

SolarDuster

CleanTech Segment – Automatic Solar PV Panel Cleaning System with IoT Monitoring & Management



Intelligent.

Water-Free Cleaning.

Autonomous.

Fits on existing Solar Panels.

Monitor from Anywhere in the World.

SolarDuster

Autonomous. Water-Free. IoT Monitoring. Robotic Cleaner.

Overview

SolarDuster is a fully automatic Solar Panel Cleaning technology product by MEMIGHTY. It is a robotic machine with cleaning brushes and it is having an IoT (LoRa) Controller for monitoring and configuring operations of the machine from anywhere in the world.

SolarDuster is described by 3 major components:

1. SolarDuster – The Robot
2. LoRa Gateway
3. Web Panel

1. SolarDuster – The Robot

SolarDuster consists of a solar panel for re-charging its own battery, thus it is fully autonomous in function.

It can detect obstructing object using smart ultrasonic sensors which are used in robot's auto parking assistance.

It is installed on existing Solar Panels (Solar Panel frame). As per schedule, it runs parallel to the length of the solar panel tables and using the rotating soft nylon brushes it cleans the surface of solar panels. It is a complete water-free cleaning solution.



SolarDuster – Robot for 2 m



SolarDuster – Robot for 4 m

Technical Specifications – SolarDuster – The Robot

Product Name	SolarDuster
Product Models	SolarDuster for 1 meter SolarDuster for 2 meter SolarDuster for 3 meter SolarDuster for 4 meter SolarDuster for 6 meter <i>*These are ideal models. As this is customized product as per site requirements, custom models available</i>
Power Source	Battery Li-ion (Self-Powered by on-robot Solar Panel)
Battery Capacity	4000 mAh (default) <i>*Customizable as per length of Solar Panel Rows / Arrays</i>
Control & Configuration System	Configuration using Web Panel from anywhere in the world
Cleaning Material	Soft Nylon Bristle
Mechanical Structure Material	Galvanized Iron
Cleaning Speed	0.6 (meter per second) (approx.) <i>*Design specifications depend on various site parameters and dimensions of solar panel plant structure. Above specifications are for understanding purposes only</i>
Installation	Direct (On Existing Solar Panel Frame)
Controller Connectivity	Wireless (upto 10 km Line-Of-Sight (LOS))
Controller Frequency	867 MHz
Warranty	1. Electronics: 12 Months repair / replacement warranty against manufacturing defects. 2. Mechanics: 36 Months repair / replacement warranty against manufacturing defects.

2. LoRa Gateway

Product Description

LoRa Gateway collects data from all IoT Controllers (SolarDusters) and sends to the Web Panel (Cloud/Server).

LoRa Gateway can be connected via Intranet (Local Network) or Internet.

Technical Specifications – LoRa Gateway



Product Code	SD-LRAGWY-A
Product Name	LoRa Gateway
Frequency	867 MHz
Range	8 km (Outdoor – Line-Of-Sight (LOS))
Compatibility	Ethernet/GSM
Installation	Base / DIN Rail <i>(*Tower Erection is required at a high location for gateway installation and Line-Of-Sight with LoRa Dongles)</i>
Package Contents	1x LoRa Gateway, Product Manuals
Warranty	12 Months repair/replacement warranty against manufacturing defects.

**Sample Image. Images are for representation purposes only.*

3. Remote Monitoring Web Panel (Dashboard)

Product Description

Web Panel displays list of all SolarDusters & their status on its Dashboard.

If any fault is detected in any SolarDuster then alert is displayed on the Dashboard.

SMS/Email Alerts to concerned authorities (for example: Plant Manager, Maintenance Manager, etc.) shall be sent if internet is available.

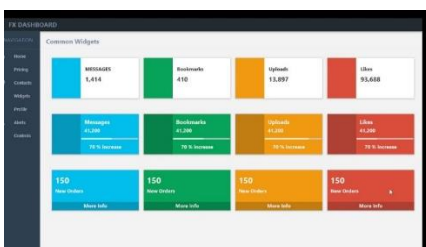
Manual scheduling, remote configuration and remote access of SolarDuster(s) is possible over the Web Panel.

Web Panel also displays Health History, Event History, Real-Time data, Motor parameters, battery parameters, speed of SolarDuster(s), forward/reverse cycle operation, object distance, etc.

System Requirements for Server/Cloud

- Windows/Linux OS Computer PC (Server)
- Back-up power for PC (UPS – Uninterrupted Power Supply)
- Processor: i5 or equivalent
- RAM: 8 GB
- 24 x 7 Running capacity
- Suitable cooling
- Unique Static IP Address of the Intranet required (Unique Static IP Address must be accessible by any node of the user)

Technical Specifications – Remote Monitoring Web Panel



**Sample Image. Images are for representation purposes only.*

Product Code	SD-RMWBCD-A
Product Name	Remote Monitoring Web Panel
Product Type	License Key
License Key Validity	5 Years
Package Contents	1x CD-ROM, Product Manuals
Warranty	12 Months support included. Additional plugins/modules/features will be chargeable.

Real-time IoT Monitoring & Management System

For monitoring SolarDuster – The Robots and remote fault detection, MEMIGHTY has developed LoRa Technology based remote monitoring plugins which can be added with SolarDuster to remotely monitor & manage SolarDuster robotic machines over a Web Panel (Dashboard).

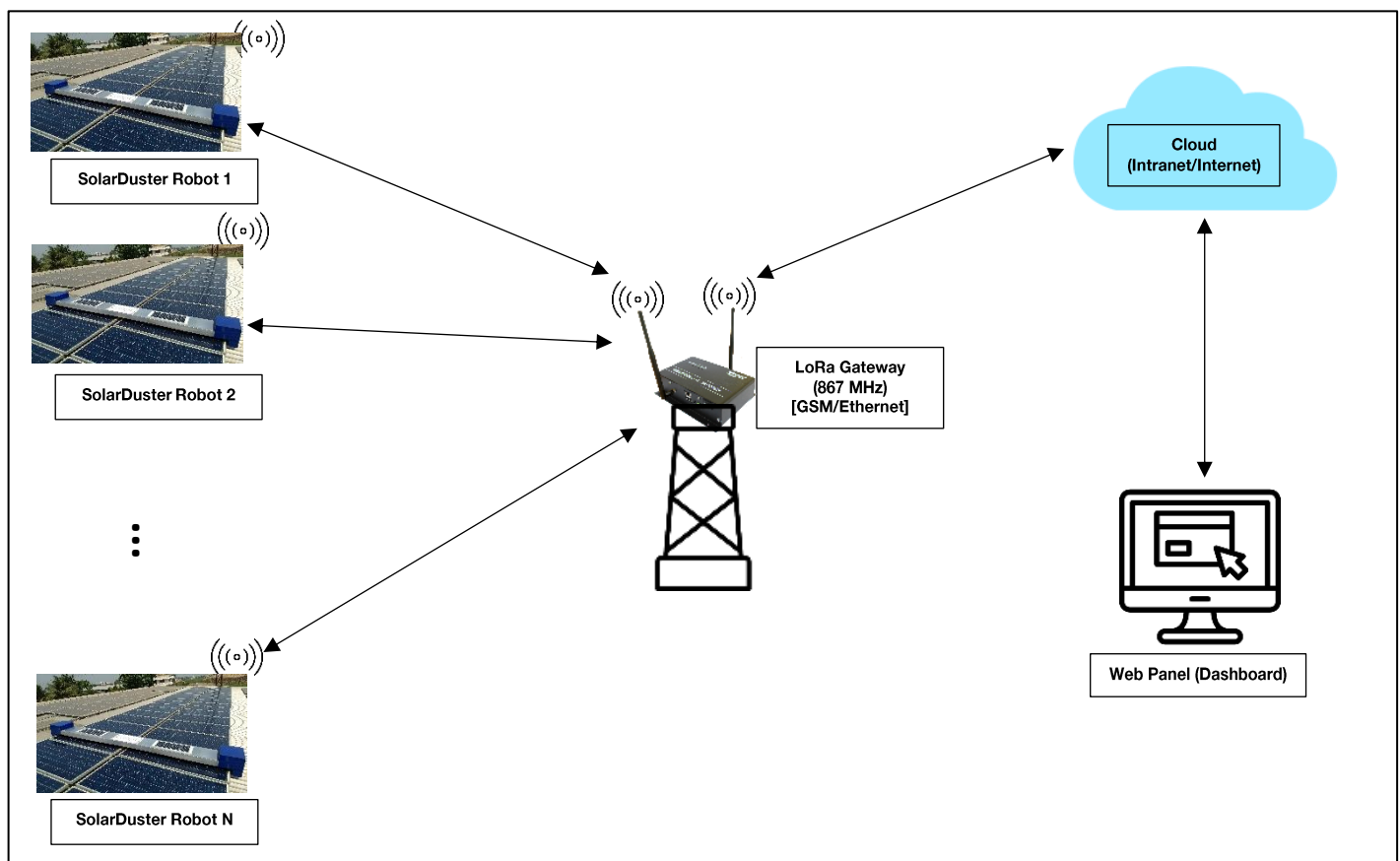
There are 3 components:

1. IoT Controller (in SolarDuster – The Robot)
2. LoRa Gateway
3. Web Panel (Dashboard)

Why LoRa technology?

LoRa (Long Range in kilometers) permits inexpensive, low power and long-range connectivity for Internet of Things (IoT) devices in remote and offshore industries.

How it Works?



*Quantity of LoRa Gateways are to be calculated as per site requirements.

- The IoT Controller in the SolarDuster robot consists of various data of SolarDuster such as:
 - Battery parameters
 - Forward/reverse cycle operation
 - Schedules
 - Object distance
 - Speed of machine
 - Event history
 - Real-time machine analytics
 - Solar Panel Voltage
 - Charging Status

These parameters are synchronized to the central IoT Gateway at regular intervals using LoRa technology.

- IoT Gateway is connected to the server/cloud via Internet and sends all SolarDuster data to the Web Panel.
- A remote monitoring Web Panel is connected to the server/cloud and administrator of the web panel can monitor, configure, control and manage each and all SolarDuster machines at various sites

Tips for best cleaning with SolarDuster:

- Ideally, Schedule 2 cleaning times for SolarDuster
 - First in Morning before sunrise
 - Second in Evening at sunset

Features

- **Water-free Cleaning.**
SolarDuster uses brush based dry cleaning method to clean solar panel plants, so no extra requirements of water
- **Labour-free Cleaning.**
Hassle-free 100% automated system for daily cleaning. Zero labour required.
- **Self-Powered. Solar Powered.**
Rechargeable Battery powered machine. Battery is recharged using own solar panel of SolarDuster
- **Retrofit.**
SolarDuster fits on existing solar panels frame and as per width of Solar Panel tables.
- **Auto Fault Detection.**
In case of any failures / faults, SolarDuster alerts to the Web Panel for further course of action.
- **Remote Monitoring & Management.**
With SolarDuster LoRa – IoT based Controllers, Gateways & Web Panel, you can control & monitor your SolarDuster(s) from anywhere in the world using Internet.
- **Automated Parking Assistance.**
SolarDuster consists of smart parking sensors to detect object even at high speeds for detecting end of solar panel row / array.

Project Management Methodology

1. Technical Verification & Survey of Solar Power Plant
2. Customize Product Development as per Site Requirements
3. Delivery as per timeline & Installation is carried after technical verification and site preparation

Case Study

The number of SolarDuster implementation depend on the solar power plants layout, some of the examples of SolarDuster implementations are as follows:

1. Horizontal, Long continuous Arrays (Rows)

Row1																			
Row2																			
Row3																			
...																			
RowN																			

**For conceptual understanding & representation purposes only.*

If the solar power plant is built in a similar kind of a layout as shown by diagram above then N number of SolarDusters are implemented for cleaning of Solar Panel arrays.

2. Horizontal, Long distributed Arrays (Rows)

Row1	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Row2	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Row3	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
...	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
RowN	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

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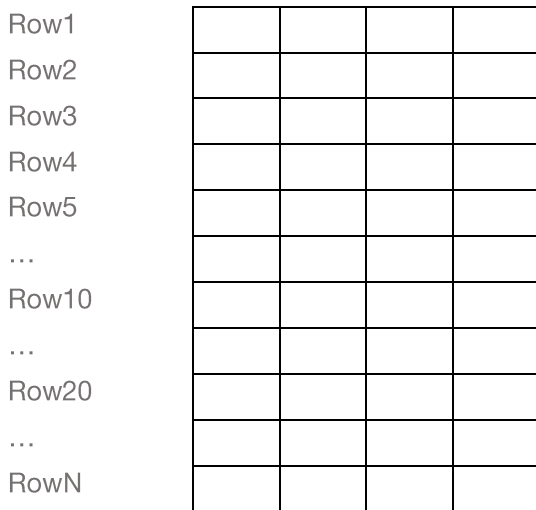
If the solar power plant is built in a similar kind of a layout as shown by diagram above then N number of SolarDusters are implemented for cleaning of Solar Panel arrays, provided that mechanical joints are to be fabricated to make long, continuous arrays as shown in orange colour lines below.

Row1																			
Row2																			
Row3																			
...																			
RowN																			

**For conceptual understanding & representation purposes only.*

Mechanical Joint Fabricated to connect distributed table arrays

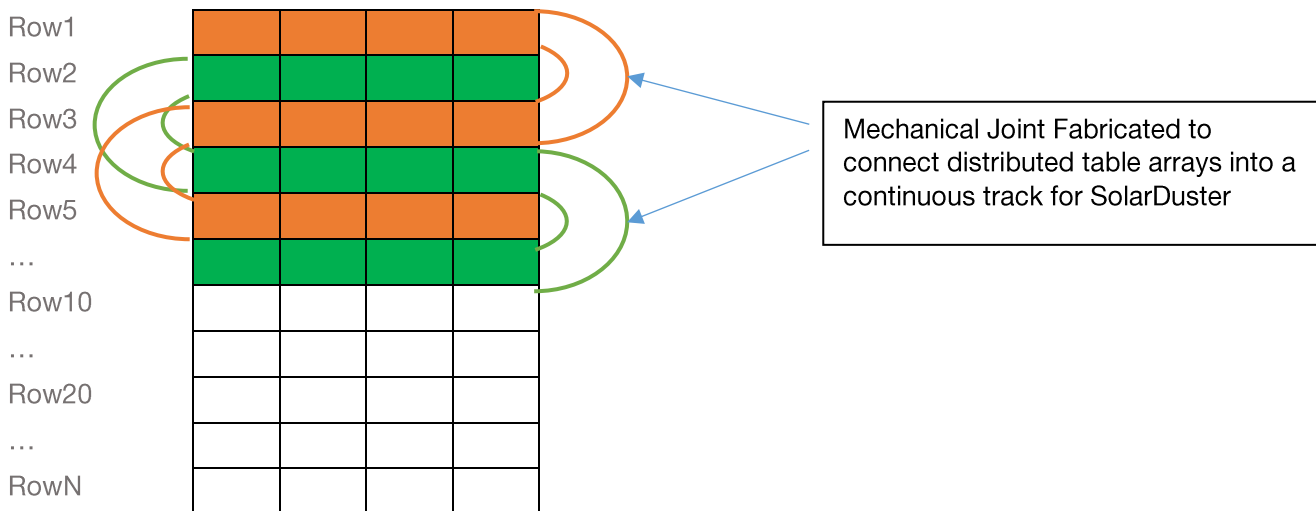
3. Vertical, Short Continuous Arrays



**For conceptual understanding & representation purposes only.*

If the solar power plant is built in a similar kind of a layout as shown by diagram above, then tracks can be made suitable to connect either 2 rows, 3 rows, 4 rows, etc. (as per site requirements) which is as shown below. If the provision of mechanical tracks are made then the number of SolarDusters required shall be $(N \div x)$, where x = number of continuous rows formed by track

For example: If 3 rows are connected by tracks to form one continuous row / array of Solar Panel table arrays, then SolarDusters required are ' $N \div 3$ ' as shown below.



**For conceptual understanding & representation purposes only.*

4. Horizontal, Long distributed Arrays (Rows)

If there is a site where Case-2 and Case-3 are seen together then provisions in both cases must be taken into consideration

Notes

Note:

- Due to continuous process of R & D, design and specifications are subject to change without prior notice.
- Images are for representation purposes only. Final product may change.
- User is recommended to ensure the suitability of the products for intended application.
- MEMIGHTY is not responsible for consequential damage out of use of its products.



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