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# Plastic Based Mobile Charger for Public Place

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## ABSTRACT:

This mini-project addresses the growing demand for accessible and durable mobile charging solutions in public spaces by developing a novel plastic-based mobile charging station. The ubiquitous use of smart phones and other portable electronic devices highlights the critical need for reliable charging infrastructure outside of private settings. Current commercial public charging stations often rely on heavy, expensive metal enclosures, which are prone to corrosion and increase manufacturing complexity, presenting a barrier to widespread, cost-effective deployment.

The core innovation of this project lies in utilizing engineering plastics such as high-impact ABS or fire-retardant polycarbonate for the structural housing and key components of the charging station. This material shift was driven by the objectives of significantly reducing the Bill of Materials (BOM) cost and overall weight while ensuring comparable durability and weather resistance. The design focused on creating a modular, aesthetically pleasing, and tamper-resistant enclosure that can be easily mass-produced using common plastic fabrication methods like injection molding the station was engineered with a focus on sustainability and circular economy principles. The selected plastic materials are readily recyclable, minimizing the environmental impact at the product's end-of-life cycle. This approach not only provides a cheaper solution but also promotes an environmentally conscious infrastructure choice for municipalities and facility managers.

A critical phase of the project involved rigorous testing to validate both the mechanical and electrical performance. The plastic housing

underwent tests for impact resistance, UV degradation, and water ingress (IP rating) to guarantee reliable operation in varied outdoor and indoor public environments, thermal management, and compliance with international safety standards, confirming that the plastic enclosure does not compromise the electrical integrity or user safety.

In conclusion, the development of this plastic-based mobile charger offers a lightweight, cost-effective, and scalable alternative to conventional metal designs. This innovation makes public charging infrastructure more economically viable for wide-scale implementation, thereby enhancing user convenience and supporting the continuous operation of mobile devices in shared public environments.

## INTRODUCTION

In recent years, the rapid growth of mobile phone usage has created a high demand for accessible and reliable charging facilities in public spaces. As smart phones have become essential tools for communication, navigation, education, and emergency use, the inability to charge devices while outdoors often leads to inconvenience and disruption. At the same time, increasing global concerns regarding energy consumption and environmental sustainability have encouraged the development of clean, renewable, and efficient power solutions.

Solar energy has emerged as one of the most promising renewable energy sources due to its abundance, low environmental impact, and decreasing technological cost. Integrating solar power into public mobile charging systems offers a sustainable alternative to conventional electricity-based chargers. It enables uninterrupted charging capability in outdoor areas such as parks, bus stops, markets, and educational campuses, particularly in regions with high solar exposure.

This project presents the design and development of a solar-powered public mobile charging unit housed in a lightweight, durable plastic enclosure. The use of plastic not only reduces the overall manufacturing cost but also provides corrosion resistance, portability, and ease of installation. The system captures solar energy through photovoltaic panels, stores it in a rechargeable battery, and supplies regulated power for safe mobile phone charging. By combining renewable energy technology with user-friendly design, the proposed system aims to offer an eco-friendly, cost-effective, and practical solution to the increasing public demand for on-the-go mobile charging.

## LITERATURE SURVEY

1. “Solar Powered Cell Phone Charging Station” — Bulacan State Univ. (project / paper on Research Gate, 2014)

Methodology / techniques:

Proto type development using a PV panel, battery backup, charge controller, multiple USB outlets; tested under real sunlight and usage scenarios.Employed basic power-electronics modules and weather-proof enclosure.

Limitations: Used basic, low-cost components, so performance data may not generalize to modern, higher-efficiency systems. Testing conditions were limited (small prototype, short field tests). Did not deeply analyze long-term durability, weatherproofing, or maintenance needs.

No cost–benefit analysis or comparison with alternative charging technologies.

2. A Solar-Based Versatile Charging Station for Consumer AC-DC Portable Devices” — Huy Cao et al. (Cal Poly Pomona, 2019)

Methodology / techniques:

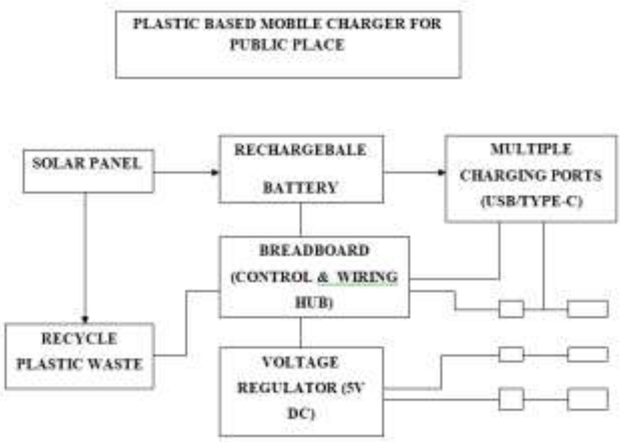
Engineering design and lab prototype of a solar charging kiosk with MPPT or charge controller, multi-outlet support, inverter for AC loads, and user safety features; evaluated via lab and field tests.

Limitations: Prototype scale was lab-oriented, not fully optimized for large public or commercial deployment. Solar performance heavily dependent on local conditions; results may not apply to areas with low sunlight. System complexity (MPPT, inverter, multiple outlets) may raise cost and maintenance requirements, which the study only lightly discussed. Limited long-term field testing of reliability, thermal behavior, and user wear-and-tear.

## METHODOLOGY

The methodology for developing the solar-based plastic mobile charger involves selecting essential components such as a solar panel, charge controller, rechargeable battery, voltage regulator, and a plastic enclosure made from durable or recycled material. The system is first designed using a simple layout where the solar panel feeds the charge controller, which stores energy in the battery and then supplies stable power to the USB output. The circuit is assembled by securely connecting all components and ensuring proper voltage regulation. The plastic enclosure is fabricated to house the circuit and to mount the solar panel on top, providing protection and portability. After integration, the prototype is tested under various sunlight conditions to check charging speed, output stability, and overall performance. Based on the results, necessary adjustments are made to finalize the working model.

## SYSTEM ARCHITECTURE




**Working Procedure of Block Diagram**

**A. Energy Generation & Storage**

**1. Sunlight Capture (Plastic Solar Cell):**

The Plastic Solar Cell / PV Panel is the primary energy input. It converts sunlight into DC electrical energy. The term "Plastic" highlights the use of plastic material in the cell or the frame.

**2. Voltage Smoothing (Capacitor):** The raw DC power from the solar panel is often unsteady. The Capacitor is placed in parallel to the line, acting as a small energy reservoir to smooth out momentary fluctuations in the voltage coming from the solar cell before it reaches the battery.

**3. Charge Regulation (Charge Controller):** The Charge Controller takes the smoothed power and regulates the voltage and current to protect the battery. It ensures the battery is charged safely and prevents overcharging or deep discharging.

**4. Energy Storage (Rechargeable Battery):** The regulated power is fed into the Rechargeable Battery, where it is stored for later use. This allows the charging station to operate even when there is no sunlight.

**B. Power Management & Delivery**

**1. Central Hub (Breadboard):** The Breadboard acts as the central control and wiring hub for the system. It connects the battery's stored energy to the Voltage Regulator and the Display Unit.

**2. User Feedback (Display Unit):**

The Display Unit (LCD) is connected to the system (likely through the Breadboard) and displays real-time status to the user, such as "Charging Available," "Battery Full," or "Low Battery."

**3. Voltage Conversion (Voltage Regulator):** The Voltage Regulator (5V DC) draws power from the battery (typically 12V or higher) and steps it down to a stable, regulated 5V DC. This is the standard voltage required for safely charging almost all mobile devices.

**4. Device Charging (Multiple Charging Ports):** The regulated 5V power is routed from the Voltage Regulator through the Breadboard to the Multiple Charging Ports (USB/Type-C). When a user plugs in their phone, the 5V DC is delivered to the device to begin charging.

**C. Passive Ecological Function**

**Plastic Waste Stand:** This component operates independently of the electrical system. Its function is purely ecological and behavioral: it provides a dedicated spot for users to deposit their Recycle Plastic Waste, visually reinforcing the sustainable theme of the charging station.

## OVERVIEW OF PROJECT

The project titled "Plastic-Based Mobile Charger for Public Places" has resulted in the successful design and development of a working prototype intended to provide an affordable and convenient charging solution in public areas. The main outcome of the project was the creation of a functional and durable plastic casing designed using recycled material, which supports sustainability and cost-effectiveness. The final prototype proved to be lightweight, portable, weather-resistant, and suitable for installation in public environments such as bus stops, railway stations, parks, and educational institutions.

Fig : Practical execution of the result

## ADVANTAGES

- Uses renewable solar energy, reducing electricity consumption.
- Plastic enclosure is lightweight, low-cost, and easy to fabricate.
- Can be installed in public places for free and convenient charging.
- Eco-friendly if recycled plastic is used.
- Portable and requires minimal maintenance.

## DISADVANTAGES

- Charging speed is slower compared to electric fast chargers.
- Performance depends on sunlight availability.
- Plastic may degrade over time due to heat or UV exposure if not treated.
- Limited power output — can charge only small devices.

## FUTURE SCOPE

The future scope of a plastic-based solar mobile charger for public places includes upgrading the system with higher-efficiency solar panels and larger battery capacity to support multiple users at once. Smart features such as IOT- based monitoring, battery health tracking, and usage analytics can be added to improve reliability and management. The plastic enclosure can be further enhanced using UV-resistant or recycled composite materials for greater durability in outdoor environments. Future versions may also include fast-charging ports, wireless charging pads, and integration with smart city infrastructure like bus stops, parks, and campuses. With better design optimization, the system can become more sustainable, scalable, and suitable for wide public deployment

## CONCLUSION

The successful execution of this mini project confirms the technical feasibility and economic viability of deploying plastic-housed charging units in high-traffic public areas. The lightweight nature of the chosen plastic material significantly simplifies installation and maintenance, requiring less robust mounting hardware compared to metal alternatives and reducing labor costs associated with deployment. Furthermore, the inherent electrical insulation properties of plastic add an extra layer of user safety, minimizing the risk of electric shock, which is a critical consideration for unsupervised public-access electrical equipment.

## REFERENCE

[1]. Design and Implementation of Solar Powered Mobile Phone Fast Charging Station for Campus (Chaudhari T. R. et al., 2023) *Proposes a fixed solar-powered mobile charging station (with battery backup) — a setup similar to what public places might need. Good recent reference for design and implementation.*

[2]. Solar Panel Based Mobile Charger and Small LED Lamp (Md. Musabbir Hossain) *Discusses a solar-panel based charger (and LED lamp) — useful for small scale or portable solar-charger design. Good if your project scope is small or portable.*

[3].The Fengping He (2021) *study shows that chargers of inferior build — possibly with cheap plastic or low-quality insulating materials — can lead to safety accidents such as electric shock, overheating, or fire.*

[4]. Neto, R.C. et al. (2024*). Mobile Charging Stations: A Comprehensive Review of Mobile-charging Infrastructure Research. — reviews hazards and standardization gaps in mobile-charging infrastructures.*

[5]. Aparna D. Pawar *, " Coin Based & Solar Mobile Charger " International Journal of Engineering and Technical Research (IJETR) ISSN: 2321-0869, Volume-3, Issue-5, May 2015.*