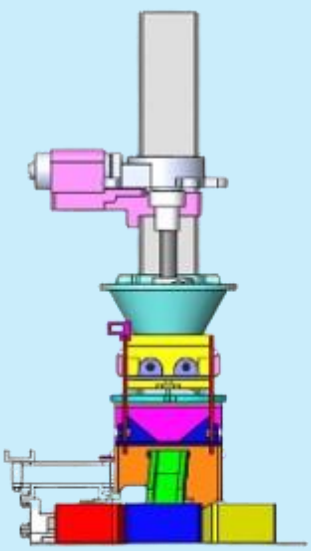
Prototype Design and Research Collection

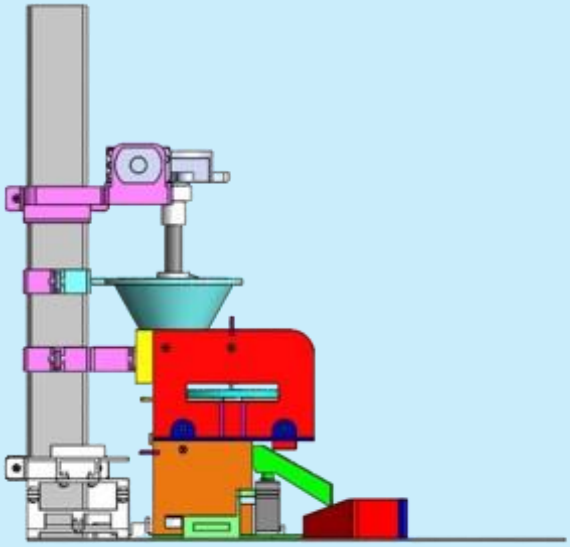
Series 1

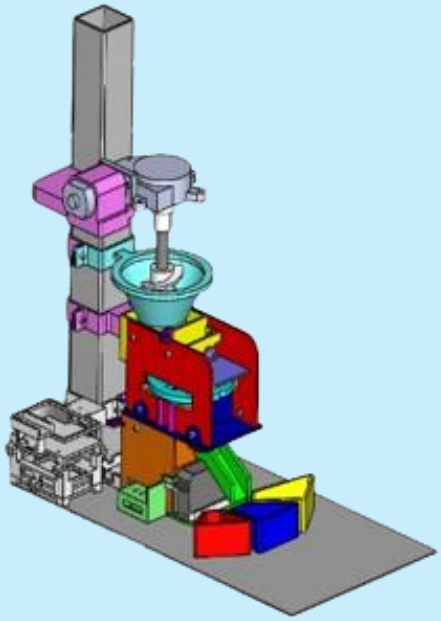
Universiti Teknologi MARA
Pasir Gudang Campus

Prototype Design and Research Collection

Series 1







AHMAD NAJMIE RUSLI

CHIEF EDITOR:

Ahmad Najmie Rusli

EDITOR:

Nurul Nadiah Rasdi

PUBLISHER:

Universiti Teknologi MARA

Cawangan Johor Kampus Pasir Gudang,

Jalan Purnama, Bandar Seri Alam, 81750 Masai, Johor

September 2025

eISBN: 978-967-0033-63-1

FOREWORD

This digital book on Prototype Design and Research Collection Series 1 (PDRC Series 1), is designed as a comprehensive reference for mechanical engineering students. The designs featured in this collection undergo an extensive analysis process, incorporating both prototype development and research to ensure a thorough understanding of design principles. Each project is carefully analysed before the prototype fabrication with detailed summaries of the project description and design parameters. The design and research products presented in this series cover a wide range of tools and equipment for various applications including household, workshop and entrepreneurial purposes.

This collection aims to foster innovation by offering students valuable insights into both the technical and research aspects of product design. It is hoped that this book will inspire future engineers and designers to approach product development with a deeper understanding of the design and research processes.

Table of Contents

eISBN: 978-967-0033-63-1

CHAPTER 1

Development of a Motorized Skateboard Prototype

Nurzarifah Athirah binti Zamanhuri [1] and Kamariah binti Md Isa [2*]
[1,2] *Faculty of Mechanical Engineering, Universiti Teknologi MARA Johor Branch, Pasir Gudang Campus, Bandar Seri Alam, 81750 Masai, Johor Darul Ta'zim.*
**Corresponding author (e-mail): kamariahisa@uitm.edu.my*

ABSTRACT

According to findings, many individuals in the community are concerned about the safety of skateboards, which may reach high speeds and are sometimes difficult to manage. To address these issues, a novel motorized skateboard was proposed so that it can be more closely controlled, if not outright outlawed, to safeguard the safety of riders and pedestrians. Hence, this project aims to design and fabricate a motorized skateboard. The prototype of the motorized skateboard consists of a motor, battery, wheels, deck, and speed control. The axle has two wheels at the front and back that will connect to a deck but one of the axles has a motor and timing pulley that connect to it so that the wheels can rotate automatically by the motor. Other than that, to move the motor and speed control, a 12V 1.3AH battery that generated as a power source to the motor so that it can move the skateboard.

Keywords: Motorized skateboard, Remote control

1 INTRODUCTION

A motorized skateboard is a device that has a motor and can be moved by humans without the need for any force. This invention was made for those who enjoy skating, but in a unique fashion in which the skateboard can move on its own and the user simply needs to put their feet on the deck and move about with it. Furthermore, the skateboard is often controlled by a wireless hand-held throttle remote or by the rider changing body weight between the front of the board for forward speed and the back for braking. This autonomous skateboard comes with cruise control and a motor that allows the skateboard to go from one location to another. Cruise control is a useful function seen in many automobiles, and it is easy to put it on a motorized skateboard to make the experience even more comfortable. This will allow individuals to drive at a consistent speed in their little vehicles [1].

Motorized skateboards are fresh to those who have never heard of them, and they are something that people should try. Motorized skateboards have grown in popularity in recent years, and with good reason. They have several advantages over traditional skateboards, making them a more practical mode of transportation for many people. Riders on a motorized skateboard can travel longer distances more quickly and with less physical effort, allowing them to cover more ground in less time. This makes them an excellent choice to work or school, running errands, or simply exploring the city.

This project aims to develop a motorized skateboard that can converts motor power to mechanical power. The process of development of the prototype starts with the design of the

eISBN: 978-967-0033-63-1

prototype using SolidWorks. Then, the prototype were fabricated using cutting, grinding, drilling, turning and assembly.

2 LITERATURE REVIEW

A skateboard is a type of sports equipment used for skateboarding. It typically consists of a wooden board or deck, with four wheels attached to the underside [2]. The deck is usually made of high-quality wood and the most commonly used is maple wood due to its slow growth under impact and possess high stability [2]. The wheels are usually made of urethane or other durable materials. Skateboards come in a variety of shapes and sizes, with different designs and features depending on the intended use. Some skateboards are designed for street skating, while others are designed for downhill racing or cruising. Skateboarding can be a fun and exciting way to get exercise and explore the outdoors.

There are several motorized skateboards that are already patented. One of it is as shown in Fig. 1, a skateboard patented by Aaron M. King from United States (Pattern number: US20200391098A1). In this patent, it is explained that the motorized skateboards allow users to utilize a power supply, such as a rechargeable battery pack, that is remote with respect to the skateboard. The skateboards can also have the battery mounted on, under, partially or wholly enclosed within, and/or integral with the skateboard deck. The drive wheel adaptor allows the user to modify standard skateboard wheels to use as drive wheels for the electric skateboard. Because of the strength of the link between the drive hub and the wheel, the skateboard can use higher torque without failing [3].

Another example of patented electric skateboards is an invention by Peter Treadway and Janelle Wang from United States (Pattern number: US20220023746A1)[4]. They indicated that their electric skateboard has a frame assembly that includes a deck with an opening of the deck to house a battery case mounted to the bottom of the deck. The first and second wheels are powered by one motor with a differential and a shaft coupled to the first and second wheel. The motor is then coupled to the shaft to rotate the first and second wheels. The motor is electrically connected to the battery pack through a rear channel. The motor rotates the first and second wheels in the same direction and propels the electric skateboard forward and backward [4].

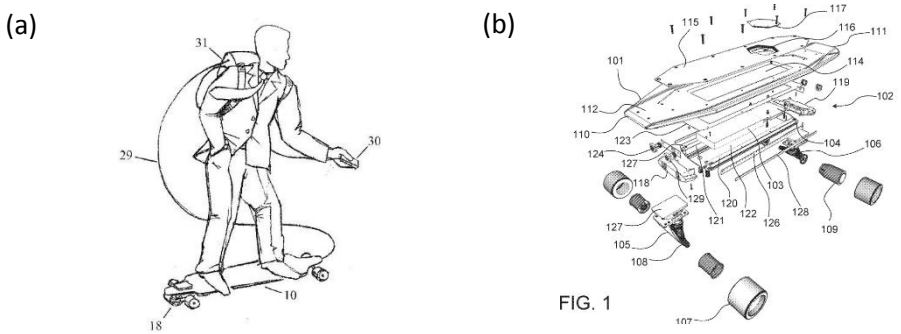


Fig. 1: Motorized skateboards patented by (a) Aaron M. King [2] and (b) Peter Treadway and Janelle Wang [3].

3 METHODOLOGY

3.1 Design Process

The 3D model parts were designed using Solidworks. An assembly document was created by joining all parts through regular and mechanical mates. Finally, a technical drawing was generated from the assembly document with all dimensions and a list of material necessary to build the prototype [5].

3.2 Fabrication Process

The fabrication process was conducted using the design completed in Solidworks. The fabrication process done were as shown in Table 1.

Table 1: Fabrication process of a motorized skateboard.

Process	Picture
Marking the board The deck of the motorized skateboard will go through a marking process first. The dimension was 200 mm wide and 750 mm length.	
Cutting process using vertical saw machine The cutting process were conducted using a vertical saw machine with the help of assistant engineer to make sure that no accidents happen during this process.	
Grind the board using sanding belt machine The board was grinded to get a smooth surface at every corner of the board to make sure there is no wood fragments each vertex.	
Cutting the plate using vertical saw machine The plate was cut with the applied dimension to put it under the deck so that it can support the weight of the rider that uses the skateboard.	

eISBN: 978-967-0033-63-1

Drilling process Drilling were used to make holes in the deck. Safety precautions were taken by wearing a glove when use the machine.	
Turning process The process proceeds with turning process to make wheels with nylon by using a lathe machine. This process needs to be done to get the wheel with inner diameter that has been applied through turning process.	
Plate Drilling Process Plates were placed under the board to make sure the board has more strength to support the load. Holes on the plate were also conducted using drilling process. This is done so that the board will not easily bend or break because it has the strong support.	
Assembly Process Assembly processes were conducted using screws to connect the parts. Motor was placed and connected to the motor holder and timing pulley that was already connected to the wheels.	 

eISBN: 978-967-0033-63-1

4 RESULTS AND DISCUSSION

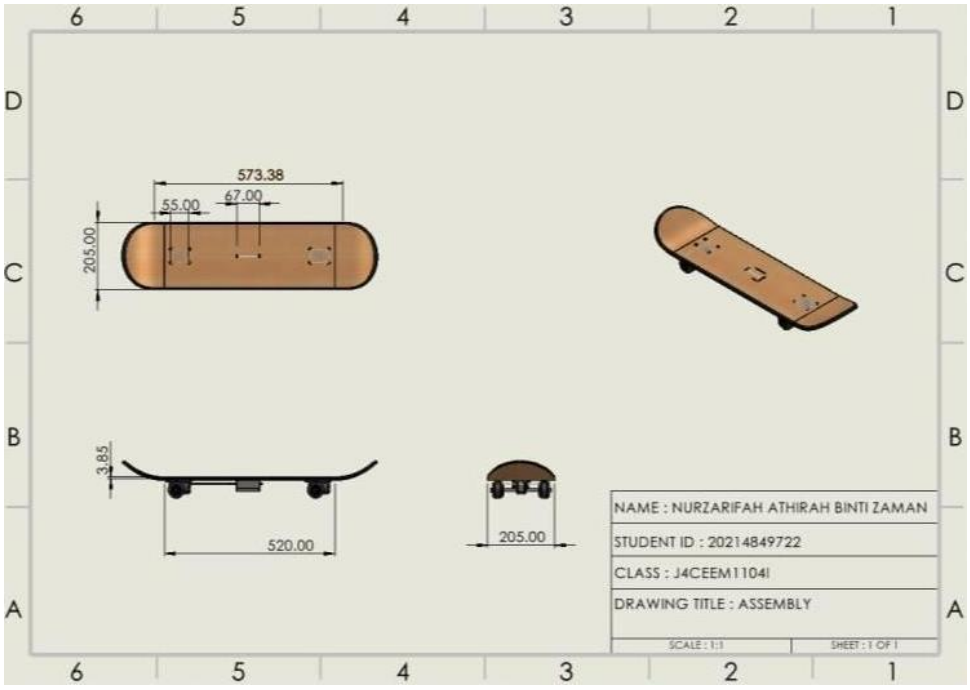


Figure 3.1 Assembly Drawing

An assembly shows the final assembly on the drawing board with a dimension and final design of motorized skateboard. The whole dimension is 573.38 mm and 3.85mm in thickness.

4.1 Final Fabricated Prototype

The prototype of the motorized skateboard consists of motor, battery, wheels, deck and speed control (Figure 4.1 ~ Figure 4.3). The axle has two wheels at the front and back that will connect to a deck but one of the axles has motor and timing pulley that connect to it so that the wheels can rotate automatically by the motor. Also, the motor will connect to the speed control to control the speed whether the rider wants it to be slow or faster. Other than that, to move the motor and speed control, two of these will connect to the battery 12V 1.3AH that generate as a power source to the motor so that it can move the skateboard.

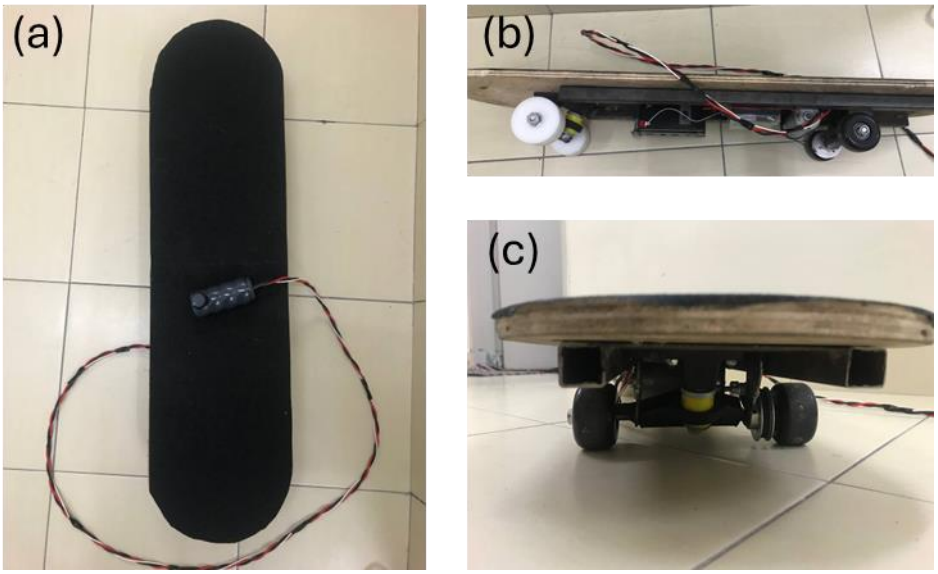


Figure 4.1 (a) top view, (b) side view, and (c) front view of the motorized skateboard.

5 CONCLUSIONS

In conclusion, designing a motorized skateboard requires careful consideration of the power source, control system, construction and adherence to local regulations. By taking these factors into account, it can create a motorized skateboard that offers a thrilling and safe riding experience.

REFERENCES

[1] M. A. R. B. KHALID, M. W. I. B. SAJURI, and S. N. A. B. S. HAIZAR, "DEVELOPMENT OF SMART SKATEBOARD," 2015.
[2]A. Abid and A. A. Bhuiyan, "A finite element analysis approach to design and optimize the static structural impact on a skateboard," Materials Today: Proceedings, vol. 60, pp.
[3] Aaron M. King, Redrock Boardshop, Llc, " Electric Skateboard," US Patent US20200391098A1, Dec. 12, 2020.
[4] Peter Treadway and Janelle Wang, TREADWAY "Battery powered skateboard," US Patent US20220023746A1, Oct. 4, 2021.
[5] M. Aguair and K. Behdinan, "Design, prototyping, and programming of a bricklaying robot," Journal of Student Science and Technology, vol. 8, no. 3, pp. 27-34, 2015.