

# Smart Distribution Electrical Grid for India

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## ABSTRACT

The smart grid is a new technology that adds efficiency to the electrical grid system. The smart distribution grid architecture proposed in this research work solves major problems faced by the Indian electrical grid such as wastage of energy by the careless usage of consumers, poor power theft and line fault detection method, and manual billing system. The intelligent devices that are placed in different parts of the distribution electrical grid together with the intelligent controlling system make the electrical grid smart.

## Keywords

electrical grid; smart grid; distribution system; single phase; wireless sensors;

## 1. INTRODUCTION

Smart grid is the future generation power grid system that can intelligently integrate all the devices, consumers and generators associated with it. Intelligent devices are placed throughout the smart grid system, which updates the traditional power grids by automatic and intelligent controlling of grid using digital technology [1]. Now the electrical grid in the entire world is trying to change its visage and trying to commence a new era in the electrical engineering track.

Indian electrical grid system is facing a lot of problems compared to the electrical grid in the developed nations. The major problems faced by the Indian grid system are the wastage of energy, the power theft, the poor detection method for line fault, and the manual controlling and billing system. These problems mainly affect the economic growth thereby social welfare of the country.

The power theft is one of the major problems faced by Indian electrical grid, which makes a big hole in the economic system that is liable for the out flow of a part of the country's wealth. The line fault detection method is also poor in existing grid system such that the administrator did not get the specific position of fault in the transmission line. The smart grid has sensors throughout the grid system so that it can solve these two problems very effectively and efficiently. Manual billing and controlling system of electrical grid lacks efficiency and wastes manual energy. This can be solved by the implementation of a smart grid feature called advanced metering infrastructure [2].

## 2. ARCHITECTURE

The single phase secondary distribution system consists of a step down transformer which steps down 11KV to 230V. The phase line is stretched from the transformer to the single phase consumers through the transmission line posts. The electric secondary distribution system is taken as research subject as it is

more prone to the problems like wastage of energy by the consumers, the power theft, the poor line fault detection method, and manual billing and controlling system. To solve the above mentioned problems, wireless intelligent devices are placed on the feeder circuit of the transformer, on the top of every line posts, and associated with the electric meters of every consumer [3]. Figure1 shows the schema of the smart distribution system for India.

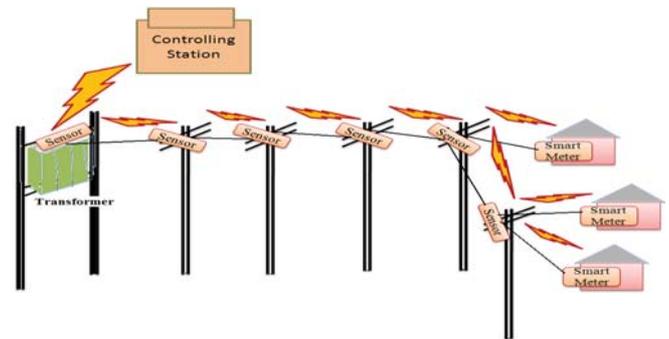


Figure 1. Smart distribution system for India.

The smart meters in every home measures the average power and energy consumption and send these parameters to the nearby sensor in the line post. The energy consumption value will propagate through the distribution grid and reaches the controlling station. Thus the controlling station can make bill for each consumer. Thereby automatic billing feature is capable in the electric grid system. Also by measuring the power in one second, it is possible to give warning signal in peak time, if any consumer exceeds their consumption limit. Thus it is possible to decrease the wastage of energy by the consumers.

The line post sensor measures the power by its own and receives the power value from the sensors it directly connected. The line post sensors also do some comparison methods between the measured power value and the summation of the received power value. This enables to detect the correct position of the power theft and line fault in the smart energy distribution system. This smart distribution system efficiently tackles the major problems faced by the Indian grid system.

## 3. TEST SCENARIO

### 3.1 Experimentation Setup

The testing scenario consists of three line posts with a phase line and a neutral line passing over these posts. The experimentation scenario is shown in the figure 2. The smart meter module connected to the test setup communicates with the controlling station. The controlling station includes the computer system and the communication module. The smart energy metering circuit

transmits the power line parameters to the controlling station. In the controlling station, the received consumption details are recorded in the database for smart grid.



Figure 2. Test Scenario for Amrita Smart Grid.

### 3.2 Admin Visualization and Consumer Visualization

The authority visualization software is developed using the programming language JAVA. It allows the administrative officers to view the changes in the entire electric grid from their offices itself. It shows the electric grid structure with all the nodes. This setup allows the authority to add or delete nodes and it also shows the indications of power theft and line fault in any segment of the transmission line. Figure 3 shows the authority visualization applet.

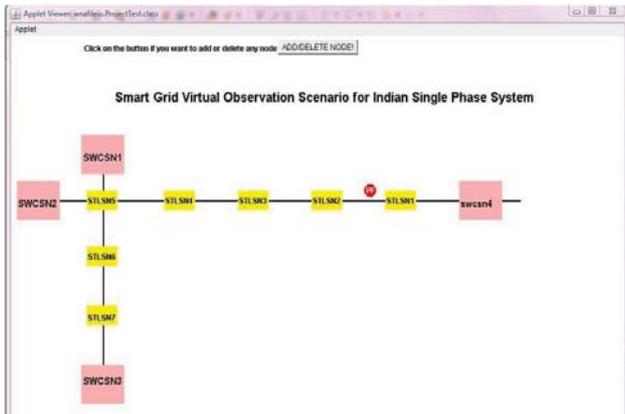


Figure 3. Admin Visualization for Amrita Smart Grid.

The consumer visualization allows the consumers to view the details about their own consumption and billing status. The wireless smart grid system has a feature of automated billing and controlling. The web page for the consumer visualization is shown in the figure 4. By this system the consumer can view their

consumption and billing status at any time. This avoids the problem associated with the existing inefficient manual billing system. In the smart grid system, the consumer is provided with a unique ID and password. Using these unique details, the consumer can login and view their details.



Figure 4. Consumer Visualization for Amrita Smart Grid.

## 4. CONCLUSION

The architecture for smart distribution grid is proposed in this work. The test scenario for the proposed architecture will demonstrate how the smart distribution grid architecture solves the major problems faced by the Indian electrical grid.

## 5. ACKNOWLEDGMENTS

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