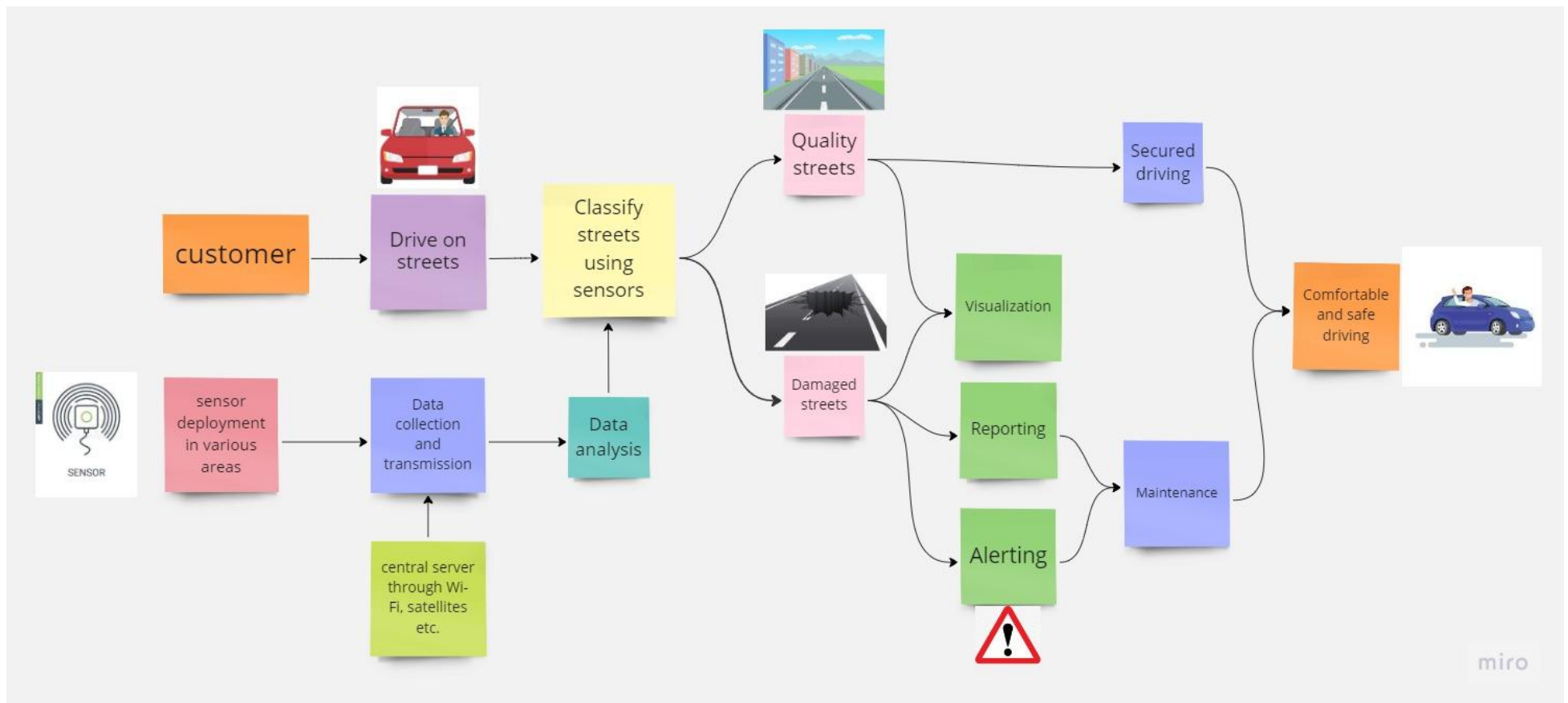


Project Design Phase-II Technology Stack (Architecture & Stack)

Date	12 May 2023
Team ID	NM2023TMID22230
Project Name	Project - SQUID: Street Quality Identification

Technical Architecture:



S.No	Component	Description	Technology
1.	IoT Sensors	Sensors installed on street pavements to collect data on various parameters such as vibration, temperature, humidity, and pressure.	Accelerometers, temperature sensors, humidity sensors, pressure sensors.
2.	IoT Gateway	A device that preprocesses the data from the sensors and transmits it to the cloud-based server. It can also perform data aggregation and filtering.	Raspberry Pi, Arduino, or other microcontroller boards with built-in wireless communication modules such as Wi-Fi, LoRa, or Bluetooth.
3.	Cloud-based Server	A cloud-based server to store and process the preprocessed data. The server can use a variety of technologies for data storage and processing such as databases and big data processing tools.	IBM Cloud, Amazon Web Services (AWS), Google Cloud Platform (GCP), Microsoft Azure, Apache Cassandra, Apache Hadoop, Apache Spark.
4.	Data Analytics	Machine learning algorithms to analyze the collected data and identify street quality parameters such as road roughness, potholes, and cracks.	Python libraries for machine learning such as scikit-learn, TensorFlow, Keras, and PyTorch.
5.	Data Visualization	Techniques to present the identified quality parameters in a visual format such as graphs, charts, or maps.	Web-based visualization tools such as D3.js, Plotly, or Tableau.
6.	Alert Generation	A system to generate alerts when identified quality parameters exceed a certain threshold. The alert can be sent via SMS, email, or push notification to the concerned authorities.	Python, AWS Simple Notification Service (SNS), AWS Simple Queue Service (SQS).
7.	Mobile Application	A mobile application for users to view street quality parameters and provide feedback on maintenance needs.	Android or iOS development frameworks such as Flutter, React Native, or Xamarin.
8.	System Integration	Integration with existing transportation management systems to streamline maintenance workflows and improve decision-making.	APIs, microservices architecture, event-driven architecture, message queuing.
9.	Security	Purpose of Machine Learning Model	Object Recognition Model, etc.
10.	Infrastructure	Infrastructure components such as load balancers, failover mechanisms, and cloud-based services to ensure high availability and minimize downtime.	Load balancers such as AWS Elastic Load Balancer, failover mechanisms such as AWS Route 53, and cloud-based services such as AWS Lambda.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Accelerometers, gyroscopes, sensors, cameras and other IoT devices are used.	TensorFlow, Keras, OpenCV, Scikit-learn, PyTorch, Apache Spark etc.
2.	Security Implementations	Authentication, Authorization, Data encryption, Use of firewalls, Intrusion prevention, Regular security audits, Secure data storage, Secure communication protocols and User activity logging	TLS/SSL, role-based access control (RBAC), Linux based IoT device, Snort,VLANs etc.
3.	Scalable Architecture	Both 3-tier and microservices architectures are designed to be highly scalable. In a 3-tier architecture, each tier can be scaled independently to handle the load.	A 3-tier architecture can be implemented using technologies such as Java, .NET, and Node.js, while a microservices architecture can be implemented using technologies such as Docker, Kubernetes, and Spring Boot.
4.	Availability	Load Balancers, Distributed Servers, Cloud Services, Replication, Monitoring and Alerting	HAProxy, Nginx, Apache Cassandra, Apache Kafka, IBM Cloud, Apache ZooKeeper, Apache Hadoop, PagerDuty, Slack etc.
5.	Performance	Number of requests per second, Use of Cache, Use of Content Delivery Networks (CDNs), Use of Asynchronous Processing, Use of Load Balancers, Use of In-Memory Databases	Docker, Kubernetes, Redis, Celery, HAProxy or Nginx, Memcached etc.