Cover Page

Team Name : SolarSurge

Please highlight your chosen category:

- **Open Category**
- **Student (Senior) Category – Universities**
- **Student (Junior) Category – Polytechnics, ITE**

Please note that as long as your team contains at least one working professional, you will only be eligible for the Open Category.

Please highlight the challenge statement(s) your proposal intends to address.
You may select more than one.

- **Manufacturing, Trade and Connectivity (MTC)**
- **Human Health & Potential (HHP)**
- **Smart Nation & Digital Economy (SNDE)**
- **Urban Solutions and Sustainability (USS) - Energy Reset**

Background Information

- Solar power is becoming more popular as a sustainable alternative to energy generation.
- However, Solar panels have plenty of room for optimisation. The average efficiency is only 15-20%
- Changing weather conditions, variations in energy demand or breakdowns can all contribute to this low efficiency.
    - 25-35% of efficiency is lost due to the sun moving around
    - Accumulation of dust can decrease efficiency by up to 50%
- AI can be used to do demand forecasting, predictive maintenance and parameter tuning to make solar panels more efficient and reliable
- This will make solar panels more appealing, making it easier for people to invest and adopt a sustainable solution for energy generation

Problem / Opportunity (Unreliable Energy Production)

Problem:
The integration of AI-driven predictive maintenance in solar panels confronts inefficiencies caused by environmental factors, showcasing up to a 30% decrease in efficiency. AI algorithms analyzing real-time sensor data enable a proactive approach, reducing downtime by 50% and enhancing overall efficiency by approximately 15%.

Opportunity:
Current solutions primarily rely on basic monitoring systems lacking AI's predictive capabilities. While some companies have started implementing machine learning for predictive maintenance, traditional systems struggle to accurately forecast maintenance needs, leading to unexpected downtimes. In essence, AI-driven predictive maintenance presents a significant opportunity to enhance efficiency and reliability in renewable energy, surpassing the limitations of conventional monitoring systems.

Problem / Opportunity (Inefficient maintenance)

Problem:

In solar energy systems, the shift from reactive to AI-driven predictive maintenance revolutionizes the approach by leveraging real-time sensor data. This proactive strategy prevents downtime, optimizes performance, and curtails maintenance costs for sustainable solar energy production.

Opportunity:

Current solutions include AI-powered predictive maintenance systems and condition monitoring tools. However, these solutions, especially condition monitoring systems, lack advanced analytics and predictive capabilities. They offer data based on known issues but struggle to analyze complex patterns effectively, highlighting the need for more sophisticated AI-driven predictive maintenance systems in the renewable energy sector.

Problem / Opportunity (Energy storage)

Problem:

The challenge of efficient energy storage in solar panels persists due to limitations in managing surplus energy and meeting varying demand. Current systems struggle to adapt to changing demand patterns and real-time grid needs, hindering the optimization of solar energy utilization.

Opportunity:

They employ basic algorithms without considering multiple influencing factors, like weather forecasts or consumption fluctuations. This gap creates an opportunity for AI-driven solutions to dynamically optimize energy storage systems by analyzing real-time data, ensuring maximal utilization and addressing inefficiencies in energy storage.

Solution

Battery: the system can output a reliable energy source for a short period of time by using batteries optimally

- Energy supply and demand Prediction:
    - The system estimates and predict the amount of power generated in a period of time
    - The system takes into account the amount of energy used on a daily basis to best determine how many batteries to charge and to what capacity it should be charged.
    - Data used: temperature, weather conditions, historical data , cleanliness and how well maintained the solar panel is
- Battery level optimization:
    - when the battery is nearing a charge capacity of 100%, the charging will slow down. Hence to not overcharge the battery.
    - Data used: the rate of charging and the battery’s total capacity.
    - Technology used auto cut-off chargers.

Solution

Maintenance: The system is meant to optimize the lifespans of the solar panels

- Predictive maintenance:
    - The system has a real time monitoring system that visualises data(the solar panel's efficiency), to determine its health and performance
        - Through data analytics it can warn users for abnormalities of variables that negatively affects the efficiency
        - Using an AI model, it uses the past data and variables that negatively affects the efficiency to predict which part of the solar panel needs maintenance
    - Technology used: SocketIO(Or data transfer protocol), Flask Server, SQL, DEMATEL(for data analytics)

Underlying Technology

Unique value for customers:

- **Energy supply prediction:** Estimate the time taken to charge a battery.
  - based on heat of the solar panel, weather and historical data using data analytics algorithms and ML models.

Existing solution replacing technologies:

- **Dynamic Battery Level Optimization:** Disconnect the battery at full charge
  - Optimizes battery health and longevity.
  - Uses auto cut-off chargers.
- Maintenance:
  - **Proactive Maintenance:** Our system identifies and addresses potential issues in real-time.
    - Minimizes downtime, reduces maintenance costs, increases transparency in the renewable energy process,and enhances the overall reliability of solar panel systems.
  - **Holistic Self-Maintenance:** An automated self-cleaning and damage prevention system.
    - This makes a general solar panel solution market.
    - Integrate anti-PID technology, real-time monitoring, and wildlife deterrence creates a comprehensive

Product Roadmap

DATE The release date or timeframe	*Date or timeframe* March Week 1-2 2024	*Date or timeframe* March Week 2-4 2024	*Date or timeframe* April-May 2024	*Date or timeframe* June 2024
NAME The name of the new release	*Name/version* Project Initiation	*Name/version* Data Insights and Model Development	*Name/version* Prototype Testing and Feedback	*Name/version* Solution Optimization and Scaling
GOAL The reason for creating the new release	*Goal* Establish a solid foundation for the AI-driven solar panel efficiency improvement solution	*Goal* Lay the groundwork for predictive maintenance and energy supply/demand prediction models	*Goal* Assess the initial effectiveness of the AI-driven solution in a controlled environment	*Goal* Enhance the solution based on feedback and scale it to a larger set of solar panels
FEATURES The high-level features necessary to meet the goal	Detailed analysis of existing solar panel technologies Definition of project goals, objectives, and KPIs.	Collection and preprocessing of historical data Development of predictive maintenance models Initiation of energy supply/demand prediction model development	Building a prototype integrating predictive maintenance and energy prediction Initial testing in a controlled environment Feedback gathering from a small-scale pilot program	Analysis of pilot program results Adjustment of AI models and algorithms Scaling up the solution for diverse environmental conditions
METRICS The metrics to determine if the goal has been met	*Metrics* Completion of technology analysis Finalized project goals and KPIs	Completion of data collection Preprocessed and cleaned data Initial predictive maintenance models Initiated energy supply/demand prediction models	Prototype development completion Successful initial testing Feedback collected from pilot program Identified areas for improvement	Analysis of pilot program results Adjusted AI models and algorithms Successfully scaled solution

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Go-to-Market Strategy

Our solution aims to improve the efficiency of solar panels and focuses on gaining traction in the industrial sectors of Singapore like in Jurong. The main beneficiary of our solution are thus industrial sectors looking to become more sustainable. However, this could also expand to more commercial buildings in the future such as shopping malls. Likely investors of this product are people that are seeking out more efficient and eco-friendly ways of generating energy. This includes large corporations in the industry sector, government agencies and Energy Service Companies (ESCOs).

Go-to-Market Strategy

Total Addressable Market (TAM):

- According to LinkedIn, the global solar panel market is projected to reach $264 billion by 2030, with a compound annual growth rate (CAGR) of 8.2% from 2023 to 2030.

Serviceable Addressable Market (SAM):

- The SAM for our solar panel efficiency solution is defined by its focus on the industrial sectors in Singapore, particularly in Jurong. The main beneficiaries are industrial sectors looking to enhance sustainability.

Service Obtainable Market (SOM):

- The SOM is the realistic segment of the market that our solution aims to capture. In this case, it involves targeting industrial sectors in Jurong initially, where there is a clear demand for sustainability in energy practices.

Financial Projections

Key Businesses:

Battery Level Optimization: Providing solutions to prevent overcharging, extending battery lifespan.
Predictive Maintenance: Analyzing data for early detection and maintenance of issues in solar panels.

Real-time Monitoring and Warning System: Alerting and maintaining solar panels based on weather conditions and abnormalities.

Self-maintaining Solar Panels: Implementing features like anti-PID boxes, self-cleaning mechanisms, and wildlife deterrents.

Projected Financials:

- Year 1-2: Focus on R&D, product development, establishing partnerships, and initial market penetration. Revenue growth might be modest during this phase.
- Year 3-5: Expansion of customer base, increased sales of products and services, and wider market reach.

Team Introduction

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Photographs are optional. Please provide appropriate details based on your category.

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Roadmap was made using
https://draft.io/ctgye5p4s2wpv97sdwpu7mgzsghe2f7ujrw9dm2phcdj