



Study of Intelligent Transportation Systems in India

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ABSTRACT

Avenue site visitors' congestion is a habitual hassle international. In India, a quick growing economy, the problem is acutely felt in nearly all predominant towns. That is typically due to the fact infrastructure growth is gradual compared to boom in wide variety of cars, due to space and value constraints. Secondly, Indian traffic being non-lane based and chaotic is basically unique from the western visitors. The distinction can be understood completely handiest via experience; however a few instance eventualities can be seen at. For this reason, clever shipping systems (ITS), used for efficient visitors' management in evolved international locations, cannot be used as it is in India. ITS techniques ought to go through version and innovation to fit the contrasting visitor's characteristics of Indian roads.

On this role paper, we present a complete take a look at of all to be had ITS structures, inclusive of each research prototypes and deployed structures. We next pose a hard and fast of thrilling open research troubles inside the context of Indian ITS. Finally, we listing a hard and fast of public and private organizations that play a function in Indian traffic control and research, as significant collaboration between discipline practitioners and researchers are needed for efficient switch of applicable era. Although our paper focuses on the Indian site visitor's scenario because of our arms-on experience of running with it, many of the problems and solutions mentioned in this paper are relevant for different developing international locations as properly.

Keywords: GPS,GPRS,Intillegent Transport system, Sensor, Wi-fi.

INTRODUCTION

India, the second maximum populous us of a in the world, and a quick developing economic system, is seeing horrible road congestion troubles in its towns. Constructing infrastructure, levying right taxes to lessen non-public car growth and enhancing public shipping facilities are lengthy-term answers to this hassle. These permanent solution techniques want authorities' intervention. The government of India has dedicated Rs.234, 000 corers[1] inside the urban infrastructure region. Bus rapid Transit (BRT), metro rails and mono rails are being built in extraordinary cities to encourage the usage of public shipping. However still there is a steep boom of personal motors. A few towns like Bangalore, Pune, Hyderabad and Delhi-NCR, with their sudden growths within the IT sector, also have a steep increase in population, further increasing transportation desires. Assembly such boom with infrastructure increase is outwardly infeasible, often because of space and fee constraints. Sensible management of visitors flows and making commuters more knowledgeable about visitors and road



repute can reduce the terrible impact of congestion, though cannot solve it altogether. This is the concept in the back of shrewd shipping systems (ITS). ITS in India, but, cannot be a mere replication of deployed and examined ITS inside the advanced nations. The non-lane based disorderly visitors with excessive heterogeneity of vehicles, need the present strategies to be tailored to the Indian scenario, before they may be used. As a result ITS inside the Indian context desires large R&D efforts. ITS is an interdisciplinary research area Constructing road sensors need embedded systems historical past. The use of cellular phones for sensing wants cell computing history. Studying sensed information desires sign processing or laptop vision background. Verbal exchange amongst sensors and traffic manipulate authorities need stressed or Wi-Fi networking heritage. The site visitors' classification and prediction algorithms need machine gaining knowledge of or data historical past. Applications like visitors signal control want transportation engineering history. So the ITS literature could be very tremendous with papers appearing in apparently unrelated venues. In this paper, we make a complete listing of ITS literature, to offer an outline of all existing strategies. We follow it up with a set of open research questions within the context of Indian roads and traffic. sooner or later, we list a fixed of public and personal sector corporations and educational establishments, [2]who are lively in studies or application on this area, as meaningful collaborations and generation switch should show up if research has to make any practical effect.

II. APPLICATIONS OF ITS

Indian traffic can gain from several feasible ITS applications. One set of packages is for traffic control.

- 1) **Intersection manipulate**- At intersections, finding out the overall sign cycle and the cut up of green instances among specific flows, is one of the most primary visitors control programs .
- 2) **Incident detection**- Pinpointing locations of injuries or car breakdown is important to deal with the emergency conditions.
- 3) **Automobile type**- knowing what form of motors, and in what proportions, ply a positive road stretch, facilitates to pick out appropriate street width and pavement substances.
- 4) **Tracking** - pollutants and road high quality monitoring are essential for taking corrective measures.
- 5) **Revenue collection** - Toll taxes for infrastructure renovation and fines for rule enforcement want to be collected.

Ancient visitors' facts- long term data enables to plot new infrastructure, calibrate visitors signal instances, upload public shipping and so on.

Every other set of applications can aid the commuters 'on roads.

- 1) Congestion maps and travel time estimates - these help commuters in course choice.
- 2) Public transport information - statistics approximately arrival of public transport enables in preference of tour mode and reduces wait delays.
- 3) Individual automobile control- Getting statistics approximately parking places or estimates of carbon foot print assist proprietors of personal cars.
- 4) Accident handling- Emergency offerings after accidents are a essential necessity.

Sensing: To deal with any road software, the first aspect that we need is data from the road. Sensors on roads can offer such data. There are several current modes of sensing:



Static sensing: in which sensors are statically located on the street,

Mobile sensing: where sensors are located inside the Shifting automobiles.

Hybrid sensing: where in both in-automobile and on-avenue infrastructure are wished. On this segment, we speak the key technology in every class and outline a few open questions in the context of Indian roads.

Static Sensing: Techniques

- 1) **Loops and magnetic sensors** - car detection and counting using magnetic sensors or loops under the street floor, has been explored in studies and deployed Structures.
- 2) **Photographs and videos** - Video surveillance to screen visitor's states and locate incidents and hotspots is fairly not unusual Gives complete survey of the essential computer imaginative and prescient strategies utilized in site visitors programs.
- 3) **Acoustic sensors**- some latest research is being achieved to use acoustic sensors for site visitor's state estimation, mainly in growing areas, wherein site visitors being chaotic is noisy.
- 4) **RF sensors**- Wi-Fi radio positioned across the street have verbal exchange alerts affected by means of vehicular movement in between. There are business merchandise and research efforts the usage of this for traffic tracking.

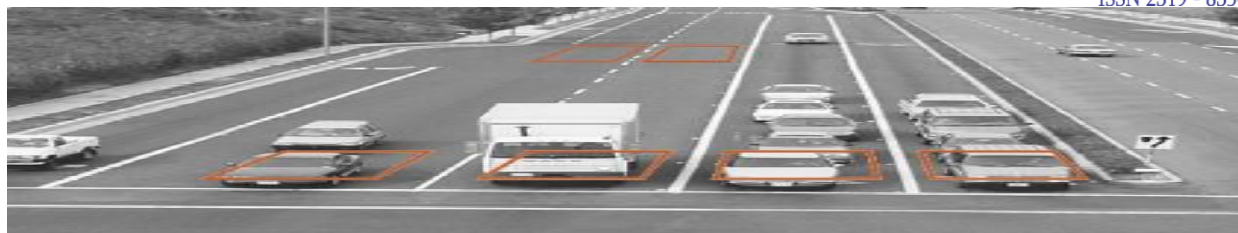
Static Sensing: India Specific Questions

Adapting to chaotic site visitors - Magnetic loops have historically been used in developed nations with lane-primarily based [3]orderly traffic (see Fig. 1.1) (a). Loops are placed underneath every lane. How have to the position been in absence of lanes? (Fig1. 2) What techniques to matter and classify vehicles could work for heterogeneous traffic that passes in a chaotic fashion?

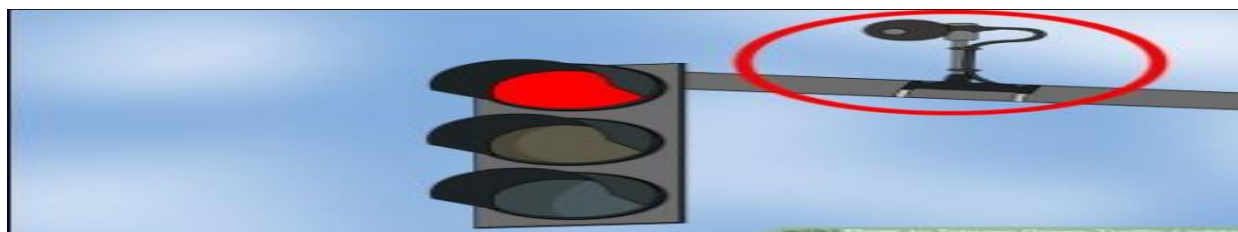
In addition, imaginative and prescient algorithms exist for settings like Fig.1.1 (b). Is an initial work on photo processing algorithms for chaotic site visitors? The algorithms in are offline, so the alternate-off between computation and verbal exchange isn't always understood. Additionally the sensing accuracy itself has been examined on most effective 2 minutes of video clip. Is any other current work to apply low first-rate images from CCTV for site visitors sensing. But computational overhead, real-timeliness and accuracy of the designed algorithms haven't been evaluated. consequently for present sensing mechanisms like loops and pix, several components like sensor placement, actual time algorithms to degree chaotic site visitors, implement ability of algorithms in on-avenue embedded structures, computation vs. conversation to remote server alternate-offs, accuracy to deal with exclusive applications and so forth. Ought to be cautiously designed and empirically evaluated in actual settings.



(a)



(b)



(c)

Fig1. 1 Loops and cameras in lane based traffic

New techniques for chaotic Indian traffic- other than adapting conventional sensors to chaotic visitors, efforts may be made to layout new sensing answers for chaotic visitors. If those solutions are low-price and deployable on avenue-facet, (under street sensors like loop abate glide during installation and upkeep), with a view to add more price. We have arisen with such strategies based totally on acoustic sensing and RF sensing. There are several different alternatives to discover like passive infrared sensors, pollution sensors, vibration Sensors and so on. For each technique, a number of the important thing questions to discover are - (a) what to experience, (b) how lengthy to sense to deal with the actual-timeliness vs. accuracy alternate-off, (c) how to build sensing fashions for one-of-a-kind road widths and car kinds with minimal manual supervision and so on.



Fig1. 2 Indian traffic

Mobile Sensing: Techniques

- 1) **GPS on public transport or fleet automobiles** – Many public delivery and fleet organizations have GPS installed in their motors for actual time tracking. Several studies projects have tried to exploit those as a source of road facts. Become one of the early papers to analyze GPS strains from buses to categories avenue segments as free-go with the flow and congested using threshold based classification. The cellular Millennium undertaking at Berkeley used GPS on a fleet of taxis and expected journey times in London over 6 months. Is a latest big scale look at of GPS traces of a taxi fleet in Singapore, to realize fare and tour delays in real time?[4] Some other class of work the use of GPS on public delivery has been to expect bus arrival times.

- 2) **Sensors on smart phones-** aside from GPS, smart phones also have sensors that can offer interesting statistics. Solved the trouble of reorienting the accelerometer of a phone to in shape the automobile axes. The accelerometer readings had been then used to locate venue activities like bumps and brakes. A number of braking followed through honking (detected through phone microphone) changed into interpreted as congestion. Improves up on the accelerometer reorientation mechanism through the use of smart phone magnetometer. Uses smart phone accelerometer to detect if the telephone is in a transit automobile and in that case, uses GPS to realize travel instances and arrival instances of the automobile.[5] Uses the telephone microphone for urban noise mapping and makes use of the cell phone camera to be expecting the visitors signal beforehand for automated speed control of vehicle.
- 3) **GPS on smart phones -** With the recent proliferation of smart phones, Smart phones' GPS is being studied for hotspot detection and travel time estimation, after handling noise in GPS readings.
- 4) **Social networking-** took a clean perspective of getting statistics from crowd thru blogs published through smart phones.
- 5) **Specialized hardware on motors -** a few researchers have used specialized hardware in motors. , Which detects street anomalies and, which tracks stolen properties are examples? , which makes use of ultrasound transceivers to locate empty parking spaces and which calculates gasoline usage, are applications for individual vehicle proprietors the use of customized hardware.
- 6) **Using regular phones-** a few researchers have tried the use of ordinary cellular telephones, in place of smart phones, for traffic sensing .Localizing normal phones primarily based on most effective mobile tower and wireless records and including sensors to normal cell phone hardware are fundamental studies awareness in this area This sensing the use of phones, popularly known a scrod sourcing or participatory sensing,[2] has related studies on privacy and power (problems, as these could have an effect on user participation.

Mobile Sensing: India Specific Questions

Adapting strategies for Indian roads - GPS is known to have mistakes that have an effect on localization of visitors' facts. Does this mistake have more impact at the dense Indian avenue Networks? Is improving GPS with Wi-Fi, feasible? To peer Wi-Fi penetration and coverage, battle-driving efforts might be made on Indian roads.

New social networking models - everyday cell-smart phone penetration and utilization could be very excessive in India. Weblog or MMS based totally crowd sourcing desires GPRS or 3G connectivity. Rather, regular sms or voice calls can be explored for information sharing to boom the player pool manifold.

Incentive models- Designing right incentive models for participatory sensing is a lively research area. Comparable questions for the Indian population will deliver interesting research issues. Must we use a payment based totally system or need to we use video games? What type of games should we design? Should low earnings businesses like car-rickshaw and taxi drivers receive economic incentives whereas the middle and better income businesses are given gaming incentives?[6] If such incentive schemes are not empirically evaluated, all the cell sensing techniques mentioned above would be rendered vain in practice.



Noise discount- Trustworthiness of net information is a recent lively location of research .Still more modern is research on trustworthiness of participatory data inside the context of participatory sensing for Indian ITS,[7] comparable work on data trustworthiness and noise discount will be interesting. Paid incentive fashions run the risk of inducing egocentric behaviour among individuals, who could start contributing incorrect data. The device ought to be able to go check information sanity, likely thru information aggregation from a couple of participants. [8]This will need high to moderate level of penetration. Any other viable choice is to build recognition structures the use of enter from other sensors (say video), for elements of the facts. Members who rating high in these assessments can be given better weights in future than the participants who rating low.

Hybrid Sensing: Techniques

There are a hard and fast of strategies that use both static infrastructure and mobile sensors to gain traffic facts.

- 1) **Teledensity** -cell phone operators can give approximate car densities within the community of a given cell tower, based totally on subscribers visible at that tower. There are industrial structures like and studies efforts primarily based on this.
- 2) **Bluetooth** -is a system where roadside Bluetooth detectors experience Bluetooth radios in telephones inside vehicles. Correlating the sensed Bluetooth addresses amongst exceptional detectors, offers journey instances of the motors between the detectors.
- 3) **RFID** -comparable structures are being explored the use of RFID tags on automobiles and RFID readers on roads.

III. THE ITS ARCHITECTURE

Having discussed a hard and fast of meant programs and several viable sensing methods, the following question to ask is how to put all of it together for Indian towns, so that the most viable ranges of programs are treated with ease and accuracy. Have to we prioritize the list of packages, so that a few are given higher importance than the others? How ought to we choose what sensing strategies to use? What must be the overall machine architecture, inclusive of the communiqué version needed to gather sensed and/or computed facts from the roads and expend statistics returned to commuters on the road? A lot of those result in interesting research questions as we are able to see.

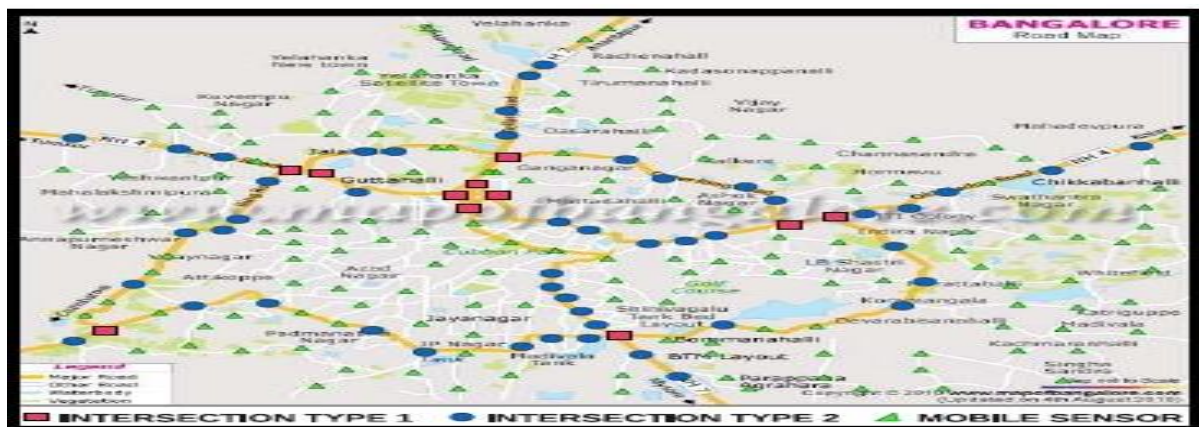


Fig1. 3 Citywide sensing architecture



Preference of applications -Our discussions with the Bangalore traffic Police gave us perception into their ITS wishes. Fig. three indicates an avenue map of Bangalore. There are two foremost kinds of roads, the yellow strains denote the most important roads and the white traces denote minor roads. The junctions where the predominant roads intersect one another are proven via crimson squares and people where the minor roads intersect the essential roads are proven by using blue dots. Site visitors' mild control is an essential necessity for both those form of intersections, with a purpose to govern the visitors float sample over the entire metropolis. Presently, in absence of automatic sign control techniques, the visitors lighting fixtures are either statically calibrated, or managed by way of on-street policemen, or remotely managed via manually seeing video feeds on the visitors manipulate room. Localizing incidents is some other important utility, to send visitors personnel's to affected regions or penalize traffic violators. The alternative packages described in segment 2 are also necessary, in no precise order of precedence. As most Indian cities have comparable street styles, the application wishes of different site visitors manage authorities are anticipated to be comparable.[9] As for Indian commuters, the visitors programs presently to be had are rudimentary, with periodic updates collected from visitors police broadcast on FM radios. There are a few course planners that give bus and train plans, but the plans are static, without thinking about the modern-day congestion tiers on distinctive roads. As a consequence any software, mentioned in phase 2 would be precious to commuters.



Fig1. 4 Bangalore Traffic Control Room

Choice of sensing technique -Participatory sensing statistics is inherently noisy. Additionally probe cars may not be gift at a given intersection always. Such sensing techniques can for that reason be used for applications like travel time estimates and congestion maps to be disseminated to commuters, that can tolerate aperiodicity and noisiness. Packages like traffic mild control however, need committed static sensors on the road that deliver enormously accurate and strictly periodic updates about site visitors' situations.[6] Static sensors are luxurious but accurate, mobile and hybrid sensors are reasonably-priced but noisy. Primarily based on packages, we want to make a cautious choice of which mode to apply while and how to blend them correctly. The purple squares and blue dots in Fig. 1.3 would therefore be in all likelihood applicants for static sensing, whilst the mobile and hybrid sensors could span the town, in various densities over the years, as the green triangles in the parent. Even within each mode,[4] selections can be made based on degree of information wanted and set up and preservation fees. If automobile class is vitally vital, movies are a have to. But if handiest stage of congestion or duration of traffic queues is wished for certain intersections, RF sensors, cheaper than Videos or loops may be used.

Choice of communication model -Given a hard and fast of chosen packages and a fixed of sensing techniques to deal with them, how should the conversation model be? For static sensors, the sensed statistics want to be transferred to site visitors control rooms.[7] At present, out of one hundred sixty cameras in Bangalore, linked to primary traffic manage room via BSNL leased traces, at maximum 90 cameras ship facts at any given time because of problems in the wired connections. as opposed to this megastar topology, will a tiered architecture help, wherein video feeds from a subset of roads are processed at nearby manipulate rooms, earlier than the statistics is exceeded to important manipulate? Need to there be a combination of stressed out and Wi-Fi verbal exchange to reduce value and overhead of lying copper, or will wireless be too unreliable? [2]Can verbal exchange prices be reduced through in-area computation and facts compression? As for cell sensing fashions, quantitative evaluation of 3G and GPRS overall performance on Indian roads, using cell cloud for statistics add and download, peer-to-peer networking amongst commuters with similar tour styles, are some thrilling verbal exchange problems to discover.

IV. A SUBSET OF THE PLAYERS IN INDIAN TRANSPORT

We would recognize what visitors applications are needed for Indian roads. We would design and put into effect sensing technology needed to manage the ones programs for Indian chaotic site visitors. We might build robust, low-fee verbal exchange models to accumulate facts from sensors and disseminate facts to commuters. However until we test our answers in the area in medium to large scales, we can never come to recognize about sensible.

Organization type	Website
Academic institutions	IISC - http://cistup.iisc.ernet.in/index.html IIT Delhi - http://tripp.iitd.ernet.in/ IIT Chennai - http://coeut.iitm.ac.in/ IIT Bombay, Civil - http://www.civil.iitb.ac.in/~patil/research.html IIT Bombay, CSE - http://www.cse.iitb.ac.in/silmaril/br/doku.php?id=proj:carts IIT KGP - http://www.iitkgp.ac.in/fac-profiles/showprofile.php?empcode=bSmUS IIT Delhi - http://www.iiitd.edu.in/muc/
Private Organizations	Mapunity - http://www.mapunity.in/ Logica - http://www.logica.in/we-do/innovation/ KritiKal - http://www.kritikalsolutions.com/products/traffic-analyzer.html Embarq - http://www.embarq.org/en/about/about-embarq iTrans - http://www.itrans.co.in/aboutus.html Traffline - http://www.traffline.com/default.aspx
Some city traffic control authorities	Mumbai - http://www.trafficpolice.mumbai.org/ Bengaluru - http://www.bangaloretrafficpolice.gov.in/ Chennai - http://www.chennaitrafficpolice.in/ Delhi - http://delhitrafficpolice.nic.in/
Government R&D lab Center for Development of Advanced Computing (C-DAC)	http://www.intranse.in/its1/
City bus authorities with GPS installed in buses	Bengaluru - http://www.bmtcinfo.com/site/index.jsp Chennai - http://www.mtcbus.org/
Research labs	Microsoft [28], IBM [15], Alcatel Lucent [55], Infosys [60]

Table1. 1 Players in Indian ITS

Building collaboration with the general public quarter is an absolute necessity for this area as lab checks and simulations will in no way give the genuine image of the road. Additionally massive scale video or GPS facts are sometimes available from visitors manage government, that researchers can use in their paintings. On this phase, we therefore listing a fixed of key players in the Indian traffic scenario. This consists of government companies like town traffic control authorities, academic establishments, start-ups and research labs. The information is given in Table 1.1, in which data unique to each employer can be found within the corresponding listed website.



V.CONCLUSION

Traffic congestion is a crucial hassle in Indian towns. The characteristics of Indian roads and site visitors make the trouble interesting to solve. There may be scope for evaluating present ideas in exclusive and difficult visitors eventualities, innovate new solutions and empirically evaluate ideas in collaboration with public and personal sectors. On this paper, we make a small attempt to prepare the different ideas and humans relevant in Indian ITS, in order that it gives a top level view of the hassle and there to be had solutions and outlines a hard and fast of open questions to answer.

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