

# SMART ELECTRONIC SECURITY SYSTEM FOR CARGO CONTAINERS

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**Abstract:** The cargo containers carry materials of high value and in high quantity. These containers are more prone to the pilferage and hence to protect the material we need an effective technique which minimizes the loss. The technical work undertaken here aims at providing an alternative mechanism to prevent pilferage in the cargo containers by implementing an electronic lock and having series of basic security checks like biometric verification of driver and by entering the password which is sent at the time of delivery to the owner. Therefore it minimizes the human involvement in the process. Present technologies of locking and monitoring do not provide efficient solution for the situation. A small corruption among employees can cause huge loss to the industry. This project aims at providing a new mechanism to prevent the pilferage in the cargo containers by implementing electronic lock and minimizing the human interference in the security of the cargo containers.

**Keywords—** Sim808(GPS and GSM); Electronic lock; Biometric sensor; vibration sensor;

## I. INTRODUCTION

There is huge pilferage in capital of cargo industries due to pilferage from the cargo containers which is used in transporting huge amount of manufactured projects from one place to another. Due to this the authorities whether guilty or not comes under the light of suspicion. This results in huge loss to industries.

As mentioned before, the cargo containers are more prone to pilferage and a little corruption among employees can easily deceive the whole security system. So protect the material we require a sound technique which minimizes the loss due to involvement of corrupt employees. This project aims at providing a sound technique so as to minimize the pilferage in cargo containers by applying electronic lock and minimizing the human interference.

In another part of smart lock, biometric system will be implemented to record the database of drivers for further use.

The operator monitors the message received from the device to determine a proper response. The sensor information includes sensor data or alarm state information. The message includes GPS co-ordinates and personalized message.

This mechanism secures the containers by using electronic lock which will require the series of security check during opening of the lock. The lock is controlled and monitored by the base station.

Thus, by considering all the aspects of cargo containers starting from loading of a container till the destination where cargo is unloaded, a clear idea is given to develop a strong securing system for the cargo. Where each and every movement of the cargo is tracked and updated to the centralized monitoring system or Authorized person.

## II. METHODOLOGY

### 2.1 Base Station

Centralized monitoring system is required to ensure the reliability and security of cargo container. Real-time data such as hardware and network performance, building power management, and environmental conditions need immediate attention if behaviour deviates from the desired or normal operating ranges.

A Centralized monitoring system is present to check the activity of the Cargo container represented as Base station in the Fig 2.1. The Base station will communicate to the Cargo containing vehicle through SIM 808 which has the features of GPRS+GPS modules.

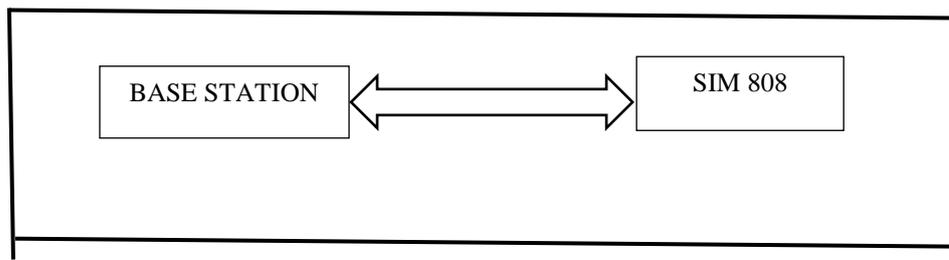


Fig 2.1 Base Station

The Base station functioning reduces the Labour cost in the system as it ensures a much safe and secure system. As the human interference reduces the risk of safety and security of the cargo container reduces as well as this provides a cheaper functioning of the system.

The compact design which integrated GPRS and GPS in a SMT package will significantly save both time and costs for customers to develop GPS enabled applications. Featuring an industry-standard interface and GPS function, it allows variable assets to be tracked seamlessly at any location and anytime with signal coverage.

Communication and monitoring of the vehicle is done by emergence of GSM/GPRS module. When an unauthorized person tries to break the cargo, message will be sent Base station. There is a simple Electronic Lock which is used to secure the cargo. Authorized person will be given with an encrypted message using which the cargo can be unlocked.

### 2.2 Electronic Locking System

Here we make use of a low power consumption and fast response microcontroller ARM7-LPC2148 as our main board. It is a balance among classic as well as new-Cortex sequence. It suits completely for an apprentice to obtain in detail hardware & software design implementation. It is interfaced with SIM808 for the communication with the Base station.

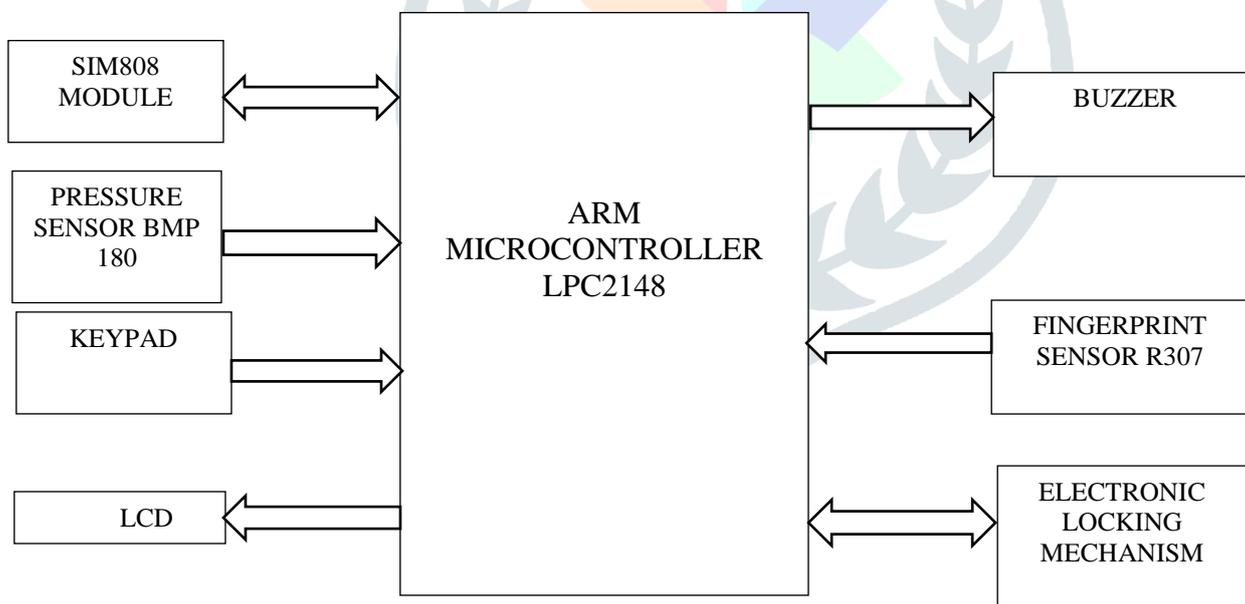


Fig.2.2 Electronic Locking System

ARM7 microcontroller also makes use of Pressure sensor BMP180 which is the best low-cost sensing solution for measuring barometric pressure and temperature. The main Function of BMP 180 is to alert the system in case of any pilferage that is beyond a threshold value if someone tries to hit the door of the cargo containing vehicle a message is sent to Base station.

Keypad (4x4) and the Fingerprint sensor R307 are given as input to the ARM7. The main purpose of the Keypad is to enter the password generated from the Base station that is unlocked by the owner at the destination. If the password entered is correct then the Electronic Lock is opened to unload the container. The fingerprint sensor is used to recognise the drivers of the cargo container vehicle if there is change of driver that is updated in the Base station.

LCD and buzzer are the outputs of ARM7 microcontroller. The LCD displays the status of the system and the buzzer is used to alert the system if in case there any thief or malfunction in the cargo container.

For Electronic Lock we make use of DC motor as it moves the door to open and close and the motor driver drives the motor after receiving the code signals from the microcontroller.

### 2.3 Flow Chart

#### A. Security System for Cargo Container

The detained flowchart of the system working is shown below.

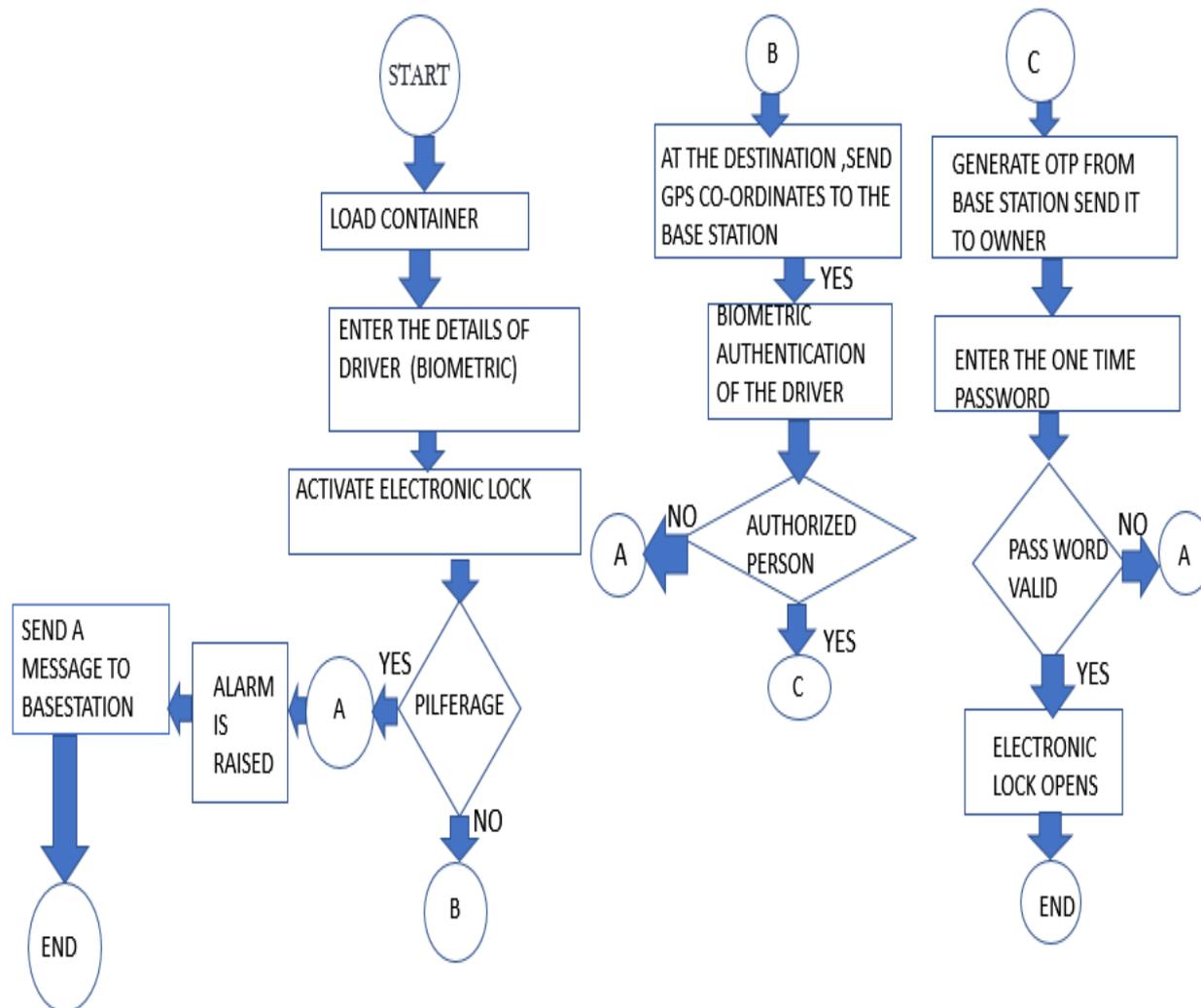


Fig.2.3 Flow diagram of Cargo Containers

To secure the system more we make use of One Time Password scheme after reaching the destination if the co-ordinates matches with the predefined co-ordinates of the system an OTP is generated from the Base station to the owners mobile using which the owner can unlock the Electronic lock.

## B. Change of Drivers

For long distance of travelling there are chances of having more than one driver keeping the safety of the cargo container we consider the scenario of drivers change.

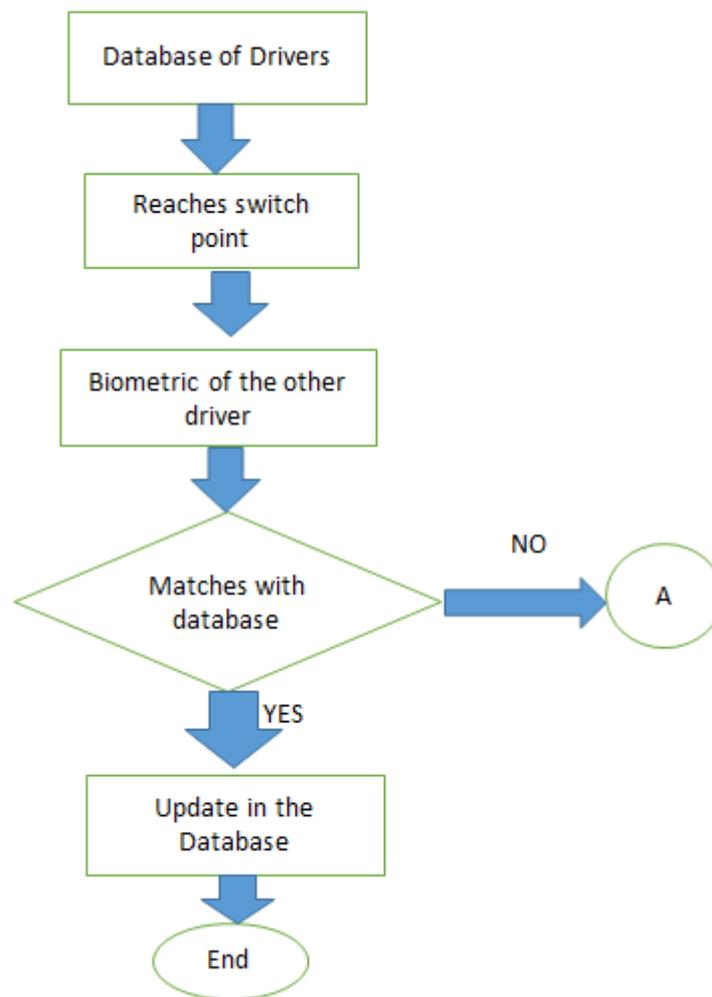


FIG.2.4 CHANGE OF DRIVERS

Base station will have the data base of all its drivers including the biometric information of the drivers. To switch between the drivers the biometric of the new driver is used which is automatically updated in the data base of the Base station.

If the biometric is not matched then there is raise in alarm and message is sent to the Base station also we can track the cargo container throughout its journey as it contains GPS module.

### III. RESULTS:

At the base station when the cargo container gets loaded till and after it reaches the destination, there are many security checks and procedures taken place. The result of all these are explained in following cases.

#### **Case 1: At the Base station when the cargo is to be loaded with materials.**

Initially, at the base station after loading the cargo, the authorization of the driver will be asked for. If he is an authorized person then the door will be closed and he will be allowed to ride the cargo if not the buzzer rings and the message will reach the destination.

- If the driver is an authorized person

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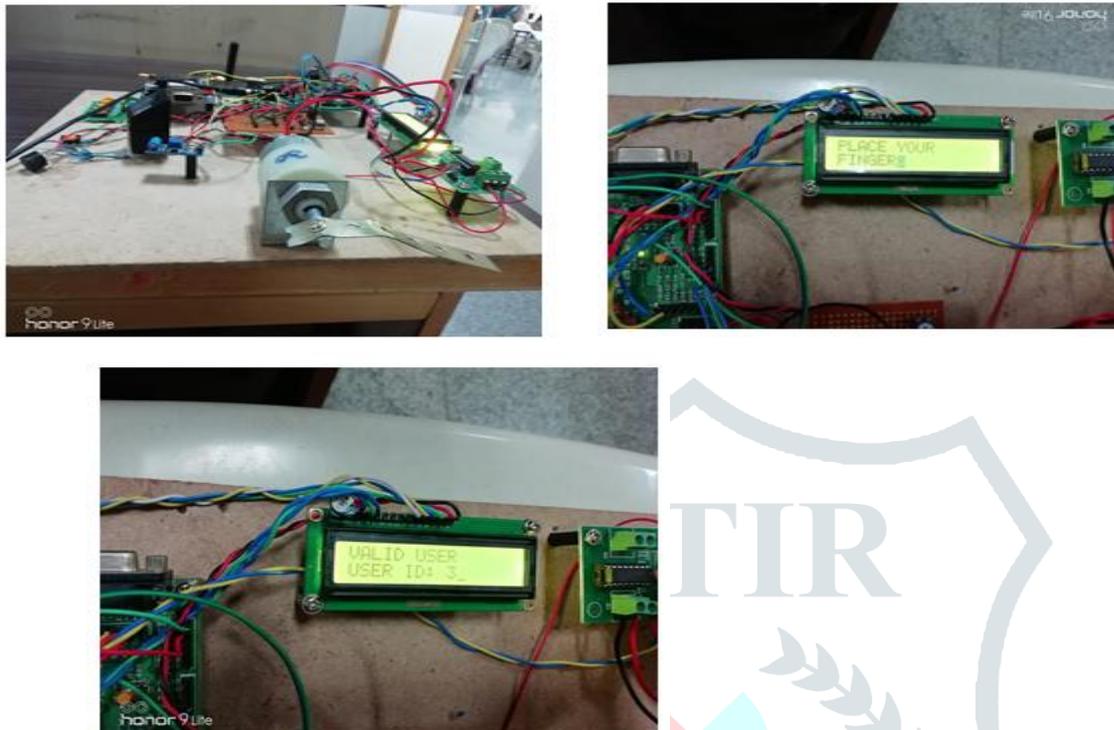


Fig.3.1 Authorized Driver's authentication

- If the driver is not authorized  
If the driver is not authorized, he will not be allowed to ride the cargo and the buzzer rings.



Fig.3.2 Unauthorized Driver

**Case 2 : If an intruder tries to open the container.**

At any point if an unauthorised person tries to open the container either by hitting the container or by an unauthorised fingerprint then the theft action is detected by the vibration sensor and a message will reach the base station and buzzer rings.

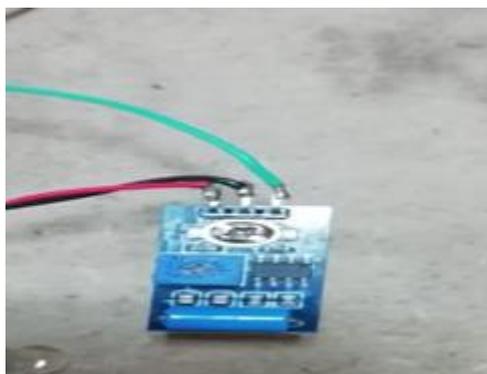


Fig.3.3 Theft action

**Case 3 : Change of drivers.**

When drivers get changed at every switching point the finger print of the next driver will be checked for authentication and if he is an authorised person then he will be allowed to ride the cargo or else a theft message as shown in Fig.3.2 will be sent to the base station and buzzer rings.



Fig.3.4 Change of driver at switching point

**Case 4 : When the container reaches the destination :**

When the container reaches the destination, a message will be sent to the base station and then the biometric of the driver will be asked for. If he is authorized then OTP will be sent from the base station to the owner at the destination. If the driver is not authorized person then the OTP will not be sent and the buzzer rings and the door will not open.





Fig.3.5 OTP checking at the destination

#### IV. CONCLUSION:

A design of providing an effective mechanism to prevent the pilferage in cargo containers by implementing 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 a large amount of maintenance problem and improve the security to a great extent. The performance of the system was found to be satisfactory. A similar design principle can be adopted for the security of other containers. So this technical work can be extended further for designing as well as improving the performance of the security system.

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