

GSM Based Remote Energy Meter Monitoring USING RASPBERRY-Pi Board

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Abstract: GSM Based Remote Energy Meter Monitoring Using RASPBERRY-PI Board is used to continuously monitor the meter reading and give weekly information about the number of units consumed along with its cost to the consumer and electricity department. Major components used in this project are RASPBERRY-PI board, GSM model, LCD display, energy meter circuit, and load. RASPBERRY-PI is a credit card size minicomputer developed in UK. It acts as a fast processor system. RASPBERRY_PI is a central unit of this project. RASPBERRY_PI board is connected to monitor, GSM, LCD, and energy meter through various ports. In this project consumption of energy through variable load stored in an internal memory location of RASPBERRY-PI board. ADE 7757 IC counts the number of units consumed which get displayed on a LCD display along with its cost. The same information is provided to the electricity department through GSM Modem. This system enables the electricity service provider to read meter reading regularly without the person visiting each house so that manual meter reading will get reduced. Customers will get weekly update regarding power consumption through SMS. Power theft can be detected as this system gives information about the no. of units consumed along with its cost.

INTRODUCTION

The purpose of this project is remote monitoring and control of the Domestic Energy meter. Automatic meter reading system is an effective way of data collection that allows substantial power saving through continuous monitoring of the meter reading with greater accuracy. This system enables the Electricity Department to read the meter readings regularly without the person visiting each house. It sends meter reading to the consumer & Service provider through SMS using a GSM Modem. A RASPBERRY_Pi unit continuously monitors and records the Energy Meter readings in its permanent (non-volatile) memory location. Raspberry Pi board is used as the Central Unit of this Project. Energy measuring circuit is connected to Raspberry Pi Board. In this system we give a unique Id number for every energy meter. This ID number is interlinked to SIM card service number of the user & service provider. This system continuously monitors the energy consumption and sends weekly SMS to the service provider and the user. The meter reading is stored in database of Raspberry Pi board. Customer will be updated with weekly consumption of energy and also amount of the bill.

I. MAJOR COMPONENTS



a) Raspberry pi:

Fig.1 Raspberry Pi Board

The RASPBERRY-Model B+ with RAM 512MB is a credit card sized computer that plugs into your monitor and a keyboard, it's like a little PC which can be used for many of the things that your desktop PC does, like spreadsheets, word processing and games. It also plays high definition video. The design is based around a Broadcom BCM2835 SOC, which includes an ARM11 76JZF-S 700MHz processor, Video Core IV GPU, and 512Mbytes of RAM. The design does not include a built in hard disk or solid state drive, instead relying on a micro SD card for booting and long term storage. This board is intended to run Linux kernel based operating systems.

Features:

- Integrated video core 4 GPU capable of playing full 1080p high definition Blu-Ray quality video Free, versatile, and highly developer friendly Debian GNU/Linux operating system.
- HDMI video output and RCA video output.
- Four USB ports.
- 4-pole 3.5mm stereo audio jack with composite video output.
- 5V micro USB power input jack.
- Micro SD, MMC, SDIO flash memory card slot.
- 40 pin 2.54mm header expansion slot.
- 2.1 GSM MODEM GSM Modem is use to send SMS, make and receive calls, and do other GSM operations by simple AT commands through a serial interface from Raspberry pi board. It uses the highly popular SIM900A module for all its GSM operations.

b) ADE 7757

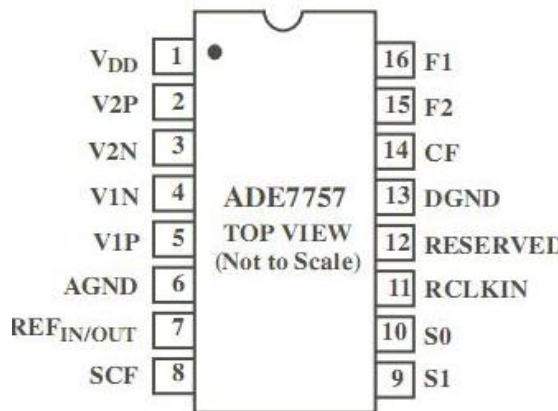


Fig. 2 Pin Diagram of ADE7757

ADE7757 is a 16 pin, low-cost, single-chip solution for electrical energy measurement. The ADE7757 is a high accuracy electrical energy measurement IC. It is a pin reduction version of the ADE7755 with an enhancement of a precise oscillator circuit that serves as a clock source to the chip. The ADE7757 eliminates the cost of an external crystal or resonator, thus reducing the overall cost of a meter built with this IC. The chip directly interfaces with the shunt resistor and operates only with ac input Its salient features are: Can read up to 999999 units (kWh) with a resolution of 0.01 units Designed for normal 230V AC and maximum line current of 30 amps. The meter count is 100 pulses/kWh, i.e., 100 pulses will be required to register one unit.

c) GSM modem

GSM stands for Global System for Mobile Communications. This system is developed by the European countries. We are using USB port to communicate with the

computer. Which will notify the registered customers about their vehicle information that it is legal or no, etc.

II. Working Of The System

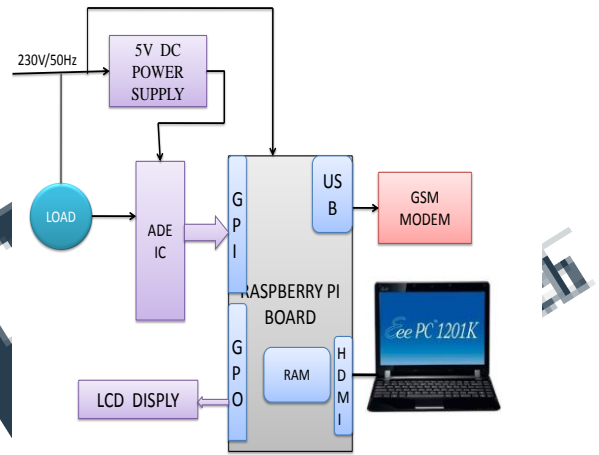


Fig. 3 Block Diagram of the system

In this system we are using Raspbian operating system, & Linux is the kernel. Python is the main programming language. When switch is on 230V/50Hz power supply is applied to load, RASPBERRY PI BOARD through adapter & 5V DC converter circuit it will convert into 5V. DC. 230V supply applied to ADE IC. As load is ON output of the load is given as input to the ADE IC. Which converts instantaneous consume power into digital pulses; it can read up to 999999 units (kwh). This digital pulses are applied to the RASPBERRY PI Board which stored in external memory of RASPBERRY PI Board. The meter reading is stored in database of Raspberry Pi board Raspberry Pi board is used as the Central Unit of this Project. Energy measuring circuit is connected to Raspberry Pi Board. In this system we give a unique Id number for every energy meter. This ID number is interlinked to SIM card service number of the user & service provider. This system continuously monitors the energy consumption and sends weekly SMS to the service provider and the user. The meter reading is stored in database of Raspberry Pi board. Customer will be updated with weekly consumption of energy and also amount of the bill.

III. Required Analysis Hardware And Software

a) Hardware

TABLE I.

Sr.no	Component s	No. Of componen ts	Specification
1	ADE IC	1	7757
2	Opto coupler IC	1	MCT2E
3	Voltage Regulator IC	1	7805
4	Transistor	1	BC547
5	Diode IN4007	7	IN4007
6	LED	1	5mm
7	Zener Diode	1	15V 1W
8	Resistors	13	499Ω,1KΩ,470Ω,100Ω,350Ω,6.2KΩ
9	capacitors	12	10μF,0.1μF,0.01μF,470μF,0.068μF
10	Inductor	4	
11	LCD	1	16*2
12	HDMI	1	
13	Adaptor	1	5V
14	Raspberry Pi	1	5V
15	GSM	1	900MHz

b) Software

In this system we are using Raspbian operating system, & Linux is the kernel. Python is the main programming language

Conclusion

GSM Based Remote Energy Meter Monitoring system uses RASPBERRY PI set up which is a central unit of this project; it is a credit card size minicomputer which acts as a fast processor system. This system enables the electricity service provider to read meter reading regularly without the person visiting each house so that manual meter reading will get reduced. Customers will get weekly update regarding power consumption through SMS. Power theft can be detected as this system gives information about the no. of units consumed along with its cost. This system facilitates to make effective usage of electricity thereby it will help to minimize the power crisis in our country.

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- Giving Raspberry Pi a static IP address : www.modmypi.com/blog/tutorial-how-to-give-your-raspberry-pi-a-static-ip-address : A tutorial on the official website of ModMyPi LTD. ModMyPi LTD was founded in February 2012 following the public release of the ground breaking Raspberry Pi Model B. ModMyPi LTD specialise in the 3D design and manufacture of unique, professional and high-quality Raspberry Pi Cases.
- Setting up Raspberry Pi Server: www.jeremymorgan.com/tutorials/raspberry-pi/how-to-raspberry-pi-web-server : Blog of Jeremy Morgan, who is a Silicon Forest Hacker / Developer writing about Tech, Programming, SEO and Marketing.
- <https://github.com/openenergymonitor/documentation/blob/master/Applications/HomeEnergyMonitor/HomeEnergyMonitor.md>
- <http://www.raspberrypi.org/forums/viewtopic.php?f=37&t=1989&start=25>