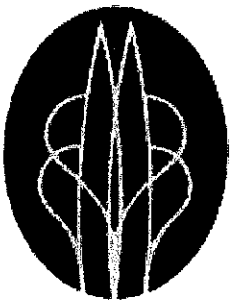

UNIVERSITI
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FINAL YEAR PROJECT

FINAL REPORT

SAFETY BRAKES AND WIRELESS WARNING SYSTEM FOR BABY STROLLER

Submitted to the Electrical & Electronics Engineering Programme

for the Degree Bachelor of Engineering (Hons)

(Electrical & Electronics Engineering)

By

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CERTIFICATION OF APPROVAL

Safety Brakes and Wireless Warning System for Baby Stroller

by

Nor Wani Idayu Bt Ab Wahid

A dissertation report 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 by,

(Dr.Fawnizu Azmadi Hussin)
Project Supervisor

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

DECEMBER 2011

CERTIFICATION OF ORIGINALITY

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

ayu.

(Nor Wani Idayu bt Ab Wahid)

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ABSTRACT

Safety Brakes and Wireless Warning System is a design-based project where a 'Radio Frequency (RF) Wireless Communication System' plays the main roles to stop the baby stroller automatically. This system comprises an external motor controller circuit that interfaces with the RF receiver on the stroller. The author will deal with RF devices and motor controller for Final Year Project 1. The goals for Radio Frequency (RF) devices are to design and construct a wireless-based system that monitors and informs their status which will then be used to transfer the signals to controller circuit and in other similar applications. The benefits of this system are to replace the current safety methods by brakes the stroller manually and it also offer a better enhancement system. For advanced application, other application such as alarming system can be integrated together with the RF devices if security is the major concern. The final output from the direct current motor is a prototype of a braking system which is the integration of RF communication based and controller circuit connected via wired link to the baby stroller. The RF receiver and RF transmitter devices can be applied by leaving the devices alone but separated in any place that in the frequency range so that they can communicate. The receiver can receives the transmitted signal from the transmitter. Overall, the project is the best platform to improve the safety braking system and ignites another innovative invention in the future.

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LIST OF ABBREVIATIONS

Direct Current	DC
Alternating Current	AC
Radio Frequency	RF
Printed Circuit Board	PCB
Electromagnetic	EM

CHAPTER 1
INTRODUCTION

In this chapter, the author will explain comprehensively about the Radio Frequency (RF) Wireless Communication preface and background. All the information and research is done through many resources such as internets, journals and guidelines from lecturers. Elements that will be emphasized in this chapter are the background of study, problem statement, objectives and scope of study. The details discussed throughout this chapter will help the readers grasp the idea of the project and understand the concepts and principles applied.

1.1. BACKGROUND OF STUDY

The Radio Frequency (RF) Wireless Communication System was designed based on the importance of an effective communication and portability devices for certain applications and physical connections without the guidance from engineers. Definitely, a reliable and effective wireless warning system seems to be the main criteria of baby stroller that parents looking for. Example of baby stroller used for integrating this kind of system is shown in Figure 1.

Figure 1: Baby Stroller

Current types of strollers product generally includes at least three rotating wheels and is equipped with manual push handles fixed to the body frame. The rear wheels are provided with wheel brakes of friction or interlocking types that must be engaged or disengaged by the parent holding the baby stroller. Instead of a standard foot brake, an additional safety feature of braking system is developed which is the strap that ensure stroller is not rolling away and in control by tied it around the parent's wrist. Therefore, this wireless warning system was developed based on integration of the RF transmitter and receiver, controller circuit, direct current motor, rechargeable battery, and hopefully an alarming system can be added soon.

The term 'transmission' indicates that the data from the transmitter will be transferred to the coupled receiver that connected with the controller circuit via electrical wiring method. The integrated devices, which is transmitter and receiver devices is an efficient system where it is portable and light weight since it is a wireless communication system. These two great qualities allow the devices to be communicated easily from one place to another within various interval of frequency range. They find that the system contributes an efficient and importance within everyday affairs. Regarding the motor controller circuit, it is just a simple circuit that plays the roles to receive the signal from RF receiver to activate the movement and operate the motor so that the motor can move the brake lever to engaged position. At the same time, the wheels can be protected from rolling away and ensure the safety of the children.

The overall system of this project as simplified as in the diagram:

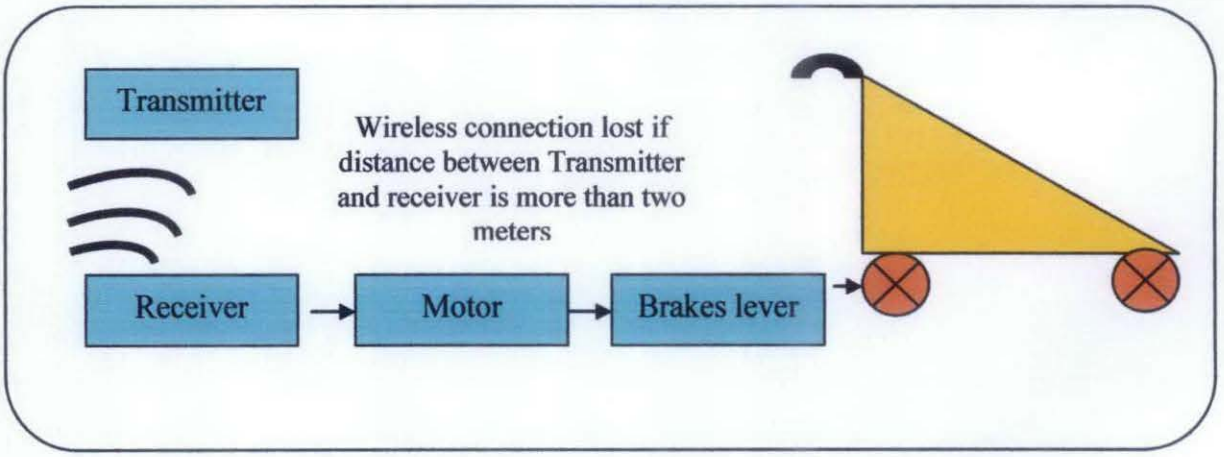

Figure 2: Overall System

1.2 PROBLEM STATEMENT

1.2.1 Problem Identification

Most of the current systems available in stroller manufacturers are manual braking system, where the parent will push the brake lever that mounted on the wheels with their foots and make sure the stroller's wheels is engaged so that the stroller does not rolling away as shown in the Figure 1.2. This is quite a dangerous and passive system that is less safe and unmanageable because it is does not having the automatic safety system. Safety is basically the major concern for most manufacturers since safety should be considered as an important element to achieve an excellent braking system. This safety warning wireless-based system is important since its concern upon the children's safety and people around. Therefore, the *Radio Frequency Wireless Warning System* perhaps introduces a systematic and safer braking system to replace the manual traditional method.

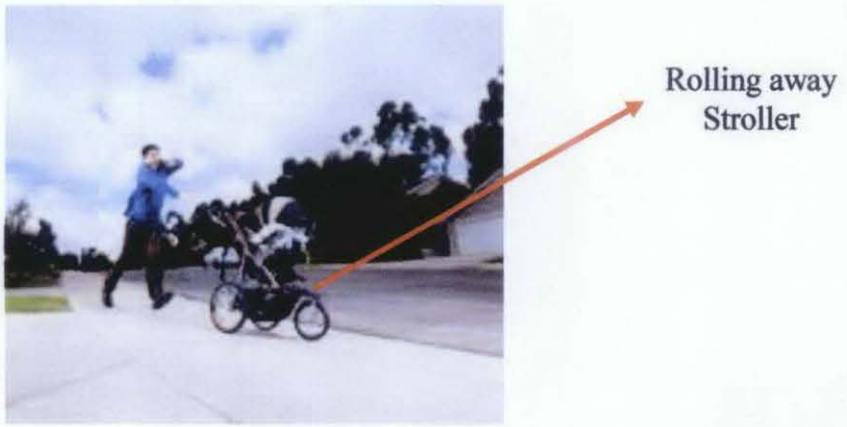

Figure 3: Rolling Away Stroller

1.2.2 Project Significant

The project exclusively represents a safe and efficient system that handles the braking and warning alarm through the RF devices that is integrated with the controller circuit. It is a portable and friendly user system where the transmitter is held by the parent, while RF receiver and controller circuit will be installed on the stroller.

The *RF Wireless Warning System* demonstrates the integration and application of design system engineering discipline which is a good platform for better understanding on engineering principles applications.

1.3 PROJECT OBJECTIVES

The aim and goal of this project is as follows:

- To design the safety braking system associated with wireless warning system that can ensure children's safety in baby stroller.
- To design and invent a self-braking system to wirelessly detect a distance between the parent and baby stroller.
- To perform invention of a self-braking system to engage the brake lever into locking position automatically by the communication between RF devices and controller circuit.
- To invent a self-braking device fitted to the current stroller.
- To develop safer and systematic braking system that replaces the manual traditional manned method.
- To design a system that user-friendly, portable and reliable to the real environment.

1.4. SCOPE OF STUDY

The scope of study in this chapter is based on elements listed as below:

i. Communicating and receiving the signal between transmitter and receiver through a Radio Frequency (RF) communication activity.
ii. Giving distance sensor signal into external RF receiver by located the RF transmitter within two meters.
iii. Signal transmitted to the controller circuit via electrical wiring

CHAPTER 2
LITERATURE REVIEW

The fundamental concepts applied in this project were some applications that are very useful for innovation and design system engineering area. The author tends to view and present the concept of the wireless braking system by designing a prototype that has all the features required. This particularly chapter discusses the important development stages which comprises RF Transmitter, RF Receiver, Motor Controller Circuit, and Rechargeable Battery.

2.1 RADIO FREQUENCY WIRELESS COMMUNICATION

By definition, wireless is the uses of no wires to transmit the data in terms of analog signal over a specified distance [10]. The data transmission distance maybe long or short. With the aid of electromagnetic (EM) waves which is Radio Frequency (RF), signal propagation is accomplished without any electrical conductors. Quiet a lot advantages when using wireless communication which are inexpensive, flexible, faster data transmission and more efficient compared to wired communication.

The chosen RF rate of oscillation is in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. This chosen frequency range is suited with the distance which is in the interval 1 to 10 meters. RF usually refers to electrical [11] rather than mechanical oscillations, although mechanical RF systems do exist. For allowing the signal propagation through space, electromagnetic (EM) field must be induced by injection of ac current to an antenna. The frequencies associate with the field covers a significant segment of electromagnetic spectrum. In the spectrum, there are several bands which represents different range of frequency with respect to the power of 10 its magnitude as illustrate in the Table 1.

Frequency, f	Designation	Wavelength, λ	Abbreviation
30 - 300 Hz	Extremely low frequency	$10^4 - 10^3$ km	ELF
300 - 3000 Hz	Voice frequency	$10^3 - 10^2$ km	VF
3 - 30 kHz	Very low frequency	100 – 10 km	VLF
30 - 300 kHz	Low frequency	10 – 1 km	LF
300 kHz - 3 MHz	Medium frequency	1 – 0.1 km	MF
3 - 30 MHz	High frequency	100 – 10 m	HF
30 - 300 MHz	Very high frequency	10 – 1 m	VHF
300 MHz - 3 GHz	Ultra high frequency	100 – 10 cm	UHF
3 - 30 GHz	Super high frequency	10 – 1 cm	SHF
30 - 300 GHz	Extremely high frequency	10 – 1 mm	EHF

Table 1: Radio Frequency (RF) Spectrum

Table 1 shows a relationship between frequency (f) and wavelength (λ). A wave or sinusoid can be completely described by either its frequency or its wavelength. They are inversely proportional to each other and related to the speed of light through a particular medium. The relationship in a vacuum is shown in the following equation:

$$C = f \bullet \lambda$$

C is the speed of light. As frequency increases, wavelength decreases. For reference, a 1 GHz wave has a wavelength of roughly 1 foot, and a 100 MHz wave has a wavelength of roughly 10 feet.

2.1.1 RF Transmitter

RF Transmitters, also known as radio frequency transmitters have a lot of applications such as robots, special effects, model cars, home automation, as well as any other application that may need some sort of a wireless signal transfer of data, like wireless routers, radio, and television, along with various forms of telecommunication [12]. The speed for the wireless transfer would depend solely on the RF transmitter as well as the RF receiver.

Depending on the project at hand, we are purchasing ISM band RF transmitter/receiver modules, a new range of low cost high performance RF modules for the industrial, scientific and medical (ISM) band. There are many factors to consider when deciding on the right kind of RF transmitter or this project. These can be broken down by their power output, their design, the cooling of the final stages, the building which will host the transmitter and its control devices, as well as the legal aspects as to where you would use the RF transmitters [11].

The RF transmitter that will be chosen has a small size and light in weight. The modules use a FSK modulated signal in the 315MHz bands and comply with FCC and ETSI regulations. Communication with other electronics is achieved via a SPI interface which means that these devices are easy to integrate into designs. The units operate using a 2.2V - 5.4V power supply and have low power consumption with a stand by current of less than 0.3μA. Other features include:

- wakeup timer,
- programmable output power,
- low battery detection and
- automatic tuning.

These low cost, high performance modules offer module tuning free during production. The small size of it can be compared to the MasterCard logo on the credit card as shown in the Figure 4:

Figure 4: RF Devices

Two of the advantages of transmission are a **narrow bandwidth**, which requires less output power, and a **degree of intelligibility** that is **high** even under severe noise conditions. We also need a method of turning the RF output ON and OFF keying in accordance with the intelligence to be transmitted an antenna to radiate the keyed output of the transmitter.

2.1.2 RF Receiver

While for wireless RF receiver, it has good stability, high sensibility, and low power, widely used in all kinds of big interference. The lack of metal interconnects eliminates the one source of failure.

Description for the project, the receiver is placed on the stroller where it is connected to the controller circuit and DC motor. It is connected wirelessly to the transmitter which is the handheld device carry by the parent. At first, there is RF wireless communication between the transmitter and receiver. After the transmitter and receiver is parted more than two meters, the transmitter transmit signal to RF receiver. The receiver will send electrical signal to the controller circuit and then its convert to mechanical signal to move the motor. After that, the brakes are engaged to lock position and stop the stroller.

2.2 DC MOTOR CONTROLLER CIRCUIT

Main purpose of this controller circuit is to receive the electrical signal from the receiver and then convert into mechanical signal to activate the DC motor as well as move the brakes lever into engaged position. It is a simple additional connection which is the potential voltage from battery. The connection is between the RF receiver motor and battery, using the wires comes out from the output of receiver connected to the common port of the DC motor. The positive and negative ports from the DC motor are connected to the battery power supply. As known, the DC motors means direct current electrical energy convert into mechanical energy. DC machines act like an AC machines in that they have AC voltages and current within them.

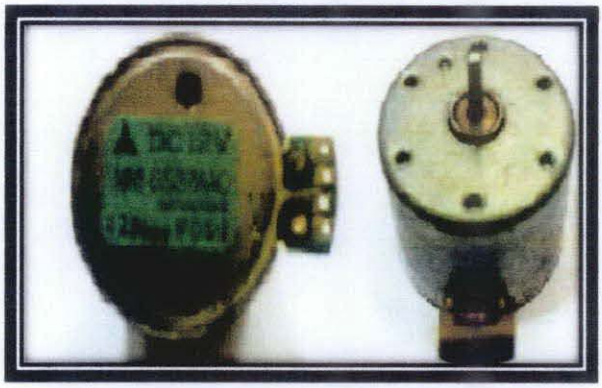

Figure 5: 12V DC Motor

There will be a mechanism occurred named commutation that converts the internal ac voltages to dc voltages at their terminals where the output is also in dc. There are simple fundamental principles involves in the operation of dc machines. But, unfortunately they are usually somewhat hidden by the complicated construction of real motor which does not move in a straight line they are rotating. Toward understanding real dc motor is to study the simplest possible example of rotating motor that consists of a single loop of wire rotating within the fixed axis which called rotor or armature while, the static part is called the stator.

2.3 MAGNETIC SENSOR

In order to complete the wireless communication, existence of a sensor is necessary. In this case, we are using the magnetic sensor to make sure the brakes lever is engaged after the emergency stop. For this project, using of the magnetic sensor is suitable with the design. During many years experience of using magnetic encoders there have been occasions when a seal has failed [13], and a pulse generator has been found to be completely covered in a thick layer of brake dust and other dirt, but such pulse generators still functioned perfectly.

Magnetic scanning systems were previously simply too expensive to use, but recently, a multichannel pulse generator became available, that is not only fundamentally superior to previous pulse generators in its robustness and resistant to dirt, but also sets a new standard for flexibility. Here, for comparison, are a few of its key features:

- from one to eight channels
- up to three different pulse values per revolution from a single encoder
- from 1 to 400 pulses per revolution
- voltage output, current output, signals with a 7 V idle voltage

There is now a new variant with a maximized hysteresis of ± 90° relative to a signal period. When installed under unfavorable conditions and exposed to severe vibration this variant suppresses any unrelated pulses while the vehicle is at an idle. Altogether, these innovative pulse generators offer new features that also open up entirely new possibilities for system integrators [13]. It is possibly to supply significantly more subsystems with independent, electrically isolated output signals. And naturally installation well-matched pulse generators can be configured for the stroller. The magnetic measuring principle and optimized bearing technology increases the pulse generator's reliability, not only increasing maintenance intervals but also significantly reducing maintenance costs.

2.4 RECHARGEABLE BATTERY

In this project, the battery is needed to supply power to the transmitter circuit for converting electrical signal to mechanical signal or vice versa. This conversion will operate the motor that will then moved the brake lever to engaged or disengaged lock position. We will be using the 9V Rechargeable Battery Pack and Universal Charger with Auto-Shutoff/LED Indicator Feature as the power supply and give enough torque for operation of the motor to engage the brake lever. The transmitter circuit will communicate with the receiver and controller circuit. For safety braking system of baby stroller, we are applying direct current (DC) motor as discussed in Section 2.3.

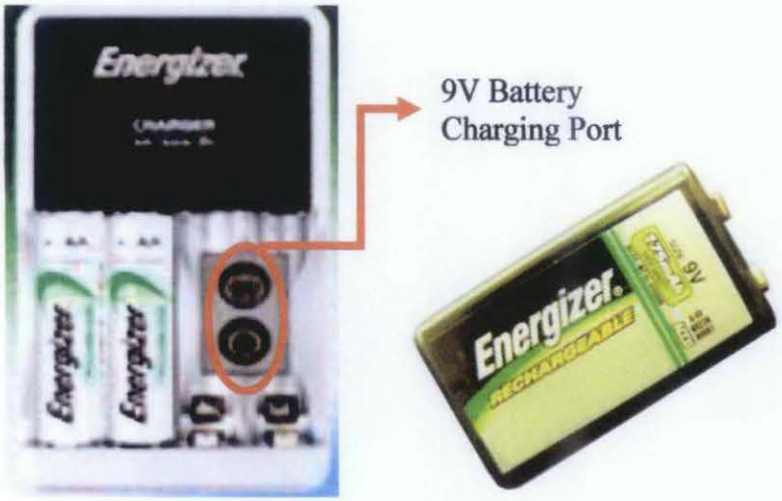

Figure 6: Charger and Rechargeable Battery

This is a 9V Rechargeable alkaline battery. These are applied to power the new Super Droid ATRs and vectoring robots [7]. They can also have many other uses too like 12V DC motor used in this project even the potential is slightly low. The batteries are alkaline so they do not have the memory issues. The battery is being put just inside the charging port specially made for 9V battery. Maximum period for the battery to be fully charged is 8.5hours.

The charger features a LED indicator on it and will automatically stop charging once the battery is fully charged [7]. It's light weight and small size so we can take it with us anytime and anywhere. They can be connected onto the wire ends and offer a great way of disconnecting the batteries for charging.

CHAPTER 3
METHODOLOGY

Methodology is the main part in this report, where the author will present the methods and the prototype installation development stages. The flow of project development is segregated into few stages for FYP 1 and FYP 2. It is the overall view of the integration of the hardware device.

3.1 Procedure stage for prototype installation

STAGE 1 Week 1- week 4	STAGE 2 Week 5- week 7	STAGE 3 Week 8- week 10	STAGE 4 Week 11- week 14
• Research and study of project. • Extended Proposal Submission. • Tools identification. • Draft design of prototype. • If test pass, proceed with stage 2.	• Proposal Defense Presentation. • Purchased the RF Devices, DC Motor, and tools needed. • Integrate and interface RF Devices • If pass, proceed to next stage.	• Integration if RF Transmitter and Receiver • Testing to see the connection in the lab. • If this stage passes, the next stage will be proceeding.	• Purchasing Rechargeable Battery • Draft Report submission • Interim report submission

Table 2: Procedure stage for FYP 1

The procedure involved in Safety Brake and Wireless Warning System are based on the descriptions in Table 2. The procedures are identified to ensure the project accomplishment within time frame provided. The process starts with some study regarding previous similar project and research of literature review including knowledge about the project such as the design features and the function of it. During this period of time, a lot research has been done to search for the improvements. By identifying its function, we started designing the features part by part.

Installation of the DC motor that move the brake into lock position will be done where the wireless communication is disconnected. The next step is by doing the process on how to make the wireless devices and magnetic sensor. The work progress continues with the handheld device that has the wireless connection with the controller circuit. This is actually for final year project 1 work progress. While for final year project 2, a procedure to enhance the system is structured and plan to a better system after done the testing of the prototype designed.

STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
• Research on the magnetic sensor and Radio Frequency transmission • Module of wireless system. • Progress Report 1 submission. • If pass, proceed to next stage.	• Integrating the wireless system with controller circuit and magnetic sensor device. • Testing the workability and troubleshooting device. • Draft report submission. • If pass, proceed to next stage.	• Transferring and installing devices in prototype. • Final report submission (soft cover). • If pass, proceed to next stage.	• Additional elements added (Gyroscope) • Technical Report submission. • If pass, proceed to next stage.	• Testing and troubleshooting devices. • Design and decoration of physical appearance of project for EDX preparation and oral presentation. • Final Report submission (Hard cover)

Table 3: Procedures stages for FYP 2

With great hope, this project will be done till the end and the objectives can be achieved. At the same time it will bring us a simple and innovative design of safety baby stroller. The presentation and documentation will be prepared and submitted on time.

3.2 Tools required

Tools and equipments are the items used to aid for completing the work and make it easier, or even make it to do at all. The hardware and software needed is listed in the Table 4:

No.	Tools and Equipments	Description
1	Printer	-print the documentation onto the paper
2	Printed circuit board (PCB) Development Tools	-for cutting , acid etching, alcohol washing, and soldering process -required blade, fluorescence light, etching powder and thinner for the process
3	Printed circuit board (PCB) Assembly Tools	-obtained from electronics laboratory -need cutter, pliers, soldering iron n jigs and mini driller

Table 4: Tools and Equipments

CHAPTER 4
RESULT AND DISCUSSIONS

This section discusses the results obtained from researches done. Most of all, at the beginning of the project, the author discovers more about the project before remaining to the technical part. Based on the findings, the author manages to come out with the basic schematic for the circuit which interfaces the RF Transmitter and Receiver, Controller Circuit and Magnetic Sensor. It is the integration of hardware tools.

4.1 Data Gathering and Analysis

4.1.1 Magnetic Sensor

The magnetic sensor detects magnetic fields in a small scale of range. The magnetic sensor has a unique clamping device that accommodates variety of different sized power cords. The base of the clamping device is removable when magnetic field detection is desired. The features are adjustable sensitivity and delay.

As a basis for main operation system to be activated, a magnetic sensor is chosen to provide a notification on identification of the brakes lever which either in lock or unlock positions. Other electrical swithes manufactured has generally required a great number of separate parts, including biasing spring, and have required individual assembly of that required parts.

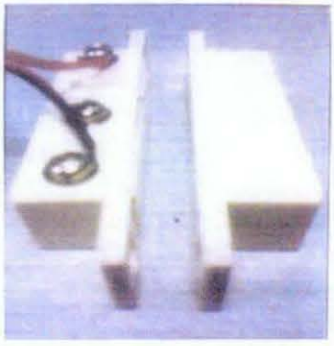

Figure 7: Sample of Magnetic Sensor

4.1.2 Direct Current (DC) Motor

A 12V DC motor is an electric motor that runs on direct current electricity. For this application, the motor will run after receive the converted electrical signal from the RF receiver. An electric motor repair process can be a horrifying task. Electric motor repair tasks generally need to be done by qualified and professional technicians or companies that specialize in electric motor repair. But for DC electric motor that is generally small motor and sets inside the electronic high torque 12v dc motors

Figure 8: DC Motor

Due to the fact of preference on using battery, a DC electricity as a power supply, DC motor is the most suitable 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. This kind of motor fulfills the requirement to have a small, lightweight, portable and can be implemented on the stroller nicely. The DC motor is an important part for emergency breaking the stroller which has the connection with the RF Receiver.

4.1.3 Wireless Transmitter and Receiver

In order to propagate the signal through air with suited and stable frequency, modules of transmitter and receiver is required. The detection can be obtained with the presence of interface of tuned receiver. While, for the design, develop and test in real circuit function with the analysis of experiments are present in the next section of this report. The block diagram of transmitter and receiver that relevant for this project development is shown in the Figure 8 and Figure 9.

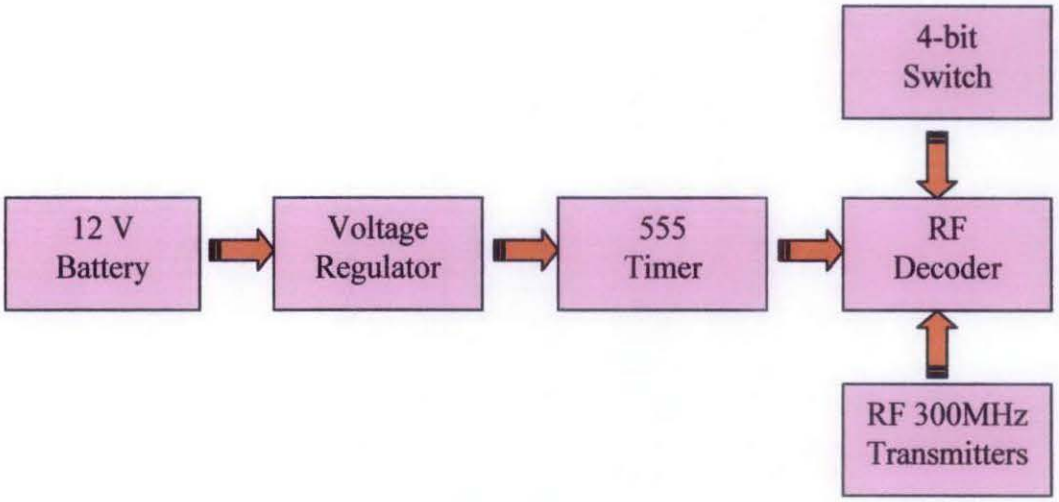

Figure 9: Block Diagram for Transmitter

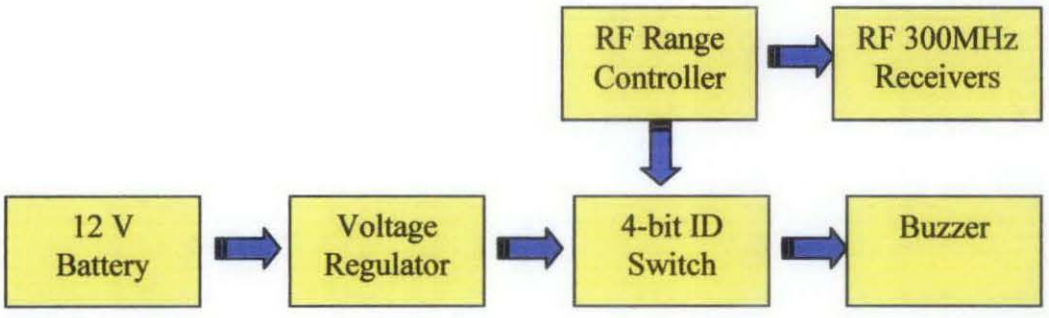

Figure 10: Block Diagram of Receiver

4.2 Analysis, Experimentation and Testing

Through out this section, we will go through the analysis and experimentation that has been done. The parts that have progress are DC Motor, Wireless Transmitter and Receiver Operating Circuit Modules, and Voltage Regulator Module.

The wiring connection has been done for all devices that is there which is RF transmitter, RF receiver, direct current motor, and 9V battery using the single core wires and soldering tools. Some of the stuff is obtained from the electronic store and some of it is self bought. The devices purchased are as followed:

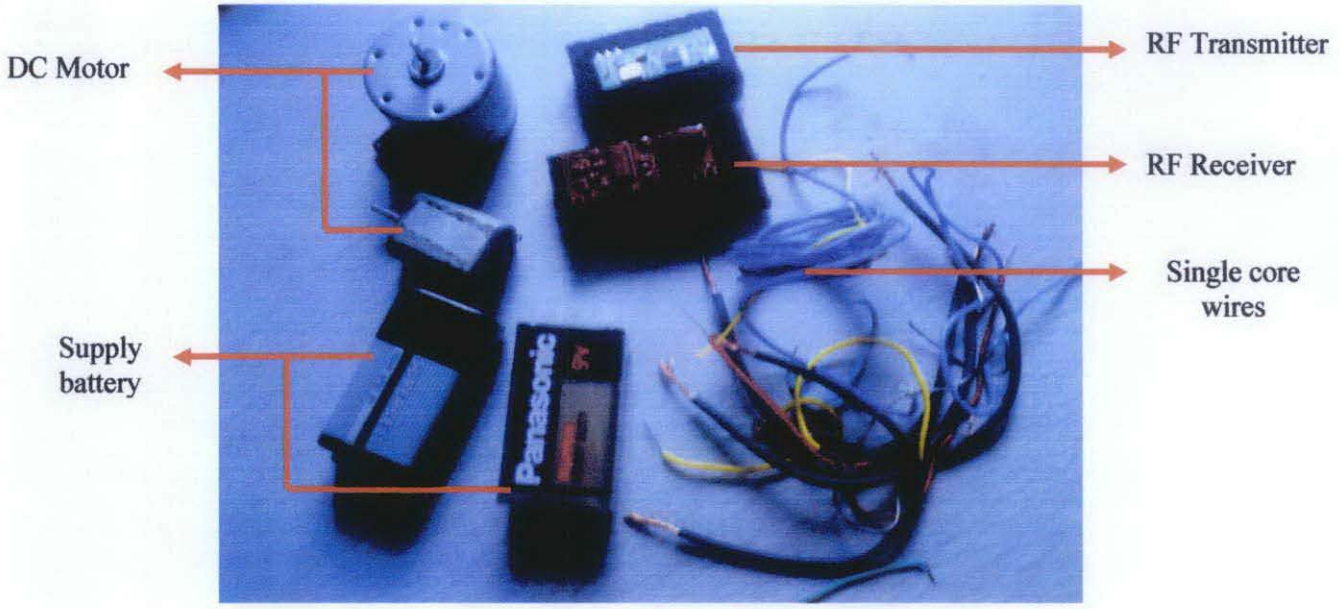

Figure 11: Devices Purchased

For the connection of RF transmitter and receiver, the pin connected must be checked and correct so that there is no error during the testing procedures. The pin descriptions are as follow for the transmitter RTFQ2 model and receiver RRQ3 model:

RTFQ2	NAME	DESCRIPTION
N/A	EN	Enable (active high)
5	IN	Data input
1	GND	Ground, connect to RF earth return path
3	Vcc	Supply Voltage
4	GND	Ground, connect to RF earth return path
2	EA	Enable antenna

Table 5: Pin Description for RF Transmitter

RTFQ2	NAME	DESCRIPTION
1	Vcc	Supply voltage
2	GND	Ground, connect to RF earth return path
3	IN	Data in (Antenna)
7	GND	Ground, connect to RF earth return path
11	GND	Ground, connect to RF earth return path
12	NC	Not connected
13	RSSI	Output
14	OUT	Data out
15	PD	Power down input

Table 6: Pin Description for RF Receiver

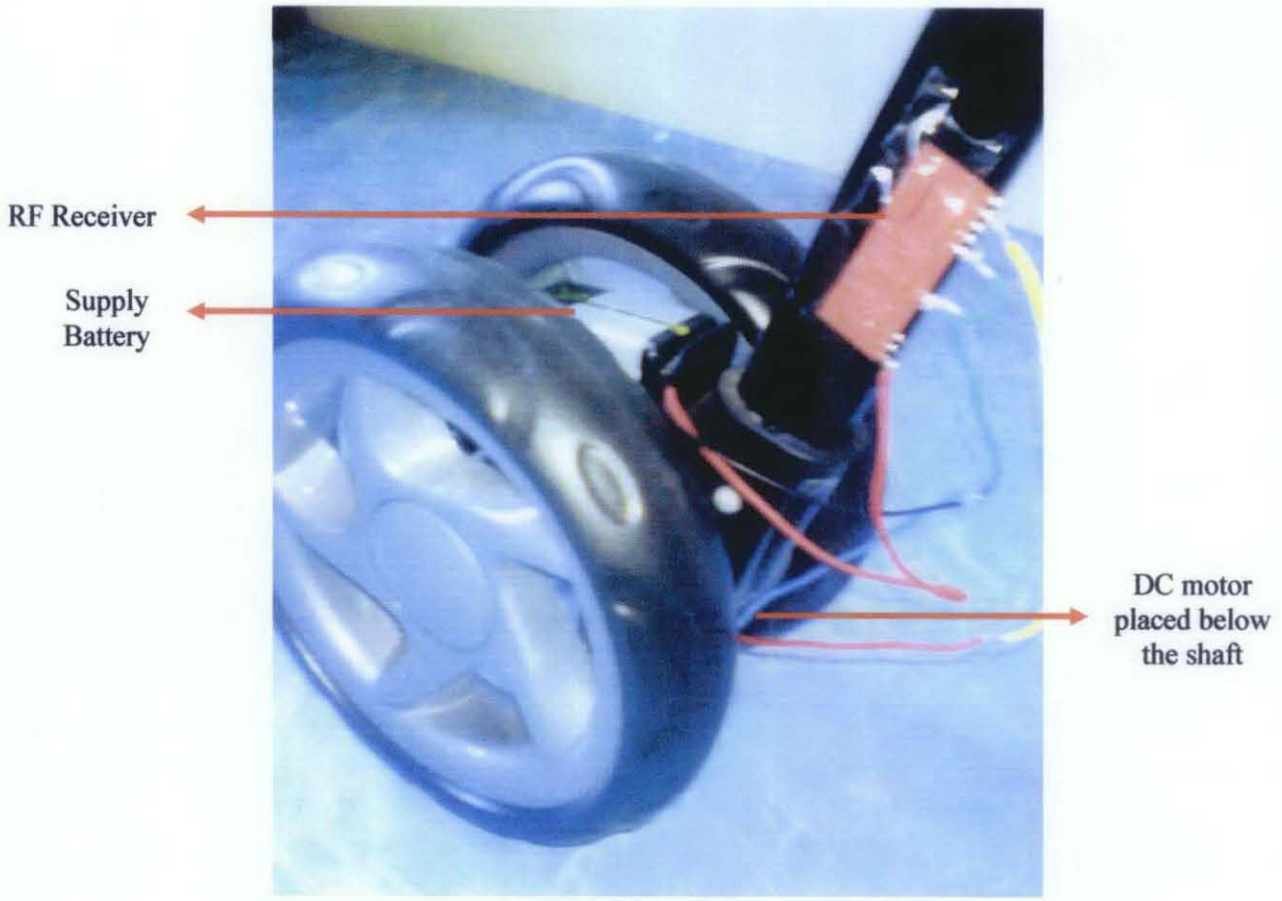

Figure 12: Devices Installment to the Stroller

The choice of the devices purchased has been made properly based on the requirement, portability factor, light weight, and easy to install on to the baby stroller. The equipment at first has been connected without soldered iron. It has been tested for the connection, polarity, power on operation and also the wireless transmission data.

But, quit a number of test has been done for the wireless connection, but still didn't get the required data range within the frequency range. It may need longer time to test troubleshoot the problems or any mistakes occurred during the testing or installment procedures.

Though, the wiring connection and placing the devices has been made according to estimated expected system. Since the stroller has a pair of wheel, its need the brakes to be applied at the same time so that there will not be another dangerous to the children inside. So, another one wheel has to be attached another same type of DC motor and it is connected to the RF receiver by single core wire as seen if Figure 13:

Figure 13: Both wheels connected by a single core wire

4.2.1 Direct Current

The DC motor principle of operation gives theoretical understanding for self-propelled motorized braking system which is powered by the invented DC motor for the baby stroller. The two modes of operation in the motor are, motoring and braking. But we are using motoring to activate DC motor for breaking the stroller; it converts electrical energy to mechanical energy, which supports its motion. The advantages of DC drives are:

- Adjustable speed
- Good speed regulation
- Frequent starting, braking and reversing

This invention will then help to avoid accidental driving force or any unexpected stroller movement. The brake mechanisms of brake lever can be independently driven with the motive power for the movement provides by operation DC motor. Important point to be considered is the DC motor must be simultaneously triggered when:

- the magnetic sensor detect the unlock position of brake lever
- distance between parents and baby stroller is exceeding the acceptable range more than two meters

4.2.2 Wireless Transmitter and Receiver Operating Circuit

The system will activate the transmitter and receiver when comparison to the un-braking condition is done. The respective **transmitter and receiver** will then initiate signal transmission within maximum range of two meters. The transmitter controls the signal transmission to the receiver in continuous manner. **The 555 Timer** is being put together to generate digital pulses for each 1 second.

It will allow the signal to be passed through an RF 315MHz transmitter which will then transmit the signal directly to the receiver. A **4 bit Dual In-line Package** (DIP) switch is a set of manual electrical switches that are packaged in a standardized group. DIP's is to encode the signal received by the receiver. In addition, the charge isolation provided by the optical link protects the electronic circuitry [12]. The connection of the circuit is as in Figure 14:

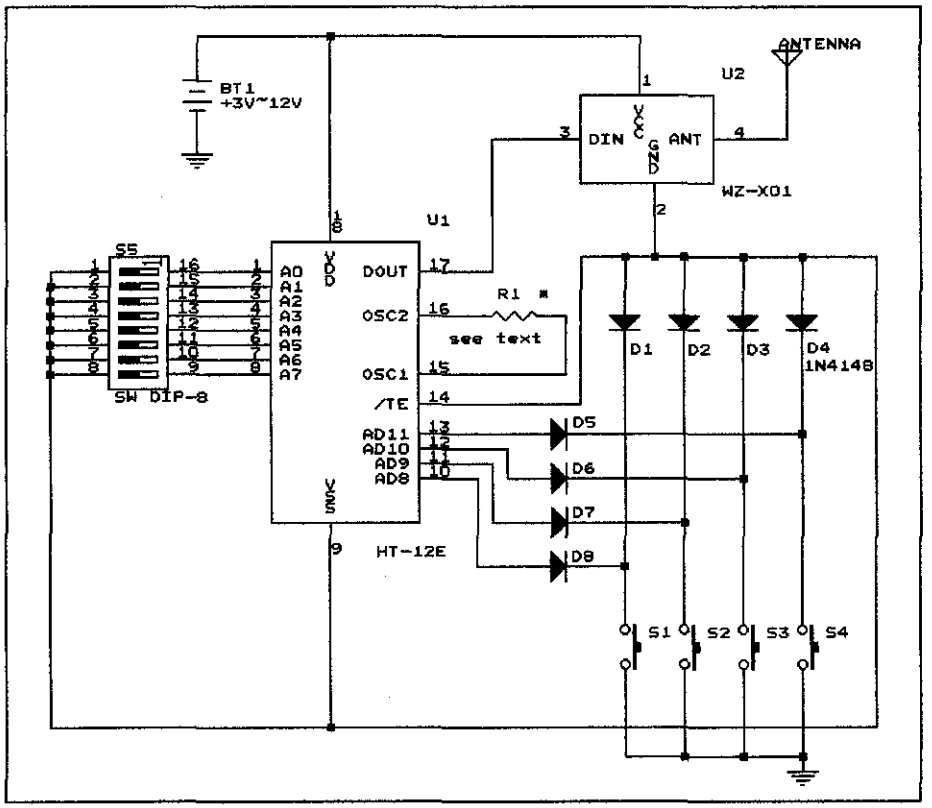

Figure 14: RF Transmitter Schematic Diagram

Fortunately, other receiver cannot disrupt the particular RF pair. The receiver is using RF 315MHz module where the output of the module is passed through a RF range controller. The controller controls its efficient range of frequency. Finally, the signal will pass through a 4 bit RF decoder to confirm the received signal is either applicable or not. Additional features, if no signal or any invalid entry is detected, within the time limit, the receiver will turn on the buzzer for 1 second. This additional feature maybe will be implemented during FYP 2. RF receiver circuit connection is shown in Figure 15:

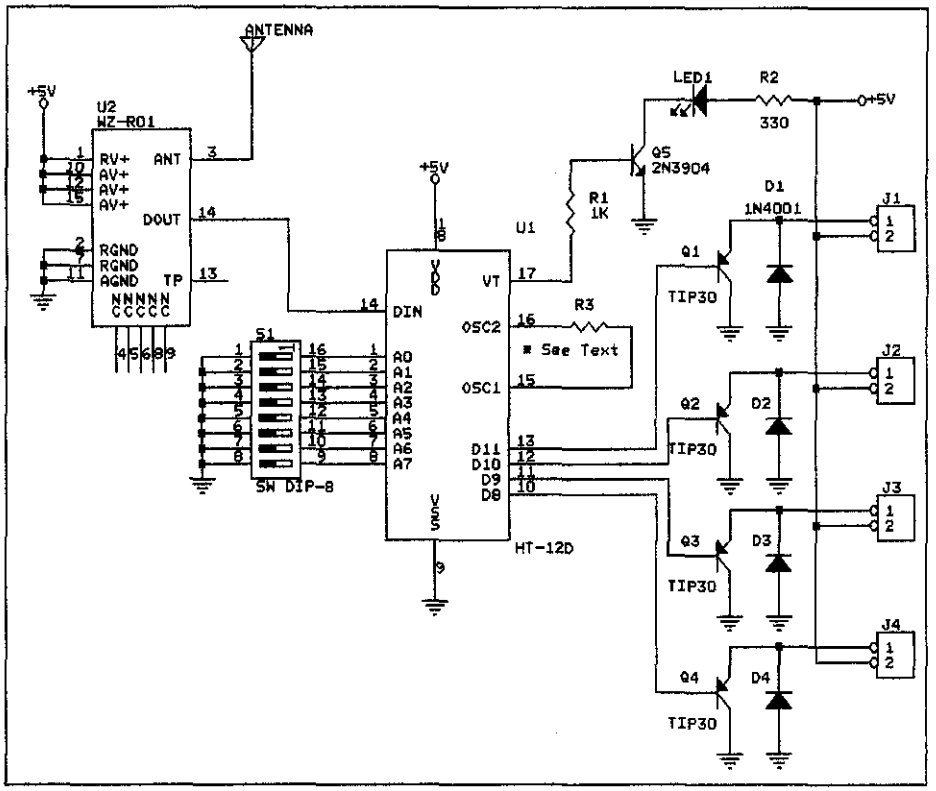

Figure 15: RF Receiver Schematic Diagram

RF integrated circuit with super-heterodyne working mode and Surface Acoustic Wave (SAW) are to the RF modules for completing the operation. The features are strong ability of anti-jamming and good stability. It has been applied at some industrial control that having the high requirement.

Radio Frequency (RF) modules have its own technical specifications. Those specifications are listed below:

- communication data: serial 8 – bits data
- control range: 10 – 100 meters
- working frequency: 315 MHz
- transmitting velocity: < 9600bps
- modulation mode: AM/OOK/ASK
- resonance mode: Sound Acoustic Wave resonance (SAW)

The RF transmitter and receiver that have been purchased are in Figure 16 and Figure 17:

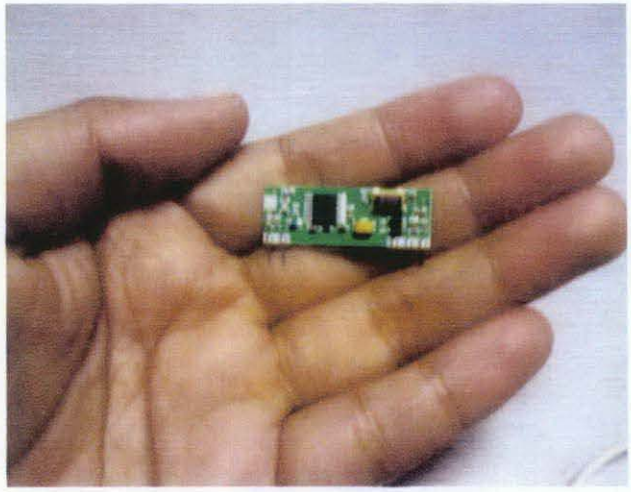

Figure 16: RF Transmitter

These RF transmitter modules are very small in dimension and have a wide operating voltage range which is 3 to 12 V. The low cost of RF transmitter can be used to transmit signal up to 100 meters. The antenna, working environment and supply voltage will seriously impact the effective distance. It is good for short distance and battery power device development. In this project, a RF transmitter module 315 MHz is used.

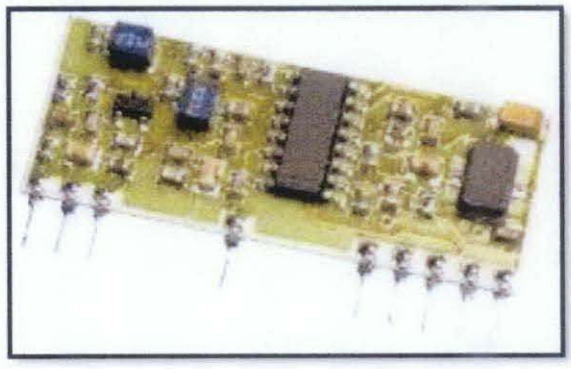

Figure 17: RF Receiver

These RF receiver modules also very small in dimension and suit with our objective which is we want the small size and portable devices. The low cost RF receiver is used to receive RF signal from paired transmitter at specific frequency which determined by the product specifications. In this case, we are limited the communication between two meters. Super regeneration design ensure sensitive to weak signal. In this project we are also using 315 MHz RF receiver modules.

RF receiver allows developers to build robust and low-cost RF data links. It is ideal for high-volume wireless applications including remote control systems, home security and alarm systems, wireless keyboard. The receiver is shipped in total knock down format and can be easily integrated into an existing design or its components can be used. The gain block has the benefit of having high gain across a broad range of frequencies while also providing very low noise, allowing for use in both receiver and transmitter chains for high performance systems.

Another materials need for this project is the magnetic sensor and voltage regulator. Both RF devices are set to activate depending on the dual arrangement of the magnetic sensor that will be associates with the brake lever. The voltage regulator plays the main role to protect the IC and other connected sensor or actuators from overdrawn voltage. If overdrawn voltage occurred during the operation, it will cause any of the modules burned.

CHAPTER 5
CONCLUSION & RECOMMENDATION

As a conclusion, the author strongly agrees that this project is a relevant and efficient system that contributes towards a safety and comfortable management of baby stroller. The developments of prototype of this safety brake and warning system consist of the integration of hardware and software application. For current progress, we had investigated and survey the preferred types of motor and model for RF devices for the wireless communication.

The progress so far after the PreEDX poster presentation does not gives huge impact to the development of the product. A number of testing has been done and troubleshooting the devices does not gives quite a positive reflect. Since the period of the semester is limited, the project has to be continued personally by the author. Improvement for the operation will be investigated and found the solution of the problems occurred. The author has thought about the recommendation for improvement that can be includes which are:

- ✓ Additional alarm system.
- ✓ Actual magnetic sensor to the brake lever.
- ✓ Gyroscope which detect the angle of the surface where stroller is.

Those planned additional improvement can only be added once the basic objectives has been achieved. This is to make sure that the main safety function of the stroller is placed on the top of our view. For this fourteen weeks doing this project, the author has reviewing the objectives, scope and the time frame, it can be sum up that this is a comprehensive prototype-based project. Basically, function of the Radio Frequency (RF) is the system that detects the wireless connection between the transmitter and receiver devices for the distance till two meters. Once it greater than two meters, the connection is lost and signal sent to the motor for breaking the stroller and warn the parent at the same time.

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No.	Details/Week	1	2	3	4	5	6	7		8	9	10	11	12	13	14
1	Selection of Project Topic	■	■													
2	Preliminary Research Work		■	■	■	■	■									
3	Preparing Extended Proposal				■	■	■		Mid Semester Break							
4	Submission of Extended Proposal							●								
5	Proposal Defense									■	■					
6	Project Work Continues											■	■	■		
7	Submission of Interim Draft Report														●	
8	Submission of Interim Report															●

No.	Details/Week	1	2	3	4	5	6	7		8	9	10	11	12	13	14	15
1	Prepare the schematic drawing of mechanical brake mechanism																
2	Preliminary research on types of mechanical brakes mechanism																
3	Research for the development tools of mechanical brake mechanism																
4	Research of motor and development of prototype																
5	Combination of mechanical and electronic prototypes																
6	Prototypes modification / improvements																
7	Submission of Progress Report																
8	Prototypes preparation for pre-EDX																
9	Pre-EDX																
10	Submission of Draft report																
11	Submission of Final / Technical Report																
12	Oral Presentation (VIVA)																

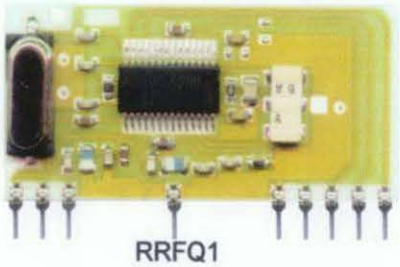
Mid Semester Break

FM TRANSMITTER & RECEIVER HYBRID MODULES.

FM-RTFQ SERIES FM-RRFQ SERIES

- FM Radio Transmitter & Receivers
- Available As 315 or 433 or 868MHz
- Transmit Range Up To 250m
- Miniature Packages
- Data Rate upto 9.6Kbps
- No Adjustable Components
- Very Stable Operating Frequency
- Operates from –20 to +85^{0}C

RTFQ1



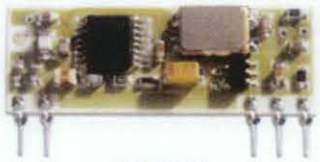
RRFQ1

Transmitter

- 3-12 Supply Voltage
- SIL or DIL Package

Receiver

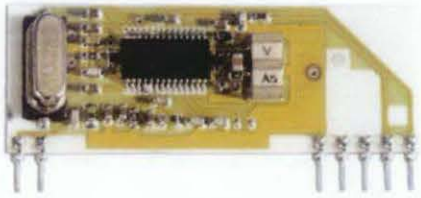
- PLL XTAL Design
- CMOS/TTL Output
- RSSI Output
- **Standby Mode (max 100nA)**
- 5V Supply Voltage



RTFQ2

Applications

- Wireless Security Systems
- Car Alarms
- Remote Gate Controls
- Remote Sensing
- Data Capture
- Sensor Reporting



RRFQ2

Description

These miniature RF modules provide a cost effective high performance FM Radio data link, at either 315, 433.92 or 868MHz. Manufactured using laser trimmed Thick Film ceramic Hybrid the modules exhibits extremely stable electronic characteristics over an Industrial Temperature range. The hybrid technology uses no adjustable components and ensures very reliable operation.

This transmitter and receiver pair enables the simple implementation of a data link at distances upto 75 metres in-building and 250 metres open ground.

These modules will suit one-to-one and multi-node wireless links in applications including car and building security, EPOS and inventory tracking, remote industrial process monitoring and computer networking. Because of their small size and low power requirements, both modules are ideal for use in portable, battery-powered applications such as hand-held terminals.

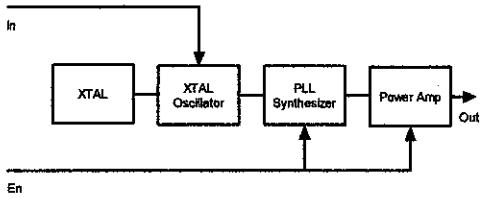
Transmitters

There are two versions of transmitter:

RTFQ1; A Dual in Line Package operating at 3.3V. This provides the most rugged mechanical fixing to the host PCB. Power Down mode is also available.

RTFQ2; A Single in Line Package incorporating a voltage regulator for 3-12V operation. (Compatible with many other RF transmitter modules available)

Transmitter Block Diagram



Part Numbering

Part Number	Description
FM-RTFQ1-315	DIL FM Transmitter Module 315 MHz
FM-RTFQ1-433	DIL FM Transmitter Module 433.92 MHz
FM-RTFQ1-868	DIL FM Transmitter Module 868.35 MHz
FM-RTFQ2-433R	SIL FM Transmitter Module 433.92 MHz 3-12V I/P
FM-RTFQ2-868R	SIL FM Transmitter Module 868.35 MHz 3-12V I/P

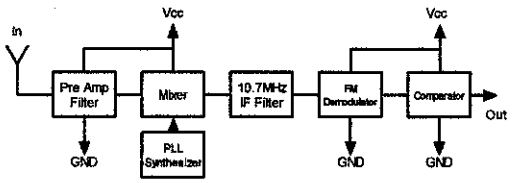
Receivers

There are two versions of receiver:

RRFQ1: A Single in Line Package with sleep / Power down mode.

RRFQ2: A Single in Line Package, pin compatible with many other receivers

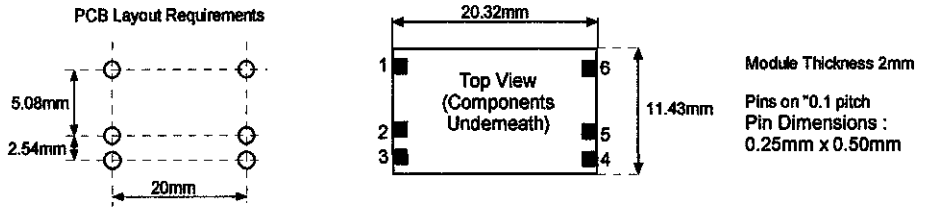
Receiver Block Diagram



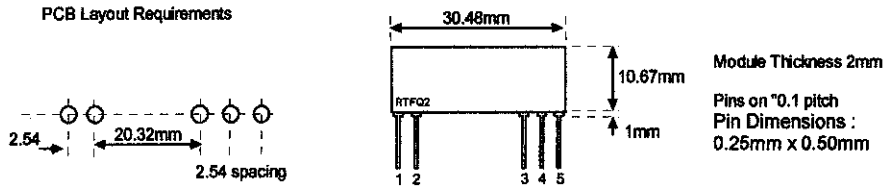
Part Numbering

Part Number	Description
FM-RRFQ1-315	SIL FM Receiver Module 315 MHz
FM-RRFQ1-433	SIL FM Receiver Module 433.92 MHz
FM-RRFQ1-868	SIL FM Receiver Module 868.35 MHz
FM-RRFQ2-433	SIL FM Receiver Module 433.92 MHz
FM-RRFQ2-868	SIL FM Receiver Module 868.35 MHz

RTFQ1 Mechanical Dimensions



RTFQ2 Mechanical Dimensions



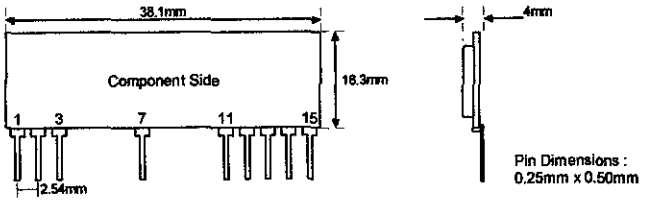
Pin Description

RTFQ1	RTFQ2	Name	Description
1	N/A	En	Enable (active high)
2	5	IN	Data input
3	1	GND	Ground, Connect to RF earth return path
4	3	Vcc	Supply Voltage
5	4	GND	Ground, Connect to RF earth return path
6	2	EA	External Antenna

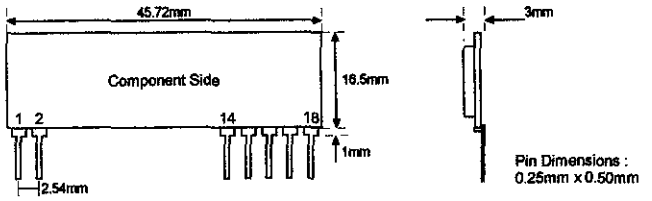
Technical Specifications

Electrical Characteristics	MIN	TYPICAL	MAX	DIMENSION
Supply Voltage RTFQ1	2.1	3.3	4.00	V
Supply Voltage RTFQ2	2.5		12.00	V
Supply Current		7	8	mA
Standby Current (IN = EN = Low)			100	nA
Frequency		315.0 433.92 868.35		MHz
RF Output into 50Ω (Vcc=3.3V)		+5 / +5 / +1		dBm
Initial Frequency Accuracy	-35	0	+35	KHz
FM Deviation	25	30	35	KHz
Harmonic Spurious Emissions		-50		dBc
Input High Voltage RTFQ1	1.5		Vcc	V
Input High Voltage RTFQ2	1.5		5.5	V
Power up Time (En to full RF)			1	mS
Power up Time (Power on to full RF)			5	mS
Max Data Rate			9.6	KHz
Operating Temperature	-25		+80	°C

RRFQ1 Mechanical Details



RRFQ2 Mechanical Details



Pin Description

RRFQ1	RRFQ2	Pin Description
1	16	+Vcc
2, 7,11	2,15	GND
3	1	Data In (Antenna)
12		NC
13	14	Received Signal Strength Output
N/A	17	AF Output
14	18	Data Out
15	N/A	Power Down 0V = Standby 5V = Operating

RSSI Output*

RF In (dBm)	RSSI (V)
-120	1.20
-110	1.32
-100	1.50
-90	1.78
-80	2.06
-70	2.35
-60	2.62
-50	2.72
-40	2.75

RSSI Output

The RSSI provides a DC Voltage proportional to the peak value of the receive data signal. This output can be used as an indicator for the received signal strength to use in wake-up circuits etc.

An RC circuit is normally used to provide the timing for the RSSI signal. The modules have a 10nF capacitor internally connected to GND, therefore a pull down resistor (to GND) connected to the RSSI pin may be used to generate a simple RC network time constant for the RSSI signal output.

Please note that the maximum output current is typically 950µA, the discharge current is lower than 2µA

Technical Specifications

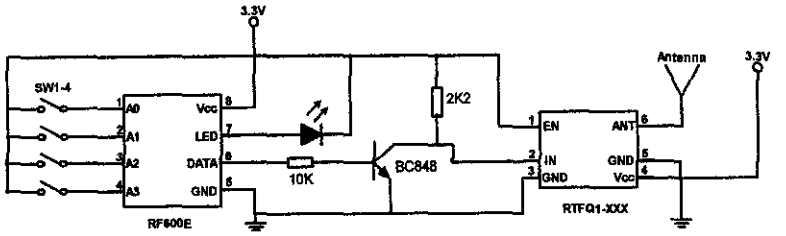
Electrical Characteristics	Min	Typical	Max	Dimension	Notes
Supply Voltage (Vcc)	4.5	5	5.5	V	
Supply Current (Operating)		5.7	6.8	mA	
Supply Current (Standby)			100	nA	
Receiver Frequency		315.00 433.92 868.35		MHz	
R.F Sensitivity (100% AM) 315 ,433MHZ versions 868MHz versions		 -103 -100		dBm	
3dB Bandwidth		+/-150		KHz	
Data Rate	300		9,600	Hz	
Turn on Time			5	mSecs	1
Turn on Time		8		mSecs	2
Level of Emitted Spectrum			-70	dBm	
Low Level Output Voltage			0.8	V	I = 200uA
High Level Output Voltage	Vcc-1			V	I = 200uA
RSSI Output		0.95		mA	
Operating Temperature Range	-25		+80	°C	

Notes
1. Time from PD pin going high to stable data. (RRFQ1 only)
2. Time from Power ON to stable data.

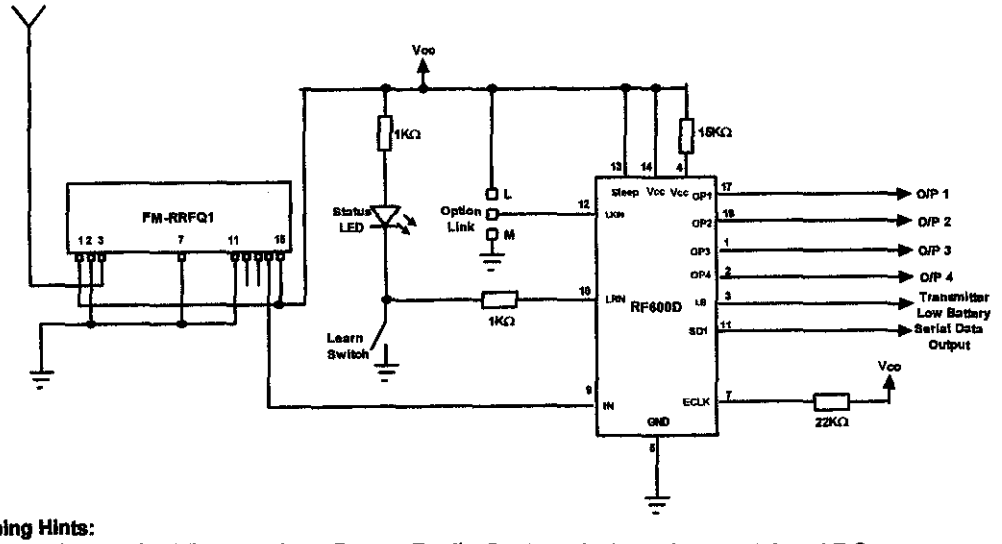
Typical Application

The following circuits show a remote control system with 'self learning feature' for more information please see Datasheet DS600

Transmitter Circuit



Receiver Circuit



Prototyping Hints:

It is essential when building any Low Power Radio System that you have a 'clean' DC power source. Typically the ripple voltage should be less than 10mV Peak to Peak. Normally a 470uF decoupling capacitor is sufficient de-coupling for an AC derived DC power source.

Never place a Transmitter or Receiver directly into Vero-Board or any similar prototyping board. This will severely restrict the range. Rather, use small lengths of wire from the prototyping board to the pins of the Transmitter or Receiver.

A useful antenna, for testing purposes, for both the Transmitter and Receiver on 433MHz is to use a piece of wire 17.3cm long (23.8cm at 315MHz) soldered directly to the antenna pin.

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