'I/We declare that had read this work and from
my opinion this work is adequate from scope and quality aspect for award of
Bachelor Degree of Mechanical Engineering (Automotive)'

Signature ; .....

Supervisor ; ..... HERDY RUSNANDI

Date ; 21/5/2010

ENCIK HERDI RUSNANDI
Pensyarah
Fakulti Kejuruteraan Mekanikal
Universiti Teknikal Malaysia Melaka
Karung Berkunci 1200, Ayer Keroh
75450 Melaka

Declaration

"I hereby declare that all information provided in this report is true and is my own work except for the details that I already explained from whom/where it is taken from"

Student Signature :
Student's Name : Neilson Peter David Sorimpuk
Date : 7 APRIL 2010

ACKNOWLEDGEMENT

Deepest grateful are acknowledged to my supervisor, Mr. Herdy for the guidance along completing this project, Mr. Stephen Chong (TOYOTA UMW Ind. Sabah Branch Service Division Manager) who is still in contact and providing lots of information, Mr. Charles Herman (Chief Mechanic and vice Service Division Manager of TOYOTA UMW Ind. Sabah Branch) who is always supporting me with his years of experience in automotive electrical systems, Mr. Peter David Sorimpuk (my own father) who is always providing me tools and materials, and all fellow friends for supporting and information sharing.

ABSTRACT

This report is about the development of the automatic car starter which can be remotely activated by a phone call. Details in circuit, schematic, function, and programming codes regarding on the system are included in this report.

TABLE OF CONTENT

NOMENCLATURE

1. MCU	= microcontroller uint
2. IC	= Intergrated Circuit
3. ACC	= Accessories
4. CPU	= Central Processing Unit
5. BAT	= Battery
6. IG	= Ignition
7. LED	= Light Emitting Diode

LIST OF TABLES AND FIGURES

LIST OF FIGURES

LIST OF APPENDIX

1.0 INTRODUCTION

1.1 Problems Statement

Vehicle left parked at open area is exposed to the surrounding temperature and sun shine thus heating the inside compartment of the car. As the car ventilation is closed during parked, the heat inside the compartment will accumulate and dissipates slowly as the air conditioner is switched on, or the side windows are rolled down. The inconveniency arises when we are picking up our car; we start the car manually then we have to sweat inside waiting the car's air conditioner lowering the temperature.

1.2 Objectives

The objectives of this project are:

1. To study the sequence of car starter system.
2. To develop a car automatic starting system using a remote control.
3. The system developed should able to activate the air conditioner automatically.

1.3 Scope

a. For PSM 1:

1. Problems statements: Studying and identifying problem that arisen.
2. Specification: Determining the requirements to solve the problems.
3. Alternative: Providing options that may have the potential to solve the problem.
4. Solution: To choose the best option based on the criteria and requirement outlined.
5. Preliminary design: Providing the concept of design and modification.

b. For PSM 2:

1. Design Detail: Providing a full detail on the design including the complete wiring diagram and programming data base.
2. Fabrication: Developing or simulating the system.
3. Evaluation: Examining the system in terms of its functionality.
4. Modification: Performing any necessary improvements or adjustments.

1.4 Specification

The system developed should be:

- Simple
- low power consumption
- packed in a small size
- able to override the key ignition system
- Can be triggered by a long range or short range signal using a remote control unit.
- Time triggered
- Complete with security systems which only can be triggered by the authorized personnel or the owner of the vehicle.
- Can be installed in driver or engine compartment
- Electronically based

2.0 LITERATURE REVIEW.

2.1 Background studies.

Our local climate can be described as hot especially during the midday. Living with temperature within the average of 29-32 degree of Celsius a day can be considered as inconvenience by certain peoples. For this reason, we are always choosing to hide behind the shades during the day as to avoid the temperature from the sun. We build shelter to protect ourselves from the uncomfortable feeling of being exposed to the heat. Besides of living comfort in the shelter, we are also wanted to be comfortable in traveling. Air conditioners are equipped in the vehicles to do so. But, every time we are picking up our car which parked outside the shelter, we will wish that our air conditioner system is operating at double times so the heat inside the compartment will be lowered down very soon. This problem arisen as the car was exposed to the direct heat from sun, the heat will build up inside the compartment. As the ventilating system of the car is closed, the heat inside the compartment will continuously accumulating until a certain degree. So, the time taken for the car air conditioning system to lower the temperature will be much longer.

A complete vehicle vehicle's starting system is consisting of ignition switch, power supply unit, several relays, a starter motor, and the ignition systems including the spark plugs and fuel pump. Most of vehicle's starter system is triggered by a key which is located at the driver compartment (near to the steering wheel). Users have to turn it into several positions before starting their vehicle's engine. For a safety reason, each of the key design is unique to each of the vehicle so only that the vehicle can be started only by using a correct key which match to the ignition switch. The ignition switch can be described as a main switch for the whole electrical system of the vehicle. Designed with several position; *lock, acc, on, and start,* it is used to control the sequence of starting an engine.

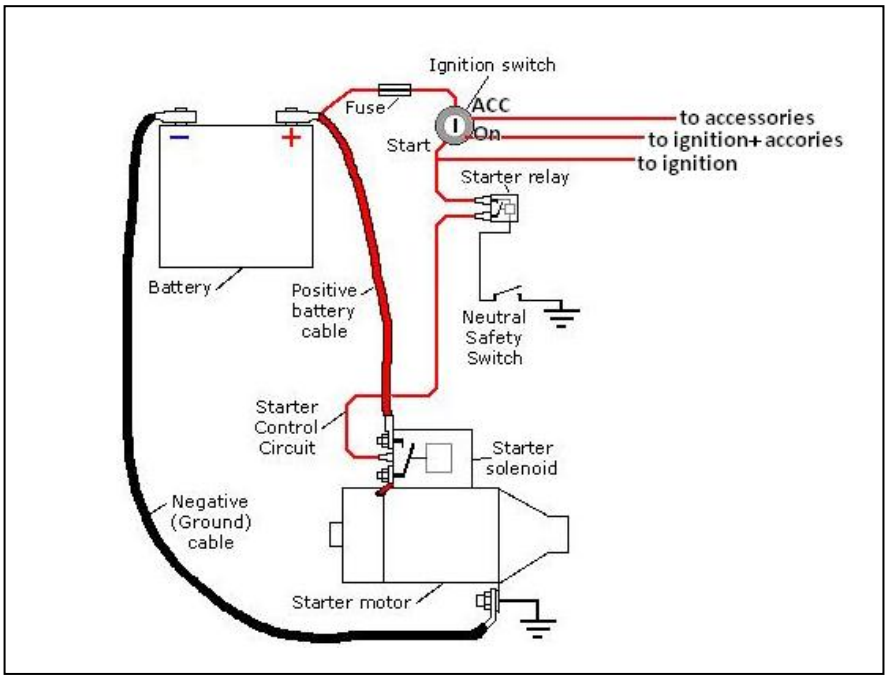
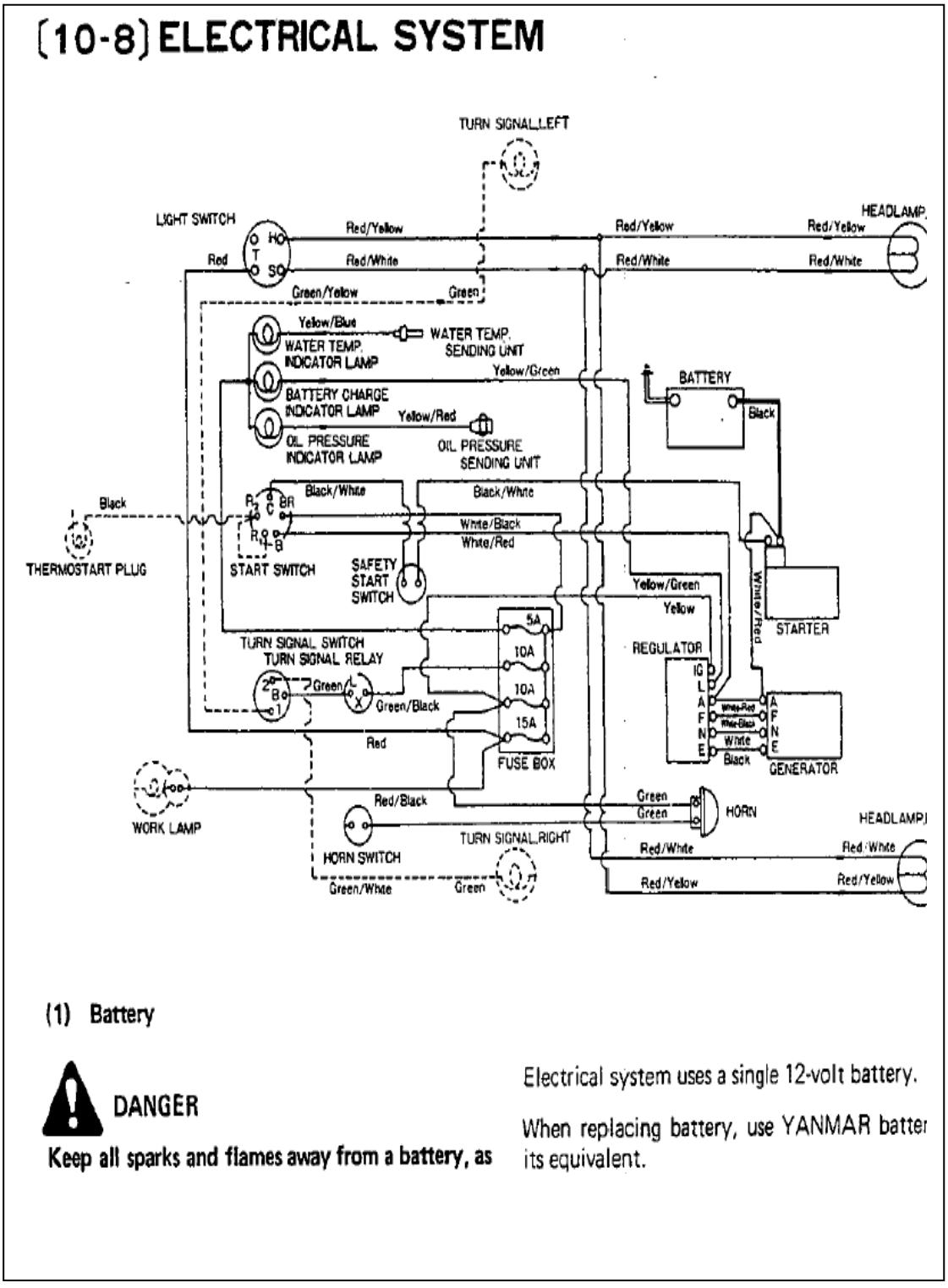


Figure 1: A Simple Starter Diagram
(Image taken from www.autoshop101.com)



(1) Battery

DANGER

Keep all sparks and flames away from a battery, as

Electrical system uses a single 12-volt battery.

When replacing battery, use YANMAR batter
its equivalent.

Figure 2: A Typical Mazda 323 1985 Model Starter Wiring Diagram

(Image taken from www.autoshop101.com)

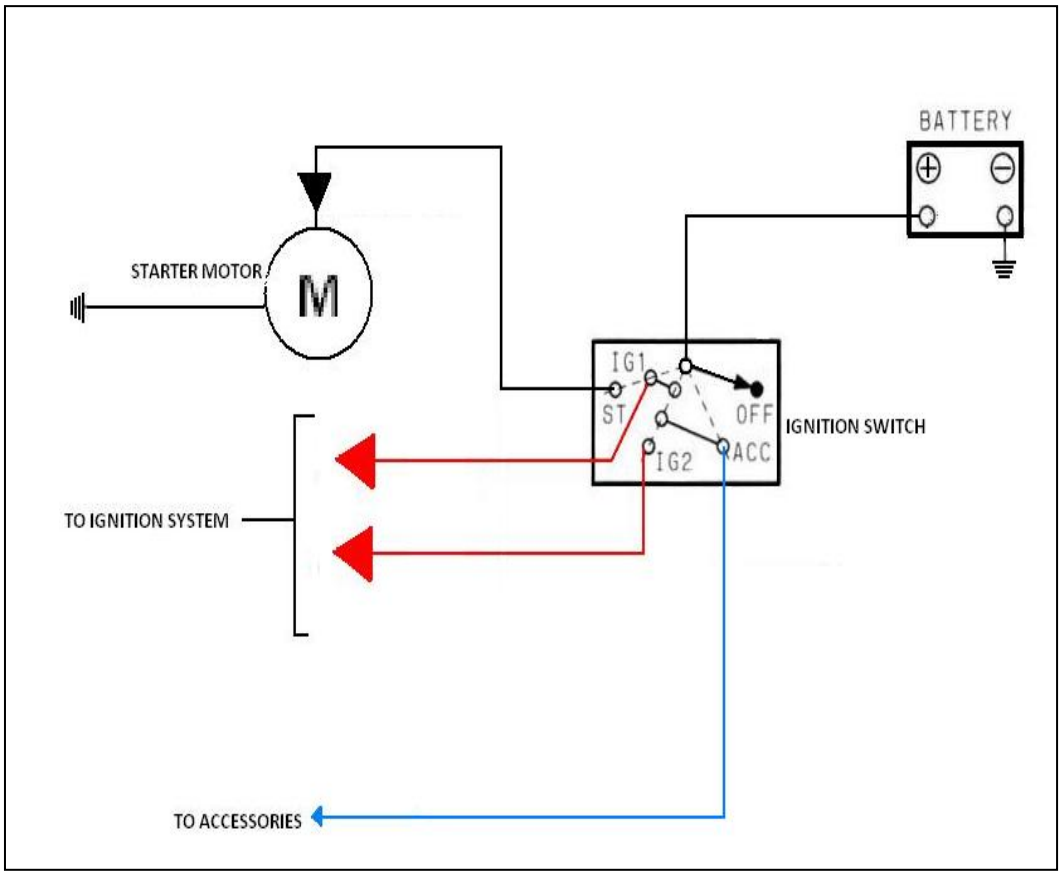


Figure 3: A simplified Conventional Starter System Diagram

2.2 Parts and Components Studies

2.2.1 Ignition Key

The ignition switch generally has four positions: *off*, *accessories*, *on*, and *start* and some cars have five including *lock* position. At the *accessories* position, low power consuming accessories, such as the radio, are activated; however, high power consuming accessories such as window motors remain off in order to prevent the car's battery from being drained.
The *accessories* position uses the least amount of battery power when the engine is not running,

The *on* position turns on all of the car's systems, including the fuel pump and this is the position the ignition switch remains in while the engine is running.
The *start* position is spring loaded so that the ignition switch will returns to the *on* position when the key is released. When the key is released from the *start* position, it returns to the *on* position, cutting power to the starter. This is because the engine runs at speeds that the starter cannot match, meaning that the starter gear must be retracted once the engine is running on its own.

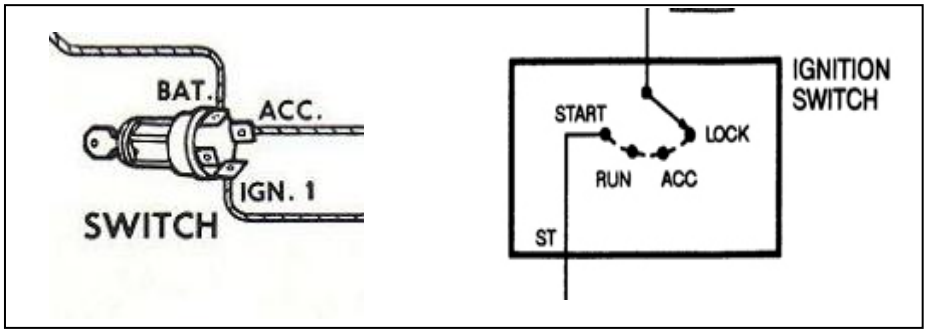


Figure 4: Ignition Switch Diagram
(Image taken from www.autoshop101.com)

2.2.2 Starter Motor

The starter motor is a powerful electric motor as it is needed to spin the engine at the beginning of starting the engine. It is attached with a small gear (pinion) which will meshed with a larger gear (ring), which is attached to the engine upon activation. The starter motor then spins the engine over so that the piston can draw in a fuel/ air mixture, which is then ignited to start the engine. This is done by pushing the pistons to create a vacuum volume which will open the air intake valve and sucks the air entering the combustion chamber. After the engine is running on its own, the starter motor must be deactivated to avoid damage on its gear and components as the engine is spinning faster than the motor. However, a coupling or clutch like system is installed on the starter motor which allows the motor to detract automatically whenever the engine gear is rotating faster than the motor itself.

Usually, a starter motor is paired with a starter relay or a starter solenoid to allow the starter being activated by a low current from the ignition switch.

Figure 5: Starter Motor
(Image taken from www.autoshop101.com)

2.2.3 Relay

Relay is an electronic switch that is controlled by electric current. Working by the principle of a solenoid, relay is often used to control the flow of a larger current to a circuit while it is actuated only with a small amount of current.

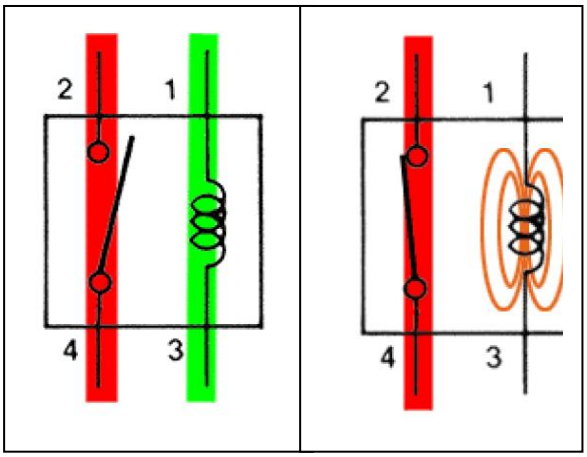


Figure 6: Relays Operation
(Image taken from www.autoshop101.com)

2.2.4 Micro-Controller Unit

The microcontroller is a single chip of Integrated Circuit (IC) which is programmable and used as a controller in a system. It is consists of several parts such as Timer, Counter, Memory, and build in circuit interface. Also known as Central Processing Unit (CPU) with reduced computing power, it is installed in a system as a controller to process any inputs from sensors or other circuit into an output to the mechanical actuators. The inputs collected by the microcontroller are processed based on the commands that are programmed by the inventor using computer programs. Able to repeat the command lines as many as it is programmed to, compact, adaptive as the programmed data can be change or modified according to the needs, and is also can perform multi tasks upon activation makes it is the most significant component that should be applied on this project.

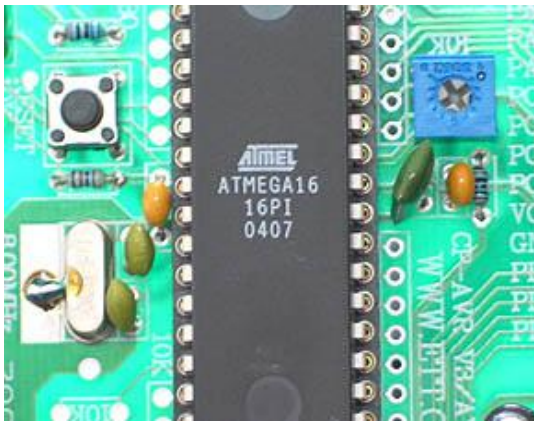


Figure 7: ATMega16 microcontroller

Figure8: ATmega16 Development Board

2.3 Previous Invention Studies.

Several studies and development on this invention had been made since 1992. According to the US Patent 5129376 (year 1992):

a. The remote control starter is activated by a mobile phone as a sender and a pager as a receiver.
b. Since the pager will beep upon receiving a signal, the user decided to use a sound sensor as the circuit controller/switch.
c. Along with the starter unit, temperature and oil pressure monitoring unit are also installed.
d. The invention are claimed to be able to reactivate the car starter if the engine dies within a minute automatically.
e. The honk will be also activated as the indicator when the engine reached the desired temperature.

From the studies that have been made from several previous inventions, there are several critical points that should be noted on this previous invention.

a. circuit design
   - The circuit is consists of several relays and timers which actuated in several sequences. Studying the circuit is helping on relays and timers usage as a switch and sequence triggering.

b. process sequence
   - The operation begins with the sound sensor receiving input from the pager then actuates the first relay and so on until the engine is started.

c. feedback systems.
   - If the engine is not started by the first attempt, the whole system will loops again for one more try. This is done by applying a pressure and heat sensor which will measure the conditions of the engine. Those sensors are also functioning as the “shut down” switch which will shut down the engine as the engine reached at desired condition.

The advantages are:

- The system able to restart by itself if there is a failure on the attempt within the first minute.
- The system consists of engine pressure and temperature monitoring systems which will decide how long the car will be in ignited.
- The system is operated by fully electronic based components. Thus, it is more reliable and easier to be operated.
- The system consists of status display (by LED) which will ease the user to operate it.

The disadvantages are:

- As claimed by the inventor, the device is operated within a 75 miles radius. This is still not applicable for those who need a longer range.
- The system is relies on sound sensor to interpret the signal from the user. This may leads to accidentally triggering if there is a noise penetrating through the acoustic chamber to the sensor.
- Practically, the invention is out dated since it is using a pager, and also is quiet complex to be understood.

2.4 Alternative

Based on the problems stated and by referring the previous invention that ever made, there are few alternatives that can be applied to trigger the engine starter and has the requirement as the solution. Each of them has the advantages and disadvantages which will be compared as follows.

Alternatives	Advantages	Disadvantages
1. Via radio wave remote control.	• Low cost • Simple • Easy to use • Small size of controller unit.	• Short range • Easily effected by surrounding interference • Least frequency variable • Remote control unit and receiver unit are usually manufactured as a package-lost of remote controller may results in high cost of replacement.
2. Via Mobile Phone (GSM wave)	• Wide range and coverage • Can be applied to a specific phone number • Everyone has a mobile phone • Mobile phone itself has the alarm clock feature.	• High cost • Is restricted to be turned on in the gas station area because of its electromagnetic wave transmitting.