# IOT Based Smart Grid System

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**ABSTRACT**

The transmission lines plays an important role for transmitting power from generation end to consumer end. In traditional electrical grid network energy is generated in centralized power plants and it is not possible to communicate bidirectional. Smart grid system is the advancement of convectional electric grid system. Whenever one grid system that transfer power to consumer but due to some fault issue the power supply can be cut off. To overcome this difficulty we can connect all loads connected to grid station with some other station with the help of IOT. The IOT performs the function and maintenance by using diiferent types of sensors. So we can give uninterrupted power supply to the consumer.

**INTRODUCTION**

As the population is increases the demand of energy is also increases at faster rate than energy supply. As increase in energy consumption greenhouse gas emissions problem also increase and it can harm the environment. With the increase in energy costs , customer expectations also increasing.

Customers want to do more to protect environment , use less energy and control their cost. One of the main issues with today's outdated grid deal with efficiency. The grid become overloaded during peak time or seasons. It is also possible to hack the system, and basically take free electricity.

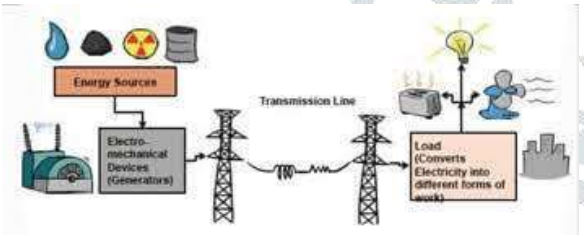


**Fig (1) :- Conventional Grid System**

**SMART GRID SYSTEM**

The smart grid is decentralised system where power flows in both direction , from generation end to consumer end and vice versa. Smart grids are based on communication between provider and consumer. It is energy consumption monitoring and measuring system. With the help of smart grid consumer and owner get daily electricity consumption reading and owner can cut electricity through internet if bill is not paid.


**Fig (2) :- Smart Grid System**

Smart grid can be complement of traditional electric grid system by including renewable energy resources, such as wind, solar and biomass, which is environmentally cleaner as compared to fossils fuels.

**SMART GRID VISION FOR INDIA**

"Transform the Indian power sector into a secure, adaptive, sustainable and digitally enabled ecosystem that provides reliable and quality energy for all with active participation of stakeholders"

**BENEFITS OF SMART GRID ARE SUMMERISED AS**

Better forecasting

Widespread instrumentation and advanced computer models allow system operators to better predict and manage RE variability and uncertainty.

**SMART INVERTERS**

• Inverters and other power electronics can provide control to system operators, as well as to automatically provide some level of grid support. Demand response.
• Smart meters, coupled with intelligent appliances and even industrial scale loads, can allow demand-side contributions to balancing.

**INTEGRATED STORAGE**

• Storage can help to smooth short-term variations in RE output, as well as to manage mismatches in supply and demand.

**REAL-TIME SYSTEM AWARENESS**

• Sensors across networks allows system operators to have real-time awareness of system conditions, and the ability to actively manage grid behavior.

| | TRADITIONAL GRID | SMART GRID |
|---|---|---|
| Metering | **ElectronicFunction, Solid State** | *Digital Microprocessor* |
| Communication | **One-Way And Local Two-Way Communication** | *Global/Integrated Two Way Communication* |
| Customer Interaction | **Limited** | *Extensive* |
| Generation | **Centralised** | *Centralised And Distributed Generation* |
| Power Flow Control | **Limited Protection, Monitoring And Control System** | *WAMPAC, Adaptive Protection* |
| Monitoring | **Blind** | *Self Monitoring* |
| Restoration | **Manual** | *Automated, 'Self-healing'* |
| Operation & Maintanance | **Check Equipment Manually** | *Monitor Equipment Remotely* |
| Control | **Limited Control System Contingencies** | *Prevarsive Control System* |
| Reliability | **Estimated: Prone To Failures And Cascading Outages** | *Predictive: Pro-Active Real Time Protection* |
| | | *And Islanding* |
| Topology | **Radial** | *Network* |

**IOT**

The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, and smart homes.

**ARDUINO UNO :**

Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world.

**WIFI MODULE :**

Wi-Fi is a technology for wireless local area networking with devices based on the IEEE 802.11 standards. Wi-Fi is a trademark of the Wi-Fi Alliance, which restricts the use of the term Wi-Fi Certified to products that successfully complete interoperability certification testing.

**ROLE OF IOT IN SMART GRID**

IOT can be used in customer side in smart meters to measure different types of parameters.

**SMART METER**

Benefit Analysis

| Key Benefits | Current Operations | Smart Meter Operations |
|---|---|---|
| Energy Accounting | • **Estimated & Done At Sub Division/Substation Level/feeder level** | • *Enable Near Real Time Energy Accounting At Feeder & DT Level* |

| | | |
|---|---|---|
| Meter Reads | • **Meter Readers (Third Party*) walk from house to house to capture meter data.**<br>• **Manual Punching Of Meter Data By Employees** | • *Send interval data directly to the utility and hence eleminating most of manual meter reading and punching* |
| Meter Operations | • **Field visits required to verify if meter is functioning correctly/ damaged**<br>• **Manual visits for meter disconnection/reconnection** | • *Real-time remote diagnostic to ndetermine if meter is operating normally. If meter reciving voltage, no field personnel required to investigate* |
| Billing | • **Overall Billing cycle takes around 15-20 days**<br>• **Average of provisional Billing For cases of meter failure or inaccessible consumer** | • *Enable auto disconnect /reconnect*<br>• *Billing cycle to reduce by 11 days.*<br>• *No cases of average Billing* |
| Management | **accurate records on sanctioned load**<br>• **Sizing Of DT Based on estimates** | *Distribution Transformer Failure*<br>• *With monitoring of sanctioned loan use and utilization of DT, optimized transformer load planning can be undertaken* |
| Power Theft | • **Current meters do not offer capabilities to detect tempering (mis-wired or bypassed meters)** | *Generate tempering alarms and monitored meter data to identify theft.* |
| Grievance Redressal | • **Large no. of complaints related to meter reading and billing**<br>• **Revenue department involved in both recovery and grevance redressal** | *Enable reduction in consumer complaints on bill, meter failures and outages and hence reducing cost for grevance redressal* |

| Key Benefits | Current Operations | Smart Meter Operations |
|---|---|---|
| Load | • **Lack of** | • *Reduced* |

The smart grid is part of IOT framework which can be used to remotely monitor and manage everything from lighting, traffic signs, trafic congestion, parking spaces , road warnings and early detection of things like power influxes. The role of IOT in smart grid is very crucial. Internet of things is in large part the enabler of smart grid as it technological amd infrastructural components are mostly IOT based.

The data on energy consumption comes from sensor enabled IOT devices, appliances and hubs which control a smart house or any connected space. This data is then use to analyze electricity usage , calculate cost , remotely control appliances , make decission on load distribution , recognize devices, detect malfunctions and risk of outages etc.

## IMPACT ON COST

It is simpler to establish a wireless network whereas implementation of wired network invols proper planning and instalkation. While implementing smart grids, power failure are intolerate. This factor may lead to increased cost of implementation. Despite the huge implementation costs, smart grids and IOT save large amounts of energy by rerouting power instantly on detection of power failure.

## CONCLUSION

In this paper, we breifly studied about the IOT based smart grid system. Smart grid represents one of the most promising and prominent internet of thing application. By applying IOT technologies , various intelligent services can be created. The development of most aspects of the smart grid would be enhanced by applying IOT. It provides very effective measures of delivering electric power to various consumers.

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## REFERENCES

(1) International reasearch journel of engineering and technology (IRJET). Internet of things based on smart grid, Shahid Yusuf wani, shaver Sharma.
(2) a review on iot based smart grid, maninder kaur and Dr. Sheetal Kalra.
(3)] U. S. DOE, “Communications requirements of Smart Grid technologies,” Tech. Rep., US Department of Energy, 2010, http://energy.gov/gc/downloads/communications-requirements-smart-grid-technologies.
(4) U. S. Department of Energy, Smart grid type @ONLINE, June.
(5) https://www.eesi.org
(6) Design of IoT Based Monitoring System for Miniature Smart Grid Waluyo, Febrian Hadiatna, Andre Widura