WIRELESS BRAKING DEVICE FOR BABY STROLLER

By

SITI ZULAIKHA BINTI ZAINOL

FINAL PROJECT REPORT

Submitted to the Electrical & Electronics Engineering Programme
in Partial Fulfillment of the Requirements
for the Degree
Bachelor of Engineering (Hons)
(Electrical & Electronics Engineering)

Universiti Teknologi Petronas
Bandar Seri Iskandar
31750 Tronoh
Perak Darul Ridzuan

CERTIFICATION OF APPROVAL

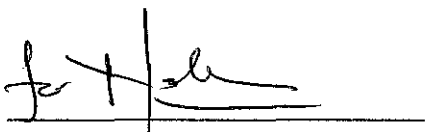
WIRELESS BRAKING DEVICE FOR BABY STROLLER

by

Siti Zulaikha binti Zainol

A project dissertation submitted to the
Electrical & Electronics Engineering Programme
Universiti Teknologi PETRONAS
in partial fulfilment of the requirement for the
Bachelor of Engineering (Hons)
(Electrical & Electronics Engineering)

Approved:



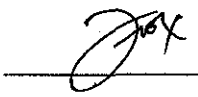
Dr. Noohul Basheer bin Zain Ali
Project Supervisor

UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK

May 2011

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



Siti Zulaikha binti Zainol

ABSTRACT

Baby strollers are essential piece of equipment for family life. They help parents get on with what need to do when children cannot be keeping up with. Each product in the market, including foldable strollers, single seat or twin seat strollers are made with some sort of braking system, but guardian sometimes forget to put them on or do not put them on appropriately causing a child in a stroller rolling towards dangerous obstacles. Motivated by the high number of children treated each year for stroller-related injuries, an improved braking system is developed as a resolution to decrease the child's risk of injury. The system is disclosed whereby when the stroller is at rest and not being pushed by a guardian, the wheels of the stroller are automatically locked to prevent accidental propulsion or any unforeseen stroller movement, particularly when stopped on an inclined surface. In accordance with the invention, the system uses a handheld unit, carry on by the guardian, wirelessly connected to the brake levers associated with the rear wheels of the stroller. Split by more than two meters range cause the wireless connection to disconnect. In the occurrence of failure signals propagation due to ineffective range of frequency, alarm will be triggered and simultaneously the self- braking system is put in motion to preclude the wheels from rotation. It is designed to easily retrofit to existing strollers with the aim to prevent any unintentional rolling movement.

ACKNOWLEDGEMENTS

In the name of Allah, the Most Gracious and Most Merciful. Praise be to Him, Sustainer of the Universe, for His blessings and compassions I am able to complete this project.

Foremost, I would like to express my sincere gratitude to my supervisor, Dr. Noohul Basheer bin Zain Ali. His wide knowledge and his logical thinking have been of great value for me. His understanding, encouraging and personal guidance have provided a good basis for the present project and report. Thank you for the invaluable advices and assistance, the experienced I had in completing this project will always be treasured.

Not to forget, the Coordinator of Final Year Project, Dr. Zuhairi bin Hj. Baharudin, as well as entire committee members and all the lecturers for your immense effort in providing me with a thorough knowledge, not only in areas relating to this course but others as well.

Special appreciation to my parents, Zainol bin Isa and Zahrah binti Ahmad, who have brought me into existence with Allah's will, forgiving my mistakes and bestowed upon me unconditional love throughout the course of life. I will never be here, where I am today without your endless supports and encouragements.

Last but not least, millions of thanks to my entire colleague which have contribute either directly or indirectly in completing this project.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Direct Current (DC)

Alternating Current (AC)

Radio Frequency (RF)

Printed Circuit Board (PCB)

CHAPTER 1
INTRODUCTION

Baby strollers have come a long way in a history that cross nearly three hundred years. These days a baby stroller has become the number one must-have piece of equipment for all guardians to transport a child without difficulty. Up until now, baby strollers have come in many varieties with different styles, looks and colors. Most are equipped by highly modernized safety features and meet the needs of an active society. Braking system, safety harness and sharp edges and corners are the essentials number of points that should not be overlooking while choosing and using a stroller. Among those three, braking system is the most crucial part which leads to most strollers' related injuries nowadays. In this chapter, we are going to deliberate the background of study that has been carried out to give a brief overview of the entire project. After that, we will discuss a clear concise description of problem statement regarding the failure of existence baby stroller braking system. Last but not least, the objectives and scope of study will cover on the rational and limitation of this project.

1.1 Background of Study

Baby strollers are commonly used to transport babies or young children under any circumstance when carrying a child would be burdensome or tiring; outdoors for walks or to complete short errands, or indoors to shop. Most ideal modern strollers are made to be lightweight and easily maneuverable. The manufacturers put a lot of focus on accommodating many functional features in addition to the average strollers invented on the earlier days.

For any type of strollers' product, it generally includes at least three free rotating wheels for easy moving of the stroller and is equipped with manual push handles affixed to the body frame thereof. The rear wheels of most modern day strollers are provided with wheel brakes of friction or interlocking types which must be purposely engaged or disengaged by the attendant person [1]. Thus, the attendant person

wishing to park the modern day stroller, and inhibit its rolling movement, is usually required to depress by foot actuation a brake lever associated with each rear wheel of the stroller. Before again pushing the stroller the attendant person must release the brake mechanisms by lifting each brake lever-usually by engaging the underside of the lever with the toe-portion of one's foot [1]. Instead of a standard foot-brake, an additional safety feature of braking system has been manufactured. When brake is not engaged, a suitable strap must ensure to be tied around the attendant wrist to retain control of the stroller; therefore preventing any unintentional rolling movement and the safety of the baby carried therein is assured.

Figure 1 Stroller

Even though the strollers are equipped with sort of trouble-free braking system, in some instances the stroller attendant forgets to set the wheel brakes or loses control of the stroller thereby jeopardizing the safety of the baby carried therein. For that

reason, an improved self-braking system which able to preclude the wheel from rotation should be invented as a purpose to reduce stroller related injuries in young children.

1.2 Problem Statement

There were an estimated 64 373 stroller related injuries to children three years old and younger treated in hospital emergency departments in the United States during the 5-year study period [2]. The median age at the time of the injury was 11 months; with slightly more boys than girls injured (51% to 49%). The annual rate of injury among children less than one year old was 184.4 per 100 000. The number of injuries found were head or face injuries; 87% of all the injuries found were the head or face. Of the nearly 1,000 children admitted to a hospital, 70% were for head trauma. Lacerations, contusions (bruises) closed-head injuries and fractures accounted for most of the injuries [2].

All this number above shows how important it is to utilize all the safety features provided on the baby stroller. In particular, unintentional rolling movements of the baby stroller have lead to major contribution towards the high number. To engage the brake levers on most strollers require just a few seconds to do. It just need to simply press a foot down on a lever located at the rear wheel of the stroller. By setting the lever in the lock position, it puts weight on the rear wheel making it difficult for the stroller to roll. Else, a suitable tether strap can be simply tied around the wrist to permanently control the stroller from rolling away.

Even if only take a few extra seconds to lock the brakes but a number of guardians do overlook to activate the system causing the stroller to slip down and runs towards dangerous obstacles vehicles, walls or falls in a risky place. Due to that, a specific preventive strategy; a brake design modification is practically invented in order to reduce the rate of stroller related accidents. The appropriate braking system would likely be helpful to prevent the incidents of stroller-related injuries.

1.3 Objectives and Scope of Study

The objectives of this project which describe future expected outcomes are as written below:

- To invent a self-braking system to wirelessly detect a distance between the attendant person and the baby stroller.
- To invent a self-braking system to automatically engage the brake lever into locking position.
- To invent a self-braking device which may be retro-fitted to standard strollers.

The scopes of this project will be simplified as follows:

- To provide an improved reliable self-braking system for wheeled baby strollers of both foldable and non-foldable.
- To provide baby strollers with automatic safety device to prevent accidental propulsion particularly when stopped on an inclined surface.

CHAPTER 2
LITERATURE REVIEW

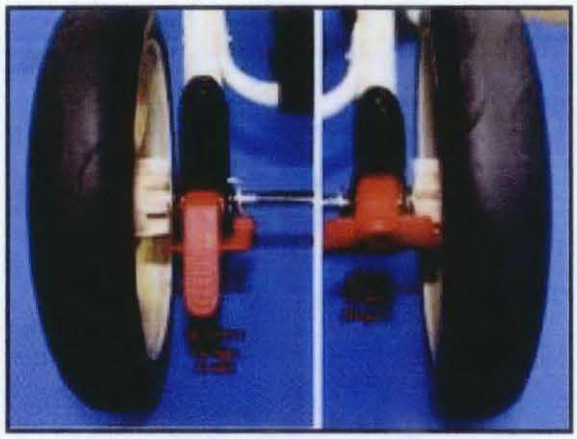
Up till now, baby strollers have come in many varieties with different styles, looks and colors. Mainly are equipped by highly modernized safety features and meet the needs of an active society. In this chapter, we are going to look in depth the existence manual baby stroller braking system. Next, in view of the fact that we will use the Direct Current (DC) motor to automatically set the brake lever into locking position, the theory of DC motor is discuss in detail. Subsequently, as we planned to establish a wireless connection between the baby stroller and the handheld unit carries on by attendant person, concept of wireless communication is introduced. Among all types of wireless communication, radio frequency is preferable for this present invention. Due to that, the theory of RF signal as well as RF transmitter receiver is discussed in further details afterward.

2.1 Baby Stroller Braking System

Baby stroller which otherwise known as baby carriage is a mechanism used to transport a newborn or small child in a sitting position, usually facing forwards, instead of facing the pusher [3]. All baby stroller products have to be provided with manual push handles affixed to the body frame thereof together with other basic parts including seat-belt and wheels [4].

The rear wheels or wheel sets of most ideal modern baby strollers are equipped with wheel interlocking types known as brake lever which must be purposely engaged or disengaged by the attendant person [4]. Thus the attendant person wishing to park the modern-day baby stroller, and restrain its rolling movement, is usually required to engage a brake lever associated with each rear wheel by foot actuation [4]. Before again pushing the baby stroller the attendant person must disengage each brake lever – usually by lifting the underside of the lever with the toe portion of one's foot [4]. The foot brake is very easy to work with, yet in

some instances the attendant person forgets to engage the brake lever or loses control of the baby stroller thereby endanger the safety of the baby or small child carried therein.



(a) Brake lever engaged (b) Brake lever disengaged

Figure 2 Stroller foot-brake system

In accordance with the raising stroller related injuries among young children, a new mandatory standard for baby strollers has been developed by the Australian Competition and Consumer Commission [5]. The standard requires that each baby stroller must be affixed with tether strap as additional safety feature which help to retain control of the baby strollers [5]. When brake is not engaged a suitable strap must ensure to be tied around the attendant wrist so the baby stroller cannot roll away. Conversely, this additional feature has lead to different stroller incidents. As the attendant person moves in the opposite direction from the stroller in speedy movement while hand wrist constantly is tied up with tether strap, this will give a high impact to the stroller and could cause it to tip over.

Figure 3 Stroller tether-strap

However, the stroller related incidents have continued to happen, regardless of the new mandatory standard. In view of that reason, an extra consideration is needed to improve an existence braking system of baby strollers so that unintentional rolling movement thereof is inhibited and the safety of the baby or small child carried therein is assured.

2.2 Direct Current (DC) Motor Operation Principles

Dc motors convert dc electric energy to mechanical energy. Most dc machines are like ac machines in that they have ac voltages and currents within them – dc machines have a dc output only because a mechanism exists called a commutator that converts the internal ac voltages to dc voltages at their terminals.

The fundamental principles involved in the operation of dc machines are very simple. Unfortunately, they are usually somewhat obscured by the complicated construction of real motor which does not move in a straight line-they rotate. Toward understanding real dc motor is to study the simplest possible example of rotating motor consists of a single loop of wire rotating about a fixed axis. The rotating part of the motor is called the rotor or armature, and the stationary part is called the stator. Figure below illustrates the basic parts of DC motor.

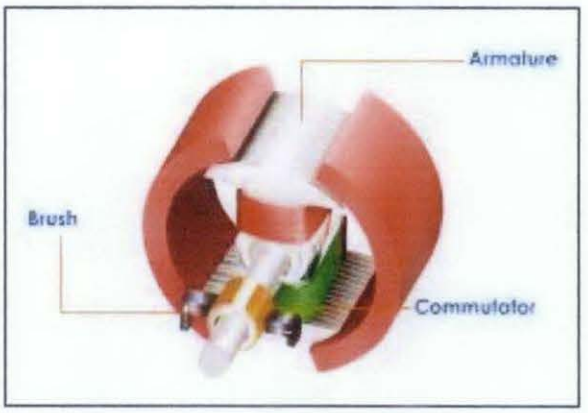


Figure 4 Parts of a DC motor

Dc motor operates through the interaction of two magnetic fields associate with flux density formed. One field is produced by a permanent magnet assembly while the other is produced by an electrical current flowing in the motor windings. These two fields tend to oppose each other results in a torque which tends to cause a rotation of the rotor. As the rotor turns, the commutator will rotate as well due to the continuous torque produced by the current flowing in the windings. The torque speed characteristic of dc motor is very linear because of constant magnetic field produced by permanent magnet.

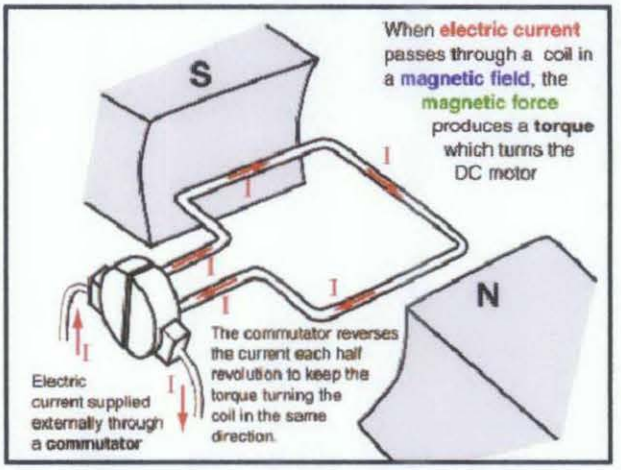


Figure 5 Operation Principles of DC motor

When a dc motor is first connected to a battery, there is no back electromagnetic force (EMF) induced and no current will be flowing through the motor. This is because of the mutual voltage supplied by the battery and voltage generated by the motor at the first place. To vary the voltage fed to the motor, a speed controller is used. Initially, at zero speed, the controller will feed no voltage to the motor, so no current flows. As the motor speed controller's output voltage increases, the motor will start to turn [9].

As summary, there are several types of dc motors, differing in the way in which their magnetic field flux densities are derived which affects the way it varies with the load, which in turn affects the motor's torque-speed characteristic.

2.3 Wireless Communication

Wireless communication is by means no use of wires to transmit data (signal) over a specified distance [10]. The distances involved may be short or long. With the aid of electromagnetic waves well-known as Radio Frequency (RF), signal propagation is accomplished without any electrical conductors. Wireless communication provides more flexible yet inexpensive ways to send and receive data. This improved communications has leads to faster data transmission towards increasing the efficiency. There are several kinds of wireless technologies which differ by their effective range of frequency.

2.3.1 Radio Frequency (RF) Signal

RF is one of the widespread wireless technologies used in most practical devices in daily life. With the injection of ac current to an antenna, an electromagnetic (EM) field is induced to allow signal propagation through space. The frequencies associate with the field covers a significant segment of electromagnetic spectrum which can be further divided into several ranges, or bands. Each band illustrates below represents an increase range of frequency corresponding to an order of magnitude (power of 10).

Table 1 Radio Frequency (RF) Spectrum

Designation	**Abbreviation**	**Frequencies**	**Free-space Wavelengths**
Very Low Frequency	VLF	9 kHz - 30 kHz	33 km - 10 km
Low Frequency	LF	30 kHz - 300 kHz	10 km - 1 km
Medium Frequency	MF	300 kHz - 3 MHz	1 km - 100 m
High Frequency	HF	3 MHz - 30 MHz	100 m - 10 m
Very High Frequency	VHF	30 MHz - 300 MHz	10 m - 1 m
Ultra High Frequency	UHF	300 MHz - 3 GHz	1 m - 100 mm
Super High Frequency	SHF	3 GHz - 30 GHz	100 mm - 10 mm
Extremely High Frequency	EHF	30 GHz - 300 GHz	10 mm - 1 mm

2.3.2 Radio Frequency (RF) Transmitter and Receiver

In general, a radio transmitter and receiver is used for performing a radio transmission and receiving signal operation, whereby a high frequency signal outputted from a modulator is transmitted to an antenna of the radio transmitter and is transmitted there from to a remote radio transmitter and receiver, or the thusly transmitted signal is received through another antenna [12]. The transmitting baseband signal is subjected to a predetermined signal process, input to a modulator, which modulates a carrier wave signal. The modulated carrier wave signal is converted into a radio frequency by a transmitting radio-frequency circuit and amplified to a predetermined transmitting power, and transmitted to the base station from the antenna via the duplexer [12].

RF receivers commonly either convert an input RF signal to an intermediate frequency, or directly mix an input signal to a direct current (DC) signal. The RF receiver receives an RF signal, converts the RF signal to an intermediate frequency (IF) signal, and then converts the IF signal to a baseband signal, which it then provides to the baseband processor. The RF receiver is coupled to the antenna and includes a low noise amplifier, one or more intermediate frequency stages, a filtering stage, and a data recovery stage. The low noise amplifier receives an inbound RF signal via the antenna and amplifies it. The one or more intermediate frequency stages mix the amplified RF signal with one or more local oscillations to convert the amplified RF signal into a baseband signal or an IF signal [12].

Transmitters and receivers for communication systems broadly are designed such that they are tuned to transmit and receive one of a multiplicity of signals having widely varying bandwidths and which may fall within a particular frequency range [12].

CHAPTER 3
METHODOLOGY

This chapter describes the methodology used for Wireless Braking Device project development. Procedure identification is a set of procedures conducted as the aim to accomplish the project according to the time frame. A flowchart is attached to graphically illustrate how the entire project is going to be carried out step by step. After a comprehensible description about the project development, we go in depth to project specification as well as tools and equipments to be use that will point up the operation system of the project in complete structure.

3.1 Procedure Identification

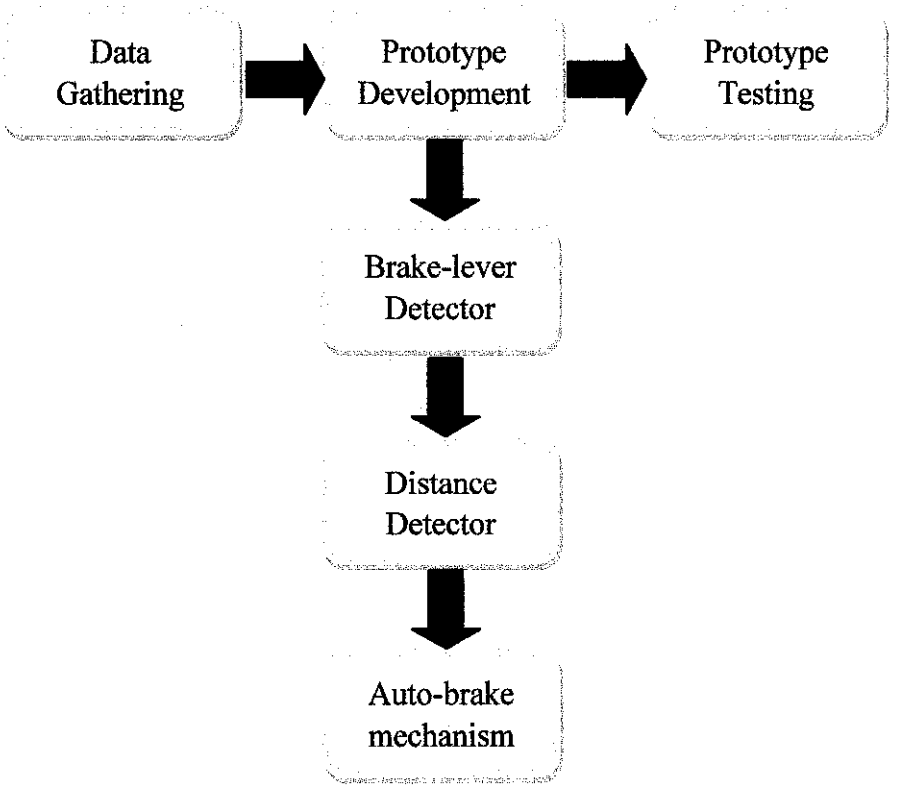


Figure 6 Procedure Identification

As a starting point to gather information related to the topic undertaken, it involves the use of qualitative data such as direct observations, survey and analysis of documents and material. Documents review is the major research method used for developing idea of this prototype-based project. Many electronic documents as well as printed documents from the web have been revised to better familiarize oneself with the theoretical concept to be used. Research on wireless communication and RF signal which serve as primary operating system together with the alert system has been carried out. DC motor capabilities are studied as well in order to construct the self-braking system.

It is a general objective of the present invention to provide baby strollers with a wheel brake device which automatically inhibits rolling movement of the stroller when the attendant person's hand are purposely or accidentally out of holding or gripping contact with the push handle of the stroller [3]. In accordance with the present invention, the brake device includes a transmitter which is mounted on the body frame of the stroller and a receiver; a handheld unit, carry on by the attendant person.

Wireless connection of RF connects both transmitter and receiver to operate a brake assembly incorporating with the wheels. To attain the interconnection between the transmitter and receiver, a dual magnetic arrangement with one magnet is associated with travel, attached to the brake lever and the other permanently affixed relative to a reed switch or the like, and attached to the wheel. The wireless connection is set to be established as the moment both magnets detect the unbraking condition of the particular wheel. The transmitter will then able to transmit signal to the movable receiver, carry on by the attendant person as a handheld unit.

In the occurrence of failure signals propagation due to ineffective range of frequency, alarm will be triggered and simultaneously the self- braking system is put in motion. In the preferred embodiment, the DC electric motor provides the motive power to drive each brake lever associated with the rear wheel independently as driven by a 12volt battery. Once the motor is set to operation mode, it constrains a sufficient amount of torque to automatically actuate the brake lever into locking position to preclude from rotation. Before again moving the stroller the attendant person have to manually lift up the underside of the brake lever with toe-portion of

one's foot, then the wheels are free to rotate with pushing or pulling movement of the stroller.

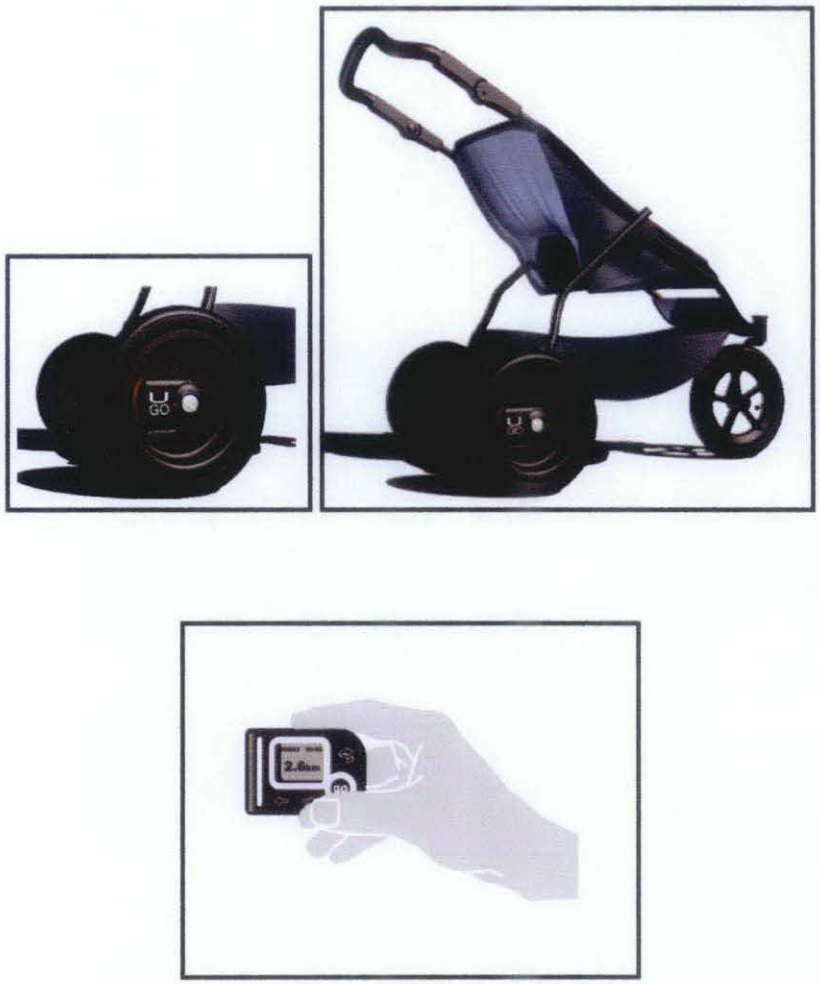


Figure 7 (a) Transmitter mounted on wheel (b) Receiver as handheld unit

The final stage is the prototype testing phase. In this phase, all the implementations are setup as a unit and put into trial in real application. Troubleshoot and any improvement could be done within this stage in order to meet the requirement of this project.

3.2 Project Activities

A flow chart below is a graphically representation of the overall process and the implementation throughout the time frame. Each step in the process is represented by a different symbol and contains a short description of the process step. Every symbol is linked together with arrows showing the process flow direction.

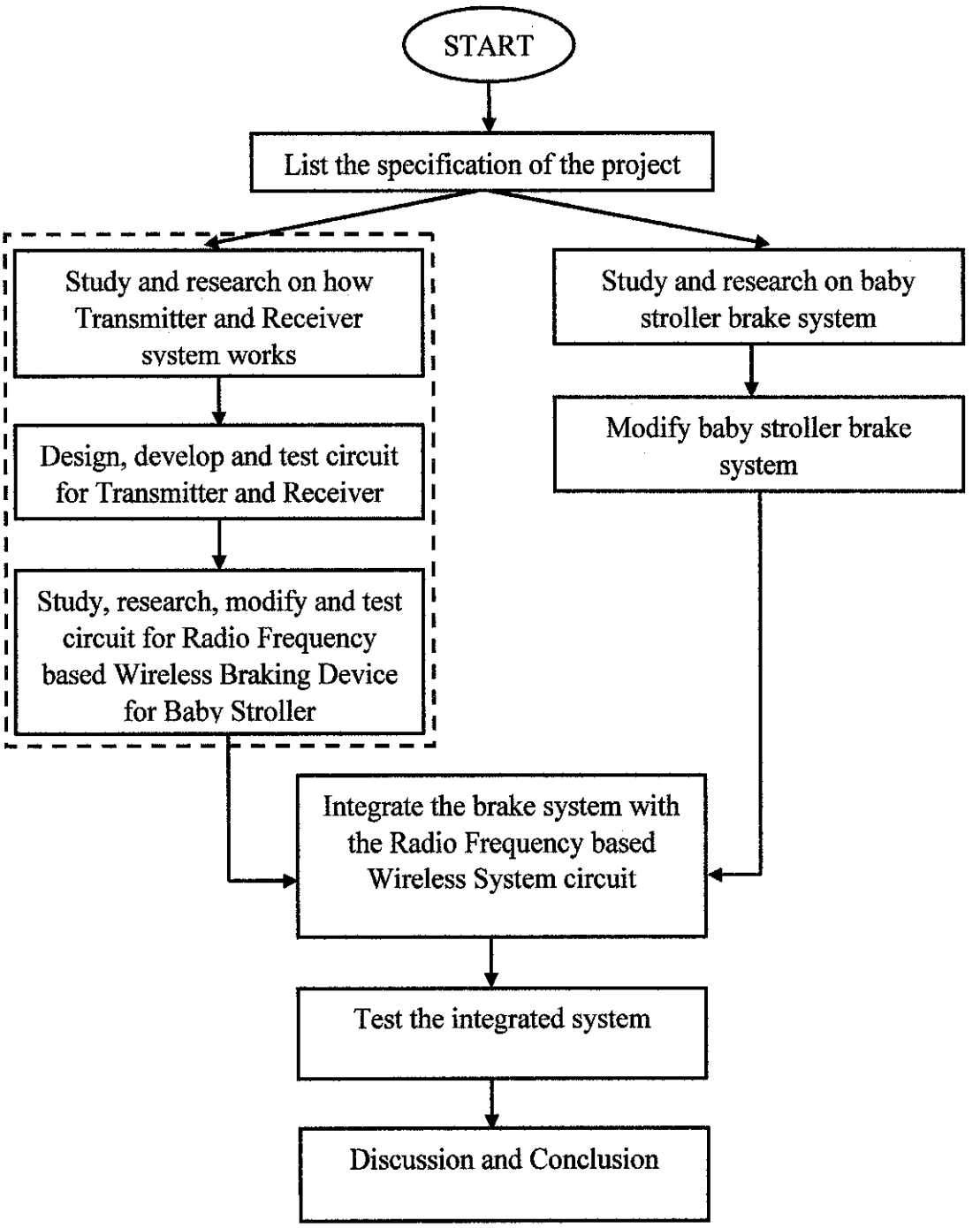


Figure 8 Project Methodology Flow Chart

As depicted in the Project Methodology flow chart itself, this Wireless Braking Device project is divided into two subsequent parts; which completed in two semesters of Final Year Project time frame. The first part of the project, as in the red box has been accomplished in Final Year Project I. It begins with the project topic selection and the preliminary researches on theoretical concept of wireless communication and RF signal. Along with studying on the theoretical concept, I have come out with the idea to design and develop the circuit of transmitter and receiver which work on the basis of wireless communication. These circuits will practically works to detect the distance range between attendant person and baby stroller.

Complete with the main operating system, next is the step to modify the circuits according to the project specifications that have been listed up. This is where the Final Year Project II started with all the researches and literature review to be conducted. The magnetic sensor will be applied in this project to detect the brake locking position. Thus, a depth study has been revealed on the magnetic sensor operating system to ensure it can be works in a well manner for this project. Moving further, dc motor capabilities also been revised as to agree on the most typical type that can meet up the project specification. This is where all the magnitude of torque, forces as well as the power supply plays main subjective to the preference type of dc motor.

The next step is data gathering and project design. Using all the information from the literature review that has been conducted earlier, modification on the existence braking system could be done. Some adjustments by adding a dc motor will enable the brake mechanisms to be automatically actuated without the need of human force. Both systems; wireless transmitter and receiver together with dc motor application is then be connected in a particular working conditions and tested for further troubleshooting procedure and also some improvements. All the result from practical works will be discuss in depth in the preceding chapter.

3.3 Gantt chart

The Gantt chart is provided together with the report in Appendix A. The Gantt chart is a guideline for the project time frame. It can be changed from time to time depending on certain circumstances.

3.3.1 Project Milestone

As illustrate in the Gantt chart, Week 1 of the semester is completed by doing a preliminary research on types of braking mechanism of existence baby stroller. It contains the exploration on how does the mechanism take place in putting the stroller into braking position. Afterward, a few of modifications are set to be done in order to ensure the brake operating system is eligible for this project. Thus, a depth study should be carried out by Week 2 on the development tools to be applied in this system. For Week 3 and Week 4, I work on the prototype development which includes hardware setup and testing it in the following week. Any difficulty will be troubleshooting during Week 5. Those parts that have been assembled will then be combined with the electronic circuit completed in Final Year Project I. Followed by that, Week 7 is assigned for prototype modifications and improvements. Submission of progress report is done during Week 8. In Week 9, the prototype will be prepared for Engineering Design Exhibition that happens to be organized in Week 10. Week 11 and Week 12 is going to be a time when the Draft Report, together with the Final and Technical Report should be submitted. Lastly, in Week 13, students have to tie up the project work and prepare to deliberate in oral presentation, known as Viva.

3.4 Tools and Equipments Required

Tools are those items used to aid in making the work easier, or even make it possible to do at all. In the following subchapters, a list of all tools and software required to work out this comprehensive prototype-based project are discussed in concise.

3.4.1 Protel DXP 2005 software

The computer with Protel DXP 2005 software is required to draw the schematic diagram and PCB of the project. This software can automatically convert the schematic file to PCB design by several steps undertaken.

3.4.2 Laser printer

After completed the PCB design, the laser printer will be used to print PCB drawing on transparency. It will be further used for PCB fabrication.

3.4.3 Printed Circuit Board (PCB) Development Tools

A number of steps are needed to be taken in PCB development. It starts with PCB Cutting and moves on with PCB Developing, Acid Etching, Alcohol Washing and end up with Drilling and Soldering process. All the processes will require appropriate tools to be completed such as; blade (to cut PCB into proper size), fluorescence light (to do photo etching for PCB) and also PCB developer with etching powder and thinner (to develop electronic track on PCB).

3.4.4 Printed Circuit Board (PCB) Assembly Tools

The tools that are need in PCB assembling process are the usual equipments that can be obtained from electronic laboratory. Once completed the PCB development procedure, this will be a simple process to be continued. The cutter, pliers, soldering iron and also the mini driller are the tools required in assembling the components on the respective PCB.

CHAPTER 4
RESULTS AND DISCUSSION

This chapter is comprised of two major sections. The first section addresses the mechanisms involved and the characterization that make them applicable in this project. This is followed by the second section, which accounts the prototype experimentation and modeling with performances are particularly analyzed to ensure the compatibility towards this project.

4.1 Data Gathering and Analysis

4.1.1 Magnetic Sensor

As a basis for main operating system to be activated, it is a must to identify the brake lever which either in lock or unlock position. For that reason, a magnetic sensor is chosen to provide a notification on that. Other electrical switches as heretofore manufactured has generally required a great number of separate parts, including biasing springs, and have required individual assembly of such parts.

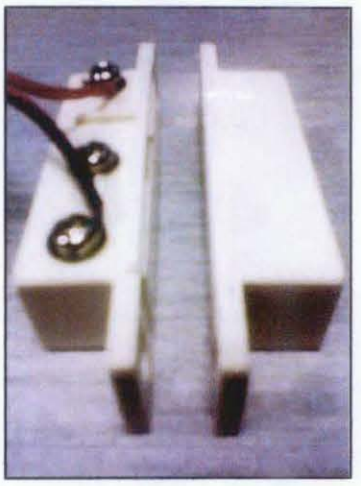


Figure 9 Magnetic sensor

Due to that, they have not been particularly well adapted in this project due to the limited gap between the brake lever and the wheel itself. As will be appreciated, there are many installations in which switches must be sealed. The normal arcing and sparking attendant upon opening and closing electrical switches cannot be tolerated in an explosive atmosphere as it will endanger surrounding. Using a magnetic sensor has skipped all the procedures of sealing switches as it come in a package of sealed pattern.

4.1.2 Direct Current (DC) Motor

A dc motor is an electric motor that runs on direct current (DC) electricity. Due to the fact of preference on using battery; a dc electricity as power supply, dc motor is the most particular types of motor to be relevant for this project. From specified dc power supplied, dc motor able to generate significant magnitude of torque by using internal commutation, stationary permanent magnet as well as rotating electrical magnets. This type of motor provides high reliability, yet simple control of motor speed with low initial cost.

Figure 10 12volt DC motor

4.1.3 Wireless Transmitter and Receiver

Transmitter and receiver are the modules required to propagate signal through air which range of frequency must well suited and sufficiently stable to allow detection by a tuned receiver in the presence of interference.

Figures as shown in the subsequent page represent the transmitter and receiver block diagram that are applicable for this project development. Both are design,

develop and test in real circuit function with the analysis of experiments are present in the following chapter.

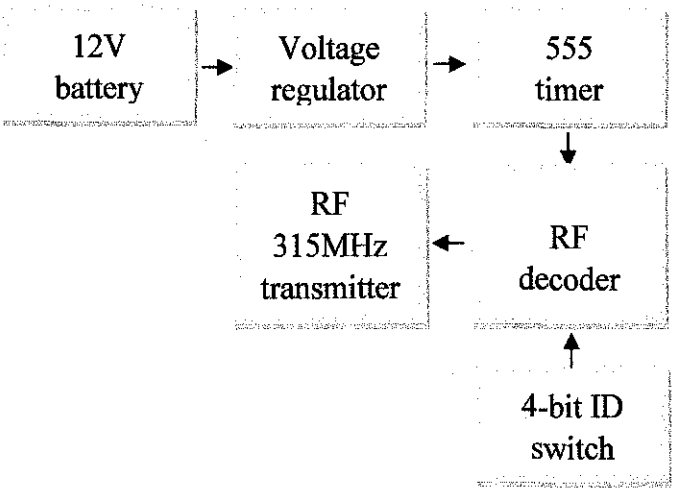


Figure 11 Transmitter block diagram

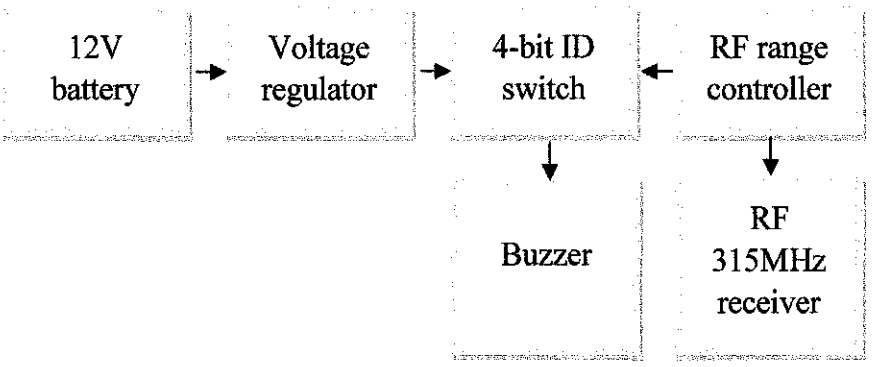


Figure 12 Receiver block diagram

4.2 Experimentation and Modeling

As clarified earlier, in this Chapter 4.2, we are going to analyze the experimentation that has been carried out in real application.

4.2.1 Magnetic Sensor

The central operating system of present invention comprises a set of transmitter and receiver interconnects by wireless connection having an effective range of frequency of two meters. Both transmitter and receiver are set to activate depending on the dual arrangement of magnetic sensor associates with the brake lever. Figures below illustrate the actual demonstration of the dual magnetic arrangement mounted on the rear wheel of the stroller for both braking and un-braking conditions.

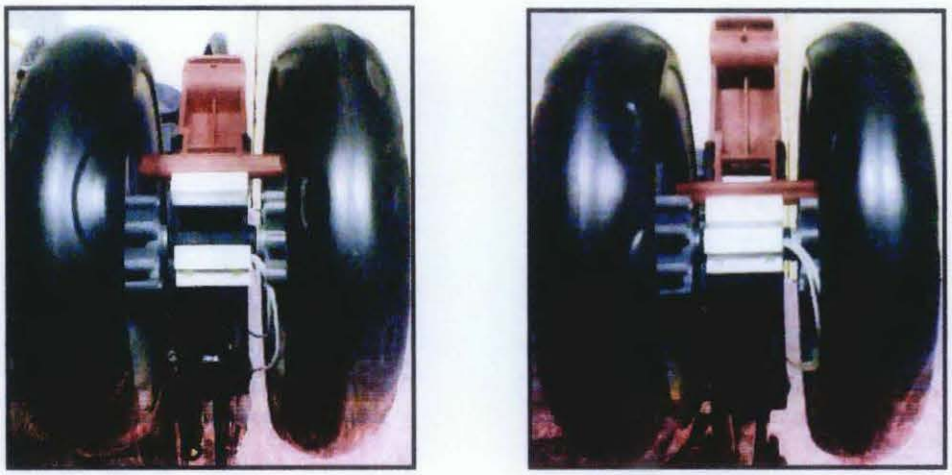


Figure 13 Brake and Un-brake condition of magnetic sensor associate with brake lever

A dual magnetic arrangement with one magnet is associated with travel, attached to the brake lever and the other permanently affixed relative to a reed switch or the like, and attached to the wheel body. As the moment both magnetic bars are within acceptable gap of limits; braking condition, the system remains discharged as the brake lever is by now engaged to preclude the stroller from rolling movement. When each end of both magnetic bars are in the position exceeding acceptable gap of

limits; un-braking condition, the system is set to energize. The reed switch opens and closes in response of magnetic flux. This flux is generally produced by a permanent magnet which is attached to a wheel. Movement of the brake lever, and consequently the movable magnet, varies the magnetic flux and opens and closes the associated reed switch. The fixed magnet maintains the reed switch open except when its magnetic field is effectively cancelled by the impermanent magnet.

4.2.2 Direct Current (DC) Motor

With the aid of theoretical understanding on DC motor principles of operation, a self-propelled motorized braking system powered by DC motor is invented for the baby stroller. In the preferred embodiment, the DC electric motor provides the motive power for the movement of the brake mechanisms by driving a brake lever independently. The DC motor must be simultaneously triggered once the magnetic sensor detect the unlock position of brake lever and the parents is out of the acceptable range within the stroller which more than two meters. This invention will then help to prevent accidental propulsion or any unforeseen stroller movement.

4.2.3 Wireless Transmitter and Receiver operating circuit

Relative to the un-braking condition, the system will then activate the transmitter and receiver to initiate signal transmission within maximum range of two meters. The transmitter controls the signal transmission to the receiver in continuous manner while a 555 timer is put together to generate digital pulses for each 1 second and allow the signal to be passed through an RF315MHz transmitter which will then transmit the signal directly to the receiver. The signal is encoded using a 4 bit Dual in-line Package (DIP) switch. A DIP switch is a set of manual electrical switches that are packaged in a standardized group. Thus other receiver cannot interrupt to the particular RF pair. The receiver is using RF 315MHz module. Then, the output of the module is passed through a RF range controller to control its effective range of frequency. As a final point the signal will pass through a 4-bit RF decoder to verify the received signal is either valid or not. If no signal received within the time limit, the receiver will turn on the buzzer in 1 second. The buzzer used is 5 Volt (V) buzzer which will be connected directly to the Integrated Circuit (IC). Whenever invalid

entry detected the buzzer will turn on. Else it remains off. Below attached are the particular modules of both transmitter and receiver.

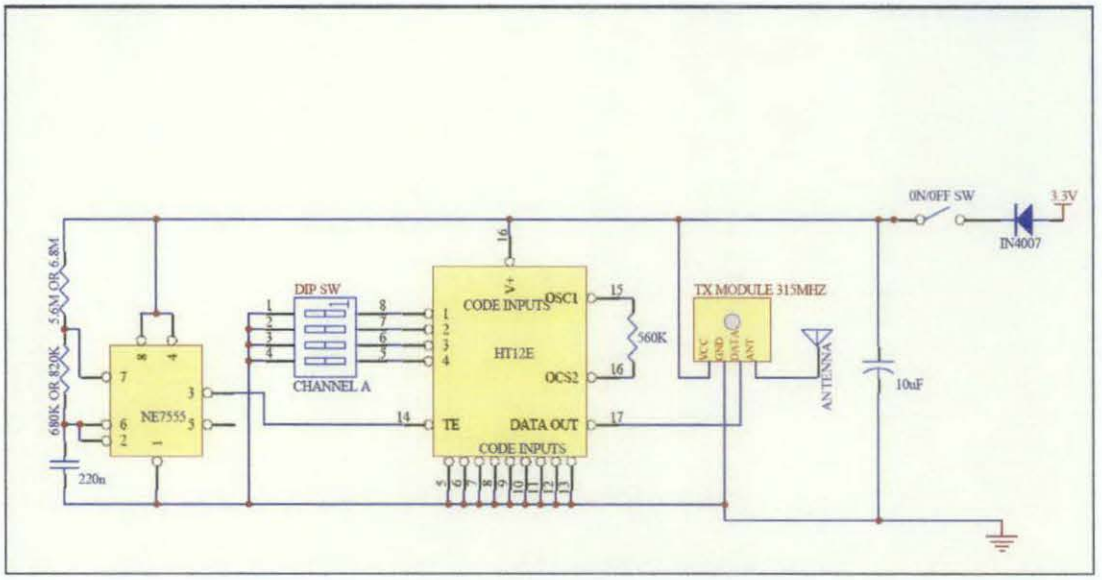


Figure 14 Transmitter schematic diagram

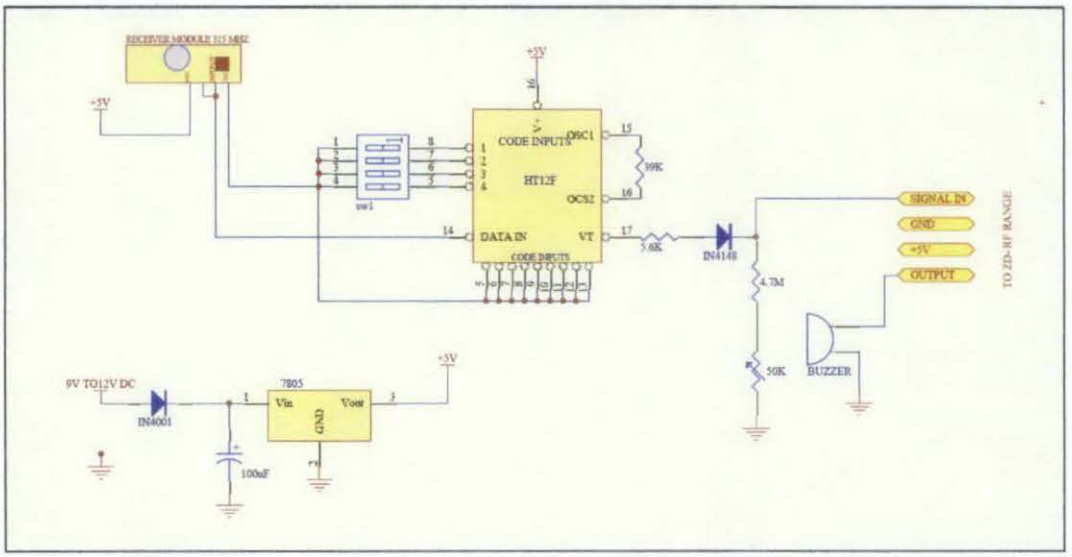


Figure 15 Receiver schematic diagram

As a final point the signal will pass through a 4-bit RF decoder to verify the received signal is either valid or not. If no signal received within the time limit, the receiver will turn on the alert signal buzzer within 1 second. The buzzer used in this project is 5 Volt (V) buzzer which will be connected directly to the Integrated Circuit (IC). Whenever invalid entry detected the buzzer will turn on. Else it remains off.

These RF modules are adopting RF integrated circuit with super-heterodyne working mode and Surface Acoustic Wave (SAW) resonance. Its features are stability and strong ability of anti-jamming. It is widely used at some spot of industrial control that has high requirement. Below are the technical specifications of the Radio Frequency (RF) modules:

- Control range: 20-50 meters
- Communication: Serial 8-bit data
- Resonance mode: Sound Acoustic Wave resonance (SAW)
- Modulation mode: AM/OOK/ASK
- Working frequency: 315MHz
- Transmitting velocity: <9600bps
- Antenna length: 24cm

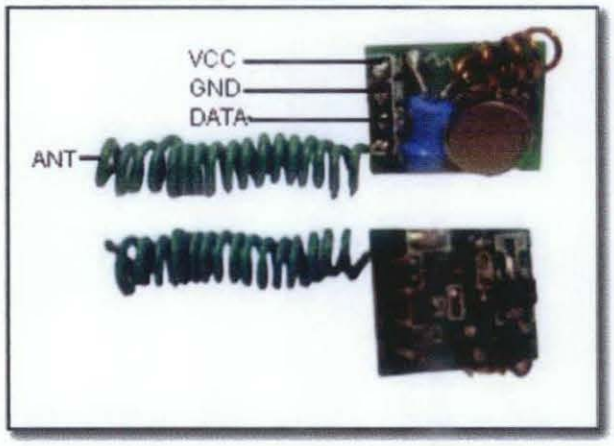


Figure 16 RF Transmitter module

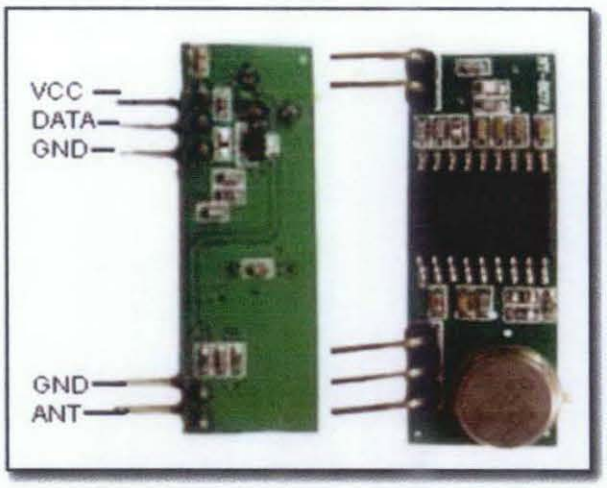


Figure 17 RF Receiver module

The voltage regulator module is used to protect IC and other connected sensors or actuators from overdrawn voltage. This is because IC and all other connected sensors or actuators are supporting 5 V of Direct Current (DC) only. Any overdrawn voltage will cause any of the modules burned. LM7805 is used to regulate voltage in this system and output of 5V DC with maximum output current of1000mA. It will support the input voltage from 7V DC to 18V DC. If the input voltage is over, the LM7805 will burn or auto shutdown due to overheat. The generated 5V from LM7805 voltage regulator will be noise filtered by 0.1uF ceramic capacitor and a 1000uF electrolytic capacitor. This is to avoid high frequency oscillation on the outputs which may cause system hang or unstable. A diode is connected at the input of the LM7805. This is to avoid voltage connected reversely. An on/off switch is used to turn on/off the system and a Light Emitting Diode (LED) with specification of 5V, 5mA is used to indicate the system is power on/off. The LED is connected through 1Kohm resistor to limit the current passing through LED is in the range of 5mA.

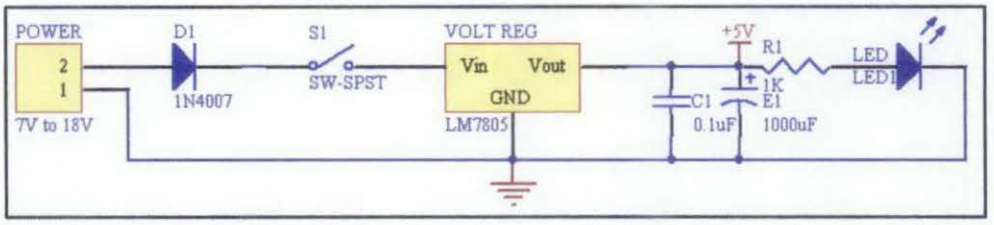


Figure 18 Voltage regulator module

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Baby strollers are essential piece of equipment for family life. However, as with any 'tool' there are always risks and dangers. Despite of additional safety features that have been manufactured up until now, stroller related accidents keeps rising in numbers. The appropriate braking system would likely be helpful to prevent the incidents, circumstances and stroller-related injuries. Functioning on the basis of wireless connection of Radio Frequency (RF), the system is set to turn on when the stroller is in un-braking condition. It will then operate to transmit signal between the transmitter mounted on stroller body and the receiver carry on by attendant person as a handheld unit. The signal transmission will take place up until a distance of two meter. With a range beyond two meter, the wireless connection is broken and no signal will be received. The receiver will then turn on the buzzer within 1 second and simultaneously run the DC motor to automatically actuate the brake lever into braking position. The stroller is permanently attached to the ground and the objective to inhibit any unintentional rolling movement towards dangerous obstruction is attained.

After reviewing the objectives, scopes and time frame of this project, it can be sum up that this is a comprehensive prototype-based project. Up until now, the circuit diagram of transmitter and receiver circuit has been modeled. Functioning on the basis of Radio Frequency (RF) theory, the system will detect a wireless connection between transmitter and receiver up until a distance of two meter. With a range beyond two meter, the connection is broken and the alert signal will trigger simultaneously to notify parents about the circumstance.

5.2 Recommendations

After studying a few alternatives for future development, the Wireless Device Braking project can be further improved by:

i. Develop a way to provide a brake system powered by the rotation of the wheel and is fully contained within the wheel hub.

ii. Provide a design that can be retro-fitted to strollers which have foot actuated brake levers associated with the rear wheels.

iii. Provide a system which can determine the angle of tilt on incline surface and automatically actuates the brake mechanism.

REFERENCES

[1] David Greig, "UGO brings strollers to safe stop", May 2009. [Online] Available: http://www.gizmag.com/ugo-brings-strollers-to-safe-stop/11826/ [Accessed: August 9, 2010]

[2] Official Journal of the American Academy of Pediatrics, "Incidence and Description of Stroller-Related Injuries to Children", November 2002. [Online] Available: http://wwwlib.murdoch.edu.au/find/citation/ieee.html [Accessed: August 10, 2010]

[3] "Stroller and pushchairs", [Online]. Available: http://en.wikipedia.org/wiki/Baby_transport#Strollers_and_pushchairs [Accessed: August 10, 2010]

[4] "Baby Stroller or Baby Carriage Braking System". [Online]. Available: http://www.freepatentsonline.com/5370408.html [Accessed: August 6, 2010]

[5] Queensland Injury and Surveillance Unit, "Pram and Stroller Related Injuries in Queensland Children under 5 years of age", December 2009. [Online] Available: http://www.qisu.org.au/module_newsletter/files/Bulletin-108.pdf [Accessed: August 14, 2010].

[6] "Stroller Tip Prevention" [Online]. Available: http://www.freepatentsonline.com/7234711.html [Accessed: October 19, 2010].

[7] "Electric Motor" [Online]. Available: http://en.wikipedia.org/wiki/Electric_motor [Accessed: October 20, 2010]

[8] "Principle of Operation of DC Electric Motors, [Online]. Available: http://www.pc-control.co.uk/dc-motors.htm [Accessed: October 20, 2010]

[9] "Wireless". [Online]. Available: http://en.wikipedia.org/wiki/Wireless [Accessed: August 10, 2010].

[10] "Radio Frequency", Available: http://searchnetworking.techtarget.com/sDefinition/0,,sid7_gci214263,00.html [Accessed: September 20, 2010]

[11] http://www.electronics- manufacturers.com/info/rf/microwave-electronics/rf-transmitter-module.html [Accessed: September 20, 2010].

[12] "Transmitter and Receiver Architectures", Available: http://www.avren.com/Courses/TX_RX_Architectures_plain.htm [Accessed: September 19, 2010].

APPENDICES

APPENDIX A GANTT CHART FYP II

No.	Details/ Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Preliminary research on types of mechanical brake mechanism														
2	Research for the development tools of mechanical brake mechanism														
3	Prepare the schematic drawing of mechanical brake mechanism														
4	Mechanical prototype development														
5	Prototype testing														
6	Combination of mechanical and electronic prototypes														
7	Prototypes modification/improvement														
8	Submission of Progress Report														
9	Prototype preparation for PRE-EDX														
10	PRE-EDX														
11	Submission of Draft Report														
12	Submission of Final /Technical Report														
13	Oral presentation (Viva)														