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M2M Communication Based Wireless SCADA for Real-Time Industrial Automation

Sagar Joshi[1], Amit Joshi[2], Sanket Jabade[3], Ameya Jathar[4]
Electronics & Telecommunication[1, 2, 3, 4],K.J Somaiya Institute of Engineering & Information Technology, Mumbai[1, 2, 3, 4]
Email: sagar141291joshi@gmail.com[1]

Abstract- This project deals with the design of a Machine to Machine based Wireless Supervisory Control and Data Acquisition System for better Interactive Industrial Automation. It consists of a coordinator, various sensor nodes for sensing different parameters (temperature, pressure, light etc.), relay circuit for controlling the same parameters, a SIM900 module for wireless transmission and reception and a remote computer system for monitoring the required parameters. The GSM module is used for wireless communication between microcontroller board and the monitoring PC. The GSM module is programmed using AT commands. The system collects the information from all sensor nodes on demand and provides it to the end user through wireless network. Relays are used to control the measured parameters. The system is implemented using 8051 microcontroller family IC (89S52). The proposed system has low power consumption, low cost and targeted towards automation. The data gathered by sensor nodes can be monitored from any part of the world and from any computer having proper internet connection established in it.

Keywords: M2M Communication; Sim900; Monitoring & Controlling.

1. INTRODUCTION

The Machine to Machine communication refers to communication between computers, embedded processors, smart sensors, actuators and mobile devices, with or without human intervention. M2M is a new business concept originating from the telemetry technology, used for automatic transmission and measurement of data from remote sources by wire, radio or other means. Typically, M2M is based on very common and ubiquitously used technologies – wireless sensors, mobile networks and the Internet. Using GSM SIM 900 the working of industrial plant can be monitored and controlled from any part of the world. The core objective of the project is to implement wireless machine to machine communication using GSM SIM 900 module for industrial automation without having any distance barrier. In any business sector, managing remote assets requires time and effort. The business performance depends on the ability to monitor, to report and manage business process conditions at any of the re- mote unmanned sites. In order to make these processes easier and optimize them, wireless SCADA has been made**.**

2. LITERATURE SURVEY

With 4.9 billion of the total worldwide population (7.08 billion) already connected through mobile telephony, the market for Human-to-Human (H2H) communication will soon be saturated. The next era for mobile communication will be driven by extending mobile connections to machines, where only 1% of the total 50 billion machines have connection capability. The commercial market for M2M communication is expected to grow rapidly in the next ten years. There are many that would benefit from being able to communicate by the year 2020 [2]. The future M2M market will be fuelled by the wide variety of applications that this technology enables. These machine to machine applications can be grouped into the following categories: Home, Vehicular, e-Health, Telemetry, Fleet Management, Tracking, Finance, Maintenance, and Security. The drawback of existing SCADAs is that they all are having distance barrier. In the proposed system the communication between monitor and industrial plant is achieved using GPRS, the distance barrier is eliminated and automation is achieved from any part of the world.

3. IMPLEMENTATION

The structure of M2M communication based SCADA is as shown in the Figure 1. The circuit is implemented using the de- signed block diagram. The graphical layout of circuit diagram is developed in EAGLE 6.2.5 software. The PCB is made using the graphical layout .The explanation of each block is as follows.

3.1 Sensors:

Here the sensors used are basically analog sensors (like temperature, LDR, LPG and humidity) which detect or sense analog parameters and provide them to the Analog & Digital Converter i.e. ADC.

- **Temperature:** Temperature sensor used is LM35 which is analog temperature sensor. It is actually a voltage divider network in which the resistance varies according to the temperature and so does voltage across that resistor.
- **Humidity:** Humidity sensor is an SL-HS-220 humidity sensor module which gives analog output voltage.
- **Light:** For monitoring light, LDR (Light Dependent Resistor) is used which is also a voltage divider circuit. When light across the LDR increases, the resistance of the circuit de- creases and so the voltage across it varies.
- **Liquefied Petroleum Gas (LPG):** LPG sensor is MQ-6 gas sensor which can detect gas in the range 200 to 10000ppm which is widely used in security systems.

3.2 Analog to Digital Converter (ADC 0809):

Here ADC used is 0809 which is an 8 channel analog to digital converter. This block gets the input from analog sensors in the form of parameters to be measured and converts the same into digital form. ADC0809 provides high speed, high accuracy, reliability, minimal temperature and minimum power consumption.

Resol
ution-
8 bit

Suppl
y- 5V
Conversion time- 100
micro seconds
Low power- 15mW.

Algorithm for Analog to Digital Conversion:

- Send address on address lines
- Activate ALE
- Send Start of Conversion (SOC)
- Send End of Conversion (EOC)
- Wait for EOC
- Read data on data lines.

3.3 Microcontroller (89S52):

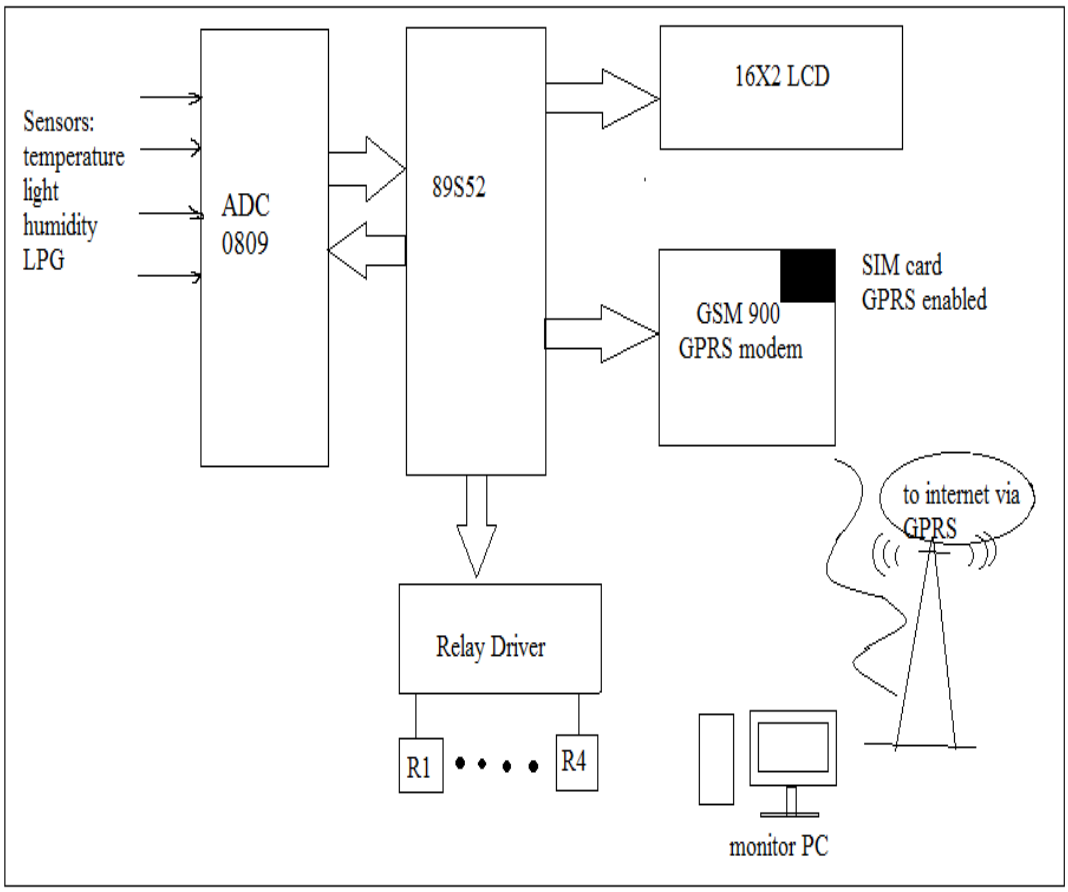
The microcontroller used in this block is from 89s52 family. It processes the data and displays the parameters on the LCD as well as provides it to the GSM module.

- 8 KB of ISP flash memory
- Operating frequency of 0 to 33 MHz
- 256*8 bit internal memory
- Full duplex UART serial channel
- Three 16 bit timers/counters
- Operating Voltage 4 to 5.5V
- 32 I/O lines

3.4 SIM 900:

SIM 900 GPRS module is used which has GPRS enabled SIM card. This module receives the processed data from microcontroller and it transmits the same wirelessly via GPRS to a remote PC. This is the most vital part of the system as the main advantage is that the access of the system can be done from any part of the world via mobile phone or any remote PC with internet connection.

3.5 Block Diagram:



4. CONCLUSION & FUTURE SCOPE

- The use of M2M communication is an advantage over the traditional Data Acquisition System (DAS) as the monitoring and controlling can be done without human intervention.
- As the system becomes fully automatic so the amount of error decreases and the efficiency of the system increases drastically.
- With the use of machine to machine technology and using GPRS connection the data can be viewed from any part of the world
- Even if the GPRS connection fails the system will be controlled at the factory/plant and even the data will be logged to analyze the problem later.
- The further improvement can be made by making the use of switches/routers to make a network make and also make system ore secure, the use of wireless camera can also be an added advantage for monitoring.

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