Control of Instruments in Process Plant Through Mobile Phone

AR. Ramaiah

Electronics and Instrumentation Engineering

SRM's Easwari Engineering college

Chennai,India

Abstract—**Control of instruments in process plant through mobile phone" is designed to control instruments or high end appliances in process plant through mobile phones. Temperature sensor, pressure sensor and heater coil are connected to the PIC microcontroller using suitable signal conditioning circuits. A program is written to compare the set point values and measured values. If the measured value crosses the set point value, the PIC microcontroller sends an alter SMS to the process engineer's mobile phone. The GSM module is used for transferring the alert message to the GSM network. An FBUS data cable is used to interface GSM module with PIC microcontroller.**

I.INTRODUCTION

The major problem faced by the industry is monitoring instruments in process plant throughout the process by an engineer. Our project is going to solve this problem by using GSM technology. The project is designed to control instruments in process plant by using mobile phone; this uses sensors, signal conditioning circuits, PIC Microcontroller, GSM network with module, FBUS data cable. GSM (Global System for Mobile communication) is a global network which allows international roaming capability, digital cellular technology used for transmitting mobile voice and data services at the speed of 9.6kbps and it operates in the bands of 850MHz to 1.9GHz. Terrestrial GSM network covers more than 90% of the world's population. GSM satellite roaming has also extends service access to areas where terrestrial coverage is not available. "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 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. The messages are sent from the mobile set that contain commands in written form which are then processed accordingly to perform the required task. 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).

Keywords – GSM, SMS, MODEM, CONTROL.

II. INSTRUMENTATION PHYSICAL SETUP

LM35 Temperature sensor

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ^{o}C).The general equation used to convert output voltage to temperature is:

Temperature (in ^{o}C) $= V_{out}*(100\ ^{o}C/V)$

- Integrated Circuit
- More accurate
- Sensor circuitry is sealed
- Not subjected to oxidation
- Higher output voltage

KP200 Pressure sensor

Infineon Technologies KP200 is a fully monolithically integrated pressure sensor for the detection of different pressure. In this application, the pressure sensor is interfaced with PIC microcontroller trough suitable signal conditioning circuit. KP200 provides a signal pulse which is proportional to the pressure change in the process. The height of the signal pulse is independent of the ambient pressure, but dependent on the relative pressure change.

Ambient pressure range	53.6 to 110 kpa
Absolute pressure range	50.9 to 126.5 kpa
Supply voltage	4.5 to 11 V
Operation temperature	-40° to 85° C

PIC Microcontroller

PIC is a family of modified Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1650 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller".PICs are popular with both industrial developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability

- Dual In-line Package
- Reduction Instruction Set Computing architecture
- Built in oscillator with selectable speeds
- Inexpensive microcontrollers
- Wide range of interfaces including USB, Ethernet
- Reduced complexity in Assembly programming.

III. Communication between Instruments and GSM module:

FBUS
RS232 FBUS (Fast BUS) is an ANSI/IEEE data bus oriented towards mobile phones. The standard specifies a way for various pieces of electronics hardware to communicate, typically with one piece acting as master (sending a request) and another acting as slave (returning an answer). It's a **bidirectional full-duplex serial type bus running at 1,15,200 bits/sec.** It has three pins as follows:

- First pin for **data transmit**
- Second pin for **data receive**
- Third pin for **ground**

GSM Network with module

GSM is a second generation of mobile technology. GSM module has a modem which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone (For mobile operator, a GSM modem looks just like a mobile phone). Thus modem Generate, transmit and Decode data from a cellular network, this establishing communication between the cellular network and the microcontroller.
AT commands are used to control modem. AT is an abbreviation for **Attention**. Wireless modems need AT commands to interact with microcontroller. This covers a way to dial a particular GSM mobile number as well as sends a

SMS to it using AT commands with the help of Microcontroller.
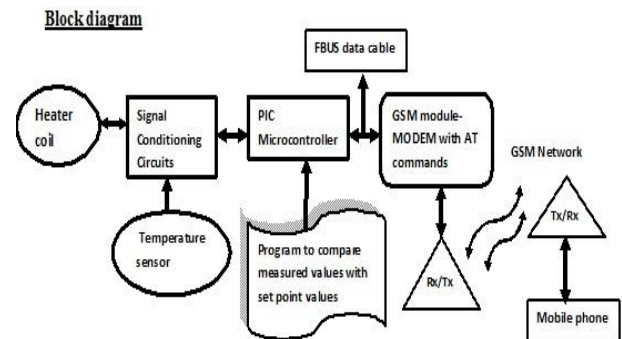
IV. Block Diagram

Fig.I Block diagram

V. Working:

GSM module is used to establish communication between a computer and a system**.** Global System for Mobile communication (GSM) is an architecture used for mobile communication in most of the countries. Global Packet Radio Service (GPRS) is an extension of GSM that enables higher data transmission rate. GSM module consists of a GSM modem assembled together with power supply circuit and communication interfaces (like RS-232, USB, etc) for computer.
Wireless MODEMs are the MODEM devices that generate, transmit or decode data from a cellular network, for establishing communication between the cellular network and the computer. These are manufactured for specific cellular network or specific cellular data standard technology (GPS/SIM). Wireless MODEMs like other MODEM devices use serial communication to interface with and need Hayes compatible AT commands for communication with the computer (any microprocessor or microcontroller system). GSM MODEM is a class of wireless MODEM devices that are designed for communication of a computer with the GSM network. It requires a SIM (Subscriber Identity Module) card just like mobile phones to activate communication with the network. Also they have IMEI(International Mobile Equipment Identity) number similar to mobile phones for their identification. A GSM MODEM can perform the following operations:

1. Receive, send or delete SMS messages in a SIM.
2. Read, add, search phonebook entries of the SIM.
3. Make, Receive, or reject a voice call.

The MODEM needs **AT commands**, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The MODEM sends back a result after it receives a command. Different AT commands supported by

the MODEM can be sent by the processor/controller/computer to interact with the **GSM cellular network**.

TABLE I. AT-Command set overview

Command	Description
AT	Check if serial interface and GSM modem is working.
ATE0	Turn echo off, less traffic on serial line.
AT+CNMI	Display of new incoming SMS.
AT+CPMS	Selection of SMS memory.
AT+CMGF	SMS string format, how they are compressed.
AT+CMGR	Read new message from a given memory location.
AT+CMGS	Send message to a given recipient.
AT+CMGD	Delete message.

System is controlled by SMS commands:

- Start
- Stop
- Status
- SET Value
- RESET Value
- Default Value
- SET Time
- RESET Time
- Default Time

VI. ADVANTAGES

- Cost Effective as it uses ICs.
- Simply set up/ construction.
- Closed loop control system with negative feedback is not required, which also reduces complicated system arrangement.
- Wireless communication between various equipments/devices.
- Easy implementation.

VII. APPLICATION

- Can be employed in thermal power stations, in boiler drum operations to control **Temperature**.
- This set up can be used to control **Pressure** process also by replacing heater coil by I to P transmitter and replacing temperature sensor by pressure sensor.
- Both the process can also be controlled at the same time by small enhancement in the set up.
- Can be employed in process plants having higher end appliances.
- Can be employed in industries where physical monitoring of process plant is much complex.

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