# 1.0 Vehicle Maintenance System First Iteration

The system under development is for an Augmented Reality Vehicle Maintenance System in a technicians environment. The technician interacts directly with the system.

1.1 Use Case Diagram

The first iteration of the Use Case model is a simple diagram with only one use case and a use case description.

It covers the complete system functionality in summary form.

Technician

1. Using the Augmented Reality Vehicle Maintenance System

Augmented Reality Vehicle System
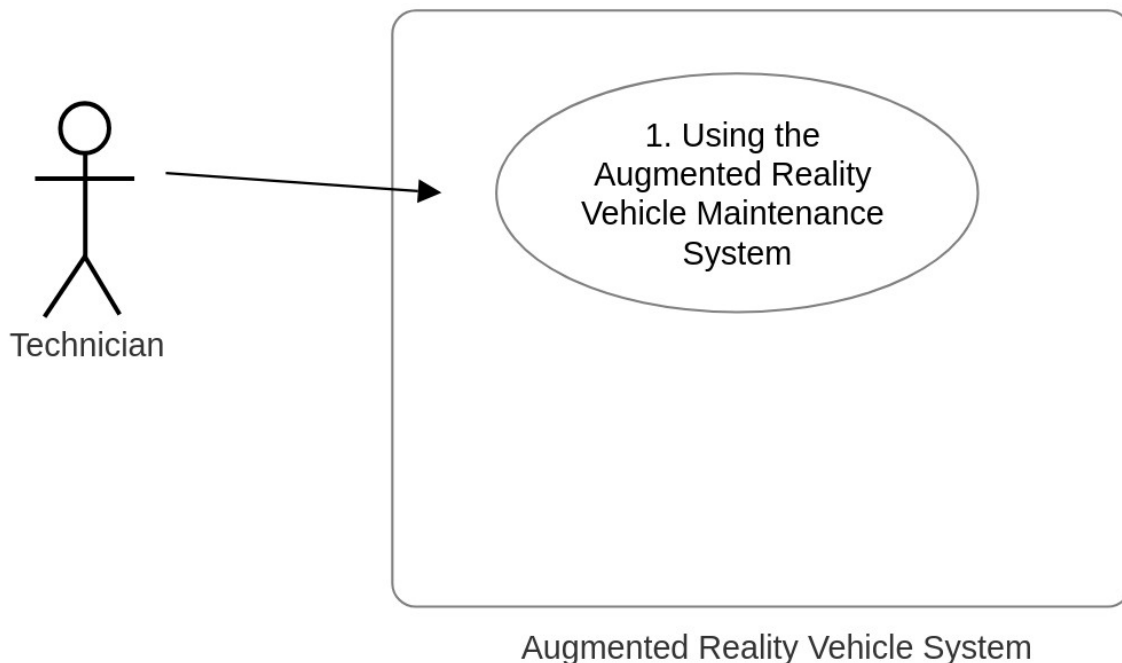
1.2 Use Case Narrative

The diagram forms part of the use case model. A detailed description of each use case is also required. The description is referred to as the use case narrative. This focuses on how a specific use case is used, i.e. a specific scenario.

In this scenario it is the technician actor who starts the interaction by requesting to repair a vehicle. It is required to have a description of the steps involved in using the system. A suitable format for describing the scenario is using a use case narrative.

Functional Requirement

USE CASE	1	Using the AR Vehicle Maintenance System
Goal in Context Brief Description	Using the Augmented Reality Vehicle Maintenance System to repair a vehicle in a shop. Provide real-time, augmented reality assisted guideance, to techniciand, for vehicle maintenance, repair ans step-by-step instructions on a live view of the vehicle to help them complete maintenance tasks with precision and accuracy. Reduce the need for paper manuals, increase error detections and improve the troubleshooting process.	
Scope & Level	System. Summary	
Preconditions	- Have the app on a compatible device - The device's camera is working properly - The vehicle is present and accessible	
Success End Condition Post-condition	- The vehicle's mechanical issues have been fixed - The maintenance task is succesfully completed - The vehicle is in good condition	
Failed End Condition Post-condition	- The vehicle's issues have not been fixed - The vehicle is not in good condition (mechanical issues left)	
Primary, Secondary, Actors	Technician	
Trigger	User requests to repair a vehicle	
DESCRIPTION	The system provides interactive, real-time maintenance assistance directly on a mobile device or smart glasses. The primary goal is to improve the efficiency, accuracy and safety of maintenance tasks. The system will use the device's camera to detect and identify the vehicle model and will retrieve up-to-date technical information, wiring diagrams and relevant maintenance history from the database. The user can select the specific maintenance task they want to perform, such as inspecting the engine, performing a wiring diagnostic, or changing parts. The system will then display 3D representations of the vehicle's components onto the live camera feed, highlighting specific areas the user needs to focus on. Step-by-step instructions will be provided guiding the user on what to do next. The system will respond to the user's actions, confirming correct procedures and issuing alerts if something is not properly done. The system offers remote support for technicians who encounter issues they cannot solve. The technician can connect with remote experts who can see the live-view. During and after task completion, the system will capture key performance data such as parts replaced and errors encountered. This data is later used for developing a maintenance report. If internet connectivity is lost, the system switches to offline mode, allowing the user to continue their tasks but using static models and information.	

Main Flow		
Step	**Action**	**Alternate**
1.1	User presents identification to system (The system requests identification from the user)	
1.2	The system authenticates the user	
1.3	The user points their device's camera at the vehicle	
1.4	The system recognizes vehicle's model	E.F. 1.4
1.5	The system retrieves necessary technical data	E.F. 1.5
1.6	The user selects the task to perform (maintenance, diagnosis, ...)	
1.7	The system generates 3D models and displays instructions	
1.8	The user follows real-time instructions	
1.9	The system tracks the user's progress	
1.10	The system monitors for errors	
1.11	The user finishes all the steps	E.F. 1.11
1.12	The system generates report about the task	
1.13	The system updates vehicle information	
1.14	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 1.4: Error flow at step 4 of Use Case 1: Vehicle not recognized

The system is not able to recognize the vehicle through the input provided by the device's camera.

Step	Branching Action	Alternate
1.4.1	The system indicates to the user it was unable to identify the vehicle	
1.4.2	The user inputs the vehicle model manually	
1.4.3	Go to Main Flow step 1.5	

EXCEPTIONS or ERROR Flow Description
E.F. 1.5: Error flow at step 5 of Use Case 1: Data retrieval failed

There was an error retrieving the vehicle data from the database.

Step	Branching Action	Alternate
1.5.1	The system indicates to the user there was an error loading data	
1.5.2	The system will notify when data is retrieved correctly	
1.5.3	Go to Main Flow step 1.6	

EXCEPTIONS or ERROR Flow Description
E.F. 1.11: Error flow at step 11 of Use Case 1: User unable to complete a task

The user is not able to complete a task due to lack of knowledge or experience.

Step	Branching Action	Alternate
1.11.1	The user notifies to the system it is unable to complete a task	
1.11.2	The system offers to connect the user to an specialist remotely (remote assistance)	

1.11.3	The user completes the task	
1.11.4	Go to Main Flow step 1.12	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

| RELATED INFORMATION	Use Case: 1	Using the AR Vehicle Maintenance System
Priority:	High, essential for system functionality	
Product: Performance	- Process and memory capacity: should run smoothly with 2GB RAM and 1.5 Ghz processor as minimum - Throughput: should support up to 50 concurrent users without performance loss - Response time: should load within 2 seconds on standard device	
Product: Efficiency	- Memory usage: average should not exceed 400 MB - Processor usage: CPU usage should not exceed 15% during normal operation	
Product: Reliability	Must operate correctly 99.9% of the time, it can have a downtime of 2 hours in 1 year	
Organisation: Standards	Follow ISO for data security and quality management, along with required documentation for all updates	
External: Legislation	- Privacy and data protection: comply with data privacy regulations like GDPR, ensuring user data is securly stored and protected. - Data retention: only necessary data - Safety standards: meet industry safety standards to ensure the instructions provided are accurate and safe	
Frequency	Daily use during maintenance sessions	
Channels to actors	Accesible through interactive interfaces on authorized devices such as phones, tablets and AR glasses	

Functional requirements

- Describe **functionality** of the system

- Depend on the *type of software, expected users* and the *type of system* where the software is used.

- Functional user requirements may be high-level statements of what the system should do but functional system requirements should describe the system services in detail.

- Functional requirements determined from the key stakeholders related to using the system

Non-functional requirements

- These define system properties and constraints e.g. reliability, response time and storage requirements.

- Non-functional requirements may be more **critical** than functional requirements. If these are not met, the system is useless.

Non-functional requirement types
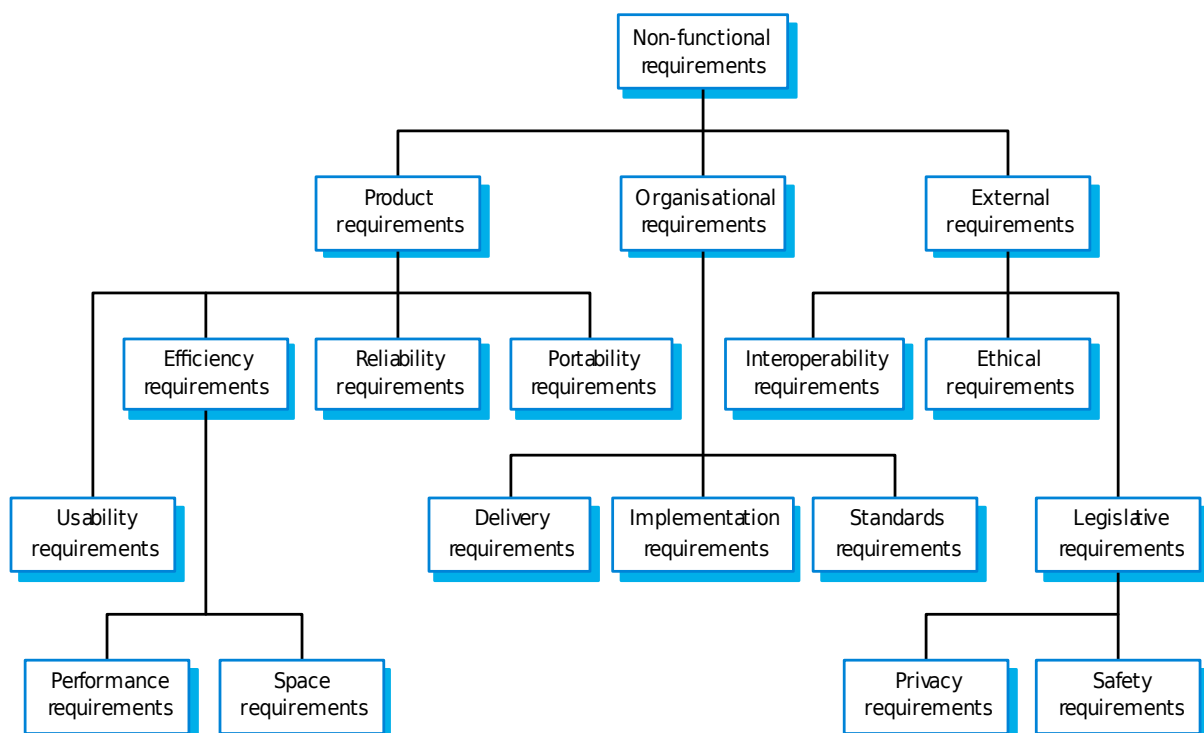
Non-Functional Requirements

- **Product requirements**
  - Usability
  - Efficiency

- Memory space usage
- Processing time
  - Reliability
  - Portability
  - Security
- **Organisation Process requirements**
  - delivery
  - implementation
  - standards compliance
- **External requirements**
  - interoperability
  - ethical requirements
  - legislative
    - privacy
    - safety

Non-functional Product Requirement Metrics

- Efficiency
  - Throughput: Current Transactions / sec
  - Capacity: Maximum Transactions / sec
  - Response time: Time to complete an operation or deliver a service
    - Total time including: the service request time plus service delivery time
- Space
  - Main memory amount required
  - Auxiliary memory type and amount required
    - Cache, Disk, . . .
- Usability
  - Training time
  - Number of choices, menus and options
  - Mouse clicks required
- Reliability
  - Availability over a period of time   (%)
  - Mean time to failure

- Downtime probability
- Failure rate
- Robustness
  - Time to recovery
  - % of incidents leading to catastrophic failures
  - Data corruption probability after a failure
- Portability
  - Number of systems where software can run
  - % of non-portable code

2.0 Iteration 2
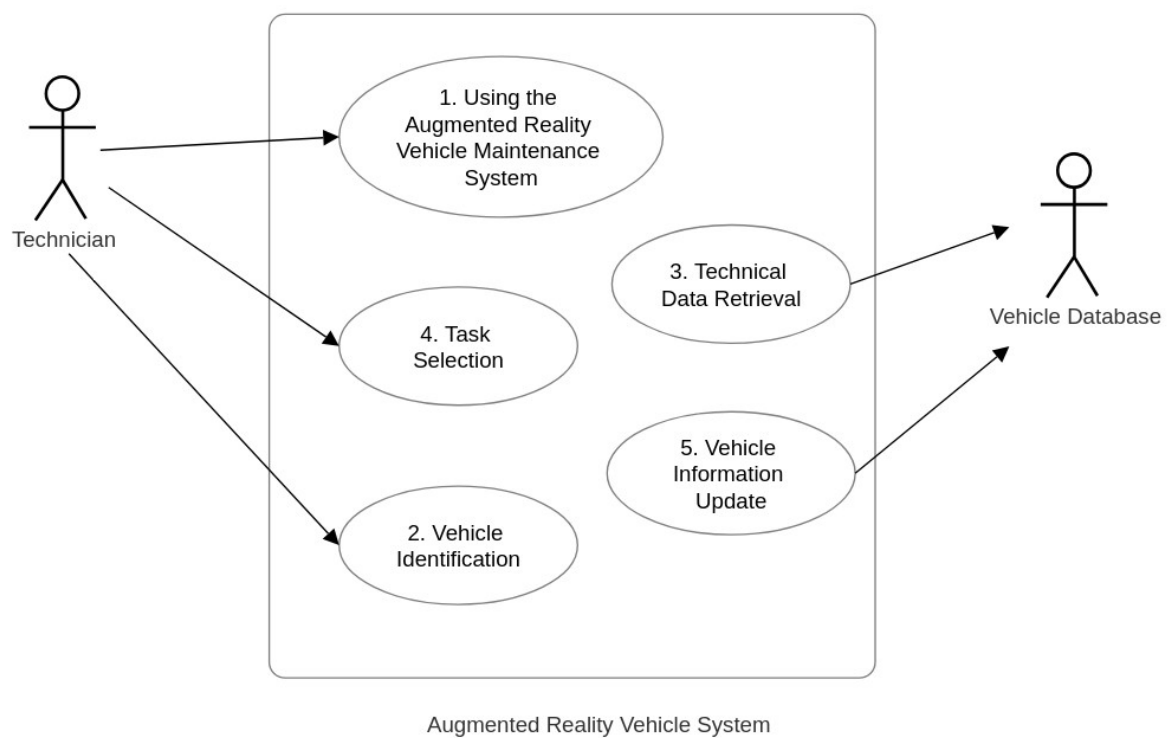
The second iteration provides more detailed information on the features of the system, building on the foundation established in the first one.

2.1 Use Case Diagram for Iteration 2

The second iteration of the Use Case model is a diagram with only five use cases and a use case description for each.

It covers more specific functionalities of the system.

Augmented Reality Vehicle System

2.2.1 Narrative for Use case 1 Using the AR Vehicle Maintenance System

USE CASE	1	Using the AR Vehicle Maintenance System
Goal in Context Brief Description	Using the Augmented Reality Vehicle Maintenance System to repair a vehicle in a shop. Provide real-time, augmented reality assisted guideance, to techniciand, for vehicle maintenance, repair ans step-by-step instructions on a live view of the vehicle to help them complete maintenance tasks with precision and accuracy. Reduce the need for paper manuals, increase error detections and improve the troubleshooting process.	
Scope & Level	System. Summary	
Preconditions	- Have the app on a compatible device - The device's camera is working properly - The vehicle is present and accessible	
Success End Condition Post-condition	- The vehicle's mechanical issues have been fixed - The maintenance task is succesfully completed - The vehicle is in good condition	
Failed End Condition Post-condition	- The vehicle's issues have not been fixed - The vehicle is not in good condition (mechanical issues left)	
Primary, Secondary, Actors	Technician	
Trigger	User requests to repair a vehicle	
DESCRIPTION	The system provides interactive, real-time maintenance assistance directly on a mobile device or smart glasses. The primary goal is to improve the efficiency, accuracy and safety of maintenance tasks. The system will use the device's camera to detect and identify the vehicle model and will retrieve up-to-date technical information, wiring diagrams and relevant maintenance history from the database. The user can select the specific maintenance task they want to perform, such as inspecting the engine, performing a wiring diagnostic, or changing parts. The system will then display 3D representations of the vehicle's components onto the live camera feed, highlighting specific areas the user needs to focus on. Step-by-step instructions will be provided guiding the user on what to do next. The system will respond to the user's actions, confirming correct procedures and issuing alerts if something is not properly done. The system offers remote support for technicians who encounter issues they cannot solve. The technician can connect with remote experts who can see the live-view. During and after task completion, the system will capture key performance data such as parts replaced and errors encountered. This data is later used for developing a maintenance report. If internet connectivity is lost, the system switches to offline mode,	

	allowing the user to continue their tasks but using static models and information.	

Main Flow

Step	Action	Alternate
1.1	User presents identification to system (The system requests identification from the user)	
1.2	The system authenticates the user	
1.3	The user points their device's camera at the vehicle	
1.4	The system recognizes vehicle's model	E.F. 1.4
1.5	The system retrieves necessary technical data	E.F. 1.5
1.6	The user selects the task to perform (maintenance, diagnosis, ...)	
1.7	The system generates 3D models and displays instructions	
1.8	The user follows real-time instructions	
1.9	The system tracks the user's progress	
1.10	The system monitors for errors	
1.11	The user finishes all the steps	E.F. 1.11
1.12	The system generates report about the task	
1.13	The system updates vehicle information	
1.14	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 1.4: Error flow at step 4 of Use Case 1: Vehicle not recognized

The system is not able to recognize the vehicle through the input provided by the device's camera.

Step	Branching Action	Alternate
1.4.1	The system indicates to the user it was unable to identify the vehicle	
1.4.2	The user inputs the vehicle model manually	
1.4.3	Go to Main Flow step 1.5	

EXCEPTIONS or ERROR Flow Description
E.F. 1.5: Error flow at step 5 of Use Case 1: Data retrieval failed

There was an error retrieving the vehicle data from the database.

Step	Branching Action	Alternate
1.5.1	The system indicates to the user there was an error loading data	
1.5.2	The system will notify when data is retrieved correctly	
1.5.3	Go to Main Flow step 1.6	

EXCEPTIONS or ERROR Flow Description
E.F. 1.11: Error flow at step 11 of Use Case 1: User unable to complete a task

The user is not able to complete a task due to lack of knowledge or experience.

Step	Branching Action	Alternate
1.11.1	The user notifies to the system it is unable to complete a task	

1.11.2	The system offers to connect the user to an specialist remotely (remote assistance)	
1.11.3	The user completes the task	
1.11.4	Go to Main Flow step 1.12	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 1	Using the AR Vehicle Maintenance System
Priority:	High, essential for system functionality	
Product: Performance	- Process and memory capacity: should run smoothly with 2GB RAM and 1.5 Ghz processor as minimum	
	- Throughput: should support up to 50 concurrent users without performance loss	
	- Response time: should load within 2 seconds on standard device	
Product: Efficiency	- Memory usage: average should not exceed 400 MB	
	- Processor usage: CPU usage should not exceed 15% during normal operation	
Product: Reliability	Must operate correctly 99.9% of the time, it can have a downtime of 2 hours in 1 year	
Organisation: Standards	Follow ISO for data security and quality management, along with required documentation for all updates	
External: Legislation	- Privacy and data protection: comply with data privacy regulations like GDPR, ensuring user data is securly stored and protected.	
	- Data retention: only necessary data	
	- Safety standards: meet industry safety standards to ensure the instructions provided are accurate and safe	
Frequency	Daily use during maintenance sessions	
Channels to actors	Accesible through interactive interfaces on authorized devices such as phones, tablets and AR glasses	

2.2.2 Narrative for Use case 2 Vehicle Identification

USE CASE	2	Vehicle Identification
Goal in Context Brief Description	Identify the vehicle model when the technician points their device at the vehicle	
Scope & Level	System. User goal	
Preconditions	- The technician is logged into the system - The vehicle is within the range of the device's camera	
Related Use Cases	UC 1 includes this UC 3 gets the preconditions from this postconditions UC 4 gets the preconditions from this postconditions	
Success End Condition Post-condition	- The vehicle model is successfully identified	
Failed End Condition Post-condition	- The system fails to identify the vehicle model	
Primary, Secondary, Actors	Technician Vehicle Database	
Trigger	The technician points the device at the vehicle to begin the identification process	
DESCRIPTION	The system identifies the vehicle model after the technician points their device at the vehicle. Using image recognition, the system compares the vehicle's visible features against entries in the vehicle database to establish a match and retrieve relevant vehicle information.	

Main Flow		
Step	**Action**	**Alternate**
2.1	The technician activates the identification feature in the system	
2.2	The system prompts the technician to align the device's camera with the vehicle	
2.3	The technician points the device at the vehicle	
2.4	The system captures images of the vehicle	E.F. 2.4
2.5	The system analyzes the images for recognizable features	
2.6	The system sends the extracted data to the vehicle database for matching	
2.7	The system searches for potential matches within the database	E.F. 2.7
2.8	The system displays the identified model for technician confirmation	
2.9	The technician confirms the vehicle model	
2.10	End of use case	

EXCEPTIONS or ERROR Flow Description

E.F. 2.4: Error flow at step 4 of Use Case 2: Image Quality Issue

The captured image is unclear due to poor lighting, bluriness, etc.

Step	**Branching Action**	**Alternate**
2.4.1	The system indicates to the technician the image quality is	

	poor	
2.4.2	The system prompts the technician to take other images	
2.4.3	Go to Main Flow step 2.5	

EXCEPTIONS or ERROR Flow Description
E.F. 2.7: Error flow at step 7 of Use Case 2: No match in the Database

The vehicle database returns no matches according to the features identified from the images.

Step	Branching Action	Alternate
2.7.1	The system notifies the technician that the vehicle model cannot be identified	
2.7.2	The system prompts the user for manual identification	
2.7.3	The user provides the vehicles model	
2.7.4	The system searches the database for the model	
2.7.5	Go to Main Flow step 2.8	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 2	Vehicle Identification
Priority:	High, critical for beginning any specific maintenance task	
Product: Performance	- Process and memory capacity: minimal memory (100 MB) and should operate with under 10% CPU usage - Throughput: process up to 100 identifications per hour - Response time: vehicle identification should complete within 5 seconds	
Product: Efficiency	- Memory usage: should not exceed 50 MB - Processor usage: under 10%	
Product: Reliability	Must operate correctly 95% of the time	
Organisation: Standards	Image capture and identification should comply with ISO for records management	
External: Legislation	- Privacy and data protection: comply with data privacy regulations like GDPR, ensuring user data is securely stored and protected. - Data retention: only necessary data, apply anonymization to stored images for privacy	
Frequency	Once per maintenance session (daily use)	
OPEN ISSUES	- How to handle unknown vehicle models	

2.2.3 Narrative for Use case 3 Technical Data Retrieval

USE CASE	3	Technical Data Retrieval
Goal in Context Brief Description	Retrieve relevant technical data for the identified vehicle model	
Scope & Level	System. Sub-function	
Preconditions	- The vehicle model has been successfully identified - The system is connected to the vehicle database	
Related Use Cases	UC 1 includes this UC 2 provides the precondition UC 4 gets the preconditions from this postconditions	
Success End Condition Post-condition	The necessary technical data for the identified vehicle is retrieved and available for the technician	
Failed End Condition Post-condition	Technical data retrieval fails and the data cannot be accessed	
Primary, Secondary, Actors	Vehicle database	
Trigger	Successful vehicle identification triggers technical data retrieval	
DESCRIPTION	After identifying the vehicle model, the system retrieves relevant technical data, such as specifications, repair history and maintenance instructions from the vehicle database.	

Main Flow		
Step	**Action**	**Alternate**
3.1	The system begins technical data retrieval immediately after the vehicle identification is confirmed	
3.2	The system sends a request to the vehicle database with the vehicle id (of the identified vehicle)	E.F. 3.2
3.3	The vehicle database processes the request	
3.4	The vehicle database returns relevant technical information	E.F. 3.4
3.5	The system receives the data package and parses the information	
3.6	The system categorizes the data filtering information based on the task requirements	
3.7	The system compiles a summary view of critical information	
3.8	The system displays the summary for technician review	
3.9	The techniciam reviews the data and confirm it is adequate for task selection	
3.10	The system marks data retrieval as complete	
3.11	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 3.2: Error flow at step 2 of Use Case 3: Database Connection Failure   The system cannot connect to the vehicle database.

Step	Branching Action	Alternate
3.2.1	The system retries to restablish the connection	
3.2.2	The system logs the issue and notifies the technician	
3.2.3	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 3.4: Error flow at step 4 of Use Case 3: Data Unavailable

The requested data is unavailable in the database.

Step	Branching Action	Alternate
3.4.1	The system notifies the technician that technical data cannot be retrieved	
3.4.2	The system may suggest contacting technical support	
3.4.3	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 3	Technical Data Retrieval
Priority:	High, essential for providing necessary information	
Product: Performance	- Process and memory capacity: under 100 MB of memory - Throughput: up to 200 data retrievals per hour - Response time: data should be retrieved within 3 seconds	
Product: Efficiency	- Memory usage: 50 MB during data retrieval - Processor usage: should not exceed 10% CPU usage	
Product: Reliability	Must operate correctly 99% of the time	
External: Legislation	- Privacy and data protection: comply with data privacy regulations like GDPR, especially when handling sensitive vehicle information.	
Frequency	Whenever a task requiring technical data is selected (daily use)	
Channels to actors	Accessed interactively via technician's device with data retrieved from a database	

2.2.4 Narrative for Use case 4 Task Selection

USE CASE	4	Task Selection
Goal in Context Brief Description	Allow the technician to select a specific task to perform based on available technical data	
Scope & Level	System. User goal	
Preconditions	- Technical data has been retrieved for the identified vehicle - The technician is logged into the system	
Related Use Cases	UC 1 includes this UC 3 provides the precondition	
Success End Condition Post-condition	- The system loads the necessary intructions and resources for the selected task	
Failed End Condition Post-condition	- The technician is unable to select the task or the resources could not load	
Primary, Secondary, Actors	Technician	
Trigger	The techician initiates task selection after reviewing the technical data	
DESCRIPTION	The technician views a list of tasks based on the retrived technical data. The system allows the technician to select a specific task from the list provided. Available tasks are filtered based on the vehicle's characteristics. The system then loads and displays the resources needed for task execution.	

Main Flow		
Step	**Action**	**Alternate**
4.1	The technician acceses the list of available tasks through the system interface	
4.2	The system presents a filtered list of tasks specific to the vehicle model	
4.3	The technician selects a task from the task list	E.F. 4.3
4.4	The system confirms the selection, checking for any additional requirements or dependendies	
4.5	The system retrieves task-specific resources	E.F. 4.5
4.6	The system loads any necessary safety instructions or prerequistes for the selected task	
4.7	The system displays the task instructions for technician review	
4.8	The technician confirms to proceed with the task	
4.9	The system marks task selection as complete	
4.10	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 4.3: Error flow at step 3 of Use Case 4: No Tasks Available

There are no tasks available for the identified vehicle.

Step	Branching Action	Alternate
4.3.1	The system informs the technician there are no available tasks	
4.3.2	The system returns to technical data view	
4.3.3	End of use case	

EXCEPTIONS or ERROR Flow Description

E.F. 4.5: Error flow at step 5 of Use Case 4: Task Loading Error

An error occurs while loading task details.

Step	Branching Action	Alternate
4.5.1	The system attempts to reload	
4.5.2	The system logs the error and notifies the technician	
4.5.3	End of use case	

ALTERNATIVE or VARIATION Flow Description

No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 4	Task Selection
Priority:	Medium, important for user experience but not critical for system functionality	
Product: Performance	- Process and memory capacity: under 50 MB memory usage (lightweight) - Throughput: up to 20 selections per minute - Response time: task list should populate within 2 seconds	
Product: Efficiency	- Memory usage: below 20 MB for task listing - Processor usage: up to 5% CPU usage	
Product: Reliability	Must operate correctly 98% of the time for displaying tasks	
Organisation: Standards	- Comply with ISO for user interface usability standards	
Frequency	Once per maintenance session (daily use)	
Channels to actors	Interactive, displayed on the technician's device with touch options and drop-down menus	

2.2.5 Narrative for Use case 5 Vehicle Information Update

USE CASE	5	Vehicle Information Update
Goal in Context Brief Description	Updates vehicle information based on completed tasks and maintenance data	
Scope & Level	System. User goal	
Preconditions	- The technician has completed the selected task - The system is connected to the vehicle database	
Related Use Cases	UC 1 includes this	
Success End Condition Post-condition	- Vehicle information is successfully updated with the lastest task and maintenance data	
Failed End Condition Post-condition	- The system fails to update the vehicle information in the database	
Primary, Secondary, Actors	Vehicle Database	
Trigger	Task completion by the technician triggers the vehicle information update	
DESCRIPTION	After the technician completes a task, the system updates the vehicle's service record in the database with the latest task and maintenance information.	

Main Flow		
Step	**Action**	**Alternate**
5.1	The technician confirms task completion in the system interface	
5.2	The system compiles relevant data	
5.3	The system formats this data for the vehicle database	E.F. 5.3
5.4	The system sends an update request to the vehicle database	
5.5	The database receives and processes the update request	
5.6	The vehicle's maintenance record is updated	E.F. 5.6
5.7	The system verifies that the update was successfully recorded	
5.8	The system notifies the technician that the update was successful	
5.9	The system logs the update as part of the vehicle's maintenance history	
5.10	The system displays a confirmation to the technician	
5.11	End of use case	

EXCEPTIONS or ERROR Flow Description		
E.F. 5.3: Error flow at step 3 of Use Case 5: Data Formatting Error An error occurs during data formatting.		

Step	**Branching Action**	**Alternate**
5.3.1	The system attempts to reformat the data	
5.3.2	The system logs the error and informs the technician	

5.3.3	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 5.6: Error flow at step 6 of Use Case 5: Database Update Failure

The database fails to process the update.

Step	Branching Action	Alternate
5.6.1	The system retries the request	
5.6.2	The system logs the error and informs the technician	
5.6.3	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 5	Vehicle Information Update
Priority:	High, critical for maintaining accurate and up to date vehicle information	
Product: Performance	- Process and memory capacity: up to 100 MB of memory - Throughput: up to 50 concurrent updates - Response time: the database should reflect the changes in less than 1 minute after confirmation	
Product: Efficiency	- Memory usage: up to 50 MB for update process - Processor usage: up to 5% CPU usage per update transaction	
Product: Reliability	Must operate correctly 99% of the time	
External: Legislation	Comply with data retention and privacy regulations, especially with sensitive information	
Frequency	Frequent use, when new information needs to be recorded	
Channels to actors	Interactive updates submitted via the device interface. Secure transmittions to the database	

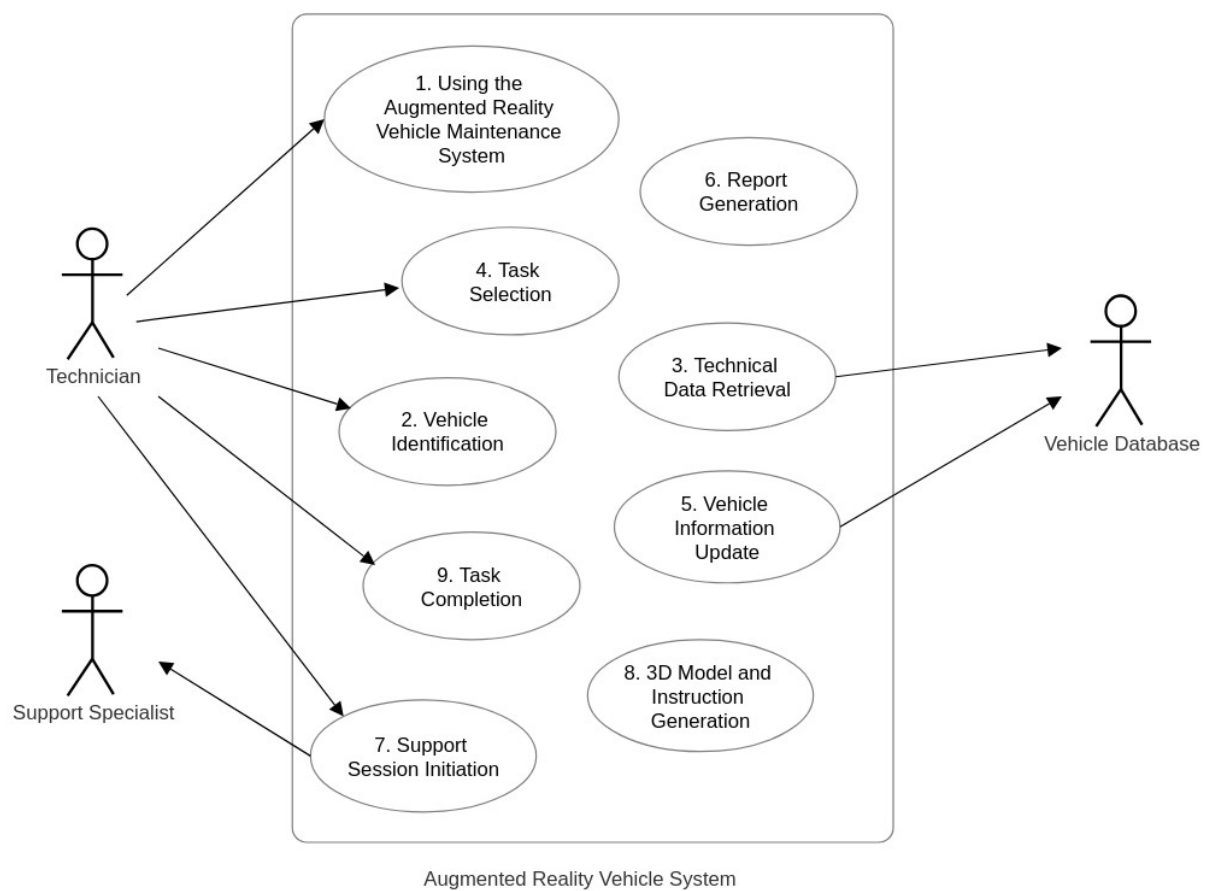# 3.0 Iteration 3

The third iteration provides extended information on more features of the system, building on the information provided in the previous two.

3.1 Use Case Diagram for Iteration 3

The third iteration of the Use Case model is a diagram with nine use cases and a use case description for each.

It covers more specific functionalities of the system.

Augmented Reality Vehicle System

3.2 Use Case Narratives for Iteration 3

3.2.1 Narrative for Use case 1 Using the AR Vehicle Maintenance System

USE CASE	1	Using the AR Vehicle Maintenance System
Goal in Context Brief Description	Using the Augmented Reality Vehicle Maintenance System to repair a vehicle in a shop. Provide real-time, augmented reality assisted guideance, to techniciand, for vehicle maintenance, repair ans step-by-step instructions on a live view of the vehicle to help them complete maintenance tasks with precision and accuracy. Reduce the need for paper manuals, increase error detections and improve the troubleshooting process.	
Scope & Level	System. Summary	
Preconditions	- Have the app on a compatible device - The device's camera is working properly - The vehicle is present and accessible	
Success End Condition Post-condition	- The vehicle's mechanical issues have been fixed - The maintenance task is succesfully completed - The vehicle is in good condition	
Failed End Condition Post-condition	- The vehicle's issues have not been fixed - The vehicle is not in good condition (mechanical issues left)	
Primary, Secondary, Actors	Technician	
Trigger	User requests to repair a vehicle	
DESCRIPTION	The system provides interactive, real-time maintenance assistance directly on a mobile device or smart glasses. The primary goal is to improve the efficiency, accuracy and safety of maintenance tasks. The system will use the device's camera to detect and identify the vehicle model and will retrieve up-to-date technical information, wiring diagrams and relevant maintenance history from the database. The user can select the specific maintenance task they want to perform, such as inspecting the engine, performing a wiring diagnostic, or changing parts. The system will then display 3D representations of the vehicle's components onto the live camera feed, highlighting specific areas the user needs to focus on. Step-by-step instructions will be provided guiding the user on what to do next. The system will respond to the user's actions, confirming correct procedures and issuing alerts if something is not properly done. The system offers remote support for technicians who encounter issues they cannot solve. The technician can connect with remote experts who can see the live-view. During and after task completion, the system will capture key performance data such as parts replaced and errors encountered. This data is later used for developing a maintenance report. If internet connectivity is lost, the system switches to offline mode,	

	allowing the user to continue their tasks but using static models and information.

Main Flow

Step	Action	Alternate
1.1	User presents identification to system (The system requests identification from the user)	
1.2	The system authenticates the user	
1.3	The user points their device's camera at the vehicle	
1.4	The system recognizes vehicle's model	E.F. 1.4
1.5	The system retrieves necessary technical data	E.F. 1.5
1.6	The user selects the task to perform (maintenance, diagnosis, ...)	
1.7	The system generates 3D models and displays instructions	
1.8	The user follows real-time instructions	
1.9	The system tracks the user's progress	
1.10	The system monitors for errors	
1.11	The user finishes all the steps	E.F. 1.11
1.12	The system generates report about the task	
1.13	The system updates vehicle information	
1.14	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 1.4: Error flow at step 4 of Use Case 1: Vehicle not recognized

The system is not able to recognize the vehicle through the input provided by the device's camera.

Step	Branching Action	Alternate
1.4.1	The system indicates to the user it was unable to identify the vehicle	
1.4.2	The user inputs the vehicle model manually	
1.4.3	Go to Main Flow step 1.5	

EXCEPTIONS or ERROR Flow Description
E.F. 1.5: Error flow at step 5 of Use Case 1: Data retrieval failed

There was an error retrieving the vehicle data from the database.

Step	Branching Action	Alternate
1.5.1	The system indicates to the user there was an error loading data	
1.5.2	The system will notify when data is retrieved correctly	
1.5.3	Go to Main Flow step 1.6	

EXCEPTIONS or ERROR Flow Description
E.F. 1.11: Error flow at step 11 of Use Case 1: User unable to complete a task

The user is not able to complete a task due to lack of knowledge or experience.

Step	Branching Action	Alternate

1.11.1	The user notifies to the system it is unable to complete a task	
1.11.2	The system offers to connect the user to an specialist remotely (remote assistance)	
1.11.3	The user completes the task	
1.11.4	Go to Main Flow step 1.12	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 1	Using the AR Vehicle Maintenance System
Priority:	High, essential for system functionality	
Product: Performance	- Memory usage: average should not exceed 400 MB - Processor usage: CPU usage should not exceed 15% during normal operation	
Product: Efficiency	Must operate correctly 99.9% of the time, it can have a downtime of 2 hours in 1 year	
Product: Reliability	Follow ISO for data security and quality management, along with required documentation for all updates	
Organisation: Standards	- Privacy and data protection: comply with data privacy regulations like GDPR, ensuring user data is securly stored and protected. - Data retention: only necessary data - Safety standards: meet industry safety standards to ensure the instructions provided are accurate and safe	
External: Legislation	Daily use during maintenance sessions	
Frequency	Accesible through interactive interfaces on authorized devices such as phones, tablets and AR glasses	
Channels to actors	- Memory usage: average should not exceed 400 MB - Processor usage: CPU usage should not exceed 15% during normal operation	

3.2.2 Narrative for Use case 2 Vehicle Identification

USE CASE	2	Vehicle Identification
Goal in Context Brief Description	Identify the vehicle model when the technician points their device at the vehicle	
Scope & Level	System. User goal	
Preconditions	- The technician is logged into the system - The vehicle is within the range of the device's camera	
Related Use Cases	UC 1 includes this UC 3 gets the preconditions from this postconditions UC 4 gets the preconditions from this postconditions	
Success End Condition Post-condition	- The vehicle model is successfully identified	
Failed End Condition Post-condition	- The system fails to identify the vehicle model	
Primary, Secondary, Actors	Technician Vehicle Database	
Trigger	The technician points the device at the vehicle to begin the identification process	
DESCRIPTION	The system identifies the vehicle model after the technician points their device at the vehicle. Using image recognition, the system compares the vehicle's visible features against entries in the vehicle database to establish a match and retrieve relevant vehicle information.	

Main Flow		
Step	**Action**	**Alternate**
2.1	The technician activates the identification feature in the system	
2.2	The system prompts the technician to align the device's camera with the vehicle	
2.3	The technician points the device at the vehicle	
2.4	The system captures images of the vehicle	E.F. 2.4
2.5	The system analyzes the images for recognizable features	
2.6	The system sends the extracted data to the vehicle database for matching	
2.7	The system searches for potential matches within the database	E.F. 2.7
2.8	The system displays the identified model for technician confirmation	
2.9	The technician confirms the vehicle model	
2.10	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 2.4: Error flow at step 4 of Use Case 2: Image Quality Issue

The captured image is unclear due to poor lighting, bluriness, etc.

Step	**Branching Action**	**Alternate**
2.4.1	The system indicates to the technician the image quality is	

		poor	
	2.4.2	The system prompts the technician to take other images	
	2.4.3	Go to Main Flow step 2.5	

EXCEPTIONS or ERROR Flow Description
E.F. 2.7: Error flow at step 7 of Use Case 2: No match in the Database

The vehicle database returns no matches according to the features identified from the images.

Step	Branching Action	Alternate
2.7.1	The system notifies the technician that the vehicle model cannot be identified	
2.7.2	The system prompts the user for manual identification	
2.7.3	The user provides the vehicles model	
2.7.4	The system searches the database for the model	
2.7.5	Go to Main Flow step 2.8	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 2	Vehicle Identification using AR
Priority:	High, critical for beginning any specific maintenance task	
Product: Performance	- Process and memory capacity: minimal memory (100 MB) and should operate with under 10% CPU usage - Throughput: process up to 100 identifications per hour - Response time: vehicle identification should complete within 5 seconds	
Product: Efficiency	- Memory usage: should not exceed 50 MB - Processor usage: under 10%	
Product: Reliability	Must operate correctly 95% of the time	
Organisation: Standards	Image capture and identification should comply with ISO for records management	
External: Legislation	- Privacy and data protection: comply with data privacy regulations like GDPR, ensuring user data is securly stored and protected. - Data retention: only necessary data, apply anonymization to stored images for privacy	
Frequency	Once per maintenance session (daily use)	
OPEN ISSUES	- How to handle unknown vehicle models	

3.2.3 Narrative for Use case 3 Technical Data Retrieval

USE CASE	3	Technical Data Retrieval	
Goal in Context Brief Description	Retrieve relevant technical data for the identified vehicle model		
Scope & Level	System. Sub-function		
Preconditions	- The vehicle model has been successfully identified - The system is connected to the vehicle database		
Related Use Cases	UC 1 includes this UC 2 provides the precondition UC 4 gets the preconditions from this postconditions		
Success End Condition Post-condition	The necessary technical data for the identified vehicle is retrieved and available for the technician		
Failed End Condition Post-condition	Technical data retrieval fails and the data cannot be accessed		
Primary, Secondary, Actors	Vehicle database		
Trigger	Successful vehicle identification triggers technical data retrieval		
DESCRIPTION	After identifying the vehicle model, the system retrieves relevant technical data, such as specifications, repair history and maintenance instructions from the vehicle database.		
Main Flow			
Step	**Action**		**Alternate**
3.1	The system begins technical data retrieval immediately after the vehicle identification is confirmed		
3.2	The system sends a request to the vehicle database with the vehicle id (of the identified vehicle)		E.F. 3.2
3.3	The vehicle database processes the request		
3.4	The vehicle database returns relevant technical information		E.F. 3.4
3.5	The system receives the data package and parses the information		
3.6	The system categorizes the data filtering information based on the task requirements		
3.7	The system compiles a summary view of critical information		
3.8	The system displays the summary for technician review		
3.9	The techniciam reviews the data and confirm it is adequate for task selection		
3.10	The system marks data retrieval as complete		
3.11	End of use case		
EXCEPTIONS or ERROR Flow Description **E.F. 3.2:** Error flow at step 2 of Use Case 3: Database Connection Failure The system cannot connect to the vehicle database.			

Step	Branching Action	Alternate
3.2.1	The system retries to restablish the connection	
3.2.2	The system logs the issue and notifies the technician	
3.2.3	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 3.4: Error flow at step 4 of Use Case 3: Data Unavailable

The requested data is unavailable in the database.

Step	Branching Action	Alternate
3.4.1	The system notifies the technician that technical data cannot be retrieved	
3.4.2	The system may suggest contacting technical support	
3.4.3	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 3	Technical Data Retrieval
Priority:	High, essential for providing necessary information	
Product: Performance	- Process and memory capacity: under 100 MB of memory - Throughput: up to 200 data retrievals per hour - Response time: data should be retrieved within 3 seconds	
Product: Efficiency	- Memory usage: 50 MB during data retrieval - Processor usage: should not exceed 10% CPU usage	
Product: Reliability	Must operate correctly 99% of the time	
External: Legislation	- Privacy and data protection: comply with data privacy regulations like GDPR, especially when handling sensitive vehicle information.	
Frequency	Whenever a task requiring technical data is selected (daily use)	
Channels to actors	Accessed interactively via technician's device with data retrieved from a database	

3.2.4 Narrative for Use case 4 Task Selection

USE CASE	4	Task Selection
Goal in Context Brief Description	Allow the technician to select a specific task to perform based on available technical data	
Scope & Level	System. User goal	
Preconditions	- Technical data has been retrieved for the identified vehicle - The technician is logged into the system	
Related Use Cases	UC 1 includes this UC 3 provides the precondition UC 7 gets the preconditions from this postconditions UC 8 gets the precondition from this postconditions	
Success End Condition Post-condition	- The system loads the necessary intructions and resources for the selected task	
Failed End Condition Post-condition	- The technician is unable to select the task or the resources could not load	
Primary, Secondary, Actors	Technician	
Trigger	The techician initiates task selection after reviewing the technical data	
DESCRIPTION	The technician views a list of tasks based on the retrived technical data. The system allows the technician to select a specific task from the list provided. Available tasks are filtered based on the vehicle's characteristics. The system then loads and displays the resources needed for task execution.	

Main Flow		
Step	**Action**	**Alternate**
4.1	The technician acceses the list of available tasks through the system interface	
4.2	The system presents a filtered list of tasks specific to the vehicle model	
4.3	The technician selects a task from the task list	E.F. 4.3
4.4	The system confirms the selection, checking for any additional requirements or dependendies	
4.5	The system retrieves task-specific resources	E.F. 4.5
4.6	The system loads any necessary safety instructions or prerequistes for the selected task	
4.7	The system displays the task instructions for technician review	
4.8	The technician confirms to proceed with the task	
4.9	The system marks task selection as complete	
4.10	End of use case	
EXCEPTIONS or ERROR Flow Description **E.F. 4.3:** Error flow at step 3 of Use Case 4: No Tasks Available		

There are no tasks available for the identified vehicle.

Step	Branching Action	Alternate
4.3.1	The system informs the technician there are no available tasks	
4.3.2	The system returns to technical data view	
4.3.3	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 4.5: Error flow at step 5 of Use Case 4: Task Loading Error

An error occurs while loading task details.

Step	Branching Action	Alternate
4.5.1	The system attempts to reload	
4.5.2	The system logs the error and notifies the technician	
4.5.3	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 4	Task Selection
Priority:	Medium, important for user experience but not critical for system functionality	
Product: Performance	- Process and memory capacity: under 50 MB memory usage (lightweight) - Throughput: up to 20 selections per minute - Response time: task list should populate within 2 seconds	
Product: Efficiency	- Memory usage: below 20 MB for task listing - Processor usage: up to 5% CPU usage	
Product: Reliability	Must operate correctly 98% of the time for displaying tasks	
Organisation: Standards	- Comply with ISO for user interface usability standards	
Frequency	Once per maintenance session (daily use)	
Channels to actors	Interactive, displayed on the technician's device with touch options and drop-down menus	

3.2.5 Narrative for Use case 5 Vehicle Information Update

USE CASE	5	Vehicle Information Update
Goal in Context Brief Description	Updates vehicle information based on completed tasks and maintenance data	
Scope & Level	System. User goal	
Preconditions	- The technician has completed the selected task - The system is connected to the vehicle database	
Related Use Cases	UC 1 includes this UC 6 provides precondition UC 9 triggers this and provides the precondition	
Success End Condition Post-condition	- Vehicle information is successfully updated with the lastest task and maintenance data	
Failed End Condition Post-condition	- The system fails to update the vehicle information in the database	
Primary, Secondary, Actors	Vehicle Database	
Trigger	Task completion by the technician triggers the vehicle information update	
DESCRIPTION	After the technician completes a task, the system updates the vehicle's service record in the database with the latest task and maintenance information.	

Main Flow		
Step	**Action**	**Alternate**
5.1	The technician confirms task completion in the system interface	
5.2	The system compiles relevant data	
5.3	The system formats this data for the vehicle database	E.F. 5.3
5.4	The system sends an update request to the vehicle database	
5.5	The database receives and processes the update request	
5.6	The vehicle's maintenance record is updated	E.F. 5.6
5.7	The system verifies that the update was successfully recorded	
5.8	The system notifies the technician that the update was successful	
5.9	The system logs the update as part of the vehicle's maintenance history	
5.10	The system displays a confirmation to the technician	
5.11	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 5.3: Error flow at step 3 of Use Case 5: Data Formatting Error

An error occurs during data formatting.

Step	**Branching Action**	**Alternate**
5.3.1	The system attempts to reformat the data	

	5.3.2	The system logs the error and informs the technician	
	5.3.3	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 5.6: Error flow at step 6 of Use Case 5: Database Update Failure

The database fails to process the update.

Step	Branching Action	Alternate
5.6.1	The system retries the request	
5.6.2	The system logs the error and informs the technician	
5.6.3	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 5	Vehicle Information Update
Priority:	High, critical for maintaining accurate and up to date vehicle information	
Product: Performance	- Process and memory capacity: up to 100 MB of memory - Throughput: up to 50 concurrent updates - Response time: the database should reflect the changes in less than 1 minute after confirmation	
Product: Efficiency	- Memory usage: up to 50 MB for update process - Processor usage: up to 5% CPU usage per update transaction	
Product: Reliability	Must operate correctly 99% of the time	
External: Legislation	Comply with data retention and privacy regulations, especially with sensitive information	
Frequency	Frequent use, when new information needs to be recorded	
Channels to actors	Interactive updates submitted via the device interface. Secure transmittions to the database	

3.2.6 Narrative for Use case 6 Report Generation

USE CASE	6	Report Generation
Goal in Context **Brief Description**	Generate a report documenting the steps performed	
Scope & Level	System. User goal	
Preconditions	- The technician has successfully completed the task - All task steps have been recorded and logged in the system	
Related Use Cases	UC 1 includes this UC 5 gets precondition from this postconditions UC 9 triggers this and provides the precondition	
Success End Condition **Post-condition**	- A report is successfully generated and stored in the system	
Failed End Condition **Post-condition**	- The report generation fails - The task is undocumented	
Primary, Secondary, Actors	Technician	
Trigger	Task completions triggers report generation	
DESCRIPTION	After the technician completes a task, the system generates a detailed report documenting the steps performed, time taken, errors encountered and any additional observations. This report can be reviewed by the technician and stored in the system for future reference.	

Main Flow		
Step	**Action**	**Alternate**
6.1	The task is marked as completed in the system	
6.2	The system retrieves all recorded data for the task	
6.3	The system compiles the data into a structured report format	E.F. 6.3
6.4	The system generates a summary of the task and adds it to the report	
6.5	The system attaches any relevant images or other media captured during the task	
6.6	The system displays a draft fo the report to the technician for review	
6.7	The technician reviews the report and confirms it is complete	
6.8	The system saves the report to the vehicle's maintenance history	E.F. 6.8
6.9	The system confirms report generation success and logs the report in the technician's task history	
6.10	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 6.3: Error flow at step 3 of Use Case 6: Data Missing for Report

Some required data to generate the report is missing.

Step	**Branching Action**	**Alternate**

6.3.1	The system notifies the technician	
6.3.2	The system requests manual review	
6.3.3	The technician inputs required data	
6.3.4	Go to Main Flow step 6.4	

EXCEPTIONS or ERROR Flow Description
E.F. 6.8: Error flow at step 8 of Use Case 6: Report Storage Failed

The system fails to save the report.

Step	Branching Action	Alternate
6.8.1	The system retries to save the report	
6.8.2	The system logs the issue and notifies the technician	
6.8.3	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 6	Report Generation
Priority:	Medium, necessary for logging information but not critical for system functionality	
Product: Performance	- Process and memory capacity: under 200 MB memory - Throughput: up to 50 reports per hour - Response time: report should generate in under 10 seconds	
Product: Efficiency	- Memory usage: 100 MB for generated report file - Processor usage: should not exceed 10% CPU usage	
Product: Reliability	Must operate correctly 98% of the time for report generation and storage	
Organisation: Standards	Reports must meet documentation standards	
Organisation: Delivery	Reports are catalogued monthly, technicians have access to them immediately after generation	
External: Legislation	Comply with GDPR and report storage complies with data retention policies	
Frequency	At the end of each task session (daily use)	
Channels to actors	Generated as a static file in PDF format	
OPEN ISSUES	- How to handle users with older devices?	

3.2.7 Narrative for Use case 7 Support Session Initiation

USE CASE	7	Support Session Initiation	
Goal in Context Brief Description	Initiate a support session to solve issues encountered during tasks		
Scope & Level	System. User goal		
Preconditions	- The technician is performing a task		
Related Use Cases	UC 1 includes this UC 4 provides precondition		
End Condition Post-condition	- A support session is successfully initiated - The technician is connected to a specialist		
Failed End Condition Post-condition	- The support session fails - The technician is left without assistance		
Primary, Secondary, Actors	Technician Support specialist		
Trigger	The technician encounters an issue and selects the option to initiate a support session		
DESCRIPTION	The technician can initiate a support session if they encounter or need assistance during the task completion. The support session connects the technician to a remote expert who can provide guidance.		

Main Flow			
Step	**Action**		**Alternate**
7.1	The technician selects the "Initiate Support Session" option on a task step		
7.2	The system displays a confirmation message to ensure the technician wants to proceed		
7.3	The technician confirms the request for support		
7.4	The system connects to the support network and searches for an available support specialist		E.F. 7.4
7.5	The system shares task details with specialist		
7.6	The system notifies the technician that a support specialist is connecting		
7.7	The support specialist estalishes a communication channel		
7.8	The technician and specialist communicate to resolve the issue		E.F. 7.8
7.9	The technician receives guidance from the specialist		
7.10	The system logs the support session details		
7.11	End of use case		
EXCEPTIONS or ERROR Flow Description **E.F. 7.4:** Error flow at step 4 of Use Case 7: No Available Support Specialist No support specialist is available at the moment.			
Step	**Branching Action**		**Alternate**

7.4.1	The system notifies the technician	
7.4.2	The system offers to retry after some time	
7.4.3	Go to Main Flow step 7.4	

EXCEPTIONS or ERROR Flow Description
E.F. 7.8: Error flow at step 8 of Use Case 7: Connection Failure

The connection to the support specialist fails.

Step	Branching Action	Alternate
7.8.1	The system notifies to the technitian of the connection failure	
7.8.2	The system retries to establish the connection	
7.8.3	The system logs the issue	
7.8.4	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 7	Support Session Initiation
Priority:	High, critical for technician assistance during complex tasks	
Product: Performance	- Process and memory capacity: under 100 MB memory - Throughput: up to 20 active session at the same time - Response time: connection initiation should complete in under 10 seconds	
Product: Efficiency	- Memory usage: no more than 50 MB - Processor usage: up to 15% CPU usage	
Product: Reliability	Must operate correctly 98% of the time, regarding connection stability and quality	
External: Ethical	Support sessions should respect the technician's privacy and be closed immediately after the task is completed	
Frequency	Frequent use, on demand by the technician	
Channels to actors	Interactive, connect the technician to a remote specialist via real-time video chat	
OPEN ISSUES	- How to handle if there are no available suport specialists?	

3.2.8 Narrative for Use case 8 3D Model and Instruction Generation

USE CASE	8	3D Model and Instruction Generation
Goal in Context Brief Description	Generate 3D models related to the vehicle parts and display instructions.	
Scope & Level	System. User goal	
Preconditions	- Vehicle is identified - Technical data is available - The technician has selected a specific task	
Related Use Cases	UC 1 includes this UC 2 provides precondition UC 3 provides precondition UC 4 provides precondition	
Success End Condition Post-condition	- 3D models and instructions are generated and displayed for the technician	
Failed End Condition Post-condition	- The system fails to generate the models or instructions	
Primary, Secondary, Actors		
Trigger	Task selection triggers the 3D models and instruction generation	
DESCRIPTION	Based on the selected task and vehicle model, the system generates 3D models of the relevant parts of the identified vehicle and diplays step-by-step instructions to guide the technician through the procedure.	

Main Flow		
Step	**Action**	**Alternate**
8.1	The system receives the task selection and confirms specific task requirements	
8.2	The system retrieves the necessary technical data and 3D model files related to the vehicle and task	E.F. 8.2
8.3	The system loads the 3D model of the relevant part to assembly	
8.4	The system positions and adjusts the model to ensure clear visibility for the technician	E.F. 8.4
8.5	The system retrieves detailed step-by-step instructions for the selected task	
8.6	The system overlays the instructions onto the 3D model	
8.7	The system allows the technician to rotate, zoom and inspect the model for a detailed view	
8.8	The system displays the step's instructions with model highlights for important parts	
8.9	End of use case	
EXCEPTIONS or ERROR Flow Description **E.F. 8.2:** Error flow at step 2 of Use Case 8: Missing 3D Model or Instruction Data		

A necessary model or instruction data is missing.		
Step	**Branching Action**	**Alternate**
8.2.1	The system notifies the technician and logs the missing data	
8.2.2	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 8.4: Error flow at step 4 of Use Case 8: Model Rendering Failed

The 3D model fails to render.

Step	**Branching Action**	**Alternate**
8.4.1	The system notifies the technician	
8.4.2	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	**Branching Action**	**Alternate**

Choose a limited number appropriate non-functional requirements relevant to the Use Case.

Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

- External, imposed by outside bodies

RELATED INFORMATION	Use Case: 8	3D Model and Instruction Generation
Priority:	High, essential for guiding the technician through the task	
Product: Performance	- Process and memory capacity: up to 500 MB RAM for smooth 3D rendering - Throughput: up to 10 active sessions - Response time: up to 5 seconds for model loading	
Product: Efficiency	- Memory usage: compress models to reduce memory usage - Processor usage: up to 20% CPU usage for intensive interaction with 3D models	
Product: Reliability	Must operate correctly 95% of the time	
Organisation: Standards	-Comply with CAD standards for consistent model quality	
Organisation: Delivery	Update every 3 months for new model integrations and improvements	
External: Ethical	Models and instructions must respect intellectual property rights	
Frequency	Frequent use	
Channels to actors	Interactive via AR on the technician's device	

3.2.9 Narrative for Use case 9 Task Completion

USE CASE	9	Task Completion
Goal in Context **Brief Description**	Complete a task and verify it	
Scope & Level	System. User goal	
Preconditions	- The technician has completed all steps in the task - The system has tracked the technician's progress	
Related Use Cases	UC 1 includes this UC 5 gets precondition from this postcondition UC 6 gets precondition from this postcondition	
Success End Condition Post-condition	- The task is marked as completed	
Failed End Condition Post-condition	- The system fails to confirm task completion	
Primary, Secondary, Actors	Technician	
Trigger	The technician completes all task steps and confirms the task is finished	
DESCRIPTION	After following the provided instructions, the technician completes the task. The system verifies task completion, updates progress logs, and prompts for any final details before marking the task as completed.	

Main Flow		
Step	**Action**	**Alternate**
9.1	The technician confirms task completion	
9.2	The system verifies all steps have been marked as completed	
9.3	The system prompts the technician to comfirm completion accuracy	
9.4	The technician confirms all steps were performed correctly	E.F. 9.4
9.5	The system logs the final task completion status	
9.6	The system prompts the technician to add any final notes or observations	
9.7	The technician enters additional notes and marks the task as finished	
9.8	The system saves the completion data	E.F. 9.8
9.9	The system confirms the task has been completed	
9.10	End of use case	

EXCEPTIONS or ERROR Flow Description
E.F. 9.4: Error flow at step 4 of Use Case 9: Step Completion Verification Failed

The system cannot verify that all steps have been completed.

Step	**Branching Action**	**Alternate**
9.4.1	The system notifies the technician it was unable to verify step completion	

Step	Branching Action	Alternate
9.4.2	The system prompts the technician to manually verify	
9.4.3	The system logs the issue	
9.4.4	Go to Main Flow step 9.5	

EXCEPTIONS or ERROR Flow Description
E.F. 9.8: Error flow at step 8 of Use Case 9: Data Save Failed

The system fails to save task completion data.

Step	Branching Action	Alternate
9.8.1	The system logs the issue and informs the technician	
9.8.2	End of use case	

ALTERNATIVE or VARIATION Flow Description
No alternative flows as no options given in Use Case

Step	Branching Action	Alternate

Choose a limited number appropriate non-functional requirements relevant to the Use Case.
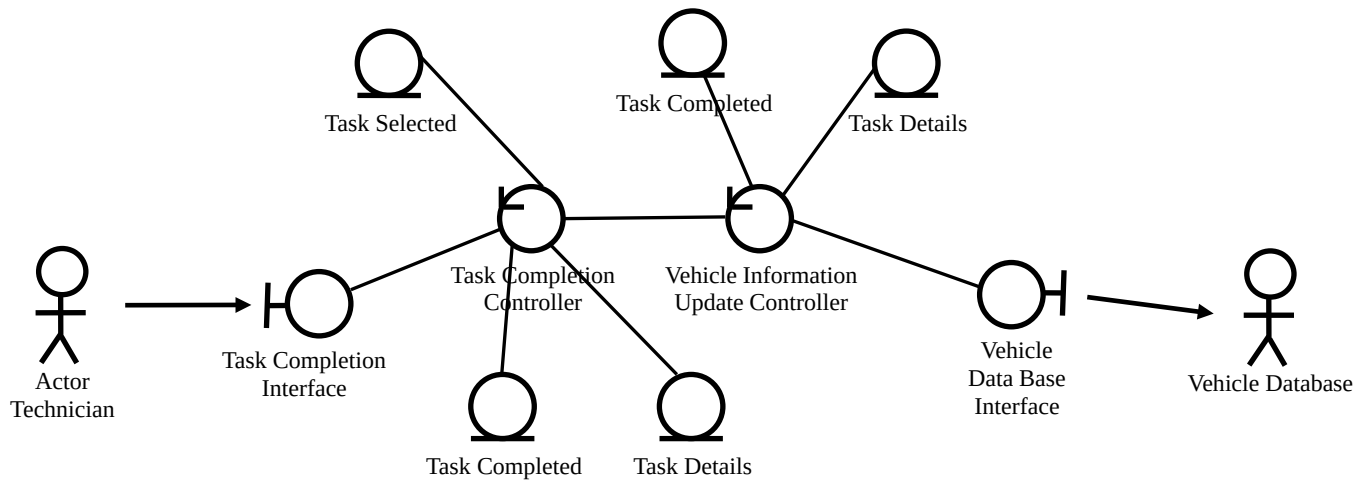
Non Functional Requirements can be categorised as

- Product related

- Organisation related, process and approaches set by the company

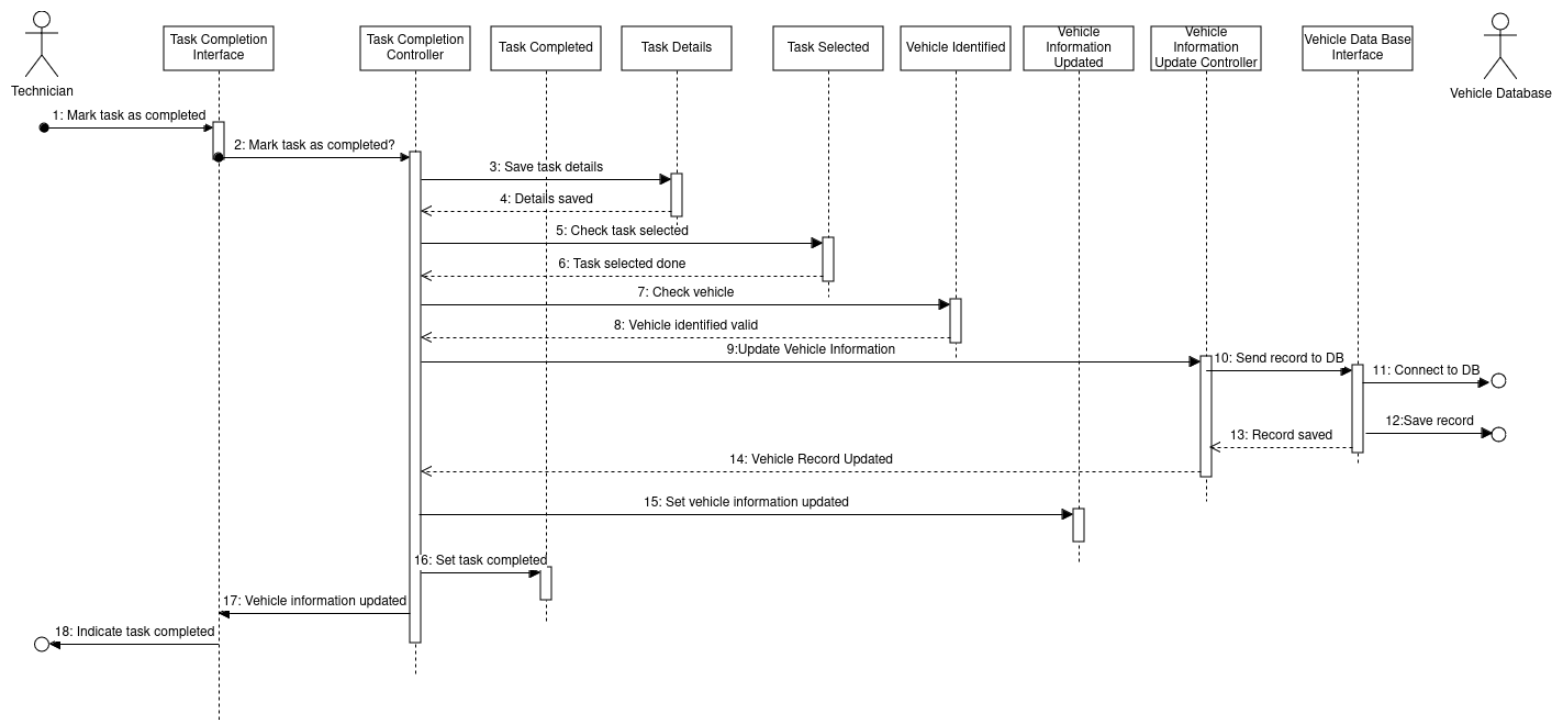- External, imposed by outside bodies

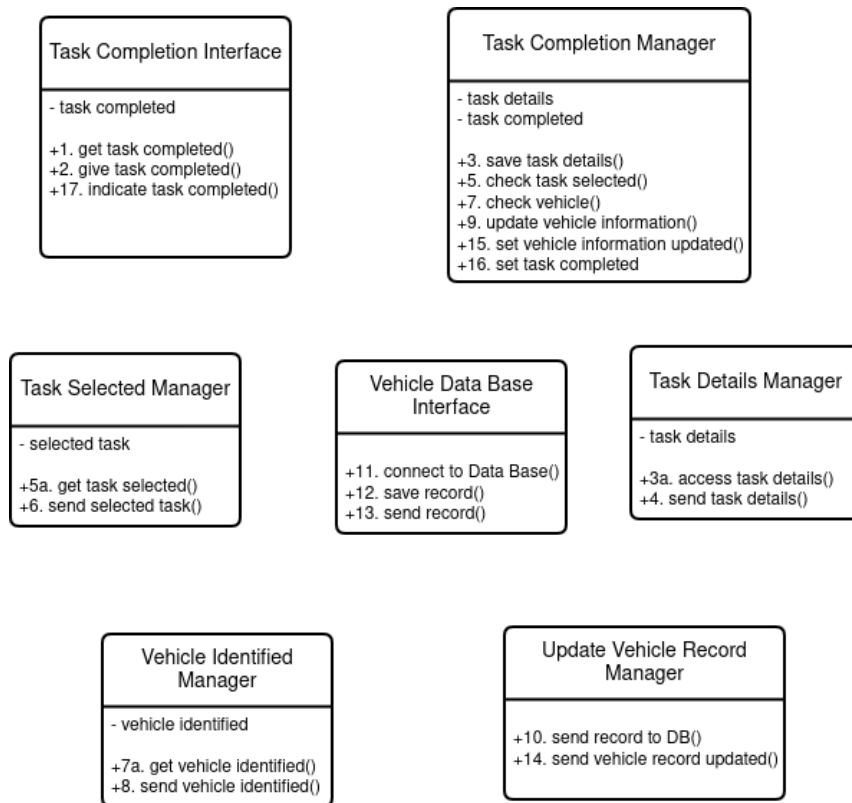| RELATED INFORMATION	Use Case: 9	Task Completion
Priority:	High, essential for marking the task as finished	
Product: Performance	- Process and memory capacity: under 50 MB of memory for marking tasks as complete - Throughput: up to 100 task completions per hour - Response time: up to 5 seconds for logging task completion	
Product: Efficiency	- Memory usage: up to 20 MB per task - Processor usage: up to 5% CPU usage	
Product: Reliability	Must operate correctly 99% of the time for recording and storing completion data	
Organisation: Delivery	Completion logs must be available immediately after completion	
Frequency	Frequent use, after each maintenance task	

4.0 Other Digrams and Classes

4.1 Analysis Classes

4.2 "Improper" Sequence Diagram Using Analysis Classes

4.3 Design Classes

Task Completion Interface

- task completed

+1. get task completed()
+2. give task completed()
+17. indicate task completed()

Task Completion Manager

- task details
- task completed

+3. save task details()
+5. check task selected()
+7. check vehicle()
+9. update vehicle information()
+15. set vehicle information updated()
+16. set task completed

Task Selected Manager

- selected task

+5a. get task selected()
+6. send selected task()

Vehicle Data Base Interface

+11. connect to Data Base()
+12. save record()
+13. send record()

Task Details Manager

- task details

+3a. access task details()
+4. send task details()

Vehicle Identified Manager

- vehicle identified

+7a. get vehicle identified()
+8. send vehicle identified()

Update Vehicle Record Manager

+10. send record to DB()
+14. send vehicle record updated()

4.4 Design Class Sequence Diagram