Effective Peak Traffic Management by Shifting Lane Usage leveraging IoT & Deep Learning

Do you have a solution to Bengaluru's traffic woes? Here is how you can help

Example For IEEE CCEM 2020 TechnoBizPlan Showcase

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Solution: Shift lane directions on key arterial roads with multiway junctions at both ends

Problem: Adaptively Predict when to do it!

Lane Direction Changing Procedure:
1) Police blocks lane incoming traffic & clears the lane
2) Once police at other end find that the lane is empty, they permit the traffic in reverse direction

Solution 1: Use Manual Bollards

Solution 2: Use color controlled LED lane lighting (red, white, yellow) with traffic direction indicators at regular intervals

Adaptively Predicting Traffic Density

Using Image processing & Machine Learning to process road surveillance camera images & predict the appropriate time to:

a) Turn on the lanes shifted LED lighting (Red, white, yellow etc)
b) Turn on the lights of the Traffic Direction indication boards for those lanes

Preliminary Results of our Image processing to identify vehicular density shown (Canny Edge Detection & Contour detection combined with CNN)

Implementation
Prototype
Hardware:
- WiFi network
- Cameras
- Wireless Lighting Controls
- Traffic Direction Light controllers
- LED lane lights

Software:
- Cloud Services
- C/C++ libraries
- scikit learn Python package
- opencv Python package
Business Analyses

Project pricing (approx Oct 2020) Rates for 1 km long 8 lane road for LED Lane lighting solution

- Team Structure, Roles, Costs PA
  - Project Leader – Overall Management: ₹ 24L
    - Transportation Consultant: ₹ 15L
    - Data Scientist: ₹ 18L
    - Embedded Systems Specialist: ₹ 12L
    - Software Programmer: ₹ 12L
    - Municipality/Government Laisson Manager: ₹ 8L

- Pilot/Prototyping Costs: (3 Months)
  - Manpower: ₹ 22 L
  - Hardware -Systems & IoT Devices: ₹ 10L
  - Software Licences & Cloud: ₹ 4L
  - Education & Training: ₹ 3L
  - Marketing & Workshops: ₹ 12L

- Production & Deployment Costs
  - Costs: ₹ 70L
  - FasTag Toll roads Infra: ₹ 10L
  - Operational Manpower: ₹ 20 L
    - Technical: ₹ 12L
    - Non-Technical: ₹ 8L
  - Insurance & Overheads: ₹ 12L

Financials Summary

- Project Costs: ₹ 1.2 Cr
- Toll Collections: ₹ 10L/yr
- Revenue CAGR: 5% Approx
- Expenses CAGR: 4% Approx

Disclaimer:
These ₹ numbers are Approximate & Conservative on the higher side.
Risks & Mitigation

• Solution can be implemented over long stretches with multiple lanes (at least 6 or better 8) that have multi-way junctions at both ends. Anything less is not very effective.

• Risks for this project are of categories: (a) Management Manpower (b) Technological (c) Governmental Rules & Regulations (d) Transportation (e) Acts of God

• While traffic throughputs will get enhanced on the arterial road, the traffic diffusion factor at both the ends matter a lot – one end merging several incoming traffic roads and the other end diffusing the traffic into multiple roads – Several examples of such roads exist

• Lane discipline while driving is critical – traffic entry enforcement into right lanes critical as well. Traffic Police Personnel oversight might be critical The lane direction indicator units can also sense & raise alarm so Traffic police can be alerted

• Toll collection at minimal levels will ensure compliance costs are met readily

• The software will adaptively predict when to change lane directions (lane lighting colors). Since it is continuously learning, the timings of lane change cannot be predicted much in advance. This dynamic lanes direction changing can yield optimal traffic regulation

• Similar approaches in other contexts/countries have yielded fruitful results
For the current situation of traffic jams, how are we impacted?
* Wasting productive time stuck in slow moving traffic
* Pollution & related health problem costs (like Asthma, Wheezing, Allergies, Stress etc)
* Failing in Medical Emergencies – Ambulances passage!
* Substantial Wear & Tear: Citizens, Police, Roads, Infrastructure & Vehicles!

And some of this yearly loss is not formally accounted for at all....

**Economic Value Add of our Innovation:**

Even if 10% of the roads use our solution, Bengaluru can save Rs 370+ crores PA & India 10k+ crores PA

Bengaluru ISEC Researchers say:
The researchers estimated the cost of illness by adding up the average cost of medication (Rs 4,944 per year), the average loss of productivity (Rs 15,520 per year) and preventive measures cost (Rs 31,800 per year). On an average, a commuter loses Rs 52,264 per year directly due to congestion, they noted.

India wastes Rs 1.44 lakh crore due to traffic congestion, says Uber study

The congestion levels in Kolkata and Bangalore stand alarmingly higher at 171 per cent and 162 per cent respectively, while Delhi emerged as the least congested city (129 per cent).

References: