DESIGN AND DEVELOPMENT OF GUI FOR A REMOTELY CONTROLLED CAR

MOHAMAD FIKREE BIN ALIAS

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DESIGN AND DEVELOPMENT OF GUI

FOR A REMOTELY CONTROLLED CAR

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By

MOHAMAD FIKREE BIN ALIAS

Faculty of Manufacturing Engineering
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SYAMIMI BINTI SHAMSUDDIN
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Author's Name   : **Mohamad Fikree Alias**

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (*Robotics and Automation*). The members of the supervisory committee are as follow:

Mrs. Syamimi Bt. Shamsuddin
(PSM Supervisor)

SYAMIMI BINTI SHAMSUDDIN
Pensyarah
Fakulti Kejuruteraan Pembuatan
Universiti Teknikal Malaysia Melaka
Karung Berkunci 1200, Ayer Keroh
75450 Melaka

ABSTRACT

This project describes the control of a Remote Control Car (RCC) using the Graphical User Interface (GUI) that has been developed using the Microsoft Foundation Classes (MFC) dialog-based. The platform in developing the GUI is Visual C++ 6.0 (VC++). The idea of the project is for the GUI to send the input to the Integration Board (IB) which consists of the Programmable Intelligent Computer (PIC). The output on the PIC will then activate the signal from the Radio Frequency (RF) controller to move the RCC. During the design and development process, several problems have been encountered thus giving a large obstacle in completing the project. These problems being identify during the two tests that has been conducted after the project has been fabricates. The first test shows the integration of the IB and the RF controller in giving out signals. The result shows that the integration between two boards is working as planned. However, on the second test, there is a problem that has been encountered from the aspect of the PIC source code. The PIC did not manage to compare the value given from the GUI in order to gives signals to appropriate port. Several attempts in solving the problem have been done but the result still the same. The problem did not manage to be solved thus failing the integration between the GUI and the IB. In the end, the project only manages to achieve two out of three objectives. Nevertheless, apart from the PIC source code problem, the GUI functions perfectly, from the serial connection coding to the data transfer coding. On the electronics side, the integration of the IB and the RF controller is a success. The RF controller is able to emit the frequency to the RCC according to the output given from the IB. This project basically gives quite a challenge as it mainly focusing on the aspect of programming where the programming has to be done in two parts; the GUI and the PIC.

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ABSTRAK

Projek ini berkisar mengenai mekanisma untuk mengawal kereta kawalan jauh dengan menggunakan *Graphical User Interface (GUI)* yang di bina daripada *Microsoft Foundation Classes (MFC) dialog-based*. Platform yang digunakan dalam membina aplikasi itu adalah *Visual C++ 6.0 (VC++)*. Idea di dalam projek ini adalah untuk *GUI* yang dibina itu dapat menghantar *input* kepada *Integration Board (IB)* yang mempunyai *Programmable Intelligent Computer (PIC)*. *Output* dari *PIC* itu akan mengaktifkan isyarat dari alat kawalan *Radio Frequency (RF)* untuk menggerakkan kereta kawalan jauh itu. Di dalam proses membangunkan projek ini, beberapa masalah timbul yang memberikan impak yang besar dalam penyiapan projek ini. Masalah-masalah ini dikenal pasti melalui ujian yang dijalankan selepas projek ini siap difabrikasi. Ujian pertama merujuk kepada kolaborasi antara *IB* dan juga alat kawalan *RF*. Keputusan menunjukkan kolaborasi antara *IB* dan alat kawalan *RF* berjaya tanpa sebarang masalah. Bagaimanapun, di dalam ujian kedua, terdapat masalah yang berpunca dari kod di dalam *PIC* di mana *PIC* gagal untuk membezakan data atau nilai yang dihantar oleh *GUI* bagi mengaktifkan signal pada alat kawalan *RF*. Beberapa jalan penyelesaian telah dicuba namun masalah masih gagal ditangani. Ini menyebabkan kolaborasi antara *GUI* dan *IB* gagal. Akhirnya, projek ini berjaya mencapai dua dari tiga objektif yang digariskan. Selain dari masalah kod *PIC*, aplikasi *GUI* tidak memberis sebarang masalah dan berfungsi seperti yang dikehendaki. Dari sudut elektronik, kolaborasi antara *IB* dan alat kawalan *RF* adalah berjaya. Alat kawalan *RF* mampu untuk memancarkan frekuensi kepada *RCC* berdasarkan input yang diberi daripada *IB*. Projek ini memberikan cabaran yang ketara dari sudut programming di mana terdapat dua perkara yang harus diprogramkan; *GUI* dan *PIC*.

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Praise to Allah, Allah the almighty. To Him I pray my wish and to Him I sang my worries. For all in the things in this world, I only seek for His love to comfort me, His guidance to lighten me and His forgiveness to clear the sins from me. Without Him I am lost and without Him I am nothing. For He has given me two hands and a functional brain to work with. Praise to Allah.

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LIST OF ABBREVIATIONS, SYMBOLS, SPECIALIZED NOMENCLATURE

VC++	-	Visual C++ 6.0
VB	-	Visual Basic
RF	-	Radio Frequency
PC	-	Personal Computer
GUI	-	Graphical User Interface
IB	-	Integration Board
JVM	-	Java Virtual Machine
HMI	-	Human-Machine Interface
MFC	-	Microsoft Foundation Classes
DC	-	Direct Current
AC	-	Alternate Current
PANs	-	Personal Area Networks
MMS	-	Multimedia Messaging System
ELF	-	Extremely Low Frequency
SLF	-	Super Low Frequecy
ULF	-	Ultra Low Frequency
LF	-	Low Frequency
MF	-	Medium Frequency
HF	-	High Frequency
UHF	-	Ultra High Frequency
VHF	-	Very High Frequency
SHF	-	Super High Frequency
EHF	-	Extremely High Frequency
RCA	-	Radio-controlled Airplane
RCB	-	Radio-controlled Boat
RCC	-	Radio-controlled Car

RAD	-	Rapid Application Development
DTE	-	Data Terminal Equipment
DCE	-	Data Circuit-terminating Equipment
PIC	-	Programmable Intelligent Computer
USART	-	Universal Synchronous/Asynchronous Receiver – Transmitter

CHAPTER 1

INTRODUCTION

1.1 Background

Radio frequency (RF) has been widely used nowadays. From the simplest things to more complex routine of human life, RF has been a very great help in the industry especially in expanding the work capability of human. Not only that, RF also being used in controlling things and toys. For instance the remote controlled car or even for some robots, it use the RF signal to move according to the user command. However, the method of using the RF in controlling still in the native or conventional way where the signal only being transmitted through the remote control to the robot.

This method is the simplest method to be use of RF in controlling system but, one thing that is missing is that this type of controlling system lack a bit of Human-Machine Interface (HMI). Of course, the user can controlled the car or the robot by using the already built controller but one thing that needs to be put in mind is that the user needs to follow the thing that they controlled.

From this view, the idea of developing a Graphical User Interface (GUI) project came out. Basically, the project will turn the RF controller from mobile, to Personal Computer (PC) based. In other words, the native RF controller will be integrated with the PC using an additional board (namely Integration Board) and from that, the user can control the car or robot from the PC! However, in this project, the author decided to use

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the control car as the medium of RF receiver. Figure 1.1 explains the basic idea of operation of the project.

Thus this project will emphasize more on the programming development as it is the main ingredients in designing the GUI. Not only that, a development from the electronics part will also plays it roles as this project requires effective integration between the PC and the RF controller.

GUI on the host
PC

Integration Board   Data sent to the
                           control car

Remote Control Car
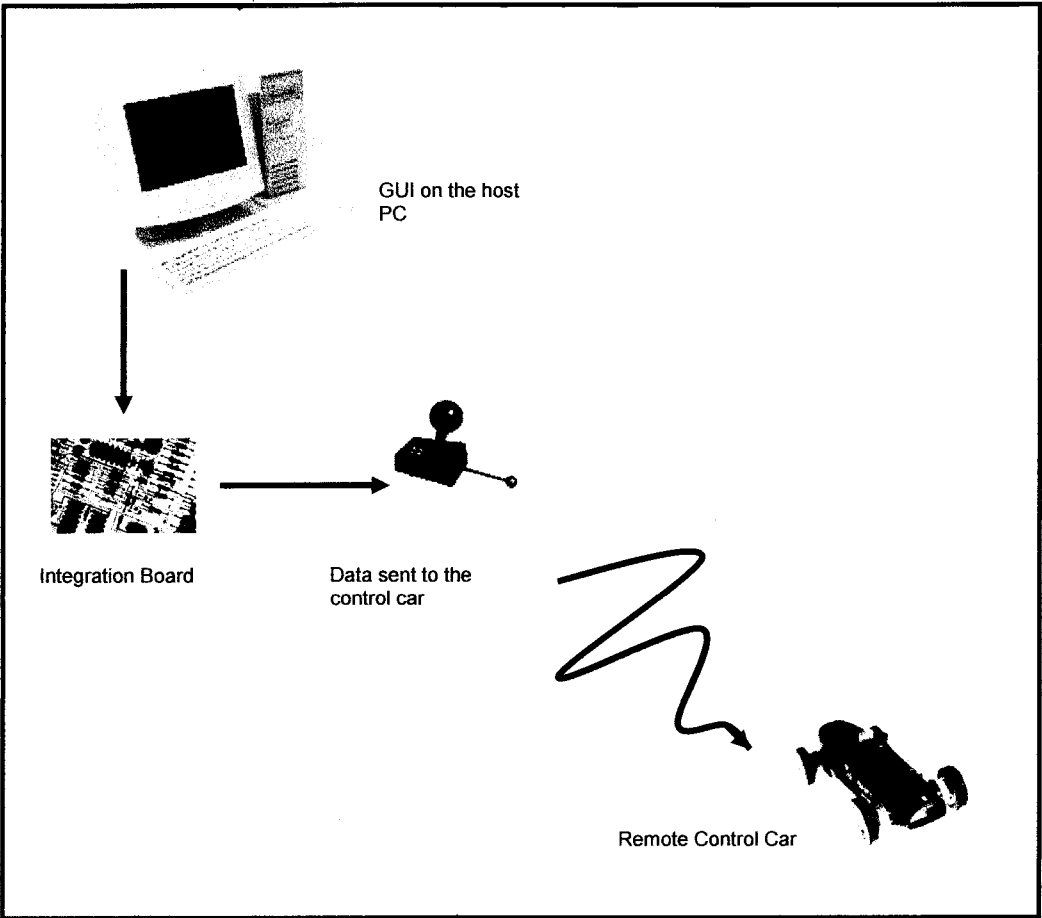
Figure 1.1: Basic idea of the project

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1.2 Problem statement

The idea of develop and design this project begins when the author realize that in becoming an excellent robotics and automation engineer, one's must have strong basics in three main aspect of engineering: mechanical, electrical and electronics and software development. As the author believes that having strong basics in these three aspects will be very beneficial for fresh graduates as these basics can be expand into knowledge's that can be used later on.

This project main challenge is to develop a GUI to be used in controlling the car. The GUI design and development must considered aspects such as easy to use, user-friendly and simple but effective. The display of the GUI also plays role in designing it. On top of that, in order to design such GUI, skills and creativity are the criteria that one's must have. Opinions from the tester also can be taken into consideration to improve the GUI that being developed.

Not only has that, in order to integrate the RF controller with the PC that contains the GUI, modification to the RF controller needs to be done. This is where the electrical and electronics parts came in. The RF needs to be modified so that the command sent from the PC can be read by the RF controller thus transmitted it to the car for action. For this cause, basic skills and knowledge in electrical and electronics will help a lot in designing the circuit to be used for the integration. Also, the component to be put in the circuit must also being taken into consideration, not to be mention the value of resistors that needed aligned with the transistors.

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1.3 Objectives

There are three main objectives of this project. In order to verify the project as a success, these three objectives must be achieved.

1. To add the Integration Board (IB) for the RF controller to be able to receive data sent from the host PC.
2. To design and develop a GUI using Visual C++ 6.0 for the user to control the car from the PC.
3. To integrate both systems (RF controller and GUI) in order for the car to carry out tasks sent from the host PC.

1.4 Scopes

Project scopes are important in order to help in the development and the progress of the project. Not only have those, scopes also helped in deciding the path and secure the flow of the project. The scopes of this project are simple. Below are the descriptions of this project:

a. Project materials :-
The project will use the PC as the based for the GUI, the RF controller as the RF transmitter and the RF car as the RF receiver.

b. Software development :-
Visual C++ 6.0 will be used for the design and the development of the GUI. The GUI will be simple but user-friendly. It will consist of basics command of the car movement such as the forward, backward, left and right.

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c. Electrical and electronics :-

In order to build the IB, the circuit will be build only to perform the operation of converting the command sent by the PC to be understand by the RF controller so the RF can be transmit.

d. Integration :-

The IB will be integrated with the PC containing the GUI along with the RF controller. The idea is to connect the PC by using the RS-232 com port and connect it to the IB, while the IB will be connect with the RF controller through simple wiring.

e. Testing and development :-

Testing and improving being made in order to make the GUI to be more user-friendly and the project system works perfectly.

1.5 Project planning

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TASK	PERIOD
1.0 TITLE SELECTION	1 Week
1.1 List of PSM titles	
1.2 Find supervisor	
1.3 Submit PSM title	
2.0 PROJECT PROPOSAL	9 Days
2.1 Draft proposal	
2.2 Checking and finalize	
2.3 Submit and approval by supervisor	
3.0 LITERATURE REVIEW	12 Weeks
3.1 Visual C++	
3.1.1 MFC dialog-based	
3.1.2 RS-232 to RCC controller	
3.1.3 Add function to buttons	
3.2 Electric and Electronics	
3.2.1 Components and functions	
3.2.2 Understanding circuit design	
4.0 PSM 1 REPORT	8 Weeks
4.1 Planning	
4.2 Chapter 1	
4.2.1 Draft	
4.2.2 Submit	
4.3 Chapter 2	
4.3.1 Draft	
4.3.2 Submit	
4.4 Chapter 3	
4.4.1 Draft	
4.4.2 Submit	
4.5 Compile and submit	
5.0 PSM 1 PRESENTATION	3 Weeks
5.1 Planning & drafting	
5.2 Design PSM 1 presentation	
5.3 Present	

WEEKS: WK 1, WK 2, WK 3, WK 4, WK 5, WK 6, WK 7, WK 8, WK 9, WK 10, WK 11, WK 12, WK 13, WK 14, WK 15, WK 16, WK 17, WK 18
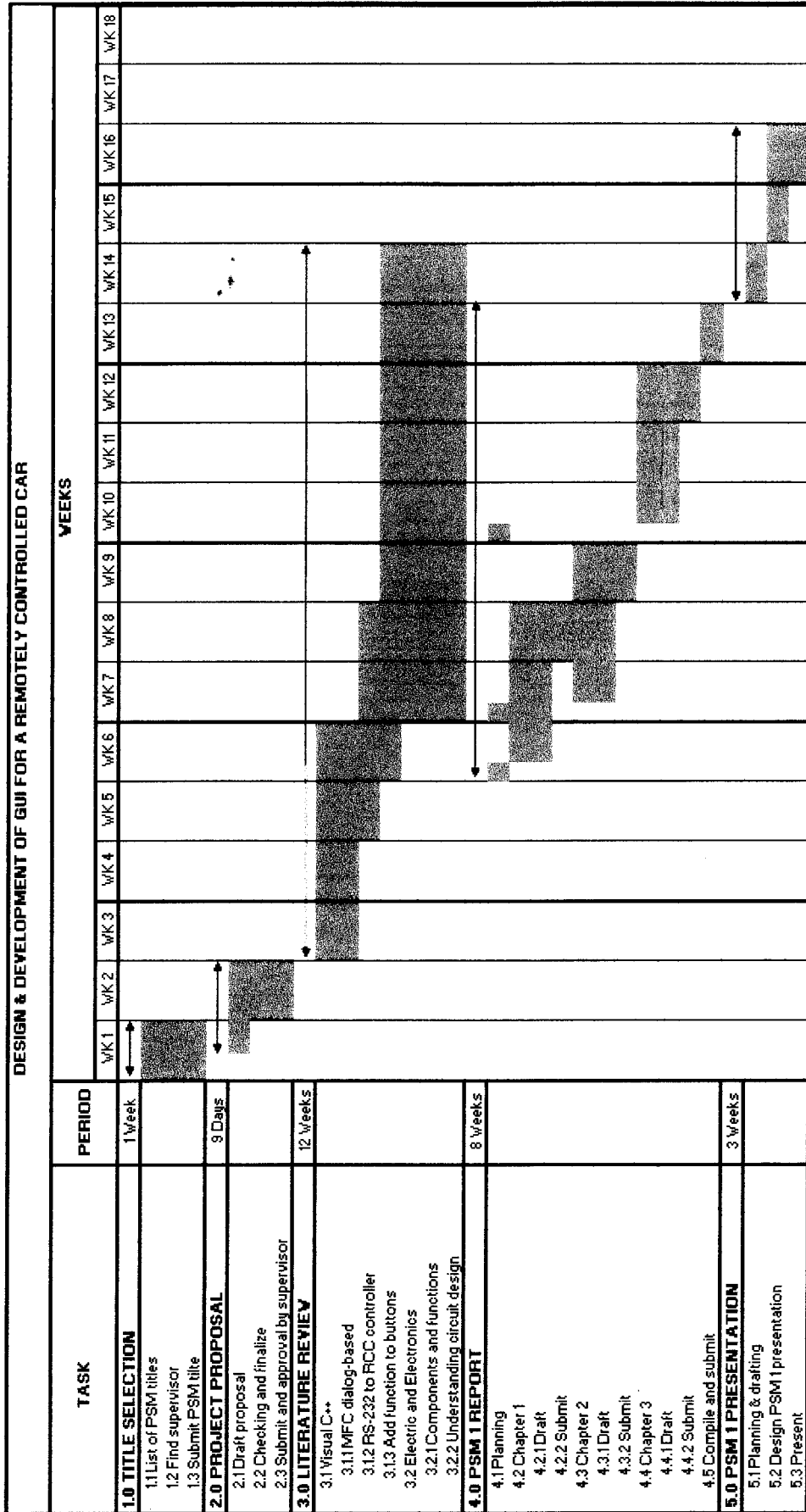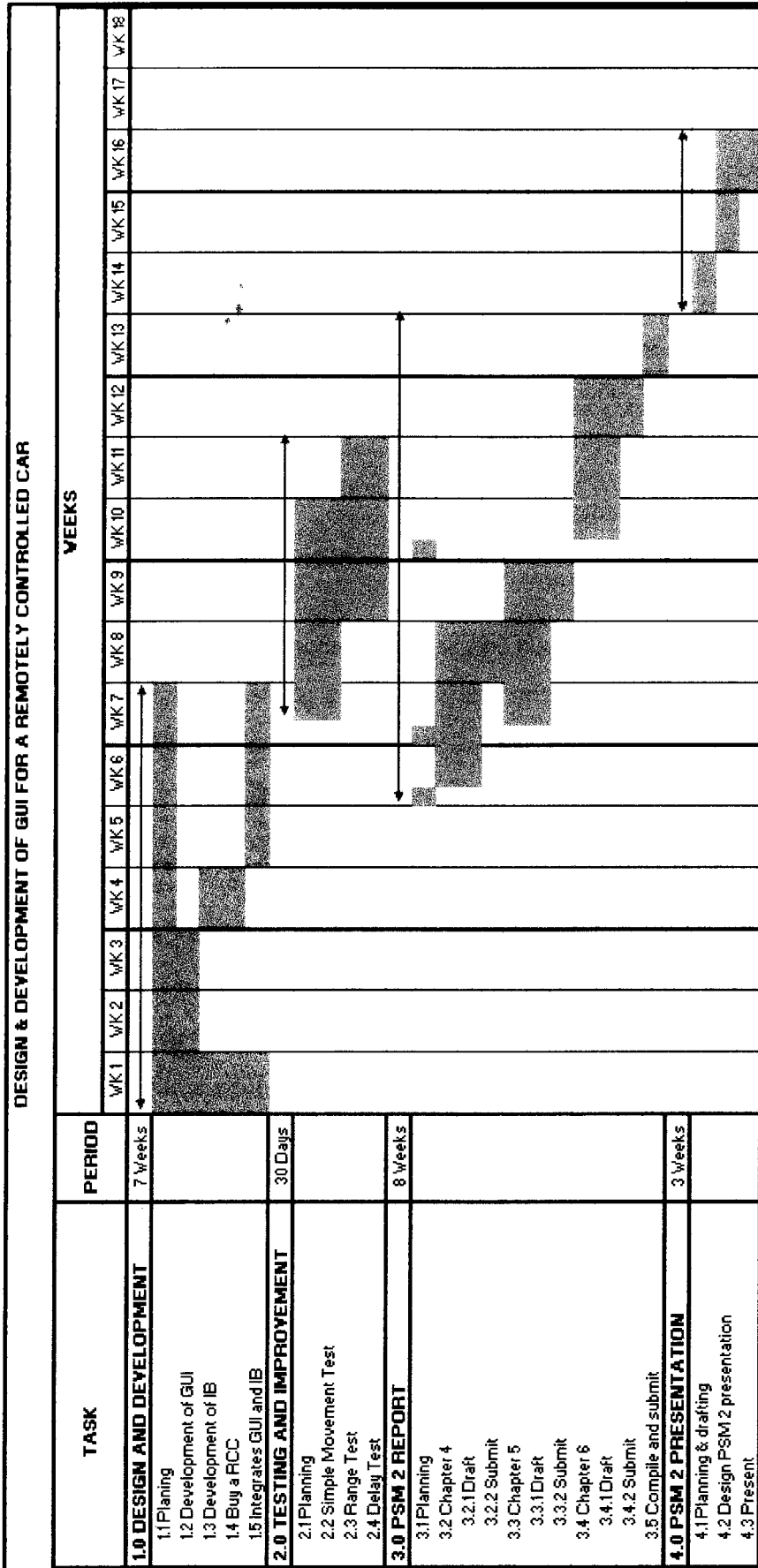
Figure 1.2: PSM 1 Gantt chart

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Figure 1.3: PSM 2 Gantt chart

Figure 1.2 explains the flow of the project planning for the PSM 1. In it, the relevant processes for the PSM 1 being put along with the required time for each process while Figure 1.3 shows the flow of the PSM 2 in details.

1.5.1 Title Selection

At the beginning of the academic week, the selection of the PSM title was the first thing that needs to be done. In acquiring the title, students being given lists of titles and supervisor that was in charge of each title. They can either choose from the lists given or came up with their own title. The submission of the PSM title being done after the title that has been chosen has a supervisor and is available.

1.5.2 Project proposal

After the title selection, a proposal regarding the corresponding PSM title will be made. This is the first step to test the knowledge and understanding of the student regarding their title. From the proposal, the course and scope of the project will be determined so that the flow will be clearly explained. The proposal will then be evaluate by the supervisor for final submission.

1.5.3 Literature review

This was the process where the data collections being done. For this process, any source regarding the related aspects in the PSM project that is available will be search. For this project, the aspects that need to be focus more are on the programming skills regarding the Microsoft Foundation Classes (MFC) Visual C++ 6.0 and the electrical and electronics field. In order to do so, sources such as journals, books and relevant websites are very helping.

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