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Instrumentation Network Protocol

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Abstract - *There is an increased demand for a reliable and efficient Automatic Meter Reading (AMR) system. Our project 'Instrumentation Network Protocol' aims to replace traditional meter reading methods and enables remote access of existing energy meter by the energy provider. Normally, Electricity department sends employees to take meter reading every month, which is an expensive and time consuming job. The proposed project provides a convenient and efficient method to avoid this problem. The electricity department and the user can get the readings of the energy meter of consumers via SMS using GSM technology. A microcontroller input is effectively interfaced to a digital energy meter (using I2C Protocol) that takes the reading from the energy meter and displays the same on an LCD.*

Key Words: **Automatic Meter Reading System (AMRS), GSM, Eagle software, SDCC**

1. INTRODUCTION

Instrumentation is a general term for measuring instruments such as indicators, measuring and recording physical quantities. **Instrumentation networks** are basically industrial communication networks that allow any automated devices or instruments to exchange data with other systems dedicated to the measurement. **Protocols** defines ways in which different communicating entities interact. In today's era, electrical power has become one of the most important necessities for survival and progress of mankind. Apart from efforts to meet growing demand, automation in the energy distribution is also necessary to enhance standard of living. So there is an increased need for Automatic Meter Reading (AMR) systems which collects meter readings electronically. In existing meter reading techniques in India, an electro-mechanical meter is fixed in the premise for measuring the usage.

The meters currently in use are only capable of recording kWh unit which are recorded by meter readers monthly, individually. The recorded data is then processed by a meter reading computer loaded with developed meter reading software and information required for conducting the reading. Each meter reader has to read approximately 300-500 meters daily. The manual meter reading is generally associated with many disadvantages. Since a service technician has to go to the premises and read out all the values of the meters. The resident should be also present to allow the service technician to read out the meter values, which is non-convenient. The manual reading also leads to errors, since the service technician is always under stress and has to read out the values in a short time. It is a tedious task. Also when meter reader is recording the electricity usage in the premise, he may come in contact with live wires possibly in dilapidated building premises. This motivates us to think about making a system which saves time and ensures safety of meter reader. The design process of our project title 'Instrumentation Network Protocol' is solely based on microcontroller.

There is always chance to improve any system and therefore our system is no exception to this phenomenon.

The following improvements can be done…

1. Further this project can be interfaced with a non volatile memory IC like EEPROM so that the user can change the mobile number as per the requirement.

2. Also a new interactive, user friendly graphical user interface developed using Microsoft visual studio .NET framework and C#. With proper authentication, users can access the developed web page details from anywhere in the world.

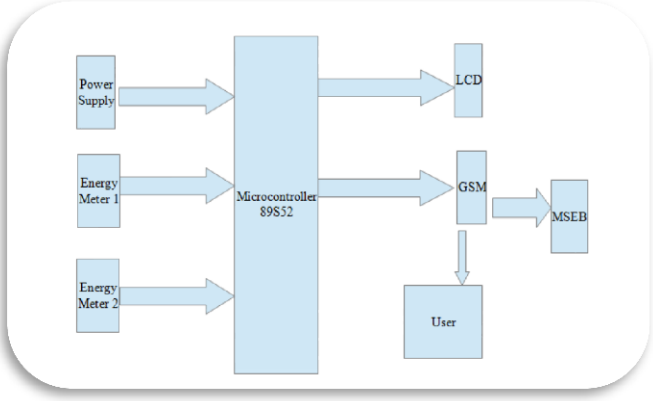
2. LITERATURE SURVEY

For this proposed system we surveyed and analyzed existing meter reading techniques in India through various IEEE papers like- In, Nayan Gupta and Deepali Shukla, "Design of Embedded based automated meter reading system for real time processing", Electrical Electronics and Computer Science (SCEECS) 2016 IEEE Students', the authors presented a new embedded technology based approach for automated energy meter reading system is proposed which enables the meter readings to be updated onto the web server automatically on a regular interval basis and sends bills to customers

each month. It provides a facility of recharging the energy meters remotely. Customers can pay bills of postpaid meters and can recharge the prepaid meters by sending a message to the service provider. The meter readings are sent to nearby located central station (gateway) using RF link and from there to web server using GSM. It also provides the facility of electricity tamper detection. The wireless controlling of meter reading system is mainly done using ARM 7 microcontroller. Embedded C is used for ARM coding and web server is designed using HTML. Database is created using MySQL. In, Manisha V Shinde and Pradip W Kulkarni, "Automation of electricity billing process", **Power Automation and Communication (INPAC) 2014 International Conference on**, pp. 18-22, 2014, the authors described Meter reading is done for the electricity, gas or water consumption where meter is used to record the consumption of this energy. For the purpose AMR (Automatic Meter Reading) they developed the concept in which automatic collection of readings, transmission and sending bill to customer is done easily. This technology mainly saves utility providers expense of periodic trips to each physical location to read a meter, so that efficiency, reliability and effectiveness increases. AMR is used efficiently as camera fixed in front of energy meter of each house will capture the image of meter when it gets command to capture and send this image to energy provider office wirelessly where it undergoes preprocessing and recognition of digits which are further used for generation of bill. This bill is again send to the respective meter owner as a message using GSM module.

Zigbee Based Energy Monitoring System with E-Billing through GSM Network published in International Journal of Innovative Research in Electronics and Communications (IJIREC) by Bhakthavathsalam R., Saqquaf S. M., Chaithra P. S., Gireesh P. G., Ravindraa K. N.

3. BLOCK DIAGRAM



8051 MICROCONTROLLER

The microcontroller 8051 was first developed by Intel in 1980 for use in embedded systems. It is based on Harvard architecture. It is an 8 bit microcontroller , later 16 bit and 32 bit variants were released. 8051 consists of 4kb ROM and 128 byte RAM. 8051 is a 40 PIN DIP IC consisting of 4 ports viz. port 0 to port 3. All the 4 ports can be configured as both inputs and outputs.

REGULATOR 7805

The microcontroller and other devices get power supply from AC to DC adapter or from direct ac lines through voltage regulator. The adapter output voltage will be 12V DC non regulated. The 7805 voltage regulators are used to convert 12V to 5V DC. Circuit details are shown in Fig.7 (a).The low cost DC power supply circuit included in the MCP3905 evaluation board which is created from a half wave zener diode-limited

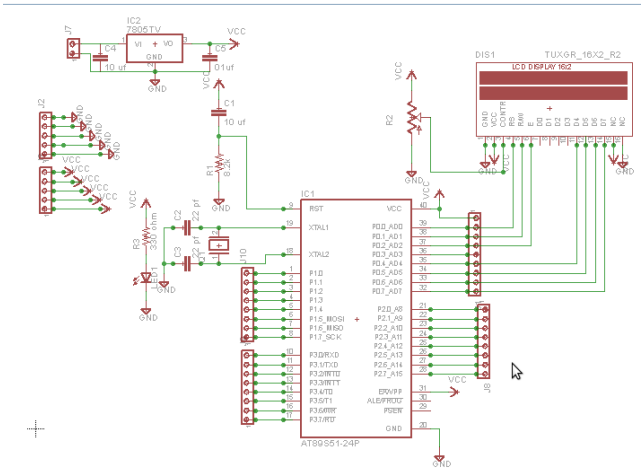
MCP3204

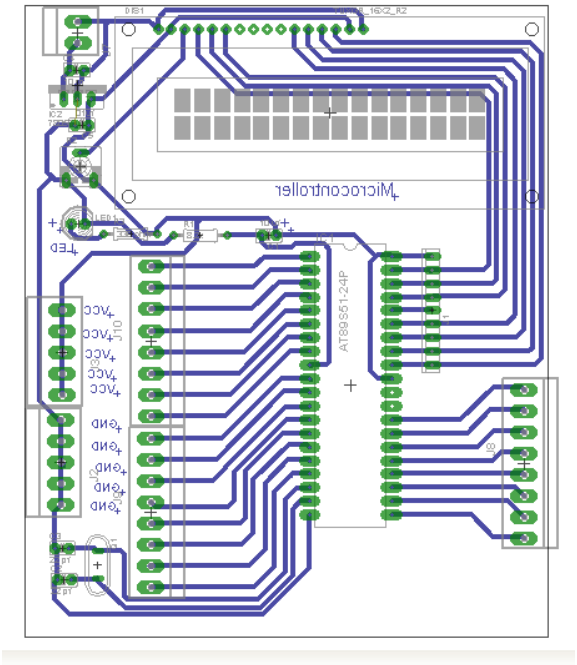
The MCP 3024 is a metering IC. This IC is manufacturing Microchip Technology Inc. The MCP3204 are successive approximation 12-bit Analog to-Digital (A/D)Converter.MCP3204/3208 both are operated on 2.7-5.2 Voltage. This IC is 12- bit resolution. The MCP3204 is programmable to provide two pseudo-differential input pairs or four single ended inputs. The MCP3024 is 14-pin PDIP & SOIC packages IC and total 6 devices are connected in input side. This IC are Hybrid IC. MCP fetching analog data to convert digital data. Differential Nonlinearity (DNL) is specified at ±1 LSB, while Integral Nonlinearity (INL) is offered in ±1 LSB (MCP3204/3208-B) and ±2 LSB (MCP3204/3208-C) versions.

LCD DISPLAY

In our project, LCD (liquid crystal display) displays output of the meters that is nothing but voltage consumed and also displays the message sent when the voltage exceeds beyond the defined threshold.

4. CIRCUIT LAYOUT

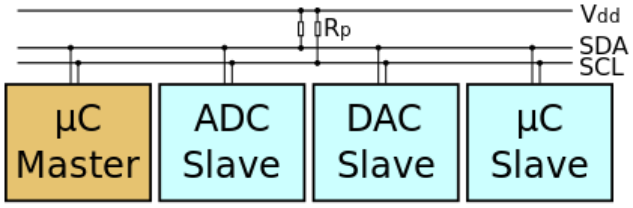




5. GSM

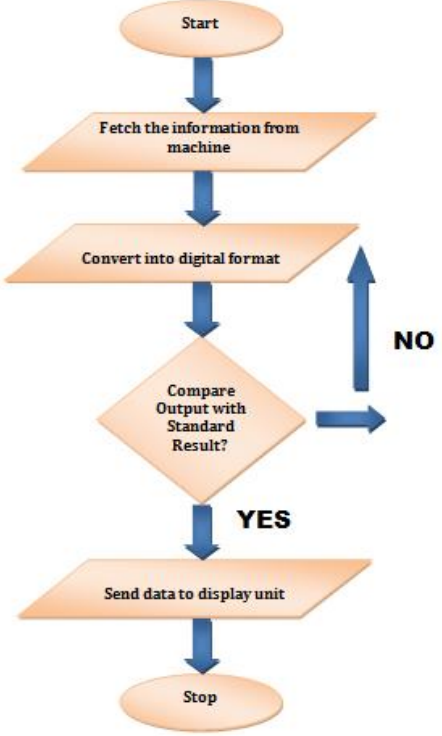
GSM stands for global system for mobile communication (GSM). GSM is a mobile communication modem. It is widely used mobile communication system in the world .
GSM system is digital system which uses time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot.
GSM system comprises of cells of different sizes such as macro, micro, pico and umbrella cells. The coverage area of each cell varies according to the implementation environment.

6. I2C PROTOCOL



I2C protocol is used for networking between the microcontroller with input and output devices.2 electronic meters are used for input pulse generation and output is obtained through a GSM module. I2C protocol uses master-slave architecture for communications between the devices. It consisted of a signal master and multiple slave components. I2C uses only two bidirectional open drain lines ,serial data line & serial clock line, pulled up with resistors. Typically voltages used ar +5V or +3.3V although systems with other voltages are permitted. I2C is popular for interfacing peripheral circuits to prototyping systems ,such as the arduino and raspberry pi.

7. FLOW CHART



8. WORKING

In this project two energy meters are interfaced with a microcontroller unit using I2C protocol.

To simulate energy meters we use two potentiometers which are connected to 12 bit ADC MCP3204.

The 12 bit ADC samples input voltages at sampling rate of 4096 samples per sec.

This gives the project a high resolution input which is converted into digital pulses by the ADC.

The output of the ADC is connected to the input port of the microcontroller.

The I2C protocol is implemented in the program which is programmed in the microcontroller.

In this protocol the microcontroller acts as a master device while the ADC, LCD and the GSM module acts as slaves.

The microcontroller displays voltages of both meters on the LCD.

Every time the voltages on any one of the meters are varied a SMS is sent to the mobile through the GSM module.

9. ADVANTAGES

[1] Its accuracy is high as compared to the conventional measurement system and has better reliability than the opto-coupler technique.

[2] It automates the procedure of meter reading which saves time and resources.

[3] It is compact in size which makes it easy to install and takes minimal space.

[4] It is very difficult to tamper and therefore safe from individuals performing malpractices which result in financial losses of the electricity companies.

[5] It will increase the level of transparency between the company and the consumers which will save consumers from paying excess amount to the company.

10. DISADVANTAGES

[1] Its design is comparatively complex which makes it difficult to design and troubleshoot.

[2] Implementation cost is comparatively higher.

[3] Maintenance is required regularly.

11. CONCLUSIONS

We conclude that our proposed project will automate the process of meter reading and will save both money and time which are both very valuable. It will benefit both the electricity company and the consumer equally by increasing the transparency in the system and increasing the safety towards the malpractices such as tampering. This project can be further modified by connecting the system with a web server which will allow the readings to be taken through the internet. This project can be used to interface with different types of metering systems in domestic as well as industrial applications.

12. REFERENCES

[1] Ashna k. Sudhish N George," GSM Based Automatic Energy Meter Reading System with Instant Billing", 2013 International Conference on Automation Computing, Communication, Control and Compressed Sensing (iMac4s), March 2013.

[2] 'The 8051 microcontroller' – Mackenzie.

[3] Nayan Gupta and Deepali Shukla, "Design of Embedded based automated meter reading system for real time processing", Electrical Electronics and Computer Science (SCEECS) 2016.

[4] GSM: protocols, terminology and implementation – Gunnar Heine

[5] Wireless automated digital Energy Meter-Bharath P. Virtha.