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SMART ENERGY MONITORING SYSTEM [SEMS]

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Abstract - *As home energy use is increasing day by day, home energy management system (HEMS) needs to consider both energy consumption monitoring and scheduling simultaneously to minimize the energy cost. This can be achieved by implementing smart metering and home automation technologies for efficient utilization of energy, thus paving the way for a cleaner and greener environment for future generations. Wireless based energy measurement modules are used to monitor the energy consumption of home appliances. The home server gathers the energy consumption data, analyses them for energy estimation, and is made available to the consumer through an android application. This system also provides a smart schedule proposal to the user examining the device connected and time of usage to minimize the energy cost. The remote energy management server aggregates the energy data from numerous home servers, compares them, and creates useful statistical analysis information. By considering and analysing the data obtained, this system is expected to optimize home energy use and results in home energy cost saving.*

Key Words: Monitoring System, Scheduling, Energy Management,

1. INTRODUCTION

Our system tries to provide the complete access of energy monitoring to the user which was out of scope in our existing building and energy monitoring structures. Here the server side processes the information collected dynamically from the energy usage stats to provide the complete detail of the currently active devices in the building, total amount due date, energy usage graph, a scheduling strategy for the user for a better power usage. The main feature of our system is that wiring of the building need not be changed.

2. PROPOSED SYSTEM

Proposed system tries to provide the complete access of energy monitoring to the user which was out of scope in our existing building and energy monitoring structures. Here the server side processes the information collected dynamically from the energy usage stats to provide the complete detail of the currently active devices in the building, total amount due date, energy usage graph, a scheduling strategy for the user for a better power usage. The main feature of our system is that wiring of the building need not be changed.

As home energy use is increasing day by day, home energy management system needs to consider both energy consumption monitoring and scheduling simultaneously to minimize the energy cost. This can be achieved by implementing smart metering and home automation technologies for efficient utilization of energy, thus paving the way for a cleaner and greener environment for future generations. Wireless based energy measurement modules are used to monitor the energy consumption of home appliances. The home server gathers the energy consumption data, analyses them for energy estimation, and is made available to the consumer through an android application. This system also provides a smart schedule proposal to the user examining the device connected and time of usage to minimize the energy cost. The remote energy management server aggregates the energy data from numerous home servers, compares them, and creates useful statistical analysis information. By considering and analysing the data obtained, this system is expected to optimize home energy use and results in home energy cost saving.

3. SYSTEM DESIGN

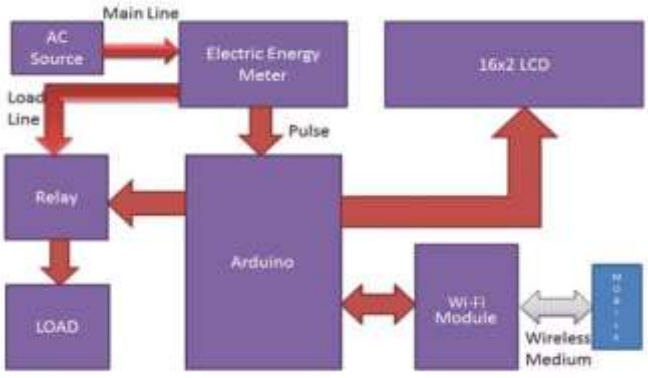

Fig 1: Block diagram of Smart Energy Monitoring System

Block diagram description:

- The "SEMS SAVER" android app is installed in consumer's smartphone and devices are updated.
- Profile and previous bill details are updated in the application.
- AC power source is given to electric energy meter.

- The generated pulse is directed to Arduino.
- Arduino compares the pulse with units calculated.
- Voltage and Current sensors connected sends data to Arduino board.
- A relay module is used to control or switch the power on to the load.
- Arduino sends the received data to the ESP 8266 Wi-Fi module and then to the server.
- Mobile app fetches the required data from the server and is made available to the consumer

4. IMPLEMENTATION

The entire system can be divided in to four modules.

Module 1:

Energy information from the appliances are obtained using Voltage sensors, Current sensors, Optocoupler and relay on Arduino board and sent to the Central unit.

Module 2:

The Central unit which consists of Coordinator, Wi-Fi module, Arduino board, sensors and display unit. This unit obtains the information received from Module 1 along with the Energy meter and send this to the server where the information are processed and analysed.

Module 3:

The server process the information received from the central unit. It also prepares a scheduling scheme and daily, weekly and monthly reports and graphs for efficient energy management using the energy usage data of the consumer.

Module 4:

The Android application receives the processed information form the server. Android app consists of the following details:

- Currently active appliances with their uptime
- Current Meter Reading, Bill Summary details
- Input Voltage, Energy usage at different time
- Power Consumption statistics for a day, week and month
- Comparison between previous electricity bills
- Energy consumed by each appliances and with maximum energy usage
- Energy Leakage detection
- Suggested Scheduling scheme for appliances

5. Result and Evaluation

An Android app provides the user the sufficient information regarding his energy consumption. The app includes

- Currently active appliances with their uptime
- Current Meter Reading, Bill Summary details
- Input Voltage, Energy usage at different time
- Power Consumption statistics for a day, week and month
- Comparison between previous electricity bills
- Energy consumed by each appliances and with maximum energy usage
- Energy Leakage detection
- Suggested Scheduling scheme for appliances
- Faulty meter detection
- Power consumption above a threshold level
- Appliances usage at pea time
- Energy Saving tips
- Theft Detection

The test results obtained by the model are quite satisfactory and found to be having very much less error then the experimental tolerance level. This has been observed that the system is quite stable and do not show any error or instability during its operation.

6. CONCLUSIONS

This system provides a smart schedule proposal to the user examining the device connected and time of usage to minimize the energy cost. The remote energy management server aggregates the energy data from numerous home servers, compares them, and creates useful statistical analysis information. By considering and analysing the data obtained, this system is expected to optimize home energy use and results in home energy cost saving.

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