

Electricity Bill Conservation System for Smart Cities

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Abstract: This Paper Describes The Development In The Energy Meter .An Initial Amount Comfortable For The User Is Given As An Input To The System .Daily Usage Of Electricity Is Measured And Units Used For The Complete Day Along With The Tariff For The Consumed Units Is Calculated And An Prediction Is Provided To The Registered Mobile Number As An Intimation Through Gsm. Based On The Consumption High Power Consuming Devices Can Be Controlled Automatically. So That The User Can Have Awareness Of The Units Used Daily And The Tariff And It Will Be Helpful To Maintain The Electricity Bill To Their Requirement.

Keywords: Wireless Meter Reading, Gsm, Microcontroller, Arm7, Lcd Display.

I. Introduction

Every Product Or Quality We Consume In Our Daily Life Is Measured Using Some Measuring Devices Such As Voltmeters Used For Measuring Voltage, Ammeters Used For Measuring Current And So On. Similarly Electric Power Consumed In Our Daily Life Is Measured Using Electricity Consumption Meters For Calculating The Electricity Charges. In Today's World Everything We Use Had Become Electrical And Also There Is A Greater Demand For Electricity. Electricity Bill Has Been Increasing Continuously. Thus An System Is Designed To Control The Usage Of Electricity And In Turn This Effectively Reduces The Electricity Bill For An Individual. The Design And Development Of A Smart Monitoring And Controlling System For Household Electrical Appliances In Real Time Has Been Reported In This Paper .The System Principally Monitors Electrical Parameters Of Household Appliances Such As Voltage , Current And Subsequently Calculates The Power Consumed. The Aim Of This System Is The Implementation Of The Controlling Mechanism Of Appliances In Different Ways.

The Wireless Electricity Bill Conservation System Facilitates The Billing Of Energy Meter Along With Load Control Using Wireless Gsm Technology. This System Will Provide Awareness Of The Power Consumed Daily And Also An Prediction Is Intimated So That The Usage Of Electricity Can Be Adjusted According To The Prediction. The Major Components Of This System Are Microcontroller, Relays, Electricity Consumption Meter, Lcd Display, Power Supply Circuit, Gsm Modem, Db9 Connector,Max232, Relay Driver And Loads. This System Provides The User To Control Their Loads By Giving Them More Detailed Information About The Power Consumed.

II. System Architecture

The Microcontroller Based Electricity Bill Conservation System Consists Of Different Blocks Such As Power Supply Block, Microcontroller Block , Gsm Block And Relay Loads Block. The Power Supply Block Is The Basic Block For All Electronic And Electrical Devices. The Microcontroller Block Is The Main Block In This System As It Is Programmed To Control All The Components As Per The Requirements. Relay , Gsm Module, Energy Meter Cannot Be Connected Directly To The Microcontroller And Control It .Hence Interfacing Devices Are Used To Control The Relay, Gsm Module, Energy Meter And They Are Controlled Effectively.

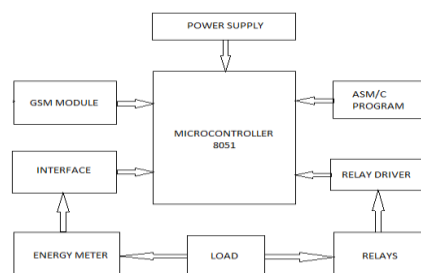


Fig. Block Diagram of Electricity Bill Conservation System

The Gsm Block Is Used To Intimate The User The Details About The Amount Of Units Used And The Tariff Through Sms To The Registered Mobile Number. The Relay Block Is Used To Control The Loads. The Loads Are Connected Between The Relays And The Energy Meter. Low Voltage Consuming Devices And High Voltage Consuming Devices Are Connected To Different Relays So That They Can Be Controlled Effectively. An Lcd Display Is Used To Display The Registered Mobile Number .The Microcontroller Is Programmed Using Embedded C.

III. Working Of Electricity Bill Conservation System

The Main Features Of This System Are Automatic Tariff Calculation, Intimating The Units Used And Tariff For The Units Used To The Registered Mobile Number Through Gsm Module, Controlling The High Power Consuming Loads When The Tariff Increases An Certain Limit. The Basic Block Is The Power Supply Block. Generally, The Power Supply Block Consists Of Step-Down Transformer, Bridge Rectifier, And Ic 7805 Voltage Regulator. The Input Power Supply Will Be 230v Ac ,This 230 V Cannot Be Directly Given To The Controller .First The 230v Ac Is Converted To 12v Using A Step Down Transformer .Thus 12 V Ac Supply Is Obtained .Ac Supply Cannot Be Used On Devices Directly .Thus An Rectifier Is Used To Convert Ac To Dc. Thus 12v Dc Is Obtained .An Ic 7805 Voltage Regulator Is Used To Limit The Voltage To 5v. Thus, The Required 5v Dc Power Supply Is Given To The Microcontroller.

The Main Block Is The Microcontroller Block. This Block Is Used To Control All The Components. The Desired Operation Is Achieved By Controlling All The Components Through This Microcontroller. In This System An Keypad Will Be Provided So That Every Individual Customer Can Incorporate Their Monthly Tariff Requirements. This Tariff Will Be Given To The Microcontroller .When The Tariff Of The Units Used Increases This Incorporated Tariff Then An Intimation Will Be Given To The User So That It Will Be An Precaution And According To The Intimation The User Can Make Use Of The Loads.Various Interfacing Devices Are Used. Opto-Isolator ,An Interfacing Device Or Middle Wire Is Used To Interface The Energy Meter With The Microcontroller. Similarly Max232 And Db9 Connector Are Used For Interfacing Global System For Mobile Communication (Gsm) Modem With The Microcontroller. As The Same Relay Drivers Are Used For Interfacing Relays With Microcontroller. The Power Used By The Consumer Daily Is Measured In Units And The Appropriate Tariff Will Be Calculated By The Microcontroller.

The Gsm Modem (Global System For Mobile Communication) Is A Communication Technology Which Is Used To Transmit Message From The Control Section To The Registered Mobile Number .Thus Through Gsm Module Information About The Units Used ,Tariff For The Units Used And The Prediction Are Sent As An Sms To The Registered Mobile Number Irrespective Of The Distance .The Intimation Can Be Given On Once In A Day ,Or Twice A Day Or Weekly Once .This Depends Upon The Consumer .

The Loads Are Connected To The Energy Meter Through The Relay. An Relay Is An Electrically Operated Switch .An Relay Switch On's Or Off's The Load Based On It Input Signal . Low Voltage Consuming Loads Are Connected To Separate Relay And High Power Consuming Loads Are Connected To Separate Relay .If The Daily Usage Of Power Exceeds The Certain Limit Incorporated By The User At The Beginning To The Microcontroller Then The High Voltage Devices Connected To The Particular Relay Will Be Automatically Controlled. When The High Power Consuming Devices Are Used Above An Certain Limit It Will Be Automatically Controlled For Two Times. An Intimation Will Be Given To The User Such That The Power Consumption And Hence The Tariff Exceeds The Limit For Twice And It Will Be Allowed For The Third Time. And The Third Time When The High Power Consuming Devices Are Switched On It Will Be Allowed.

Energy Meter Is Used For Measuring The Units Consumed. At The Beginning Analog Energy Meters Were Used Which Calculates The Units By The Number Of Turns. Here In This System Digital Energy Meter Is Used. Digital Energy Meter Calculates The Unit Used With The Help Of Number Of Pulses . Digital Meters Provide The Units Used Accurately Hence Government Is Replacing The Old Analog Energy Meters To Digital Energy Meters In All Residences. Energy Measuring Module Continuously Measuring The Instantaneous Voltage And Current And Finding The Product Of These To Give Instantaneous Electrical Power. It Is Spout The Power In The Form Of Pulses And Also Give The Information Of Power On And Off Status. This Data Are Display On To The Liquid Crystal Display.

A Liquid Crystal Display Are Interfaced To Microcontroller Unit That Are Used To Display The Meter Reading, Date Time, Power Factor, Power Status, Total Load Used Etc. Thus The Liquid Crystal Display Will Display The Basic Important Information That Will Help The Consumer To An Greater Extent.

Keil Uvision Software Is Used To Compile The Coding Of The Desired Application For The Corresponding Embedded System. This Is The Embedded C Compiler Which Is Compatible For The Arm Microcontroller To Compile The Code. Keil Software Makes C Compilers, Macro Assemblers, Real-Time Kernels, Debuggers, Simulators, Integrated Environments, And Evaluation Boards For The 8051, 251, Arm, And Xc16x/C16x/St10 Microcontroller Families .

According To The Requirement Such As The Details Of The Units Consumed,And Its Respective Tariffs Are To Be Intimated Is Programmed Using This Software And Also The Time Delay Between The Intimations Can Be Specified In The Program As Per The Requirements .

IV. Total Load Calculation

The Total Load Used In an House Can Be Calculated By Observed Or Record N Number Of Pulses In Time T That Is Given By The Equation 1

$$\text{Total load used} = \frac{K_h * N * 3600}{T} \quad \text{-----(1)}$$

Where,

K_h =Meter Constant

N=Number of Pulse

T = Total Pulse Time of N Pulses.

Thus The Total Load Consumed Can Be Calculated .Accordingly Intimation Will Be Sent To The Registered Mobile Number And Also An Prediction Will Be Made So That Future Consumption Of The Load Can Be Adjusted.

V. Conclusion

On Increasing Demand For Electricity In Today's World This System Greatly Helps The User To Conserve The Electricity Bill As Well As The Energy Can Be Saved .If The Units Consumed By The User Crosses Certain Limit, Utilization Of The Power Automatically Switch Off The Load Connected To It, So That We Can Reduce The Wastage Of Power In The Household .It Is Also Very Helpful In Large Industries, Educational Institutions, Factories Etc Where The Electricity Bill Contributes An Greater Amount . This System Is Secure And Reliable Because It Can Be Accessed Only By An Authorized Person. If Any Un-Authorized Person Tries To Access The System This System Send An Alert To Energy Provider And Also Give Warning Of That Unauthorized Person.An Additional Scope Can Be Added Such That The Entire Electricity Of An House Can Be Switched Off From An External Location Through The Registered Mobile .Thus The Entire Power Supplied To An House Can Be Controlled Through Wireless Remote. This Device Has The Capability To Revolutionize The Energy Meter Market And Will Become Help To Country Revenue By Stopping The Current Theft And Punishing The Dishonest Customers.

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