Twofold Base IoT Based Intelligent Power Quality Monitoring System by Considering Social Stewardship

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Abstract – The integration of the Internet of Things (IoT) in smart homes has led to significant advancements in power quality monitoring. This involves the use of sensors and internet connectivity to measure power and power quality in each and every home connected to a particular electrical system feeder. The data collected by these sensors is analysed and transmitted to a cloud-based server for further analysis. Through a mobile app or web interface, homeowners can access real-time updates on the power quality parameters and receive alerts if there are any issues. The advantages of implementing an IoT-based online smart home power quality monitoring system are numerous, including reduced energy costs, improved safety by detecting potential electrical hazards, and providing homeowners with a better understanding of their home's electrical system. This information enables prompt action and optimization of energy usage. Overall, the integration of IoT technology in smart home power quality monitoring is an innovative approach that enhances the quality of life for homeowners.

Keywords – IoT, Smart Home, Advances in Intelligent Systems and Technologies, Power Quality Monitoring, Sensors, Electrical System, Power Factor, Cloud-Based Server.

I. INTRODUCTION

A smart home power quality monitoring system provides homeowners with a comprehensive understanding of their home's electrical system and enables EB authorities to monitor individual houses [1-5] under one feeder and their power consumption from the EB office itself. The proposed system enables them to optimize energy usage and prevent potential hazards. This innovative approach enhances the quality of life for homeowners by reducing energy costs, improving safety, and increasing energy efficiency. IoT technology has revolutionized [6-13] power quality monitoring in smart homes, providing homeowners with greater control over their energy usage and ensuring a safe and comfortable living environment.

II. PROBLEM STATEMENT

Most consumers today are unaware of their live EB power consumption and the penalty EB imposes as a result of their overconsumption at any given time. The proposed system is specially made with a feature to protect the consumer as well as their neighbours from power quality issues. If there is any house or commercial space in a particular feeder that consumes more power than it can procure, their procurement will lead to power quality issues for them as well as their nearby customers, and that may burden them, so it is mandatory for the EB to produce a nominal amount of power and charge appropriately. The proposed system paves the way for quality power for all end users at all times. Suppose if they cross their power consumption limit more than their procurement limit, they will be provided with information to both the corresponding customer and their EB authorities to take the necessary action to protect the system from any sort of power quality issue.

III. BLOCK DIAGRAM

Fig1 shows the proposed system and it consists of the Several devices are used in an IoT-based online smart home power quality monitoring system, including:

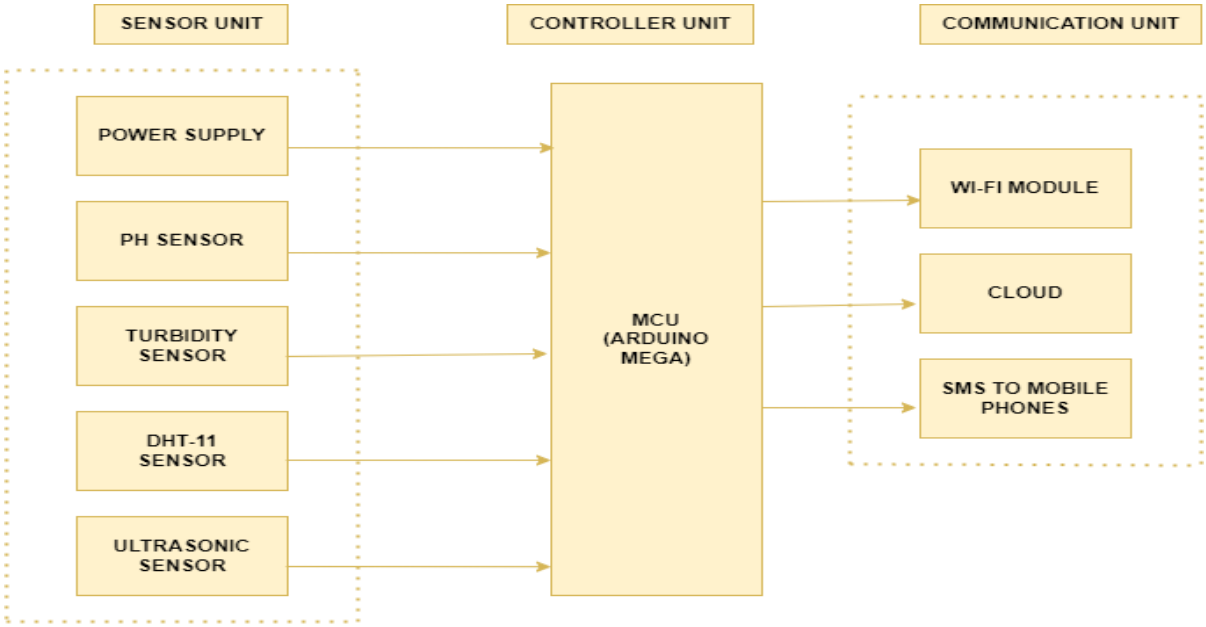

Fig 1. Block Diagram.

Sensors
Sensors are used to measure the voltage, current, power factor, and harmonic distortion of the electricity. These sensors are put in different parts of the home's electrical system, like the main distribution board, individual circuits, and electrical outlets.

Gateway Device
A gateway device acts as a bridge between the sensors and the cloud-based server. It collects the data from the sensors and transmits it to the cloud-based server for analysis.

Cloud-Based Server
The cloud-based server is where the data collected by the sensors is stored and analyzed. The server can be accessed remotely via a mobile app or web interface.
Mobile app: Homeowners can use the mobile app to get real-time updates on power quality parameters and alerts if there are any problems.

Web Interface
The web interface provides homeowners with a graphical representation of the data collected by the sensors, allowing them to analyse and optimise their energy usage.

Power Factor Correction Devices
Power factor correction devices are used to correct the power factor in a home's electrical system, which can improve energy efficiency and reduce energy costs.

Energy-Efficient Appliances
Energy-efficient appliances are made to use less energy while still doing the same job. This cuts down on energy costs and makes use of energy more efficient.
Overall, these devices work together to create an IoT-based online smart home power quality monitoring system that provides homeowners with greater control over their energy usage, ensuring a safe and comfortable living environment.

IV. SYSTEM IMPLEMENTATION

There are several steps to setting up an IoT-based online smart home power quality monitoring system. First, the system needs to be designed. This means choosing sensors and other devices, figuring out where to put them, and making a cloud-based server and a mobile app or web interface.

Next, the sensors are put in all of the homes that are connected to a certain feeder so that power quality parameters can be measured. The data from the sensors is then sent to a cloud-based server by installing a gateway device. The server is set up to store and analyze the data, and it can be accessed remotely through a mobile app or web interface that gives homeowners and EB authorities about the real-time updates and alerts.

Case-1

The proposed system senses the various parameters like voltage, current, power and power factor and have a live track record in the developed Mobile Application. Suppose if the user wants to monitor their live power consumption then they can download the appropriate Mobile App and it shows the information regarding their power consumption as shown in **Fig2**.

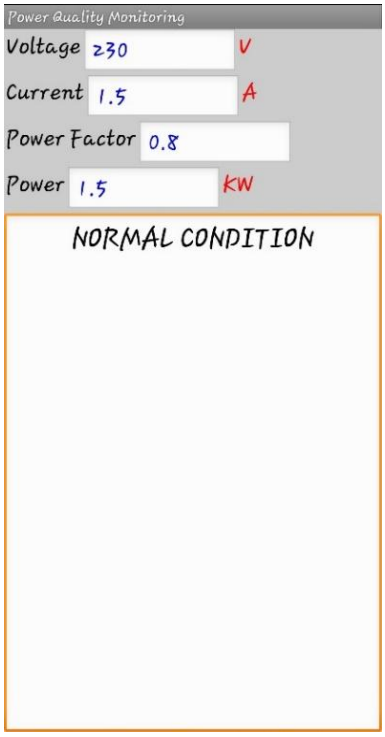

Fig2. Power Consumption Status Track in The Developed Mobile App.

Case-2

Suppose if the power consumed by one particular house under one particular feeder is higher than the procured limit, the developed mobile application will send information to the user as well as EB authority, stating that the power consumed by so and so customer and their power or power factor consumption is not within the aspect limit and they need to take appropriate action or else they may have levied a penalty as shown in **Fig 3, 4** and **5**.

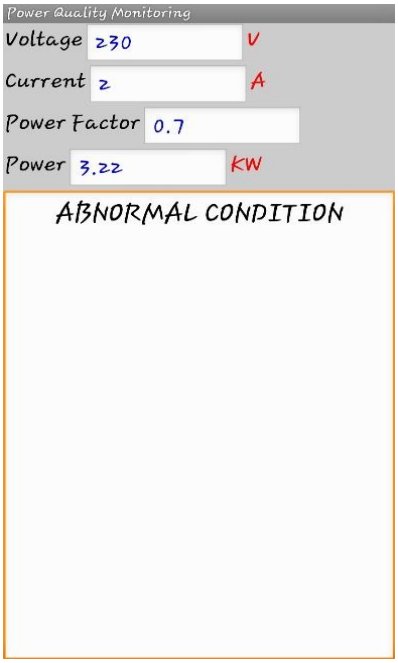

Fig3. Power Consumption Status Track Under Abnormal Condition in The Developed Mobile App.

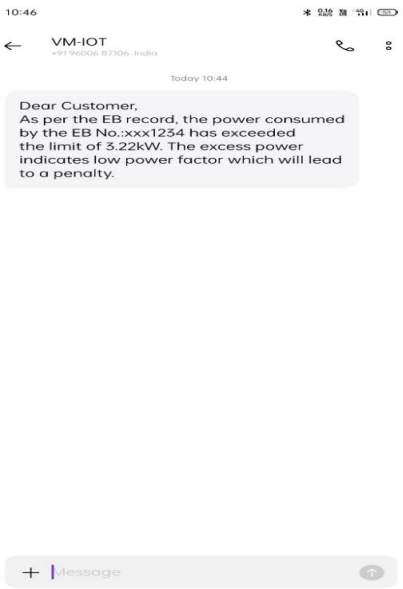

Fig 4. SMS Information Send to The Customer When They Utilize the Energy More Than Their Procurement Due to Low Power Factor.

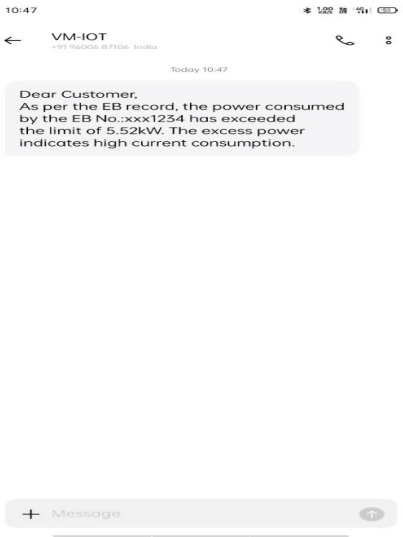

Fig 5. SMS Information Send to The Customer When They Utilize the Energy More Than Their Procurement Due to Excess Current Consumption.

V. CONCLUSION

An IoT-based online smart home power quality monitoring system is a powerful and innovative solution that provides homeowners and EB authors with valuable insights into each and every individual home's energy usage and quality. The system offers real-time updates on power quality parameters and alerts homeowners to any issues or concerns that need attention. With the help of this system, everyone can enjoy significant benefits, including reduced energy costs, improved energy efficiency, and enhanced safety. The real-time monitoring of power quality parameters ensures that homeowners and EB authorities can detect and correct any problems quickly, improving the lifespan of their appliances and electrical systems and reducing the likelihood of accidents or damage. The system offers a comprehensive solution for monitoring power quality parameters and optimising energy usage, leading to long-term cost savings and improved environmental sustainability.

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