



**DESIGN AND FABRICATE MOTOR-ASSIST SYSTEM FOR FIN  
DRIVE FOOT PEDAL KAYAK**



**BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY  
(AUTOMOTIVE TECHNOLOGY) WITH HONOURS**

**2022**



**Faculty of Mechanical and Manufacturing Engineering  
Technology**



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DRIVE FOOT PEDAL KAYAK**

**Mohamad Iman Bin Ismail**

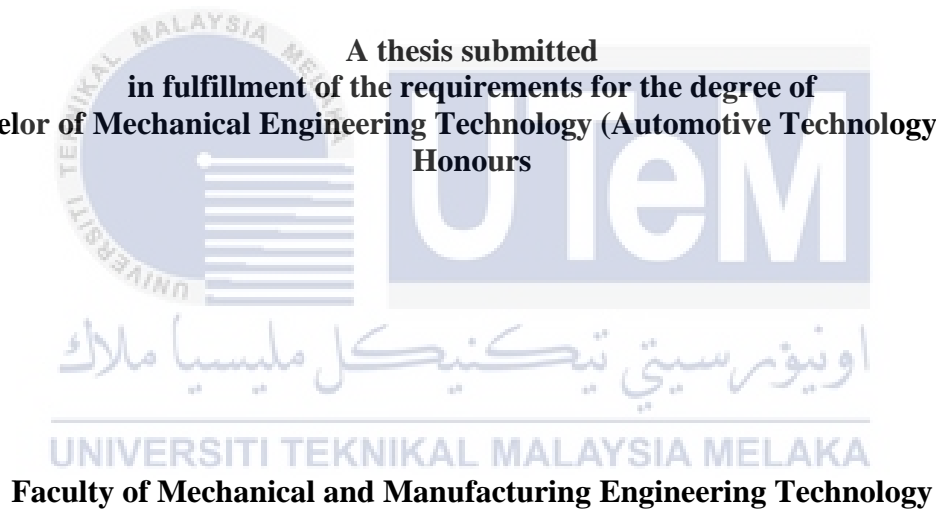
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**DESIGN AND FABRICATE MOTOR-ASSIST SYSTEM FOR FIN DRIVE FOOT  
PEDAL KAYAK**

**MOHAMAD IMAN BIN ISMAIL**

**A thesis submitted  
in fulfillment of the requirements for the degree of  
Bachelor of Mechanical Engineering Technology (Automotive Technology) with  
Honours**



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2022**

## DECLARATION

I declare that this Choose an item. entitled “Design And Fabricate Motor-Assist System For Fin Drive Foot Pedal Kayak” is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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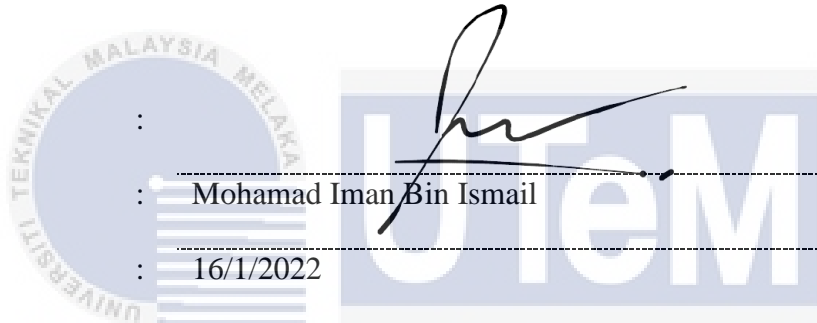
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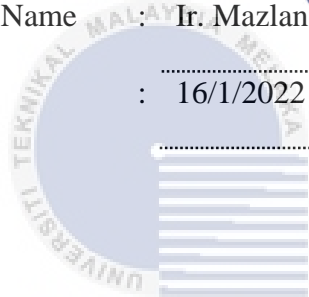
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## APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours.

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## DEDICATION

To my beloved parents and family, who have always encouraged and supported me through my educational journey. Also, to my supervisor Ir. Mazlan Bin Ahmad Mansor, and all my friends who have guided, inspired and helped me to complete my project



## ABSTRACT

Kayak fishing is divided into two types: paddle and pedal drive, including fin drive or propeller drive. Because kayaking is a kinetic energy-intensive activity, only the propeller system has a motor-assist drive. This project aims to design and fabricate a design and fabricate motor- assist system for the fin drive foot pedal. The motor-assist drive will reduce the energy needed for a person to pedal the kayak from one point to another. A motor-assist will be produced after design selection. Welding, drilling, finishing, and project components selection will be part of the process. The best design will be picked from the House of Quality method with various options at all levels. The product has been inspected and assembled on the kayak after being made. Overall, the product performs well. Although it is not as fast as a manually operated system, this project has met all the project's objectives.



## ***ABSTRAK***

Kayak memancing terbahagi kepada dua jenis: pengayuh dan pacuan pedal, termasuk pacuan sirip atau pacuan kipas. Kerana berkayak adalah aktiviti intensif tenaga kinetik, hanya sistem kipas yang mempunyai pacuan bantuan motor. Projek ini bertujuan untuk mereka bentuk dan membuat kayak bantuan motor untuk sistem pacuan sirip. Pemacu bantuan motor akan mengurangkan tenaga yang diperlukan untuk seseorang mengayuh kayak dari satu titik ke titik yang lain. Bantuan motor untuk pemacu pedal sirip akan dihasilkan selepas pemilihan reka bentuk. Kimpalan, penggerudian, kemas dan pemilihan komponen projek akan menjadi sebahagian daripada proses. Reka bentuk terbaik akan dipilih daripada kaedah “House of Quality” dengan pelbagai pilihan di semua peringkat. Produk telah diperiksa dan dipasang pada kayak selepas dibuat. Secara keseluruhan, produk berfungsi dengan baik. Walaupun ia tidak secepat sistem yang dikendalikan secara manual, projek ini telah memenuhi semua objektif projek.





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Last but not least, from the bottom of my heart gratitude to my beloved family for their encouragement and who has been the pillar of strength in all my endeavors.

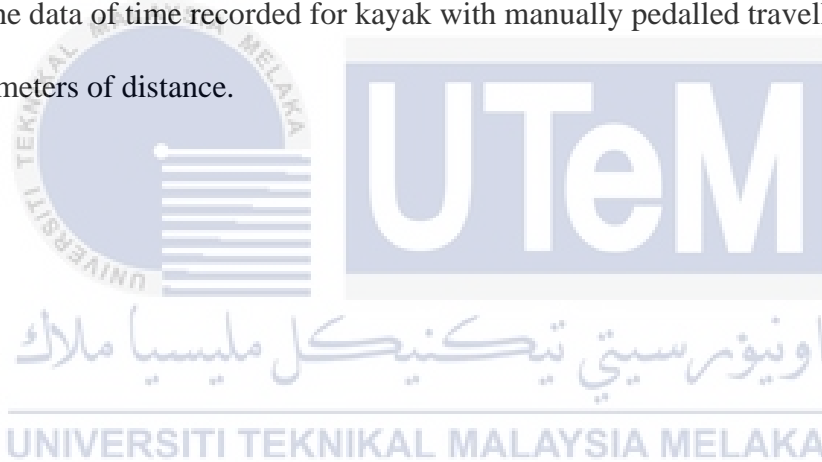
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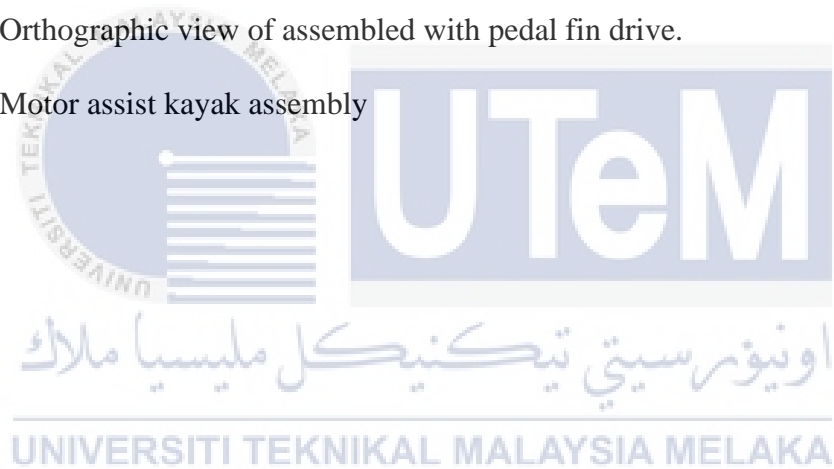
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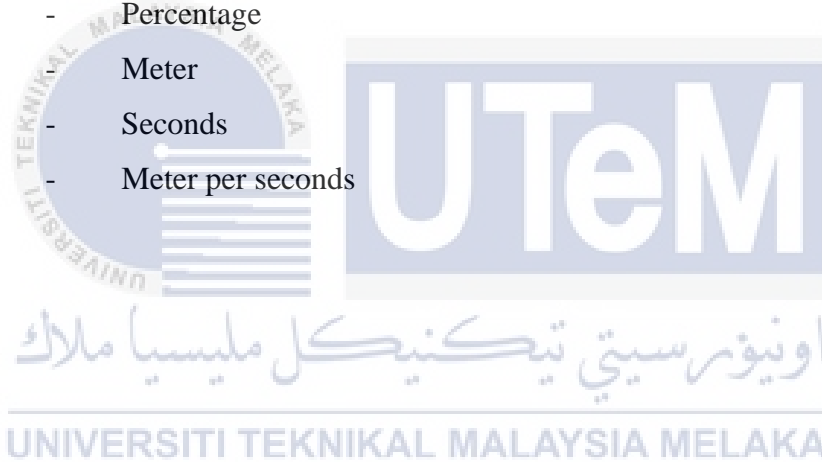
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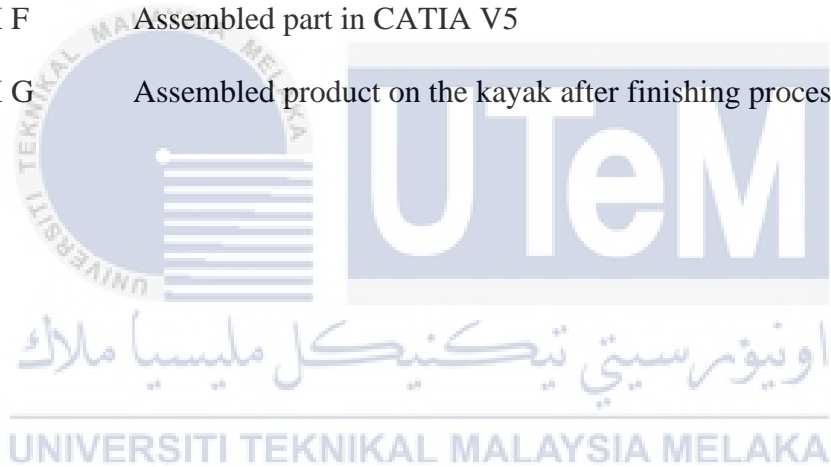
## LIST OF SYMBOLS AND ABBREVIATIONS

V	-	Volt
Ah	-	Ampere hour
RPM	-	Revolutions per minute
A	-	Ampere
L	-	Length
W	-	Width
H	-	Height
cm	-	Centimeters
%	-	Percentage
m	-	Meter
s	-	Seconds
m/s	-	Meter per seconds



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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Kayaking is a sport that places a high demand on upper-body strength and endurance. (Tesch et al. 1976 Åstand and Rodahl 1977). Nowadays, modern kayaks have grown into various categories classified as river kayaks, sea (or touring) kayaks, racing kayaks, surf kayaks, fishing kayaks, and recreational kayaks depending on users intended use. Today's kayak categories include: "Sit-In," primarily influenced by conventional kayak forms, "Sit-On-Top," which developed from paddleboards with footrests and a backrest. Moreover, "Hybrid" is essentially canoeing with a double blade paddle (also known as a "kayak paddle") and twin hull kayaks with a narrow hull for each of the paddler's legs.

Foot propulsion kayaks, also known as pedal kayaks, are among the most significant innovations in the kayak fishing industry. While pedals are not new in other industries, Hobie Kayaks popularized them among kayak anglers. In 1997, Hobie Kayaks introduced the Mirage Drive, a pedal-powered kayak. Fins that pass sideways and back and forth make up the Mirage Drive.

The pedal kayaks are consisted of two categories depending on the drive type. Propellers propel kayaks, and they are moving by fins. The mechanism that drives the propellers is very similar to that of a vehicle. The gears convert the power produced by pedaling into propeller thrust. In reverse mode, the user can cycle in the opposite direction.

Hobie's Mirage Drive is the second form of the Kayak. This Kayak has fins or blades instead of a propeller. The fins turn sideways as the user cycle the pedals. Their angles

change as they pass sideways, propelling the Kayak forward. When approaching deeper waters, the user should fold the fins under the Kayak since they are vertical. With this form of Kayak, changing the direction these fins face is needed to shift in reverse.

## 1.2 Problem Statement

Generally, there are two types of kayak fishing: paddle type and pedal drive, which consist of fin drive or propeller drive. In terms of fishing, paddling gives the ability to sneak up on skittish fish is arguably the most mentioned benefit of paddling over pedaling.

It differs from pedaling kayak, giving more advantage in terms of speed. Pedaling gives on-the-water speed and efficiency, whether a rotating pedal with a propeller or pushes/pull pedals with fins. Successful tournament anglers are usually the first to arrive at their chosen location. Anglers who frequently travel vast bodies of water will get the most out of their day if they use a pedal drive to get them where they need to go quickly. However, both paddle and pedal drive share the same problem: the limitation for aged people or people suffering from a common disease such as *cardiovascular disease*.

It is undeniable that kayaking, apart from being a pleasurable and enjoyable sport, has many health and mental benefits. However, as people get old, their physical well-being: *strength, stamina, agility, and flexibility*, drops, making everyday tasks and normal functioning more difficult for the elderly.

## 1.3 Project Objectives

Because kayaking is an activity that demands extra energy, the main aim of this project is to design and fabricate motor- assist system for the fin drive foot pedal kayak. Due to the motor assist drive being just available for the propeller system, this will reduce the

energy needed for a person to pedal the kayak from one point to another. In specific, the objectives are as follows:

- a) To design the motor-assist system for the fin drive foot pedal kayak using computer-aided three-dimensional interactive application (CATIA) software.
- b) To fabricate a motor-assist system for the fin drive foot pedal kayak with the help of a motor powered by a battery.
- c) To reduce the conservation of human energy.

#### 1.4 Scopes of Project

The scope of this research are as follows:

- To invent and fabricate the motor-assist system for the fin drive foot pedal kayak.
- The type of mechanism and motor that will be used to move the pedal fin drive system.
- Allow additional features by equipped with motor-assist for the kayak.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

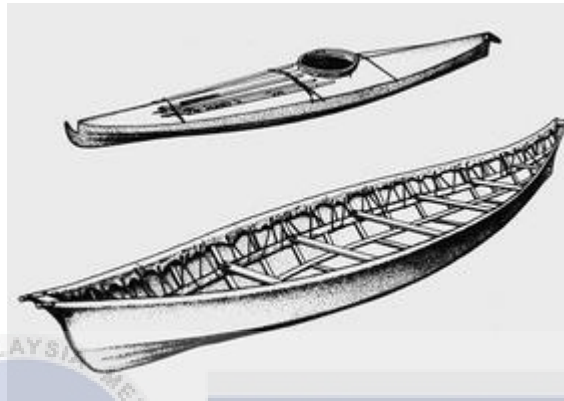
This chapter will focus on the research details and study results on the history of kayaks themselves and the variations between fin drive and propeller drive systems in terms of type, operation, and specifications. It also covers the history of the kayak, including design and analysis from the first kayak to the present. Based on the project scopes, this information will be utilized as the ground rule to select the most appropriate design from the authorized theory and factor for finishing the design.

##### 2.1.1 History of Kayak

Kayaking has recently become one of the most popular water activities, which improves general health and can also transport people to locations that are inaccessible by land. The first people to build and use kayaks were the Inuit, Aleut, and Yup'ik people. Often referred to as "Eskimos," these indigenous people live in modern-day Greenland, Canada, and Alaska ("7 Facts You Didn't Know About the History of Kayaking in Gatlinburg",2020). The word Kayak (ki ak), meaning "man-boat" in Eskimo, was found predominately in the northern parts of the world, North America, Siberia, and Greenland (International Canoe Federation,2017). The Kayak probably originates from Greenland, where the Eskimos used it, while the Canoe has been used worldwide.

Kayaks were initially designed for hunting animals or creatures that dwell in or near water. The Inuit and other indigenous peoples created kayaks by sewing animal skins together, frequently from seals, and extending this material over a frame constructed of wood

or whalebone skeletons. These early kayaking pioneers also utilized whale fat to waterproof their boats. The oldest known Kayak was displayed in the State Museum of Ethnology in Munich, Germany. This Kayak was believed to have arrived in Holland in 1577 (Ocean River Sports, 2021). However, the Kayak, or qajaq, has a considerably longer history than the coasts of Holland in 1577.



**Figure 2.1 “Kayak (qajaq) and Umaiak by Gordon Miller”**

(Source: <http://www.thecanadianencyclopedia.ca/en/article/kayak>)

### 2.1.2 The Evolution of Kayak

The kayak is not introduced in Europe until the 1800s. However, it is a significant episode in kayaking history. New developments in frames and coverings addressed the necessity for the kayak to be conveniently transported overland. One of these designs was a revolutionary collapsible kayak model called a foldboat invented in Germany in the 1800s (Encyclopedia.com, 2016). The foldboat had an outer layer of rubberized fabric stretched over a foldable tubular frame. The foldboat was designed to be dismantled and transported in just two suitcases. Kayaking as a competitive sport began during the Summer Olympic Games in Germany in 1936 and has since gained international appeal (Encyclopedia.com, 2016).

Percy Blanford designed and produced hundreds of canvas-covered plywood and wooden kayaks in the 1950s and 1960s, which popularized sea kayaking. It was a soft-sided boat at the time, and it was not long before the French and Germans began utilizing kayaks for recreation. Kayaks were particularly popular among explorers exploring the icy waters of the North and South Poles.

Kayaking as a competitive activity debuted at the 1936 Summer Olympics in Germany and has since earned world acclaim. However, it is also an essential point in kayaking history because this was the year it was adopted as an Olympic sport. It was still seen as a global sport at the time, but the Olympics launched it into an ordinary event. In 1948, the Olympics added its first women's paddling event: the 500-meter singles kayak. The first white water racing event premiered in 1972. Today, the Olympics have more than ten white water competitions ("7 Facts You Didn't Know About the History of Kayaking in Gatlinburg",2020).

In terms of design, production, and usage, most modern kayaks differ significantly from native kayaks. They are frequently designed using computer-aided design (CAD) software, frequently associated with CAD specialized in naval design. Modern kayaks are generally used for various activities, including slow and easy touring on calm water, racing and challenging maneuvering in fast-moving whitewater, and fishing. Modern forms, materials, and building processes enable us to effectively meet these needs while retaining the ideas of the original Arctic inventors.

Commonly, there are two categories of kayak: flat-water and whitewater types. There are five types of flat-water kayaks; sit-on-top, recreational, touring, inflatable, and pedaling kayaks, and four types of kayaks; Playboats, River Runners, Creek boats, Old School, and Inflatable (Duckies). Flat-water kayaks are relatively stable and suited for leisure usage. They are designed to relax in calm, quiet lakes, meandering rivers, little ponds, and quiet

coastal inlets. Whitewater kayaks are also less complicated to roll than other kayak variants. Whitewater kayaks with a hard shell are always sit-in, and the majority are composed of durable remolded plastic.

### **2.1.3 Fishing Kayak**

As kayak fishing gets popular, more kayaks are being created with more additional features. The add-ons features include pole rests, flat hulls for stability, pontoon stabilizers, and pedal-powered water wheels, which allow users to keep their hands on fishing rods while fishing. This kayak is available in two styles; sit-in and sit-on-top. They are built up like a sit-on-top kayak, but users need to pedal instead of paddling. Commonly, a fishing kayak uses a pedal, which is a step up from family-sized pedal boats. This kayak is generally short and sturdy, with enough room for a cooler box and other essentials.



**Figure 2.2 Example of fishing pedal kayak**

There are two types of pedals used in a fishing kayak: bicycle-style and stair climber style. Pedal kayaks are a good option for kayakers with shoulder and back problems since their legs do most of the work instead of their arms. Kayak users may cover a greater distance

in a pedal kayak than in a sit-on-top recreational kayak because leg muscles are more potent than arm muscles. However, pedal kayaks are heavier. Another advantage is that users may shoot images while traveling over the water with their hands-free. Rudders are also usually available on most pedal kayaks.

## **2.2 Existing Type of Kayak Propulsion**

Kayak technology has improved as kayaking has grown in popularity among water sports lovers. There was a time when there was just one style of kayak (paddle kayaks). Paddle kayaks are still popular and are not going away anytime soon. However, a new type of kayak has taken over. There are two significant types of propulsion to consider: paddling (rowing) and pedal powered.

### **2.2.1 Paddling (Rowing)**

Paddlers remind back of the days when paddling was the only sport available. While the alternatives have altered, paddling still has advantages over pedaling. The most significant advantage of a paddle kayak is that it takes slightly less deck space than a pedal kayak. One of the drawbacks to using a pedal drive system is the extra clearance needed under the boat (YakGear, 2019). In shallow water, some pedaling fishermen flutter their fins. However, anglers must flip up their fins or stop the pedal drive when fish are significantly in shallow water. A mudflat can consume valuable deck space and be annoying after a few switches.

### **2.2.2 Pedal (Fin Drive)**

The first pedal kayak that appeared in 1997 was equipped with Mirage Drive made by Hobie Kayaks. A Mirage drive is a pedal-powered device that uses two identical fins that move forward, backward, and sideways to make the kayak move (Herron, 2021). On-the-