SAP Leonardo IoT Ideation Challenge: Intelligent Parking Application

This **SAP Leonardo IoT** example is from the **Transportation category**. This example attempts to **solve parking problems** in bigger and congested cities using IoT and thus **makes our lives better**.

Have you ever been to Times Square in New York City driving your car and tried to find a parking spot? And in trying to do so have ended up parking way far from Times Square? Many of us face this situation in crowded cities. Wouldn't it be nice if you are intimated about a vacant parking spot at your desired location or about a soon to be vacant parking spot on your smart phone? This IoT example will be beneficial for Department of Transportation or municipalities of **smart cities** to **make parking easier** for their citizen, **reducing congestion** and at the same time **maximizing their earnings** from parking. Also a considerable amount of **fuel will be saved**, which is otherwise spent in finding a parking spot.

The components: High resolution cameras equipped with 3G/4G transmission technology, Gateways, Back-End system SAP Cloud Platform and SAP Leonardo Application built for Department of Transportation and Application for the parking users/customers.

The **sensors** to be used in this example are **high resolution cameras** which will be strategically placed over high rise street facing buildings so as the camera can capture a clear picture of both sides of the street. These cameras will be placed all over the city blocks. The **images** captured by the camera should be able to depict whether parking is occupied or vacant. These cameras take picture every minute so as to detect the parking availability (vacant or occupied). The picture taken by the camera is sent over **3G/4G internet connectivity** to the nearby gateway by the **IoT streaming service**. The **gateway** then transmits these images to the SAP Cloud Platform for the Department of Transportation. These images reach the **SAP Cloud Platform**, where they are scanned and analyzed by **SAP Leonardo AI/Machine Learning Algorithms** to determine vacant parking spots on the street. Every street in the city and all the parking spots on any particular street are already mapped and predefined in the **SAP Cloud Platform Application**.

Department of Transportation view: An application is developed in SAP Cloud Platform which analyzes these images and highlights vacant parking spots graphically on the city street map. The application also contains a **dashboard** which shows detailed city street parking map and displays number of vacant spots, occupied spots, streets blocked for construction/road work, upcoming special/sport events in the area to the Department of Transportation employees in **real time**. Each parking spot is mapped and given a **permanent parking spot number (Master Data)** based on the street block and street name/number so as to uniquely identify a parking spot. The parking charges associated with the parking spots depending upon the time/hour of the day, type of vehicle are also maintained. The dashboard shows **vital statistics**. Various processes are defined and set up such as booking of parking spot, allocation of parking spot based on the queue and proximity to the parking spot, payment for the parking spot, payment cancellation of the parking spot, extension of parking time, automatic charging for over parking. Customer parking history, payment history, any violations etc also can be maintained. Also certain fixed parking spots can be pre-booked few hours in advance by regular customers. Also private parking garages may **interface** with this app so as to let customers know about private parking

available besides street parking. The application can provide reports based on parking statistics and also **revenue generated** by locations. This will help the transportation department to analyze and charge appropriate parking fees, predict parking trends and **increase their revenue.**

Parking user view: An application **(SAP Fiori)** based is developed for customers/city residents which can be installed by them on their smart phone. The customers connect to the SAP cloud platform using their 3G/4G data service provided by their mobile phone carrier. The parking user is registered with a **unique identification number (Master Data)** and information about the customer such as complete name, mobile phone number (phone on which this app is installed), address, vehicle number, vehicle make/model, vehicle color is maintained by the customer in their user profile. Also payment information such as credit cards, debit cards, payment wallets are maintained, linked and authorized for this app. Geo location tracking is enabled for this app in the smart phone so that this app can use the actual location of the mobile phone as customer location to find nearby parking spots.

Intelligent Enterprise in Action:

The sensors which are high resolution cameras are intermittently capturing images (every minute) and sending to the SAP Cloud Back-End System using Gateways. The application maintains the list of current vacant parking spots available. A queue is created of customers looking for parking spots in a particular area based on their timestamp for parking spot request generated.

You are a customer of the Parking App and are driving in the city. If you are a regular user of the app then you can be allowed to book certain vacant parking spot at desired time within few hours (advance booking of parking with additional fees), which will be cancelled if you don't reach at the parking spot on the requested time.

If you are within the area and want to do street parking (without advance booking), you will be able to see the available parking spots nearby your current location in the app along with the parking charges per hour. The list may be sorted by spot distance or price. If you find a vacant parking spot nearby, you can book that spot from your app and reach that spot. You would have **booking preference** over other parking customer depending upon the proximity of the parking spot. Once at the parking spot, you will pay using the app for the parking spot for the desired number of hours. The app utilizes the payment information maintained by you and deducts the amount using the credit card/debit card information from your credit card/bank account. You are provided with an E-receipt instantly over the app for the payment done with specific details. Once at the end of the parking time, you will be sent a notification by Cloud Platform that you are approaching end of your parking time. You may extend your parking time and pay for the additional desired time. If you fail to pay for additional time and if new image capture of your spot determines your vehicle still parked at the location (by matching your make/model/color maintained in your profile to the vehicle on the spot), you will be charged extra for the additional parking time.

Once you vacate the parking spot, the spot is marked as vacant and released to open parking spot list for next customer allocation.