The future is now for autonomous solar panel cleaning

With the increasing demand for renewable energy, solar energy production is rapidly growing around the world and the size of solar plants is increasing as well. More and more nations come to realise the potential of planting solar panels in deserts which creates value on low fertility grounds.

Extending up to several million square metres with year-long sunshine, deserts are the best place for harvesting solar power. According to Power Technology, the 10 largest solar plants in the world are all situated in dry areas[1].

1 https://www.power-technology.com/features/the-worlds-biggest-solar-power-plants/

However, soiling problem is also the worst in arid and semi-arid environments around the world. Arid conditions favour atmospheric dust that easily stays on modules, resulting in high concentration of dust layer within a short period of time. Substantial impacts on electrical yield have been observed when modules are not cleaned regularly. Up to 1.5 soiling losses can be expected, sometimes even within a week.

Current solutions to solar panel cleaning in deserts: pros and cons

Current solutions to solar panel cleaning include water cleaning (wet clean) and waterless cleaning (dry clean). While wet

cleaning is widely adopted in most regions, dry cleaning remains an economic and efficient solution to panels in dry regions where water is scarce, and the thin film of wind-blown dust on solar panels can easily be swiped away with a special dry brush. Numerous technologies have been conceived and practised, each with its own pros and cons:

Manual cleaning is the first and still most prevalent method. The disadvantage of it is also obvious: it requires high manpower and is not efficient with large solar farms.

Tractor or panel-mounted system involves brushes mounted on tractors, or a brush fixed at the end of the panel that cleans the row assigned to it ('one brush one row'). Both can perform efficiently with large installations but prove to be less flexible due to their sizes and system set up. Tractor-mounted brushes require sufficient space between solar panel rows and a higher capex; brushes fixed to a panel are designed to clean a limited range of panels only, which means many brushes are needed to support maintenance necessity.

Semi-autonomous robotic systems are by far the most versatile solution which solves the challenge facing the above methods. It is a semi-autonomous robot controlled by a single user. It allows faster cleaning with less physical strain, and it is easy to transport from site to site. However, in desertic areas where large-scale installations are exposed to harsh weather and require cleaning on a weekly or even daily basis, to organise labour not only is complex but also creates logistic burden. It is also complicated to work during long hours or overnight.

The solution: fully automated cleaning robot

To address this issue, a new generation of fully autonomous, robust and efficient robots need to be invented. Here is where SolarCleano F1A comes into play. SolarCleano team has a solid experience on solar panel cleaning techniques and mechanical design. This is the starting point for providing a robust, cost effective fully autonomous solution for dry cleaning even in the harshest environments. Four years after the successful release of the semi-autonomous robot F1, SolarCleano is now launching the autonomous robot F1A, a brand-new solution dedicated to very large plants deployed in desertic area or on large rooftop, aiming at becoming a real game changer thanks to the use of Artificial Intelligence to further improve solar panel predictive maintenance.

Why autonomous: the advantages and benefits

The SolarCleano autonomous cleaning solution is the first of its range. It inherits the versatile and flexible characters from SolarCleano F1 and provides optimal cleaning result with 5cm global positioning precision. Equipped with an integrated IoT system[2], the robot's performance is based on commands sent by its autonomous unit through the cloud, which analyses data and makes real-time decision. To ease the maintenance tasks of big-scale solar plants, SolarCleano developed a multi-robot system, encompassing two types of robots, namely a cleaner, F1A, and a Transporter, T1A, as part of an IoT infrastructure. With the autonomous robots in operation, cleaning can be performed overnight in order not to jeopardise the production during the day. On-field labour task will be reduced to zero. Human involvement during the whole process can be limited to remote control and supervision through a dedicated mobile app.

In large solar plants in desertic areas, it is easy to build up a team of autonomous robots working simultaneously on different arrays at any time. The local fleet management system is the reference point and the coordinator of every movement of each robot on field. Connected 24 hours to the Headquarter, the robots can be programmed to regular cleaning sessions according to the level of soiling. They can work day and night, under high concentration of heat in desert, and can even be launched straight after sandstorms. With the autonomous robots in operation, safety is no longer an issue. With remote control and cloud system, robots can be charged automatically. Little maintenance is required and troubleshooting also becomes much easier.

The F1A autonomous robot is not only suitable to large-scale installations in desertic areas but can also work on all types of solar panel systems (ground-mounted, roof, solar trackers, etc.). With its high capacity and efficiency, SolarCleano autonomous robot is the industry 4.0 cleaning solution for maximising the energy production on your investment. It is a plug-and-play, turnkey-ready smart solution to any developing smart system and smart city.

The current status and future versions of SolarCleano F1A

The first F1A robots have been deployed. New orders from EPC with installations in Australia, Middle East, North Africa and Chile are under discussion.

SolarCleano is investing further in R&D research, seeking to turn its high-performance robots into multi-task players. The soiling scan offered by SolarCleano analyses the average annual soiling ratio based on winds, type of dust, environment, rainfall, etc., which serves to define the best solar panel cleaning strategy and technical solutions to achieve optimal production for any existing and upcoming plants. SolarCleano is planning to incorporate this data analysis capacity to its future generations of autonomous robots. Apart from cleaning, the robots will be programmed to complete other tasks such as the detection of hot spots or micro cracks on solar panels. We fully look forward to our robots to become the all-in-one solution in preventive maintenance.

www.solarcleano.com

2 Internet of Things, describes the network of physical objects—a.k.a. "things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the Internet. (Source: Wikipedia)