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SMART METERING AND HOME AUTOMATION SOLUTIONS FOR NEXT DECADE

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ABSTARCT

This project presents the design and modeling of a Energy Recharge System for prepaid Metering. The present system of energy billing in India is error prone and also time and labour consuming. Errors get introduced at every stage of energy billing like errors with electro-mechanical meters, human errors, processing errors. The aim of the project is to minimize the error by introducing a new system of Prepaid Energy Metering. This will enable the user to recharge his/her electricity account from home or any place using GSM. We can easily implement many add-ons such as energy demand prediction, real time dynamic tariff as a function of demand and supply and so on.

INTRODUCTION

Home automation refers to the process that reduces human work. An introduction to the chapters to be discussed further is also provided in this chapter. World is currently facing an increasing demand-supply gap, poor quality of supply, the resulting drop in customer satisfaction levels and inefficient usage of energy. The severity and type of problems vary in developed and other countries. Therefore the need of the next decade is an efficient energy supply chain from generation, transmission, distribution to utilization of electricity. The way the electricity network functions has not altered significantly in the last 100 years, largely constrained by the physical characteristics of electricity and the way it is generated[1]. However, that situation is beginning to change around the world, with the promise of a smarter electricity network and home automation technologies that will assist in meeting the challenges of climate change while maintaining energy security[2]. Wireless has become a reliable source for communication where by supporting cost effective and user friendly transmission. Zigbee is a nonprofit alliance of companies in the communications and computer industries that was created with the purpose

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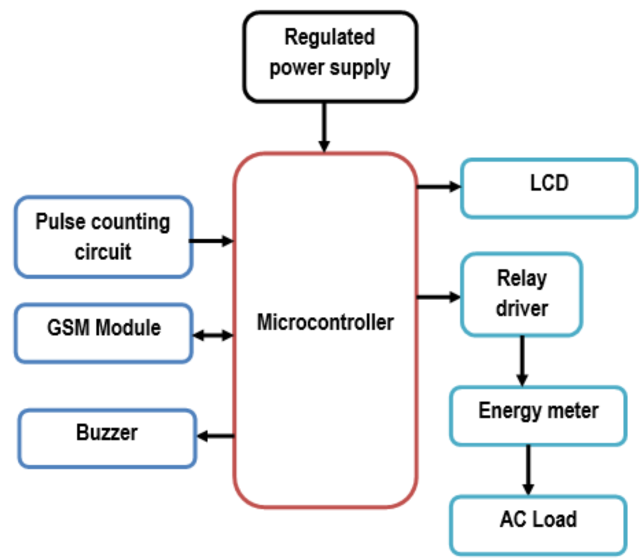
of introducing an open standard of wireless data transfer devices and applications[3]. Next decade will revolutionize smart metering, Information and communications technology (ICT) and home automation by making it affordable, efficient and within the common man's reach[4]. World over, tremendous work is going on in Advanced Metering Infrastructure (AMI), Smart Metering and Home Automation[5]. Short distance Radio Frequency (RF) technologies like ZigBee# , Z-Wave# , Low Power Radio and Distribution Line Carrier (DLC) are ready to enter every household as the Home Area Network (HAN) of the future[6] Advanced utility meters could help people cut their energy bills. Basically, the idea is simple, smart metering lets the people see how much power their home is consuming and eventually encourage them to use less energy[7].This gives an overview about the existing remote energy management systems and makes recommendations which functions would be useful in the Hungarian environment, too[8]. An energy-efficient smartmetering scheme is proposed - an effort towards minimizing the energy consumption by the smartmeters for green smart grid communication. We incorporate the use of coalition game to form multiple coalitions among smartmeters to communicate with the service provider[9]. SMART-ER, an improved version of SMART. It utilizes dependency tracking and grouping to provide exact and robust smartmetering even in the presence of communication errors. We show, that SMART-ER provides significantly more accurate results in typical churn scenarios [10].

IMPLEMENTATION



A variable regulated power supply, also called a variable bench power supply, is one where you can continuously adjust the output voltage to your requirements. Varying the output of the power supply is the recommended way to test a project after having double checked parts placement against circuit drawings and the parts placement guide.

This type of regulation is ideal for having a simple variable bench power supply. Actually this is quite important because one of the first projects a hobbyist should undertake is the construction of a variable regulated power supply. While a dedicated supply is quite handy ,it's much handier to have a variable supply on hand, especially for testing.

In electrical engineering, a potential transformer (PT) is used for measurement of electric voltage. It is differ from the normal transformer. The variation of the voltage in potential transformer is potentially. This can be conveniently connected to measuring instruments. The potential transformer operates on the same principle as a power or distribution transformer. The main difference is that the capacity of a potential transformer has ratings from 100 to 500 volt amperes (VA).The low voltage side is usually wound for 115 V .The load on the low voltage side usually consists of not only the potential coils of various instruments but may also in clued the potential coil of relays and other control equipments. In general the load is relatively light and is not necessary to have PT's with a capacity greater than 100 to 500 VA. The high voltage primary winding of a PT has the same voltage rating as the primary circuit .Assume that it is necessary to measure the voltage of a 3.3KV, single phase line. The primary of the PT is rated at 3.3KV and the low voltage secondary is rated at 110V.The ratio between the primary and the secondary winding is 3300/110 or 30/1 A voltmeter connected across the secondary of the PT indicates a value of 110V.To determine actual voltage on the higher voltage circuit, the instrument readings of 110V must be multiplied by 30. 110*30=3300V.In some cases, the voltmeter is calibrated to indicate the actual value of voltage on the primary side. As a result, the operator is not required to apply the multiplier to the instrument reading and the possibility of error is reduced. This PT has subtractive polarity.(All instrument PT's now manufactured have subtractive polarity).One of the secondary leads of the transformers in figure is grounded to eliminate high voltage hazards. PT's have highly accurate ratios between the primary and secondary voltage values. Generally the error is less than 0.5%.

In the case of voltage measurement, PT's are connected across phases of the transformer under test. The PT is rated at 230V/6V.The ac output voltage of the PT is rectified, filtered and converted into pure dc 5VIn electrical engineering, a current transformer (CT) is used for measurement of electric currents. When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring instruments. A current transformer also isolates the measuring instruments from what may be very high voltage in the monitored circuit. Current transformers are commonly used in metering and protective relays in the electrical power industry. Current transformers are used so that ammeters and the current coils of other instruments and relays need not be connected directly to high voltage lines. In other words, these instruments and relays are insulated from high voltages CT's also step down the current in a known ratio. The use of CT means that relatively small and accurate instruments relays and control devices of standardized design can be used in circuits. The CT has separate primary and secondary windings. The primary winding which consists of few turns of heavy wire wound on a laminated iron core is connected in series with one of the line wires. The secondary winding consists of a greater number of turns of a smaller size of wire. The primary and secondary windings are wound on the same core. The current rating of the primary winding of a CT is 100 A. The primary winding has three turns and the secondary winding has 60 turns. The secondary winding has the standard current rating of 5A; therefore the ratio between the primary and secondary current is 100/5 or 20/1.The primary current is 20 times greater than the secondary current. Since the secondary winding has 60 turns and the primary winding has 3 turns, the secondary winding has 20 times as many turns as the primary winding. For a CT, then the ratio of primary to secondary currents is inversely proportional to the ratio of primary to secondary turns. In figure Ct is used to step down current in a 3300V, single phase circuit. The CT is rated at 100 to 5 A and the ratio of current step down is 20 to 1.In other words, there are 20 A in the primary winding for each ampere in the secondary winding. If the ammeter at the secondary indicates 4A, the actual current in the primary is 20 times this value i.e;80A.The CT in the figure has polarity markings in that the two high voltage primary leads are marked H1 and H2, and the secondary leads are marked X1 and X2.When H1 is instantaneously positive,X1 is positive at the same moment. Some CT manufacturers mark only the H1 and X1 leads. When connecting the CT's in circuits; the H1 lead is connected to the line lead feeding from the source while the H2 lead is connected directly to the ammeter. Note that one of the secondary leads is grounded as a safety precaution to eliminate high voltage hazards. CT's are connected in series with phases of the transformer under test. The CT is rated at 5A /0.5 A. A shunt resistor of value 10 ohm is connected across the CT. Hence we have 0 to 5V AC given as the input to the rectifier unit and by a similar procedure as seen in the previous case, we get pure dc 0 to 5V at the output stage

CONCLUSION The project initially aimed at smart metering of power consumed in a home and to reduce manual work. Need for automation was necessary and Zigbee was the communication module which was chosen. At first circuits was designed to measure power and display it in LCD display. Further Zigbee was used to transfer the power values to the EB side database. Since power has to be conserved now a days, a concept of demand control was brought, in which the user can set a certain value of power according to his need and when value gets exceeded, tripping with information is given by the module. Phase power off was also considered by doing phase shift when it occurs.A three phase user side and EB side circuit diagram was designed. The power was shown with cost in LCD display and then automated by Zigbee to EB database. Bill intimations were given to user from the EB side. Demand control was established by tripping information when the power value exceeded the fixed value.When the power in a phase is not given, phase shifting was done.

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