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## **Executive Summary:**

The pothole detection mobile app is designed to address the problem of identifying and reporting potholes on roads. The app uses advanced computer vision algorithms to detect potholes on road surfaces and alerts users to their presence. The app also allows users to report potholes to local authorities, making it easier for them to locate and repair them.

The app is easy to use, with a simple and intuitive interface that allows users to report potholes quickly and easily. It uses the GPS capabilities of the user's smartphone to pinpoint the location of the pothole, making it easy for authorities to locate and repair them.

The pothole detection mobile app has the potential to significantly improve road safety and reduce the costs associated with pothole damage to vehicles. By identifying and reporting potholes promptly, the app can help prevent accidents and reduce the risk of injury to drivers and passengers.

Overall, the pothole detection mobile app is a valuable tool for anyone who wants to help make our roads safer and more efficient. Its user-friendly interface, advanced technology, and ability to identify potholes quickly and accurately make it an essential tool for drivers, local authorities, and anyone who cares about road safety.

## Table of Contents

1.0 INTRODUCTION.....	8
1.1 Project Overview:.....	8
1.2 The purpose of the Project.....	8
1.2.1 background .....	8
1.2.2 Defining the problem:.....	9
1.2.3 Issues:.....	9
1.2.4 Objectives:.....	9
1.3 The Scope of the Work and Project Deliverables.....	10
1.3.1 Requirements:.....	10
1.3.2 Constraints: .....	10
1.3.3 Solution Alternatives:.....	10
1.3.4 Proposed solution:.....	10
1.3.5 process model.....	11
1.4 Local and global impact of the proposed solution: .....	11
1.5 Naming Conventions and Definitions .....	11
2.0 Feasibility Study.....	11
2.1 Technical Feasibility.....	11
2.2 Operational Feasibility.....	12
2.3 Economic Feasibility .....	13
2.4 Schedule Feasibility.....	14
2.5 Legal Feasibility.....	14
3.0 Project Management Plan .....	14
3.1 Project Organization.....	14
3.2 Roles and Responsibilities .....	15
3.3 Software Process Model.....	15
3.4 Tools and Techniques.....	16
3.5 Work breakdown.....	16
3.5.n Project Tasks.....	16
3.5.n.1 Task Description.....	16

3.5.n.2 Deliverables and Milestones.....	17
3.5.n.3 Resources needed.....	17
3.5.n.4 Dependencies and Constraints.....	18
3.6 Assigning Team Members to Tasks.....	19
3.7 Project Schedule (Gantt chart and PERT diagram).....	20
Gantt chart.....	20
PERT diagram.....	20
3.8 Risk Analysis.....	21
<b>Examples of project, product, and business risks.....</b>	<b>21</b>
<b>Examples of different risk types.....</b>	<b>22</b>
3.9 Monitoring, Reporting, and Controlling Mechanisms.....	23
4.0 Software Requirements Specifications (SRS).....	23
4.1 System Stakeholders and Requirements Sources.....	23
4.2 User Requirements Definition .....	24
4.3 Use Cases .....	25
4.4 System Functional Requirements Specification .....	26
4.6 Non-functional Requirements.....	32
4.6.1     Performance Requirements.....	32
4.6.2 Dependability Requirements .....	32
4.6.3 Security Requirements:.....	32
4.6.4 Usability Requirements: .....	32
4.6.5     Operational and Environmental Requirements:.....	33
4.6.6 Maintainability Requirements:.....	33
4.7     Data Requirements.....	33
5.0 Analysis and Design.....	34
5.1 Activity Diagrams .....	34
5.2 Sequence Diagrams .....	38
5.3 Class Diagram.....	44
5.4 Object to ER Mapping .....	45
5.5 Physical Database Design .....	46
5.6 Architecture Design.....	47
5.7 Classes and Components Design .....	48
5.8 Graphical User Interface Design.....	49

6.0 Implementation.....	79
6.1 Graphical User Interface Implementation (Required) .....	79
6.2 Database Implementation (Bonus) .....	79
6.3 Other Components Implementation (if needed) .....	79
7.0 User Manual.....	79
8.0 References: books and tools .....	82

## List Oof Tables

Table 1 .....	13
Table 2 .....	14
Table 3 .....	16
Table 4 .....	19
Table 5 .....	21
Table 6 .....	22
Table 7 .....	24
Table 8 .....	26
Table 9 .....	27
Table 10 .....	27
Table 11 .....	28
Table 12 .....	29
Table 13 .....	29
Table 14 .....	30
Table 15 .....	30
Table 16 .....	31
Table 17 .....	31

## List of figures

Figure 1.....	18
Figure 2.....	20
Figure 3.....	20
Figure 4.....	25
Figure 5.....	25

Figure 6.....	34
Figure 7.....	35
Figure 8.....	36
Figure 9.....	37
Figure 10.....	38
Figure 11.....	39
Figure 12.....	40
Figure 13.....	41
Figure 14.....	42
Figure 15.....	43
Figure 16.....	44
Figure 17.....	45
Figure 18.....	46
Figure 19.....	47
Figure 20.....	48
Figure 21.....	49
Figure 22.....	50
Figure 23.....	50
Figure 24.....	51
Figure 25.....	51
Figure 26.....	52
Figure 27.....	52
Figure 28.....	53
Figure 29.....	53
Figure 30.....	54
Figure 31.....	54
Figure 32.....	55
Figure 33.....	55
Figure 34.....	56
Figure 35.....	56
Figure 36.....	57
Figure 37.....	57
Figure 38.....	58
Figure 39.....	58
Figure 40.....	59
Figure 41.....	59
Figure 42.....	60
Figure 43.....	60
Figure 44.....	61
Figure 45.....	61
Figure 46.....	62
Figure 47.....	62
Figure 48.....	63
Figure 49.....	63

Figure 50.....	64
Figure 51.....	64
Figure 52.....	65
Figure 53.....	65
Figure 54.....	66
Figure 55.....	66
Figure 56.....	67
Figure 57.....	67
Figure 58.....	68
Figure 59.....	68
Figure 60.....	69
Figure 61.....	69
Figure 62.....	70
Figure 63.....	70
Figure 64.....	71
Figure 65.....	71
Figure 66.....	72
Figure 67.....	72
Figure 68.....	73
Figure 69.....	73
Figure 70.....	74
Figure 71.....	74
Figure 72.....	75
Figure 73.....	75
Figure 74.....	76
Figure 75.....	76
Figure 76.....	77
Figure 77.....	77
Figure 78.....	78

## **1.0 INTRODUCTION**

### **1.1 Project Overview:**

Road Vision Ai is a mobile phone app, can detect a street pothole using computer vision, The app will be designed to work on both Android and iOS platforms and will be able to provide real-time information to users about potholes present on the streets. The app will be designed to use the camera on a mobile device to capture images of the street and then analyze these images using AI and computer vision algorithms to detect any potholes. which helps drivers to avoid the pothole and the Street repair companies to Saving money through some of the features of the application.

### **1.2 The purpose of the Project**

The primary goal of the project is to improve road safety by providing real-time information to drivers and pedestrians about potholes present on the streets. The app aims to reduce the number of accidents caused by potholes and increase awareness about the importance of road safety and infrastructure maintenance. The project also aims to create a user-friendly interface that is easy to use and navigate. Ultimately, the project aims to leverage the power of AI and computer vision to promote safer roads and prevent accidents caused by potholes.

#### **1.2.1 background**

Potholes are a significant problem on streets and roads worldwide. They are formed due to the gradual degradation of pavement materials and can cause serious accidents, damage to vehicles, and other hazards to road users. The issue of potholes is especially severe in areas with extreme weather conditions, such as heavy rainfall or snow, which can exacerbate the damage to the street.

Traditionally, the detection and repair of potholes has been done manually, which can be time-consuming, expensive, and sometimes ineffective. Moreover, it is often challenging to detect potholes early enough to prevent accidents and minimize damage to vehicles. Therefore, there is a need for a more efficient and effective solution to detect potholes on the streets.

The advent of AI and computer vision technology provides a promising solution to the problem of pothole detection. AI and computer vision techniques can be used to analyze images of streets captured by mobile devices and automatically detect potholes. This technology has the potential to provide real-time information about potholes to drivers and pedestrians, allowing them to avoid hazardous areas and reduce the risk of accidents.

#### **1.2.2 Defining the problem:**

Potholes are a common issue on many streets and roads, and they can pose a serious safety risk to drivers, cyclists, and pedestrians. Potholes can damage vehicles, cause accidents, and lead to serious injuries or even fatalities. Detecting and repairing potholes is an ongoing challenge for city governments and transportation agencies, as it requires significant resources and can be time-consuming.

#### **1.2.3 Issues:**

- 1-The high labor cost of searching for potholes
- 2-Incorrect estimate of the amount of asphalt used to repair potholes
- 3-Not reaching all potholes

#### **1.2.4 Objectives:**

- 1-Access to all potholes
- 2-Determine the correct amount of asphalt
- 3-Repair the potholes as soon as possible

### **1.3 The Scope of the Work and Project Deliverables**

#### **1.3.1 Requirements:**

Compatibility: The mobile app should be compatible with both iOS and Android platforms.

Image capture: The app should have the ability to capture high-quality images of the road surface.

Computer vision: The app should use computer vision algorithms to analyze the captured images and detect potholes in the road surface.

Real-time processing: The app should be able to process images in real-time to detect potholes.

Accuracy: The app should have a high level of accuracy in detecting potholes to minimize false positives and false negatives.

#### **1.3.2 Constraints:**

- The app must be compatible with different types of smartphones and operating systems.
- The app should be able to access the camera and GPS functionalities of the user's device.
- The app should be designed with scalability and future updates in mind to ensure its longevity and relevance.
- The project must be completed within 3<sup>rd</sup> June 2023.
- The total budget for the project is \$120,000.

#### **1.3.3 Solution Alternatives:**

We will develop a new system from scratch. Developing a new system from scratch would allow for more flexibility and customization but would also require more resources and development time.

#### **1.3.4 Proposed solution:**

Create an app to detect potholes in the road; by allowing people to report potholes on the road by taking a photo of the pothole and submitting it through the app. The app will then use image

processing techniques to detect the depth and area of the pothole and calculate the necessary number of workers and material needed to fix it. The app will also provide information on the location of the pothole and its accessibility, so that the repair crew can plan accordingly. Finally, the app will calculate the estimated cost of fixing the pothole based on the type of material used and the size and depth of the pothole.

### **1.3.5 process model**

The process model for this project is an Agile development model. The app will be developed with a small integrated team who will communicate informally throughout the development process. The model will be incremental in nature, with the app being developed in multiple phases, each with its own set of features and functionalities. This approach allows for flexibility and adaptability, as the development team can incorporate feedback from users and stakeholders throughout the process.

### **1.4 Local and global impact of the proposed solution:**

The pothole detection app is designed for users, such as commuters, pedestrians, and cyclists, to report potholes and view a map or list of reported potholes in their area

### **1.5 Naming Conventions and Definitions**

IOS: is Apple's mobile operating system that powers the iPhone and iPod Touch.

## **2.0 Feasibility Study**

### **2.1 Technical Feasibility**

there is some research's contains a way for detect street pothole using Artificial intelligence and computer vision, but there is no one merged this Idea with a mobile app, so we A new system must be developed since there aren't any existing solutions in place ,a street pothole detection mobile app using AI and computer vision is technically feasible, given the availability of

appropriate technology, data sources, and computational resources. There are many techniques that can be used such as TensorFlow, YOLO, PyTorch and OpenCV, our team is proficient enough to complete the project within the given constraints. Awareness sessions would be held to help familiarize the team with the technology and techniques that will be utilized throughout the project this way we ensure that the team could complete their tasks in time, if there are one or more team members who are unfamiliar with technology used intensive training will be done.

## 2.2 Operational Feasibility

The app's success depends on the willingness of users to adopt it and report potholes. Therefore, it is important to ensure that the app is user-friendly and intuitive to use, with clear instructions and a simple reporting process. The app's success also depends on the cooperation of local authorities in responding to pothole reports. The app needs to ensure that user data is protected and kept secure. The app needs to be continuously maintained and updated to ensure that it remains functional and up to date with the latest technology and data sources. It is also important to provide users with ongoing support and assistance, such as troubleshooting and technical support, and all the above is available in our project.

## 2.3 Economic Feasibility

Table 1

Employee	Number of Employees	Hours per Day	Total Hours	Total Cost per Hour (\$)
<b>Computer Vision Engineer</b>	2	8	16	50\$
<b>Artificial Intelligence Specialist</b>	1	8	8	60\$
<b>Mobile App Developer</b>	1	8	8	45\$
<b>Quality Assurance Tester</b>	1	8	8	40\$
<b>Project Manager</b>	1	8	8	55\$
<b>Total</b>	6	-	48	250*48= 120,000\$

*Table2 Operating table*

*Table 2*

Number	Operating	Cost per Hour (\$)	Hours per Day	Total Cost (\$)
1	Development and Maintenance	60\$	3	180\$
2	Server Hosting	70\$	3	210\$
3	Third-Party APIs/Libraries	45\$	2	90\$
4	Salaries/Wages	100\$	2	200\$
5	Data Collection/Labeling	150\$	5	750\$
6	Licensing Fees	30\$	3	90\$
7	Marketing and Promotion	50\$	2	100\$
8	Customer Support/Maintenance	75\$	3	225\$
9	Insurance/Legal Fees	30\$	2	60\$
<b>Total</b>	-	-	-	1935\$

## 2.4 Schedule Feasibility

Each task has been given sufficient time to be completed. Any delays are improbable based on the team's skills and the plan.

## 2.5 Legal Feasibility

Any legal complications were avoided because the source code was written by the experiences of our team.

## 3.0 Project Management Plan

### 3.1 Project Organization

The team of five will work together to develop a street pothole detection mobile app using AI and computer vision technology. The designers will be responsible for creating a user-friendly interface, while the developers will work on the backend development and integration of the AI

algorithms. The analysts will be tasked with identifying potential issues and limitations in the technology and coming up with solutions to ensure optimal performance. Since the project is limited in size, each team member may have to take on tasks that are outside their respective roles to ensure the success of the project. The team will work collaboratively to create a workflow plan, identify potential risks, and have contingency plans in place. The PM will act as a liaison between the team and stakeholders, ensuring that the project stays on track and that all requirements are met. Through effective communication and collaboration, the team will work towards delivering a high-quality mobile app that can accurately detect potholes on the streets.

### 3.2 Roles and Responsibilities

- Manager: Mohammad AlNajjar(leader)
- AI/computer vision specialist: Mohammad Al-Najjar(leader), Farah Al-Sadi
- Designers (UX): Mohammad Jehad, Farah Al-Sadi
- Developers: Farah Al-Sadi, Rayah Al-Rababaha
- Quality Assurance: Abdullah Nader

### 3.3 Software Process Model

As a mobile app, an agile development approach is the best project model for our app. Agile emphasizes collaboration, continuous improvement, and rapid prototyping, with short sprints resulting in functioning prototypes that can be refined based on feedback. This allows for flexibility and quick responses to changing requirements or unexpected challenges. With a complex project involving multiple disciplines, such as designing, developing, and integrating AI and computer vision algorithms, collaboration and open communication between team members are essential to identify and address potential risks and adjust the project plan as needed.

### 3.4 Tools and Techniques

Table 3

Tool	Usage
<b>Microsoft Teams</b>	Used for communication and collaboration with team members
<b>Microsoft Word</b>	Used for creating project proposal, user manuals and reviewing project documents with team members
<b>Figma</b>	Used for UI/UX design
<b>Lucid Chart</b>	Used for drawing diagrams
<b>Google Collab</b>	Used for image processing and analysis
<b>Social Media Platforms</b>	Used for implementing marketing plan
<b>YOLO v8</b>	To train our data
<b>Roboflow</b>	To label our data

### 3.5 Work breakdown

#### 3.5.n Project Tasks

1. Establish project objectives.
2. Identify requirements.
3. UX/UI design
4. Collect data.
5. Algorithm Exploration
6. Algorithm Testing
7. Backend Development.
8. Test functionality
9. user manuals.
10. Implement Marketing Plan.
11. Feedback Analysis.

#### 3.5.n.1 Task Description

1. Establish project objectives: Define the project scope, goals, and constraints. Identify the expected outcomes and deliverables.

2. Identify requirements: Gather requirements from stakeholders to define the functional and non-functional requirements for the app.
3. UX/UI design: Design the user interface and user experience (UI/UX) of the app and create prototypes.
4. Collect Data: Collecting information and images that are necessary for the project, these data can be multimedia in different forms.
5. Algorithm Exploration: The process of analyzing the collection data and experimenting with different image processing algorithms.
6. Algorithm Testing: testing the image processing algorithms that have been developed to ensure their accuracy and effectiveness in achieving the project objective .
7. Backend development: Develop the backend of the app to handle user requests, process data, and communicate with the database.
8. Test functionality: Use testing frameworks and tools to automate testing and identify and fix bugs and performance issues.
9. User manuals: Create user manuals and documentation to guide users on how to use the app.
10. Implement marketing plan: Develop and execute a comprehensive marketing plan to promote the app and attract users.
11. Feedback analysis: Collect and analyze user's feedback to improve user experience.

### **3.5.n.2 Deliverables and Milestones**

Every activity in the process of working on a software project is a milestone, such as the feasibility study and the requirement analysis.

Deliverables are work products that are delivered to the customer.

### **3.5.n.3 Resources needed**

In this section the skills, hardware, and software that are needed to complete the project or are used throughout the duration of the project are identified.

Skills: project management skills, Proficiency in programming languages such as Python, Database Management Skills, Knowledge of AI and computer vision techniques and algorithms, Familiarity with data collection and preparation techniques, including image annotation and labeling, Strong problem-solving and analytical skills.

Hardware: A high-performance computer or server with a powerful graphics processing unit (GPU) for AI model training and development, A mobile device or emulator for app testing and development, A camera-equipped mobile device for capturing street images

Software: AI and computer vision libraries and frameworks such as TensorFlow, PyTorch, or OpenCV for developing and training the AI model, Mobile app development tools such as Android Studio or Xcode for app development, Cloud services such as Amazon Web Services or Microsoft Azure for AI model deployment and hosting, Image annotation and labeling software such as Roboflow for preparing the dataset

#### 3.5.n.4 Dependencies and Constraints

This table provides an overview of the interdependencies between the different tasks involved in the project, and every task in the project is dependent on one or more preceding tasks.

Task	Predecessor
Establish project objectives	Other tasks in the project depend on this task
Identify requirements	Establish project objectives
UX/UI design	Identify Requirements
Collect data	Identify Requirements
Algorithm Exploration	Collect Data
Algorithm Testing.	Algorithm Exploration
Backend Development	Algorithm Testing.
Database integration	Backend Development
Test functionality user manuals.	Database integration 1. Test functionality 2. UX/UI design
Implement Marketing Plan	1. Test Functionality 2. UX/UI Design
Feedback Analysis.	1. User manual 2. Implement Marketing Plan

Figure 1

**Constraints:**

- The app must be compatible with different types of smartphones and operating systems.
- The app should be able to access the camera and GPS functionalities of the user's device.
- The app should be designed with scalability and future updates in mind to ensure its longevity and relevance.

### 3.6 Assigning Team Members to Tasks

Table 4

Task	Responsibility Of
<i>Project Overview</i>	<i>Mohammad Al-Najjar</i>
<i>background of the business</i>	<i>Farah Al-Sadi</i>
<i>problem definition</i>	<i>Mohammad Al-Najjar</i>
<i>issues</i>	<i>Abdullah Nader</i>
<i>objectives</i>	<i>Abdullah Nader</i>
<i>business requirements</i>	<i>Mohammad Al-Najjar</i>
<i>constraints</i>	<i>Rayah Al-Rababah</i>
<i>proposed solution</i>	<i>Rayah Al-Rababah</i>
<i>Local and Global Impact of The Proposed Solution</i>	<i>Farah Al-Sadi</i>
Naming Conventions and Definitions	<i>Mohammad Al-Najjar</i>
<i>Feasibility Study</i>	<i>Mohammad Al-Najjar</i>
<i>Project Management plan</i>	<i>All members</i>
<i>Software Requirements Specifications (SRS)</i>	<i>Rayah Al-Rababah</i>
<i>Activity Diagrams</i>	<i>Mohammad Al-Najjar</i>
<i>Sequence Diagrams</i>	<i>Mohammad Al-Najjar</i>
<i>Class Diagram</i>	<i>Mohammad Al-Najjar</i>
<i>Object to ER Mapping</i>	<i>Farah Al-Sadi</i>
<i>Physical Database Design</i>	<i>Farah Al-Sadi</i>
<i>Architecture Design</i>	<i>Rayah Al-Rababah</i>
<i>Classes and Components Design</i>	<i>Rayah Al-Rababah</i>
<i>Graphical User Interface Design</i>	<i>Mohammad Jehad, Farah Al-Sadi</i>
<i>Implementation</i>	<i>Abdullah Nader</i>

<i>User Manual</i>	<i>Farah Al-Sadi</i>
<i>References</i>	<i>All members</i>

### 3.7 Project Schedule (Gantt chart and PERT diagram)

#### Gantt chart

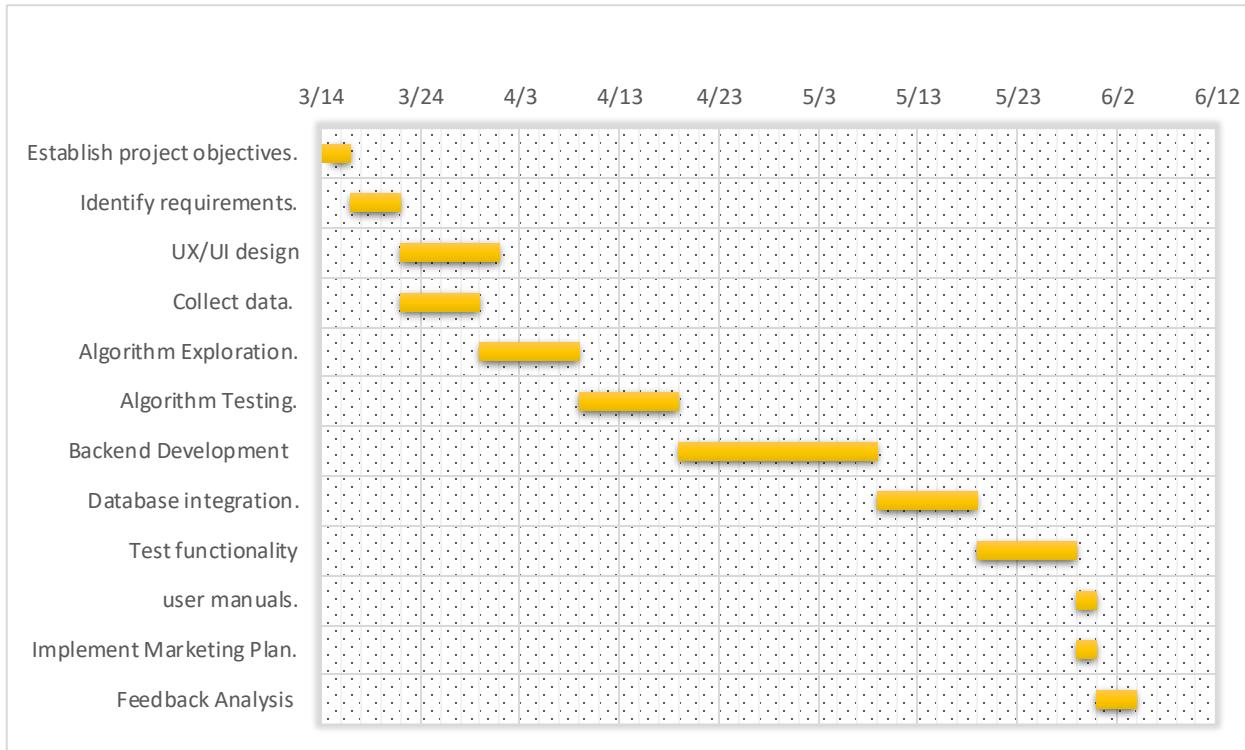


Figure 2

#### PERT diagram

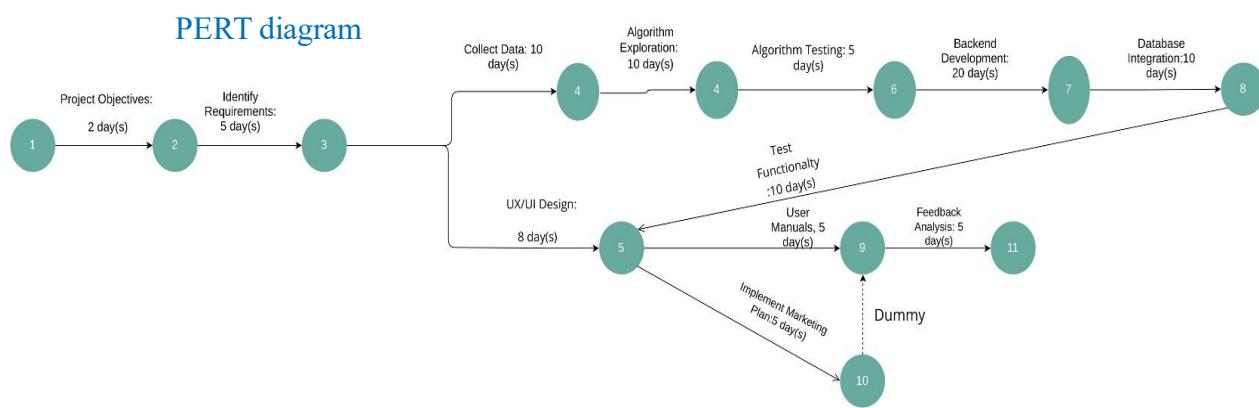


Figure 3

### 3.8 Risk Analysis

Risk analysis for our project can help identify potential risks and develop strategies to mitigate or avoid them.

#### Examples of project, product, and business risks

Table 5

<b>Risk</b>	<b>Affects</b>	<b>Description</b>	<b>Mitigation Strategy</b>
<i>Technical risks</i>	Project	Difficulty in integrating AI and computer vision algorithms, inaccurate detection results, or compatibility issues with different mobile devices.	Conduct thorough testing and debugging, consult with experts in the field, use appropriate software development tools and frameworks.
<i>Schedule risks</i>	Project	Delay in software development or testing, unexpected issues	Develop a realistic project plan, establish clear milestones and deliverables, identify potential roadblocks, and establish contingency plans.
<i>Data privacy and security risks</i>	Product	Unsecured data, vulnerability to hacking or cyber-attacks.	Implement robust data security measures, such as encryption and secure data storage, and comply with relevant data privacy regulations.
<i>User adoption risks</i>	Product	Difficulty in attracting and retaining users, competition from other similar apps.	Develop a user-friendly, visually appealing app with useful features, implement effective marketing strategies, such as social media campaigns and partnerships with local authorities.
<i>Financial risks</i>	Business	Insufficient revenue or funding, unexpected costs.	Develop a realistic budget, seek funding from various sources, explore potential revenue streams

<i>Regulatory and legal risks</i>	Business	Failure to comply with regulations or obtain necessary permits or licenses.	Research and understand relevant regulations, seek legal advice if necessary, and adhere to intellectual property laws
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### Examples of different risk types

Table 6

Risk type	Possible risks	Probability	Seriousness
<b>Technology Risks</b>	1-Compatibility issues with different mobile devices or operating systems. 2-Inaccurate pothole detection results due to errors in the AI and computer vision algorithms. 3-Difficulty in integrating AI and computer vision algorithms with the mobile app's user interface. 4-Unexpected technical issues that may arise during development or deployment of the app.	1- Medium 2- High 3- Medium 4- Medium	1- High 2- High 3- Medium 4- Medium
<b>Organizational Risks:</b>	1-Lack of communication and coordination among team members. 2-Insufficient resources, including funding, hardware, and software. 3-Lack of alignment between the project goals and the organization's overall strategy. 4-Difficulty in managing stakeholders and addressing conflicting requirements.	1- High 2- Medium 3- Medium 4- High	1- Medium 2- High 3- Medium 4- Medium
<b>People Risks</b>	1-Inadequate skills or expertise among team members. 2-High turnover rates or absenteeism among team members. 3-Lack of motivation or commitment among team members. 4-Communication issues or conflicts among team members.	1- Medium 2- Medium 3- Medium 4- High	1- High 2- Medium 3- Medium 4- Medium
<b>Requirements Risks</b>	1-Unclear or incomplete user requirements for the app. 2-Difficulty in obtaining accurate and up-to-date data on potholes and road conditions. 3-Inadequate user testing and feedback during the development process. 4-Changes in user requirements or stakeholder expectations during the project.	1- High 2- Medium 3- Medium 4- High	1- High 2- Medium 3- Medium 4- Medium

<b>Estimation Risks</b>	1-Inaccurate estimation of project costs or timeline. 2-Underestimation of the complexity of the AI and computer vision algorithms. 3-Overestimation of the app's potential revenue or user adoption. 4-Failure to account for unforeseen events or risks that may impact the project.	1- High 2- Medium 3- Medium 4- High	1- High 2- High 3- Medium 4- Medium
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### 3.9 Monitoring, Reporting, and Controlling Mechanisms

A meeting will be held twice a week, each team member will report on their progress and issues they have faced. The project manager will compare the team's progress with the proposed schedule and a proposed solution will be made. Team members are required to update their leader on their progress, and leaders do the same for the project manager.

## 4.0 Software Requirements Specifications (SRS)

### 4.1 System Stakeholders and Requirements Sources

The main stakeholders from which requirements are gathered:

- Reporters
- Workers.
- The software's owner
- Development Team

## 4.2 User Requirements Definition

Table 7

#FR	Requirement	Requirement's Description	Stakeholders
1	Reporter Sign Up/In	<i>The app should provide the option for users to sign up and sign in as Reporter.</i>	Reporter
2	Worker Sign Up/In	<i>The app should provide the option for users to sign up and sign in as a Workers</i>	Workers
3	Potholes Reporting	<i>The app should allow Reporter to report potholes they face.</i>	Reporter
4	Image Attachment	<i>The app should allow Reporter to attach images of the potholes they are reporting.</i>	Reporter
5	Input's Location	<i>The app should allow Reporter to provide the location of the pothole they are reporting.</i>	Reporter
6	Input's Description	<i>The app should allow Reporter to provide descriptions to the potholes they are reporting.</i>	Reporter
7	Duplicate prevention	<i>The app should have a mechanism to prevent Reporters from submitting duplicate reports for the same pothole</i>	Developers, Reporter
8	Real-time Pothole Detection	<i>The app should provide a feature that allows Reporter to scan and detect potholes in real time using their device's camera.</i>	Reporter, Developers
9	Input's Measurements	<i>The app should be able to measure the size and depth of reported potholes.</i>	Developers, Workers.
10	Input's Representation	<i>The app should represent each pothole on the map by a pin or marker.</i>	Reporter, Workers
11	Completion Proof	<i>The app should provide a feature that allows workers to provide proof of completion after fixing reported potholes</i>	Workers
12	Notifications	<i>The app should notify Reporter when reported potholes have been fixed.</i>	Reporter

### 4.3 Use Cases

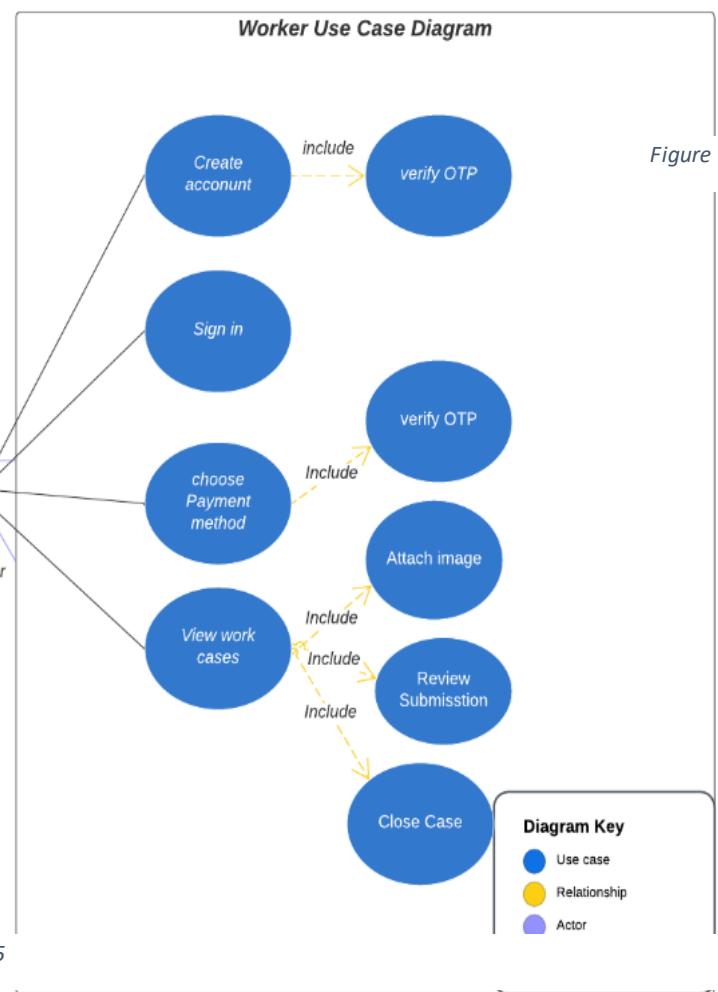


Figure 4



Figure 5

## 4.4 System Functional Requirements Specification

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Table 8

User story: <b>As a worker, I want to be able to update the report status after I finish my job</b>	
<b>Scenarios</b>	
<b>Normal scenario</b>	<i>The worker completes a job assigned to them, and then opens the app to update the job report status. he will select "close this case" option, and then attach an image for closed pothole and a bill of what worker have paied to close this case</i>
<b>What can go wrong</b>	<i>The worker clicks on the " close this case " button after finishing a job, but nothing happens</i>

Table 9

<b>User story: As a worker, I want to be able to view job cases</b>	
<h2>Scenarios</h2>	
<b>Normal scenario</b>	<i>A worker logs into the app and views all cases which are named "open". The app displays the location of this job and the reporter's name and the description of pothole</i>
<b>What can go wrong</b>	<i>The Worker notice that the description is not available, so then they will use Report feature to report the issue.</i>

Table 10

<b>User story: As a reporter, I want to be able to report potholes I face in the road.</b>	
<h2>Scenarios</h2>	
<b>Normal scenario</b>	<i>A reporter encounters a pothole on the road, opens the app, selects the "Report" button, Enter the location of the pothole, attaches an image of the pothole, provides a description of the pothole, and submits the report.</i>
<b>What can go wrong</b>	<ul style="list-style-type: none"><li><i>A reporter tries to report a pothole that has already been reported by another reporter. The app detects the duplicate report and informs the reporter that the pothole has already been reported.</i></li><li><i>A reporter tries to report a pothole, but the app's automatic location detection feature is inaccurate, either due to poor GPS signal or incorrect mapping data. The app prompts the reporter to manually enter the location of the pothole.</i></li></ul>

## User story: *As a user, I want to be able create account*

### *Scenarios*

<b>Normal scenario</b>	<p><i>A new user downloads the app and selects the "create account" option. the user will be able to choose to continue as worker or continue as reporter they are prompted to provide their username, full name, email address, phone number, Age, gender, and a password. If user is worker, the worker should provide Company ID and Worker ID , After submitting the registration form, the app prompts the user to verify their phone number by entering a verification OTP that was sent via SMS, the user will sign in using username and password</i></p>
<b>What can go wrong</b>	<p><i>-A user attempts to sign in with an incorrect email address or password. The app displays an error message prompting the user to try again or reset their password.</i></p> <p><i>-The app prompts the user to verify their phone number by entering a verification code that was sent via SMS. If the user doesn't receive the verification code, they can request a new code or choose to verify their phone number later.</i></p>

Table 11

#### 4.5 Use Cases Description

Road Vision Ai: Create Account	
<b>Actors</b>	Reporter
<b>Description</b>	The system shall allow the Reporter to create an account. The reporter shall enter his first name, last name, phone number, email address and create a password. Also, he shall enter his age and choose whether he is female or male.
<b>Data</b>	First Name, Last Name, Age, Gender, phone number, e-mail address, and password.
<b>Stimulus</b>	The user enters the app, then clicks on the “Continue as a Reporter” button.
<b>Response</b>	system will send an OTP verification code to the reporter for authentication. This code will be sent via SMS message or email.
<b>Comments</b>	The entered information is necessary to create a unique reporter profile within the system

Table 12

Table 13

Road Vision Ai: Sign-in	
<b>Actors</b>	Reporters, Workers.
<b>Description</b>	The system shall allow the users to sign into their account. The users shall enter his username and password. Also, they should have an option to sign in using their Google, Apple, and Facebook accounts.
<b>Data</b>	Username, and password.
<b>Stimulus</b>	The user enters the app.
<b>Response</b>	Upon entering the correct information during creating the account, the users will be directed to the home page of the application.
<b>Comments</b>	The users must already have an account.

Table 14

<b>Road Vision AI: Report</b>	
<b>Actors</b>	Reporter
<b>Description</b>	The reporter starts the report creation process then he is prompted to attach images to the report. He has the option to choose images from either the camera or the gallery using the "Attach Images" functionality. After attaching the images, the reporter is prompted to add the location of the report using the "Location" functionality. He can either enter the location manually or automatically. Following that, the reporter is prompted to provide additional information related to the report using the "Additional Information" functionality to add description. Then, he can see review to his report before submitting it.
<b>Data</b>	Image URL, Date and Time, Location Address.
<b>Stimulus</b>	Signed in as reporter.
<b>Response</b>	After the reporter submits a report, he will receive a message notifying that he has earned a reward.
<b>Comments</b>	The user must be logged in as Reporter.

Table 15

<b>Road Vision Ai: Create Account</b>	
<b>Actors</b>	Worker
<b>Description</b>	The worker shall be able to enter their first name, last name, worker ID, company ID, phone number, email address, and create a password. Additionally, the worker is required to provide their age and indicate their gender by choosing between the options of female or male
<b>Data</b>	first name, last name, worker ID, company ID, phone number, email address, age and gender.
<b>Stimulus</b>	The user enters the app, then clicks on the “Continue as a Worker” button.

<b>Response</b>	system will send an OTP verification code to the reporter for authentication. This code will be sent via SMS message or email.
<b>Comments</b>	The entered information is necessary to create a unique worker profile within the system

Table 16

<b>Road Vision AI: Payment method</b>	
<b>Actors</b>	Worker
<b>Description</b>	When workers sign up, they are required to add a payment method. This can be done by entering their credit card.
<b>Data</b>	Billing address.
<b>Stimulus</b>	signed in as worker.
<b>Response</b>	Upon successful completion of the payment method process, the system will prompt the worker to verify their payment method using an OTP verify number
<b>Comments</b>	The user shall sign in as a worker.

Table 17

<b>Road Vision AI: Work Cases</b>	
<b>Actors</b>	Worker
<b>Description</b>	The worker shall be able to see a list of work cases. Also, the worker shall be able to click on specific cases. Then, the worker will be directed to a detailed view of the case. Within this view, he will have access to various information, including the location, needed materials, width, depth, and status associated with the report.

	Then, the worker will be directed to “Closing Case” to fill in the actual info of the report and upload a picture of the fixed case and purchase invoices.
<b>Data</b>	location, needed materials, width, depth, and status.
<b>Stimulus</b>	signed in as worker
<b>Response</b>	The worker will get a message with the amount of money which is transferred to his account.
<b>Comments</b>	The user must be logged in as a Worker.

## 4.6 Non-functional Requirements

### 4.6.1 Performance Requirements

- The app should load quickly and be responsive to user actions.
- The application must be efficient, and the system should be designed accurately.

### 4.6.2 Dependability Requirements

- The app must ensure 24/7 availability and reliability to users, with any scheduled maintenance downtime kept to a minimum and not exceeding 120 minutes per month.
- The app should open quickly and not have frequent interruptions.

### 4.6.3 Security Requirements:

- The system should ensure the confidentiality and integrity of user data by implementing encryption mechanisms for data storage.
- The system should use authentication factors to ensure that only authorized users can access sensitive data.

### 4.6.4 Usability Requirements:

- The app should have a clear and intuitive interface.

- The app should provide instructions to users to use the app.

#### 4.6.5 Operational and Environmental Requirements:

- The app should work on a variety of devices with different screen sizes.
- Regular updates and bug fixes should be provided to ensure the app remains compatible with the latest operating systems and devices.

#### 4.6.6 Maintainability Requirements:

- The app should be easy to update and maintain.
- The app's code should be well-documented and organized.

### 4.7 Data Requirements

Reporter's Data: First Name, Last Name, Email Address, Phone Number Password, Age, Attachments, Description, Report status, Location

Worker's Data: First Name, Last Name, Email Address, Phone Number Password, Age, company ID, Worker ID, payment method

## 5.0 Analysis and Design

### 5.1 Activity Diagrams

-sign in activity diagram

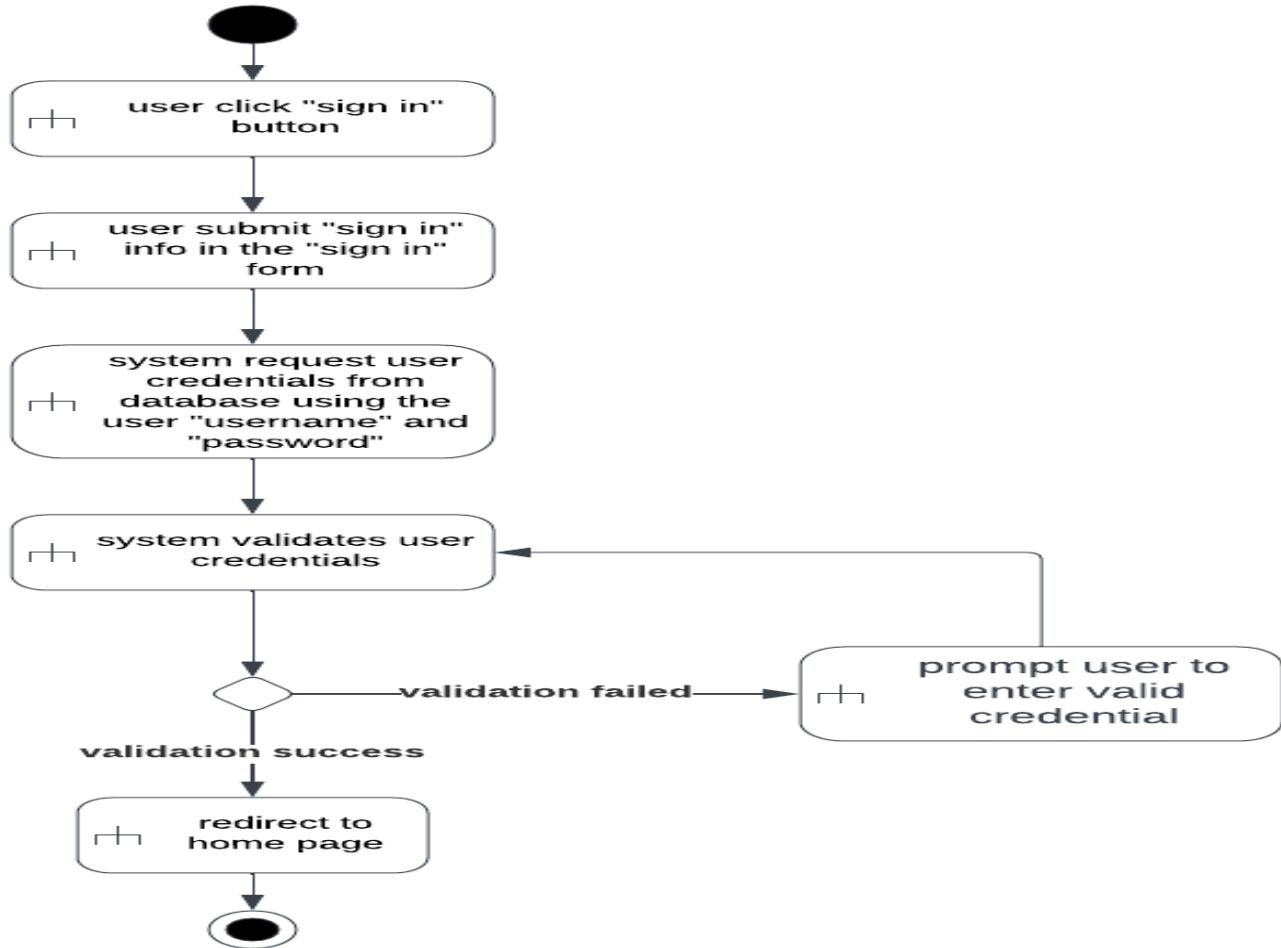


Figure 6

-create account activity diagram

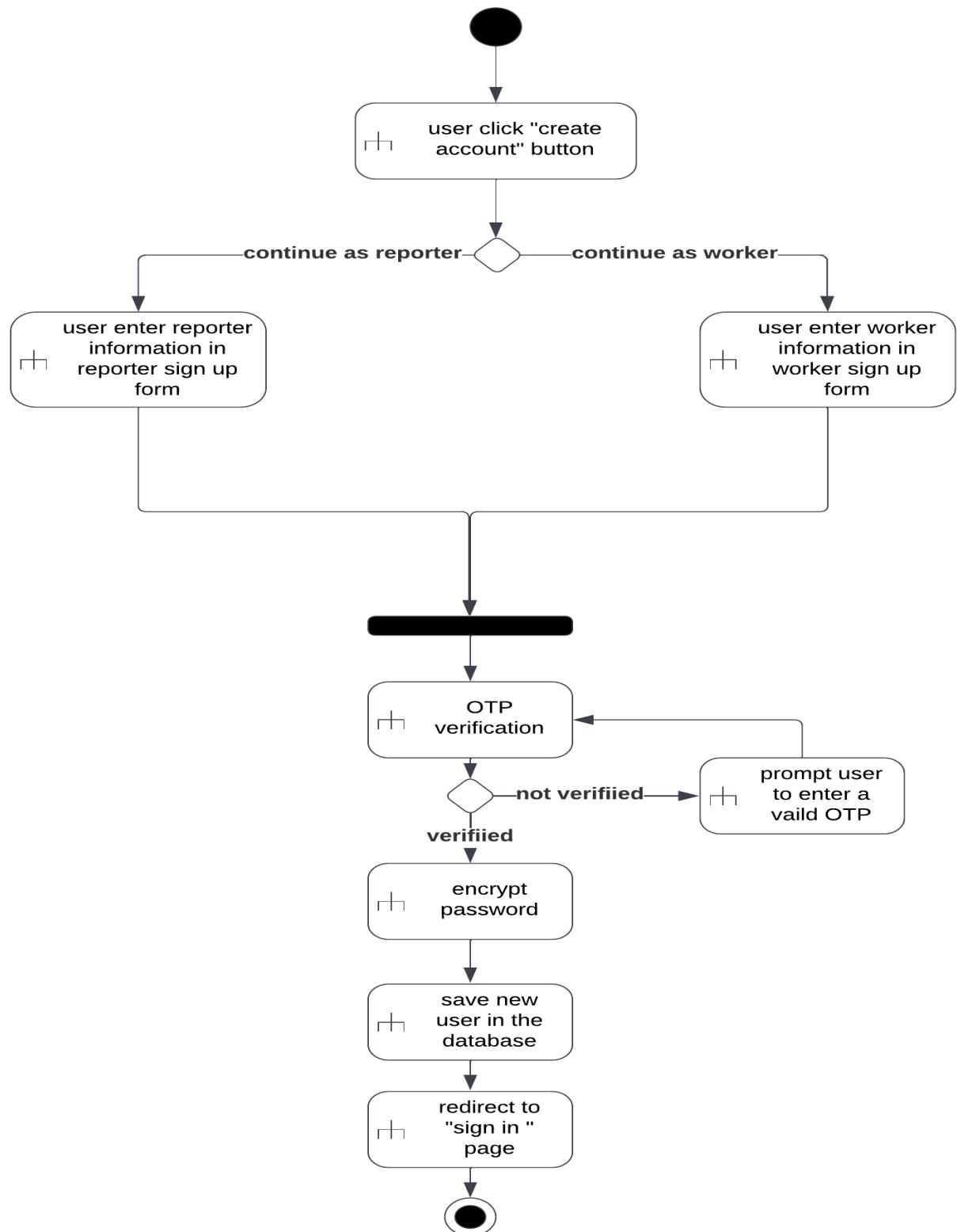


Figure 7

## -Report activity diagram

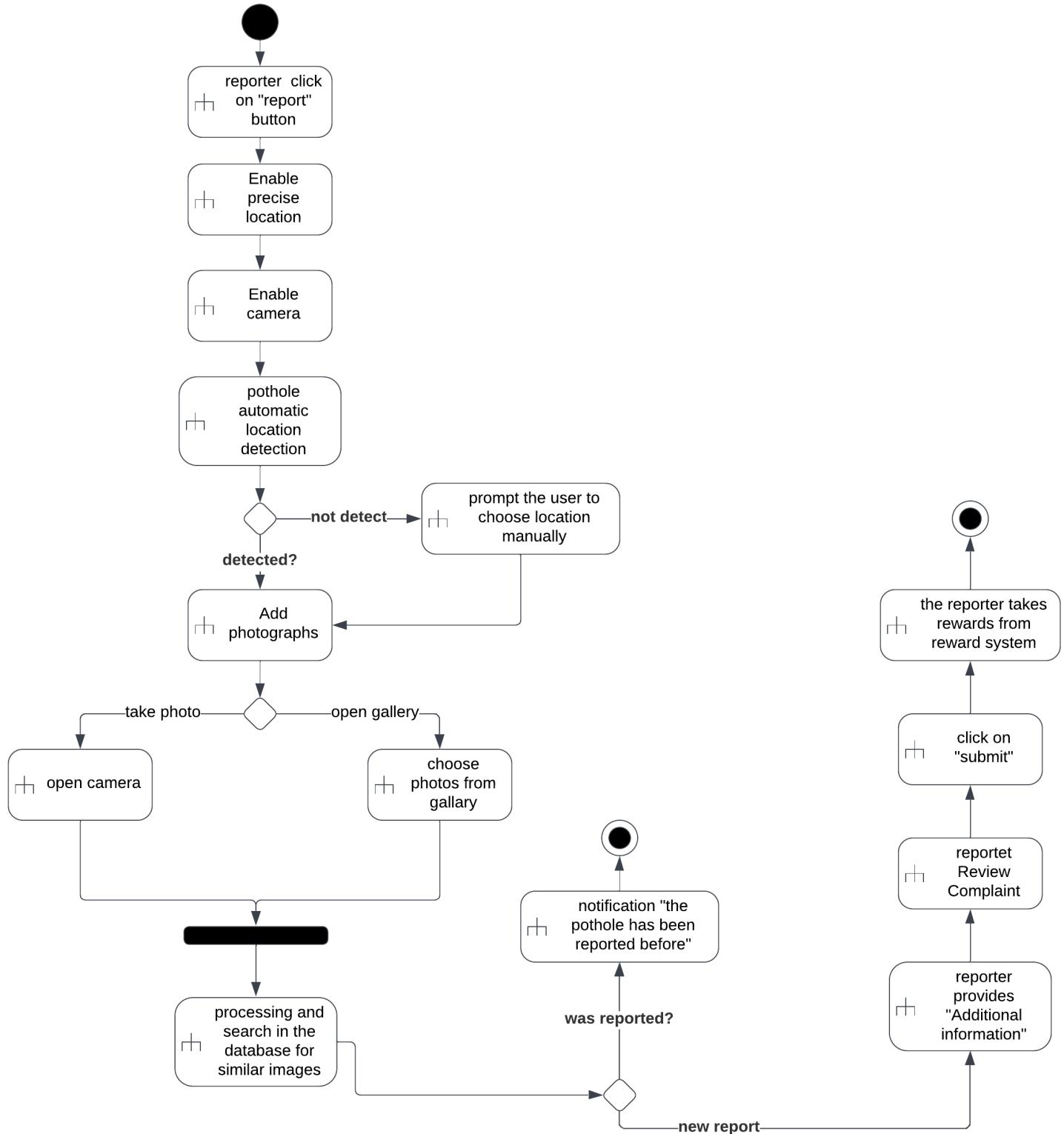


Figure 8

-work activity diagram

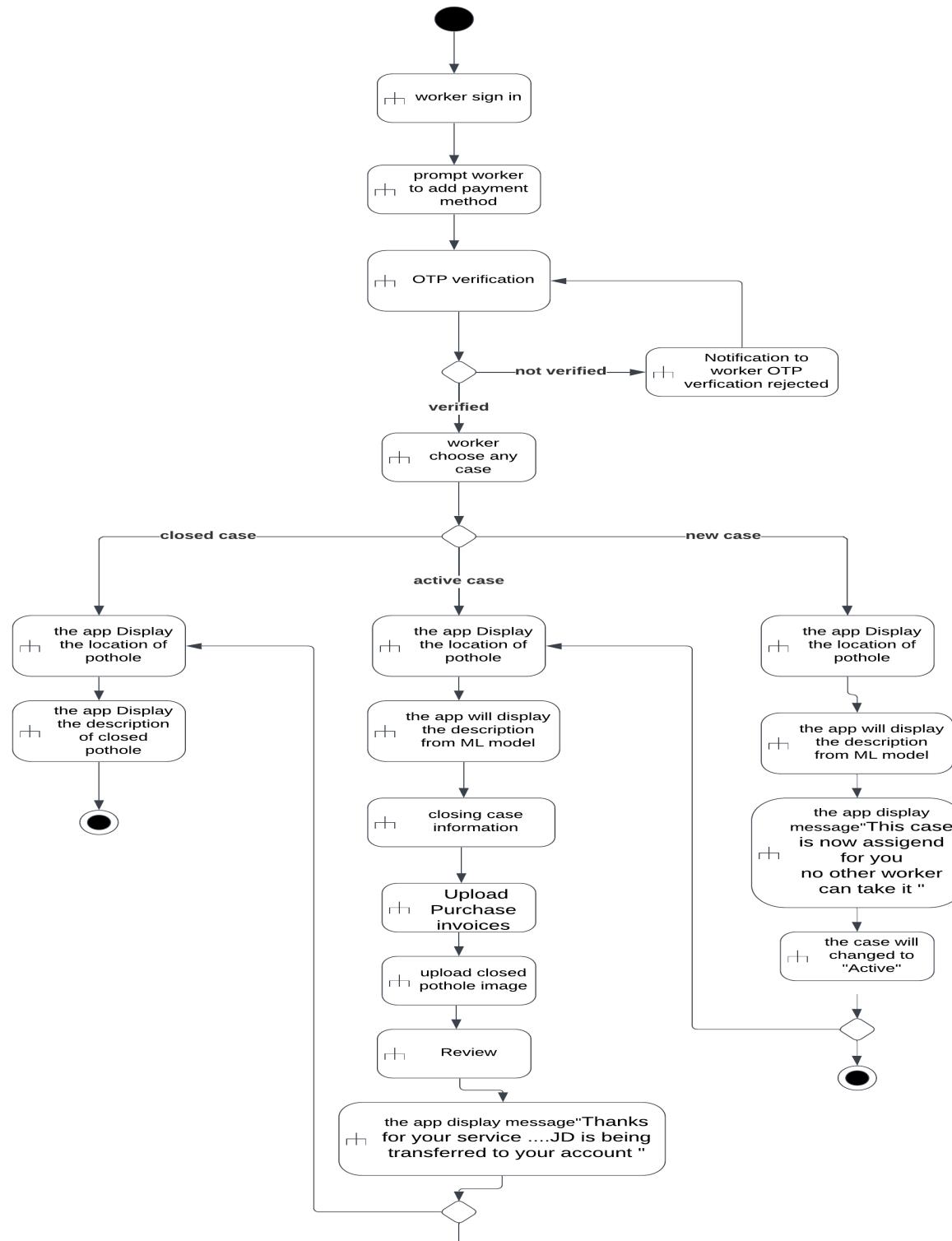


Figure 9



## 5.2 Sequence Diagrams

-sign in sequence diagram

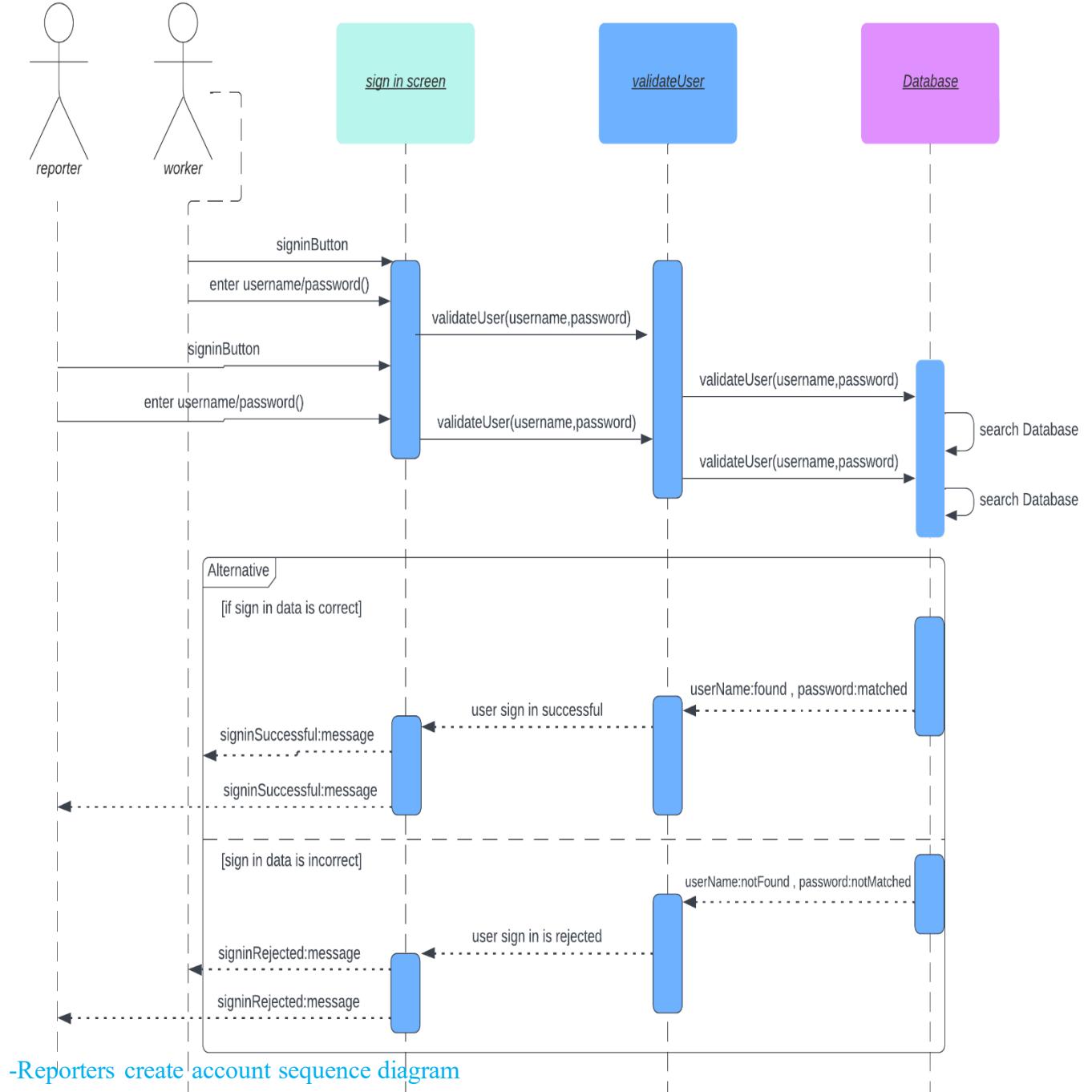


Figure 10



Figure 11

## - Worker create account sequence diagram



Figure 12

## -Report sequence diagram

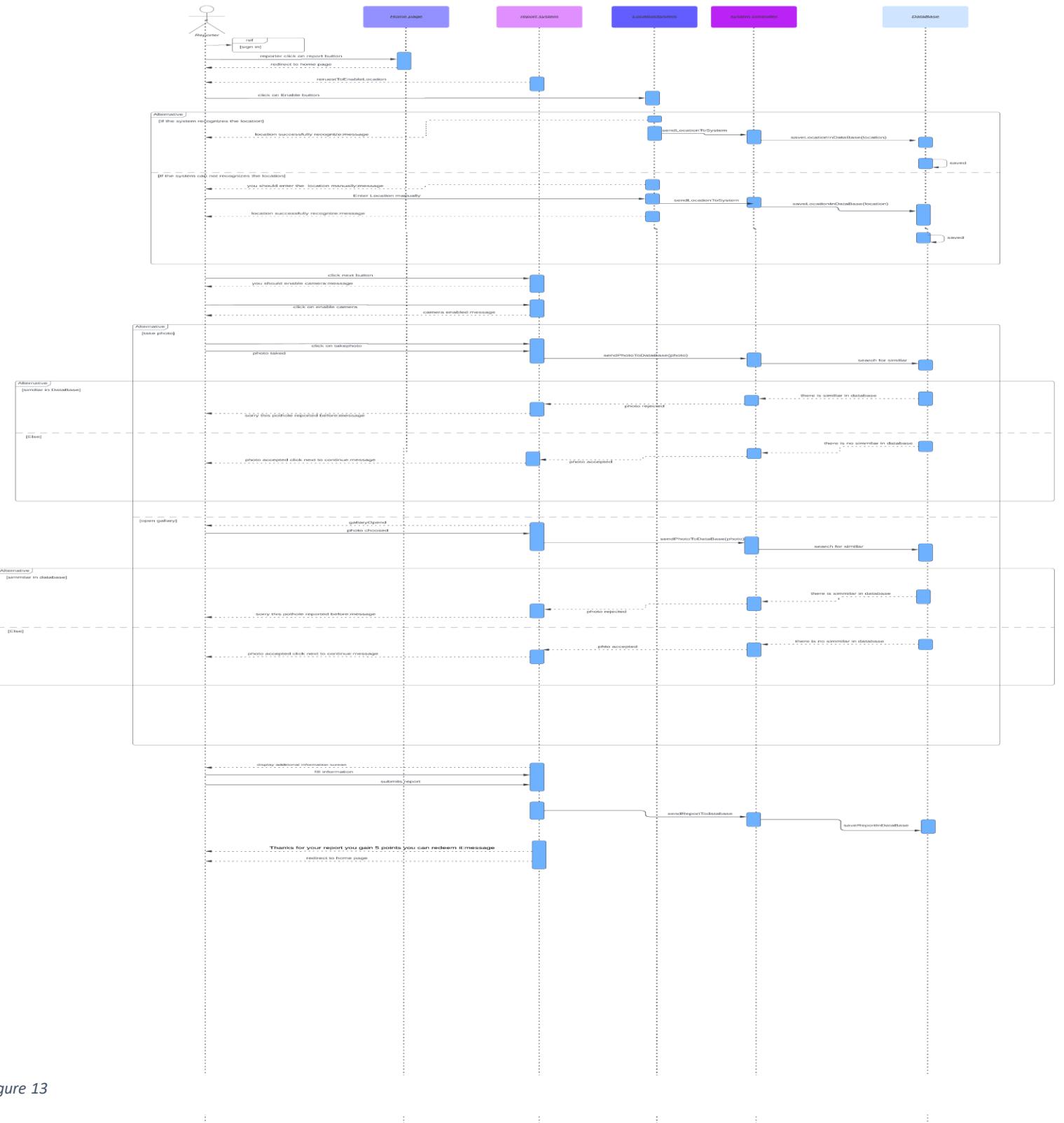


Figure 13

## -work sequence diagram

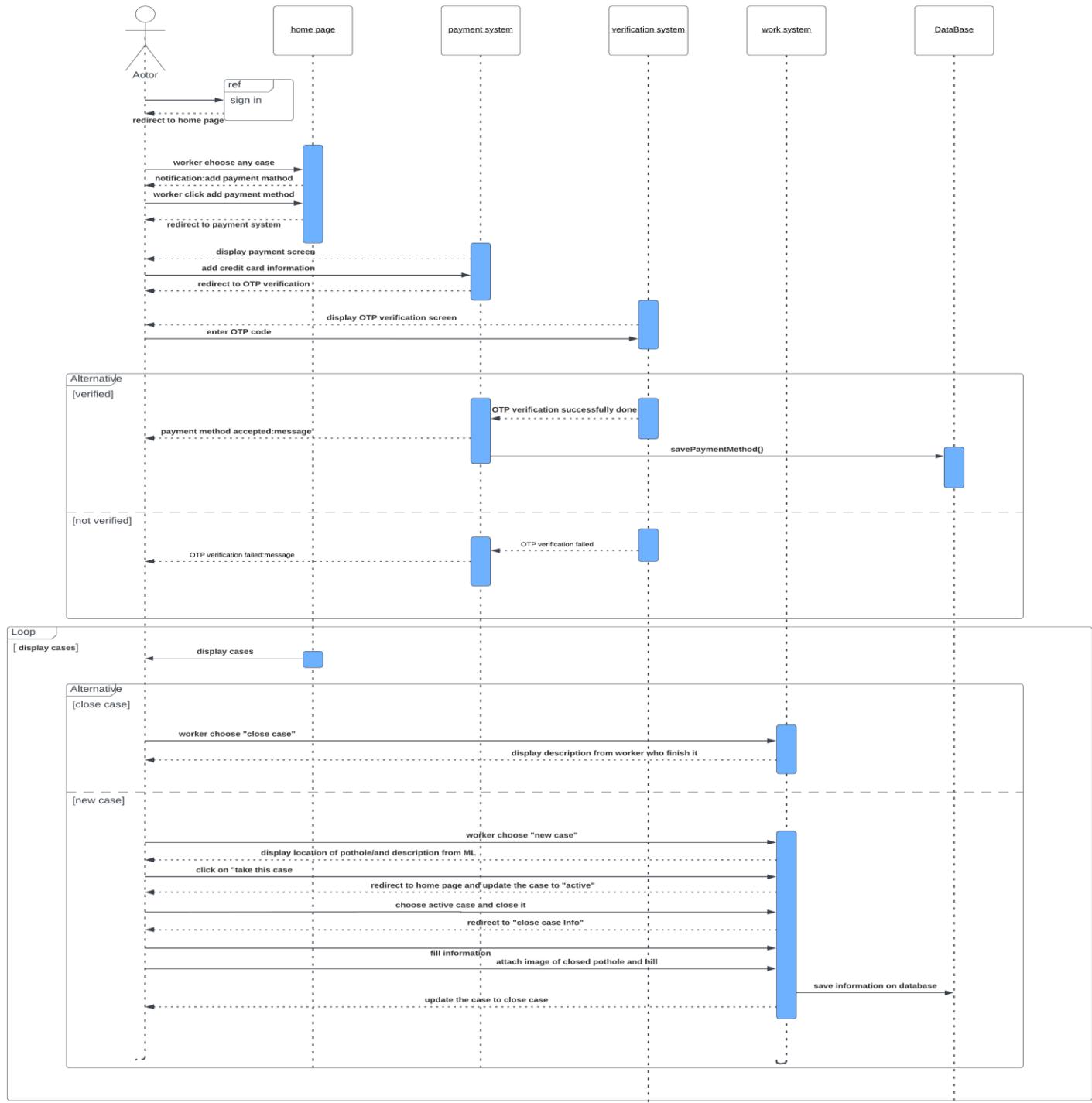


Figure 14

## -Reward system sequence diagram

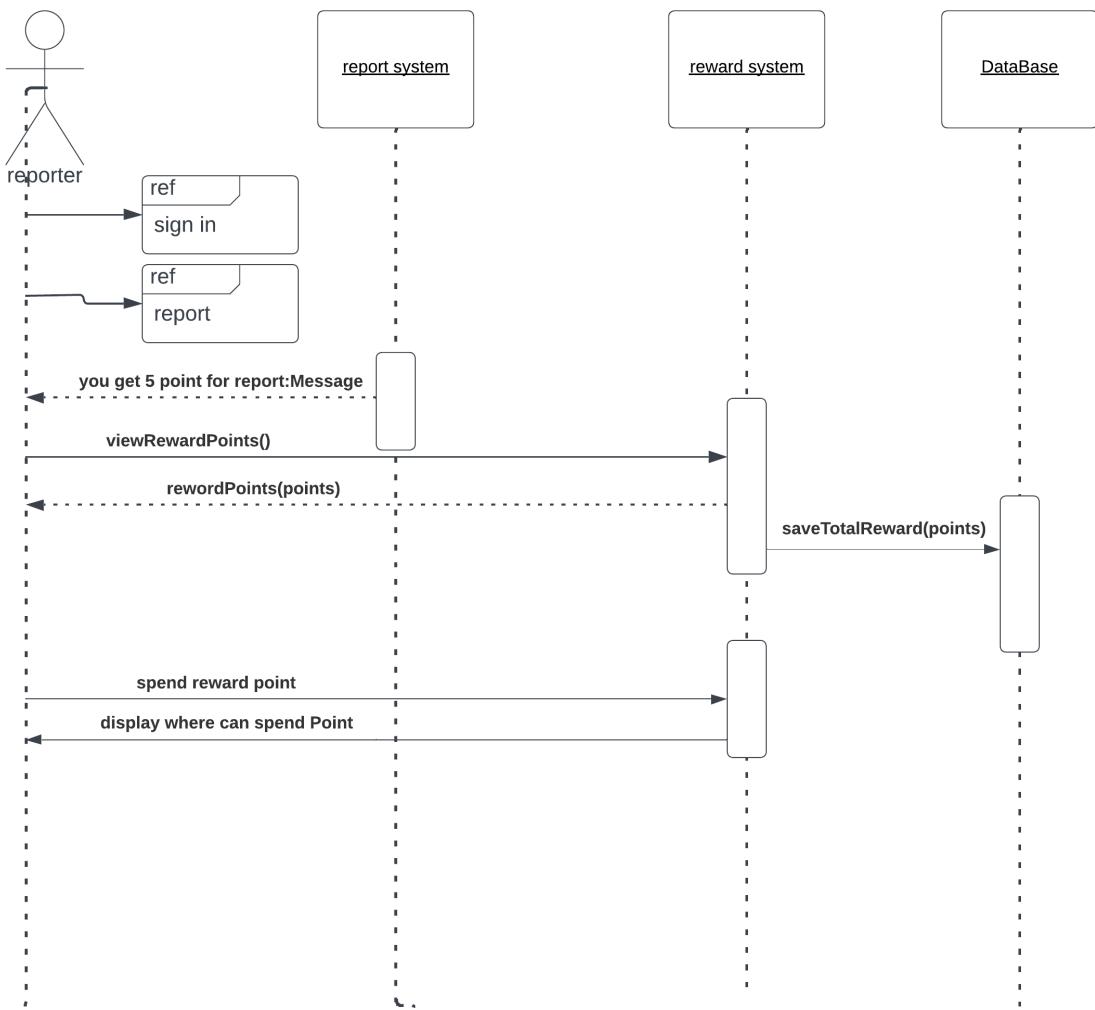


Figure 15

## 5.3 Class Diagram

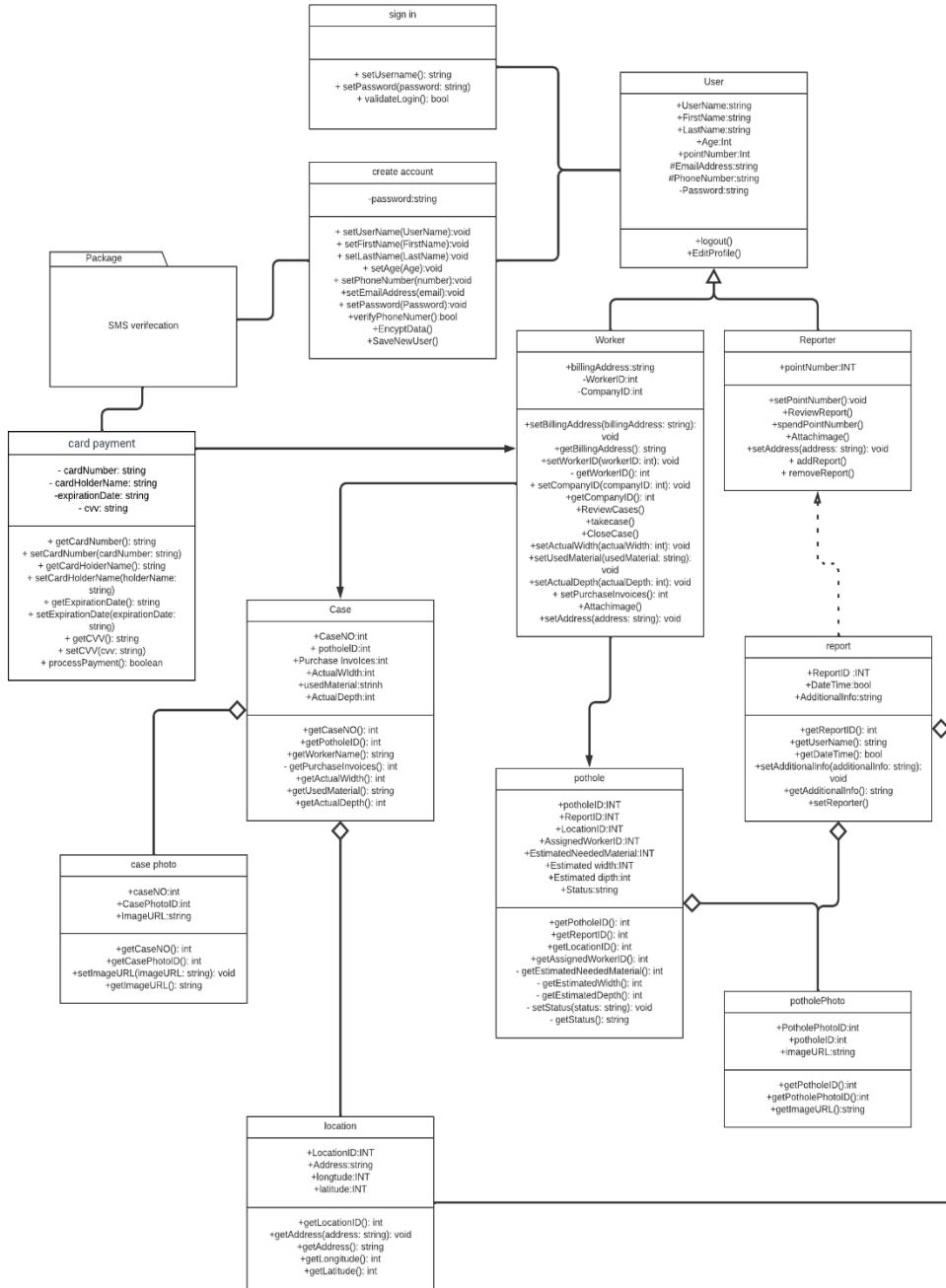


Figure 16

## 5.4 Object to ER Mapping

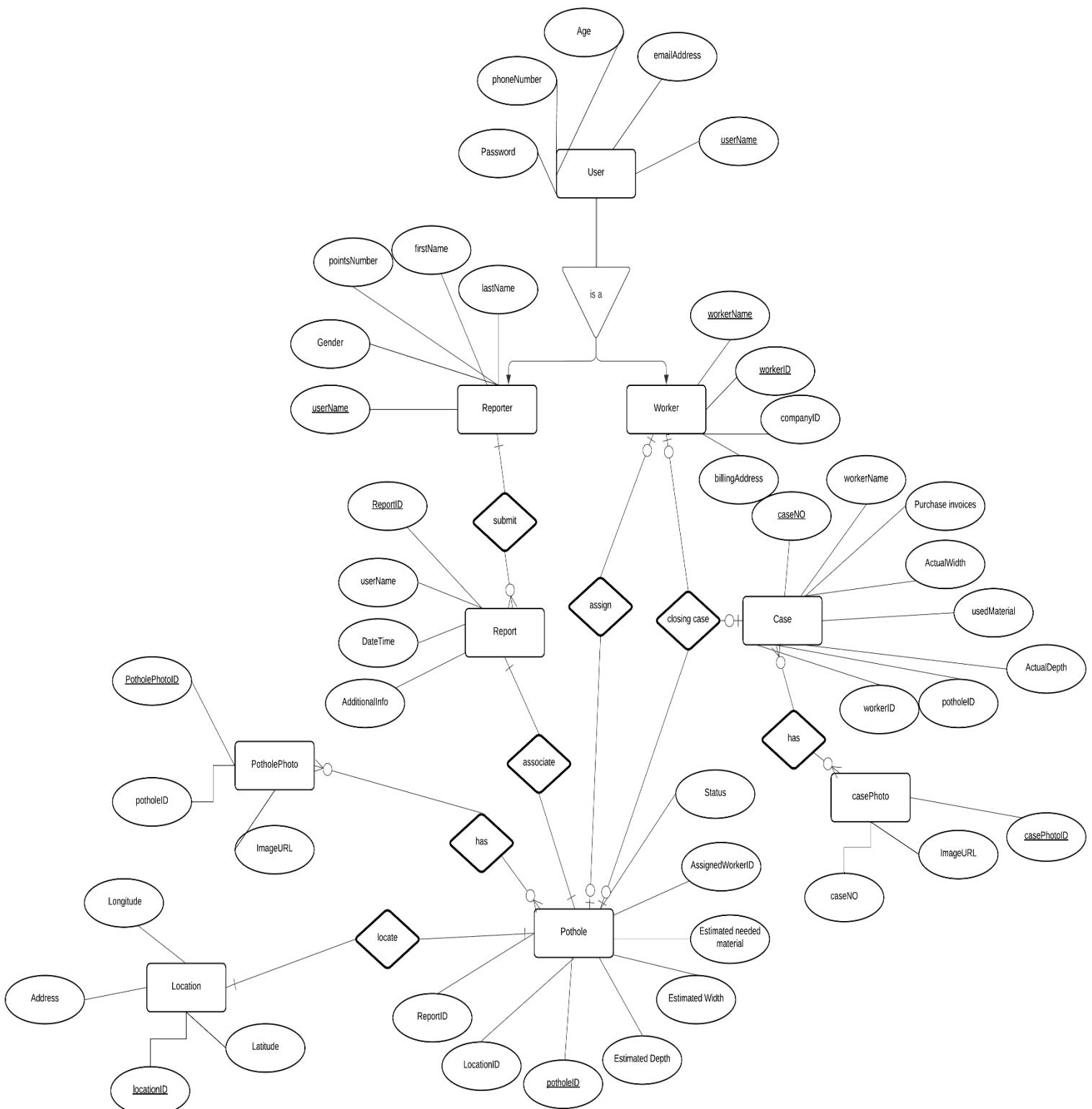


Figure 17

## 5.5 Physical Database Design

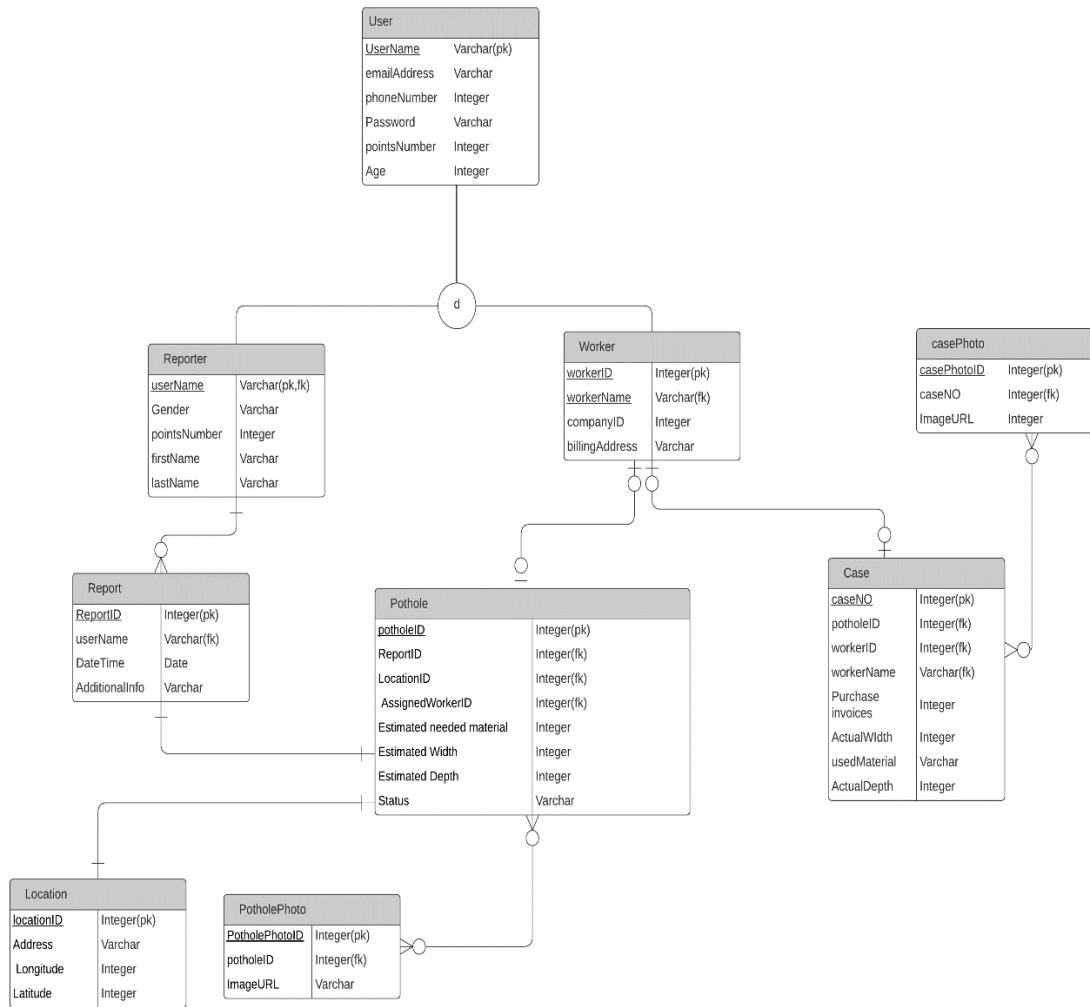


Figure 18

## 5.6 Architecture Design

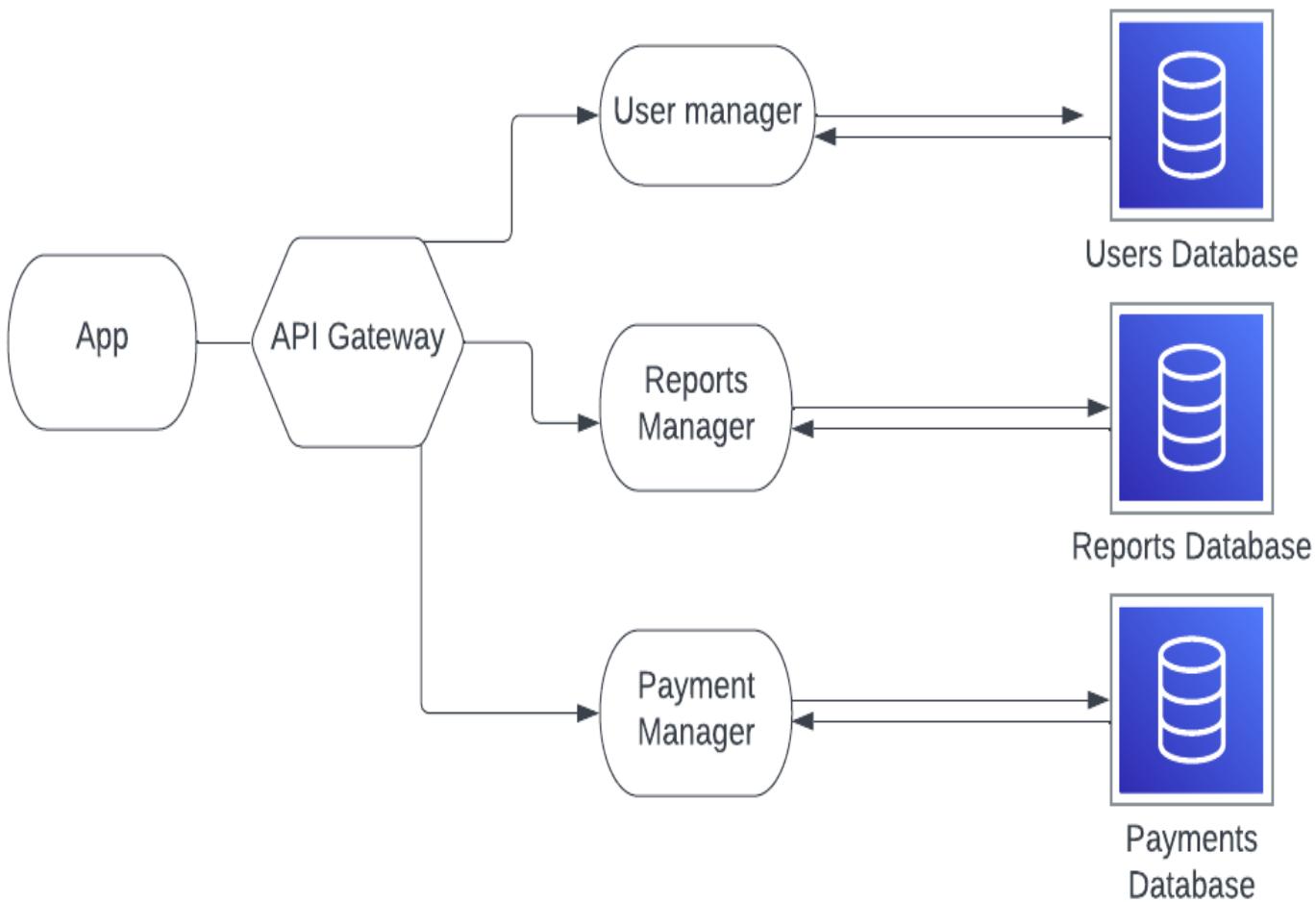


Figure 19

## 5.7 Classes and Components Design

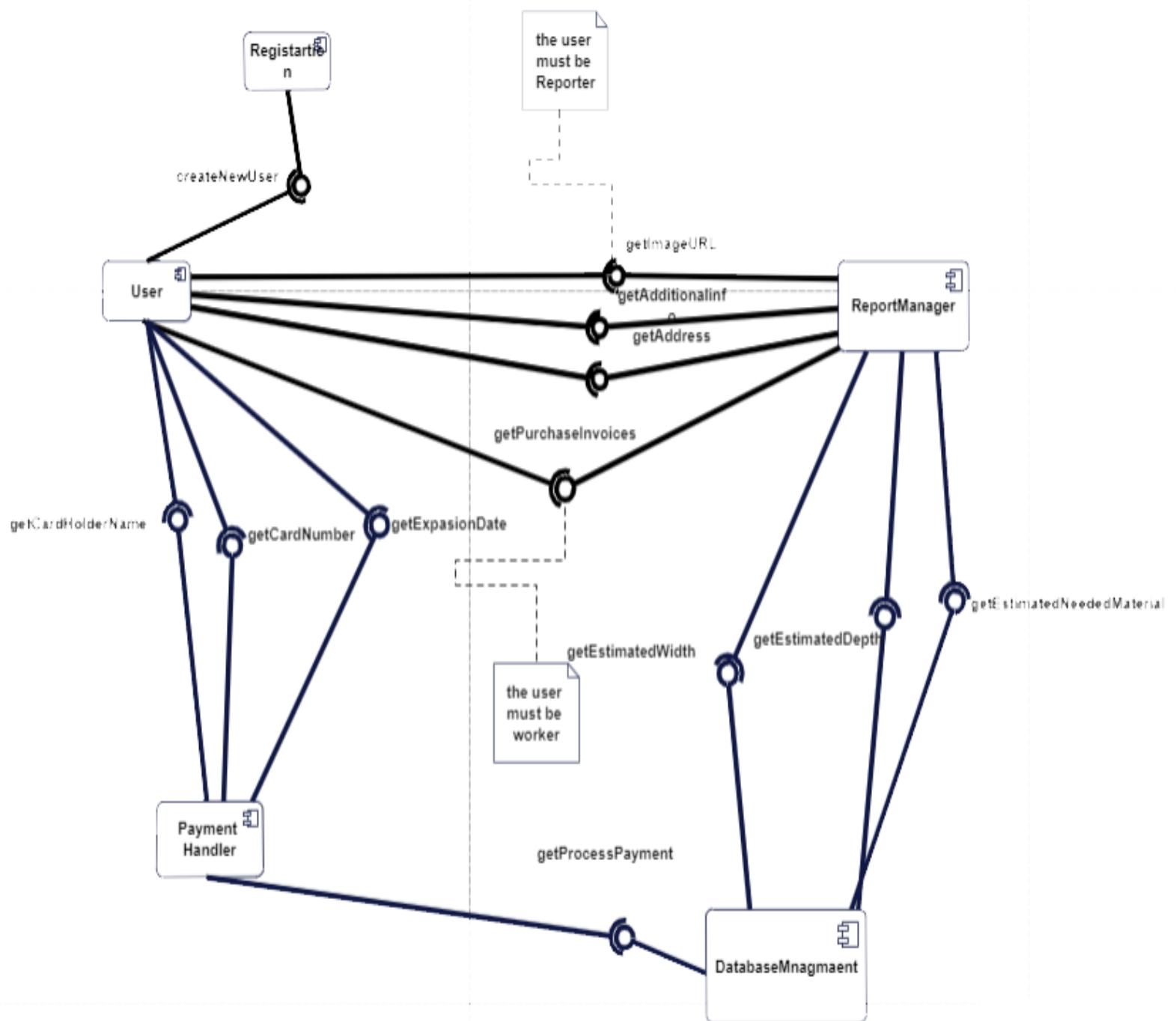


Figure 20

## 5.8 Graphical User Interface Design



Figure 21



Figure 23

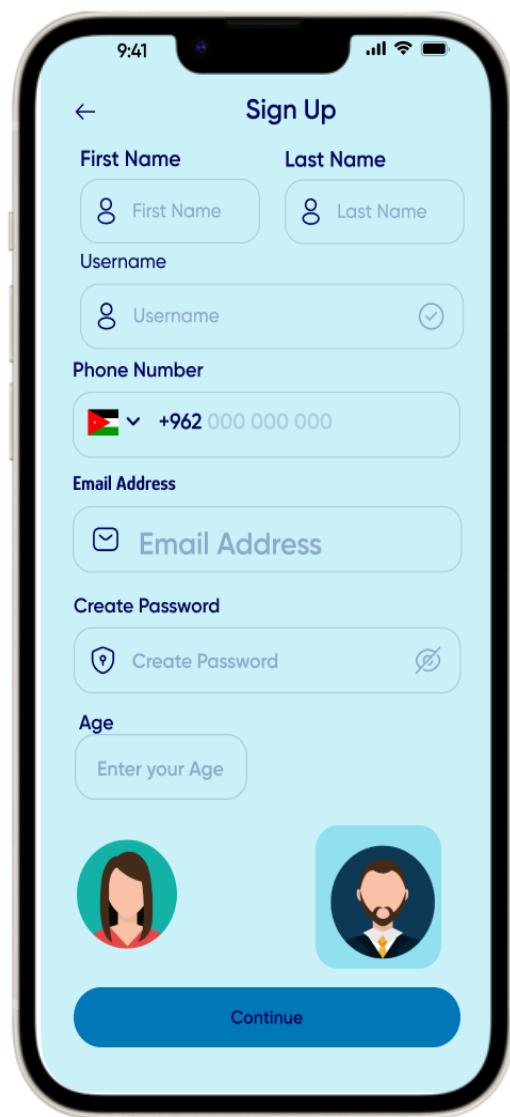


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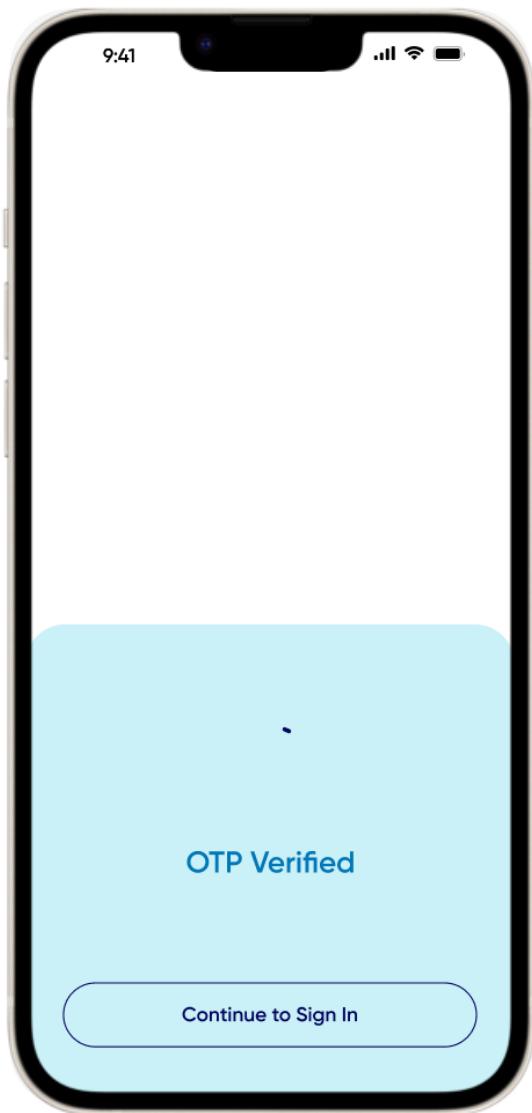
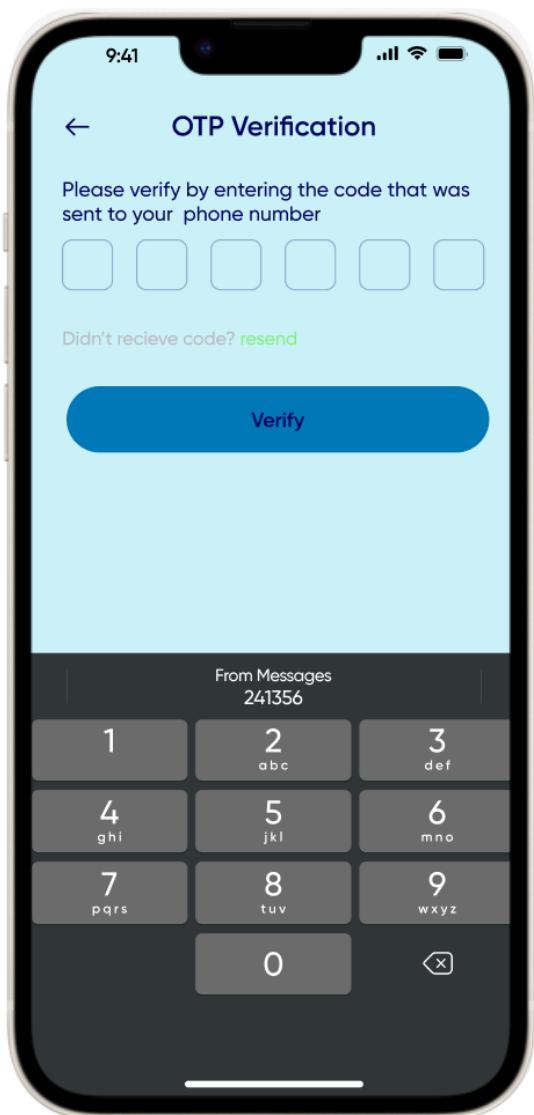


Figure 25

Figure 24

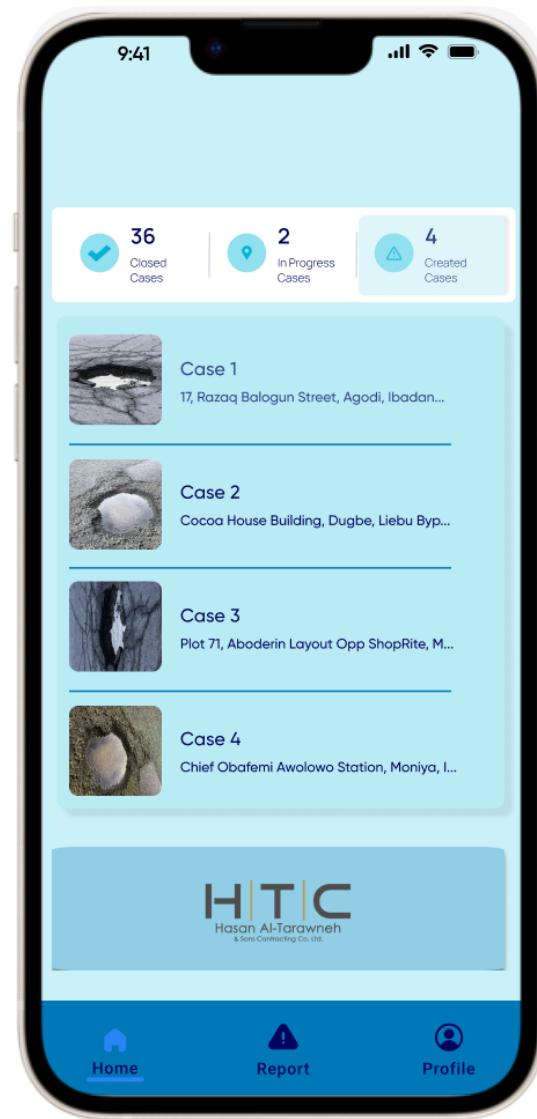
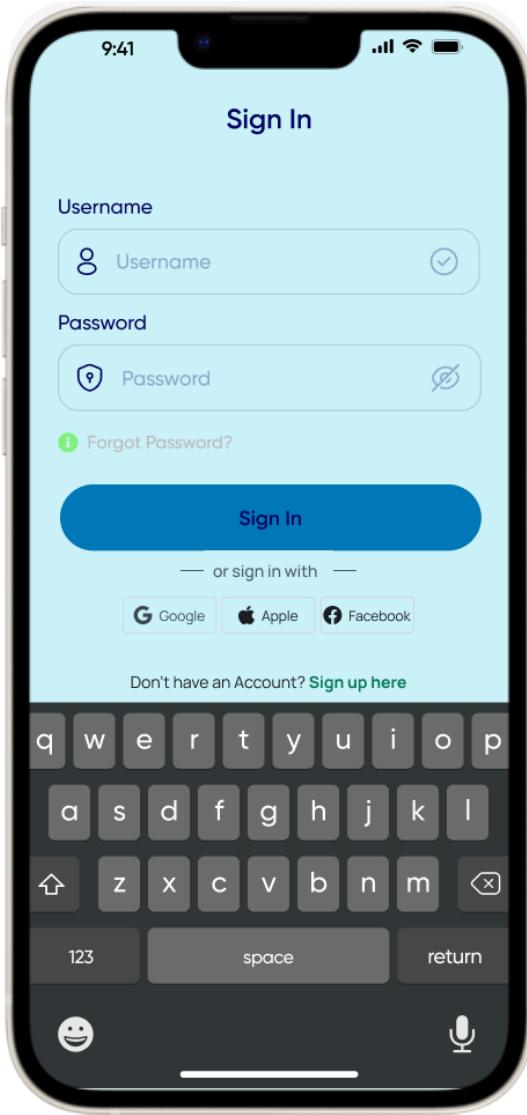


Figure 27

Figure 26

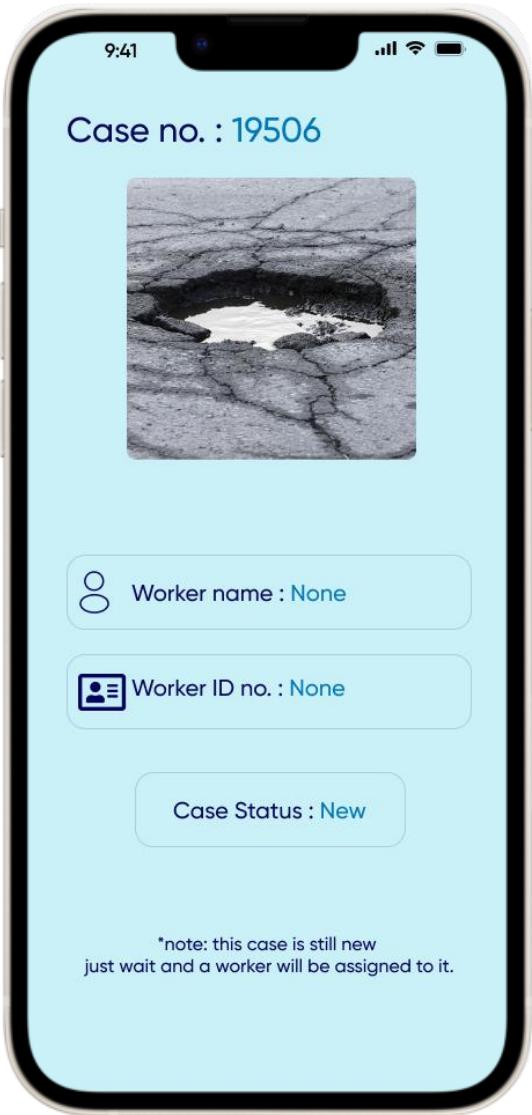


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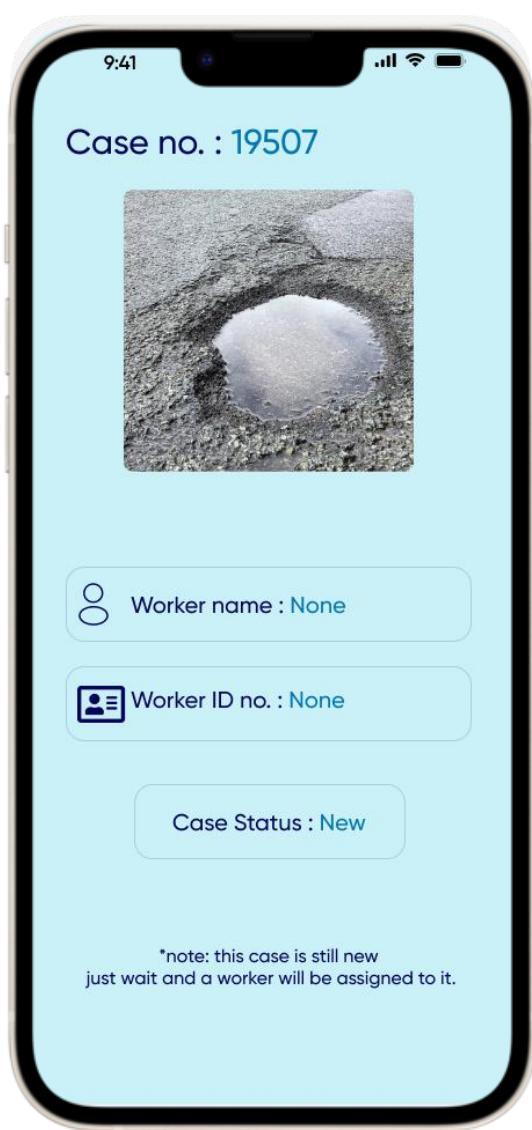


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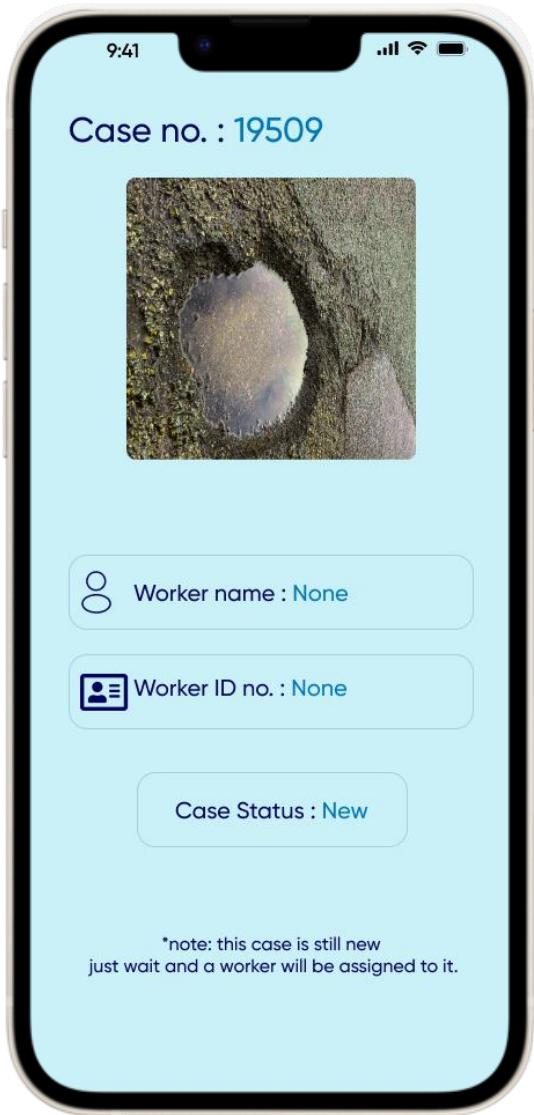


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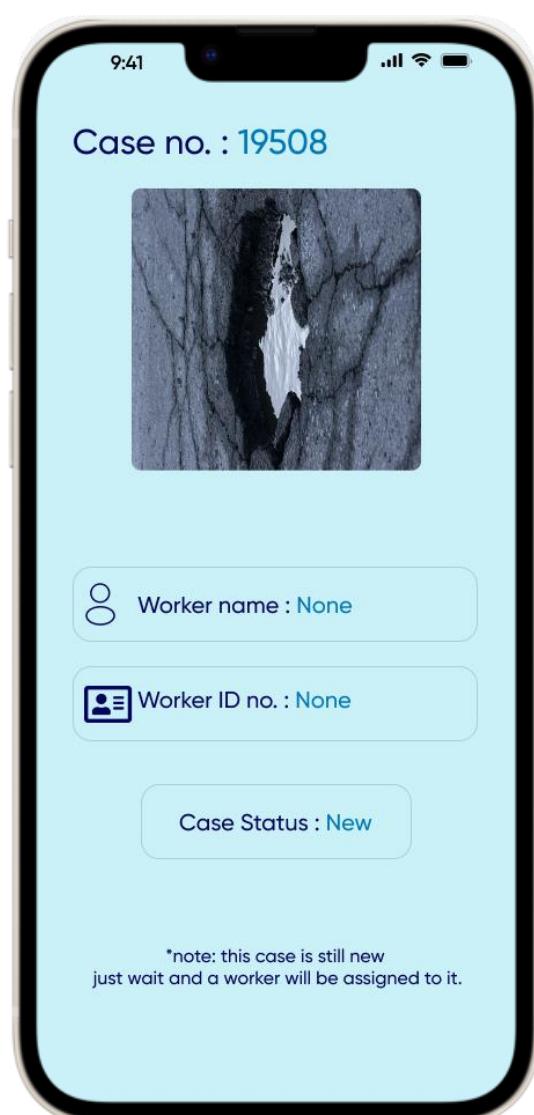


Figure 30

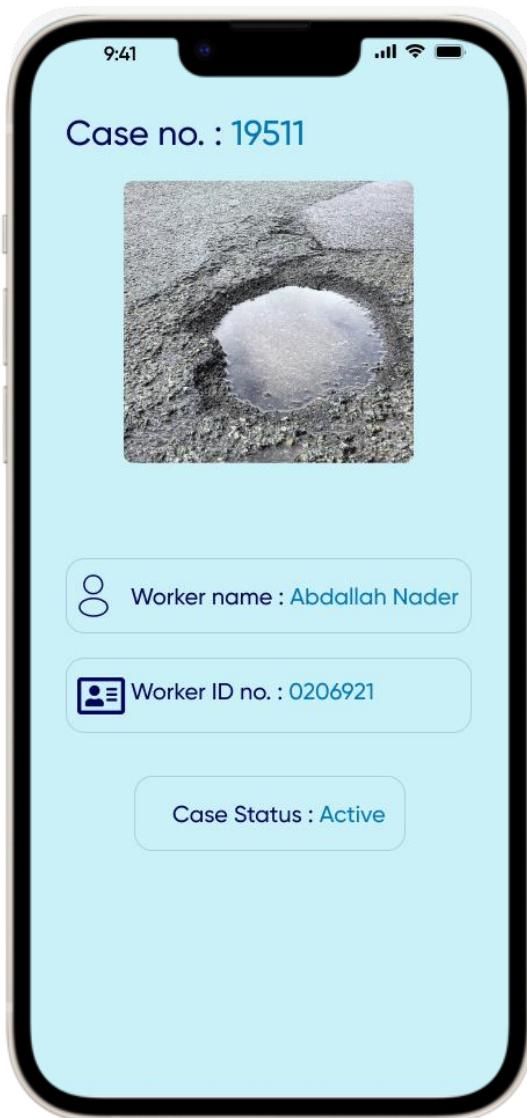
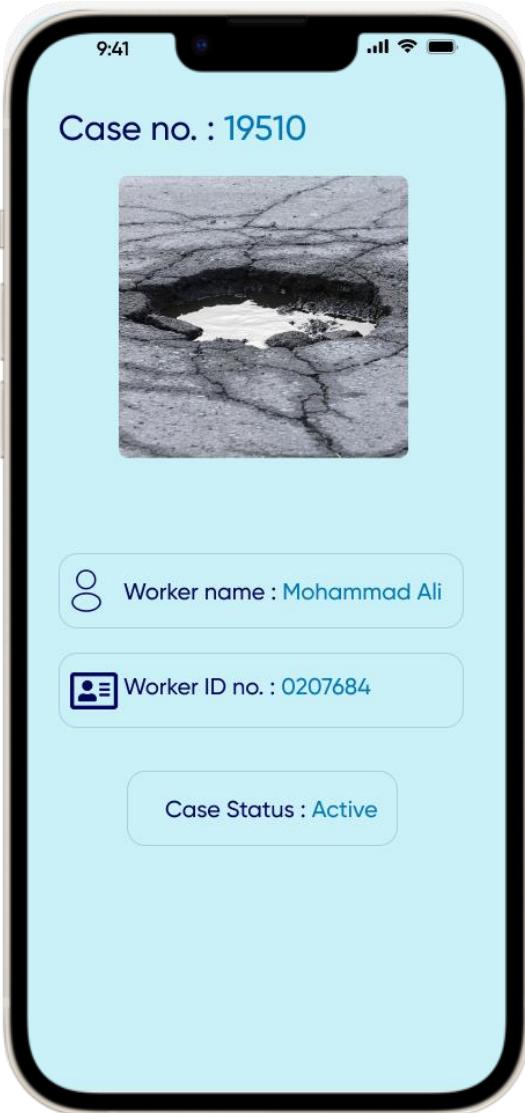


Figure 33

Figure 32

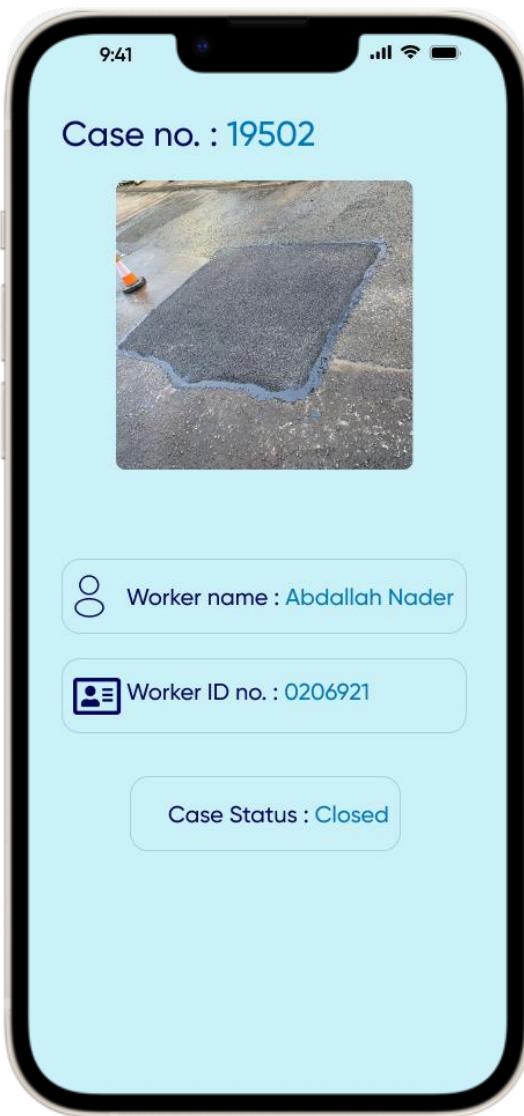
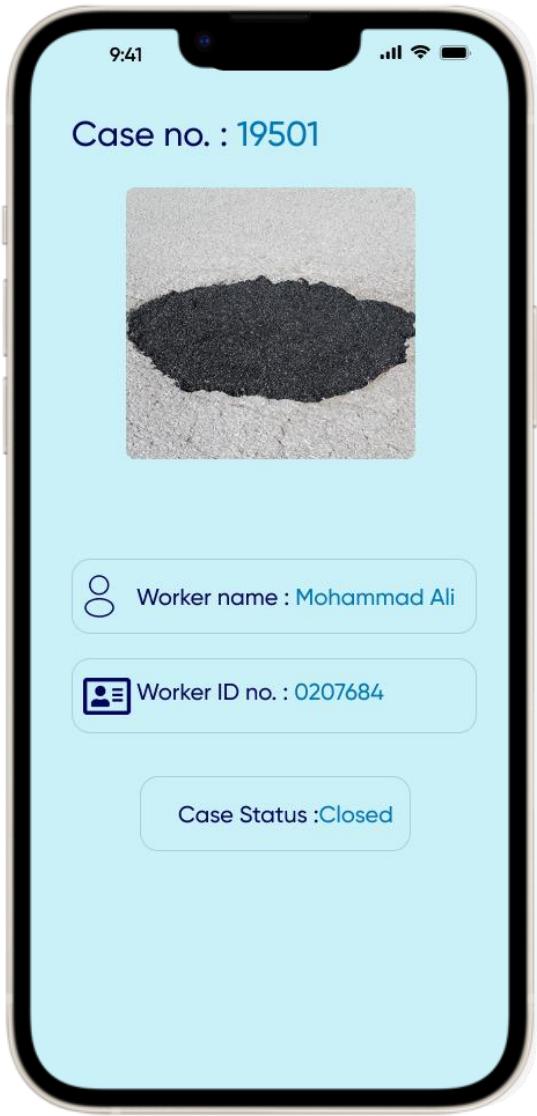


Figure 35

Figure 34

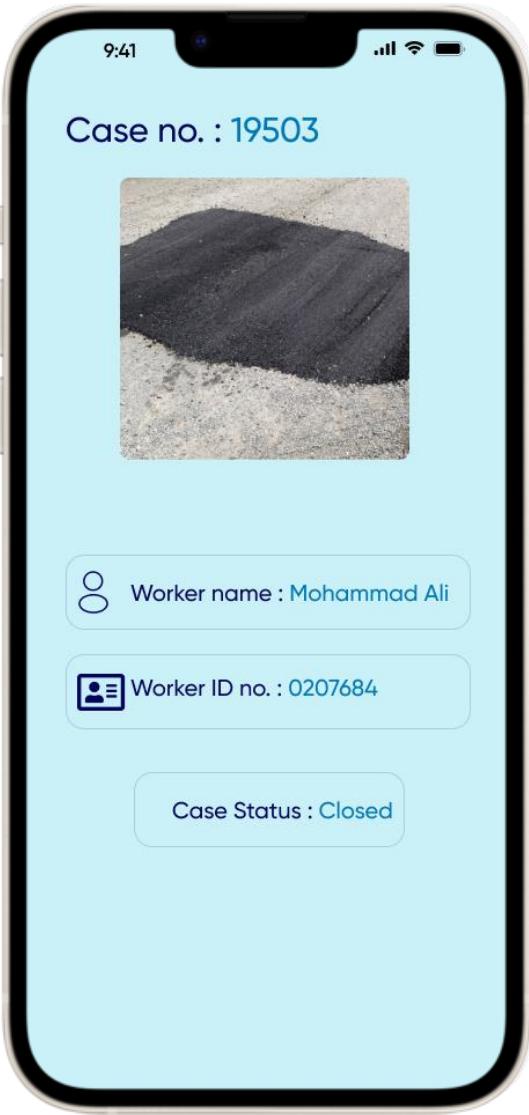


Figure 37

Figure 36

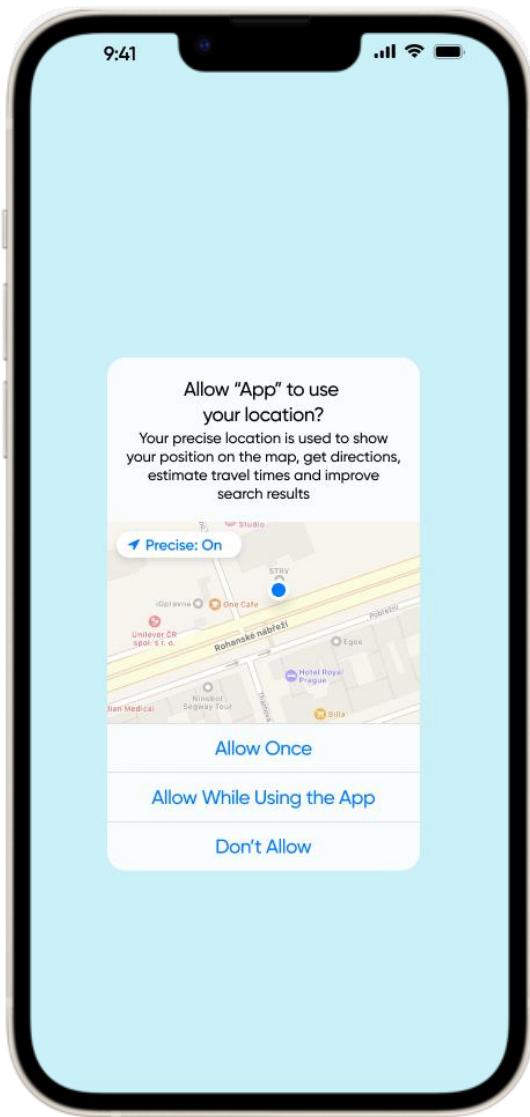
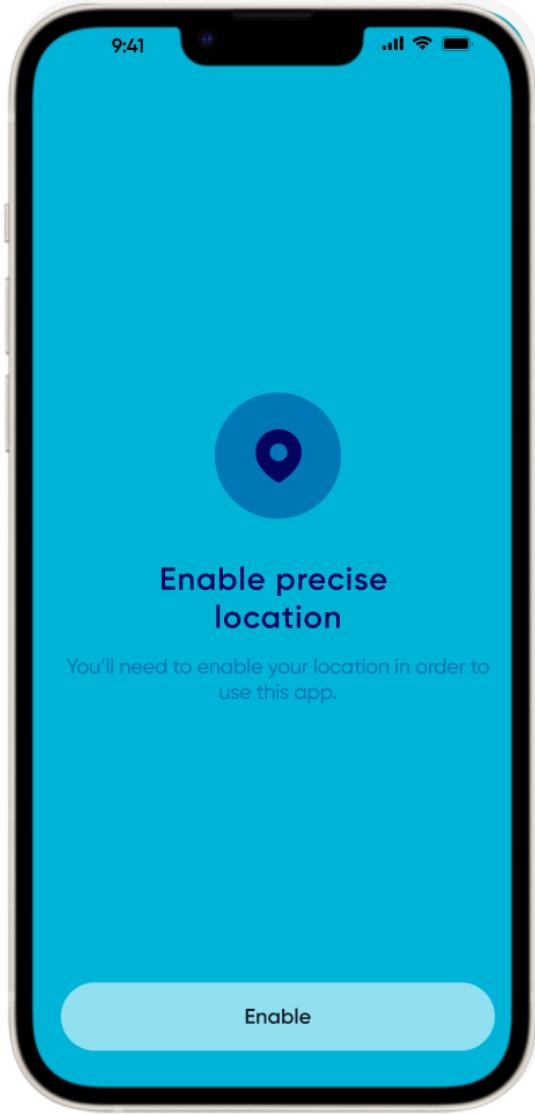


Figure 38

Figure 39

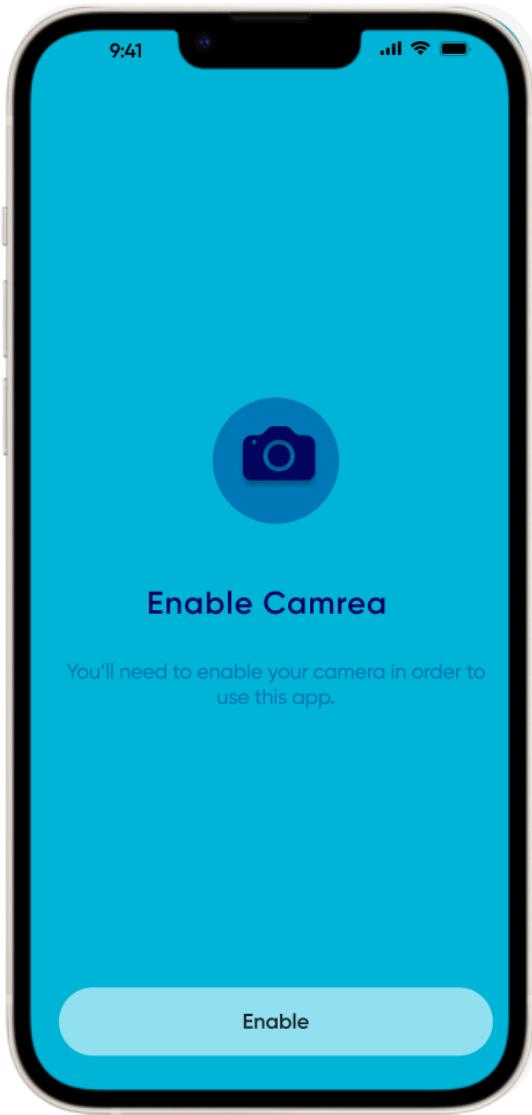


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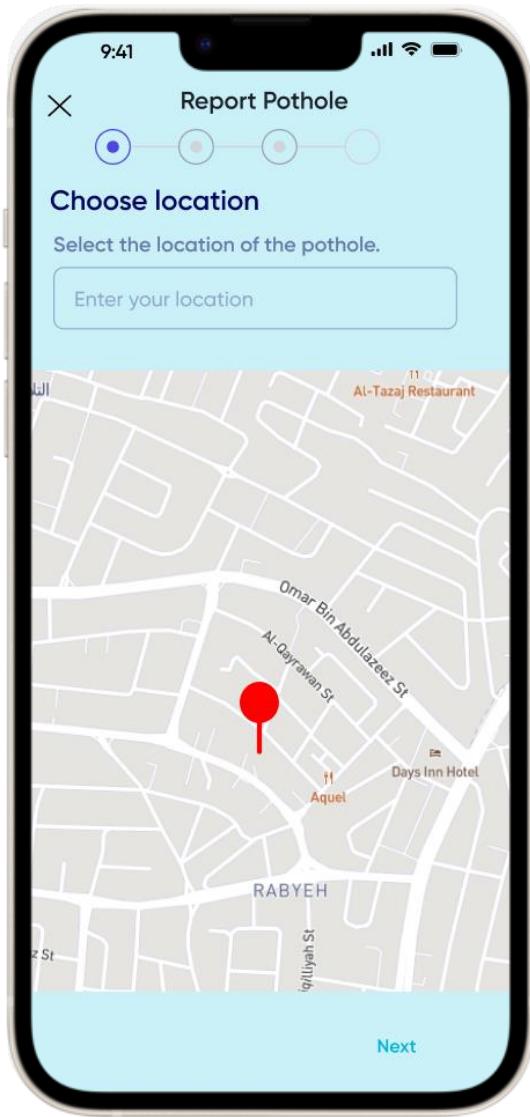


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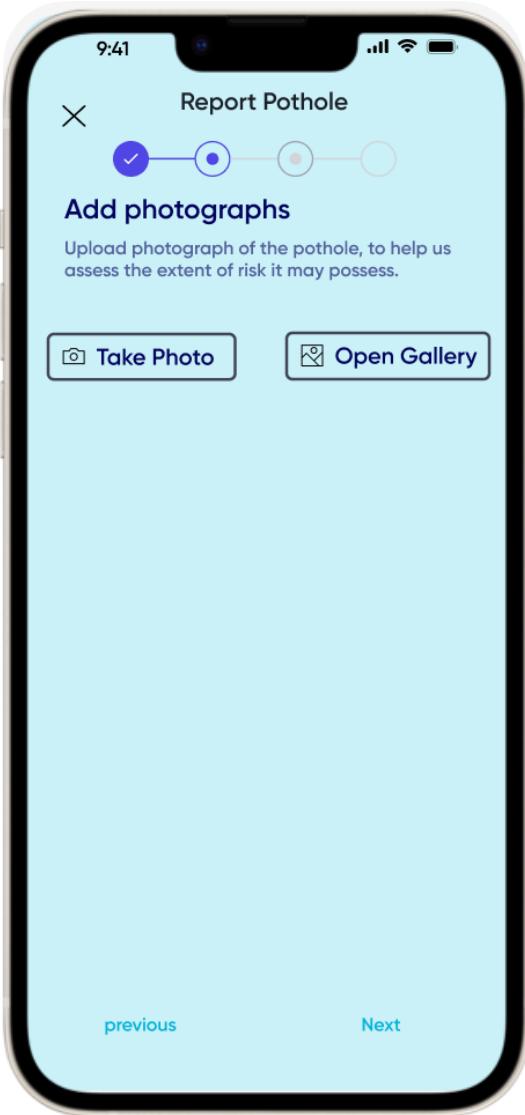


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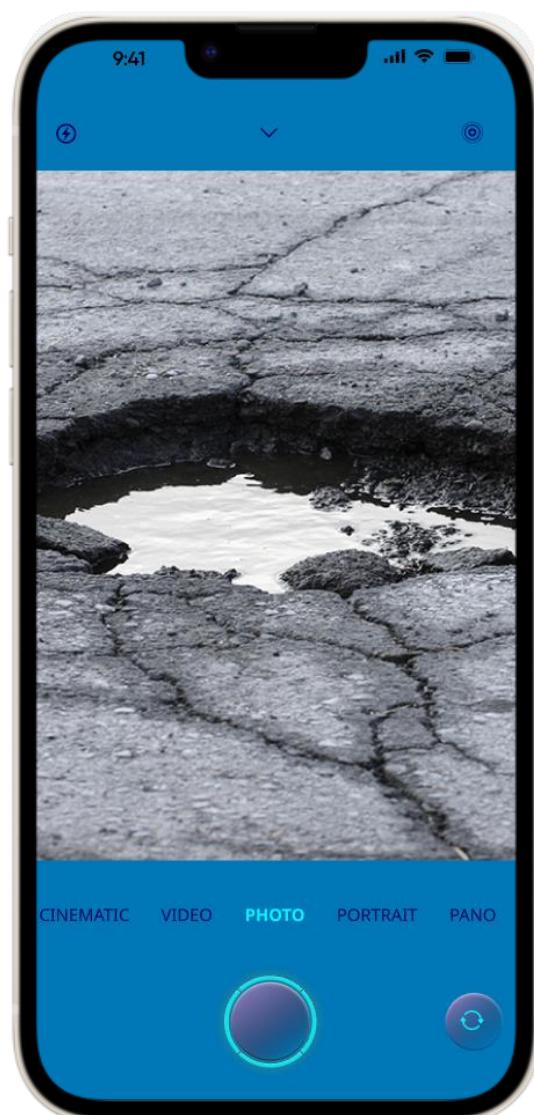


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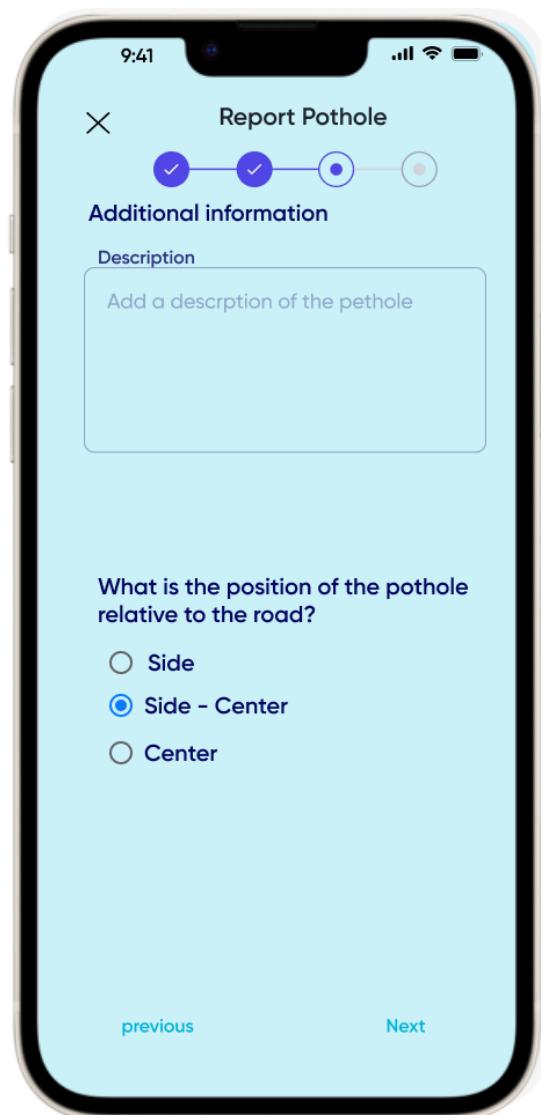
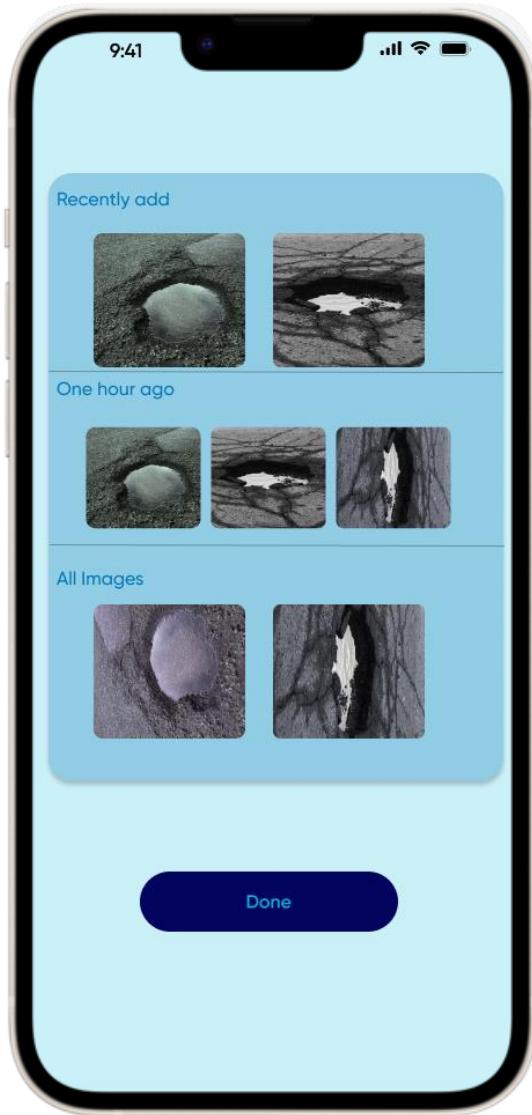


Figure 45

Figure 44



Figure 47

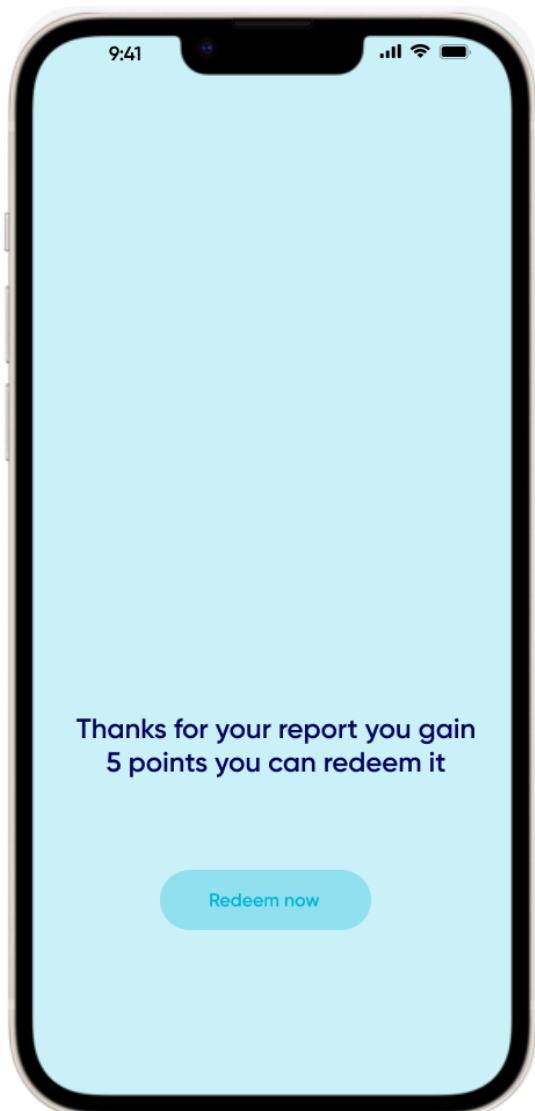


Figure 46



Figure 49



Figure 48

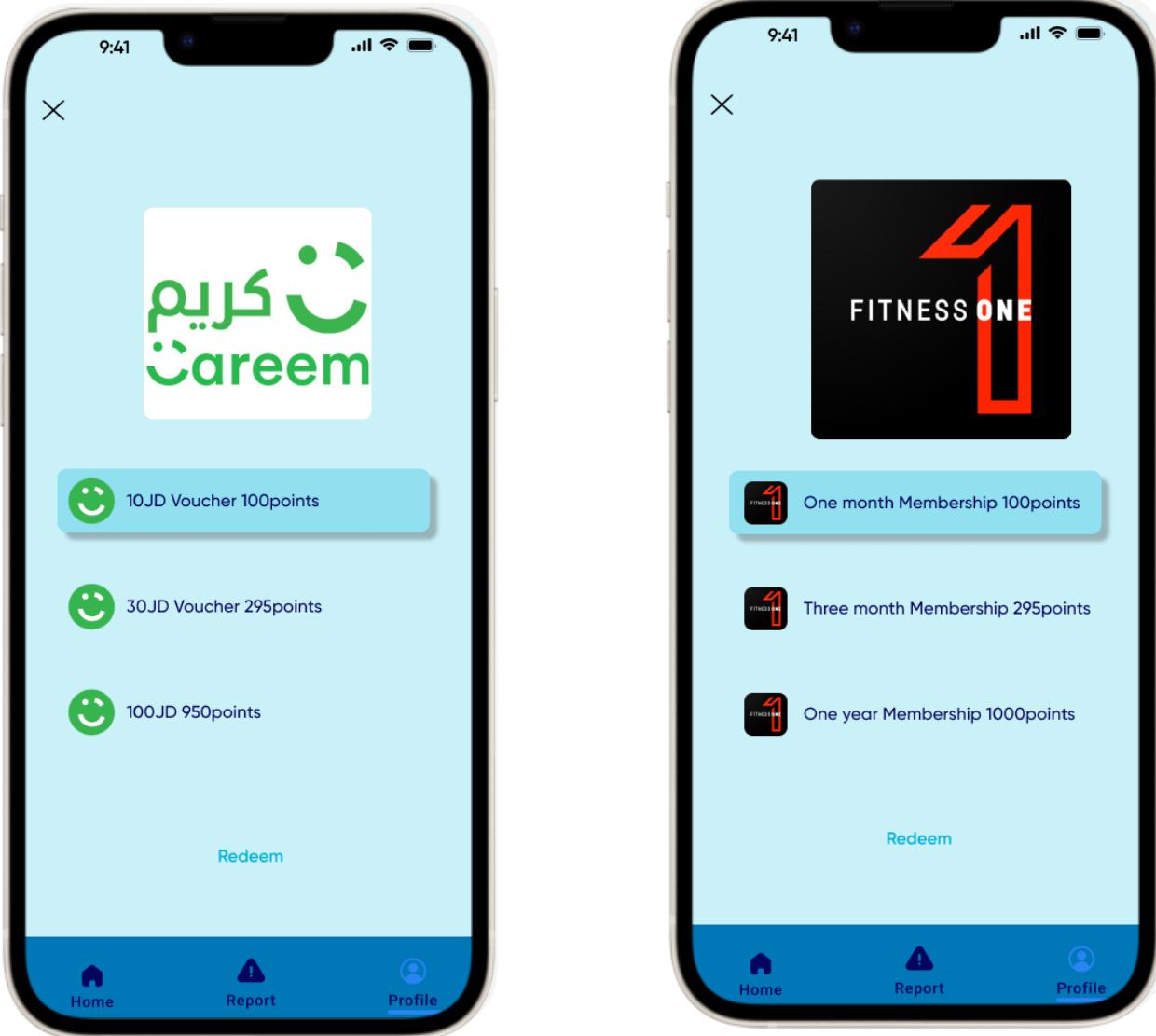


Figure 51

Figure 50



Figure 53

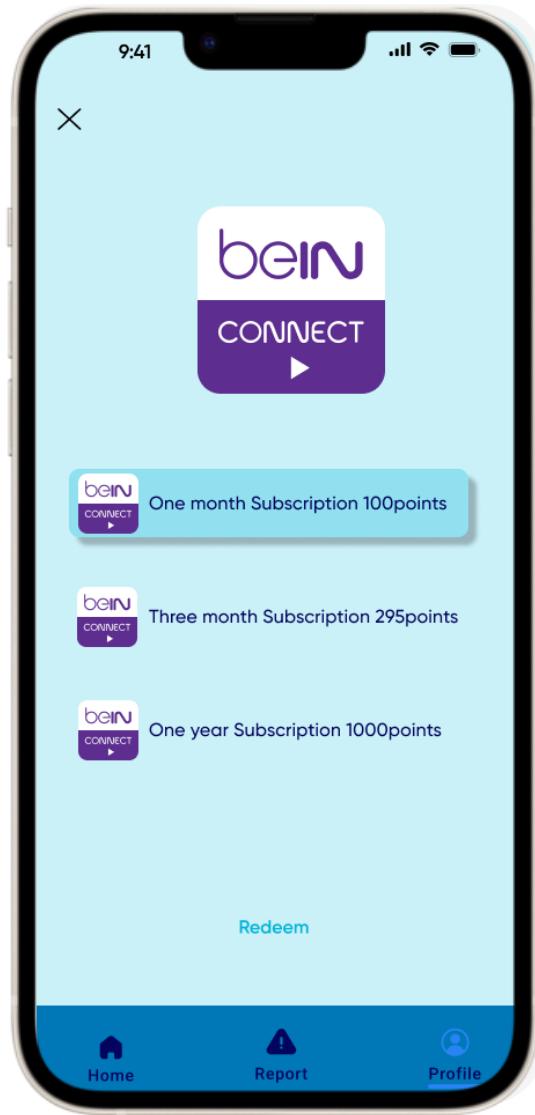


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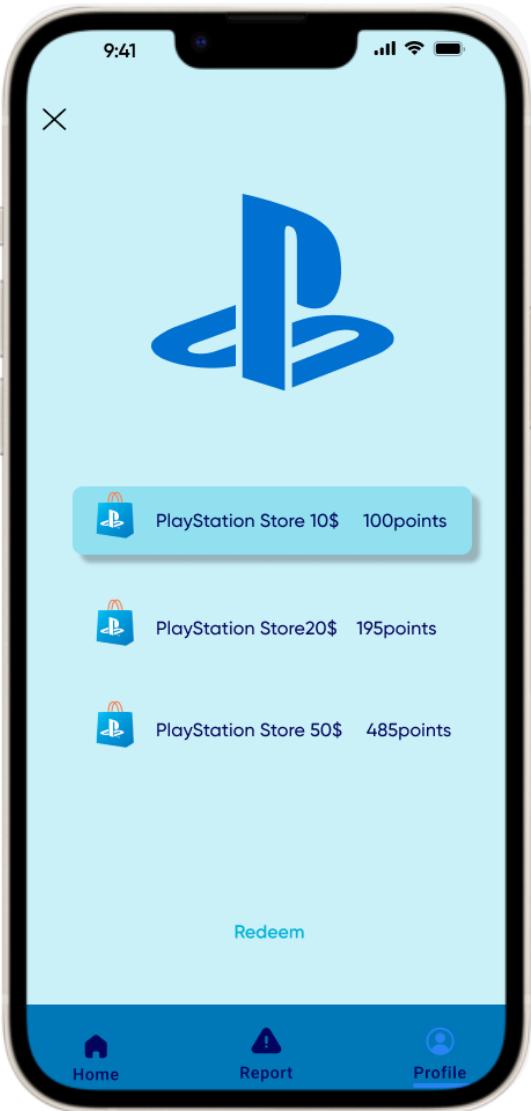


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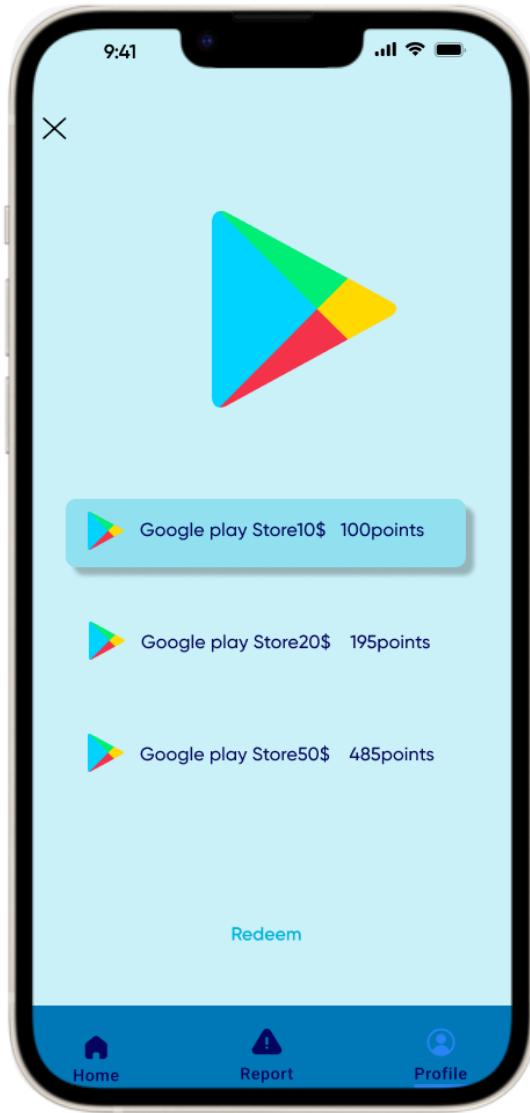


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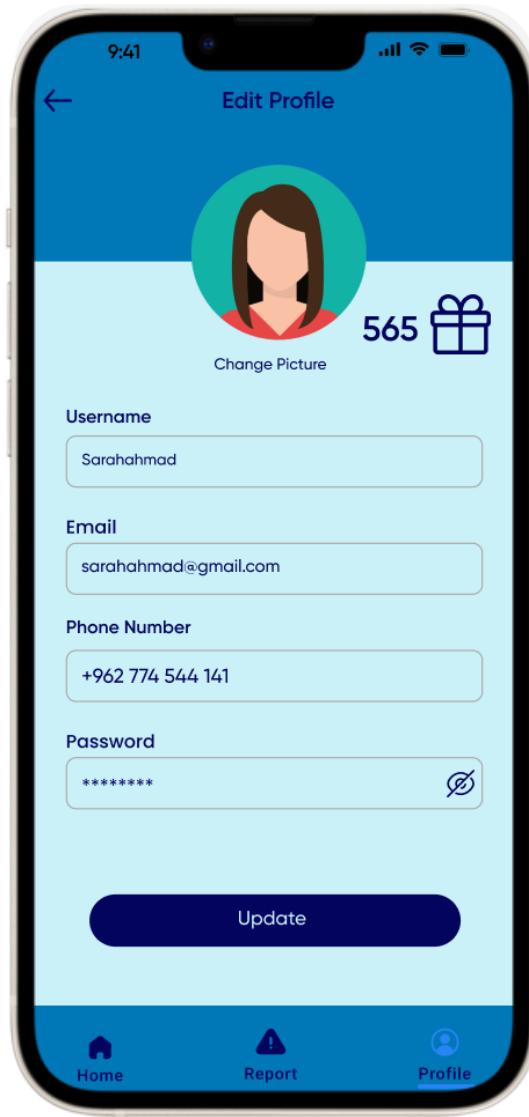
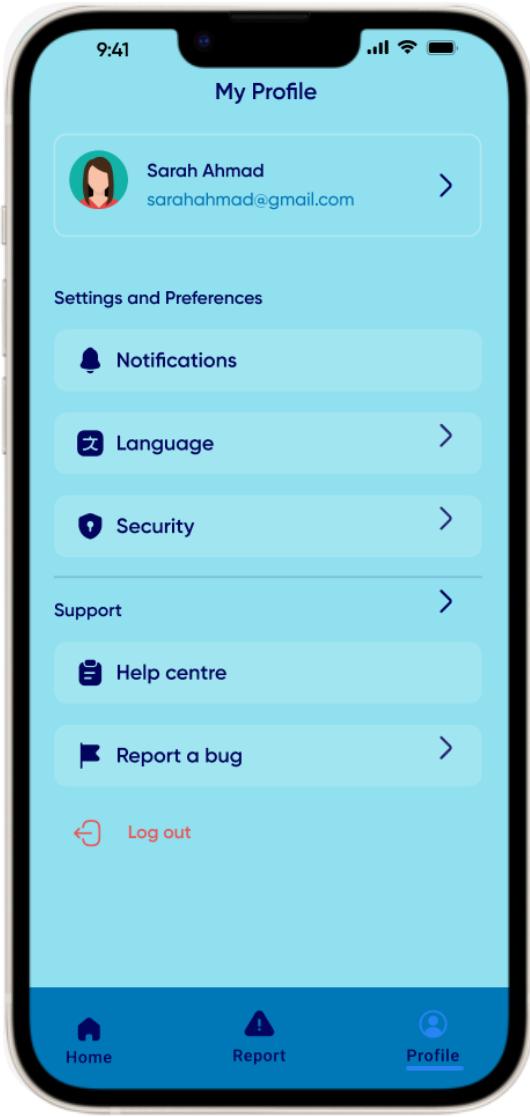


Figure 57

Figure 56

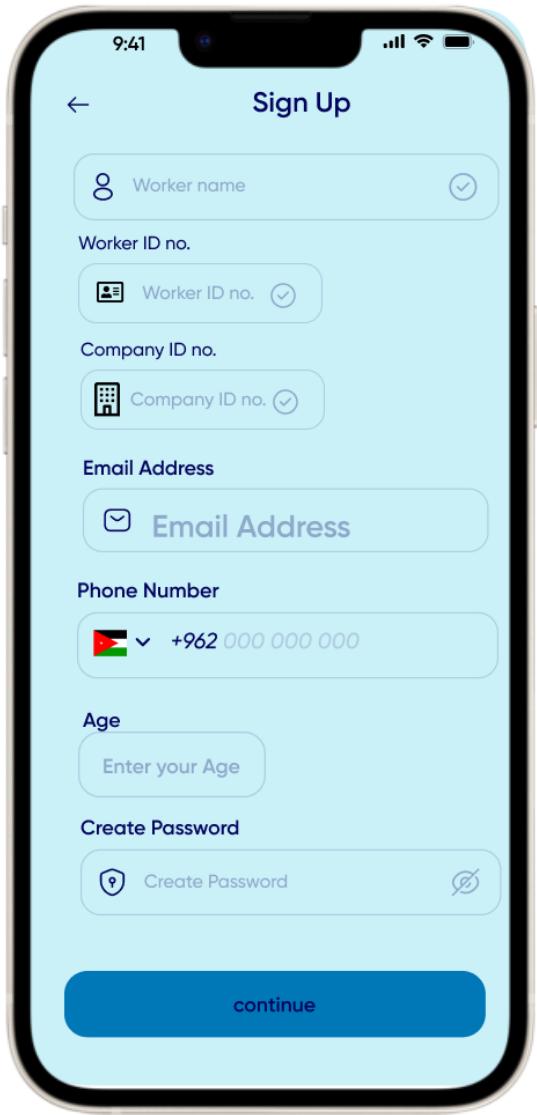


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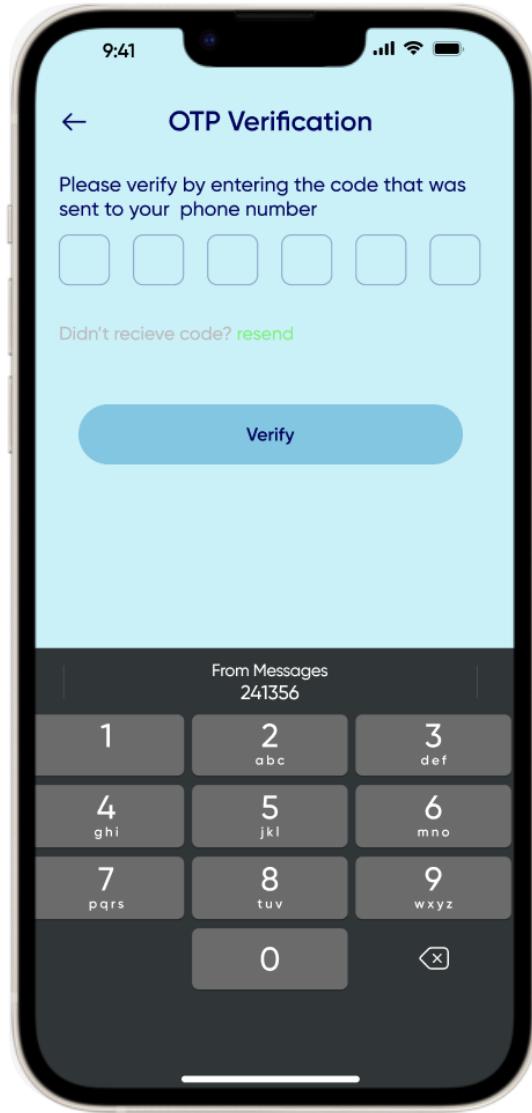


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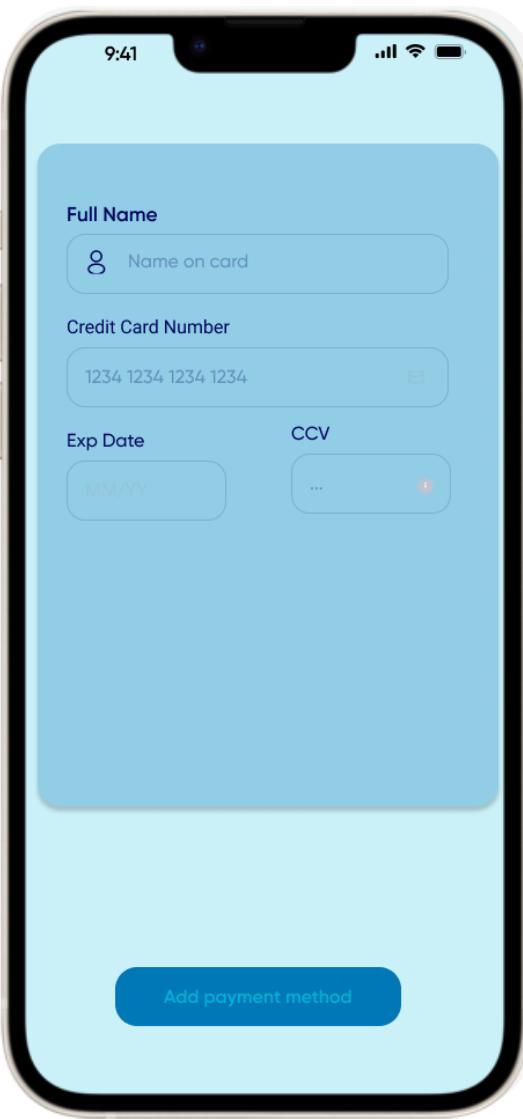
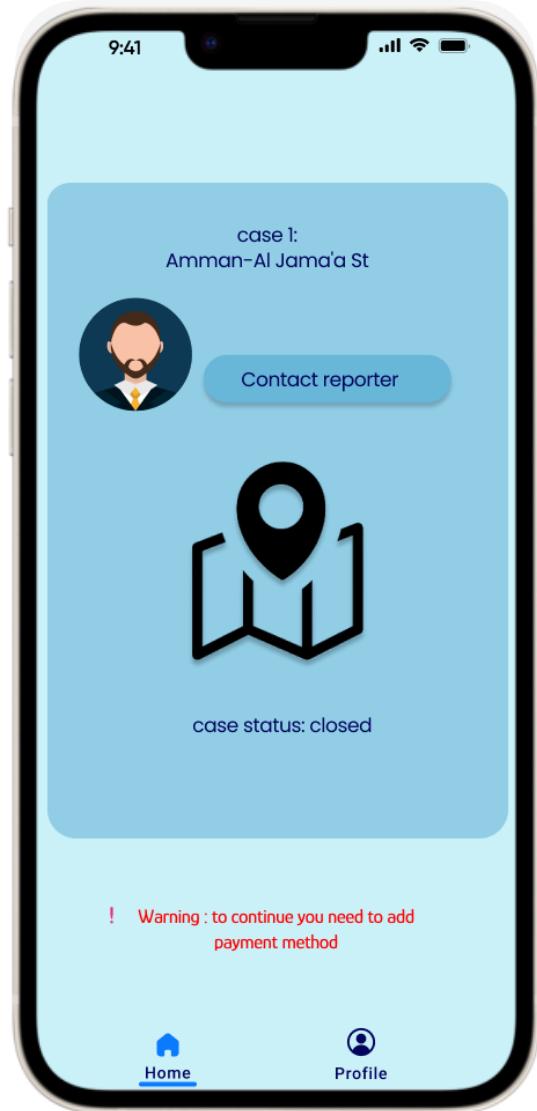


Figure 61

Figure 60

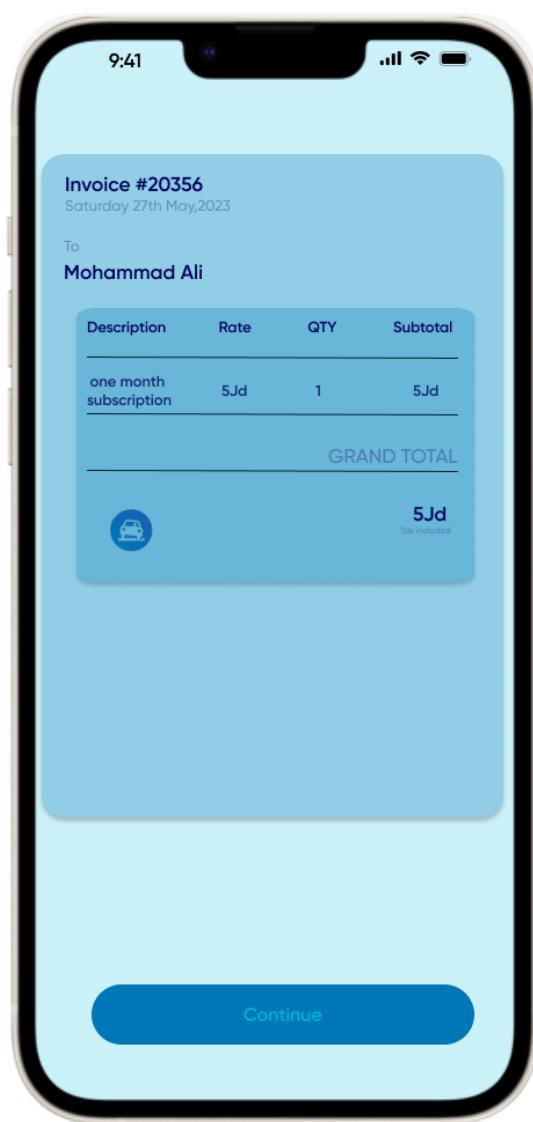


Figure 63

Figure 62

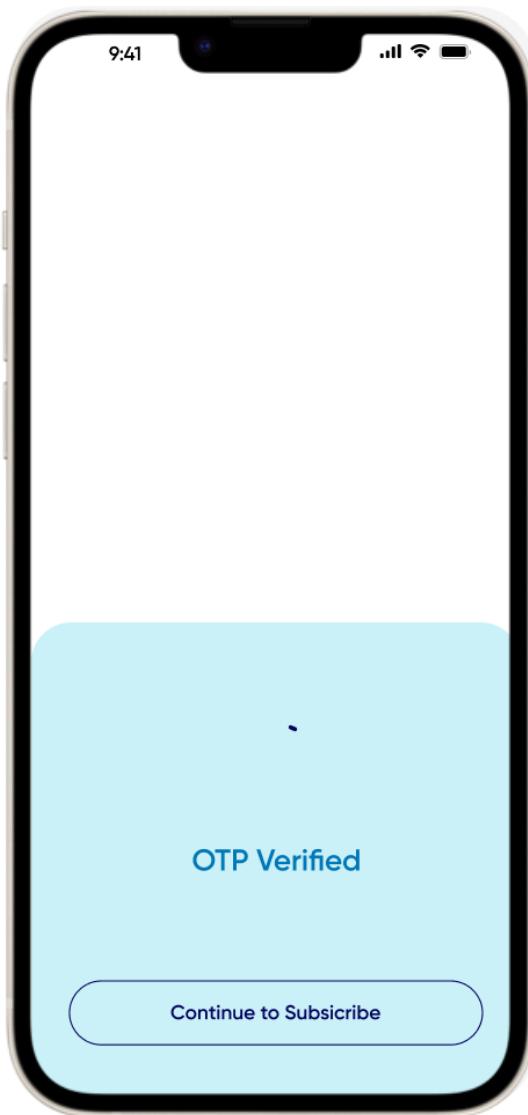
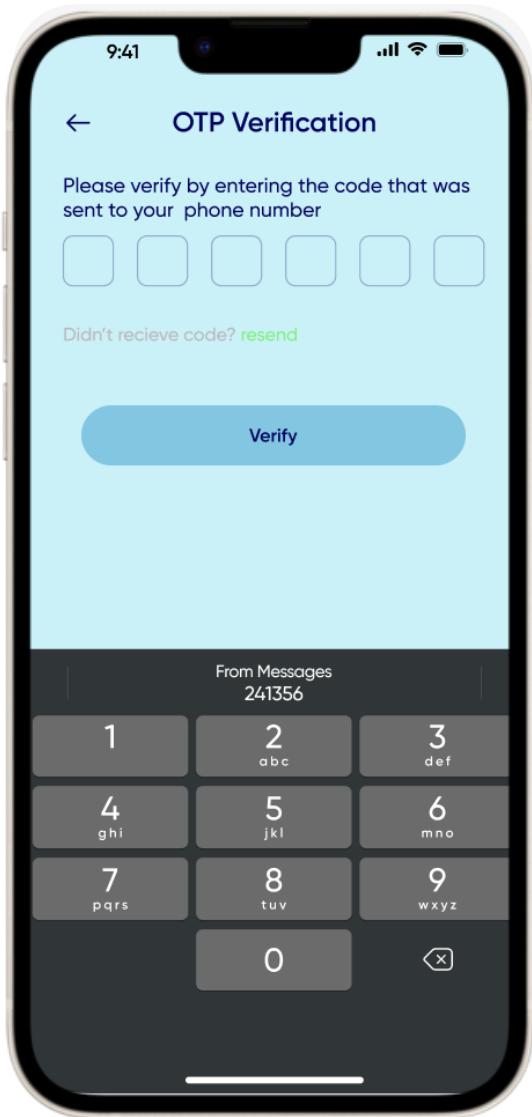


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Figure 64

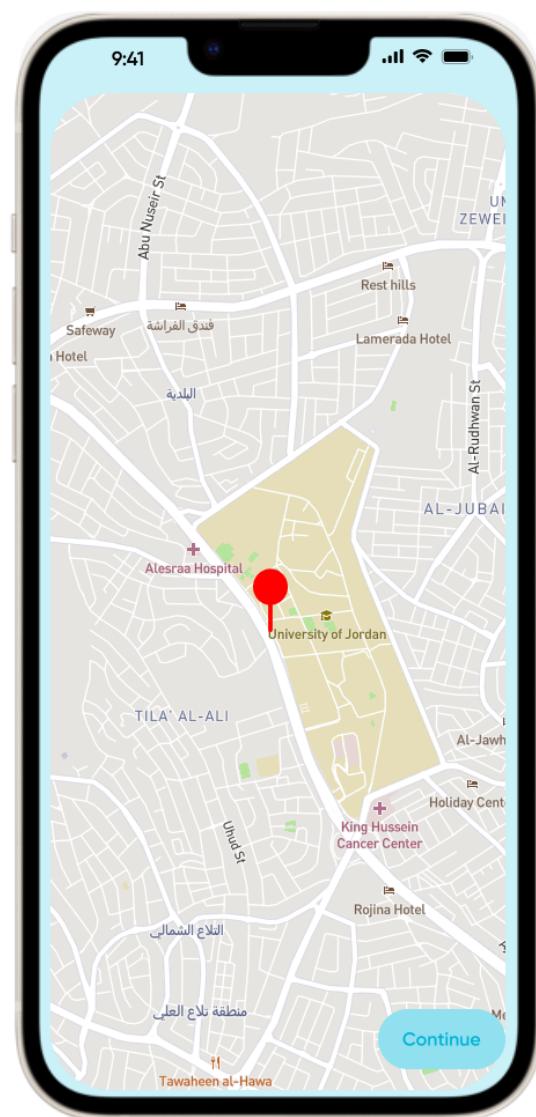


Figure 67

Figure 66

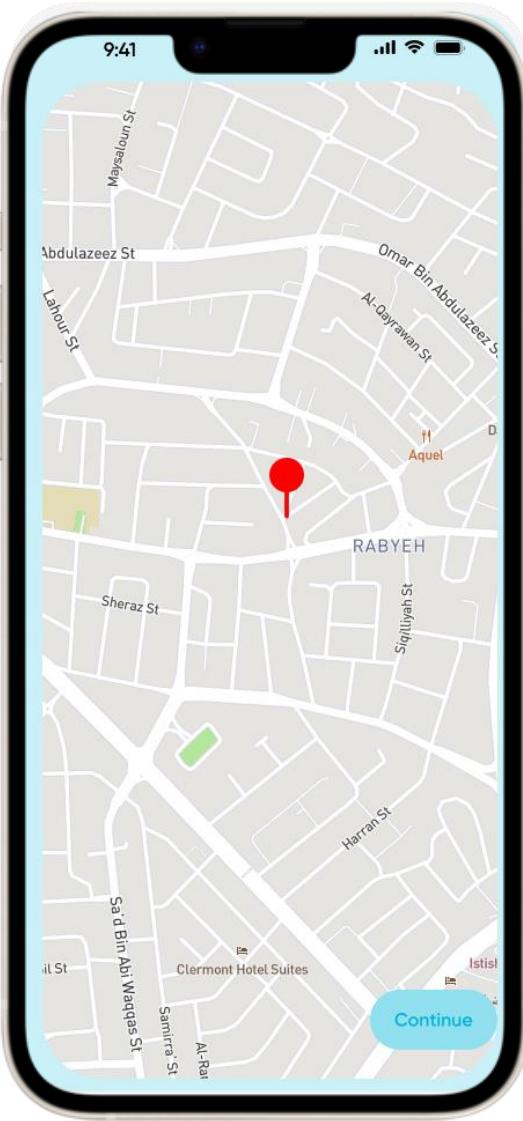


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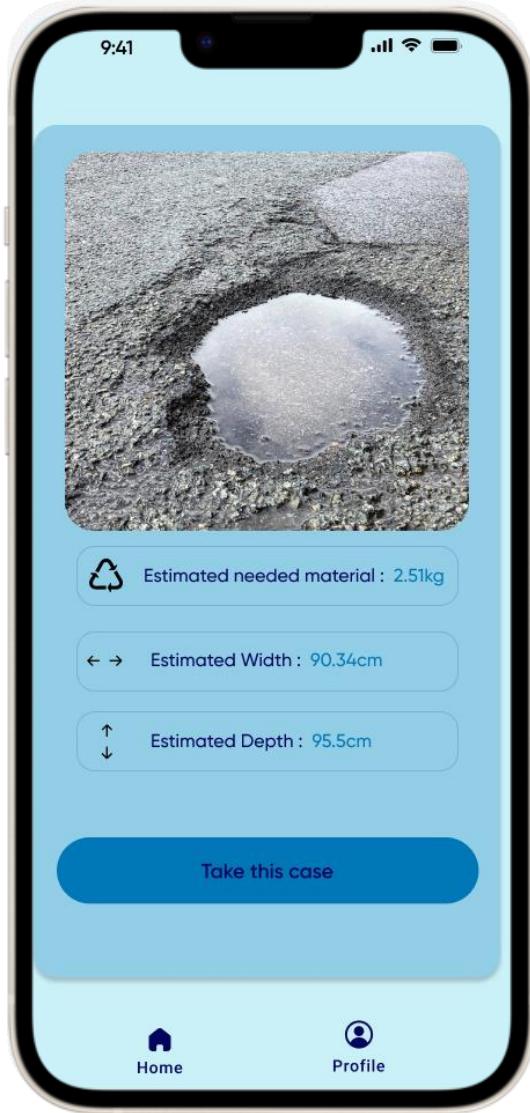


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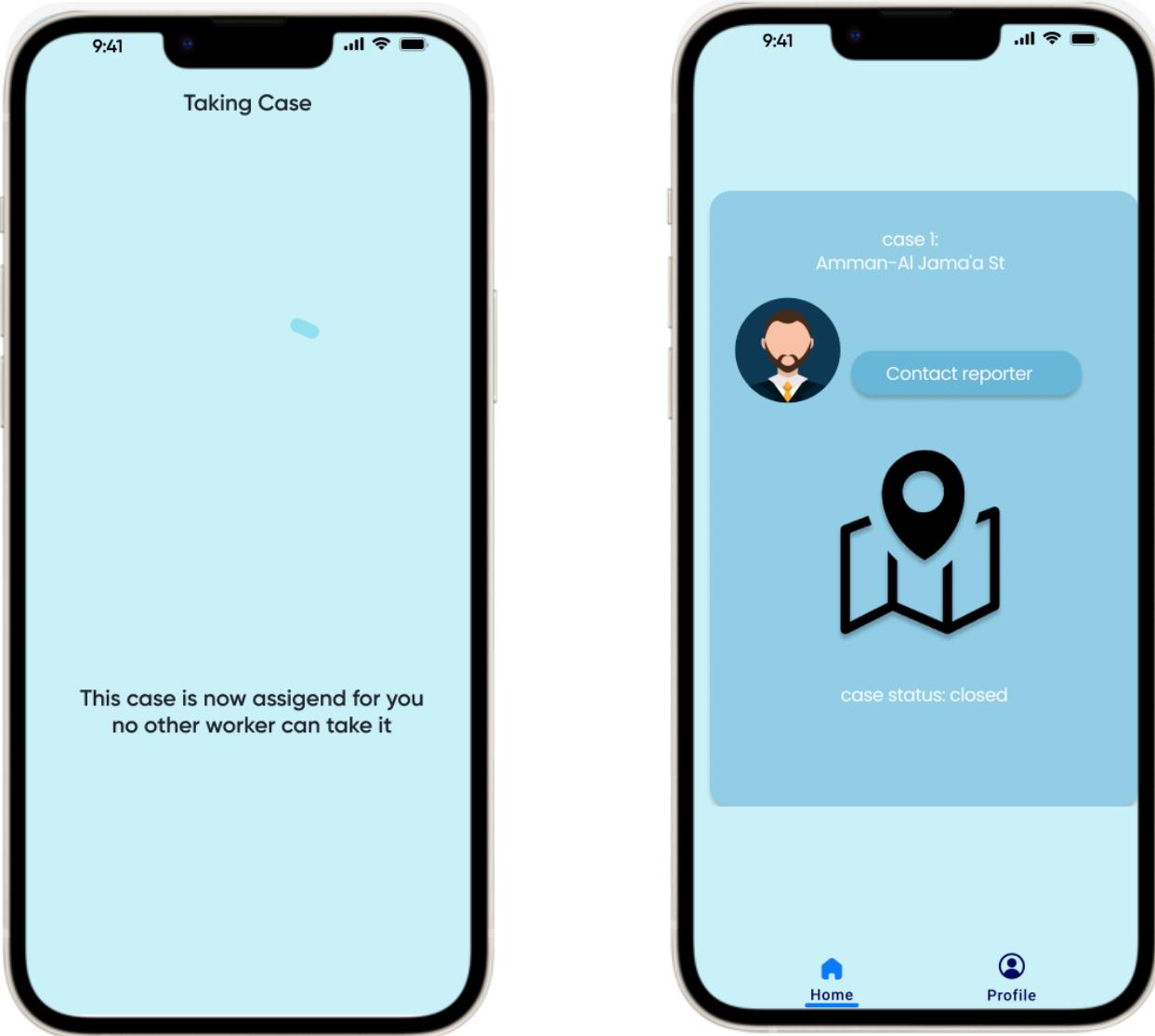


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Figure 70

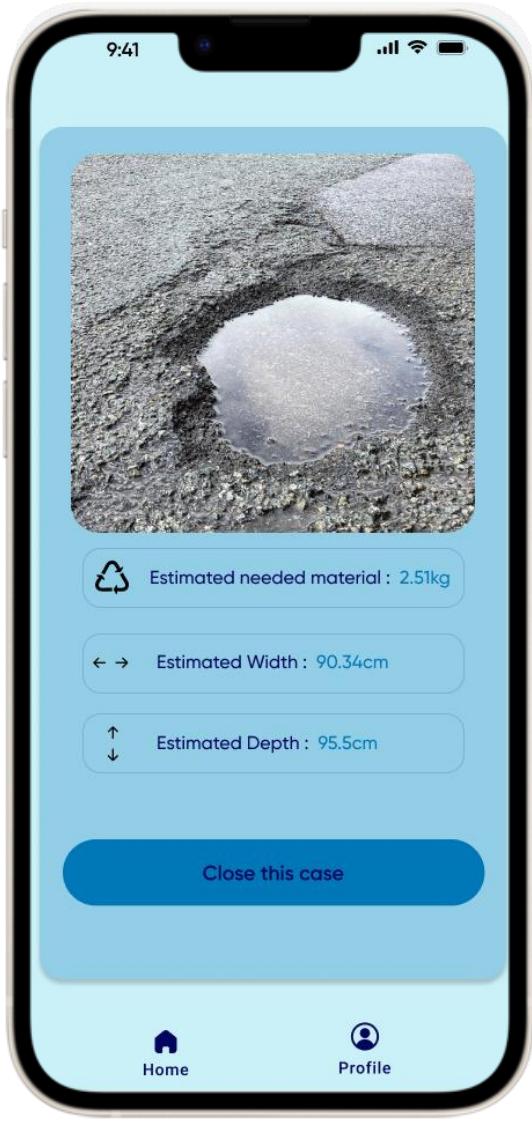


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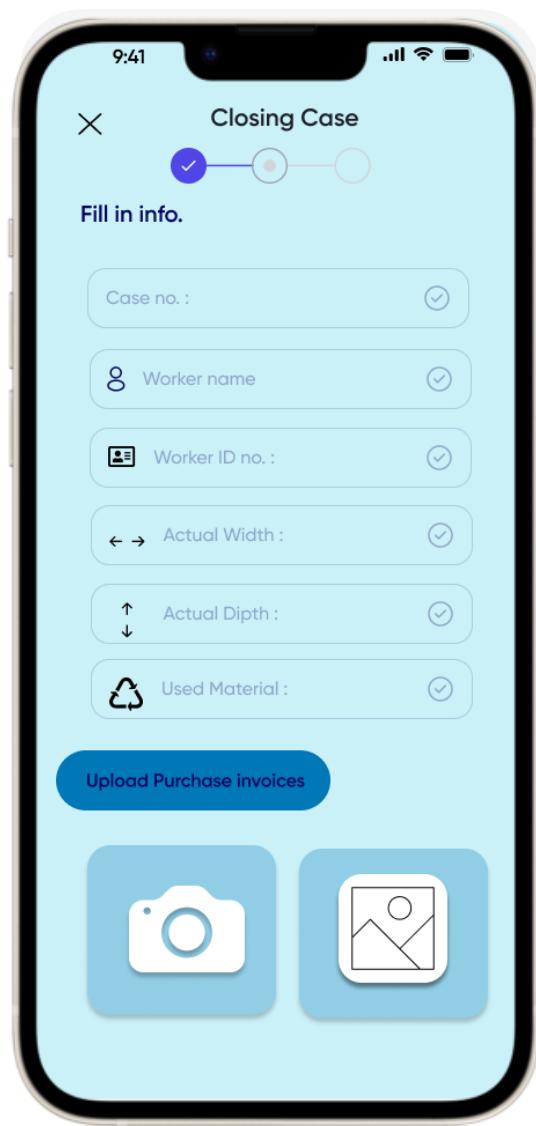


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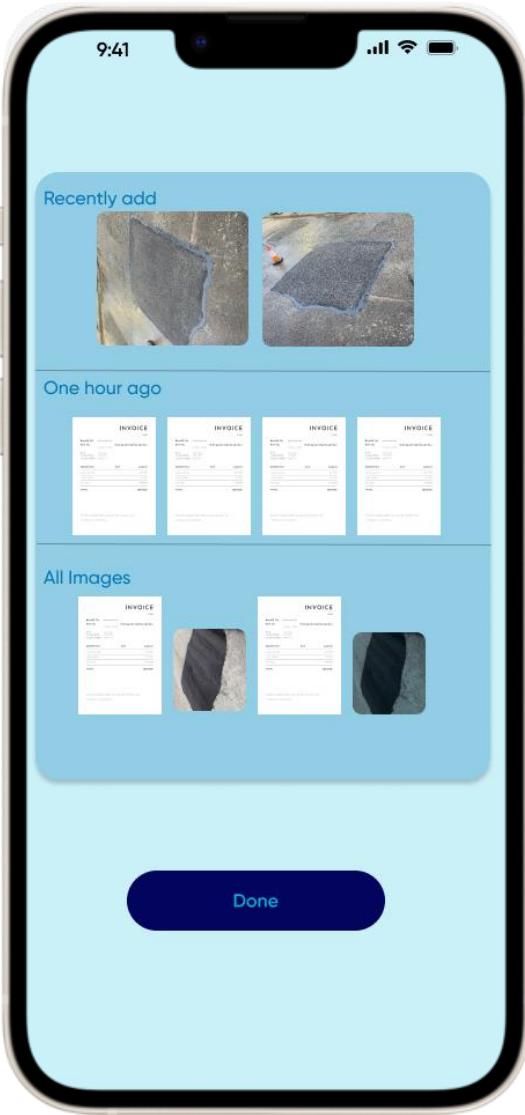


Figure 75

Figure 74

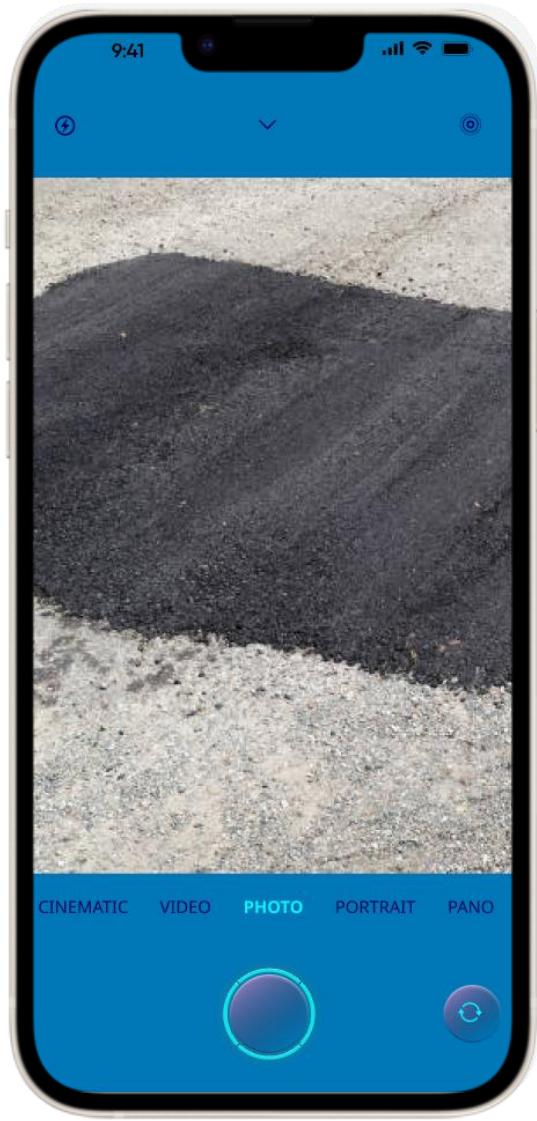


Figure 77

Figure 76

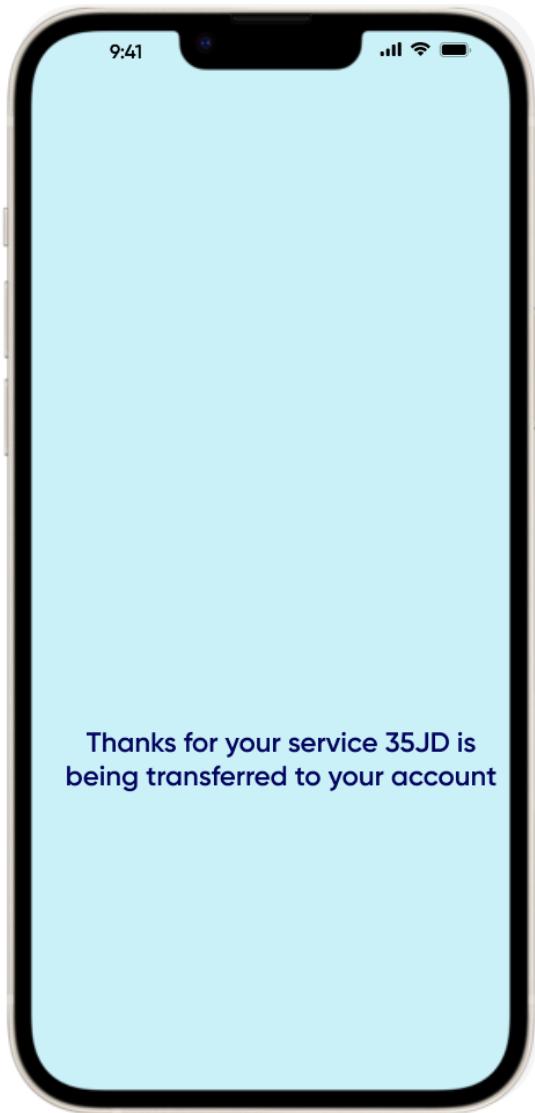


Figure 78

## 6.0 Implementation

### 6.1 Graphical User Interface Implementation (Required)

<https://drive.google.com/file/d/1PRcqi4mihq8UgQbELxox79Ul0oob7dQ4/view?usp=sharing>

### 6.2 Database Implementation (Bonus)

[https://drive.google.com/file/d/1-VoD0iR4F\\_MK8F3C\\_vTwCV2YjwGLGHQ6/view?usp=sharing](https://drive.google.com/file/d/1-VoD0iR4F_MK8F3C_vTwCV2YjwGLGHQ6/view?usp=sharing)

<https://drive.google.com/file/d/13fe3btl9fWDADksnuo2cBiergiwA8zFU/view?usp=sharing>

### 6.3 Other Components Implementation (if needed)

<https://drive.google.com/file/d/1oZ2I9P2Lxxu08luljgxqjm3j84441php/view?usp=sharing>

## 7.0 User Manual

### For Reporter:

#### 1. Download and Installation:

- Visit your device's app store (App Store or Google Play Store).
- Search for "Pothole Reporter" and download the app.
- Install the app on your device.

#### 2. Account Setup:

- Launch the app and create a new account.
- Provide the required information and set a secure password.

#### 3. Reporting a Pothole:

- Open the app and tap "Report Pothole."
- Enter the pothole details, such as location and severity.
- Include a description and attach photos, if available.
- Submit the report.

#### 4. Tracking Pothole Status:

- On the app's dashboard, view the reported potholes.

- Check the status of your reported pothole.
- Receive updates on its progress.

## 5. Exchanging Points for Services:

- Accumulate points by reporting and contributing to the app.
- Visit the "Rewards" section to view available services.
- Exchange your points for services offered by our partners.

## 6. Providing Feedback:

- Help us improve by providing feedback through the app.
- Share your suggestions or report any issues encountered.

## 7. App Settings:

- Customize notification preferences in the app settings.
- Update your profile information if needed.

## **For Workers:**

### 1. Download and Installation:

- Follow the same steps as users to download and install the app.

### 2. Login and Account Setup:

- Launch the app and login with your worker account.
- If you're a new worker, create an account using provided credentials.

### 3. Add Billing Address:

- Before assigning a pothole, add your billing address in the app.
- Go to "Account Settings" and enter your billing address details.

#### 4. Viewing Assigned Potholes:

- Access the "Assigned Potholes" section to see your assigned tasks.
- Tap on a pothole to view its details, including location and severity.

#### 5. Inspecting and Updating Potholes:

- Visit the pothole's location using the in-app map or address.
- Assess the severity and update the pothole's status accordingly.

#### 6. Recording Repair Details:

- If responsible for repairs, update the app with repair information.
- Record the repair date, materials used, and any additional notes.
- Upload "after" photos to showcase the completed repair work.
- Upload the invoice for the repair service provided.

#### 7. App Settings:

- Customize notification preferences in the app settings.
- Update your profile information if needed.

#### 8. Contact Support:

- For technical assistance or inquiries, email support@roadvisionair.com.
- Call our customer support hotline at +1-800-123-4567.

Thank you for using the Pothole Reporter app. Your contributions help improve road conditions and ensure safer journeys. We appreciate your support!

## 8.0 References: books and tools

Figma

Google collab

Lucid chart

Software book

MySQL

Roboflow