KEMENTERIAN PENGAJIAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

POLITEKNIK MALAYSIA
TUANKU SYED SIRAJUDDIN

National Conference on TVET for Undergraduate Students

e-Proceedings NCTS 2022

NATIONAL CONFERENCE ON TVET FOR UNDERGRADUATE STUDENTS

E-PROSIDING
NATIONAL CONFERENCE
ON TVET UNDERGRADUATE STUDENTS
2022

This book contains information submitted by the author based on his knowledge, experience and expertise in the field of teaching cost accounting. In addition, this book also contains some information obtained from other parties whose original source is stated through reference.

However, since this book only covers topics related to element costs then readers are encouraged to refer to the contents of other related books to gain a detailed understanding in cost accounting.

Published by:
Politeknik Tuanku Syed Sirajudddin (PTSS)
Pauh Putra, 02600 Arau, Perlis
Tel No. : 04-988 6200
Fax No. : 04-988 6300
www.ptss.edu.my

e ISBN 978-967-2258-97-1

9 7 8 9 6 7 2 2 5 8 9 7 1

e-Proceedings NCTS 2022

DEVELOPMENT ON PORTABLE LUMBAR SUPPORTER WITH ELECTRONIC MOTOR MASSAGER FOR LOW-BACK PAIN RELIEVER

N.B.R. BASO[1], W.R.W. Omar[2],
Electronic Engineering Technology (Medical Electronic),
Department of Electrical Engineering, Politeknik Sultan Salahuddin Abdul Aziz Shah, Malaysia.
balqisraihana.baso@gmail.com [1],
rosemehah@psa.edu.my [2]

ABSTRACT

L1 through L5 are lumbar vertebrae between the chest and sacrum. Large lower back muscles move the trunk. Overworked or spasming muscles might cause lower back pain. According to observations and research, prolonged sitting in an unergonomic workstation causes low-back pain. This project's objectives are as follows. Develop a portable lumbar supporter with an electronic motor massager to relieve lumbar pain from non-ergonomic seating. The 'Blynk' app on a smartphone able to manage the massager's speed and usage time. The produced product is validated by following the standard operating procedure of the product's operation conducted on a subject. Future enhancements to the product's usability have been recommended based on the findings of this study.

Keywords: - Low-Back Pain, non-ergonomic workstation, lumbar supporter, electronic motor massager

1. INTRODUCTION

Lumbar discomfort, also referred to as low back pain, is a significant and ongoing problem in today's culture due to its impact on people's health. The condition is considered an epidemic because it has a high prevalence and spreads quickly across the world, particularly during the pandemic era when professional individuals were forced to perform their task at home without any preparation of setting up a proper working environment(Kamaludin et al., 2020). The most prevalent causes of lumbar discomfort in the home include restricted movement, lengthy periods of sitting, and workplace conditions that are not ergonomically appropriate(Jung et al., 2021). Accordingly, studies have shown that with the appropriate application of non-invasive joint lumbar support massage treatment, it is possible to reduce the intensity of lumbar pain(Mohammad Yusof et al., 2021).

A lumbar supporter, also known as a lumbar orthosis, is a device that, according to the suggestions made by medical professionals, is intended to alleviate some of the pressure that is exerted on the spinal structures by unloading some of the weight that is typically carried by the lower back(Grondin et al., 2013) .This piece of equipment helps to keep the lower back in the best possible posture while working in a sitting position, which is especially helpful in a workplace that is not designed to be ergonomically friendly. As a result, the amount of strain that can be caused by working in this position is reduced(Schott et al., 2018).

A back that is in discomfort can benefit tremendously from using an electric back massager that does not involve any sort of invasive procedure(Gasibat & Suwehli, 2017). The greatest level of pain relief can be attained by using a massager that is adapted to the user's way of life and has motions that are targeted especially at the painful places. The device achieves its purpose by stimulating an increase in blood flow to the skin and muscles via a massaging action that is generated by a motor that is coupled to a device that performs the massaging action(Zheng et al., 2012). This assists in relieving discomfort and stiffness in the area of the low back.

Therefore, the research on product development was put to good use there, serving its own aims. In the first place, the development of a portable hybrid gadget that relieves low back pain by combining a lumbar supporter and a lumbar massager into one product. The second objective is to design and build an electronic motor lumbar massager that can be controlled by the user's smartphone through an internet of things application called blynk. Last but not least, for the purpose of analysis, to analyze variations in motor speed by simulating Pulse Width Modulation (PWM), and to evaluate the device's efficiency in speed rate based on the amount of time spent utilizing the newly developed device

2. METHODOLOGY

This chapter expressed in details the development of a product based on first and second objectives that is aimed at providing a spinal support system as well as reducing the load of spinal pain through the use of a non-invasive massage that can be controlled

remotely using user's smartphone. Then, the developed device is tested via simulation test and evaluation method on the speed's pace.

Figure 1 displays the initial design of a Lumbar Supporter with an Integrated Massager that is intended for professionals and students who are forced to sit for extended periods of time due to the nature of their employment, which might result in low back pain (LBP). Even if the user is sat in a non-ergonomic place, each component of this device will contribute to their enjoyment and comfort while executing their task. The device has the ability to perform two distinct functions when in operation. The first function is that of a Lumbar Supporter, which entails maintaining a straight spine in order to rectify body posture. The second objective is to reduce lumbar pain by decreasing pressure on the lumbar region. During this process, the lumbar region is massaged in an effort to ease lower back discomfort (LBP) that can be controlled using user's smartphone via blynk application.

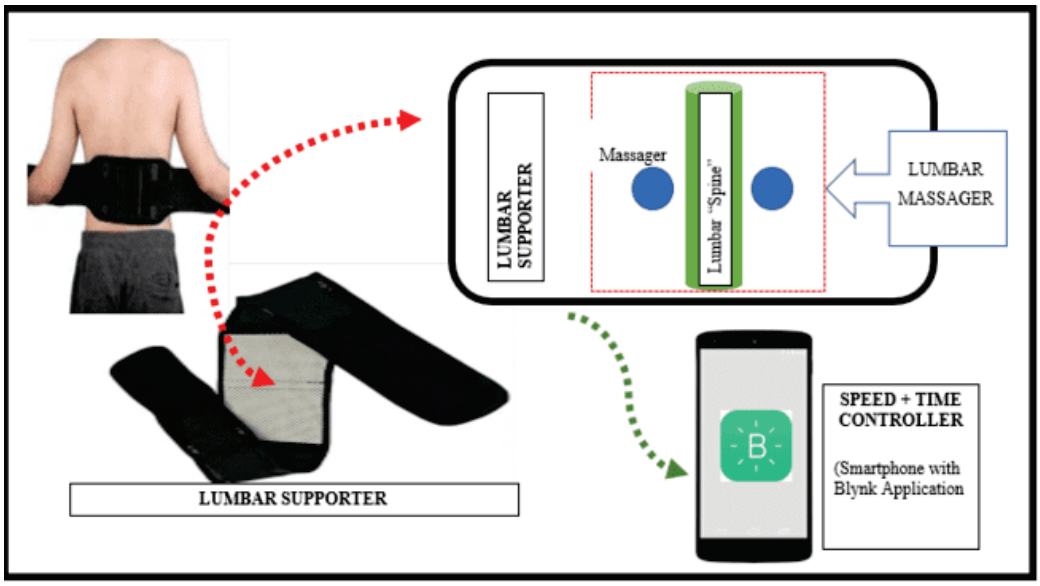

Figure 22 Initial Design of the Portable Lumbar Supporter with Massager

A 3D design of the product was drawn by using tinkercad based on different angle to enhance and realizing the idea of this project from different angle. Figure 2 is the top view of the product which consist of two motor massager and implemented in the lumbar

belt/orthoses. Meanwhile, Figure 3 shows the back view of the product that is attached together with the control system of the massager with power supply.

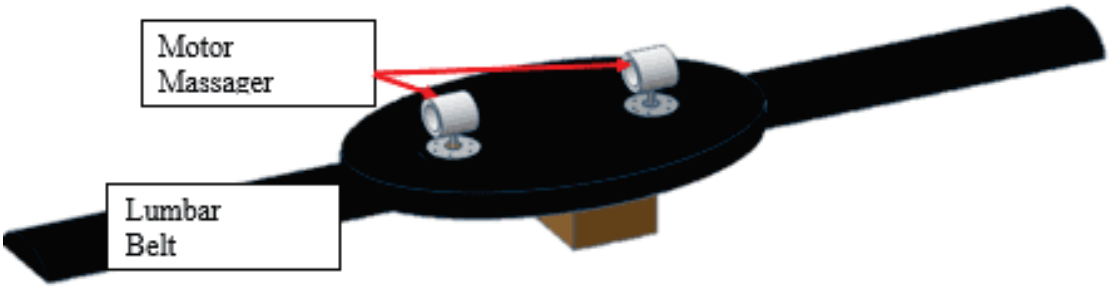

Figure 23 Top view of product

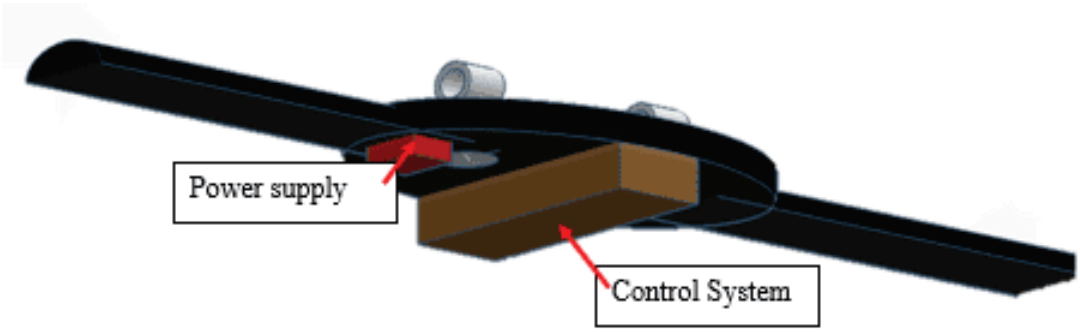

Figure 24 Back View of product

3. RESULT AND DISCUSSION

In this section, the results of developed product Portable Lumbar Supporter with Electronic motor massager are explained in details on based on the hardware implementation, interface of the blynk application and standard operating procedure in using the product.

Developed Portable Lumbar Supporter with Electronic Motor Massager

Products from this project have been successfully developed as shown in Figure 4 and Figure 5. The lumbar belt-style massager is worn around the lower back and provides a comfy massaging sense.

Figure 25: Developed product at top view angle

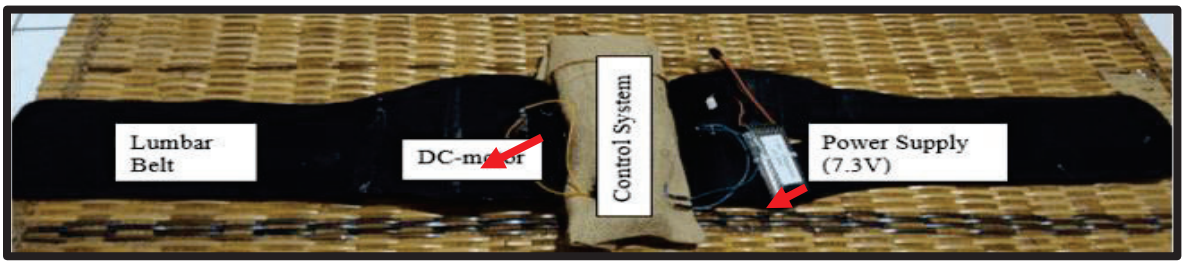

Figure 26: Developed product at back view angle

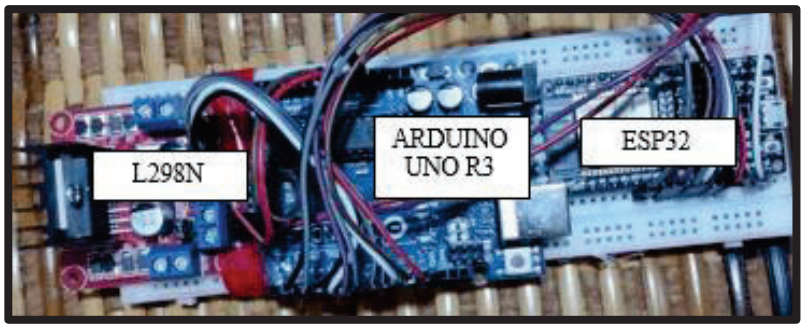

Figure 6: Control system for messaging device

As been shown in the Figure 6 below, massager electronic components (control system), the Arduino Uno R3 microcontroller and the Motor Driver (L298), which controls two DC motors, are powered by a 7.3-volt power source (installed together in control system). Activating the sequence rollers on each DC motor causes a shiatsu-like movement in the motor. The device itself can be controlled from user's smartphone via blynk application Figure 7 by creating communication from ESP 32.

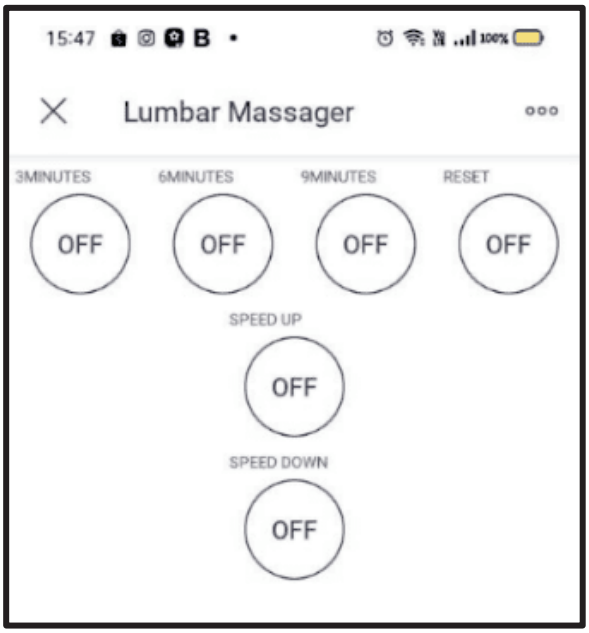

Figure 7: Blynk's Interface Control Panel for Massaging Device

The purpose of each button displayed in the Blynk application's interface for the massaging device is outlined in Table 1.

Table 1: Blynk application's button functions for massaging device

Button	Function
3MINUTES	Massaging device switch ON and operates for 3 minutes straight
6MINUTES	Massaging device switch ON and operates for 6 minutes straight

9MINUTES	Massaging device switch ON and operates for 9 minutes straight
RESET	Switch OFF massaging device
SPEED UP	Increase level of massaging speed till maximum (Option: 250Hz and 255Hz)
SPEED DOWN	Decrease level massaging till minimum (Option: 250Hz and 200Hz)

3.1. Evaluation of the product's usability by adhering to the product's standard operating procedure

This section fully described the standard operating procedures (SOP) (Figure 12) for sequentially employing the Portable Lumbar Supporter and the Lumbar Massager. When the user has been sat for a lengthy amount of time in a non-ergonomic setting (Figure 10) and begins to experience lumbar discomfort, which can be a precursor to lower back pain (LBP), the user should begin utilizing the device (Figure 11). Consequently, it is advised that the user wear the lumbar supporter to offer support for the low back region. In addition, the supporter can assist the user in altering their body posture, which can help relieve pain, especially in the back. As soon as the user noticed lumbar discomfort, they were urged to instantly turn on the lumbar massager. The discomfort in the targeted area will be reduced by the massager, which uses DC motors to provide a shiatsu motion. The massager focuses on the quadratus lumborum muscle, a lumbar area muscle. While utilizing the massager, the user has complete control over the strength of the massaging. The user of the 'blynk' program on a smartphone can adjust the speed rate to 200Hz (the lowest), 250Hz (the moderate), or 255Hz (the highest), as well as the time duration to 3, 6, or 9 minutes. These settings rely on the preferences of the user. When the user's discomfort has been reduced, the device may be withdrawn from the body, or the user may continue to use it as a posture supporter, especially for the lumbar region

Figure 10: Subject (1) before wearing Lumbar Supporter and Massager

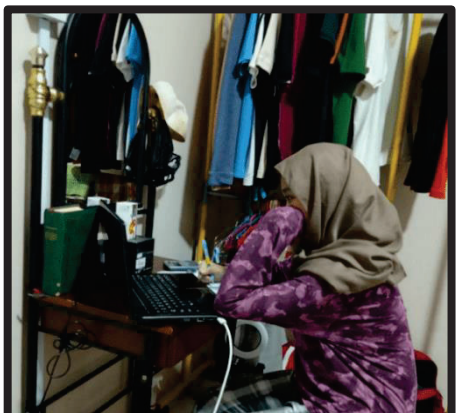

Figure 11: Subject (1) while wearing Lumbar Supporter and Massager

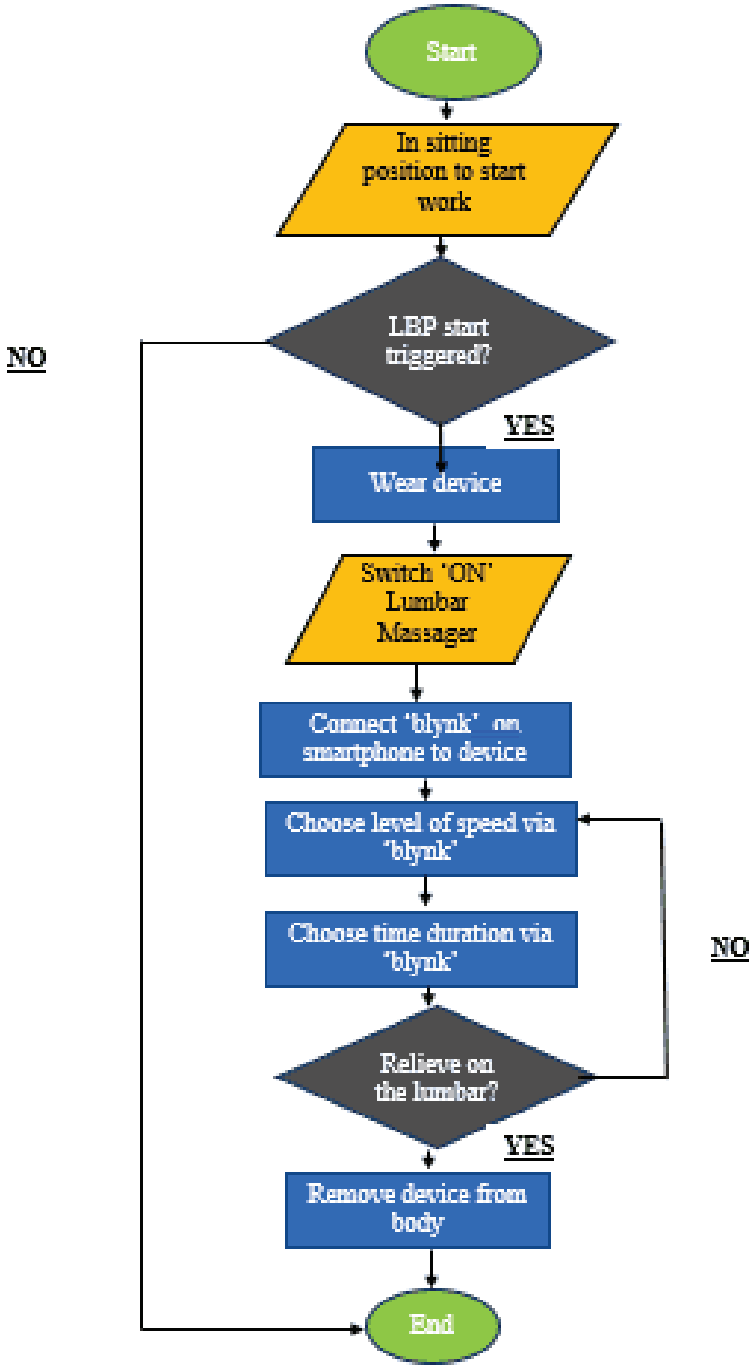
Start
In sitting position to start work
LBP start triggered?
NO
YES
Wear device
Switch 'ON' Lumbar Massager
Connect 'blynk' on smartphone to device
Choose level of speed via 'blynk'
Choose time duration via 'blynk'
Relieve on the lumbar?
NO
YES
Remove device from body
End

Figure 12 SOP's Portable Lumbar Supporter with

Electronic Motor Massager with Blynk Usage

4. CONCLUSION

These studies had two distinct purposes that were successfully achieved. First, the development of portable lumbar supporter with electronic motor massager is achieved with a control system that can be controlled remotely by using user's smartphone via blynk application. It was shown that frequencies of 200Hz, 250Hz, and 255Hz provide the most pleasant massage based on given duration. Despite the fact that the product was successfully built, there were a few suggestions to improve its usability that were made. Increase the size of the lumbar belt so that it can be utilized by a wider range of people.

5. ACKNOWLEGMENT

Dr. Hjh Wan Rosemehah binti Hj Wan Omar has been an amazing instructor, mentor, and thesis adviser, providing counsel and encouragement with the correct blend of wit and intelligence. It is a privilege and an honour to take instruction and completed this research with Dr. Wan Rosemehah.

6. RREFERENCES

Gasibat, Q., & Suwehli, W. (2017). Determining the Benefits of Massage Mechanisms: A Review of Literature. *Article in Journal of Rehabilitation Sciences*, *2*(3), 58–67. https://doi.org/10.11648/j.rs.20170203.12

Grondin, D. E., Triano, J. J., Tran, S., & Soave, D. (2013). The effect of a lumbar support pillow on lumbar posture and comfort during a prolonged seated task. *Chiropractic and Manual Therapies*, *21*(1), 1–9. https://doi.org/10.1186/2045-709X-21-21

Jung, K. S., Jung, J. H., In, T. S., & Cho, H. Y. (2021). Effects of prolonged sitting with

slumped posture on trunk muscular fatigue in adolescents with and without chronic lower back pain. *Medicina (Lithuania)*, *57*(1), 1–8. https://doi.org/10.3390/medicina57010003

Kamaludin, K., Chinna, K., Sundarasen, S., Khoshaim, H. B., Nurunnabi, M., Baloch, G. M., Sukayt, A., & Hossain, S. F. A. (2020). Coping with COVID-19 and movement control order (MCO): experiences of university students in Malaysia. *Heliyon*, *6*(11), e05339. https://doi.org/10.1016/j.heliyon.2020.e05339

Mohammad Yusof, N. A. D., Karupiah, K., Tamrin, S. B. M., Rasdi, I., How, V., Sambasivam, S., Jamil, P. A. S. M., Mani, K. K. C., Naeini, H. S., & Nata, D. H. M. S. (2021). Effectiveness of lumbar support with built-in massager system on spinal angle profiles among high-powered traffic police motorcycle riders: A randomised controlled trial. *PLoS ONE*, *16*(10 October), 1–15. https://doi.org/10.1371/journal.pone.0258796

Schott, C., Zirke, S., Schmelzle, J. M., Kaiser, C., & Fernández, L. A. I. (2018). Effectiveness of lumbar orthoses in low back pain: Review of the literature and our results. *Orthopedic Reviews*, *10*(4). https://doi.org/10.4081/or.2018.7791

Zheng, Z., Wang, J., Gao, Q., Hou, J., Ma, L., Jiang, C., & Chen, G. (2012). Therapeutic evaluation of lumbar tender point deep massage for chronic non-specific low back pain. *Journal of Traditional Chinese Medicine*, *32*(4), 534–537. https://doi.org/10.1016/s0254-6272(13)60066-7