ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Smart and Secured Power Reading System

D.Udayasree
M. Tech Scholar,
Vidya Bharathi Institute of Technology and Sciences.

G.Vijay Kuma
Associate Professor,
Vidya Bharathi Institute of Technology and Sciences.

S.Anil Kumar
Application Engineer,
Unistring Tech Solutions Pvt Ltd.

Abstract:

In this system an Intelligent Energy Meter is installed in every household unit. The meter is communicating with GSM module which facilitates bidirectional communication between the two ends using the existing GSM. Server can easily control energy meter by sending a command using SMS. The bidirectional GSM communication using SMS ensures the effectiveness of these measures. Actions against Illegal consumers can also be taken.

Keywords:
GSM, ARM, LPC2148, Energy Meter

Introduction:

An Electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device. But sometimes the limited functionality of these meters restricts their application; especially in inaccessible positions. A possible solution is a Wireless Energy Meter (WEM) which is able to send its data via wireless communication to a PC or a remote device where monitoring and analysis of the data will be easily made. This measurement system is aimed to be used in measuring energy related quantities such as units consumed, consumed power, active load etc. of a house.

2. Proposed System:

In the proposed system the power utility maintains a server and each consumer are provided A Smart energy meter. The server and meters use GSM module respectively to communicate with each other using the GSM network.

The Smart energy meter consists of a Microcontroller (ARM7), GSM module, current transformers, potential transformers, LCD display and a relay. The Microcontroller calculates the energy consumption by counting the output of Current and potential transformers on an Interrupt basis. The Microcontroller uses AT command set to communicate with the GSM module (mobile phone). The Embedded C programming language and the Keil uvision4 software have been used to program the Microcontroller. As the user consumes energy, the corresponding units are updated to consumed units are displayed using LCD. After regular time intervals the server sends a command to the user meter system, enquiring about the consumed energy. After receiving the command the system will read the EEPROM units reading and will send the consumed energy along with the details of the user. In the mean time of the bill generation, if the user did not respond to pay the bill, then immediately the server send a command to meter system to disconnect the load. If the user pays the amount of the bill then server sends a command to connect the load. By this the human power is less used.

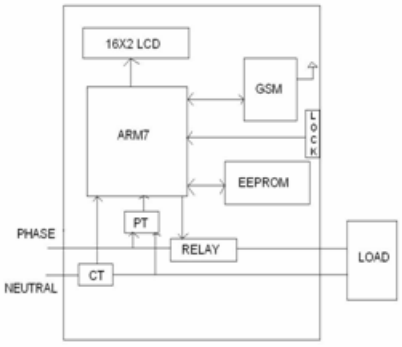

Fig 2: Block Diagram

For the designing of the proposed system we are using LPC2148 microcontroller for controlling the whole system by programming it.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Potential Transformer (PT) is used to calculate the voltage. Current Transformer is used to calculate the power consumed by the load. Relay is used to "CONNECT" or "DISCONNECT" the load. Load is designed by a bulb setup for showing the consumption of the electricity. EEPROM is used to store the consumed units. LCD is used to display the units to the user.

3. Theft Control Measure

Protection against Tampering

Consumers or professional ones may try to open the energy meter and tamper it to show low or no energy consumptions. To get rid of this problem, one switch is used at opening side of the proposed energy meter. Output of switch is connected to external interrupt pin of the Microcontroller. In normal conditions, the switch will be closed and the Microcontroller will detect 5V at its external interrupt pin. If consumer tries to open the energy meter the switch will be opened and the Microcontroller will detect 0V at its external interrupt pin. If this occurs, the Microcontroller immediately notifies the server and disconnects the load from the supply.

4. Hardware Implementation

History of ARM:

ARM stands for Advanced RISC Machine. The first Processor in ARM family was developed at Acorn Computers Ltd between October 1983 and April 1985. Acorn Computers was a British computer company established in Cambridge, England, in 1978. The company worked for Reduced Instruction Set Computer (RISC) processor design. The company produced a variety of computers which were very popular in the United Kingdom. These included the Acorn Electron, the BBC Micro and the Acorn Archimedes. Particularly BBC Micro computer dominated the UK educational computer market during the 1980s and early 1990s. The ARM7TDMI core is a 32-bit embedded RISC processor delivered as a hard macro cell optimized to provide the best combination of performance, power and area characteristics.

ARM7TDMI Features:

- 32-bit ARM instruction set for maximum performance and flexibility
- 16-bit Thumb instruction set for increased code density
- Unified bus interface, 32-bit data bus carries both instructions and data
- Three-stage pipeline
- 32-bit ALU
- Very small die size and low power consumption
- Fully static operation
- Coprocessor interface

LPC2148 MICROCONTROLLER

LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support that combines the microcontroller with embedded high speed flash memory of 512kb. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces the code by more than 30% with minimal performance penalty.

Features:

- 16/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 to 40 kb of on-chip static RAM and 32 to 512 kb of on-chip flash program memory.
- 128 bit wide interface/accelerator enables high speed 60 MHz operation.
- Two 10-bit A/D converters provide a total of 14 analog inputs, with conversion times as low as 2. 44 µs per channel.
- Two 32-bit timers/external event counters

LIQUID CRYSTAL DISPLAY

A liquid crystal display (LCD) is a flat display or other electronic visual display that uses the light-modulating properties of liquid crystals.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

A16x2 LCD display is very basic module and is very commonly in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. This LCD has two registers, namely Command and Data. The command Register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing it screen, setting the cursor position, controlling display etc. The Data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed.

RELAY:

A Relay is an electrical switch that uses an electromagnet to move the switch from OFF to ON position instead of person moving switch. It takes relatively small amount of power to turn on a relay but the relay control something that draws the much power. The relay allows the isolation of two separate sections of a system with two different voltage sources i. e. , a small amount of voltage/current on one side can handle a large amount of voltage/current on the other side but there is no chance that these two voltages mix up. When current flows through the coil, a magnetic field are created around the coil i. e. , the coil is energized. This causes the armature to be attracted to the coil. The armature's contact acts like a switch and closes or opens the circuit. When the coil is not energized, a spring pulls the armature to its normal state of open or closed. A relay is an electrically controllable switch widely used in industrial controls, automobiles and appliances.

GSM:

GSM (Global System for Mobile communications) is the technology that underpins most of the world's mobile phone networks. GSM is an open, digital cellular technology used for transmitting mobile voice and data services. GSM operates in the 900MHz and 1.8GHz bands GSM supports data transfer speeds of up to 9.6 kbps, allowing the transmission of basic data services such as SMS. The GSM standard is intended to address these problems. In the current work, SIM300 GSM module is used. The SIM300 module is a Tri-band GSM/GPRS solution in a compact plug in module featuring an industry-standard interface. Fig. 5 GSM Modem Features of GSM:

- Single supply voltage 3. 2V to 4. 5V.
- Storage: SIM card. SIM300 tri-band.
- Supported SIM Card: 1. 8V, 3V.

In this hardware SIM300 is only interfaced with RS232, Regulated power Supply 4. 0V SIM Tray Antenna with LED indications. The power line current is measured by passing it through a current transformer, output of which is a current proportional to the line current, the turns ratio being the constant of proportionality. A precision resistor converts the output current into equivalent alternating voltage. The voltage across resistor passes through precision rectifier, ripple eliminator and voltage divider stages before being finally fed to the inbuilt ADC peripheral of the Microcontroller. Current transformer, for current measurement, is an efficient measurement technique compared to shunt resistor (which changes the line voltage at higher line current), thus having higher linearity and virtually zero burden current. A given period of time gives energy used by the consumer. The on chip Timer interrupts the controller every second. This is extremely important since if this time duration itself has error then the measurement would be erroneous as it is calculated at an interval of every 1 second. The system utilizes two voltage levels, one of ±9 V for the signal conditioning circuitry and other of 3.3V for the microcontroller. Both voltage levels are provided using a single power supply board.

5. Hardware & Results:

As per the proposed system the results are obtained. Fig 3 is the hardware setup for the proposed system.

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Fig 3: Prototype of the Proposed System

Fig 4: Internal Connections of CT & PT

Fig 5: Message Received When User Tried to Open the Meter Case

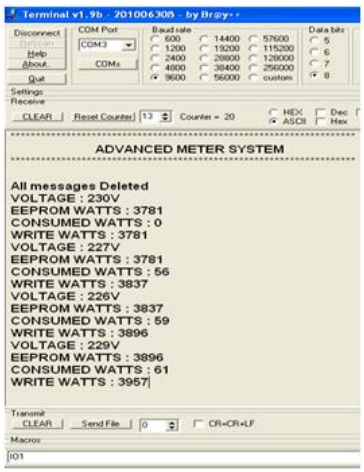

Fig 6: Terminal Screen shot

6. References

[1] Yujun Bao and Xiaoyan Jiang, "Design of electric Energy Meter for long-distance data information transfers which based upon GPRS", ISA 2009. International Workshop on Intelligent Systems and Applications, 2009.

[2] Bharath P, Ananth N, Vijetha S, Jyothi Prakash K. V. ,"Wireless automated digital Energy Meter", ICSET 2008.

[3] Li Kaicheng, Liu Jianfeng, Yue Congyuan, Zhang Ming. "Remote power management and meter-reading system based on ARM microprocessor", Precision Electromagnetic Measurements Digest, 2008. CPEM 2008. Conference on Digital Object Identifier.

[4] Subhashis Maitra "Embedded Energy Meter- A new concept to measure the energy consumed by a consumer and to pay the bill", Power System Technology and IEEE Power India Conference, 2008.

[5] A. H. Nizar and Z. Y. Dong, "Identification and detection of electricity customer behaviour irregularities," in proceedings of IEEE Power Systems Conference and Exposition, pp. 1-10, Mar. 2009.

[6] A. Pasdar and S. Mirzakuchaki, "A solution to remote detecting of illegal electricity usage based on smart metering," proceedings of 2nd International Workshop on Soft Computing Applications, pp. 163-167, Aug. 2007.

7. Authors

D. Udayasree is presently pursuing final semester M. Tech in VLSI & Embedded Systems at Vidya Bharathi Institute of Technology and Sciences, Secunderabad, Telangana, India.

Mr.G.Vijay Kumar is presently working as Associate Professor in the department of Electronics and Communication Engineering in Vidya Bharathi Institute of Technology and Sciences, Secunderabad, Telangana, India.

S.Anil Kumar is presently working as Sr. Application Engineer in Unistring Tech Solutions Pvt Ltd, Hyderabad, Telangana, India.