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Optimization of Solar Farm Using IOT

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Abstract - In alternative energy, solar panels are the most generation elements. Whereas gained power from the photovoltaic solar battery may be a main factor & reflects the panel performance. This affects by many parameters like dust density, candlepower, ambient temperature. to get energy at full efficiency timely maintenance like cleaning & solving electrical issues is must. Delay in maintenance causes reduction in generation & even damage to the system. Also, by knowing the expected amount of generation of energy from solar panels, it's also possible to manage the employment & consumption of power in better way. during this project, current and voltage sensors are going to be used to live generating power from electrical device. By detecting generation deficiency, we will find defective panels & improve the generation by completing maintenance on-time. By detecting dust in air tentative day of maintenance are going to be predicted. With the assistance of vibration sensors physical damage to the panel mounting are going to be detected. Also, safety measures is taken associated with theft by detecting movement of panel. By measuring amount of sunlight, a generation are often predicted for the day so energy is often managed in efficient way. With the assistance of IOT all the parameters & alert are going to be shown on webpage.

Key Words: Solar Panel, Arduino Uno, Wi-Fi Module, Sensors, Atmega328 microcontroller.

1. INTRODUCTION

Solar energy has been recognized as the most promising source of renewable energy all over the world. Solar energy possesses the potential to replace highly carbon intensive technology. As per the recent IEA declaration renewable is not a niche fuel any more it has become a mainstream fuel. Solar and wind is surpassing the other renewable energy sources, to be the largest share in renewable market. The drastic decline in the cost of solar PV modules has accelerated its growth and has led the energy enthusiasts all over the world to consider it. Because of the increasing demand for solar energy, the efficiency of solar panels is more important than ever. However, solar panels are very inefficient. Soiling of PV panels drops the panel efficiency even farther. This accumulation of dirt on the panels is a well-documented effect that can cause a loss of efficiency.

Many electronic monitoring systems are proposed in literature for continuous measuring, recording, and/or controlling functions. Microcontroller unit is used for the mentioning/controlling functions in many studies due to the programming and connection with the personal computer for interaction activities, i. e. programs loading, data collecting and analysis.

Since solar energy generation system is high-cost investment, it must be run at full efficiency. In this project, an automation is performed with the help of sensors to make sure that solar farm run at full efficiency and detect situation in case of any maintenance. IOT technique is used to visualization and alert.

2. SYSTEM DETAILS

While developing any microcontroller based electronic system, there are some steps which must be followed. These steps are:

1. Deciding system specifications i.e., Block diagram
2. Selection of system components
3. Design of circuit diagram
4. Simulation of circuit
5. Design of PCB layout
6. Manufacturing of PCB layout
7. Component mounting & soldering
8. Testing and troubleshooting of hardware
9. Design of enclosure or structure if any

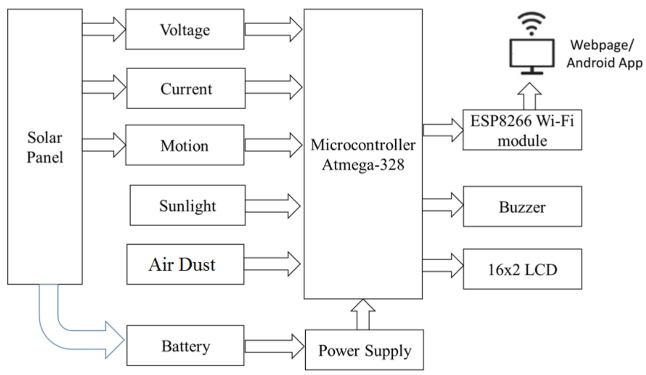

Figure 1: System Block Diagram

Current and voltage sensors are going to be accustomed measure generating power from solar array. By detecting generation deficiency, we are able to found defective panels & improve the generation by completing maintenance

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on-time. By detecting dust in air tentative day of maintenance are going to be predicted. With the assistance of vibration sensors physical damage to the panel mounting are going to be detected. Also, safety measures are often taken associated with theft by detecting movement of panel. By measuring amount of sunlight, a generation are often predicted for the day so energy will be managed in efficient way. With the assistance of WIFI module all the parameters & alert are shown on webpage.

3. SYSTEM DESIGN

Design of Solar Charge Controller:

Output of solar panel depends on amount of sunlight fall on it More sunlight gives more voltage whereas less sunlight cause reduction in output voltage Maximum output voltage of panel we are using is 18V.Whereas as per the battery requirement, we need constant 13V dc to charge the battery. To satisfy this requirement, a variable voltage regulator IC as shown in figure bellow.

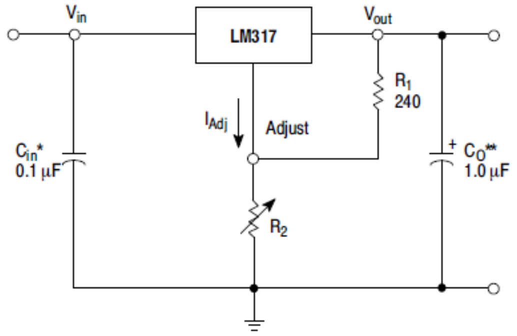

Figure 2: LM317 Basic Configurations

In above figure, C_{in} is required if regulator is located an appreciable distance from power supply filter. C_o is not needed for stability, however, it does improve transient response. Since I_{Adj} is controlled to less than 100 uA. The error associated with this term is negligible in most applications. As per the requirement of 13V output, consider R1=240 ohm. So as per the equation,

$$V_{out} = 1.25\text{V}(1 + \frac{R2}{R1})$$

$$13 = 1.25\text{V}(1 + \frac{R2}{240})$$

$$R2 = \left(\frac{13}{21.25} - 1\right) * 240$$

R2=2256 Ohm

R2=2.256 KOhm

As there is no resistor of this value, a variable resistor of 10KOhm can be used.

Design of Voltage Measurement Circuit:

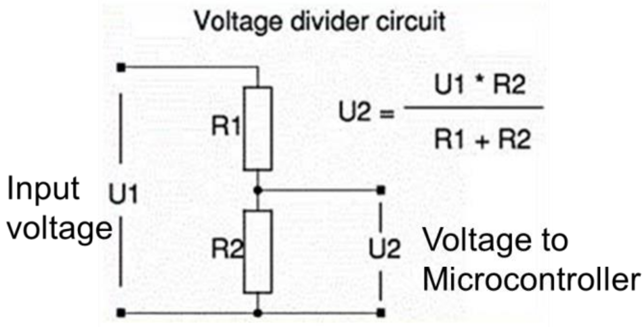

Figure 3: Voltage Divider Arrangement

To measure the voltage coming from panel, it needs to be given on analog input pin of microcontroller. But before that it's important to bring it bellow 5V. For which a voltage divider circuit is needed. To reduce the voltage to be measured up to 5v max**.** Insert the values of V1 & V2 chose any value for R2, & calculate value for R1 using formulae,

V2= (V1* R2)/(R1+R2)

For, V1=18 & V2=4, let R2= 10Kohm

R1= 35 KOhm

Interfacing of Buzzer with Microcontroller:

The digital buzzer needs a supply of 5V and 50mAmp maximum to generate sound at full intensity. The HIGH signal at the microcontroller output pin generated 5V and 200mAmp maximum current which is sufficient for buzzer. So, it can be directly connected to the output pin of microcontroller.

Design of Crystal Oscillator:

Pins XTAL1 and XTAL2 of Atmega328 microcontroller are input and output, respectively. This oscillator may be a full swing oscillator, with rail-to-rail swing on the XTAL2 output. this can be useful for driving other clock inputs and in noisy environments. Higher the clock frequency, higher the swiftness of controller. As 8-16Mhz crystals are best suited as per datasheet. Whereas C1 and C2 should be equal for both crystals and resonators. The optimal value of the capacitors depends on the crystal or resonator in use, the number of stray capacitances, and also the electromagnetic noise of the environment. For ceramic resonators, the capacitor values given by the manufacturer should be used. For the frequency range of 8-16 MHz recommended range for capacitors C1 and C2 are 12 to 22pf. So here for 16Mhz crystal, 22pf capacitors are used.

4. RESULTS

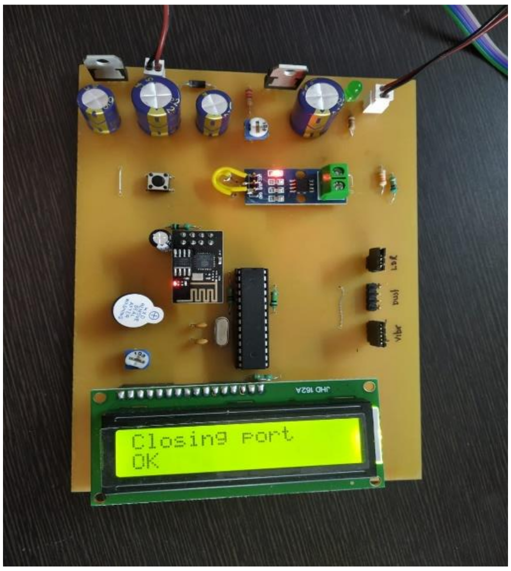

Figure 4: Hardware after power on

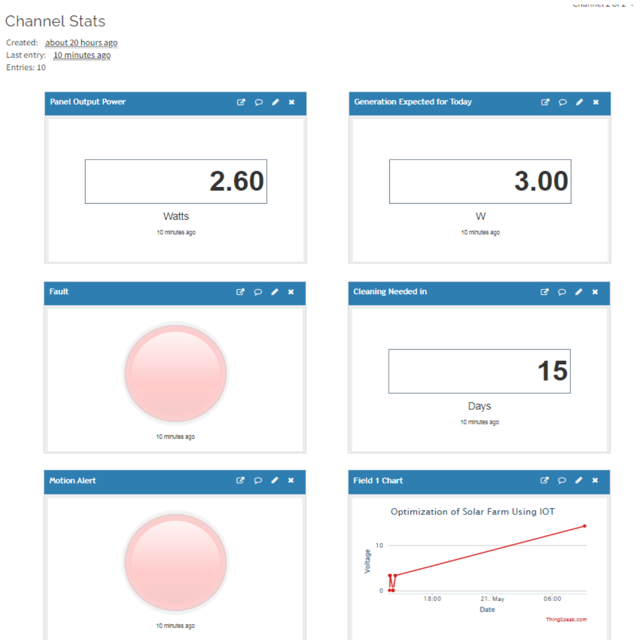

Figure 5: Webpage after power on

In above figure 5.1.1, display showing the process to upload data on webpage, whereas result of webpage is shown in figure 5.1.2. In those calculated values from microcontroller are shown in numeric display whereas alert status is shown in lamp indicator form.

Results after motion detection:

When the motion detected, lamp indicator of motion alert field will turn on. This can be seen in figure 6

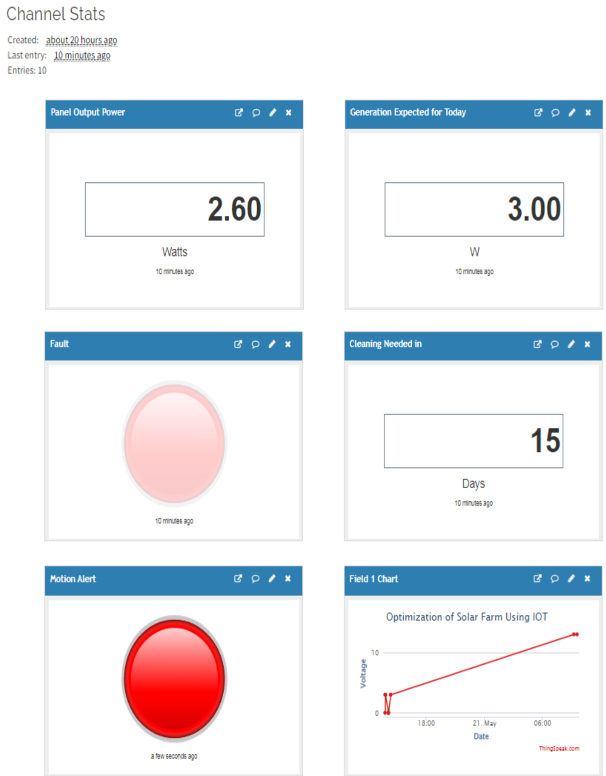

Figure 6: Webpage after accident

5. CONCLUSION

We believe that this project will be extremely helpful for increasing the efficiency and maintenance alert for solar power plants. This will ultimately reduce the troubleshooting time and manpower needed for maintenance work. Also, with the features of energy generation prediction and cleaning time prediction, it will be easy to manage things. Due to use of IOT, a remote monitoring is possible.

In this project by considering all the situations and possibility, we decided the objectives for project and chosen components which are helping to achieve the desire target. Though, design of circuit is critical due to non-availability of some of module in Proteus software. Whereas due to the use of Arduino development tools, reduce difficulties during programming & troubleshooting was reduced.

6. REFERENCES

1. D Saravanan; T Lingeshwaran, "Monitoring of Solar Panel Based On IOT" IEEE International Conference on System, Computation, Automation and Networking (ICSCAN) 2019.
2. Ahmad Amhani; Hussain A. Attia "Online multi-parameters electronic monitoring system for solar photovoltaic panel applications" International Conference on Electrical and Computing Technologies and Applications (ICECTA) 2017
3. Soomin Lee; Sehyeong Lee; Laith Ellis; Anthony H Smith; Minsun Lee "Design of Solar Panels Efficiency Monitoring

System" IEEE International Conference on Consumer Electronics - Asia (ICCE-Asia) 2020

4. Pritam Pokhra, Rajeshwari, Raj Kumar Yadav, "A Project Report on automatic Sun Tracking Solar Panel Based on Open Loop Concept", International Journal of Engineering and Applied Sciences (IJEAS), May 2020
5. Babu K, Dinesh Kumar P, Kamala priya S, Kathirvel P, "Solar Panel Cleaning Robot", International Journal of Innovative Science and Research Technology, 2018
6. K.G.Srinivasan, Dr.K.Vimaladevi, Dr.S.Chakravarthi,, "Solar Energy Monitoring System by IOT", Special Issue Published in Int. Jnl. Of Advanced Networking & Applications (IJANA), 2018
7. Purusothaman, SRR Dhiwaakar, et al. "Implementation of Anrduino-based multi-agent system for rural Indian microgrids." 2013 IEEE Innovative Smart Grid Technologies-Asia (ISGT Asia). IEEE, 2013.
8. Kabalci, Ersan, Alper Gorgun, and Yasin Kabalci. "Design and implementation of a renewable energy monitoring system." Power Engineering, Energy and Electrical Drives (POWERENG), 2013 Fourth International Conference on. IEEE, 2013.
9. Jiju, K., et al. "Development of Android based on-line monitoring and control system for Renewable Energy Sources." Computer, Communications, and Control Technology (I4CT), 2014 International Conference on. IEEE, 2014.
10. Goto, Yoshihiro, et al. "Integrated management and remote monitoring system for telecommunications power plants with fully DC-powered center equipment." INTELEC 07-29th International Telecommunications Energy Conference. IEEE, 2007.
11. Suzdalenko, Alexander, and Ilya Galkin. "Case study on using non-intrusive load monitoring system with renewable energy sources in intelligent grid applications." 2013 International Conference-Workshop Compatibility and Power Electronics. 2013.
12. Nkoloma, Mayamiko, Marco Zennaro, and Antoine Bagula. "SM 2: Solar monitoring system in Malawi." Kaleidoscope 2011: The Fully Networked Human? - Innovations for Future Networks and Services (K-2011), Proceedings of ITU. IEEE, 2011.
13. Md. Masud Ali Shah; Md. Shahariar Parvez; Abir Ahmed; Md. Rifat Hazari "IoT Based Power Monitoring of Solar Panel Incorporating Tracking System" International Conference on Automation, Control and Mechatronics for Industry 4.0 (ACMI) 2021.
14. Sivagami P; Jamunarani D; Abirami P; Pushpavalli M; Geetha V; Harikrishnan R, "Review on IoT Based Remote Monitoring for Solar Photovoltaic System", International Conference on Communication information and Computing Technology (ICCICT) 2021.