

## A REVIEW ON SCOPE OF MANAGEMENT OF SOLAR ENERGY SYSTEM BY IOT

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**ABSTRACT:** It is possible to improve the efficiency, observation and handling of solar power generation plant when the technology connected with Internet of Things is used. This paper has focused on role of IOT in solar power management. The solar power is proven cost effective and environment friendly mechanism to provide power to home appliances. But there is need to provide the solar management system using IOT. The integration of IOT to manage solar power based appliances would be suitable to reduce the wastage of solar power. The researches related to IOT and existing solar power system are explained in this paper.

**Keywords:** IOT, Cells, Networks, Cost, Power, Matlab.

### [1] INTRODUCTION

The **Internet of Things (IOT)** becomes a structure of visible properties and items. Hardware, software, automobile, premises and lots of other material make this structure. All of these things are implanted in the company of computerized hardware, computer programs, sensing elements, network connectivity. Due to this, these materials are able to accumulate and transfer data. It becomes possible to sense and manage objects at a certain distance under the existing system structure. It provides opportunity in favor of direct combination of external world in the company of computer based systems. It increases performance, consistency & cost effective advantages. When internet of things is build up in the company of sensing elements, control devices it becomes an example of broad category of computerized geological machine. It contains technical equipment which makes automatic control of home appliances, smart grids, intelligent building, smart transportation and intelligent cities possible. With the help of computing system enclosed by a particular object it is possible to identify each object in a unique way. But for this purpose it is essential that these systems are engaged in the

company of Internet infrastructure. Up to year twenty twenty it is expected that internet of things will consist of nearly fifty thousand million objects.

### 1.1. SOLAR POWER

As we all know that sun contains a lot of heat and energy. This energy can be converted in to other form of energy. Solar energy is the converted form of the sun's energy. The energy which is obtained after conversion is a non conventional source of energy. It means, a "green" source of energy. In solar energy production system water is heated through the heat of sun rays. This boiled water is then used to heat the steam turbines. Energy generated from solar plants are used in various forms .

This amount of energy generate when the radiation coming out through Sun is exploited. These radiation are put under harness when different type of developed technologies are used. Photo voltaic cell, solar thermal energy, solar pattern and artificial photosynthesis are comes under the developed category of technology.

It becomes a very helpful source of non conventional energy. Different type of methods which are used for its generation exists either

ISSN : 2278-6848



9 772278 684800 03  
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Research Publication and Seminar

in the form of quiet or active methods. This form is decided by knowing the manner in which they harness and transmit solar energy or change it into solar power. All the methods like photovoltaic cells, concentrated solar power, and solar water heating which are used for exploiting the energy comes under the category of energetic methods. In comparison to this, all the methods like aligning of structure in Sun's direction, choosing of substance which contains large amount of thermal or qualities like light scattering comes under the category of quiet methods.

#### **Advantages of Photovoltaic Cell**

1. This type of cell provide power at the time of full sunshine.
2. For the installation of these cell less space is required and they can be easily implemented in other open places.
3. Once they implemented they do not require regular maintaince. They require occasionally cleaning to make them dirt free.
4. These cells do not produce either noise pollution or air pollution at the time of generation. This means that installations aren't intrusive – whether they're in crowded urban locations or quiet rural ones.
5. These type of cells are very secure because they can not emit harmful gasses.

#### **Disadvantages of Solar power**

The greatest weak point of photovoltaic cells is, they don't produce electricity in cloudy situations or in night time. For the generation of electricity, panels require a spectrum of visible light. It means for generation of

electricity, solar panels required high amount of light. Its generation capacity depends directly on the intensity of the sunlight.

#### **1.2 SOLAR POWER MONITORING SYSTEM USING IOT**

It is possible to improve the efficiency, observation and handling of solar power generation plant when the technology connected with Internet of Things is used. Due to the increase in technologies the cost of hardware which are used in renewable energy plant reduced. It encourages usage of solar plant. These solar plants which are implemented in large amount need sophisticated systems in support of automation. These automation is required for the observations of plant from the places which are distant from plant. For this purpose a post which is derived on the basis of internet is employed. Most of plants are implemented in areas which are unapproachable. It becomes very difficult to observe them from a required position. For examine the efficiency of solar plant from distant position an economical method which is derived on the basis of IoT are used. When this method is used real time observations, handling, and identification of defects becomes easy.

For achieving maximum output from a plant time to time observation is necessary. When a plant is observed on regular basis then it becomes possible to achieve maximum output because the inappropriate connection of solar panels, dust connected on panels and some other problems which will make a huge impact of efficiency will resolved. A system which is derived on the basis of iot is used in order to observe the factors of solar system. This is a mechanical system. It permits the observation

of solar plant from distant location. For this purpose a system which is derived on the basis of ATmega controller is employed. This system keeps a constant eye on solar plant system. It distributes resultant power in the direction of IOT system. It is done with the help of web. At this point factors of solar power are allocated to server by internet. At this point it shows these variables in the direction of user. For this purpose they employ graphical user interface in a very effective way. In addition to this, it also delivers warning signal in situations where output drops down below definite value. Due to this, remote controlling of solar plants becomes simple. It also gives best power output. Construction of IoT based monitoring system Solar power monitoring system using IoT

#### **ATMEGA 328**

It becomes useful because of its simple and conventional functioning. It reduces the differences in the middle of solar panel and IOT (Internet of Things). In the functioning of ATmega 328 a supply of five volt is required.

#### **VOLTAGE AND CURRENT SENSOR (INA219)**

Exactly it works in the form of sensing elements. The amount of power exhausted through shunt load is provided by it. It delivers every single reading in the direction of ATmega 328. All these values are delivered in computerized form. Readings related to current and voltage of shunt load is determined by software which are established in ATmega 328.

#### **LIQUID CRYSTAL DISPLAY (LCD)**

It is a device which is used to show product name and overall expenses. As soon as digitization of an object is completed it will highlight its name and cost. Similarly if another object is digitised, then its cost

will be added to the previous products and now it highlights the overall price of two objects.

#### **Wi-Fi MODULE (ESP8266)**

Information determined through ATmega 328 requires additional treatment. This treatment is required for storing them in IOT server. This additional treatment is provided by the Wi-Fi Module. This stored information is analyzed on a regular basis. For the achievement of this purpose popular IoT platform Thingspeak is used.

#### **Working-**

Details related to various solar plants are combined by the programme of Internet of Things (IoT). As soon as details are combined it implements analysis techniques in order to examine the usefulness of details. After that depending upon examination highly useful details are shared in the company of applications which are made to tackle useful requirements. These IoT programs like Thingspeak, Microsoft Azure and Google cloud are very capable. They can easily sense either the information is helpful or not.

With the help of these details existing faults are identified and they provide guidance due to which some other kind of issues are identified before their occurrence. Depending upon information which is selected directly through attached sensing elements useful decisions are made. It brings down the requirements of time and expenses up to minimum level.

Such type of system takes care of solar power plant on a regular basis. Due to this, plants are analyzed in a very simple and useful manner. This analysis becomes helpful in the detection of faults which take place inside a power plant due to which the records of power plants show that production of energy is not consistent.

#### **[2] LITERATURE REVIEW**

Several models of related systems have been reviewed here:

In 2020, S. M. Thaug et al.[1] on the basis of system which control health related issues remotely proposed an assessment of experimental Data. For this purpose they use internet of things. The basic intention behind the invention of this arrangement is to make assessment of experimental Data. These data is related to the health condition of an individual according to isolated human services observing framework in their various exercises. In this system, accumulated wellbeing data can be seen by using both PC and mobile phones. The constant aftereffect of detecting elements which are used in the detection of humidity, pattern of human heart and SPO2 present on ThingSpeak is tried. EDA investigation is done on estimated information measurement to realize the human movement for compelling social insurance checking utilizing IoT. The trial examines have been completed dependent on the possibility of clinical specialists in the medical clinic.

In 2020, L. Leong and S. Wiere[2] recognized pattern on the basis of wrist movements and safety issues related to intellectual IoT device which are wearred on wrist and put them in written form. They showed that wearable IoT equipment can get on the unpretentious developments during composing. With PCA and highlight building they had the option to recognize distinguishableness or uniqueness between developments related with the composing digit zero and the digit one. PCA and Full Feature models were fabricated and performed well while foreseeing the composed digits in the test set

In 2020, So Hasegawa et al[3] discussed those methods of channel selection which are derived on the basis of machine learning. These methods are

put in to operation on that hardware of internet of things which are used for sensing purpose in coexisting internet of things Networks. It is estimated that in future, no of internet of things devices grow in a dramatic manner. Due to presence of large internet of things devices, large amount of traffic generates. Due to this, in addition to congestions of network, chances of packet loss are also increased. In order to control network traffic, author proposed machine learning on the basis of channel selection metod in support of internet of things hardware. They designed channel selection in the form of Multi-Armed Bandit issue. In order to resolve these concerns, on the basis of energetic process like Tug-of-War they formed a method. In addition to this, in situations where the quantity of used hardware is large they confirmed the selection of energetic channel.

In 2019, R. P. Tripathi et al.[4] put in to forward photovoltaic cells in the company of its structure, qualities and development process. These cells are sometimes known as solar cells because they produce solar energy. Here, in this work author comparatively consider a photo vultic cell whic is made from only one plate of silicone layer. After forming its structure they show the consequences of this cells on the basis of sunlight. They also show the manner in which it adjust light energy. In this work, the effect of J-V properties and its production capability on the performance of this cell is bring in to light. the after effect of . with produced efficiency. It was represented by them in computer copy, that the efficiency of almost five percent and almost power of twelve mWh was achieved.

In 2018, M. Shirbhate et al.[5] said, solar energy is a one of the cleanest form of non conventional energy resource, it does not affect greenhouse atmosphere. In the present scenario, the energy

generated from sun established in the form of biggest source of non conventional energy. In comparison to solar, hydro and wind are other source which produces energy higher than that of solar. This source of energy becomes more and more demanding in all over the world. When the management of photovoltaic cells are controlled in a managed way then it becomes possible to enhance its performance. The system which was introduced here put in to operation in two stages, first is a panel level monitoring system and second is a solar power prediction system. For the purpose of supervision of Internet of Things is used by them. They supervised the production of solar energy. If the supervision was done in a proper way then the efficiency observations and control of the solar plant improves. The solar monitoring system collects several constraints being by sensors In order to examine the efficiency at panel level detecting elements conducted an assessment to find out the limitations. These limitations gathered by the monitoring system. This system continuously trace the production of solar energy in the company of atmospheric situations, like temperature and humidity of particular location. This system determines the defects in addition to panel's working lifespan. In the next step, design of Markov Model was used in order to determine the production of solar power. The prediction we get in this phase is appropriate when the connection in the middle of initial value to subsequent value is taken in to account in time-series. When its consequences are compared in the company of present prediction unit it has been come in to notice that future unit delivers highly accurate estimation.

In 2018, H. Sharma et al.[6] said that system of detecting elements which is wireless becomes the fundamental constituent elements in support of internet of Things (IoT) arrangement which is used

in the present scenario. These IoT arrangement is implemented for the construction of intelligent infrastructure, parking space, and cities. The design of WSN nodes are done in such a way that they left with one limitation. This limitation is limited battery power. It means, it is possible for them to operate but it can operate only for a few days. These working days are totally depends upon the extent of its utilisation. Here, for the sake of this limitation a solution was provided by them. For providing this solution they used ecological settings of photovoltaic energy. In this work, in support of those batteries which can be charged again and again, an extraction design was introduced by them. This design was very useful and exceptional. These batteries was formed on the basis of WSN nodes. Normally, for the extraction of maximum solar Energy, it was estimated that the nodes of wsn required infinite working lifespan. In this work, in support of WSN nodes they put in to forward a system for the very first time. The batteries of this system are charged by the help of solar power. This system is very helpful and exceptional. This system was put in the company of optimal power point tracking. In this work, the factor which was mainly taken in to account was the improvement in performance of extraction system. This efficiency mainly depends upon the performance of solar cell, performance of buck boost converter which is managed by MPPT and the performance of rechargeable battery. Lots of design procedures are already formed in support of system which is used for the extraction of solar energy. Inside matrix laboratory simulation work was carried out in repetitive manner in support of buck boost converter. These converter gets power through solar energy. All this work was done in the company of MPPT for getting maximum output. It was represented by them in computer copy, that the

system which was introduced by them achieve efficiency up to ninety six percent ( $\eta_{sys}$ ).

In 2018, S. K. Ram et al.[7] carried out their research in the direction of a system which is designed for the purpose of power extraction. It is a system which is controlled through microprocessor. As soon as the behavioral pattern of solar system is examined, an appropriate and fully managed method was accepted by them in support of optimal energy point tracing. In addition to arithmetic circuit, charging of battery is continuously observed by the operating unit. Capacitor value modulation (CVM) is used in order to compare electrical resistance modifying value of capacitor are employed. It has been found that buck boost converter shows a conversation efficiency which varies from eighty seven percent to ninety seven percent. Output results varies from three to fifty five volt.

In 2017, Kekre et al.[8] said, implementation of photovoltaic cells are increasing day by day. The reason behind this increment is the continuously decreasing cost of non conventional source of energy. The cost of non conventional source of energy is reduced because from the last years new techniques are continuously developed. In more than fifty percent case solar power is installed in the form of an alternative source of power. It is possible to implement them in a very close vicinity like on the roof of house or they can be implemented at location which are far away from us like in dessert. In situations where they are installed in desert they need an advanced method in the support of monitoring purpose. For this purpose they use system whose range is very wide. Here, a fixed system for the observations of photovoltaic cells was put under consideration. This system was economic and controlled through IOT. In this system, in addition to GPRS form, an

economic microcontroller is used for the transmission of data which is determined at the production side on the internet. It is possible to retrieve this data from all over the world. Due to this, details related to installation are achieved in original time. These details make the work of repairing and fault detection easy. They will deliver a record of all the data time by time.

In 2016, S. Charmonman [9] surveyed on IoT in Thailand. This article will talk about six arrangements of instances of IoT exercises in Thailand. The principal set of models is at colleges and schools. The second arrangement of models is at IoT organizations. The third arrangement of models is from gatherings of people keen on IoT. The fourth arrangement of models is IoT by coordinators of workshops and meetings. The fifth arrangement of models is found out social orders which have exercises on IoT. The 6th arrangement of models is at Government offices

In 2016, M. Babar et al.[10] put safe application related to controlled engine in to to discussion in support of intelligent societies. For this purpose, researcher use industrial internet of things, in addition to analysis techniques of Big Data. This article will examine six arrangements of instances of IoT exercises in Thailand. The principal set of models is at colleges and schools. The second arrangement of models is at IoT organizations. The third arrangement of models is from gatherings of people keen on IoT. The fourth arrangement of models is IoT by coordinators of courses and meetings. The fifth arrangement of models is found out social orders which have exercises on IoT.

In 2006, John A, et\_al[11] put in to written form a research topic in the support the Internet of Things. Numbers of professional societies are striving to achieve research subjects that will provide some help in support of Internet of Things (IoT)

technique. Present world shows, operation, detection, transmission, and management become very complicated and common. These societies are seriously intersects with each other from different point of view. Increased collaboration in the middle of these societies is recommended. When a foundation is required for discussing the issues of longitudinal study in internet of things, it becomes necessary to present a perception in support of how internet of things could modify the universe in the coming time. After that a list of eight subjects are prepared for research work. Issues related to this research within those topics are bringing in to discussion. One perspective from future point of view is, internet of things becomes very useful in the company of improved knowledge in operation, detection, transmission, and management. Due to this we get a lifestyle which is almost dissimilar in comparison to modern lifestyle. No body knows what type of lifestyles a people want to live. It is true that no one knows the manner in which lives are modified. They did not predict the Internet, the Web, social networking, Facebook, Twitter, millions of apps for smartphones, etc., and these have all qualitatively changed societies' lifestyle. New research problems arise due to the large scale of devices, the connection of the physical and cyber worlds, the openness of the systems of systems, and continuing problems of privacy and security. Increased collaboration in the middle of these societies is recommended for solving the myriad of problems sooner as well as to avoid re-inventing the wheel when a particular community solves a problem.

In 2019, Saiful Islam, et al [12] made a system on the basis of internet of things for controlling the rush of people public gathering like hajj . For this, they use Wemos D1 in the company of Machine Learning methods. In some situations large

numbers of people's are gathered in a very small place. In situations where thousands of human being grouped in a place which is comparatively very small is called a hypothetical situation. At this point, to manage such a huge amount of people in a controlled manner is a complicated and compulsory work. At the time of this gathering if any mishappenig occurs thousands of people rush in random direction due to which lot of casualties come in to existence. In this research, gathering of people are managed in order to give safety and for controlling the rush of people. At this point, in order to carry out their work they take an example of Hajj. Here an E-wrist belt is introduced by them. This belt is a combination of sensing elements, in addition to Wemos D1 in which technology related to Internet of Things (IoT) is used. Normally, chances of rush take place in public gathering due to various atmospheric and physical reasons. Such type of methods are employed In order to examine the chances of such panic situations these type of methods are implemented. Chances of rush are evaluated by examining atmospheric conditions. For this purpose they method of machine learning. The basic intention behind their work represents the improvement of controlling system standard. It is used at present for the purpose of crowd management in hajj by using E-wrist belt.

In 2019, Kirti Sharma, et al [13] in the company of internet of things takes a literature survey in to account which was done over Machine Learning Fusion. A significant contribution is done by quickly developed sensible technology and their connection in the company of hardware and computer program applications in the appearance of different sensing elements. These elements are linked with each other by means of internet for making a connection in the company of visible property and items of this world. In this way, one

can define that IoT is a technology in which variety of hardwares are connected with each other by means of online network which becomes famous in the form of internet of things (IOT). Lot of details has been generated by the Internet of things in terms of their properties and features. When the technology of machine learning is combined with internet of things then extensive evolution is ensured. This will improve internet of things devices perception.

In 2018, Pramathi J Navarathna, et al [14] described role of artificial intelligence in the assessment of smart city and put it in to written form. It is expected, Artificial intelligence provides a significant help in the sustainable expansion of upcoming smart cities. A lot of contribution is provided by those fields of artificial intelligence which are already grown. Due to their contribution normal cities are modified in to cities which are highly equipped. The basic intention behind the development of smart cities is to provide a good quality of living. For this purpose, different type of technology is implemented in daily routine works of human being. Here at this point, different technologies are provided in order to tackle the problems which are addressed by common people in the absence of digitization. It contains problems like structure of city, public safety, security and offers good solutions for the same. In addition to artificial intelligence, Internet of Things usage remain considered by them in the development of fully equipped smart city.

In 2018, Yasuo KATO [15] made a discussion on the usage of Artificial Intelligence (AI) in support of Cosmetics. From the last few years technology of artificial intelligence gets a lot of attraction. Technology of Artificial Intelligence is formed, when the engineering related to computer program and appliances are used in integration form. Deep

learning represents software technology whereas GPU represents hardware technology. Full form of GPU is Graphic Processing Unit. GPU is highly potential and capable of doing concurrent execution with a very high rate similar to human mind. The system of AI which is available at present are introducing by the growth of “GPU” and “Deep Learning”. Deep learning is frequently adopted, but it is not possible to define the available AI technology in the absence of GPU evolution.

In 2018, Daniel Howard et al [16] carried out an evaluation on responsible Artificial Intelligence the promise of Genetic Programming Multi-run Subtree Encapsulation. Solutions which are provided on the basis of hierarchical technology, in addition to artificial neural system becomes less clear, Due to this white-box solutions becomes necessary. In this paper the manner in which Multirun Subtree Encapsulation offers identical white box solutions in order to support responsible Artificial Intelligence.

### **[3]PROBLEM STATEMENT**

However there are several researches related to IOT and solar power systems. But there is need to develop efficient, secure and flexible mechanisms to handle the home appliances remotely that are working on solar energy. As it is found than solar energy is not available every time thus wastage of solar energy should be restricted by controlling home appliances that are working on solar energy.

### **[4]TOOLS AND TECHNOLOGY**

#### **MATLAB**

MATLAB is used in different sectors of education such as mathematics, academics. It is mostly useful in Universities for research purposes. MATLAB



allows the execution of computationally tasks quicker as compare to other language. It has several toolboxes such as image tool box, simulink, simscape etc. Matlab is allowing performing tasks rapidly. It is performing better than languages.

Other Programming languages allow the user to perform tasks at a time. On the other hand MATLAB offers to work within complete matrices quickly & easily. In proposed work the integration of clustered approach would reduce the time consumption along with space in reinforcement learning system.

**MATLAB**-The full form of MATLAB is matrix laboratory. It has been known as an upgraded programming language. In the task related to technical computing are performed with the use of Matlab. Therefore it is considered as a user friendly software .In this software all the questions and their answers are presented in a well-known numerical form. Thousands of functions are incorporated in Mat lab. It is possible to draw 2Dimension and 3Dimension graph in MATLAB. It also provide a facility to user due to which any user can write down its own function. It is feasible due to the presence of huge quantity of apparatus. It can be used for various purposes which is illustrated below

1. Math and calculation
2. For the growth of algorithm
3. It can be used for the purpose of modelling, simulation, and prototyping

#### [5] RESEARCH METHODOLOGY

Research methodology is a method which is followed to conduct the research work of a topic. There are different research methodologies. Quantitative researches are systematical investigation on defined

topic whereas qualitative researches provide the study of research subject. These researches are descriptive and apply reasoning. The Researchers can use qualitative and quantitative research methodology together in their research work. The experiments based researches are systematic, scientific approach and provide results whereas the survey based research provides us review on a topic.

#### [6]FUTURE SCOPE

Research is considering IOT managed solar systems that would be beneficial to propose a better and efficient solution to resolve the existing issues. This research work discusses the challenges that are faced when solar energy is wasted when home appliance are not switched off when not required. The proposed system would enable to efficient use of solar energy for home appliances.

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