

SMART CARGO MONITORING AND SECURITY SYSTEM

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Abstract: Today's world 90 percent cargo is transported through containers which play a prominent role in the world trade. However, there is an issue related to security of cargo containers resulting in huge loss in the world market. In this paper new emerging technologies have been explored for creating a new level of security by proposing a centralized monitoring and security system to ensure the safety of the high valued containers. Here real time tracking system for the cargo using RFID tag, GPS and wireless sensors networks are used for the efficient security of containers. The RFID tags used are sealed at all the openings of the container. The RFID reader and GPS tracker are used for testing grounds which are wirelessly connected to the databases which secures the container from any theft. A GSM module is also used for sending SMS or any other notifications in real-time.

Keywords—Global Positioning System (GPS); Global System for Mobile (GSM); Radio Frequency Identification (RFID) tags.

I. INTRODUCTION

There is huge export of cargo and it is estimated that there are 20 million containers transported each day [1]. Also, 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.

Tracking of cargo can be done not only using passive RFID trackers but also active RFID trackers for long distance communication [2]. There are two RFID based tracking proposed where systems work on Relevant Time Tracking System (RTS) and Real Time Location and Tracking System (RTLTS) [3]. The implementation of the system is very complex and expensive. This is resolved by tracking of the container by GPS for maintaining precise location information and RFID tags are used for sealing of the containers [4]. It is prominently dependent of internet and if the server goes down this leads to system failure.

GPS is used for monitoring the cargo and the data is sent to authorized person or the centralized monitoring system where tracking of container carrying cargos in real-time. GPS technology is used to keep the track of cargo's geographical positions till cargo reaches its destination [5-6]. GPS is usually used for tracking cargo for long distance transportation but for short distance GPS is not accurate.

Also, the network of sensors are used to tracking individual objects as well as to establish communication links between the sensors [7]. As the number of sensors increase, the complexity of the system is also increased.

Communication and monitoring of the vehicle is done by emergence of GSM module. When an unauthorized person tries to break the cargo, message will be sent to authorize person. 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 [8-10]. The system cost will be expensive as the components used for securing system is more with less human interference.

A centralized monitoring system and internet based securing system is aided in the identification or authorization of drivers and the tracking of cargo containers. The system will accomplish the security checks in real-time scenario using internet and database [11]. After starting the cargo, the current GPS location and a message is sent to the Authorized person and also it is indicated in the Centralized monitoring System [12]. It requires labor cost with more maintenance charges for the Cargo container.

Thus, by considering all the aspects of cargo containers starting from loading of a container till the destination where a 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.

This Paper proposes RFID tags which are used for sealing the containers, GPS module used to track the location of the vehicle, GSM module used for communication which updates the status of the cargo container and also it employs a basic locking system which ensures the security of the container.

II. METHODOLOGY

The cargo system makes use of web-based software or a centralized monitoring system or Automated Commercial Environment (ACE), services and databases. The delivery will be accepted from various employers which will further be approved by government if needed and will be delivered to the appropriate destination. Later if the delivery is successful then a then message will be given to the Authorized person. In every cargo transportation, shipper, carrier and receiver plays main role. The shipper takes the responsibility of searching and controlling the cargo through web. The carrier delivers the container from source to destination. The receiver is the person present at the destination who is responsible for receiving the container at the destination as well as the integrity of the container. The receiver can also track the container by accessing it through web and can send a negative feedback if there is problem with the container.

As mentioned earlier, the RFID technology is used in this paper. The method used is an automatic identification method which uses RFID tags for relying on storing and remotely retrieving data. For the cargo transportation vehicle this is placed as e-seals. There are three types of RFID tags available: passive, active and semi-passive tags. The RFID tags used here are the passive tags. The advantage of passive tag is that it doesn't require an internal power source. When a reader comes in contact the tag, the tag gets activated and it powers the tag. The radio frequency signal which induces current in the antenna provides power for the integrated circuit which further powers up the tag and transmits a response. The response thus transmitted by the e-seal is 128-bit unique ID number which corresponds to the cargo ID number. This number will be provided by the manufacturer and cannot be altered by anyone. Whenever the cargo reaches the destination, the unique ID number will be sent to the source or shipper. This number will be matched with the one present in the source (stored number). If both the number matches, it means that the cargo has reached the destination safely without any theft or threats. After checking each and every e-seal, the container will be tracked in real time through the database. For confirming the status of integrity, the system generates OK or NOT OK status of shipment. After successful verification, the container will be opened. The receiver then sends a positive feedback to the source about the integrity of the container.

In this paper, the GPS technology is used in order to trace the cargo containers so that authorized or related people will have the information about the location of the container. For now, the system here is made such that 500 cargo containers could be tracked on a single map. The locations of cargo will be inserted in real time into the database. Superimposition of historical data visualization is done on an interactive map

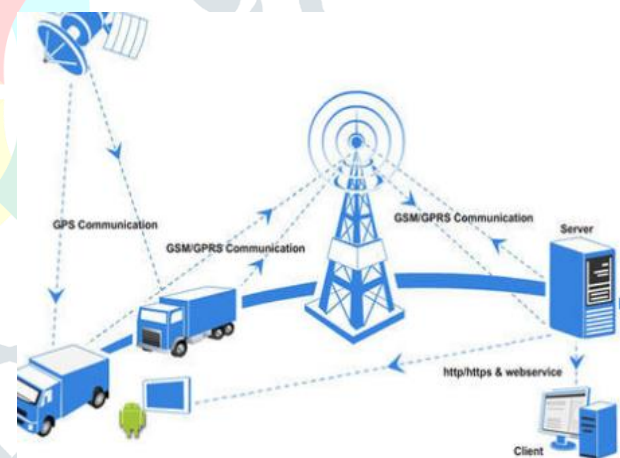


Fig 1 Cargo Security System Structure

Fig 2 GPS tracker

In order to secure the cargo container and to have quick update of the high valued goods the centralized monitoring system has advanced its technologies where the client can keep track of the cargo vehicle. Communication is very important from the point of view of logistics. It is very crucial to use an innovative communication channel which will be more reliable and less expensive. Also, communication is at faster rate where for any change in the vehicle, the client or receiver will receive the message to their mobile phones using GSM technology. This can also make a pathway for direct communication between the carrier and the receiver.

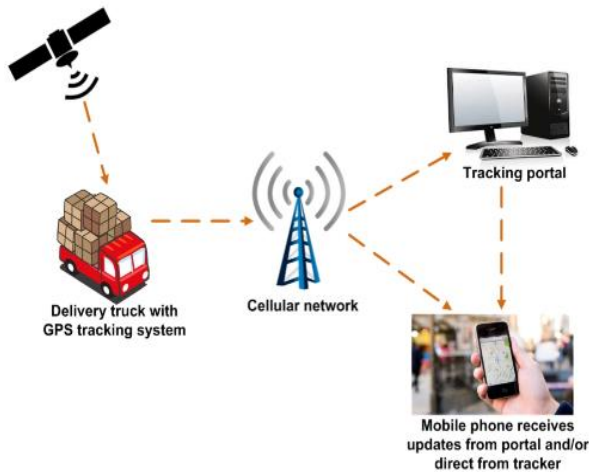


Fig 3 GPS and GSM Communication

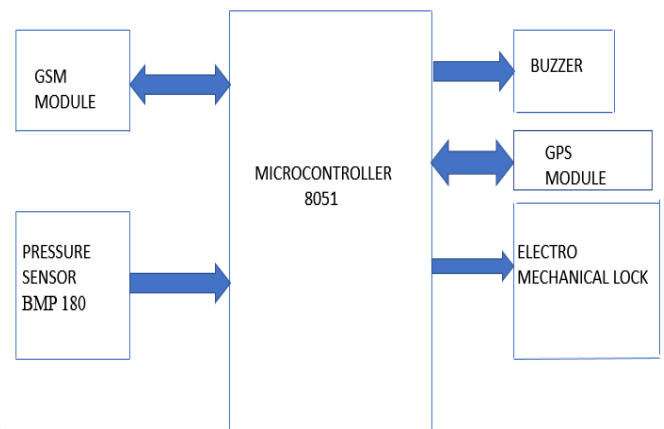


Fig 4 A Proposed Electromechanical Lock System

This Paper proposes Electromechanical Locking system to minimize less human interface in cargo containers and also to ensure the security of the containers in cargo, controlled by a Relay, which is locked soon after the cargo is loaded and then activating monitoring system. Once the door is closed, it will not open in any case until it reaches the destination. If in case the door is attempted to open forcefully, the buzzer provided will rise an alarm or alert in the centralized monitoring system. However, the centralized monitoring system will keep sending status message to check the vehicle also the GPS is used to track the Cargo location. Once the vehicle reaches its destination, the door is unlocked by the receiver and the communication will happen through GPS & GSM module. This Locking System ensures basic security of the container.

III. CONCLUSION:

This Paper provides a design of sound mechanism to avoid the theft or pilferage in Cargo containers by deploying an electromechanical locking system which is explained in the above work. While dealing with the safety of cargo, many factors were taken into consideration. This kind of security and monitoring system has a lot of advantages in this world of trade. They reduce cost of maintenance problem and also is a great improvement in securing cargo containers. It also focuses on tracking movement of the cargo container and updates the receiver about the status of cargo. Technical work undertaken here covers the basic security protection to the high valued cargo. However, this can be extended further to improve security system for cargo containers.

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