

# TRACKING AND CHECKING CARGO CONTAINERS PILFERAGE USING ELECTRONIC LOCK

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**Abstract**— Present technologies of locking and monitoring the cargo do not provide effective solution for the situation. A little corruption among the employees can easily deceive whole security system. Since the cargo contains materials of high value and in high quantity, these containers are more prone to the pilferage and hence to protect the material we need a sound technique which minimizes the loss due to involvement of the corrupt employees. The technical work undertaken here aims at providing a sound mechanism to prevent pilferage in the cargo containers by implying an electronic lock and having series of basic security check like swapping the RFID card provided to the customer, biometric sensor and by entering the password which is sent at the time of delivery to the customer. Therefore it minimizes the human interference security of the cargo containers.

This paper proposes a cost effective method of tracking cargo mobility using GPS. The system gives current vehicle location whenever needed with reliable accuracy. The system uses GSM and GPS Technology, helping in efficient monitoring of the desired vehicles. The paper also discusses the proposed GPS based vehicle Tracking System using GSM technology in which the coordinates are forwarded to Central monitoring system. The position of the vehicle can be traced on Google / Local maps. The paper gives functional, Technical description and Software implementation for the GPS and GSM based Vehicle Tracking System.

**Index Terms**— GPS (Global Positioning System), GSM (Global System for Mobile Communications), Pilferage, RFID, Vehicle Tracking system.

## I. INTRODUCTION

“ISLAMABAD: In a bid to hush up Rs. 50 billion scam of pilferage of thousands of containers of Afghan Transit Trade (ATT), the Federal Board of Revenue (FBR) has reinstated over 22 suspended staff in grade 14 to 18 apparently after pressure from the Supreme Court of Pakistan. It is learnt that the apex court of the country has taken suo moto notice of pilferage of containers scam causing billions of rupees loss to the national kitty. The FBR was under pressure at that time that resulted into suspension of officials of customs in grade 14 to 18 mainly at Karachi Port to settle down the dust for the time being. When contacted, Acting Chairman FBR Mehmood Alam who is also looking after the affairs of Customs because Member of Customs went abroad, told The News on Wednesday that legal opinion of FBR’s team were sought before instating the suspended officials because no one could be suspended for an indefinite period”. This news article shows the loss of huge sum of money due to pilferage from the Cargo containers which is used in transporting huge amount of manufactured product or raw material from one place to another. In the course of transportation, the pilferage or employee theft is done and all the authorities involved whether

guilty or not comes under the light of suspicion. This results in culminate loss of the industry and people involved in the process of transportation.

At present days, during the course of transportation, a scam of pilferage is being done. This results in culminate loss of industry. So, to overcome this type of theft, we aim to provide a sound mechanism to prevent the pilferage in the cargo container by implying an electronic lock and minimizing the human interference in the security of the cargo containers. This mechanism secures the container by an electronic lock which requires a series of security check during opening of the lock. The lock is controlled and monitored by the base station.

The paper describes the idea of tracking a vehicle using latest technology of GPS and GSM. The number of industry related vehicles like oil tankers (trucks), vans carrying huge amount of money for ATMs are increasing at a very fast rate and keeping a track of these vehicles is becoming difficult day by day. To keep a check on these kinds of vehicles, these technologies prove to be very useful since in case of theft or missing of vehicles, they can be easily traced and tracked on the website or cell-phones. Mobile technologies such as GSM / GPRS and GPS can be used for displaying the current position of the vehicle indicating the latitude, longitude and height from sea level. This displaying of location of the vehicle can be done by a number of methods. The location can be sent via SMS to a GSM modem kept at the control station or to a cell phone.

## II. PROBLEM DEFINITION

As discussed above, in the course of transportation of goods like PETROL, MILK products, RAW IRON, VEHICLE etc, if pilferage happen then every concerned person associated with the task whether guilty or not comes under the light of suspicion. This results in huge loss of money and also the industry’s reputation is at stake causing havoc to the company and the people involved in the process of transportation. This is due to the absence of strong security system. Presently we have Vehicle tracking system where we can only trace the location of the vehicle using GSM & GPS, but we cannot avoid the theft of goods.

Another scenario is when the vehicle is reaching the destination much later than the scheduled time but provide a fake delivery time report to the company. During this time the vehicle will be used for other illegitimate purposes like shifting the other company goods or products in local area, pick & drop etc in the company’s expenses.

## III. PROPOSED SYSTEM

We have proposed a sound mechanism to prevent pilferage in the cargo containers by implying an electronic lock and having series of basic security check like swapping the RFID

card provided to the customer, biometric sensor and by entering the password which is sent at the time of delivery to the customer, thereby minimizing the human interference with regard to the security of the cargo containers. This paper proposes a cost effective method of tracking cargo mobility using Global Positioning System (GPS). The system gives current vehicle location whenever needed with reliable accuracy. The system uses GSM and GPS technology, helping in efficient monitoring of the desired vehicles. The paper also discusses the proposed GPS based vehicle Tracking System using GSM technology in which the coordinates are forwarded to Central monitoring system. The position of the vehicle can be traced on Google / Local maps. The paper gives functional and technical description and Software implementation for the GPS and GSM based Vehicle Tracking

Here we are providing Electromechanical Lock, controlled by a Relay, which is locked after loading the consignment and the monitoring system gets activated. Once the door is locked, it will not get opened in any case until it reaches the destination. If in case it is tampered, the buzzer which is provided gets activated for alert. The monitoring system keeps sending status message to the vehicle to check and track the Cargo location. We have a monitoring *front end* designed using VB.NET, interfaced with Google map for mapping the cargo.

Once the vehicle reaches the destination, a message is sent to Monitoring system. If the coordinates match then a password is sent to the person who is collecting the consignment. Once the password is reached, LCD displays "SWIPE THE RFID CARD AND ENTER PASSWORD". Upon the card swiping and password entering, if these two parameters are accurate only then the door opens, otherwise the monitoring system gets a tampering message. The user gets only 3 attempts to enter the correct password.

By using this technology, we can track the Vehicle to avoid theft of consignments and loss for the company due to over trip and illegal usage of diesel. Figure 1 describes the design of the proposed system.

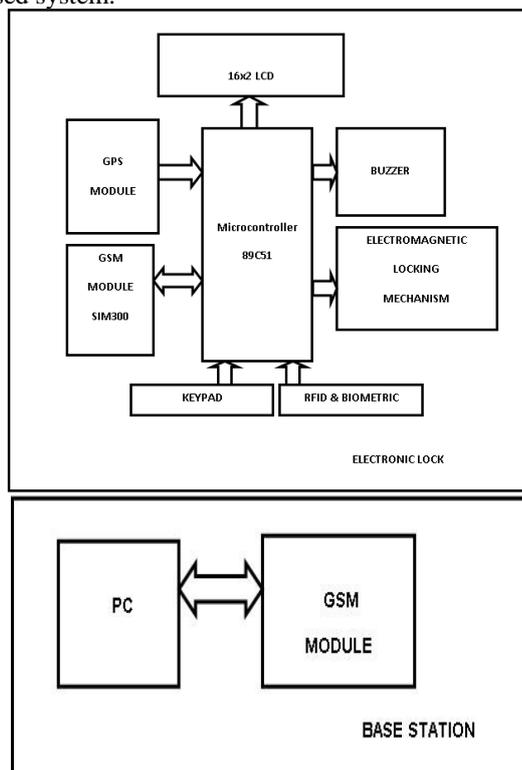


Fig.1. Block diagram for GPS and GSM/GPRS based system

#### IV. HARDWARE DESCRIPTION

The SMS Based Vehicle Tracking System has been implemented using GPS module and GSM / GPRS module SIM300. Figure above shows the block diagram for the implementation of a GPS based vehicle tracking and monitoring system. GPS module receives signals from a series of satellites and calculates its current geographical location, speed etc. The microcontroller processes this data through MAX232 level converter. GSM module receives request for sending vehicle location from system registered cell phone.

The GSM module sends reply SMS to same cell phone giving the vehicle location. The information about vehicle location i.e. latitude, longitude and height from sea level can also be stored for later retrieval or frequently transmitted to a control station where it can be displayed on a high-resolution geographical map or can be directly sent to a data server through GSM module. The LCD at the system end indicates coordinates and speed of the vehicle. The system consists of following modules.

##### A. GPS Module

GPS receivers are composed of an antenna, tuned to the frequencies transmitted by the satellites, receiver-processors and a highly stable clock (often a crystal oscillator). They may also include a display for providing location and speed information to the user.

##### Features:

- 65 channels to acquire and track satellites simultaneously
- Industry-leading TTFF speed
- Tracking sensitivity reaches -161 dBm
- 0.5 PPM TCXO for quick cold start
- Integral LNA with low power control
- SBAS (WAAS/EGNOS) capable
- Cold start 29 sec under clear Sky
- Hot start 1 sec under clear Sky
- Accuracy 5m CEP
- Operable at 3.6V-6V
- Both of RS232 and UART interface at CMOS level
- Small form factor of 32mm W x 32mm L x 8mm H
- Mountable without solder process
- 6 pins wafer connector

##### Applications:

- Automotive and Marine Navigation
- Automotive Navigator Tracking
- Emergency Locator
- Geographic Surveying Personal Positioning

##### B. MAX 232

MAX232 is an integrated circuit that converts signals from an RS232 serial port to signals suitable for use in TTL compatible digital logic circuits. MAX232 is a dual driver/receiver which typically converts the RX, TX, CTS and RTS signals. Here, in this device, the MAX 232 is expected to serially interface the GPS module with the microcontroller so that the microcontroller can accept the GPS frames sent by the GPS module in an efficient way.

##### C. Microcontroller 89S52

In this system, the microcontroller 89S52 plays the most vital role. The code burnt in the microcontroller decodes the data received from the satellite using the concept of counter. Thus converting the GPS frames received from the GPS

module in an understandable format. Moreover, the microcontroller is also responsible to send the required information through MAX232 and GPRS/GSM to the monitoring.

#### D. GSM/GPRS Module SIM 300

SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz SIM300 provides GPRS multi-slot class 10 capabilities and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

- The keypad and SPI LCD interface will give you the flexibility to develop customized applications.
- Two serial ports can help you easily develop your applications.
- Two audio channels include two microphones inputs and two speaker outputs.
- This can be easily configured by AT command.

#### GSM300 AT commands:

- AT+CMGF=1 <ENTER>:To check the modem
- AT+CPIN="0000" <ENTER> :To check the network
- AT+CMGF=1 <ENTER>: To send the message in text format
- AT+CMGS="NUMBER"<ENTER>: To enter the destination number
- AT+CNMI=2,2,0,0,0<ENTER>: To receive the message

#### Features of GSM 300:

- SIM300 Tri-band: EGSM 900, DCS 1800, PCS 1900.
- The band can be set by AT COMMAND, and default band is EGSM 900 and DCS 1800.
- Power supply: Single supply voltage 3.4V – 4.5V
- Normal operation: -20°C to +55°C
- Supported SIM card: 1.8V ,3V
- Programmable via AT command

#### E. RFID

RFID (Radio Frequency IDentification) is a technology that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency (RF) portion of the electromagnetic spectrum to uniquely identify an object, animal, or person. RFID is coming into increasing use in industry as an alternative to the bar code. The advantage of RFID is that it does not require direct contact or line-of-sight scanning. RFID is sometimes called Dedicated Short Range Communication (DSRC).

#### Components:

A basic RFID system consists of three components:

- An antenna or coil
- A transceiver (with decoder)
- A transponder (RF tag), electronically Programmed with unique information
- The antenna emits radio signals to activate the tag and to read and write data to it.
- The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its

power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal.

- The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

#### F. Electromagnetic Lock

An electromagnetic lock, magnetic lock, or mag-lock is a locking device that consists of an electromagnet and an armature plate which is used by attaching the electromagnet to the door frame and the armature plate to the door.

#### Operation:

The magnetic lock relies upon some of the basic concepts of electromagnetism. Essentially it consists of an electromagnet attracting a conductor with a force large enough to prevent the door from being opened. In a more detailed examination, the device makes use of the fact that a current through one or more loops of wire (known as a solenoid) produces a magnetic field. This works in free space, but if the solenoid is wrapped around a ferromagnetic core such as soft iron the effect of the field is greatly amplified. This is because the internal magnetic domains of the material align with each other to greatly enhance the magnetic flux density.

#### Advantages:

- Easy to install: Magnetic locks are generally easier to install than other locks since there are no interconnecting parts.
- Quick to operate: Magnetic locks unlock instantly when the power is cut, allowing for quick operation in comparison to other locks.
- Sturdy: Magnetic locks may also suffer less damage from multiple blows than do conventional locks. If a magnetic lock is forced open with a crowbar, it will often do little or no damage to the door or lock.

### V. RESULTS

The complete project is implemented using software KIEL UV4 for Programming, debugging and compiling. Once this program is compiled and target is generated, flash the program into the IC using software FLASH MAGIC. KICAD is used for schematic and PCB designing of the complete project and VB6.0 software is used for Front-end design for monitoring system.

The below figures depict the software and results of *front-end* and Hardware implementation.

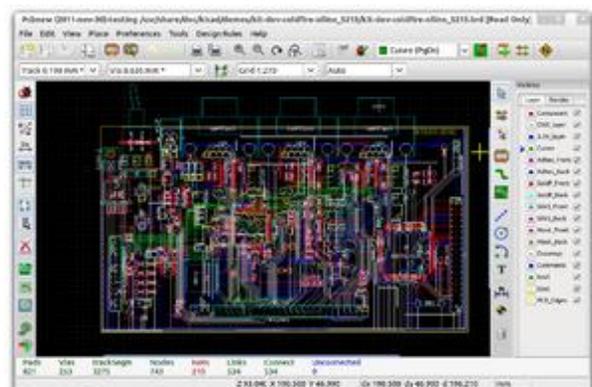
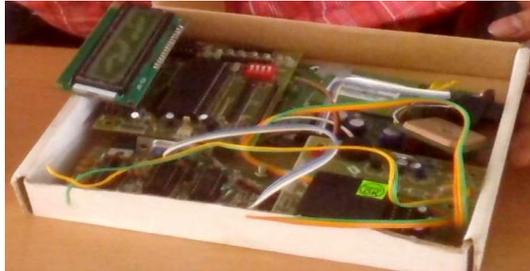


Fig. 2: Board designing using KICAD



**Fig. 3: Hardware arrangement of Module**



**Fig. 4: Complete Hardware arrangement of Module**



**Fig. 5: Monitoring System designed using VB 6.0**

Once the module is implemented as shown in above figures, Hardware module is initialized and monitoring of *front-end* which is designed using VB.NET, interfaced with Google map, for mapping the cargo, is executed on the PC. Monitoring system gets initialization message and status message for every request. Once the vehicle reaches the destination, a message is sent to Monitoring system. If the coordinates match, then the Password is sent the person, who is in charge of collecting the consignment. Once the password is reached LCD displays “SWIPE THE RFID CARD AND ENTER PASSWORD”. Once the card is swiped and password is entered, if both matches then the door opens, otherwise the monitoring system gets an alert message about the tampering. The user has 3 attempts to enter the correct password.

#### VI. CONCLUSION

A design of providing a sound mechanism to prevent the pilferage in the Cargo containers by implying an electronic lock was carried out in the above explained work. While designing the cargo many factors were considered. These kind of security systems have a lot of advantages in this developing world. They reduce large amount of maintenance problem and improves the security to a great extent. The performance of the checking of cargo pilferage was found to be satisfactory. A similar design principle can be adopted for the security of other vehicles which carry out material of high value and in high quantity. So this technical work can be extended further

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