Process Parameter Monitoring and Control using RF Technology

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ABSTRACT

In today's world networking is important part of industrial automation for monitoring and control of industrial process parameters. To provide this automation we implement a system which uses 8051 Processor with RF & sensors. This design basically consists of RF communication module, processor module and sensor interface module. Due to which system has high performance and offers widest range of features such as flexibility, reliability, durability when compared with conventional and old solution to monitor and control. The main aim of our project is to implement an Industrial automation console that can be easily accessible from distant places through system running inside the industry. The basic functionalities in this proposed system includes automatic control of temperature, level, & gas parameters.

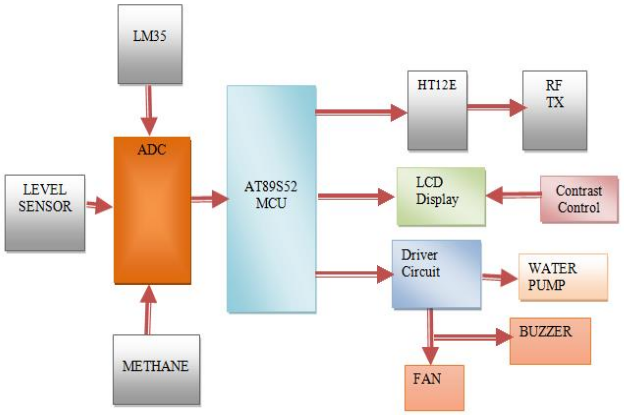
Keywords-*Microcontroller AT89S52, Sensors, RF Transceiver, Driver circuit.*

1. INTRODUCTION

Monitoring and control of industrial process parameter is complete system in which sensors are used to collect the data from the actual industrial environment. This actual environment may be the boiler, nuclear reactor or dairy plant etc. whose temperature, pressure, humidity and gas we have to monitor over the RF. RF supplies networking capability to group of computers in close proximity to each other such as in an office, school or a home. Most RFs are built with relatively inexpensive hardware. Radio frequency (RF) is any of the electromagnetic wave frequencies that lie in the range extending from around 3 kHz to 300 GHz, which include those frequencies used for communications or radar signals. RF usually refers to electrical rather than mechanical oscillations. Although radio frequency is a rate of oscillation. It describes the use of wireless communication, instead of electric wires. In this project we can use CC2500 RF Transceiver Module. It is low cost and designed for very low wireless applications. This circuit is intended for 2400-2483.5 MHz frequency band. This RF transceiver is integrated with high configuration modem. Modem supports various modulation formats and has 500 kBaud data rate. The encoder IC HT12E is used for encode the information.it simply convert 12-bit parallel data in to serial form which is suitable for the transmission. then RF transmitter transmit these data.in the other end the receiver received these data. The data is in serial form so we can convert these data in to parallel form i.e. decode these data using decoder IC HT12D.then display these parameters on personal computer with the help of RS-232.the R-232 is used for serial communication. We have used 230V AC power supply for fan as well as motor and 5V DC power supply for microcontroller. The step down transformer is used to reduce the voltage level and then bridge rectifier is convert this AC voltage in to pulsating DC voltage. This is not pure DC voltage the filter circuit gives us to pure DC voltage. And finally regulator regulates this voltage i.e. it maintains constant voltage level. We have used 7805 voltage regulator. The 78 describes the positive voltage series and 05 describes the voltage rating. We have used embedded C as a programming language and Keil 2.0/3.0uv as a software. using microcontroller flash software, we have dumping our HEX code in to microcontroller. In this paper we can monitored and control the parameters such as temperature and level from remote location and also display same information to control room on PC using RF technology.

2. SYSTEM ARCHITECTURE

- **Transmitter section**



- Receiver section

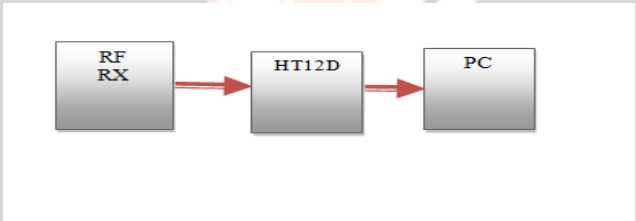


Fig-1. block diagram of RF based measurement.

Block diagram of a system is shown in fig-1.
It consists of –

- Temperature, level and gas sensor.
- .ADC 0808
- .Microcontroller
- Driver circuit.
- RF transceiver module.

In the system 8051 processor is used to measure and control the parameters. Input port is used to sense the Temperature, pressure and gas and output port is used to control the process. RF provides communication capability to the system. Sensors are used to collect the data from actual industrial field. Sensor is the device which converts the one form of energy in to another form. Data from three sensors i.e. LM35, Methane sensor and Level sensor are collected & send to the ADC. This collected information send to ADC 0808. We cannot provide analog value to microcontroller 8051 because microcontroller only reads digital values. So we should have to convert analog value to digital value using ADC 0808.In this project LM 35 is used to switch on/off fan when temperature goes low/high above set value. Level sensor is used to on/off pump when tank level goes to high/low. Gas sensor is used to detect gas and give buzzer when it is detected.

2.1 LM35 (TEMPERATURE SENSOR)

The LM35 is precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It has +10mv/ºC scale factor i.e. every change of 1ºC it gives +10 mv output. Range of LM35 is -55ºC to 150ºC. It is operated on 4V to 30V power supply.

2.2 LEVEL SENSOR

Level sensors detect the level of liquids and other fluids. In this project we can use magnetic reed liquid level sensor. The purpose of level switch is to make or break contacts as per liquid level i.e. when liquid level falls, the switch make the contact and motor will start. When liquid level rises, the switch break the contact and motor will stop and it will control the liquid level.

2.3 GAS SENSOR

Gas sensor detects the presence of gas in the atmosphere and according to that it generates the alarm condition. In this project we are using TGS 2611 type gas sensor. It is used to detect the methane gas. It consumes very low power and have a high sensitivity to methane. Life of this sensor is very long and has low cost.

2.4 ADC 0808

An analog-to-digital converter is a device that converts continuous physical quantity to a digital number. The output from the sensor is in analog, here microcontroller does not read this value, hence we can convert this analog value into digital form with the use of ADC 0808.

2.5 MICROCONTROLLER

In our project we can used AT89S52 microcontroller. It is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory, also it has 256 bytes of on chip RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a full duplex serial port, on-chip oscillator, and clock circuitry. It is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

2.6 DRIVER CIRCUIT

In driver circuit there are two relays considered as device 1 and device 2 respectively. Device 1 is used to control temperature. When device 1 get ON it means relay 1 will turn ON to turn ON the fan. Device 2 is used to control level. When device 2 get ON it means relay 1 will turn ON the pump.

2.7 RF TRANSCEIVER MODULE

The RF transceiver module is used for wireless communication. It includes RF transmitter and receiver section. The RF transmitter is placed in field area and receiver is placed in control room. In this project we can use CC2500 RF Transceiver. The signal from microcontroller is encoded through encoder HT12E and then it transmits through transmitter. At another end receiver receives this information and it is decoded through decoder IC HT12D and displays the parameters on PC.

3. ADVANTAGES

- Remote operation is achieved by using RF.
- Transmitting the information over wireless.
- Low disturbances.
- Programming code is not always required to change for different input parameters.
- Highly secure and easy to install.

4. RESULT ANALYSIS

We have designed system to monitor and control the different process parameters like temperature, level, and gas. We can display this information on LCD display as well as the PC in the control room. This parameter is controlled through driver circuit with the help of fan and motor. In future we can control more parameter of process through this technology.

5. CONCLUSION

This system is implemented to provide concepts and a prototype system for industrial automation using RF. It is implemented to monitor industrial parameters like temperature and gas with the help of the different sensors which can act as a network node using RF. RF provides higher data transfer rates and lack of leased telecommunication lines. RF's potential as a network for distributed measurement and control is virtually unlimited. RF provides inexpensive, relatively high speed network access to individual users and low delay that can support many applications. RF continues to be enhanced with greater performance, higher determinism and lower cost implementations.

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