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## Conference Paper

# An approach to design a real-time transportation information application with enabling technologies

19th Biennial Conference of the International Telecommunications Society (ITS): "Moving Forward with Future Technologies: Opening a Platform for All", Bangkok, Thailand, 18th-21th November 2012

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# **The 19th ITS Biennial Conference 2012**

## **“Moving Forward with Future Technologies: Opening a Platform for All”**

18 - 21 November 2012, Thailand

An Approach to Design a Real-time Transportation Information Application with  
Enabling Technologies

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## Abstract

Real-time transportation information (RTTI) brings convenience by immediate traffic information for drivers and minimizes uncertainty of waiting time for bus passengers. Information about heavy rains suddenly flood underground passages and traffic accidents cause road blocking can be accessed immediately through an application service via smartphones. Bus passengers can check bus waiting time from Internet before moving to bus stations by RTTI.

With the development of information communication technology (ICT), benefits of real-time transportation information can be realized by an integration of location based service (LBS), smartphone, applications, 3G network and cloud computing service.

In order to gain insight of RTTI service, we carry out this research with two steps. The first, the study collects existing transportation related applications from both Apple iOS platform and Google Android platform to analyze their features. Next, we analyze enabling ICT technologies to design a RTTI service model and the issue on energy saving and CO<sub>2</sub> emission reduction. The outcome of this research can provide a clear model to assist transportation regulators, municipalities and application developers to evaluate benefits and costs of RTTI service.

Keywords: real time transportation information, ICT, energy saving, CO<sub>2</sub> emission

# Introduction

## 1.1 Research Background and Motivation

Real time traffic information Apps bring convenience of traffic information access and reduce fuel consumption, CO<sub>2</sub> emission via smart phones of a modern society. With real time traffic information Apps, people can reduce possibilities of traffic jams from different routes and bus waiting time. In addition, air pollution from CO<sub>2</sub> emission also can be decreased from fuel saving. About Apps, there is some positive correlations between smart phones popularity and App development. Because of smart phones, Apps can offer different kinds of value-added service to our daily life. According to Canalys statistics about smart phone usage, smart phone shipment is only 2.99 hundred millions in 2010 but the record has been augmented about 63% in 2011(Canalys, 2012).

In 2008, iTunes of Apple's App store has launched for iPhone and iPod. At that time, there are ten million Apps were downloaded in the first week from iTunes and 25% of those Apps were free. A few months later, Android built its own App store (ReadWriteWeb, 2012). Other firms also developed Apps for their business and purposes to speed up App convenience and popularity. The complementary feature between smart phone and Apps can accelerate its market growth and development. Therefore, with indirect and direct effect of network externality, smart phone users are growing quickly and they have high acceptability for value-added services from Apps.

With an aid from rapid development of smart phone and App, real time traffic information (RTTI) App has bloomed quickly. Their enabled technologies, such as touch screen, location based service (LBS), global position system (GPS), the third generation mobile communication systems are critical factors to affect functionalities of RTTI Apps. For these parameters affecting RTTI Apps development, the main factor is whether mobile network can provide reliable mobile data service. According to Cisco Visual Networking Index, mobile data traffic will increase 18-fold between 2011 and 2016 globally (Cisco, 2012). With strong demand of mobile data traffic, on the one hand, mobile operators have to upgrade their existing communication networks and purchase extra radio spectrum to enhance capacity and service quality. On the other hand, App developers and App stores make efforts on different kinds of App to supply this market. In addition, App users need to download search and download Apps from App stores (iTunes and Google Play) from a smart phone or portable devices (tablet PC and iPad), otherwise convenience and versatility of App cannot be experienced from desktop computers and laptops. Forecasting indicates that mobile network usage will overtake desktop internet usage in 2014 and more than 50% of all "local" searches were done from a mobile device at 2011 (digitalbuzz, 2011). Mobile network is turning to be a basic utility for developed countries with convenience and efficiency. Apps of smart phones enable people to communicate, relax and to do business via mobile network in society.

Mobile network and smart phones becomes reliable, many app stores with value-added service expand as fast as they can. With huge success from iTunes of Apple, Apps become a solution to improve our life. Google, RIM, Microsoft and other application vendors have created similar application platforms service. For mobile operators, apps service becomes a profitable business and attractive service for users(Kimble, 2010). Now, users can design an app easily with support and

contribution from Google, Apple and other firms, who offer simple and easy platforms for users. Apps can offer multimedia players, navigation, instant message and other value-added service. Mobile app downloads are forecast to soar from 10.7 billion in 2010 to 182.7 billion in 2015, according to a new forecast from International Data Corporation (IDC, 2011). This is a new step for everyone enjoys convenience and saves cost with apps in internet era.

In App service, RTTI Apps are important and bring more efficiency in our life. Real time traffic information includes personal positioning, traffic information search and alternatives routes chosen etc. And every service is close to users as they share their location information with their society. This service makes users know traffic information instantly and they can make efficient decisions depends on information. Therefore, it is potential to develop this service and improve our life quality.

First of all, the reason why real time traffic information is needy because it can reduce traffic jams happen, time cost and convenient for our life. In order to work or to travel for life necessary and convenience, transportation is important for our life. However, transportation is not only brings convenience, but also brings some problems. When vehicles owners increase, it is easy to stick in traffic jams. It also causes air pollution. According to China Mobile Communication Co. Ltd's report in 2009, it tells us that when vehicles owners increase will bring serious traffic jams and then economic loss happen. In this study, we find out existing traffic apps Owing to this information, we can understand why real time traffic information is needy and important.

Next, traffic information is highly dynamic in our society now. For users, static information can not satisfy their need anymore. External environment now changes quickly. In order to solving this situation, traffic apps can only offer real time traffic information that users can know the latest information instantly. Its benefits are information updates and keep refreshing new things which users are interested in (Dick , Edward, Kam-Yiu., S.W Ng &Tei-Wei, 2004). The last one is RTTI apps would can offer users some useful and timely information. When we drive or walk on the road, there is always some unexpected things happen. With real time traffic apps, users can understand situation and choose other alternatives.

In the past, although there is a database about traffic information, it cannot be effective enough with static traffic database when facing people's demand. Most static traffic database is built by the past historical information. For users, this static information still has its own usefulness, but it cannot satisfy for real time traffic information. With aid from smart phones and mobile network to offer everywhere and anything service, APPs developers offer value-added apps for users to enjoy real time traffic information service. However, most of these traffic Apps can only use in specific areas or countries, so this study analyzes real time traffic information and users can make optimistic choice with limited external environment.

About existing traffic apps, they cannot satisfy users' real demand at present. In this study, we find out most traffic apps focus on traffic information of freeways or express ways. It seldom offers local traffic information which can be closer to our daily life. Although some companies serve their traffic information and location via mobile devices owners sharing with traffic information, its accuracy isn't high enough and map information will have some mistakes easily.

Besides, local traffic information which collected information from social media needs more people use it. So it can have some positive impact from network effect. However, it is not only need real time traffic information for our daily life, but also need it for famous landmarks or tourist spots. World tourism market is still growing during global economic regression and other unstable factors around world. According to World Tourism Organization, international tourist arrivals grew by over 4% in 2011 to 982 million. They forecast a growth in international tourist arrivals of between 3% and 4% in 2012(UNWTO, 2012). That means tourism is a big and important market for every countries. Therefore, this study would also try to make a new app for tourists. It can save time and help users make decision when they plan to travel some places.

## **1.2 Research Objective and Goals**

In the study, we analyze existing traffic apps and their advantages or weakness. And we collect and discuss traffic apps information for users, government or other relative firms. Next, we analyze enabling ICT technologies for design a suitable RTTI service and evaluate how much energy saving and CO<sub>2</sub> emission reduction can be contributed by RTTI Apps.

## **2. Literature Review**

### **2.1 Traffic congestion**

In our life, transportation is important and necessary. With transportation, people can exchange merchandise, traveling and working, life become improvement and society advances quickly. But world population increase continuously and traffic is still increasing, the possibility of traffic jams or accidents occurrence will be higher than before. According to Texas A&M Transportation Institute's report, traffic congestion caused urban Americans to travel 4.8 billion hours and also to purchase an extra 1.9 billion gallons of fuel for a congestion cost of \$101billion(Texas A&M Transportation Institute, 2011).

Owing to the huge cost of traffic congestion, this study chooses transportation for discussion and tries to solve traffic problems at present. As the front paragraph tells, if a country is high population density, it may face the same large congestion cost problems. Therefore, people can find out when we are in traffic jams or encounter accidents, it makes inconvenience. Social benefits may become butterfly effect and transfer it to be time and money cost with time passed by.

### **2.2 Real time traffic information**

From past literatures, most researches about real time traffic information are relative with the best route chosen or positioning techniques. Nowadays, traffic is one of important problems for our life. Offering real time traffic information can help users choose the best route and use new parameters or systems to solve traffic problems(Khosroshahi, Keshavarzi, KoozehKanani, & Sobhi, 2011). Also, some of them present system which can collect traffic information and monitor the traffic flow when facing traffic problems. The system can also combine with RFID and wireless sensor networks to improve traffic problems(Yulian, Wenfeng, & Jian, 2011).

About real time traffic information issue, it is not only discussing about the best route chosen, but using for other objectives. For time-sensitive air-cargo, it is hard to

know the freights' travel time or departure delays without real time traffic information(Azadian, Murat, & Chinnam, 2012). Or customers don't want to drive and prefer to transit by their ways, they may consider it is fast and comfortable or not. In order to improve transit travel time and to avoid cost too much, real time traffic information can be necessary and useful(Watkins, Ferris, Borning, Rutherford, & Layton, 2011). With real time traffic information, we can also reduce the possibility of car accidents happened for our safety. And we may predict visibility related crashes and reduce these accidents happened(Abdel-Aty, Hassan, Ahmed, & Al-Ghamdi, 2012).

In conclusion, we can find out traffic problems is one of main problems in our society and need to solve it. In this study, we analyze existing apps for understanding and do practical experiment to satisfy and find out the most suitable solvation for users' real demand.

### **3. Research Method**

In this study, we analyze existing traffic apps and find out their advantages and also know their weaknesses which cannot satisfy users demand (Table 1.). These existing traffic apps are chosen from App Store or Google Play. We download all of these apps and experience them for experiment. About advantages and weakness in Table 1., we summarize our experience and other users' comments from app stores. Understanding existing traffic apps can know what limits users' choice. After discussing existing traffic apps, we try to design a new real time traffic information app for users. About mobile devices, most users use PND or GPS devices in the past. But now, mobile devices are popular than before, such as smart phones or tablet personal computers. People have more opportunities to have different mobile devices with value-added service.

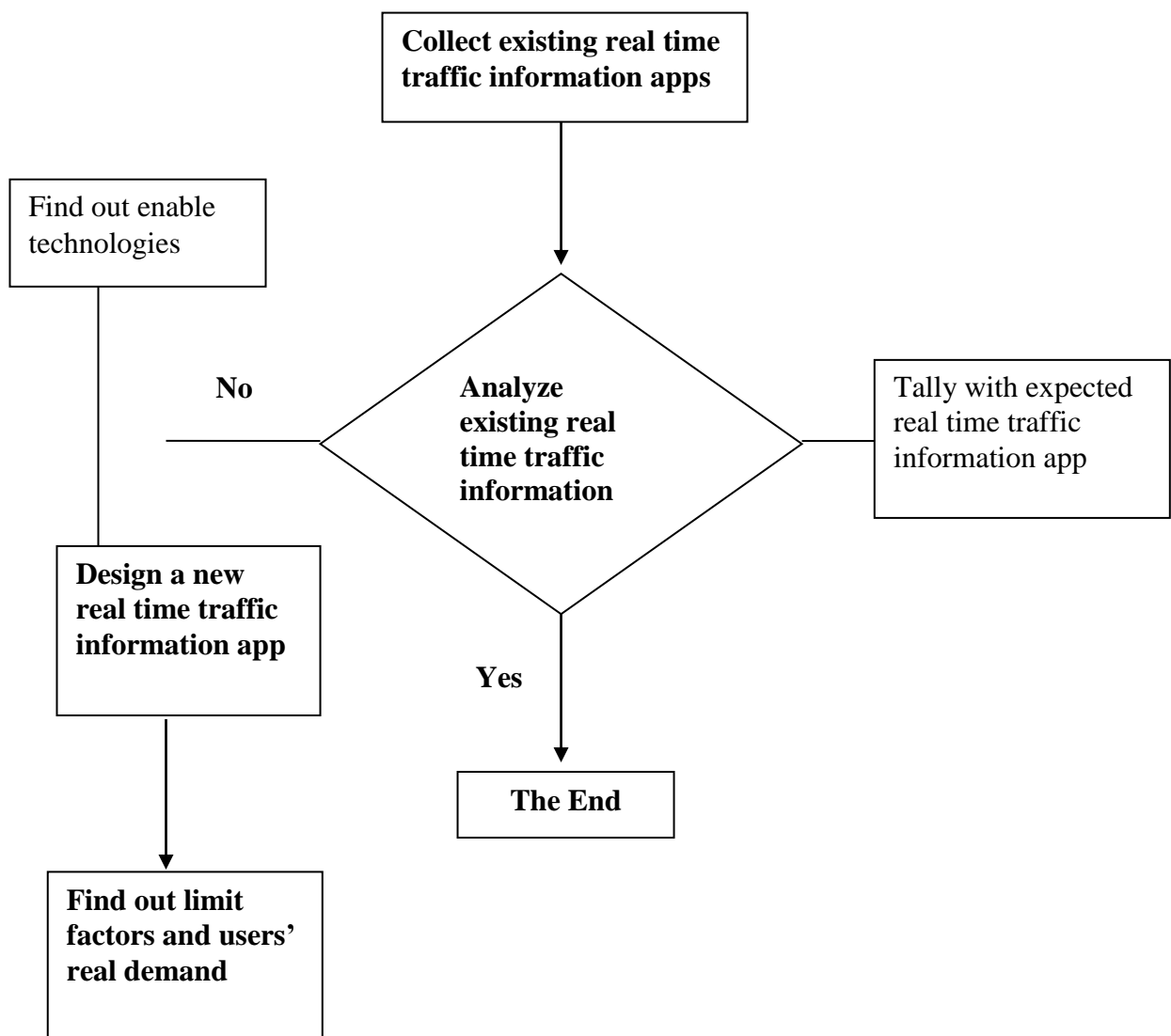
From the Table 1, we can find out most traffic apps have some basic service, such as real time images, personal positioning and real time traffic information. But we know those apps aren't accuracy enough or information isn't correct or instant enough. Besides, many apps only can use in specific areas or countries, they cannot offer local traffic information which aren't close to users' life enough.

After analyzing existing real time traffic information apps, this study would compare the existing apps with expected apps. Facing users' demand, they cannot satisfy these existing apps at present. Therefore, this study will continue to improve current traffic app depends on analysis and make a real traffic app for society. Finally, this study would arrange the information and technologies we need in the process for application developers, government or other firms (Research Structure).

In the collecting information process, this study integrates the information and starts making integration about real time traffic apps structure (Traffic App Structure). First, we need nearly complete traffic information collection which is important in this model. We can get this traffic information from radio, GPS positioning, government or social media. Also, we can not only focus on specific transportation, but try to collect most transportation as much as we can to satisfy different users. Besides, we need some basic technologies and calculation plan to make our process better. Users can use this app smoothly and positioning correction. Then, we can put

this information all together with examination or standards and it becomes a dynamic and useful real time information contents. After that, this app can upload on various app stores. For users, they need mobile devices to experience app service. Facing different mobile devices, users make their decision depends on operating systems, functions or brands. Then users can surf app stores and experience various apps via their mobile devices. For firms, it is important to know revenue in designing apps process. The normal strategy for them is just make users pay for download apps. Or maybe when firms are coding the apps, they can add advertisement code to apps' program. The last one is the most popular method. Firms can use free apps attract users first, and then users can choose whether pay for value-added service or not (Traffic App Contents).

### Research Structure





**Table 1.**

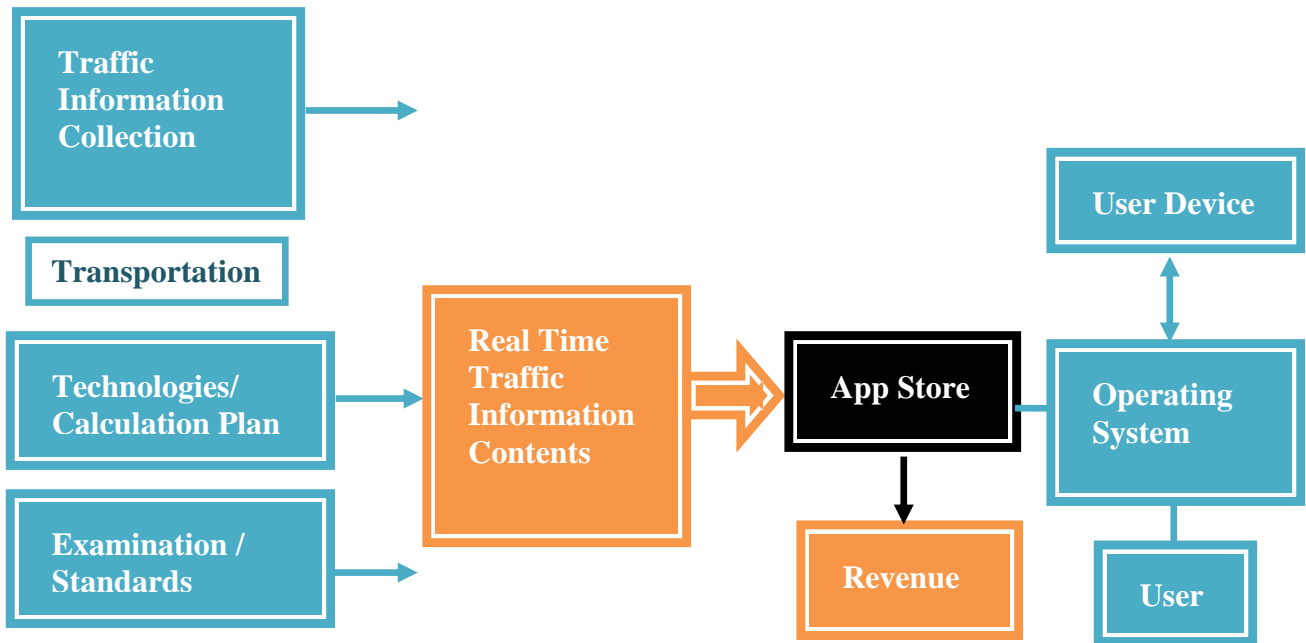
<b>APP Name</b>	<b>System</b>	<b>Description</b>	<b>Advantages</b>	<b>Weaknesses</b>
<b>i68 國道資訊 HD (Taiwan)</b>	Android & iOS	It can show different freeways' real time situation and speed at present. If there is a camera on the freeways, it can show real situation at that place. With GPS, it can also check alternative roads with offline.	<ol style="list-style-type: none"> <li>1. Easy to use</li> <li>2. Show real time traffic information on freeways</li> </ol>	<ol style="list-style-type: none"> <li>1. Low resolution on map</li> <li>2. Only support in Chinese</li> <li>3. Cannot log in at present on Google Play, but can use on App Store</li> <li>4. Only use on freeways and doesn't upgrade new routes</li> </ol>
<b>高速公路 1968 (Taiwan)</b>	Android & iOS	Route plans and real time traffic information on the freeways can know them instantly. There is 24hr attendants stand by for telling users the latest situation and shows real time roads information.	<ol style="list-style-type: none"> <li>1. 24hr service center and professional attendants stand by</li> <li>2. A shortest time and distance planner.</li> </ol>	<ol style="list-style-type: none"> <li>1. Vocal navigation is needy and safety.</li> <li>2. Only support in Chinese.</li> <li>3. Maps cannot zoom in and zoom out.</li> <li>4. Only use on freeways.</li> </ol>
<b>ITS Good Road Cam (Taiwan)</b>	Android & iOS	Users can access into system and see freeways' situation instantly by camera. And it is easy to use.	<ol style="list-style-type: none"> <li>1. No latency for real time traffic camera</li> <li>2. It can correct wrong information with real time traffic camera</li> </ol>	<ol style="list-style-type: none"> <li>1. Can't find out which ways are from north or south</li> <li>2. Only support in Chinese</li> <li>3. Only can use on freeways and doesn't show current speed</li> </ol>
<b>Taipei Spotlight</b>	iOS	Offer real time traffic information in Taipei and parking spaces related information	<ol style="list-style-type: none"> <li>1. Show the main traffic formation depends on users' position which is in the range of 300 meters</li> <li>2. Show parking spaces information depends on users' position which is in the range of 1000 meters</li> </ol>	<ol style="list-style-type: none"> <li>1. Vocal navigation is needy and safety.</li> <li>2. Only support in Chinese.</li> </ol>
<b>ITS Good Road Quk (Taiwan)</b>	Android & iOS	It can show current speeds, traffic flow and voice	<ol style="list-style-type: none"> <li>1. Positioning search and nearby traffic</li> </ol>	<ol style="list-style-type: none"> <li>1. Can use for some urban or rural areas.</li> </ol>

		notifications. Also, it can calculate travel time and other value-added service, such as gasoline price or weather information.	information 2. Value-added: gasoline price or weather 3. Be a widget on screen 4. Voice sound automatically	Data resource is from radio. 2. Only support in Chinese.
<b>路況快易通(Taiwan)</b>	Hami Apps/ Android/ iOS	Users can have their own personal traffic information and it can also notice users when accidents happen.	There is voice notification to notice users about current traffic information.	1. Latency for showing information 2. Some of videos don't show up 3. Only support in Chinese 4. Only can use on freeways
<b>交通路況隨身行(Taiwan)</b>	Android/ iOS	This app can check freeways' traffic information and accidents' time or location, so that users can avoid driving there.	1. Easy to use 2. Show real time traffic information on freeways	1. A few routes to choose 2. Now, it cannot log in or even install it 3. Only support in Chinese 4. Only can use on freeways
<b>INRIX</b>	Android/ iOS	Key INRIX Traffic Features: - Avoid delays with real-time traffic information from the world's largest traffic network. - View traffic incidents on your route such as accidents, police, construction, and events. - Explore traffic in remote locations. (Google Play)	Users can correct the right traffic information or share information.	1. Cannot serve route plans with Android system 2. Routes won't change automatically when users are in traffic jams 3. 4G may be better than 3G for using this. 4. Only offer for some countries
<b>Glob - Traffic &amp; Radar</b>	Android/ iOS	It shows real time traffic information, such as speed or directions. And it will warn users if they are close to accidents or traffic jams.	1. Real time traffic information is world's information 2. It can warn users instantly when emergency things happen.	Real time traffic information is from Google.
<b>Live Traffic &amp; Weather in HK</b>	Android/ iOS	It shows the main roads' specific traffic information, speed, weather and warnings. Also, it can tell users when is the right time to cross harbor.	1. Store traffic information in the past 24hr automatically 2. Weather report, speed and more than	It isn't support in English, so it's inconvenience for HK residents.

			one screen to see.	
<b>Michelin Traffic</b>	Android/ iOS	Its coverage areas include main city and most freeways in Europe countries. It can also show camera, traffic accidents or parking spaces.	Offer different countries' traffic information	<ol style="list-style-type: none"> <li>1. Only for some of Europe counties</li> <li>2. Interface isn't comfortable to use.</li> <li>3. Accuracy needs to be improved</li> </ol>
<b>Waze (Israel)</b>	Android/ iOS	It connects every user's positions and users share their traffic information instantly. The more people use this app, the more users can know real time traffic information. Users can know each other's location and speed. Also, users don't have to touch mobile devices, they just have to wave in front of devices and then it will start to be voice control.	There is gasoline price, chats with friends and shares with each other's location. Also, it can voice control to show traffic information.	<ol style="list-style-type: none"> <li>1. Drains mobile devices' battery too fast</li> <li>2. Language chosen can't get right</li> <li>3. Map isn't accuracy and incomplete</li> </ol>
<b>Which Way FREE</b>	Android	It helps users find the fastest way to get to the destination. And it can record your actual commuting time.*	Use this app, it can record time and predict for next time.	It only offers the fastest way to go.
<b>BeTransit</b>	Android/ iOS	It can report traffic information and position in the navigation map. And it identifies users' location, allowing easy and fast access to traffic information.*	Interface design is pretty good.	<ol style="list-style-type: none"> <li>1. Only shows where traffic congestion is.</li> <li>2. Users cannot use it without e-mail.</li> </ol>
<b>Beat Traffic</b>	Android/ iOS	It shows where traffic is moving or slow, and it also provides accident alerts. It also displays icons for traffic cams, which you can view by tapping on the icon and then the blue arrow to the right of its description.*	<ol style="list-style-type: none"> <li>1. Show not only traffic information on map but also videos</li> <li>2. Set users' favorite routes.</li> </ol>	<ol style="list-style-type: none"> <li>1. Only video can check whether users choose route is congestion or not</li> <li>2. There is no speed or accidents information.</li> <li>3. Only can use in USA</li> <li>4. Traffic information is from Google.</li> </ol>

\*: Resource from Google Play and prepared by authors

## Traffic App Structure



Prepared by authors

## Traffic App Contents

<b>Traffic Information Collection</b>	Social Media, Government, Radio, GPS
<b>Examination / Standards</b>	TMC standard, ISO14819-2
<b>Real Time Traffic Information Contents</b>	Accidents, Speed, Weather, Gas station, Transfer/Interchange information
<b>Transportation</b>	Walking, Airplane, Train, Bus, MRT, High-speed rail
<b>Revenue*</b>	<ol style="list-style-type: none"> <li>1. Add advertisement code to apps' program</li> <li>2. Using free apps attract more users first, then offering value-added service and pay for these service. This idea must attract users first so that there are more chances to earn money. If they can support in multi-lingua, these can attract users try them.</li> <li>3. Pay for download apps</li> </ol> <a href="http://mag.chinatimes.com/mag-cnt.aspx?artid=8128&amp;page=3">http://mag.chinatimes.com/mag-cnt.aspx?artid=8128&amp;page=3</a>
<b>App Store</b>	Google Play, iPhone app Store, Window Marketplace, BlackBerry App World, Samsung Mobile Applications Store Beta, Ovi Store

<b>User Device</b>	Tablet, Smartphone, E-book, PND
<b>Operating System**</b>	Android, iOS, Symbian, Research In Motion, Bada, Microsoft
<b>Calculation Plan</b>	GIS(XML,GML,KML), Positioning:Cell-ID, Enhanced Observed Time Difference (E-OTD), Observed Timed Difference of Arrival (OTDOA), Wireless Assisted GNSS (A-GNSS) and hybrid technologies (combining AGNSS with other standard technologies)
<b>Technologies</b>	RDS-TMC, Internet(WiFi, cable), Automatic Vehicle Identify System, Automatic Vehicle Identification, Automatic Incident Detection , Ultrasound, Infrared, Digital Image Processing, Microwave Radar, Aerial Image Processing, Shortest Path Algorithm, Embedded System Cross-Platform Software Design, Electronic Maps Interface Design, Induction Coil, Maps Information System, Floating Car Data

\*: Resource from <http://albertk.pixnet.net/blog/post/26937765>

<http://stupid77.com/internet/how-free-app-make-money.html>

\*\* : Resource from <http://www.gartner.com/it/page.jsp?id=1924314>

**Prepared by authors**

Facing external environment is important for us to make eco-strategy. In the prior paragraph, we can know real time traffic information's convenience and necessary. To protect environment is a great challenge. In this study, we can find out real time traffic information brings better life quality for our society. Real time traffic information apps' service includes speed, accidents alarm and traffic information at present. According to ARTC, it explains the relation between car speed and gasoline consumption (ARTC, 2010). It tells us there is better average speed for vehicle owners, this better average speed can save gasoline consumption. Therefore, we use the traffic information offered by apps and analyze these apps can bring CO<sub>2</sub> reduction effect (Table 2).

In Table 2 and Table 3, we can find out real time traffic information apps with speed information which can be used to figure out gasoline consumption and CO<sub>2</sub> discharge amount. With the speed prediction of road situation, people can make their decision and know this action brings effect on our society instantly. They can avoid congestion and make alternative strategy before they go out. It would produce too much CO<sub>2</sub> discharge amount when users stick in traffic jam with low speed. Also, we can figure out CO<sub>2</sub> discharge amount and gasoline consumption depends on car speed. Because of these data, users can save their money, time and our nature would be better. This is good for our life and society.

Table 2

<b><u>Energy saving and CO2 reduction come from RTTI APPs</u></b>		
<b>Main value of RTTI</b>	<b>Formula about CO2 emission reduction or energy efficiency</b>	<b>Description</b>
1. Congestion avoidance (new route to prevent from traffic accidents , flooding of under passage, congestion status of tourism places, )*	<p><b>【Gasoline consumption per hour for every type of vehicles in throat situation(Without air condition)】</b></p> <p>According to Taiwan Bureau of Energy's CO2 discharge coefficient, vehicle gasoline is 2.26 kg CO2/L.</p> <p>1. Oversize Vehicle is about 2L/hr. =2*2.26=4.52kg CO2/hr</p> <p>2. Medium weight vehicle is about 1.0~1.4L/hr. =2.26~3.164kg CO2/hr</p> <p>3. Light-duty vehicle is about 0.5~0.7L/hr. = 1.13~k1.582g CO2/hr</p>	<p>Real time traffic apps offer car speed at present, users can know traffic information instantly. Therefore, they can make decisions and choose alternatives depends on information. Then they reduce their time cost for waiting time which causes CO2 discharge amount increases.</p>
2. Accident reporting (APP users can report traffic accident or travel speed)	<p>Users can know road situation to make their efficient decisions and reduce CO2 discharge amount.</p>	<p>Some real time traffic information apps can provide accidents alarm</p>
3. Speed increasing (route with low traffic volume or prevent from congestion) **	<p>Gasoline consumption can save 20% at 90 km/hr than at 110 km/hr. According to Taiwan Bureau of Energy's CO2 discharge coefficient, vehicle gasoline is 2.26 kg CO2/L.</p> <p>If the car gasoline costs 10L/hr at 110km/hr, it means CO2 discharge amount is 22.6kg CO2/hr. → 10*2.26=22.6kg CO2/hr</p> <p>If the car gasoline costs 8L/hr at 90km/hr, it means CO2 discharge amount is 18.08kg CO2/hr. → 8*2.26=18.08kg CO2/hr</p> <p>In conclusion, driving at 90 km/hr reduces 4.52kg CO2/hr than at 110 km/hr.</p>	<p>According to U.S. Department of Energy research report, general vehicle drive at 80 or 90 km/hr which can achieve efficient gasoline consumption.</p>

4. Information obtaining (congestion information, public transportation information: bus, train, airplane )	Users can know road situation to make their efficient decisions and reduce CO2 discharge amount.	Real time traffic apps offer car speed, traffic volume and weather or parking space. Users can know some based traffic information instantly. Also, some apps offer transfer information. Therefore, they can make decisions and choose alternatives depends on information. Then they reduce their time cost for waiting time which causes CO2 discharge amount.
5. Convenience enhancing (to calculate travel time more accurately, make public transportation system useful)	Users can know road situation to make their efficient decisions and reduce CO2 discharge amount.	Some real time traffic information apps offer alternatives for users.
6. Fuel (Petroleum/Electricity) **	<p>Gasoline consumption can save 20% at 90 km/hr than at 110 km/hr. According to Taiwan Bureau of Energy's CO2 discharge coefficient, vehicle gasoline is 2.26 kg CO2/L.</p> <p>If the car gasoline costs 10L/hr at 110km/hr, it means CO2 discharge amount is 22.6kg CO2/hr.  <math>\rightarrow 10 \times 2.26 = 22.6 \text{ kg CO}_2/\text{hr}</math></p> <p>If the car gasoline costs 8L/hr at 90km/hr, it means CO2 discharge amount is 18.08kg CO2/hr.  <math>\rightarrow 8 \times 2.26 = 18.08 \text{ kg CO}_2/\text{hr}</math></p> <p>In conclusion, driving at 90 km/hr reduces 4.52kg CO2/hr than at 110 km/hr.</p>	Because of car speed, users can know their gasoline consumption easily. Then they will start to do efficient decisions.

\*: Resource from

<http://ecolife.epa.gov.tw/userinfo/Cooler/Download/05/99%E5%B9%B4%E6%8E%92%E7%A2%B3%E9%87%8F%E4%B9%8B%E8%BD%89%E6%8F%9B%E4%BF%82%E6%95%B8.pdf>

<http://www.sym-motor.com.tw/09a.html>

\*\* : Resource from

<http://ecolife.epa.gov.tw/userinfo/Cooler/Download/05/99%E5%B9%B4%E6%8E%92%E7%A2%B3%E9%87%8F%E4%B9%8B%E8%BD%89%E6%8F%9B%E4%BF%82%E6%95%B8.pdf>

[http://www.volvotrucks.com/trucks/taiwan-market/zh-tw/trucks/environment/pages/fuel\\_consumption.aspx](http://www.volvotrucks.com/trucks/taiwan-market/zh-tw/trucks/environment/pages/fuel_consumption.aspx)

<https://auto.itri.org.tw/mode.htm>

**Prepared by authors**

**Table 3**

Main value of RTTI	1. Congestion avoidance	2. Accident reporting	3. Speed increasing	4. Information obtaining	5. Convenience enhancing	6. Fuel
i68 國道資訊 HD (Taiwan)	✓		✓	✓	✓	✓
高速公路 1968 (Taiwan)	✓		✓	✓	✓	✓
高速公路 ITS Good Road & ITS Good Road Cam (Taiwan)	✓	✓	✓	✓	✓	✓
路況快易通 (Taiwan)	✓	✓	✓	✓		✓
交通路況隨身行 (Taiwan)	✓	✓	✓	✓		
INRIX		✓		✓		
Glob - Traffic & Radar	✓	✓	✓	✓		
Live Traffic & Weather in HK	✓		✓	✓		
Michelin Traffic	✓	✓	✓	✓		
Waze (Israel)		✓		✓		
Beat Traffic	✓		✓	✓		

**Prepared by authors**

#### **4. Research Result**

Nowadays, smart phones and mobile network grow reliable. Firms, application developers and other related firms find apps and other value-added service brings appreciable profit. This derives many value-added service blooms as fast as they can. In this study, we can know real time traffic information's importance and convenience. It can reduce pollution, save cost and give users choices to make efficiency decisions. According to existing traffic apps, we know that these apps still have some based functions for users, such as traffic volume and traffic information. However, we need to design an app which is closer to users' demand.

About traffic app contents, we consider that we can offer more value-added service for real traffic information. This study wants to serve a real time traffic app which can be close our daily life. When users go to work or school, they may need some traffic information to know road situation and accidents happen or not. For drivers, they may need more about parking information. Also, we can cooperate with stores and offer coupons when pedestrians or drivers. For travelers, it may be more convenient to get sightseeing spots' traffic information. If travelers only see the



existing traffic apps' information, they cannot get real road situation from the platforms.

For our environment, real time traffic information can also make our society better. Users can know their destination's traffic situation first and decide other alternatives or change their plan. It makes users' save their time and money. Owing to greenhouse effect and pollution, energy saving and CO<sub>2</sub> reduction become important issue for our earth. Real time traffic information apps can be one of useful methods for CO<sub>2</sub> reduction. We find out information can be used to calculate gasoline consumption and users' can save their money for gasoline depends on car speed. In this study, we would design a traffic app which includes energy saving and CO<sub>2</sub> reduction information and formula. Users can clearly understand their action would bring high effect on our environment.

With real time traffic information service, firms can decrease users and society's economic loss. Users can make more efficient and effect decisions when facing different traffic situations. That's why this study will discuss how we can design a real time traffic app which can satisfy users really need for their life. Finally, we would get all existing traffic apps' advantages and users' real demand together. We would offer road situation in our daily life or famous landmarks, users can make decision before they go. This study tries to figure out the appropriate traffic app for people and solve their traffic problems in their daily life instantly. People can enjoy and experience this service which can make our earth better.

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