Phase 1: Problem Definition and Design Thinking

Overview:

As technology is growing all over the world, the need for technological advancements is also a advancing concern. With the successive trend of procuring a car in ever household, parking spaces in places like shopping complex, malls, company buildings etc need to be modernised and virtualised for smart thinking and to facilitate the consumer conveniences.

Problem Definition:

As vehicles and parking lots both increase in number; consumers experience hard time to find the perfect spot for their vehicles in commercial places as well as corporate sectors. Because of this, fuel is wasted in all the time taken in waiting and searching. At the same time, customer satisfaction is compromised, as they lose their patience and time over such a meagre issue.

Design Thinking:

The solution for this is Smart Parking System powered by Internet of Things (IoT) Technology and the smart use of sensors.

Project Objective:

- The idea is to create an application that can be accessed by the customers at the time of parking their vehicle in a shopping complex or mall.
- Each of the parking spaces would be monitored using sensors and the field outline of the parking space will be displayed in the app which will display the availability of the space. The users can be reserving their parking lots beforehand or at the time of their arrival to the place.
- The customers can check which space is engaged, vacant or reserved previously. Reserved parkers will be intimated about their reservation through mail.
- The application would ease the user by signalling them periodically whenever a parking space is occupied to avoid collision.
- In IoT, As the data collected from the continual services is essential for future use, the application would also store information about the past parking. This will be accessible by the creator of the application (Here, we the students)

IoT Sensor Designing:

- Sensor Selection: Selecting the right sensor for a smart parking system is crucial because it directly impacts the system's efficient functionality. We will opt for any one of these: Ultrasonic Sensors, Magnetic Sensors, Infrared Sensors, and Camera-based Sensors.
- Connectivity and Power Supply: We need to choose the appropriate communication protocol such as Wi-Fi, cellular, or LPWAN to transmit data from the sensors to a central server or cloud platform. We also need to consider power sources for the sensors. Options include batteries, solar panels, or wired connections.

- Data Processing: Efficient data processing is at the core of IoT smart parking systems, enabling them to convenience drivers, optimize parking space usage, and improve overall efficiency. We will use algorithms to process data from the sensors which includes recognizing when a parking space is occupied or vacant and updating the status.
- User Interface: Users can reserve or book parking spaces in advance through the interface, ensuring they have a guaranteed spot upon arrival.
- Cloud Integration: We can store and manage data in the cloud platforms like AWS, Google Cloud and Azure for scalability and accessibility.
- Maintenance: Most importantly, we should ensure the sensors are maintained and replace if necessary. Plan for scalability as the number of sensors and parking spaces may increase over time.

Programming with RaspberryPi:

- The selected sensors would be connected to the GPIO pins of RaspberryPi by the means of wiring and soldering the cables.
- Python will be used to write code to integrate the sensors and collect data. Libraries like RPi, GPIO and GPIO Control will be used.
- In real-time processing to update the application periodically about the availability of spaces, RaspberryPi would communicate with the central server or cloud platform.
- The server-side logic will also be set up so that the server will be able to process the requests from RaspberryPi and collection of data.

The main stakeholders also include the building owners as the application will implement and access the field outline, sensor, and parking information of their site only at their bidding.

With this implementation, the owners can ensure that customer satisfaction is up to the mark along with the efficiency of the parking spaces and safety to the customers' vehicles. The customers would also have a seamless parking experience, thereby, saving them time and money.