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Original Article

Smart Voltage Protection System for Industries

K. Arunganesh[1], Sureshkumar. R[2], Ilayaraja. K[3], Madhavan. S[4]

[1]*Assistant Professor / EEE, Periyar Maniammai Institute of Science & Technology*

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Abstract *- Industries has grown in popularity in recent years as the fast advancement of technology has made day-to-day life easier. Almost everything has gone digital and is now fully automated. A method for integrating sensors, actuators, and other data sources for numerous home automation is presented in this study. We will monitor the voltage received by the industry in this paper, and if there is a sudden under or over voltage, the main supply from the EB will be tripped immediately to protect the load. If the load is suddenly exposed to low or high voltage, the load will be harmed. This initiative is being implemented at an industrial level to safeguard loads against harm in a variety of sectors. By adopting our idea in industry, we can preserve the load from harm while also increasing the industry's productivity during power outages.*

Keywords - *IoT, Wireless sensor network, EB.*

I. INTRODUCTION

The Internet of Things (IoT) is a system that connects and monitors items remotely through the Internet. The Internet of Things (IoT) idea has evolved significantly in recent years, and it is now employed in a variety of areas like smart homes, telemedicine, industrial settings, and so on. [1]. Wireless sensor network technologies that are part of the Internet of Things enable the worldwide networking of smart devices with improved capabilities. [2]. The main technology for creating intelligent homes is a wireless home automation network, which is made up of sensors and actuators that share resources and are connected to one another. The concept of a "smart house" is based on the Internet of Things and strives to incorporate home automation. When items and equipment in a house are connected to the Internet, people may monitor and manage them from afar [3]. Light switches that can be turned on and off with a smartphone or voice command, thermostats that adjust indoor temperatures and generate energy usage reports, and smart irrigation systems that start at a specific time of day, on a custom monthly schedule, and thus control water waste, are just a few examples. In recent years, smart home solutions have grown in popularity. Figure 1 depicts an example of a smart house that incorporates several IoT-connected services. One of the most appealing features of home automation systems is their ability to be managed and controlled from a variety of devices, such as smartphones, laptops and desktop computers, tablets, smart watches, and voice assistants. Home automation systems have a number of advantages: they increase safety by controlling appliances and lighting, they secure the home by using automated door locks, they increase awareness by using security cameras, they increase convenience by adjusting the temperature, they save time, they give control, and they save money. In the previous decade, academic scholars have advocated IoT in the literature. Different technologies have been utilised in wireless-based home automation systems, each with its own set of advantages and disadvantages. Bluetooth-based automation, for example [4–6], is low-cost, quick, and simple to deploy, but it is restricted to small distances. Wireless technologies such as GSM and ZigBee are also commonly employed. GSM allows for long-distance communication for the expense of a mobile plan from a local service provider. Zigbee [7–12] is a low-cost, low-power wireless mesh network standard aimed for battery-powered devices in wireless control and monitoring. It, however, has a low data speed, transmission, and network reliability, as well as a high maintenance cost. [9,11–18] make use of WiFi technology. Price, complexity (meaning simplicity), and accessibility are all advantages of Wi-Fi technology over ZigBee or ZWave. To begin with, Wi-Fi-enabled smart gadgets are often inexpensive. Furthermore, do-it-yourself Wi-Fi equipment are easier to come by, resulting in a less priced choice. Second, because Wi-Fi has become a need in most houses, it is easier to purchase gadgets that are already Wi-Fi enabled. Finally, Wi-Fi is known for its simplicity, which means that for a home network, a user only has to connect a small number of devices. Wi-Fi, on the other hand, is not meant to establish mesh networks; it uses ten times more energy than devices that use ZigBee, Z-Wave, or Bluetooth, for example, and many Wi-Fi routers can only connect up to thirty devices at a time. Wi-Fi provides various advantages over Ethernet, including the ease of connecting and accessing multiple devices, expandability (adding more devices without the inconvenience of extra wiring), cheaper cost, and the necessity for only one access point. The disadvantages include a limited range (a Wi-Fi network with standard equipment can be limited in range through walls and other obstructions in a typical home), a limited number of devices, interference and complex propagation effects, obstacles that can block the WiFi signal and affect the devices connected to it, and connection speed (Wi-fastest Fi's speed is much slower than a wired network), Internet security, and privacy concerns. In the home automation area, open source hardware components such as Arduino and Raspberry Pi microcontroller unit (MCU)

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boards, as well as a combination of sensors, have been widely employed. [3,19–23] proposes home automation using Arduino boards. Arduino is a versatile, open-source, low-cost, and simple-to-programme platform [19]. Furthermore, the presence of a big and active user community is a huge bonus. Figure 1 depicts the utilisation of smart sensing devices for various applications in an IoT-based smart home. In the recent decade, academic academics have presented several IoT-enabled home automation systems in the literature. . Different technologies have been utilised in wireless-based home automation systems, each with its own set of advantages and disadvantages. Bluetooth-based automation, for example [4–6], is low-cost, quick, and simple to deploy, but it is restricted to small distances. Wireless technologies such as GSM and ZigBee are also commonly employed. GSM allows for long-distance communication for the expense of a mobile plan from a local service provider. Zigbee [7–12] is a wireless mesh network standard that is intended at battery-powered devices in wireless control and monitoring applications and is designed to be low-cost and low-power consumption. It, has a low data speed, transmission, and network reliability, as well as a high maintenance cost. In [9,11–18], Wi-Fi technology is employed. Price, complexity (meaning simplicity), and accessibility are all advantages of Wi-Fi technology over ZigBee or Z-Wave. To begin with, Wi-Fi-enabled smart gadgets are often inexpensive. Furthermore, do-it-yourself Wi-Fi equipment are easier to come by, resulting in a less priced choice. Second, because Wi-Fi has become a need in most houses, it is easier to purchase gadgets that are already Wi-Fi enabled. Finally, Wi-Fi is known for its simplicity, which means that for a home automation system, a user only has to connect a small number of devices. Because it is so widespread, there is no need to invest in additional hardware; a user simply requires the basic configuration for a home automation system. Wi-Fi, on the other hand, is not meant to establish mesh networks; it uses ten times more energy than devices that use ZigBee, Z-Wave, or Bluetooth, for example, and many Wi-Fi routers can only connect up to thirty devices at a time. Wi-Fi provides various advantages over Ethernet, including the ease of connecting and accessing multiple devices, expandability (adding more devices without the inconvenience of extra wiring), cheaper cost, and just requiring a single access point. The disadvantages include a limited range (a Wi-Fi network with standard equipment can be limited in range by walls and other obstructions in a typical home), a limited number of devices, interference and complex propagation effects, obstacles that can block the Wi-Fi signal and affect the devices connected to it, and connection speed (the fastest Wi-Fi speed is muIn the home automation area, low-cost, open-source hardware components, such as Arduino and Raspberry Pi microcontroller unit (MCU) boards, and a combination of sensors have been widely employed. [3,19–23] proposes home automation using Arduino boards. Arduino is a versatile, open-source, low-cost, and simple-to-programme platform [19]. Furthermore, the presence of a big and active user community is a huge bonus. Arduino, on the other hand, is not meant to manage the high levels of complexity that come with advanced projects. Raspberry Pi is a superior choice for more complex and real-time projects. Raspberry Pi is a cutting-edge technical advancement that is far less expensive than any desktop computer or mobile device [24]. The majority of Raspberry Pi software and projects are open source, and they are maintained by online user groups who are always thrilled about new initiatives. Python is the language of choice for building applications on the Raspberry Pi since it is comparatively easy (fewer lines and less complexity) compared to other programming languages. Raspberry Pi is energy efficient and does not require any cooling systems, in addition to its affordable price. [9,12,15,25,26] suggest smart home automations using Raspberry Pi. ESP8266 chips are low-cost Wi-Fi modules that are ideal for Internet of Things (IoT) projects. The ESP8266 is an 80 MHz single-core CPU. In [9,21,27–30], ESP8266 chips were employed in home automation applications.

This research introduces a prototype for over voltage protection and energy conservation in smart homes. To manage the air conditions, the prototype employs an Arduino microcontroller with different sensors, such as a current sensor, as well as actuators. The energy-saving principle of this system is based on managing the number of functioning devices at any one time. This is accomplished by selecting a sufficient maximum load to turn the devices ON and OFF, resulting in a restricted number of devices in operation at any given moment.

II. SOFTWARE DESIGN OF THE OVER VOLTAGE PROTECTION SYSTEM

This section discussed the over voltage protection system's software design, which is based on the Visual Basic application. The program's graphical user interface is shown in Figure 1. The developed system comprises 10 fields for selecting the current of various household devices at random. Some equipment, such as air conditioners, indicate large current loads, while others, such as lights, represent low current loads. A total of ten fields were added to pick the sequence of operation from each device at random. The form also has ten areas for indicating the status of the devices (ON or OFF) once the programme has been run. The ‘combo box' is used to select the maximum current that can be utilised. The actual currents consumed by the functioning devices are displayed in separate text boxes once the software has been run. The software utilised to carry out this method is reliant on reading all of the devices' currents. Each device's current is stored in a single element of a one-dimensional array. The order of operation of each device is stored in a separate one-dimensional array. A combo box is used to choose the maximum allowable current, which is then saved in other variables in the application. The overload protection method begins by sorting the array of device currents in an increasing order, and the content of the sorted array is also adjusted in accordance with this new arrangement. Now, starting with the first element, the contents of the over voltage array elements are summed, and the results are more than the maximum.

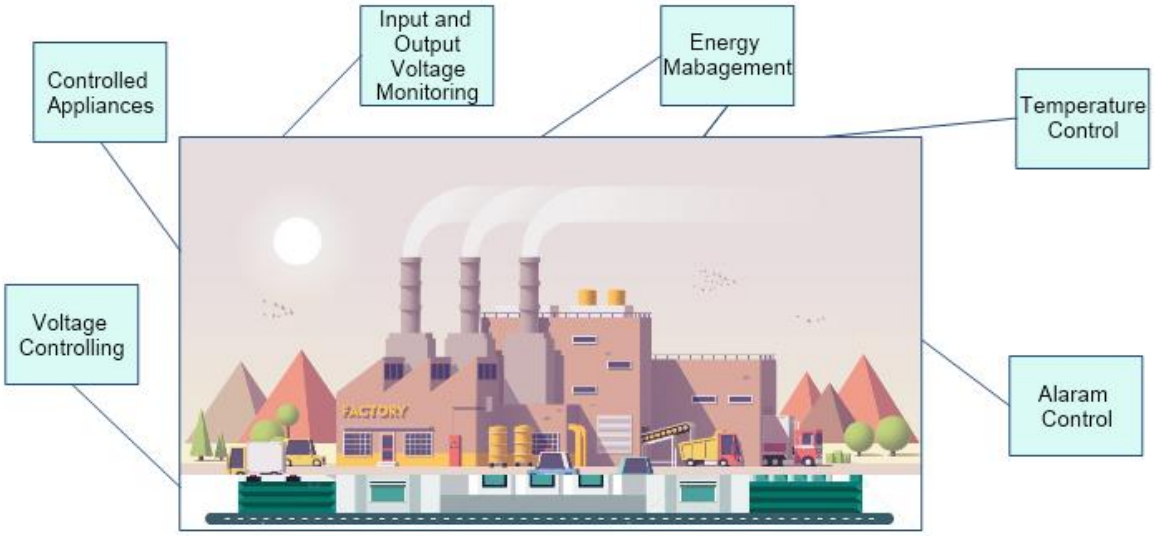


Fig. 1 General Block diagram

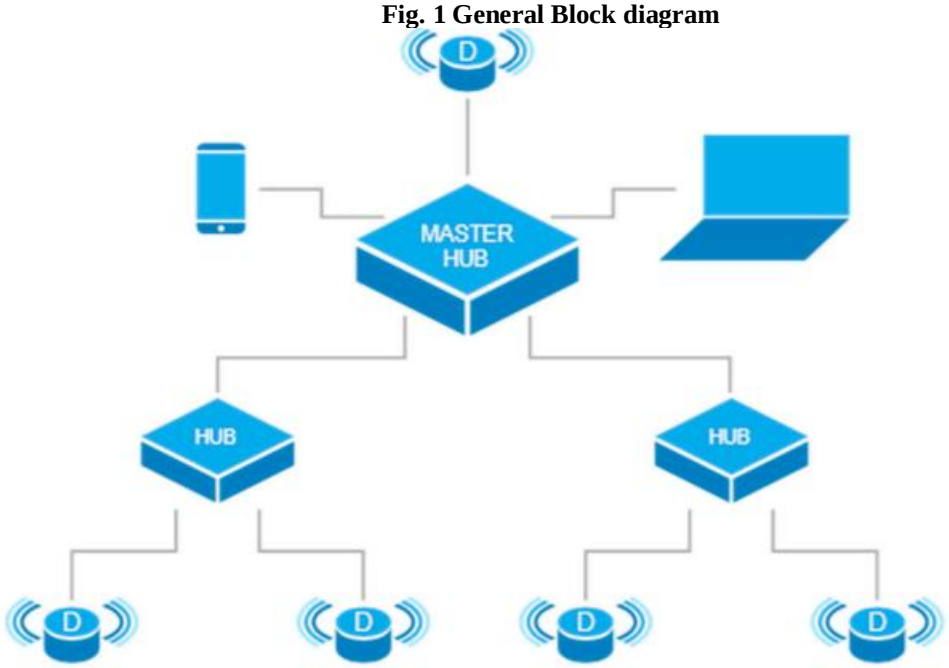


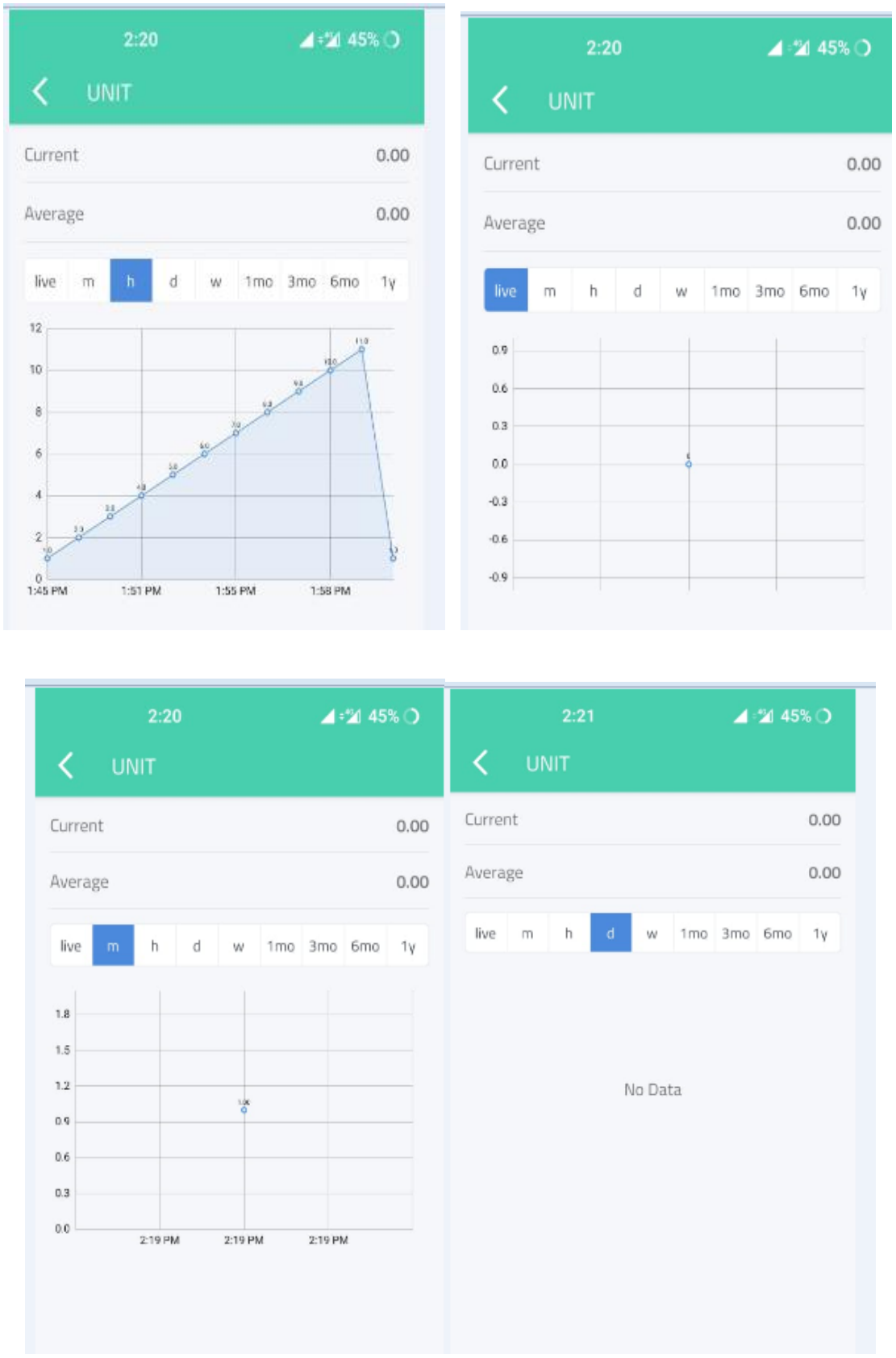
Fig. 2 Software topology

III. RESULTS AND DISCUSSION

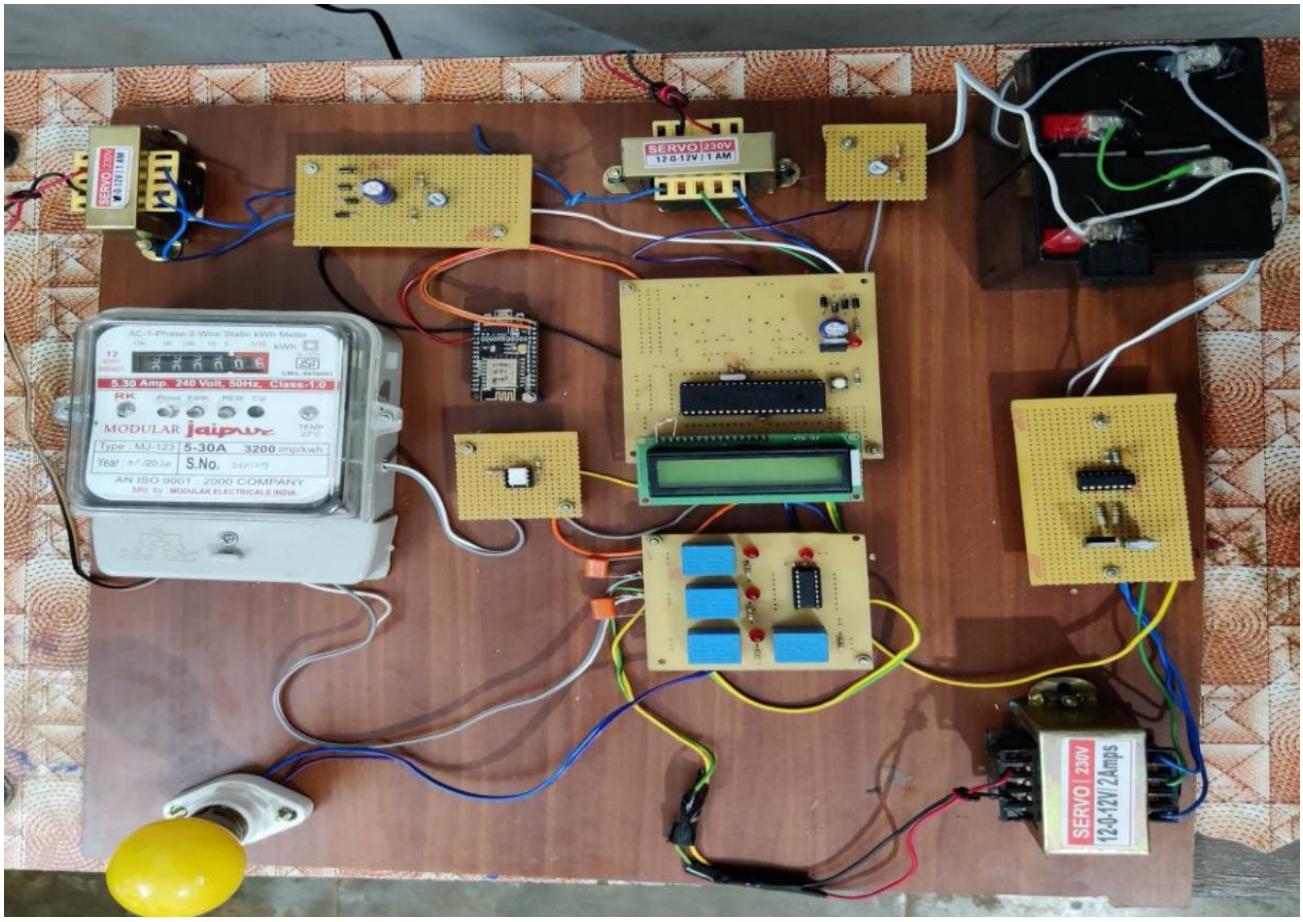
Fig. 5 depicts an industrial smart voltage protection system that has been built. The system to monitor the voltage received by the industry, if there is a sudden increase in under or over voltage, the main supply 230v AC from the EB will be tripped automatically, then the solar panel charged through inverter supply will be turned on to protect the load, and the load will not be damaged in the industrial. Supply from the inverter to show how the system reacts to under and over voltage conditions caused by the inverter at the time

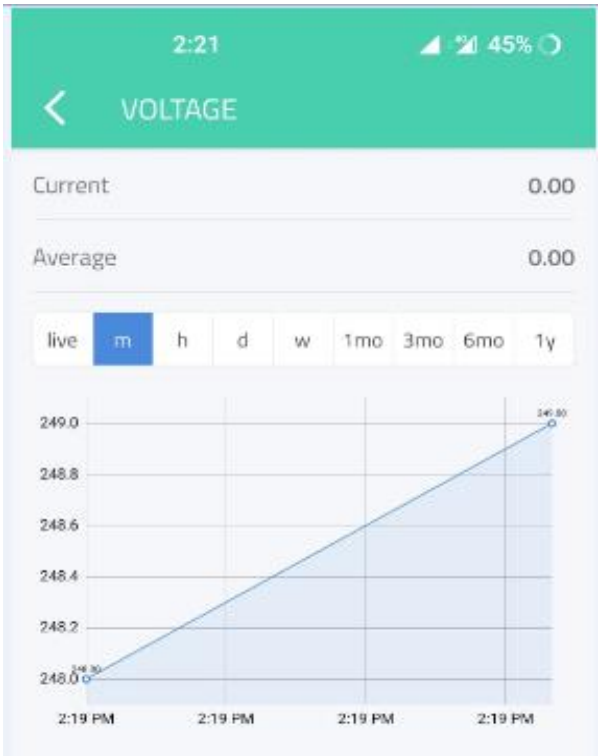
EB voltage

High Voltage unit



Above picture depicts that system is worked in under voltage condition in High voltage unit.


SERVO 230V
12-0-12V / 1 AM
5-30 Amp. 240 Volt 50Hz. Class 1.0
MODULAR jaipur
Type MJ-123 5-30A 3200 imp/kWh
S.No.
AN ISO 9001 : 2000 COMPANY
SERVO 230V
12-0-12V/2Amps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VOLTAGE
Current 0.00
Average 0.00
live m h d w 1mo 3mo 6mo 1y
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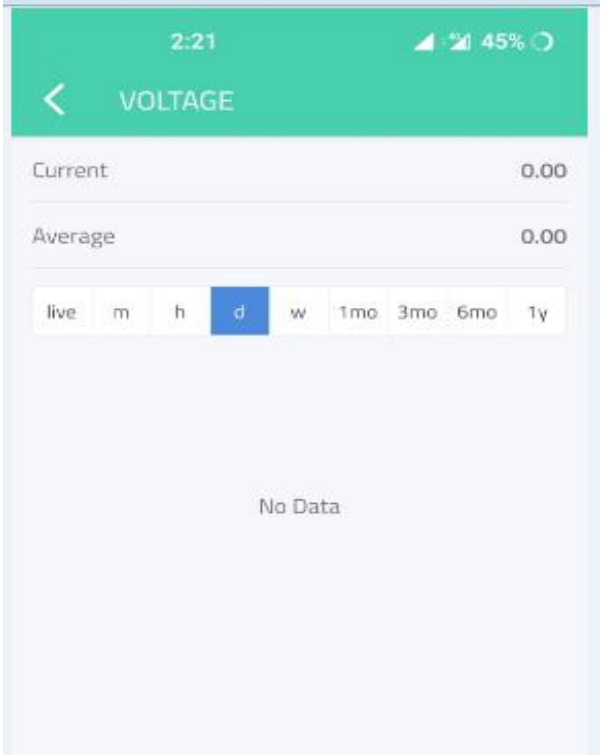
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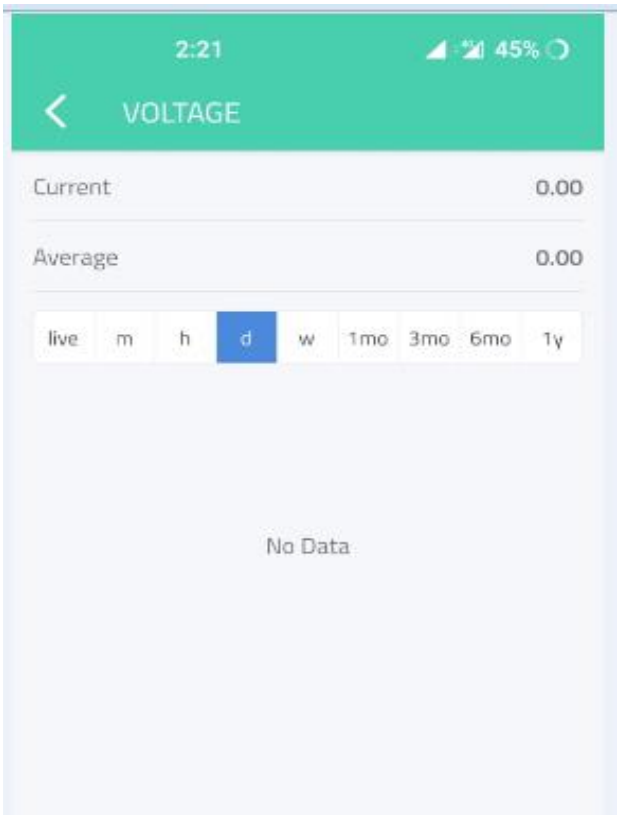
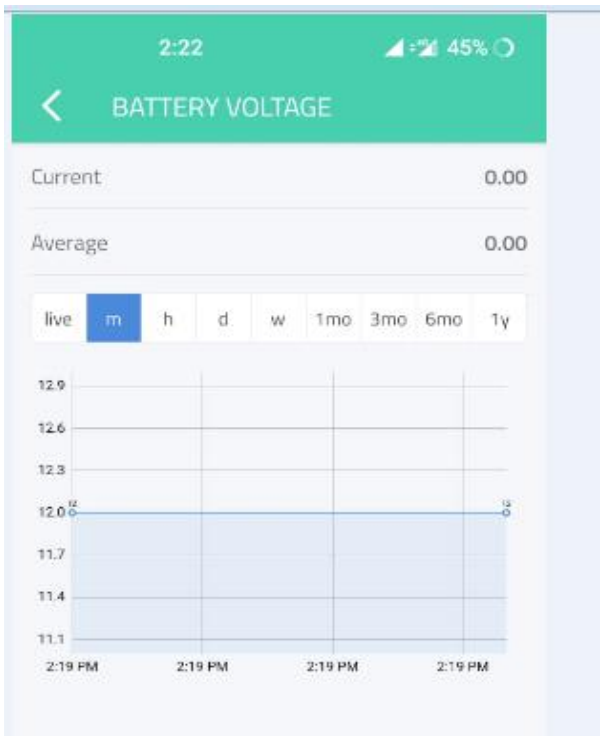
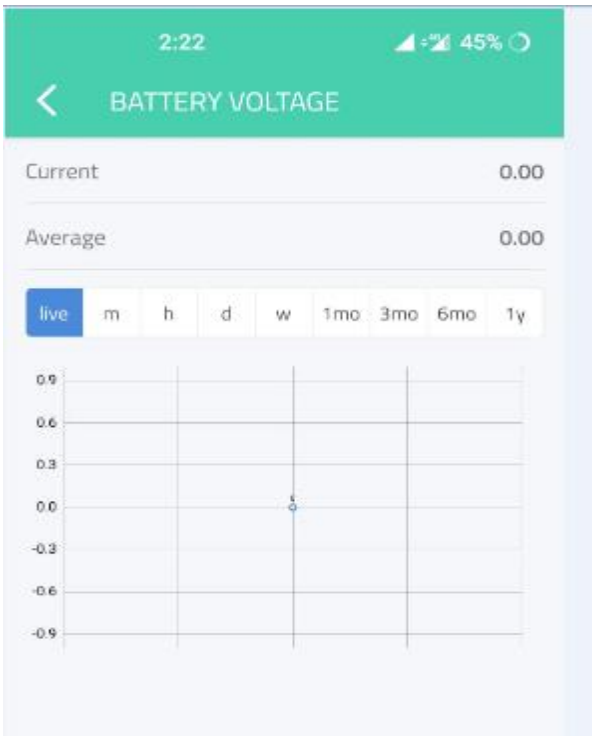
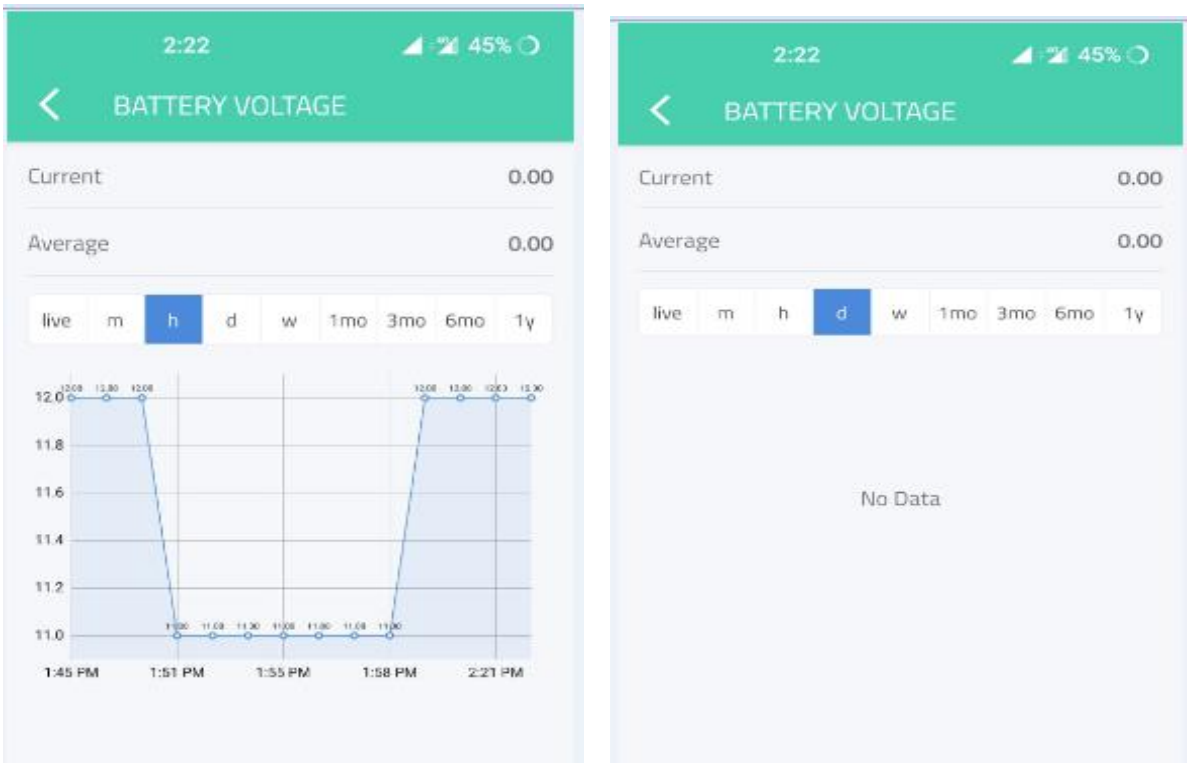


Above picture depicts that system is worked in under voltage condition in EB voltage unit.

A. BATTERY UNIT VOLTAGE







Above picture depicts that system is worked in under voltage condition in Battery voltage unit.

III. CONCLUSION

Under voltage and overvoltage problems are fairly widespread, and they can cause problems for consumer goods and industrial applications, according to our talk. As a result, the system should be secured by a security mechanism. As a result, the system is represented with a comparator and a relay to cut power when there is an overvoltage or undervoltage problem.

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