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Intelligent Transportation System: A Review

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Abstract— Traffic obstruction has been increasing worldwide as a result of increased motorization, urbanization, populace growth and changes in population density. Obstruction reduces productivity of transportation infrastructure and increase travel time, air pollution and fuel consumption. Intelligent Transportation System (ITS) are advanced personify intelligence as such aim to provide innovative service relating to different modes of transport and traffic management. Using participatory sensing data collection from mobile phone sensors owned by people who voluntarily sense their environment and share this information using existing cellular and internet communication infrastructure. By using this technique we can improve transportation productivity and also improve public transportation efficiency. Our focus on frequent traveler to collect their data using mobile phone sensors. We use collected data in research for transportation productivity and also used for capacity building, e.g. road safety, any public transportation capacity, any infrastructures capacity.

Keywords—Intelligent Transportation System; Sensors; Android Application; Data Collection; framework

I. INTRODUCTION

India, the second most crowded country in the world, and a fast increase economy, is seeing terrible road congestion problems in its cities. Building infrastructure, levying proper taxes to curb private vehicle growth and improving public transport facilities are long-term solutions to this problem[1]. The Government of India has committed Rs.2,34,000 corers in the urban infrastructure sector [2]. In our hand no experience of intelligence transportation system (its), nowadays ITS is very important subject for transportation system. ITS is an interdisciplinary research area[1]. ITS (Intelligent Transportation System) has been developed since the beginning of 1970s, which makes human, vehicles, roads united and harmonic and establishes a wider range, fully efficient, real-time and accurate information manage system[3].

In ITS having many application for control traffic and other problem related to transportation system. Two type of system available embedded and wireless system. In embedded system install on road side and wireless system is not install on road, its mobile sensor technology. Nowadays trending technology is participant sensing, participatory sensing is attracting attention for collecting sensor information using Smartphone [4]. Although there are two key advantages to this approach, its low cost and wide range of sensing, they come at the tradeoff of both the battery and storage. With participatory sensing in which users observe surrounding conditions with portable terminals such as Smartphone, information of a particular area is not collected using a specific sensor but rather many users over a wide area. When users Smartphone are utilized as sensors, anyone can observe only by the distribution of the application and it is possible to collect data over a wide area [5].In this paper we can collect the data using participant sensing and this data using for capacity building in transportation system. Capacity building is very important for transportation infrastructure because by capacity building we can proper utilize the transportation infrastructure and cost effective build infrastructure. This paper is all about the capacity building of infrastructure and improves public transportation. So those governments can properly management the transportation system and also survey of particular area by using the participant sensing technique.

This paper presents a review about the Intelligent Transportation System (ITS) and their benefit for transportation productivity. Section II we present the Literature Review of different transportation methods and technologies. It also gives some main challenges and issues about the transportation system. In section III, shows the proposed work of the System, Section IV Conclusion.

II. LITERATURE REVIEW

In order to study all the existing approaches for capacity building in Intelligent Transportation System (ITS), we have reviewed in detail available solutions for detect frequent traveler in participatory sensing with their objective. We have also analyzed challenges and issues involved in this approaches. With the help of this literature review we have formulated our problem definition as "A detect frequent traveler data using participatory sensing for capacity building".

Participatory Sensing is the concept of communities (or other groups of people) contributing sensory information to form a body of knowledge. All crowd sourcing applications rely heavily on determining the location of user using different sensors such as GPS, GSM, Wi-Fi etc [4]. Introducing even a relatively simple extension to the basic service, like a

timetable updated in real-time, calls for the deployment of a costly vehicle tracking infrastructure (consisting of sensors; communication and back-end informatics system; front-end user devices; etc).

The transportation mode such as walking, cycling or on a train denotes an important characteristic of the mobile user's context. They propose an approach to inferring a user's mode of transportation based on the GPS sensor on her mobile device and knowledge of the underlying transportation network. The transportation network information considered includes real time bus locations, spatial rail and spatial bus stop information [10]. We identify and derive the relevant features related to transportation network information to improve classification effectiveness. Another motivation for transportation mode detection is transportation surveys. Travel demand surveys have taken multiple formats, such as telephone interviews and questionnaires. These data collection strategies rely on manual labeling of data after the trip, and thus, inaccuracies are introduced.

A. Chalanges

In Intelligent Transportation System collect data from frequent traveler and used that data for research purpose it is very difficult to implement. Following different type of challenges given.

1. Advanced Traveler Information Systems: Advanced Traveler Information System (ATIS) is any system that acquires, analyzes, and presents information to assist surface transportation travelers in moving from a starting location (origin) to their desired destination. The technical performance of these systems varied greatly depending on the type of system. Most pre-trip systems did not introduce cutting edge technology but rather new configurations of existing technologies. These new configurations worked well after some initial data integration problems were rectified. Enroute systems had a wider range of technologies. Some personal communication devices were difficult to read because of poor back lighting. The in-vehicle devices tested performed well.

Advanced traveler information includes static and real-time information on traffic conditions, and schedules, road and weather conditions, special events, and tourist information. It can be offered with value added options like sports scores, stock quotes, yellow pages and current news. ATIS is classified by how and when travelers receive their desired information (pretrip or en-route) and is divided by user service categories. Operations essential to the success of these systems are the collection of traffic and traveler information, the processing and fusing of information - often at a central point, and the distribution of information to travelers. Important components of these systems include new technologies applied to the use and presentation of information and the communications used to effectively disseminate this information.

2. Advanced Public Transportation Systems: Advanced public transportation systems (APTS) seek to apply transportation management and information technologies to public transit systems to increase their efficiency of operation and improve the safety of public transportation riders. Examples of APTS applications include real-time passenger information systems, automatic vehicle location systems, bus arrival notification systems, and systems providing priority of passage to buses at signalized intersections. Advanced Public Transportation System consists of three related technologies: A Digital Geographic Database (DGD), An Automated Trip Scheduling System (ATSS), and Automated Vehicle Location Equipment (AVLE). However, because the commercial vehicles and indeed almost all the vehicles in the study area are not installed with AVLE, this aspect of APTS is not included in the developed software package. The ATSS technology automates many aspects of trip reservation which enhances the service quality to transit users (commuters). For example, customers are able to book rides with the transit agency more easily and reliably, well ahead of the actual time of the trip. The critical information of whether vehicles are available and the operating bus departure headways are helpful ITS framework for an urban trip making network. Furthermore, workload of schedulers or operator could be significantly reduced as ATSS is capable of providing all desired information such as trip schedules, transportation fare, and availability of carriers at their finger tips while booking ride requests. Desired information on the screen in a timely manner as well as the headways at particular times of the day are also available.

3. Detect frequent traveler: The collection of high quality traffic data is one of the basic requirements for traffic studies. It is unquestionable that traffic data is the primary source for any kind of traffic and transportation projects and necessarily the data should be reliable and precise. The manual method of data collection involves deployment of huge number of man power and there are relatively more chances for errors in data collection. The technological advancements have brought out much advancement in of traffic data collection. The current ITS collect an enormous amount of data about the operations of the transportation systems and transmits data into different forms to be used by the authorities, carriers and other actors of the transportation networks. A part of this collected and transmitted data is not useful and in many cases very detailed data is still processed and acted upon by the human operators without having enough decision-support tools. Identification of the types of transportation information that are used or supported by the ITS and its effect on transportation functions and performance dimensions is an initial step for making such systems more effective for the operators. It might lead to further developments of ITS in a way to fill the information demands of the actors of the freight transportation networks more effectively. According to complex aims and effects of ITS including efficiency, safety, and environment makes evaluation of ITS a complicated issue. The reviewed literature in this area indicates a lack of a general overview on the way that ITS contribute to supporting the transportation functions and improving the performance dimensions considering the types of information that are used or supported by such systems.

B. Issues

There are a range of other technologies that can improve transport outcomes, particularly in the areas of vehicle design for example car frontal impact technologies, alternative fuels or the use of carbon fiber to build lighter, more fuel efficient airliners. Some of these technologies face issues similar to those faced by ITS (for example the role of international standards) and are very much of interest to government. However, the focus of this conversation paper is on those technologies that specifically support the development of ITS systems.

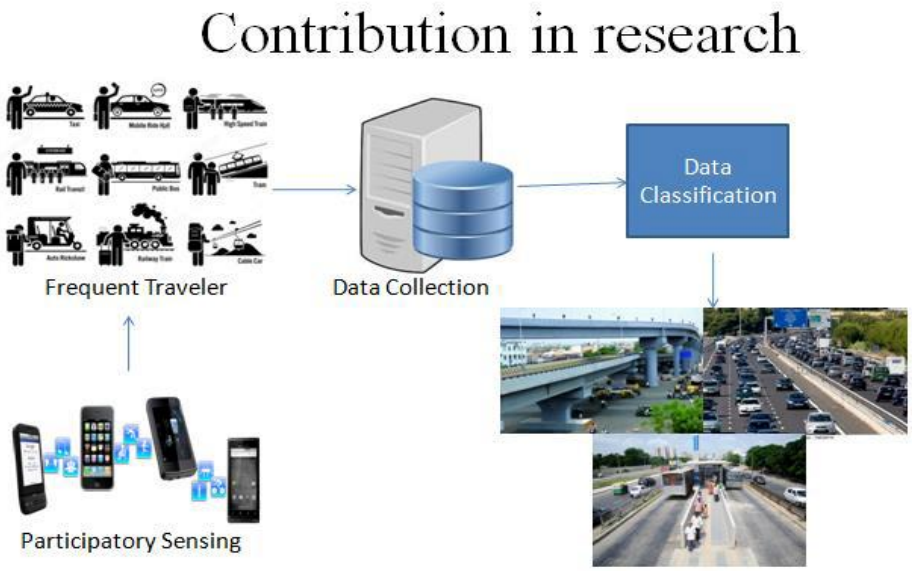
1. Road traffic congestion: Road traffic congestion is a recurring problem worldwide. In India, a fast growing economy, the problem is acutely felt in almost all major cities. This is primarily because infrastructure growth is slow compared to growth in number of vehicles, due to space and cost constraints. Secondly, Indian traffic being non-lane based and chaotic is largely different from the western traffic. The characteristics of Indian roads and traffic make the problem interesting to solve. There is scope for evaluating existing ideas in different and challenging traffic scenarios, innovate new solutions and empirically evaluate ideas in collaboration with public and private sectors.

2. Collected data from Participatory Sensing : Using participatory sensing we can collect the amount of data real time. With the spread of high-performance mobile terminals that include sensors, participatory sensing is attracting attention for collecting sensor information using Smartphone. Although there are two key advantages to this approach, its low cost and wide range of sensing, they come at the tradeoff of both the battery and storage. Therefore, efficient collection is required. There is also a challenge posed by how to collect data from environments in which the network infrastructure does not work. Classification technique is used to solve the above challenges which classify the big data according to the format of the data that must be processed, the type of analysis to be applied, the processing techniques at work, and the data sources for the data that the target system is required to acquire, load, process, analyze and store. With participatory sensing in which users observe surrounding conditions with portable terminals such as Smartphone, information of a particular area is not collected using a specific sensor but rather many users over a wide area. When users Smartphone are utilized as sensors, anyone can observe only by the distribution of the application and it is possible to collect data over a wide area. There have been several studies on participatory sensing using Smartphone Research on data collection in the event of a disaster has been carried out, but participatory sensing using a Smartphone that can connect to the Internet is not utilized in most of these data collection methods. Therefore, in this paper we focus on an efficient method of collecting data observed by participatory sensing under the assumption that a Smartphone cannot connect to the Internet.

3. Infrastructure Cost: To support the deployment of ITS to address the challenges facing the transportation system, the JPO has developed a suite of knowledge resources. This collection of four Web-based resources provides ready access to information supporting informed decision making regarding deployment and operation of ITS to improve transportation system performance.

III. PROPOSED FRAMEWORK

Proposed Architecture is contributed in Transportation area that refers Intelligent Transportation System (ITS) techniques help for the research in particular part of the transportation. In this system participatory sensing used that is very important and efficient for this research.



In this system main components are participatory sensing, frequent traveler, data collection system, data classification techniques given [5]. Data on which all the classifiers and features are tested have been collected by different people in varying conditions (fast, slow, indoors, outdoors, straight stairs, round stairs, etc). A variety of activities like walking, running, jumping, jogging, sitting, standing, ascending and descending stairs were performed to create the dataset. Also, to check consistency of our results, same activity is performed on different phones and compared.

A. Acceleration Module

We have used a binary classifier to classify the movements of users, where resulting values close to 1 predict staircase pattern while values close to 2 show occurrence of other activities. This module takes 20 samples per second and buffer the data for 10 seconds to detect the event. There are two options to implement this module either to train the system on client side or deploy a preprocessed training model. It is a difficult task to make the system learn about the staircase pattern on client side. That will involve a lot of user intervention. So a training model is created and deployed with the Android application [7]. Training set includes two types of data sets which is collected from various devices for different activities and then labeled. First set contains actual bus boarding event and staircase climbing data. The second set includes all other remaining activities . Various features are extracted from raw acceleration data and a training model is created for classification. We analyzed various classification techniques on different feature sets and found Support vector machines gives best results.

B. GSM Module

It has two sub modules. First is to look for continuous acceleration vector in one direction for a long period and second is to start polling for location changes using low power GSM data for speed estimation. Algorithm explains the detailed flow of the approach. This algorithm is implemented in Android app. Initially, acceleration module is started and if it detects moving pattern continuously together. Otherwise, acceleration module starts polling for continuous acceleration vector detection and GSM module for speed detection. Acceleration module is polled at 10 seconds intervals now and GSM module at 1 minute intervals. If either of them gives positive result, the event is detected, else initial pattern recognition is deemed as false and restarted [15].

C. Analysis of different classification techniques

Our first analysis was to check the accuracy of different classifier for moving prediction using accelerometer data. In travel mode identification event, duration of moving pattern is very big. In this data set, we labeled the moving activity as class 1 and all other activities as class 2. Different classifiers such as Support vector machine (SVM), Decision tree classifier and regressor, Naive Bayes (Gaussian, Bernoulli), stochastic gradient descent and Nearest neighbor are trained on this data set. After training, these classifiers are deployed in our android app and volunteers tested these to detect the travel mode event [12].

IV. DATA CLASSIFICATION

Here, we given the work flow of how classified the sensor data that collect by help of participatory sensing technique. Data classification is main part of the research. Because we have big data collection for accurate result.

A. *Processed data*

This data are collect from the mobile sensors using participatory sensing technique. Collect data from mobile we use android application that collect participant mobile sensor data. The acceleration and rotation are important parts for motion profiling. Noise is introduced into these data by activities such as suddenly picking up the phone, walking inside a subway/bus and other activities which are irrelevant to the travel mode[8].

B. *First-Level classification*

In this classification first we classified wheeled and non-wheeled travel mode .our main focus is wheeled travel mode, so we only process on wheeled travel mode data. Here, for classification we are using data mining classification. In the data mining many algorithm uses for classification.

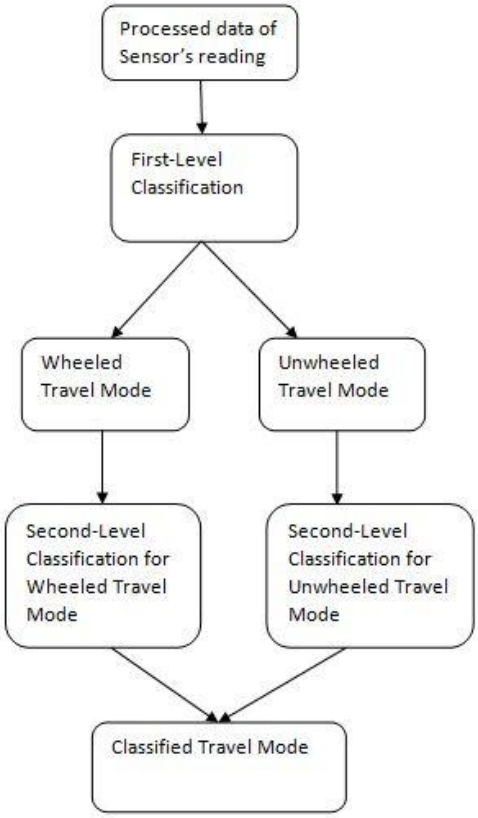


Fig 2:

C. Second level classification

After first level classification we classified wheeled and non-wheeled travel mode. we focus on wheeled travel mode and classified it. Using data classification algorithm we classified different travel mode using the sensor data. Here we classified car, bike, bus, cycle, auto five travel mode. We divide the collected data into the initial training set, the add up training set and the test set with certain ratios[8]. The initial training set is used to train a general model. In initial training set, the data is a mixture of multiple users' travel data. The add up training set for one specific model will only include a single person's travel data.

V. CONCLUSIONS

In this paper we have focused on the Frequent Traveler to capacity building for transportation infrastructure. Here also we use participatory sensing technique for collect the real time data. Our application is built on the latest Android platform with multimodality sensors. By carefully designing the time domain and frequency domain features, together with a hierarchical classification model, our classification system design complies with all the design principles and achieves all the five travel modes.

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