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Smart Energy Meter

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Abstract: The Proposed model will monitor their power consumption anytime by using their mobile phone via sms for the consumers and also for the supplier. It could be a huge beneficial for the customers on a real time basis. ATmega 328 and SCADA interface between energy meter and global system for mobile communication module. The integration of the ATmega and GSM modem to transmit the data like consumed energy in Kwh, generated bill, security services over GSM mobile network for power companies or organizations to provide the services among the consumers without man power and requires less time with more accuracy.This project provides the smart energy meter for the automatic metering and alert.In this system it will display the corresponding amount and unit consumed on the LCD/TEXT HMI .The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter. Also it can monitor the meter regularly without man power.

Keywords: Smart Energy meter ,Liquid Crystal Display,GSM,SCADA,RS 232/485,SATA.

Introduction:

Automation technology is entering a period of rapid change and technical advances to improve operations. In the year of 2019, about 15 billion people using computer, laptop, smart phones and tablets, but most of the devices will be intelligent sensors and embedded processors. The demand of power increasing exponentially with time. On avenue which today's energy problem can be addressed through the reduction of energy usage. This has increased the emphasis on the need of accuracy and less time. The main goal is to provides information in optimized manner. The smart energy meter is an electronic device that records the energy consumption of electrical energy and provides the information to the electricity supplier for observation. It is a two way communication between the meter and the central system. The proposed smart meter has characteristic to inform the consumer about energy consumption, this feature works for energy consumption reduction by self-awareness of actual consumption. The main advantage of this system, it will reduce the difficulties between consumers and employees regarding consumption.The system operates with high accuracy and consumes less time.As power consumption increases amount will decreases the unit of energy consumed are detected by the digital energy meter which shows the amount of power consumed in form of energy unit and display remaining amount on LCD. Smart energy meter is used to record the consumption of energy. It communicates the information to electricity supplier for controlling and monitoring. It is a two way communication between the meter and the central system.

Block diagram:

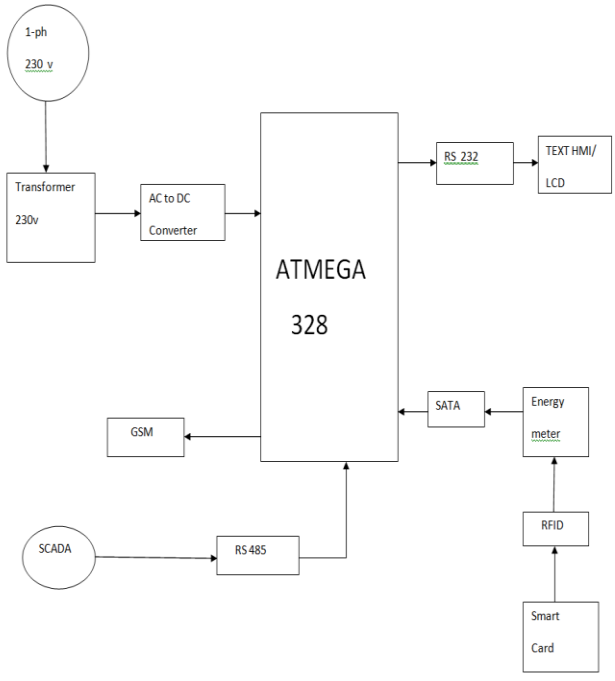

Figure 1: Block Diagram of Proposed Model

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SATA-Serial Advanced Technology Attachment
GSM- Global System for Mobile Communication

Overall operation of proposed model:

ATmega328 pu is the main component of our proposed model. The SCADA are used for automation process that is used to calculate the data either monitoring or controlling purpose. The SCADA and ATmega are interfaced by using RS485/232 as shown in Figure 1. A supply of 230V is connected to step up transformer of 230/9V.Then it is connected to AC to DC converter and connected to ATmega. The GSM module is connected to ATmega so that the output is displayed in LCD. SATA is used to extract the data from energy meter and connect to the ATmega. SATA is the cable that transfers the data. The energy meter is connected to ATmega to generate the output in text HMI through GSM module.We can pay before use the power. No bill protection is required. No bill distribution required. No need to chase payments. No further actions such as disconnection. This can be done as rental accommodation.

Problem in existing model:

In existing model the units consumed by the consumer is taken manually. This takes more time to calculate the energy consumption and it causes the human error. The consumer or electrical department has to spend more amount for installing this kind of smart energy meter. Economically it is not advised. We propose a Smart energy meter has gone for recording and paying bill calm. This requires the clients to pay for the power before its whole utilization is over. The printed charging at times may get lost.

METHODOLOGY:

The Microcontroller microchip ATmega 328 and RS 485/232 is used to develop the proposed smart energy meter. SCADA is used as briny component of this system. The In touch software system is used to control and monitor the energy consumption data.

COMPONENTS:

The below components are used in smart energy meter.

ATMEGA 328 pu:

The ATmega328 is a single chip microcontroller, a product of Atmel in the mega AVR family. It has a altered Harvard architecture 8 bit RISC processor core. ATmega 328 is fundamentally an advanced virtual RISC (AVR) micro-controller. It reinforcement the data up to eight bits. ATmega made up of 28 pins. This ATmega is wounded on Arduino UNO board.The below shown diagram Figure 2 is the structure of Arduino Board.

Figure 2: Structure of Arduino UNO Board

PIN DIAGRAM:

PIN CONFIGURATION:

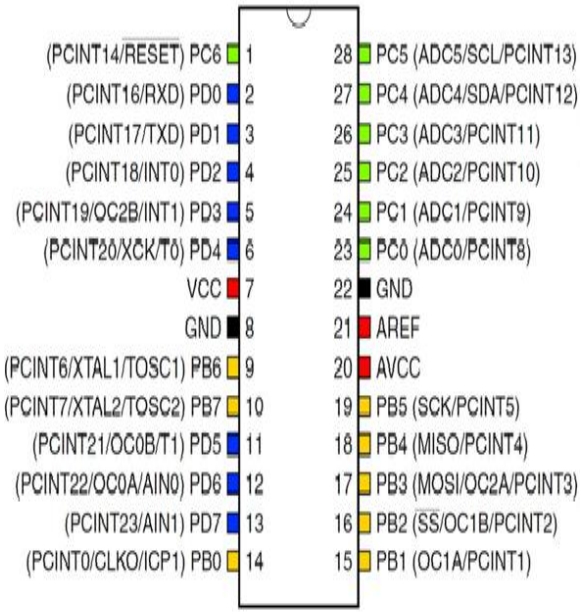

Figure 3:Pin Diagram

PIN DESCRIPTION

VCC Digital supply voltage:

GND Ground:

Port A (PA7-PA0) -Port A do as the analog inputs to the A/D Converter. Port A serves as an 8-bit bi-directional input/output port shown in Figure 3, if the A/D Converter is not used. The Port A output buffers have symmetrical drive characteristics with high sink and source capability. When pins PA0 to PA7 is used as inputs and also externally pulled low, then the source current will flow internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition go active, even if the clock is not standing.

Port B (PB7-PB0) -Port B is an 8-bit bi-directional input/output port with internal pull-up resistors. The Port B output have symmetrical drive characteristics with both high sink and source capability. As input, Port B are externally pulled low will source current if the pull-up resistors is activated. The Port B pins are tri-stated when a reset state becomes active. Port B also service as the functions of various special features .

Port C (PC7-PC0) -Port C is an 8-bit bi-directional input /output port with internal pull-up resistors. The Port C output will have symmetrical drive characteristics with high sink and source capability. As input, Port C are externally pulled low will source current. The Port C pins are tri-stated. If the JTAG is enabled, the pull-up resistors on pins PC5, PC3 and PC2 will be activated. The TD0 pin is tri-stated inferior TAP states that shift out data entered. Port C also provide the functions of the JTAG .

Port D (PD7-PD0) -Port D is a 8-bit bi-directional input/output port made of internal pull-up resistors. The Port D output will have symmetrical drive characteristics with high sink and source capability. As input, Port D pins are externally pulled low will source current if the pull-up resistors are excited. The Port D pins are tri-stated .

Reset- Reset Input A low level pin. In this pin for various than the minimum pulse length will generate a reset. Shorter pulses are not secured to generate a reset.

SATA:

Stands as "Serial Advanced Technology Attachment," or "Serial ATA." It is used as interface to connect ATA. ATA is a hard drives which is connected to the computer motherboard.

Besides faster transfer rates, the SATA interface has several advantages over the other interfaces. SATA cables can be as long as one metre. Serial ATA is a better, and much more economical interface than the dated PATA (Parallel ATA).

RS 485:

RS 485 is known as TIA-485 is a standard defining the electrical characteristic of drives and receivers for use in serial communication systems. Electrical signaling is balanced and multipoint systems are supported.

RS 232:

The RS 232 is a protocol used for serial communication .It is used for connecting computer audits peripheral devices to allow serial data exchange between them. RS 232 is an example for full duplex communication.

SCADA:

Supervisory Control and Data Acquisition (SCADA) is control system which uses data communications and graphical user interface .It is used for controlling and monitoring data .The main objective of SCADA is analyze & calculation of complex the process and maintain accordingly the Control Signals.The SCADA is a remote terminal unit which is also called as RTU. Most control actions are mechanically performed by RTUs or PLCs.

LIQUID CRYSTAL DISPLAY:

A liquid-crystal display is a flat panel display or other electronic optical device .Liquid crystal does not emit light emit directly. LCDs are used in wide range of application. It allows them to reflect_light. LCDs are used for displaying the output datas.

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RF ID (RC 522):

Radio frequency identification function of electromagnetic fields. It automatically identify and track tags attached to objects. This uses SPI to communicate with microcontrollers. The cost is low and small sized non- contact card chip.The best choice for intelligent and portable handheld devices.

SMART CARD:

Same size as a regular credit card. A microchip integrated in a plastic card to store collection. Latest silicon technology doesn't need use of batteries. A chip can be program to carry through specific function.

FEATURES:

This smart energy meter gives accurate measurement and reduces the time. This can also used to calculate the energy consumed for more consumers without wasting a time.

SCOPE OF THE PROJECT:

Based on the cost, the information is provided. Ability to reduce energy consumption by understanding the amount energy utilizing and wasting. More flexible ways to top up. Better tracking of their usage to avoid unexpectedly running out of energy credit. Automatic or scheduled top ups so households no longer need to worry if they are running low on energy credit.

FLOW CHART:

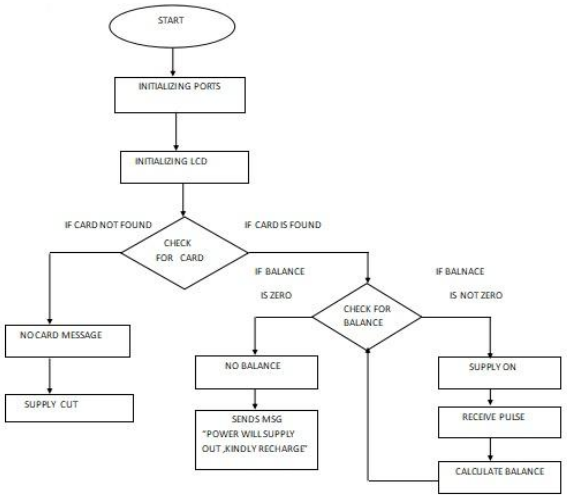

Figure 4: Overall Flow Chart

ALGORITHM:

STEP 1:START the process

STEP 2:Initialize the ports

STEP 3:Initialize the LCD display

STEP 4:Check for the card

STEP 5:If card is found ,then check for balance

STEP 4:If balance is zero,it will show message

"POWER SUPPLY WILL OUT KINDLY RECHARGE SOON".

STEP 5: If balance is not Zero, it will send message about the balance and also about the expiry date.

STEP 6:If card is not found, it will sends message no card found.

RECHARGE SECTION;

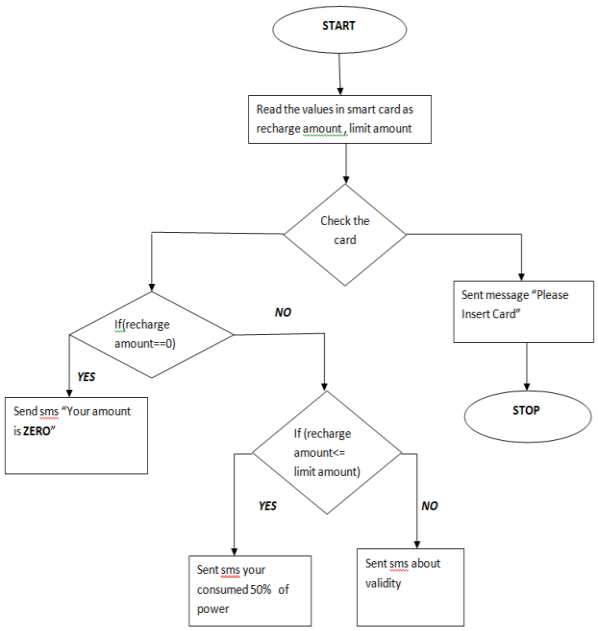

Figure 5: Flow Chart for Recharge Section

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ALGORITHM:

STEP 1: START the process
STEP 2: Initialize the amount to be recharged and the minimum amount.
STEP 3: Check for the card
STEP 4: If yes, check for amount. If it is zero, send message as "Your amount is Zero"
STEP 5: If the recharged amount is less than the limited amount, if yes send an alert that 50%of power is consumed. If no, send about the validity information.
STEP 6: If the card is not found, send message "Please insert card".
STEP 7: STOP

OVERALL BLOCK DIAGRAM:

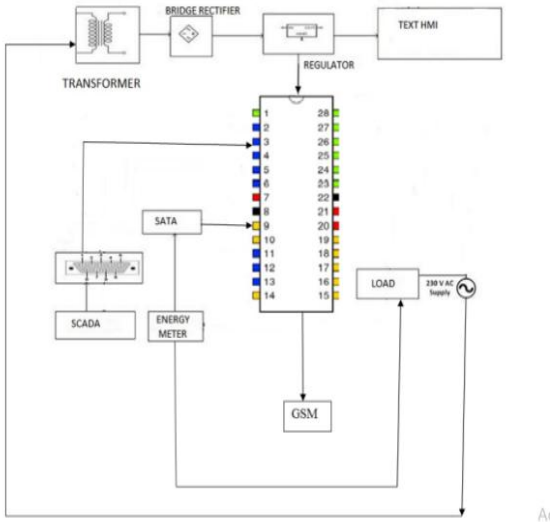

Figure 6: Overall Block Diagram

The working of the proposed system is clearly shown in Figure 6. The transformers carry the supply of 230V AC supply which is step down transformer. The transformer which has high voltage on primary side and low voltage on secondary side are called as step down transformer. Then the transformer is connected to bridge rectifier. The rectifier converts the ac supply to dc supply. The microcontroller can hold the supply of dc only. The regulator, which maintain constant voltage. The main advantage of the regulator is, if any deviation on the input supply, it can also generate the required output voltage. The voltage from the regulator is supplied to ATmega328.SCADA is used to monitor and analysis the input data .The machine to machine communication carried out by RS 485/232.RS 485/232 is act as cable to transmit the datum. SATA is used to extract the data from energy meter and connect it to the ATmega. GSM is a module used to send the alert or sms to the costumers as well as supplier.

CIRCUIT DIAGRAM:

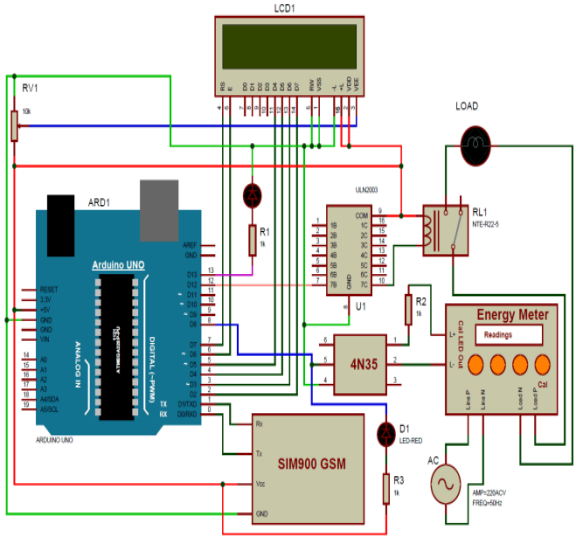

Figure 7:Overall Circuit Diagram

The internal circuit (Figure 7) in which the ATmega 328 connected to the RS 485 and RS 232. The main function of RS 485 and 232 is act for machine communication. The switch which is act as input supply of 230V .The operation of GSM module is to send message alert to the consumer about the balance of recharge amount. It holds an antenna for signal communication. The work of TEXT HMI is same of LCD which display the output.

CONCLUSION:

This paper is intended to present an overview of smart energy meter which can minimize the usage of electricity on consumerto avoid the wastage of power. Smart energy meter is a concept to minimize the electricity consumption with a cost efficient mode. The users are not conjugate to pay more amount of money, in spite of that users can pay according to their requirement. Smart energy meter is

more reliable and user friendly. This remote energy meter proves to be a boon in the power sector. It control the utilization of electricity on consumer said to prevent wastage of power.. However the design has to meet certain prepaid modular and regulations. The only concern is the security and privacy of data as they are prone to cyber attack. The use of GSM in the system provides many advantages over methods which are already in use. Data transmission is charged at standards SMS rates, thus the charges are not based on the duration of data transmission. The cost efficient of readings. The proposed system willprovide information about daily, monthly and yearly power usage. Details about daily power consumption will help consumer to manage their power usage. This proposed system is reliable and secure as only authorized person can access the system .

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