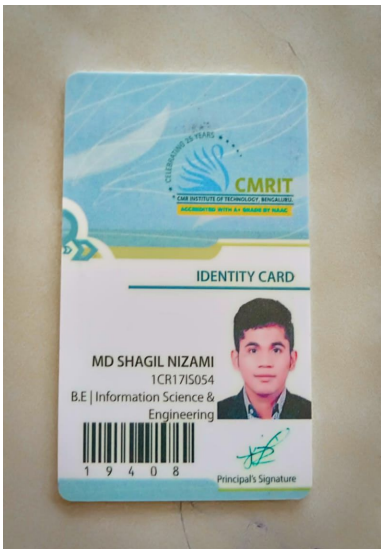
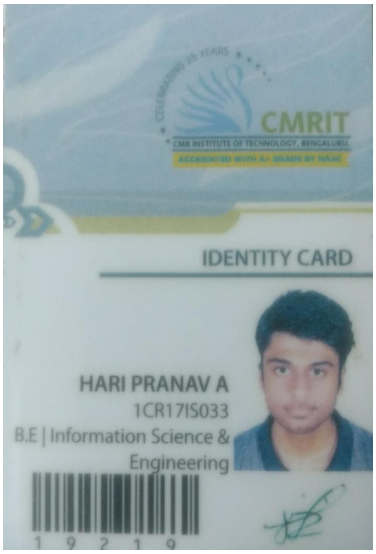
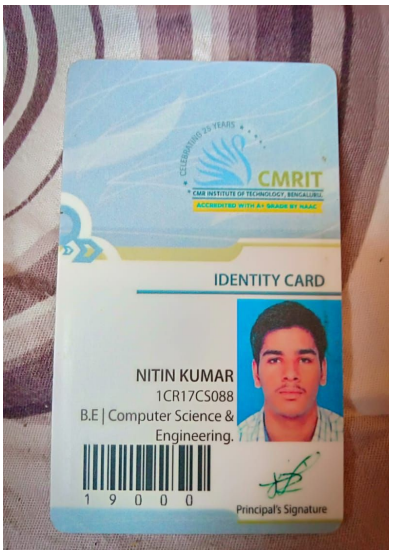
Project proposal for DST & Texas Instruments
Inc. India Innovation Challenge Design Contest
2018 Anchored by NSRCEL, IIM Bangalore

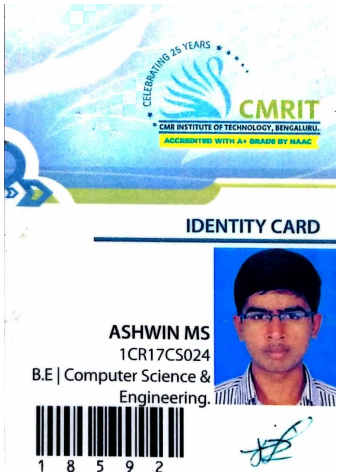
<Traffi'k - AI traffic control>
<CMR Institute of Technology>

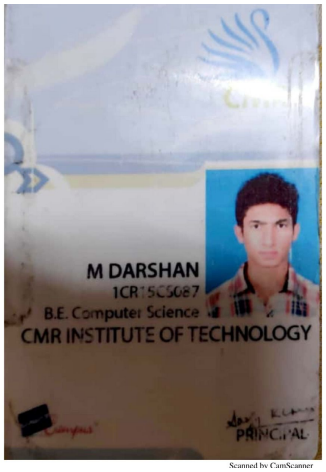
Name	College ID/Roll No.	UG/PG	Course/Branch	Semester
1) M. Darshan	1CR15CS087	UG	CSE	VII
2) Hari Pranav A.	1CR17IS033	UG	ISE	III
3) Ashwin M.S.	1CR17CS024	UG	CSE	III
4) Nitin Kumar	1CR17CS088	UG	CSE	III
5) MD Shagil Nizami	1CR17IS054	UG	ISE	III











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Authorization Certificate

From:
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Date: 31-08-2018

Dear Sir,

This is to certify that **Ms. Akhilaa** will authorize to mentor the **378496** comprising of **Mr. Neeraj Kumar, Mr. Shubhankar Bera, Mr. MD. Shagil Nizami, Mr. Sourav Kumar Giri, Ms. Soumya Srivastava, Mr. Nitin Kumar** in the IICDC 2018 contest.

If the team is shortlisted for the Qualifying Round Phase -1, I agree to receive the TI tools worth 200 $ and drive the teams to submit the Prototypes.

With Regards,
Ms. Akhilaa

31/8/18

Assistant Professor
Information Science Engineering

CMR Institute of Technology * Bangalore *

Affiliated to Visvesvaraya Technological University, Approved by AICTE New Delhi, Accredited by NBA New Delhi, Recognised by Government of Karnataka.

Accredited A+ by NAAC

Project Abstract

Keywords— <Pothole, Traffic jam Traffic Violation & Traffic Density detection, IOT, Computer Vision, Machine learning, Image based object detection, Object identification, Mobile App, Traffic Signal control unit>

The effective traffic management – by analyzing the traffic density through image based object analysis – vehicle position, line alignments, at signal, and collaborating information about traffic from multiple vehicle on road at various points, further refined by availability of ambulance, VVIP, procession, accidents, vehicle standstill and traffic volume come from other directions.

The concept then leverage the platform to address other concerns like PotHole, Man Holes, Humps, road damages, water logging to tag with the work tender and terms to measure effective penalties, rating the contractors, providing the comprehensive calculations of damage and cost analysis so that solution enabled govt authorities to come up with penalties, plan, policies and rating/tracking work and effective payment plans for work. The observation can be mapped on Google to provide comprehensive delay, guidance to avoid hiccups. The solution further used to detect accidents, theft vehicles, and traffic violations and then enable authorities to trace charge and avoid wrong claims of insurances and also notify respective agencies to address the emergencies. Using advanced technologies like blockchain to make safe and effective handling of information to enhance transparency, anti manipulation check points. The solution can be enhanced further to predict traffic pattern, violation/ accident zones, rash driving pattern and meeting with accidents and etc.

Team Members – Roles & Responsibilities

S.No.	Student Member Name	Role	Justification
1)	M. Darshan	Design Software,technical	Has good coding and software skills.
2)	Hari Pranav A.	Design Software,technical	Has good coding and software skills.
3)	Ashwin M.S.	Design Software,technical,marketing.	Has good coding and software skills and marketing ideas/approach.
4)	Nitin Kumar	Design Hardware,operations,marketing	Has good knowledge about hardware components and and marketing ideas/approach.
5)	MD Shagil Nizami	Design Hardware,operations,marketing	Has good knowledge about hardware components and marketing ideas/approach.

Market Analysis

A. Customer Need Identification -

<1) For hassle free and faster commuting

2) For faster services of Emergency Service vehicles such as ambulance.

3) For a smart traffic controller- signaling automatically on it's faulty functioning

4) Enhanced mobility and improved safety

5)For identification and notifying the authorities of potholes,broken roads,etc.

6) For Providing Advanced information about light change:

a)ensures less wastage of fuel

b) results in less noise and air pollution

7) Provides fast and undisruptive routes: avoid people shun their responsibilities due to traffic jams.
8) For Cargo/transportation vehicles journeying mostly during nights
9)Providing real time data inflow, and automated control and display from control centre.
10) For traffic policemen, fighting pollution and facing health hazards- an alternative to switch with our product.>

B. Serviceable Addressable Market (SAM) Identification & Justification -
<The Metropolitan cities such as Delhi,Mumbai,Chennai,Bengaluru,etc will be our first area for SAM.Our product, will then be expanding to other developing cities, where a significant increase in no. of traffic population over the years.
And also, will help in reduce traffic accidents, mostly occurring at junctions. We enable reduction in corruption tender process and Govt dept like PWD, BBMP will be our customers. >

C. Product Differentiation w.r.t. Competition & Justification - <
Features:
1)works on real-inflow data: helps in survey for identifying traffic density at different time intervals
2) Compatible with existing traffic lights
3) Designed to tackle trouble spots directly from control centre.
4) Automated detection and notification system.
5)Effective insurance rates for vehicle calculation, validating insurance claims.
6) Vehicle Zone mapping: helps in navigation; solve theft vehicle cases.
7) Records harassment case in public and notifying to police.
8) Provides advanced information of light change.
9) Has air quality and other generic sensors for vehicle hardware - be used for analysis by control board.>

D. Understanding of your customer & user- <

Users:	Potential Customers:
1) Working Professionals / Private organizations employee 2) Students & Government employees 3) Pedestrians/vendors/etc. on roads 4) Transportation vehicles(including defence vehicle supplies) 5) BBMP/Municipal road authorities 6) Citizens of the country	1) Businessman,VIP & VVIPs 2) Traffic Police 3) Government scheme Tie-ups 4) Private Hospitals Tie-ups(for their fast ambulance service advertisements) 5) Science projects/research projects in educational institutions & professional bodies/private organizations. 6) Revenue from social drive and smart- city project 7) BBMP/Municipal road authorities 8) Our app -blockchain for accessing fast travel features. 9)PCB(pollution control board)- For air-quality analysis,etc.

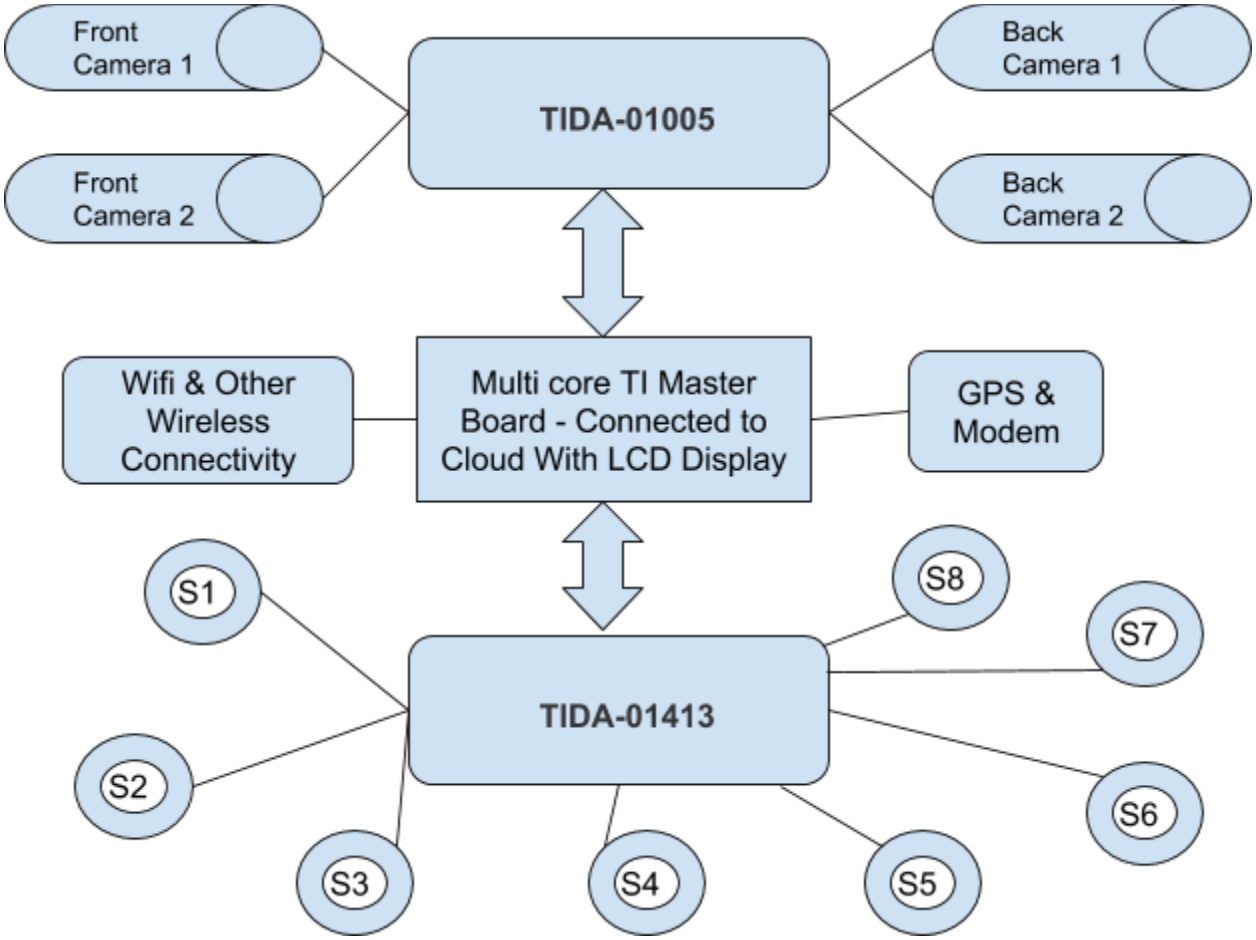
E. Distribution Channel Identification - <

1) Building welfare channels
2) Corporate wellbeing workshops
3) Campus & industry/private organizations drive
4) Social media
5) Government schemes & Traffic Police.
6) Product awareness events.>

Proposed Design

A. Objective - To build Smart Multi utility Hardware for vehicle which enable comprehensive traffic management.
   a. Front & Rear Camera based main controller with Display panel at Moving Vehicles.
   b. CCTV camera and Traffic signal controlling system at each signal.
   c. Mobile Application
      i. Mobile App for Traffic police at each signal - Auto tagging with signal point, Authentication base
      ii. Traffic management Police centre Rooms - Control room
      iii. Higher Authorities - Roaming squad Apps
      iv. Ambulance / VVIP App - Geotagged to Route map for faster transport, always one signal.

B. Proposed Solution -
   a. Block Diagram - A clear block diagram highlighting all the subsystems and supported with a detailed explanation for each block/subsystem Teams to share all relevant circuit diagrams, any simulation results, and details of any software algorithms to support your proposed solution. Teams are encouraged to use WEBENCH for power designing power supply.

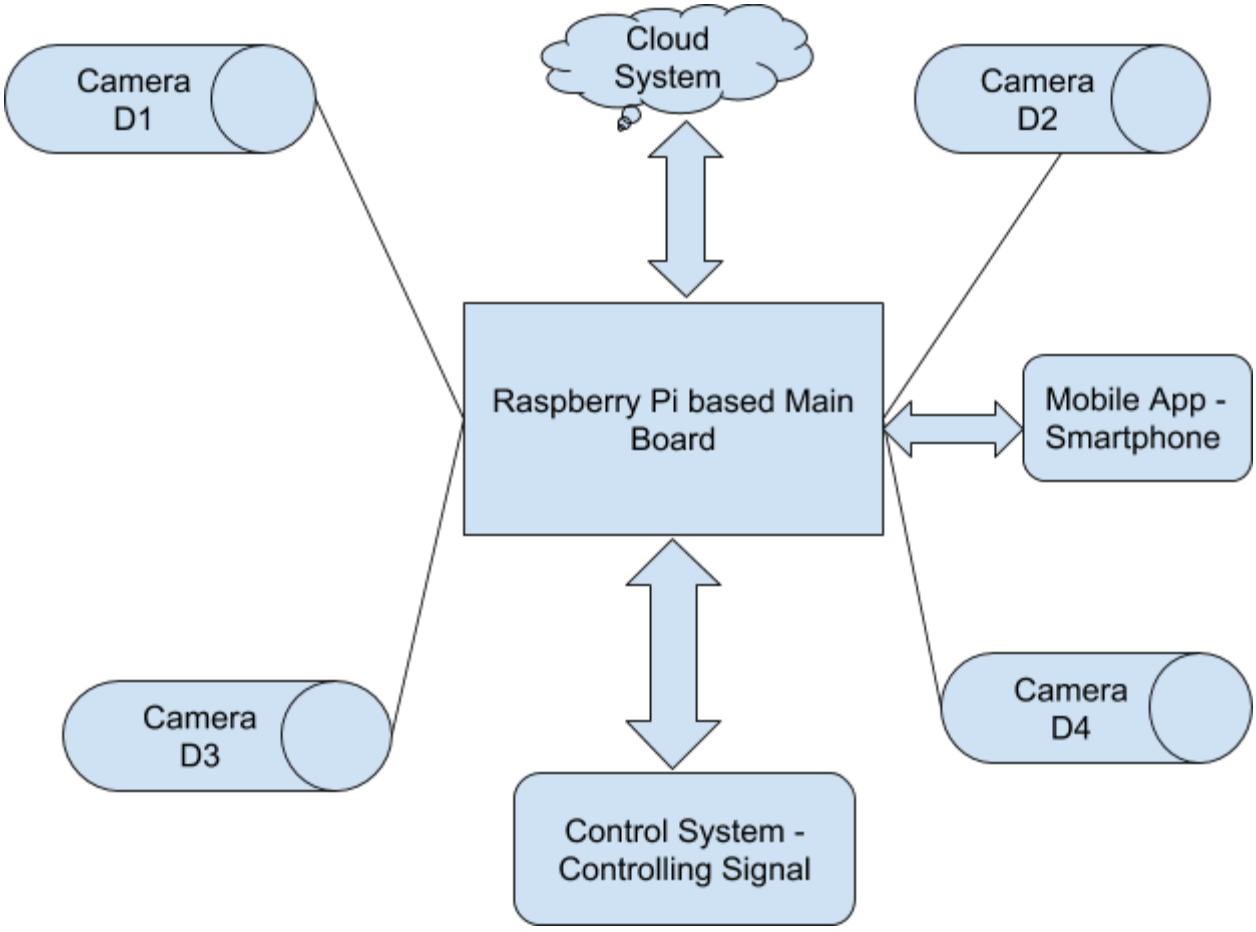


On Vehicle Master System: We used high processing and multiple processor as we use multiple application and comprehensive solution, which needs high computations.

TIDA - 01005 Will get the images and does minimal process and then send info to master system. Master system tags, adds location info and other info to send to Cloud. The processing of images and further analysis will be done on cloud.
TIDA-01413 Connected with multiple sensors like Accelerometer, Gyroscope, Magnetometer, Barometric pressure sensor.Ambient temperature sensor, Collision Sensor & Low cost air quality sensors
Collect information and does some processing and analysis and then send to main system.

Main Controller does further processing, tagging and send details to cloud.

The Cloud solution calculates various scenarios and send the traffic control time and other details to System at various signals across city or country.



For POC we used Generic Hardware with low capacity, For final product we use different Hardware. The Raspberry pi Adds Geotag, Signal Id and Authentication Authorized Traffic Policy handling System at that signal - for manual module.

The system works in two way modes - send information to cloud and then get the Signal control instructions from cloud to control the traffic signal in auto control Mode.
Images are captured and send to cloud after basic processing and then send with specific tags and other information of preferences from the control room or police person

C. Component Used - List all the TI Parts (worth <= 200$) and non - TI parts to be used in designing the proposed solution.

1)BEAGLEBOARDX15 + Beagle Bone M2M + LCD Penal to display - As master Board.
2) We use at Signal side :Generic Hardware raspebary Pi 3.0 with 4 cameras Sensor Hub - multiple sensors to track movement.

3) Other module & Sensors for vehicle: Impact pressure, Accelerometer, Gyroscope, Magnetometer, Barometric pressure sensor,Ambient temperature sensor,sensors to detect fall, Air Quality .(total 8 sensors) .

The attached hardware for vehicle :

Category(IC/EVM)	TI Part Number	Link to the part no.	Qty	How is it being used in the proposed solution? Explain its role/functionality	Available in TI E Store (Y/N
IC	MSP430	MSP430's family & modes.	1	LCD Display - with two hub one for camera and other for sensors.	Y
EVM	TIDA-01413	http://www.ti.com/tool/TIDA-01413?keyMatch=TIDA%2001413&tisearch=Search-EN-Everything	1	For connection of up to four 2-megapixel cameras and up to four radar modules over coaxial cable, providing power, backchannel communication, and clock synchronization to the sensors.Support dual-outputs of the Mobile Industry Processor Interface (MIPI). http://www.ti.com/general/docs/lit/getliterature.tsp?baseLiteratureNumber=tiducm4&fileType=pdf	N
IC	MSP430FR4133	http://www.ti.com/product/MSP430FR4133?keyMatch=TI%20MSP430FR4133&tisearch=Search-EN-Everything	1	Low cost air quality sensors	Y
IC	PGA450-Q1	http://www.ti.com/product/pga450-q1?keyMatch=collision%20sensor&tisearch=Search-EN-Everything#relEnds	1	Collision Sensor - to detect, track, count and identify human activity to make critical decisions.	Y

Innovativeness of the Proposed Solution

1. Instead of identifying traffic density and calculating traffic signal time
    a. ML Image solutions for Object Detection - Apart from finding the density of traffic or count of moving vehicles at the signal, the solution considers other points and information feeds from other agents as mentioned below to provide effective traffic prediction and support system
        i. Number of vehicles approaching the signals
        ii. Vehicles parked or halted on road, Ambulance, School Van, VVIP and other emergency
        iii. Vehicles with Smart Traffic assistance system on road will feed further information about the traffic heading towards the single and above details.
    b. AI/ML algorithm also takes consideration of past history/learning along with above point to calculate the traffic signal time, which signal to be activated. The system works on two mode
        i. Notify details to the Traffic Police authenticated at signal - based on GPS location and then with system at signal and app synced.
        ii. In auto mode, system controls the traffic signal.
2. Detection of Pothole, Manhole, Bad / damaged Road, traffic Jams, accidents on road using multiple mode
    a. Apart from images capture and ML algorithms. Multiple sensor information like one wheel lowered position, compared to other and other methods to re-validate the situation.
    b. Mapping those on google Map to provider better traffic prediction.
    c. Using Blockchain data added on open ledge and tracked expected actions done or not.
3. The solution is scalable and multiple utilities can be added using same SW and HW solution and provide the platform for any third party can add solution or plugins over the platform in collaboration with us to make system more holistic.

Impact of the proposed solution

Key impacts of solutions are as follows

Traffic Management

1. Instead of static traffic signal management, providing effective traffic handling while considering lot of inputs so that
    a. smooth flow of vehicles achieve, reduced traffic Jams,
    b. Faster ambulance, VVIP or other emergency handling
    c. Attending the accidents or wrongly parked or halted vehicles on road, knowing the jam zone to address faster.
    d. Synchronize the traffic movements, dynamically detect deviation and adjust.
2. Helping Traffic authorities
    a. Finding violations, violators, zone of violations, accidents zones
    b. Tracking missing theft vehicles, abscuding violators
    c. Provide deep analysis, insights for planning effective human resources usage to manage concerns at best cost, fast response.
    d. Enable them to plan changes in route / one ways etc to handle traffic

Civic Bodies & Govt

1. Help us to correlate the bad road with contract and people who approved it, so that any potholes, road damaged, etc will be used to measure the cost of loss - to Penalise the respective team
    a. Gives details of road/ infrastructure damaged and track the progress of repairs and how long the road in well condition
    b. The comprehensive system gives fair rating for the contractors to give further work or penalise
    c. System also gives overall maintenance cost, frequency and further insights, which agencies can use planning, budgeting and tracking.
2. Provide current status of road, load on infrastructure and routes which are becoming bottleneck, junctions becoming bottlenecks so that agencies plan better infrastructure for future.
    a. Growth over a period, changes in partner enable agencies predict for future growth and then plan accordingly.
    b. Also helps while building, repairing stretch what is effective plan to reduce traffic impact.

Insurance Companies

1. Identify misleading claims
2. Building effective insurance policy for charging often violator more and other best price to make people more discipline

Other utility

1. Rash driving by driver on road
2. Detecting and notifying Accident met or sudden failed vehicle to respective members.

3. Mapping the road condition on google map and enabling more insights about the road, better prediction about time to travel and guide vehicle to avoid such points while driving.