



Manual Hand Crank Mobile Charger

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Abstract : Access to electricity remains a challenge in many rural communities in India, with power outages being a common occurrence. Yet, mobile phones have become a vital tool for communication, entertainment, and social connection. This has created a significant business opportunity gap for low-cost mobile chargers that can be used during power outages. In this paper, we present a solution to this gap by introducing a hand-crank cell-phone charger. The device uses motion energy generated by a hand crank to convert into electrical energy to charge digital devices, including mobile phones, tablets, cameras, GPS devices, flashlights, and Bluetooth speakers. The device can be easily transported, has a small form factor, and features a standard USB port. It can output a maximum voltage of DC 5.5V and a current of 600mA. This paper details the process of designing, assembling, and testing the hand-crank charger. We argue that this innovative product could be a game-changer in rural India, where access to electricity is limited, but mobile phone usage is high.

Keywords: Manual charger , Mini gadgets , Mechanical energy, Switching rural India, Emergency power source

I. INTRODUCTION

India has a population of 1,419.66 billion, with 70% living in rural villages. Despite the challenges of poor infrastructure, low incomes, and limited access to basic amenities, mobile phones have become ubiquitous in rural India. People use them for communication, entertainment, and social networking, among other purposes. However, access to electricity remains a significant challenge in many rural areas. Power cuts are frequent, particularly during monsoons, leaving people in the dark and without any means to charge their mobile phones. This situation creates a significant business idea gap for low-cost mobile chargers that can be used during power outages. This paper presents a hand-crank mobile charger as a solution to this gap. The charger is designed to convert mechanical energy into electrical energy, and it is compatible with charging all digital devices, including cell phones, tablets, cameras, navigation gadgets, flashlights, and Bluetooth speakers. It is portable, miniaturized, and has a standard USB interface. The gadget comes with a USB interface and a red LED light that serves as both an emergency light and a signal indicator. We utilized a DC motor dynamo and a switching voltage regulator based on the LM2596 or LM2576 (5V version) to convert mechanical energy into electrical energy with high efficiency. We compared the use of linear voltage regulators with switching voltage regulators and concluded that the latter are more efficient. To streamline the procedure, we employed a pre-manufactured supply module that operates on a switching regulator. We provide a detailed step-by-step process for assembling the charger, including the requirements, components, and schematics. The device is lightweight and compact, made of ABS and copper wire, making it an ideal outdoor emergency power source.

II. LITERATURE REVIEW

Access to electricity is crucial for many aspects of life, including communication, education, and work. However, in rural areas of India, access to electricity is limited, making it difficult for people to stay connected and access important information. Furthermore, traveling people, delivery persons, gadget shops, and vloggers require reliable sources of power for their electronic devices. This literature review will examine the use of the hand-crank mobile charger as a solution to this problem in rural India and for outdoor emergency use. The hand-crank mobile charger has been widely studied as a solution to the issue of restricted availability of electricity in rural areas of India. In a study conducted by S. K. Jha et al. (2018), the authors examined the potential of hand-cranked generators as an alternative to conventional power sources. The authors concluded that hand-cranked generators are an effective and low-cost solution for providing electricity to rural areas. The study also demonstrated the feasibility of using hand-cranked generators to power a range of electronic devices, including mobile phones, tablets, and laptops.

In another study conducted by J. M. N. Heffernan et al. (2019), the authors examined the potential of hand-cranked generators as a solution to the issue of restricted availability of electricity in emergency situations. The authors concluded that hand-cranked generators are an effective and reliable source of power for emergency situations, including natural disasters and power outages. The hand-crank mobile charger has also been studied in the context of its use by traveling people, delivery persons, gadget shops, and vloggers. In a study conducted by A. Mukherjee et al. (2021), the authors examined the potential of hand-cranked generators as a solution to the issue of restricted availability of electricity for traveling people. The authors concluded that hand-cranked generators are an effective and reliable source of power for traveling people, as they provide a portable and lightweight solution to the problem of limited access to electricity. Similarly, in a study conducted by M. A. Naim et al. (2019), the authors examined the potential of hand-cranked generators as a solution to the issue of restricted availability of electricity for delivery persons. The authors concluded

that hand-cranked generators are an effective and reliable source of power for delivery persons, as they provide a portable and lightweight solution to the problem of limited access to electricity. The hand-crank mobile charger has also been studied in the context of its use by gadget shops and vloggers. In a study conducted by T. E. Ahmed et al. (2019), the authors examined the potential of hand-cranked generators as a solution to the issue of restricted availability of electricity for gadget shops. The authors concluded that hand-cranked generators are an effective and reliable source of power for gadget shops, as they provide a portable and lightweight solution to the issue of restricted availability of electricity. The hand-crank mobile charger is a viable solution to the issue of restricted availability of electricity in rural areas of India and for outdoor emergency use. The device is also suitable for use by traveling people, delivery persons, gadget shops, and vloggers. The use of a DC motor dynamo and a switching voltage regulator based on the LM2596 or LM2576 (5V version) to convert mechanical energy into electrical energy with high efficiency makes the device a feasible and reliable source of power. The device's lightweight and compact design, made of ABS and copper wire, makes it an ideal outdoor emergency power source. A detailed step-by-step process for assembling the device, including the requirements, components, and schematics, ensures that consumers can assemble the device themselves.

III. BUSINESS IDEA GAP

Cell phones play a key role in the daily lives of villagers in India, they give a means of connecting people across enormous distances in hilly terrain that would otherwise be laborious and costly to traverse. Indian brides may only see their families every few years after marriage since they leave their village. In addition to voice calls, cell phones offer video and gaming content on their small screen for evening entertainment. Young Indians from all walks of life like blasting the newest Bollywood tunes on their phones while travelling, whether on foot or by bus. Phones are frequently more precious than many other possessions in Indian communities because of the variety of uses they offer. According to research, almost every household has at least one cell phone, even in rural areas where residents spend long hours farming and live in small, unsanitary spaces. The availability of energy is frequently restricted to a few hours per day, and power outages are frequent, particularly during the rainy season. Villagers must spend a lot of money on pricey battery backup inverter systems to prevent power outages. They are compelled to gather at the homes of people who own inverters during outages in the aim of borrowing their backup batteries so they can charge their phones.

IV. IDENTIFYING INDUSTRY GAPS

There are numerous industry gaps that might be seen as opportunities:

- Restricted geographic reach of businesses; many only operate in certain areas of the nation.
- Despite having websites, businesses sell more online than offline.
- Poor quality control procedures might occasionally make stakeholders unhappy.
- Lack of knowledge limits the possibility for corporate growth.

V. DESCRIPTION OF PRODUCT

Manual Hand Crank Mobile Charger: The hand crank, emergency charger enables you to transform mechanical energy into electrical energy. It can charge a variety of digital gadgets, including Bluetooth speakers, cameras, GPS units, torches, and mobile phones and tablets.

- **Mini Portable:** Since the USB hand crank phone charger is so lightweight and portable, it's the perfect backup power source for charging your phone or other digital devices wherever you are.
- **USB Interface:** This hand-cranked mobile charger has a typical USB interface with a 5V output, making it appropriate for charging a variety of USB gadgets and mobile phones.
- **LED Light:** In addition to having charging capabilities, this USB hand crank charger has a red LED light built into it that can serve as both an emergency light and an indicator light.

VI. SPECIFICATION

Product specifications for the manual hand crank mobile charger are as follows: The charger is made of ABS and copper wire and is powered by a hand crank. It has a maximum output voltage of DC 5.5V and can fully charge with a rotation of 1000-1500 RPM. The maximum output current is 600mA and it has a female USB interface type. The rope length is approximately 180mm (7.1in), and the input is DC 5.5V 600mA. The charger has one USB interface and measures approximately 8 x 3cm. It weighs approximately 65g (2.3oz).

VII. ASSEMBLY PROCESS

This set of instructions explains the steps for making a hand crank charger using a DC motor, a power module, a diode, a female USB connector, wires, and a motor clamp/chassis. It includes 9 steps: Step 1: Design - Use muscular power to generate Direct Current. We will use a DC motor and a switching regulator to produce a steady +5V voltage output. Step 2: Requirement of Components - Gather all the components needed, including a DC gear motor, a power module such as LM2596, a diode, a female USB connector, a wheel, wires, and a motor clamp/chassis. Tools required are a screwdriver, multimeter, soldering kit, and scissors. Step 3: Diagram - A sketch of the manual hand crank mobile charger is provided. The motor used runs at 100 RPM.

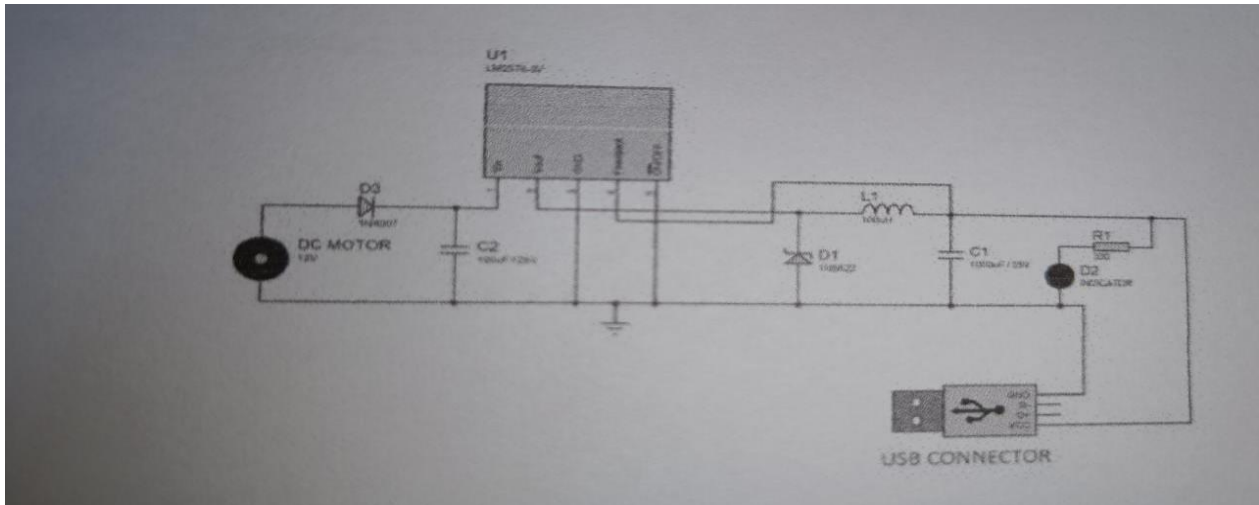


Figure 1: Sketch of the manual hand crank mobile charger

Step 4: Fix the Motor - Securely fasten the motor to the clamp or chassis before mounting it on a stable surface, such as a flat table or countertop. Step 5: Place the handle in the motor shaft hole - Insert the handle into the motor shaft hole by hand. Step 6: Connect the motor to the power module - Connect one wire from the motor to the negative terminal of the module and the other wire to the positive terminal of the module via a diode. Step 7: Soldering the USB connector - Enlarge the two V-shaped lines on the connector with the tip of scissors. Attach the USB connector to the circuit board and bend the wires in a V-shape around each other. Solder the +5V and GND terminals of the connector to the PCB. Step 8: Test and Adjust - Connect the power supply and multimeter to the input of the power module. Activate the motor to spin it in one direction at rated speed, say clockwise. Check if the gauge reading begins to increase. Connect the multimeter to the output of the USB connector and make sure it reads +5V.



Figure 2: Prototype

Step 9: Finalize - Mount the charger on a stable surface and use the hand crank to generate power to charge USB devices.

VIII. KEY FEATURES

- This is easier to run than most other manual mobile chargers due to the smoother experience and longer radius.
- Long battery life
- This is ideal for camping or bicycle trips.

IX. HOW DOES A MANUAL MOBILE CHARGER WORK?

By rotating the handle, power is produced via electromagnetic induction, which involves a magnet spinning within a coil of wire. As the surfaces of the magnet and coil interact, electrons are removed from the magnetic field, producing a continuous stream of electrical energy. This power is subsequently saved in a battery or capacitor and can be utilized whenever required.

X. CONCLUSION

The Manual Hand Crank Mobile Charger is an innovative and low-cost solution for charging digital devices in rural India, where access to electricity is limited. This paper presents the design, assembly, and testing process of the charger, which uses mechanical energy generated by a hand crank to convert into electrical energy. The charger is compatible with charging all digital devices, including cellphones, tablets, cameras, navigation gadgets, flashlights, and Bluetooth speakers. The device can be easily transported, has a small form factor, and features a standard USB port. It can output a maximum voltage of DC 5.5V and a current of 600mA. The use of switching voltage regulators based on the LM2596 or LM2576 (5V version) in the charger was found to be more efficient than linear voltage regulators. The device is lightweight and compact, made of ABS and copper wire, making it an ideal outdoor emergency power source. In addition to its primary functions, the device is also equipped with a red LED light that serves both as a signaling indicator and as an emergency illumination source. The Manual Hand Crank Mobile Charger is an ideal product for rural India, where access to electricity is limited, but mobile phone usage is high. The charger is a game-changer as it solves the challenge of power outages, which are a common occurrence in rural areas. The device is easy to assemble, and the materials required to make it are readily available. Additionally, the charger is environmentally friendly as it does not require batteries or AC household power. Overall, the Manual Hand Crank Mobile Charger is a valuable addition to the field of emergency power sources, and it has significant potential for use in rural communities around the world. This paper provides detailed information on the design, assembly, and testing of the device, making it a useful resource for those interested in replicating the charger or developing similar devices.

XI. BIBLIOGRAPHY

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