**Unit-2**

**Domain specific applications of IoT:**

**DOMAIN SPECIFIC IoTs**

1) **Home Automation:**

**a) Smart Lighting:** helps in saving energy by adapting the lighting to the ambient conditions and switching on/off or diming the light when needed.

**b) Smart Appliances:** make the management easier and also provide status information to the users remotely.

**c) Intrusion Detection:** use security cameras and sensors (PIR sensors and door sensors) to detect intrusion and raise alerts. Alerts can be in the form of SMS or email sent to the user.

**d) Smoke/Gas Detectors:** Smoke detectors are installed in homes and buildings to detect smoke that is typically an early sign of fire. Alerts raised by smoke detectors can be in the form of signals to a fire alarm system. Gas detectors can detect the presence of harmful gases such as CO, LPG etc.,

**2) Cities:**

**a) Smart Parking:** make the search for parking space easier and convenient for drivers. Smart parking are powered by IoT systems that detect the no. of empty parking slots and send information over internet to smart application back ends.

**b) Smart Lighting:** for roads, parks and buildings can help in saving energy.

**c) Smart Roads:** Equipped with sensors can provide information on driving condition, travel time estimating and alert in case of poor driving conditions, traffic condition and accidents.

**d) Structural Health Monitoring:** uses a network of sensors to monitor the vibration levels in the structures such as bridges and buildings.

**e) Surveillance:** The video feeds from surveillance cameras can be aggregated in cloud based scalable storage solution.

**f) Emergency Response:** IoT systems for fire detection, gas and water leakage detection can help in generating alerts and minimizing their effects on the critical infrastructures.

**3) Environment:**

**a) Weather Monitoring:** Systems collect data from a no. of sensors attached and send the data to cloud based applications and storage back ends. The data collected in cloud can then be analyzed and visualized by cloud based applications.

**b) Air Pollution Monitoring:** System can monitor emission of harmful gases (CO2, CO, NO, NO2 etc.,) by factories and automobiles using gaseous and meteorological sensors. The collected data can be analysed to make informed decisions on pollutions control approaches.

**c) Noise Pollution Monitoring:** Due to growing urban development, noise levels in cities have increased and even become alarmingly high in some cities. IoT based noise pollution monitoring systems use a no. of noise monitoring systems that are deployed at different places in a city. The data on noise levels from the station is collected on servers or in the cloud. The collected data is then aggregated to generate noise maps.

**d) Forest Fire Detection:** Forest fire can cause damage to natural resources, property and human life. Early detection of forest fire can help in minimizing damage.

**e) River Flood Detection:** River floods can cause damage to natural and human resources and human life. Early warnings of floods can be given by monitoring the water level and flow rate. IoT based river flood monitoring system uses a no. of sensor nodes that monitor the water level and flow rate sensors.

**4) Energy:**

**a) Smart Grids:** is a data communication network integrated with the electrical grids that collects and analyze data captured in near-real-time about power transmission, distribution and consumption. Smart grid technology provides predictive information and recommendations to utilities, their suppliers, and their customers on how best to manage power. By using IoT based sensing and measurement technologies, the health of equipment and integrity of the grid can be evaluated.

**b) Renewable Energy Systems:** IoT based systems integrated with the transformers at the point of interconnection measure the electrical variables and how much power is fed into the grid. For wind energy systems, closed-loop controls can be used to regulate the voltage at point of interconnection which coordinate wind turbine outputs and provides power support.

**c) Prognostics:** In systems such as power grids, real-time information is collected using specialized electrical sensors called Phasor Measurment Units(PMUs) at the substations. The information received from PMUs must be monitored in real-time for estimating the state of the system and for predicting failures.

**5) Retail:**

**a) Inventory Management:** IoT systems enable remote monitoring of inventory using data collected by RFID readers.

**b) Smart Payments:** Solutions such as contact-less payments powered by technologies such as Near Field Communication(NFC) and Bluetooth.

**c) Smart Vending Machines:** Sensors in a smart vending machines monitors its operations and send the data to cloud which can be used for predictive maintenance.

**6) Logistics:**

**a) Route generation & scheduling:** IoT based system backed by cloud can provide first response to the route generation queries and can be scaled upto serve a large transportation network.

**b) Fleet Tracking:** Use GPS to track locations of vehicles in real-time.

**c) Shipment Monitoring:** IoT based shipment monitoring systems use sensors such as temp, humidity, to monitor the conditions and send data to cloud, where it can be analyzed to detect food spoilage.

**d) Remote Vehicle Diagnostics:** Systems use on-board IoT devices for collecting data on Vehicle operations(speed, RPM etc.,) and status of various vehicle subsystems.

**7) Agriculture:**

**a) Smart Irrigation:** to determine moisture amount in soil. This can improve crop yields while saving water. Smart irrigation system uses IOT devices with soil moisture sensors to determine the amount of moisture in soil and release the flow of water through irrigation pipes only when moisture levels go below the predefined threshold

**b) Green House Control:** to improve productivity. Green houses are structures with glass or plastic roofs that provide conductive environment for growth of plants. The climatological conditions inside a greenhouse can be monitored and controlled to provide the best conditions for the growth of plants.

**8) Industry:**

**a) Machine diagnosis and prognosis:** machine prognosis refers to predicting the performance of a machine by analysing the data on the current operating conditions and how deviations exits from the normal operating conditions. Machine diagnosis refers to determining the cause of a machine fault

**b) Indoor Air Quality Monitoring:** monitoring indoor air quality in factories is important for health and safety of the workers. Harmful and toxic gases such as carbon monoxide (CO), nitrogen monoxide (NO), nitrogen Dioxide (NO2), etc., can cause serious health problems.

**9) Health and LifeStyle:**

**a) Health & Fitness Monitoring:** wearable IOT devices that allow non-invasive and continuous monitoring of physiological wearable can help in continuous health and fitness monitoring. There wearable devices from a may can be in various forms such as belts and wrist-bands.

**b) Wearable Electronics:** wearable electronics such as wearable gadgets (smart watches, smart glasses, wristbands, etc.) and fashion electronics (with electronics integrated in clothing and accessories) provide various functions and features too assist us in our daily activities and making us lead healthy lifestyles.