INVENTION DISCLOSURE FORM

Details of Invention for better understanding:

1.TITLE: AI-Enhanced Solar Panel Configuration for Maximum Energy Production

2.INTERNAL INVENTOR(S)/ STUDENT(S): All fields in this column are mandatory to be filled

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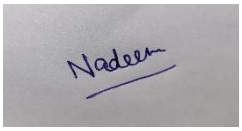
Signature (Mandatory)	
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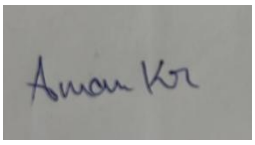
Signature (Mandatory)	
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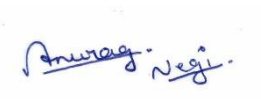
Signature (Mandatory)	

3. DESCRIPTION OF THE INVENTION:

This invention makes use of both artificial intelligence (AI) and machine learning (ML) algorithms with data from IoT sensors to optimize rooftop solar panel configurations. The system intelligently recommends or modifies panel orientation and positioning to maximize solar energy output by constantly analyzing real-time metrics such as solar radiation, roof angles, shading behaviour, and environmental factors. The coordination of AI with IoT makes a responsive, efficient, and automated solution for energy optimization in both residential and commercial solar panel systems.

A. PROBLEM ADDRESSED BY THE INVENTION:

Normal rooftop solar panel installations are often fixed and do not change with different environmental conditions such as seasonal sunlight variation, temporary interference (e.g., debris, snow), or complex roof structures. These fixed and static systems often lead to more energy consumption and more setup costs.

This invention removes and solves such limitations by using ML models trained with real-time IoT sensor data installed on rooftops. These models process data(variables) such as sunlight intensity, weather patterns, roof slope and nearby obstacles to decide the most suitable configuration for each installation. As a result, energy output, efficiency, and cost management are improved.

B. OBJECTIVE OF THE INVENTION:

- **Objective 1:** Create a machine learning framework that uses sensor data to determine optimal panel orientation and tilt, adapting to weather changes and direction of the sun.
- **Objective 2:** Provide continuous system monitoring and real-time recommendations for solar panel adjustments to keep things running smoothly throughout the day and in all seasons.

C. STATE OF THE ART / RESEARCH GAP / NOVELTY:

Sr. No.	Patent ID / Reference	Abstract	Research Gap	Novelty
1	US10298146B2	Describes a real-time solar tracking system using irradiance sensors and PLCs.	High costs and complexity make it less suitable for small-sized roofs.	Uses low-cost IoT sensors and software-based ML, removing the need for physical tracking mechanisms.
2	CN111317246A	Uses meteorological big data and cloud processing to optimize solar panel angles.	Focuses on general regional data, lacks granularity for individual rooftops.	Delivers real-time, localized optimization through AI trained on site-specific sensor data.
3	“AI-driven Solar PV Optimization” (Energy Reports, 2020)	Discusses output prediction using deep learning based on weather forecasts.	Emphasizes prediction rather than layout configuration.	Goes beyond forecasting to include design and adjustment of physical layout informed by predictive analysis.

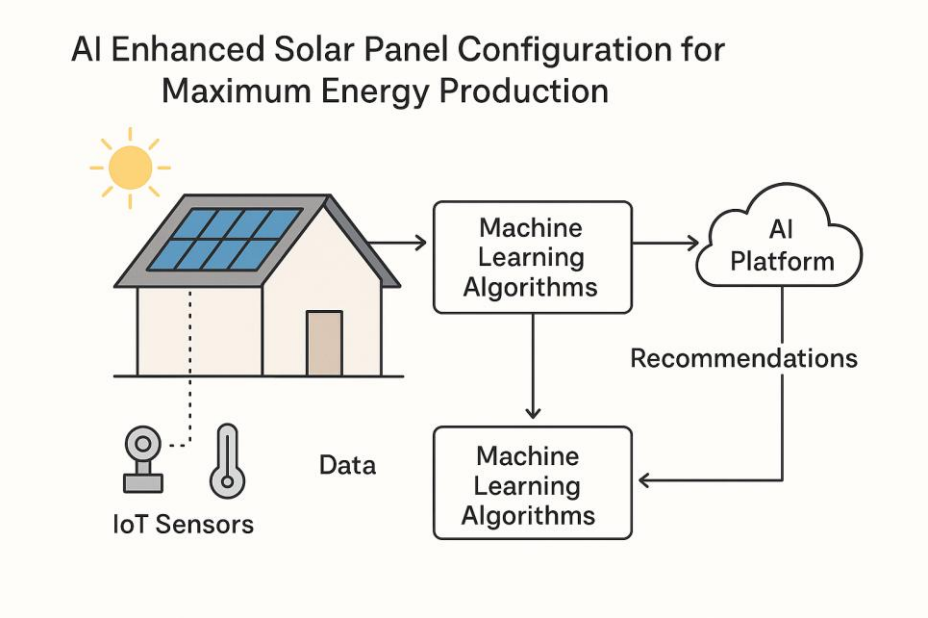
D. DETAILED DESCRIPTION:

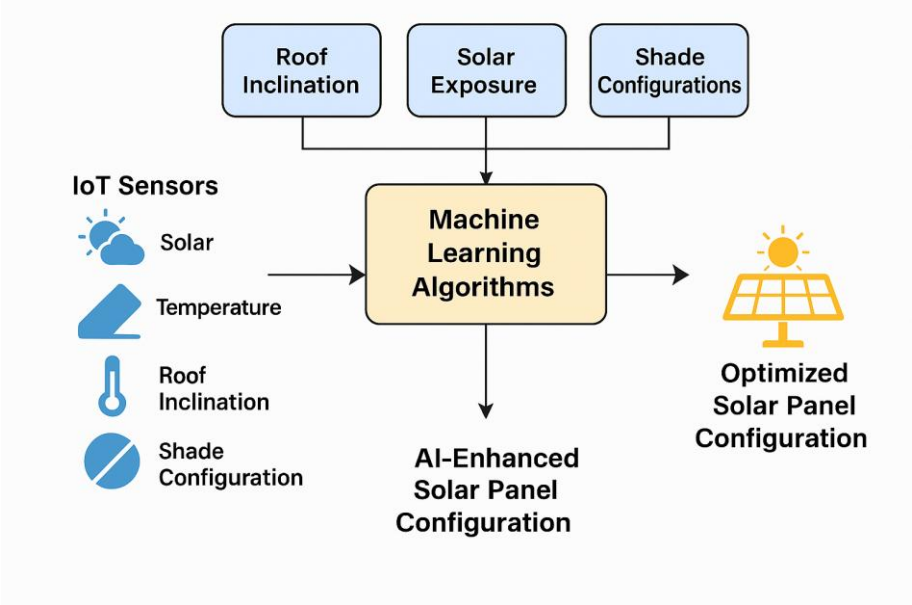
The AI-powered solar configuration system consists of a network of rooftop-installed IoT sensors such as solar irradiance detectors, environment sensors (temperature, humidity), gyroscopic inclinometers, and shadow detectors. These sensors feed data into a cloud-hosted AI engine.

Machine learning models which use supervised and reinforcement learning process this input to generate information regarding:

- Best-fit panel tilt angles
- Optimal azimuth based on sun movement on days/seasons
- Proper positioning to avoid shadowed or inefficient zones
- Alerts for maintenance tasks (e.g., obstruction or soiling detection)

This results in a software-centric configuration system that adapts to real-time environmental input without human intervention.





E. RESULTS AND ADVANTAGES:

- Up to 20–30% increase in solar energy generation compared to fixed systems
- Adaptive configuration based on real-time environmental reaction
- Improved investment value
- Removal of mechanical tracking components reduces cost and complexity
- Adjustable and compatible with pre-existing photovoltaic infrastructure
- Promotes sustainable energy usage by maximizing solar utilization

F. EXPANSION:
For improved functionality, the system can also include:

- High-precision weather API integration
- Rooftop 3D modelling tools for improved configuration accuracy
- Data from solar inverter systems for real-time performance validation

G. WORKING PROTOTYPE / FORMULATION / DESIGN / COMPOSITION:
Initial prototype development has begun with ML models trained on datasets.
Expected time for a fully functional prototype with sensor integration: 3–4 months.

H. EXISTING DATA:
Comparative simulation using public rooftop datasets and benchmark generation data shows a measurable improvement in energy efficiency over traditional fixed setups.

4.USE AND DISCLOSURE (IMPORTANT): Please answer the following questions:

A. Have you described or shown your invention/ design to anyone or in any conference?		**NO (No)**
B. Have you made any attempts to commercialize your invention (for example, have you approached any companies about purchasing or manufacturing your invention)?		**NO (No)**
C. Has your invention been described in any printed publication, or any other form of media, such as the Internet?		**NO (No)**
D. Do you have any collaboration with any other institute or organization on the same? Provide name and other details.		**NO (No)**
E. Name of Regulatory body or any other approvals if required.		**NO (No)**

5. Public Disclosure Details (if any):
Not Applicable

6. MOU/Collaboration Terms (if applicable):
Not Applicable

7. Potential for Commercialization:
Yes

8. Suggested Companies for Commercial Contact:

- Tata Power Solar
- Loom Solar
- Vikram Solar
- SolarEdge Technologies

9. Existing Patent Royalties or Dependencies:
non-applicable

10. Filing Option:
Complete Filing

11. Keywords:
AI-Based Solar Tuning

Intelligent Solar Panel Configuration

IoT-Driven Solar Efficiency

Smart Rooftop PV Management

Renewable Energy Machine Learning Optimization