INTEGRATED STATISTICAL APPROACH FOR SMART CITY IN INDIA USING IOT, A CASE STUDY

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Abstract

The proposed paper compares various schemes for calculating the pedestrian count or vehicles in any smart transportation scheme. The smart city concept is going to flourish in India within few years with complete integration with real time computing and decision making platform. One of the parameters for achieving this vision is to monitor continuously the pedestrian and vehicle traffic in each of the roads and major junctions of the road. The traffic monitoring helps in long term decision making especially while formulating transport policies and budgets. It also guides the law enforcement agencies to properly understand the variations of such traffic and properly take precautionary measures like installation of security cameras and other control measures.

Keyword: Smart city, smart transportation, sensors;

Introduction:

It has been recognized that cities are the engines of growth and are drawing a million people every minute from rural areas. Based on expert opinion, [4] global urban population would double by 2050 as more and more people are moving towards cities at a steady pace every single day. It means adding an equivalent 7 New Delhi cities every single year.

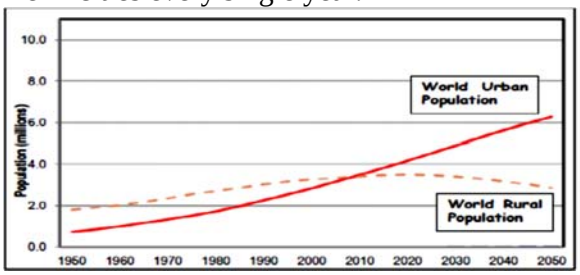


Fig. Urbanization trend: [4]

Compared to China which has over 160 cities each with population above one million, India possess only 40 such cities. To meet these challenges drastic increase in the number of cities should be proposed. To support the development of newer cities challenges of urban transportation and mobility needs to be addressed immediately. A comprehensive and support policy framework for urban transportation needs to be developed for establishing new smart cities with sustainable urban spaces.

One of the desired outcomes while designing a Smart Cities [4] is to promote cities that provide core infrastructure and offer quality of life to citizens, a clean and sustainable environment and application of 'smart' solutions, but the Smart Cities Mission still has its own challenges [1] to face. Some of the difficulties are discussed below.

The High Power Expert Committee (HPEC) on Investment Estimates in Urban Infrastructure has assessed a Per Capita Investment Cost (PCIC) of Rs. 43,386 for a 20 year period. The above mentioned estimate also covers sewerage, water supply and infrastructure for transportation. The total investment estimation required for the services of HPEC comes close to Rs.7.0 lakh crores over 20 years, using an average figure of 1.0 million people in each of the 100 smart cities. This translates into an annual requirement of Rs.35,000 crores. However these estimates need to be analyzed for the purpose of funding by the Central Government. Therefore, a large part of the financing for Smart Cities will have to come from the Private sector with the States/Cities and the Central Government only supplementing that effort.

The Central Government's support will be in three forms:

(i) Financial support

As huge investment is needed innovative methods of raising revenue have to be developed by the states and adequately supplemented by central government through the Ministry of Urban Development and other related ministries specifically collaborating

(ii) Policy support and legal backing

Even though urban development is a state subject as per the Constitution of India, Central government plays a supporting role in facilitating appropriate policies that provide a framework for urbanization. Developing 100 Smart Cities across the country will need a large number of professionally trained manpower and several decision support systems to be in place.

(iii) Approval Process

The States would be required to submit proposals for approval of the respective Satellite Cities, Cities of Tourist and religious importance as well as Cities in the 0.2–1.0 million population range, These proposals would be reviewed by a Committee that will be serviced by a regional multidisciplinary Programme Management Unit. Retrofitting existing legacy city infrastructure to make it smart: There are a number of latent issues to consider when reviewing a smart city strategy. The most important is to determine the existing city's weak areas that need utmost consideration, e.g. 100 percent road access to pedestrians and improving the road infrastructure to achieve citywide efficiencies can be a significant challenge.

Financial policy decisions have been usually affected by the inappropriate data substantiating the urgent requirements of the cities. Providing clearances in a timely manner is a major issue to be resolved. For timely completion of the project, all clearances should use online processes and be cleared in a time-bound manner. A regulatory body should be set up for all utility services so that a level playing field is made available to the private sector and tariffs are set in a manner that balances financial sustainability with quality. Cities need to shift towards renewable sources and focus on green buildings and green transport to reduce the need for electricity. Unnecessary utilization of public fund in infrastructure projects and its enhancements should be properly analyzed with reliable data before its been finally approved.

In the proposed paper we evaluate the effectiveness of various sensors for counting vehicle traffic and with the help of an analytical model the effective technique for the same is analyzed. The analytical method helps to utilize the data collected by counting the vehicles using vehicle counters and provide funding guidelines to government agencies. The analytics help to learn more about trends and traffic patterns so that policy settings and decision making process will get more insight and information.

1.1Motivation

In today's world, In order to continued business success and growth automation and data are essential. Vehicle counters [2] solve the issue of collecting both vehicle information and vehicle counting. Most companies and organizations have a general idea of the traffic in and out of their facilities, but they facing a big issue for make strategic decisions according the huge number. Sales and activity which help us to get a huge idea about what has happened throughout the day, week or month, but if we want to know about the traffic with the vehicle counters and analytics software, you must want to capture some knowledge on pattern, trends and opportunities.

Manual counts

One of the simplest methods is manual counting of pedestrians and vehicles. It is a simple as well as an accurate method of traffic counting, which comprises people manually counting vehicles. In this method the people who stand at the side of the road takes count using an electronic hand held counter or record data using tally sheet. Also most of them watch the recorded video and take the counting from that. This method having the accuracy 99%, in a small sample of data is taken - typically over less than a day - and results are extrapolated for the rest of the year or season.

Video Vehicle Detection

Manual intensive is a major drawback of manual count method. There are number of systems which are used to analyze the video and detecting cars with a similar accuracy to that of people watching the video. This process automates the counting of vehicles. This method is not only cost effective, but it can also count vehicles in any direction. One of the advantages

of this process is that it requires only one camera for several lanes.

Minimizes the bandwidth usage because of the local video. Through Internet the counts can upload, so traffic engineers can view live (down to 15 minute intervals for example) and historic counts from their web browsers. Count can be verified by watching the video and checking the automated counts. Video traffic counting typically takes place continuously, year round, giving precise figures.

Pneumatic Road tube counting

This has for many years been a popular method of vehicle sensing. Here we stretching more than on rubber across the road and connected at one end to a data logger. The other end of the tube is sealed. Air pressure in the squashed tube get activates when a pair of tube hits the tube the data logger which records the time of the event.

We can stretch a pair of tube in several lanes. By identify which tube hit first by the wheel; it's able to know the direction. The only one drawback for this mechanism is that if two vehicles cross the tubes at the same time then the direction can't be accurately determined. Should two cars be very close together when they cross the tubes, the system may see them as one multiaxle vehicle?

Vendors claim an accuracy of 99%. Studies show though, that the absolute error of a typical 15-minute count averaged closer to ten percent. This pointing that the level of inaccuracy is being masked by the positive and negative counting errors cancelling each other out. From the loggers we need to be physically downloaded the counts onto a computer at the roadside .There should be at least one road tube for each direction on every road or junction at which you want to count. Installation requires working within the traffic lane. Road tubes work well for short duration counts on lower volume roads. But these are not as effective on higher volume, multi-lane highways.

Piezoelectric Sensor

By converting mechanical energy into electrical energy piezoelectric sensors collecting the data. The piezoelectric sensor [2] is mounted in a groove cut into road's surface. The piezoelectric sensor get squeezes, when a car drives over it and causes an electric potential - a voltage signal. The size of the signal is proportional to the degree of deformation. , The voltage reverses, when the car moves off. This change in voltage can be used to detect and count vehicles.

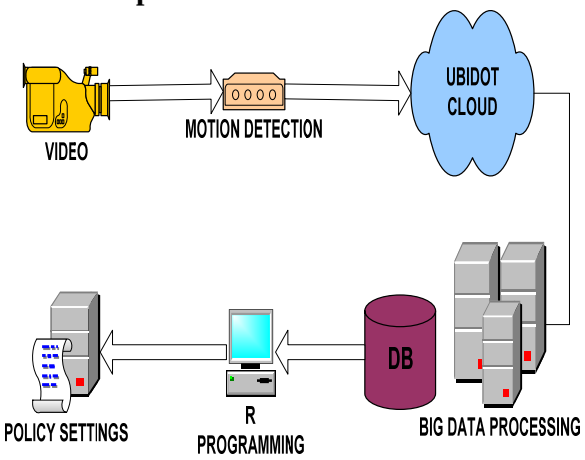
Inductive Loop

The square of wire embedded into or under the road is the inductive loop. The principle that utilizes by the loop is that a magnetic field introduced near an electrical conductor causes an electrical current to be induced; A large metal vehicle acts as the magnetic field in the case of traffic monitoring and the inductive loop as the electrical conductor. The signals generated are recorded by the device at the roadside.

Magnetic Sensor

The change in the earth's magnetic field is measured as the vehicles pass over the detector; these measurements are used in this mechanism to detect the vehicle. The sensor is either buried in the road, or enclosed in a box by the side of the road. If vehicles are following each other very closely, the magnetic detector may have difficulty discriminating between them.

Proposed Architecture:



Experimental Results:

The count taken from various sources can be compared and based on the location and priority, the appropriate type of sensors or counting device can be selected. The count of pedestrians and vehicles gives directed design plans for laying funds in future infrastructure projects. The government agencies like public works department can get the fund allocated with authentic data without delays. The policy makers make use of such automated counting system to get better idea about developing predictable

models. The counting system can be effective if it can be integrated with cloud platform like Ubidot. Ubidot or other cloud platforms act as one of the future extension to the predictive automated counting system. Such integration gives better analytical decision making data in time for policy makers.

References:

1. An Investigation on the Manual Traffic Count Accuracy, Procedia - Social and Behavioral Sciences 12/2012;43: 226-231.DOI: 10.1016/j.sbspro.2012.04. 095
2. Accuracy of Pneumatic Road Tube Counters. McGowen and Sanderson. A report prepared for the 2011 Western District Annual Meeting Institute of Transportation Engineers Anchorage, AK May 2011.
3. Traffic Monitoring Guide, 2013, U.S. Department of Transportation.
4. India. Ministry of Urban Development, Draft Concept Note on Smart City Scheme, p.1.
5. H. Schaffers N. Komninos M. Pallot B. Trousse M. Nilsson A. Oliveira "Smart cities and the future internet: Towards cooperation frameworks for open innovation". The Future Internet Lect. Notes Comput. Sci. vol. 6656 pp. 431-446 2011.
6. M. Dohler I. Vilajosana X. Vilajosana J. Llosa "Smart Cities: An action plan", Proc. Barcelona Smart Cities Congress pp. 1-6 Dec. 2011.
7. J. M. Hernández-Muñoz J. B. Vercher L. Muñoz J. A. Galache M. Presser L. A. Hernández Gómez J. Pettersson "Smart Cities at the forefront of the future Internet". The Future Internet Lect. Notes Comput. Sci. vol. 6656 pp. 447-462 2011.
8. N. Bui M. Zorzi "Health care applications: A solution based on the Internet of Things" Proc. ISABEL pp. 1-5 Oct. 2011.
9. https://www.kochimetro.org/wp-content /uploads/2014/11/Traffic-Transportation-study-report-for-kochi.pdf.
10. URL: http://smartcities.gov.in/content/
11. http://www.mospi.gov.in/statistical-year-book-india/ 2016/190
12. https://www.natpac.kerala.gov.in/images/-ar2010-11.pdf