GSM Based Water level and Temperature Monitoring System

MANASA, G VIJAYA LAXMI

Assistant Professor, M.TECH STUDENT
Dept of ECE,Megha Institute of Engineering & Technology For
womens,Edulabad,Ghatkesar mandal,RangaReddy Dist,Telangana ,India

Abstract- The system we have proposed is an extended approach to monitor a control industrial system. We can monitor the industrial system from any location, due to this it will save lots of time in this busy era. In this project, we have designed GSM based water level and temperature monitoring system (WLTMS). We detect the water level of the tank which is connected to the industry. We also monitor the temperature of the tank. For this purpose, we used LM35 sensor which defines the parameters of the temperature sensor. Analogue output of LM35 is amplified through a process of signal conditioning, where OP-741 is used to amplify the signal. Amplified signal is fed into an ADC for the sake of digital data. This digital data is transferred to an LCD for displaying result. PIC microcontroller is used for this procedure. Modem is also connected to this controller for the wireless communication of the data through GSM technology by receiving an alert through SMS.

I. INTRODUCTION

Hughes et al. 2006 introduced a flood monitoring and warning system with the help of intelligent technique. This paper represents the wireless sensor network for flood warning which can be used in many programs like it can work with remote fixed network and in flood purpose and also capable to perform on flood site. Local computations are available to provide warnings to local stakeholders but combination of local and remote computation gives the opportunity of adaptation of the sensor network to maintain its optimal skills in further environmental conditions. By developing sensors on sites of flood we can manually collect data through GSM telemetry method and can be used in flood prediction. If more intelligence is required than Grid Stix sensor used as powerful embedded hardware [1]. Tseng et al. 2006 described a feasibility study on application of GSM–SMS technology to field data acquisition. This paper represents a study on GSM-SMS technology application to the data acquisition. This is a prototype system which is composed of field monitoring and host control platforms. Data transmission and communication are performed by GSM-SMS methodology. This paper indicates the format of short message which is suitable for monitoring the area and field data collection such as (temperature, humidity etc). By making the prototype system tests were conducted.

This paper is applicable for correction field data collected by using GSM-SMS and assures that integrity of transmission is guaranteed [2]. Wang et al. 2006 explained a Wireless sensor in food and in agriculture industry. This paper revolves around the new development in wireless sensor technologies that is suitable for wireless communication as applied to wireless sensors. For monitoring the agriculture and food production wireless sensors are used. This paper gives the facility of automation and in trace system. This paper defines the advantages of wireless sensor and secure from their fast adoption. Wireless sensors are suitable for impossible sensor applications, such as monitoring dangerous, hazardous, remote areas and locations. This technology provides nearly unlimited installation flexibility for sensors and increased network robustness [3]. Cao et al. (2006) analyzed Remote Meter-Reading System which is based on Wireless Communication Technology. This paper represents GSM and Bluetooth technology. There is meter reading system which consists of measures sensor intelligent terminals, meter, management centre and wireless communication network. The meter reading system is described and system's hardware and software are in detailed. Bluetooth technology defined information that can be get from meters and sensor control. GSM network communicated between intelligent terminal and management centre. This system has excellent features such as wireless, good quantity of data transmission, low workload, low expenses and high veracity [4]. Xiaorong et al. 2007 defined Data Acquisition System Based on GPRS. This paper indicates that in modern industry, control data acquisition plays an important role like in many cases data can be transferred to monitored which away from the manufacturing field. This paper is analyzing on GPRS technology and shows the result that system works for data acquisition and transferring on GPRS which has value on remote monitoring and remote diagnosis [5]. Alkar et al. 2009 demonstrated data-acquisition system in real-time applications. This paper shows the applications of low cost but considerable internet based data acquisition system. The main headline of the system it is an embedded hardware which is running by LINUX program.

(GPRS) which is available for any corner of the world through web program that is already available in that system. GPRS gives a real-time transformation data and allows producing interaction. In short this paper tells this system is fine for different embedded application [6]. Guozhen et al. 2009 designed communication system in Photovoltaic Power Plant by using SCADA. The features of SCADA introduced in this paper. Supervisory Control and Data Acquisition (SCADA) Systems are used in photovoltaic (PV) power plants for monitoring, control, remote communication purposes. In order to make reliable of the SCADA system (PV) plant, this paper defines two constructive solutions. One is security control plan and other is redundancy method. Control strategies have some parameters like security and data information. These parameters will able to resolve the differences between the SCADA system and remote terminal units (RTU). Redundancy mechanism has been solved through four redundancy services [7]. Frankowiak et al. 2009 designed microcontroller-based monitoring system by using Petri-Nets. This paper defines the research in the field of Petri-Nets. Petri nets used for processing and system monitoring. Petri nets are largely used in modeling and in simulation. Petri nets features interfacing with the world and it can be embedded within the process using a microcontroller procedure. The advantage is to provide low cost powerful and excellent access and gives the improvement in microcontroller [8]. Kishore et al 2010 defined a reliable data acquisition system with GPS and GSM. This paper represents the low cost Internet based data acquisition system. The system is running by LINUX application. The device communicates through GPRS which makes approachable in the world through web. The system eliminates the need for server software and maintenance. This system is available for different embedded applications by using real time modules through interfaces [9]. Meihua et al. 2011 described a remote medical monitoring system which is based on GSM network. This paper is based on GSM and represents the remote medical monitoring system. The system structure of the monitoring system is designed for each module. This system takes the liberty of GSM network to represent a remote communication in the form of messages. This paper describes that FPGA use as control to define the medical monitoring network. In this paper, FPGA of Acted Fusion series is chosen the control of each module. These FPGA includes the features of analog-to-digital conversion function [10].

Li et al. 2011 designed wireless sensor network that is based on water-level monitoring system and its implementation. Water-level monitoring has been widely used to reduce the danger of disasters and make sure the safety of ship channels and monitoring and control the aquatic environment. This paper defines that remote water-level monitoring system (RWMS). The RWMS has real-time remote monitoring, gives the knowhow of the future events and use for the protection of the safety of monitoring under the dangerous circumstances. RWMS consist of sensor module, data centre module, base station module and web releasing module. It has excellent features in the form of advantages like anti-jamming and expand abilities capabilities. This system shows excellent result in Poyanghu Lake [11]. Palafox et al. 2011 gives solution of SMS based water level monitoring system .This project work as warning device in difficult situations like it is helpful in flood water level during typhoons and in heavy downpours. At critical water level it can send message to that are associated with this device and he will alarm the sound. This project consists of two features one is Base unit and other is Sensor. The base units are designed with slim board with encore of ZiLOG. The sensors are made up of wires which are connected to make a simple switch. When sensor triggered it follows the instructions and GSM modem send warning messages to each level. The programme can be used in a C++ language [12]. Johari et al. 2011 provide detailed of tank water level monitoring system by using GSM Network. This paper presents the development of water level monitoring system with an integration of GSM module to alert the person through Short Message Service (SMS).This project gives the solution of shortage of water supply in dense population like in hostel where students are suffers from this situation because there is no system for monitoring the water level, when it reached at critical level. There is no person when the situation becomes bad due to this reason water level is monitored and data through SMS. The system was tested to reduce the shortage of water supply [13]. Ramani et al. 2012 defined and give solution of water level and for bore well by using GSM. In early there is no method for monitoring water level and bore as well. Farmers have to face very difficult situation and they work for the whole to switch the pump motor off but they cannot sort the solution. It can solve by GSM and it will automatically give alarm sound to mobile user. In this paper it describes its solution when the water level in the bore well drops threshold below or rises to the threshold level for pumping.

The user will immediately switch on or off the pump motor by mobile phone through SMS. By this method we will also able to avoid the air gap and empty running motor pump. This system has excellent advantages it is reliable, affordable and portable .By using sensor it will identify the water level to activate and deactivate the motor [14]. Klimchynski et al. 2006 defined embedded web server architecture or structure for internet based data acquisition and control. This paper gives solution for instrumentation, educational laboratories, industrial and home automation by web access. Web pages enhanced with Java Script .This system has some advantages Optimal and gives support of typical analog and digital transducer inputs/outputs. For Internet browsers that does not require an extra cost sensitive solution for low-end devices [15]. Alkandari et al. 2011 implements wireless network for monitoring water level system. Wireless sensor network can say the most important technology in this century. There were many achievements in the field of micro sensor technology and the low power electronics sector. WSNs provide a great amount of the excellent and supervision applications, especially for the critical environment like monitoring in sea. This project simplifies the hardware for the data acquisition and data visualization [16]. Sumeetha et al (2012) this project defined remote control application using by mobile phone. This paper provides the development of mobile phones as control and centre application for the induction of motor-pump which is used in the agriculture. Due to frequent power and abnormal voltage it is necessary to distribute water efficiently to the fields in normal conditions; the temperature sensor is used to detect the temperature of the environment and capacitive sensor is used to sense the water flow in the pipe. The microcontroller provides includes the protection against over-current, dry running and single phasing. It is expected or assumed that this application provides easy access to motor [17]. Murugan et al. 2012 this project indicated the industrial based temperature monitoring system by using GSM. The temperature monitoring system using GSM defines three stages signal conditioning circuit, analog to digital converter and with GSM Modem then message is send to mobile.ADC is used microcontroller works with digital inputs. GSM modem can be used to send and receive SMS through commands or procedure. At the transmitter side, the user sends an SMS to the GSM modem using AT commands.

The GSM modem performs the operation of sending message to a defined SIM number. GSM technology provides with high quality signal and giving them way to reach high quality digital communication at very lowest rates [18].

II. METHODOLOGY
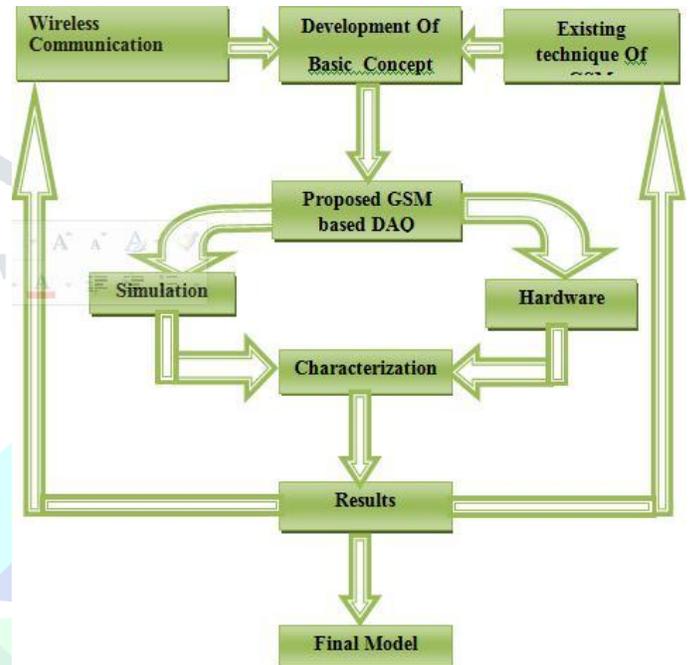
Figure 1: Flow chart of wireless communication method

This flow chart of wireless communication method specifically defines the GSM based data acquisition (DAQ). This flow chart determined the procedure of data acquisition, when we simulated the proposed GSM based (DAQ). The simulated result will be characterized and simulated process defines on the hardware and then the desired result will be display. If there is error in the simulation then it cannot works properly on the hardware. Due to this whole procedure of DAQ goes in above direction where the wireless communication theory is present and do the same procedure to reduce the error in simulation to characterize the simulation of DAQ.

III. SIMULATION

Figure 2: Simulation diagram

Figure 3: Hardware

Temperature sensor LM35

LM35 is temperature sensor and its accuracy is 1 ° C. LM35 have ranges from -55 ° C to 150°C. Its output is linear and each degree Celsius is equal to 10mv.e.g like 150 ° C = 1500mV and -40 ° C =-400mV.

LM35 does not need for external trimming to give accuracies of $\pm 1/4°C$ at room temperature .and $\pm 3/4°C$ over a full -55 to $+150°C$ temperature range. It can be easily useable for single supplies of power and it has also comfort level at minus supplies.

➢ *Applications*

LM35 is applicable in many ways like other temperature sensors. Its temperature will be 0.01°C of the surface temperature. It has assumed that air temperature and surface is approximately equal. If the air temperature is lower or higher than the surface temperature it will be die in between the air temperature and surface temperature. To solve this problem it is held at that temperature at which surface satisfies their interest. The simplest way to minimize this issue it cover up with wires and make it possible that wires are all at same temperature as surface then LM35 die's temperature will not be affected by air temperature. Temperature sensor LM35 does not need for any additional circuit. Due to its low output impedance, its output and its linear calibration it is possible that it will install easily and integrated in a control circuit. Due to low supply of current it has an effect of very low self-heating. LM35 sensor used in TO-96 plastic transistor. It used in TO-46 metal can transistor. LM35 is available in TO-202 package and also useable in 8-lead surface mount SO-8 package.

➢ *Advantages*

- LM35 can measure temperature more accurately than a thermistor.
- LM35 is sealed sensor circuit and there is no subject of oxidation.
- The LM35 generates a higher output voltage than thermocouples and does not require that output voltage is amplified.

Microcontroller (16f877A)

It is most demanded microcontroller. It has 40 pins and it has also many internal peripherals. The 40 pins ensures that it has capability to make it possible to use peripherals as functions and also make it possible that is there any need of external device or not if there are enough pins doing the same job.

Figure 4: 16f87A pin configuration

➢ *Family*

It has also family members like

- PIC16F873A
- PIC16F874A
- PIC16F876A
- PIC16F877A

➢ *Peripheral Features:*

- It has Universal Synchronous Asynchronous Receiver
- It hast transmitter of 9-bit address detection
- It has Parallel Slave Port (PSP) which is 8 bits wide with external RD, WR and CS controls.

➢ *Analog features*

- It is 10-bit up to 8-channel with Analog-to-Digital Converter (A/D)

  ➢ *CMOS Technology*

  - Its design is fully static
  - It has large operating voltage range (2.0V to 5.5V)
  - It is capable of Commercial and Industrial temperature ranges
  - It has low-power consumption

➢ *Advantages*

PIC is the series of microcontroller and has good features, they are comparatively better than microcontroller 8051. One advantage is that they have good speed in comparison to 8051 and we can also interface usb through it. PIC microcontroller are small in size and they carry out number of tasks, actually they are good in industrial works because due to low cost, large availability, better application files and serial programming capability. Architecture or designing of PIC are featured by number of attributes. They have separate codes and data spaces, small number of instructions. Some instructions are single cycle with one delay. RAM function works as both source and destination. Data space occupied Peripheral register, ports and CPU. There is no difference between register space and memory space because RAM provides equally service.

MAX232

MAX232 is actually an IC. It is serial interface RS232 for PC uses and its voltage range in between -12v and +12v. For the signal use voltage range is -3v to-12v and it stand for a logic one (1) and +3v to +12v then it stand for logic zero (0). It which converts the signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits.The MAX232 work as driver and receiver and converts the RX, CTS, TX and RTS signals. Its drivers provide an RS-232 voltage level output which is approximately.± 7.5 V from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it possible and useful for implementing RS-232 in devices. otherwise they do not need any voltages outside the 0 V to + 5 V range, as design of power supply which is not require to be more complicated to provide just driving the RS-232 in this case. To adjust to signal to voltage levels which are available on microcontroller pins it is compulsory to use voltage level converter.

SIM900D

The SIM900D is a complete Quad-band GSM/GPRS solution. The SIM900D delivers GSM/GPRS 850, 900, 1800, 1900MHz performance for voice Data, SMS and Fax in a small form factor and with low power consumption. It is designed with a very powerful single-chip processor. It can be available in all space requirements in M2M application.

➢ *Features*

- It has low power consumption
- Operation temperature between30°C to +80°C

Hitachi HD44780 LCD

Hitachi HD44780 LCD (liquid crystal display) controller. Hitachi organized the microcontroller to drive LCD display with interface which is connected to microprocessor or microcontroller. This device can show result in ASCII characters.

Figure 5 : diagram of LCD

The screens of LCD are limited to text and are generally used in laser printers, copiers and fax machines and in networking equipment such as data storage and in routers. The screens are in small number of configuration, mostly 16*2, 20*2 and 20*4. HD44780 chip can show address up to 80 characters. Character of LCD display with backlight which can be fluorescent and LED. With a standard use of 16 pins interface generally using pins on 0.1 inch / 2.54mm centres. Those LCD they do not have backlights used 14 pins, basically two pins used for to power the lights.

The HD44870 defines two modes of interfacing one for 4 bits and other one is 8 bits. By using the 4 bit mode is complex, but it reduces the number of active connections that we needed. In 8 bit mode instruction set are designed to allow switching without requiring the lower four data pins. If it is in4 bit mode, character and control data is transferred as pairs of 4 bit "nibbles" on the upper data pins, D4-D7.

The generator ROM of HD44870 contains 32 characters in a 5×10 dot matrix, and 208 characters in a 5×8 dot matrix. European version which include Cyrillic and a Japanese version of the ROM which display kana characters. The 7 bit ASCII is non standard for Japanese mostly we found YEN blackish character.

PGM Serial Programmer

Microcontroller burner is a hardware device which is designed with software and used to transfer the code of machine language to the microcontroller through PC. The compiler converts the code which is written in assembly, C, java languages to machine language code and then store it in hex file**.**

Microcontroller burner or microcontroller programmer applicable as interface in between PC and desired controller. The software of the programmer reads data from the hex file and then stored on the PC and put result into the memory of the controller. By using ZIP socket target controller programmer can be burned. By using serial, parallel and usb ports we can transfer data from PC to hardware.
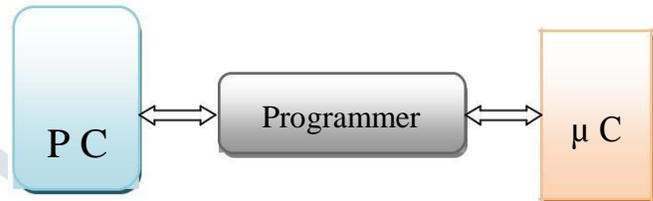

Figure 6: flow chart for whole circuit

IV. RESULTS AND CONCLUSION

This project has achieved its objectives and provides solution in the form a system that can monitor water level and sensing temperature via SMS by using GSM technology. This system has capability to detect water level of the tank and sense the temperature of the tank. For sensing the sensing the temperature we use sensor LM35. It notifies GSM modem to send SMS to intended user phone or you can say person in charge. The PIC microcontroller used as central processor which is connected to the modem by using MAX 232 to interface to check the microcontroller operation. A series of tests are organized and we found system is working properly. But delay in receiving SMS can occur due to detecting the circuit and the programming of PIC.
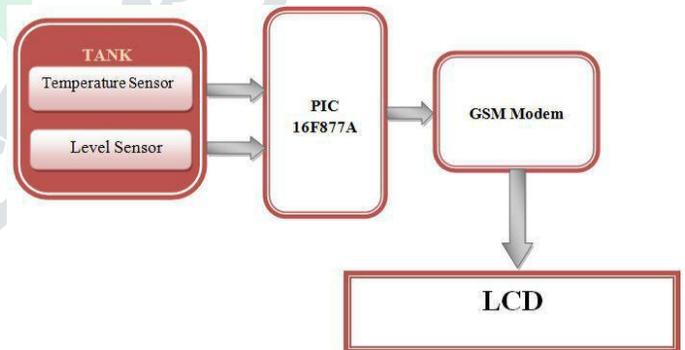

Figure 6: flow chart for display to sensors

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