

## Project Design Phase-II Technology Stack (Architecture & Stack)

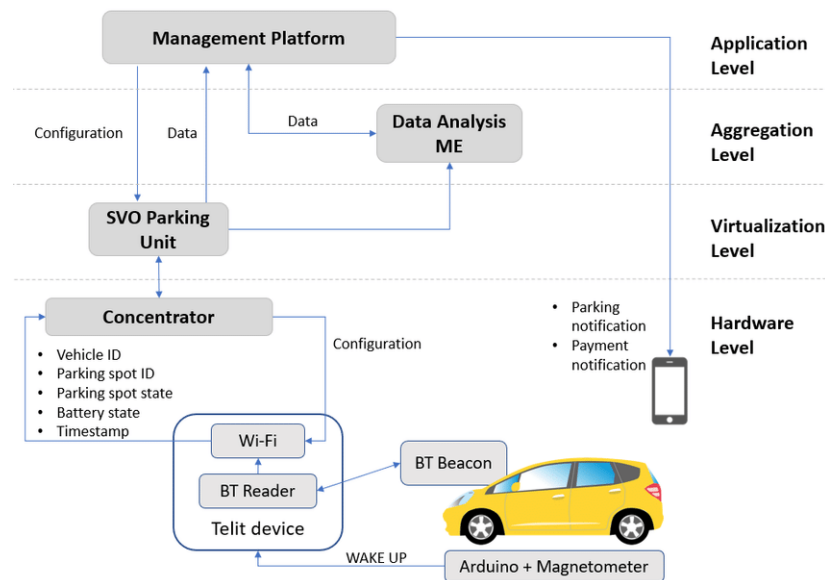
Date	09 May 2023
Team ID	NM2023TMID07918
Project Name	AI enabled car parking using open CV
Maximum Marks	4 Marks

### Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

### Example: Order processing during pandemics for offline mode

Reference: <https://www.figma.com/file/imvf0YWI8reEbaOsqOvsKX/solution-architecture?node-id=0%3A1&t=5eS2UBOAhu96fdl-1/>



### Guidelines:

1. Include all the processes (As an application logic / Technology Block)
2. Provide infrastructural demarcation (Local / Cloud)
3. Indicate external interfaces (third party API's etc.)
4. Indicate Data Storage components / services
5. Indicate interface to machine learning models (if applicable)

**Table-1 : Components & Technologies:**

S.No	Component	Description	Technology
1.	Camera setup	Install cameras in the parking lot to capture images of the cars entering and leaving parking space	OpenCV's VideoWriter, GigE Vision
2.	Collect training data	To train the model, you will need to collect a dataset of images of parking spots and whether they are occupied or empty. You can either capture the images manually or use an existing dataset	parking lot, ultrasonic sensors or magnetic sensors
3.	Train the model	Once you have the dataset, you can train a machine learning model using OpenCV's machine learning module. You can use different algorithms like SVM, Decision Trees, Random Forest, etc., to train your model.	TensorFlow and PyTorch
4.	Detect cars in the parking spot	After training the model, you can use it to detect the presence of a car in the parking spot. You can use OpenCV's object detection algorithms like Haar cascades or HOG to detect the car in the image.	(YOLO) algorithm , Haar cascade classifier
5.	Determine parking spot availability	Once you have detected the car in the image, you can determine whether the parking spot is occupied or empty. If the car is detected, the spot is occupied; otherwise, it's empty.	Machine learning algorithms
6.	Display parking information	You can display the parking information on a screen or a mobile app. You can also use OpenCV's GUI functions to display the parking spots and their availability in real-time.	Web portals , Digital displays
7.	Add additional features	You can add additional features like automatic number plate recognition (ANPR) to track the parked car's license plate, send alerts when a parking spot becomes available, or create a	LED lights, Signage

		reservation system to reserve a parking spot in advance.	
8.	Image processing	The first step in creating an AI-enabled car parking system is to preprocess the images of the parking lot to extract the features that are relevant park	color, texture, localizing objects
9.	Image acquisition	OpenCV provides a set of functions and classes for acquiring images from various sources, including cameras and video files. These functions can be used to capture images of the parking lot and the cars within it.	Ultrasonic sensors , Infrared sensors
10.	Object detection	OpenCV provides several object detection algorithms, including Haar cascades and HOG (Histogram of Oriented Gradients) detectors. These algorithms can be used to detect and localize objects within an image, such as cars within a parking lot.	Object Recognition Model, etc.
11.	User interface	OpenCV provides a set of graphical user interface (GUI) functions and classes that can be used to create custom user interfaces for car parking systems. These interfaces can display parking availability, location, and other relevant information to users.	Web or mobile application, LED displays, LCD displays

**Table-2: Application Characteristics:**

S.No	Characteristics	Description	Technology
1.	Real-time processing	The OpenCV library provides fast and efficient image processing functions, making it possible to detect and track vehicles in real-time. This is important for car parking systems, as it allows parking availability information to be updated in real-time.	Technology of detection
2.	Scalability	An AI-enabled car parking system using OpenCV can be easily scaled to accommodate a larger	e.g. Car leaves a space, the red box turns green.

S.No	Characteristics	Description	Technology
		number of parking spots. This is achieved by adding more cameras and processing power to the system.	
3.	Accuracy	OpenCV provides accurate object detection and tracking algorithms, making it possible to accurately detect and track vehicles within the parking lot. This is essential for providing accurate parking availability information to drivers.	Technology used
4.	Customizability	OpenCV provides a wide range of customizable image processing algorithms, allowing car parking systems to be tailored to specific requirements. For example, the system can be trained to detect and track specific types of vehicles, such as motorcycles or trucks.	Technology used
5.	Integration	OpenCV can be easily integrated with other technologies, such as IoT sensors or payment systems. This allows car parking systems to be seamlessly integrated with other systems and services.	Technology used

#### References:

<https://easychair.org/publications/preprint/hVnT>

<https://towardsdatascience.com/find-where-to-park-in-real-time-using-opencv-and-tensorflow-4307a4c3da03>

<https://medium.com/swlh/build-a-simple-smart-parking-project-using-python-and-opencv-2bd891d05199>

<https://www.pantechsolutions.net/car-parking-management-system-using-image-processing-open-cv-projects>

[https://www.researchgate.net/publication/325979046\\_OpenCV\\_and\\_Matlab\\_based\\_car\\_parking\\_system\\_module\\_for\\_smart\\_city\\_using\\_circle\\_hough\\_transform](https://www.researchgate.net/publication/325979046_OpenCV_and_Matlab_based_car_parking_system_module_for_smart_city_using_circle_hough_transform)