I hereby declare that I have read this project report and found its content and from to meet acceptable presentation standards of scholarly work for the award of Bachelor of Mechanical Engineering (Structure and materials)

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Name of Supervisor : .Dr. Ir. Hady Efendy.....

Date : .....

To design and fabricate projectile motion prototype device for students use in dynamic laboratory

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DECLARATION

I declare that this project report entitled "*To design and fabricate projectile motion prototype device for students use in dynamic laboratory"* is the result of my own research except as cited in the references.

Signature : .....
Name : .....
Date : .....

To My beloved mom and siblings
for their endless love and support

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ABSTRACT

This study presents the design and fabrication projectile motion machine heave for students' use in dynamic laboratory. An educational and historical study of the projectile motion with drag forces dependent on speed shows, by simple results, that trajectories quite similar to those depicted before the Galilean era may be obtained with a realistic choice of quantities involved. Numerical simulations of the trajectory in space and velocity coordinates help us to understand the dynamics of motion. This project use a toss mechanism in drop distance weight toss where found dynamic element and spring force imposed at making that spring toss. In addition, a comparing results between theoretical and experimental during the experiment. There were some concept designs suitably to make main subject before committing process design ergonomics to the student that use in the laboratory. The best concept is to keep student comfortable to use projectile motion device in best term is user friendly.

ABSTRAK

Kajian ini membentangkan reka bentuk dan peluncur pembuatan mesin usul lambung untuk penggunaan pelajar-pelajar dalam makmal dinamik. Satu kajian pendidikan dan sejarah bagi usul peluncur dengan seretan memaksa untuk bergantung kepada kelajuan yang ditunjukkan dengan keputusan-keputusan serta laluan-laluan menyerupai seperti digambarkan sebelum era penduduk Galileo yang mungkin diperolehi dengan satu pilihan realistik didalam kuantiti terlibat. Simulasi-simulasi berangka trajektori di lapangan dan halaju selaras untuk memahami usul dinamik. Projek yang di hasilkan menggunakan satu mekanisma lambungan dalam lambungan jarak berat di mana terdapat unsur dinamik dan daya pegas yang dikenakan untuk membuat satu lambungan pegas. Di dalam projek ini juga terdapat pengiraan teori untuk dibandingkan dengan keputusan eksperimen semasa eksperimen ini dijalankan. Terdapat beberapa reka konsep sebenar bagi menjadikan subjek utama sebelum melakukan reka bentuk ergonomik untuk pelajar yang menggunakan didalam makmal dinamik. Konsep yang terbaik ialah untuk pelajar selesa semasa menggunakan mesin usul peluncur dalam durasi terbaik dalam kontek mesra pengguna.

TABLE OF CONTENT

LIST OF TABLE

LIST OF FIGURE

LIST OF SYMBOL

$\vec{v}_i$	=	Initial velocity ($^{m}/_{s}$)
θ	=	angle (rad)
a_x	=	Acceleration,($^{m}/_{s^2}$)
x	=	distance, (m)
g	=	Gravity
t	=	Time, (s)
h	=	height (m)
F	=	Force (N)
k	=	Stiffness($^{N}/_{mm^2}$)
l	=	Length(m)
u	=	Work done(N)
°	=	Degree
N	=	Newton

CHAPTER I

INTRODUCTION

Generally, the high school and university students meet many difficulties in understanding of plane motions, although these are daily observed. Such difficulties are relative either to vectorial characteristic of involved kinematic quantities and to various ways in which the same quantities can be graphically represented.

Other difficulties are relative to abstraction with which normally the concept of function is usually introduced without any connection to concrete experiences. It is necessary to underline that, although velocity and acceleration are terms of common language, frequently the students do not distinguish this quantities between them, with important consequences in correct understanding of Dynamics.

Furthermore, the overall of the design is very user friendly compare to the old design. The main purpose of this section is to find the user of this projectile launcher, to research and planning. By doing so, the user especially student will be determined, the situation need to be analyzed the student specification can be generated and proper planning can be constructed. This step is important to ensure that are design in not an obsolete design and it will fulfill the student needs.

In the setting up of this laboratory we made interactive all the parameters that characterize projectile motion, by focusing attention to the easily representation of

design involved, not neglecting the recreational aspect, useful for making the use of this machine either attractive or thought-provoking.

1.1 Objective:

a) To design and fabrication machine heave for students' use in dynamic laboratory for experiment projectile motion.
b) Propose a new design for the projectile motion.
c) To get the comparison between the theoretical value and experimental value.

1.2 Scopes

a) Literature review on projectile motion.
b) Design a projectile motion launcher by using Solidwork(3D).
c) Fabricate a prototype of projectile motion launcher.
d) Testing the design that had been fabricated.

1.3 Problem Statement

In the dynamic laboratory before doing the experiment most of the student must pick up one by one the equipment to build the projectile launcher such as 1 ballistic pendulum, 1 recording carbon paper, 1 steel ball, 1 meter scale and 1 speed measuring attachment. All the equipment is very trifling to combine it and waist our time when doing the experiment.

1.4 Flow Chart for PSM 1

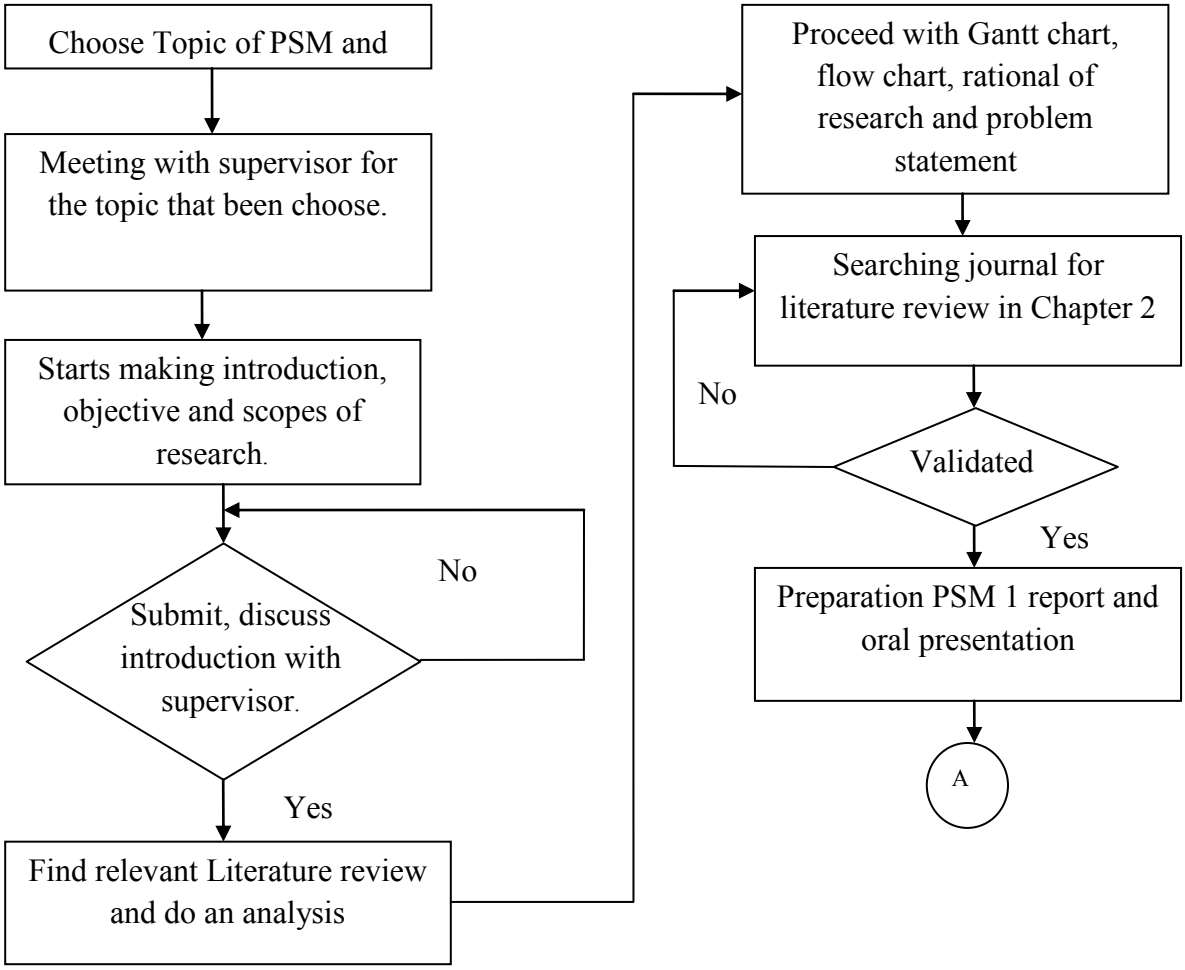

Figure 1.1: Stage of PSM1

1.4 Flow chart of PSM 2

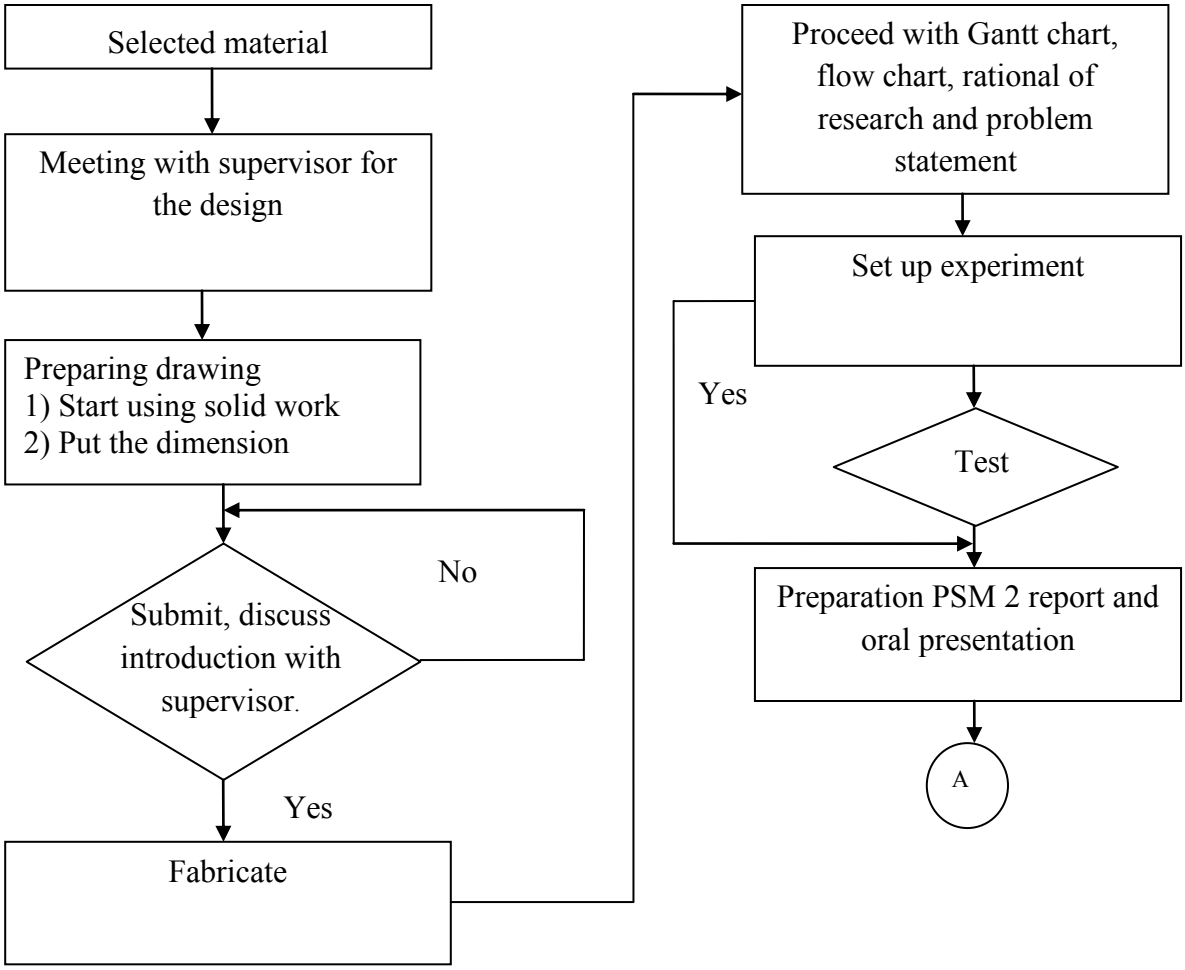

Figure 1.2: Stage of PSM 2

1.6 Research Frame

This project is done with 6 main chapters which are introduction, literature review, methodology, design, result, discussion and conclusion. Chapter one briefly explained the objective, scope, problem statement, rational of research, research methodology and research frame arrangement. Chapter two is a literature review which consist the definition Projectile Motion, reasoning about Projectile Motion, Cranz's ''Normal Trajectories'', projectile motion situation and about springs. Chapter three is mentioned about how the way of project whereas stated the method and technique that will be used from beginning process until final process. The chapter also included the drawing by using Solidwork. In chapter four will present the expectation result, in this chapter have variable tables to fill in when the experiment is running and sample calculation for theoretical result and construct a variable graph. In the chapter five is a discussion about the theoretical value and the design. Finally is a chapter six will be the conclusion for the line out all the chapters.

CHAPTER II

LITERATURE REVIEW

2.1 History of Projectile Motion

In the early of discovery of projectile motion, motion of projectile of shot object (i.e a cannon ball) is thought a straight line until it lost its impetus, at which point it fell abruptly to the ground a show in figure 2.1. This theory was based on Aristotle's views of motion. However, Galileo realized that projectiles actually follow a curved path, as this is following illustration shows and he is the first person who ever accurately described projectile motion.

Figure 2.1: Galileo application on cannon

(Source: Joseph W. Dauben, 1991)

Galileo said that projectile motion could be understood by analyzing the horizontal and vertical component separately, he even took this idea further with his realization there was more than one force in projectile motion. By utilizing these revolutionary insights, he then concluded that the curve of projectile is a parabola. This idea have help us examine how two objects which in vacuum can hit the ground at the same time even with different shape and mass if both are dropped from the same height.

2.2 Projectile Motion

Baseballs and tennis balls flying through the air, Olympic divers, and daredevils shot from cannons all exhibit is a projectile motion. A projectile is an object that moves in two dimensions under the influence of only gravity. Projectile motion is an extension of the free-fall motion, detail this is to neglect the influence of air resistance, leading to results that are a good approximation of reality for relatively heavy objects moving relatively slowly over relatively short distances. Projectiles in two dimensions follow a parabolic trajectory like the one seen in figure 2.2.

Figure 2.2: The parabolic trajectory of a bouncing ball
(Source: Raymond A. Serway.2001)