and high power consumption. All the methods discussed above are quite expensive and complex to design. So we implemented this project through Lpc2148-arm7 and GSM. By this project we can monitor all parameters which are in industries, controlled and make the system to off by sending SMS from anywhere that covered by GSM service.

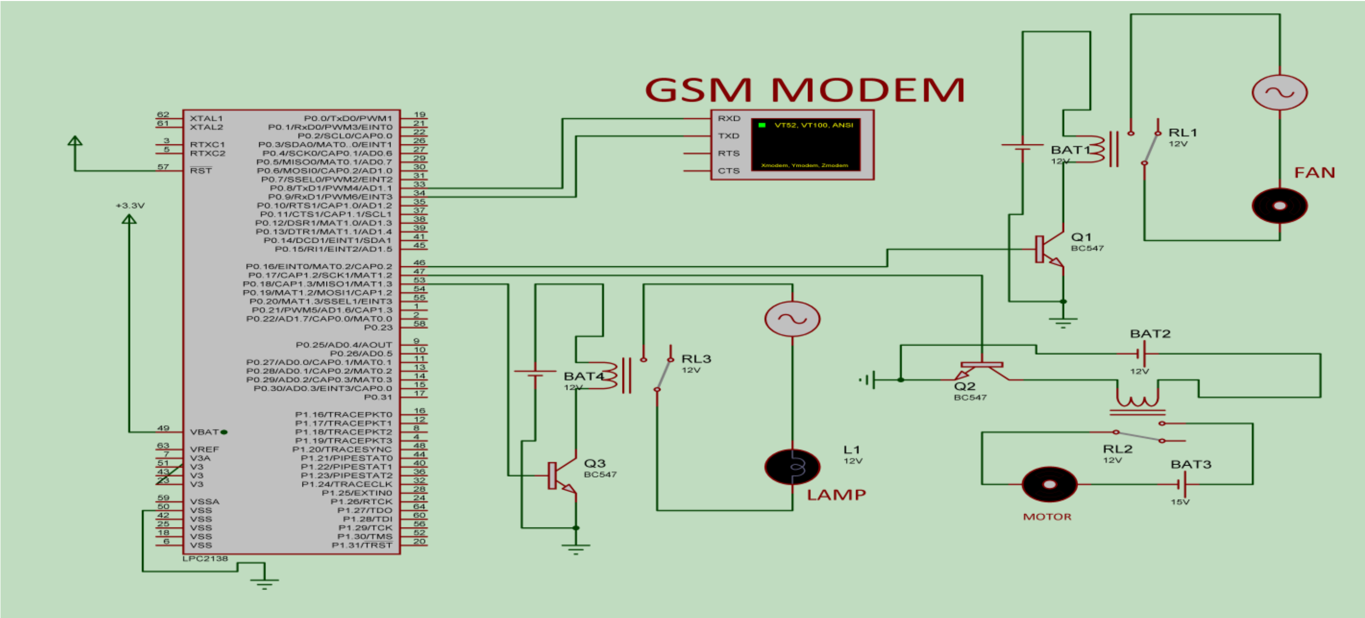

FIG9: CIRCUIT DESCRIPTION & WORKING PROCEDURE

APPENDIX

Introduction, Hardware description, blocks diagram description, working procedure, software description, conclusion and result.

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