C-SW312 – Deliverable #1 Report

Automated University Garage Management System (AUGMS)

Semester: Fall 2025
Course: Systems Analysis and Design (C-SW312)

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System Vision Document

University parking areas frequently suffer from disorganization, congestion, and inefficient manual verification processes.
Students and faculty often spend unnecessary time searching for available parking spots, while attendants must manually verify vehicle permissions—resulting in delays, long queues, and increased chances of human error.
Although the university has already installed smart sensors, these devices remain underutilized and are not integrated into daily parking operations.
The proposed Automated University Garage Management System (AUGMS) directly addresses these issues by offering a digital, automated solution that manages the entire parking process—from vehicle registration and verification to real-time parking space monitoring—all through seamless integration with the university's existing sensors.

System Capabilities

- User Registration – Collects and stores student and faculty details such as name, university ID, car model, and license plate.
- Automated Entry and Exit Verification – Matches incoming vehicle data with registered records to grant or deny garage access.
- Real-Time Occupancy Tracking – Utilizes the existing sensor infrastructure to monitor and update parking space availability continuously.
- Live Parking Display – Presents up-to-date parking data to both users and administrators through intuitive web dashboards.
- Service Management – Manages requests for optional on-site services such as EV charging and car cleaning.
- Activity Logging – Records vehicle entries, exits, and service usage to maintain accurate operational history and support future analysis.
- Scalability and Flexibility – Designed with a modular structure that allows adaptation for various environments.

Business Benefits

The AUGMS provides the following key benefits:
• Efficiency – Reduces congestion and manual effort by automating verification processes.

• Time Saving – Enables users to find available parking spots instantly.
• Security – Enhances safety by preventing unauthorized access.
• Resource Utilization – Maximizes use of existing smart sensors.
• User Satisfaction – Improves overall user experience.
• Scalability – Adaptable for future expansion.

Project Scope

In Scope:
• Vehicle registration for students and faculty.
• Automated verification and gate access.
• Real-time parking monitoring and dashboards.
• Management of optional on-site services (EV charging, car cleaning).
Out of Scope:
• Mobile application development.
• Third-party sensor integration.
• Online payment systems (future upgrade).
• AI-based predictive analytics (future phase).

Expected Outcome

By implementing AUGMS, the university will achieve an efficient, secure, and sustainable parking experience.
The system minimizes delays, enhances operational flow, and maximizes the value of existing smart sensor infrastructure.
It also supports future smart campus initiatives.

Stakeholder Identification

The following table lists all internal and external stakeholders for AUGMS:

Stakeholder	Type	Category	Role / Responsibilities	Interest / Impact
Students	Internal	Operational	Register and use parking system.	Convenience and speed.
Faculty Members	Internal	Operational	Access garage and view availability.	Reliability and ease.
Garage Administrators / Staff	Internal	Operational	Manage registrations and monitor spaces.	Efficiency and control.
IT Department	Internal	Support	Maintain system and troubleshoot.	Stability and security.
University Management	Internal	Executive	Oversee reports and system success.	Data-driven decisions.
Security Department	Internal	Operational	Monitor entries and exits.	Safety and accuracy.
Maintenance & Sensor Providers	External	Operational	Ensure sensor operation.	System integration.
Visitors (Future)	External	Operational	Temporary parking users.	Smooth access.

Primary stakeholders include students, faculty, and administrators, who interact daily with the system.

Supporting stakeholders such as IT and maintenance ensure reliability, while executive stakeholders oversee performance and strategy.

Functional Requirements

The **Automated University Parking System (AUPS)** requirements have been carefully categorized into **functional** and **non-functional** aspects to ensure comprehensive system behavior, high performance, and user satisfaction.
These requirements were identified and refined through interviews, questionnaires, and observations conducted with key stakeholders including students, faculty members, administrators, and IT personnel.

The following subsections outline the system's main functionalities and quality attributes that define how the system should perform under various conditions.

Functional Requirements

The functional requirements describe the core operations and services that the AUPS must provide to achieve its objectives.

Key Functional Requirements:

1. **User Registration**
   The system shall allow students and faculty members to register by entering their personal and vehicle details such as name, university ID, car model, and license plate number.
2. **Secure Data Storage**
   All user and vehicle information shall be securely stored in the system's centralized database to ensure data integrity and privacy.
3. **Automated Vehicle Verification**
   The system shall automatically verify the vehicle's license plate using the existing sensor network at the entry and exit gates.
4. **Access Control**
   Based on verification results, the system shall either grant or deny garage access, ensuring that only authorized users can enter.
5. **Real-Time Parking Monitoring**
   The system shall continuously monitor parking space availability through sensor input and update occupancy data in real time.
6. **Administrator Dashboard**
   Administrators shall be able to view system activity, monitor available and occupied spaces, manage registered users, and handle service requests.
7. **Service Management**
   The system shall handle requests for additional services such as electric vehicle (EV) charging and car cleaning.
8. **Activity Logging**
   The system shall record every vehicle's entry, exit, and service usage in the activity log for reporting and auditing purposes.

9. **Report Generation**
   The system shall generate daily and monthly reports summarizing parking occupancy, peak hours, and service utilization trends.
10. **Scalability and Integration**
    The system shall be capable of integrating additional sensors and expanding to multiple parking areas with minimal reconfiguration.

Non-Functional Requirements

Non-functional requirements specify the quality standards, performance metrics, and constraints that the system must meet to operate effectively.

1. **Performance:**
   The system shall process license plate data and verify vehicle access within two seconds of detection to minimize queue times.
2. **Usability:**
   The interface shall be intuitive and user-friendly, requiring minimal training for both administrators and end-users.
3. **Security:**
   All sensitive information shall be encrypted, and user access shall be controlled through authentication mechanisms.
4. **Reliability:**
   The system shall maintain at least 99% operational uptime during university working hours and ensure consistent data accuracy.
5. **Maintainability:**
   The system architecture shall be modular to allow for easy updates, debugging, and feature enhancements.
6. **Scalability:**
   The system shall be capable of supporting additional users, vehicles, and sensors without a significant decline in performance.
7. **Portability:**
   The web-based application shall be compatible with multiple browsers and accessible from both desktop and mobile devices.

Summary

The defined functional and non-functional requirements ensure that the Automated University Parking System (AUPS) will deliver a secure, efficient, and scalable solution for managing university parking facilities.
A detailed tabular version of these requirements, including their priority levels and dependencies, is available in the supplementary document **“Functional_Requirements.docx.”**

Requirements Elicitation Techniques

To ensure a comprehensive understanding of user needs and system objectives, several **requirements elicitation techniques** were employed during the analysis phase of the **Automated University Parking System (AUPS)** project.
These techniques enabled the team to gather both qualitative and quantitative data from various stakeholders including students, faculty, garage administrators, and IT personnel.

The combination of these methods ensured that the collected requirements were **accurate, validated, and aligned** with real operational needs.

Applied Elicitation Techniques

1. **Interviews**
   Structured interviews were conducted with key stakeholders such as parking staff, administrators, and frequent users to gather detailed insights about existing issues, workflow inefficiencies, and feature expectations.
   This technique provided in-depth qualitative data that helped shape the functional requirements and system priorities.
2. **Questionnaires and Surveys**
   Questionnaires were distributed to students and faculty members to collect broad feedback regarding their parking experiences and desired system features.
   The quantitative data gathered from these surveys supported trend analysis and user preference identification.
3. **Observation**
   Direct observation sessions were conducted at the university parking areas to analyze real-time operations, vehicle flow, and sensor interactions.
   This allowed the team to identify practical challenges such as congestion patterns and manual verification delays.
4. **Document Analysis**
   Existing parking policies, access records, and infrastructure diagrams were reviewed to understand current processes and system constraints.
   This helped ensure that the new system aligns with university regulations and existing sensor technology.
5. **Research and Benchmarking**
   A comparative study of other smart parking systems and IoT-based solutions was carried out to identify best practices, standard technologies, and potential areas of innovation for AUPS.

Outcome

The combination of these elicitation techniques ensured a **well-rounded understanding** of system requirements, user expectations, and environmental constraints.
This approach reduced the risk of incomplete or conflicting requirements and provided a solid foundation for developing accurate use cases, workflows, and design specifications.

Interview Agenda and Questionnaire

The **interview agenda and questionnaire** were designed to facilitate structured discussions with key stakeholders involved in the **Automated University Parking System (AUPS)** project.
These tools ensured that both **functional** and **non-functional** requirements were thoroughly explored, documented, and validated.

The main objective of these sessions was to collect detailed information about user needs, system expectations, operational challenges, and desired improvements to the current parking process.

Interview Agenda

The interviews were conducted in a semi-structured format, allowing flexibility for open discussion while maintaining focus on specific project objectives.

Agenda Overview:

1. **Introduction (5 minutes):**
   Introduce the purpose of the project, explain the interview process, and ensure participants understand their role in the study.
2. **Current Parking Challenges (10 minutes):**
   Discuss existing issues with parking management, including manual verification, congestion, and lack of real-time updates.
3. **System Expectations (10 minutes):**
   Identify features and improvements stakeholders expect from the Automated University Parking System (AUPS).
4. **Operational Requirements (10 minutes):**
   Explore workflow needs from the perspective of garage administrators, IT staff, and end-users.
5. **Non-Functional Requirements (10 minutes):**
   Discuss performance, security, reliability, and usability expectations to ensure system quality.
6. **Conclusion (5 minutes):**
   Summarize key discussion points, clarify open questions, and thank participants for their input.

Questionnaire

In addition to interviews, a structured questionnaire was distributed to students, faculty, and parking staff to capture broader feedback and quantify user perspectives.

Example Questions:

1. How often do you use the university parking facilities?
2. How would you rate the current parking process in terms of convenience and efficiency?
3. Have you experienced any recurring issues while entering or exiting the garage?
4. Would you be interested in a system that shows live parking availability before arrival?
5. How important do you consider data security and privacy in such a system?
6. Which additional services (e.g., EV charging, car cleaning) would you find most useful?
7. How often do you believe maintenance or technical issues occur in the current setup?
8. What features would you like to see in an automated parking management system?

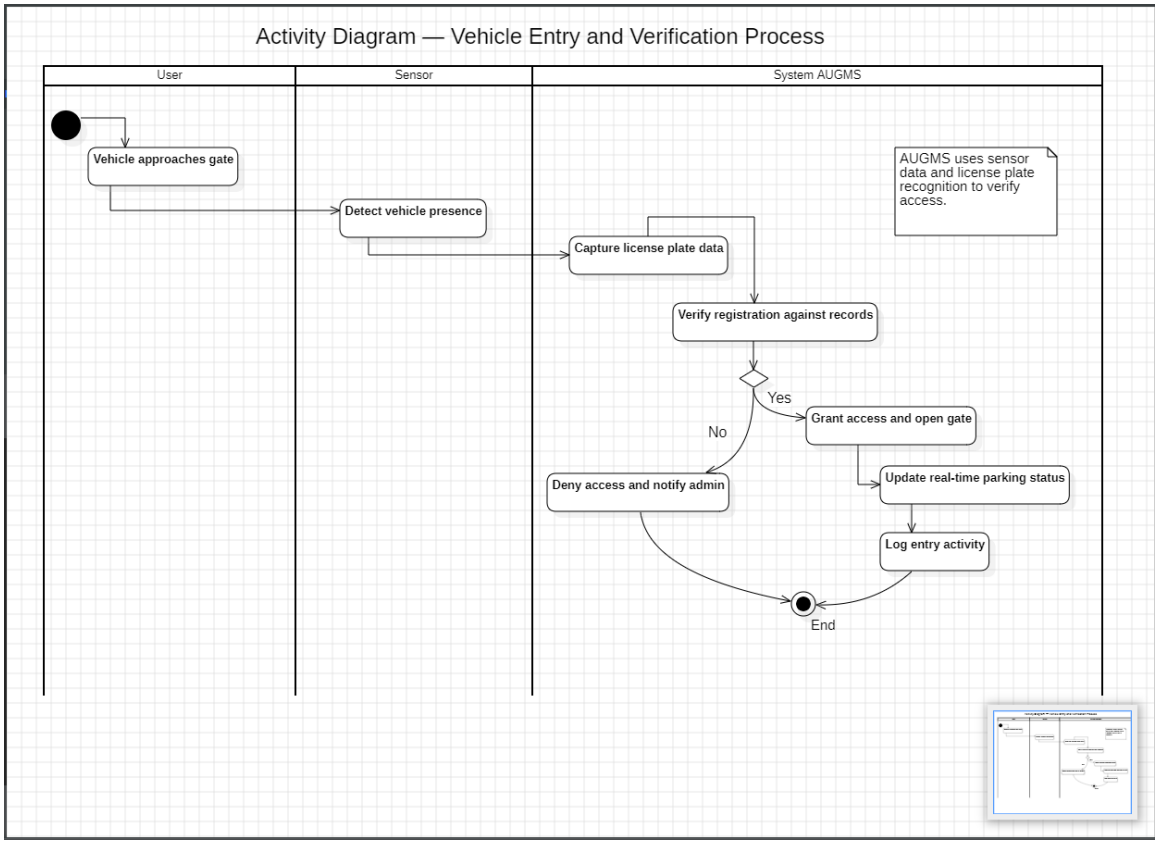
Outcome

The responses from the interviews and questionnaires provided **critical insights** into user preferences, operational gaps, and key functional priorities.
These findings played an essential role in defining the **Functional Requirements**, **System Capabilities**, and **Workflow Design** of the AUPS project.

A complete record of the conducted interviews, question sets, and collected responses is available in the accompanying document
"Interview_Agenda_and_Questionnaire.docx."

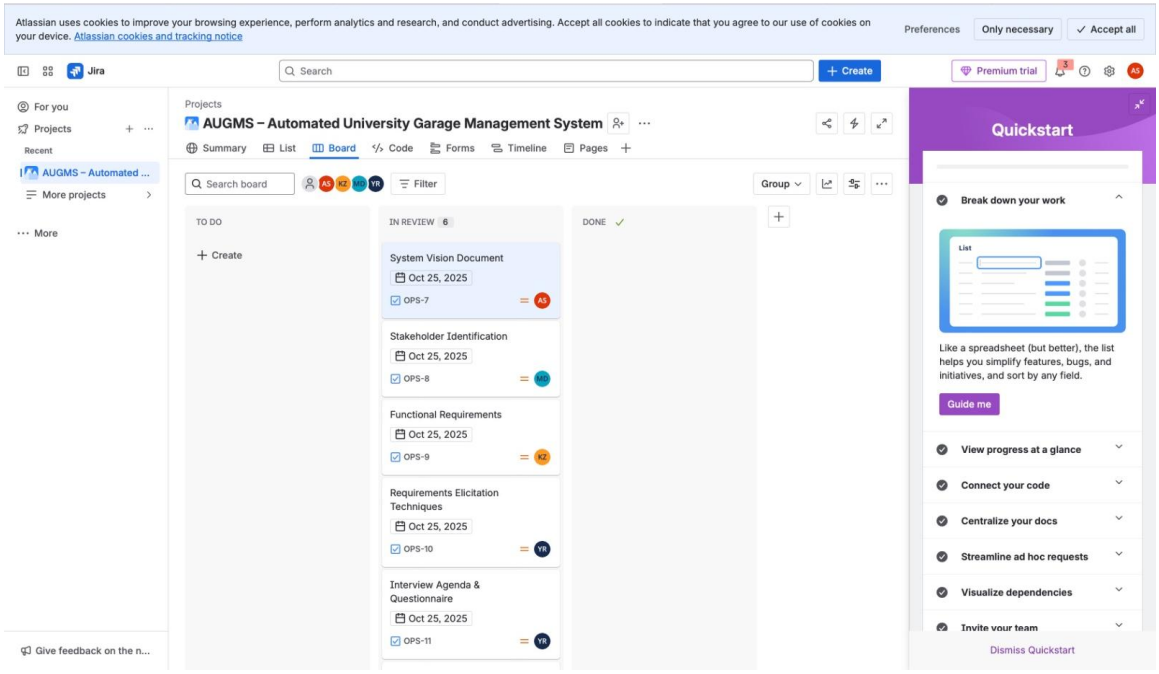
Workflow Documentation (Activity Diagram)

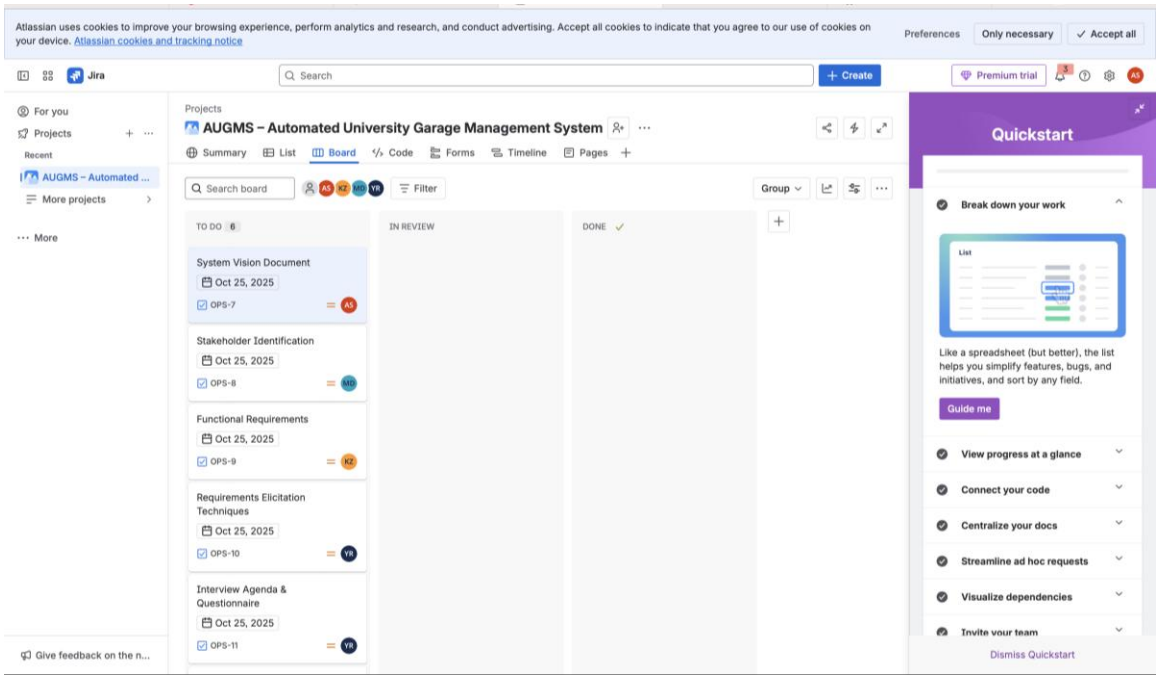
The following activity diagram represents the **Vehicle Entry and Verification Process** in the **Automated University Parking System (AUPS)**. It illustrates how the system manages vehicle detection, verification, and access control in an automated manner. When a vehicle approaches the gate, the system detects it through installed sensors, captures its license plate, and compares it against the registered database. If the license plate is recognized, the system grants access and updates the parking availability status. If not, access is denied and the event is logged for administrative review. This workflow ensures secure, efficient, and real-time parking management.

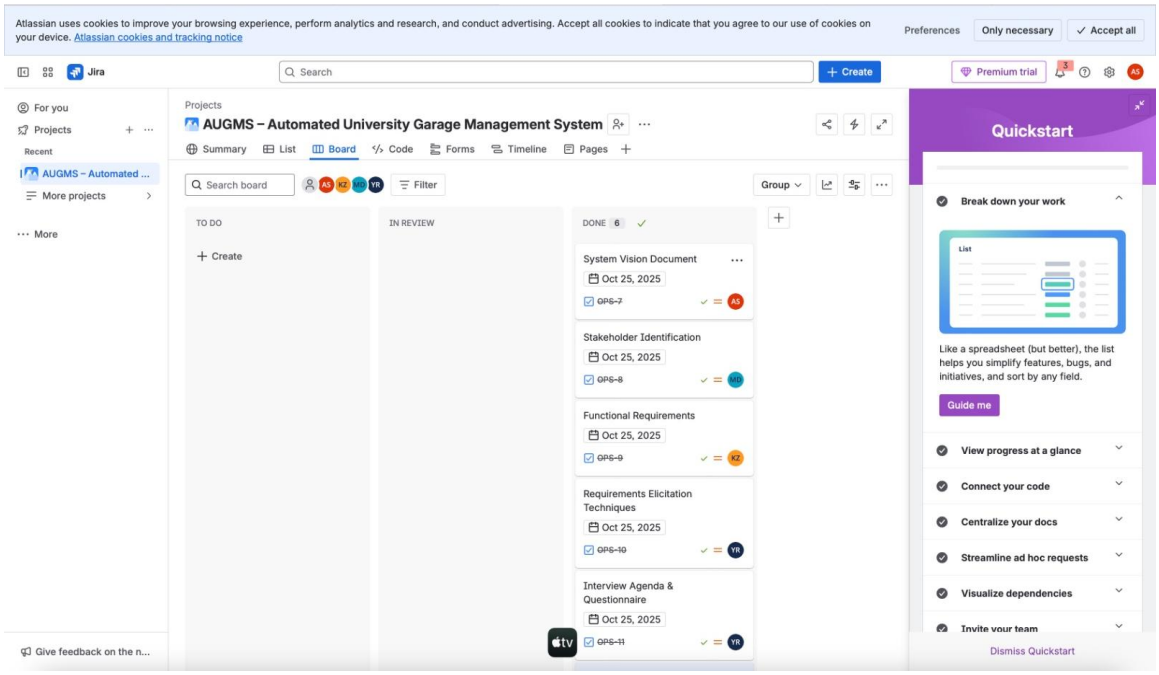


Activity Diagram – Vehicle Entry and Verification Process

Jira Project Snapshots



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AUGMS – Automated ...
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IN REVIEW
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OPS-9
Requirements Elicitation Techniques
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Interview Agenda & Questionnaire
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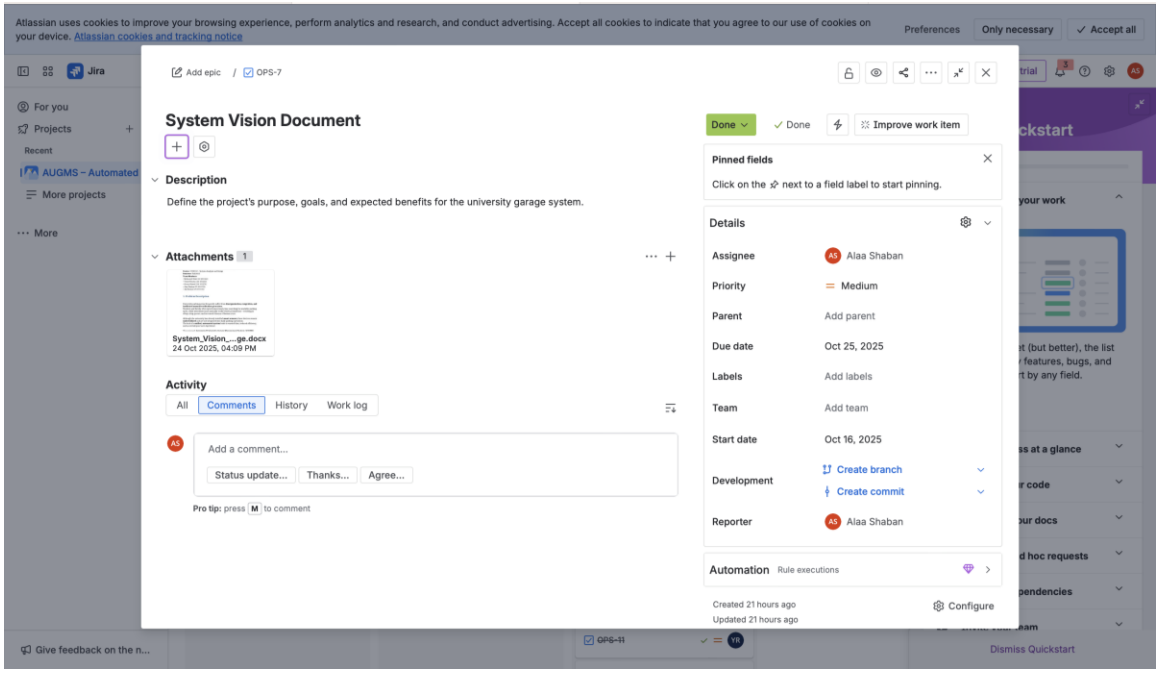
OPS-11
Give feedback on the n...
Quickstart
Break down your work
List
Like a spreadsheet (but better), the list helps you simplify features, bugs, and initiatives, and sort by any field.
Guide me
View progress at a glance
Connect your code
Centralize your docs
Streamline ad hoc requests
Visualize dependencies
Invite your team
Dismiss Quickstart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Preferences
Only necessary
Accept all
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Add epic / OPS-7
System Vision Document
Description
Define the project's purpose, goals, and expected benefits for the university garage system.
Attachments 1
System_Vision_...ge.docx
24 Oct 2025, 04:09 PM
Activity
All
Comments
History
Work log
Add a comment...
Status update...
Thanks...
Agree...
Pro tip: press M to comment
Done
Done
Improve work item
Pinned fields
Click on the next to a field label to start pinning.
Details
Assignee
Alaa Shaban
Priority
Medium
Parent
Add parent
Due date
Oct 25, 2025
Labels
Add labels
Team
Add team
Start date
Oct 16, 2025
Development
Create branch
Create commit
Reporter
Alaa Shaban
Automation
Rule executions
Created 21 hours ago
Updated 21 hours ago
Configure
Give feedback on the n...
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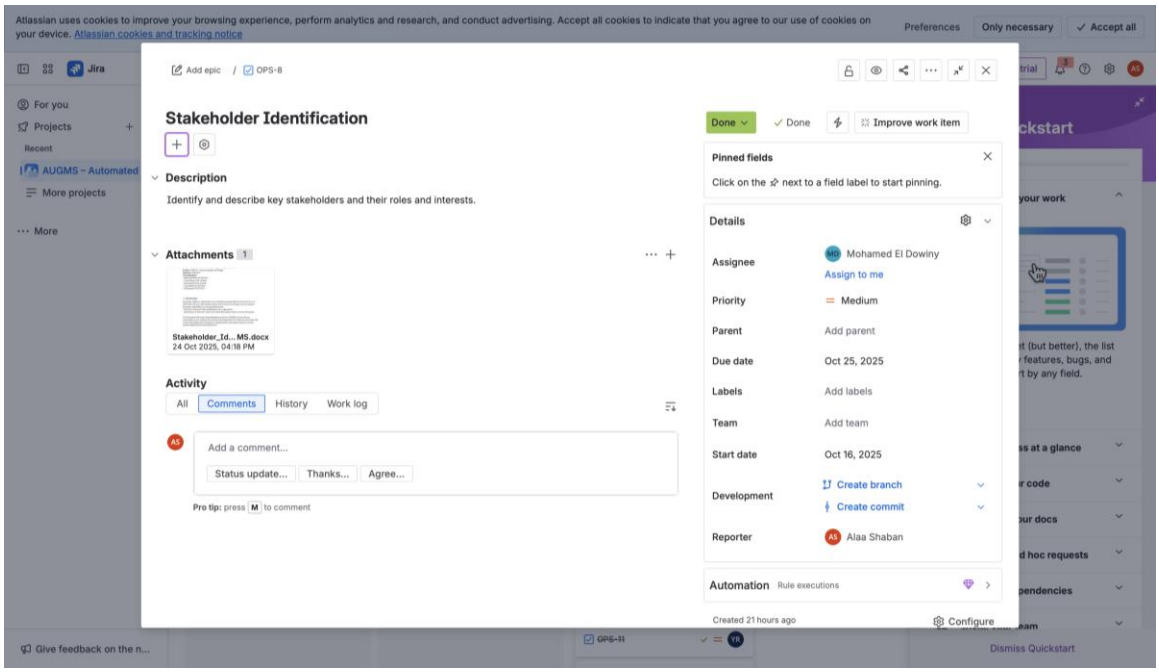
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Add epic / OPS-8
Stakeholder Identification
Description
Identify and describe key stakeholders and their roles and interests.
Attachments 1
Stakeholder_Id... MS.docx
24 Oct 2025, 04:18 PM
Activity
All
Comments
History
Work log
Add a comment...
Status update...
Thanks...
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Pro tip: press M to comment
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Improve work item
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Click on the next to a field label to start pinning.
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Assignee
Mohamed El Dowiny
Assign to me
Priority
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Parent
Add parent
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Oct 25, 2025
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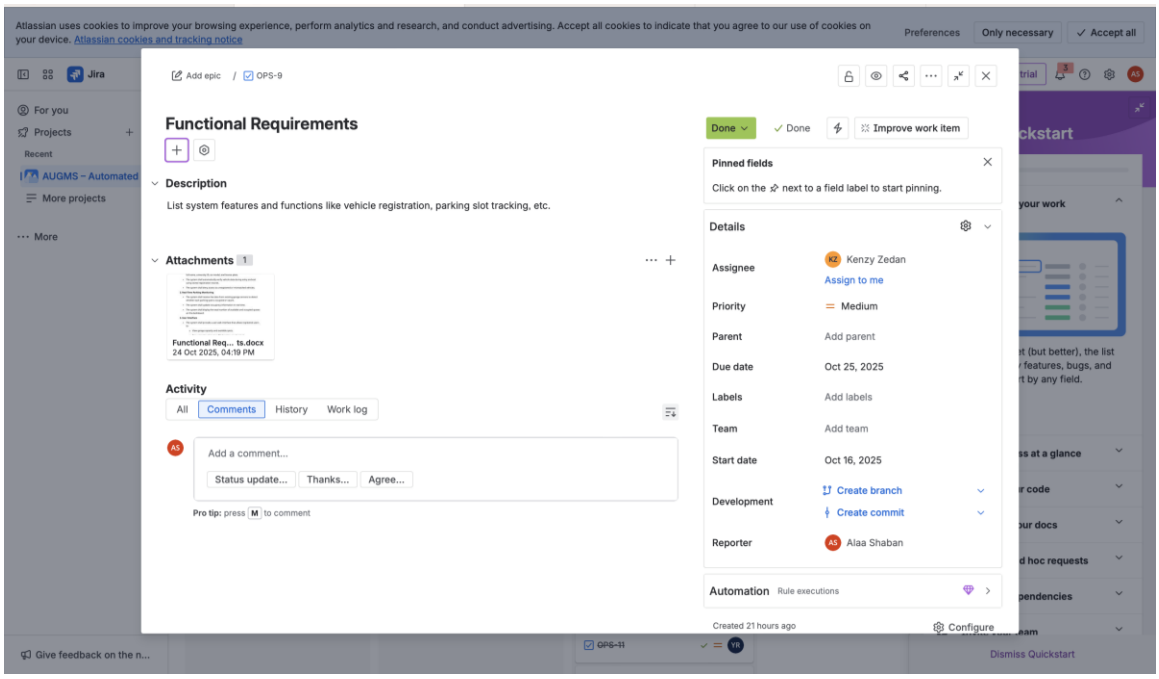
Functional Requirements
Description
List system features and functions like vehicle registration, parking slot tracking, etc.
Attachments 1
Activity
All
Comments
History
Work log
Add a comment...
Status update...
Thanks...
Agree...
Pro tip: press M to comment
Done
Improve work item
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Kenzy Zedan
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Alaa Shaban
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References And Tools

- Satzinger, J. W., Jackson, R. B., & Burd, S. D. (2016). Systems Analysis and Design in a Changing World (7th ed.). Cengage Learning.
- Lecture Slides: C-SW312 – Chapters 1 & 2.
- StarUML Documentation.
- Jira Project Management Tool.

GitHub

https://github.com/alyhassankamel/Automated-University-Parking-System.git