The IET IoT panel

IET India

IoT in India Advances Business Digitalisation in India

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1 Introduction

The “Internet of Things” (IoT) describes a system where the Internet is connected to the physical world via ubiquitous sensors. Initially coined by Kevin Ashton, a British technology pioneer, IoT for the last 20 years has provided remote insights on the health, status, efficiency, quality, and location of objects, people, and places. Over the years, IoT has evolved from simple computing and short range wireless communications to powerful data processing and the ability to monitor and control objects from long distances with minimal to no human intervention. With the continued evolution of the IoT; businesses, cities, and citizens are now benefiting from the power of living in a connected world where humans and machines live in a symbiotic relationship.

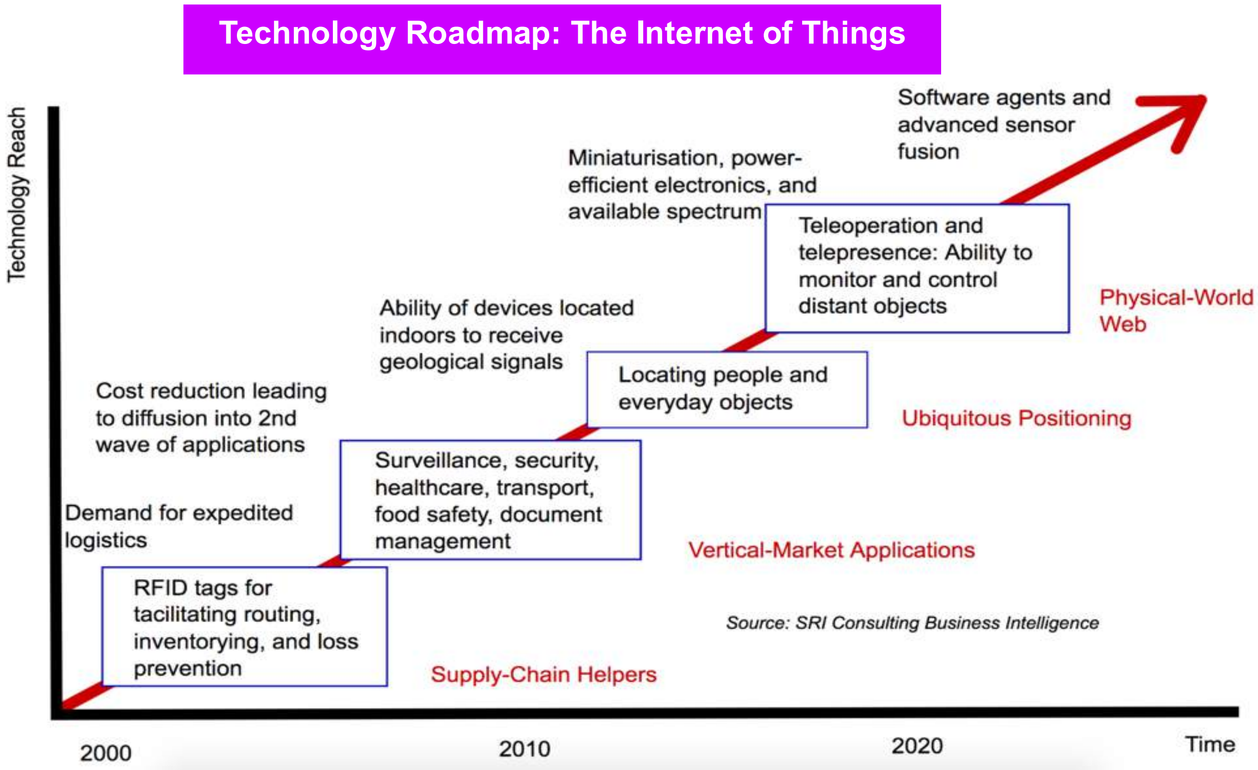


Figure 1: Technology roadmap: The Internet of Things

In a recent report by IoT Analytics, 7 billion IoT devices were connected and active in 2018 and is expected to grow to 10 billion connected devices by 2020. GSMA Intelligence in June 2018, projected that over 25 billion IoT devices will be deployed by 2025. As shown in Figure 2, the global active IoT connections is projected to grow at a 17% CAGR by 2025.

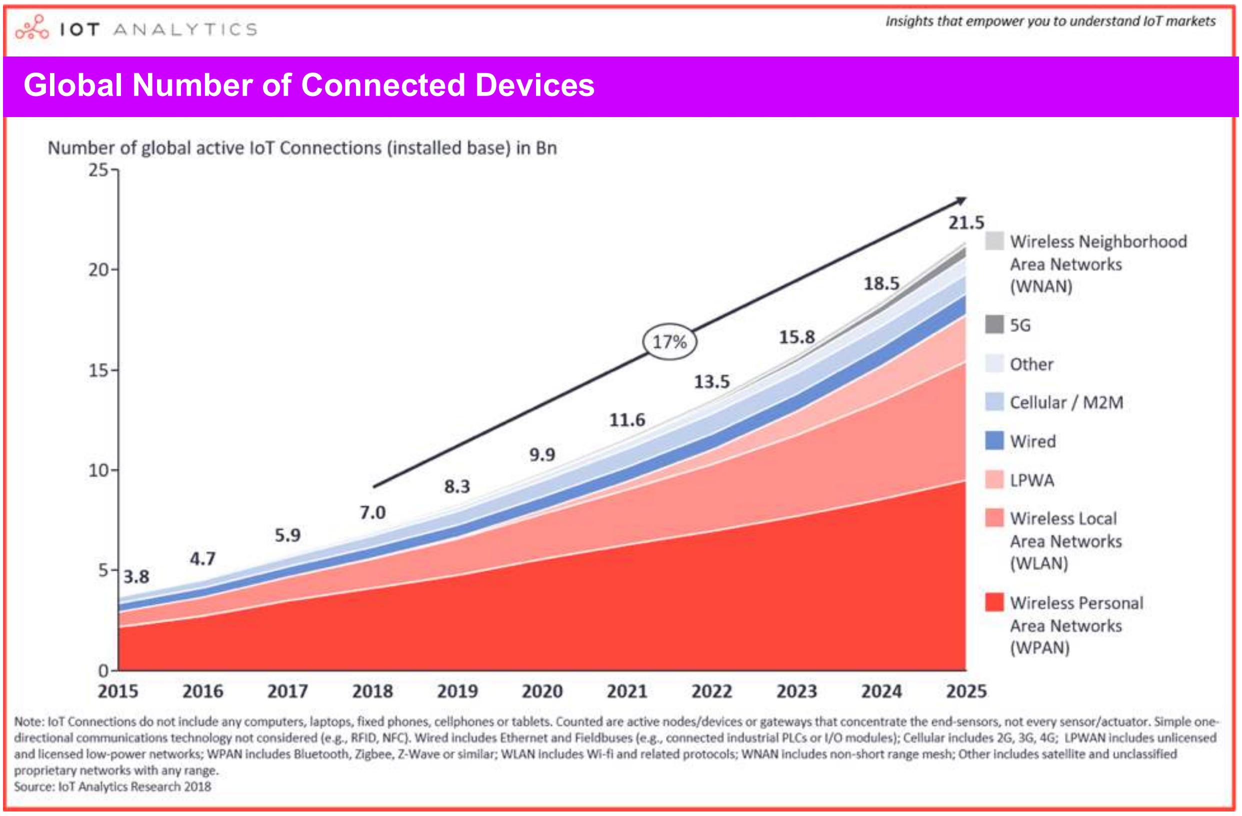


Figure 2: Global Number of Connected IoT Devices

With focus on the India market, one must wonder how India's IoT progression is doing and where it stands in the overall contribution to the global market connected devices projections. The Department of Telecommunications (DoT), a department of the Government of India's Ministry of Communications, released a National Digital Communications Policy in 2018 where it set a goal of expanding India's IoT ecosystem to 5 billion connected devices by 2022. This paper will take a deep dive into some of India's leading segments where IoT has already began to make advancements and headway as well as provide insight on the connected reality of IoT in India.

2 IoT in India

2.1 The Evolution

To understand where the IoT boom first started in India, one must travel back in time to 2013. Many experts in the field of IoT believe it all began when Qualcomm Ventures and Cisco invested $43.3 million in a Hyderabad-based system-on-chip design company named Ineda Systems. Ineda had been working on low power SoCs and wearable processor units (WPU) targeting the emerging wearable technology market. At that time, this was the largest investment a company in India had received which had been working on IoT technologies.

With the success of Ineda Systems and the backing of Qualcomm and Cisco, companies across India began to take deeper interest in the advancements of IoT and began to invest more time, money, and resources to understanding and developing solutions which could also create the same fortunes as it did for Ineda.

Aside from the dream of becoming the next tech unicorn, the Government of India saw IoT as a tremendous value add to the development of the country and their digitalisation efforts. The Government of India began to implement programs and policies to help drive the growth of India's digital capabilities, acumen, and presence to keep pace and in stride with other technological thriving countries. Three major programs where implemented to help this effort, the "Make in India Program", the "Smart Cities Mission", and the overall "Digital India" campaign. With these efforts, India began to see a major digital transformation leveraging cutting edge technologies such as IoT.

2.2 Make in India Program

In order to transform India into the global manufacturing hub, The Government of India started an flagship program called **"Make in India"** under the leadership of honourable Prime Minister of India in the year 2014. This initiative was implemented to create a new wave of tech start-ups in India which will contribute to the growth of the country's IoT ecosystem. The Make in India campaign is designed to bring the 'fourth Industrial revolution', also known as 'Industry 4.0', to the fore front creating new business opportunities for companies focused in the IoT.

In the first two years of the program, India received investment commitments worth ₹16.40 lakh crore (US$230 billion) launching India to one of the top destinations for foreign direct investments (FDI) surpassing the United States and China. Due to influx of investors entering the India tech market, India has seen an exponential growth of tech startups taking their chances in becoming the next big success story. The Economic Times recently reported that since the launch of the Make in India program, 7,700 tech startups have been created in the country, making it the third largest in the world. As of now, this program has proven to be a success and has had tremendous impact on the overall growth of the IoT market in India.

2.3 Smart Cities Mission

Another line of effort which the Government of India has implemented is called the '**Smart Cities Mission**', an urban renewal and retrofitting program, which plans to develop 100 cities across the country making them citizen friendly and sustainable. This effort is made to bring forward much advancement to cities to include smart infrastructure, smart governance, smart utilities, and smart citizens. Figure 3 illustrates how the Smart City Mission has divided their efforts and focus into six different categories to include the type of smart solutions which they are expecting to implement as part of this effort.

Figure 3: Smart City Smart Solutions

With relaxed FDI policies and Government backed funding of **$1.2 Billion USD**, India's Smart City Mission is positioned very well to create new jobs, improve quality of life, and advance India as one of the tech leaders of the world.

2.4 Digital India Campaign

With the need of connectivity and access to e-Governance, the Government of India decided to launch the Digital India campaign. This campaign ensures that Government services are made available to citizens electronically by improved online infrastructure and by increasing Internet connectivity or by making the country digitally empowered in the field of technology. This program supports **IoT based solutions** and believes it offers citizens access and awareness to the best services and technology.

Department of Electronics and Information Technology (DeitY) has come out with a draft IoT Policy document and industry leaders are joining together to contribute to the standards and policies to make India a more connected place. Due to this program, there is a large demand for development of **IoT Products** specific to India. Development of India's **IoT Infrastructure** is still in process and the Government believes leveraging proven technologies is key to the success of India's digital campaign.

3 Digitalisation of India's Businesses

With the above mentioned programs and the increased discussion on topics such as IoT, AI, Big Data, and Cloud Computing; businesses have grown more intrigued and have shown more willingness to leverage technology in order to digitally transform their businesses in hopes of more savings and gaining an edge of their competition.

3.1 Driving Factors for Digitalisation

There are several factors driving Businesses to adopt IoT and cutting edge technologies. Some of these reasons are listed below:

- Increase in customer expectations
- Desire to increase revenue and lower operational costs
- Reduce go-to-market timelines
- Obtain better customer insight
- The technology hype cycle
- Desire to improve processes and SOPs.

In addition to the above factors, some businesses in other regions of the world have already started to demonstrate improvements in their business operations, operational costs, and increased revenue with their digital transformation efforts. Businesses in India have started to join the digital transformation movement and per a recent Vanson Bourne study, almost half of the Indian business leaders believe that they'll be able to disrupt their perspective markets using digital technologies to accelerate new product/services development.

3.2 Digitalisation Challenges in India

In order for a business to ensure a successful adoption and implementation of digital transformation, they need to understand and take into account the hurdles slowing digital transformation. In a recent article in Business Today, it was stated that in India, 93% of Indian businesses believe that they are facing major challenges in digital transformation today. The main challenges they are facing are due to the lack of knowledge or uncertainty on things such as data privacy and cybersecurity, in-house skill sets, regulatory instability, and weak digital governance.

With the realization that every business will have their own challenges and issues slowing down their digital transformation, businesses are now more than ever relying on experts in the field of IoT, AI, cyber security, and data processing to help solve these issues and to assist them in their transformation process.

3.3 Case Study: Kodak's Failure to Digitalise

Up until the turn of the century, Kodak was deemed as the leading photographic firm in the world. In 1996, Kodak generated approximately $16 billion revenue with a profit of $2.5 billion by 1999. Their expertise in film production and digital cameras put them on the top of the industry. In the early 2000s, a new wave of digital photography was introduced in the film industry nearly cutting out the need for traditional film and printed photography. Kodak, being the leader in the industry and having captured the majority of the market selling film, did not feel digital photography would have an impact on their overall business and hence was slow to react to the digital revolution. Because of their slow reaction, their business began to experience massive loss in revenue plummeting from an impressive $15 Billion USD to $9.4 Billion USD by 2009.

Kodak made a critical mistake by being complacent believing that their brand, global distribution network, and variety of product offerings would protect them from the new wave of cutting edge technologies. Having leadership which were reluctant to make a change, provide a clear direction for the way forward, and unable to provide disruptive innovations resulted in Kodak filing for a Chapter 11 protection bankruptcy in mid-January 2012, signifying the downfall of Kodak.

4 IoT Advancements in India (per Segment)

Over the last few years, India has started to see a shift in IoT deployments moving from pilots and proof of concepts, to real commercial deployments. The digital transformation is now and IoT is being used across many industries. Below you will find real examples and use cases of deployed IoT projects in India and how leveraging technology improves business operations, save costs, and even generates new found revenue.

4.1 Smart Cities

India's target of reaching 5 billion connected devices by 2022 cannot happen without the efforts taking place in Smart Cities. The majority of connected devices are expected to come from the Smart Cities Mission program and will be mostly due to the smart utilities and smart mobility projects. Infoholic Research recently reported that the Smart Cities market in India will grow to $48 Billion USD by 2023 with a CAGR of 18.5% (see Figure 4). The expected grow rate is impressive and also demonstrates that India is on the right path to achieving their targets.

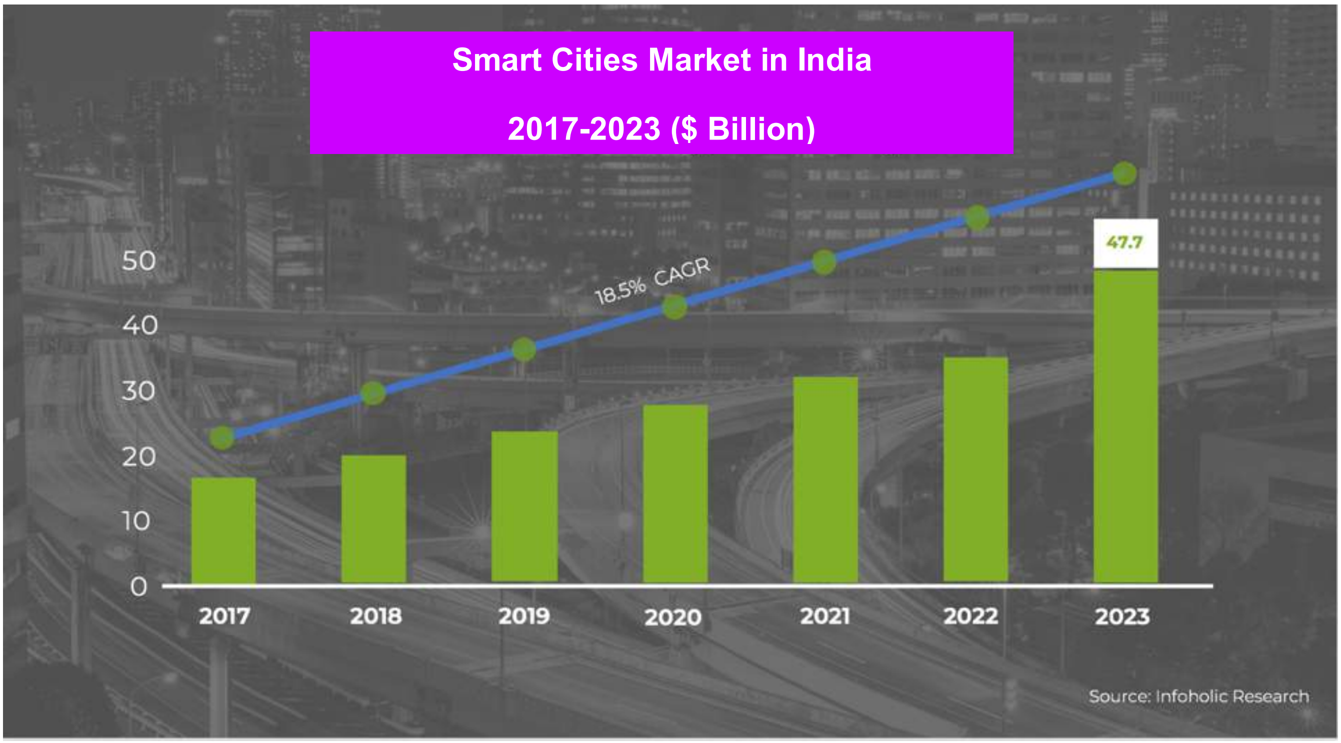


Figure 4: Smart Cities Market in India

IoT Analytics reported that Smart City IoT projects in 2018 was the leading IoT segment in which commercial deployments were taking place (see Figure 5). In 2019, we are seeing the same trend in India and expect it to continue for years to come. The below sections break down the Smart Cities projects by focus and demonstrates projects commercially deployed.

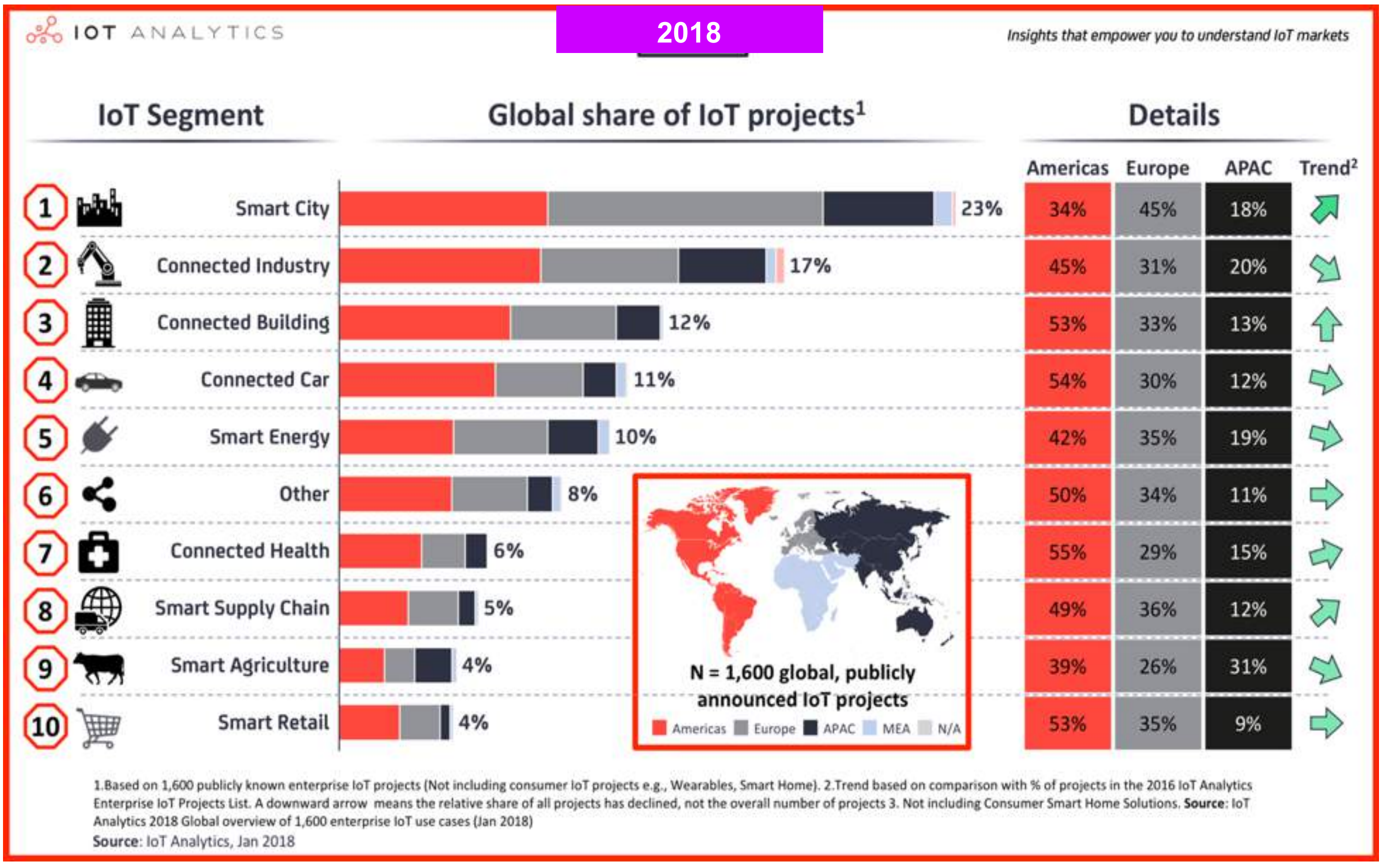


Figure 5: Global Share of IoT Projects

4.1.1 Smart Street Lights

With the digital transformation initiatives and programs set forth by the government and the aggressive timelines for developing public infrastructure, roads and highways, smart cities and smart homes, India is seeing an increase in the demand for smart street lighting solutions. The Economic Times stated that the smart street lighting market in India is expected to grow at an annual rate of 42.2 per cent with an expectation to reach USD 1,868.9 million by 2022. Smart Cities have the need to reduce energy consumption, remotely control street lights including their luminosity, and to ensure proper lighting in public areas for the safety of their citizens.

The initial deployments of smart street lights in India included the use of LED technology to reduce energy consumption. The second phase introduced the ability to control a series of street lights with a Data Concentrator Unit (DCU). With the advancements of IoT in the recent years, smart street lights now are able to be monitored, controlled, remotely turned on/off and dim individually. The below case study describes a deployment of smart street lights in the city of Jamshedpur, India's first planned industrial city. The result in this project demonstrated a 27 percent savings in power consumption for the customer, Jamshedpur Utilities and Services Company (JUSCO) Ltd.

Case Study 1 (Tata Communications Limited, 2018): Smart Lighting IoT Solution

Location: Jamshedpur in Jharkhand, India

Requirements: Customer wants to implement a smart lighting solution that can drive energy

conservation, monitor, and automate fault detection to ensure uninterrupted civil services, all from their central command control center.

Challenges:

- Monitoring and maintenance of street lights were both tedious and repetitive
- Street lights were operating at a 100% throughout the entire day and was wasting energy.
- Real-time monitoring of the lighting operations was required especially for specific areas where employee safety was critical.

Solution:

- Install LoRaWAN® smart sensors in each street light to track and optimise energy consumption
- LoRaWAN® geolocation was used to monitor the health of each street light and track the lights if stolen
- Data was routed to the customer command control center for real-time insight and operational control capabilities.

Return on Investment (ROI): 27% savings in power consumption realised in 3 years.

Contact Person: Mr. Saikata Das (email: saikata.das@tatacommunications.com)

4.1.2 Smart Waste Bins

As per the Press Information Bureau, India generates 62 million tons of waste every year, of which less than 60% is collected and around 15% processed. Due to the rate of waste accumulation, India landfills are unable to process waste at desired speeds causing greenhouse gas emissions and hazardous toxins being released in the environment. With an expected waste generation annual growth rate of 4% and the growing population in India, the pressure of addressing the waste issue is one of the top priorities for the Government of India. To address this problem, in 2014, the Government rolled-out a nation-wide campaign called “Swachh Bharat Abhiyan” or “Swachh Bharat Mission” with the objective of cleaning up the streets, roads and infrastructure of India's cities, towns, and rural areas.

Companies all across India, from start-ups to large corporations, are investing resources, finances, and time to solving this massive problem which India is facing. Leveraging IoT and data processing, waste management, waste processing, and waste monitoring are improving slowing with more innovations and available solutions. One example which uses smart sensing, wireless connectivity, and data analytics is smart bins. Smart bins simplify parts of the waste management process by providing alerts when bins have accumulated too much waste, reducing operational costs such as fuel and manpower, and determine where waste build up is more prone to occur in different parts of the city. The below case study demonstrates the use of such solution in an Indian smart city.

Case Study 2 (SenRa Tech Pvt Ltd, 2018): LoRaWAN® Smart Bins (Fill Level Detection)

Location: New Delhi, India.

Requirements: Customer wants to detect the fill-level of their metallic hydraulic waste bins and get real-time notifications when the bins are full. Customer wants to improve their waste collection operations and have insight on how long it takes for their drivers to complete their routes.

Challenges:

- Hydraulic waste bins are installed underground
- Waste bins are made of metal and installed 2 meters underground causing RF signal to have interference or weaken
- Cellular coverage is not available in all bin locations

Solution:

- Ultrasonic LoRaWAN® waste bin fill sensors provide real-time fill level measurements
- LoRaWAN® Gateway was used to send data to Cloud as and when data was received.
- Customer receive automatic alerts / notifications when waste accumulation is over specified fill level thresholds;
- Mobile app provides waste collection route optimization leveraging google map APIs

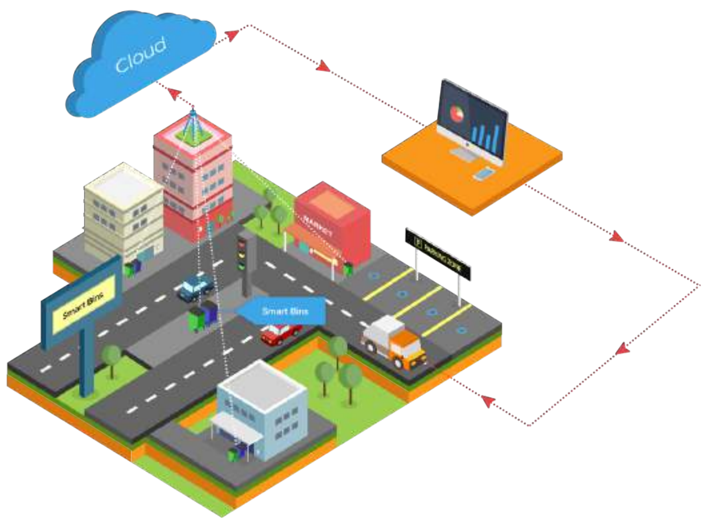


Figure 6: Smart Waste Bin - Fill Level Detection

Return on Investment (ROI): Estimated average operating cost savings of 30%.

Contact Person: Ms. Isha Sankhyadhar (email: isha.sankhyadhar@senraco.com)

4.1.3 Smart Parking

Alongside a rapid growth in population, India is seeing a steady rise in income of an average middle-class household. This rapid growth, coupled with cultural shifts such as small nuclear families, dual income households etc. has led to a rapid increase in density of motor vehicles per household. This is putting an additional strain on the existing parking infrastructure of the already over-congested cities.

As a natural alternative, most car owners, in the absence of parking spots, choose to park on temporary spots such as road side. Often these parking spots are marked illegal by the city authorities. It is estimated that on any working day, over 40% of the urban road area is taken up by parked cars.

Several cities including Delhi, Chandigarh and Pune have taken steps towards framing a parking policy to reduce parking pressure and congestion on roads and public spaces. The efforts, however, fail to balance the supply of parking spaces with efforts to reduce the overall demand for parking.

There are several problems with these conventional parking policies:

1. There is an unsustainable pressure on the available land for a wasteful use.
2. Minimal pricing for street parking irrespective of the demand
3. Illegal encroachment of public spaces and walkways
4. Restricted access for emergency services in congested areas

Even the planned smart parking management solutions have not been found to yield expected results due to choosing sub-optimal technologies. The parking sensors themselves are sometimes based on localised wireless area networks which suffer from low battery life and high maintenance costs. Instead of collecting and storing the occupancy and traffic data from these sensors and using them for advanced analytics, the data is merely displayed on an LED panel to determine vacant and occupied status. Features like parking reservation and route planning according to nearest available parking spots are not available in a centralised fashion.

Smart Parking Solutions across the world aim to leverage smart IoT technologies to manage city's organised and unorganised car parking lots in an efficient manner. The solution is based on camera based sensors and/or surface mount sensors for on-street parking and off-street parking slots. Parking Sensor are primarily used to detect the occupancy of the parking bay and communicate back the parking occupancy status to the local processing system/controller. LED display units are used for communicating the occupancy status and other relevant information at the parking entry/exit gates. In addition, entry/exits are coordinated using an arrangement of boom barriers, ticket dispensers and PoS machines to collect payments.

Although cities in India have made efforts towards such smart parking management systems, an overwhelming majority of cities still suffer from unorganised and illegal car parking due to a lack of enforcement methods and effective selection of sensor and communication technologies.

One way of addressing these issues is leveraging the smart parking sensors, long range low powered wireless communication systems such as LoRaWAN®, and real-time analytics to provide monitoring and real-time notifications of unauthorised parking activity.

Figure 7 explains how cities and law enforcement can benefit from smart parking enforcement solutions.

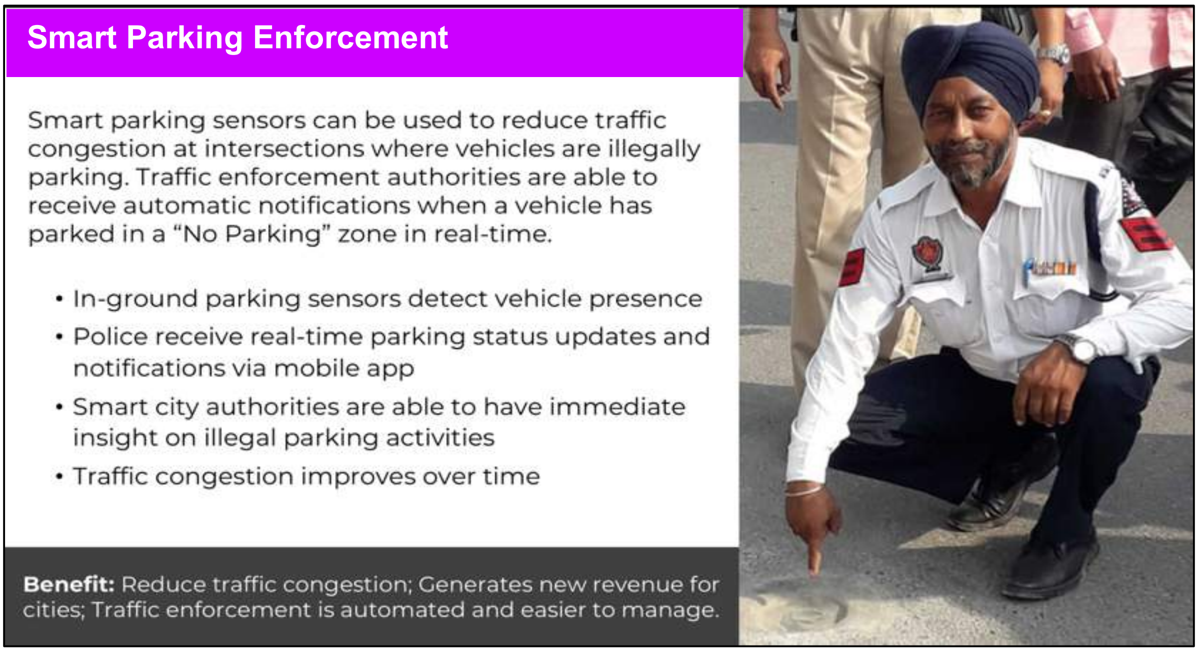


Figure 7: Smart Parking Enforcement

The following case study demonstrates how the smart parking enforcement solution reduced traffic congestion and generated new realised revenue for the city of Amritsar with a +30% return of investment.

Case Study 3 (SenRa Tech Pvt Ltd, 2018): LoRaWAN® Smart Parking Enforcement

Location: Amritsar, Punjab, India

Requirements: Smart city authorities want to reduce traffic congestion at intersections where vehicles are illegally parking. Smart city authorities want to send automatic notifications to the police when a vehicle has parked in a "No Parking" zone in real-time.

Challenges:

- Police are unable to physically monitor the illegal parking at all times
- Parking ticket issuance is not tracked properly
- Existing illegal parking solutions do not work, or the ROI is not clear.

Solution:

- Install in-ground LoRaWAN® parking sensors to detect vehicle presence
- LoRaWAN® Gateway was used to send data to Cloud as and when data was received.
- Police receive real-time parking status updates and notifications via mobile app
- Smart city authorities are able to have immediate insight on illegal parking activities
- Traffic congestion improves over time

Return on Investment (ROI): +30%

Contact Person: Ms. Isha Sankhyadhar (email: isha.sankhyadhar@senraco.com)

The following graphs demonstrate the actual data which was captured by an IoT analytics platform collected data over a period of 7 months leveraging 6 smart parking sensors deployed in 2 different locations. Parking activity (Figure 8) and the revenue generated based on issued parking tickets.

Figure 9 demonstrates a real successful use case currently active in India.

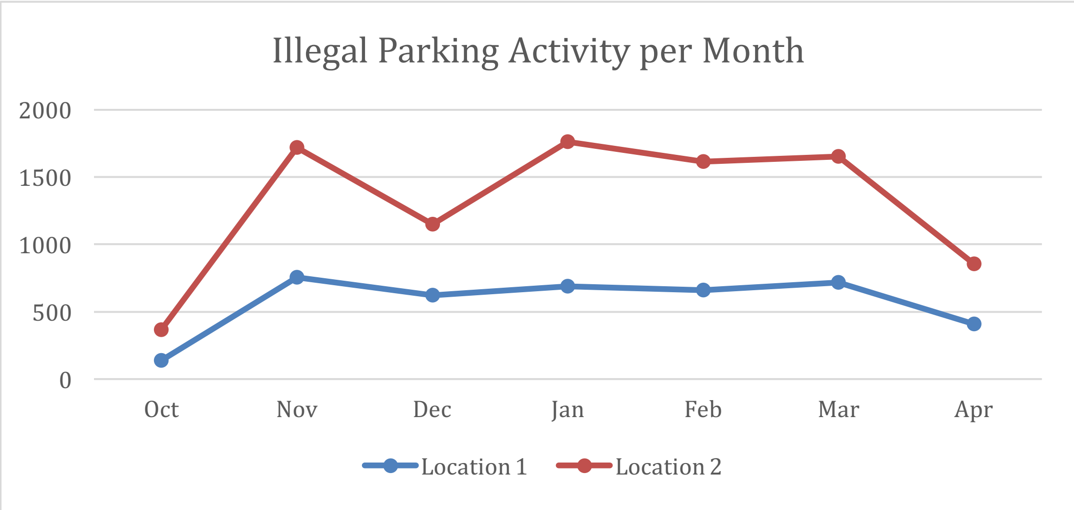


Figure 8: Illegal Parking Activity per Month

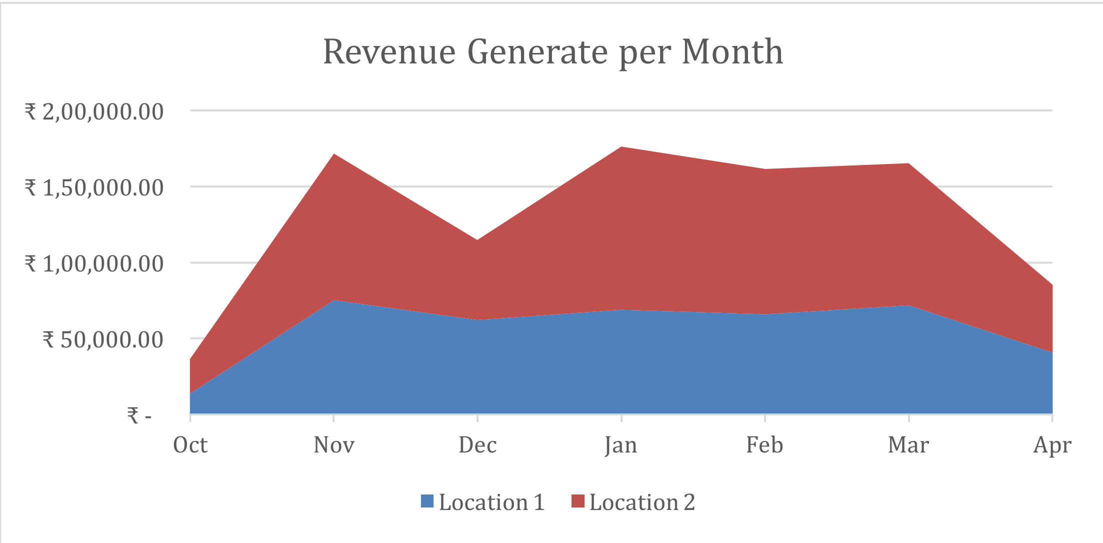
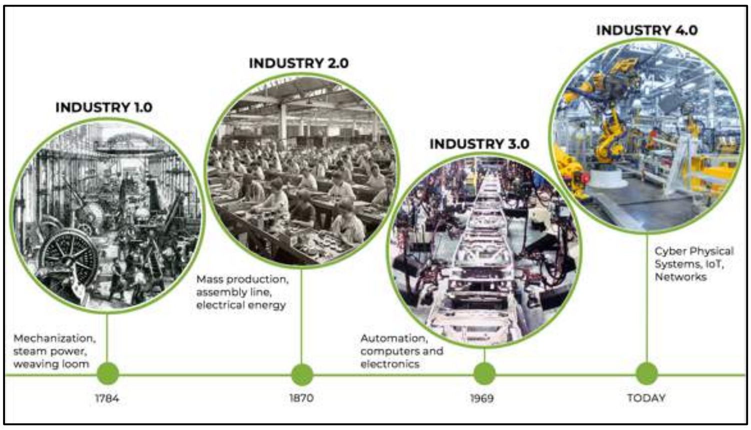


Figure 9: Illegal Parking Revenue Generated per Month

4.2 Industrial IoT (IIoT)



From the start of manufacturing businesses have searched for ways to increase outputs and speed up production. As early as 1784, manual processes where being transformed to automated processes leveraging the innovations which were available during the respective times. Since the advancements of steam powered mechanizations, assembly lines and electrical energy, to more recent computer automation techniques the manufacturing industry has always been the one of the first industries to adopt and implement new techniques, methods, and technology to gain an advantage over competition. With over two centuries of industrial movements, the Industrial sector is again witnessing another movement of advancements leveraging cutting edge tech, also known as Industry 4.0.

Industry 4.0, leveraging cloud based systems, IoT, new sensing techniques, and processing power, has now shifted manufacturing from not only focused on speeding up production but now also using technology to cut costs and improve operational efficiencies. The evolution of smart industries, also known as Industrial IoT (IIoT), has transformed the industry and has created new opportunities never conceived before. As captured in Figure 5, IIoT was the second largest IoT segment deploying solutions in 2018 and in a recent report by Deloitte, the Industrial Manufacturing sector is expected to contribute to 18% of India's IoT market share by 2020.

The global market is also seeing similar growth with a projected impact of $14.2 trillion USD on the global economy by 2030. Additionally global market predictions for IIoT is mentioned in Figure 10.

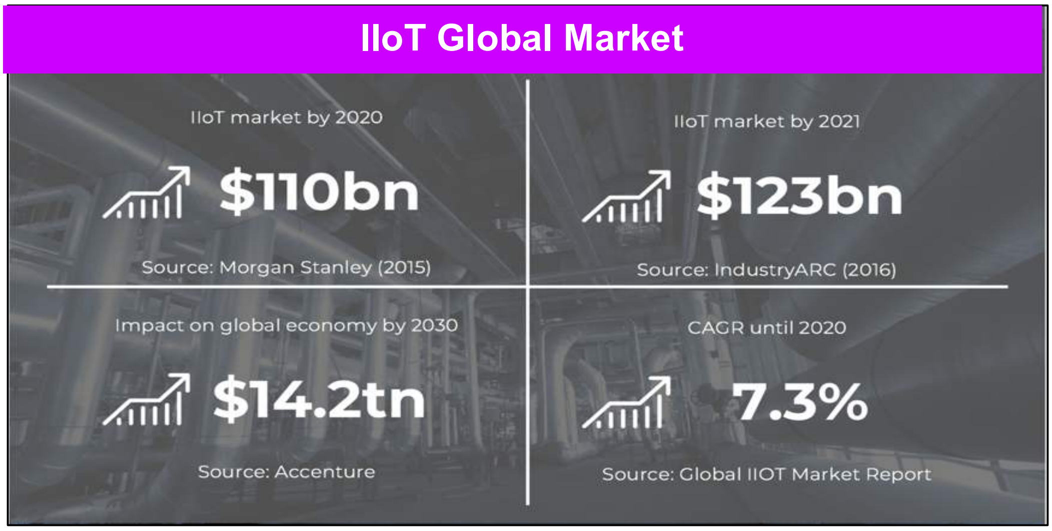


Figure 10: IIoT Global Market Forecast

4.2.1 Connected Operations

Morgan Stanley recently reported that the main industrial IoT driver for businesses is to improve operational efficiency; followed by improving productivity and creating new business opportunities.

Figure 11 describes the top ten driving factors in IIoT. Based on this information, we provide you a real use cases executed in an Indian manufacturing site addressing the operational efficiency demand leveraging IoT.

Figure 11: Industrial IoT Drivers

The following case study demonstrates how the power of data analytics and IoT provides real-time insight in production and reduced production loss by 50%.

Case Study 4 (MothersonSumi INfotech & Designs Limited, 2019): Operational Performance Improvement

Location: Unknown location in India

Requirements: Customer wants to identify the root cause of loss in throughput and lack of operational production efficiency.

Challenges:

- Operation requires manual assembly & testing
- Operator manually feeds parts into the machine for testing and places parts into output bin post testing.
- Production efficiency and throughput is slow and is impacting production output.

Solution:

- Data acquisition software module was deployed to continuously monitor signals to analyse timings for part input & output.
- Automated monitoring & analysis of data
- Intelligence reports were generated to determine root cause of issue.

Return on Investment (ROI):

- Customer was able to determine that they were suffering productivity losses to the tune of close to 50%+ on account of inconsistency in part feed timing by the operator.

The operability of machinery can also result in loss of production if not maintained in proper working condition. The following two case studies demonstrates how sensors and low-powered technology can be used to monitor the health of the equipment used during production and manufacturing, resulting in time savings and increased revenue.

Contact Person: Mr. Cheruvu Siva Rama Krishna (phone: +919600037499, email: cheruvu.krishna@mind-infotech.com

Case Study 5 (EasyReach Solutions Pvt. Ltd. , 2019): LoRaWAN® Welding Machine Analysis

Location: Unknown location in India

Requirements: Customer wants to assess contractor's performance by monitoring the welding machine use, location, and health. Items to be assessed are current consumption of welding machine**,** determining if machine has been turned on or off, GPS location of the machine, and the temperature of the machine.

Challenges:

- Customer was lacking the expertise in integrating multiple sensors onto the machinery
- Traditional GPRS connectivity was unavailable
- Placement and installation of devices/sensors onto the existing welding machines was not easy

Solution:

- Use of various sensors (GPS, Temperature, Current, ON / OFF, Battery Life indicator) were integrated on an ER990B LoRaWAN® board.
- Data was sent on various events or at a regular interval based on the necessity.
- Devices was placed inside the welding machine.
- LoRaWAN® Gateway was used to send data to Cloud as and when data was received.

Return on Investment (ROI): Customer optimised their allocation of welding machines resulting in a reduction of contractor requirements by 30%.

Contact Person: Mr. Amol Vedak (email: amol.vedak@easyreach.co.in)

Case Study 6 (EasyReach Solutions Pvt Ltd, 2019): LoRaWAN® Vibration Analysis

Location: Jaipur, Rajasthan, India

Requirements: Customer is in the business of vibration analysis and remedy. They supply fans, motors to large manufactures in automobile industries, builders etc. along with their own Vibration insulators. They wanted to monitor health of their insulators and at the same time identify anomalies along with long term prediction on failure of the insulators.

Customer Challenges:

- Cost of replacement of existing fans/motors already installed is too high
- Sensors/devices need to have long battery life to sustain the life of the equipment being monitored
- Wired connectivity was not feasible nor available and required long range data connectivity so that data could be sent to the SCADA systems for processing.

Solution:

- A LoRaWAN® ER550 board was used with the integration of vibration sensors.
- 5 years battery life was provisioned for the system. Unit was placed in IP65 enclosure with operating temperature of -10 to 70 degree C.
- Due to compact unit size, installation became very easy. There was no need for external wiring.
- Vibration Data values were received on the Application server for further analysis. Data points were converted to MODBUS over RS485 for SCADA.

Return on Investment (ROI):

- Savings on external wirings cost, time of deployment
- Quick implementation as time required for implementation on each Fan / Motor was less than 30 mins.

Contact Person: Mr. Amol Vedak (email: amol.vedak@easyreach.co.in)

Compressed air, the 4th utility, is critical to millions of businesses around the world. A compressor is used to generate compressed air in a decentralised manner. Compressors are typically operated by electrical motors, which transmit motion to compressor systems such as rotary screw compressors or reciprocating piston compressors which then use mechanical energy to compress air.

While it certainly has its advantages and challenges, compressed air is an important source of energy and a widely used utility. Today, compressed air finds application in manufacturing operations across a wide range of industry verticals spanning textiles, general engineering, food processing, plastics, automotive, pharmaceuticals. The following case study demonstrates how IoT can provide insight on performance of compressed air machinery.

Case Study 7 (Elgi Equipments Ltd, 2019): Compressor Monitoring System (Air~Alert)

Location: Unknown location in India

Requirements: Customer needed to minimise downtime and maximise efficiency of their air compressors. Customer wanted to have real-time insight on the performance of the compressors and receive alerts if something is not operating properly.

Challenges:

- Accidental downtime due to interrupted supply of compressed air
- Sub-optimal energy efficiency due to over utilisation of the air compressors

Solution:

- Implementation of a data transmission service that monitors a compressor machine's critical parameters with a view to minimizing downtime
- A GSM module is used to communicate data to the cloud
- Data Analytics are provided to the customer providing the ability to do planned maintenance, failure prediction and provide energy saving solutions
- In case of sub optimal utilisation of a compressor, energy saving Variable Frequency Drives (VFD) were used to intelligently vary the discharge air flow rate of compressor with changes in operating application demand

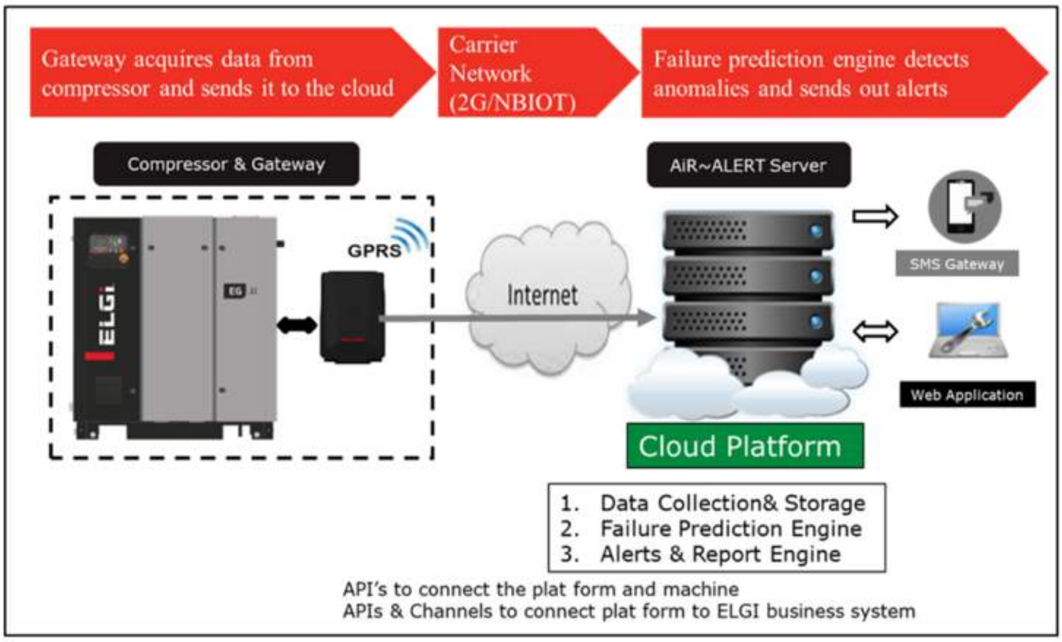


Figure 12: Air Compressor Monitoring System (**Air~Alert**) Architect

Return on Investment (ROI): Up to 25 % energy savings (approx. ₹ 3.5 Mn.)

Contact Person: Mr. Karthik Srinivasan (email: karthiks@elgi.com)

4.2.2Smart Supply Chain

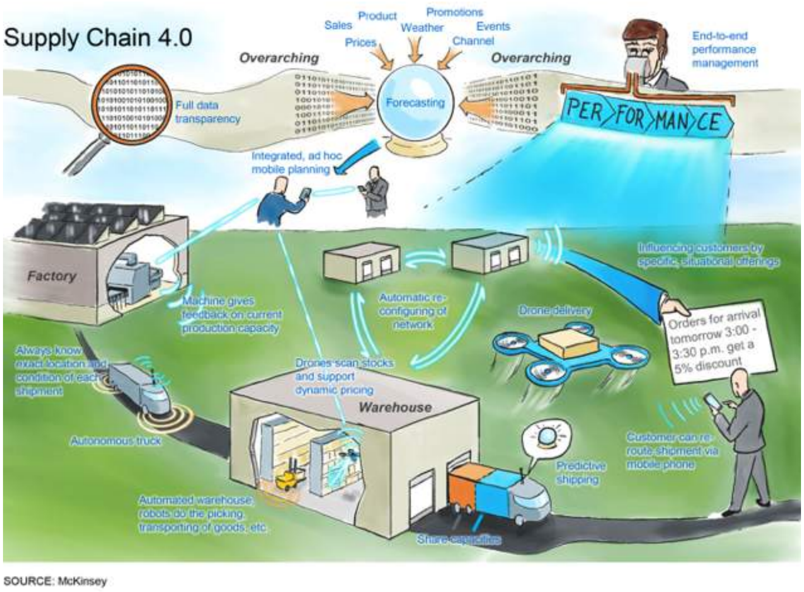


Figure 13: Supply Chain 4.0

As part of the Industry 4.0 efforts, businesses are also looking to improve their supply chain management efforts leveraging technology such as IoT, analytics, and robotics. The use of technology to advance their processes and digitalise their supply chain process can also be defined simply as Supply Chain 4.0. The diagram below in Figure 13 demonstrates the idea and possibility of Supply Chain 4.0.

Over the past three years, the supply chain sector in India has seen a huge increase in capital mainly driven by the “Make in India” program. With the new addition of the Goods and Services Tax (GST), the relaxed foreign direct investment policy, and the increased funding from the Government, the supply chain sector is witnessing its own digital transformation. PwC reported that 67 percent of businesses today “consider digital supply chain disruptive and important”.

One of the hot topics in supply chain management is cold chain. The reason why is because products, such as sensitive drugs, blood samples, and food can have critical impact to businesses if temperature control is not properly implemented. Due to regulatory pressures and unnecessary wastage, smart solutions are becoming necessary in order to keep businesses a float. As per the New Market Research report, the cold chain monitoring global market is expected to grow from USD 3.80 billion in 2018 to USD 6.46 billion by 2023, at a CAGR of 11.17% between 2018 and 2023. India is also seeing an uptick in cold chain monitoring solutions being deployed. Big companies like Bigbasket are investing in smart solutions to improve quality control and reduce loss. Below, we provide a case study on a smart cold chain solution which was deployed for Bigbasket leveraging IoT, sensors, analytics, and mobile applications.

Case Study 8 (TagBox Solutions Private Limited, 2019): Smart Cold Chain Solution

Location: PAN India

Requirements: Bigbasket wanted to ensure compliance with cold chain SOPs and guarantee quality of products at delivery. They also wanted to have location visibility of cold boxes for inventory management.

Challenges:

- Unable to determine if on-field staff are following passive-cooling SOPs while packing boxes.
- Quality of cold chain products, like dairy and meat, is not consistent due to temperature excursions.
- Cold Boxes are misplaced leading to order fulfilment issues and missing assets

Solution:

- Deployment of temperature sensors and a barcode for each cold box
- Integration done with customer's ERP system to capture order level temperature data in an analytics platform (see Figure14).
- M2M Cellular and/or Wi-Fi gateways were installed at customer warehouses providing the connectivity for data transmission from the sensors to the cloud.
- Mobile App was provided to the delivery persons enabling real-time monitoring of temperature during last mile delivery.

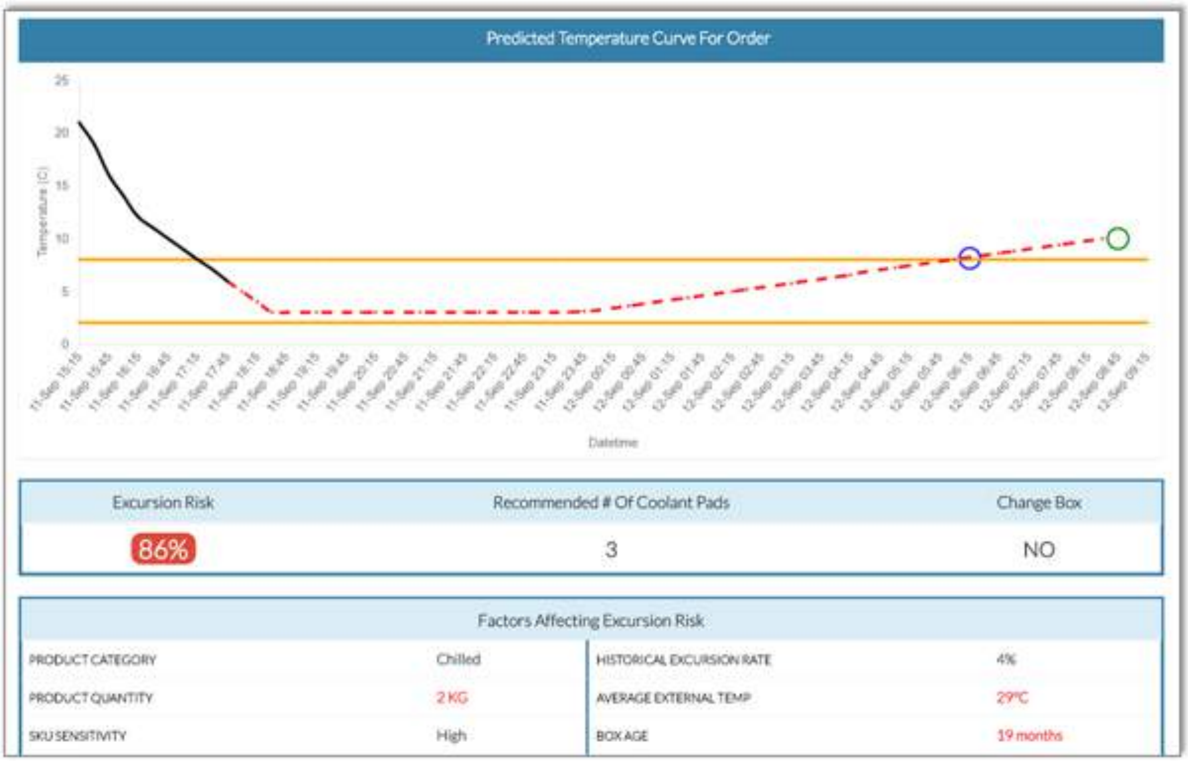


Figure 14: Predicted Temperature Data Analysis

Return on Investment (ROI): Bigbasket had a 30% reduction in product spoilage and 80% decrease in cold box loss.

Contact Person: Mr. Adarsh Kumar (email: adarsh@tagbox.in)

4.2.3Logistics / Transportation

By 2020, IoT in Logistics (also known as Logistics 4.0) will have one of the highest adoption levels in India. Per an Economic Survey 2017-1018 tabled in Parliament, India's logistics market is expected to reach about $215 billion in 2020, with a CAGR of 10.5%. Companies all around the world are looking at how they can leverage IoT to improve how they currently run their businesses. BI Intelligence reported in 2015, that Connected Logistics Solutions are expected to grow to a $20 Billion USD global market by 2020.

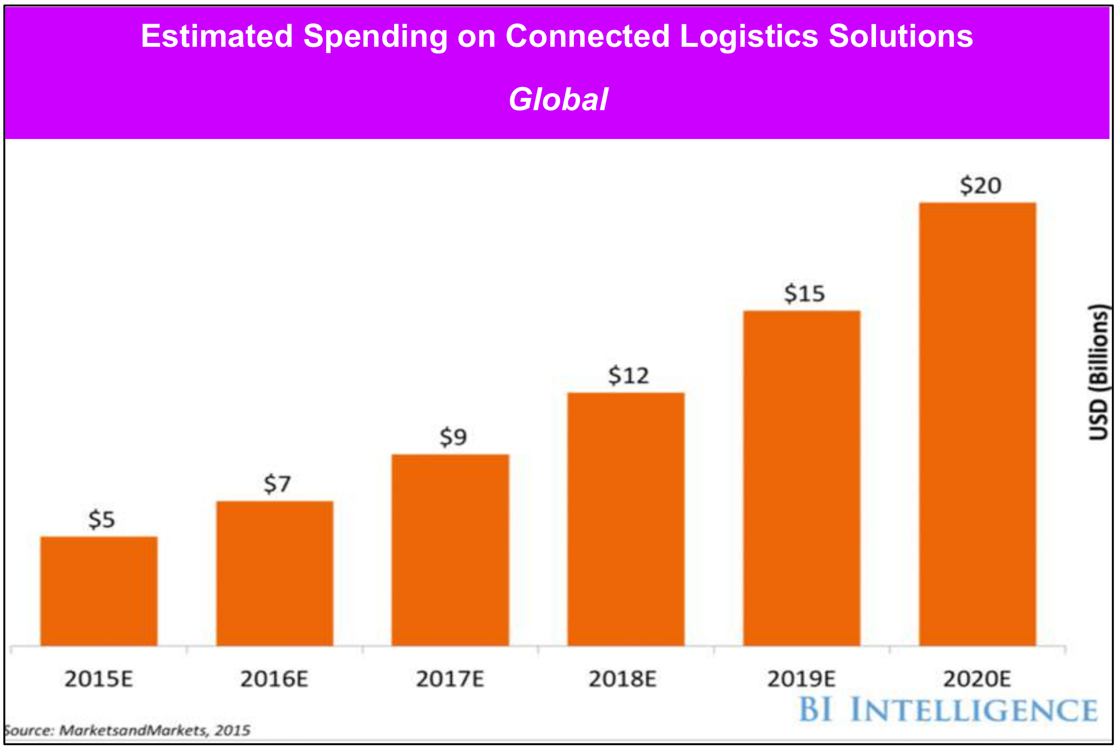
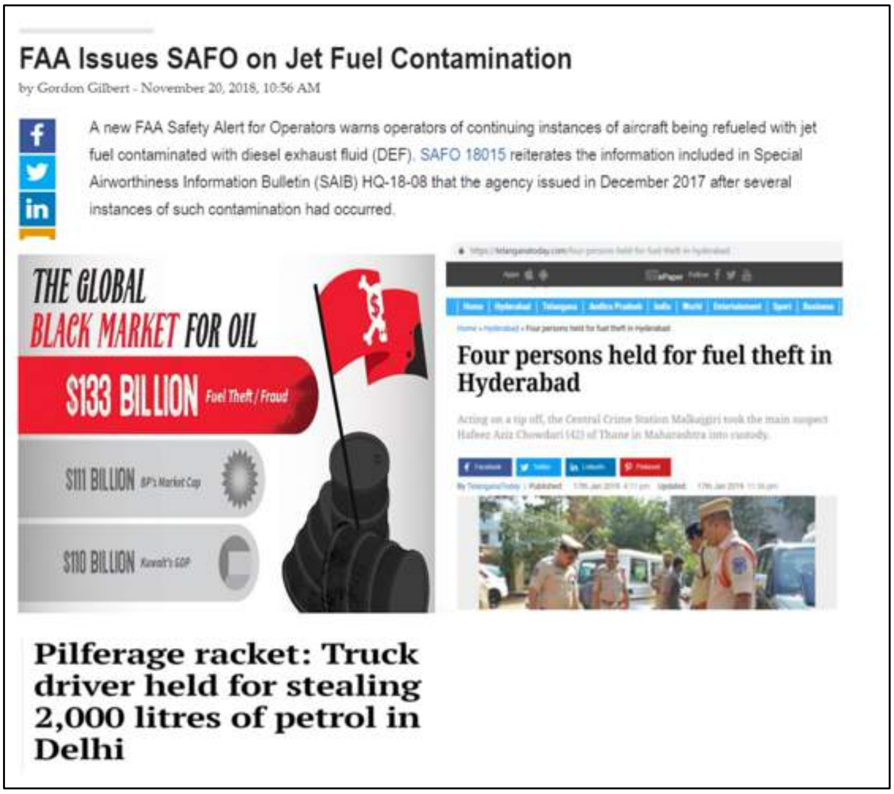


Figure 15: Global Estimated Spending on Connected Logistics Solutions

The top 8 challenges the Logistics industry is facing are fuel costs, outdated business processes, customer service, economic impacts, shortage and retention of drivers, regulatory compliances, negative impacts to the environmental, lack of technological expertise. According to a logistics study conducted by Capgemini in 2016, cutting transportation costs was the largest concern for the logistics industry.

In an attempt to demonstrate the logistical challenges companies are faced with, we will take a deep dive in the operations of one of the largest oil and gas companies in the country. This company has more than 125 terminals across India from where more than 26000 tanker trucks supply fuel to around 40000 Retail outlets. Typically, the tankers are loaded at the terminals, locked with locks whose keys are available at the destination. Every terminal has a huge lock room where locks and keys are stored, and manual records are maintained and managed. There are keys handed over to the retail outlets so that they can unlock the consignment on the tanker reaching there. When a tanker truck has been loaded and waiting to be locked the driver requests for his tanker to be locked. A clerk finds the correct lock and key set from the ledgers and retrieves the lock and key which is given to an official who goes up to the tanker and locks the access points , namely the hatches on top, the output valve at the bottom and the safety lever box at the rear. Depending on the design of the tanker truck, the number of locks per truck can vary from 1 to 5 locks per tanker truck.

There are many problems faced in this scenario of securing transportation of fuel from terminals to retail outlets with manual locks and keys. Some highlighted issues in this scenario is key management, lock management, resource constraints, duplications of keys, lack of auditing and insight on the locking/unlocking of cargo, temperature monitoring, the biggest issue of all theft / pilferage of the cargo.


FAA Issues SAFO on Jet Fuel Contamination

by Gordon Gilbert - November 20, 2018, 10:56 AM

A new FAA Safety Alert for Operators warns operators of continuing instances of aircraft being refueled with jet fuel contaminated with diesel exhaust fluid (DEF). SAFO 18015 reiterates the information included in Special Airworthiness Information Bulletin (SAIB) HQ-18-08 that the agency issued in December 2017 after several instances of such contamination had occurred.

Four persons held for fuel theft in Hyderabad

Acting on a tip off, the Central Crime Station Malkajgiri took the main suspect Hafeez Aziz Chowdari (42) of Thane in Maharashtra into custody.

Pilferage racket: Truck driver held for stealing 2,000 litres of petrol in Delhi

Figure 16: Fuel Pilferage News

The following case study demonstrates a real project executed in India leveraging IoT to address the above challenges with a result of 0.5% to 2% reduction of cargo pilferage per trip.

Case Study 9 (KritiLabs Technologies Private Limited, 2019): Smart Fuel Transportation Management

Location: New Delhi, India

Requirements: The security process during the transportation of fuel from terminals to retail outlets should be automated to alleviate the need for keys, lock management and providing an audit trail of all transactions including the time, location and authorization details. This automation should be in line with the Standard Operating Procedure (SOP) followed by the oil companies and should allow the oil companies to enforce safety procedures at the retail outlets.

Challenges:

- Pilferage of fuel results in a huge loss of value to the oil company and the retail outlet resulting in losses in operations.
- Adulteration of fuel is a huge threat especially in the aviation industry. This can pose as a huge security hazard.
- The oil company spends a huge amount of time, effort and money in organizing the security of fuel transport from terminals to retail outlets.
- Safety procedures at the retail outlet while unloading cargo is highly important since the cargo is hazardous and can result in huge damages to life and property if not properly handled.

Solution:

- A GPS device for monitoring the vehicle movement and its location
- An electronic physical lock which operates with an OTP is fixed on the tanker to secure its fuel cargo.
- IoT platform is used to manage, track, unlock/lock the devices, and provide historical data of cargo and the trip.

Return on Investment (ROI): Up to 2% savings per trip

Contact Person: Dr. L. N. Rajaram (email: rajaram@kritilabs.com)

4.3 Smart Buildings

In recent years, India has begun to see shift in commercial and residential building development where IoT, data analytics and AI are being used to reduce energy consumption, reduce greenhouse gas footprints, increase building security and resilience, as well as attract and retain employees/tenants. Per a recent Mercom India report, 72% of organizations in India are starting to pay more attention to smart building technologies and looking at how to improve the efficiencies in their buildings.

Due to government regulations such as the Energy Conservation Building Code for residential buildings (ECBC-R), 52% of organizations plan to invest and focus on energy efficiency and renewable energy. On top of the programs set forth by the government focused on energy conservation, India is also seeing a real estate boom due to increased needs for urban and semi-urban accommodations, corporate environments, and office space. Figure 17 compares the investments and focus of energy efficiency measures between India and the rest of the globe.

	INDIA	GLOBAL
INTEREST AND INVESTMENT IN ENERGY EFFICIENCY AND SMART BUILDING TECHNOLOGY	72% of organizations are paying more attention 52% of organizations plan to increase energy efficiency and renewable energy investments 33% plan to keep their investment level the same	Globally, **59%** of organizations plan to increase investment, up slightly from 58% last year.
DRIVERS IN ENERGY INVESTMENT DECISIONS	1. Energy cost savings 2. Greenhouse gas footprint reduction 3. Increasing energy security 4. Increasing building resilience 5. Attracting / retaining employees	1. Energy cost savings 2. Greenhouse gas footprint reduction 3. Increasing energy security 4. Enhanced brand or reputation 5. Attracting / retaining employees
TOP BARRIERS TO INVESTMENT	**29%** Lack of technical expertise to evaluate or execute projects **29%** Uncertainty regarding savings and performance **16%** Lack of funding to pay for improvements	**28%** Lack of technical expertise to evaluate or execute projects **22%** Lack of funding to pay for improvements **18%** Uncertainty regarding savings and performance
TOP ENERGY EFFICIENCY MEASURES		

Figure 17: Top Energy Efficiency Measures (source: Mercom India)

Below we will explain a smart building case study and how IoT was used to eliminate energy waste by monitoring central air conditioning systems.

Case Study 10 (Smart Joules Pvt. Ltd, 2019): Eliminating Energy Waste in Central Air Conditioning Systems

Location: Coimbatore, Tamil Nadu

Customer Requirements: Eliminate Energy Waste by improving chiller plant operations using IoT

Customer Challenges:

- Customer had excessive energy bills and could not determine how to reduce it
- Lack of insight on the building operations to assess where savings would be

Implemented Solution:

- Implemented an energy optimization technology to collect critical chiller plant performance parameters every minute
- Used an analytics platform, alerts were generated, and corrective actions were automatically implemented.
- Provided continuous energy auditing, automatic efficiency improvement detection
- Deployed Embedded Systems for Automatic Efficient Controls

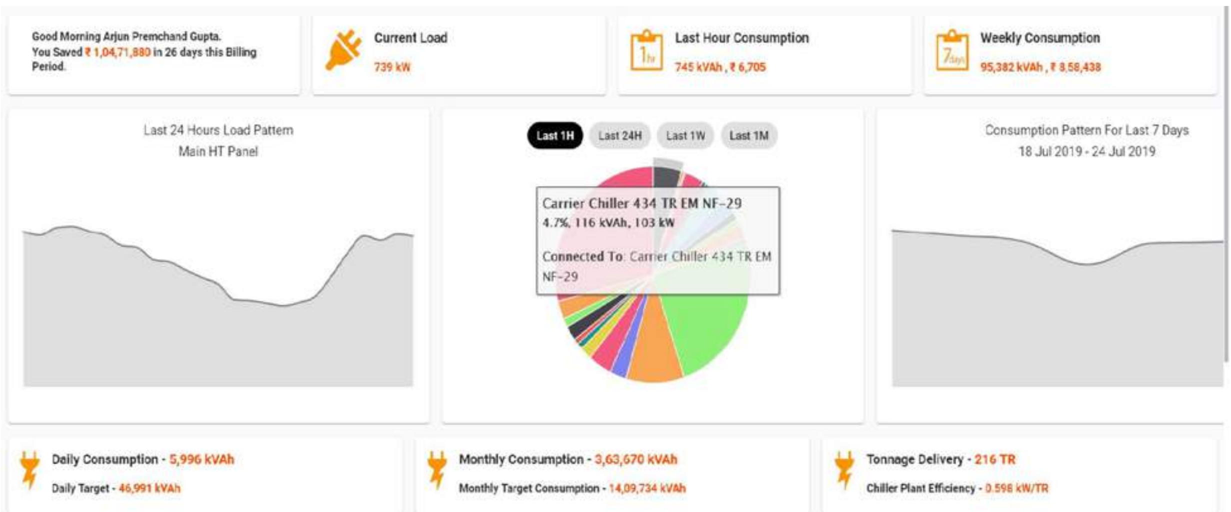


Figure 18: Energy Monitoring Dashboard

Return on Investment (ROI): Customer recouped their investment in 2 months and was able to save 30,000 kWh / year / AHU.

Contact Person: Mr. Arjun Gupta (email: arjunpgupta@smartjoules.in)

4.4 Smart Energy / Utilities

India plans to invest $44.9 billion USD in smart metering, distribution automation, battery storage and other smart grid market segments over the next decade. The investment is an attempt to reduce the country's 22.7% transmission and distribution (T&D) loss rate. Investments towards smart grid, smart metering, and utilities are increasing due to government programs, regulations, and policies to make India a clean and efficient country. It is expected that 25% of India's IoT market will be captured by the energy and utilities sector equaling to $3.75 billion by 2020. The following sections breaks down some of these segments, their impact on India business, and case studies which demonstrate the use of IoT to address challenges these sectors are facing.

4.4.1 Smart Grids

Managing electric grid infrastructure and ensuring operations, power generation, transmission, and distribution is a complicated task and is critical the livelihood of a city and the citizens which live there. Smart grids are the new evolution to electrical grid systems. With the inclusion of smart meters, smart appliances, renewable energy resources and other sensors to make operations and energy consumption more efficient, power transmission and distribution processes are now more automated and provide more insight to power companies.

The IoT and other advanced technologies have not only introduced new and better ways of managing power generation and distribution but has also created multiple facets in saving money and improving the quality of citizen lives. According to Market Research Future (MRFR), the market for smart grid sensors is set to have revenues growing approximately to $4 Billion USD by 2023 with a CAGR of 18% over the next 4 years.

The ability to sense and analyse create new opportunities never imagined before. The following case study demonstrates how IoT was used for distribution transformer monitoring and was successfully able to reduce loss.

Case Study 11 (Smart IMS India Pvt Ltd, 2019): Distribution Transformer Monitoring & Proactive Fault Management

Location: Unknown location in India

Requirements: Customer would like to have more insight in the distribution transformers performance and health of the overall equipment. Customer would like to monitor and reduce power consumption/loss.

Challenges:

- Oil temperatures of transformers rise to abnormal levels
- Fuses on the transformers go bad without anyone's knowledge
- Improper earthing/wiring of equipment is done during installation or maintenance

Solution:

- Oil temperature sensor was provided to determine the real time temperature of the oil inside the transformer.
- Continuous monitoring of voltage between phase-earth and phase-neutral was applied.
- The temperature of the fuse was monitored using fuse temperature sensors.
- Analytics platform is used to send alerts when there is any current unbalance, low voltages and failure of individual phases.
- Analytics platform is used to monitor the load of the transformer in real-time and notifying when it is overloaded.

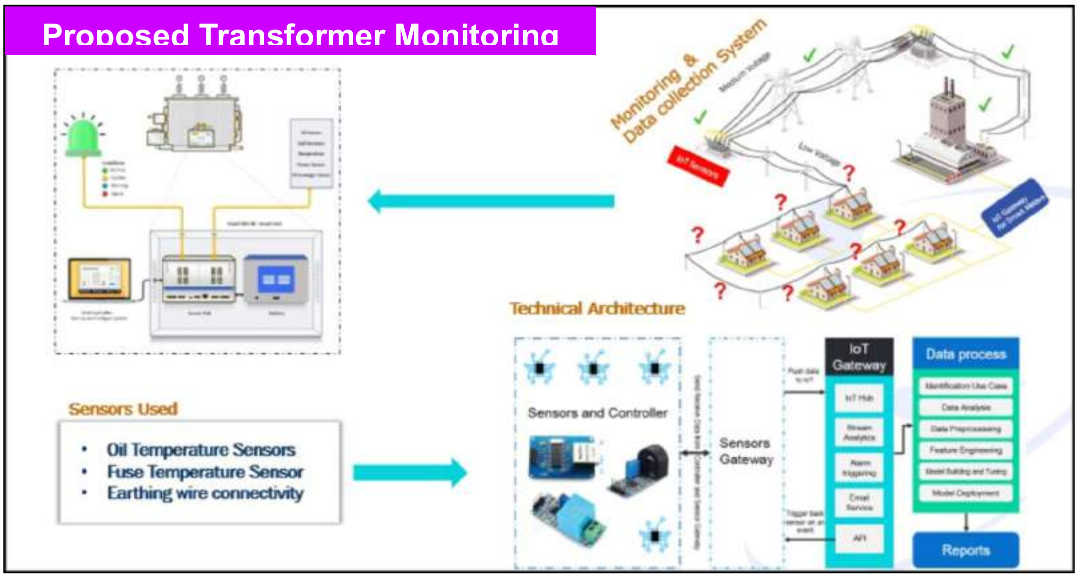


Figure 19: Transformer Monitoring System

Return on Investment (ROI): Customer was able to reduce the downtime of faulty transformers.

Contact Person: Mr. Rajashekar Matam (email: rajasekhar.matam@smartims.com)

4.4.2 Smart Water Metering

Water has become one of India's leading topics of discussion amongst government, cities, and urban decision makers in the recent years. Water scarcity, water pollution, and water consumption have fast become some of the most challenging issues to address for cities in India today. Some of the key factors to this crisis are related to increased water consumption and wastage in urban areas, industrial growth, political and regulatory disputes, water cycle imbalances, increased irrigation due to agricultural demands, and lack of technology.

In addition to mentioned factors above, the overall population, which is expected to increase to 1.6 billion by year 2050, is also contributing to the water crisis in India. According to Central Water Commission (CWC) report, water levels in 91 major reservoirs in the country were at just 25% of capacity in 2018, 30% lower than 2017 and 25% less than the average storage in a decade. It is estimated that India's water sector requires an investment worth US $13 billion to tackle these difficult problems. Hence the need to put technology in the fore front of this problem is the need of the hour.

The term "Smart Water" describes how water and water infrastructure can efficiently be transported, distributed and effectively managed to ensure water is saved and leveraged properly. Incorporated into the smart water process are systems designed to gather, analyse, detect, and notify concerned parties about the current water flow, consumption, distribution and cleanliness of a city's water. Leveraging cutting edge technology to send water data over long distances, wirelessly, at low-cost are key factors in creating an efficient solution for water management and related water maintenance activities.

In India today, the majority of the meter management and meter reading are still being accomplished in an old fashion manual process which requires resources to physically visit the meter sites and take the readings manually. This process is considerably high in the case of water metering vs electricity distribution companies, as they in their quest to cut transmission and distribution costs have shifted to smart metering solutions long ago. One of the main challenges for water distribution companies is the non-revenue losses. These companies are realizing the only way to control and increase their revenue base is to bring in smart meters which can provide real-time feedback of water consumption and promote water conservation methods.

The most efficient manner in order to achieve the above is to deploy Advanced Metering Infrastructure (AMI) instead of the old fashioned Automated Meter Reading (AMR) methodology. Smart AMI water meters provide end-to-end automated mechanisms including wireless communication, secure data transfer, and real-time analytics. These mechanisms provided the end customer, in this case typically the utilities companies, distribution companies, and city administrators, a clear view in their day to day processes. This information will provide insights for managing the entire distribution eco-system in a much more efficient manner enabling the city administration to predict behaviour of the consumption, loss, and most importantly influence behavioural changes of the consumers creating a better awareness of water saving strategies.

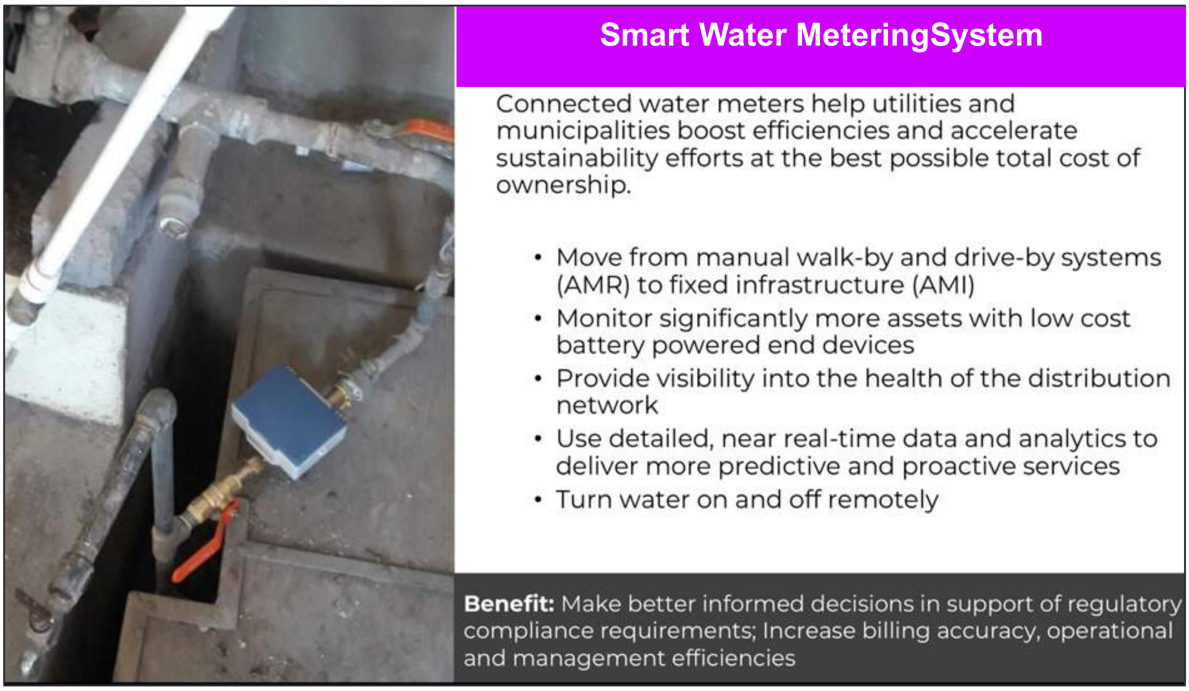


Figure 20: Smart Water Metering

In the past, access to water meter data was a very resource heavy process, requiring a lot of man-power to physically obtain information directly off the meter. With this old process, there was no real time data visibility and there were many opportunities for data to be incorrectly captured and/or altered. With the smart AMI water meters, the city is now for the first time able to obtain insight on the water metering data in real-time and make water management decisions virtually in a matter of seconds. The following table below explains the pitfalls in leveraging existing water meter solutions and explains the benefits of leveraging a smart AMI water meter solution.

Existing Water Meter Solution	Smart AMI Water Meter Solution
No real time data availability	Real time data availability
Huge investment on CAPEX and OPEX	Reduced CAPEX and OPEX
No proper billing cycle	Automated bill generation
Increased Non-Revenue Water	Minimised Non-Revenue Water
High error rates	Minimal error rates
Manual device reading	Real time reading
Minimal battery life	Up to 12 years of battery life
Data analysis is slow and process heavy	Real time data analytics leveraging artificial intelligence
Limited consumption visibility for end user	Detailed analysis of consumption provided to end user
No integrated theft detection	Theft and tampering detection available
No leak detection	Real time leak detection
High maintenance needed	Minimal maintenance required

Figure 21: Water Meter Solution Comparison

With integrated application servers / platforms the city can be provided with new information which was never available in the past. Leveraging cloud computing, artificial intelligence, complicated algorithms, and big data processing, the city can improve the existing water management, distribution, and consumption. Below is a use case of a smart water meter project executed as part of Wardha's Smart City efforts.

Case Study 12 (NRS Chariot Tech Pvt. Ltd., 2018): Smart AMI Water Metering

Location: Wardha, Maharashtra, India

Requirements: Smart city authorities want to automate their domestic water metering services, to include monitoring water flow, leakage, consumption, and real-time meter availability for their citizens.

Challenges:

- No real-time meter reading availability
- Operational costs are too high
- Billing system was not streamlined
- Unable to determine the source of water and revenue loss

Solution:

- Replace old mechanical water meters with new LoRaWAN® enabled AMI ultrasonic water meters
- Leverage partner, SenRa, public LoRaWAN® network for connectivity.
- Provide mobile app for citizens to check their consumption and pay their bills
- Provide web application for city officials to monitor the water meter network, receive alerts on leakages/theft, and provide predicative analytics on water distribution and consumption

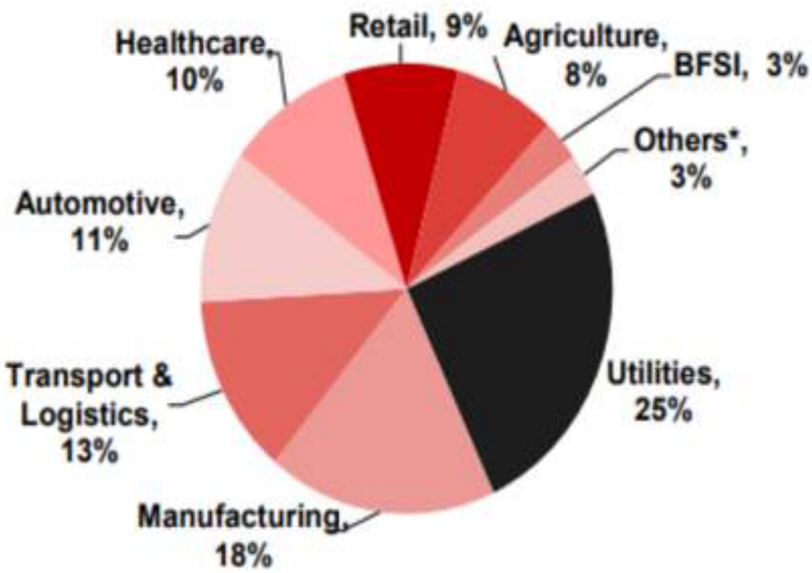
Return on Investment (ROI): The city was able to see a reduction in non-revenue water by 10%

Contact Person: Mr. Raj Garg (email: raj@chariotco.in)

4.5 Connected Health

India's healthcare market has been slow to adopt and implement IoT and technology solutions to address challenges the industry is facing. Part of the problem was due the lack of solutions available in the market. Over the last few years, a shift in the industry has occurred resulting in a rapid growth and demand for IoT and technology advancements. The growth of tech start-ups focused in the healthcare industry has also increased due to increase funding from investors, foreign and domestic, in the healthcare market. In a recent NASSCOM report, healthcare is expected to account for 10% of India's overall IoT Market by 2020.

Figure 22 provides insight on the leading IoT segments and their expected market impact in India.



India Industrial IoT market size: USD 4.95 Bn

***Others include food technology, education, construction**

Figure 22: Market size by industry (2020)

Some popular IoT use cases being executed in healthcare are related to patient monitoring, assessment of medical effectiveness and health patterns, medical storage monitoring, pharmaceutical manufacturing and associated operations.

Pharmaceutical companies specifically are helping the IoT adoption in healthcare by leveraging cutting edge technologies to improve the operations and ensure high quality of product manufacturing. With the early implementations of IoT in the Industrial and manufacturing segment, pharma companies can quickly improve their processes by using the same solutions already available in the market. The below use case explains an IoT deployment in a leading global pharma company and supplier of vaccines in India.

Case Study 13 (Gaia Smart Cities, 2018): Smart Feedback Solution to Monitor & Assure Vaccine Safety

Location: Unknown location in India

Requirements: Pharma companies need to ensure that vaccines and critical drugs are stored at temperature between 2-8 degree C to maintain their efficacy. Critical products need grid power and reliable two-level generator power backup. Pharma companies require tight control of their cold chain processes, to assure medicine quality during transit and in storage, reduction of losses, and monitoring the supply chain of medicines while stored. Pharma is a heavily regulated industry with established regulatory norms for ensuring safety and quality of medicines and vaccines. Automation of process monitoring can enable Pharma companies to avoid regulatory penalties and fines, eliminate potential end consumer legal issues, and maintain brand reputation through supply of high quality medicines and vaccines.

Challenges:

- Opaque last mile in the supply chain – lack of real time information on ambient parameters at distributed locations during transit or storage
- Assuring vaccine quality and safety at the warehouse
- Enabling faster response to safety breaches in real time
- Automating fail-safe mechanisms
- Operational efficiency and accountability of the ecosystem without data driven insights

Solution:

- Installation of smart feedback IOT devices
- Installation of temperature, door lock, power/ current sensors
- Real time analytics and monitoring of their cold warehouses monitoring
- 

Return on Investment (ROI): 50% improved response time site breaches and 100% improvement on operational visibility.

Contact Person: Mrs. Amrita Chowdhury (email: amrita@gaia.in)

4.6 Smart Agriculture

The India Brand Equity Foundation (IBEF) stated that agriculture is the primary source of livelihood for about 58 per cent of India's population. Gross Value Added by agriculture, forestry and fishing is estimated at Rs 18.53 trillion (US$ 271.00 billion) in FY18. The Indian food and grocery market are the world's sixth largest, with retail contributing 70 per cent of the sales. The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth.

While the demand for food keeps growing, the agricultural land is reducing in terms of area as well as fertility leading to the pressing necessity of increasing yield per unit area. In contrast to the challenges of rising climate change and environmental impacts due to intensive and careless farming practices, the food security needs of an ever increasing population across the world have to be met. Existing systems for monitoring essential crop parameters especially in India are highly manual and result in inefficient use of resources usually due to inaccuracy or delay in measurements. Farmers have traditionally relied on their background knowledge and experience on the field to carry out crop management which is often not very precise. For example, even getting the pH level of soil takes time as the sample has to be sent to the lab for expert testing which might deprive the crop of timely fertilisers.

Precision agriculture technologies for effective crop microclimate monitoring can be very useful for accurate assessment of yield and health. IoT makes this possible by providing necessary decisions for essential inputs such as irrigation, fertilisers, and pesticides in the required quantities at the correct time. It involves monitoring the whole ecosystem concerned with the crop starting from preparation of the soil, plantation, and growth till the harvest in order to provide precise intervention at the proper time. Specifically, this helps in (a) sensing of soil moisture and controlling irrigation, (b) determining fertiliser profile based on soil nutrients, (c) forecasting micro-climatic parameters, (d) predicting possible disease or pest conditions based on weather conditions, and (e) determining the correct time of sowing and harvest. Farmers can monitor the farms from anywhere with the help of systems with various sensors for light, humidity, temperature, soil moisture etc. and also automate the irrigation systems.

The below case study demonstrates a real project executed in Pune leveraging precision agriculture to reduce input costs by 20% and increase yield by 25%.

Case Study 14 (TCS Research & Innovation, 2018): Smart Farming (Precision Agriculture)

Location: Pune region of Maharashtra, India

Requirements: Farmers want to increase the quality of yield at a reduced cost while also having insight of the irrigation, weather, and crop-related pests and diseases.

Challenges:

- Farmers do not have a clear understanding of the soil moisture leading to loss of crops
- Lack of insight on weather patterns and forecasts create issues for the planning of crops and seasonal impacts
- Farmers are unable to assess if pests and diseases have started to spoil their crops causing loss in yield and revenue.

Solution:

- Deployment of an IoT system to monitor crop related conditions,
- Deployment of an IoT platform with integrated sensors, cameras and drones.
- Sensor deployment to monitor the temperature, humidity, leaf wetness and to send alerts on soil moisture and weather forecast to the farmers on their phone.
- Transmission of data via a Wireless Mesh Network to measure real time data of the climatological and other environmental properties.

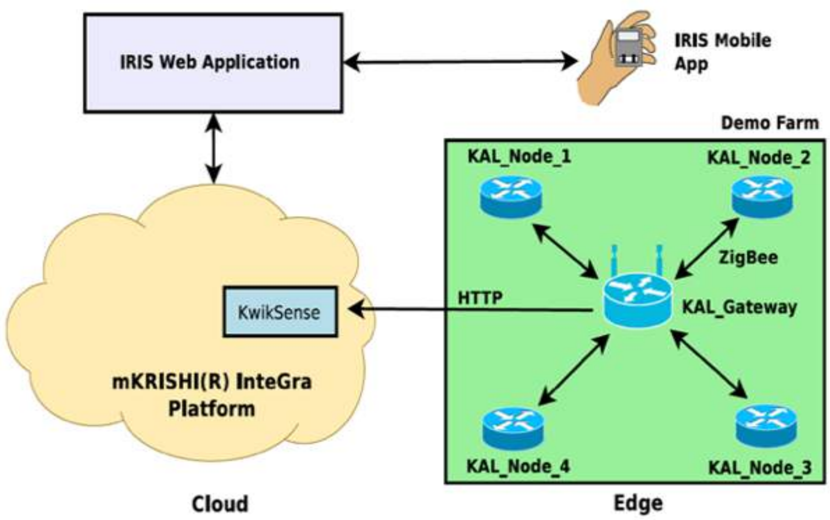


Figure 23: Deployment View of Smart Farm

Return on Investment (ROI): The solution reduced the input cost by 20%. The yield increased by 10% to 25% more.

Figure 24 demonstrate the analytics which were provided to the end customer as part of the solution.

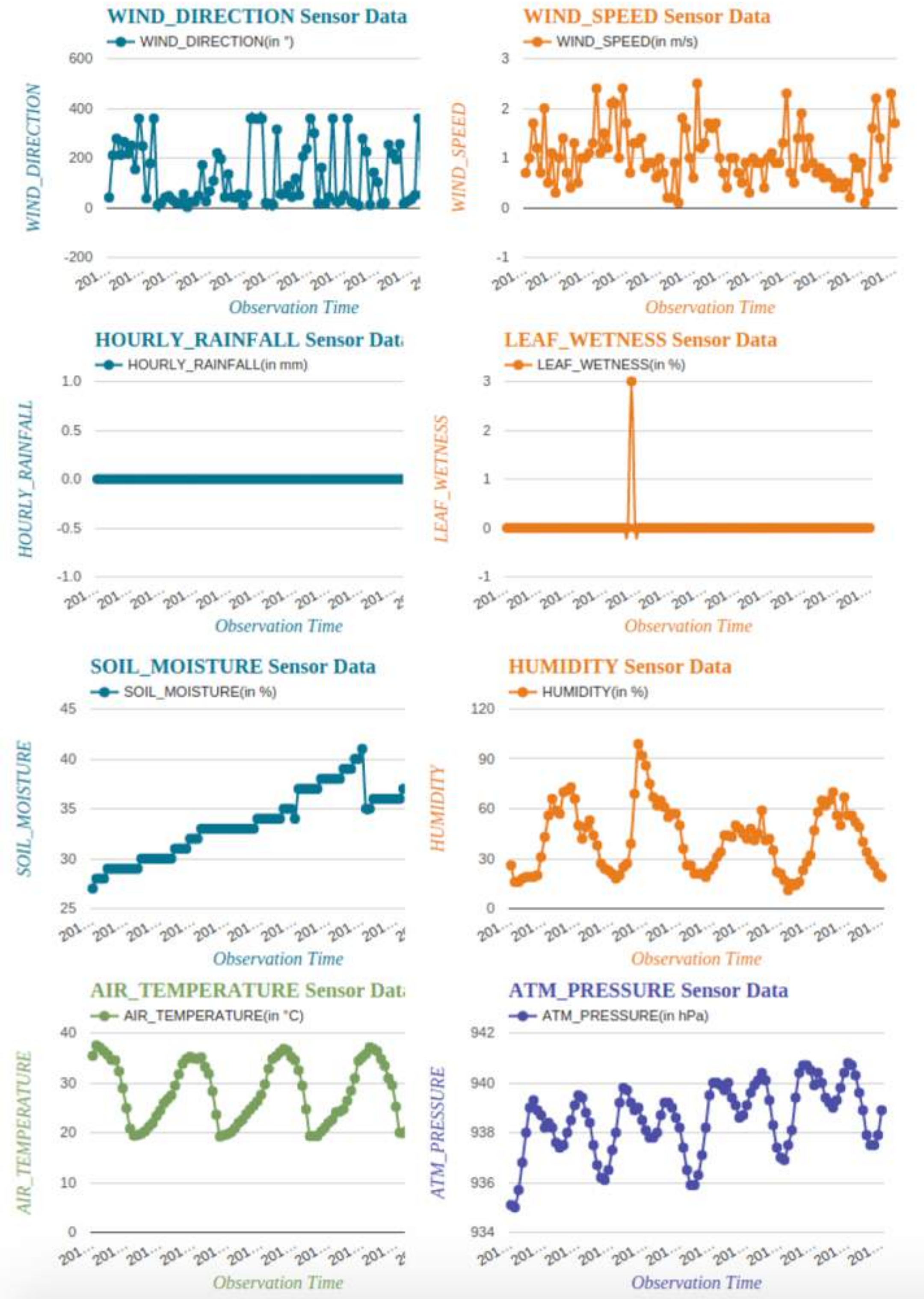


Figure 24: Web Console: Sensor Values in Charts

4.7 Smart Retail

India's retail industry has emerged as one of the fastest growing industries in the world. The IBEF stated that the retail market in India is projected to grow to $1.2 trillion USD in 2021. As seen in the manufacturing industry, GST and the relaxed foreign direct investment policy coupled with technology is helping push the Indian retail industry to the top.

Retailers are seriously looking at new technologies like IoT to help increase brand awareness, improve customer experiences, generate new revenue streams, and improve their operations. By connecting the retail products to the cloud, the way of doing business and shopping has evolved into a more convenient and efficient manner. From providing consumers the ability to purchase products virtually and find products in stores faster to enabling retailers to determine which products are more desirable to the consumer, smart retail has become the only way of doing business for the foreseeable future.

The following case study demonstrates how technology has successfully been deployed in India's retail industry and how it has created a competitor advantage for the retailer.

Case Study 15 (Axelta Systems Pvt Ltd, 2019): Retail Analytics - India's Largest Mattress Company

Location: PAN India

Requirements: Customer would like to get better insights about their franchisee's stores and operations, footfall of each store, and demographics to better assess their brand and promotional strategies are intact and working.

Challenges:

- Traditional footfall counters are not very effective as they are not able to distinguish between employees, service providers and actual customers. Typically, the ratio of actual customer footfalls and employee movement is 1:4 to 1:6. Rendering overall footfall counts of limited user
- Since the volume of stores was quite high and distributed across country with limited internet bandwidth available, the solution had to do most of the processing locally
- The system had to be plug and play so that CCTV installers could go and install it without hassles.
- Cost was a very important factor for the solution because of large volumes and business value generation

Solution:

- Deployment of a low cost plug and play Smart Camera with edge analytics and inbuilt internet connectivity that analyses the video locally, learns about employees and vendors and generates accurate footfall count as well as customer demographics was provided to the customer.
- The system uses, video analytics, facial recognition, machine learning and facial analysis for generating the output.
- Part of the computing is done locally in the camera and part of it is done on the cloud.
- The entire cloud based system has been deployed on the customers' cloud account.

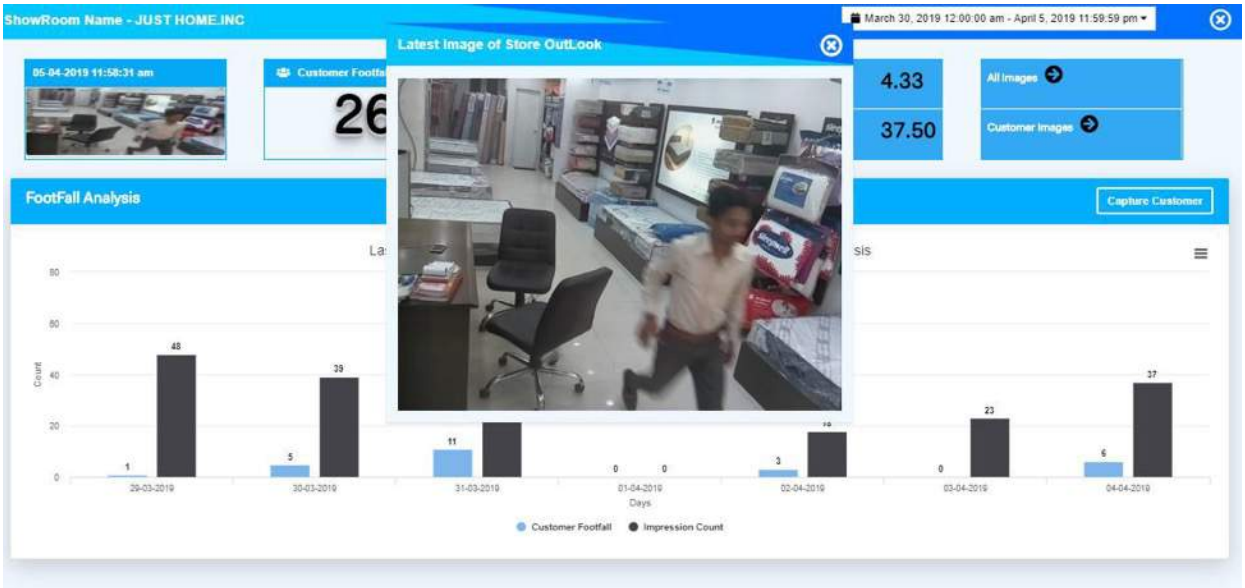


Figure 25: Retail Store Daily Analytical Insights

Return on Investment (ROI): Customer received an 8% uptick in customer loyalty. Customer has a 15% improvement in Promotion and Marketing Spends, Customer reduced the need to deploy sales staff by 50%

Contact Person: Mr. Manish Agarwal (email: manish@axelta.com)

4.8 Smart Homes

Smart Homes focuses on enabling home automation for consumers leveraging IoT, sensors, and other related services. Typically connected wirelessly to the internet, solutions are used to allow the ability to control and monitor the home's functions, infrastructure and overall health. Remote controlling devices and things in the home, such as lights, water heaters, appliances are an essential part of the smart home experience. In India, the Smart Home market is expected to show an annual growth rate of 43.6% over the next 4 years and is projected to reach a market volume of US$7,189m by 2023, per Statista market Forecast.

The below case studies demonstrate how companies presently have started to develop and productise and sell smart home solutions to consumers PAN India.

Case Study 16 (Hindware Sanitaryware India Ltd, 2019): Real RO Life Monitoring in a Water Purifier

Location: PAN India

Requirements: Consumers want to have real-time insight on their water purifier accuracy, functionality, and receive alerts when maintenance / servicing is required.

Challenges:

- Loss of service revenue for all branded players as counterfeit filters is available at much lesser price.
- Branded RO membranes are more durable and provide consistent water quality throughout the usage.
- It is very difficult for any branded player to display & justify this to customers.

Solution:

- Sensors have been placed to monitor purified water and inform when the RO membrane(s) need replacement.
- Sensor data will be used to display the right content to consumers thru mobile application
- Data will be used by to improve the performance of RO membrane for future product launches.

Return on Investment (ROI): Service revenue increases by almost 30%. Water wastages will be reduced by 25-30%.

Contact Person: Mr. Rupendra Singh (email: rupendra.singh@hindware.co.in)

Case Study 17 (Hindware Sanitaryware India Ltd, 2019): Power Saving in a Water Heater

Location: PAN India

Requirement: Consumer wants to save energy and reduce their electricity bills by having more insight on the power consumption and use of the water heaters in their homes.

Challenges:

- Water heaters consume power if simply connected to a power supply even if water is not being used.
- Consumer is not aware of the temperature of water and increases the settings to maximum levels unnecessarily.

Solution:

- Sensors are monitoring the heating cycle of the water heaters and adjust the power usage accordingly.
- Automatic shut off or standby features are added to schedule when the water heaters will be used or not.

Return on Investment (ROI): Around 15% of electricity units will be saved per smart water heater device.

Contact Person: Mr. Rupendra Singh (email: rupendra.singh@hindware.co.in)

5 Conclusion

In conclusion, many technological advancements have been made to date to provide businesses and city decisions makers with the right tools to properly plan, manage, maintain their businesses and cities. Customer satisfaction, operational efficiency, quality of life for citizens are some factors driving the digital transformation movement in India and as of today, India has demonstrated its ability to stay current with technology and to successfully execute smart solutions across the country. With improvements of processing power, cloud services, sensing, communication protocols, predictive analytics, and AI, the world is witnessing a new era of technological achievements. Businesses cannot deny the benefits technology adds to their day-to-day operations neither can they afford to sit back and be complacent. The shift from pilots and POCs to commercials is happening now and in the next 5 years, the deployment of commercial projects leveraging the IoT will exponentially increase. The Government of India has implemented programs to support the digital transformation and India is positioned well to become one of the top 5 global leaders in tech and innovation. What we are seeing in India can simply be stated as a technological phenomenon.

IET India

The IET is one of the world's largest engineering institutions with over 168,000 members in 150 countries. It is also the most multidisciplinary – to reflect the increasingly diverse nature of engineering in the 21st century.

The IET is working to engineer a better world by inspiring, informing and influencing our members, engineers and technicians. The Institution of Engineering and Technology – India, the IET office started operations in India in 2006, in Bangalore. Today, we have over 12,000 members and have the largest membership base for the IET outside of the UK. Given the increasing global importance of India as an engineering hub our aim is to make an impact that has relevance both locally and internationally. Our strategy is to make a meaningful impact on the overall competency and skill levels within the Indian engineering community and play an influencing role with the industry in relation to technology innovation and solving problems of public importance. We want to do this through working in partnership with industry, academia and government, focusing on the application of practical skills within both learning & career lifecycles, driving innovation and thought leadership through high impact sectors. Our volunteer led panels are means through which we deliver our strategy. The IET India IoT Panel was born out of this focus.

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The IET IoT panel

IET India launched its IoT panel on February 20, 2015 with Dr Rishi Bhatnagar (President – Aeris Communication) as the Chairperson. The panel, being a first of its kind in India, focuses not only on technology but the application aspect of IoT in various segments.

The focus of the panel is to facilitate discussions that will help in making the inevitable connected world more efficient, smart, innovative and safe. It will lay emphasis on technology, security and regulatory concerns and the need for nurturing capabilities and talent for quicker adoption of IoT in all spheres.

The IET India IoT Panel aims at providing a platform for stakeholders to become an authoritative, but neutral voice for the evolving movement of IoT in India. It aims to enable all the IoT practitioners (including people from the hardware – devices, portables, sensors, software, business) and IoT enablers (including people from regulatory area, training area, investors in IoT, end users) to work together on relevant areas to make this industry efficient as well as robust. The panel envisions laying a solid foundation by supporting policy makers, industry in the next step of adoption of IoT.

The panel works through 12 Working Groups - Healthcare, Social Impact, Digital Communications, Smart Cities, Skill Development, Standards, Regulatory and Legal, Cyber Security, Utilities, Manufacturing, Ganga Rejuvenation, BFSI and Agriculture.

If you are interested in volunteering for the IET or joining one of our panels, please write to us at india@theiet.in