

Tech Mahindra

Connected World. Connected Experiences.



**Tech Mahindra Response to:
Request for Information for Smart Streetlights RFI
No. 2017-0001, City Of Pittsburgh**

Submitted by: Tech Mahindra





Cover Letter

Title of RFI	Request for Information for Smart Streetlights RFI No. 2017-0001
Name and Mailing Address of Firm	Tech Mahindra, 4965 Preston Park Blvd #500, Plano, TX 75093
Contact Person Name & Title	Troy Dillard, Sr. Vice President
Mobile	775-772-1841
e-Mail	TD00453693@TechMahindra.com

Tech Mahindra further acknowledge that all responses may be considered public information in accordance with the Commonwealth of Pennsylvania Right to Know Laws as described in Section 5 of this document.

Tech Mahindra confirms that it does not have a relationship or knowledge of, or contact with any official or employee of the City that relates to this opportunity.



1	Executive Summary.....	4
2	Project Overview	5
	2.1 Our Response	5
	2.2 Additional Scope.....	7
	2.3 Scenarios	8
	2.3.1 Traffic Management:.....	8
	2.3.2 Air Quality.....	9
3	Additional Scope.....	9
4	Deployment Plan and POC –.....	10
5	Technical Specifications –.....	10
6	Operational Considerations –.....	10
	6.1 ITMS Service Operations- Solution Model	11
7	Business Model.....	11
8	Case Studies.....	12



Section 1: Document Version Control and Contact Details

1 Executive Summary

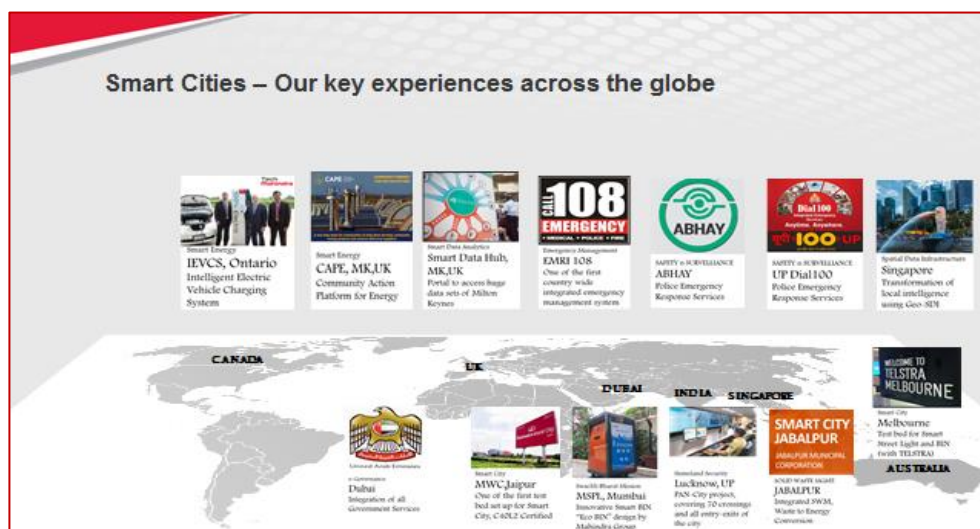
Tech Mahindra (TechM) sincerely thank City of Pittsburgh (CoP) for giving us the opportunity to submit our response for the RFI Smart Streetlights. TechM (a \$4.3 Billion USD company) is part of Mahindra & Mahindra Group (a \$16.7 Billion USD group) and has a major focus towards sustainability and smart cities. Recently one of the project, MWC, Jaipur was recognized as one of the C40 Cities for their commitment towards carbon neutral initiatives in the infrastructure projects. In addition, we working with the city of Milton Keynes in developing the CAPE platform, which enables the citizens to exchange their energy needs.

We understand that CoP has already certain systems in place such as “Surtrac” which is locally developed digital traffic control system, for public safety, city has “ShotSpotter” gunshot detection system, in limited locations though. TechM is committed to provide a “Multiple Services Platform” as required by CoP on the Smart Street Lights infrastructure. TechM has strong experience in initiatives like “Smart Poles” especially in India where multiple use cases like Environmental sensors, Security and Surveillance, Public Wi-Fi, Digital Signage and equipment provisioning for telecom infrastructure (say in this case Femtocells provisioning) has been done.

TechM is indeed looking forward to work with CoP in this transformation journey and we are committed to “co-create” or “co-invest” in certain initiatives as required by CoP as per mutual agreement and discussion seeking long-term business association.

In addition to the initiatives mentioned in the RFI, TechM has also taken some first of its kind initiatives in United States like launching the first electric vehicle by the name of genZe. In city of Reno, we have also started bike sharing initiative, which are membership based. The electric bike share stations are solar powered and are totally off grid. We would like to discuss this in detail with CoP as well, if this interests you. In addition, we are doing citywide IEVCS (Intelligent Electric Vehicle Charging System) for the City of Ontario using big data platform, SAP HANA.

In the proposal below, we have highlighted solution salient points and some of our experiences across various solution domains. Given below is a snapshot of our various projects implemented worldwide.





2 Project Overview

2.1 Our Response

Cities today might have different networks deployed around different applications - separate networks for video surveillance, environmental monitoring or streetlight management, for example. Not only do these separate networks have ongoing operational expenses, the information collected from each of them is in silos. City infrastructure issues are linked and therefore require breaking of silos between various departments. Tech Mahindra recommends a unified infrastructure methodology, under which the cities can use a common infrastructure to address issues spanning across various verticals or city services such as traffic, parking, lighting, and security. Our citywide architecture comprises several infrastructure layers working together—sensors, applications, a network communications layer, and a cloud-enabled digital platform. Lighting, CCTV, and all other solutions fit into this holistic approach.

The Architecture is developed and defined on Industry Standard Open Architecture development model and considers the requirements of availability, reliability scalability, security and a seamless tight integration of IT and non-IT systems for the City Of Pittsburgh. We also recommend a unified Operations Command center to monitor and manage end to end the building blocks of this Architecture.

Architecture Highlights:

Adherence to Layered Architecture Principles

- **Separation of concerns** – The application is broken into distinct features so as to limit the overlap in functionality to as little as possible
- **Single Responsibility Principle** – Each component or a module is responsible for only a specific feature or functionality
- **Principle of least knowledge** – A component or an object does not know about internal details of other components or objects. Integrated industry standard open platform is in place to separate the underlying components and bring in abstraction.
- **Do not Repeat Yourself (DRY)** – There is only one component providing a specific functionality. The functionality is not duplicated in any other component

Configurability

- **Modular Application Development** – Layered architecture will ensure code segmentation to support separation of concerns and easy maintainability. Functional segmentation will be achieved by modularizing code functionality using composite application blocks functionality supported by the technology platform
- **Adding a New Service** – Registration of new service at integrated industry standard open platform that can be reused across multiple front-end applications like Community portal and future applications of City Of Pittsburgh.



Solution Architecture

Application layer

It provides a GUI for management and maintenance. Streetlights can be managed and controls plans can be configured through SMS. It also supports power consumption analysis and alarm functions. The AC-EEM uses southbound interfaces to manage devices and connect to various IoT gateways. It provides open northbound interfaces to connect to various industry applications. The AC-EEM provides such functions as protocol conversion and parameter delivery.

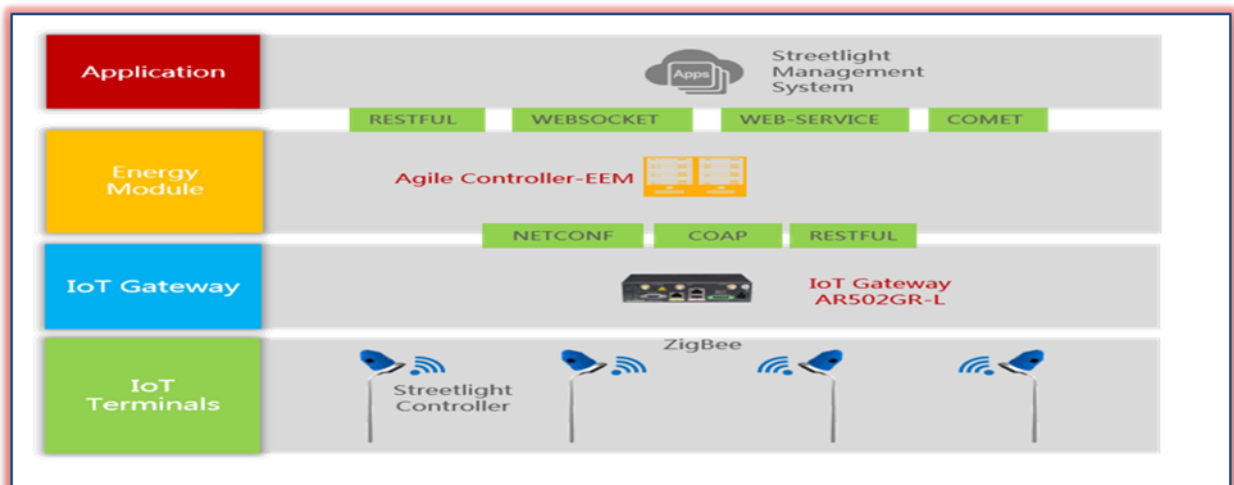
Network Layer

The industrial IoT gateway AR502GR-L is deployed at the network layer to connect to terminals such as sensors and controllers through ZigBee. The AR502GR-L converts the ZigBee network into the IP network and provides backhaul through the 3G or LTE and Ethernet.

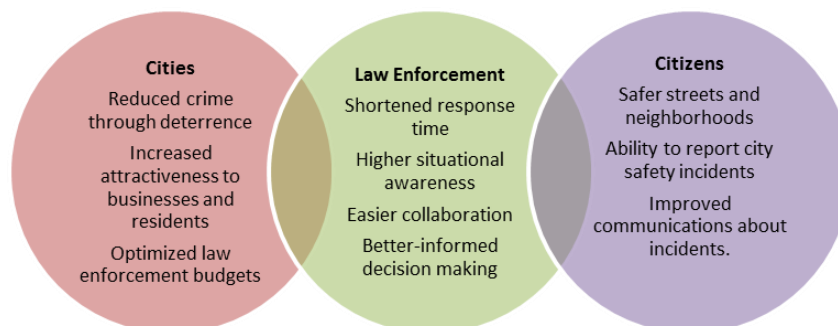
Terminal layer

The street light controller provides ANSIC136.41 interfaces and is deployed at the terminal layer. It supports the ZigBee Mesh network and is dustproof and waterproof. It is installed into the ANSI base on the top of the street light. It is simple to install and has no requirements for streetlights. Only LED street lights with standard ANSIC136.41base needs to be purchased (illumination adjustment function is required).

Architecture for a City Safety solution

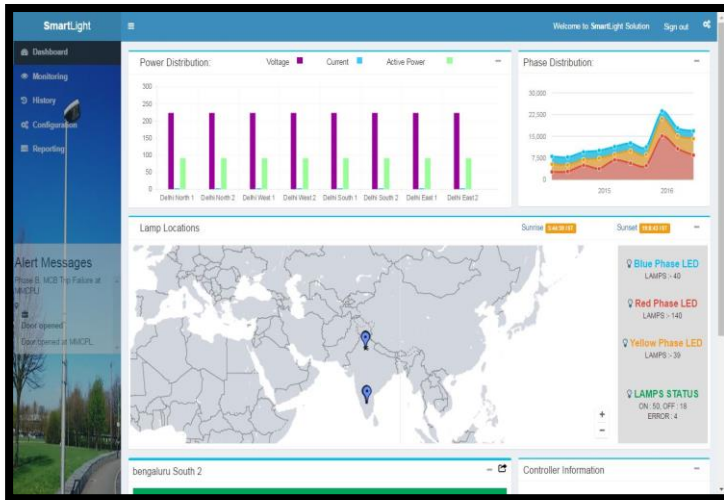


Benefits:



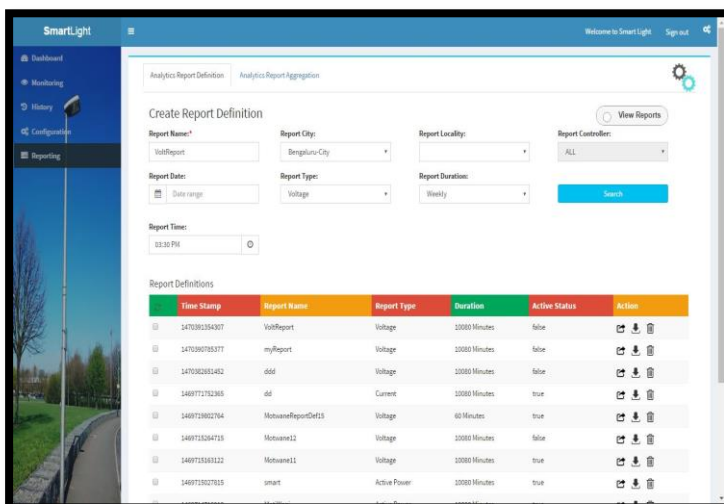


Smart Street light Dashboard:



Monitoring:

- Extensive searching/ Filtering city based capability, Location & individual controller.
- User able to see individual or collective switching point data-based on above selection.
- Allow following operations on individual lamps / switching points/ group of switching points based on the selection of city or locality



Reporting:

- Reports can be created based on following parameters:
- Periodic reports of all switching points
 - Duration: Hourly/Daily/Weekly
 - Report Type: Electricity consumption, Error reporting, etc.
 - Points based on the selection of city or locality:

2.2 Additional Scope

As cities continue to grow in number, size, and complexity, urban infrastructure and the services that rely on it are stressed. Of all urban utilities, street lighting comprises one of the largest expenses in a municipality's utility bill.

This section provides highlights on smart pole we propose across City of Pittsburgh. The scope of smart pole (intelligent pole) provide capabilities of telecom connectivity and LED lighting in a "lighting-as-a-service" model for cities. It allows city authorities to offer space within their (connected) street-lighting poles to network service providers for telecom infrastructure. Smart pole will have the facility of LED Lighting, CCTV surveillance, Environmental Sensors, EV Charging Points, Smart Bill Board and mobile wireless 4G.



2.3 Scenarios

2.3.1 Traffic Management:

Traffic management involves the use of practical applications such as extra lanes at rush hours and entrance ramp control. Furthermore, It can supervise the traffic on the motorways and can open extra lanes at rush hours. In the future, technological innovations in cars could contribute towards a better utilization of the capacity of the roads.

a) Real time adaptive Traffic signals:

- Investigates methods of real-time adaptive traffic signal control in the context of single isolated intersection and coordinated urban network applications.

b) Pedestrian Detection:

- Strategically located advance LED screens with Emergency Panel and Public Address Systems for ensuring safe and secure enhanced pedestrian safety.
- Video analytics guarantees citizen safety by integrating object recognition, face recognition, license plate recognition, and big data analysis.

Use Cases

- **Stop Abruptly** - Event occurs when a moving vehicle makes an abrupt stop within event area
- **Gathering/Grouping** - Event occurs when a crowd of objects is detected within event area
- **Illegal Parking** - Detects a car stopping in an illegal parking area
- **Falling** - Event occurs when a person suddenly falls down in the event area
- **Complex Event Processing** - CEP provides event scenario creation function by combining multiple events using GUI modeling tool.

c) Vehicle to infrastructure technology:

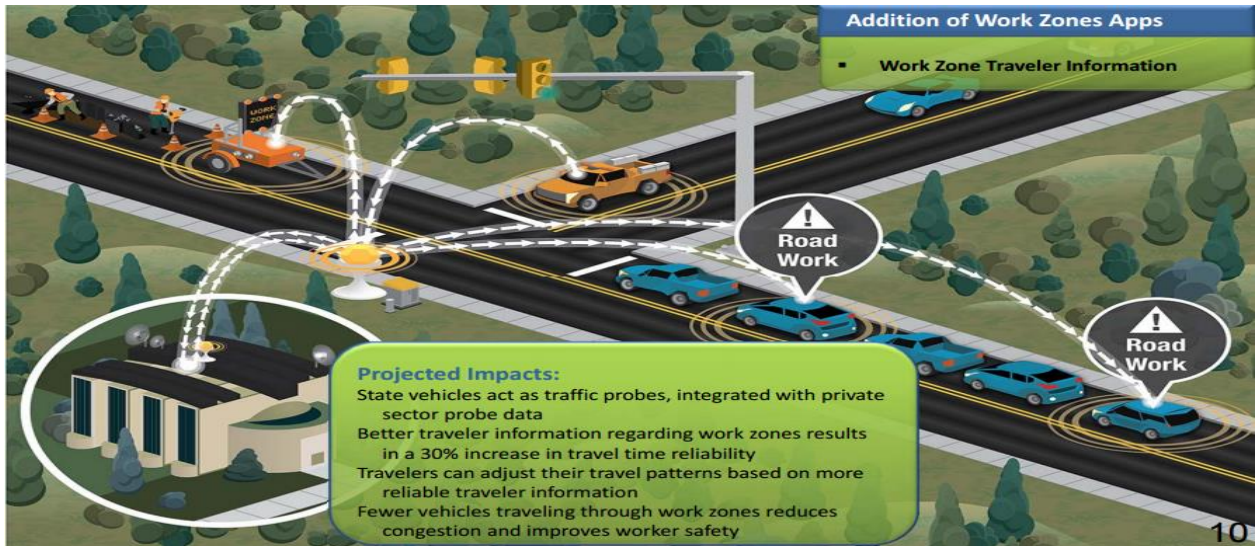
V2I is supported by the Intelligent Transportation Systems Joint Program Office within the Research and Innovative Technology Administration.

Safety applications: These will have the potential to reduce crashes through advisories and warnings. For instance, vehicle operators may be advised of a school zone, sharp ramp curve, or slippery patch of roadway ahead.



Mobility applications: These will provide a connected, data-rich travel environment based on information transmitted anonymously from thousands of vehicles that are using the transportation system at a particular time.

Environment applications: These will provide travelers with real-time information about traffic congestion and other travel conditions to help them make decisions that are more informed.



2.3.2 Air Quality

By strategically mounting air quality sensors on the smart poles, we can have information on the current PPM levels in the air. We can monitor Carbon Monoxide, Sulfur Dioxide PPM levels. Required alarms can be generated by using the smart billboards to provide required information to the citizens.

3 Additional Scope

In addition to the Smart Street light services, TechM suggest City of Pittsburgh with the following additional scope too:

Wi-Fi Services:

- Wi fi hotspot can be established on Smart Poles
- Access Point Hotspot for WiFi can be decided based on a road stretch.

Bill Board:

- Video, images, text, motion graphics, RSS feeds
- complete platform for interactive media experiences

Mobile App / SOS:

- Dashboard displaying all the activities.
- Example - User can register to the WiFi and access the services.

CCTV Surveillance

- System manage video feeds for all CCTV systems required under this project through VMS



4 Deployment Plan and POC –

Tech Mahindra would like to propose to a POC of 10 streetlights. This POC can be extended to a Smart Pole requirement with various other solutions mounted on the Smart Pole such as Public Wi-Fi, Smart Bill Boards, and CCTV cameras. A deployment plan will include the following steps with respect to this requirement –

Step	Smart Lighting	Step	Smart Lighting	Step	Smart Lighting
1	Engineering Design	9	Final Equipment List Preparation Based on Survey	17	Equipment Commissioning Phase
2	Building Readiness (Horizontal + Vertical)	10	Equipment Manufacturing & Shipment	18	Configuration & Internal Testing
3	Site Survey	11	Local Material Ordering (if Any)	19	Acceptance Testing
4	Survey Report Preparation	12	Customs Clearance	20	UAT Testing based on Approved Documents
5	Survey Report Approval	13	Delivery to Sites	21	Removal of Snags (if Any)
6	LLD Preparation	14	Equipment Installation Phase	22	POC Sign off
7	LLD Approvals	15	Wireless Sensing Network readiness		
8	Equipment Preparation & Ordering	16	Installation of Equipment		

5 Technical Specifications –

Components	Controller	Software
LED Lights	GPS Based	IOT Platform
Dimmer drivers	Micro process/Micro Controller	Cloud
Luminary with wattage	Sim module (3G/4G)	Database server
Feeder Panels	Wi-Fi	Application server
Pole (Incl'd Earthing)	RF based	
Cable as per specification		

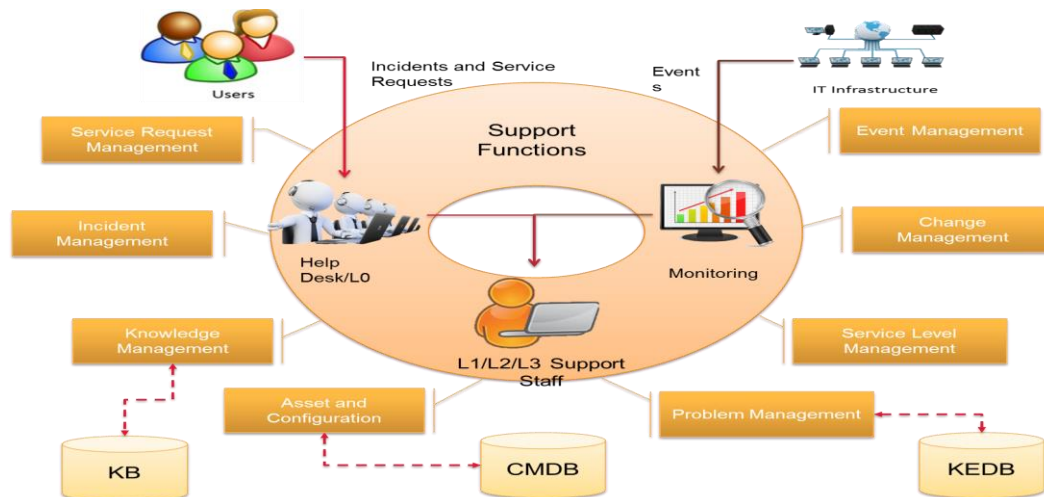
6 Operational Considerations –

Tech Mahindra leverages its living lab, which is Mahindra World City Jaipur to field test devices, and platform before it can be deployed to customer premise. Tech Mahindra will undertake end-to-end operation and maintenance of solutions including the hardware or devices and software part.



Tech Mahindra will do a back-to-back agreement with device partners and create an end-to-end commercial proposal, which will have details of annual maintenance cost of both hardware and services. Tech Mahindra operational support is based on the ITIL framework, which will ensure seamless service delivery and address pain areas.

6.1 ITMS Service Operations- Solution Model



The TechM service management team broadly divided into four levels.

- Helpdesk (Level0)-TechM
- Service Desk (L1/L2/L3)
- Device partners /OEMs (L4)

In the event that L3 is unable to resolve the incident/problem due to a failure or defect in the hardware/software, the OEM will be contacted which is the level 4 (L4) of support. Help Desk is a functional unit made up of a dedicated number of staff responsible for dealing with a variety of service events, which is reported through Mails/Phones/ Ticketing Tool.

The IT Help Desk will be the single point of contact for IT user/requestors on a day-by-day basis – and handles all incidents and service requests, using Ticketing Tool. The ticketing tool will facilitate the Help Desk staff to access more information like KEDB, CMDB via integrations that will facilitate quick response and resolution to incidents and service requests. Automatic mails and alters can also be configured on the service management tool to make parties more informed during the lifecycle of Ticket.

7 Business Model

It is our endeavor to work jointly with the City of Pittsburgh in developing smart solutions, which will benefit the city and help in increasing the quality of life of its citizens. Smart Street light solution as shared above is an initiative in that direction. This solution is capable of achieving operational savings and thus provide an in-built mechanism of self- funding the investments through the savings achieved. Further, smart street light infrastructure provides capacity to implement multiple solutions, thereby saving additional investments required on the infrastructure layout. The same infrastructure



will be used to launch additional services like – Public announcement systems, Digital billboards, security & surveillance cameras, public Wi-Fi hot spots, environmental sensors etc.





The above solutions also provides a mechanism to generate additional revenues in the form:

- Advertisements on the digital billboards
- Wi-Fi access to citizens beyond a minimum agreed limit

The revenue thus generated can be shared with the City of Pittsburgh on an agreed ratio.

We further, propose to co-create smart solutions along with the City of Pittsburgh, which will get self-funding through DOT ATCMDT grants, and other funding agencies and government initiatives. We would like to further discuss business model options with the City in next stage of this initiative.

8 Case Studies

 <p>UP Dial 100 <i>One of the World's Largest Integrated Emergency Response Centre; deployed only in 11 months</i></p> <ul style="list-style-type: none"> • Quick Response from anywhere • Single TFN for all basic emergencies • Police Fire Medical • Lang. Selection and provision for persons with special needs • 3200 4Wh 1600 2Whs +300 CC Staff +1500 Police Stations 700 Cities +100K Villages 	 <p>ABHAY - Command and Control Centre, Rajasthan <i>Video surveillance, Incident management, Crime Control, Call analyzer, Vehicle tracking, Cyber Forensic, Computer aided dispatch</i></p> <ul style="list-style-type: none"> • Video surveillance with 2000 CCTV camera in 7 cities • Video analytics with Facial recognition, ANPR and night vision features • Geo location of caller, nearest patrolling vehicles & trace data of calls 	 <p>Pan City Surveillance, Lucknow Police Command Centre (Project: Drishti)</p> <ul style="list-style-type: none"> • 280 high resolution cameras, 40 of them are installed with ANPR • Infrared technology enabled to recognize number plates • E-Challan to traffic offenders • Implemented with ANPR, Video analytics, Mobile Surveillance, Data Center 	 <p>Smart Street light POC done in Indore City of India <i>*Successful POC of Smart Street light on a smart pole in Indore, City of India</i></p> <ul style="list-style-type: none"> * Pole integrated with services like Digital Signage, CCTV camera and public Wifi * POC has brought us many accolades for Indian Government Officials
---	---	--	---



Winner for the category “Most Innovative City Surveillance Initiative” by the SWI Awards Jury



Milton Keynes

- First SI to sign an MoU with Open University and MK Council to work on integrated solutions.
- Central to the project is the creation of a state-of-the-art 'MK Data Hub' which will support the acquisition and management of vast amounts of data relevant to city systems from a variety of data sources.
- Areas of engagement- Data Hub, Smart Water, Smart Energy, Smart Education, Smart Transport, Business & Community Engagement



Dubai

- First SI to sign an MoU for establishment of Centre of Excellence(CoE) Strategically positioned to play a key role in the Smart City Industry in Dubai & Middle East
- Joint CoE established by DEC and Tech M.
- CoE to provide thought leadership & technology initiatives to Govt. of Dubai
- Provide recommendations to ministries enabling them to contribute effectively to the Smart Dubai initiative
- Jointly bid in the Smart City initiatives of the Govt. of Dubai



Melbourne

- Joint GTM signed with largest Telco & developed proof of concept for Smart City Command Centre Portal.
- Initiated discussions with all local city councils
- PoC scope finalization on going with 2 city councils
- Demonstrated Smart City Platform in MAV event



Jaipur- India

"Mahindra World City Jaipur is a Live SMART City Demonstrator"

- Spread over an area of 3000 acres , with TechM solutions deployed in IT/SEZ area covering around 400-500 acres .
- Live demos on Solutions such as Smart Boom Barrier, Smart Parking, Smart Meter, Smart BEMS, Smart Bin, Security & Surveillance, Environment Sensing

