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Development of Solar Panel Monitoring Drone

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Abstract :

It is crucial to monitor solar photovoltaic power plants so that they can operate and maintain themselves effectively. The need to continuously monitor solar power systems cannot be overstated. In this project, unmanned solar power panel monitoring systems were the main focus. The output performance of the photovoltaic plant will be improved by active control and routine maintenance, which also contributes to decent or superior returns on the initial investments. Manual inspections are used to monitor processes, but as technology advanced, intelligent systems, centralised control, and monitoring systems, surveillance cameras, robotics, drones, etc. superseded the need for manual inspections. A study on the technologies underlying drone automation and intelligence was conducted. As a result of this study, it was discovered that drones could be given more autonomy and that large-scale solar power plants could be monitored more easily thanks to recognition technologies (RT), artificial intelligence (AI), and machine learning (ML). The primary objective of this project is to track and show data on temperature, local weather, and the orientation of solar power plant panels on a monitoring system.

Keywords:
Drone technology, photovoltaic system, Monitoring system, Aerial Inspection, Thermal Imaging.

I. Introduction

A solar module is the key component of a photovoltaic (PV) system. If one of the modules fails, it affects the entire module and causes a reduction in efficiency. Modules are installed in a large area, and require a lot of maintenance anda large workforce. Therefore, finding a way to quickly monitor a module is critical to saving costs and achieving stable efficiency. Since the solar module of the solar-power plant is generally located at a high altitude, it is difficult to monitor them manually so there is need a device that can even monitor at higher altitude i.e., drone. In past decade it is observed a rapid development of drone technology in civil sector for various monitoring applications in different fields. With the help of drone, we can not only identify the defected module but can also check the weather around the PV plant. UAV(Unmanned Aerial Vehicle)

Classification of Unmanned Aerial Systems (UAS) Based on previous and current experiences, one way classify the functional capabilities of UAS is by focusing on other

main features in addition to their use. While some unmanned aerial systems are designed solely to carry out a single mission, others are actually capable of performing multiple functions simultaneously. In the previous ten years a quick improvement of UAVs have been noticed particularly in common area, for instance in checking applications, for example, natural observing, search and salvage tasks, contamination checking, port and off coastline security, woods firerecognition, etc .UAV, or unmanned aerial systems, are typically further subdivided according to their weight, size, altitude, and range.

II. Literature Survey

2.2.1 Development of Solar-Panel Monitoring Method Using Unmanned Aerial Vehicle and Thermal Infrared Sensor
Author: Dongho Lee1 and Jonghwa Park,
Methodology: For each array, module borders must be overlay in order to detect PV module monitoring and failure. In the case that a solar-module diagnosis using a UAV-based thermal infrared sensor fails, resulting in inaccuracies in the module boundary, the resolution of the thermal infrared sensor may be lower than that of the RGB image. It is therefore necessary to use imaging and merging technology to precisely grasp the PV module borders. A 2 cm resolution RGB camera was used to image both the orthoimage and PV module layers at the same time. For 3D landscape modelling and orthoimage processing, The Inspire 2 model from DJI was used. Because the UAV (Inspire controlling the shooting and the UAV takeoff after establishing the thermal infrared shooting environment and adjusting the gimbal setting. UAV-based aerial photography operations were carried out in the following order: preplanning and data gathering, sensor calibration, route setting and photography, image rectification, and image matching.

2.2.2 On the technologies empowering drones for intelligent monitoring of solar photovoltaic power plants
Author: Nallapaneni Manoj Kumara’ , K. Sudhakaöl•b, M. Samykanoa, V. Jayaseelanc
Explanation: The major objective of this study is to investigate the technology underlying the intelligent, automated drones used to monitor photovoltaic power installations. An overview of PV system monitoring is undertaken before digging into the intricacies of drone technology. There are two main categories: physical inspection by human workforce (PI- HWF) and inspection by remote monitoring (I-RM). Between PI-HWF and I-RM, several parameters are contrasted with a focus on small- and large-scale PV systems. On how drones might be used for remote monitoring and how they might work with solar monitoring systems, analysis and study have been done.

2.2.3 An Amateur Drone Surveillance System based on Cognitive Internet of Things
Aurthor: Guoru Ding, Qihui Wu, Linyuan Zhang, Yun Lin, Theodoros A. Tsiftsis, and Yu-Dong Yao In this paper, we first give a succinct overview of recent research on amateur drone surveillance, where we examine both known anti- drone systems and existing anti-drone technology. Then, by adapting the recently developed cognitive internet of things framework for amateur drone surveillance, we offer a concept called Dragnet1. The essential enabling approaches are then discussed, along with the upcoming technological difficulties and open problems. Furthermore, from the standpoint of multi-hypothesis testing, we present an illustrative case study on the detection and classification of legal and illegal amateur drones.

2.2.4 IoT based automation using Drones for agriculture
Author : Shruthi , Soudha N, Khalid Akram, Mustafa Basthikodi, Ahmed Rimaz Faizabadi Based on the light that is reflected by the crop, drones gather data. When used for agricultural applications, a particular kind of sensor can assist growers in gathering information that shows where problems are present so they can take the necessary action. Naturally, visible light is captured by plants and used to power photosynthesis. Plants have evolved to reflect near infrared light since it doesn't transport enough energy for photosynthesis but it does provide a lot of heat. As the leaf ages, this reflection mechanism disintegrates. The normalised difference vegetation index, or NDVI, is a calculation that Near Infrared sensors use to monitor the difference between NIR reflectance and visible reflectance. Strong NDVI signals indicate dense plant growth and fragile soil.On the field, trouble regions are indicated by NDVI. The NDVI always falls between -1 and +1. However, there is no clear line dividing each type of land cover. For instance, it's very likely to be water when you have negative numbers. On the other side, there is a good chance that it is dense green foliage if the NDVI score is close to +1. The absence of a green leaf and the possibility of an urbanised area are present when the NDVI is near to zero.

2.2.5 Automatic Detection System of Deteriorated PV Modules Using Drone with Thermal Camera
Author: Chris Henry 1 , Sahadev Poudel 1 , Sang- Woong Lee 1 and Heon Jeong 2,* This paper presents an independent robot based infrared thermography answer for PV modulefault recognition and confinement.A drone equipped with a gimbal and based on the Pixhawk 2.1 flight controller (FC) makes up The developed drone system.K-Pro Systems, based in Seoul, Korea, developed the 1.1-m class hexacopter drone with a 2 kg payload.The drone system was equipped with a dual camera setup that included a RGB camera (Logitech C270; Logitech, Suzhou, China) and a thermal camera (FLIR Vue Pro R; FLIRSystems, Inc., Wilsonville, Oregon, United States).The Raspberry Pi 3 was used as the mainboard to connect to the FC and dual camera setup.The USB port was used to connect the RGB camera to the Raspberry Pi, and MAVlink was used to connect the FC and the thermal camera.An SD card connected to the mainboard is used to store the captured images, GPS data, and information about the status of the drone.An offline general-purpose computer processes the saved data later.The proposed drone framework can fly independently over an automatically planned flight way by our flight arranging calculation.Our system is able to estimate the precise GPS location of the defective PV modules among thousands of PV modules because automatic hot-spot localization is one of the essential aspects of PV plant inspection.

2.2.6 Monitoring of Defects of a Photovoltaic Power Plant Using a Drone

Author: Martin Libra 1,* , Milan Daneˇcek 1 , Jan Lešetický 1 , Vladislav Poulek 1 , Jan Sedláˇcek 1 and Václav Beránek

Explanation:

In this paper, 65 PV power plants in the Czech Republic and overseas (in Romania, Slovakia, and Chile) use their own monitoring system

III. Findings From Literature Survey

From this, we fostered various advantages. An earlier paper went into great detail about the issues with this project. We learned about various parameters from the preceding literature review, including a drone-based solar powerplant monitoring system.We attempted to correct some errors in this project.

From the literature survey we found that there is no monitoring system available for solar power plant with the help of Arial technology, There is a less accurate technology available to monitor the temperature of solar panels. There is a less accurate technology available to monitor the weather of surrounding.There is a less accurate technology available to check whether the panel is in wrong direction(to check the direction

IV. Proposed system

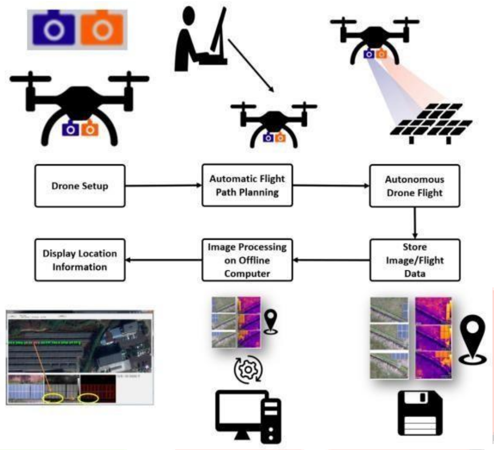

Fig3.1. Proposed system

Proposed system for Solar panel monitoring drone block diagram is shown in Figure 3.1. In the block diagram, there is drone step- up with some instrument to collect the information for the monitoring system. It is moved by a controlled for its path once data is collected and send to the cloud with Wi-Fi and result are displayed on a cloud.

HARDWARE AND SOFTWARE REQIREMENTS

- Quad copter Drone with payload of upto 1 kg
- ESP32
- Temperature sensor
- Gyro Sensor
- MCU6050
- Thermal camera

IV. Block Diagram

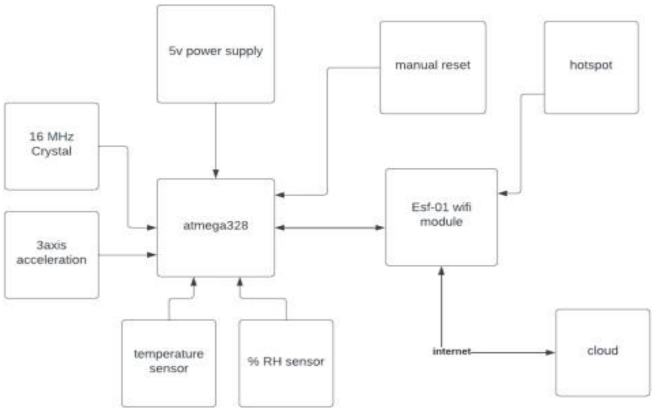

Fig 4.1. Block diagram

For Fig 4.1, the setup is externally connected to drone. The data form solar panel is collected for different parameter.This parameter are shown in the pc.

V. Flowchart

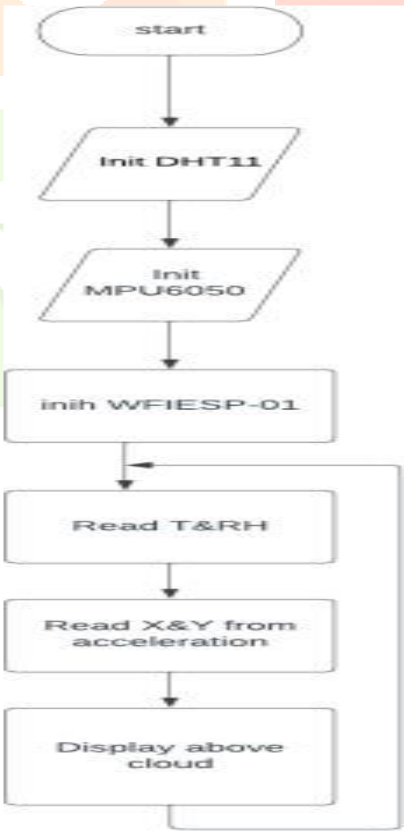

Fig 4.2. Flowchart

VI. Simulation Result

The setup of the drone will be connected with few sensors for respective parameters that are supposed to be measured along with a camera for visual detection. The temperature and gyro sensor will be at the bottom of the drone model along with the camera.

The result for the sensor will be shown at the system connected with Wi-Fi module ESP 32 on Google cloud. The images captured from the camera are also displayed over there.

Results shown are in graphical method. The result of the MCU6050 placed at one of the propeller stand measure the angle of panel to ground. When drone islanded on panel it will measure the angle and give the result in graphical method.

Camera used is thermal camera which gives the IR shots of solar panel.

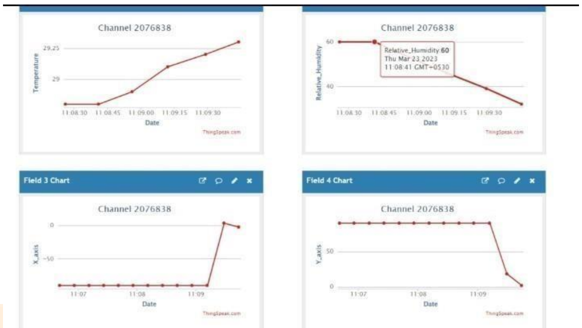

Fig 5.1. Result of the sensor displayed at the system

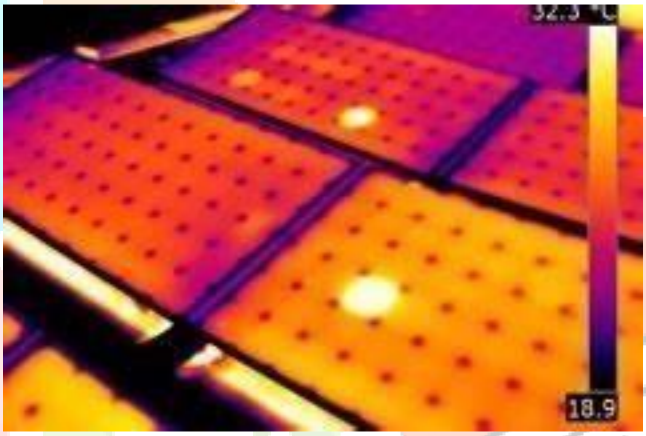

Fig 5.2. Image captured by the thermal camera

VII. Advantages

- Visual monitoring permits on-site asset security;
- Thermal imaging can be used to spot defects in PV modules or arrays;
- Inspection reliability is enabled and improved.
- Faster inspection visits;
- More accurate defect discovery;
- Less time-consuming monitoring facility;
- Improved inspection performance

VIII. Conclusion

From this project we can get a method of monitoring the solar panel form the different point of view. For past decade, the innovation for the drones is being changed based on the requirement. This drone will help in having getting a better understanding for the parameter of maintenance for panel.

IX. Acknowledgement

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X. References

[1] Lee, Dongho, and Jonghwa Park. "Development of solar-panel monitoring method using unmanned aerial vehicle and thermal infrared sensor." IOP Conference Series: Materials Science and Engineering. Vol. 611. No. 1. IOP Publishing, 2019

[2] Kumar, Nallapaneni Manoj, et al. "On the technologies empowering drones for intelligent monitoring of solarphotovoltaic power plants." Procedia computer science 133 (2018): 585-593.

[3] Ding, Guoru, et al. "An amateur drone surveillance system based on the cognitive Internet of Things." IEEE Communications Magazine 56.1 (2018): 29-35

[4] Henry, C., Poudel, S., Lee, S. W., & Jeong, H. (2020). Automatic detection system of deteriorated PV modules usingdrone with thermal camera. Applied Sciences, 10(11), 3802.

[5] Soudha N, 3Khalid Akram, Mustafa Basthikodi, Ahmed Rimaz Faizabadi Dept. of CSE, Bearys Institution ofTechnology Mangalore(IoT based automation using Drones for Agriculture Shruthi)

[6] Libra, M., Daneček, M., Lešetický, J., Poulek, V., Sedláček, J., & Beránek, V. (2019). Monitoring of defects of a photovoltaic power plant using a drone. Energies, 12(5), 795.