

## TECHNOCOGNITION '25

### Inter-College 36-Hour International Level Protothon

**Project Title :** SunSync: Dynamic Solar Energy Storage and Transfer  
Unit for Electric Vehicles  
“Charge Anywhere. Move Everywhere. Powered by the Sun.”

**Team Synchronauts – “Synchronizing Light and Motion”**

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2. Matam Udai Kiran – ENG23EC0017  
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**Theme :** Circuit Minds

# PROBLEM STATEMENT

## Problem Statement :

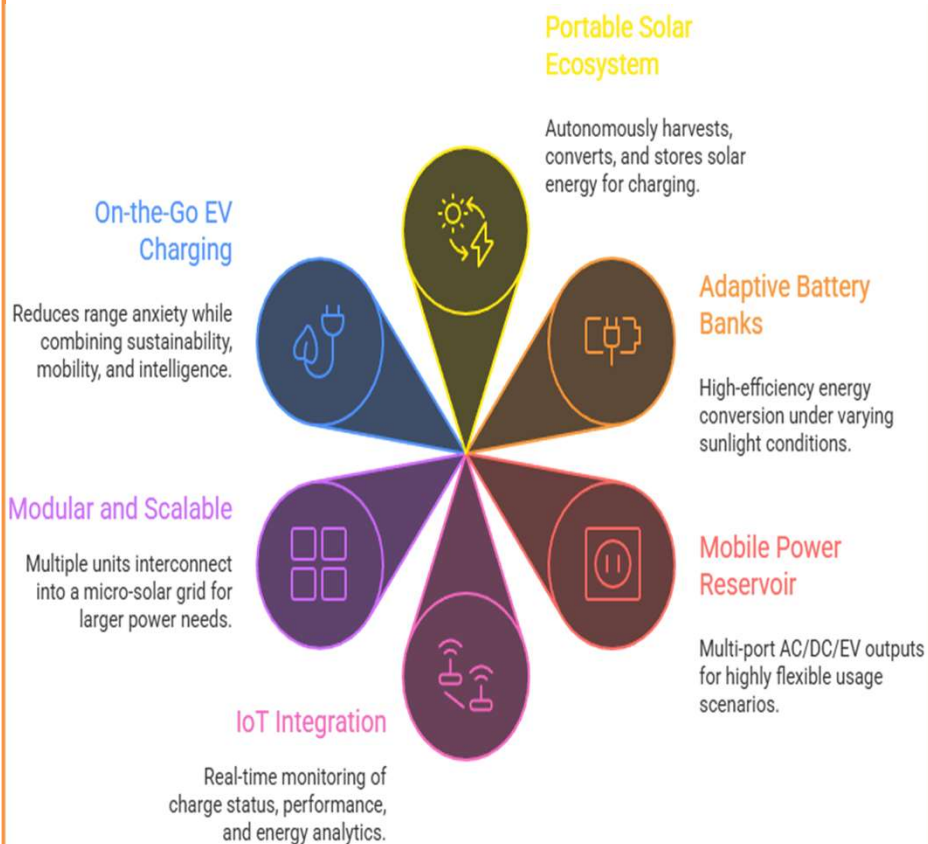
- EV adoption is rising, but rural/off-grid regions still lack reliable charging infrastructure, causing range anxiety.
- Current charging depends on stationary, grid-based power — limiting mobility and access during outages or disasters.
- Solar energy is abundant, yet present systems are fixed, non-portable, and not integrated with Evs
- Setting up permanent charging stations is costly, time-consuming, and restricted by location
- Industries, military, and remote field teams still rely on diesel generators, reducing sustainability.
- Existing solar solutions are passive and lack intelligent, real-time optimization for energy use.





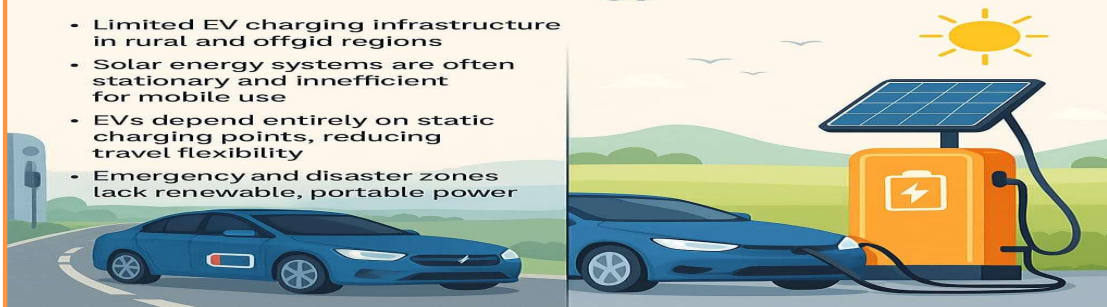
# SOLUTION OVERVIEW

## Solution Overview :



## The Growing Need for Portable Renewable Energy Solutions

- Limited EV charging infrastructure in rural and offgrid regions
- Solar energy systems are often stationary and inefficient for mobile use
- EVs depend entirely on static charging points, reducing travel flexibility
- Emergency and disaster zones lack renewable, portable power



“How can we make solar power mobile, self-sustaining, and reliable enough to support electric mobility anywhere?”

## SunSync The All-in-One Solution

A portable solar energy storage and transfer unit for EVs



- Utilizes solar panels to charge an integrated battery unit
- Stores and releases power dynamically based on EV needs
- Portable and self-sustaining: designed for use in remote areas and emergencies

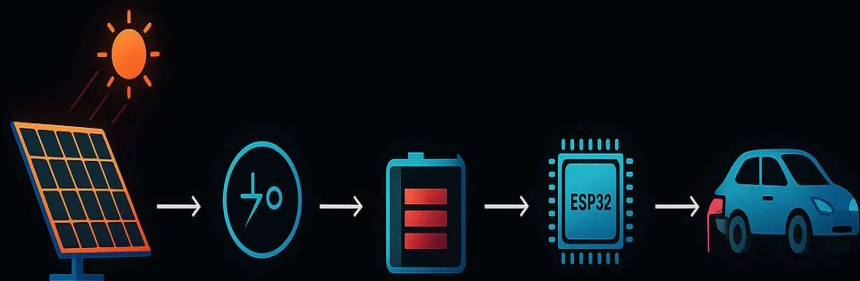
Enables EV charging without reliance on grid-based infrastructure

**Problem statement:** “How can make solar power mobile, self-sustaining, and reliable enough to support electric



# IMPLEMENTATION/PROTOTYPE

## SUNSYNC PROTOTYPE ARCHITECTURE



### INPUT

Flexible Solar Panel Array with Dual-Axis Tracking

### POWER REGULATION

MPPT Circuit for Efficient Conversion

### ENERGY STORAGE

High-Density Lithium-Ion Battery Bank with Smart BMS

### CONTROL UNIT

ESP32 Microcontroller for Monitoring, Control, and IoT Connectivity

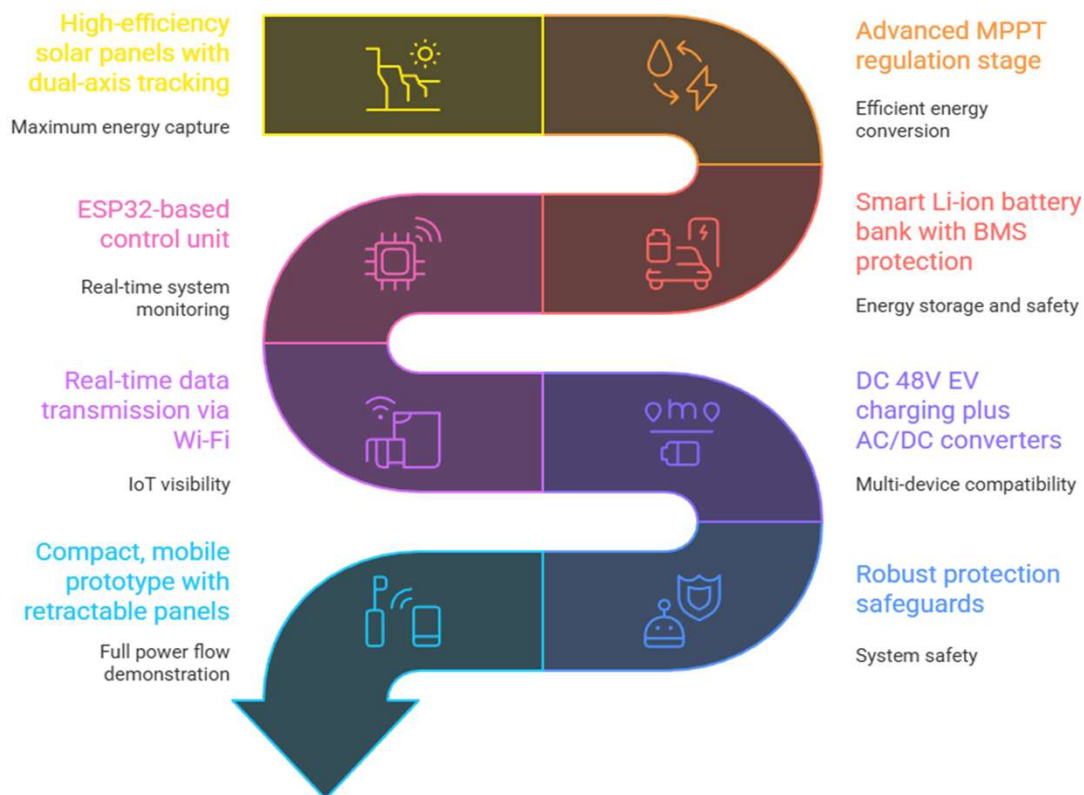
### OUTPUT

EV Charging Port + AC/DC Multi-Output Interface

### WORKING PRINCIPLE

SOLAR → MPPT CONTROLLER → CONTROLLER BATTERY BANK → BMS IOT → POWER CONVERTER → EV LOAD

## System Architecture :





# TECHNOLOGY STACK

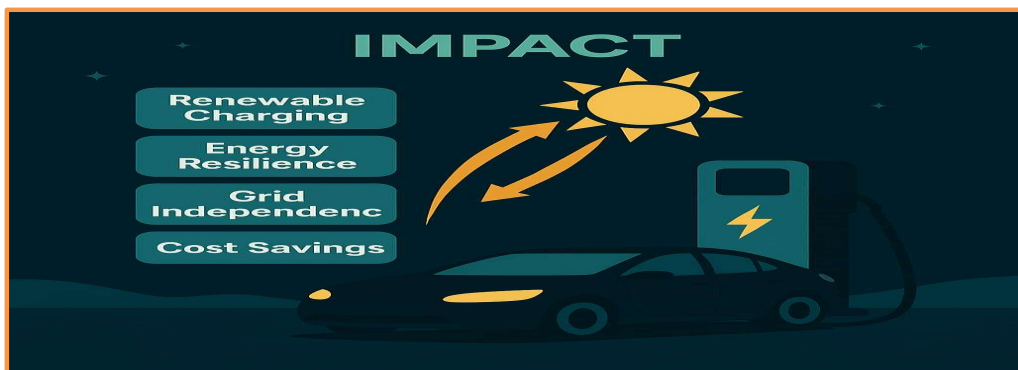
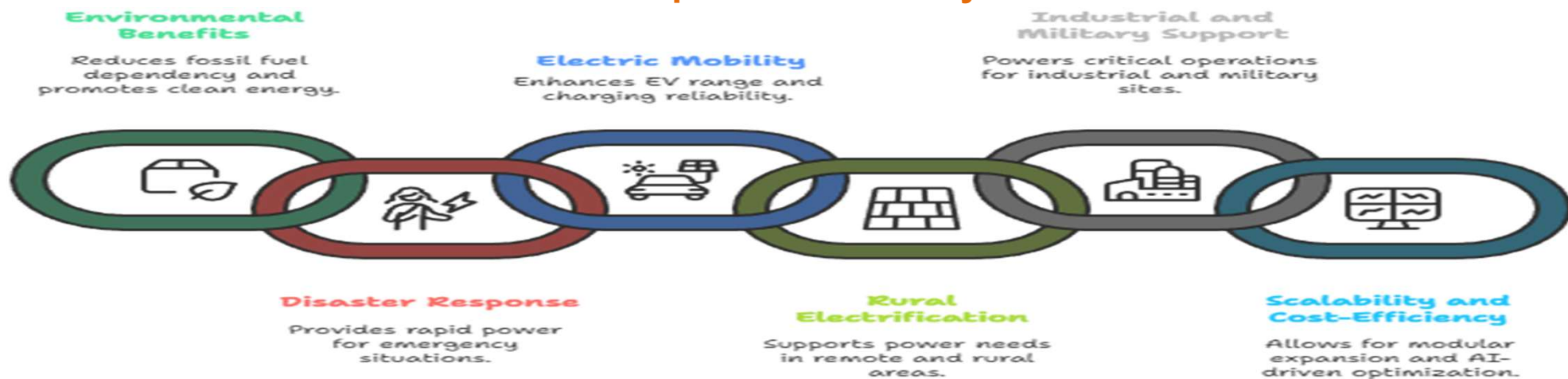
## Technologies Used :



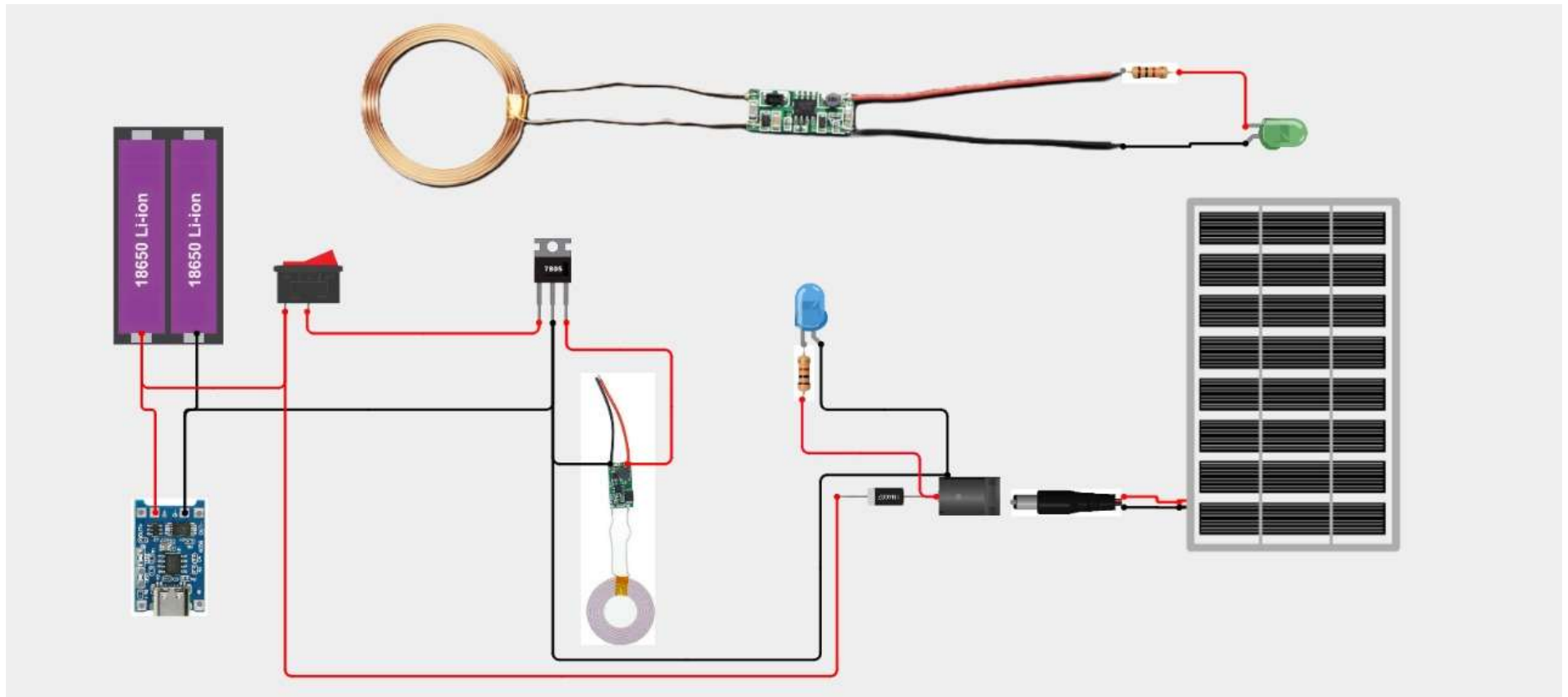


# IMPACT & SCALABILITY

## Impact & Scalability :



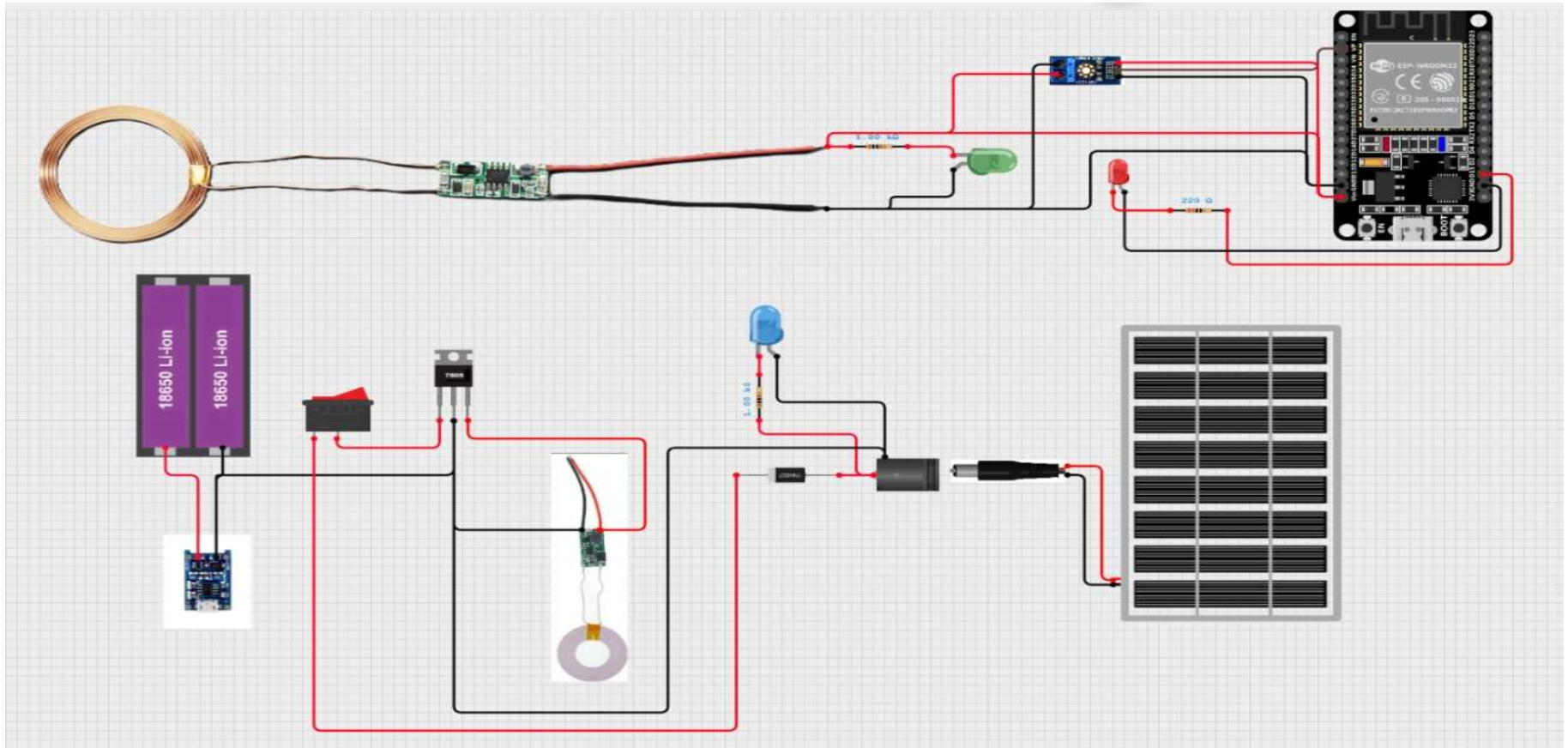
# Prototype(1)



## **Prototype 1 – Basic Circuit Description :**

Prototype 1 represents the fundamental charging and power-management system of our SunSync project. It includes a pair of 18650 Li-ion batteries charged through a TP4056 module, supported by a solar panel input with a diode for reverse-current protection. A wireless power transmitter and receiver pair is used to demonstrate inductive energy transfer. The received power is regulated using a 7805 voltage regulator, and LED indicators are added to show charging activity and power status. This basic prototype validates the core functions of energy intake, wireless transfer, regulated output, and battery charging—forming the foundational stage for the advanced ESP32-based monitoring system in the next prototype.

# Prototype(2)



## **Prototype 2 – Developed Model Description :**

Prototype 2 represents the advanced version of the SunSync system, integrating smart monitoring and wireless charging into a unified setup. This prototype includes a complete wireless power transfer path, where the transmitter delivers energy to the receiver coil, which then powers both the ESP32 microcontroller and the battery charging system. A voltage sensor is added to continuously measure the battery level, enabling the ESP32 to intelligently detect when the battery reaches full charge. LED indicators provide immediate visual feedback, while the microcontroller allows for expansion into automated notifications and smart energy management. Solar input is retained for supplementary charging, regulated through the diode and TP4056 charger module. Overall, Prototype 2 validates the seamless combination of wireless charging, solar support, regulated output, and microcontroller-based monitoring—marking a major step toward a fully autonomous EV charging unit.



# RESULTS/FUTURE SCOPE

## Results/Future Scope :

### Future Upgrades

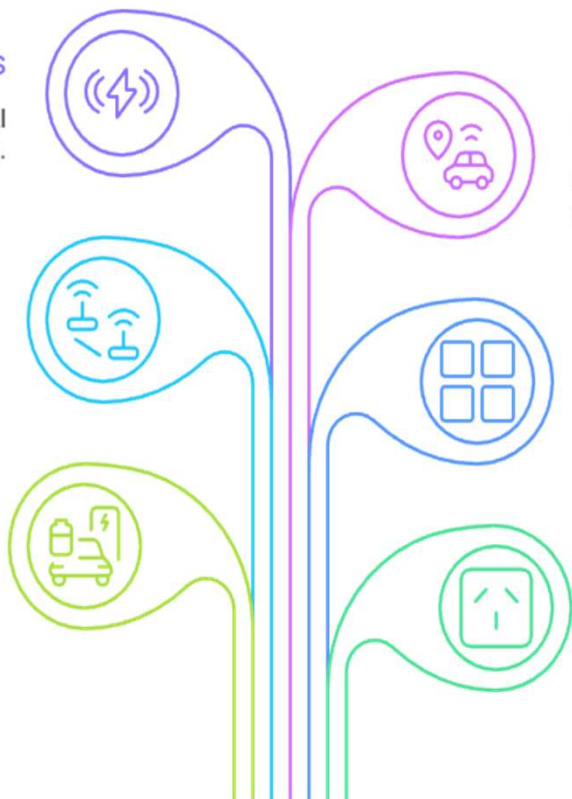
Future upgrades include AI and wireless charging.

### IoT Integration

IoT integration enables real-time performance insights.

### Conversion Efficiency

Up to 90% conversion efficiency achieved.



### Long-Term Vision

Long-term vision targets national grid sync.

### Scalability

Scalable design for rural and urban deployment.

### Load Compatibility

Successfully tested for 24V/48V loads.

## SunSync

REVOLUTIONIZING PORTABLE SOLAR ENERGY

 SUSTAINABLE

 INTELLIGENT

 MOBILE

 SCALABLE



Charge Anywhere. Move Everywhere.  
Powered by the Sun.

## THANK YOU

Presented by Team [Your Team Name]  
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