# Street Light Charging System

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## Abstract

Today, people use their mobile phones for a wide range of activities. With only a touch, almost everything can be accomplished with technology, including bill payment, online shopping, and financial services. Also, one can talk to their loved ones by phone or text while listening to music. Unfortunately, mobile phone batteries lose power over time. When the battery on the device runs out, the problem begins, particularly during a crisis or storm. The researchers created the Street Light Charging System, an off-grid solar-powered streetlight with a built-in mobile phone charging station. The researchers tested the charging station for 24 hours while testing the light for 12 hours at night. According to the study, a solar-powered device will still have power after 24 hours of use if it receives 5 hours of peak sunlight to fully charge its battery. The study's findings indicate that the device will help the community charge their cell phones outside their homes. Having recharging stations helps the city since it keeps its people connected when outside their homes.

**Keywords: Streetlight, Solar Panel, Charging System, Renewable energy**

## Introduction

No matter how big or small, any city must be ready to deal with natural disasters to keep its economy and environment healthy in the face of climate change in developed and developing countries. Suppose cities are to remain competitive in a world where the number of people living in cities is increasing. In that case, they must have a steady and continuous supply of resources like energy, water, sanitation, and other essentials.



The use of mobile phones is still growing significantly. Developed nations like Japan, the US, and Europe predict a more than 30% growth rate in the following years. Mobile phones are a necessity in modern society. Given how essential it has become to day-to-day life, most people find it difficult to live without it. On a device, almost anything is possible with a swipe, including bill payment, online shopping, and financial services. Also, users can interact with friends and family and listen to music. However, a nightmare begins when the battery dies, particularly in a storm. When charging stations are dependable and accessible, people's lives are made more straightforward, and the community is better connected.

The proposed device may be helpful in this situation. Many urban areas may install the item so people can charge their gadgets as needed. The researchers claim that the device would be helpful for bikers and people who are working outside their homes.

This study, which is focused on physics, electronics, electricity, and streetlight design, conducted pilot testing to determine the device's functionality.

The study's primary goals are to determine and evaluate how streetlights can be more beneficial besides providing light during the night. Secondly, the study aims to determine the feasibility of placing charging systems in streetlights with solar panels. The paper also highlights the device's construction, installation, and evaluation.

## Literature

Coal, petroleum, and other fossil fuels are the primary energy sources used in our modern society. Since the previous year, every learner in the classroom saw cell phones as a distraction. However, when technology integrates into contemporary education, a better result will emerge when appropriately applied. Furthermore, mobile devices can enhance the educational process by making it more straightforward for students to complete their homework and fostering more significant social interaction. Nevertheless, one drawback is that it cannot maintain a full battery charge for long.

Solar power is one of the renewable energy sources (Stephen & Eric, 2016). The sun's energy can be converted directly to electricity using photovoltaic principles. Renewable energy sources can be used to generate electricity. Energy use has been reconsidered due to rising oil prices, growing awareness of energy-related pollution, and the detrimental effects of climate change.

Finally, energy efficiency in industry, electricity production, lighting, home appliances, and transportation have all improved due to energy assessment. The improvement in energy consumption that has happened in recent decades in practically all developed countries is primarily due to the efficient use of energy, according to Lacap (2004). According to Wilczynski (2015), cell phone chargers will become increasingly prevalent as solar-powered electricity increases.

## Methods

The construction of the device was made possible through the concepts of physics, electronics, electricity, streetlight, and solar energy. The first idea is about light. In order to assess the streetlights' brightness and determine how far the light should go, we need to understand how light functions. We must determine whether the battery will have enough energy and whether the solar panel can produce enough energy for the system. The second idea is electricity; we must determine whether streetlights use the correct voltage and wattage for illumination. The third idea is to innovate the design of the streetlights so that the solar panel can be used as a source of energy and it can be used as a cellphone charging system at the same time.



Materials used in the study included strip light, PVC pipe, wire, 12V 20AH battery, cement, solar panel, charge controller, screw, acrylic, cyno, square bar, switch, and solder.

- A strip light is a multi-circuit stage lighting that offers accent, backlighting, task, and decorative lighting.
- PVC pipe is a widely utilized and versatile thermoplastic used in plumbing applications. A wire is a long, thin metal used to carry current or fasten things.
- To make cement, limestone, shells, chalk, or marl are combined with clay, slate, slate, iron ore, blast furnace slag, and silica sand.
- Photovoltaics, another name for solar panels, are devices that convert solar energy, such as sunshine, into electricity. This electricity may then run a station for charging street lights.
- A charge controller, charge regulator, or battery regulator regulates the rate at which electric current is added to or removed from electric batteries. Lighting, dimmer, and battery charging functions are provided via smart controllers.
- Portable power supply: A power-supplying device has a housing, a battery module that is housed inside the housing, a circuit board that is housed inside the housing and connected to the battery module, and a battery module that has a battery, a battery circuit board that is connected to the battery, and an ignition output port that is connected to the battery circuit board.
- Multifunctional portable power bank consists of a primary body, a circuit board, and a battery.
- There are three control units on the circuit board: a wireless transmission unit coupled to the second control unit and a second control unit coupled to the first control unit. The

first control unit controls the input voltage of an external power source and the output voltage of battery power, which tells the second control unit to switch on. With these configurations, the multipurpose portable power bank provides electricity for charging different electronic devices connected to local or wireless networks and enabling data access via those networks. The second control unit allows a router mode or a network service mode, as well as wireless access. A flexible mobile power bank, a solar-powered LED street light that can communicate its power status.

- The solar cell contains a charge controller, a battery, and a solar board.
- The charge controller may also supply DC power to the LED street light.
- The charge controller's power data digital output interface connects to a power cable data communication unit and outputs power data from the solar cell to that device.
- The main power cable monitors the condition of each LED lamp's solar cells. Solar-powered LED streetlights are fully solar-powered street lighting systems.
- Solar panels are positioned to charge a maintenance-free storage battery that can power streetlights.

**Findings**

The study's findings led to the development of street light charging devices, which have several benefits and are useful for everyone who runs out of battery. According to survey findings, many individuals are satisfied with the streetlight charging system. Based on what people said, the built-in device's ability to light up and charge the cellphone was good and acceptable. Based on the tests the researchers carried out, the battery's charge after 24 hours matches the predicted amount based on theoretical calculations. The device also works regardless of the weather, according to what the researchers experience during device testing.



The output power of the solar panel is displayed in Tables 1, 2, 3, and 4, as well as in Figures 1, 2, 3, and 4. According to Figures 1, 2, 3, and 4, the solar panel produces the most energy between 9:00 a.m. and 12:00 p.m. and between 3:00 p.m. These are the hours when the sun is the brightest. The solar panel's energy output is lowest at 6:00 a.m. and 6:00 p.m., when the sun rises or sets, respectively. The findings indicate that the solar panel works best in the middle of the day. The numbers 1, 2, and 4 demonstrate that the outside weather is always sunny or partially sunny. Even if there is some sunshine at 9:00 a.m. and 12:00 p.m., Figure 3 demonstrates that the energy produced at noon is lower than that produced at 9:00 a.m.

Table 1. (Trial 1) Solar Panel Power at Different Times of Day

| Time | Voltage (V) | Current (A) | Power (W) |
|---|---|---|---|
| 6:00 AM | 12.15 | 1.88 | 22.84 |
| 9:00 AM | 19.86 | 2.92 | 57.99 |
| 12:00 PM | 20.42 | 3.02 | 61.67 |
| 3:00 PM | 19.57 | 2.80 | 54.80 |
| 6:00 PM | 8.36 | 1.23 | 10.28 |

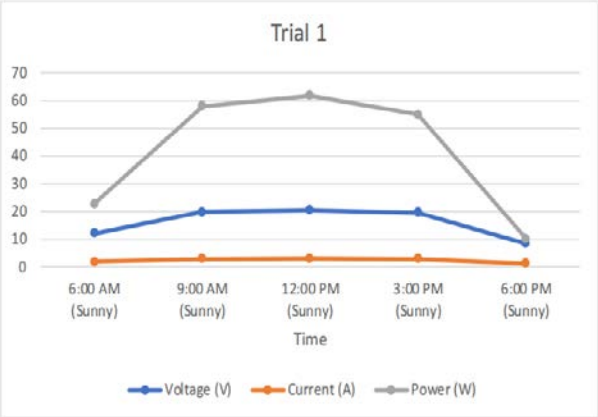


Fig. 1 Trial 1

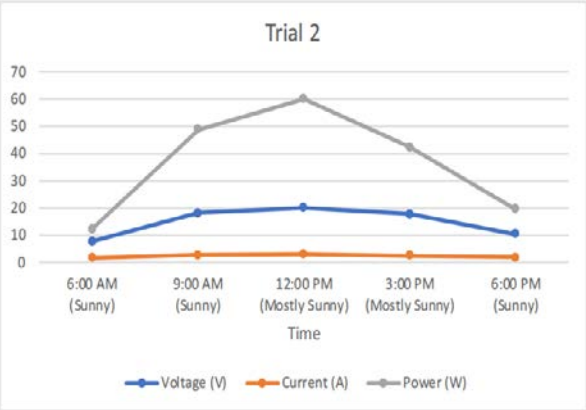


Fig. 2 Trial 2

Table 2. (Trial 2) Solar Panel Power at Different Times of Day

| Time | Voltage (V) | Current (A) | Power (W) |
|---|---|---|---|
| 6:00 AM | 7.7 | 1.6 | 12.32 |
| 9:00 AM | 18.03 | 2.71 | 48.861 |
| 12:00 PM | 20 | 3 | 60 |
| 3:00 PM | 17.6 | 2.4 | 42.24 |
| 6:00 PM | 10.3 | 1.9 | 19.57 |



Table 3. (Trial 3) Solar Panel Power at Different Times of Day

| Time | Voltage (V) | Current (A) | Power (W) |
|---|---|---|---|
| 6:00 AM | 8.1 | 1.76 | 14.256 |
| 9:00 AM | 20.8 | 2.98 | 61.984 |
| 12:00 PM | 19.2 | 2.55 | 48.96 |
| 3:00 PM | 16.8 | 2.17 | 36.456 |
| 6:00 PM | 10.2 | 1.59 | 16.218 |

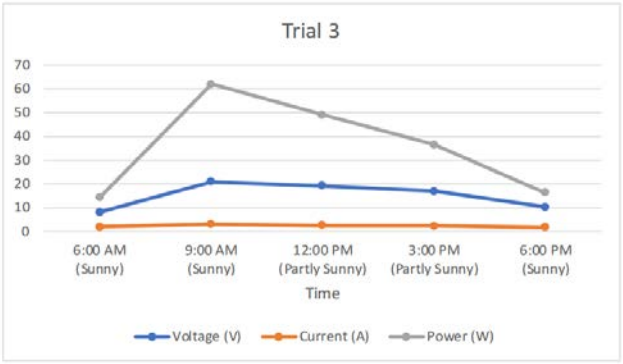


Fig. 3 Trial 3

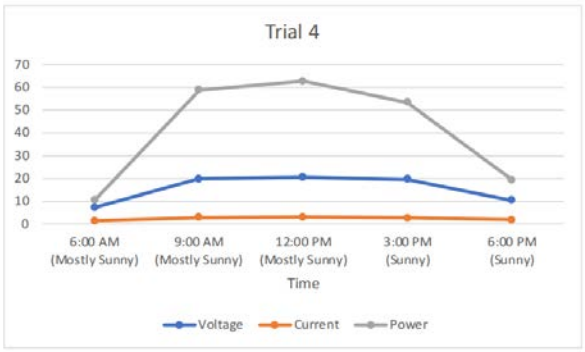


Fig. 4 Trial 4

Table 4. (Trial 4) Solar Panel Power at Different Times of Day

| Time | Voltage | Current | Power |
|---|---|---|---|
| 6:00 AM | 7.2 | 1.44 | 10.368 |
| 9:00 AM | 19.8 | 2.97 | 58.806 |
| 12:00 PM | 20.5 | 3.06 | 62.73 |
| 3:00 PM | 19.6 | 2.72 | 53.312 |
| 6:00 PM | 10.3 | 1.88 | 19.364 |



The device was built, improved, and given additional features before being tested to see how well it worked. The battery of the smartphone had a 50% charge. A 24-hour test period was used to put the device to the test. In order to draw attention to the device evaluation, the researchers tested the device in public. The researchers gave everyone who used the device access to evaluate it. The survey findings demonstrated that the device was well-made, secure, and useful.

**Conclusions**

Based on the results of the respondent's evaluations, the design and safety of the constructed device were satisfactory and acceptable; the built-in device's ability to charge cellphones and provide light was good and acceptable; and the battery's charge after 24 hours matches the amount that was predicted theoretically.

Finally, according to the investigation findings and several testing, the device functions well regardless of the weather condition. Currently, solar power systems are frequently employed to generate electricity and are the most preferred energy source for lighting because they are pollution- and environment-friendly.

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