Smart Home Electricity Monitoring System

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Abstract - This project report presents the development and implementation of a smart energy meter system aimed at enabling efficient and sustainable energy consumption. The system comprises of hardware components such as current sensors, voltage sensors, microcontrollers, and communication modules, as well as software components for data collection, processing, and analysis. The smart energy meter system provides real-time energy monitoring, user-friendly visualization, and alerts for abnormal energy usage, which helps individuals and businesses to identify and address areas of inefficiency. The report discusses the system design, implementation, and testing, as well as the challenges and limitations of the system. Overall, the smart energy meter system represents a significant step towards a more sustainable and efficient energy future.

Key Words: **Data analysis**
Real-time energy monitoring, Inefficiency identification, System design

INTRODUCTION

As we know that the rate at which electric energy is transferred by an electric circuit is called power. Power is an important electrical quantity and everything in our world today depends on having the power to keep them running. It is mandatory for a power engineer to know how much the amount of power a power plant generates and also the usage by the customer over a period of time. It helps in estimation of transmission losses between the generation- distribution and distribution-consumer apparatus. This estimation helps in power theft detection and in turn reduces the transmission losses. Measurement of electrical power may be done to measure electrical parameters of a system. Depending upon the requirement of accuracy, time and the nature of the circuit there is a choice for method and instrument to be used in any given case of measurement. In the existing power utility set up, consumers are presented with usage information only once a month with their bill. The length of time between updates about power usage is far too long for a consumer to observe a changed behaviours' effect on power usage

In addition utility bills can be convoluted in how they present usage information, and a consumer may not be able to decipher changes in their power usage from the last bill. An opportunity to educate customers on power usage is lost because of these realities. The goal of creating more awareness about energy consumption would be optimization and reduction in energy usage by the user. This would reduce their energy costs, as well as conserve energy. There are various methods for measuring power such as single and two wattmeter methods etc. Power is rate of doing work. For DC circuits and purely resistive AC circuits, power is product of voltage and current.

The electricity generation in India during 2005-06 was 23,819 Giga Watt-Hours (GWh). It increased to 1,022,614 GWh during 2013-14.

PROBLEM DEFINATION

The problem definition for the "smart energy meter" project is centered around the need for a more sustainable and efficient energy management system. Traditional energy metering systems lack the ability to provide real-time monitoring and detailed data on energy usage, leading to inefficient energy consumption. The project aims to design and implement a smart energy meter system that provides real-time monitoring, user-friendly visualization, and alerts for abnormal energy usage to enable efficient and sustainable energy consumption.

ADVANTAGES OF SYSTEM

- It requires fewer components so its cost is low.
- Increased Energy Efficiency.
- Real-time Data.

LITERATURE SURVEY:

1. The mode of economic growth is first put forward by Soviet economists in the early 1960s, because of the impact of the new technology revolution and development adjusting strategy of other countries, the Soviet Union put forward the intensive production policy, and this policy required the social production mode to change from extensive type to intensive type, and to make great achievements with less cost. As the understanding of growth mode deepened, China is abandoning the extensive economy growth mode, which only pursues quantity and speed, and now, China is exploring way to

intensive economy growth mode. This paper showed the characteristics of e-commerce in China, analyzed the impact mechanism of e-commerce to the changing of economic growth mode, proposed suggestions for the influence of e-commerce.

2. Modern day healthcare is offering more and more treatment alternatives on the Internet, so-called eHealth. In order to reform the business logic of these organizations from the traditional healthcare services towards more eHealth in their services, an implementation strategy is needed to guide this reformation. A currently popular approach to guide these reformations and to come to an eventual implementation is by the use of business models. This paper describes what business models are and what their potential for designing and implementing eHealth applications can be. Also, three recent methods of business modeling that aimed to create sustainable eHealth applications will be described as an example, followed by some potential complications and their corresponding challenges that can appear when working on a business model for innovative eHealth applications.

3. Unsupervised machine learning became a ubiquitous method appearing in E-commerce solutions that strive to provide personalized recommendations for their users. Most of those solutions embrace collaborative filtering (CF) to predict conversions, which are the beneficial user events, such as a purchase. Traditionally, the predictions were made based on rating data. However, e-commerce users seldom leave ratings. Instead, we must rely on user events, such as viewing an item or adding it to the cart. The event-based approach seems counter-intuitive, for the reason that the operation time of recommender systems increases exponentially with the increase of data-points.One of the main contributions of this paper is the UX value function. It reduces all events between an item and a user to a single user experience number, which also depends on the sequentiality of the events. We present a method to calculate this number in linear time. Then we use a deep neural network to predict the likelihood of conversions based on this number to prove the practical solvability of the problem in a scalable manner, with a relatively fast learning speed and good prediction accuracy. We have conducted an extensive experimental analysis on Kechinov's 'eCommerce Events History in Cosmetics Shop' dataset, containing 8,738,120 user events. The results of those experiments prove the efficiency and applicability of the developed approach
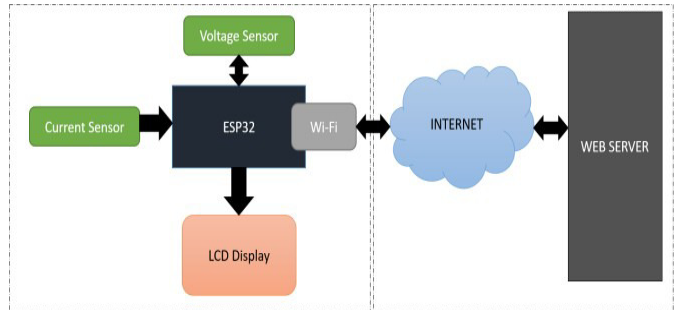
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SYSTEM ARCHITECTURE

Fig -1: System Architecture Diagram

SYSTEM REQUIREMENTS

- **Software Used:**

1. Operating System: Windows XP and later versions
2. Programming Language: C++
3. Tool: XAMP & NOTEPAD ++
4. Arduino Ide
5. Blynk

- **Hardware Used:**

1 ESP32 WiFi Module
2 ZMPT101B AC Voltage Sensor Module
3 SCT-013-030 Non-invasive AC Current Sensor
4 16x2 LCD Display
5 Potentiometer 10K
6 Resistor 10K
7 Resistor 100ohm
8 Capacitor 10uF
9 Connecting Wires
10 Breadboard

CONCLUSION

E –marketing In conclusion, the smart energy meter project has the potential to bring significant benefits to both individuals and businesses by enabling more efficient and sustainable energy usage. By monitoring energy usage in real-time and providing insights into areas of inefficiency, smart energy meters can help reduce energy consumption and save money on utility bills. They can also contribute to environmental sustainability by reducing carbon emissions and supporting the transition to renewable energy sources.

However, the success of the smart energy meter project will depend on several factors, including the accuracy and reliability of the metering system, the cost of installation and maintenance, and user adoption and education. Addressing these challenges will be critical to ensuring the long-term viability of the project and realizing its full potential.

Overall, the smart energy meter project represents an important step towards a more sustainable and efficient energy future. By leveraging advanced technologies and data analytics, it has the potential to transform the way we manage and consume energy, making it a valuable tool for individuals, businesses, and communities alike..

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