International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 3, Issue 1, pp: (268-272), Month: January - March 2015, Available at: www.researchpublish.com

Automated Energy Consumption Reduction and Power Saving By Using RF Communication

[1]Sujata Thorat, [2]Shreetej Shilamkar

[1,2]KJ College of Engineering and Management Research, Pune, India

Abstract: **This paper proposes remote-controllable and energy-saving room architecture to reduce power consumption. To realize the proposed room architecture, we proposed and designed the automatic power cut-off outlet and a RF communication. The proposed power outlet monitors the power consumption for the predetermined time and completely cuts off the power supply when the monitored power is below the threshold value. This power outlet has a function of changing the threshold power, which enables any kinds of home appliances to be applied to the power outlet. To efficiently manage the power outlets and the lights, we proposed the RF communication module. Also if the meter is tampered then admin sends message to cut the supply of that particular meter.**

Keywords: **Microcontroller LPC2148, RF Module, Power consumption, Theft detection.**

I. INTRODUCTION

This system provides the facility for the state electricity board to effectively manage the power distribution in the city. Each house will be having a control unit installed which will manage all the house hold appliances by using software programming and control. It will receive the commands from the state electricity board via RF module. And accordingly the control unit at consumer side will operate. This is very helpful for power distribution and reduction in power consumption which unnecessarily increases the load on state electricity board. The admin person from state board office will provide the command and power limit values via RF communication to all the users as per the current power usage. This is the new standard designed for automation and control network. The standard is aiming to be a low cost, low power solution for systems consisting of devices in houses, factories and offices.

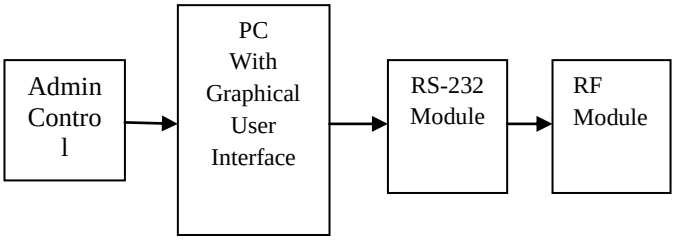
To save the energy, several countries recently made laws related to standby power consumption. To success this exertion, we should consider not only power reduction of consumer electronics itself but also efficient automatic control in networked home environment. In this paper, they present a design approach and implementation result of control mechanism for standby power reduction. Proposed mechanism has the admin-consumer based structure and uses the IEEE 802.15.4 based Wireless protocol for communication and security between admin and consumers[1].

In this paper, different hardware techniques for power monitoring, power management and automated power controlling at home and transmission side and also discuss the suitability of wireless protocol for required communication link. Smart grid is a modified form of electrical grid and mainly used in generation, transmission, distribution of the electrical power. RF protocol has a major role in power monitoring, consumption and direct load controlling for efficient power utilization. This paper describes the user friendly control home appliances, power on/off through the Graphical User Interface (GUI) [2].

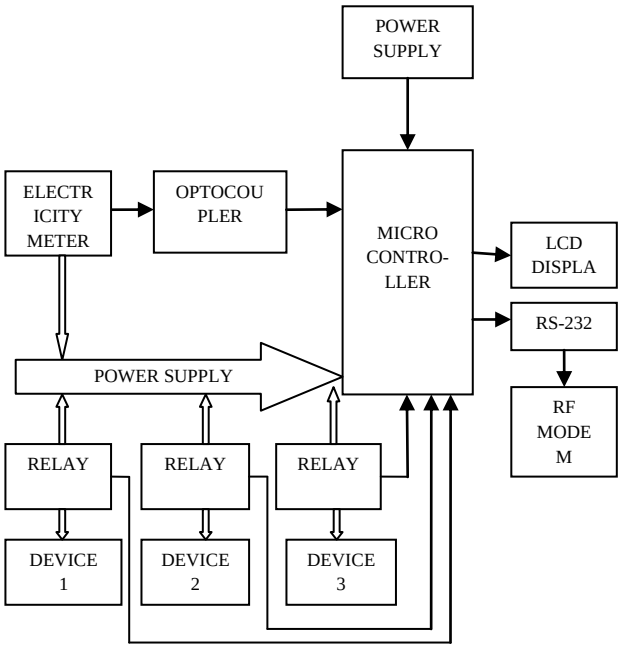
The world is facing the most critical problem of not getting the regular power. In many countries, peoples are not getting at least the primary needs of lights, fans, TV etc. In nearly every country, researchers expect existing energy production capabilities will fail to meet future demand without new sources of energy, including new power plant construction. However, these supply side solutions ignore another attractive alternative which is to slow down or decrease energy consumption through the use of technology to dramatically increase energy efficiency. To manage the available power more often the power is cut for particular area, and that area goes in dark i.e. not even a single bulb can work.

II. OBJECTIVE

The aim is to control power consumption from consumer side according to value set by admin. If user tries to use the electricity by bypassing the meter, the theft circuit will detect the tampering and it will immediately send the message to the admin, then admin will send a message to cut the supply to that particular consumer.



Block Diagram (Admin section)



Block Diagram (Receiver section)

III. WORKING OF THE SYSTEM

Receiving Section

The transmitter section consist of UART, LCD display, microcontroller, ADC, RF, Energy meter, Load. Micro Controller interfaced with energy meter through optocoupler. In this system microcontroller will count pulses from energy meter through optocoupler. Frequency of the pulses depends on power consumption. Optocoupler is added in between meter and controller to isolate high voltage and low voltage circuitry. The controller will count these pulses and accordingly calculate the number of units consumed by the user it provides commands to entire system, from microcontroller measured values is displays on LCD and compare it with the power consumption value received from RF through UART.

In this project we proposed mechanism of RF communication protocol between host and agents for sensing information and standby power control command transmission. Agent acquires the local information such as power consumption using the various embedded sensors and sends this sensing value to the host then, host compares this sensed value with defined control algorithm and sends the power control command to the agent. The system will calculate the total unit and bill and send it to the admin department via RF. RF is a wireless module which is used to transfer data from receiver to transmitter section.

Transmitting Section

On transmitter side there is one more RF module is used, admin controller set a value through a PC this set value will transfer through RS 232 to RF. And this value will transfer to receiver side RF.

ARM 7

ARM core has a built-in JTAG debug port and on-chip "embedded ICE" that allows programs to be The principle feature of the ARM 7 microcontroller is that it is a register based load-and-store architecture with a number of operating modes. While the ARM7 is a 32 bit microcontroller, it is also capable of running a 16-bit instruction set, known as "THUMB". This helps it achieve a greater code density and enhanced power saving. While all of the register-to-register data processing instructions are single-cycle, other instructions such as data transfer instructions, are multi-cycle. To increase the performance of these instructions, the ARM 7 has a three-stage pipeline.

In order to keep the ARM 7 both simple and cost-effective, the code and data regions are accessed via a single data bus. Thus while the ARM 7 is capable of single-cycle execution of all data processing instructions, data transfer instructions may take several cycles since they will require at least two accesses onto the bus (one for the instruction one for the data). In order to improve performance, a three stage pipeline is used that allows multiple instructions to be processed simultaneously.

The pipeline has three stages; FETCH, DECODE and EXECUTE.

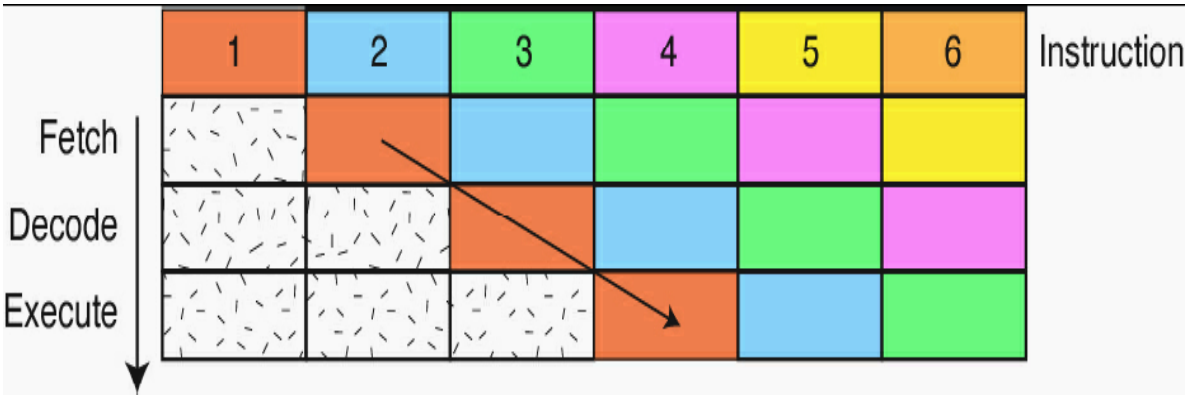


Fig. stage pipeline of ARM 7

LPC2148

Features and benefits

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.
- 128-bit wide interface/accelerator enables high-speed 60 MHz operation.
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software. Single flash sector or full chip erase in 400 ms and programming of 256 B in 1 ms.
- Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.
- USB 2.0 Full-speed compliant device controller with 2 kB of endpoint RAM.
- In addition, the LPC2146/48 provides 8 kB of on-chip RAM accessible to USB by DMA.
- One or two (LPC2141/42 vs. LPC2144/46/48) 10-bit ADCs provide a total of 6/14 analog inputs, with conversion times as low as 2.44s per channel.
- Single 10-bit DAC provides variable analog output (LPC2142/44/46/48 only).
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input

RF

Figure: - RF

RF is an alternating current which, if supplied to an antenna will give rise to an electromagnetic field that propagates through space. Low power wireless (RF) systems operate on shared radio channels and hence are subject to regulation. RF products do not require a license or air time fee for operation.

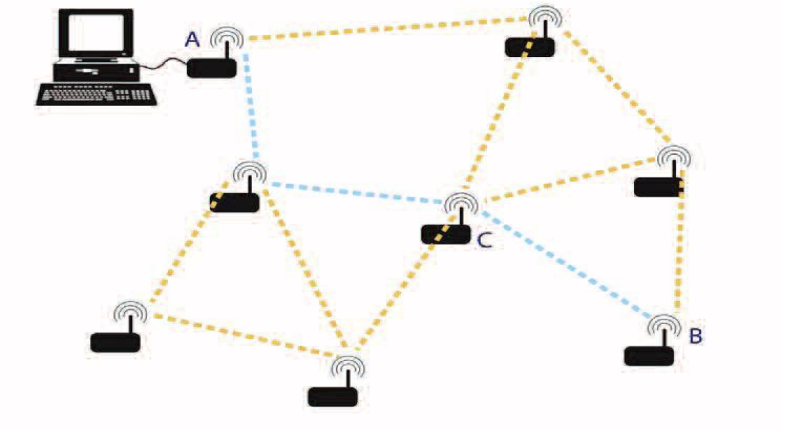


Figure:- RF Communication

Characteristics

- Low power consumption
- Good operating range
- Supports data rate upto 1-2 Mbps
- Does not require a direct transmission path.

RF Features

- Serial interface (RS232)
- Power supply
  - 4.5 Vdc from three 1.5 V AAA batteries.
- Operating frequency: 916.50 MHz
- Maximum data rate: 22.5 kbps
- Operating range: up to 25 meters
  - Obtained in an electrically quiet outdoor location
  - Greatly influenced by building construction materials and contents, other radio systems operating in the vicinity, and noise generated by nearby equipment
- Provide link-layer packet protocol

RS232

RS 232 is the most known serial port used in transmitting the data in communication &interface. Even though serial port is harder to program than the parallel port, this is most effective method in which the data transmission requires less wire that yields to less cost. The RS 232 is the communication line which enables the data transmission by only using three wire links. The three links provides transmit, receive &common ground.

The transmit & receive line on this connector send & receive data between the computers. As the name indicates, the data is transmitted serially. The two pins are TXD &RXD. There are other lines on this port as RTS, CTS, DSR, DTR & RTS, RI.

The '1'&0 are the data which defines a voltage level of 3v to 25v and -3v to -25v respectively.

The electrical characteristics of the serial port as per the EIA (Electronics Industry Association) RS 232c Standard specifies a maximum baud rate of 20,000bps, which is slow compared to today's standard speed. For this reason, we have chosen the new RS-232D Standard, which was recently released.

The RS-232D has existed in two type's i.e.-type 25 pin connector & D-type 9 pin connector, which are male connectors on the back of PC. The pin outs of both D-9 & D-25 are show below.

Advantages

- Wireless control of power increase energy saving.
- System helps to reduce power cuts in once particular area.
- Reduce the cost by effective use of energy across the city elaborate advantages.
- RF can form a network , hence its easy to builds a wide network for client units
- Admin control helps to strictly follow the energy distribution policies.
- Easy to modify.

Application

- Building & home automation system
- Security system
- Remote control
- Remote meter reading & computer peripheral

IV. CONCLUSION

- We have developed an effective system to remotely monitor the use of power and are able to detect power theft in power system in accurate and cost effective way. This will help in preventing huge loss of power.
- Real time power monitoring of the various consumers can be done such as either domestic, commercial or industrial.
- The system has the ability to inform or send data about the consumer's consumption to the admin using wireless radio link and sending control commands from admin to consumer.
- Thus we can successfully and effectively address problems related to power theft by the consumers in a completely automated, wireless, cost effective and most importantly reliable way.
- It found that the according to set power level the load is working & above that set value the load is cut off according to the set priority value.

REFERENCES

[1] A IEEE paper entitled "Design and Implementation of Control Mechanism for Standby Power Reduction" by Joon Heo etc.

[2] A IEEE paper entitled "Monitoring and Controlling Power using Wireless Communications" by N. Javaid etc.

[3] Basic Electronics-J.S. Katre

[4] The 8051 microcontroller and embedded system, Muhammed Ali Mazidi.

[5] Datasheet LPC2148.