MASTER'S DEGREE IN COMPUTER ENGINEERING

INDUSTRIAL APPLICATIONS

PROJECT DISCUSSION

MoodPilot

IDEA
PRESENTATION

PROFESSORS

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CURRENT **CHALLENGES** IN RIDE-SHARING SERVICES

Subjective passenger ratings can be inconsistent or influenced by temporary emotions.

Existing two-way rating systems are limited in providing a comprehensive view of the actual driving quality.

Difficulty in obtaining real-time feedback about the passenger's experience during the ride.

IMPACT ON **STAKEHOLDERS**

PASSENGERS

Limited tools to express real-time concerns. Potential safety and comfort issues not fully addressed.

DRIVERS

Risk of unfair ratings affecting opportunities, lack of actionable feedback.

COMPANIES

Difficulty in ensuring consistent quality and reliability across drivers, reliance on subjective feedback.

SO, WHAT'S THE **PROBLEM**

How can we achieve a **more objective**, **real-time** assessment of driver performance that reflects both **safety and passenger comfort** ?

How can ride-sharing platforms move beyond basic ratings to gain insights that **improve service quality** ?

GOALS OF THE RESEARCH

1 Integrate new technologies like Facial Expression Recognition and telemetry for a data-driven, **unbiased evaluation system**.

2 Provide a holistic view of driver performance that includes **passenger comfort and safety metrics**.

FACIAL EXPRESSION RECOGNITION IN **AUTOMOTIVE** CONTEXTS

ENHANCEMENT OF PASSENGER SAFETY AND EXPERIENCE

STATE OF THE **ART**

[1] DRIVER EMOTION RECOGNITION FOR INTELLIGENT VEHICLES: A SURVEY (2020)

Provides a comprehensive literature survey of work addressing the problem of human emotion recognition in an automotive context.

[2] AUDIOVISUAL AFFECT RECOGNITION FOR AUTONOMOUS VEHICLES: APPLICATIONS, CHALLENGES, AND OPPORTUNITIES (2023)

Examines the use of audiovisual emotion recognition in autonomous vehicles, highlighting technical challenges and opportunities for improving human-machine interaction.

[3] REVIEW AND PERSPECTIVES ON HUMAN EMOTION FOR CONNECTED AUTOMATED VEHICLES (2023)

Discusses the importance of recognizing human emotions in connected automated vehicles, focusing on implications for passenger safety and experience.

TWO-WAY RATING SYSTEMS FOR DRIVER EVALUATION

EFFECTIVENESS IN ASSESSING DRIVER PERFORMANCE

STATE OF THE **ART**

[4] PLATFORM-MEDIATED REPUTATION SYSTEMS IN THE SHARING ECONOMY (2020)

Analyzes how platform-driven reputation systems impact service quality in ride-sharing, highlighting benefits and limitations in maintaining consistent quality.

[5] A SYSTEMATIC LITERATURE REVIEW OF RIDE-SHARING PLATFORMS, USER FACTORS, AND BARRIERS (2021)

Provides a systematic review of ride-sharing platforms, focusing on user adoption factors and barriers, including the effectiveness of rating systems.

[6] UNDERSTANDING RIDE-SHARING SYSTEMS IN URBAN AREAS: LOCATION, USERS, AND BARRIERS (2020)

Explores ride-sharing in urban areas, examining the role of location, user types, and system barriers with specific reference to two-way rating mechanisms.

GLOBAL MARKET ANALYSIS

UBER

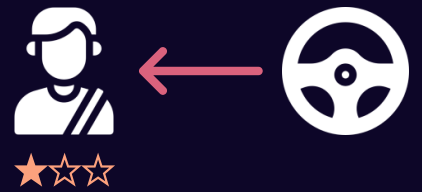
At the end of each ride, passengers rate drivers and vice versa.

Ratings are anonymous to ensure honest feedback.

POST-TRIP EVALUATION

DRIVER'S AVERAGE RATING

Calculated based on the last 500 ratings received. A high rating improves visibility for future trip requests, while a consistently low rating may lead to account deactivation.



PASSENGER'S AVERAGE RATING

Calculated using all the trips taken. Passengers with lower ratings may experience difficulty finding drivers.

DIDI CHUXING

TELEMETRIC MONITORING

Uses vehicle sensors to track driving behaviors, such as: sudden braking, sharp turns, accelerations. These metrics are analyzed alongside passenger ratings to provide a more objective evaluation of driver performance.

AI-DRIVEN SAFETY ALERTS

Machine Learning algorithms analyze telemetric data and provide real-time safety alerts to drivers, reducing risky behaviors and ensuring safer rides.

THE **IDEA**

MoodPilot

MoodPilot

FACIAL EXPRESSION RECOGNITION

INTEGRATION

During the ride, a camera monitors the passenger's facial expressions in real time.

FER algorithms analyze emotional states, such as:

- COMFORT: Smiles, neutral expressions.
- DISCOMFORT: Frowns, signs of stress or frustration.

AUTO-FILLED FEEDBACK FORMS

EMOTION-BASED

Based on detected emotions, the system auto-fills a feedback form. Captures key metrics such as comfort level, perceived safety, and overall satisfaction. Generates a final passenger rating by summarizing the feedback from the analyzed expressions.

THE AUTO-FILLED FEEDBACK FORM

COMFORT DURING THE RIDE

1 HOW WOULD YOU RATE YOUR LEVEL OF **COMFORT** THROUGHOUT THE RIDE?

→ 1: VERY UNCOMFORTABLE - 5: VERY COMFORTABLE

PERCEIVED SAFETY

2 HOW **SAFE** DID YOU FEEL DURING THE TRIP?

→ 1: VERY UNSAFE - 5: VERY SAFE

OVERALL EXPERIENCE

3 HOW WOULD YOU RATE YOUR **OVERALL** EXPERIENCE?

→ 1: VERY POOR - 5: EXCELLENT

SPECIFIC MOMENTS

4 WERE THERE ANY **SPECIFIC MOMENTS** DURING THE RIDE THAT CAUSED **DISCOMFORT** OR **CONCERN**?

- NONE
- A FEW MOMENTS (E.G., SUDDEN BRAKING OR HARSH TURNS)
- FREQUENT MOMENTS (PERSISTENT DISCOMFORT THROUGHOUT THE RIDE)

RATING

SOLUTIONS **COMPARISON**

	MoodPilot	DiDi	Uber
1. PASSENGER **COMFORT** ASSESSMENT			
2. **AUTOMATIC** EVALUATION			
3. **CONTINUOUS** DRIVER MONITORING			
4. **OBJECTIVE** FEEDBACK			
5. PASSENGER **STRESS** DETECTION			
6. **TWO-WAY** RATING SYSTEM			
7. **PRIVACY** AND **CONSENT**			

SYSTEM **SPECIFICATION**

PASSENGER

1. Create a personal account;
2. Log in to access personal features;
3. View automatic evaluations from previous trips;
4. Provide manual feedback for trips;
5. Access, modify, or request deletion of personal data (GDPR compliance);
6. Receive communications from the administrator (e.g., warnings or system updates);
7. Submit reports to the administrator regarding trip experiences or other issues.

DRIVER

1. Log in to access personal features;
2. View received evaluations;
3. Provide manual feedback for passengers;
4. Receive notifications about performance and suggestions for improvement;
5. Receive communications from the administrator;
6. Submit reports to the administrator regarding issues encountered during trips;
7. Update personal profile;

FUNCTIONAL REQUIREMENTS

TECHNICIAN

1. Log in to access system configuration features;
2. Configure the car controller system in vehicles, including hardware setup and calibration;
3. Verify communication between the car controller and the backend;
4. Perform system diagnostics and calibration tests;
5. Update firmware for the car controller;
6. Configure system-wide parameters;
7. Monitor the status of installed systems and report any hardware issues.

ADMINISTRATOR

1. Log in to access management features;
2. Monitor system operations through a dashboard;
3. Manage user requests for data access, modification, or deletion;
4. Analyze system performance and generate reports;
5. Communicate with drivers to address risky behaviors or provide feedback;
6. Communicate with passengers to address reported issues or behaviors;
7. Receive reports from drivers and passengers and address them appropriately;
8. Configure communication policies for the system.

FUNCTIONAL REQUIREMENTS

NON-FUNCTIONAL REQUIREMENTS and CONSTRAINTS

NF1. ACCURACY AND CONSISTENCY

- The model must achieve a minimum accuracy of 80% in emotion recognition on a diverse and balanced dataset.

NF2. SYSTEM USABILITY

- The user interface for passengers and drivers should require no more than 3 steps to complete evaluations or provide feedback.
- The system setup for new users or vehicles must be completed within 10 minutes.

NF3. SCALABILITY AND EXTENSIBILITY

- The architecture must support the addition of new models to detect facial expressions or customized forms without more than 1 hour of downtime during updates.

NF4. PRIVACY PROTECTION

- Sensitive data must not be stored for more than 30 days, unless explicitly authorized by users for specific purposes.

NON-FUNCTIONAL REQUIREMENTS and CONSTRAINTS

NF5. RESILIENCE AND SECURITY

- The system must ensure 99.9% uptime on a monthly basis, with scheduled downtime limited to a maximum of 4 hours per month.
- All communications between the frontend and backend must be encrypted using TLS 1.3 standards.

NF6. RESOURCE EFFICIENCY

- The system must consume a maximum of 120 Wh of energy per day on onboard devices, ensuring minimal impact on electric vehicle batteries.
- The model for facial expression recognition must operate within 2 GB of RAM on embedded vehicle systems.

NF7. BACKEND TECHNOLOGY

- The backend must be implemented in Python to ensure compatibility with the pre-developed models for facial expression recognition.
- It should be compatible with Python frameworks like Flask for high performance and easy extensibility.

DATABASE

BACK-END

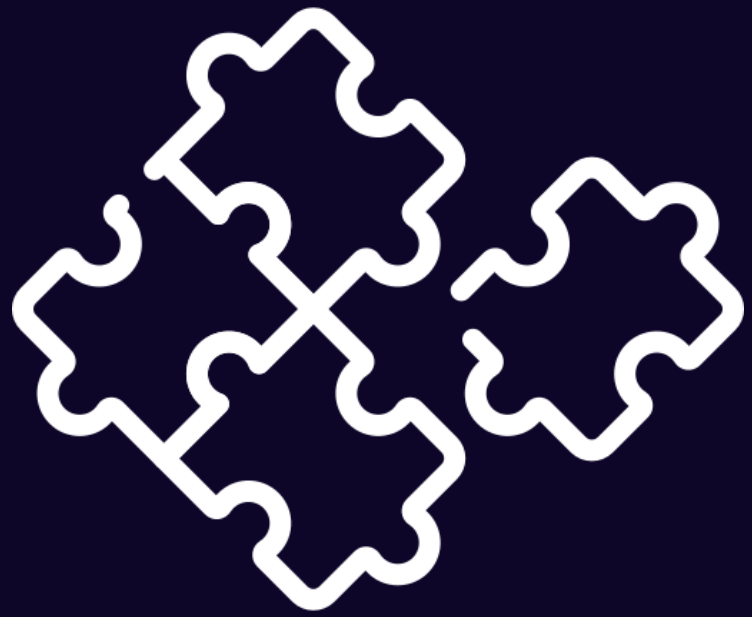
CAR CONTROLLER

MoodPilot

FRONT-END
MOBILE **APP**

SYSTEM **ARCHITECTURE**

WORK PACKAGES



1 WP

TITLE
DATABASE CONFIGURATION AND DESIGN (DB)

START MONTH 1

END MONTH 2

MOTIVATION

A well-designed database is essential for efficiently storing and managing data collected by the system, such as FER evaluations, manual feedback, and sensor data from vehicles. Its structure must ensure query speed, data integrity, and scalability to handle an increasing number of vehicles and users.

CLASSIFICATION

RESEARCH and INNOVATION

GOALS

1. Design a robust, normalized database schema optimized for primary queries.
2. Deploy the database on a local or cloud server.
3. Ensure data scalability and integrity.
4. Optimize queries for the backend system.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SENIOR DEVELOPER (DB)	2	2

1 WP

TITLE

DATABASE CONFIGURATION AND DESIGN (DB)

START MONTH 1

END MONTH 2

TASKS

1. Requirements Analysis:
   - Collect system-required data (FER, evaluations, feedback, sensor data).
   - Identify relationships between main entities.
2. Schema Design:
   - Define main tables (e.g., `Passengers`, `Drivers`, `Trips`, `Evaluations`).
   - Normalize the schema to eliminate redundancies and ensure consistency.
3. Database Implementation:
   - Create tables and define relationships (e.g., 1:N, N:N).
   - Configure indexes to optimize primary queries.
4. Query Optimization:
   - Develop queries for common operations (e.g., insert evaluations, calculate the average of the last 500 evaluations).
   - Optimize performance on simulated datasets.
5. Testing and Validation:
   - Verify referential integrity and query functionality.
   - Simulate increasing loads to assess scalability.

CLASSIFICATION

RESEARCH and INNOVATION

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SENIOR DEVELOPER (DB)	2	2

1 WP

TITLE

DATABASE CONFIGURATION AND DESIGN (DB)

START
MONTH 1

END
MONTH 2

DELIVERABLES

1. Database Schema: Documented ER diagram model.
2. Implemented Database: Fully operational database with all tables and defined relationships.
3. SQL Scripts: Scripts for table creation, constraints, and indexes.
4. Report: Documentation of primary queries and applied optimizations.

CLASSIFICATION

RESEARCH and INNOVATION

MILESTONES

1. ER diagram delivery (end of Month 1).
2. Database implementation and working SQL scripts (mid-Month 2).
3. Query validation and final report (end of Month 2).

DEPENDENCIES AMONG WPS

- WP2 (Backend): Required to test communication between the database and API endpoints. Database design must be completed before proceeding with the backend.
- WP5 (Integration): Database must be complete and functional before system integration.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SENIOR DEVELOPER (DB)	2	2

1 WP

TITLE
DATABASE CONFIGURATION AND DESIGN (DB)

START MONTH 1

END MONTH 2

REQUIRED TOOLS OR SOFTWARE

- Relational Database: MySQL or PostgreSQL (already available).
- Modeling Tools: DbSchema or MySQL Workbench (already available).
- SQL Language: For database implementation and optimization (no additional cost).
- Profiling Tools: EXPLAIN for query analysis (available in chosen DBMS).

CLASSIFICATION

RESEARCH and INNOVATION

REQUIRED ROLES

- Database Developer: Expert in relational database design and optimization (MySQL or PostgreSQL).

COST PER ROLE (CALCULATED BASED ON PERSON-MONTH)

- Database Developer: €5,000/month
- Project Manager: €6,000/month

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SENIOR DEVELOPER (DB)	2	2

→ **TOTAL COST** OF WP1

€13.000

2 WP

TITLE
BACKEND DEVELOPMENT

START
MONTH 2

END
MONTH 4

MOTIVATION

The backend is the core of the system, managing data flow between various components: database, car controller, and frontend. It must expose RESTful API endpoints, and ensure efficient management of evaluations and collected data, with a strong focus on security and scalability.

CLASSIFICATION

RESEARCH and INNOVATION

GOALS

1. Implement a robust and scalable backend in Python to manage data flow.
3. Expose RESTful API endpoints to communicate with the frontend and car controller.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 BACKEND DEVELOPERS	3	6

2 WP

TITLE
BACKEND DEVELOPMENT

START
MONTH 2

END
MONTH 4

TASKS

1. Development Environment Setup:
   - Configure the backend framework (e.g., Flask).
   - Structure the project.
2. RESTful API Implementation:
   - Create endpoints for communication with the car controller, frontend, and database (e.g., `/sendEvaluation`, `/getUserData`).
   - Validate and authenticate API requests.
3. Database Integration:
   - Connect to the database using an ORM (Object-Relational Mapping).
   - Develop backend queries to handle complex data operations (e.g., calculate the average of the last 500 evaluations).
4. Security and Privacy:
   - Implement security protocols (e.g., TLS 1.3 for communications).
   - Encrypt sensitive data.
   - Create data management policies compliant with GDPR.
6. Testing and Validation:
   - Test APIs (unit tests and integration tests).
   - Simulate workloads to ensure scalability.

CLASSIFICATION

RESEARCH and INNOVATION

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 BACKEND DEVELOPERS	3	6

2 WP

TITLE
BACKEND DEVELOPMENT

START
MONTH 2

END
MONTH 4

DELIVERABLES

1. Operational Backend: Complete source code with API.
2. Technical Documentation: Details on implementation, API endpoints, and usage instructions.
3. Data Management Logic: Functions implemented to interact with the database and car controller.
4. Test Report: Results of integration tests and load simulations.

CLASSIFICATION

RESEARCH and INNOVATION

MILESTONES

1. Delivery of basic working APIs (end of Month 2).
2. Completed database integration (end of Month 3).
3. Backend validation in a simulated environment (end of Month 4).

DEPENDENCIES AMONG WPS

- WP1 (Database): Database design must be completed to develop the backend.
- WP5 (Integration): The backend must be completed to integrate components.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 BACKEND DEVELOPERS	3	6

2 WP

TITLE
BACKEND DEVELOPMENT

START
MONTH 2

END
MONTH 4

REQUIRED TOOLS OR SOFTWARE

- Backend Framework: Flask or FastAPI (available).
- Security Libraries: PyJWT for authentication, OpenSSL for encryption.
- ORM: SQLAlchemy or equivalent for database interaction.
- Testing Tools: Postman for API testing, pytest for automated tests.

CLASSIFICATION

RESEARCH and INNOVATION

REQUIRED ROLES

- Backend Developer: Specialist in Python, experienced in RESTful API development.
- Data Engineer: To optimize data flow between the backend and database.

COST PER ROLE (CALCULATED BASED ON PERSON-MONTH)

- Backend Developer: €5,000/month
- Project Manager: €6,000/month

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 BACKEND DEVELOPERS	3	6

→ **TOTAL COST** OF WP2

€36.000

3 WP

TITLE
CAR CONTROLLER DEVELOPMENT

START
MONTH 3

END
MONTH 5

MOTIVATION

The car controller is responsible for running the FER model onboard the vehicle. It must collect sensor data, process facial expressions in real-time, and communicate results to the backend. Its design must ensure efficiency, reliability, and low power consumption, as it is a critical system component.

CLASSIFICATION

RESEARCH and INNOVATION

GOALS

1. Implement car controller software to run the FER model in real-time.
2. Establish secure communication between the controller and the backend.
3. Collect sensor data (e.g., speed, braking) and send it to the backend.
4. Optimize performance for vehicle-specific hardware.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 EMBEDDED DEVELOPERS	3	6

3
WP

TITLE

CAR CONTROLLER DEVELOPMENT

START
MONTH 3

END
MONTH 5

TASKS

1. Hardware Setup:
   - Configure the hardware environment (e.g., edge device, GPU, or TPU).
   - Install libraries required to run the FER model.
2. FER Model Deployment:
   - Adapt the FER model for embedded hardware.
   - Test model performance in simulated scenarios.
3. Sensor Data Collection:
   - Develop drivers or scripts to read data from the vehicle (e.g., CAN bus).
   - Validate collected data and convert it into usable formats.
4. Backend Communication:
   - Configure secure communication via RESTful APIs or WebSocket.
   - Implement a protocol to transmit FER results and sensor data to the backend.
5. Optimization and Testing:
   - Optimize performance to ensure low latency (<500 ms).
   - Test in real environments and simulate workloads.

CLASSIFICATION

RESEARCH and INNOVATION

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 EMBEDDED DEVELOPERS	3	6

3 WP

TITLE
CAR CONTROLLER DEVELOPMENT

START
MONTH 3

END
MONTH 5

DELIVERABLES

1. Car Controller Software: Complete code to run the FER model, collect data, and communicate with the backend.
2. Technical Report: Implementation details, hardware configuration, and applied optimizations.
3. Test Logs: Results from tests conducted in simulations and real scenarios.

CLASSIFICATION

RESEARCH and INNOVATION

MILESTONES

1. Completed hardware setup (end of Month 3).
2. FER model deployment finalized (mid-Month 4).
3. Backend communication functioning (end of Month 4).
4. Validation in real environments (end of Month 5).

DEPENDENCIES AMONG WPS

- WP2 (Backend): APIs must be completed to enable communication with the car controller.
- WP5 (Integration): The car controller must be developed and operational for system integration.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 EMBEDDED DEVELOPERS	3	6

3 WP

TITLE
CAR CONTROLLER DEVELOPMENT

START
MONTH 3

END
MONTH 5

REQUIRED TOOLS OR SOFTWARE

- AI Framework: TensorFlow Lite or PyTorch for running the FER model (available).
- Communication Libraries: Requests or aiohttp for RESTful API.
- Car Controller Hardware: Edge device with GPU support (e.g., NVIDIA Jetson Nano, Coral TPU).
- Simulation Tools: CAN simulators for testing sensor data collection.

CLASSIFICATION

RESEARCH and INNOVATION

REQUIRED ROLES

- Embedded Developer: Specialist in edge devices with expertise in AI and hardware optimization.

COST PER ROLE (CALCULATED BASED ON PERSON-MONTH)

- Project Manager: €6,000/month
- Embedded Developer: €5,500/month

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	1	1
2 EMBEDDED DEVELOPERS	3	6

→ **TOTAL COST** OF WP3

€39.000

4
WP

TITLE
FRONTEND DEVELOPMENT (MOBILE APP)

START
MONTH 5

END
MONTH 6

MOTIVATION

The mobile app is the main touchpoint between users (passengers and drivers) and the system. It must provide an intuitive and user-friendly interface to view evaluations, complete forms, manage personal data, and interact with the backend. Effective design is essential for an excellent user experience.

CLASSIFICATION

RESEARCH and INNOVATION

GOALS

1. Create an intuitive user interface for passengers and drivers.
2. Implement features for viewing and modifying evaluations and forms.
3. Ensure a smooth user experience and compatibility with Android and iOS devices.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
2 FRONTEND DEVELOPERS	2	4

4 WP

TITLE
FRONTEND DEVELOPMENT (MOBILE APP)

START MONTH 5

END MONTH 6

TASKS

1. UI/UX Design:
   - Create wireframes and mockups for key app sections (e.g., evaluation screens, user profiles).
   - Validate design with a sample of users.
2. Implementation of Core Features:
   - Integrate with the backend via RESTful APIs.
   - Develop screens for viewing and modifying forms completed by FER.
   - Create sections for providing manual evaluations (passengers) and viewing evaluations (drivers).
3. Personal Data Management:
   - Design a screen for user profile management, allowing data updates and visualization.
   - Implement GDPR-compliant policies (e.g., data deletion requests).
4. App Testing:
   - Test the app on Android and iOS devices to ensure compatibility and performance.
   - Identify and fix bugs.
5. Final Optimization:
   - Improve performance (e.g., loading times).
   - Apply feedback from user tests.

CLASSIFICATION

RESEARCH and INNOVATION

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
2 FRONTEND DEVELOPERS	2	4

4 WP

TITLE
FRONTEND DEVELOPMENT (MOBILE APP)

START
MONTH 5

END
MONTH 6

DELIVERABLES

1. Functional Mobile App: Fully operational for Android and iOS devices.
2. Technical Documentation: Details on implementation, APIs used, and deployment instructions.
3. Test Report: Results from tests on real devices.

CLASSIFICATION

RESEARCH and INNOVATION

MILESTONES

1. Delivery of finalized wireframes and mockups (end of Month 4).
2. Core features implemented (end of Month 5).
3. Complete testing and delivery of the final app version (end of Month 6).

DEPENDENCIES AMONG WPS

- WP2 (Backend): Required to implement and test backend communication.
- WP5 (Integration): Frontend must be completed and tested for system integration.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
2 FRONTEND DEVELOPERS	2	4

4 WP

TITLE
FRONTEND DEVELOPMENT (MOBILE APP)

START MONTH 5

END MONTH 6

REQUIRED TOOLS OR SOFTWARE

- Development Framework: Flutter or React Native (available).
- Design Tools: Figma or Adobe XD for UI/UX design.
- Communication Libraries: Axios or HTTP for API integration.
- Testing Tools: BrowserStack or real devices for cross-platform testing.

CLASSIFICATION

RESEARCH and INNOVATION

REQUIRED ROLES

- Frontend Developer: Specialist in mobile development, proficient in Flutter/React Native.

COST PER ROLE (CALCULATED BASED ON PERSON-MONTH)

- Project Manager: €6,000/month
- Frontend Developer: €4,000/month

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
2 FRONTEND DEVELOPERS	2	4

→ **TOTAL COST** OF WP4

€11.000

5 WP

TITLE
SYSTEM INTEGRATION

START
MONTH 7

END
MONTH 8

MOTIVATION

System integration ensures all components (DB, backend, car controller, and mobile app) communicate effectively. This WP focuses on making the system function cohesively and ensuring data flows seamlessly across components.

CLASSIFICATION

SUPPORT and SERVICES

GOALS

1. Ensure smooth communication between system components.
2. Validate data flow in real and simulated scenarios.
3. Identify and resolve interoperability issues.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SYSTEM INTEGRATOR	2	2

5 WP

TITLE

SYSTEM INTEGRATION

START MONTH 7

END MONTH 8

TASKS

1. Preparation for Integration:
   - Review interfaces and APIs exposed by the backend and mobile app.
   - Configure a test environment for integration.
2. Backend-Database Integration:
   - Validate query handling and data storage.
   - Test primary operations (e.g., read/write evaluation data).
3. Backend-Car Controller Integration:
   - Validate secure transmission of sensor data from the car controller to the backend.
   - Test communication latency.
4. Backend-Frontend Integration:
   - Verify functionality of RESTful APIs for the frontend.
   - Test core features (e.g., retrieving forms, submitting evaluations).
5. Bug Fixing and Optimization:
   - Resolve bugs identified during tests.
   - Optimize data flow to reduce latency and improve performance.

CLASSIFICATION

SUPPORT and SERVICES

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SYSTEM INTEGRATOR	2	2

5 WP

TITLE
SYSTEM INTEGRATION

START
MONTH 7

END
MONTH 8

DELIVERABLES

1. Integrated System: All components functioning cohesively.
2. Technical Report: Details on integration, tests performed and resolved issues.
3. End-to-End Test Logs: Results from real-world simulations and tests.

CLASSIFICATION

SUPPORT and SERVICES

MILESTONES

1. Backend-database integration completed (end of Week 2, Month 7).
2. Backend-car controller integration completed (end of Month 7).
3. Backend-frontend integration completed (mid-Month 8).
4. End-to-end testing completed (end of Month 8).

DEPENDENCIES AMONG WPS

- WP1 (Database): Database must be complete and functional for backend integration.
- WP2 (Backend): Backend must be operational to integrate with other components.
- WP3 (Car Controller): Car controller must be ready to transmit data to the backend.
- WP4 (Frontend): Mobile app must be completed to test frontend-backend communication.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SYSTEM INTEGRATOR	2	2

5 WP

TITLE
SYSTEM INTEGRATION

START
MONTH 7

END
MONTH 8

REQUIRED TOOLS OR SOFTWARE

- Monitoring Tools: Postman for API testing, Grafana for monitoring data flow.
- Integration Environment: Local or cloud server with dedicated configuration.
- Simulators and Real Tests: CAN simulators for car controller data and real mobile devices for frontend tests.

CLASSIFICATION

SUPPORT and SERVICES

REQUIRED ROLES

- System Integrator: Specialist in complex system integration, with backend, API, and infrastructure expertise.

COST PER ROLE (CALCULATED BASED ON PERSON-MONTH)

- System Integrator: €6,000/month
- Project Manager: €6,000/month

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SYSTEM INTEGRATOR	2	2

→ **TOTAL COST** OF WP5
€15.000

6 WP

TITLE
SECURITY AND PRIVACY

START MONTH 6

END MONTH 7

MOTIVATION

Protecting sensitive data collected by the system is essential to comply with GDPR and ensure user information security. This WP focuses on implementing advanced security protocols, data encryption, and GDPR-compliant policies.

CLASSIFICATION

SUPPORT and SERVICES

GOALS

1. Ensure secure communication between system components.
2. Protect sensitive data through encryption and controlled access.
3. Ensure compliance with GDPR and other applicable regulations.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SECURITY EXPERT	2	2

6
WP

TITLE

SECURITY AND PRIVACY

START
MONTH 6

END
MONTH 7

TASKS

1. Data Encryption:
   - Implement AES-256 encryption for data stored in the database.
   - Configure TLS 1.3 for communications between car controller, backend, and frontend.
2. Credential Management and Authentication:
   - Develop a token-based authentication system (e.g., JWT) for RESTful APIs.
   - Create mechanisms for secure credential management (e.g., bcrypt hashing).
3. GDPR Compliance and Privacy Policies:
   - Create tools for users to view, modify, and delete their data.
   - Implement anonymization logic for historical data.
4. Monitoring and Audit:
   - Configure monitoring tools to detect suspicious activities.
   - Conduct system audits to verify compliance with security and privacy policies.
5. Testing and Validation:
   - Conduct vulnerability tests on APIs and stored data.
   - Simulate common attacks (e.g., SQL injection, man-in-the-middle) to ensure system robustness.

CLASSIFICATION

SUPPORT and SERVICES

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SECURITY EXPERT	2	2

6 WP

TITLE
SECURITY AND PRIVACY

START MONTH 6

END MONTH 7

DELIVERABLES

1. Security and Privacy Policies: Detailed document of implemented measures and procedures for handling sensitive data.
2. Secure System: All communications and data protected by encryption and controlled access.
3. Audit Report: GDPR compliance and system security assessment.
4. Test Logs: Results of vulnerability and security tests.

CLASSIFICATION

SUPPORT and SERVICES

MILESTONES

1. Completed encryption of stored data and communications (end of Month 6).
2. Implemented authentication and credential management system (mid-Month 7).
3. Completed system audits and security testing (end of Month 7).

DEPENDENCIES AMONG WPS

- WP1 (Database): Database must be complete for stored data encryption.
- WP2 (Backend): Necessary for implementing authentication and API security mechanisms.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SECURITY EXPERT	2	2

6 WP

TITLE

SECURITY AND PRIVACY

START MONTH 6

END MONTH 7

REQUIRED TOOLS OR SOFTWARE

- Encryption Tools: OpenSSL for TLS, PyCryptodome for AES.
- Authentication Framework: PyJWT for token management.
- Audit Tools: OWASP ZAP or Burp Suite for security testing.
- Monitoring: Grafana or equivalent for activity detection.

CLASSIFICATION

SUPPORT and SERVICES

REQUIRED ROLES

- Security Engineer: Expert in cybersecurity and GDPR compliance.

COST PER ROLE (CALCULATED BASED ON PERSON-MONTH)

- Security Engineer: €5,500/month
- Project Manager: €6,000/month

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	0.5	0.5
1 SECURITY EXPERT	2	2

→ **TOTAL COST** OF WP6

€14.000

7 WP

TITLE
SYSTEM TESTING AND ACCEPTANCE

START
MONTH 1

END
MONTH 9

MOTIVATION

Testing and validation are essential to ensure the system meets functional and non-functional requirements. This WP focuses on unit, integration, and end-to-end testing, ensuring the system operates correctly in real scenarios and is robust, reliable, and secure.

CLASSIFICATION

SUPPORT and SERVICES

GOALS

1. Validate that all components meet functional and non-functional requirements.
2. Identify and resolve bugs or issues across system components.
3. Ensure the system integrates all components correctly.
4. Test system robustness under load and stress conditions.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	2	2
2 QA ENGINEERS	4	8

7 WP

TITLE

SYSTEM TESTING AND ACCEPTANCE

START MONTH 1

END MONTH 9

TASKS

1. Unit Testing:
   - Create and execute unit tests for each component (DB, backend, frontend, car controller).
   - Verify code coverage (at least 80%).
2. Integration Testing:
   - Test interactions between the backend and database.
   - Verify communication between the car controller and backend.
   - Validate frontend-backend interaction through APIs.
3. End-to-End Testing:
   - Simulate complete scenarios, such as a trip with FER data collection, processing, and feedback.
   - Verify complete data flow and integrity.
4. Performance Testing:
   - Simulate high loads to test system scalability.
   - Measure API response times (<200 ms under normal load).
5. Security Testing:
   - Verify implemented security measures (e.g., encryption, authentication).
   - Simulate common attacks (SQL injection, brute force, man-in-the-middle).
6. Issue Resolution:
   - Analyze test results to identify bugs or bottlenecks.
   - Resolve issues and retest to confirm fixes.

CLASSIFICATION

SUPPORT and SERVICES

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	2	2
2 QA ENGINEERS	4	8

7 WP

TITLE
SYSTEM TESTING AND ACCEPTANCE

START
MONTH 1

END
MONTH 9

DELIVERABLES

1. Testing Report: Detailed documentation of tests, results, and resolved issues.
2. Validated System: Confirmation that the system meets functional and non-functional requirements.
3. Test Logs: Detailed records of all tests, including load and vulnerability tests.

CLASSIFICATION

SUPPORT and SERVICES

MILESTONES

1. Complete design of test cases for all components (end of Month 1).
2. Completed unit testing for backend and car controller components (end of Month 6).
3. Completed end-to-end and security testing (end of Month 8).
4. Completed integration testing (mid-Month 9).

DEPENDENCIES AMONG WPS

- WP1 (Database): Required for integration tests with the backend.
- WP2 (Backend): Must be ready to verify APIs and data handling logic.
- WP3 (Car Controller): Must be operational to validate FER data transmission.
- WP4 (Frontend): Mobile app must be completed for end-to-end testing.
- WP5 (Integration): Entire system must be integrated for final testing.
- WP6 (Security and Privacy): Security measures must be implemented for vulnerability testing.

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	2	2
2 QA ENGINEERS	4	8

7 WP

TITLE
SYSTEM TESTING AND ACCEPTANCE

START
MONTH 1

END
MONTH 9

REQUIRED TOOLS OR SOFTWARE

- Unit Testing Tools: pytest for backend, Jest for frontend.
- Simulation Tools: Apache JMeter for load and stress testing.
- Security Tools: OWASP ZAP or Burp Suite for vulnerability testing.
- Testing Environment: Dedicated servers or virtual environments for end-to-end tests.

CLASSIFICATION

SUPPORT and SERVICES

REQUIRED ROLES

- Quality Assurance Engineer: Expert in manual and automated testing, familiar with advanced testing tools.
- System Engineer: To support load, stress, and complex integration tests.

COST PER ROLE (CALCULATED BASED ON PERSON-MONTH)

- Quality Assurance Engineer: €5,000/month
- System Engineer: €5,000/month
- Project Manager: €6,000/month

PERSON	MONTHS	PERSON/ MONTHS
1 PROJECT MANAGER	2	2
2 QA ENGINEERS	4	8

→ **TOTAL COST** OF WP7

€52.000

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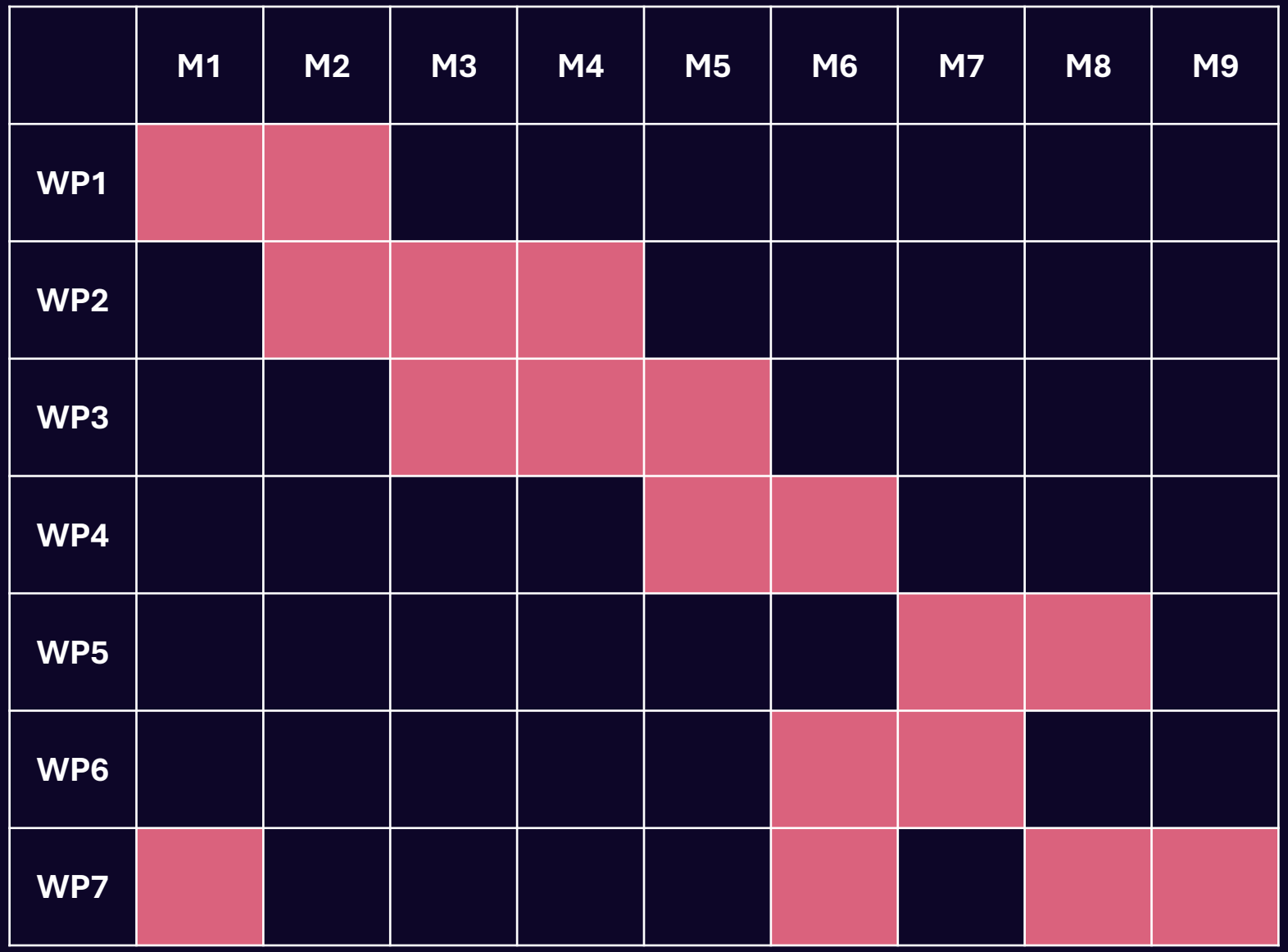
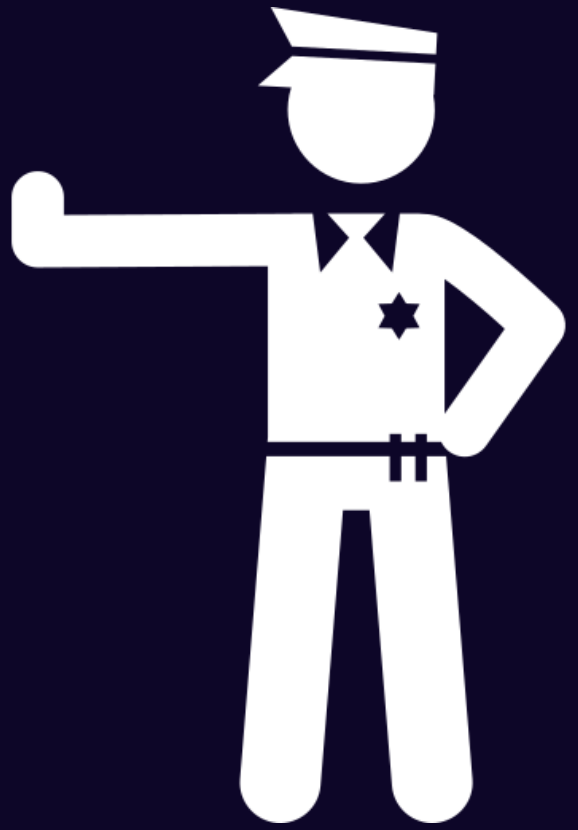




WAIT, WAIT!

WHAT ARE THE POSSIBLE RISKS?

RISK #1

RISK

GDPR COMPLIANCE CHALLENGES

Changes to GDPR or privacy regulations during the project lifecycle could result in non-compliance, leading to fines, legal issues, and loss of user trust. Adapting the system to meet new regulatory requirements may incur additional costs.

STRATEGY

1. **Audit and Monitoring Processes** (€9,000 for the first 3 years): Perform regular audits to proactively identify potential areas of non-compliance in light of evolving regulations.
2. **Regulatory Update Analysis** (€2,000/year): Allocate resources for ongoing monitoring of regulatory changes and their implications for the system.
3. **Contingency Fund** (€5,000/year): Set aside a contingency fund to cover potential system modifications or legal consultations required to address regulatory changes.

COST

- Audit and Monitoring Processes (initial 3 years): €9,000
- Regulatory Update Analysis : €2,000/year
- Contingency Fund: €5,000/year

→ **TOTAL COSTS** (for the initial 3 years)**: €30,000**

RISK

DEPENDENCY ON THIRD-PARTY DASHCAM PROVIDERS

The project heavily relies on dashcam providers for data collection. Any change in their service terms, availability, or performance could disrupt operations and data reliability.

STRATEGY

1. **Backup Plan with Alternative Providers** (€15,000): Identifying and onboarding at least one alternative dashcam provider to ensure uninterrupted data collection. This cost covers initial research, provider evaluation, and integration.
2. **Developing In-House Solution Feasibility Study** (€8,000): Conduct a study to explore the costs and benefits of creating a proprietary dashcam solution.
3. **Legal and Contractual Agreements** (€5,000): Engage legal consultants to establish robust contracts ensuring service reliability with the primary provider.

COST

- Backup plan: €15,000
- Feasibility study: €8,000
- Legal agreements: €5,000

→ **TOTAL COSTS: €28,000**

RISK #3

RISK

RAPID EVOLUTION OF FER MODELS AND AI TECHNOLOGY

Newer FER models or AI technologies could outperform the current model, making it less effective or competitive.

STRATEGY

1. **Periodic AI Advancement Reviews** (€5,000/year): Allocate resources for annual evaluations of the latest FER models, ensuring the system remains competitive.
2. **Modular Architecture for Model Updates** (€12,000): Design a flexible backend structure that allows easy integration of new AI models without significant redevelopment.
3. **Evaluation Framework for New Models** (€10,000): Build a standardized framework to test and validate emerging FER models before integration.

COST

- AI reviews (initial 3 years): €15,000
- Modular system design : €12,000
- Evaluation framework : €10,000

→ **TOTAL COSTS** (for the initial 3 years)**: €37,000**

ROLES & RESPONSIBILITIES

PROJECT **MANAGER**

BUDGET

€6.000/MONTH

KEY RESPONSIBILITIES

- Oversee the overall project timeline and budget, ensuring milestones are met across all work packages (WP1–WP7).
- Coordinate communication between team members and stakeholders.
- Monitor risks and identify mitigation strategies.
- Ensure deliverables align with project objectives and client expectations.
- Review progress reports and make adjustments to workflows when necessary.

REQUIRED TECHNICAL SKILLS

- Strong understanding of software development lifecycle (SDLC).
- Experience in managing complex, multi-disciplinary IT projects.
- Familiarity with project management tools (e.g., Jira, Trello, MS Project).
- Knowledge of relational database design, API integrations, and AI technologies (a plus).

SOFT SKILLS

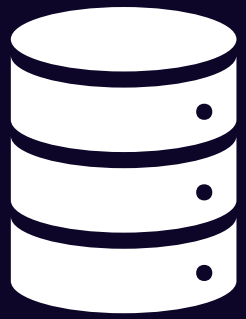
- Strong leadership and communication skills.
- Exceptional organizational skills and attention to detail.
- Ability to manage stress and ensure team motivation.

EXPERIENCE REQUIRED

- 5+ years as a project manager in IT or related fields.
- Proven track record of successfully delivering projects on time and within budget.

EDUCATION

- Master’s degree in Computer Engineering, Business Management, or related fields.



DATABASE DEVELOPER

BUDGET

€5.000/MONTH

KEY RESPONSIBILITIES

- Design and implement a robust and normalized database schema as defined in WP1.
- Create and optimize SQL queries for efficient backend integration and reporting (WP2, WP5).
- Configure indexes and ensure data integrity and scalability.
- Perform load testing and optimize query performance based on simulated datasets.

REQUIRED TECHNICAL SKILLS

- Expertise in relational database design (MySQL, PostgreSQL).
- Proficiency in SQL and query optimization.
- Experience with ER diagram modeling tools (e.g., DbSchema, MySQL Workbench).
- Knowledge of indexing strategies and database profiling tools (e.g., EXPLAIN).

SOFT SKILLS

- Analytical mindset with problem-solving abilities.
- Strong documentation and communication skills.

EXPERIENCE REQUIRED

- 3+ years of experience in database development and optimization.
- Experience in designing databases for scalable systems.

EDUCATION

- Bachelor’s degree in Computer Science, Data Engineering, or related fields.

BACKEND DEVELOPER

BUDGET

€5.000/MONTH

KEY RESPONSIBILITIES

- Develop and maintain a scalable backend system as outlined in WP2.
- Implement RESTful APIs for communication between frontend, database, and car controller.
- Ensure security protocols (e.g., TLS 1.3, token-based authentication).

REQUIRED TECHNICAL SKILLS

- Proficiency in Python and backend frameworks (e.g., Flask, FastAPI).
- Experience with ORM tools (e.g., SQLAlchemy).
- Familiarity with API security standards and token management (e.g., PyJWT).
- Knowledge of testing tools such as Postman and pytest.

SOFT SKILLS

- Strong team collaboration skills.
- Detail-oriented with a focus on delivering high-performance solutions.

EXPERIENCE REQUIRED

- 3+ years of experience in backend development.
- Experience in integrating AI models is a plus.

EDUCATION

- Bachelor’s degree in Computer Science, Software Engineering, or related fields.

DATA ENGINEER

BUDGET

€5.000/MONTH

KEY RESPONSIBILITIES

- Design and optimize data pipelines between backend and database (WP2).
- Ensure efficient handling and storage of complex data structures.
- Collaborate with the backend team to streamline data workflows.

REQUIRED TECHNICAL SKILLS

- Strong knowledge of data engineering tools and techniques.
- Proficiency in SQL and database optimization.
- Familiarity with Python for data manipulation.

SOFT SKILLS

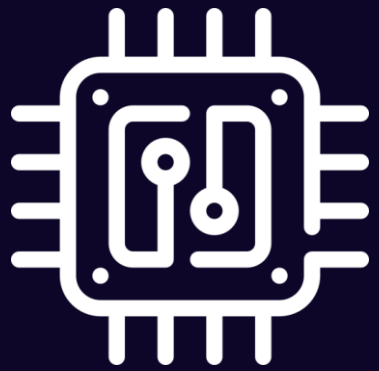
- Problem-solving mindset.
- Effective communication skills to collaborate across teams.

EXPERIENCE REQUIRED

- 3+ years of experience in data engineering or similar roles.

EDUCATION

- Bachelor’s degree in Data Engineering, Computer Science, or related fields.



EMBEDDED DEVELOPER

BUDGET

€5.500/MONTH

KEY RESPONSIBILITIES

- Develop and optimize software for embedded systems (WP3).
- Adapt and deploy facial expression recognition models on edge devices.
- Integrate vehicle sensor data collection (e.g., CAN bus) and ensure secure data transmission to the backend.

REQUIRED TECHNICAL SKILLS

- Expertise in embedded development with edge devices (e.g., NVIDIA Jetson Nano, Coral TPU).
- Proficiency in AI frameworks (e.g., TensorFlow Lite, PyTorch).
- Experience with hardware communication protocols (e.g., CAN bus).

SOFT SKILLS

- Strong debugging and problem-solving skills.
- Attention to detail in performance optimization.

EXPERIENCE REQUIRED

- 3+ years in embedded systems or edge device programming.

EDUCATION

- Bachelor’s degree in Computer Engineering, Electronics, or related fields.

FRONTEND DEVELOPER

BUDGET

€4.000/MONTH

KEY RESPONSIBILITIES

- Develop a mobile app with a user-friendly interface for passengers and drivers (WP4).
- Implement core features, including evaluation viewing and feedback submission.
- Ensure cross-platform compatibility (Android and iOS).

REQUIRED TECHNICAL SKILLS

- Proficiency in mobile app development frameworks (e.g., Flutter, React Native).
- Familiarity with API integration libraries (e.g., Axios).
- Experience in UI/UX design tools (e.g., Figma, Adobe XD).

SOFT SKILLS

- Creative problem-solving for user experience challenges.
- Strong communication skills to gather user feedback.

EXPERIENCE REQUIRED

- 2+ years in mobile app development.

EDUCATION

- Bachelor’s degree in Software Engineering or related fields.

SYSTEM **INTEGRATOR**

BUDGET

€6.000/MONTH

KEY RESPONSIBILITIES

- Ensure seamless integration of all system components (WP5).
- Validate data flow across backend, database, car controller, and mobile app.
- Troubleshoot and resolve interoperability issues.

REQUIRED TECHNICAL SKILLS

- Strong knowledge of system integration principles.
- Proficiency in testing and monitoring tools (e.g., Postman, Grafana).
- Familiarity with cloud and local integration environments.

SOFT SKILLS

- Strong troubleshooting and diagnostic skills.
- Effective communication across teams.

EXPERIENCE REQUIRED

- 3+ years in system integration or related roles.

EDUCATION

- Bachelor’s degree in Systems Engineering or related fields.

SECURITY ENGINEER

BUDGET

€5.500/MONTH

KEY RESPONSIBILITIES

- Implement security protocols to protect system communications and sensitive data (WP6).
- Ensure GDPR compliance and perform vulnerability testing.
- Monitor system activities and detect security threats.

REQUIRED TECHNICAL SKILLS

- Expertise in encryption standards (e.g., AES-256, TLS 1.3).
- Proficiency in security testing tools (e.g., OWASP ZAP, Burp Suite).
- Knowledge of token-based authentication systems (e.g., JWT).

SOFT SKILLS

- Analytical skills for threat detection.
- Strong documentation skills.

EXPERIENCE REQUIRED

- 3+ years in cybersecurity roles.

EDUCATION

- Bachelor’s degree in Cybersecurity or related fields.

QUALITY ASSURANCE ENGINEER

BUDGET

€5.000/MONTH

KEY RESPONSIBILITIES

- Perform unit, integration, and end-to-end testing across all system components (WP7).
- Identify bugs and ensure compliance with functional and non-functional requirements.
- Simulate high loads to test system scalability.

REQUIRED TECHNICAL SKILLS

- Proficiency in testing frameworks (e.g., pytest, Jest).
- Experience with load testing tools (e.g., Apache JMeter).
- Familiarity with testing APIs (e.g., Postman).

SOFT SKILLS

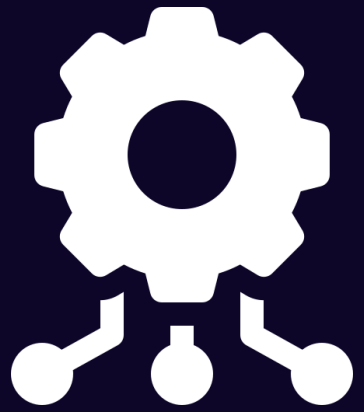
- Attention to detail in test case design.
- Strong analytical skills.

EXPERIENCE REQUIRED

- 3+ years in QA engineering.

EDUCATION

- Bachelor’s degree in Software Quality or related fields.



SYSTEM ENGINEER

BUDGET

€5.000/MONTH

KEY RESPONSIBILITIES

- Support performance testing and load simulations to validate system scalability and robustness (WP7).
- Collaborate with the QA team to conduct stress testing and resolve bottlenecks.
- Ensure the system operates effectively under high loads and adverse conditions.
- Provide technical support during end-to-end integration testing.

REQUIRED TECHNICAL SKILLS

- Expertise in system performance analysis and optimization.
- Proficiency in simulation and testing tools (e.g., Apache JMeter).
- Knowledge of distributed systems and their challenges.
- Familiarity with monitoring tools (e.g., Grafana) for identifying bottlenecks.

SOFT SKILLS

- Strong diagnostic and troubleshooting skills.
- Ability to work collaboratively with multidisciplinary teams.

EXPERIENCE REQUIRED

- 3+ years of experience in system engineering or performance testing roles.
- Experience with large-scale system architectures is a plus.

EDUCATION

- Bachelor’s degree in Computer Engineering, Systems Engineering, or related fields.

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TOOLS

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www.flaticon.com

THANKS

FOR YOUR ATTENTION