International Journal of Research In Science & Engineering e-ISSN: 2394-8299
Volume: 2 Issue: 3 March-April 2017 p-ISSN: 2394-8280

ANALYSIS OF WIRELESS ENERGY METER BY USING RADIO FREQUENCY CONTROLLER

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Abstract—The existing traditional method for retrieving the energy meter data and billing is not convenient and time consuming, hence in this paper we suggest a billing strategy via radiofrequency which is convenient and reduces the manpower. This system is a boon for remote monitoring and automatic tariff updating. This system gives the information regarding meter reading, power cut, total load used and tempering on request or regularly in particular interval through radio frequency. This information is being sent and received by concerned energy provider company with the help of Global System. Hence this system not only reduces the labor cost and also increase meter reading accuracy and saves both time and money.

Keywords- radio frequency, automatic tariff calculation, energymeter, load scheduling.

I. INTRODUCTION

Advanced Metering Infrastructure (AMI) consists of smart meters which exchange information with network applications using Machine to Machine technology over communication networks .The traditional method of electricity billing system Involves meter readers to periodically visit every house to take readings. There are many issues related to this method such as taking wrong readings, lack of meter readers, and houses in very remote areas, meters in inconvenient location and so forth. Many technological advancement have been carried out and one such is employing software agent replicating human beings to collect energy values by means of power line communication. In some cases, wireless technologies are used where energy meter embedded with Zigbee sensor making it wireless accessible for retrieving energy values for billing and some even Employed GPRS for retrieving the energy units for billing from wireless remote meter .The purpose of this project is to remote monitoring and control of the Digital Energy Meter. This system enables the Electricity Department to read the meter readings regularly without the person visiting inside each house. This can be achieved by the use of Microcontroller unit that continuously monitors and records the Energy Meter readings in its permanent (non-volatile) memory location. This system also makes use of a RF Transceiver for transmitting the readings of Energy Meter.

RF Communication ranges in between 30 KHz to 300 GHz. RF communication works by creating electromagnetic waves at a source and being able to pick up those electromagnetic waves at a particular destination. These electromagnetic waves travel through the air at near the speed of light. The wavelength of an electromagnetic signal is inversely proportional to the frequency; the higher the frequency, the shorter the wavelength. RF transceiver has both transmitter and receiver section with it.

The Microcontroller based system continuously records the readings and the live meter reading can be sent to the Hand held device. The receiver end comprises of RF Transceiver, which receives the data from the transmitter. The data received at the receiver

end is fed to the microcontroller present at the receiving end. The microcontroller at the receiving end is provided with a LCD. The readings received is processed and displayed on the LCD. The Microcontroller is programmed using Embedded C language.

The major advantages of this system are making use of RF transceiver modules which helps for a wireless transmission and the readings can be seen on hand held device (LCD display).

II. SYSTEM DESIGN

In propose system consisting of two sections- transmitter & receiver. Let's see each section one by one. Energy meter consist of phase and neutral. Phase's wires are two first is voltage sensitive and second is current sensitive. We know that power =VI from which we count power consumption ofany household appliances. Here with using optocoupler circuit which is a parallel combination of photodiode and transistor which is envelope in single packet, therefore whatever input supply that is grounded by resistance. In transistor, on collector side 5 V supply is given (which is come from powercircuit). A Switch is attach between collector and emitter, so whenever 5V pulse come switch is on circuit is completed and 5V pulses output is given to PC5 (port c pin no.5) of microcontroller. Microcontroller has in built A/D converter which converts analog input into digital serially. In generalenergy meters have power load capacity of 1000 KWh means, when the LED blinks 3600 times then 1 unit is counted. But for demo purpose provision has made such that 1 blink counts for 1 unit. In microcontroller burn the program in such a way that for blinking of LED 1 time then 1 unit is counted. If transmitter section is off then "NO SIGNAL" is shown on LCD display. Whole programming is takes place in embedded C. For programming purpose "MIKROC PRO AVR" Software is which is used to simulate program in embedded C. Here with using microcontroller Atmel8 which have in buildE P ROM which stores count.Microcontroller sends count to LCD present on transmitter .It display units on it. Microcontroller sends data from TXD pin (PD1) to transmitter section serially bit by bit (e.g. if count is 3 then it send 00000011).

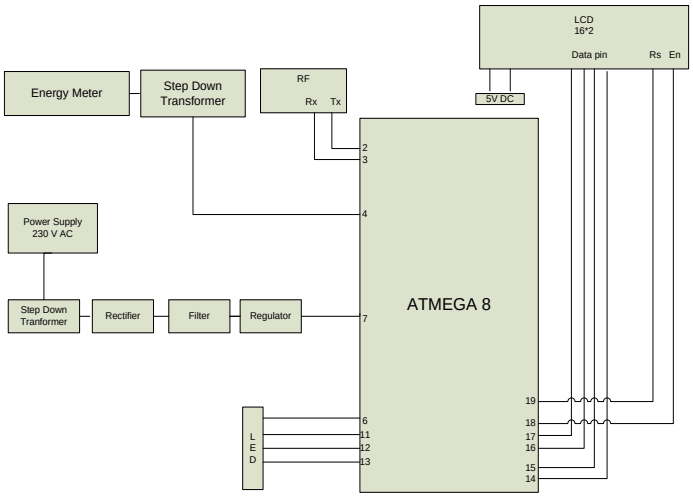

Fig.1 Block diagram of Transmittersystem

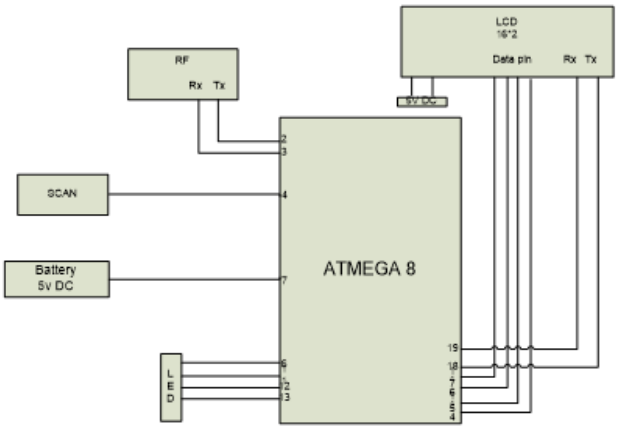

Fig.2 Block diagram of Receiver system

Transmitters take 5V supply from power supply unit, and serially receive data from microcontroller and sends to antenna. Here transmitter is operated at 433 MHz of frequency. RS232 protocol is used for communication purpose. It sends data to receiver section at the baud-rate of 1200 bits/sec. On receiver side 9V dc supply is given to circuit. This voltage is storage in capacitor in the form of charge, which is further regulated by IC 7805 to provide constant 5V supply to the microcontroller. Antenna receive signal from transmitter side (which is operated at 433MHz).This signal given to RXD (PD0) pin of microcontroller and fed to LCD to display units on it. Operating distance of RF is 200 m. System can be reset by shorting the jumper terminals on the kit then EPROM clears data and system start to count units from zero

III. HARDWARE IMPLEMENTATION

In this system power supply is provided to meter. A RF unit shows the interfacing with the microcontroller. The collected data from energy meter and transferring it on specific base stat ion for the purpose of billing and analyzing, this reduces the man power with the more accuracy. Hardware implementation includes following points as discussed below

A. Power supply

The input to the circuit is applied from the regulated power supply. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present
even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

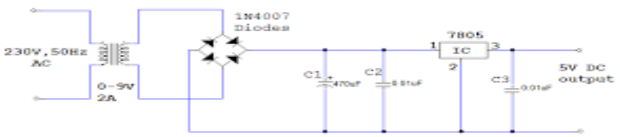

Fig.3 Regulated Power Supply

B. Eenergy Meter

The energy meter in the system is a multi-rate energy meter, using RS485 bus or power line carrier to communicate with the collector. To realize multi-period control, it uses real-time clock chip PCF8563, which designs three rates, namely peak, flat and valley and is totally compatible with power industry standard "DL/T645-1997 Multi-functional Energy Meter Communication Protocol". Energy metering module mainly completes the measurement of electric energy; data storage module completes the timely storage of power energy's information, while RS485 communication module and carrier module achieve the data exchange between the collector and the energy meter; Liquid Crystal Display (LCD) module provides users with a clear and real-time electric quantity information; real time clock module provides multi-rate energy meter with accurate time information in order to achieve the measurement of electrical energy under different rates; send and interrupt electricity module can realize the function of overload interrupt of power supply as shown in fig 3.

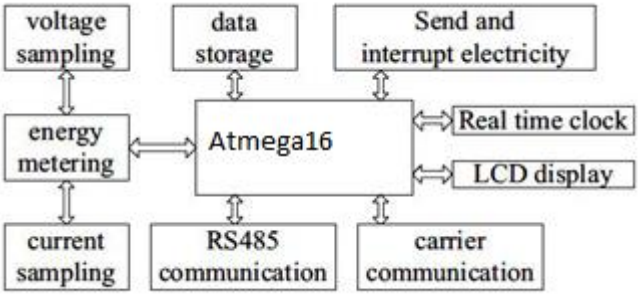

Fig.4 Energy Meter Structure

C. RF Transmitter

RF modules are usually very small in size and operate with voltage range of 3V to 12V. RF transmitter modules are designed to work with 433MHz frequency. If transmitting logic is zero then no power is drawn by transmitter. For transmitting logic one, it consumes power about 4.5mA with 3V. the transmitter and receiver are interfaced with microcontroller for desired operation. RF transmitter has supply voltage in the range of 3V to 6V and output power in the range of 4V to 12V with frequency of 433.92MHz.

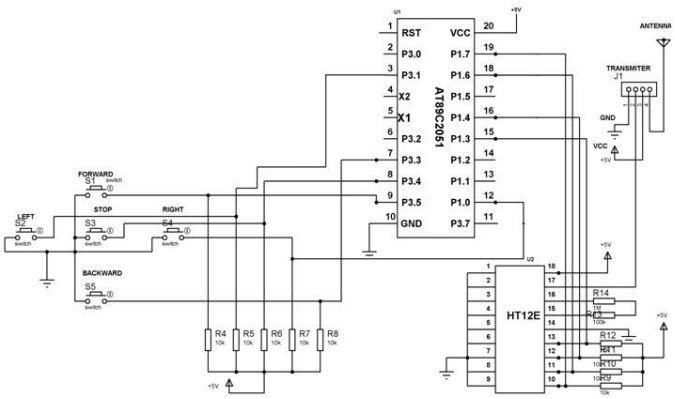

Fig.5Pin connection of RF Transmitter Circuit

D. RF Reciever

The receiver ST-TX01-ASK is an ASK Hybrid transmitter module. ST-TX01-ASK is designed by the Saw Resonator, with an effective low cost, small size, and simple-to-use for designing, frequency range:315 / 433.92 MHZ, supply voltage: 3~12V.

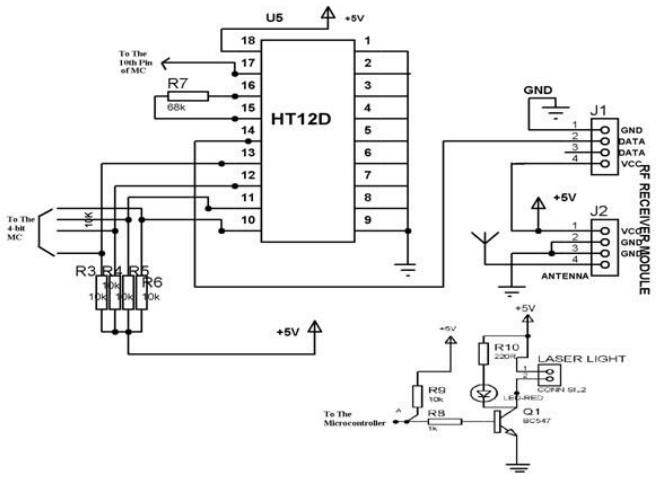

Fig.6 Pin connection ofRF Reciever Circuit

E. LCD

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. 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 its 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 on the LCD.

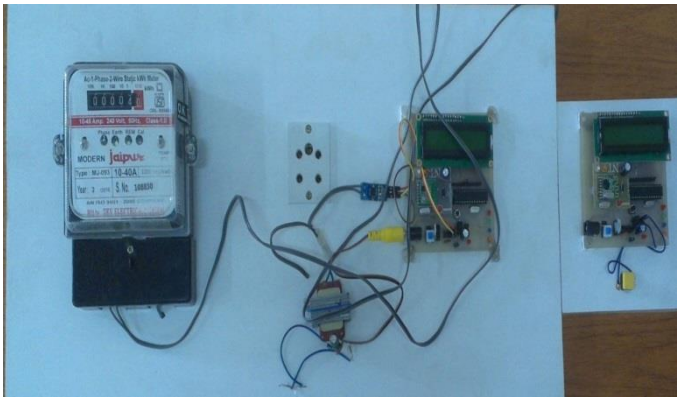

Fig.7 Implementation of Proposed System

IV. SINGLE-PHASE CALCULATIONS

Basic electrical theory tells us that for a single-phase system, kW = (V × I × PF) ÷ 1,000. For the sake of simplicity, let's assume the power factor (PF) is unity. Therefore, the above equation becomes kW = (V × I) ÷ 1,000.Solving for I, the equation becomes I = 1,000kW ÷ V

Now, if we look at the "1,000 ÷ V" portion of this equation, we can see that by inserting the respective single-phase voltage for "V" and dividing it into the "1,000," you get

a specific number (or constant) you can use to multiply "kW" to get the current draw of that load at the respective voltage.

V. RESULT

Testing is done to ensure the system operation and to check the integration between transmitter and receiver working properly.

Table1 Reading of different load condition

Sr. No.	Types of Load	Reading of Meter	Reading In kWH	Distance in Meter (M)
1	No Load	0.95	0.21	5 M
2	Laptop (any domestic load)	2	0.46	7 M

Fig.9 Transmitter Reading of Proposed System

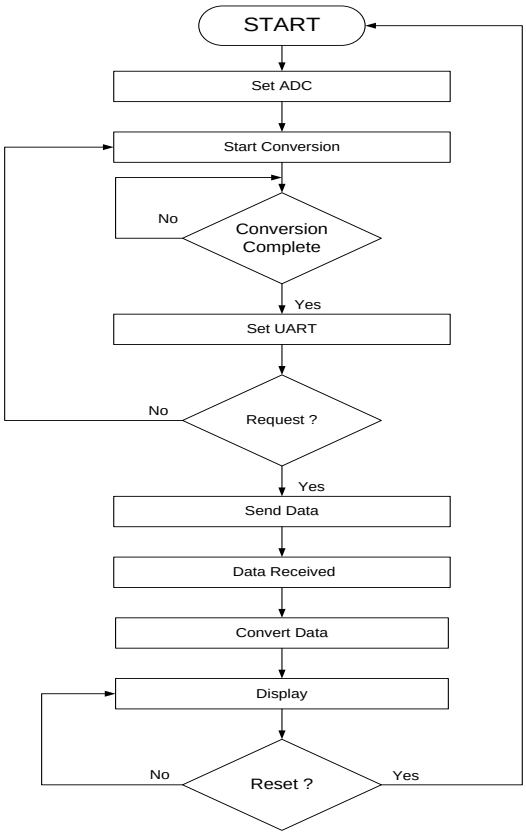

Fig.8 *Flow* Chart of System

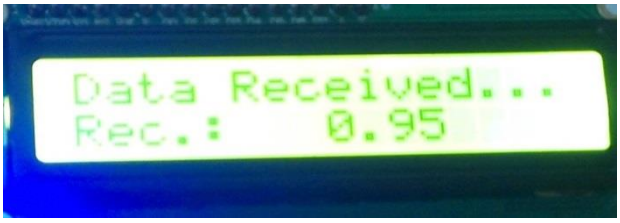

Fig.10 Receiver Reading of Proposed System

VI. CONCLUSION

Here we have successfully implemented the wireless energy meter up to the range of 30M. Here we can connect the different load such as laptop charger, electrical appliances etc. Also we can connect different domestic load and we get the accurate reading. This system is very useful in case of multistage building.

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