

# A Review of Monitoring and Analysis of Photovoltaic Grid System

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**Abstract:** Due to huge population and the society of modern industries, the energy demand increases exponentially and the need arises to motivate use of alternate energy sources to improve the quality and efficiency of power. As for the literature survey of renewable energy sources is concerned the use of photovoltaic energy has emerged as a primary resource because the solar energy is clean, environment friendly. As far as the power grids are concerned the demand is a smart concept to be introduced and thus different IOT concepts need to be imperatively implemented to monitor and control the statics of grid. The paper presents the complete review of the proposed system.

**Keywords:** IOT, Smart Grid, PV, DER

## I. INTRODUCTION

Every organization and field are automatized. There, however, are still areas which lack in the same and agricultural sector is one such area. This is one of the primary sectors on which the economy of the country depends. Manual organization in the entire process of growing crops and identifying disease has been going on for a long time. It is time consuming and expensive and not completely reliable. Automation is thus very important for detection of diseases and monitoring the growth of plants. Internet of Things (IOT) in simple terms can be defined as a means to communicate between machines. As per the International Telecommunication Union IOT is as “A global infrastructure for the information Society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies.” As there is increase in population every year, the farming industry needs to advance and inculcate the technology. Smart techniques in farming can be adapted to get better crop productivity and also good quality. Basically, IOT is the connection of day-to-day objects to the internet.

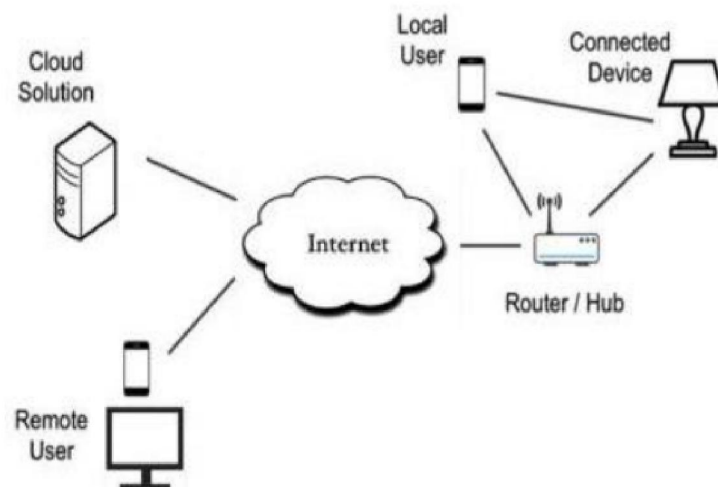


Figure 1.1: IOT Components.

With significant boost to empower huge scope development of renewable sources, solar technology has been accepting a nonstop rising interest in the course of recent many years. Clean and less expensive source of energy has consistently

been a value mission. In 2011, sunlight-based force represented 0.5% of worldwide power interest as assessed by Centre for Climate and Energy Solutions abridged as (C2ES). Most importantly, the sun radiates around multiple times more energy than is required energy interest of the whole world. This implies that a colossal measure of energy is as yet undiscovered from the sun. Because of the developing emergency, numerous legislatures began declaring appealing motivating forces to embrace sustainable power sources, for example, solar power. By creating power from the sun, these legislatures are pointed toward decreasing reliance on coal-based force plants that produce billions of huge loads of carbon dioxide. The complete introduced limit of sun-oriented power plants worldwide for 2018 is estimate to arrive at 508 GWp. To accomplish 100 GW of this energy as an objective by 2022, the Indian government has presented various endowments, from huge PV parks to little rooftop and off-framework establishments, through different plans.



Figure 1.2: A Rooftop Installation of PV sheets.

In India just as in different nations, establishment of roofsolar PV for the private, business, and instructive structure premises are in expanding pattern due to the reduced PV cost, ecological mindfulness, and government sponsorship, and so on. A wide utilization of the structure consolidated photovoltaic frameworks is one of the advances with thestate of art improvement in the solarPV framework.

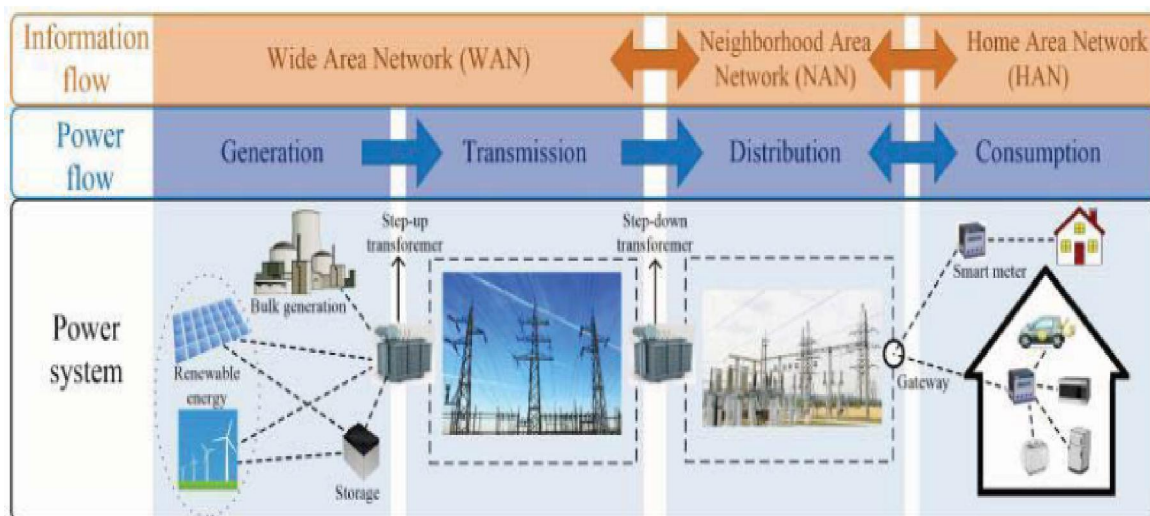


Figure 1.3: An Overview of a Smart Grid.

The utilization of sustainable power sources for energy creation has been strongly developing in the edge of ecological concerns just as considering the significant accomplishments in the field of frameworks, and solar energy changing frameworks, respectively. The vast majority of the applications with respect to the photovoltaic power plants (PV power plants) comprise of grid connected frameworks, which are utilized for energy infusion into the powergrid. The grid-connected solar inverter constitutes one of the main parts of photovoltaic power plants. In this way, the electronic gadgets utilized for various grid-converted inverters may influence the electric flow waveform. In addition, inverters can cause rise inharmonic deformation flows into the public power grid. Harmonic distortion in low voltage electrical networks can cause framework issues if the aggregate sum surpasses certain necessary stretches. The photovoltaic power plants should thusly meet certain base specialized prerequisites to be associated with public grids so protected activity of the force frameworks can be guaranteed. Reconciliation of circulated PV power plants in the vicinity of consumers, particularly in low and medium voltage appropriation networks, can cause precariousness in the power system activity. The primary electromagnetic aggravations that can be controlled by a photovoltaic force plant and effect the electric lattice are appeared in the following table.

Disturbance Type	Influencing Parameters	Observations
Harmonic Distortion	The level of the short-circuit current in PCC; the type of the used inverter and power grid filters	Modern Pulse-Width Modulation inverters provided with output filters generate insignificant harmonics.
Unbalanced	The single phase equipment connected to the three-phase low voltage grid	Three-phase power equipment (over 5 kW) do Not cause unbalances.
Voltage Variations	The installed power of the equipment, the PCC short-circuit current, the connection point (on the bus or within the Electrical substation), the variation of the solar irradiance	The voltage variations may exceed the admissible values especially when connecting the systems to the medium voltage lines. The voltage variation is even more important when considering higher distances from the station bus to the PCC and also more significant power output.
Voltage Fluctuations	The rapid variation of the solar irradiance, the PCC short-circuit current	Voltage fluctuations may appear in cloudy days with Fast-moving clouds.
Power Factor Variation	The electrical grid load variation	The photovoltaic power plants generate a near unity power factor. For the power factor control, either specialized equipment (SVC, STATCOM) or appropriate control of the interface inverter is required in order to ensure the corresponding phase shifting to the necessary reactive power (for voltage-source converters).

Table 1.1: Disturbances.

## II. LITERATURE REVIEW

**Rehman et al. (2019):** In the paper titled “**Weighted Based Trustworthiness Ranking in Social Internet of Things by using Soft Set Theory.**”, it has been stated that IOT is an advancing research subject throughout the previous twenty years. The joining of the IoT and social organizing idea brings about building up an interdisciplinary research region called the Social Internet of Things (SIoT). The SIoT is prevailing over the customary IoT due to its structure, usage, and operational sensibility. Here, gadgets cooperate with one another freely to set up a social relationship for aggregate objectives. To set up reliable connections among the gadgets fundamentally improves the connection in the SIoT and mitigates the marvel of danger. The issue is to pick a reliable hub who is generally reasonable as indicated by the decision boundaries of the hub. This paper builds up a weighted based reliability positioning model by utilizing soft set theory to assess the reliability in the SIoT. The reason for the proposed research is to lessen the danger of false exchanges by distinguishing the most confided in hubs.

**Durrani et al. (2019):** In the paper titled, “**An Automated Waste Control Management System (AWCMS) by Using Arduino,**” has described the formulation and working of an Automated Waste Control Management System (AWCMS) has been planned which incorporates an electronic waste location gadget and a focal control unit. An infrared sensor for detecting waste levels, GPS for area recognizable proof, Arduino Board having a microcontroller and GSM Module for sending the message containing the data with respect to squander container being is full or void. The focal control unit contains an accepting gadget which gets a message from the waste recognition gadget through a GSM Module and sends it to the PC programming by means of a USB link utilizing Arduino Board's miniature regulator. The product has a capably planned GUI which empowers the client to perform and screen all the necessary activities for squander checking and location in the waste canisters put in a region or a city. All the data like scope, longitude, the status being full or void and so forth are shown in the GUI of the product in case of a waste-receptacle getting full and afterward being exhausted by city squander trucks or field laborers. Subsequently, all the parts in this general framework work in a smart way to make robotized squander the executives conceivable with the goal that the waste is gathered and arranged to the unloading locales just when it is fundamental at an appropriate time. This work principally centres around ideal and programmed squander assortment and transportation component.

**Al-Turjman et al. (2019):** In the paper titled “**IoT-enabled Smart Grid via SM: An overview,**” it has been stated that power quality and dependability issues are huge difficulties to both specialist organization and buyers in ordinary grids. The continuous mechanical headways in the Internet of Things (IoT) period give better answers for upgrade the administration of these difficulties and authorize the proportions of a Smart Grid (SG). (AMI) and Smart Metering (SM) advancements are empowering agent advances that can modernize the traditional force matrix through uncovering the concealed subtleties of electrical force by presenting two-way correspondence conspire during power exchange measure among utilities and purchasers. The paper thoroughly audits the possibility of utilizing SM for power quality and dependability observing.

**Alireza Ghasempour (2019):** In the paper titled “**Internet of Things in Smart Grid: Architecture, Applications, Services, Key Technologies, and Challenges**” it has been stated that one of the most important applications of IoT is the Smart Grid (SG). SG is a data communications network which is integrated with the power grid to collect and analyze data that are acquired from transmission lines, distribution substations, and consumers. In this paper, we talk about IoT and SG and their relationship. Some IoT architectures in SG, requirements for using IoT in SG, IoT applications and services in SG, and challenges and future work are discussed.

**Velmurugan et al (2018)** the exploration paper entitled “**Hybrid Renewable Energy Based Micro Grid**” portrays the after effect of non-renewable energy sources on the world warming. The paper characterizes the significance of micro-grid partner degree could be an origination that coordinates the DER (Distributed Energy Resources) to build up an independent electrical foundation. This paper introduces the significance of the preparing of hybrid sustainable power source based generally little grid as a promising side inside the route forward for power frameworks. With this aim the little grid configuration is implied comprising of high infiltration of dispersed generators associated with the grid through sensible force electronic based for the most part gadgets, nearby the incorporation of correspondence strategies, power stockpiling frameworks.

**Morello et al. (2017):** In the paper titled “A smart power meter to monitor energy flow in smart grids: the role of advanced sensing and IoT in the electric grid of the future.”, the authors have summarized the capacities of sensing systems and IOT to keep track of the flow of energy amidst nodes of electric network. Data regarding the utilization and quality of power permits the grid to course proficiently the energy by methods for more appropriate choice measures. The flow of energy should have the option to alter its course as per needs. Currently, this isn't possible by taking only criterion based on the simple shortening of transmission path. The paper proposes smart meter which helps monitor electricity proficiently and effectively.

**W. Ejaz (2017):**In the paper titled “Efficient energy management for internet of things in smart cities,” it has been mentioned how the Internet of Things (IoT) offers many complex and pervasive applications for savvy urban communities. The energy interest of IoT applications is expanded, while the IoT gadgets keep on filling in the two numbers and their prerequisites. Subsequently, keen city arrangements should be able to proficiently use energy and handle related difficulties. Energy the executives is considered as a critical worldview for the acknowledgment of complex energy frameworks in keen urban communities. This paper additionally talks about the energy reaping in keen urban areas, which is a promising answer for expanding the lifetime of low force gadgets and its connected difficulties. We detail two contextual investigations, the first one targets energy-productive booking in quite a while and the second covers remote force move for IoT gadgets in brilliant urban communities. Recreation results for contextual investigations exhibit the gigantic effect of energy-productive planning enhancement and remote force move on the presentation of IoT in brilliant urban communities.

**Haider et al. (2017):** In the paper titled “A Three Stage Load Sharing Routing Algorithm to Increase Lifetime of Cognitive Radio Sensor Networks.”, mentions a CRSN or Cognitive Radio Sensor Network which is an organization of wireless radio sensor hubs, they sense information and communicate over accessible range groups. Further, a three-stage directing calculation for effective execution has been presented. In the principal stage, we ascertain the transmission delay for each connection as interface cost. In the subsequent stage, the expense of each connection is changed between essential radio sensor hubs and intellectual radio sensor hubs as indicated by the condition of essential clients. In the third stage, a heap sharing calculation is applied to improve the life of entirety hub sensors in such a manner to get most extreme yield.

**Morello et al. (2017):** In the paper titled “Advances on Sensing Technologies for Smart Cities and Power Grids: A Review,” discusses the rising technologies closely related to smart grid and city. The improvement in performance of the grid has been seen due to advanced devices like transducers and sensing systems. Various features related to the same have also been discussed.

**S. E. Collier (2016):** In the paper titled “The emerging Enernet: Convergence of the Smart Grid with the Internet of Things,” US grid transformations have been discussed. New turns of events and inspirations are changing longstanding models and strategies. The authentic underpinnings of the grid have disintegrated while new choices have emerged that change how electric energy is created, used and managed. There is an extraordinary, quickening expansion of dynamic new segments and gadgets on the appropriation edge of the grid. These change its electrical properties and how it should be arranged, designed, worked etc. Traditional models and techniques won't do the trick for examination furthermore, activities of the matrix. New methodologies will be needed to effectively plan, engineer, work, examine and deal with the electric dispersion network within the sight of all these appropriated, independent sources and sinks of energy. Luckily, some new gadgets and applications are being conveyed for checking, examining and controlling both the creation and the use of intensity and energy.

### III. RESEARCH METHODOLOGY

This research work will adopt a research methodology that combines the theory model with empirical evaluation and refinement of the proposed scheme on MATLAB simulation tool. MATLAB is a useful high-level development environment for systems which require mathematical modelling, numerical computations, data analysis, and optimization methods. This is because MATLAB consists of various toolboxes, specific components, and graphical design environment that help to model different applications and build custom models easier. Moreover, the visualization and debugging features of MATLAB are simple. The research methodology includes:

1. To Study the current existing system.

2. To implement new circuit in MATLAB simulator.
3. To check the reliability of system for fast switching
4. To check the stability and efficiency of system.
5. Validation of the results

#### IV. COMPRATIVE ANALYSIS

Reference	Title	Technique	Research Findings
Rehman et al	Weighted Based Trustworthiness Ranking in Social Internet of Things by using Soft Set Theory	IOT	This paper builds up a weighted based reliability positioning model by utilizing soft set theory to assess the reliability in the SIoT
Durrani et al	An Automated Waste Control Management System (AWCMS) by Using Arduino	Arduino	Describes the formulation and working of an Automated Waste Control Management System (AWCMS) has been planned which incorporates an electronic waste location gadget and a focal control unit.
Al-Turjman et al	IoT-enabled Smart Grid via SM: An overview	IOT	Describes the power quality and dependability issues are huge difficulties to both specialist organization and buyers in ordinary grids.
Alireza Ghasempour	Internet of Things in Smart Grid: Architecture, Applications, Services, Key Technologies, and Challenges	IOT, SG	Describes the IOT applications in terms of smart grids.
Velmurugan et al	Hybrid Renewable Energy Based Micro Grid	DER	Introduces the significance of the preparing of hybrid sustainable power source based generally little grid as a promising side inside the route forward for power frameworks.
Morello et al	A smart power meter to monitor energy flow in smart grids: the role of advanced sensing and IoT in the electric grid of the future	IOT	proposes smart meter which helps monitor electricity proficiently and effectively
W. Ejaz	Efficient energy management for internet of things in smart cities	IOT	This paper talks about the energy reaping in keen urban areas, which is a promising answer for expanding the lifetime of low force gadgets and its connected difficulties

#### V. CONCLUSION

Solar PV innovation has been set up to be solid in enhancing the power demand in certain zones, and methods for addressing some power emergencies in off power crises zones in various nations. A power monitoring and control framework can be planned and created towards the usage of power grids. The system will monitor and control the overall PV grid by designing a protection circuit. Overall reduction of cost and improvement using a filtering circuit can be done.

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