CHAPTER TWO
LITRITURE REVIEW

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Literature Review

2.1 Literature Review:

In 19, December 2014 a paper titled Intelligent Vehicle Theft Control using Embedded System showed car theft is major problem and accident prevention is challenging. So in order to bring a solution for this problem the proposed system was implemented. Vehicle security enhancement and accident prevention system can be developed through tracking and locking. The need for this is to provide security to the vehicles by engine locking system which prevents the vehicle from unauthorized access. Method of vehicle tracking and locking systems used to track the theft vehicle by using GPS and GSM technology. [9]

N.Chandra Kumar and others from Knowledge Institute of Technology, India presented the design and development of an embedded system in march 2014, which was used to prevent the theft of a vehicle. The development model was based on embedded system with GSM technology. The main theme of this project is to control the outlet of the fuel injector by means of electronic solenoid valve, which will be controlled by the microcontroller through the driver circuit. The driver circuit will drive the solenoid valve. Thus the enabling and disabling of solenoid valve will be controlled by the microcontroller. The password is given to the authorized

person of the vehicle (owner and driver) to start it by enter the keyword. If he enters the keyword, the normally closed solenoid opens and the vehicles will be ready to start. If the password is entered by the unauthorized person, the system will send an alert message to the authorized person through GSM to safeguard their vehicle. [10]

In 4, April 2015 a paper titled Emerging Vehicle Control Using Embedded and Wireless in Transportation System presented that almost all people are having their own vehicle hence vehicle security and control becomes very essential. The need for the proposed system is to provide security to the vehicle by engine locking system. Method of vehicle tracking and locking which is used to track the theft vehicle using GPS and GSM technology. The system is put into the sleeping mode when the vehicle is handled by the owner or authorized persons; otherwise the system goes to theactive mode. The mode of operations is changed by persons or remotely. When the vehicle theft is detected, the authorized person sends SMS to the micro controller, and the controller sends the control signals to stop the engine motor so that all the doors are locked. To open the doors or to restart the engine authorized person needs to enter the passwords. In this method, the vehicle can be easily tracked. [11]

A paper published by Jayanta Kumar Pany& R. N. Das Choudhury titled Embedded Automobile Engine Locking System, using GSM Technology in 2011, this paper deal with the design & development of an embedded system, which is being used to prevent /control the theft of a vehicle. The developed instrument is an embedded system based on GSM technology. The instrument is installed in the engine of the vehicle. An interfacing GSM modem is also connected to the microcontroller to send the message to the owner’s mobile. The main objective of this instrument is to

protect the vehicle from any unauthorized access, through entering a protected password and intimate the status of the same vehicle to the authorize person (owner) using Global System for Mobile (GSM) communication technology. This system deals with the concept of network security. The main concept in this design is introducing the mobile communications into the embedded system. The entire designed unit is on a single board. [12]

In March 2015 Kuldeep Dasadiya and others presented that theft is happening sometimes in driving insecurity places and parking. The safe of our vehicles is highly essential for public private vehicles. Vehicle tracking and locking system developed in the public or private vehicle, to locking engine motor and track the place. The location of the vehicle identified using Global system mobile communication (GSM) and Global Positioning system (GPS). These systems constantly monitor a moving Vehicle and gives output as base on the status. When the theft identified or happening, the responsible person send massage to the microcontroller, then microcontroller sends a control signals to stop the engine motor. Authorized person need to send the password to microcontroller to restart the vehicle and open the door of the car. This is more reliable, secured and low cost. [13]

Ch. Bhanu Prakash&K. Sirisha from Malla Reddy Engineering College published a paper titled Design and Implementation of a Vehicle Theft Control Unit using GSM and CAN Technology in 2014, This paper presented Design & Development of Multi level Anti-theft security system to control the theft of a vehicle using GSM and Biometrics. The main objective of this is to offer an advanced security system in multiple levels to protect the car from unauthorized access using GSM technology. It provides

a protected password to unlock the car and real time biometric user authentication in second level to start the ignition after finger print verification is done. If the fingerprint does not match with that in database, ARM produces the interrupt Signal to disable the ignition and initiates an alarm and also informs the car owner about the unauthorized access via short Message Services (SMS) by means of GSM modem.[14]

In April 2013 in Sinhgad college of engineering Rajesh Borade and others presented that Nowadays, automobile thefts are increasing at an alarming rate all over the world. Security of their vehicle has always been a concern to people, therefore developed secured vehicle tracking and control system. In this system the user will be able to control his vehicle through an android based Smartphone. A secured mode of communication between Smartphone and vehicle is established via GSM network. Using his/her Smartphone, the owner will be able to lock and unlock the vehicle and track the vehicle in case of theft. If the GSM network is not available momentarily, a secured Bluetooth channel will be used instead. The project will be helpful in digitization of documents of Regional Transport Office. [15]

2.2 Technical background:

The following figure to show basic components in ignition system in vehicle:

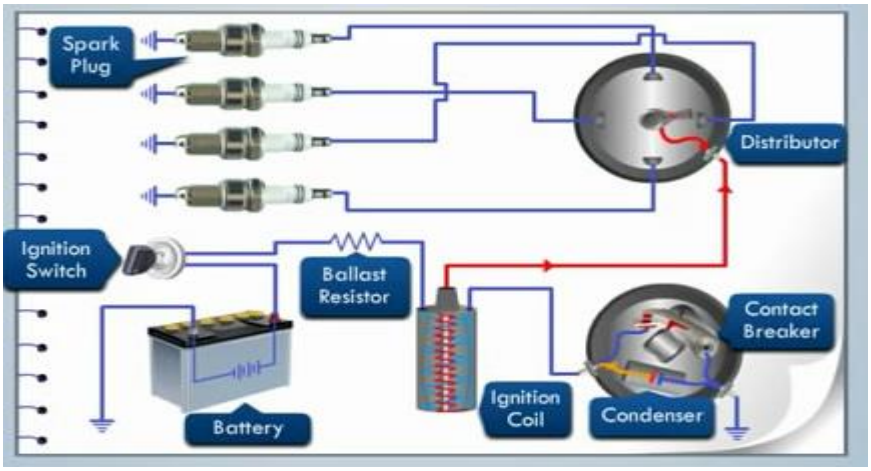

Figure 2.1: The Ignition System

2.2.1 Basic components of ignition system:

2.2.1.1 Battery:

- Stores the electrical energy for the ignition process.
- Recharged by using dynamo driven by the engine.

2.2.1.2 Ignition switch:

- Helps in turning the ignition system ON and OFF.

2.2.1.3 Ballast resistor:

- Made of iron wire.
- Under prolonged condition, the temperature of the ignition coil increase.
- Its electrical resistance increases rapidly as a certain temperature exceeded.
- Helps in keeping the current down to a safe value.

2.2.1.4 Ignition coil:

- Source of ignition energy.
- Steps up the low voltage to induce an electrical spark in the spark plug.
- Primary winding consist of 200 – 300 turns (outer winding).
- Secondary winding consist of 2100 turns (inner winding).

2.2.1.5 Contact breaker:

- Making and breaking the primary circuit.
- Consist of two metal points (movable, fixed).
- Pivoted arm has a heel attached to in the middle which breaks the contact point due to action of the cam.

2.2.1.6 Distributor:

- Distributes the ignition surges to the individual spark plug in the correct sequence and at the correct time.
- Consist of a rotor in the middle and metallic electrodes at the periphery and those connected directly to the spark plugs, also known as the ignition harness.
- As the rotor rotates, it passes the high tension current to the ignition harness which then carry these high tension current to the speak plugs.

2.2.1.7 Spark plugs:

- Output part of the whole ignition system.

- Spark plug consists of two electrodes (central electrode, ground electrode), the potential difference between these electrodes ionize the gap and thus create a spark between them.

2.2.2 Operation of ignition system:

When the ignition switch is turned on, the primary circuits get closed and current start flowing through it. This current, known as primary current going to the ignition coil.

The ignition coil is two separate coils of wire, they are known as the primary winding (low voltage equal to 12 volt) and secondary winding (high voltage equal to 22k volt) turning around soft iron core. The primary coil made up of 200-300 turns and carries ten amps or more of current ,when the secondary winding consist of 21000 turns.

When the primary current flows from the battery through the primary coil where one end is connected to the contact breaker, it set up a magnetic field around the soft iron core of the ignition coil. There is a cam which is connected directly to the camshaft opens and closes the contact breaker points according to the number of engine cylinders .When the breaker points close, the current was flowing through the contact breaker after that when the breaker points open by the action of the cam lobe, the current which was flowing through the contact breaker starts flowing through condenser. As the condenser charges, the primary current comes from the primary circuit falls and the magnetic field collapses. This change in the magnetic field induces a current in the primary winding which flows in the same direction as the primary current and charges the condenser to a voltage much higher than battery voltage, thus stopping the current flow from the battery. Due to this,

the condenser discharge into the battery, thus reversing the direction of both primary current and the magnetic field. This rapid collapse and reversal of the magnetic field induces a very high voltage in the secondary winding of the ignition coil. This high voltage is then carried through the high tension cable to the distributor .A rotor inside the distributer rotates according to the ignition timing, when the rotor comes exactly in front of the distributor point, the voltage passes due to the air gab through one of the ignition harness into the spark plug, which consist of central electrode, ground electrode and insulator. The voltage continues to transfer through the central electrode which is sealed using insulator. [1]

A voltage difference is generated between the central electrode and ground electrode. When the voltage exceeds the dielectric strength of the gases between these electrodes, the gases are ionized. Due to ionization, gas becomes a conductor and allows the current to flow through the gab and spark is finally produced.

Another very important function of the condenser is to prevent the arc across the breaker points, if the condenser was not connected in the primary circuit, the induced extra voltage due to the collapsing magnetic field would case an arc across the breaker points which would be hazardous. To prevent this, the condenser is used which absorbs all the voltage to charge itself above the battery voltage. [2]

2.2.3 Motors:

An electric motor is a device for converting electrical power into mechanical power. There are four basic classifications of motors: DC motor, synchronous motors, three phase induction motors, one phase induction

motors, special types of motors (linear induction motor (LIM), stepper motor, servo motor .. etc)[3]. Below some types of motors in details

2.2.3.1 Dc motor:

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types relay on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. Most types produce rotary motion; a linear motor directly produces force and motion in a straight line. DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. The operation of DC motor as follows:

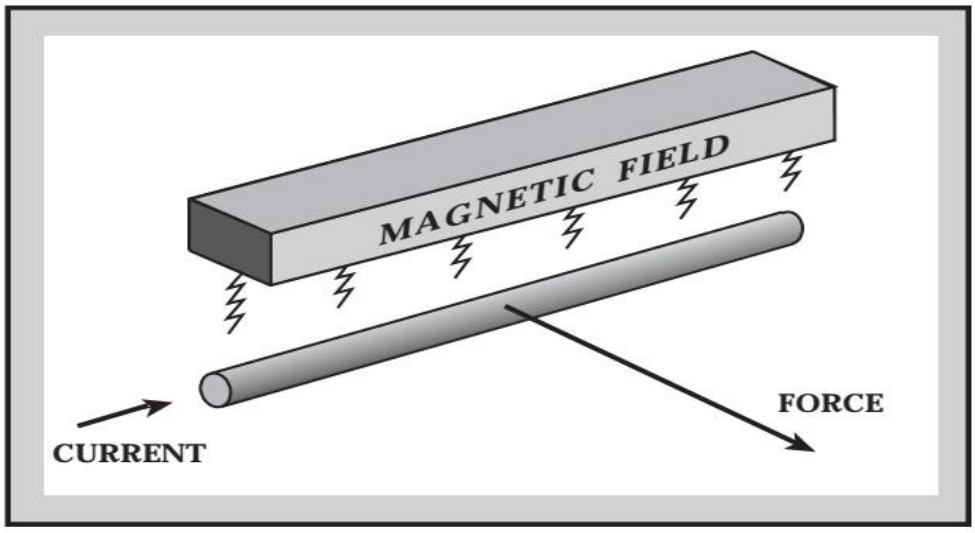

Figure 2.2: DC motor operation

The concept basically state if a conductor, or wire, carrying current is placed in a magnetic field, a force will act upon it. The magnitude of this force is a function of strength of the magnetic field, the amount of current passing through the conductor and the orientation of the magnet and conductor. The direction in which this force will act is dependent on the direction of current and direction of the magnetic field. Electric motor design is based on the placement of conductors (wires) in a magnetic field. A winding has many conductors, or turns of wire, and the contribution of each individual turn adds to the intensity of the interaction. The force developed from a winding is dependent on the current passing through the winding and the magnetic field strength. If more current is passed through the winding, then more force (torque) is obtained. In effect, two magnetic fields interacting cause movement: the magnetic field from the rotor and the magnetic field from the stators attract each other.

The following table shows advantages, disadvantages and applications of DC motors:

Table 2.1: Advantages, Disadvantages and Applications of DC motors.

Advantages of DC motor	○ It is easy to control their speed in a wide range. ○ Quick starting, stopping, reversing and acceleration. ○ Easy to understand design. Simple, cheap drive design.
Disadvantages	○ High maintenance (care required to maintain the mechanical interface used to get current to the rotating field). ○ RF noise from the brushes may interfere with nearby TV sets, or electronic devices, Etc.

	○ DC motors are also expensive relative to AC motors. [4]
Applications	○ Elevators, Electric trains, and Toys.

2.2.3.2 Stepper motor:

Step motors are electromechanical actuators which convert digital inputs to analog motion. This is possible through the motor's controller electronics.

A step motor is particularly well suited to applications where the controller signal appears as pulse trains. One pulse causes the motor to increment one angle of motion. This is repeated for one pulse. Stepper motors are, however, limited to about one horsepower and 2000 rpm, therefore limiting them in many applications. There are three basic types of stepper motor: variable-reluctance, permanent-magnet and hybrid.

The below table represent main advantages, disadvantages and applications of stepper motor:

Table 2.2: Advantages, Disadvantages and Applications of Stepper motor.

Advantages	○ The rotation angle of the motor is proportional to the input pulse. ○ Excellent response to starting/stopping/reversing. ○ The motors response to digital input pulses provides open-loop control, making the motor simpler and less costly to control.
Disadvantages	○ Resonances can occur if not properly controlled. ○ Not easy to operate at extremely high speeds.

Applications	o Industrial machines: in automotive gauges and machine tooling. o Security: new surveillance product for security industry. o Medical: inside medical scanner, sampler's also digital dental photography. o Consumer electronic: for automatic electronic digital camera "focus and zoom function".

2.2.3.3 Servomotor:

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. The Mechanism of servo motor as follows:

As the name suggests, a servomotor is a servomechanism. More specifically, it is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is some signal, either analogue or digital, representing the position commanded for the output shaft.

The main advantages, disadvantages and applications of servo motors showed in the below table:

Table 2.3: Advantages, Disadvantages and Applications of Servomotors.

Advantages	○ High performance. ○ High speeds. ○ Accurate positioning (because of feedback).
Disadvantages	○ High cost. ○ Requires setup/tuning.
Applications	○ Robotics. ○ CNC machinery or automated manufacturing.[5]

2.2.4 Relay switching circuit:

The following figure shows the basic component of the relay switch circuit (relay switch is on):

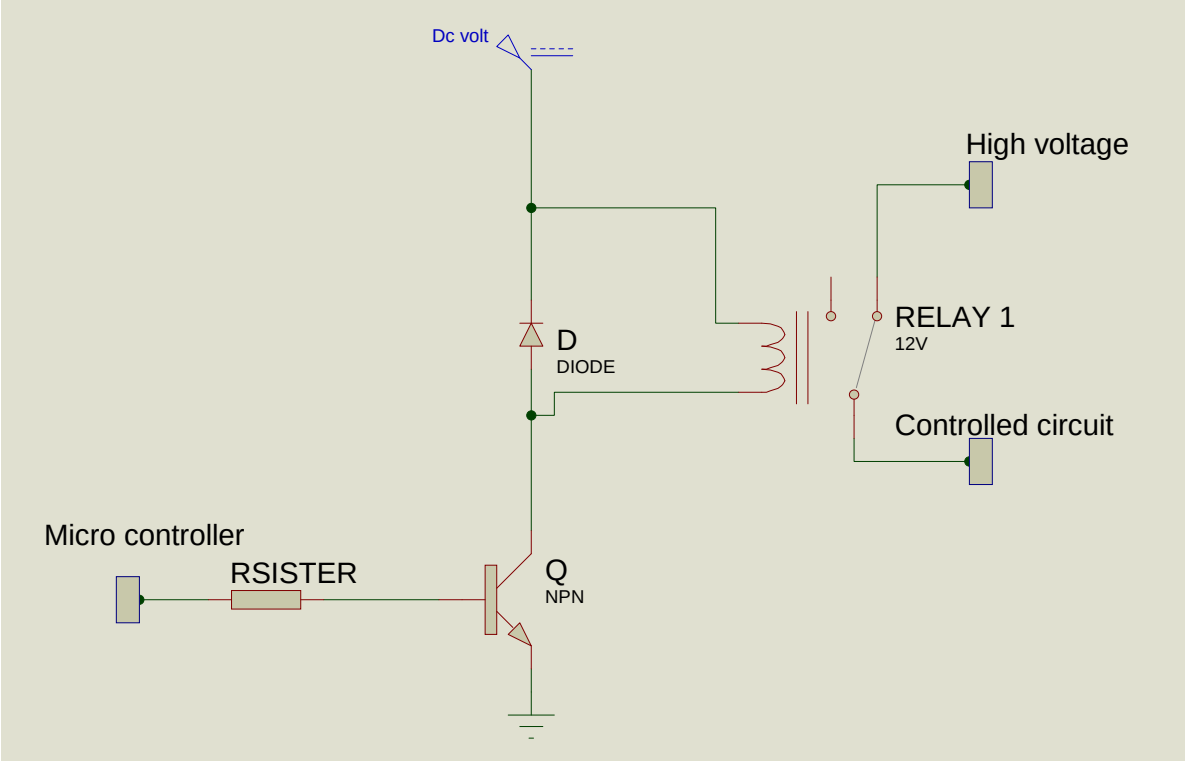

Figure 2.3: Relay switch circuit.

A relay is electromechanical device that use an electromagnet to operate a pair of movable contactor from an open position to a closed position. Relays are used where it's necessary to control circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Relay switch circuit used to control high voltage circuit by low voltage circuit, the principle of operation is illustrated as following:

When the microcontroller sends logic 1 the NPN transistor act as close switch and current flowing through relay create magnetic field which causes the relay switch to be closed (from normal open to normal close).

When the transistor switches “OFF”(due to logic 0), the current flowing through the relay coil decreases, the magnetic field collapses and relay switch will be open.

Table 2.4: Relay merits and demerits.

Advantages	o They are quick acting and can be reset fast. o They are simple in instruction. o They are reliable.
Disadvantages	o Suffer from the effects of ages, as the time passes, the springs and the linkages inside they relay grow weak. o Relays are required to be calibrated periodically and tested. o Multi-functioning is not possible, one relay can perform only one function.[6]

2.1.5 AT commands:

AT commands are instructions used to control a modem. AT is the abbreviation of ATtention. Every command line starts with "AT" or "at". That's why modem commands are called AT commands. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control or end the data call) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones. Besides this common AT command set, GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from

storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

Note that the starting "AT" is the prefix that informs the modem about the start of a command line. It is not part of the AT command name. For example, D is the actual AT command name in ATD and +CMGS is the actual AT command name in AT+CMGS.

2.1.5.1 Types of Commands:

AT commands have three basic structures, some of which are not applicable to all command types, for further information see the individual commands.

•Test Commands (ATxxx=?) test's the existence of a command and checks it's range of subparameters.

•Read Commands (ATxxx?) reads the current value of the sub-parameter(s).

•Set Command (ATxxx=a,b) will attempt to set a new sub-parameter(s) value. If the command is successful the AT command interpreter will return OK (if ATV1, ATQ0) otherwise an error or informative result code will be returned.

Here are some of the tasks that can be done using AT commands with a GSM/GPRS modem or mobile phone:

- Get basic information about the mobile phone or GSM/GPRS modem. For example, name of manufacturer (AT+CGMI), model number (AT+CGMM), IMEI number (International Mobile Equipment Identity) (AT+CGSN) and software version (AT+CGMR).
- Establish a data connection or voice connection to a remote modem (ATD, ATA, etc).
- Send and receive fax (ATD, ATA, AT+F*).

- Send (AT+CMGS, AT+CMSS), read (AT+CMGR, AT+CMGL), write (AT+CMGW) or delete (AT+CMGD) SMS messages and obtain notifications of newly received SMS messages (AT+CNMI).
- Control the presentation of result codes / error messages of AT commands. For example, you can control whether to enable certain error messages (AT+CMEE) and whether error messages should be displayed in numeric format or verbose format (AT+CMEE=1 or AT+CMEE=2).
- Save and restore configurations of the mobile phone or GSM/GPRS modem. For example, save (AT+CSAS) and restore (AT+CRES) settings related to SMS messaging such as the SMS center address.[7]

2.1.6 SMS Packet Format:

To use the SMS you have to declare the number of the Short Message Service Centre (SMSC) in the Mobile Station (MS), provided that the MS supports Short Message Service-Mobile Originated (SMS-MO).Figures below represent SMS-DELIVER and SMS-SUBMIT packets:

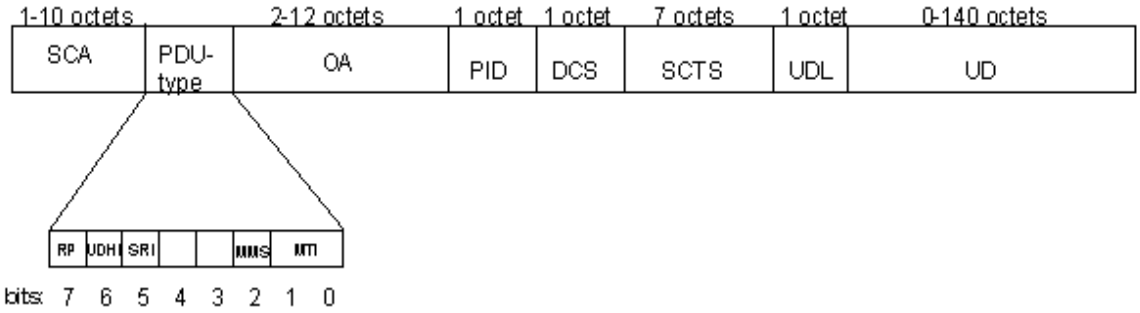

Figure 2.4 SMS packet mobile terminated

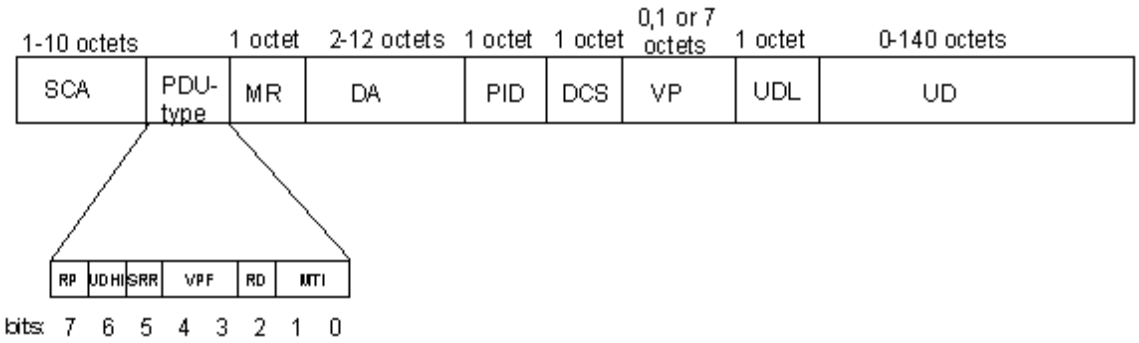

Figure 2.5 SMS packet mobile originated.

*Notice:

Any unused bits will be set to zero by the sending entity and will be ignored by the receiving entity

The following table explain each field of the SMS packet fields

Table 2.4: SMS packet frame fields:

SCA	Service Centre Address information Telephone number of the Service Centre element.
PDU Type	Protocol Data Unit type.
MR	Message Reference, Successive number (0..255) of all SMS-SUBMIT Frames set by the M20.
OA	Originator Address, Address of the originating SME.
DA	Destination Address, Address of the destination SME.
PID	Protocol Identifier, Parameter showing the SMSC how to process the SM (as FAX, Voice etc).
DCS	Data Coding Scheme, Parameter identifying the coding scheme within the User Data (UD).
SCTS	Service Centre Time Stamp, Parameter identifying time when the SMSC received the message.
VP	Validity Period, Parameter identifying the time from where the

	message is no longer valid in the SMSC.
UDL	User Data Length, Parameter indicating the length of the UD-field
UD	User Data, Data of the SM.
RP	Reply Path, Parameter indicating that Reply Path exists.
UDHI	User Data Header, Parameter indicating that the UD field Indicator contains a header.
SRI	Status Report Indication, Parameter indicating if the SME has requested a status report.
SRR	Status Report Request, Parameter indicating if the MS has requested a status report.
VPF	Validity Period Format, Parameter indicating whether or not the VP field is present.
MMS	More Messages to Send, Parameter indicating whether or not there are more messages to send.
RD	Reject Duplicate.
MTI	Message Type Indicator, Parameter describing the message type 00 means SMS-DELIVER 01 means SMS-SUBMIT. [8]