Smart Truck Driver Assistant: A Cost Effective Solution for Real Time Management of Container Delivery to Trucks

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Project Objective

In this project, we developed a mobile application (app) that utilizes the rich environment and features of smartphones. Our app uses the widely available resources of smartphones (at no additional cost to drivers or terminals) to collect data from port accessing trucks and provides the latest information to stakeholders at the touch of a finger. Our methodology can be flexibly extended beyond any truck tracking or port monitoring system while providing both capabilities. Our goal is to help develop a set of reliable criteria that the port community can employ to evaluate the truck queuing and terminal visit times and hence assess the productivity at the Twin Ports.

Problem Statement

The twin ports of Los Angeles and Long Beach are two of the busiest ports in the country, and the marine terminals at these ports are under tremendous pressure to enhance their level of performance. One major measure of productivity and ultimately overall performance of a terminal is the truck visit (turn) time. The truck visit time consists of two main components: 1) queue time, time spent waiting in lines outside the gates; and 2) terminal time, the span of time from a truck's arrival at the terminal to its departure with its container. A 2011 study found that the distributions of truck visit time at the Twin Ports are highly skewed and dependent on the time of visit. The reduction of truck visit times is of significant value for the robust management of operations at the Twin Ports. As an approach to achieve this goal, most of the terminals in the Twin Ports have adopted some form of an appointment system, but recent studies have indicated low rates of utilization and an uncertain impact on reducing queuing at terminal gates due to the unpredictability of traffic in the metropolitan Los Angeles area. Therefore, a robust solution to the truck visit time problem not only needs to be cost effective, but it also needs to be real-time to make the implementation of dynamic scheduling decisions feasible.

Aiming at such a goal, a few studies have tried to employ new technologies to implement an accurate measurement of truck visit time. In 2007, Lam et al. used time stamped digital images of trucks captured by a few cameras mounted at various critical points at the Twin Ports (e.g., the entry gate, the bobtail entry, the pedestal, and the exit gate) to obtain several time measures including truck terminal times. However, the matching of truck images was not an automated process, and required manual efforts to record the profile info of each truck entering at a terminal gate. This is a limiting factor in real-time applicability of such an approach. Recently, Noronha et al. used GPS trackers on 250 trucks to study truck visit times at the Twin Ports. But GPS

measurements are subject to multiple errors and cannot provide the fine-grained data needed for such an application. Hence, Noronha et al.'s findings were limited by the capability of the GPS equipment, only accounted for instrumented trucks and did not provide a conclusive analysis of turn times at the Twin Ports. These studies and their limitations necessitate development of a cost effective, unbiased (verified and accepted by all parties involved including ports, terminal operators and truck companies) and yet precise data collection method. Such collection of data will provide us with the ability to develop a model of port functionality and such a model in turn can be used for future decision-making.

Research Methodology

In this project we developed a mobile (software) application that, when employed by truck drivers (installed on their smartphones), will allow all stakeholders at the ports to obtain precise information about the physical location of a truck in real time. This information can then be used to determine truck turn times and to provide stakeholders with precise information about the current condition of the truck segment of the supply chain at or near the ports.

Our application, once installed and authenticated on a driver's smartphone, does not require the driver to enter any information on his phone. The driver can simply ignore our application and the application will automatically collect information about the trucks location and movements. This information will be accessible to the trucking company that provided the current assignment to this truck driver and it can also be made available to other stakeholders such as terminal operators. Terminals, if permitted by the trucking company, would be able to see which container a truck is dropping off or which container it wants to pick up.

Our system uses role-based access control to ensure that each participant or stakeholder can only access the appropriate or permitted information. If, for example, a truck is on its way to pick up a container from one terminal, only the terminal where the pick-up is planned will be able to see this information. Our system also implements the principle of least privilege at all times. Namely all stakeholders have only access to the minimum amount of information they need to complete their current task.

Results

We have completed the development of our application and conducted several tests at mock terminals successfully. The test results show that our app is fully functional and provides the expected outcomes. We are currently in discussion with several stakeholders to conduct a field test of our application. So far, we have received very positive responses from trucking companies and a few ports. They all believe that our approach is very promising and should be pursued. We expect that within the next few months we will be able to test our application with a trucking company at the ports.

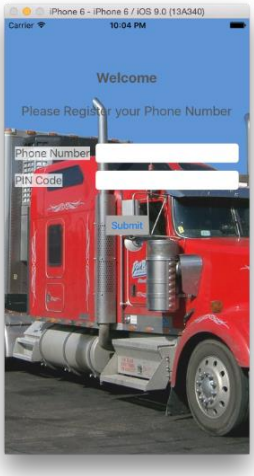

Figure 6. Client phone registration view.

Figure 7. Client trip view.