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SMART ELECTRICITY DISTRIBUTION USING IoT DASHBBOARD

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Abstract: There has been much recent discussion on what distribution systems can and should look like in the future. Terms related to this discussion include smart grid, distribution system of the future, and others. Functionally, a smart grid should be able to provide new abilities such as self-healing, high reliability, energy management etc. From a design perspective, a smart grid or a smart electric distribution system will likely incorporate new technologies such as advanced metering, automation, communication, distributed generation, and distributed storage.

***Index Terms* – smart grid, energy management, distributed generation.**

I. INTRODUCTION

Owing to the challenges related to the production, reliability, and efficiency of electricity, Electrical Power Systems across the globe are transforming. Due to the rapid deterioration of conventional power resources, there is an urgent need to replace them with renewable sources. On a commercial basis, existing power grids with vertically integrated structures will not be supported. Non-conventional energy resources are not available in abundance in the majority of areas, which makes them unfit for mass production. Moreover, their availability is highly scattered which makes them less reliable and hence, eliminates the possibility of centralized production. But with the introduction of decentralization of the existing network and distributed generation, there can certainly be a feasible solution [1][2].

Globally, several power networks have already taken initiatives in this direction. Economic incentives are provided as encouragement from utility grids to the small-scale generations within the premises, industrial or domestic. Conventional power systems have been experiencing transitions, from centralized supply-side management to decentralized supply and demand-side management, intending to enhance the efficiency

of a decentralized network. Therefore, due to the new operating environment, load management becomes more difficult than that under the conventional environment [4][7]. Because of the consumer's ignorance, electrical energy consumption is not efficient in most buildings. Due to the grid overloading especially during peak hours grid failures occur. This results in the wastage of a large number of resources [3].

Adopting techniques such as Demand Response (DR) from the load end could bring about definite improvement in this aspect. By managing the utilization from the consumer side rather than from the supply side, the wastage of energy can be controlled more efficiently. The supply-Demand gap can be greatly reduced by adopting Demand Response (DR), as the total effect of this Demand Response will be huge. The regular usage of power consumption is informed to the user to overcome high bill usage. With the use of IoT, users are able to check the power usage at any interval of time from anywhere [10].

The communication between hardware and information sensing, processing, analyzing, and controlling it as an intelligent system is one of the key successes of the smart grid. Implementing this system will benefit both the distributor and the consumer.[9]

The main elements of distribution system assessment are:

• Reliability
• Efficiency
• Voltage regulation
• Cost
• Environmental and aesthetic impact
• Safety.

This project aims at implementing demand response by scheduling the loads from the user end with the target of minimizing the dependency on the utility grid.

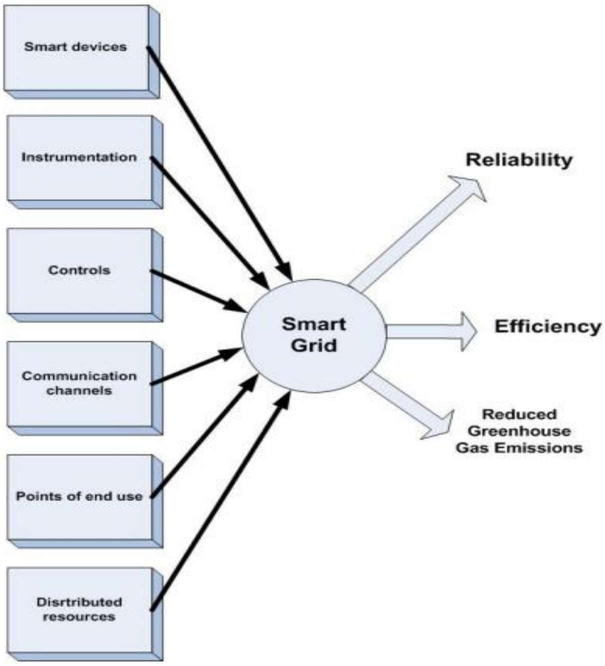


Fig. 1

II. LITERATURE REVIEW

1. Through Distributed Generation (DG), the expansion of electricity generation carried out by the inclusion of sustainable sources (Photovoltaic, wind, biogas, geothermal, etc.), has the advantage of generating positive impacts on the environment with the advantage of greenhouse gas emission. However, this new model turns the complexity of distribution, until now caused by factors such as variable demand and need for loss reduction, even more challenging [1][2].

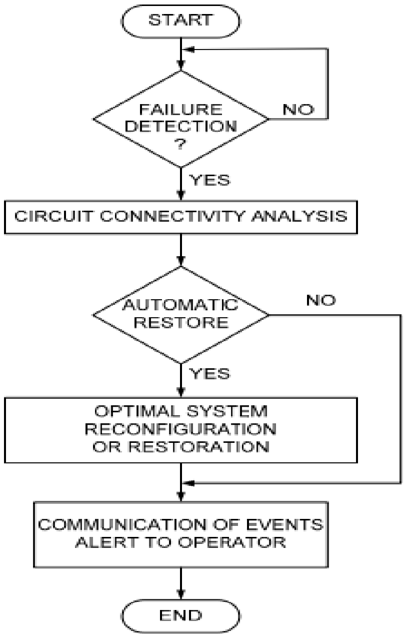
2. In order to deal with this challenge, there are the inclusion of innovative communication and information technology solutions generating the Smart Grid (SG). Smart Grid is to be interpreted as a concept and not a specific technology. It can be defined as an electrical network that uses sensing, information technology, and automation in order to supply electricity efficiently, reliably, and safely [10].

3. Several solutions are being proposed in this direction. For example, in the Brazilian electrical system, there is a development plan aiming to implement a national intelligent electricity grid with the goal to optimize generation and distribution [2].

4. One of the main goals in SG is to converge technologies for the balancing and control of grids with DG [1].

5. As a result, optimizing the distribution and use of smart grids will increase the efficiency of electrical systems, as well as reduce the causes of impacts and losses in the production and distribution of electricity in conventional models. Moreover, more efficient distribution of electricity will no longer require excessive use of resources, optimizing those already employed [6].

METHODOLOGY



Automated monitoring of system connectivity in real-time

Fig. 2

1. ESP32 Microcontroller is used in this system. It has inbuilt Wi Fi which makes it suitable for IoT Applications.
2. The system checks for status of AC Supply using the current sensor.
3. The voltage sensor sense's the status of the battery source.
4. If the AC Power Source is working properly all the devices will operate normally.
5. If AC Power source is not available the system will work on Rechargeable Battery Source where only limited devices can be operated.
6. Moreover when the Rechargeable Battery Source is low on power (below 20%) the number of devices that can be operated will reduce further (only high priority devices will work).
7. If the Rechargeable Battery Source has no power all the devices will stop working.
8. The complete system is interconnected with the help of IoT.
9. Data from each unit is stored and can be retrieved from IoT Cloud Server.
10. Based on the cases mentioned in points 4-7 the IoT Application created will configure the system in such a way that only specific devices that can be operated as per priority will remain on while other devices will automatically become disabled.
11. The IoT Dashboard also displays the current status of both power sources while the cloud saves data when the main power source is unavailable.

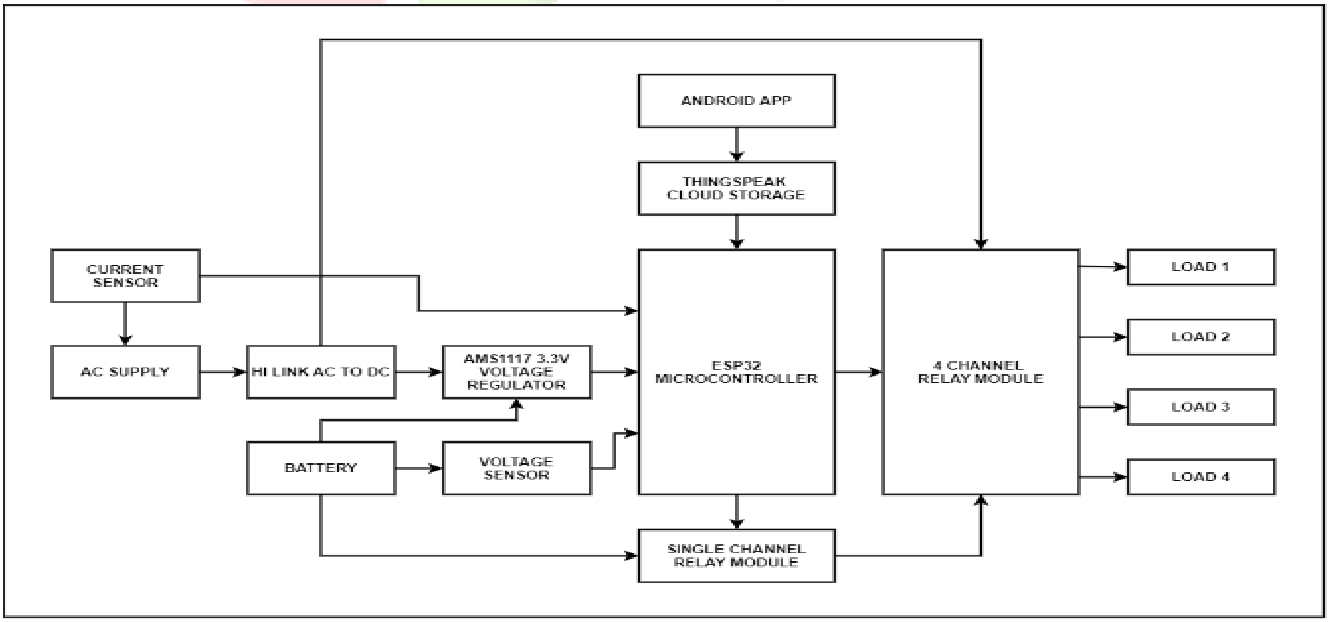


Fig. 3

IV. RESULTS AND DISCUSSION

Algorithm

Step I: Start.
Step II: Check for internet connection. If no internet connection; try connecting to internet.
Step III: Check for AC Supply availability using Voltage Sensor and Battery Status using Voltage Sensor.
Step IV: Update data on cloud storage.
Step V: If the AC Power Source is working properly all the devices will operate normally.
Else if AC Power source is not available the system will work on Rechargeable Battery Source where only limited devices can be operated.
Else if the Rechargeable Battery Source is low on power (below 20%) the number of devices that can be operated will reduce further (only high priority devices will work).
Else If the Rechargeable Battery Source has no power all the devices will stop working.
Step VI: Check for commands from Android App.
Step VII: Go back to Step III and Repeat or else go to Step VIII.
Step VIII: Stop.

Fig. 4

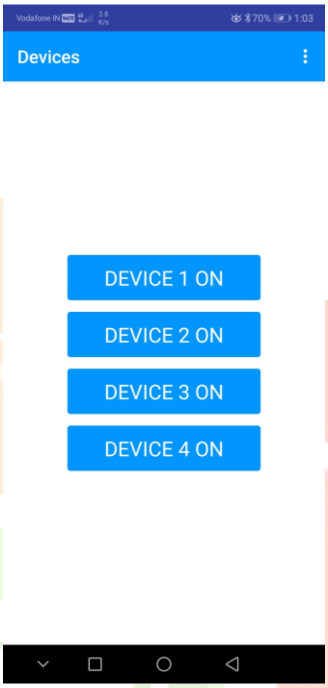


Fig. 5

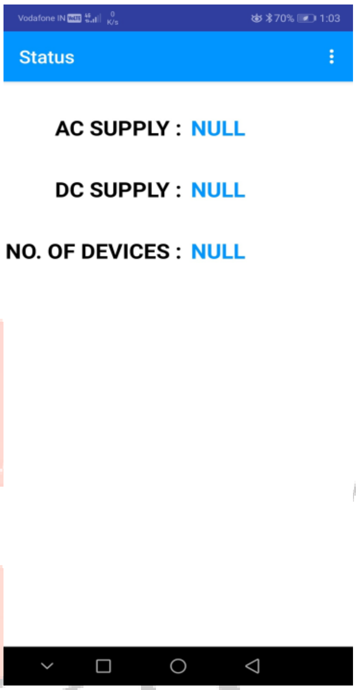


Fig. 6

ThingSpeak Cloud service stores data and acts as a communication channel between the android app and the microcontroller. The instant we change the status of device from on to off or vice-versa it is updated in the cloud and command is given to the ESP32 Micro-Controller which is a Wi-Fi module and the devices are turned on or off using the relays.

V. CONCLUSION

The proposed work provides an efficient way for load control at real time. The ESP32 based system is designed specially to facilitate load scheduling, sharing and control. The design scheme consists of dual supply system. The method used in the project provides necessary stages from overload detection to switching and cutting of supply. The IoT Application created will configure the system in such a way that only specific devices that can be operated as per priority will remain on while other devices will automatically become disabled.

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