Enterprise Mobility Application for Efficient Vehicle Terminal Management In Sri Lanka Ports Authority

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ABSTRACT

This paper presents a research carried out at Sri Lanka Ports Authority (SLPA), on vehicle terminal business process management in Sri Lanka Ports Authority. The growth of complexity of cargo handling due to the large influx of imports has created problems for port management, specifically vehicle terminal management. For instance, the Vehicle Terminal is reaching its capacity limits and increasingly leading to traffic and port congestion [1].Vehicle terminal managers have several, often conflicting goals, such as serve a car carrier as fast as possible while minimizing terminal management costs.

The need to manage the complex system of Vehicle Terminal requires novel technologies such as context awareness and location based servicesusing mobile technology. The approach taken in this research is to optimize the business process of the vehicle terminal operations.

The Vehicle Terminal Management System (VTMS)developed based on their needs supports terminal operations of the vehicle importing, transshipping and delivering. Based on terminal operations, an integral decision model for manpower planning and vehicle handling is incorporated into VTMS. This smart Vehicle Terminal Management System increases the efficiency, effectiveness, employee satisfaction, customer satisfaction, reliability and profit of Vehicle Terminal of SLPA using mobile technologies.

1. INTRODUCTION

The logistics of finished vehicles has grown impressively during the last decade. Therefore ports must face up to market demands and deliver quality service with improved efficiency. To this end the authors have set out to develop a decision planning and scheduling system intended to support vehicle terminal operations. Decision-making related to vehicle terminal operations can draw on methodological support offered by standard approaches to ship routing and scheduling, design of vehicle storage areas and finally vehicle loading and unloading issues. As yet, there has been no efficient methodological support available for vehicle terminal operations. Terminal operations in vehicle transshipment and unloading differ significantly from container transshipment and unloading. The reasons for that are firstly, container handling is uniform whereas diversity of vehicle types made it complex. Secondly, containers may be relocated several times during their stay in a hub. Due to the risk of damage, the practice of relocation is avoided at vehicle hubs. Thirdly, containers can be stacked upon one another, reducing the need for storage space, whereas vehicles cannot. Fourthly, vehicle parts should be protected from missing while container cargoes are not having such issues. In vehicle transshipment, the bulk grouping of vehicles requires reasonable planning. Since the relocation of vehicles should be kept to a minimum, their assignment to appropriate locations is a matter of importance. Finally, the area taken up by vehicle stocks is enormous, so that the distances to be covered become an important component in the planning process. These findings have motivated the design of a

planning and scheduling system, rather than doing it manually.

I. MANAGEMENT OF THE VEHICLE TERMINAL OF SRI LANKA PORTS AUTHORITY

SLPA handles in excess of 1 million vehicles per year [2]. Incoming and outgoing traffic produces a high frequency of carrier callings. SLPA is visited by 1350 deep sea carriers and feeders annually. Nearly 90,000 vehicles can be stored on 1.6 million square meters.

Importing vehicles to local customers is the major operation of vehicle terminal and another large portion of imported vehicles is subject to transshipment arrangements. In particular, Further, vehicle manufacturers use the terminal as a ‘‘buffer stock’’ place, because they have to acquire space in order to manufacture vehicles. Due to high volume and complexity, operations of the vehicle terminal have thus far been characterized by short-term reaction, rather than planning. As often observed, manual planning tends to result in the inefficient and unreliable implementation of work processes. In order to improve the efficiency and reliability of work processes, a planning and scheduling system has been developed.

In Section 2 we introduce the proposed method of the Vehicle Terminal Management System (VTMS). Under the section 2 in sub section 1 we explain why Sri Lanka Ports Authority (SLPA) needs a VTMS. Then under sub section two we present the improvements of SLPA vehicle terminal using VTMS and then we discuss about design and implementation of the VTMS. Finally the special features that VTMS contains.

2. PROPOSED METHOD

I. PROPOSED VEHICLE TERMINAL MANAGEMENT SYSTEM FOR SLPA

When we seek real life problems in Sri Lanka being in this nature, we understood that the current Vehicle Terminal Management System in SLPA is having lots of locale which need to be improved. Heavy paper work, high time consuming in vehicle management process, space wasting in vehicle parking, difficult inquiry handling and lack of customer care service are some of the issues identified in the current Vehicle Terminal Management System.Figure 1 depicts the work flow of the VTMS. Such as vehicle unloading, Tally clerk checking vehicles, Security checking vehicle and vehicle parking.

II. IMPROVEMENT OF SLPA VEHICLE TERMINAL USING VTMS

In the current process when a “Car Carrier” reaches the unloading and freighting station, drivers have to bring vehicles one by one to the vehicle yard. According to the present system, the details of the vehicles are entered manually by Tally clerks who checks the vehicle features using invoices. It makes difficulties in vehicle searching process due to heavy documentary handling. Thereafter the drivers are assigned to the vehicles to bring them to one of the mentioned vehicle yards. There is no well organized way to assign drivers to the vehicles, to select a vehicle parking yard and to assign a parking slot to the vehicle. Therefore it makes difficulties to find a suitable place at vehicle yard for parking the vehicle. As a result of that, sudden traffic queues may occur inside the vehicle parking yards. Lack of a proper service to handle emergency situations, such as finishing fuel problems and vehicle break downs, vehicle handling process make much inefficient.

In the present system, it is difficult to identify the responsible person in case of certain vehicle damage. Therefore the customer claim handling process is not properly managed due to lack of evidences. Major reason for that is, there is no proper way to keep vehicle parking information in the present process. Therefore it makes hard to maintain reliability of the present vehicle management procedure. Due to the inefficient vehicle parking at the vehicle yard, the Gate Keeper has to spend much more time to verify a particular vehicle and to find it from the vehicle yard. Especially the improper tagging system for the vehicle key is another major problem identified. There is no proper customer care service which provides information at the request of the customer. Therefore it reduces the customer satisfaction. Lack of proper mechanism to measure the efficiency and accuracy of workers is another weakness we identified in the current system.

Using VTMS it is possible to produce detailed plans for forthcoming work-shifts and identify capacity bottlenecks at an early stage.

Although differently skilled personnel work together in order to perform a task, we focus on the drivers, whose costs are almost proportional to the number of vehicles moved and the distance covered. Therefore, storage locations are assigned to tasks such that the overall distance of storage and retrieval is minimized. Even if equal overall distances are considered, the distribution of storage locations has a significant impact on the manpower usage. In a congested situation, VTMS allocates vehicles into a nearby location. In this way the utilization of drivers is kept at a higher efficiency level and it will allow reserve drivers for future peak situation.

The choice of modes of performance links location capacity planning and detailed task scheduling into one integral problem.

III. DESIGN AND IMPLEMENTATION OF VEHICLE TERMINAL MANAGEMENT SYSTEM

For gathering requirements and getting the operational idea about the process, we have done a field observation and several formal interviews with the authorized personnel of the SLPA. After analyzing gathered data we have computed the average time taken to complete one transaction which is 3 days. Figure 2 depicts the system architecture of the VTMS.

According to the proposed system, vehicle yard and unloading and freighting stations are mapped using barcode and GPS. All the data about vehicles, employees, yards are fed into the Central Information System which is hosted in the SLPA. The connectivity between Central Information System and MC65 mobile computer, and other desktop computers which are operated at both logistic and Store Keeper offices has been accomplished using WLAN.

MC65 mobile computer are given to all tally clerks, security officers and drivers to record, verify and update their specific operations. Figure 3 depicts the physical appearance of the MC65 mobile computer.

As a result of using MC65 device, both Tally clerks, security officers shifted from doing time consuming paperwork and this will be an important aspect in the proposed system. Further, this MC65 device has been automated to display the parking location and navigate path to the drivers to efficiently park the vehicle. Figure 4 depicts the interfaces of the mobile application.

This proposed system can be able to track the driving path through GPS and it will be useful to trace the driver's accountability to the job. Further, the vehicle image storing process can be use to verify the condition of the vehicle at various stages of this business process and ability to getting the digital signatures of authorized personal improve the reliability of this system. Integrated messaging service is important to vehicle terminal employees as well as car importers and their agents to promptly receive messages related to the business operations.

IV. SPECIAL FEATURES

a. Improvement of data quality: complete and accurate data entry and retrieve of vehicle data using barcode and mobile technologies.

b. Process acceleration: immediate vehicle identification and vehicle handling in important terminal areas – delivery area, tally area, terminal gate as well as storage areas.

c. Reduction of process flows: decrease of search activities caused by improper parking of vehicles, etc.

d. Enhancement of process transparency: generation of correct vehicle identification, complete recording of all vehicle movements and responsible people and an up-to-date vehicle stock. Monitor every movements of the vehicles in each stage correctly and up-to-date.

e. Improvement of process stability: decrease of costs resulting from faulty operations.

f. Improvement of working conditions: simplification of operation tasks through more comprehensive and improved computer-aided support.

g. Protection and improvement of the market position: development of competitive advantages due to early adoption of new information and communication technologies in association with innovative logistic planning and control methods.

Table 01 depicts the recognized delays at each stage of the current system and the measurements of improvements identified from the simulated environment.

3. CONCLUSION

In this paper we have described about the current weaknesses of the Sri Lanka Ports Authority and the proposed mobile software solution to overcome those issues. The proposed system will be able to provide competitive edge to SLPA by ensuring cost effective, efficient and reliable service to the importers and exporters thus improving the quality of the SLPA services. Further, this system helps to gain economic benefits to the country by reducing unnecessary port payments. In the current process, if a ship delays around 10 days the port should pay nearly 0.8 million rupees to shipping agent. Due to the use of this system it is estimated that this amount can be reduced by 50% by reducing the operational time by 50%. Hence it helps save money within the country which can be spent for national development.

4. ACKNOWLEDGEMENTS

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Tables

Table 1 : Functions and features provided to enhance the quality of service in SLPA

Actor	**Weaknesses we have identified in the current System**	**Special features to enhance the business process**
Planning director	Issues in gathering relevant employees when a car carrier arrives. *Currently it takes at least 30 seconds to inform the message to an employee.*	Instant messaging service for efficient gathering Tally Clerks and Drivers. *The message will be sent automatically to the employees through the proposed system within few seconds (5s) and no human need to be involved.*
	Poor customer claim handling due to lack of evidences.	Introduce an image capturing and record keeping process (responsible drivers, tally clerks, security officers, and tracking drivers' activities) to facilitate an efficient claim handling. *It takes only a few seconds to find the relevant details with regard to a claim.*
	Inefficient vehicle searching process due to heavy documentary handling *The time takes to find details of a vehicle depends on the number of vehicle papers per a car carrier. Usually it takes number of hours to find a particular vehicle detail paper.*	Provide efficient vehicle detail searching facilities through the barcode system. *Within a few seconds the proposed system gives the details of a particular vehicle.*
	Lack of customer care service which provides information at the request of the customer. *In the current system customers do not*	Introducing customer care service to let them know about the relevant details regarding his/her vehicles. *Within a few seconds system automatically*

	know a relevant person to contact, therefore it wastes much time of customers and also it takes number of hours to find the arrival of a vehicle.	*sends the message of arrival of a vehicle to relevant customer.*
	Lack of a data analyzing tool to analyze relevant data which will be much helpful for the strategic level planning. *Currently it takes weeks and months of time to analyze the data and it wastes human resources also.*	Provide a sophisticated data analyzing tool. *Within a few seconds system analyzes the data and graphically visualizes it.*
	No proper vehicle yard planning.	Introduce a function to prepare advance planning for slot allocation or block allocation by analyzing records (vehicle size and type wise or shipping agent wise or transshipping or local customer wise or vessel type wise, etc...) [5,6] *Within a few seconds system generates the yard plan.*
	Lack of a proper service to handle emergency situations, such as finishing fuel problems and vehicle break downs. *Currently it takes at least one day to handle these kinds of situations and it creates vehicle traffics in the yard.*	Introducing an efficient emergency situation handling service. [Fig 5] *Proposed system provides immediate relevant solutions and continues the process efficiently.*
Tally clerk	Inefficient tagging system for the vehicle and vehicle key. *Currently it takes 15 seconds*	Using barcodes for the vehicles and vehicle keys may make efficient the identifying of vehicles and keys. *Using proposed system it can be done within 5s*
	Heavy documentary handling for an instance: handling tally sheets.	Introducing an electronic tally sheet which minimizes time consuming of vehicle tallying process.
	Heavy paper works *In the current system one tally clerk checks*	Tally Clerk has only to tick on the interface which is same as tally sheet.(reduce learning

	30 vehicles per hour.	time) *Using our system, it is estimated that one tally clerk can check 53 vehicles per hour. Thus the efficiency of the process will be increased nearly by 50%.*
	Lack of evidence in customer inquiry handling.	Introduce image capturing feature for the damaged vehicles which can be used for further inquiry handling.
Driver	No proper place to park a vehicle which affects subsequent vehicle releasing process. *To find a parking slot it takes average 8 minutes time in current system. When releasing a vehicle it takes average 30 minutes to find a vehicle. It depends on the number of vehicles in the yard.*	Proving a proper place to each vehicle which should be parked in the yard. [3,4] *Within a few seconds system gives the location of a vehicle.*
Security Officer	Heavy documentary handling for an instance: rechecking tally sheets. *In the current system one security officer checks 30 vehicles per hour.*	Introducing an electronic tally sheet which minimizes time consuming of vehicle checking process. *Using our system, it is estimated that one tally clerk can check 53 vehicles per hour. Thus the efficiency of the process will be increased nearly by 50%.*
	Lack of proper mechanism to measure the efficiency and accuracy of workers.	Record all relevant data of employees in every instance of time period.
Store Keeper	Due to lack of proper mechanism for finding vehicle keys, it has become to a much time consuming process. *In the current system it takes average 15 minutes to find a vehicle key and it depends on the number of stored vehicle keys*	Introducing a mechanism which provides a key-tag for each vehicle key consisting of a barcode and indicating the location of the vehicle key holder board will be mapped to the relevant vehicle details stored in the system. This process will enhance the efficiency of key releasing process. *Using proposed system key can be found within few seconds.*

Logistic Department	Heavy paper work.	Allow store keeper to check for payment status before releasing the key, allows Logistic Department to view various reports regarding VAT and port charges and allow custom preventive unit to check for payment status before releasing the vehicle from the port, through department integration process.
Other	Lack of electronic database management system.	Avoid data redundancy
	Heavy paper work	Computerized signature capturing to authenticate releasing of vehicles
	Resource wasting of SLPA	Resource saving of SLPA

Figures

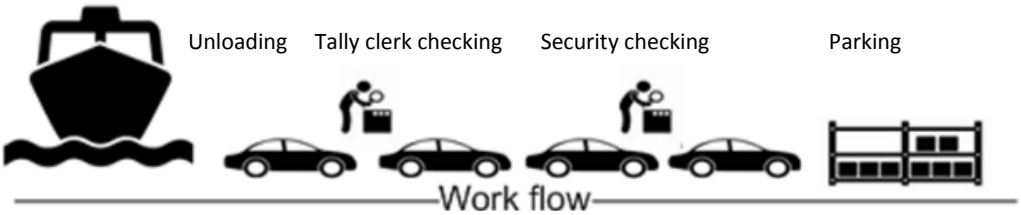

Fig 1: Work flow of the VTMS

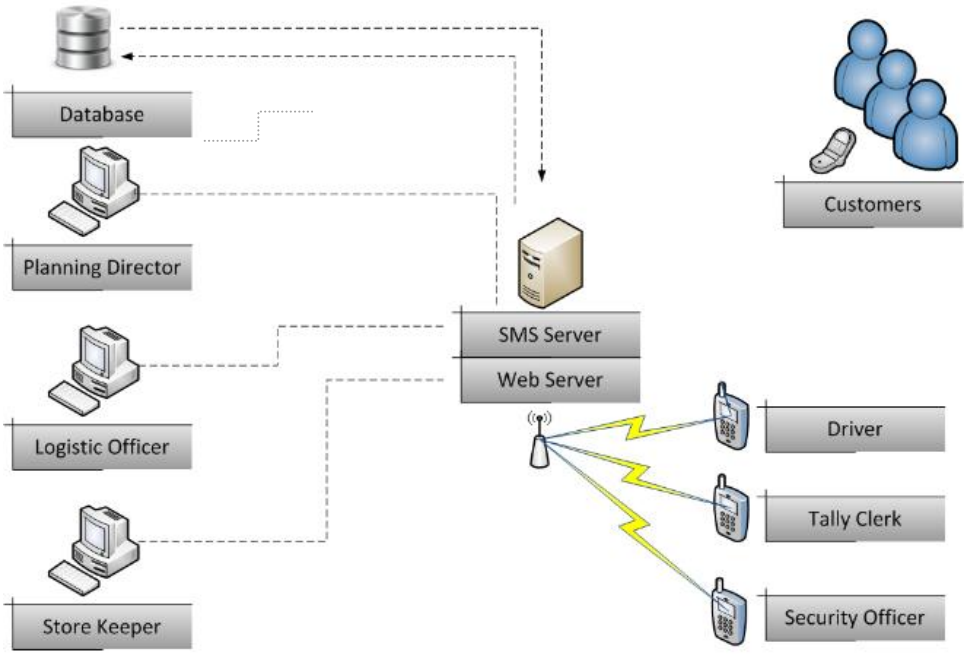

Fig 2: System architecture of the VTMS.

Fig 3: MC65 mobile computer

Fig 4: Interfaces of the mobile application.

Fig 5: Proposed Emergency Service of the VTMS.