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Adaptive Solar Energy Management System based on Internet of Things

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***Abstract:** This Paper proposes the adaptive controlling and monitoring method of solar power plant using IoT. Solar power plant activities cannot be remotely accessed and monitored by traditional PLC technology. So, approach of Internet of Things (IoT) is introduced in management of solar power systems. Internet of things is a combination of various physical technologies along with cloud uses. Basic required terms are heterogeneous network for communication of objects, required hardware of each object, and processing / computing power of each object and security of each element in the IOT. The solar power generation can be monitored and increased using this novel method. Rotation of solar panels can be controlled using servomotors as per the sun direction; hence it will enhance power generation efficiency. To reduce energy demand and environmental impact, nowadays adoption of renewable energy sources is one of modern and essential way. Government sector as well as private companies are involved in solar and wind power generation to resolve the issue of power crisis in their states.*
***Keywords:** Renewable Energy, Internet of Things, Solar Energy, Energy Management System, SCADA etc.*

I. INTRODUCTION

For every research work, process of data collection and acquisition is very essential asset. For the same purpose visit [7] to "Dr. Babasaheb Ambedkar solar thermal power plant, Osmanabad, and Maharashtra, India" was very beneficial. It helped lot to identify the factors and issues related to solar power Plant. Visited Solar power plant is of 1 MW capacity and generating power of 1.5 Million units per year with the use of Poly crystalline type of solar panel technology [7]. Power generation from the Solar Photovoltaic plants is variable due to changes in solar light intensity, temperature and other factors. Every solar photovoltaic solar array should be monitored to know its current status because monitoring is very essential for performance evaluation as well as controlling panels to work in a better condition. Currently this power plant is monitored by PLC. So, all records of energy [7] are can be monitored only on site or plant on SCADA Device.

Fig. 1 Visit to solar power plant of 1 MW power generation capacity.

In this Proposed work, We are going to develop a model of online solar power monitoring as well as controlling so authorized person can monitor or control panels remotely by home also.

II. EXISTING METHODS FOR MONITORING AND CONTROL OF SOLAR POWER PLANTS

The 2000's and 2010's have brought even more advancement to the world of solar energy technology.

Year	Inventor	Invention
1883	Charles Fritz	First selenium solar cell
1888	Aleksandr Stoletov	First true solar cell
1891	Clarence Kemp	First commercial solar water heater
1905	Albert Einstein	Photoelectric effect

Fig 2: History of Solar Energy

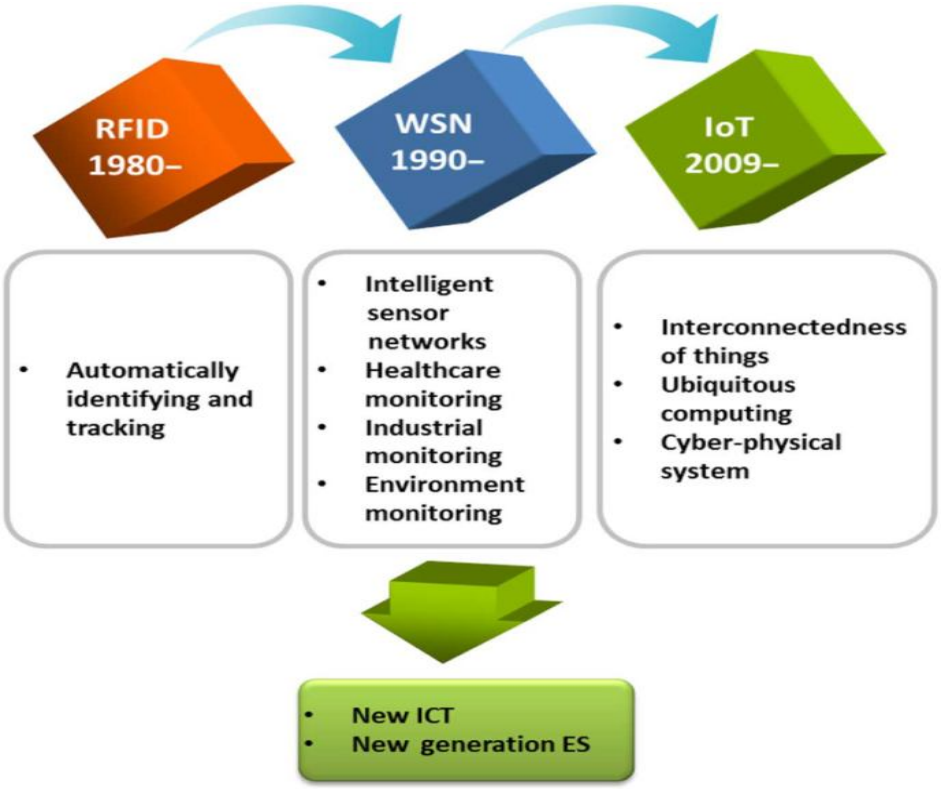

Fig 3: History of Internet of Things.

IoT is employed for a network of medico connecting the items and exchange the data. IoT has a pair of components one is web and different is Things. Web suggests that the backbone if property and things suggests that devices.

III.PROPOSED METHOD: ADAPTIVE CONTROL SYSTEM FOR SOLAR POWER PLANT USING IOT

IOT primarily based solar energy observance system that permits for automated solar energy observance from anyplace over the net. At Mega controller primarily based system to watch solar array parameters. Our system perpetually monitors the solar array and transmits the facility output to IOT system [8] over the net. Here we have a tendency to use cloud Interface to transmit solar energy parameters over the net to Cloud Interface server. It currently displays these parameters to the user mistreatment an efficient GUI and additionally alerts user once the output falls below specific limits. This makes remotely observance of star plants terribly straightforward and ensures best power output. Internet of Things (IoT) platform integrates information from the various star panels and applies consistently to share the foremost valuable data with applications engineered to deal with specific desires. This data is accustomed notice faults, build consideration, and notice attainable issues before they occur. Fig. 4 shows the block diagram of adaptive controlling and monitoring of solar power plant using Internet of Things or Web of Things.

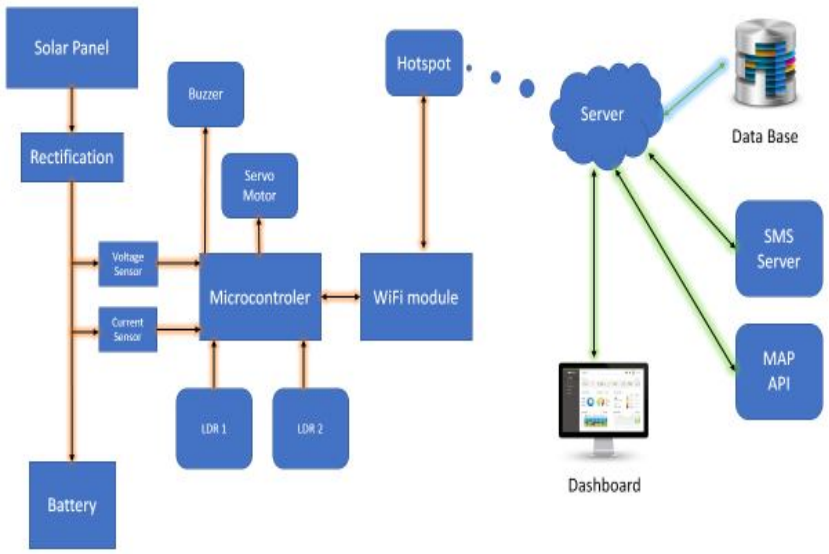

Fig 4: Block diagram of adaptive control system for solar power plant using IoT

At Mega [8] is associate eight bit AVR Microcontroller with thirty two K a flash program memory, thus essentially thirty two and eight provides info regarding memory. At Mega is associate open supply Hardware and computer code element, Project and user persons is that style a manufacture single microcontroller. LCD (Liquid Crystal Display) is employed for displaying the merchandise name, total price and Result. Once device is placed into plant, it'll show the ON and OFF standing, Voltage and Current device Values.

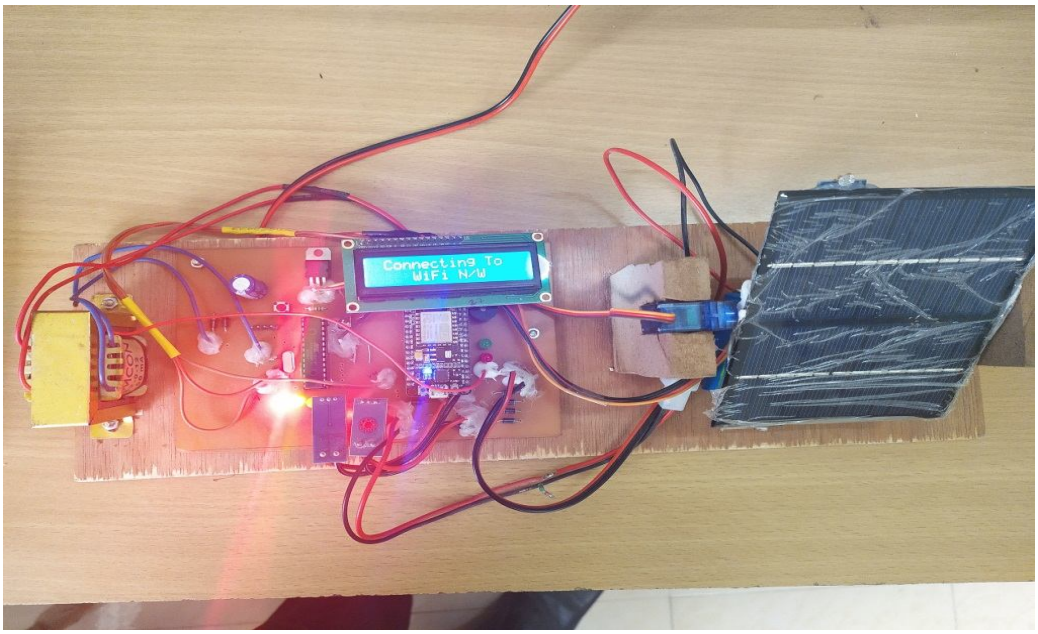

Fig 5: Hardware setup of Adaptive control system for solar power plant using IoT

Figure 5 shows the experimental setup of Adaptive control system for solar power plant using Microcontroller 8051 [8] contain memory or program memory 4k so is has 4kb ROM and its additionally comprise of knowledge memory (RAM) of 128 computer memory unit. LDR could be a element that encompasses a resistance which will amendment with the sunshine intensity that falls thereon. This allows them to be employed in the sunshine sensing circuit. The information is hold on the physical server maintained on the cloud. Cloud computing is that the use of Hardware and computer code to deliver a server over a Network.

IV. RESULTS AND DISCUSSION

The graphical visualization of the collected information represents that all records will be available to authenticated user over cloud, so all panels and system can be monitored and tracked online with the help of IoT.

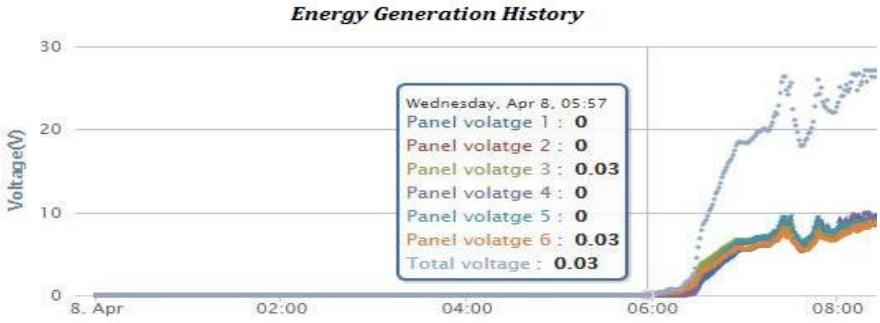

Fig 6: Graphical Visualization of Solar power on created Website for solar power plant using IoT

Applications of tracking systems are in the Rooftop Solar panels; Ground mounted Solar panels, solar cities, Smart villages, smart environments, smart micro grids and Solar Street lights. This internet of things or web of things era [7] finds many applications and so on. For the efficient energy management system, various traditional methods were used like PLC, SCADA, Bluetooth, Zigbee but IoT makes it easier to track the solar panels and remotely access all the records of Energy generated at solar power plant**.**

V. CONCLUSION

The visualization of the collected data in the control station has been done using website designed. Fig. 6 shows the software implementation of proposed method. All the records [7] are remotely accessed by user through this created webpage. This proposed work will enhance the efficiency of solar power stations to generate more power. This monitoring is carried out through controller using flask framework as interface. Physical devices are not connected these systems but can be controlled remotely through the internet connections. Smart tracking or monitoring of solar power plant will highly increase day by day use of renewable strength in solar power stations. This will help the user to analyze the power utilization, it impacts on the renewable power utilization and energy issues in solar power stations.

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Mr. Ganesh V. Karbhari is pursuing Ph.D. Degree from Oriental University, Indore under he supervision of Dr.Pragya Nema Professor in Electronics and Communication Engineering Department. His research interests are renewable energy, solar energy, Machine Learning, IoT, Antenna etc.

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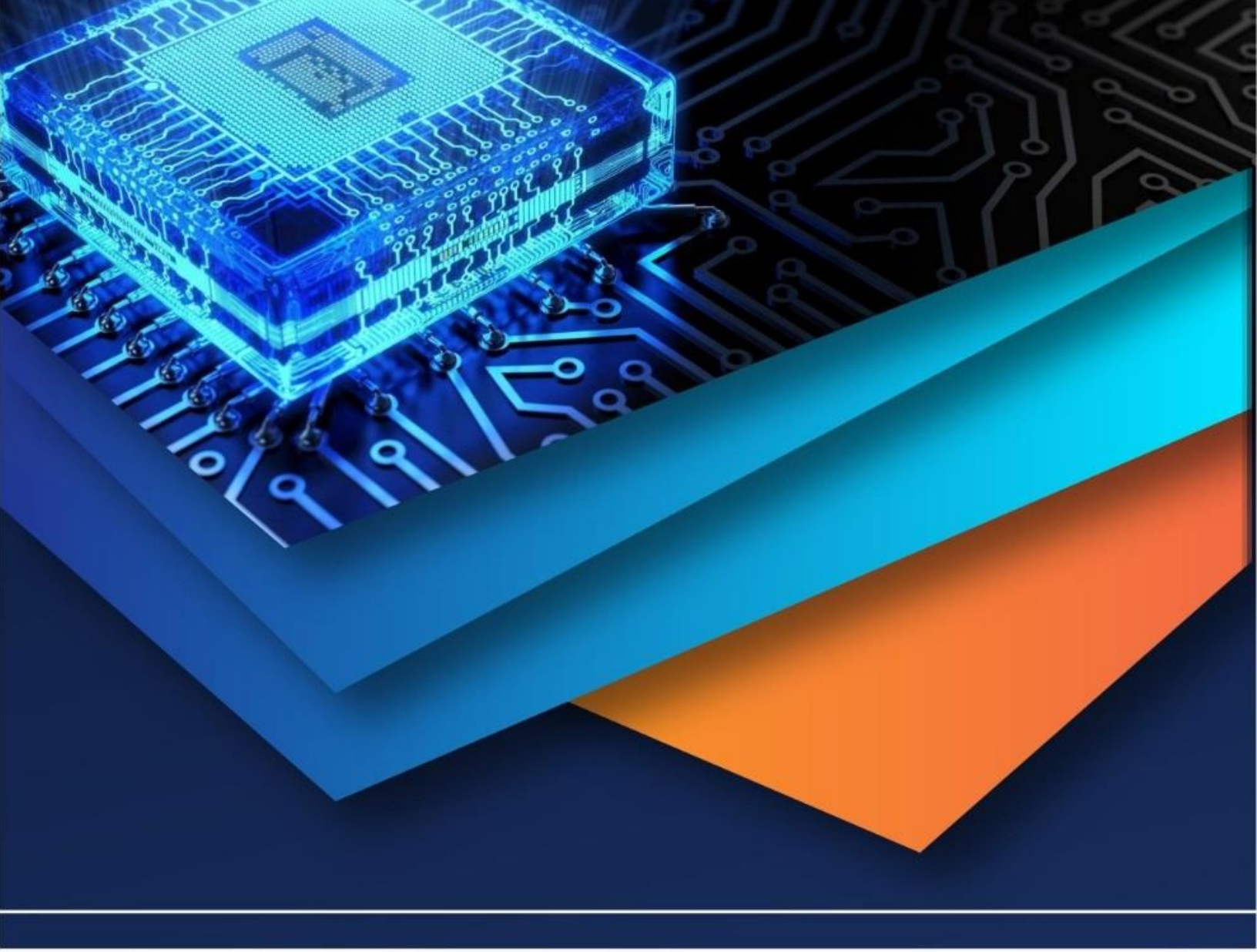

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