

Smart Mobility

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Dr. Om Krishan Singh

**Scientist 'D'/Joint Director (R&D in Electronics & IT)
Ministry of Electronics and Information Technology
Government of India, New Delhi**

Outline of Presentation

- **Introduction – E-Mobility, Preferences & Statistics**
- **MeitY- EV initiatives & its Schemes**
- **Development of Indigenous EV Technology – The Journey so far**
- **Smart Mobility solutions - ITS**

Introduction



Need

- Rising air pollution
- Reliability
- Efficiency



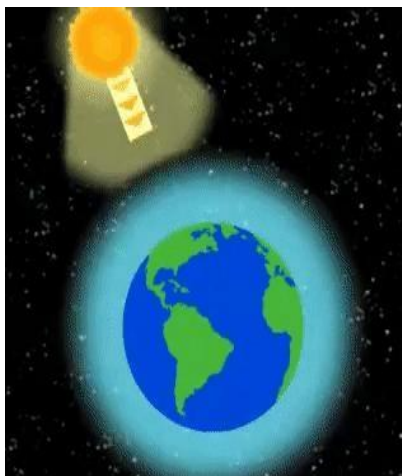
Fuel depend ency

- Fast depletion of fossil fuel
- Economic & Environmental Impact

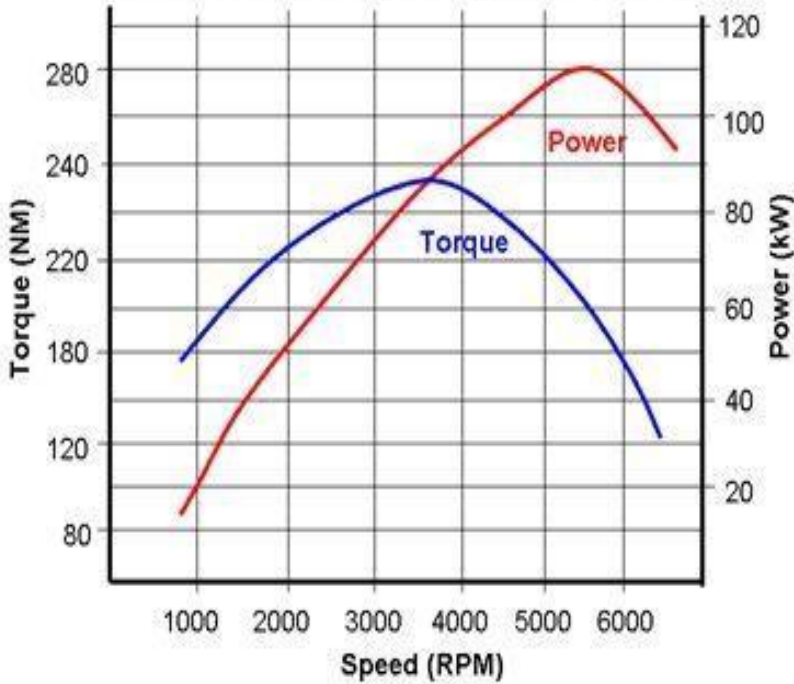


Air quality in India

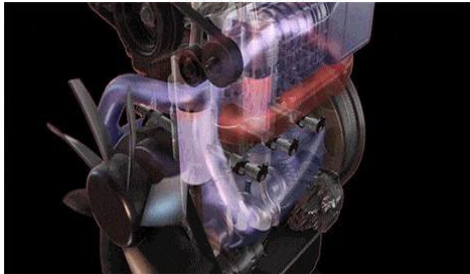
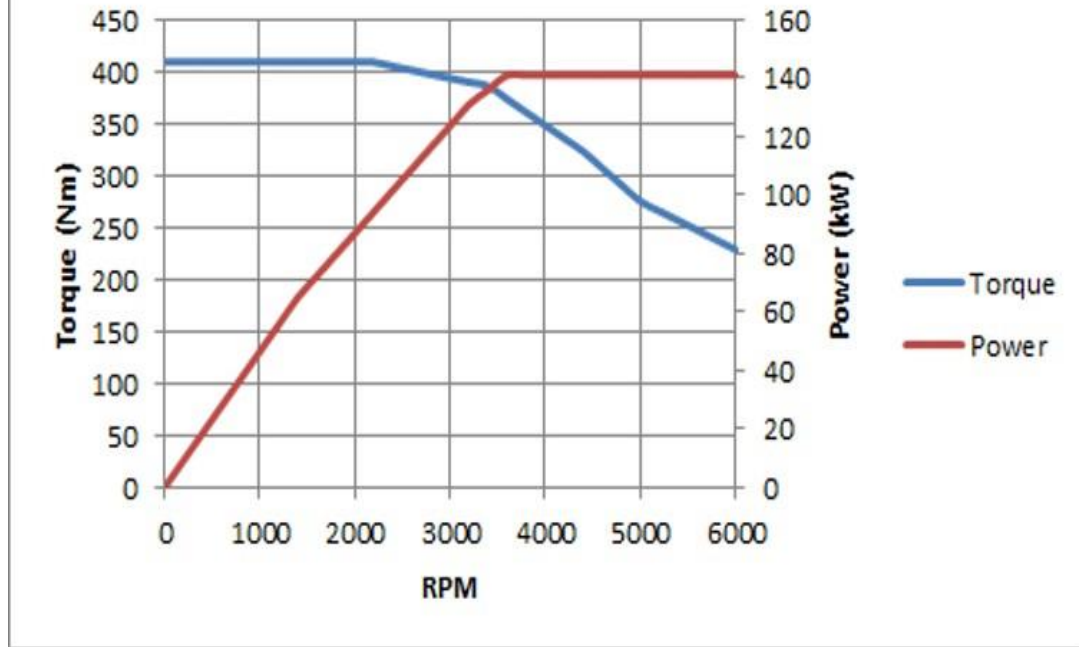
- 14 % of top 20 most polluted cities in the world
- 20% of PM 2.5 emissions in Delhi
- 26% Of NOx emissions in Delhi



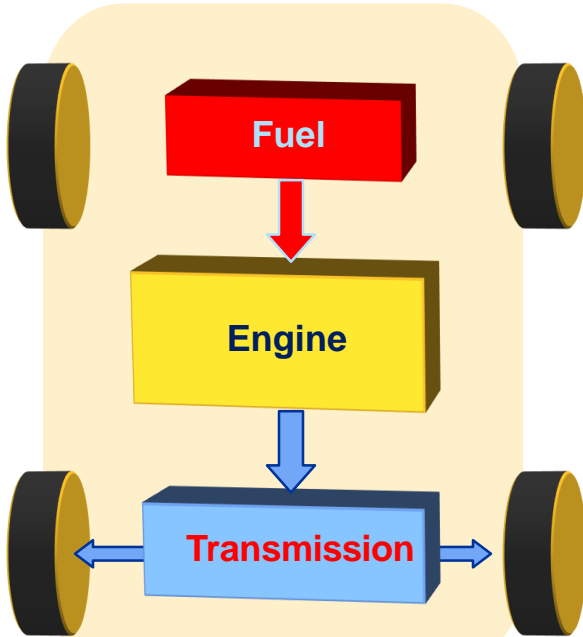
Engine Power and Torque Curves



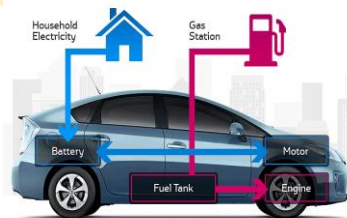
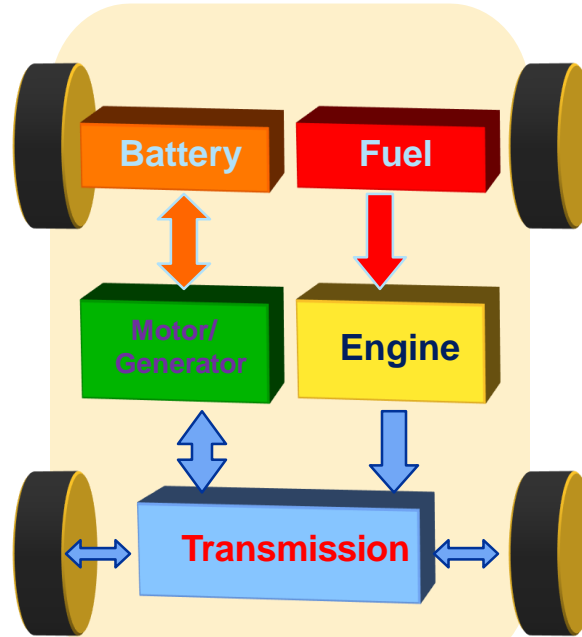
Typical Electric Motor Torque & Power Curves



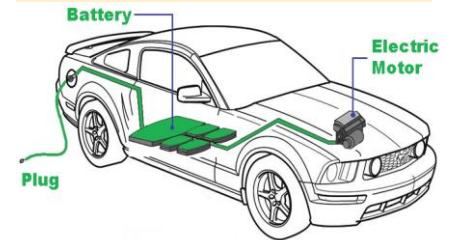
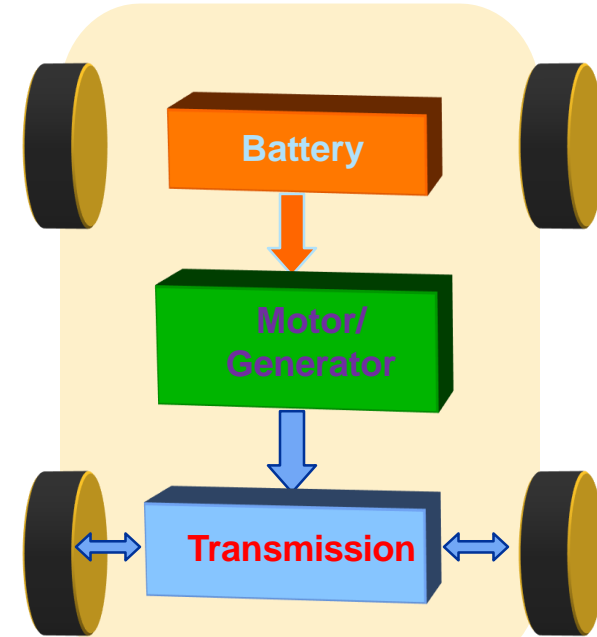
Conventional



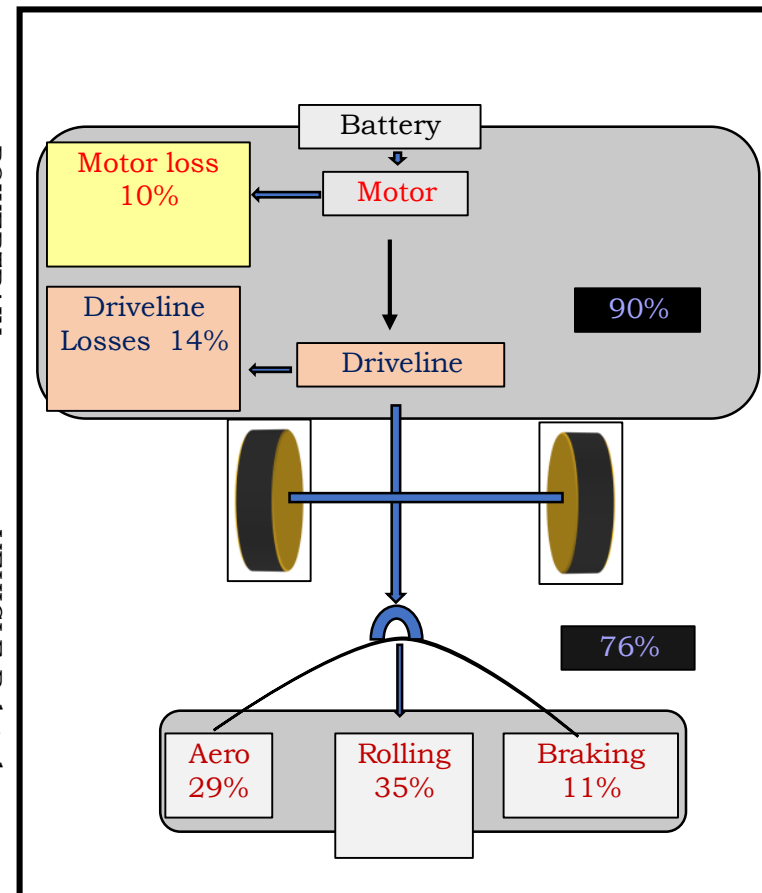
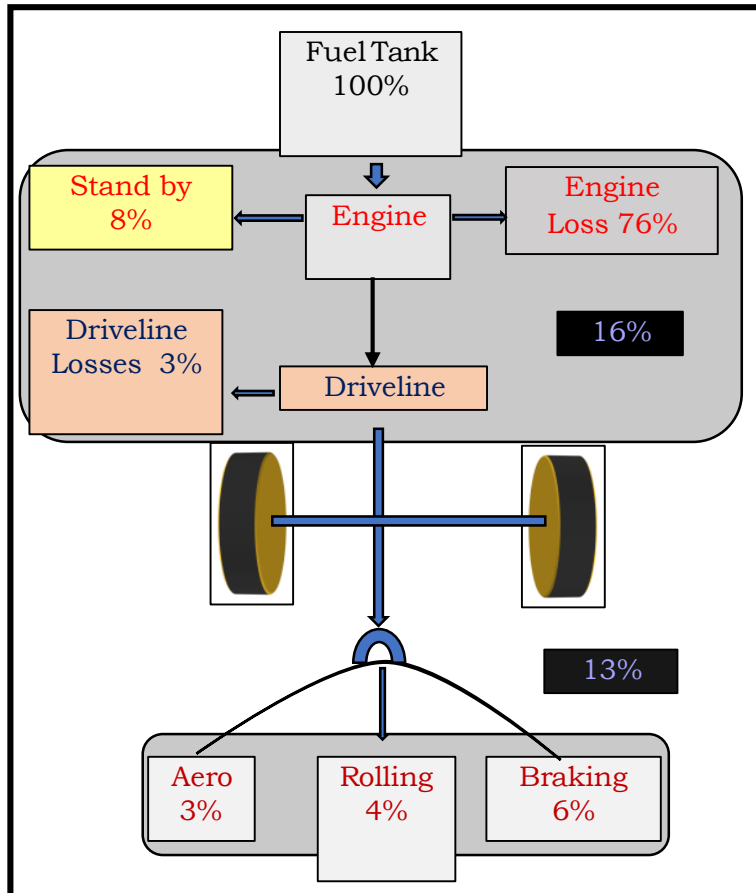
Hybrid



Battery Electric



Energy Loss: City Driving- IC Vehicle



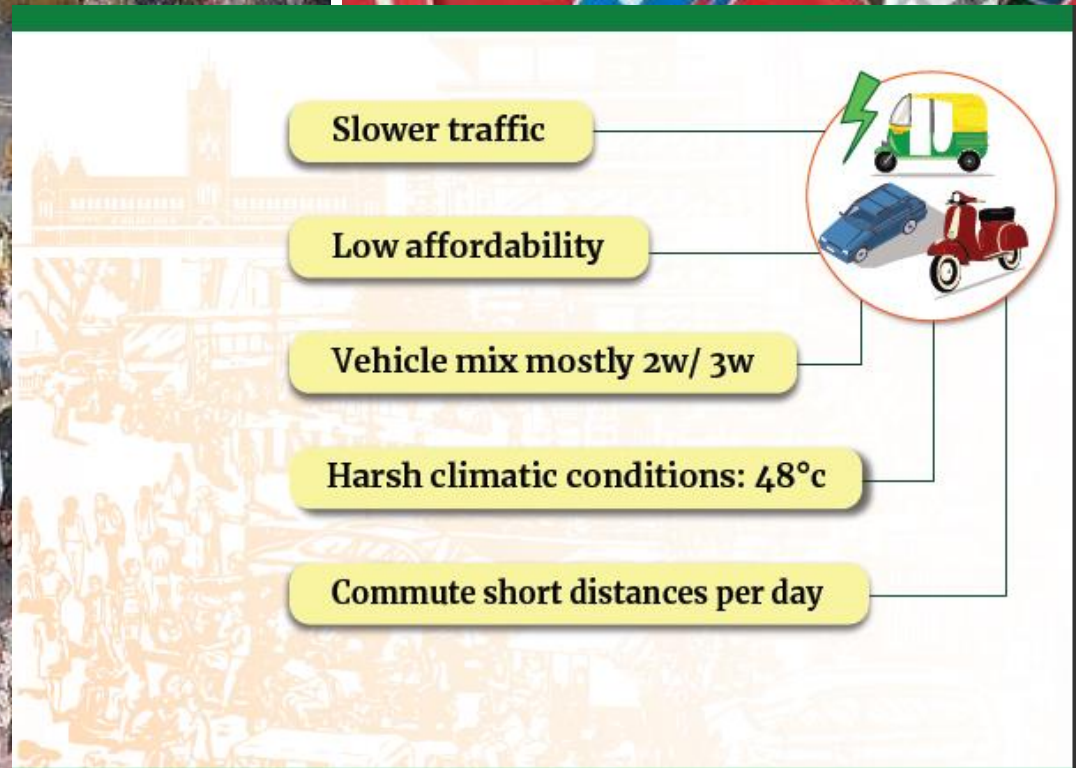
Urban Drive Cycle Energy Balance 2005 3 L Toyota Camry



US Traffic



India Traffic



Why EVs for INDIA



GoI Target by 2030

To electrify 70% of all CV, 30% of private cars, 40% of buses, and 80% of 2W & 3W sales.



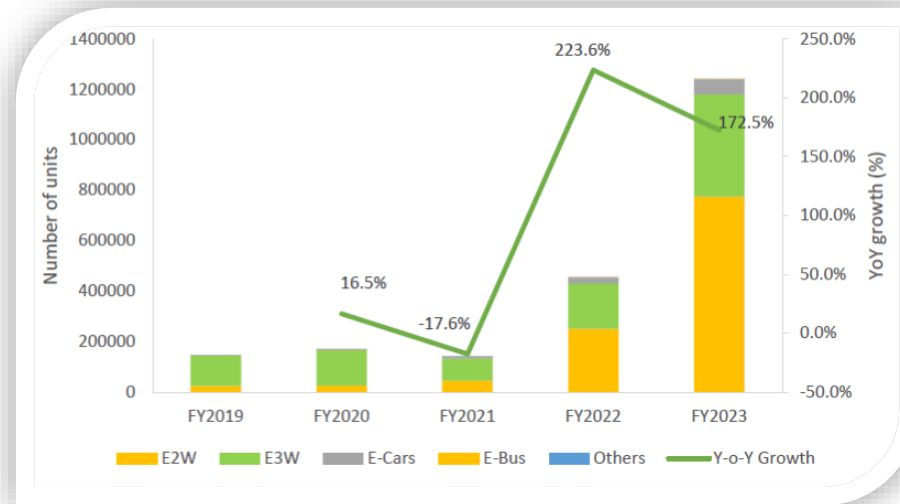
EV Market

~ \$206 billion opportunities by 2030 if India maintains steady progress to meet its ambitious 2030 target.



Demand of EV

Rapid increase in registration of EV



Annual Electric Vehicle sales by category

Deliverable

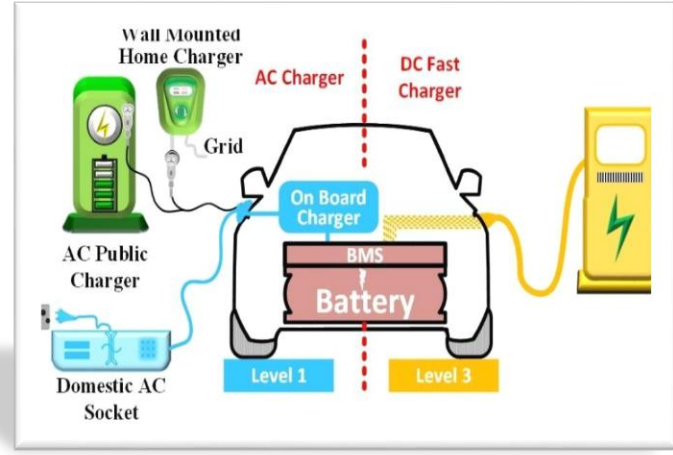
Technology/ product has to be cost-effective, quality competitive, suitable to our environment, and ready for commercialization.

Objective

To develop high-performance, reliable & cost-effective electric vehicle subsystems in different areas (Motor/controller/converter/Charger/BMS).



EV Charger



BMS for EV's Battery

Battery	Advantages	Disadvantages
NMC	lowest cost, highest specific energy	Slow charging, Temperature sensitive
LTO	Fast Charging), Temperature insensitive,	Highest cost
LFP	Temperature tolerant between NMC and LTO	Energy-density and costs between NMC and LTO

Motors for EV

Traditionally used Motor: Induction Motor

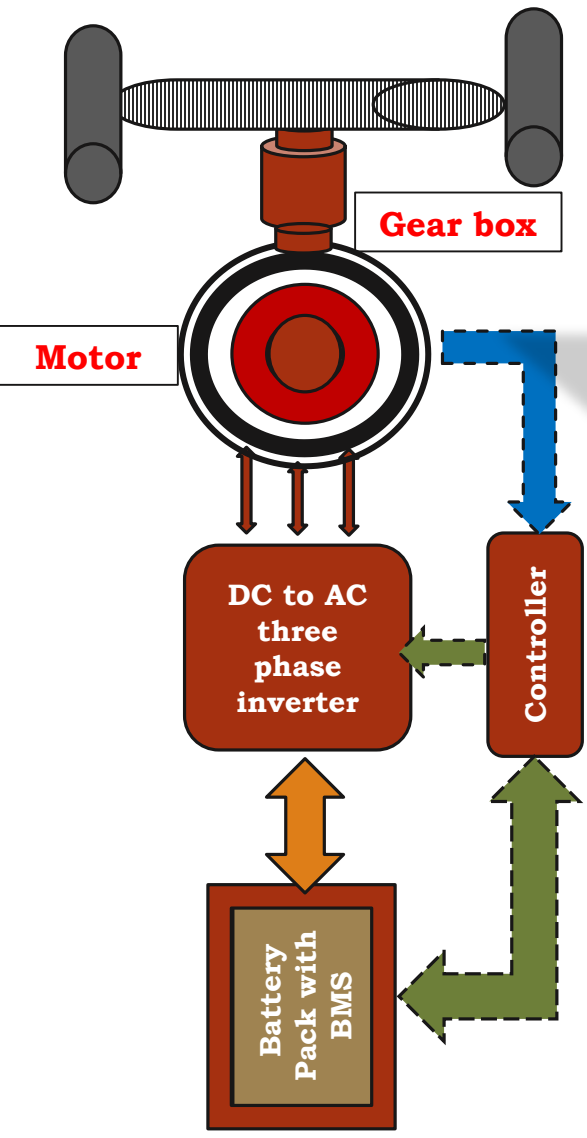
- Does not perform efficiently across all speeds; lower efficiency at lower speeds
- Limited Torque delivery

Intermediate Solution : BLDC

- Good for lower power rating
- Uncomfortable drive, and Torque ripple

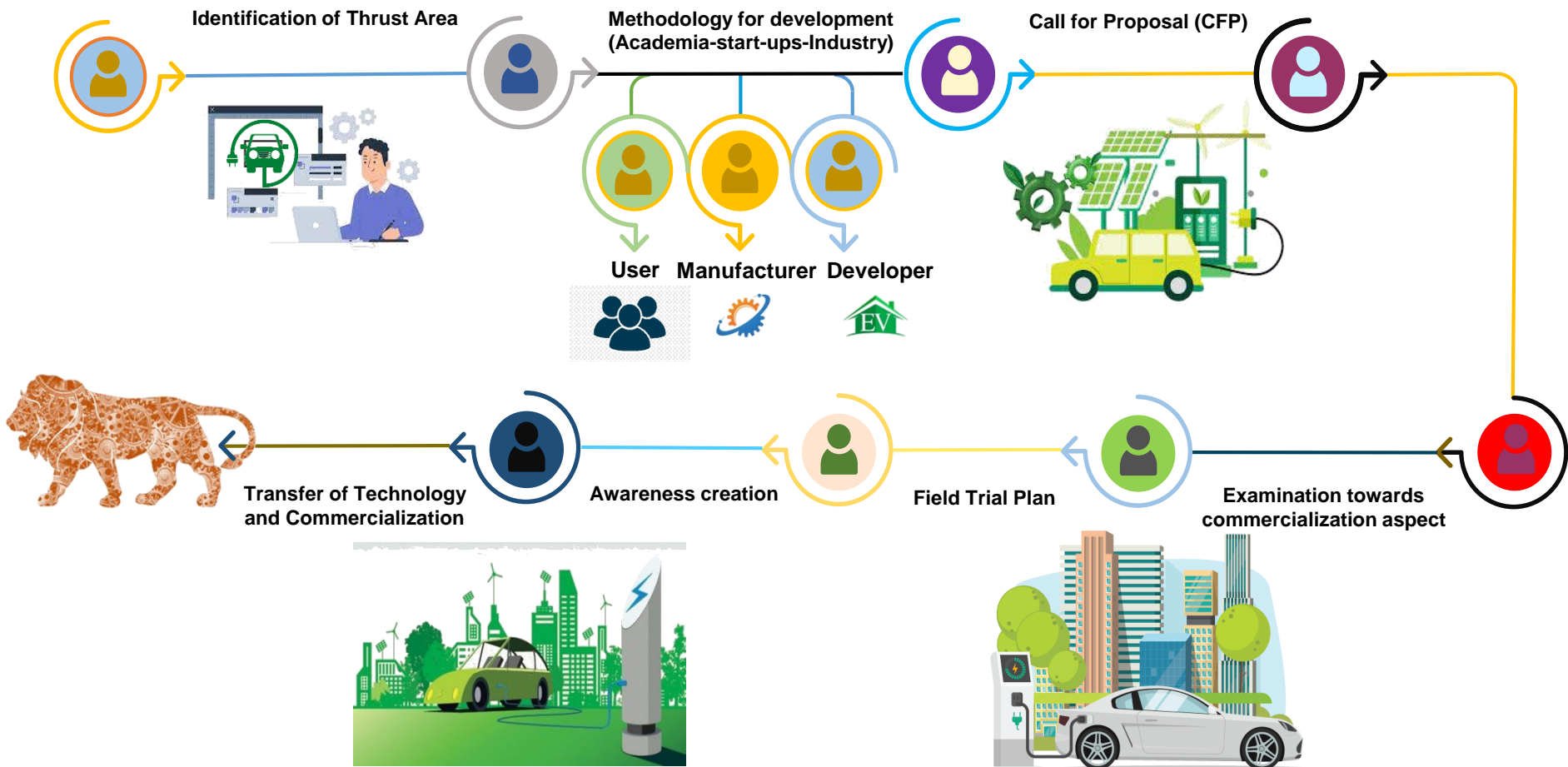
PMSM Motor

- High efficiency in the entire operating speed range
- High power density, high torque to weight ratio
- Improved driving comfort
- Low cogging torque improves ride experience
- Low torque pulsation



DC-DC Converter





Road Map



2020 **2021** **2022** **2023** **2024** **2025** **2026**

Initiation of EV Programme

Prototype development & Field trial at TRL 6

Commercialization of 2/3W component at TRL 6 & above

The prototype Development at TRL 5 (SiC & GaN based drive)

The prototype development and field trial at TRL 7& Initiation of 4W/heavy vehicle component development

Commercialization & Production of Motor/controller/ converter/Chargers/BMS at TRL 7

The prototype development and field trial above TRL 7 for 4W/heavy vehicles

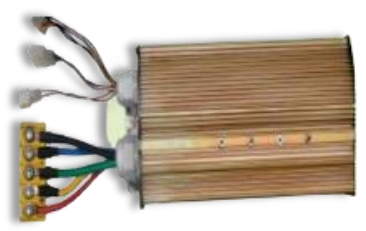
Development



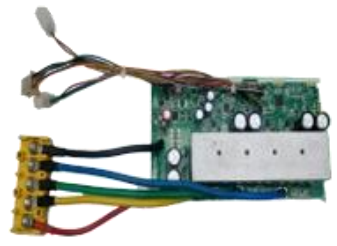
PMSM Motor



PMSM Controller



BLDC Motor



BLDC Controller

14 EV technology development of motor/controller/ converter/ Chargers/ BMS etc. are in the final stage of field trails, certification and ToT.

2020 **2021** **2022** **2023** **2024**

EV Motors/Controllers

- Technology of Permanent Magnet Synchronous Motor (PMSM)/controller for 2W/ e-Rikshaw has been developed, tested and transferred to **M/s Alphasine and M/s Amber** for production /commercialization.
- Technology of BLDC Motor/controller/vehicle control unit(VCU) is ready and being transferred to **M/s Brushless Motor, M/s Lithion Power** for production



Electric Motor
Controller



An electric motor that beats to the nation's pulse

Made In India | Best In Quality | Affordable In Price

High Efficiency IPMSM E-Rickshaw Motor

Motor Type	IPMSM	Controller Type	FOC Sinusoidal
Rated Power	1.2 kW	Operating Range	40 - 60 V DC
Rated Torque	4Nm	Nominal Voltage	48V
Rated Speed	2800 RPM	Power Nominal	1.4kW

Launching of PMSM Motor



RAPTEE



BRUSHLESS MOTORS INDIA
PRIVATE LIMITED



LITHION

Indigenous Motor Controller



BLDC MOTOR CONTROLLER FOR e-RICKSHAW



- Made in India
- Affordable
- Efficient
- Ecofriendly

Designed & Developed by : **DELHI TECHNOLOGICAL UNIVERSITY**

In Collaboration with : **LITHION POWER PVT. LTD.**

Funded and Supported by : **MINISTRY OF ELECTRONICS AND INFORMATION TECHNOLOGY**

KEY FEATURES

- 3-half bridge Inverter topology with N-Channel Power MOSFETs
- Motor control based on 6-step commutation algorithm with rotor position feedback
- CAN, UART and Bluetooth communication capabilities
- Test Points to monitor key motor parameters
- Fault Diagnostics capability
- Compatibility with 5V Throttle

PROTECTION FEATURES

- Reverse Polarity Protection
- Over Voltage Protection
- Under Voltage Protection
- Short Circuit Protection
- Over Current Protection
- Thermal Protections



Controller Type	: Trapezoidal
Input Voltage Range	: 42 - 56V DC
Nominal Voltage	: 48V DC
Nominal Power	: 1kW
Peak Power	: 2.8kW
Nominal Continuous Current	: 20A
Peak Current	: 60A
Controller Dimensions	: 225x120x75mm (lxbxh)

Contact Us : sales@lithionpower.com | +91 8929065286

Indigenous Motor Controller

Electrification Package for Light Duty EVs



Industry First Features

- SOC & range estimation, safety features
- Multi-featured drive information system
- Combined regenerative and mechanical braking for enhancing range
- Fault monitoring and reporting



BLDC Motor
(1.2kW continuous, 48 V DC)
ICAT certified: AIS041, IP67



**Integrated Motor cum vehicle
controller**
(1.5 kW Continuous, 48 V DC)
Patent Filed



Funded by
Ministry of Electronics and
Information Technology
Government of India



Designed & Developed by
Indian
Institute of
Technology
Kharagpur



Industry Partner
**Brushless
Motor
India**



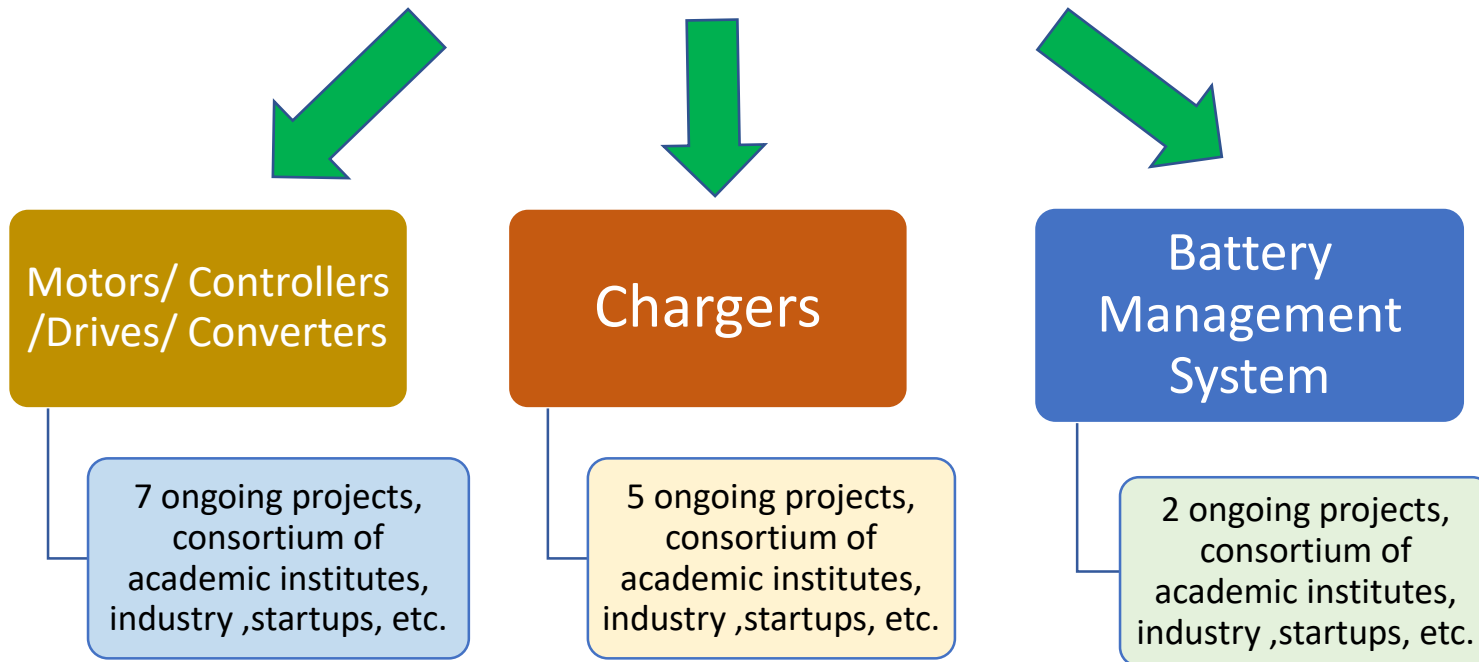
Digital India
Week 2022

Digital India
Week 2022



Ongoing Projects under EVSS Programme

14 On-going Projects



Outcome of EVSS Programme

A **5kW** Single Phase AC Charger powered by solar energy

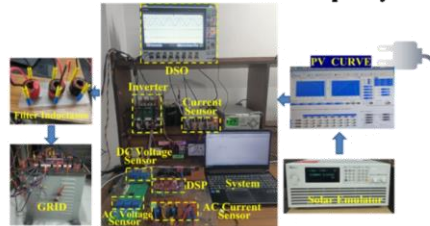


Specification:
DC Voltage- 70V-350V
AC Voltage- 230V RMS
Switching frequency- 20kHz
Power-5kW
Line Frequency-50HZ



A **10kW** Three Phase AC Charger powered by solar energy

Specification:
DC Voltage- 650V-1000V
AC Voltage- 230V RMS
Switching frequency- 20kHz
Power-10kW
Line Frequency-50HZ



Parameter	Description	Min	Nominal	Max
Input Specifications				
Input Voltage		450 V	650 V	800 V
Input Current				<7.3 A
Input Capacitance			20 uF	
Efficiency		92%		
Power Consumption @24Vdc				8 W
Output Specifications				
Output Current	(@ 28Vdc)			110 A
Output Power	Continuous 3kW; Peak 3.5kW (for 10 Seconds)			3 kW
Output Voltage Set Point		27.8V	28V	28.06V
Turn-On Delay	From start to Nominal Voltage			60 Sec
Turn-Off Timing	PS WAKEUP delay; (monotonic Vo fall)			100 ms
Output Volt Ripple				2% of Vout
Output Volt Noise				2% of Vout
Environmental Specifications				
	Operating: 62 kPa absolute pressure		3,600	
Operating Temp (Deg C)	Coolant temp with no derating Ambient temp @ full load, with no power derating	-40°C	65°C	80°C

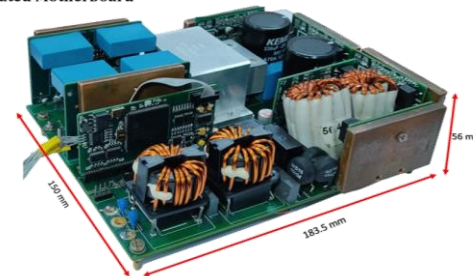
The AI-Enabled Solar-based Multi-port High Gain Electric Vehicle AC Charging Station for domestic and commercial use

3 kW DC-DC converters for medium and small size electric trucks



BATTERY SPECIFICATIONS	
Battery Capacity	20 kWh
Cell Chemistry	LTO
No. of Cycles	15000 Nos
Charging Method	GB/T or 3kw
SYSTEM SPECIFICATIONS	
No. of AC Outlets	3 Nos
No. of Vehicles Charged Simultaneously	3 Nos @ 3.3 kW
No. of Fast Charging Ports	1 Nos
Maximum Output Power	12.5 kW
Output Type	1-phase AC
Output Voltage	230 V
Max Output Current	200 A
System Weight	~560 Kgs
Dimensions	215 x 158 x 183 cm

Integrated Motherboard



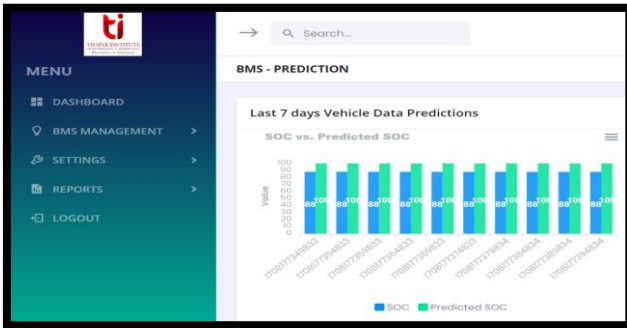
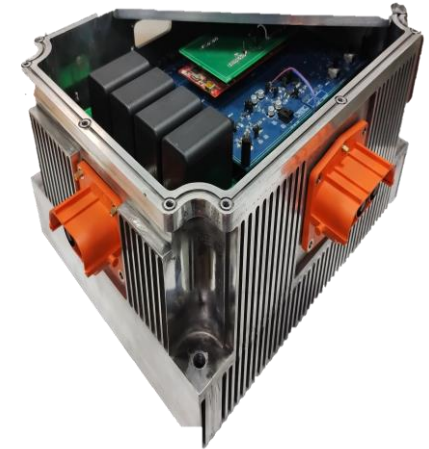
Enclosure size: 200 mm x 160 mm x 75 mm (L x B x H)



Development and Deployment of EV DC Fast Charger

Development of On-board (In-Vehicle) Fast DC Chargers using High-Speed GaN HeMTs for Two-Wheelers(2W) Electric Vehicles

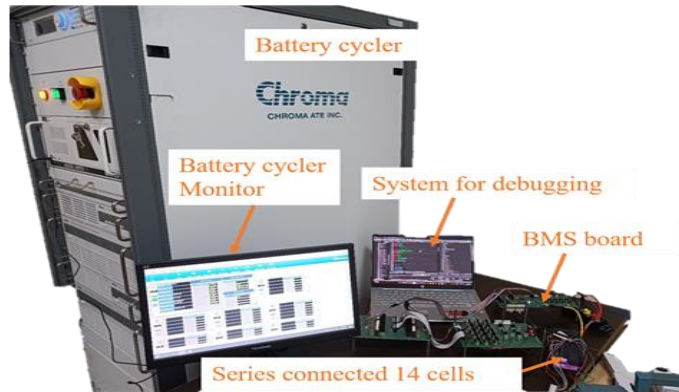
Parameters	
Operating Conditions	
Voltage	0-96 V
Operating Temperature Range	-15 to 65 C
BMS Type	Smart Cloud Storage
Monitoring	Cloud based real-time monitoring
User Interface	
Interface	1. Cloud
	2. API Integration
	3. MQTT based Protocol
	4. Bi-directional Communication
Communication Protocol	1. CAN Bus
	2. Wi-Fi
Security	1. GPRS with live monitoring and tracking
	2. AWS KMS (Key Management Service)
	3. AWS IAM (Identity and Access Management)
	4. Authorization and authentication (SQL Database)



A Smart Battery Management System with Real-Time Estimation for State of Charge (SoC) and State of Health (SoH) of Electric Vehicles Batteries using Hybrid Models

Design and Development of Next Generation cost-effective Reconfigurable On-Board Battery Charger with Health and Fault Monitoring

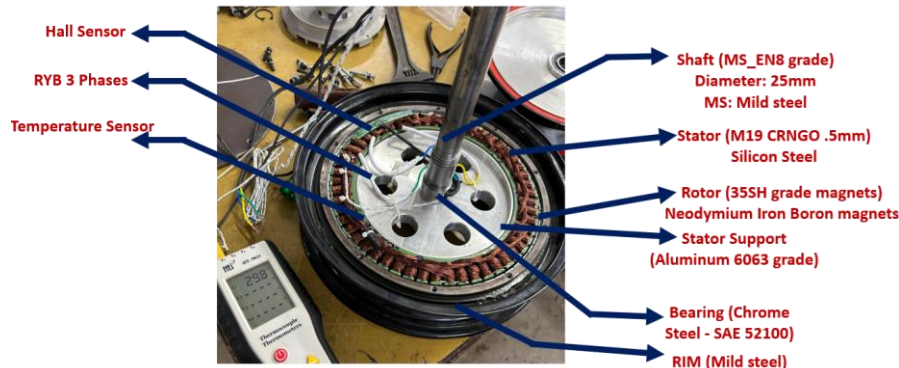
Development of High-Efficiency Motors and Controllers for EVs for Indian Driving Conditions



Development of an efficient module-integrated battery management system



Development of high-efficiency portable chargers for electric 2W/3W



Final specifications considered for fabricating first prototype: Stator Slot Gap = 2.5mm + Winding 18 strains X 8 Turns X 26 (SWG) + Rotor magnets width = 13.05mm + N38H grade type rotor magnets:

Performance Parameters:	Final Specifications
Rated Power	500 watt
Peak Power	750 watt
Rated Speed	264 RPM
Peak Speed	350 RPM
Rated Torque	18.1 Nm
Cogging Torque	0.859 Nm
Stator Teeth Flux Density	1.61 T (No Load) 2.07T (Peak)
Current Density	3.442 (A/mm ²)
HV testing winding Resistance	75 mOhm (Match with Simulation Results)
HV testing winding Inductance	0.44 mH (Match with Simulation Results)
Efficiency	87.4 %
IP Protection	IP68 (water + Dust)

Indigenous development and Commercial Possibilities of electronic differential system along with two in-wheel motors for electric 3-wheelers

National **M**ission on **P**ower **E**lectronics **T**echnology is a mission programme launched by the Ministry of Electronics and Information Technology (MeitY)

Mission: To facilitate **R**esearch, **D**evelopment, **D**eployment and **C**ommercialization of Power Electronics Technology by enhancing indigenous R&D expertise and infrastructure in the country with active participation from Academic Institutions and Industries

www.nampet.in

NaMPET - Program

Industry Partners

 Ashok Leyland	 BARC	 CPRI	 Indian Railways	 Indian Air force
 Megatech Power Equipments	 Numeric Power Systems	 Hykon Power Electronics	 Power one Micro systems Pvt. Ltd	 HBL Power Systems Limited
 Keltron	 Emerson	 Veeral Controls	 Amararaja	 Electrohms
 Kerala Automobiles Ltd.	 Techser Power Solutions	 NMRL	 ICD-Industrial Controls & Drives	 Hind Rectifiers
 Electrotherm Ltd.	 Tata Power	 Renault Nissan	 NPOL	 IPR
 ELGI Ltd.	 Anert	 Consul neowatt	 RRB Energy Ltd.	 Crompton Greaves
 BHEL	 ABB	 Autometers Alliance Ltd.	 Mosar Technologies	 ITI Ltd. Palakkad
 Powertec Energy Ltd	 United Electrical Industries Ltd.	 Zreyah Semiconductors		

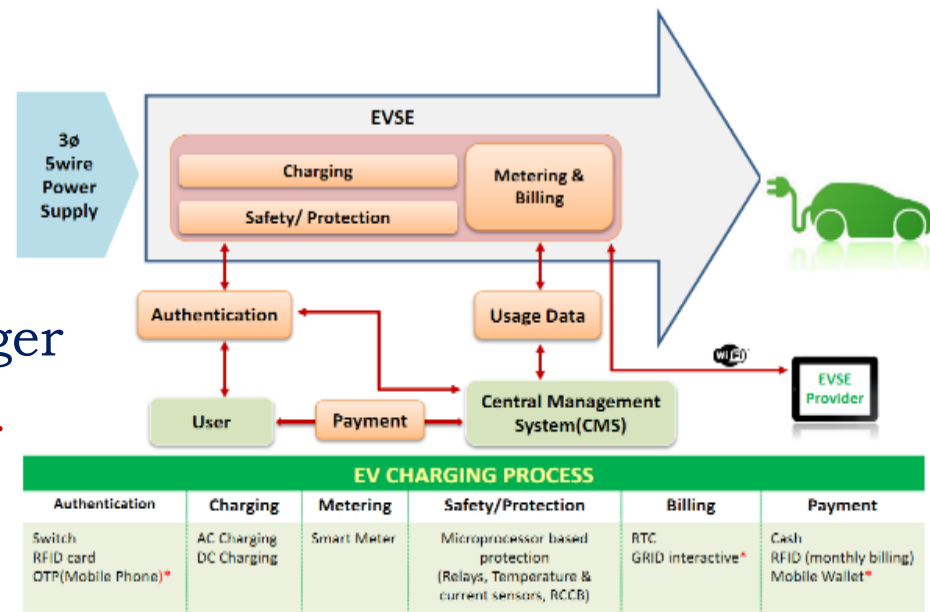
Academic Partners

 IIT Roorkee	 CET, Trivandrum	 BIT Ranchi	 NITK Surathkal	 IIT Madras
 NIT Rourkela(NITR)	 IEST shibpur	 NEHU, Shillong	 NIT Trichy	 NIT Calicut
 NIT Warangal	 IIT(BHU) Varanasi	 IIT Patna	 VNIT Nagpur	 NIT Goa
 MNIT Jaipur	 NIT Jamshedpur	 NIT Mizoram	 SVNIT Surat	 NIT Allahabad
 NIT Agartala	 IISc Bangalore	 IIT Bombay	 IIT Kanpur	 IIT Kharagpur
 IIT Delhi	 RIT Kottayam	 Anna University	 Amal Jyothi College	

Development of **WBG** based **EV** Supply **E**quipment for Charging (**WBG-EVSE**)

Objective and Targets - WBG EVSE

- ❑ 3.3kW Single Phase AC Charger
- ❑ 7kW & 22kW AC Fast Chargers
- ❑ SiC based 15kW DC Dual Point Charger
- ❑ GaN based 3.3kW SPV DC Charger
- ❑ SiC based 50kW DC fast charger



*Future Enhancements

Specification of EV Chargers

Parameter	Values	Parameter	Values
AC Supply System	Three-Phase (22kW) Single-Phase (7kW) AC system	Nominal Input	3-phase 415VAC
Input voltage & frequency	230V / 415V (+10% and -10%) , 50Hz, ±3Hz	Rated Output Power	15 kW / 30kW (Phase 1) , 3.3kW (Pg 2) 50 kW
Number of outputs	1	Switching Frequency	50 kHz 50 kHz
Output Current	32A	Intermediate DC Bus	700 VDC 750 VDC
Output Connector Compatibility	IEC 62196 Type II	Output Voltage	48VDC/72VDC 250 – 420 VDC
EV- EVSE communication	Control pilot and proximity pilot function	Output Current	200 A 125 A
Parameter	Values	Output Connectors	GB/T CCS, CHAdeMO
AC Supply System	Three-Phase	Parameter	Values
Input voltage & frequency	415V (+10% and -10%) , 50Hz, ±3Hz	Nominal Input	230V Single Phase AC 50Hz
Number of outputs	3	Power	3300W
Output Current	16 A	SPV Nominal Voltage	225V DC
Output Connector Compatibility	IEC 60309	Switching Frequency	100kHz
CMS- EVSE communication	OCPP	Output Voltage	48V DC
		Intermediate DC Bus Voltage	400V DC
		Solar Panel Technology	Mono crystalline
		Output current	68A max.

Chargers developed under WBG-EVSE



3 Port AC Charger



Single Port AC Charger



22kW AC Fast Charger



7kW AC Fast Charger



15kW DC Charger

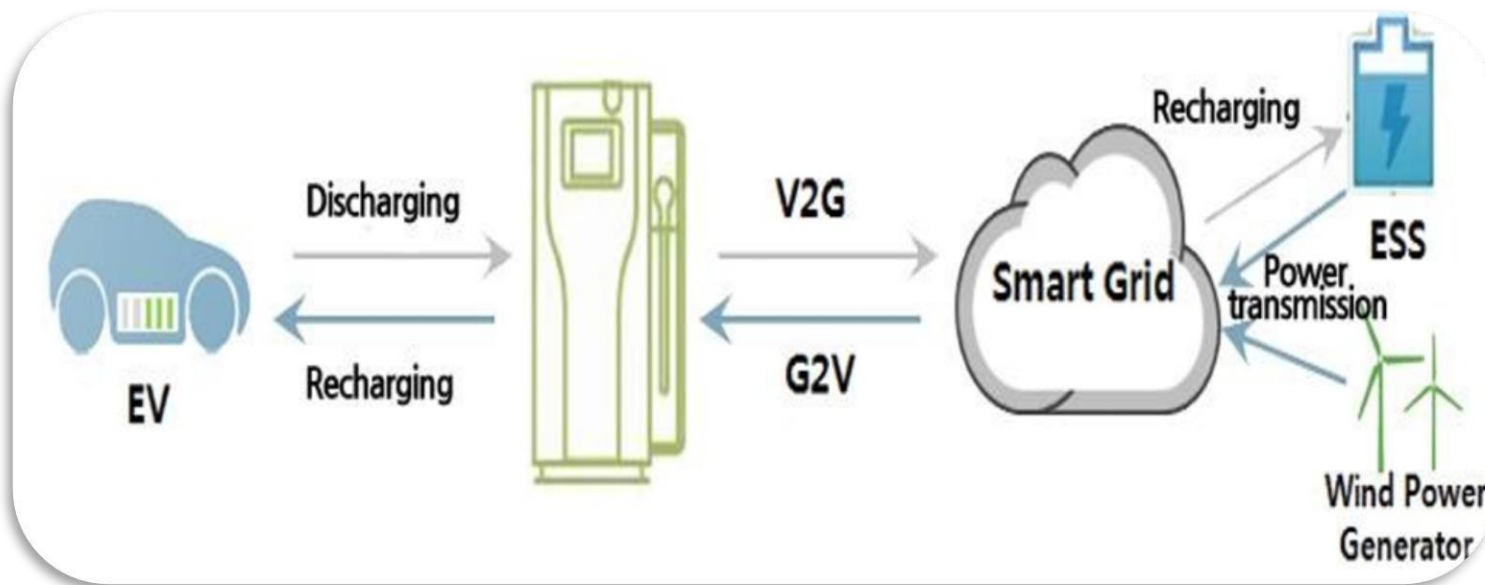


3.3kW SPV DC Charger



50kW Mechanical Model

- ❖ Allows communication between utility and vehicle
- ❖ Allow integration of more renewable like wind/solar
- ❖ Used EV batteries could be used as stationary batteries for utilities
- ❖ Batteries could provide ancillary services



Source: McKinsey

Smart Mobility solutions for Intelligent Transport System



ITS products for Smart Mobility

- ATCS Compatible Vehicle Actuated Traffic Signal Controller Adaptive Traffic Control System (ATCS) software capable of handling non-lane based, mixed traffic flow conditions (TraMM-EnV / CoSiCoSt-EnV)
- Pedestrian Safety Enhancement Controller (PeSCo)
- Emergency Service Vehicle Priority System (EmSerV)
- Bus Priority System
- Fleet Management system & Passenger Information System (FMS & PIS)
- Personalized Transit Route Guidance System (PTRGS) for bus passengers

Salient Features

- Universal Interface for Vehicle Detector
- Compatible to switch 24V DC lamps
- Green-Green Conflict Monitoring
- Malfunction Management
- Input Voltage Monitoring
- Lamp Intensity control using PWM
- Police Panel Operation (Auto/Manual/Forced flash/ Hurry call)
- Transit Signal Priority for BRTS Bus in dedicated lane
- GPS Based Distributed Time Synchronization
- Remote monitoring of signals through 4G/MLLN link
- Pedestal mount
- Technology readiness –TRL9

Industry Connect

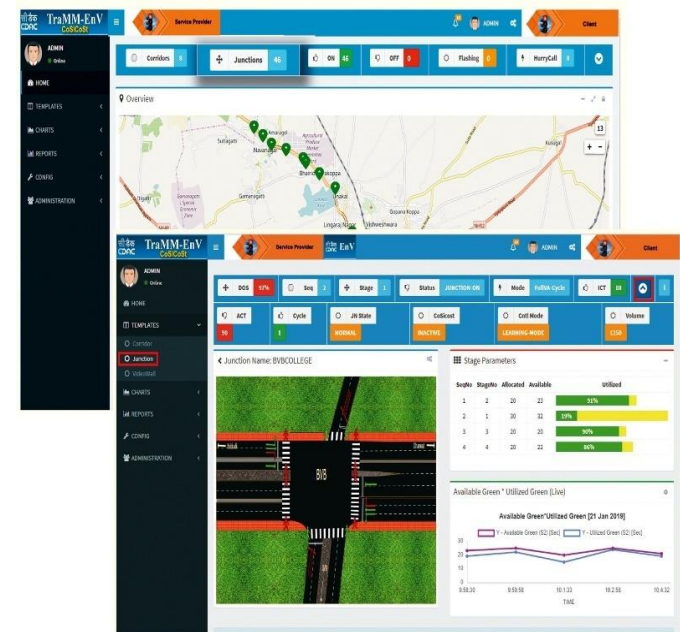
- TOT partners – 9 nos.



TraMM-EnV is a software tool used to remotely monitor and manage a network of Traffic Signal Controllers installed at different traffic junctions in a city from the Traffic Command and Control Centre.

Salient Features

- GIS based user interface with dashboard
- User Management and Alarm Management with SMS, MAIL and Dashboard alerts
- Junction configuration, live animation of traffic signal status and Video Wall display
- Corridor configuration for ATCS
- Time Space Diagram for monitoring signal coordination
- Grouping of junctions for Green corridor
- User defined permanent and temporary scheduler
- Standard and custom reports and charts for data analysis
- Web Service for sharing traffic signal data in Smart City dashboards and other third-party products.
- Technology readiness –TRL9



Industry Connect

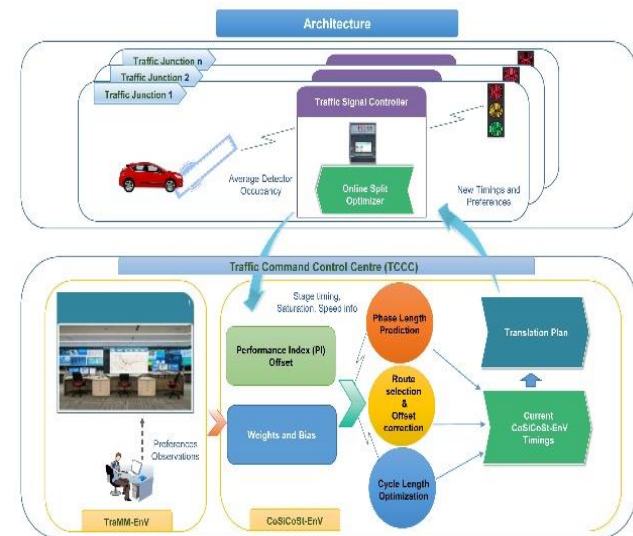
TOT Partners – 9 nos.

CoSiCoSt-EnV is an Adaptive Traffic Control System (ATCS) software algorithm for optimizing signal timings for the typical Indian driving and traffic conditions such as poor lane discipline and high heterogeneity.

Indian Patent (No: 239258) Title: “A Method for Synchronizing Heterogeneous Road Traffic and System thereof”

Salient Features

- Distributed and highly scalable system
- Use Stop-line detection with special filters to address poor lane discipline and high heterogeneity
- Real-time signal coordination in vehicle actuated mode of signal operation.
- Quick offset correction and cycle optimisation
- Plan transition based on Degree of Saturation (DoS)
- Self calibrating
- Green-wave invocation and emergency vehicle prioritising on selected routes
- Prioritising major arterials in a corridor for signal coordination
- Logical isolation and re-join of traffic junctions automatically to manage synchronization in real time
- Technology readiness –TRL9



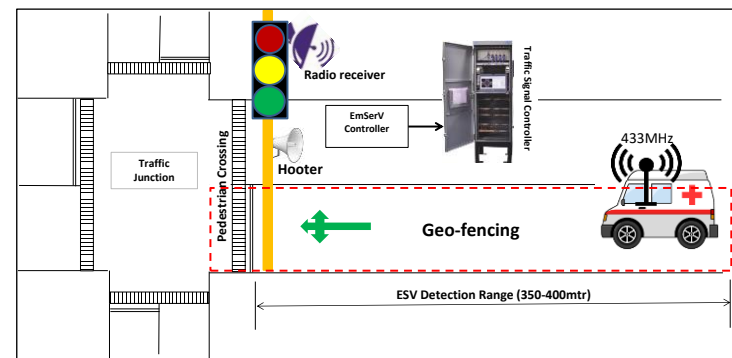
Industry Connect

- TOT partners – 8 nos.

EmSerV allows the smooth passage of priority enabled Emergency Service Vehicles (ESV) such as ambulances and fire engines through the signalised traffic junctions safely and quickly in emergency situations

Salient Features

- De-centralised solution with GNSS based geo-fencing and RF communication (433MHz & 400m range)
- Central server connectivity with Ethernet
- Include Controller Unit(CU) and Vehicle Mount Unit(VMU)
- Compatible with all traffic signal controller having Hurry Call feature
- Remotely configurable junction parameters
- Vehicle authorization using vehicle IDs
- Gives alert at the junction using hooter on arrival of ESV
- Technology readiness –TRL9



EmSerV Architecture

Industry Connect

Technology is ready for TOT, EOI floated
Deploy scenario

- Controller unit in all traffic junctions in a corridor leading to hospital
- VMU in all emergency service vehicles

Implementation

- POC implementation in Trivandrum



Pedestrian Safety Enhancement Controller (PeSCo)

PeSCo is a Pelican Signal Controller which provides extended walk time for differently abled, visually challenged and elderly people by identifying pedestrian demands detected through various input devices detected like push button switch, RFID and ultrasonic sensor devices.

- ### Salient Features
- Provide appropriate Pedestrian Crossing Time based on configuration & category of pedestrian identified
 - Programmable Walk time and pedestrian categories
 - Provide audio/visual indications for pedestrians - wait, stop, and walk
 - Instructions in Braille Labels for visually challenged pedestrians
 - Pedestrian Detection using Ultrasonic sensors, RFID Card and Push Button
 - Audio Instructions for safe crossing
 - Technology readiness –TRL9



19.5 inch x 11.6 inch PeSCo Controller

PHASE	PEDESTRIAN TYPE	ELAPSED TIME	PHASE TYPE	INPUT TYPE
2	VISUALLY CHALLENGED	12	PEDESTRIAN	SMARTCANE

SAFE CROSS TIME	ALLOCATION TIME
PEDESTRIAN TYPE	29
Visually Challenged	29
Physically Challenged	26
Elderly Person	29
Children	27
Normal Pedestrian	20

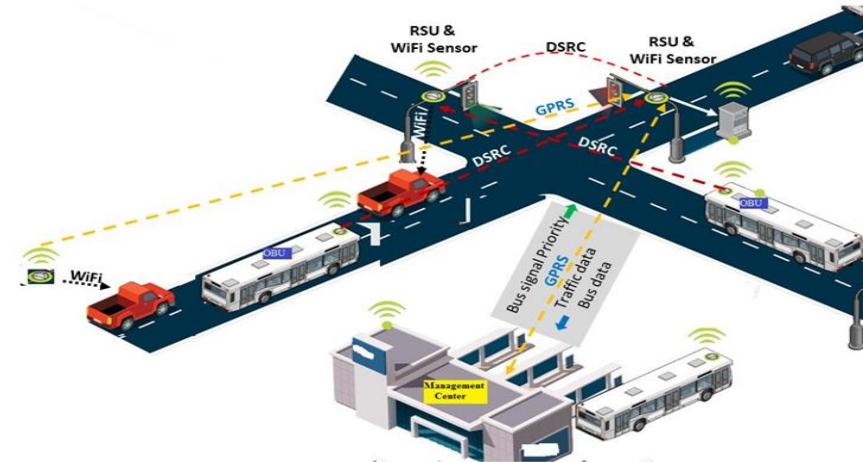
Web Interface for PeSCo

- ### Industry Connect
- Technology is ready for TOT, EOI floated
- ### Deployment scenario
- Schools, Hospitals and Midblock pedestrian locations

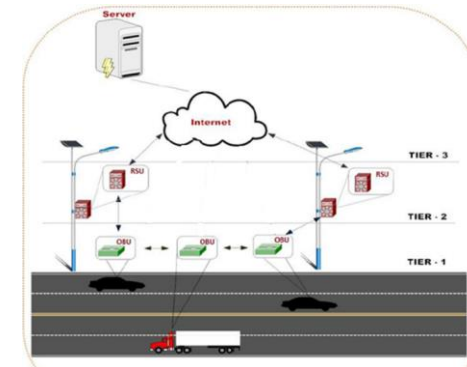
- ### Implementation
- POC implementation in Trivandrum

Bus Priority System at signalized intersections using V2I communication

- Use of DSRC and Wi-Fi devices for TSP application
 - Bus data collection using DSRC
 - Traffic data collection using Wi-Fi sensors
- Intersection traffic state estimation and prediction based on traffic flow theory
- An optimal bus priority system based on predicted traffic state
- Integration and evaluation of the solution with a simulated network
- A scalable and transferable bus priority system for isolated signals



- Wi-Fi sensors
 - all approaches
 - roadside
- OBU
 - on the buses
- RSU
 - at intersection
- Analysis at the control center
- Signal Control



Salient Features

- Intelligent & Automated tracking based fleet management
- Route Management and optimization
- Alerts, Trip Scheduling and Dispatch
- Fleet Utilization and Driver Score Analysis
- Reports & Analytics
- Logistics Tracking
- Vehicle Expense Management
- Decision Support Dashboards
- All in one mobile app based solution
- PIS Mobile App in Android & iOS
- Complaint with AIS-140 standard VLT devices
- Available in cloud and on-premise deployment
- CERT-In certified for security audit
- Technology Readiness -TRL 9

Industry Connect

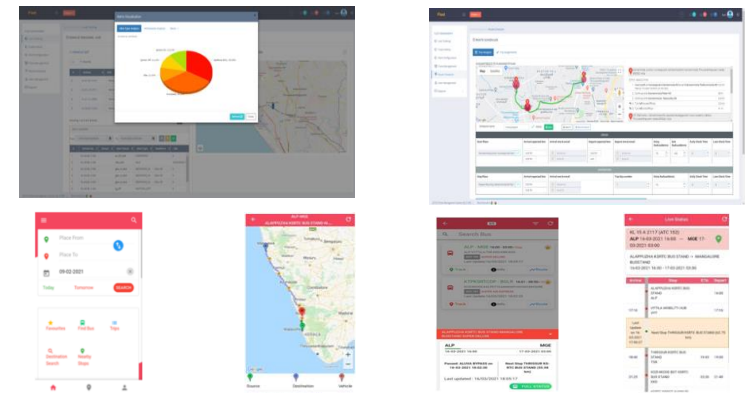
- TOT – 4nos.

Deployment use case

- Vehicle & Goods Tracking
- Bus Arrival & Personalized Transit Route Guidance Information (Mob App)

Implementation

- Kerala MVD , Civil Supplies Dept, Demo to STA

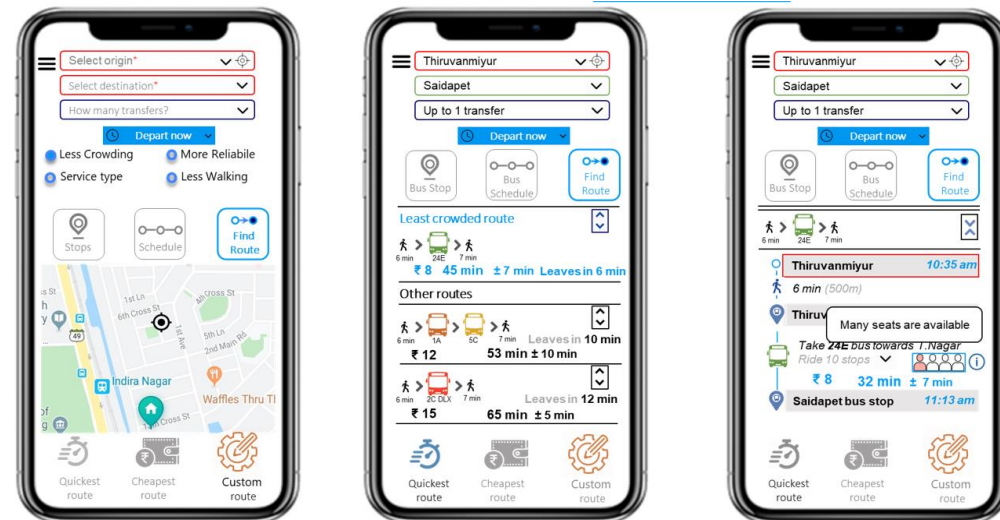


Mobile App for PIS

A mobile application for passengers with optimal or customized routes based on real-time information about location of buses and passenger demand. Passengers can find bus stop, bus arrival time, and bus route information and routes can be selected based on minimum **travel time, cost, crowding, or maximum reliability.**

Salient Features

- Real-time transit data using multiple sensors
 - ❖ Large amount of data collected through VTU,ETM and Waybill
 - ❖ Integrated sensing of transit demand, reliability, traffic and supply characteristics
 - ❖ Easy integration with fleet management systems
- Dynamic transit state estimation
 - ❖ Data driven and analytical estimation techniques
 - ❖ Estimation of travel time, reliability & crowding
- Real-time routing on bus transit network
 - ❖ Combines network topology with schedule-based routing
 - ❖ Multi-objective and custom routing preferences



Industry Connect

- Software and Hardware are ready for TOT

Sl. No.	TOT Partners
1	M/s. Keltron, Trivandrum
2	M/s. Envoys Electronics Pvt Ltd, Gurgaon
3	M/s. DIMTS Limited, New Delhi
4	M/s. Onnyx Electronysis Pvt Ltd, New Delhi
5	M/s. Shakti Enterprises, Jaipur
6	M/s. Metro Infrasy Pvt Ltd, New Delhi
7	M/s. Electroads, Indore
8	M/S. BEL, Bengaluru
9	M/s. Microtrans Infratech Limited, Noida
10	M/s ARS Traffic and Transport Technology (India) Pvt Ltd
11	M/s ITS Planners & Engineers Pvt Ltd, Hyderabad
12	M/s IBI Group
13	M/s L&T

Technology Partners

Thermal Camera

1. M/s. Prama India Pvt. Ltd., Mumbai
2. M/s. Samriddhi Automations Pvt. Ltd., Noida
3. M/s. RRP S4E Innovation Ltd. (Prop.), Mumbai
4. M/s. Scita Solutions, Bangalore
5. M/s. Tak Technologies Pvt. Ltd., Noida
6. M/s. Vehant Technologies Pvt. Ltd., Noida
7. M/s. Norden Research & Innovation Centre Pvt. Ltd., Kochi
8. M/s. Aabmatica Technologies Pvt. Ltd., New Delhi
9. M/s. Aditya Infotech Limited, New Delhi



Industrial Vision Sensor - iViS 10GigE

1. M/s. Spookfish Innovations Pvt. Ltd., Bangalore



Reseller Partners

Decision Support Tools for Public Transit Agencies FlexiFleet, PTRGS and OSHR

1. M/s. IBI Group India Pvt. Ltd., Gurgaon
2. M/s. Unidad Techno Labs Pvt. Ltd., Kerala
3. M/s. UL Technology Solutions Pvt. Ltd., Kerala
4. M/s. Atulya Abhinav Tech Pvt. Ltd., Odisha



Thank You

www.meity.gov.in www.nampet.in
om.krishan@meity.gov.in
intranse.in