SMART HYBRID ENERGY METER AND UTILIZATION

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ABSTRACT

A cloud-based smart metering infrastructure allows handling smart meters measurements and supporting the automation of future distribution grids and its smart management and control. Smart Metering architecture has to expose Web Services and APIs (Application Programming Interface) to access data using open and web-oriented standard data-formats. Demand Side Management (DSM) will play a significant role in the future smart grid by managing loads in a smart way. Through our project work we propose smart hybrid system for monitoring and solar based approach for energy generation. This paper presents a hybrid smart energy meter for an automatic metering and billing system also it switching the power source either MSEB or SOLAR.

KEYWORDS: Smart Hybrid, Utilization

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INTRODUCTION

Electricity is the driving force behind the development of any country. With the rapid increase in residential, commercial, and industrial consumers of electricity throughout the world, it has now become imperative for utilities companies to devise better, non-intrusive, environmentally-safe techniques of gauging utilities' consumption so that correct bills can be generated and invoiced. Electricity is supplied to our house, also we do know that to keep electricity supply we have to pay the bill. Utility Computing is just like that, we use electricity at home as per our requirement and pay the bill accordingly likewise you will use the services for the computing and pay as per the use this is known as 'Utility computing'. Utility computing is a good source for small scale usage; it can be done in any server environment and requires Cloud Computing.

We propose smart hybrid system for monitoring and solar based approach for energy generation.

In the hybrid power solution two sources are perform as smart switch We are using controller to sense the current flow through load. This sensor gives how much energy flowing through load upload the data to cloud data base. The controller is capable to decide the switch the load as per power available. The inductive load takes high pulse energy at initial time. Due to high pulse it gives high load on solar power source. Our idea is to remove the high pulse load on solar power. When we want to start the inductive load another small Wi-Fi controller connected to inductive load. This controller message to main controller to switch the load to main power source. Due to this initial pulse is removed. After some time, load is again connected to solar power. The cloud data give analytical representation of both sources. Using this analytical data, we can optimize and utilize the energy in right way as per our requirement.

Existing System

Figure 1

Electricity is one of the fundamental necessities of human beings, which is commonly used for domestic, industrial and agricultural purposes. Power theft is the biggest problem in recent days which causes lot of loss to electricity boards. In countries like India, these situations are more often. If we can prevent these thefts, we can save lot of power. This is done using Smart Hybrid Energy Meter and Utilization. It is an electronics device having hybrid energy meter chip for measuring the electric energy and utilization of energy consumed and a wireless protocol for data communication. This paper presents a hybrid smart energy meter for an automatic metering and billing system also it switching the power source either MSEB or SOLAR. In this meter energy utilized and the corresponding spend energy will be displayed on the mobile phone and communicated to the controlling base station.

The feedback from the user helps in identifying the usages between authorized and unauthorized users which helps in controlling the power theft. Communication between user/household and substation is done using IOT. IOT platform is used for monitoring cloud. This meter can work as either prepaid or post-paid meter. The proposed system replaces traditional meter reading methods and enables remote access of existing energy meter by the energy provider. Also, they can monitor the meter readings regularly without the person visiting each house.

LITERATURE SURVEY

For any specific research to occupy the place in the development of a discipline, the researcher must thoroughly familiar himself not only with previous theory and research but also with industry background. To assure this familiarity a review of the relevant literature is done. A Survey of related studies was undertaken by the researcher to get an insight into the work that has already been in the field of this investigation in the context of related industry. An attempt is made in this chapter to review the existing literature on the subject of research. The available literature related to the present research work studied by the researcher is divided into the following subcategories: -

- Prior studies on power sector
- Power sector scenario in India
- Recent issues & challenges of Indian power sector

- Overview of Indian power sector performance
- Power sector reforms in Maharashtra
- The concept of performance & its measurement x KPI approach of performance measurement
- Power distribution utility
- The Concept of Customer satisfaction
- Summary and research gaps

SYSTEM DESIGN AND IMPLEMENTATION

Hardware Implementation

Figure 2: Block Diagram of System.

System Operation

Through project work we propose smart hybrid system for monitoring and solar based approach for energy generation. In the hybrid power solution two sources are perform as smart switch. We are using controller to séance the current flow through load. This sensor gives how much energy flowing through load upload the data to cloud data base. The controller is capable to decide the switch the load as per power available. The inductive load takes high pulse energy at initial time. Due to high pulse it gives high load on solar power source. Our ideas are to remove the high pulse load on solar power. When we want to start the inductive load another small Wi-Fi controller connected to inductive load. This controller message to main controller to switch the load to main power source. Due to this initial pulse is removed. After some time load is again connected to solar power. The cloud data give analytical representation of both sources. Using this analytical data we can optimize and utilize the energy in right way as per our requirement. Major components involved are current sensor module and Wi-Fi module. These two are briefly described below

ACS712 (CURRENT SENSOR)

Figure 3: ACS712 Module.

Specifications

- 30A,20A,5A
- The terminals of the conductive path are electrically isolated from the signal leads
- Sensitivity (Typ) 66 mV/A
- Fully Integrated, Hall Effect-Based Linear Current Sensor IC with 2.1 kVRMS Isolation and a Low-Resistance Current Conductor
- The Allegro™ ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switch mode power supplies, and overcurrent fault protection.
- The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging.
- The output of the device has a positive slope ($>V_{IOUT}(Q)$) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power loss.

Figure 4: Pin Diagram of ACS712.

Terminal List Table

Number	Name	Description
1 and 2	IP+	Terminals for current being sampled; fused internally
3 and 4	IP-	Terminals for current being sampled; fused internally
5	GND	Signal ground terminal
6	FILTER	Terminal for external capacitor that sets bandwidth
7	VIOUT	Analog output signal
8	VCC	Device power supply terminal

Figure 5: Terminal List Table.

ESP 8266-12e

- ESP8266EX offers a complete and self-contained WiFi networking solution; it can be used to host the application or to offload WiFi networking functions from another application processor. When ESP8266EX hosts the application, it boots up directly from an external flash. It has integrated cache to improve the performance of the system in such applications. Alternately, serving as a WiFi adapter, wireless internet access can be added to any micro controller based design with simple connectivity (SPI/SDIO or I2C/UART interface). ESP8266EX is among the most integrated WiFi chip in the industry; it integrates the antenna switches, RF balun, power amplifier, low noise receive amplifier, filters, power management modules, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area. ESP8266EX also integrates an enhanced version of Tensilica's L106 Diamond series 32-bit processor, with on-chip SRAM, besides the WiFi functionalities. ESP8266EX is often integrated with external sensors and other application specific devices through its GPIOs; sample codes for such applications are provided in the software development kit (SDK)
- Es press Systems' Smart Connectivity Platform (ESCP) demonstrates sophisticated system-level features include fast sleep/wake context switching for energy-efficient VoIP, adaptive radio biasing for low-power operation,

advance signal processing, and spur cancellation and radio co-existence features for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation

Figure 6: Pin Diagram of ESP 8266-12e.

Figure 7: Block Diagram of ESP 8266-12e.

SOFTWARE DESIGN

Ubidots

- **Ease-of-use:-**Ubidots value-add in development time and cost saved is only increased when combined with its usability. With a core architecture focused on data efficiency and an engaging UX (user experience), Ubidots users can connect, build, and deploys cloud IOT applications with ease, leaving Ubidots to handle the cloud and end-user UX infrastructure.
- **Support:-**Internet connected solutions are not easy, no emerging technology is, but Ubidots focuses on key inputs to deliver the right tools and in a timely fashion to see your solution succeed. Despite inevitable setbacks, we rise to the occasion and never settle for adequate; always working to make your data more valuable.
- **Education:-**Ubidots for Education is an IOT enablement platform that give users the tools to learn and make an impact - be it big or small.

Figure 8: UI Design on Ubidots.

API and SDKs

Connect hardware to Ubidots cloud easily with more than 200 user-proven libraries, SDKs, and tutorials to guide your integration over HTTP, MQTT, TCP, UDP, or by Parsing custom/industrial protocols. Whether on boarding 1 or 1,000 devices, it takes the same amount of effort with Ubidots Device Types. Replicate creating the new device in Ubidots automatically configuring variables, device properties, and appearance each time a new piece of hardware is detected.

3rd Party Data Input / Output

Create your own API and parse data into a Node.js cloud GET or POST HTTP function extending your connect solution beyond the boundaries of Ubidots architecture and capabilities. Parse data and ingest any 3rd party protocols or device clouds like Sigfox, Particle Cloud, mcCloud, NB-IoT, TTN, LoRaWan networks, and more. Extend the monitoring and data analytics of your applications with API integrations like Weather Underground, IBM's Watson, Google Locations, Zapier, and more.

Figure 9: Flow of Ubidots API.

RESULTS, FUTURE SCOPE & CONCLUSIONS

Results

According to the final experimental arrangement our system will look like shown below and following results will be displayed on the LCD & with the help of Cloud Service Ubidots

- **PIC:**16f877a 40 pins
- **Energy Meter** :3200 imp/kwh
- **ACS712** :current sensor 5A,30A
- **LCD:**20*4 display
- **ESP8266:**wifi module

Figure 10: Internal Arrangement of the System Implemented.

Future Scope

- Analytic and internet of things can help companies provide smart energy and also utilization solution to customer.
- Data access transference in billing energy efficiency performance and compliance are immediate opportunities from smart meters
- IOT and big data analytics will pave the way for multiple devices to be connected.

Conclusions

The following conclusions are made from the result of implemented system-

- Energy saving takes place by smart hybrid system for monitoring and solar based approach. In the hybrid power solution two sources are perform as smart as switch. The current and wattage of load and also switching of source data uploads to cloud.
- As the system is made user friendly customer does not need any special training which reduces the time and also, they can monitor their system from anywhere.

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