Development of Warning System for Intelligent Transport Systems in the Road Traffic Network Passing Through the Central Provinces of Vietnam

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Abstract– **The research on one of the applications of intelligent transport systems (ITS) in the management and control of transport activities on the road network in order to reduce the risk of traffic accidents is essential. In this paper, the driver information system with warning function for traffic participants about traffic incidents, black spots about the risk of traffic accidents when drivers move through the provinces in central Vietnam region is proposed. This system uses digital maps, Video streaming technique, Internet Information Services (IIS), several programming languages such as Java, HTML, JavaScript, PHP, XML … and is integrated with mobile devices such as phones, tablets. The results also demonstrated that this system not only satisfies desired requirement but also have the ability to replicate across the entire territory of Vietnam.**

Keywords – Intelligent transport system; traffic warning; traffic incidents; smartphone warning; video streaming.

I. INTRODUCTION

Nowaday, the development trend of Intelligent Transport System – ITS applications is the indispensable tendency for many developed countries in the world [1] [2] [3] [4]. In recent years, Vietnam is also in the process of integration and the launch of ITS applications in the transport system and up to this time this term is seem to be falimiar to community as well as researchers in Vietnam [5]. However, because of both subjective and objective reasons that is the understanding of ITS, limited funding and especially is the particular characteristics of cars in Vietnam, so the applications of ITS is very few or have been implemented, but desultory and ineffective, mainly for some highways in the North of Vietnam [6][7]. The typical characteristic of Vietnam transport system is that there are differences in infrastructure, complex type of vehicles, asynchronous management and low awareness of people especially in big cities such as Hanoi, Ho Chi Minh City, Da Nang, Can Tho where 2-wheel vihicles rate reaches nearly 80%... Although the Government has made great efforts in infrastructure development, network planning and traffic demand management and develops public transportation policies, the situation has not made progress, overall picture of urban transport is not clear and there are many remainig weaknesses and shortcomings such as traffic jams in big cities, traffic jam and more and

more hard to control. This fact causes enormous loss to society and order in urban commuter extremely messy, insecurity...Apart from Ha Noi and Ho Chi Minh cites, the largest urban areas in the central region such as Da Nang, Hue, Tam Ky, Quang Ngai have been encoutering the above situation with very serious level traffic accidents in suburb. However, the study of ITS applications in these places is also very limited. The research on theory and experiment for applying intelligent technology to manage the road traffic with paticular characteristics in Vietnam is fresh in the last 10 years and there are some applications of ITS in management and traffic control in urban areas [8][9]. Besides, the solution of information technology applications (or intelligent traffic - ITS) to manage and control the traffic has also been applied in some cities such as VOV systems in Hanoi and Ho Chi Minh. However, this system remains many limitations as requiring a lot of reporters, collaborators, operational technicians and not selective information, which makes confused to the drivers. Moreover, these applications just stop at a small scale, sporadic and not popular as in developing countries. Therefore, the research and implementation of information technology (ITS) in traffic management, construction of warning system for traffic accidents and providing the necessary information to the driver is very essential to reduce the risk of traffic accidents and contribute to improving the efficiency of using the entire road network.

In [10], we have created a database of 28 dangerous points occurred on the 1A highway from Da Nang to Quang Nam - Quang Ngai. Based on this database, we propose the solution to establish an automatic safety warning system for the road traffic in the central provinces of Vietnam via Smart phone system. The main contributions of our work are the following:

Establishing a Server system on PC:

- Have ability to receive location report of objects in traffic and store in database.
- Receive the requirements and transmit the warning information about black point in traffic to the drivers from the database via his smart phone.

Establishing an application software on smart phone:

- Send periodic updates on his location to Server

- Send requirements; receive information about black point in traffic from the stored database in server.

II. RELATED WORK

This section presents an overview of related technology, standards and framework used in the next sections.

A. Video Streaming technique

Video streaming is a quite popular technique in network applications. There are several practical examples such as softwares (media player, web browser ...) on the client computer can access and view video on the server according to the server/client model; video conference; E – learning; Monitoring and remote control over real time images…

Video streaming replays the stored video on network computer to users but does not require them to download this video to their computer. In essence, video streaming is the process of splitting the video into frames and then passing each frame in turn to the viewer's computer buffer and displaying the contents of that frame.

Common techincal steps to carry out video streaming:

- The softwares on Client computer media player, web browser ...) need to connect to the streaming server and determine the desired video file on it.
- The requirement of this video will be sent to the streaming server to find it.
- Streaming program of streaming server will split the video file into frames and send them to client computer using HTTP or RTSP protocols.
- When these frames arrived at client computer, they will stored in buffer and the content of each frame will be play on video player program such as VLC.

B. Internet Information Services (IIS)

IIS is the extensibility master network, which researched and developed by Microsoft using Window operating system. IIS supports HTTP, HTTPs, FTP, FTPS, SMTP, NNTP protocols. IIS is an indispensable component of the Windows operating system, although it may absent in the first few versions (Windows XP Home). IIS is not opened defaulty. IIS Manager is accessed through Microsoft Management Console or Administrative Tools in the Control Panel.

IIS 7.0 provides some new characteristics that help web administrators and Internet Service Providers creating Websites or Web application. The inovation of IIS 7.0 is that increasing the operating efficiency, reliability, meanwhile decreasing using fee and improving Web application environment.

IIS 7.0 structure:

IIS 7.0 is a service of Windows 2012 Server, which means that it is designed to work closely with many other services that run on Windows 2012 Server. Fig.1 shows the relationship between IIS 7.0 and other services you can install on Windows 2012 Server.
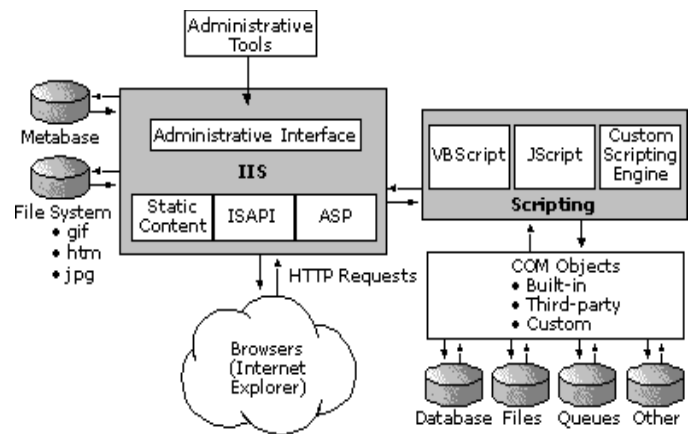

Figure 1. IIS 7.0 structure.

III. SYSTEM ARCHITECTURE AND DESIGN

Intelligent warning systems on traffic safety on the road network passing through the provinces of the central region are described as Fig.2. We have to crreate a database system for real black point in traffic on the road network [10]. Then, the database will be sent to the processing center (server). The data will be collected and compared to the standard data from database. Based on this comparison, the system will provide the safety traffic warning to the traffic participants by the software on smart phones.
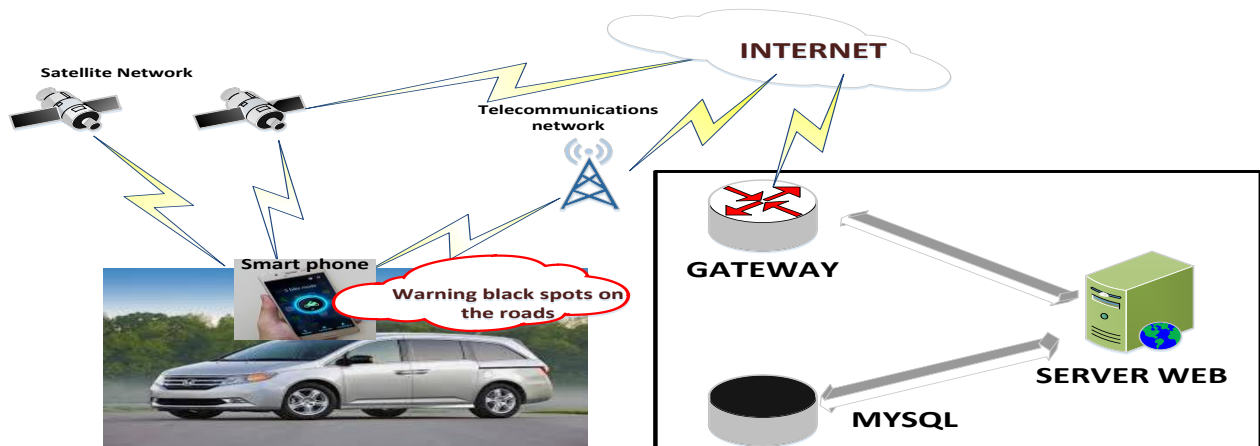

Figure 2. Intelligent warning systems for safety traffic on roads

Base on the above analysis, we construct a new system including:

Server system:
- Have ability to receive the locaton of mobile phone and store it to the database.
- Reveive requirement about location and transmit waring information in the form of video file for mobile.

Warning software on mobile phone:
- Send periodic updates on his location to Server
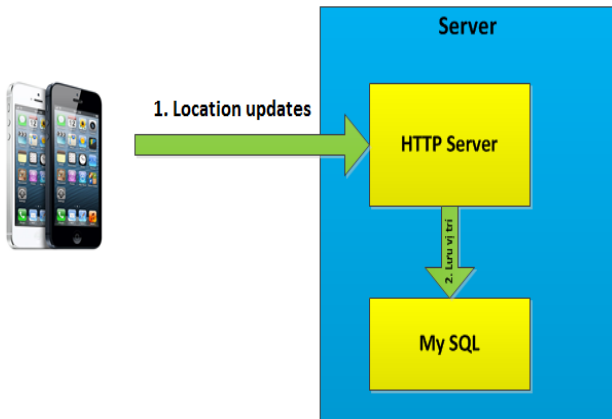- Send positioning requirement and receive waring information in the form of video file from server

Figure 3. Smartphone location updating for servers system block diagram
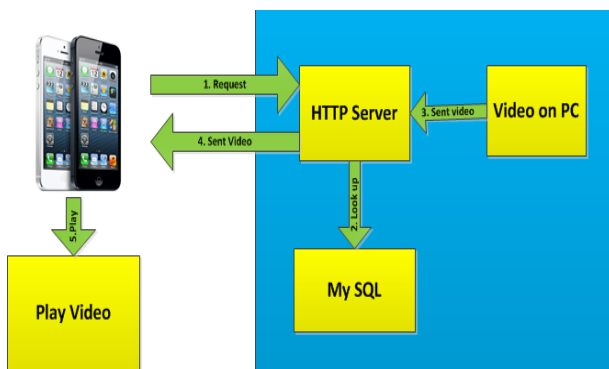

Figure 4. Server – Smartphone warning information transmitting and receiving system block diagram

IV.   SERVER SYSTEM ESTABLISHMENT

Server is constructed base on Window server 2012 Enterpries inclusing:

A.   *Installing and deploying IIS 7.0 services to use Video streaming*

Figure 5. IIS7 Interface

B.   *Installing and programing NodeJs to execute web service and connect to Mysql server to receive the traffic participant's location.*
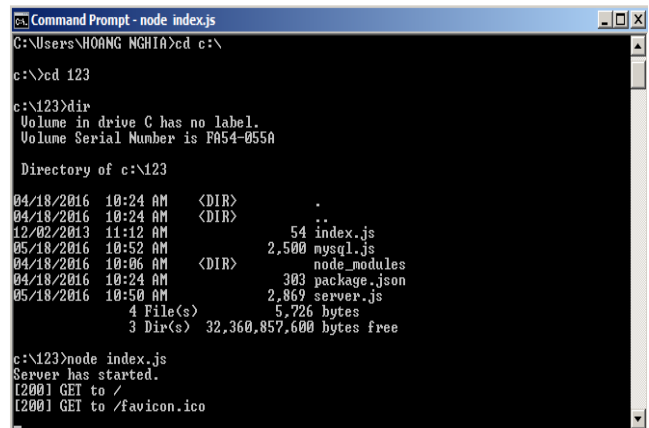

Figure 6. Nodejs Interface

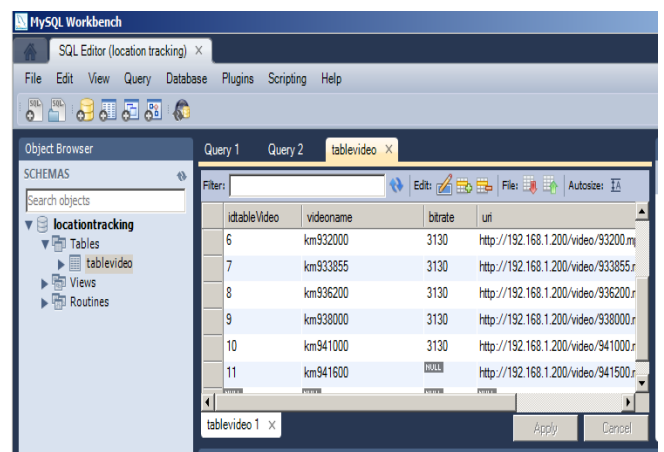C.   *Installing Mysql-essential-5.0.91to store data with Mysql-workbench-gpl-5.2.47 (Management software)*

Figure 7. Mysql-workbench Interface

V. WARNING SOFTWARE ON SMART PHONE IMPLEMENTATION

- The warning software is developed based on Android operating system as in Fig.8. This softwave is programed by Java.
- Using GPS, which is available on mobile phone, to get and send his location to sever periodicaly.
- The software requires Server to send warning information in the form of video file related to his location.
- Android software application with digital map interface displays warning information of that location and automatically plays video files warn.

Figure 8. The interface of warning software on the smartphone

Functions of warning software:

- StopUpdate: turn off the warning service
- StartUpdate: turn on the warning service
- Map: google map
- Videoplayer: play warning video

In order to display warning information, the StartUpdate function need to be turned on firstly. In the next step, after turning on Map functions, the software will display warning location as in Fig.9 and play video file warning as in Fig.10.
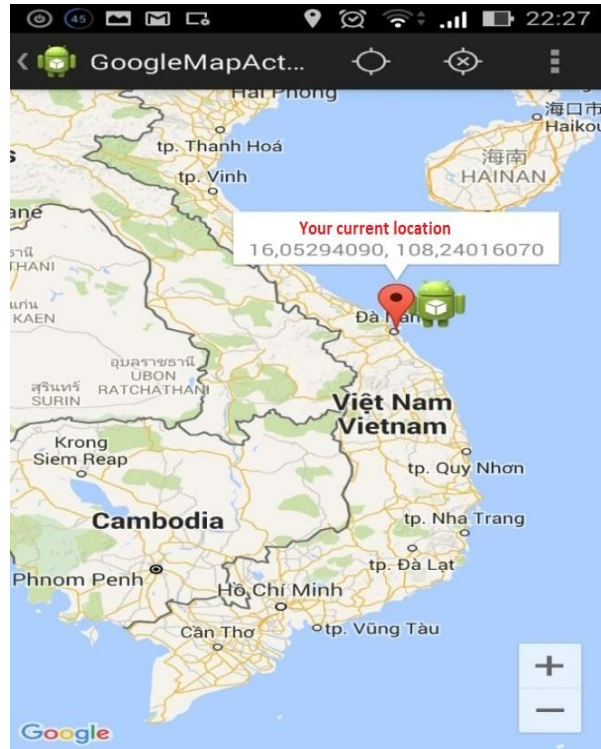

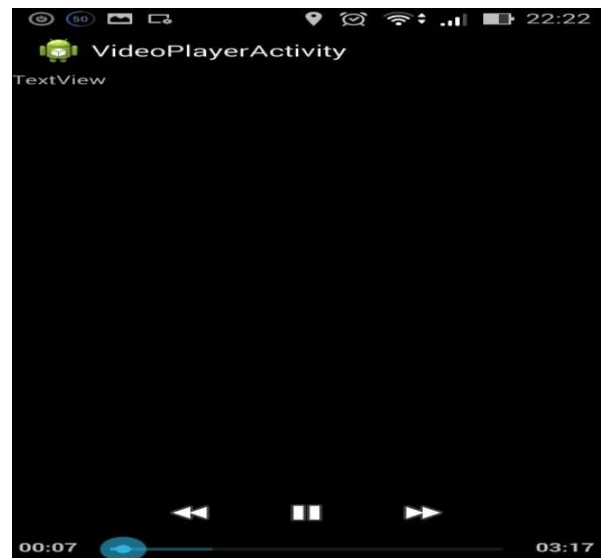
Figure 9. The position of the warned smartphone

Figure 10. Warning Video files

VI. EXPERIMENTAL RESULTS

As the result in [10], we have carried out the practical survey on black points, nearly black point and potentially dangerous points in traffic to get exactly the name and address of road at these points. Then we look for their co-ordinate of Google Map and mark them to make warning network of traffic accidents on 1A highway from Da Nang to Quang Nam - Quang Ngai as Fig.11. Length of this section is 170 km with 28 dangerous points in traffic inclusing 6 black points, 13 nearly black points and 9 potential accident points.
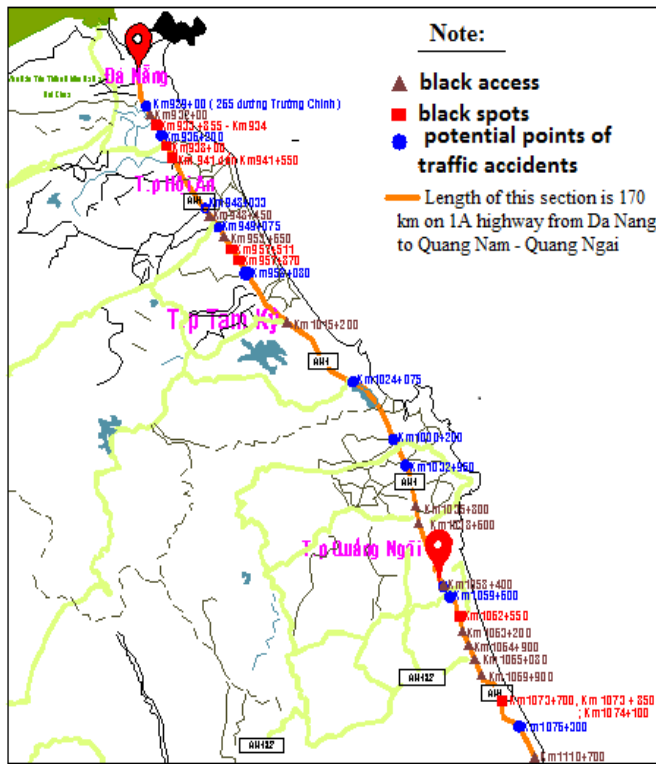
Figure 11. Warning point network of traffic accidents map on 1A highway from Da Nang to Quang Nam - Quang Ngai [10]

Based on the results shown in Fig.11, the warning software on smart phone is created. In order to evaluate the accuracy of warning system, we drove on highway passing throught the central Vietnam Provinces. Driver used his smart phone with warning software and he got the warning information as following:
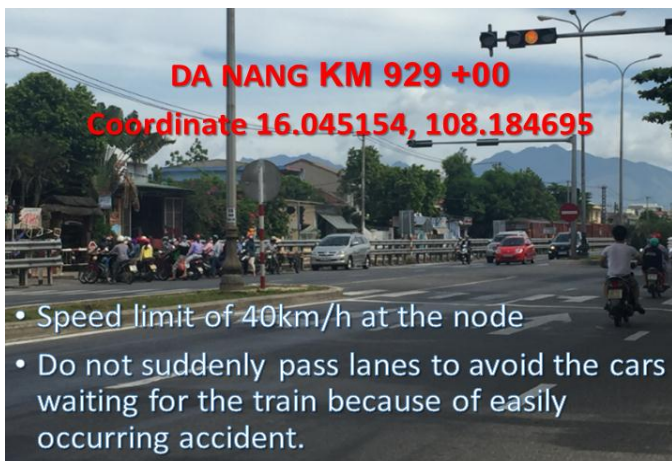
Result 1: Danang KM 929 + 00

Figure 12. Warning result at KM 929 + 00 diocese of Da Nang

Result 2: Quang Nam KM 957 + 870

Figure 13. Warning result at KM 957 + 870 diocese of Quang Nam

Result 3: Quang Nam KM 958+ 080

Figure 14. Warning result at KM 958+ 080 diocese of Quang Nam

Result 4: Quang Ngai KM 1069 + 900

Figure 15. Warning result at KM 1069 + 900 diocese of Quang Ngai

Based on the results shown in Fig.12, Fig.13, Fig.14 and Fig.15, it can be seen that the proposed system has provided accuracy warning messages in comparison with the actual surveys that be done on the highway passing throught the central provinces of Vietnam.

VII. CONCLUSION

In this paper, we used experimental research method to apply smart technology to traffic controlling on the road network in the middle of Vietnam with the specific characteristics in our country. This system is easily installed and it helps the traffic participants to reduce potential accident as well as improve the safety, efficiency and confort of journey.

Based on this paper, in the future, we will propose to build a traffic safety warning system on the entire territory of Vietnam.

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