INTERNATIONAL JOURNAL FOR TRENDS IN ENGINEERING & TECHNOLOGY
VOLUME 1 ISSUE 1 – OCTOBER 2014 - ISSN: 2349 - 9303

Optimized Power Controller for Residential Energy Consumption

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ABSTRACT:
This proposed system is designed to reduce the power cuts during heavy demands. By limiting the power usage in all the residential areas it's possible to save the power. This concept is mainly based on power sharing; the power is shared equally and distributed to the residential areas. A particular watt is fixed to each residence which is given by the Electricity board. If watts are finished meansfor user identification alarm or buffer is used. It beeps before few seconds watts are available for usage. If the user uses the power more than the limit, then alarm gets turn on. If the user exceeds the limit of usage of watts more than three times, then the power supply to that residential home gets turn off. When no person is inside the room the power supply gets switched off automatically by using IR sensor. Infra red sensor senses and that information are converted into equivalent electrical signal. If the power cut occurs many times means user can use renewable energy sources like solar and wind energy. The electricity is stored in the batteries and used. We can gain more electricity from solar and wind energy. So within 2-4 years we can gain the initial cost. For each home a database is maintained in Electric Board office computer. Totally there is a power demand means fewer amounts of watts can be fixed in residential unit. If the less watts is fixed means user can switch one or two lights and fans. In one area the power is not used means it will be shared to the other area network. We are using PIC microcontroller is used for controlling the power.
Keywords- level converter, pic microcontroller, encoder, decoder, relay driver, IR sensor,

1. INTRODUCTION

A particular watt is fixed to each residence which is given by the Electricity board. If the user wants more amounts of watts, they can get the required watts from Electricity board by paying penalty. If the user purchases new electronic equipment means the power usage will be more when compared to before. Depend upon the usage the can get penalty from the electric board. The completion of watt can be identified by the alarm or buffer which beeps before few watts are available for usage. If the user uses over the limit, then alarm gets turn on. If the user exceeds the limit of usage of watts more than three times, then the power supply to that residential home gets turn off. Then the user should inform to the EB office to turn on the power supply. When no person is inside the room the power supply gets switched off automatically by using IR sensor. Infra red sensor senses and that information are converted into equivalent electrical signal. If the power cut occurs many times means user can use renewable energy sources like solar and wind energy. If solar energy is used in this projects means solar cells are inserted in the home to absorb the solar energy from the sunlight. Solar cells are made up of semiconductor materials. When sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity. This process of converting light (photons) to electricity (voltage) is called the photovoltaic (PV) effect. The electricity is stored in the batteries and used. The initial cost of renewable energy is high only. But we can gain more electricity in this. So within 2-4 years we can gain the initial cost. For each home a database is maintained in EB office computer. In that database contains full in formations of user like user EB usage, required watts, and full address, recent changes are in that. Totally there is a power demand means fewer amounts of watts can be fixed in residential unit. If the less watts is fixed means user can switch one or two lights and fans. In one area the power is not used means it will be shared to the other area network. Compact fluorescent bulbs are four times more energy efficient than incandescent bulb sand provides the same lighting. In both the EB and residential units the PIC 16CF877A is used. The first & foremost criterion in choosing a Micro controller is that it must meet the task at hand efficiently & cost effectively. Among other considerations in the category are: Speed,Packaging,Power consumption,The amount

of RAM & ROM on chip, The number of I/O pins & the timer on the chip,Cost per unit,Many inbuilt function. The second criterion in choosing a micro controller is how easy it is to develop products around it. Key considerations include the availability of an assembler, debugger, a code – efficient c language compiler, emulator, technical support, and both in-house and outside expertise. Intelligent microcontroller to purify the water.The proposed UV water-treatment system boasts the advantages, such as compactness, low cost, and energy saving, and is suitable for residential users. According to the experimental results, the energy-saving capability of the proposed system is better than 50%[2] In this UV light is exposed into water to kill bacteria. In this power consumption is reduced without using microcontroller. This user-friendly graphical user interface (GUI) is developed using Lab VIEW. The proposed system can.Identify the operating characteristics of the UV lamp and design the power stage accordingly. Automatic identification system is used in this to manage power effectively. By this all concepts this new concept is developed in this project. In order to demonstrate the energy-saving capability of the proposed controller, the measured monthly energy consumption of the water-treatment system, with or without the proposed controller is provided. UV water-treatment systems provide a fast unique way to disinfect water without heat or chemicals, such systems are quickly gaining popularity in the consumer market. Conventionally, the UV lamp in these systems operates at full load without taking the flow-rate and/or lamp-aging effect into account, which results in unnecessary energy losses. [2] The survey of recent elecricity says that Installed electricity generation capacity of 18,382 MW (as on 31st January, 2013). Renewable power forms 52% of the total installed capacity (including small hydro).State constitutes 9% of the total installed electricity generation capacity of India which is mainly from fossil fuels such as coal and natural gas. Private sector has a 47% share in the total installed capacity[4].Electricity deficit in the state has increased from 1% to 11% in 2005-12. Between 2005-06 and 2011-12,electricity requirement grew at CAGR of 9%, while availability only grew at around 7% leading to increasing electricity deficits.In order to overcome the demand the proposed system is used.

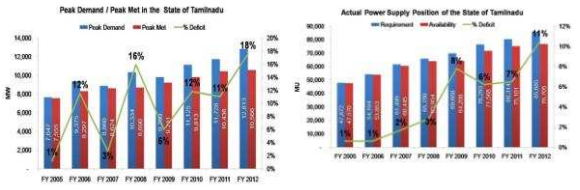

Figure 1.1: Current scenario of electricity demand of Tamil Nadu

2. BLOCK DIAGRAM AND EXPLANATION

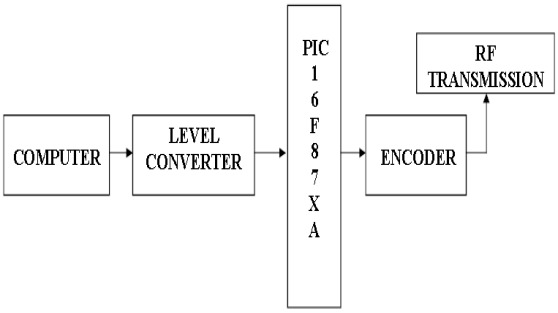

Fig 2.1 Block Diagram of EN UNIT

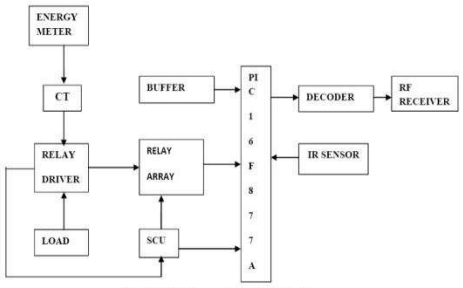

Fig.3.2: Block diagram of residential unit

2.1 PIC MICROCONTROLLER

Microcontroller used in the project is PIC16F877A.Key considerations include the availability ofan assembler, debugger, a code – efficient c language compiler, emulator, technical support, and both inhouseand outside expertise.PIC is a family of Harvard architecture microcontrollers made by MicrochipTechnology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Programmable Interface Controller", but shortly thereafter was renamed "Programmable Intelligent Computer". PIC are popular with developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes,availability of low cost or free development tools, and serial programming (and re-programming with flashmemory) capability .

2.2 CURRENT TRANSFORMER

A current transformer is a type of "instrument transformer" that is designed to provide acurrent in its secondary which is accurately proportional to the current flowing in its primary. When current in a circuit is too high to directly apply to measuring instruments, a currenttransformer produces areduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer alsoisolates 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.

2.3 RELAY

A relay is an electrically operated switch. Current flowing through the coil of the relay creates amagnetic field which attracts a lever and changes the switch contacts. The coil current can be on oroff so relays have two switch positions and most have double throw (changeover) switch contact. Relays allow one circuit to switch a second circuit which can be completelyseparate from the first. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can beas much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannotprovide this current and a transistor is usually used to amplify the small IC current to the larger valuerequired for the relay coil.

2.4 SIGNAL CONDTIONING UNIT(SCU)

In electronics, signal conditioning means manipulating an analog signal in such a way that itmeets the requirements of the next stage for further processing. Most common use is in analog-to digital converters. In control engineering applications, it is common to have a sensing stage (which consists of asensor), a signal conditioning stage (where usually amplification of the signal is done) and aprocessing stage (normally carried out by an ADC and a micro-controller). Operational amplifiers(op-amps) are commonly employed to carry out the amplification of the signal in the signalconditioning stage. Noises are removed and filtering is done in the SCU.

2.5 ENCODER / DECODER

An encoder can be a device used to change a signal or data into a code. The code serves anyof a number of purposes such as compressing information for transmission or storage, encryptingor adding redundancies to the input code, or translating from one code to another. This is usuallydone by means of a programmed algorithm, especially if any part is digital, while most analogencoding is done with analog circuitry.The HT12E encoder is a CMOS IC built especially for remote control system applications. Itis capable of encoding 8 bits of address (A0-A7) and 4 bits of data (AD8-AD11) information.Each address/data input can be set to one of the two logic states, 0 or 1.Grounding the pins is taken as a 0 while a high can be given by giving +5V or leaving the pins open.In the project HT12D decoder is used for decoding the data. The decoder is capable of decoding 8 bits ofaddress (A0-A7) and 4 bits of data (AD8-AD11) information. For proper operation, a pair ofencoder/decoder with the same number of addresses and data format should be chosen. Thedecoders receive serial addresses and data from programmed encoders that are transmitted by acarrier using an RF or an IR transmission medium. The decoders are capable of decoding information that consists of N bits of30address and 12_N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and4 data bits, and HT12F is used to decode 12 bits of address information.

2.6 BATTERY

Battery serves as a backup device when there is no power. In this project Lead acid Battery is used for storing renewable energy sources.A lead-acid battery is an electrical storage device that uses a reversible chemical reaction tostore energy. It uses a combination of lead plates or grids and an electrolyte consisting of a dilutedsulphuric acid to convert electrical energy into potential chemical energy and back again.

2.7 INFRARED SENSOR

To know the human presence in the residence IR sensors are used. Infrared radiation is the portion of electromagnetic spectrum having wavelengths longer thanvisible light wavelengths, but smaller than microwaves, i.e., the region roughly from 0.75μm to1000 μm is the infrared region. Infrared waves are invisible to human eyes.The wavelength region of 0.75μm to 3 μm is called near infrared, the region from 3 μm to 6μm is called mid infrared and the region higher than 6 μm is called far infrared. Infrared sensor units are capable of emitting infrared light, which cannot be seen by thehuman eye, and are able to turn on devices when the infrared light is disturbed.

2.8 RF MODULE

Radio Frequency (rf) transmission uses radio waves like radio or television signals to transmitaudio via a carrier from a transmitter to a receiver. Like a radio station transmitter the transmitterhas an antenna usually attached to the transmitter unit which needs to be positioned to adequatelycover the listening area. Small hand held portable transmitter usually with have a built-in antenna.The receiver units are either single channel or multichannel and they receive the modulated radiowaves and convert them back into an audio signal .Multichannel receivers will have a channel selector which allows a user to select a specific transmission channel.

3. WORKING PRINCIPLE

At first, the required amount of watts to be fixed depends upon the total power. This information is given to each residential unit from the computer based on the maximum and minimum usage of the user. Computer is made up of CMOS logic and microcontroller is made up of TTL logic. To interface these both for transmission level converter is used. Serial communication is used for transmission. The voltage levels and current of controller and computer is not same. Level converter converts the output of the computer to send through the controller. Level

converter used RS232 cable for transmission. Max232 is an IC that converts RS232 serial output to suitable TTL logic. The micro-controller requests to send the signal to the residential unit kit. The required number of watts to be fixed in the sender side.For example 1 means the residential home watts is 100 watts and so on. The fixed watts information is sent in the short code words from the Controller. For transmission purpose RF transmission is used. The output of controller is sent to encoder. The RF transmission is within the 10m.The RF communication is limited to 10m to avoid interference to other regular service band. If required, GSM communication can be used instead of RF communication. The RF Module frequency is 433MHz.for demo purpose we can use RF. Because both the kits are designed in this project. By connecting wires for transmission means it takes more time and cost wise and manpower is wasted. So wireless communication is used in this project. In the residential unit is used in home. In that energy meter is used to measure the amount of watts to be consumed in the residential unit. In the current transformer the DC supply is converted in AC supply. And relay acts as a switching device. It switches the load power supply if more watts are required. Signal conditioning unit is used to select the nearest values that do not affect the processor. For buffering the power supply, we are using IC 7454 in this and it is given to the relay unit. If the power is switched off means by using solar energy we can get electricity. If no one is in room means the IR sensor will turn on and electric appliances in that room turn off automatically.

Figure 2.2 EB unit

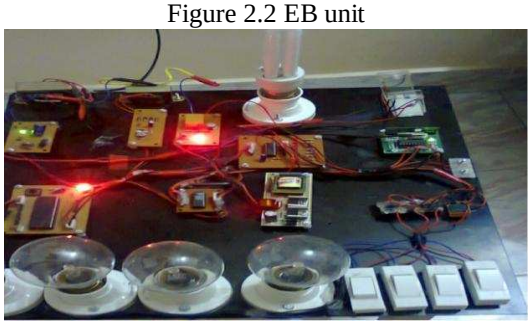

Figure2.3 Residential Unit

The required usage of watts will vary for each person's based upon their usage. If the user wants more amounts of watts means they should get penalty from EB unit. For showing demo purpose the values to turn on the electric device is given in hyper terminal software. For coding MP lab software is used or LABVIEW software is used for getting serial data.

4. CONCLUSION & FUTURE WORK

This thesis has presented power saving for residential purpose, where the power is shared equally and supplied to each residence. This project is designed mainly to solve the power cuts during heavy demands. The watts are fixed by the EB unit and it is given to each area. The power transmitted from the EB unit is encoded and given to the residential unit, where it is decoded and used. For showing demo for this project two-four bulbs are connected at the residential unit. In homes we can use GSM or others. Battery to be added in this project in future. It charges automatically from the help of solar panel. For controlling and limiting more power the more number of devices are used. Transmission of information from the EB unit to residential unit is through wireless and digital form. By implementing this project all over the country the wasted power is saved and remaining power is utilized for other important work. Later it can be implemented in industries, factories, Institutions by modifying some changes in this project. This project has been implemented in large level means the project cost will be reduced.

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