جامعة الأخوين

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AL AKHAWAYN UNIVERSITY

Semester Project: Final Report

CSC 4307 01

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e-Ifrane

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Abstract

This final report outlines the design, development, and implementation of a web application aimed at empowering citizens to actively contribute to the improvement of urban infrastructure by reporting anomalies observed in the streets. The application leverages Agile software engineering principles to ensure flexibility, responsiveness, and continuous improvement in addressing the diverse and dynamic needs of both citizens and specialized authorities.

The web application provides a user-friendly interface allowing citizens to effortlessly submit reports on various anomalies such as potholes, damaged signage, malfunctioning streetlights, and other issues impacting public spaces. The Agile methodology is employed to foster collaboration between citizens and authorities throughout the development process, ensuring that the application evolves to meet the evolving expectations and requirements of its users.

Key features of the application include real-time anomaly reporting, multimedia uploads for detailed issue documentation, and a feedback loop that enables citizens to track the resolution progress of their reported anomalies. By adopting Agile practices such as iterative development, continuous feedback, and frequent releases, the development team ensures that the application remains adaptable to emerging challenges and responsive to user feedback.

The report highlights the Agile principles and practices applied in the development life cycle, including user story mapping, sprint planning, regular demonstrations, and retrospectives. It also discusses the challenges encountered and lessons learned throughout the development process.

The positive impact of the web application on civic engagement and municipal services is assessed through user feedback, adoption rates, and the efficiency of anomaly resolution by specialized authorities. Overall, the report emphasizes the importance of Agile methodologies in the successful development and deployment of a citizen-centric web application, contributing to the creation of smarter, more responsive, and inclusive urban environments.

Introduction

In the ever-evolving landscape of urban living, the collaboration between citizens and municipal authorities plays a pivotal role in shaping the quality and functionality of public spaces. This report presents a comprehensive overview of a groundbreaking initiative—a web application designed to facilitate citizen reporting of anomalies observed in city streets. More than just a technological solution, this project is underpinned by the principles of Agile software engineering, aiming to enhance civic engagement and streamline municipal services.

Cities worldwide face an array of challenges, from routine maintenance issues to unforeseen anomalies that affect the daily lives of residents. Recognizing the need for a more dynamic and responsive approach to urban anomaly resolution, our project seeks to empower citizens to actively participate in the improvement of their surroundings. The web application serves as a conduit for citizen-generated reports on street-related anomalies, creating a direct channel of communication with specialized authorities responsible for urban maintenance.

The core philosophy driving the development of this web application is rooted in Agile methodologies. Agile's iterative and collaborative nature aligns seamlessly with the dynamic environment of urban spaces, allowing for rapid adaptation to emerging challenges and evolving citizen needs. By embracing Agile principles such as user-centric design, iterative development cycles, and continuous feedback loops, the project aspires to create a solution that is not only technologically robust but also deeply attuned to the expectations and experiences of its end-users—our city's residents.

This report will delve into the intricate details of the web application's development process, emphasizing the Agile principles and practices employed to ensure its success. We will explore key features of the application, the methodology behind its user interface, and the mechanisms in place for efficient anomaly resolution by municipal authorities. Furthermore, we will assess the impact of the application on civic engagement, emphasizing the potential for technology to bridge the gap between citizens and local governance.

As we navigate through the various phases of development, challenges encountered, and lessons learned, this report aims to provide a comprehensive understanding of how Agile software engineering can be a catalyst for positive change in urban governance.

The outcomes of this project are not merely technological milestones but represent a step towards creating more responsive, inclusive, and resilient cities through the active participation of the very individuals who call them home.

2. Product Development life cycle

2.1- Product vison

Our project aims to develop an intuitive and user-friendly web application that empowers citizens to easily report any irregularities or anomalies they encounter in their daily lives to the appropriate authorities. The goal is to foster a safer, more efficient community by enabling swift and effective communication between citizens and authorities. By leveraging the power of collective vigilance, we aim to enhance the responsiveness of our public services and contribute to the overall betterment of our urban environment.

2.1.1- Moore's vision

For Ifrane's citizens WHO desire to report issues and anomalies they observe in the city. THE e-Ifrane is a web-app THAT allows Ifrane ctizens to report the concerns related to their city by letting them take pictures and add comments that will be directly sent to the people in charge. UNLIKE the traditional procedures involving direct contact with the local authorities, or phone calls, or social media communities discussing the issues of Ifrane. OUR PRODUCT provides a new digitilazed way of comunication between citizens and responsibles using a user-friendly web app.

2.2- Scenarios

Personas

Sofia Larbi

Screening Question: Are you a young business owner in Ifrane?

Sofia Larbi is a 28-year-old Moroccan entrepreneur with a dynamic and modern approach to her career. As a resident of Ifrane, a city known for its Swiss-like architecture and a diverse population, she's often seen at the heart of her trendy cafe and restaurant. Sofia exudes a vibrant, creative spirit and has an eye for combining traditional Berber influences with a contemporary ambiance, creating a unique and inviting space for her customers. Her youthful and energetic presence, often found in casual yet stylish attire, draws in both students and locals, reflecting her passion for culinary arts and dedication to her restaurant business.

Thinks	Sofia's thoughts are consistently focused on establishing her cafe and restaurant as a beloved local establishment in Ifrane. She contemplates innovative menu additions and creative marketing strategies to attract a diverse clientele. Her forward-thinking mindset drives her to envision expanding her business and creating new culinary experiences for her community
Sees	Sofia observes the vibrant tapestry of her city, where international and local influences meet. She sees a diverse range of customers visiting her restaurant, from university students seeking a cozy hangout to locals enjoying a Moroccan meals. She is also acutely aware of the condition of the city's streets and infrastructure, taking note of street anomalies like potholes and road closures, which can impact her restaurant's footfall and the efficiency of deliveries
Feels	Sofia is driven by a profound passion for culinary arts and entrepreneurship. She is deeply committed to creating a warm and inviting atmosphere in her restaurant. Her emotions are rooted in a desire to see her business flourish and become an integral part of Ifrane's culinary scene. At the same time, she feels a sense of responsibility to address the challenges posed by street anomalies to ensure the seamless operation of her restaurant

Problem Scenarios, and Propositions

Problem Scenarios/JTBD	Current Alternatives	Your Value Proposition
Sofia encounters street anomalies such as road closures and broken lights that disrupt her restaurant's customer access and makes her restaurant invisible to tourists. She needs a quick and efficient way to report these issues to ensure the smooth operation of her business	Sofia often tries to reach the local authorities via phone calls and visiting their offices	Our web app streamlines the process of reporting street anomalies to local authorities, allowing Sofia to report issues near her restaurant with ease. The app tracks the status of the reported anomalies and provides Sofia with real-time updates on repairs, ensuring that the smooth functioning of her restaurant
Because of Ifrane's whether and frequent snow, Sofia faces daily problems with the food delivery trucks as they can't enter the street where the restaurant is located because of big potholes and/or snow. Her team needs to carry the delivered items for a long distance. Sofia needs the potholes to be fixed and the snow to be removed in a tight deadline.	Sofia's employees carries the delivered food for a long distance which impact their productivity	E-Ifrane provides dedicated feature for collecting and sending the reports in a live way, which will help the responsible logistics department to intervene as soon as the report is created.
Sofia wishes to foster a stronger sense of community and engagement among the residents of Ifrane. She's looking for a way to bring the local community together and create a sense of unity and involvement in local issues while marketing and creating influence for her business.	Sofia currently relies on traditional marketing and occasional community events, but she feels there's an opportunity to better engage with local residents and create a stronger sense of community.	Our web app not only allows for reporting street anomalies but also offers a dedicated section for fostering local community engagement by linking up citizens leaving in the same neighborhood. Sofia can use the platform to create and promote local events, charitable initiatives, and neighborhood forums. It enables residents to interact with one another, share ideas, and engage in discussions about local issues and initiatives. By providing a space for the community to connect and collaborate, Sofia can play a pivotal role in bringing the people of Ifrane closer together, creating a vibrant and engaged local community while promoting her restaurant.

Personas

Amine El Fassi
Screening Question: How many community service hours have you dedicated to improving city services in Ifrane over the past semester?

Amine El Fassi is a 21-year-old student at Al Akhawayn University in Ifrane, pursuing a degree in Environmental Studies. As a resident of Ifrane, a city celebrated for its Swiss-like architecture and multicultural community, he's frequently spotted at local libraries, parks, and student-friendly cafes. Amine embodies a curious, proactive spirit and is always eager to participate in community initiatives. He's particularly passionate about the city's services, from public transportation to waste management, and often discusses these topics in his academic projects. His casual, student-friendly attire, often adorned with a backpack filled with books and a reusable water bottle, makes him a relatable figure among the university crowd. His dedication to understanding and improving Ifrane's services stems from his academic interests and a personal commitment to making the city better.

Thinks	Amine's thoughts are constantly revolving around the student experience in Ifrane, especially in terms of the city's services and amenities. He ponders over the efficiency of public transportation, the availability of student-friendly spaces, and the overall safety of the city at night. His academic background in Environmental Studies propels him to think about sustainable solutions for common urban challenges. He dreams of an Ifrane where students can seamlessly integrate with the local community, benefiting from efficient city services.
Sees	Amine observes the daily life of fellow students in Ifrane, noting how they interact with the city's services. He sees peers struggling with inconsistent bus schedules, the lack of well-lit study spots, and the need for more recycling points around the university. He's also aware of the city's unique blend of natural beauty and urban development, recognizing areas where the two could coexist more harmoniously for the benefit of both students and locals.
Feels	Amine observes the daily life of fellow students in Ifrane, noting how they interact with the city's services. He sees peers struggling with inconsistent bus schedules, the lack of well-lit study spots, and the need for more recycling points around the university. He's also aware of the city's unique blend of natural beauty and urban development, recognizing areas where the two could coexist more harmoniously for the benefit of both students and locals.
Does	In his role as a student and an active community member, Amine often conducts surveys to gather student opinions on city services. He attends town hall meetings, representing the student body, and collaborates with local NGOs on community projects. Whenever he identifies issues that particularly affect the student community, such as a lack of safe pedestrian crossings or the need for more green spaces, Amine takes the lead in reporting these to the university and city officials. He often collaborates with fellow students to brainstorm solutions, ensuring that the student voice is always at the forefront of city planning discussions.

Problem Scenarios, and Propositions

Problem Scenarios/JTBD	Current Alternatives	Your Value Proposition
Amine often struggles with the city's public transportation system, especially during peak university hours. Buses are either overcrowded or don't adhere to their schedules, making it challenging for him and other students to reach the university or return home on time. This unreliable transportation not only disrupts his academic schedule but also limits his participation in after-school activities and community events. Amine needs a reliable platform where he can report these transportation inconsistencies, ensuring that the city's public transportation system caters effectively to the large student population.	To address transportation issues, Amine often resorts to organizing carpools with fellow students or relying on private taxis, which can be more expensive. He also tries to voice his concerns through the university's student council, hoping they can liaise with the city's transportation department on behalf of the student body.	Our web app streamlines the process of reporting transportation inconsistencies to Ifrane's transportation department. With a user-friendly interface, Amine can quickly highlight bus schedule discrepancies or overcrowded routes. The app provides real-time updates on the actions taken, ensuring that the city's public transportation system is continually optimized for the needs of its student population.

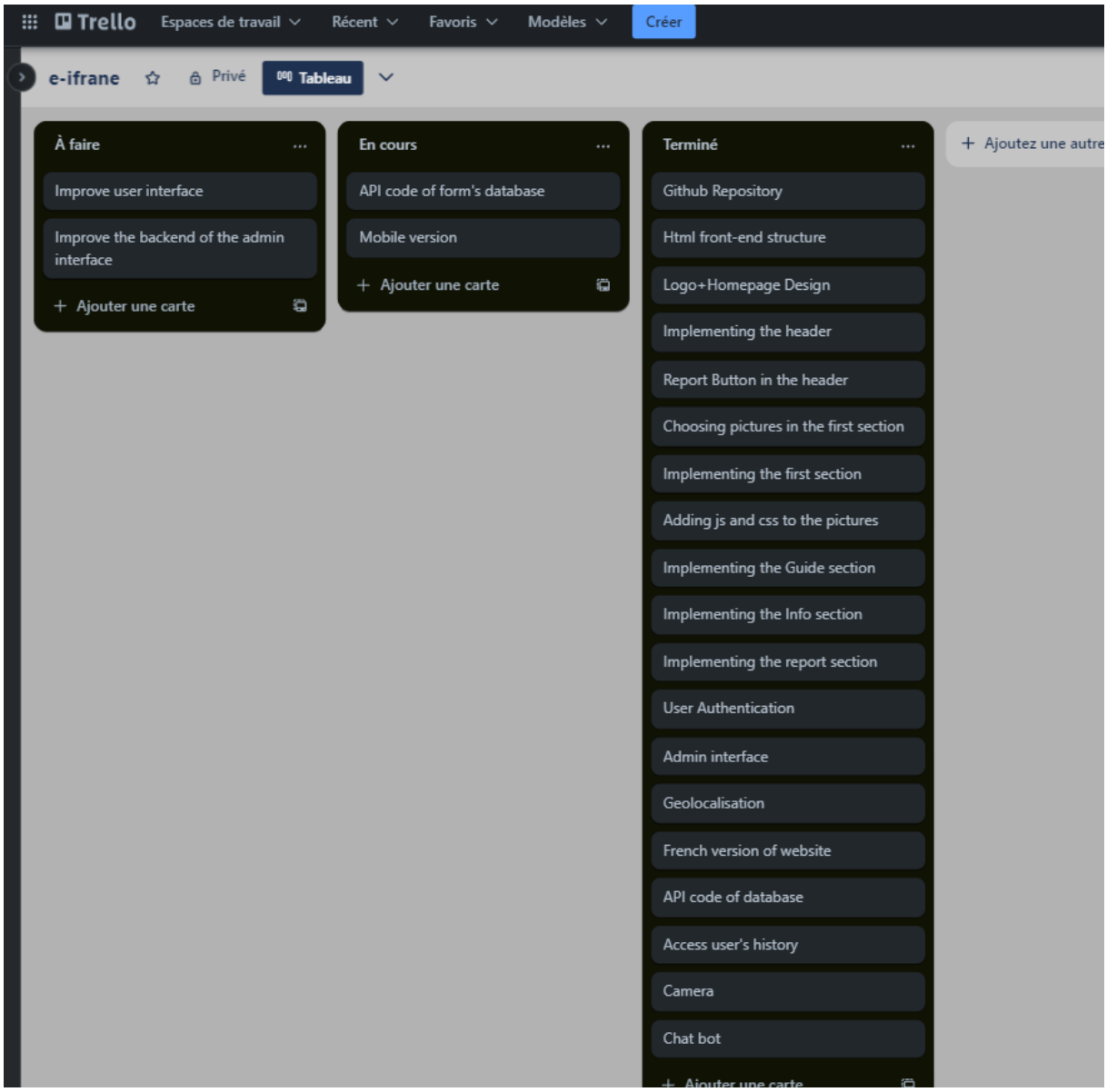
Given Ifrane's chilly climate, Amine has noticed that many of the city's study spots and cafes lack adequate heating or insulation. This makes it uncomfortable for students to study for extended periods, especially during the winter months. Furthermore, some of these spaces, being historical buildings, lack modern amenities like charging ports, essential for students. Amine wishes for a platform where he can highlight these concerns, ensuring that popular student spots are equipped with the necessary amenities to support their academic needs and provide a comfortable environment.	For the lack of adequate amenities in study spots, Amine and his peers frequently bring portable heaters or battery packs to cafes and study areas. They also try to provide feedback directly to the owners of these establishments, suggesting improvements. However, these are short-term solutions and don't address the broader need for modernized student-friendly spaces in the city.	E-Ifrane now features a dedicated section for students to report and discuss amenities in popular study spots and cafes. This feature allows Amine and his peers to highlight areas lacking modern amenities or adequate heating. The platform then communicates these concerns directly to the relevant business owners and city departments, ensuring that student-friendly spaces in Ifrane are both comfortable and functional.

2.3- Product Backlog

User Stories:

- As a user, I want to create an account so that I can report anomalies.
- As a user, I want to login to my account using my credentials.
- As a user, I want to report an anomaly by inputting its details and location.
- As a user, I want to upload photos of the anomalies I report.
- As a user, I want to view the status of the anomalies I have reported.
- As a user, I want to receive notifications when the status of my reported anomalies changes.
- As a user, I want to add comments to my reported anomalies to provide additional information or updates
- As a user, I want to view and participate in discussions on reported anomalies to get community insights and updates
- As a user, I want to view the history of my reported anomalies to keep track of my contributions
- As a user, I want to see statistics of reported and resolved anomalies in my area to understand the effectiveness of the system.
- As a user, I want to get rewarded for reporting anomalies to encourage active participation
- As a user, I want a leaderboard system to compare my contributions with other users for a bit of friendly competition
- As a user, I need to receive real-time updates and notifications on the anomalies I've reported to stay informed about the progress
- As a user, I want a leaderboard system to compare my contributions with other users for a bit of friendly competition
- As an admin, I want to access statistics of reported and resolved anomalies to monitor performance and identify areas of improvement
- As an admin, I want to add comments to reported anomalies to provide official updates and ask for more information if needed
- As an admin, I want to view the reported anomalies in my jurisdiction.
- As an admin, I want to update the status of reported anomalies after taking action
- As an admin, I want to view and manage reported anomalies to resolve them in a timely manner
- As an admin, I need to update the status of reported anomalies to keep residents informed about the resolution process

- As an admin, I want to reward and highlight active users to encourage more residents to use the app



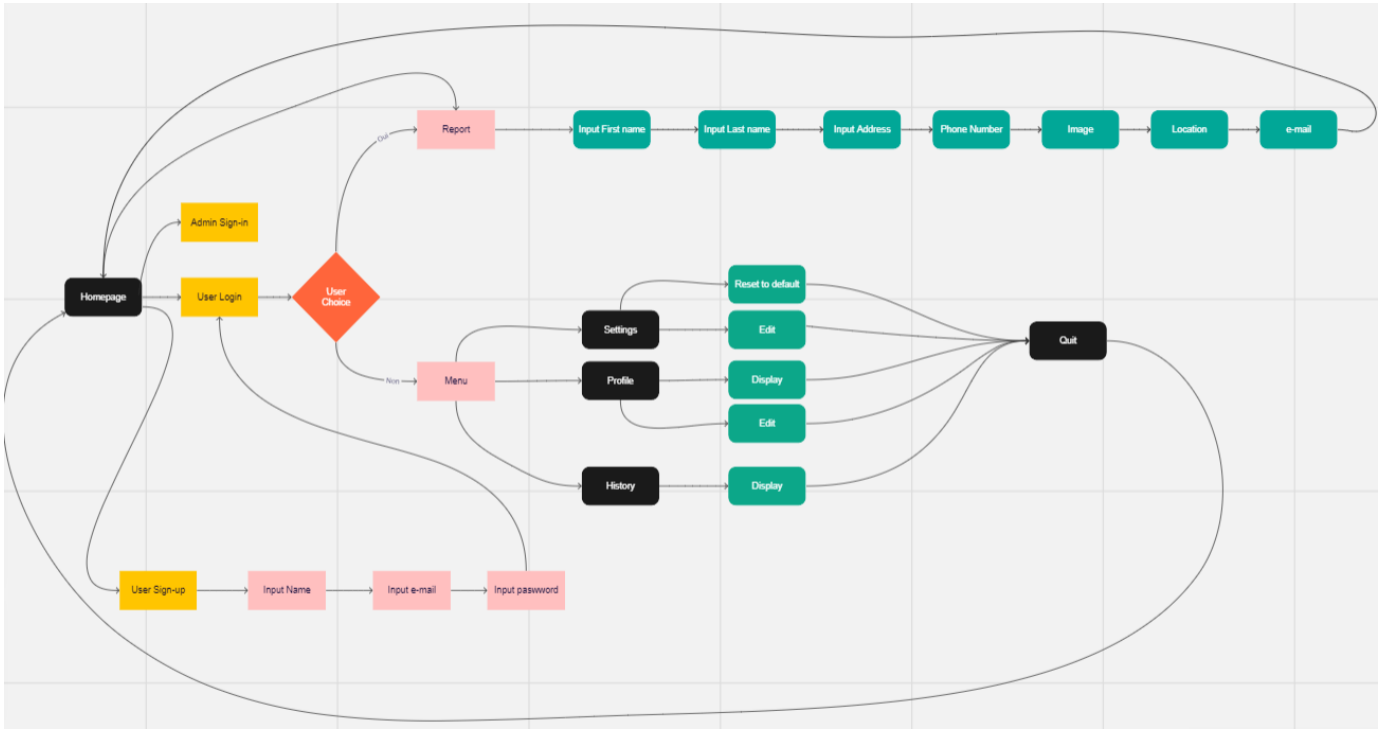
Trello

Non-functional Requirements:

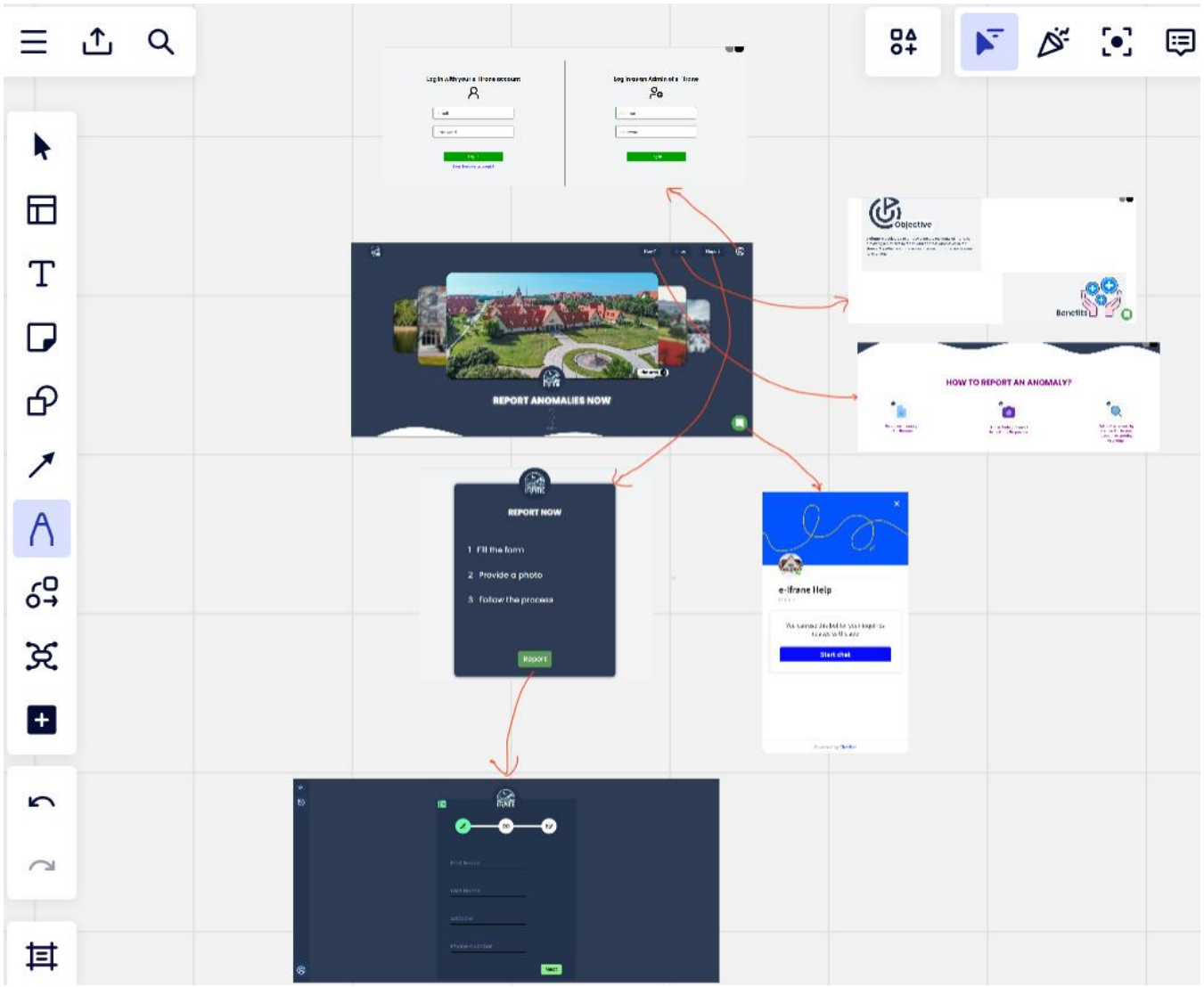
- The web application should be compatible with various browsers like Chrome, Firefox, and Safari.
- The web application should be responsive to fit different screen sizes.
- The web application should ensure the security and privacy of the user data.
- The web application should have a user-friendly interface.
- The web application should load within 2 seconds to ensure a smooth user experience.
- The web application should be able to handle a high volume of simultaneous users without performance degradation.

- All user data should be encrypted both in transit and at rest to protect user privacy.
- The web application should include measures to prevent common web attacks such as SQL injection and cross-site scripting (XSS).
- The web application should follow accessibility guidelines (WCAG 2.1) to ensure usability for people with disabilities.
- The web application should support multiple languages to cater to a diverse user base.
- The codebase should adhere to a clean code philosophy to ensure easy maintenance and updates.
- There should be a comprehensive set of automated tests to catch regressions and other issues early.
- The architecture of the web application should be scalable to accommodate future growth and expansion.
- The web application should be able to quickly scale up resources in response to sudden increases in user load.

2-4- Product prototype using Miro



Link to Miro's model: shorturl.at/bCWY4



Wireframes using Miro

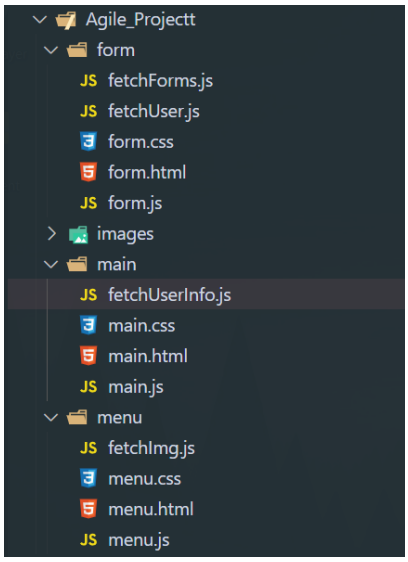
2-5 High-level architecture

The N-tiers architecture has been meticulously chosen for our web app, which serves as a platform for citizens to report anomalies observed in the street to the appropriate authorities. This architecture offers a multitude of benefits that align perfectly with the requirements of our project. At the presentation layer, HTML, CSS, and JavaScript combine to create an intuitive and user-friendly interface, enabling citizens to easily report anomalies with minimal effort. The application layer, implemented using server-side JavaScript frameworks such as Node.js, houses the core business logic. It efficiently processes user requests, validates data, and orchestrates seamless interactions between various components. The data access layer, powered by Firebase, a cloud-based NoSQL database, ensures secure and real-time storage and retrieval of reported anomalies. This architecture's modularity and scalability enable us to independently develop and maintain each layer, facilitating ongoing enhancements and future-proofing the system. Furthermore, the N-tiers architecture provides a clear separation between the presentation layer, application layer, data access layer, and infrastructure layer, which enhances system understandability and manageability. Overall, this architecture empowers our web app to effectively address the needs of citizens by streamlining the reporting process and

facilitating swift communication with specialized authorities, ultimately contributing to a safer and more responsive urban environment.

The codebase is organized in the following folders

1. Presentation Layer:
    - Contains HTML, CSS, and JavaScript files.
    - Handles the user interface and interaction.
    - Responsible for creating visual elements and handling user events on the client-side.
    - Communicates with other layers through APIs.
2. Application Layer:
    - Implements server-side JavaScript frameworks like Node.js.
    - Contains the business logic of the web app.
    - Handles processing of user requests.
    - Performs data validation.
    - Orchestrates the interaction between different components.
3. Data Access Layer:
    - Utilizes Firebase as the cloud-based NoSQL database.
    - Handles data storage and retrieval.
    - Performs CRUD (Create, Read, Update, Delete) operations.
    - Provides APIs for the application layer to access data.
4. Infrastructure Layer:
    - Includes servers, networks, and other infrastructure components.
    - Provides the hosting environment for the web app.
    - Incorporates load balancers and caching mechanisms for performance optimization.
    - Ensures the scalability, availability, and reliability of the application.



2.6- Technology Stack

The technology stack employed in this project showcases a comprehensive and robust combination of tools and frameworks, tailored to meet the specific needs of our application. At the front-end, we utilize HTML, CSS, and JavaScript to create a visually appealing and interactive user interface, ensuring a seamless experience for citizens reporting anomalies in the street. For the back end, we leverage server-side JavaScript frameworks, particularly Node.js, to implement the application layer.

- Front-end:
    - HTML, CSS, and JavaScript for the user interface.
    - Ensures an engaging and interactive experience.
- Back-end:
    - Node.js as the server-side JavaScript framework.
    - Efficient handling of user requests and data validation.
    - Seamless integration between components.
- Database:
    - Firebase, a cloud-based NoSQL database.
    - Secure and real-time storage and retrieval of reported anomalies.
- Overall:
    - Powerful and user-centric solution.
    - Streamlines the anomaly reporting process.
    - Facilitates effective communication between citizens and authorities.

3. Description of agile practices

Our team of 4 students embarked on the development of this product with a strong commitment to agile practices. By adopting the Scrum framework, we embraced an iterative and collaborative approach to deliver a high-quality solution. Through user stories and a prioritized product backlog, we focused on incremental development and continuous feedback. Daily stand-up meetings ensured effective communication and coordination, while continuous integration and testing maintained the product's stability. By actively seeking user feedback and remaining adaptable, we were able to create a product that met the needs of our users and evolved with their expectations.

- **Scrum Framework:** The team adopted the Scrum framework to manage the development process. They divided the project into smaller, manageable units called sprints, usually lasting 1-2 weeks. During each sprint, the team defined and prioritized tasks, conducted daily stand-up meetings to discuss progress and challenges, and held sprint reviews and retrospectives to evaluate and improve their work. Also, two team members dedicated to front-end development utilized HTML, CSS, and JavaScript to create an engaging user interface while collaborating closely with the other two members working on the backend and database to ensure a seamless user experience. Also, GitHub was used as a version control system to share and manage code.

- **User Stories and Product Backlog**: The team created user stories to capture the requirements and user perspectives. These user stories were added to the product backlog, which served as a prioritized list of features and functionalities to be implemented. The team regularly reviewed and updated the product backlog based on feedback and changing project needs.
- **Iterative Development:** The team embraced an iterative development approach, continuously delivering working increments of the product. They focused on developing core features first and then iteratively adding enhancements and refinements based on user feedback and priorities.
- **Daily Stand-up Meetings**: The team conducted daily stand-up meetings to ensure effective communication and coordination. Each team member shared progress discussed any obstacles or challenges and collaborated on finding solutions. These short, focused meetings helped the team stay aligned and quickly address any issues that arose.
- **Continuous Integration and Testing:** The team implemented continuous integration practices, frequently integrating their code changes into a shared repository. They also conducted regular testing, including unit testing and integration testing, to ensure the quality and stability of the product throughout the development process.
- **Regular User Feedback:** The team actively sought user feedback at various stages of development. They conducted user testing sessions, gathered feedback through surveys or interviews, and incorporated the insights gained into their development process. This iterative feedback loop helped them validate assumptions, identify areas for improvement, and ensure the final product met user expectations.
- **Collaboration and Adaptation**: The team emphasized collaboration, regularly sharing knowledge and supporting each other. They remained adaptable and open to change, responding to evolving requirements and adjusting their plans accordingly. They embraced an empirical approach, using feedback and data to make informed decisions and continuously improve their work.

4- Product Implementation

The implementation of our web app was executed with meticulous attention to detail and adherence to best practices. The front-end development team diligently translated the design specifications into a visually appealing and intuitive user interface. They leveraged HTML, CSS, and JavaScript to create responsive layouts, optimize performance, and ensure cross-browser compatibility. The back-end development team seamlessly integrated the necessary business logic, leveraging technologies such as Firebase, and Node.js. They implemented robust data processing, authentication, and authorization mechanisms to ensure the security and integrity of user interactions. Throughout the implementation phase, rigorous testing was conducted, encompassing unit tests, integration tests, and user acceptance testing. This comprehensive testing approach validated the functionality, reliability, and usability of the product. The team successfully deployed the product on a scalable infrastructure, leveraging some cloud services, ensuring high availability and performance. The implementation phase demonstrated the team's technical proficiency, collaboration, and commitment to delivering a high-quality product.

5- Conclusion

In conclusion, the development and implementation of this product by our team of four students exemplified the successful application of agile practices and collaborative teamwork. Through the adoption of the Scrum framework, we effectively managed the project, delivering incremental value and adapting to changing requirements. The division of responsibilities between front-end and back-end development allowed for focused expertise and efficient progress. Leveraging GitHub as a code sharing platform facilitated seamless collaboration and version control. The meticulous implementation process, encompassing front-end design, back-end development, and rigorous testing, ensured a high-quality and user-centered product. The successful deployment of the product on a scalable infrastructure further demonstrated our technical proficiency. Overall, this project served as a valuable learning experience, highlighting the significance of agile methodologies and effective teamwork in achieving successful outcomes.