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IOT BASED EB MONITORING ANDTHEFT DETECTION

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***Abstract*—** The Existing local Energy meter perusing frameworks generally exist numerous issues, for example, trouble in development, excessive contract data transmission, poor ongoing, not two-way correspondence rapidly, and so forth. To take care of the above issues, this paper utilizes remote innovation for the Automatic Meter Reading framework. A proposed strategy gives the correspondence between the Electricity Board segment and the purchaser utilizing the Internet of things (IoT) for transmitting the client's power utilization and bill data that is computed utilizing a microcontroller. The power variances are checked to utilize the voltage sensor and the current sensor is encouraged to the microcontroller which shows it to the Electricity Board. Contingent upon the power era, household gadgets are controlled naturally. From the Electricity Board segment, the data in regards to the bill sum and installmentare conveyed to the customer using Global System for Mobile correspondence. The power and charging data are constantly transmitted by the utilization of the Internet of Things and observed by the Electricity Board area. At whatever point there is power robbery distinguished can be sent from the Electricity Board area to slice the supply tothe client.

I. INTRODUCTION

Power is the main thrust behind the improvement of any nation. With the fast increment in private, business, and mechanical purchasers of power all through the world, it has now turned out to be basic for utility organizations to devise better, non-meddlesome, earth-safe systems of gaging utilities' utilization so that the right bills can be created and invoiced. In the Internet of Things (IoT)show, huge numbers of the living and non-living things that incorporate us will be on the web in some frame. Driven by the prevalence of contraptions enabled by wire-less mechanical advancement, for example, Wireless Bluetooth, Radio Frequency Identification, Wireless-Fidelity, and installed sensors, IoT has movedout from its starting stage and it is really on the edge of changing the present settled between net into an all-around highlighted up and coming Internet. Rightnow there are just about nine billion associated contraptions and it is assessed to touch very nearly fifty billion devices by 2022.

There is a joining of portable innovation into the MSEB computerization framework because of the quickly propelling versatile correspondence innovation and the diminishing in expenses. We propose a framework that gathers the vitality utilization from private and corporate zones and sends it straightforwardly to the focal server where handling is done on that information for the readiness of bills. AMR framework can be separated into wire AMR framework and remote AMR framework as indicated by the correspondence medium utilized. The existing framework for gathering vitality utilization information is that the agents of MSEB month to month come and visiteach private, take the depiction and corporate, and physically peruse the utilization information from the meter.

II. EXISTING SYSTEM

The existing framework just gives criticism to the client toward the finishof the month that how much power is expended as a bill. The purchaser has no real way to track their vitality use on a quicker premise. The shoppers are becoming exponentially quick and the load on power-giving divisions is

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quickly rising. In the current framework, meter altering should be possible effortlessly and it's one of the significant downsides of a vitality emergency. In any case, to the best of our insight, a completely programmed grouping technique has not been already reported in the zone of recognizing intracardiac masses in echocardiograms. Regularly, this sort of grouping technique is made out of four sections including DE speckling, division, highlight extraction, and arrangement.Dissimilar to the added substance, white and Gaussian (AWG) commotion, the dot in the ultrasound picture is a multiplicative clamor, whose surface regularly conveys valuable anatomical data.

LIMITATIONS

- Eliminating manual meter reading
- Monitoring the electric system more quickly
- Making it possible to use power resources more efficiently
- Providing real-time data useful for balancing electric loads and reducing power outages (blackouts)

III. PROPOSED SYSTEM

we proposed a framework, the purchaser can control administration by knowing vitality use from time to time. The Customer needs to pay the bill on the timetable, if proved unable, the electric power network can be killed independently from the far-off host. Since IoT is savvy contrasted with SMS, observing vitality meters at a lower cost is made conceivable. Day-by-day utilization reports are produced which can be observed through the Android applications and additionally online interface. Additionally, android clients can pay their electric bills from their android application. Non-android clients can screen and pay their bills on the web. The framework is more solid and exact perusing qualities are gathered from vitality meters. Live readings of the vitality meter can be seen through the Android application. Additionally, the readings can be seen on the web. The human concentrated work is stayed away from and every one of the qualities is kept up in the focal server. The correspondence medium is secure and altering of vitality meters can be recognized effortlessly. On the off chance that a blunder happens in the framework, the incentive in the focal serverwon't be redesigned. Once the esteem upgrade crosses the edge time, the server can confirm that something isn't right in the framework and can report the specialists in EB. In this way, distinguishing proof of blunder gets to be distinctly less demanding. Since the qualities are put away in the focal database, the reports are made available from any place on the planet. Additionally, the server is online 24x7.

we proposed framework, we supplanted the customary meter by ma entering module which comprises of metering IC and microcontroller which filters the vitality meter naturally after consistently and transmits thisgathered information to the remote station through the GSM arrange. After accepting this information is put away in the database and processed on it for the formation of bills. When bills are produced, they will sendto the buyers using the GSM system. Web of things (IoT) is the fundamental strategy for correspondence between the vitality meter and the web server. I, being a 2.5G versatile innovation, being accessible Everywherethroughout The World. It Is Additionally In A Perfect World Reasonable For Information Exchange Over A Dependably Online Association Between A Focal Area And Cell Phones. The Cost Is Per Kilobyte Of Information Exchanged, In Contrast With SMS Where The Cost Is Per Message. The Perusing Data From The Vitality Meter Progressively Is Transferred To A Focal Database Using Iot Each Client Of The Framework May Get To This Data Usingthe Internet. ARDUINO microcontroller is interfaced with the vitality meter and ARDUINO which goes about as the ace controller through RS-232. The get stick of RS-232 of PIC is associated with the transmit stick of RS-232 of ARDUINO. The transmit stick of RS-232 of PIC is associated with the get stick of RS-232 of the SIM900 module.8051 microcontroller screens each beat of the vitality meter. It sends the deliberate perusing to ARDUINO each time the esteem is changed. ARDUINO gets the perusing and afterward speaks with SIM900 through ATorders and transmits the perusing data through IoT to the focal server.

ADVANTAGE

- It is very economical as compared to electricity losses.

- Individual power theft can be calculated.
- Does not affect the power transfer capability of the line.

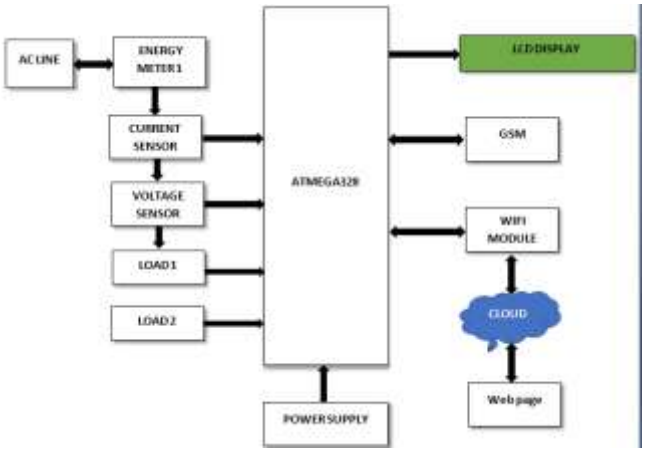


Figure 1 : Block diagram

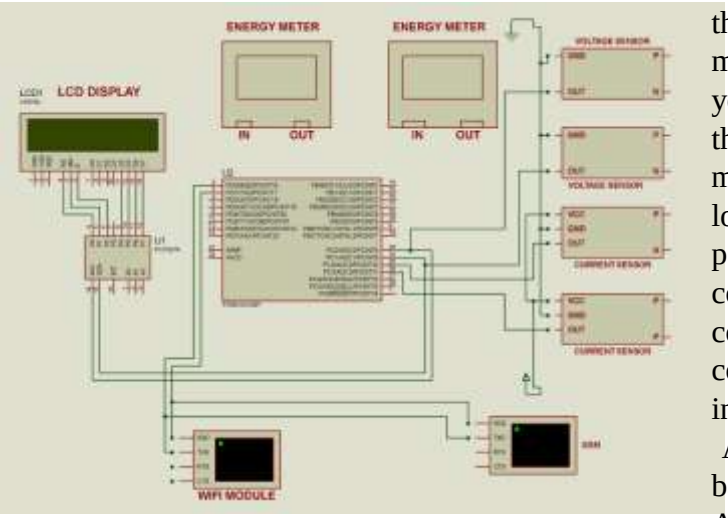


Figure 2 : CIRCUIT DIAGRAM

IV. HARDWARE

HARDWARE REQUIREMENT:

- ARDUINO
- VOLTAGE SENSOR
- CURRENT SENSOR
- ENERGY METER
- POWER SUPPLY
- LCD DISPLAY
- LOAD
- WIFI MODULE

1)ARDUINO

INTRODUCTION TO ARDUINO

Arduino interface boards provide the engineers, artists, designers, hobbyists and anyone who tinker with technology with a low-cost, easy- to-use technology to create their creative, interactive objects, useful projects etc., A whole new breed of projects can now be built that can be controlled from a computer.

Arduino is a open source electronics prototyping platform based on flexible, Easy - to-use hardware and Software. It's intended for artists, designers, hobbyists, and anyone interested in Creating interactive objects or environments.

It's an open-source physical computing platform based on a microcontroller board, and a development environment for writing software for the board. In simple words, Arduino is a small microcontroller board with a USBplug to connect to your computer and a number of connection sockets that can be wired up to external electronics ,such as motors, relays, light sensors, laser diodes, loudspeakers, microphones, etc., They can either be powered through the USB connection from the computer or from a 9V battery. They can be controlled from the computer or programmed by the computer and then disconnected and allowedto work independently.

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activatinga motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and theArduino Software (IDE), based on Processing.

HISTORY OF ARDUINO

While teaching a physical computing class at the Interaction Design Institute Ivrea in 2005, Massimo Banzi's students were unwilling to spend the

76euros for the BASIC Stamp microcontrollers commonly used in such applications. Banzi and his collegues looked for alternatives, finally settling on the wiring platform developed by one of Banzi's students.

In his own words: we started to figure out how could we make the whole platform even simpler, even cheaper, even easier to use. And then we started to essentially re implement the whole thing as an open source project.

Once they had a prototype, a student wrote the software that would allow wiring programs to reunion the new platform. Upon seeing the project, visiting professor Casey Reas suggested that there might be wider applications than just design schools for the new product. The prototype was redesigned for mass production and a test run of 200 boards was made. Orders began coming in from other design schools and the students looking for Arduinos

The Arduino project was born and Massimo Banzi and David Cuartielles became its founders. ARDUINO is an Italian word, meaning STRONG FRIEND. The English version of the name is Hardwin. As of May2011, more than 300,000 Arduino units are in the wild.

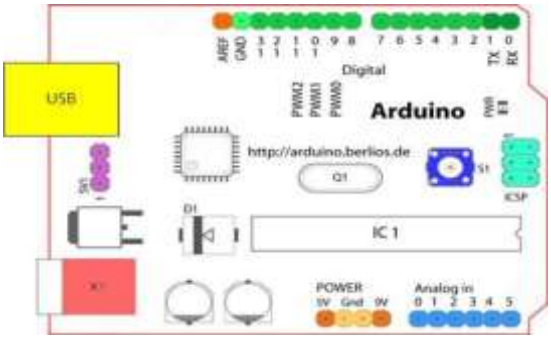


Figure 3 : ARDUINO BOARD LAYOUT

FEATURES:

- ***High-performance, Low-power AVR®***
- 8-bit Microcontroller
- ***Advanced RISC Architecture***

– 130 Powerful Instructions – Most Single-clock Cycle Execution
– 32 x 8 General Purpose Working Registers
– Fully Static Operation
– Up to 16 MIPS Throughput at 16 MHz
– On-chip 2-cycle Multiplier

- ***High Endurance Non-volatile Memory segments***

– 8K Bytes of In-System Self-programmable Flash program memory
– 512 Bytes EEPROM
– 1K Byte Internal SRAM
– Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
– Data retention: 20 years at 85°C/100 years at 25°C (1)
– Optional Boot Code Section with Independent Lock Bits

- ***In-System Programming by On-chip Boot Program***

– True Read-While-Write Operation
– Programming Lock for Software Security

- ***Peripheral Features***

– Two 8-bit Timer/Counters with Separate Prescaler, one compare

- ***Six Channels 10-bit Accuracy***

– Byte-oriented Two-wire Serial Interface
– Programmable Serial USART
– Master/Slave SPI Serial Interface
– Programmable Watchdog Timer with Separate On-chip

- ***Oscillator***

– On-chip Analog Comparator

- ***Special Microcontroller Features***

–Power-on Reset and Programmable Brown-out Detection
–Internal Calibrated RC Oscillator

–External and Internal Interrupt Sources

–Five Sleep Modes: Idle, ADC Noise Reduction, Power-save

- ***I/O and Packages***

–23 Programmable I/O Lines

–28-lead PDIP, 32-lead TQFP, and 32-pad QFN/MLF

- ***Operating Voltages***

– 2.7 - 5.5V (ATmega8L)

– 4.5 - 5.5V (ATmega8)

- ***Power Consumption at 4 Mhz, 3V, 25°C***

– Active: 3.6 mA

– Idle Mode: 1.0 mA

– Power-down Mode: 0.5 µA

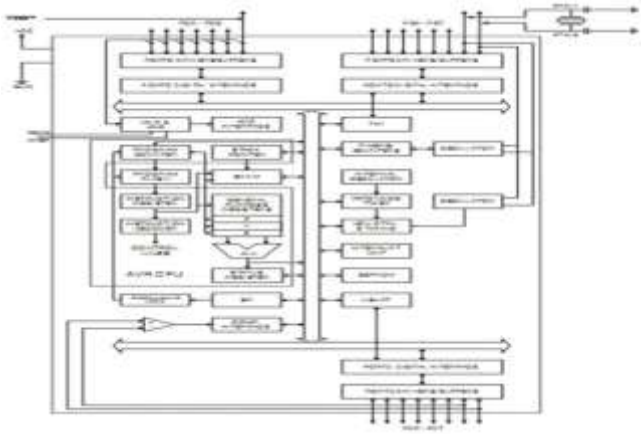


Figure 4 : ARCHITECTURE DIAGRAM

2) PIN CONFIGURATIONS

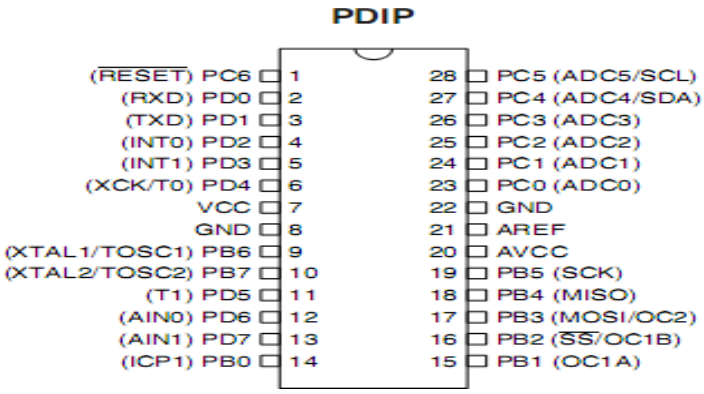


Figure 5 : PIN DIAGRAM

The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1 MIPS per MHz, allowing the system designed to optimize power consumption versus processing speed.

A. Pin Descriptions:

VCC :-Digital supply voltage.

GND:- Ground.

Port B(PC7..PB0) :- is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active,even if the clock is not running.

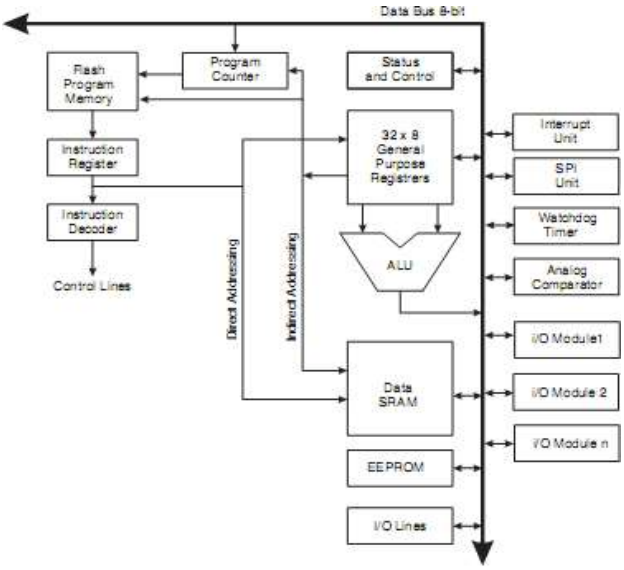
Port C (PC5..PC0) :- Port C is an 7-bit bi-directional I/O port with internal pull- up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port D (PD7..PD0) :- Port D is an 8-bit bi-directional I/O port with internal pull- up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active,even if the clock is not running.

RESET (Reset input):- A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The Shorter pulses are not guaranteed to generate a reset.

AVCC:- AVCC is the supply voltage pin for the A/D Converter, Port C (3..0), and ADC (7..6). It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-passfilter.

AREF:- AREF is the analog reference pin for the A/D Converter.These pins are powered from the analog supply and serve as 10-bit ADC channels.



Basic Function:- The main function of the CPU core is to ensure correct program execution. The CPU must therefore be able to access memories,

perform calculations, control peripherals, and handle interrupts.

Figure 7 :INTERFACING DIAGRAM

B. INTERFACING OF DATA BUS WITH DIFFERENTUNITS

In order to maximize performance and parallelism, the AVR uses a Harvard architecture with separate memories and buses for program and data.

Instructions in the Program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the Program memory. This concept enables instructions to be executed in every clock cycle.

The Program memory is In-System Reprogrammable Flash memory. The fast- access Register File contains 32 x 8-bit general purpose working registers with a single clock cycle access time. This allows single-cycle Arithmetic Logic Unit (ALU) operation. In a typical ALU operation, two operands are output from the Register File, the operation is executed, and the result is stored back in the Register File in one clock cycle.

Six of the 32 registers can be used as three 16-bit indirect address register pointers for Data Space addressing enabling efficient address calculations. One of the these address pointers can also be used as an address pointer for look up tables in Flash Program memory. These added function registers are the 16-bit X, Y and Z-register. The ALU supports arithmetic and logic operations between registers or between a constant and a register. Single register operations can also be executed in the ALU. After an arithmetic operation, the Status Register is updated to reflect information about the result of the operation. The Program flow is provided by conditional and unconditional jump and call instructions, able to directly address the whole address space. Most AVR instructions have a single 16-bit word format. Every Program memory address contains a 16- or 32-bit instruction.

5) LCD DISPLAY

The most commonly used Character based LCDs are based on Hitachi's HD44780 controller or other which are compatible with HD44580. In this tutorial, we will discuss about character based LCDs, their interfacing with various microcontrollers, various interfaces (8-bit/4-bit), programming, special stuff and tricks you can do with these simple looking LCDs which can give a newlook toyour application.

A. PIN DESCRIPTION

The most commonly used LCDs found in the market today are 1 Line, 2

Line or 4 Line LCDs which have only 1 controller and support at most of 80characters, whereas LCDs supporting more than 80 characters make use of 2 HD44780 controllers.

Most LCDs with 1 controller has 14 Pins and LCDs with 2 controller has 16Pins (two pins are extra in both for back-light LED connections). Pin description is shown in the table below.

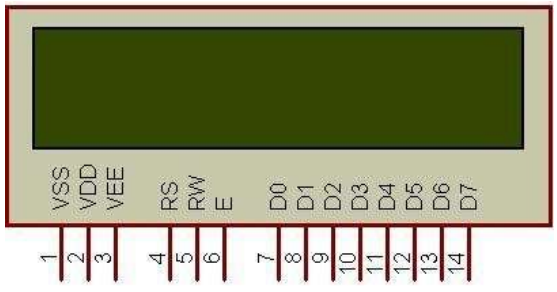


Figure 8 :LCD PIN DIAGRAM

*B. Character LCD type HD44780 Pin diagram (16*2)*

Table 1 : PIN DETAILS

Pin No.	Name	Description
Pin no. 1	**VSS**	Power supply (GND)
Pin no. 2	**VCC**	Power supply (+5V)
Pin no. 3	**VEE**	Contrast adjust
Pin no. 4	**RS**	0 = Instruction input 1 = Data input
Pin no. 5	**R/W**	0 = Write to LCD module 1 = Read from LCD module
Pin no. 6	**EN**	Enable signal
Pin no. 7	**D0**	Data bus line 0 (LSB)
Pin no. 8	**D1**	Data bus line 1
Pin no. 9	**D2**	Data bus line 2
Pin no. 10	**D3**	Data bus line 3
Pin no. 11	**D4**	Data bus line 4
Pin no. 12	**D5**	Data bus line 5
Pin no. 13	**D6**	Data bus line 6
Pin no. 14	**D7**	Data bus line 7 (MSB)

Character LCD pins with 1 Controller

Pin No.	Name	Description
Pin no. 1	**D7**	Data bus line 7 (MSB)
Pin no. 2	**D6**	Data bus line 6
Pin no. 3	**D5**	Data bus line 5
Pin no. 5	**D4**	Data bus line 4
	D3	Data bus line 3
Pin no. 6	**D2**	Data bus line 2
Pin no. 7	**D1**	Data bus line 1
Pin no. 8	**D0**	Data bus line 0 (LSB)
Pin no. 9	**EN1**	Enable signal for row 0 and 1 (1^{st}controller)
Pin no. 10	**R/W**	0 = Write to LCD
Pin no. 11	**RS**	0 = Instruction
Pin no. 12	**VEE**	Contrast adjust
Pin no. 13	**VSS**	Power supply (GND)
Pin no. 14	**VCC**	Power supply (+5V)
Pin no. 15	**EN2**	Enable signal for row 2 and 3 (2^{nd}controller)
Pin no. 16	**NC**	Not Connected

6) RECTIFIER

The Rectifier circuit is used to convert the AC voltage into its correspondingDC voltage Rectifier having three types,

- Half wave rectifier.
- Full wave rectifier
- Bridge rectifier

The most important and simple device used in Rectifier circuit is the diode. This project used to bridge rectifier.A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally. below diagram is bridge rectifier.

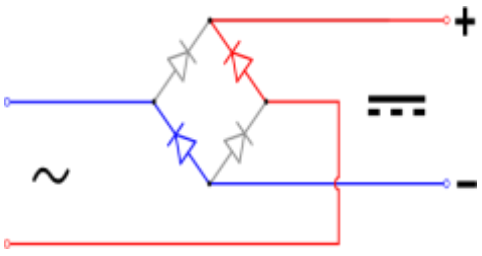


Figure 9 : RECTIFIER

The simple function of the diode is to conduct when forward biased and not to conduct in reverse bias. The Forward Bias is achieved by connecting the diode's positive with positive of the battery and negative with battery's negative.The efficient circuit used is the Full wave Bridge rectifier circuit. The output voltage of the rectifier is in rippled form, the ripples from the obtained DC voltage are removed using other circuits available. The circuit used for removing the ripples is called Filter circuit.

The simple capacitor filter is the most basic type of power supply filter. The application of the simple capacitor filter is very limited. It is sometimes used on extremely high-voltage, low-current power supplies for cathode-ray and similar electron tubes, which require very little load current from the supply. The capacitor filter is also used where the power-supply ripple frequency is not critical; this frequency can be relatively high. The capacitor (C1) shown in figure 4-15 is a simple filter connected across the output of the rectifier in parallel with the load.

Capacitors are used as filter. The ripples from the DC voltage are removed and pure DC voltage is obtained. And also these capacitors are used to reduce the harmonics of the input voltage. The primary action performed by capacitor is charging and discharging. It charges in positive half cycle of the AC voltage andit will discharge in negative half cycle. Here we used 1000µF capacitor. So it allows only AC voltage and does not allow the DC voltage. This filter is fixed before the regulator. Thus the output is free from ripples.

7) REGULATOR

Regulator regulates the output voltage to be always constant. Regulator having two types.

- Positive regulator (78XX)
- Negative regulator (79XX)

The output voltage is maintained irrespective of the fluctuations in the input ACvoltage. As and then the AC voltage changes, the DC voltage also changes. Thus to avoid this Regulators are used. Also when the internal resistance of the powersupply is greater than 30 ohms, the output gets affected. Thus this can be successfully reduced here. The regulators are mainly classified for low voltage and for high voltage. Here we used 7805 positive regulator. It reduces the 12V dcvoltage to 5V dc.

The Filter circuit is often fixed after the Regulator circuit. Capacitor is most often used as filter. The principle of the capacitor is to charge and discharge. It charges during the positive half cycle of the AC voltage and discharges during the negative half cycle. So it allows only AC voltage and does not allow the DC voltage. This filter is fixed after the Regulator circuit to filter any of the possibly found ripples in the output received finally. Here we used 0.1µF capacitor. The output at this stage is 5V and is given to the Microcontroller In the power supply circuit two regulators are used. 7805 regulator is used to produce positive 5V dc. Microcontroller and sensors are operated at 5V dc voltage. The output of the 7805 regulator is connected to Arduino Nano microcontroller.

8) ELECTRIC ENERY METER:

A.C. Single Phase, 2 Wire Solid State (Static) Fully Electronic Energy Meter, Accuracy Class 1.0 &Current Rating 5-30 Amp. with Backlit LCD Display for 240 Volt System fitted with Pilfer Proof Meter Box.

9) SCOPE

This specification covers design, engineering, manufacture, testing, inspection & supply of A.C. Single phase, two wire solid state (static) fully electronic energy meters of accuracy class 1.0 & current rating 5-30 A, with backlit LCD display for 240 Volt systems as per requirement in this specification and pilfer proof meter box (PPMB) made of engineering plastic, FR grade with self-extinguishing property suitable for single phase meter. The meter should be capable of recording & displaying energy in KWH & demand in KW for single phase two wire A.C. loads respectively for power factor range of Zero lag – unity

– Zero lead. Meters should have facility/ capability of recording tamper information.

Figure 10 : ENERY METER

It is not the intent to specify completely herein all the details of the design and construction of meter. However the meter shall conform in all respects to high standards of engineering, design and workmanship shall be capable of performing commercial operation continuously in a manner acceptable to WBSEDCL, who will interpret the meanings of drawings & specification and shall have the right to reject any work or material which in its judgment is not in accordance therewith. The offered meter shall be complete with all components,accessories necessary for their effective and trouble-free operation of the system for the purpose mentioned above. Such components shall be deemed to be within the scope of bidders supply irrespective of whether those are specifically brought out in this specification and / or the commercial order or not.

The original manufacturers of LT A.C. static energy meters shall only quote against this tender. In case of foreign manufacturers their authorized agent may also bid provided that they should be registered vendor and shall have all the testing facilities in India. They should also produce the documents authorizing them as agents, in India

It is mandatory that in case of all manufacturers, the offered meter shall be ISI marked and bidder shall have to furnish valid BIS certification along with the offer.

10) CLIMATIC CONDITION

The meters to be supplied against this specification should be suitable for satisfactory continuous operation under the following tropical conditions. Meters should be capable of maintaining required accuracy under hot, tropical and dusty climatic conditions.

1.	aximum Ambient Air Temperature in shade:	550 C
2.	inimum Ambient Air Temperature	(-)100 C.
3.	aximum Relative Humidity:	95%(non-condensing)
4.	inimum Relative Humidity:	10%
5.	eight above mean sea level Meters:	Up to 3000
6.	Average number of tropical monsoons per annum:	5 months
7.	Annual Rainfall :	100 mm to 1500 mm

11) SUPPLY SYSTEM: (1 Phase 2 Wire)

Rated voltage (Vref): 240 V – Phase to Neutral
Rated Current: Basic current 5 Amps (lb), Maximum current : 30Amps (l max)
Rated Frequency: 50 Hz

12) POWER FACTOR RANGE

The meter should be suitable for full power factor range from zero (lagging) through to Unity to zero (leading).

13) POWER SUPPLY VARIATION

The meter should be suitable for working with following supply system variations.

System	**1 Phase 2 Wire**
Specified range Of operation	70% to 120% of reference Voltage i.e. 240Volt.
Frequency	50Hz ±5%

14) ACCURACY

1. Class of accuracy of the meter should be 1.0. The accuracy should not driftwith time.
2. Maximum error limit at 1% Ib, UPF should preferably be within +/- 2%.
3. For voltage variation use of "between 70% to 50%" of Vref.allowable errorlimit is +/- 4%.

15) POWER CONSUMPTION

Voltage Circuit:The active and apparent power consumption in the voltage circuit including the power supply of meter at reference voltage, reference temperature and reference frequency should not exceed 1.0 Watt and 4 VA respectively

Current Circuit: The apparent power taken by each current circuit at basic current, reference frequency and reference temperature should not exceed 1 VA.

16) STARTING CURRENT & RUNNING AT NO LOAD

The meter should start registering energy at 0.2 % of basic current at unity power factor and first pulse must be appeared within 10 minutes (i.e. time between two consecutive pulses).

Running at no load: When 70% & 120% voltage is applied and no current flows in the current circuit, the test output of the meter should not produce more than one pulse

17) MAXIMUM CONTINUOUS CURRENT

The maximum continuous current in meters should be the current at which the meter purports to meet the accuracy requirement of the specification. The same is indicated in table in clause 4 above.

18) GENERAL & CONSTRUCTIONAL REQUIREMENTS

Meters should be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However, the following should be ensured.

a) Personal safety against electric shock
b) Personal safety against effects of excessive temperature.
c) Protection against spread of fire
d) Protection against penetration of solid objects, dust & water

The meter should be designed with ASIC (application specific integrated circuit) and should be manufactured using SMT (Surface Mount Technology) components. Power supply and voltage divider circuits may be of PTH (Pin Through Hole) technology

19) DISPLAY

The measured value(s) should be displayed on a Liquid Crystal display (LCD) register. The height X width of the digit should be minimum 8.0 X 5 mm. The KWh energy registration should take place with 6 complete digits. The display should have backlit capability for easy reading. When the LCD is placed at a constant temperature of 65 deg C for a period of 30 minutes in operating condition and 80 deg C for 30 mins. Under de-energized / storage condition, it should not get deformed.

The meter should display the required parameters in two different modes as per the sequence given below.

20) Auto Display Mode :

The following parameters hereinafter referred to as "Billing Parameters" (B.P) should be displayed in an auto-cycle mode, in the following sequence :

1. LCD Test
2. Real Time
3. Date
4. Cumulative Active energy (forwarded) reading (kWh)
5. Last Bill Maximum demand (kW)
6. Billing period counts

Each parameter should be on meter display for 10 seconds and the time gap between two auto-cycles should be 120 seconds

21) Push Button Mode :

In addition to the auto display mode parameters, the following parameters should be displayed on pressing the push button (All displays of auto mode and the following)

1. Last Bill Active Forward energy
2. Instantaneous Load (KW)
3. Instantaneous voltage, current(whichever is higher between Ip &In)
4. Maximum demand kW for Current month
5. Supply Frequency
6. TOD Energy
7. Instantaneous Power Factor
8. Tamper Count
9. Meter serial no

22) MAXIMUM DEMAND REGISTRATION & RESET

Meter should continuously monitor & calculate the average maximum demand for each demand interval time of 30 minutes and maximum of these in acalendar month should be stored along with date and time when it occurred. The maximum demand should automatically reset at 24:00 hrs. of the last date of each calendar month and the corresponding value along with date/time stamp shall betransferred to Billing(History) registers.

The integration period should be set as 30 minutes, on real-time basis.

The billing purpose parameters (active forwarded energy, maximum demand in kW) should be recorded and should be available in Bill (History) for a minimum period of last 12 months.

23) TIME OF USE / Time of Day MONITORING

The meter should offer the capability of time of use monitoring for energy. Minimum 2 registers should be capable of being configured for TOD monitoring for Peak / off peak hours. Time slots T1-23-00 Hrs. to 17-00 Hrs. of next day andT2-17-00 Hrs. to 23-00 Hrs. In case of any change of Time slots in future as per directive of SERC, the same is to be incorporated by the supplier even after completion of the order as per instruction from the appropriate authority.

24) SELF- DIAGNOSTIC FEATURE

The meter should be capable of performing complete self diagnostic check to monitor integrity of data memory location at all time. The meter should have indication for unsatisfactory / nonfunctioning / malfunctioning of the following :

a) Time and date on meter display
b) All display segments on meter display
c) Real Time Clock (RTC) status in meter reading prints out at BCS end
d) Non-volatile Memory (NVM) status in meter reading prints out at BCS end

25) COMMUNICATION PORTS AND PROTOCOL:

The meter should have a galvanically isolated optical communication port for data communication with CMRI / Laptop. The port should be compatible with IEC 1107/PACT/ANSI. Adequate sealing provision should be provided.

26) CMRI / Laptop / BCS REQUIREMENTS

The Common Meter Reading Instrument (CMRI / Laptop) should be capableof being loaded with user-friendly software (MS-DOS 5.0 or higher version compatible) for reading / downloading meter data. Windows based Base Computer Software (BCS) should be provided for receiving data from CMRI / Laptop and downloading instructions from base computer software to CMRI / Laptop..

The BCS should be WIN Xp, WIN vista, WIN 7 pro based and copy righted. The data stored in the meters memory should be available on the BCS.

27) ACS712 CURRENT SENSOR

ACS712 is a current sensor that can operate on both AC and DC. This sensor operates at 5V and produces an analog voltage output proportional to the measured current. This tool consists of a series of precision Hall sensors with copper lines.

The output of this instrument has a positive slope when the current increases through the copper primary conduction path (from pins 1 and 2 to pins 3 and 4). The internal resistance of the conduction path is 1.2 mΩ**.**

Figure 11 : CURRENT SENSOR

28) ACS712

ACS712 is a current sensor that can operate on both AC and DC. This sensor operates at 5V and produces an analog voltage output proportional to the measured current. This tool consists of a series of precision Hall sensors with copper lines.

The output of this instrument has a positive slope when the current increases through the copper primary conduction path (from pins 1 and 2 to pins 3 and 4). The internal resistance of the conduction path is 1.2 mΩ.

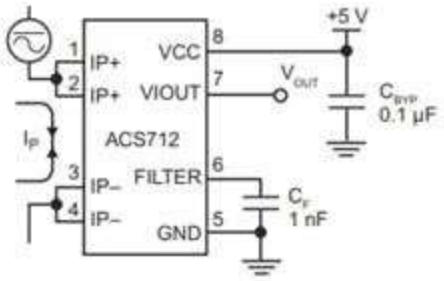


Figure 12 :LAYOUT DIAGRAM ACS 712

This sensor has an output voltage of Vcc x 0.5 = 2.5 at the input current 0A and a 5V Vcc power supply. There are three types based on the readable current range,

± 5A, ± 20A, and ± 30A with output sensitivity of each type of 185mV / A, 100mV / A, and 66mV / A respectively.

The output of this current sensor is analog, so to read it, we can directly measure the output voltage using voltmeter or measure it by using a microcontroller like Arduino through Analog Read pin or ADC pin.

29) Methodology of acs 712

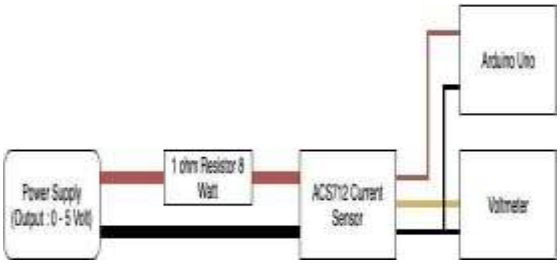


Figure 13 : MEATHODOLOGY OF ACS 712

We use Arduino UNO to give ACS712 5V power supply (to 5V pin in ACS712). The ACS712 sensor's ground is also connected to the Arduino UNO ground. For measurement, we connect the + probe of voltmeter to analog output pin in the ACS712.

VOLTAGE SENSOR

The Voltage sensor is small and low cost module whose principle is based on Resistive voltage divider circuit. With the help of it the voltage is divided by

Which makes the voltage 5 times smaller, 25/5=5 thus with this we can measure up to 25V.

Arduino AVR chips have 10-bit ADC, so this module simulates a resolution of 0.00488V (5V/1024), so the minimum voltage of input voltage detection module is 0.00488Vx5(for 25v)=0.02440V.

For 5V systems the input voltage should not be greater than 25V

For 3.3V system the input voltage should not be greater than 16.5v as 3.3X5=16.5.

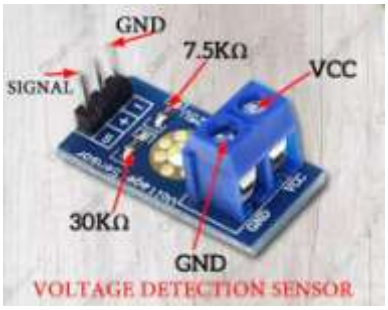


Figure 14 :VOLTAGE SENSOR

From the above pinout diagram we can notice there are 5 pins to voltage sensor module. 3 pins are male head connectors which are to be connected to Arduino and other 2 pins has a plastic screw pin terminals where the voltage to be measured is connected.

- VCC: Positive terminal for the external voltage source (0-25v)
- GND: Negative terminal for the external voltage source (0-25v)
- S: signal pin or Analog output pin
- +: Not connected
- -: Ground pin

30) GSM SIM900A MODEM

GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip(MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply . Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands

FEATURES

- Dual-Band GSM/GPRS 900/ 1800 MHz
- RS232 interface for direct communication with computer or MCU kit.
- Configurable baud rate.
- Power controlled using 29302WU IC.
- ESD Compliance.
- Enable with MIC and SPeaker socket.
- With slid in SIM card tray.
- With Stub antenna and SMA connector.
- Input Voltage: 12V DC.

31) POWER MODES

A. Power down mode

SIM900A is set power down mode by "AT+CPOWD=0"

There are two methods for the module to enter into low current consumptionstatus

B. Minimum Functionality Mode

Minimum functionality mode reduces the functionality of the module to aminimum and thus minimizes the current consumption to the lowest level.

If SIM900A has been set to minimum functionality by "AT+CFUN=0" If SIM900A has been set to full functionality by "AT+CFUN=1"

If SIM900A is set "AT+CFUN=4" to disable both the above functionality.

C. Sleep mode:

We can control SIM900A module to enter or exit the SLEEP mode in customer applications through DTR signal. When DTR is in high level and there is no on air and hardware interrupt (such as GPIO interrupt or data on serial port), SIM900A will enter SLEEP mode automatically. In this mode, SIM900A can still receive paging or SMS from network but the serial port is not accessible.

- Wake up SIM900A from sleep mode
- Enable DTR pin to wake up SIM900A. If DTR pin is pulled down to a low level.
- This signal will wake up SIM900A from power saving mode. The serial port will be active after DTR changed to low level for about 50ms.
- Receiving a voice or data call from network to wake up SIM900A.
- Receiving a SMS from network to wake up SIM900A.

1)WI-FI MODULE

The ESP01Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Figure 15 : WIFI-MODULE

Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and getabout as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-effective board with a

huge, andever growing, community.

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co- existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support.

In the *Documents* section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into anIoT (Internet of Things) solution!

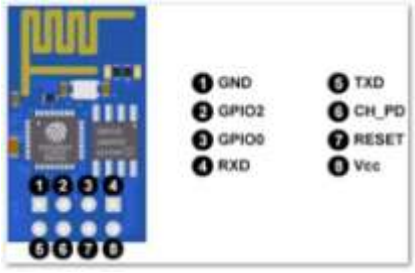
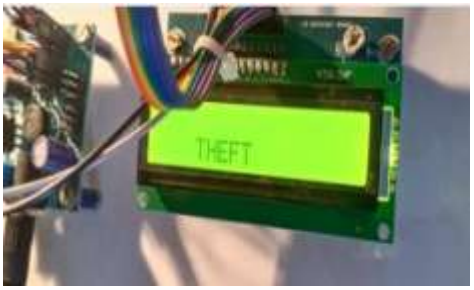


Figure 16 : PIN DIAGRAM WI-FI MODULE

V. RESULTS AND DISCUSSION

Simulation results are presented and discussed to show the effectivenessof the proposed drive system based on Arduino based automatic power theft detection andprevention from distribution line. For studying the performances of proposed system, a series of simulations and measurements have been carriedout. in this respect, the dynamic response of the propose current estimation algorithm is studied under different condition. As shown in Figure 3 Arduino based automatic power theft detection technique for electricity is proposed. In electricity metering system, tampering is done basically for the purpose of electricity theft. To protect the electricity energy meter from this theft, attempt a relay is used at the opening of the meter. The relay is connected to interrupt pin ofthe driver. Hence closed switch applies 12V to the interrupt pin and opened relay drives the voltage to zero. The relay normally closed when the meter chassis is closed. If someone tries to open or tamper with electricity energy meter, that switch gets opened, and the interrupt pin gets triggered as 0V is sensed byit. The Arduino immediately sends to GSM module forsending SMS. Upon receiving SMS, the authority can take further legal action against it and penalize the theft person as shown in Figure 4 Thus simulation result shown in Figures 3 and 4 indicate that sensing value of current, voltage and amount of power that customer used and payment /revenue/ of the consumed power. In thus simulation there is no theft which exist on the distribution line due to that green LED indicator is become bright and there is no need power interruption on the line.

Figure 17: HARDWARE DIAGRAM



Using IOT, the illegal usage of power canbe solved electronically without any human intervention and wirelessly. The simple working principle of this method is the comparison of the current passed through the current sensor value and the total algebraic sum of current sensor values the consumers connected to that line. A current sensor andrelay with IOT module is placed at each of the consumer terminal. It measures the total current consumed by the consumers and it transfers to the utility using the IOT module shown in Figure 4. It compared with the current sensors reading value. If both the values are equivalent, then there is no theft (Transmission and distribution losses are neglected). However, if the value of the pole line current sensor reading is greater than the consumer's current sensor reading, then the theft is acquired. By the help of this mismatching error readings, we can detect the power.

VI. CONCLUSION

A Wireless Electricity Theft Detection and monitoringsystem has been designed and developed with proper integration of both the hardware and the software. Without any human interface this system provides an effective and easy way to detect electrical theft. The use of IoT helps in achieving the numerous advantages of wireless network communications. Power theft is actually bypassing the energy meter but in our projectwe have indicated the theft by increasing the load also and this method is cost efficient. The design, simulation and construction of a IOT-based powertheft have been achieved. It has covered various formsof electricity theft which include unaccountability of servicemen, irregularities of billing leading to a reduction of funds by the utility companies has also been achieved as this work prevents one on one contact between the end user and the workers. With remote monitoring of the meter reading and sending SMS, whenever there are abnormal readings, in the customer electricity meter, the developed system may able to help Utilities to reduce the incidences of household electricity theft. An automatic circuit breaker can be integrated into the unit so as to remotelycut off the power supply to the house or consumer who tries to indulge in power theft. This system design mainly concentrates on single phase electrical distribution system. Automation of the customer billing system has been achieved as the meter keeps track of theconsumer's load on a timely basis. This design, therefore, removes the manual reading of meters with its attached consequences of time- consuming system and bill manipulation which affects the company while adding higher bills to the consumer.

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