

Domain Specific Iots

1. Home Automation

• **Smart lighting**

- Smart lighting for homes helps in saving energy by adapting the lighting to the ambient conditions and switching on/off or dimming the lights when needed.
- Smart lighting solutions for more home achieve energy savings by sensing the human movements and their environments and controlling the lights accordingly.

• **Smart Appliances**

- Smart Appliances make the management easier and also provide status info. to the users remotely.
- Example, Smart washer/dryer can be controlled remotely and notify when the washing / drying is complete.
- Smart Refrigerators can keep track of the items stored and send updates to the users when an item is low on stock.

• Intrusion Detection.

- Home intrusion detection systems uses security cameras and sensors to detect intrusion and raise alerts.
- Alerts can be in the form of an SMS or an email sent to the user.
- Advanced systems can even send detailed alerts such as an image grab or short video clip.

• Smoke / Gas detectors

- Smoke detectors are installed in homes and buildings to detect smoke that is typically an early sign of fire.
- It uses optical detection, ionization or air sampling techniques to detect smoke.
- Gas detectors can detect the presence of harmful gases such as CO, LPG etc.
- It can raise alerts in human voice describing where the problem is.

2. Cities

• Smart Parking

- It makes the search for parking space easier and convenient for drivers.

→ These are powered by IoT systems that detect the no. of empty parking slots and send the information over the internet to smart parking application back-ends.

• Smart lighting

- It allows lighting to be dynamically controlled remotely to configure lighting schedules and lighting intensity.
- Custom lighting configurations can be set for different situations such as a foggy day, a festival etc.
- Smart lights are equipped with sensors that can communicate with other lights and exchange information on the sensed ambient conditions to adapt the lighting.

• Smart Roads

- Smart roads can provide info on driving conditions, travel time estimates and alerts in case of poor driving conditions, traffic congestions and accidents.
- Such info can help in making the roads safer and help in reducing traffic jams.

• Structural Health Monitoring

- This system uses a network of sensors to monitor the vibration levels in the structures such as bridges and buildings.
- The data collected from these sensors is analyzed to assess the health of the structures (detecting cracks and mechanical breakdowns), remaining life of the structure).

• Surveillance:

- Surveillance of infrastructure, public transport and events in cities is required to ensure safety and security.
- City wide surveillance infrastructure comprising of large number of distributed and internet connected video surveillance cameras can be created.

• Emergency response.

- IoT systems can be used for monitoring the critical infrastructure in cities such as buildings, gas and water pipelines, public transport and power stations.
- Fire detection, gas and water leakage detection can help in generating alerts and minimizing their effects on the critical infrastructure.

- Such systems can reduce the latency of emergency services for vehicles such as ambulances and police cars while minimizing disruption of regular traffic.

3. Environment

- **Weather Monitoring**

- W.M systems can collect data from a number of sensor attached (such as temp., humidity, pressure etc.) and send the data to cloud-based applications and storage back-ends.
- The data collected in the cloud can then be analyzed and visualized by cloud based applications.
- Weather alerts can be sent to the subscribed users from such applications.

- **Air Pollution Monitoring**

- IoT based air pollution monitoring systems can monitor emission of harmful gases by factories and automobiles using gaseous and meteorological sensors.
- The collected data can be analyzed to make informed decisions on pollution control approaches.

• Noise Pollution Monitoring

- This system uses a no. of noise monitoring stations that are deployed at different places in a city.
- The data on noise levels from the stations is collected on servers or in the cloud.
- The collected data is then aggregated to generate noise maps.
- Noise maps can help the policy makers in Urban planning and making policies to control noise levels near residential areas, schools & parks.

• Forest fire detection.

- Early detection of forest fires can help in minimizing the damage caused by forest fires.
- IoT based forest fire detection systems use a no. of monitoring nodes deployed at different locations in a forest.
- Each monitoring node that collects measurements on ambient conditions including temp., humidity, light levels etc.

• River flood Detection.

- It can cause extensive damage to the natural and human resources and human life.
- IoT based river flood monitoring system use a

no. of sensor nodes that monitor the water level and flow rate.

- Monitoring applications raise alerts when rapid increase in water level & flow rate is detected.

4.

Energy

- **Smart Grids.**
- Smart Grid is a data communications network integrated with the electrical grid that collects and analyzes data captured in near real time about power transmission, distribution and consumption.
 - By using IoT based sensing and measurement technologies the health of equipment and the integrity of the grid can be evaluated.
 - Smart meters can capture almost real-time consumption, remotely control the consumption of electricity and remotely switch off supply when required.
- **Renewable Energy Systems.**
- Due to the variability in the O/P from renewable energy sources integrating them

into the grid can cause grid stability and reliability problems.

- Variable output produces local voltage swings that can impact power quality.
- When distributed renewable energy sources are integrated into the grid, they create bidirectional power flows for which the grids were not originally designed.
- IoT based systems at the point of interconnection measure the electrical variables and how much power is fed into grid.

• Prognostics

- Energy systems have a large no. of critical components that must function correctly so that the system perform their operation correctly.
- Energy systems have thousands of sensors that gather real-time maintenance data continuously for condition monitoring and failure prediction purposes.
- IoT based prognostic real-time health management systems can predict performance of machines or energy systems by analyzing the extent of deviation of a system from its normal operating profiles.

5. Retail

• Inventory Management.

- Overstocking of products can result in additional storage expenses, understocking can lead to loss of revenue.
- IoT systems using Radio Frequency Identification (RFID) tags can help in inventory management and maintaining the right inventory levels.

• Smart Payments.

- Smart payment solutions such as contactless payments powered by technologies such as Near field communication (NFC) and bluetooth.
- Customers can store the credit card information in their NFC-enabled smart phones and make payments by bringing the smart phones near the point of sales terminals.

• Smart Vending Machines.

- Smart vending machines connected to the Internet allow remote monitoring of

inventory levels, elastic price pricing of products, promotions, and contact-less payments using NFC.

6) Logistics:

• Route Generation and scheduling:

- Route generation and scheduling systems can generate end to end routes using combination of route patterns, and transportation modes and feasible schedules based on the availability of vehicles.
- As the transportation network grows in size and complexity, the no. of possible route combinations increases exponentially.
- IoT based systems backed by the cloud can provide fast response to the route generation queries and can be scaled up to serve a large transportation network.

• Fleet Tracking

- Vehicle fleet tracking systems use GPS technology to track the locations of the vehicles in real-time.
- Cloud based fleet tracking systems can be scaled up on demand to handle large no. of vehicles.

- Alerts can be generated in case of deviations in planned routes.

• Shipment Monitoring

- IoT based shipment monitoring systems use sensors such as temp., pressure, humidity, for instance to monitor the conditions inside the containers and send the data to the cloud, where it can be analyzed to detect food spoilage.

• Remote Vehicle Diagnostics.

- This system can detect faults in the vehicles or warn of impending faults.
- These diagnostic systems use on-board IoT devices for collecting data on vehicle operating status of various vehicle sub-systems.
- Such data can be captured by integrating on-board diagnostic systems with IoT devices using protocols such as CAN bus.

7) Agriculture.

• Smart Irrigation.

→ Smart irrigation systems use IoT devices with soil moisture sensors to determine the amount of moisture in the soil and release the flow of water through the irrigation pipes only when the moisture levels go below a predefined threshold.

- **Green house control**

- The climatological conditions inside a green house can be monitored and controlled to provide the best conditions for growth of plants
- The temperature, humidity, soil moisture, light and CO₂ levels are monitored using sensors and are controlled automatically using actuation devices.
- IoT systems play an important role in green house control and help in improving productivity.

8) Industry

- **Machine Diagnosis and Prognosis.**

- Machine Prognosis. - predicting the performance of a machine by analyzing the data on the current operating conditions.
- Machine Diagnosis - determining the cause of a machine fault.

- Sensors in machines can monitor the operating conditions such as temp. and vibration levels.
- IoT

• Indoor Air Quality Monitoring.

- Monitoring indoor air quality in factories is important for health and safety of the workers.
- IoT based gas monitoring systems can help in monitoring the indoor air quality using various gas sensors.
- Wireless sensor networks based IoT devices can identify the hazardous zones, so that corrective measures can be taken to ensure proper ventilation.

3) Health and Lifestyle.

• Health and fitness monitoring

- Wearable IoT devices that allow non-invasive and continuous monitoring of physiological parameters can help in continuous health and fitness monitoring.

→ These wearable devices may can be in various forms, such as belts and wrist bands.