Asian Journal of Electrical Sciences
ISSN: 2249-6297 (P); 2583-7923 (E)
Vol.13 No.1, 2024, pp.46-51

www.crijournals.org
DOI: https://doi.org/10.70112/ajes-2024.13.1.4240

Innovative Development of a Portable Medical Mechanical Mobile Charger: Converting Mechanical Energy via Acupressure for Off-Grid Applications

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(Received 6 March 2024; Revised 12 April 2024; Accepted 22 April 2024; Available online 25 April 2024)

Abstract - **This study introduces a Medical Mechanical Mobile Charger, a device designed to convert mechanical energy into electrical energy using an acupressure handle and a DC motor. The primary objective is to create a portable and versatile charging solution that operates independently of traditional power sources, addressing the need for off-grid charging capabilities. The system comprises an acupressure handle connected to a DC motor, which generates electrical energy regulated through a charging circuit, ultimately delivered via a USB port to charge mobile devices. By incorporating acupressure, the charger not only facilitates energy generation but also offers potential therapeutic benefits, supporting wellness alongside practical functionality. Experimental results demonstrate the charger's capacity to consistently provide a 5V output, effectively meeting standard mobile charging requirements. This innovation is particularly valuable for remote settings and emergency scenarios, combining convenience with health benefits.**
Keywords: **Medical Mechanical Mobile Charger, Mechanical Energy, DC Motor, Off-Grid Charging, Acupressure**

I. INTRODUCTION

Mobile chargers have long been essential tools for keeping devices powered, and to ensure optimal performance, it is important to use high-quality components along with a reliable power source for charging. The mobile chargers available in the market can cause overheating or electrocution, and their inappropriate construction may lead to fire hazards. To charge a phone with an electrical charger, a socket is also needed, which is not available in all locations. Another drawback of electrical chargers is the safety risk associated with leaving cell phone chargers plugged into an outlet, as they continue to draw electricity. A short circuit in the wiring could potentially lead to a fire hazard. Similarly, in the case of power banks available in the market, the battery gets drained if there is overcharging, which reduces the overall battery life of the mobile phone. Most power banks are bulky, and high-quality power banks and mobile chargers are often not available at low costs.

With the invention of the medical mechanical mobile charger, there is no need for a socket. It can simply charge a mobile phone by using mechanical energy without causing any fire hazards, and it does not harm the battery life of the mobile phone. Furthermore, users do not need to leave their mobile phones charging for several hours; using this system allows for instant charging according to their needs. Additionally, the various chargers available do not provide any medical benefits to the user while charging the mobile phone. The invention of a medical mechanical mobile charger not only charges mobile phones but also provides several medical benefits and addresses different health issues for users [1], [2].

According to a reiteration of earlier orders from the railway board, a policy has been implemented prohibiting passengers from using mobile charging stations on trains between 11 p.m. and 5 a.m. as a precautionary measure to reduce the risk of fire. The mechanical chargers available on the market do not provide medical benefits. This invention is beneficial for elderly individuals and health-conscious persons, and it is particularly useful in emergencies in villages and remote areas. It is ecological, economical, efficient, user-friendly, and beneficial for both body and mind. This invention falls under the categories of innovation, emerging technology, and cost-effectiveness. The human body contains many acupressure points, and stimulating these points can positively affect various regions, potentially enhancing overall well-being [3], [4].

A. Objectives of the Study

The main objective of the present invention is to offer a medical charging system that addresses the limitations of existing devices. A secondary goal is to create a system that delivers health benefits by stimulating acupressure points. Additionally, the invention aims to provide a system that operates efficiently in various settings, ensuring timely functionality along with its therapeutic advantages.

II. MATERIALS AND METHOD

A. Comprehensive Overview of the System Design

The primary aim of this invention, which will be further detailed below, is to introduce a medical mechanical mobile

charger that offers numerous advantages and unique features. This innovative charging system presents capabilities that are neither anticipated nor suggested by any existing medical mechanical mobile charging systems known in the prior art, either alone or in any combination thereof.

In this system, the medical mechanical mobile charger comprises a USB charging circuit constructed using a small general-purpose PCB board, a 12 RPM center shaft DC geared motor, a 7805 voltage regulator IC, 100 µF and 1000 µF capacitors, a female USB port and cable, and an acupressure handle. The 1000 µF capacitor is connected to the output, while the 100 µF capacitor is connected to the input pin of the 7805 IC, followed by establishing ground connections.

A female USB port is utilized to facilitate the supply of current to the mobile phone from the circuit. According to the pin configuration of the USB port, only pin 1 and pin 4 are used: pin 1 is Vcc, and pin 4 is GND. The USB port is then inserted into the PCB board and linked to the output of the voltage regulator model 7805.

According to the circuit diagram, the wires of the DC motor are connected as input to the charging circuit, enabling the DC motor to convert mechanical power into electrical energy. By connecting the mobile phone to the USB port and rotating the motor shaft using the acupressure handle, the mobile phone begins to charge through the medical mechanical mobile charger system [5], [6], [7].

B. Detailed System Functionality and Mechanism

The system involves a 12 RPM center shaft DC geared motor to generate electricity, which serves as input to the charging circuit. The motor consists of a fixed horseshoe magnet, known as the stator, and a rotating coil of wire called the armature or rotor. A direct current geared motor operates using a magnetic field created by the electrical currents generated, which drives the rotation of a rotor attached to the output shaft. The primary role of the DC geared motor is to rotate the target shaft at a slower RPM than the motor itself. This reduction in RPM enables the DC motor to deliver greater torque to the shaft, facilitating its rotation.

When the DC motor shaft is rotated at a uniform speed using the acupressure handle, direct current is produced and passes into the 7805 voltage regulator IC, which provides a regulated +5 volts power supply. The 1000 µF capacitor is connected to the input of the 7805 IC, while the 100 µF capacitor is linked to the output of the 7805 voltage regulator IC according to the schematic. This configuration reduces the fluctuating or pulsating input voltage. The input capacitor minimizes the impedance of the power supply as perceived by the regulator IC, as a capacitor has lower impedance at higher frequencies. Pin 1 of the female USB port is connected to the output of the 7805 voltage regulator IC, and pin 4 is connected to the ground for the power supply. In this manner, the electricity generated is supplied to the female USB port, which is further supplied to the mobile phone, initiating the charging process [8], [9], [10].

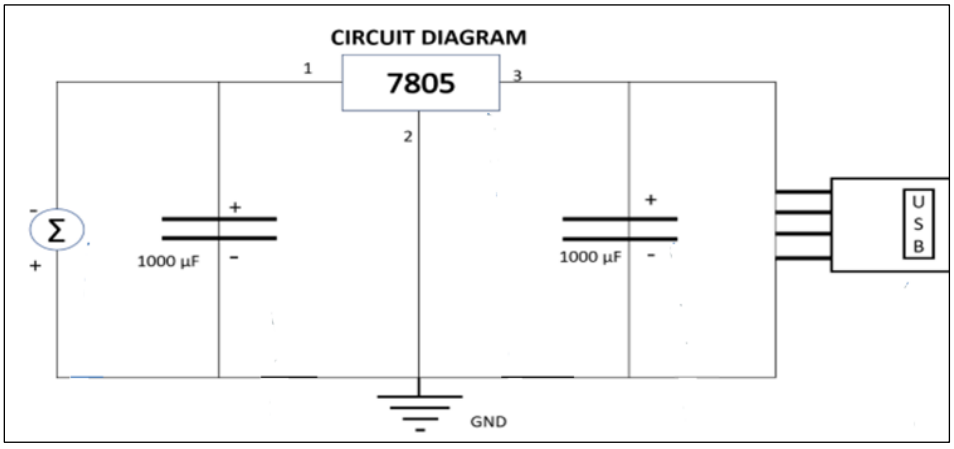

Fig. 1 Circuit diagram

1. Voltage Regulator Model 7805 IC

The 7805 voltage regulator IC ensures a stable output of 5 V across a wide range of input voltages. It provides robust protection against fluctuations in input voltage, thereby enhancing the safety and reliability of electronic circuits. The 7805 is part of the 78xx series of fixed linear voltage regulators, with the 'xx' indicating the specific output voltage supplied by the regulator. The 7805 integrated circuit operates within an input voltage range of 7 V to 35 V and has a current rating of 1 A. It provides an output voltage that varies from a minimum of 4.8 V to a maximum of 5.2 V.

2. Capacitors

A capacitor is an electronic component that accumulates and releases electrical energy within a circuit. In electronic systems, capacitors are utilized to stabilize and smooth the fluctuating direct current (DC) output or to convert varying DC into stable DC. By placing a capacitor in parallel, the amplitude of these pulses can be significantly reduced, resulting in a DC output with minimal ripple, known as ripple voltage. Specifically, capacitors used for filtering purposes, often referred to as filter capacitors, are designed to eliminate signals of certain frequencies from a circuit. Typically, these

capacitors are effective at filtering out low-frequency signals, which are close to 0 Hz and are often categorized as DC signals.

3. Female USB Port

The USB port serves to provide electrical power to devices lacking their own power sources, such as mobile phones. The female USB port, typically referred to as the host connector, is commonly found on computers, hubs, and other devices designed to accommodate peripheral connections. In the context of power supply, only two of the four pins in a USB port are utilized: Pin 1 and Pin 4, which are responsible for carrying electrical current. Pins 2 and 3 are designated for data transfer and are not used in this particular application. To charge a mobile phone, a USB cable connects the female USB port to the phone, facilitating the transfer of electrical energy [11], [12], [13].

4. Acupressure Handle

Acupressure points are considered highly sensitive areas within the human body. The primary purpose of the acupressure handle is to facilitate the flow of qi (life energy) through the 14 channels, known as meridians, within the body. This technique involves a specialized form of massage that primarily utilizes the thumbs, fingers, and palms to exert pressure on specific points. Acupressure enhances immune system function and supports the body's inherent healing processes. In this innovation, the acupressure handle is used to rotate the motor shaft to produce mechanical energy while also promoting energy flow in the body by applying pressure to the acupressure points in the hand [14], [15].

D. Functions and Locations of Acupressure Points

Since the acupressure handle is used to rotate a DC motor, it offers several medical benefits, which are as follows.

1. *Lung Meridian:* This pathway runs from the tip of the thumb down to just beyond the wrist crease on the palm side. Reflexologists believe that massaging any sensitive areas along this meridian can help alleviate symptoms of colds, including sneezing, chills, and a sore throat.
2. *Heart 7 Point:* Situated on the wrist, just outside a small bone aligned with the little finger, this point is commonly known as the "Spirit Gate." Applying pressure here may aid in managing insomnia, anxiety, depression, and heart-related concerns.
3. *Hand Valley Point:* Located between the thumb and index finger, pressing this area can help reduce stress and alleviate migraines, as well as pain in the shoulders, teeth, and neck.
4. *Small Intestine 3:* This point is found on the side of the hand, just below the little finger and above a prominent crease. Applying firm pressure to this spot may provide relief from earaches, headaches, and neck pain.
5. *Ten Dispersions:* These ten pressure points are located at the tips of each finger. Stimulating these areas through pressure or acupuncture may help relieve common flu symptoms, such as high fever and sore throat, and can also aid in treating conditions like coma or epilepsy.
6. *Four Seams:* Found on the inner side of the large joints of the index, middle, ring, and little fingers, stimulating these points may help address digestive issues, particularly in children [16],[17],[18],[19].

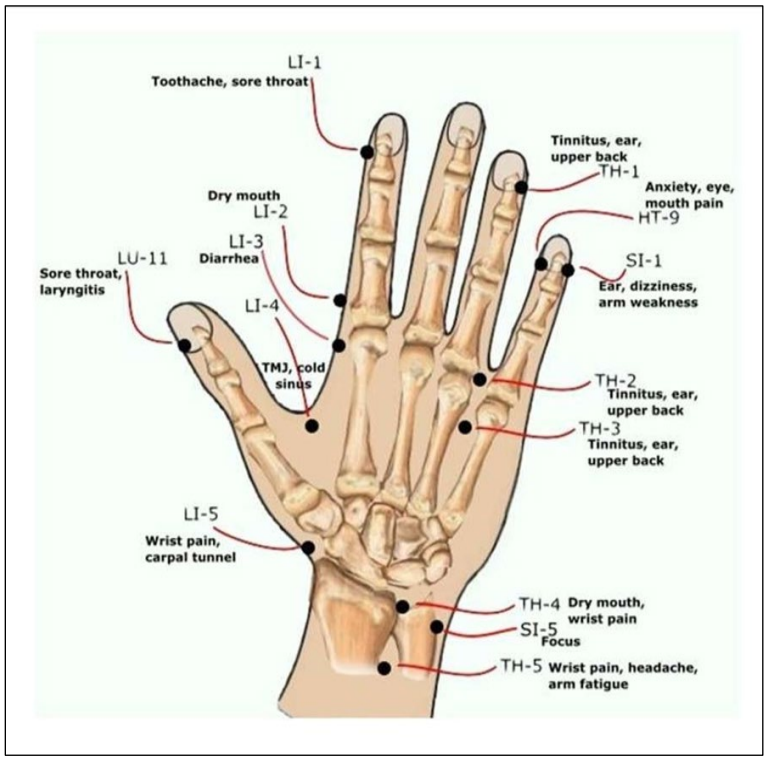

Fig. 2 Location of acupressure points in the right hand

Fig. 3 Location of acupressure points in the left hand

III. RESULTS AND DISCUSSION

The medical mechanical mobile charger was rigorously tested to assess its capability to convert mechanical energy into electrical energy and effectively charge a mobile phone. The central mechanism of this device is an innovative combination of an acupressure handle and a DC motor, which together harness mechanical energy from manual operation and convert it into usable electrical output.

During testing, the rotation of the acupressure handle, equipped with an uneven surface and strategically placed protrusions, played a dual role. First, it served as the primary source of mechanical energy. The handle's design not only made it ergonomic and easy to rotate but also ensured that the energy input was consistent and sufficient for conversion. Second, the acupressure design provided added health benefits, potentially aiding in the alleviation of conditions such as stress, fatigue, and muscular tension through the principles of acupressure therapy. The mechanical energy generated by the handle's rotation was transmitted to an RPM 12 center shaft DC geared motor, which demonstrated high efficiency in converting the input mechanical energy into electrical energy. The generated electrical energy was then passed through a 7805 voltage regulator IC, which played a critical role in stabilizing the output. This regulator ensures that the electrical energy supplied to the mobile phone is at a constant voltage of 5V, which is the standard requirement for mobile charging [20], [21].

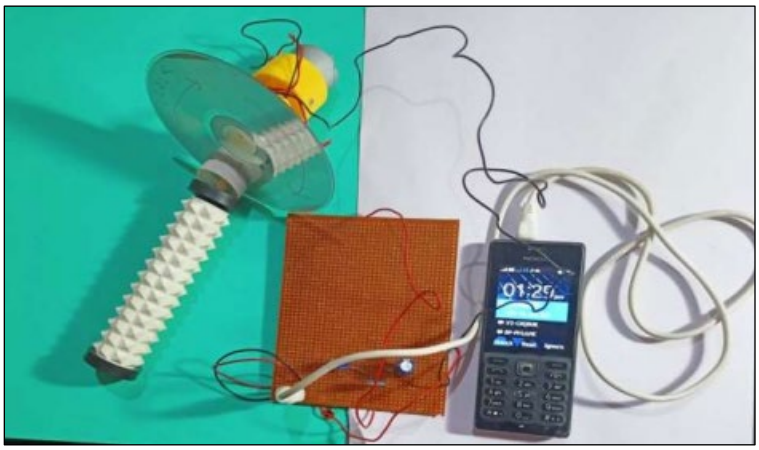

Fig. 4 Hardware Implementation of Medical Mechanical Mobile Charger

Furthermore, the effectiveness of the energy conversion process was carefully analyzed. The RPM 12 DC motor, known for its reliability and consistency, maintained a steady output even when the mechanical input varied slightly due to differences in the speed and force of handle rotation. This consistency is crucial for real-world applications, where users may not maintain a perfectly uniform rotation speed. In addition to its functional benefits, the device's design underscores the importance of integrating therapeutic elements into everyday tools, thus promoting health and well-being while serving a practical purpose. The combination of mechanical energy conversion and acupressure therapy within a single device represents a novel approach that could inspire further innovation in the development of multifunctional medical and mechanical devices.

Overall, the results indicate that the medical mechanical mobile charger is not only effective in converting mechanical energy into electrical energy but also provides ancillary health benefits, making it a unique and potentially valuable tool for both medical and practical applications. Future research could explore optimizing the design further to enhance energy conversion efficiency and expand the therapeutic benefits of the acupressure handle [22], [24].

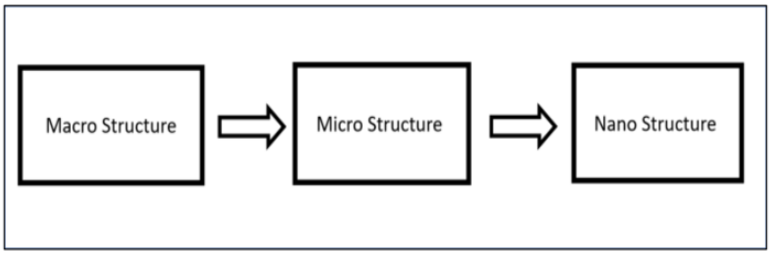

Fig. 5 Block diagram illustrating the future structural designs of mobile chargers

IV. CONCLUSION

The medical mechanical mobile charger presents a novel and practical solution for mobile phone charging, especially in environments where traditional power sources are inaccessible. By ingeniously integrating an acupressure handle, the device not only converts mechanical energy into electrical energy but also provides added health benefits through acupressure therapy. This dual functionality sets it apart from conventional chargers, offering users a unique combination of technology and wellness. The device successfully delivers a consistent 5V output, making it compatible with standard mobile phones and ensuring user safety through built-in protective measures. The findings of this study demonstrate the practicality and effectiveness of the charger, positioning it as a viable alternative in scenarios ranging from emergency situations to off-grid living. Future iterations of the device could benefit from further refinement, particularly in enhancing energy conversion efficiency and optimizing user ergonomics. Such improvements could broaden its applicability and increase user adoption, making it an even more valuable tool. This research demonstrates the potential of merging mechanical energy generation with therapeutic features, paving the way for future innovations that serve both technological and health-related needs [25], [26].

PATENTS

Kirti Yadav, Mahima Yadav, Anshul Agarwal, Medical Mechanical Mobile Charger, Indian Patent, 540483, 31 May 2024.

REFERENCES

[1] F. Cucchietti *et al.,* "Environmental benefits of a universal mobile charger and energy-aware survey on current products," *2011 IEEE 33rd International Telecommunications Energy Conference (INTELEC)*, Amsterdam, Netherlands, 2011, pp. 1-9, doi: 10.1109/INTLEC.2011.6099888.

[2] S. Gaur, "A research paper on wireless charging," *Journal of Emerging Technologies and Innovative Research*, vol. 6, no. 5, May 2019.

[3] F. He, "The effectiveness of acupressure on relieving pain: a systematic review," *J. Phys.: Conf. Ser.*, vol. 1952, no. 032037, 2021.

[4] J. S. Jeyanathan, G. Vinathi, K. Archana, M. Maheswari, and I. Divya Bharathi, "Smart wireless mobile charger," *International Journal of Creative Research Thoughts*, vol. 9, no. 2, Feb. 2021, ISSN: 2320-2882.

[5] I. J. Louis Paul, S. Sasirekha, D. N. Kumar, and P. S. Revanth, "A working model for mobile charging using wireless power transmission," *International Journal of Engineering & Technology*, vol. 7, no. 3.12, pp. 584-588, 2018.

[6] A. Jayawant and S. Zope, "A review paper on wireless charging of mobile phones," *International Journal of Engineering Research & Technology (IJERT)*, ICONET – 2014, vol. 2, no. 04, 2014.

[7] M. B. Reddy and M. Annadevi, "Wireless mobile charger," *International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)*, vol. 4, no. 12, Dec. 2017.

[8] R. Vishnoi, "A research paper on wireless charging techniques," *International Journal of Emerging Technologies and Innovative Research*, vol. 6, no. 1, pp. 340-345, Jan. 2019.

[9] L. Linqiang, W. Dahu, Z. Tong, and H. Mingke, "A manual mobile phone charger," *2010 International Conference on Electrical and Control Engineering*, Wuhan, China, 2010, pp. 79-82, doi: 10.1109/iCECE.2010.28.

[10] X. Lu, D. Niyato, P. Wang, D. I. Kim, and Z. Han, "Wireless charger networking for mobile devices: fundamentals, standards, and applications," *IEEE Wireless Communications*, vol. 22, no. 2, pp. 126-135, Apr. 2015.

[11] L. Olvitz, D. Vinko, and T. Svedek, "Wireless power transfer for mobile phone charging device," *Proc. 35th IEEE International Convention MIPRO*, pp. 141-145, May 2012.

[12] C. K. On and T. Tsang, "An experiment method of wireless power transfer for charging devices," *American Journal of Engineering Research (AJER)*, vol. 5, no. 11, pp. 110-123, 2016.

[13] H. Pandey, I. Khan, and A. Gupta, "Walking-based wearable mobile phone charger and lightning system," in *International Conference on Medical Imaging, m-Health and Emerging Communication Systems (MedCom 2014)*, doi: 10.13140/2.1.5058.6409.

[14] P. E. Harris, "Acupressure: a review of the literature," *Complementary Therapies in Medicine*, vol. 5, no. 3, pp. 156-161, 1997.

[15] P. Mehta, V. Dhapte, S. Kadam, and V. Dhapte, "Contemporary acupressure therapy: Adroit cure for painless recovery of therapeutic

ailments," *J. Tradit. Complement. Med.*, vol. 7, no. 2, pp. 251-263, Jul. 22, 2016, doi: 10.1016/j.jtcme.2016.06.004.

[16] M. Munde, V. Kerkar, O. Karande, K. Kolhe, and S. Pansare, "Design and implementation of acupressure therapy using pancake vibrators to trigger palm points," *Proceedings of Academics World 44th International Conference*, Bangkok, Thailand, Sep. 2016.

[17] Y. W. Chen and H. H. Wang, "The effectiveness of acupressure on relieving pain: a systematic review," *Pain Manag. Nurs.*, vol. 15, no. 2, pp. 539-550, Jun. 2014, doi: 10.1016/j.pmn.2012.12.005.

[18] Healthline, "8 pressure points on your hands," [Online]. Available: https://www.healthline.com/health/hand-pressure-points. [Accessed: 4-Oct-2024].

[19] J. Fletcher, "Hand pressure points," *Medical News Today*, 13-Mar-2019. [Online]. Available: https://www.medicalnewstoday.com/articles/324699. [Accessed: 4-Oct-2024].

[20] N. Saravanan, S. Preethi, R. Ramya, S. Sivaranjani, and N. Kanniyappan, "Universal wireless charger," *International Research Journal of Engineering and Technology*, vol. 3, no. 3, Mar. 2016.

[21] O. Singh, "Wireless mobile charger," *International Journal of Electronics, Electrical and Computational System*, vol. 5, no. 6, Jun. 2016.

[22] S. Das, "Wireless power transmission for charging mobile devices," *International Journal of Engineering and Computer Science*, vol. 6, no. 3, Mar. 2017.

[23] N. Krishna and P. S. Uma Priyadarsini, "Wireless power transmission," *Int. J. Pharm. Technol.*, 2016, doi: 10.9790/1676-09320105.

[24] E. Waffenschmidt, "Wireless power for mobile devices," *2011 IEEE 33rd International Telecommunications Energy Conference (INTELEC)*, Amsterdam, 9-13 October 2011, pp. 1-9. [Online]. Available: http://dx.doi.org/10.1109/intlec.2011.6099840.

[25] P. Y. Lee, H. W. Lim, and T. W. Lim, "Study on wireless charging technology for mobile devices," *Asian Journal of Electrical Sciences*, vol. 4, no. 1, pp. 10-15, 2020, doi: 10.18034/ajes.v4i1.213.

[26] H. B. Lee, "Development of an efficient wireless charging system for mobile devices," *Asian Journal of Electrical Sciences*, vol. 5, no. 1, pp. 25-30, 2021, doi: 10.18034/ajes.v5i1.289.