



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**Design and Development of Finger Based Exerciser Device  
for Computer Games Applications**

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of manufacturing Engineering (manufacturing Design) with Honours.

By

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FACULTY OF MANUFACTURING ENGINEERING

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# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

**TAJUK:** Design and Development of Finger Based Exerciser Device for Computer Games Application

**SESI PENGAJIAN:** 2008/09 Semester 2

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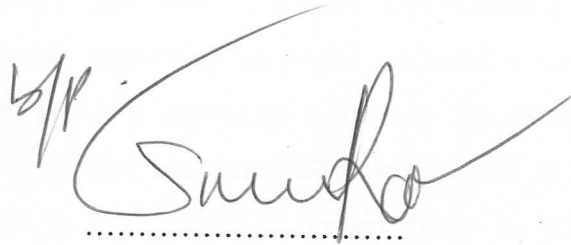
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## APPROVAL

This report is submitted to the Faculty of manufacturing Engineering of UTeM as partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design) with Honours. The member of the supervisory committee is as follow:

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## ABSTRACT

This project pursues an idea of combining exercise activities with video gaming activities through a new product. While current exercise products are used dully, incorporation of leisure elements founded in video games activities may add value which may be profitable. The project narrows down new product to be developed for musicians whom rely or exercises their fingers for their career. This report emphasis on the requirements for an organization to acquire for developing such product or a finger-based, hand exerciser instrument as a game controller for computer games applications. This report provides results of a research for proof of new products feasibility and technologies that are practically being used in which both were successfully achieved at in the end at a certain level. A prototype was also successfully developed in use for interview sessions. The development uses practical approaches for a product design and development project as outlined by previous practitioners and experts in this field. The whole project covers the earliest phases in a product design development project which include the terms in first phase of the Generic Product Development Process as outlined in the book Product Design and Development by Eppinger and Ulrich (2008).

## DEDICATION

Interested engineering students, engineers, artist, innovator, inventor, researcher, interviewer, product designer, developer, economist, academician, and entrepreneur. Should this thesis benefit your work as well, please show appreciation by citing in references.

## ACKNOWLEDGEMENT

In completing this thesis, thanks to those who were directly affecting projects completion and level of achievement level which include Ms Suriati Bt Akmal project supervisor in supervisory role of the project, to UTeM in providing such platform for its students to show any abilities, the Library Department in its excellent and appreciable services of providing knowledge resources and to my parents who provided the finance assistance.

Before you readers go any further, let me elaborate upon some things that you will notice as you proceed. First, I wish to assure the majority of readers that I intend no slight in using the masculine or any superior of the subject tenses predominantly. In writing this thesis, I was always thinking of whom my readers shall be and what profession they possess in making sure those technical terms in different subjects may not get readers running for that subjects text books (but you will and must) but to understand the broad underlying concept – a new breed or kind of exercise product. My initial attempts to eliminate pronoun problem resulted in prose that was either confusing or clumsy. Furthermore most contents written were actually achieved within projects time frame and wasn't a fundamental knowledge attained through apprenticeship and inheritance from experts in the field. I read a lot of books and thought they could help me justify any of my conducts throughout the project. Most of the books weren't even read until the end.

Secondly readers might experience uneasy flow of reading meaning that the means of some text were not supposed to be where it is. I am sorry when you do experience this as this was my first written thesis which I had to adapt to the ultimatum of specific formatting such as specific titles of a chapter

It was an intention of mine to produce an easy to read text but how well it really is, I would never really know myself. Thus thank you in picking up and spend some time and thought into reading through this thesis. I hope this thesis benefit readers in anyway, preferably in economic conducts and activities.

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## LIST OF ABBREVIATION

- QFD - Quality Function Deployment
- IC - Integrated Circuit
- USB - Universal Serial Bus



# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Strong and healthy finger are essential to personnel whose profession is dependent upon their fingers. Any sportsman or especially musician would be great to have a better grip or more control in the fingers. They are very aware of the steps they can take to reduce their risk of any - or injuries of the fingers. It is obvious that increased health and strength of the fingers should be helpful in warding off injury. Within limits, improved flexibility of the fingers, hands, and wrists should also be injury-preventing.

However to exercise has been always rigid. Putting aside sportsmen's, many consider exercise dull and boring as to exercise consumes time. This is due to less knowledge of the significance of finger-based exercising in which it also contributes to body health. A solution to promote exercise thus increase finger strength and body health is by combining the exercise elements into video game playing where the patients may enjoy while exercising since video games are always been entertaining.

The project is related to an invention of an exercise apparatus that can be used for finger-based exercise in conjunction with a personal computer. The finger-based exerciser acts as game controller to play video games aptly named Gripster as shown in Figure 1-1.

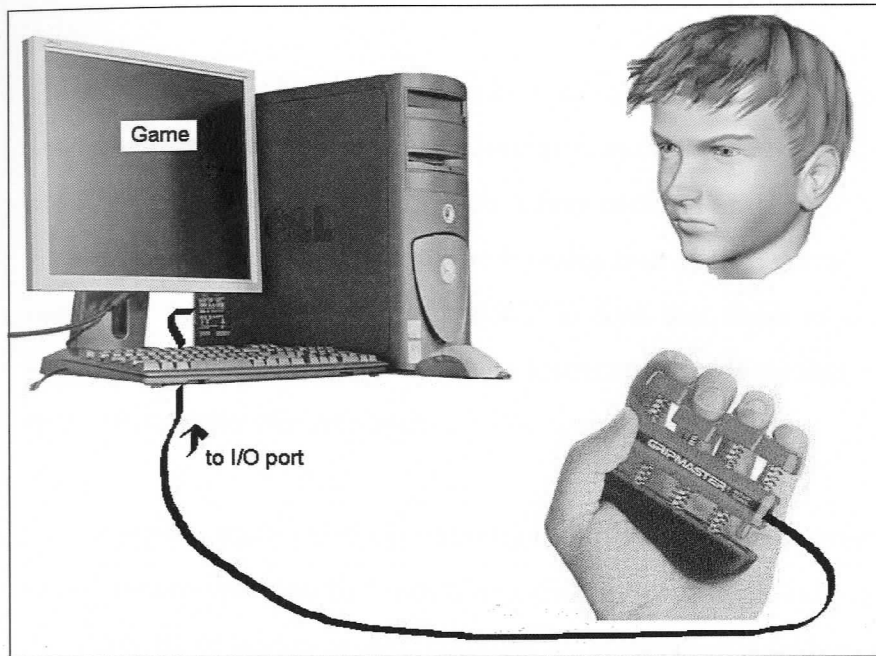


Figure 1-1: A finger-based exerciser connected to the personal computer

Figure 1-1 describes the idea the innovation of an exercise instrument, game controller. The device in red is an existing finger-based exerciser product called GRIPMASTER; the idea is that some identical device to it is connected to the computer to any suitable port like any devices (i.e. printer, mice, and keyboard) is connected.

Whilst the exerciser is a typical finger-based exercise product, it was seen of an opportunity for it to be modified or innovated to be a game controller. The new product's main purpose is to exercise the fingers while having fun playing a video game.

This project is based upon the idea of combining hand exercise elements in video game playing. To this, developments shall emphasis in the implementation of any required technology into an ordinary exerciser device as to enable it to be used in computer video game applications.

## 1.2 Problem Statement

The problem is finding a definition for a so called finger-based, hand exerciser for computers game applications. Currently, most if not all exercise instrument products were single oriented which makes exercise practice rigid, boring and dull. A conclusion derived from the investigation of the exercise promotion in the following literature suggest that it is true that there is a need for the production of a new line of exercise instrument products that can be linked with entertainment/leisure such as video games.

Consequently, there exists an opportunity to produce a new breed of exercise instrument of this kind by innovating existing exercise products to incorporate the elements of leisure or entertainment by associating it with a suitable video game.

## 1.3 Objective of the Project

The objectives of this development project include:

- a. To come up with a procedure for developing a of an exercise instrument, game controller product as presented and illustrated in Figure 1.1. As to this all requirement for project completion to achieve this will be identified and documented;
- b. To build a prototype of the exerciser instrument game controller so may be applicable to play any suitable video game and used for market testing purposes. The prototypes will be able to connect to the computer through any suitable I/O port of the computer system.
- c. To propose a new breed of exercise instrument is and presented. The application regarding health promotion will be proved through literature reviews interviews and surveys as to correctly justify the claim of such a

device would be useful for such intentions and would be a potential profitable venture to interested manufacturers and businesses;

#### **1.4 Scope of the Report**

- a. Market surveys as an approach to prove such application of an exercise instrument enabled game controller was a viable product; obtained through literature reviews.
- b. Approaches made by other people in developing similar devices. Requirements of such applications are learned here.
- c. Sequential activities done in the earliest phase of a new product design and development project. Writings shall show how an idea evolves to the first prototype.
- d. The required technology, aesthetics applied and function of components of current exercise and game controller products.
- e. Confirmation of market potential to any related information through prototype testing of the new product. This includes qualitative data to support specifications for a 'finger based exercise device for computer games application' in relation to expected buyers and manufacturing possibilities.

## CHAPTER 2

### LITERATURE REVIEW

Literature reviews primarily evaluates this projects title 'Design and Development of Finger Based Exerciser Device for Computer Games application'.

An objective of project was to come up with a procedure to conduct 'such' a project. It turned out that a 'design and development' project had been quite proverbial where there were already many experts in its field at this time thesis was written. Adaptations of methods or procedure available were suggested to be applied immediately. Earliest sections of this chapter discuss such contraction.

Ideas of current product development originated through an individuals observation and perception. How may such idea of a 'finger-based exercise instrument game controller for computer games applications' must be re-evaluated. Earliest evaluations were based through literature reviews which shall try to justify its worthiness for further development. Qualitative as well as quantitative data(s) used for justifications are included.

Products which should resemble current product to be developed are also reviewed. Theses objects shall be learning sources for product specification in terms of product technology and physical design to be applied. As in fact this project was proposed based on an existing product, so that product and usage is reviewed. Reviews of discrete components that were later founded in subsequent steps of development also included in these chapters writings. Lastly is a review of candidate game software that will be used to demonstrate current new product.

## 2.1 Product Design and Development

### 2.1.1 The Generic Process for Developing New Products

Product development is a process of creating a new product to be sold by a business or enterprise to its customers. Processes in a product design and development are generic. Ullrich and Eppinger (2007) illustrate the process as in Figure 2.1.

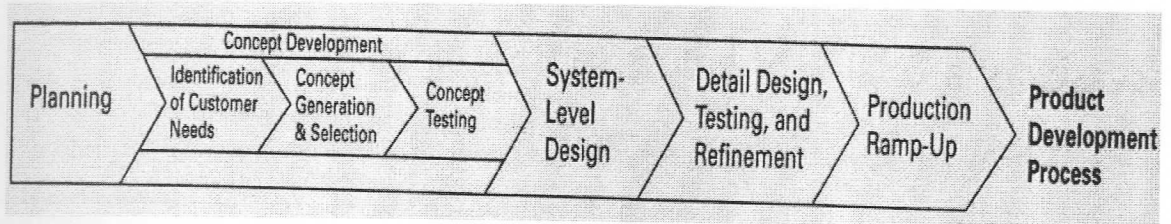


Figure 2.1: Sequential processes in product development

Design refers to those activities involved in defining physical forms of a product to meet customers need. In this context, design functions include engineering design for mechanical, electrical software, etc and industrial design for aesthetics, ergonomics, user interface, etc. A product design development process is a sequence of steps or activities which an enterprise employs to conceive, design, and commercialize a product. Ulrich and Eppinger (2007) presented the product development process functions as demonstrated in Table 2.1.

Table 2.1: The generic product development process.

Phase 0: Planning	Phase 1: Concept Development	Phase 2: System-Level Design	Phase 3: Detail Design	Phase 4: Testing and Refinement	Phase 5: Production Ramp-Up
<b>Marketing</b> <ul style="list-style-type: none"> <li>• Articulate market opportunity.</li> <li>• Define market segments.</li> </ul>	<ul style="list-style-type: none"> <li>• Collect customer needs</li> <li>• Identify lead users.</li> <li>• Identify competitive products.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop plan for product options and extended product family.</li> <li>• Set target sales price point(s).</li> </ul>	<ul style="list-style-type: none"> <li>• Develop marketing plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop promotion and launch materials.</li> <li>• Facilitate field testing.</li> </ul>	<ul style="list-style-type: none"> <li>• Place early production with key customers.</li> </ul>
<b>Design</b> <ul style="list-style-type: none"> <li>• Consider product platform and architecture.</li> <li>• Assess new technologies.</li> </ul>	<ul style="list-style-type: none"> <li>• Investigate feasibility of product concepts.</li> <li>• Develop industrial design concepts.</li> <li>• Build and test experimental prototypes.</li> </ul>	<ul style="list-style-type: none"> <li>• Generate alternative product architectures.</li> <li>• Define major subsystems and interfaces.</li> <li>• Refine industrial design.</li> </ul>	<ul style="list-style-type: none"> <li>• Define part geometry.</li> <li>• Choose materials.</li> <li>• Assign tolerances.</li> <li>• Complete industrial design control documentation.</li> </ul>	<ul style="list-style-type: none"> <li>• Reliability testing.</li> <li>• Life testing.</li> <li>• Performance testing.</li> <li>• Obtain regulatory approvals.</li> <li>• Implement design changes.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate early production output.</li> </ul>
<b>Manufacturing</b> <ul style="list-style-type: none"> <li>• Identify production constraints.</li> <li>• Set supply chain strategy.</li> </ul>	<ul style="list-style-type: none"> <li>• Estimate manufacturing cost.</li> <li>• Assess production feasibility.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify suppliers for key components.</li> <li>• Perform make-buy analysis.</li> <li>• Define final assembly scheme.</li> <li>• Set target costs.</li> </ul>	<ul style="list-style-type: none"> <li>• Define piece-part production processes.</li> <li>• Design tooling.</li> <li>• Define quality assurance processes.</li> <li>• Begin procurement of long-lead tooling.</li> </ul>	<ul style="list-style-type: none"> <li>• Facilitate supplier ramp-up.</li> <li>• Refine fabrication and assembly processes.</li> <li>• Train work force.</li> <li>• Refine quality assurance processes.</li> </ul>	<ul style="list-style-type: none"> <li>• Begin operation of entire production system.</li> </ul>
<b>Other Functions</b> <ul style="list-style-type: none"> <li>• Research: Demonstrate available technologies.</li> <li>• Finance: Provide planning goals.</li> <li>• General Management: Allocate project resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Finance: Facilitate economic analysis.</li> <li>• Legal: Investigate patent issues.</li> </ul>	<ul style="list-style-type: none"> <li>• Finance: Facilitate make-buy analysis.</li> <li>• Service: Identify service issues.</li> </ul>		<ul style="list-style-type: none"> <li>• Sales: Develop sales plan.</li> </ul>	

Source: Ulrich and Eppinger (2007)

In Table 2.1, six phases are shown which are including the task and responsibilities of key function marketing, design, manufacturing for an organization for each phase.

It is unlikely that one individual will have the necessary skills in marketing, industrial design, mechanical and electronic engineering, manufacturing processes and materials, tool-making, packaging design, graphic art, and project management, just to name primary areas of expertise. Ullman (1997)

illustrates where these necessities or knowledge apply in a design process as in Figure 2.2.

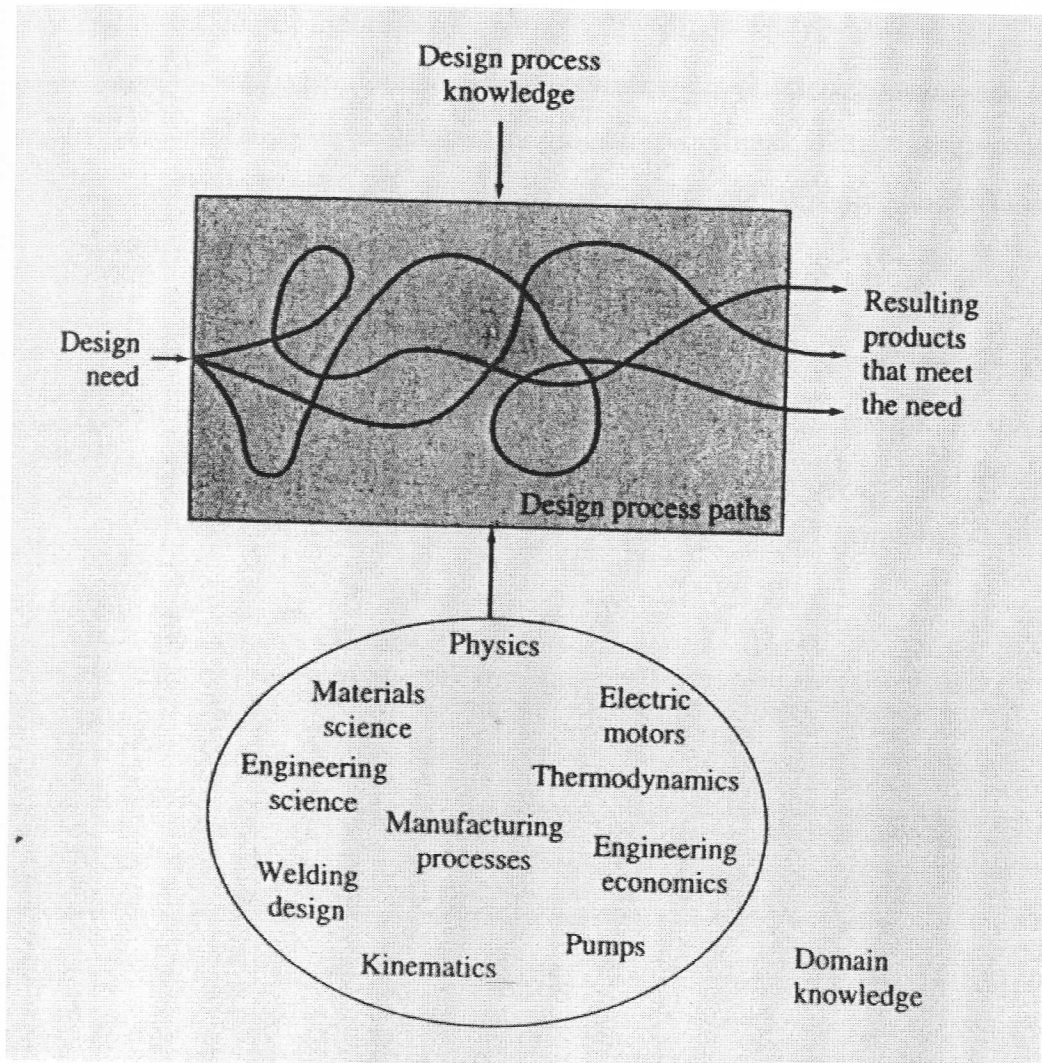


Figure 2.2: The many results of the design process

The more people involved in a project, the greater is the need for assistance with communication and for a structure to insure that nothing important is overlooked (Ullman, 1997).