

Leveraging **Information Technology** for
Economy, Transparency, Speed, Inclusion,
Scalability and Robust solutions in
Transportation

By

Vinit Goenka



#ITForParivahan





“I believe government has no business to do business. The focus should be on Minimum Government but Maximum Governance”

**Shri. Narendra Modi,
Hon'ble Prime Minister,
Government of India**

“Information Technology should be used as a decision support system in strengthening, maintaining and upgrading National Highways”

**Shri. Nitin Gadkari,
Hon'ble Minister, Ministry of Road,
Transport, Highways and Shipping,
Government of India**



Foreword



Vinit Goenka

India is on the path of becoming economic superpower by 2050. To sustain a growth of any nation, it's transportation network spanning across 'Roads, Highways, Ports and Waterways' is the driving force. To top it up, Information Technology plays an important tool to improve efficiency, safety, durability, cost management, timeliness and transparency.

We have taken various initiatives to adapt technologies in road transport & highways. For instance, a nationwide online campaign '#ITForParivahan' was initiated to crowdsource ideas from various stakeholders for effective governance in transportation sector. I am pleased to inform that a dedicated and self-motivated team of 200 technocrats across India had touched more than 1.5 crore fellow citizens in just two months through this online campaign, which received an overwhelming response from ~40,000 respondents who expressed their grievances and shared innovative ideas to improve governance and efficiency in shipping, road transport and highway sectors.

This report provides a perspective on how India's transportation sector should adapt technology for its development. The reports talks about how the current status of operations is inadequate to cater the future need of the sector and discusses how technology can bring in the desired transformation.

The whole idea behind this technology initiative is to take the nation to the next level. I hope this report will contribute to development of the transport sector and will help in simplifying the procedures by leveraging information technology.

Introduction

About AIM-IT

Association of MSMEs in Information Technology (AIM-IT) is India's first sectoral organization for Medium, Small and Micro IT enterprises (MSMEs). AIM-IT was set up in 2015 with an aim of representing, advocating & promoting interests of IT-MSMEs to ensure economic & technological advancement of the country. AIM-IT is a unique platform for all stakeholders, including IT companies, start-ups, innovators, and government and policy makers to achieve sustainable and holistic economic growth through adoption of technology.

AIM-IT has a pan-India presence with more than 800 members. It has Corporate Offices in New Delhi and Mumbai with strong presence in important geographies, including Rajasthan, Gujarat, Maharashtra, Karnataka and Tamil Nadu

About Centre for Knowledge Sovereignty (CKS)

CKS India endeavors to acquire knowledge through experts of eminence in respective field. This specially acquired knowledge will be accessible to those who may use it for betterment of society and common citizens in order to equip him/her to distinguish between good and bad, between right and wrong. Additionally, this acquired knowledge will be made available to all eminent stakeholders so that they may take appropriate decisions.

About #ITForParivahan

IT stalwarts and Govt of India's Task force members Padmashree Dr. Mohandas Pai and Mr. Vinit Goenka started a unique policy group - #ITforParivahan – to make transportation efficient, economic and transparent in India through use of technology.

With an aim to make governance effective through public participation, the campaign invited suggestions from various stakeholders in transportation sector and also public-at-large. The campaign which started in September 2015 saw a dedicated and self-motivated team of more than 200 technocrats reach out 1.5 crore Indians through a highly effective and ambitious social media campaign. In return, we received more than forty thousand responses from all stakeholders. After rigorous discussions and brainstorming sessions, our panel of eminent IT experts' shortlisted five ideas which will be presented to Govt of India. Salient Milestones of #ITForParivahan ...

- 200 technocrats reached out to 15 million Indians in 62 cities.
- 40,000 responses were received; out of which top 5 ideas were selected by leading IT experts
- Unique User Mention Count: 3001
- Total Number of User Mention Count: 37705
- Number of Tweets: 77204
- Number of impressions: 66 Million

About Vinit Goenka

Vinit Goenka is a well-recognized technocrat, educationist and social activist working in the field of public service for more than two decades.

Vinit is an active politician with expertise in the field of Information Technology, Transportation, Infrastructure and Agriculture. He is currently a member of the IT-Task force of Ministry of Road, Transport, Highways and Shipping, Government of India. In the past, Vinit has served the Bharatiya Janata Party as its National Co-convener of its central IT Cell in the run up to the general elections of 2014. During this period he spearheaded the Digital Strategy of the party. His contribution in the landslide victory of the BJP has been widely recognized by various sections of the party, media and the society.

Vinit joined mainstream politics after a very successful stint in the corporate world. His stints included leadership roles with various multi-national companies including IBM, TechSpan & Birla Consultancy.

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Use of Technologies In Road Transport and Highways

1. Background

Transport in India has become one of the most vital aspects of life, being a necessity as well as convenience. Road transport has the largest share of GDP (4.9%)¹ in comparison to the other transport segments. This indicates that it is a most widely used segment with major contribution to the economy amongst the transport modes.

The Indian road transport sector is at an interesting point on its evolution curve with more sophistication in infrastructure creation as well service offerings. There is an increased activity in the sector due to growth in Indian economy and trade, increased purchasing power resulting in rise in goods transport activity, innovative private partnerships and IT infusion. A large number of infrastructure projects in the transport sector are being created through public-private partnership models to improve operational efficiency. However, poor planning, diverse geographic conditions, poor infrastructure, ineffective policies, inadequate enforcement regime and complex tax policies are hindering faster economic growth. All the above factors are thereby resulting in poor public transport, high congestion on roads, increased pollution, growing traffic indiscipline and deteriorating road safety.

India loses INR 60,000 Crore due to traffic congestion, (including fuel wastage), slow speed of freight vehicles and waiting time at toll plazas and checking points, a study on operational efficiencies of freight transportation by roads has claimed. It said vehicles crawl at an average speed of less than 20kmph on some key corridors such as Mumbai-Chennai, Delhi-Chennai and Delhi-Mumbai stretch². Such alarming numbers of economic losses due to traffic congestions pose a big hassle for citizens and municipal authorities. Additionally, because of lack of green corridor planning, traffic departments in cities find it difficult to navigate traffic in emergencies.

There is a growing necessity for planned infrastructure and effective enforcement to ensure sustained growth of the nation and counter the challenges of increased vehicle population, emissions, accidents and urbanization.

¹ <http://www.iimahd.ernet.in/assets/snippets/workingpaperpdf/12319057932015-12-02.pdf>

² [India loses Rs 60,000 crore due to traffic congestion: Study ,Times of India](#)

2. Challenges in Road Transport and Technology Solutions to Address Them

Urbanization is affecting Indian cities in a big way. City population is growing at a much faster pace than infrastructure development, leading to many problems. Many smart transportation initiatives can reduce the need for extensive infrastructure expansion. Citizens faces many challenges like traffic congestion at toll, safety of passengers, authorized access to cars, corruption etc (more elaborated in below table)

A simple technology with a combination of RFID, GPRS, GPS, smart card reader, 3-axis accelerometer can help address many challenges. The device, 'On Vehicle Smart Module (OVSM)' which has all above mentioned technologies in combination with few upgrades on infrastructure side can bring simplification and build assurance in many procedures the way currently it's being handled. The OVSM needs to be installed on all vehicles.

Below table shows the list of various problem statements that can be solved with the help of OVSM technology.

Sr. No.	Problem statements	What can we achieve with technology
1	Authorized access to start the car	Access only through valid RCTC and driving license, elimination of physical key
2	Safety of family members in a chauffeur driven car	<ul style="list-style-type: none"> • Geo-fencing of a car • Predefine specific route for drivers • Remote engine stop, if a car goes out of specified area • Dashboard in a car for route guidance • Mobile app for tracking the car
3	Traffic congestion at toll	<ul style="list-style-type: none"> • Automatic toll collection • Elimination of manual intervention and infrastructure
4	Corruption while collecting fees and fines	<ul style="list-style-type: none"> • Automatic collection of fees and fines • e.g. one way entry, wrong turn, no-parking areas etc
5	Proper utilization of government man-power for the right purpose	<ul style="list-style-type: none"> • Automatic fine collection will ensure more police constables are available for doing work like solving crime detection, patrolling, solve accident cases etc.

6	Genuineness (feeling of being cheated) and 100% collection of fees for parking	<ul style="list-style-type: none"> • Automatic collection of parking fees • 24 x 7 ensured revenue • Removal of superficial employment
7	Unnecessary procedural time, agents OR middle man while ... <ol style="list-style-type: none"> 1. Obtaining RCTC book, Vehicle registration number while purchasing a new car 2. Ownership transfer while resale of car 3. Interstate transfer of car 4. Payment of taxes while crossing the border 	<ul style="list-style-type: none"> • Purchase, resale OR transfer of car ownership on web portal • Integrate all data centrally (make use of Vahan, Sarathi database) • Application of change in registration no., ownership transfer online
8	Intercity OR Intra-city traffic, highway jams	<ul style="list-style-type: none"> • Data analytics from these vehicles will give information like traffic jams in a particular area etc. • Route divert indications can be given in advance
9	Compliance to necessary documentation	<ul style="list-style-type: none"> • Automatic detection of PUC, Insurance expiry
10	Over speed	<ul style="list-style-type: none"> • Automatic detection of over speed and auto fine
11	Bad road condition	<ul style="list-style-type: none"> • Automatic road condition monitoring (path holes etc)

Such technologies have been implemented in countries such as Singapore and Switzerland. Similar technologies have been successfully used in Germany, Poland, Netherlands and US for toll collection and are being carried over for other challenges. In Germany for example close to 7 lakh vehicles were already fitted with such technology, by 2007.

3. Current Challenges in Implementing Such Technology Solutions

Implementation of any change is not an easy task. Many factors which would lead to hurdles, must be considered beforehand in order to have hassle free transformation. Following are some of the challenges that such a technology might face in the current scenario –

- **Acceptance of any new procedure depends upon its benefits for the stakeholders**

The user today has no incentive to switch over to new technology. Unless a benefit is seen, the user will not be convinced to adapt to this technology

- **Policy Maker Perception: Possibility of tampering/ intentional sabotage by user**

Any device used to meter, record or monitor user action will always be subject to unwanted tampering or sabotage, this leads to rendering the device unserviceable or faulty. Hence a model needs to be worked out which encourages the user to keep the device up and running

- **Production challenges: OEM's inability to immediately integrate such technologies in the near future**

Tampering of on board device can be avoided by integrating the same with the vehicle during its manufacturing, this calls in for OEM (Original Equipment Manufacturer) to modify/redesign vehicles. However, this could take a lot of time to implement and is not an advisable solution for on road vehicles which are already in use.

- **Infrastructure upgradation required**

In order to effectively implement the OVSM technology certain vehicle and infrastructure upgrades are essential. More research to define roadmap based on further directions would be required. By and large, product definition, product pilot itself may take about a year's time.

4. Proposed Model for Technology Implementation– Credit Transfer

To overcome the mentioned challenges, a new model is proposed, Credit Transfer Model in which credits will be transferred to OVSM user account. (Pradhan Mantri Jan-Dhan Yojana has already created a good penetration in terms of opening a bank accounts for an individual's)

The OVSM user account will be linked to user's bank account to perform the required transactions. The account will also be linked to the user's license, RTO records and other related interface agencies to track and maintain the records of his traffic rule violation, validity and expiry of the documents and overall driving performance.

The model will work similar to a cell phone top up except that in this case the top-up is for an OVSM account will be linked to a vehicle user. This top-up will provide sufficient credit balance in user's account. Users will be able to top up their accounts through online banking, ATMs, over the mobile or in the form of scratch cards available at local shop vendors, fuel stations etc. The balance in the user's account will be debited for traffic rule violation, toll collection, parking charges etc. Any balance credit above the minimum required balance will be refunded at year end into the bank account, which is linked to OVSM.

OVSM instruments will also have reader slots for smart license and Smart RCTC card. This will help authorities to identify unauthorized use. Without insertion of valid smart license and smart RCTC, the OVSM will debit available credit from user account as penalty.

This helps in better monitoring and other stricter enforcement of laws. The users not following the traffic rules will be monitored and penalized for the violation of the rules. Use of OVSM will also generate some quality information (such as average age of the vehicles on road, category wise share of vehicles on road, which will be useful in planning road transport to cater the need in future)

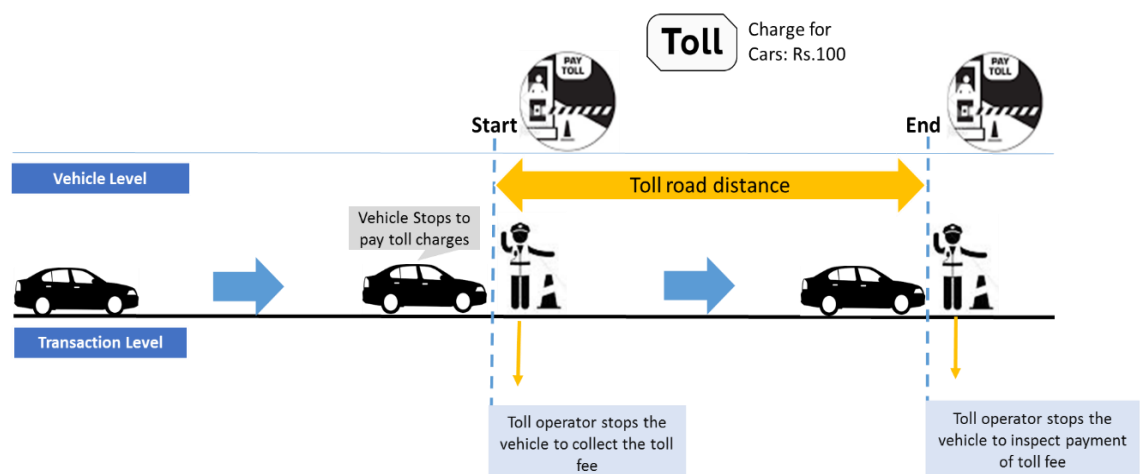
Use of OVSM will also benefit users as there will be reduction in road accidents as well as in traffic congestions, making road transport safer and hassle free. It will also reduce queuing ups for tolls, and the users will be able to pay toll per kilometer of the distance travelled (automatically). Use of OVSM will also aid in detection of thefts and unauthorized use of vehicles, thereby keeping a check on such mishaps.

5. How the Solution Will Work?

5.1. Use Case 1: Toll Collection

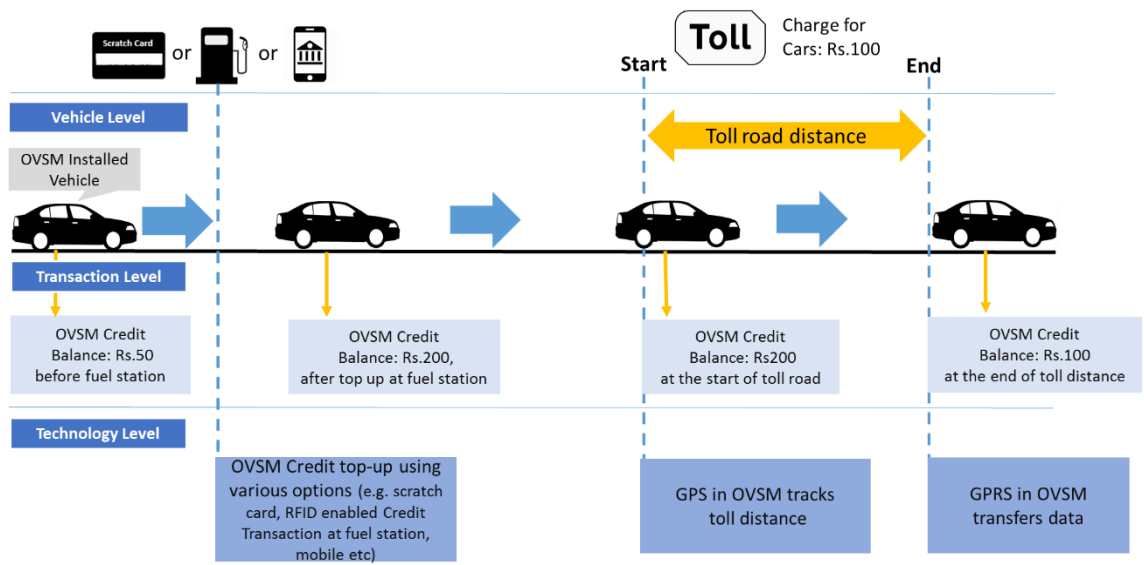
Figure 1 represents toll collection system that is currently being used in India. Any vehicle travelling on the toll applicable road has to stop at booth to pay the toll. Efficiency of the booth operator, non-availability of change to pay or repay the amount etc. result in queues at the booth. The conventional system does not provide the flexibility to pay per kilometer. Also, it needs significant manpower to be employed at the entry points of the toll area for monitoring and security purpose. More the manpower, more are the chances of system to be susceptible to errors.

Figure 1: Conventional toll collection system (Before OVSM system implementation)



On the other hand the proposed automated system which uses OVSM is represented in figure 2. As shown in the figure 2, user can top-up his OVSM account through ATM, petrol pump or mobile app. When the vehicle enters into the toll applicable zone, its entry is detected and tracked by the GPS in the OVSM device. GPS measures the distance travelled by the vehicle in the toll applicable zone, and the corresponding amount is deducted from the user's account. The required information is shared by the GPRS in the OVSM device. The system is totally free of human intervention thus there are less chances of errors. The system demands for no toll booths on the road, thus saving user's time which would have wasted in waiting in the queue to payment of the toll. The amount paid will be exact, thereby eliminating the need of carrying change for exact payment.

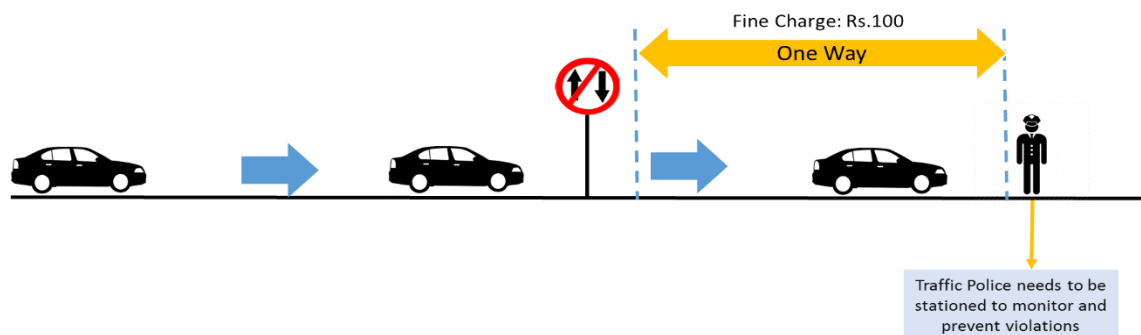
Figure 2: Automated Toll Collection (After OVSM system implementation)



5.2. Use Case 2: Traffic Rule Violation

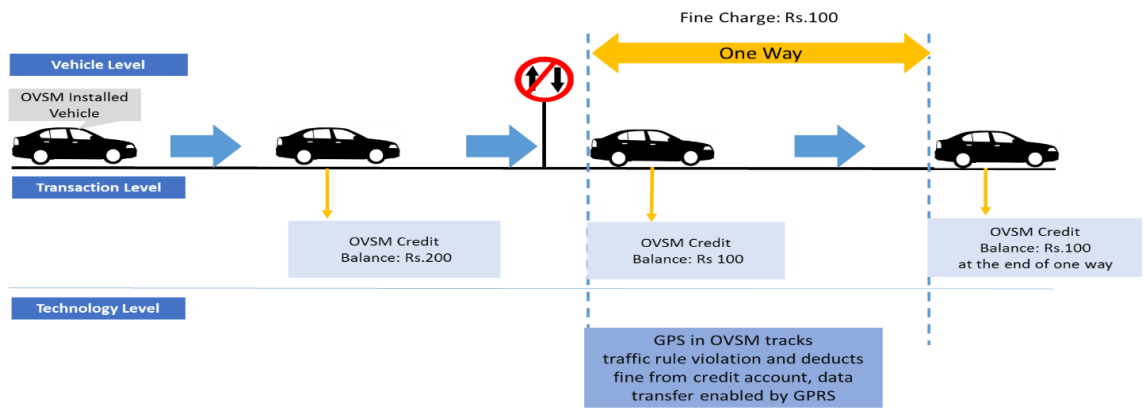
The conventional traffic controlling system is represented in figure 3. In order to have smooth flowing traffic, traffic police are required on roads to monitor and ensure enforcement of traffic rules and to penalize any violation of the rules. This also demands for significant manpower on ground, as there are limitations to the volume of traffic that can be controlled by a single policeman. More the manpower, more are the chances of the corruption.

Figure 3: Conventional traffic controlling (Before OVSM system implementation)



The proposed system, as shown in figure 4, tracks the vehicles for traffic rules violation by using GPS in the OVSM. Any violation caused will directly call for the penalty, which will be deducted from the user's account. Data of rule violation will also be stored and monitored to take serious actions such as cancellation of driving license in case continuous rules violation is observed for a particular user. The system being fully automated, leaves no chance for corruption.

Figure 4: Automated traffic rule violation detection (After OVSM system implementation)



5.3. Use Case 3: Automatic Parking Management

The OVSM technology can also be used in Automated Parking Management, especially in case of open road parking. Vehicles which will get parked on open roads will be tracked through OVSM and geo-fencing. Duration for which vehicle is in the parking can be calculated based on entry and exit of the vehicle in that area marked by geo fencing (GIS mapping). The corresponding amount to be charged for the parking can be deducted directly from the user's OVSM account.

Figure 5: Conventional Parking Management (Before OVSM system implementation)

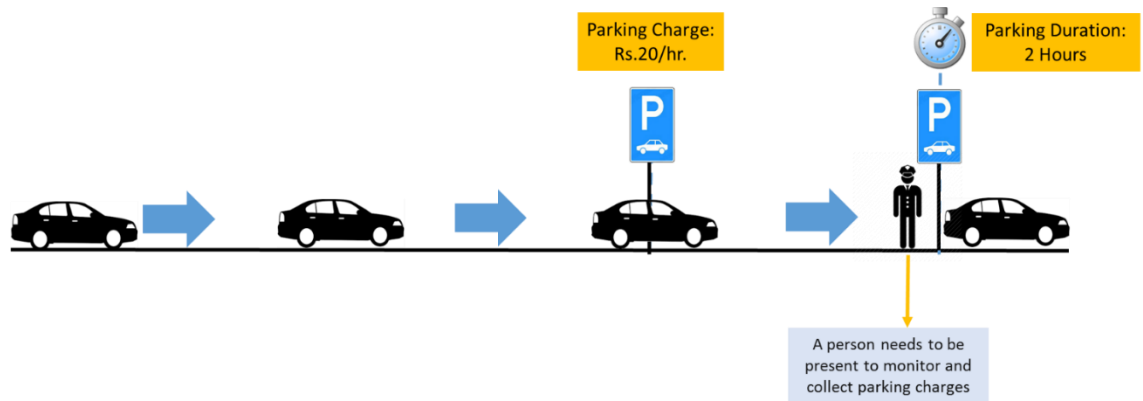
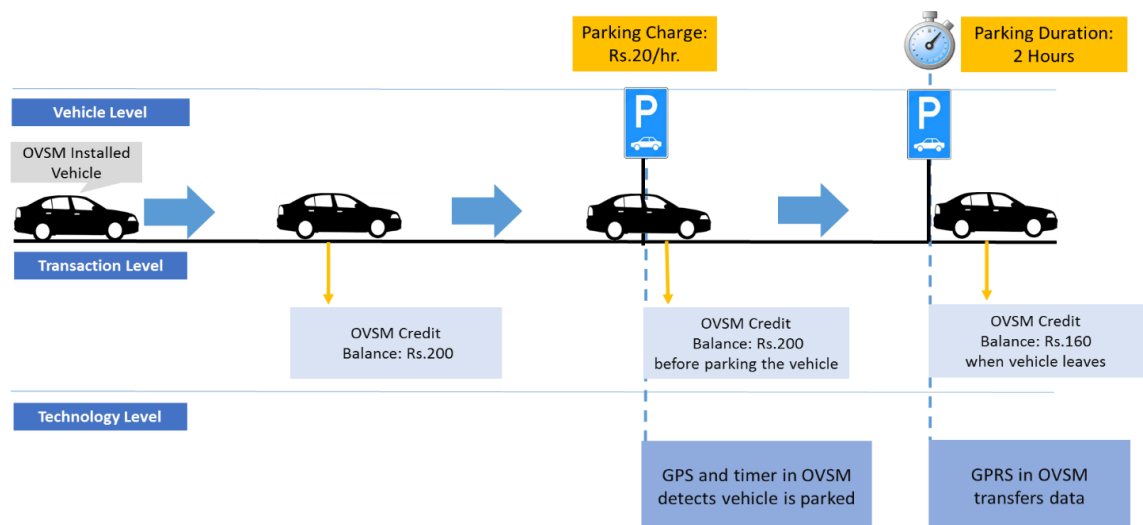


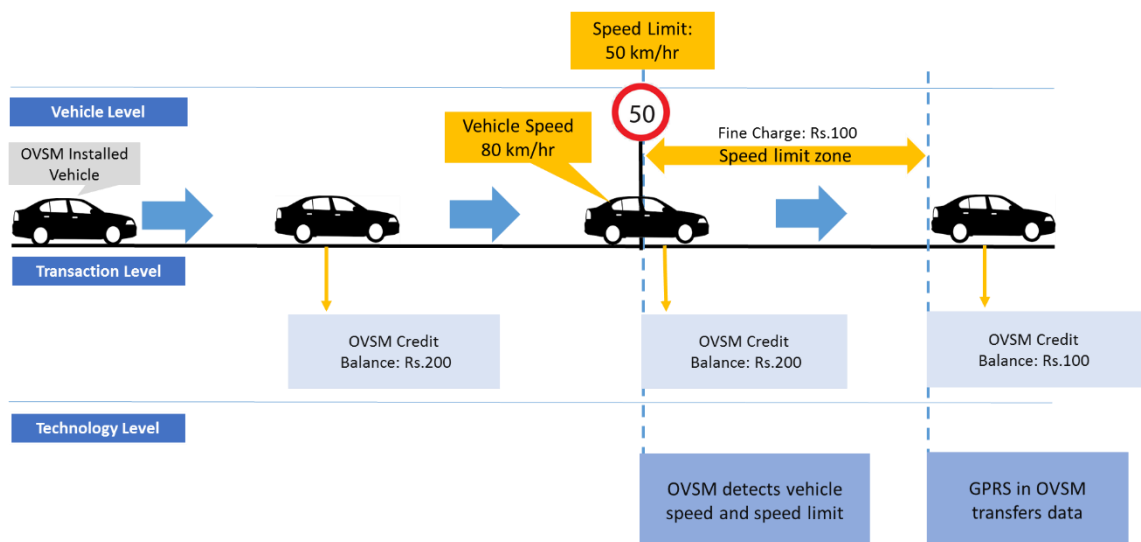
Figure 6: Automated Parking Management (After OVSM system implementation)



5.4. Use Case 4: Over Speed Detection and Fine

In case of vehicles travelling on the highways or within cities; vehicles which are commuting with higher speed can cause accidents, which could be fatal at times. Keeping check on such vehicles by current ways is extremely difficult due to reasons like lack of sufficient man power, accuracy and maintenance of speed guns, identifying the vehicle numbers to charge them with the fine etc. OVSM can help in tracking the vehicle speed, duration of over speeding and comparing it with the speed limit standards for the road. The speed limit data can be obtained from the GIS mapping of the roads (pre-feed). In case of detection of over speeding, penalty amount can be deducted from the OVSM account.

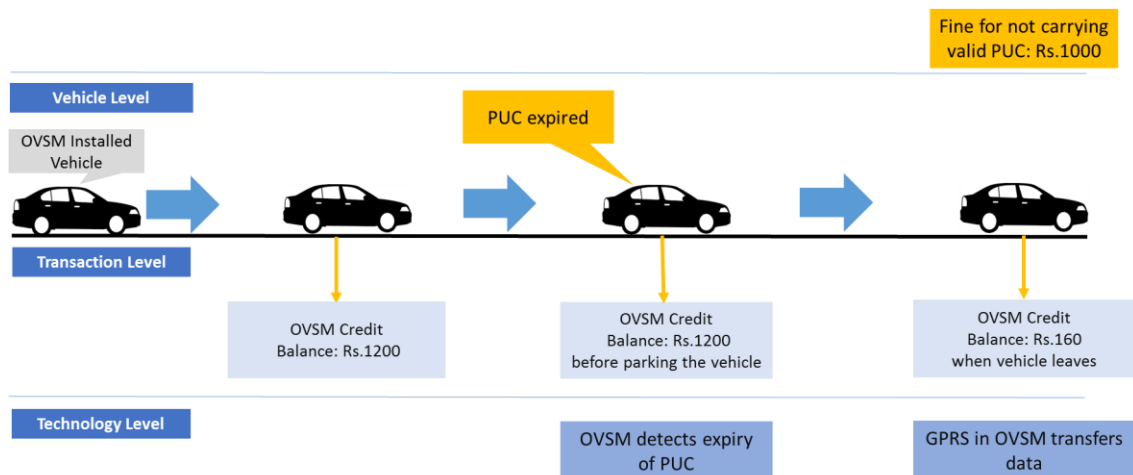
Figure 7: Over-speed detection using OVSM



5.5. Use Case 5: Automatic Document Expiry Detection

Various important documents related vehicle such as insurance, RC, TC, PUC as well as driving license can be maintained electronically in the form of smart card. This data can be stored or read by OVSM device. Based on this data, alert messages related to expiry and renewal of the respective documents can be sent to users. Users can be penalized in case of non-renewal of documents within the time. Again, the amount of the penalty will be deducted from the user's bank account linked to his OVSM account.

Figure 8: Detection and charging Fine for invalid PUC using OVSM

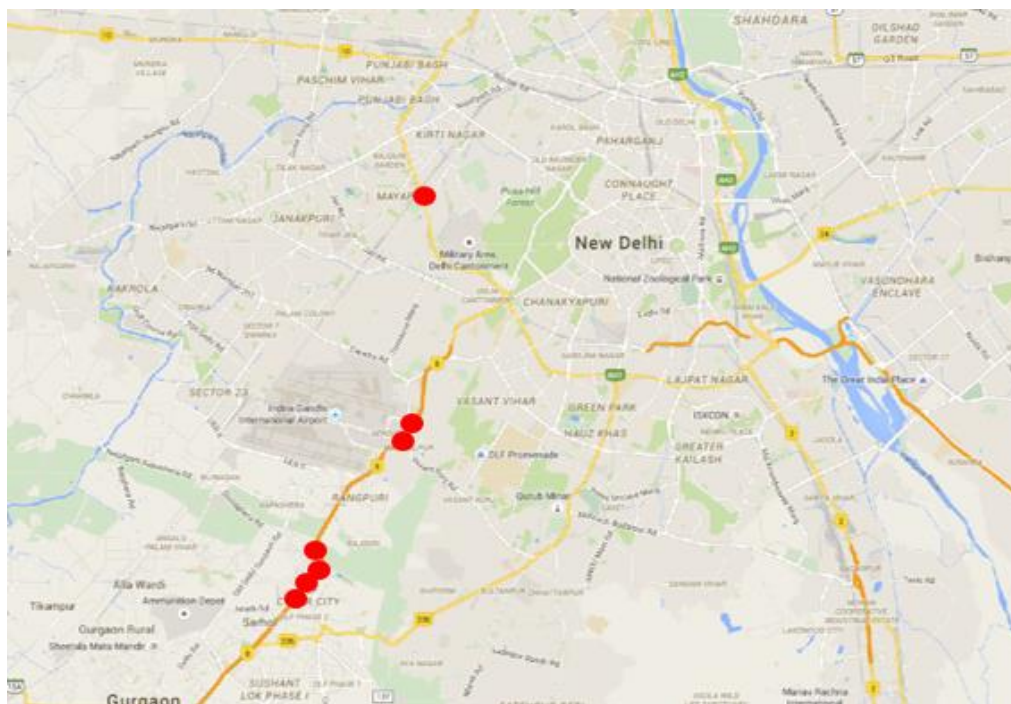


From infrastructure point of view (in this case), PUC unit is required to be upgraded to 'smart PUC unit'. Smart PUC unit can automatically update the records online and can be in synch with OVSM device (through a command centre).

5.6. Use Case 6: Detection of Accident Prone Spots

Use of OVSM along with GIS mapping can be useful in creating large data repository (big data analysis) which can be used for various analysis related to road transport. The data related to road accidents can be used to analyze the various reasons of the accidents as well as to identify the accident prone areas based on the statistics of accidents related to a particular area. This will help in precise detection of accident prone zones, thus will aid in taking safety measures to avoid accidents.

Figure 9: Detection of accidents prone zones based on OVSM data (sample case)



●: Accident prone zones (not real, for understanding purpose only)

6. Scalability

Implementation of OVSM will benefit both – the users and the enforcement authorities. OVSM technology will result in transparent process for penalty collection, better traffic monitoring and accurate data collection, which in turn aid in improving transportation and road safety.

To assure effective use of this technology, the device will ensure adequate balance in OVSM user's account before every commute. The OVSM can be programmed to prevent vehicle start if balance is not sufficient. In case of two wheeler commuters, system can be configured to detect compulsory helmet wearing by rider. The vehicle will not start if helmet is not detected.

The data collected through OVSM will also aid in electronic and transparent process of vehicle resale, as it will track the information and provide accurate data regarding vehicle's health which can help in determining the resale value.

The vehicles could also be tracked and located in case of theft. Vehicles could also be locked and immobilized if unauthorized use is detected. This will result in significant reduction in crime rate where vehicle theft is involved.

Instead of charging one particular amount as road tax, the government can collect tax based on total distance travelled annually by the vehicle, this could potentially bring more clarity for the user and revenue for the government.

Thus, a simple technology can be made scalable to adopt wider use cases and applications.

7. Conclusion

At present, man power is must for enforcement agencies to identify, act and prevent several challenges posed by the growing transportation industry and vehicular traffic. But even with such man power it is quite impossible for the agencies to execute their tasks effectively. Physical checking of each and every vehicle for its fitness, valid documents and traffic rules violation is practically not possible. Many vehicles that are not following the rules cannot be penalized if they did not go through checking. This results in revenue loss to the government and harm to the environment in some cases.

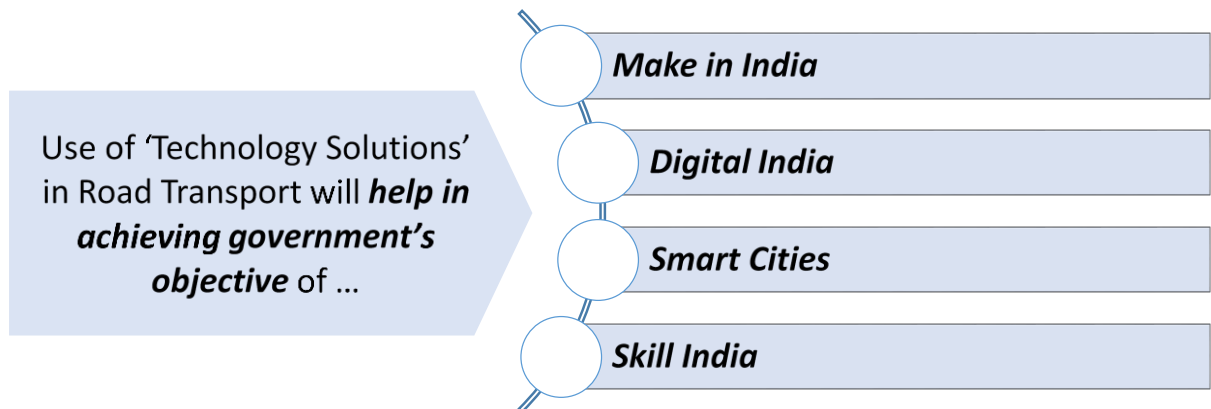
In case of toll collection, the study showed that delays at toll plazas resulted in thousands of crore worth of losses in terms of fuel wastage, while vehicle is waiting to pay toll at the collection point. According to Road Transport and Highways Minister Shri. Nitin Gadkari fuel saving of the tune of Rs. 86,000 crore could be realized annually after electronic toll collection (ETC) system becomes operational pan-India. With full scale implementation of OVSM technology, the potential savings will be much more than this with minimal investments.

Unfit, polluting vehicles on the road also cause a bigger impact on nation's environmental commitment. For an instance, in Maharashtra alone, 95 thousand vehicles were detected for pollution during FY13, those which were caught & checked. There would have been many more vehicles which did not get checked at all and hence could not get caught.

This can be avoided with use of 'OVSM Technology' and ensuring better contribution to GDP of nation as well as to the environment.

Implementation of OVSM based system is a step towards the digitization of road transportation, changing cities in to 'Smart Cities' and thus India in to 'Smart India'. The proposed OVSM system can be manufactured indigenously. Nationwide implementation of OVSM solution will create a market for manufacturing of these system components, which in turn support the 'Make in India' scheme initiated by the Indian government.

Figure 10: Long term benefits of OVSM technology implementation



Road Transport Ministry has already taken a step towards e-Governance by implementing ...

- E-Tendering
- ERP solutions
- Real Time Toll Data Management
- Road Asset Management System
- Payment monitoring system
- Vehicle Tracking System ...

Adopting this technology (OVSM) will certainly benefit department authorities of Ministry of Road Transport & Highways and will significantly improve efficiency in,

1. Collection of various fees like vehicle registration fees, pollution under control (PUC) certification fees, vehicle ownership transfer fees, parking fees, toll charges, inter-city charges, inter-state charges, etc.
2. Collection in various fines like over-speeding, illegal parking, signal break, PUC violation, driving license violation, vehicle age, driving in wrong lane/one-way, permissible time violation, vehicle overloading, etc.
3. Theft prevention, accident identification, reduced manpower to collect fees and fines, ZERO corruption and
4. Identifying high traffic zones to take suitable action in time

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*“Chitto jetha bhayashunyo, Uccho jetha shir
Gyan jetha mukto, Jetha griher prachir*

*Where the mind is without fear and the head is held high;
Where knowledge is free ”*

- Rabindranath Tagore