Original Research Paper

Opportunities and challenges of smart mobile applications in transportation

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ABSTRACT

Smart mobile applications are software applications that are designed to run on smart phones, tablets, and other mobile electronic devices. In this era of rapid technological advances, these applications have become one of the primary tools we use daily both in our personal and professional lives. The applications play key roles in facilitating many applications that are pivotal in our today's society including communication, education, business, entertainment, medical, finance, travel, utilities, social, and transportation.

This paper reviewed the opportunities and challenges of the applications related to transportation. The opportunities revealed include route planning, ridesharing/carpooling, traffic safety, parking information, transportation data collection, fuel emissions and consumption, and travel information. The potential users of these applications in the field of transportation include (1) transportation agencies for travel data collection, travel information, ridesharing/carpooling, and traffic safety, (2) engineering students for field data collection such as travel speed, travel time, and vehicle count, and (3) general traveling public for route planning, ridesharing/carpooling, parking, traffic safety, and travel information.

Significant usage of smart mobile applications can be potentially very beneficial, particularly in automobile travel mode to reduce travel time, cost, and vehicle emissions. In the end this would make travel safer and living environments greener and healthier. However, road users' interactions with these applications could manually, visually, and cognitively divert their attention from the primary task of driving or walking. Distracted road users expose themselves and others to unsafe behavior than undistracted. Road safety education and awareness programs are vital to discourage the use of applications that stimulate unsafe driving/walking behaviors. Educating the traveling public about the dangers of unsafe driving/walking behavior could have significant safety benefits to all road users. Future research needs to compare accuracies of the applications and provide guidelines for selecting them for certain transportation related applications.

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1.   Introduction

Smart mobile applications are software applications that are designed to run on smart phones, tablets, and other mobile devices. The applications are commonly known as "mobile apps" or simply "apps". In this era of rapid technological advances, mobile applications have become one of the primary tools we use daily both in our personal and professional lives. The applications are downloadable from mobile application distribution platforms for free or purchase. These applications play key roles in facilitating many applications that are pivotal in our today's society including communication, education, business, entertainment, medical, finance, travel, utilities, and social.

The history of the mobile app began with the first development of the mobile device and the first mobile phones whose microchips required the most basic of software to send and receive voice calls in 1973 (Bates, 2014; Rajput, 2015). Typically, the early applications were small arcade games, ring tone editors, calculators, calendars, and so forth. The rapid market and technology evolution of mobile contents and applications started in the beginning of the new millennium. Unlike the conventional programming environment of standard cell phones, operating systems for smart phones (Windows mobile, Symbian, RIM, Android, Mac iOS) opened development of third-party software. During this era, mobile companies tried to make mobile products that are more attractive for customers by introducing more and more applications. These rapid technological advances were partly motivated by the need for companies to increase revenues and making mobile devices that are easy to use and intuitive. Every company started and tried to facilitate the process of development so that users are able to customize their devices (Future Market Insight, 2016).

In July 2008, Apple opened its iOS App Store which was the first application distribution service (Apple, 2008). This set the standard for applications distribution services for other mobile companies. This led to consumers using their mobile devices as a way of connecting to the web. Consequently, mobile phones started to be known as smartphone due to their numerous capabilities. Mobile and software developers realized that they could take mobile website capabilities up with new applications named mobile applications. The applications would have the same functions and capabilities as websites designed for a desktop or laptop. The websites were scaled down so that they would fit mobile devices. This led to a plethora of mobile applications being developed and implemented. In 2010, the word "app" was listed as the "word of the year" by the American Dialect Society (2011). Early applications for mobile apps were for email, calendars, contacts, stock market, and weather information. High demand from users led to mobile applications being used in mobile games, factory automation, banking, order-tracking, and ticket purchases (Future Market Insight, 2016).

The mobile industry has continued to grow rapidly, with a total of 3.6 billion unique mobile subscribers at the end of 2014 and an addition of 1 billion subscribers predicted by 2020 globally (GSMA intelligence, 2015). This global penetration rate is approximately 60% of the current users. Key trends in the U.S. smartphone industry for July 2015 indicates 198.5 million people in the U.S. owned smart phones (79.1% mobile market penetration) during the three months ending in July (ComScore, 2016).

In transportation sector, the early use of mobile applications was mainly for navigation and location-based services. As of 2016, the mobile applications are used for many transportation related applications including engineering education, traffic data collection, travel information, route planning, and ridesharing. On the contrary, some applications create challenges especially in areas of enforcement and traffic safety. For example, some of the applications can detect speed camera or radar gun and alert the user to slow down a certain distance before crossing the location. These applications work similar to radar detectors that are widely available commercially but they are free or cost much less. Studies showed that radar detector users have more speed convictions compared to the general driver population (Cooper et al., 1992). Thus, increased availability of such applications may encourage some drivers to exceed highway posted speed limits, which could endanger safety of the traveling public (Cornelissen and Rudin-Brown, 2010).

In literature, there are numerous applications available purposely for traffic safety, transportation emission quantification, transportation data collection, and navigation (Dutzik et al., 2013). Realizing the potential of the applications in transportation area, several states' departments of transportation (DOT) agencies have already implemented mobile applications that showed real time travel information to the traveling public. Similarly, the National Highway Traffic Safety Administration (NHTSA, 2013) has created a mobile application named "safercar". This application is aimed to make it easier for consumers to access and submit information about important vehicle safety concerns. The Tennessee Department of Transportation (TDOT) developed its mobile application "TDOT SmartWay mobile app" for monitoring traffic operating speeds and incident notification (TDOT, 2014). With respect to traffic congestion, some states have implemented parking applications to help alleviate traffic congestion. According to USA TODAY (2013), "In Washington, the nation's most congested city, half a million users have registered for "ParkMobile". These are some evidences that there is great potential for mobile applications in transportation discipline. Despite of this only few efforts exist that quantifies or describes the vitality of mobile applications to transportation agencies and the traveling public. With increase in more sophisticated applications, most of the problems that are evident in transportation can be made simpler and more cost-effective to address than before.

Although there are many mobile applications that offer prevalent transportation related applications, no study was found that have documented their benefits and dis-benefits. For this current knowledge limitation, this study aims to review mobile applications with potential applications in transportation and identify their potential benefits and dis-benefits. The study reviews applications listed on the mobile applications distribution platforms for Apple App Store, Google Android Market, Blackberry World, Samsung App Store, Ovi Store, and Windows Store. Specifically, the objectives of this paper are listed below.