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Dedication

We dedicate this work to our families who encouraged us to complete what we started and motivated us to be what we are today.
To everyone who supported us even with one word.
To ourselves.

Acknowledgement

We would like to thank our families whose provided us with all possibilities to reach what we have reached on the threshold of success and excellence in life. Loving, motivating and patient mothers.Our fathers who suffered to see our progress and success in life.
We would like to thank our supervisor Dr.Anas Toma and Dr.Manar Qamhieh for their guidance that helped us accomplish this work in the best possible way.
Likewise, we have friends whose have stood with us in difficult times as well as in easy times, and they are appreciated from the depth of our hearts.

Disclaimer

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Abstract

Motorists usually face many problems while driving such as engine overheating, dead or discharged battery and low engine oil level. Therefore, they may need to seek urgent and guaranteed help in minimum time and from closest car technician, mechanical or electrical garage, also drivers may need to find the closest fuel station.Our project aims to develop an user-friendly website and application that supports urgent and routine services for cars on the road with minimal time and effort. By making it possible to use the map to locate the nearest auto technicians, gas or diesel stations, hospitals and hotels. It also allows the user to choose the shortest and least traffic jam. The user can get a quick glimpse of the directions of the road. In addition, this application allows garages to use their accounts to add or mange their services, view services' requests that have been sent from drivers. drivers can send their feedback to the garages.
Our project will be distinguished from other car and on road applications and websites by it's combination of car services, on road needs and garages interactions. Users need this project in their urgent conditions and when they just want to check map! garages can track their services. The system can also diagnose the problems faced by the driver, and accordingly direct him to the nearest garage that support its car type and provide service needed to fix the problem if possible and make sure drivers are getting the best experience possible.

1 Introduction

1.1 Problem

The idea of having a driver-garage-assisted application and website came as a savior for drivers and garages. Every driver must have experienced being cut off on the road due to a sudden problem and found it difficult to ask for help. There is no need to contact family and friends to ask for help after today, iDrive solved the problem!.
Another problem that drivers suffer from is the routine repairs that cars need. The driver wonders to find the nearest garage, and then wonders if this garage is available, or if this service is available in it. In most cases, drivers do not have enough experience to know the problem that their car suffers from.

Figure 1: Driver facing a problem on road

As for, the problems of roads are many, in terms of crises and finding the right directions, and searching for the intended places nearest to driver. Do you, as a driver, wonder about the nearest gas stations? Or the nearest restaurants and hospitals in a particular area? Our application provides you with the best solutions to these problems.
As for the garages, the owners of the garages suffer from great pressure in scheduling the services they provide, and a difficulty in communicating with customers who need service, which is agent in usual.

1.2 Objectives

This project aims to build a smart, user-friendly application that greatly assists the driver to get fast and best help, and also help garages through the application and website to get best experience during work. It contains several things, including:

-Map:
iDrive provide user-friendly map, which makes it possible to create and follow your own routes. Mark Sequence of points and it works out a route for you, along roads, paths and trails - automatic route-finding feature-. Also you can get directions description to your destination. Find nearest garages, fuel stations and hospitals, hotels. Garage also can detect his customers location to access them easily. And drivers can track garage staff when they are on way to him.

-Diagnostic System.:
In most cases, the driver cannot distinguish the problem that his car suffers from. iDrive provides a diagnostic system through which the driver can find out the problem and the reason of it, then choose the garage and the service he needs. Also diagnose system may suggest a recommendation to the driver to solve the problem by himself.
Through map iDrive let driver see all garages that supported his car type and provide a service to his problem.

-Booking And Unbooking Services:
iDrive make it possible to give users the opportunity to book or unbook the service that he needs from specific garage, in specific date and time. Garage can also see its customers and schedule its work.

-Ordering And Unordering Services.:
The diver can order an emergency service from the garage to reach user location, in addition to tracking the garage staff and making sure that they are on way to the driver. The garage can see the locations of all customers who order emergency service for their locations.

-Garage Service Scheduling
The garage can categorize the services it provides based on the type of service or the date of its availability, in addition to tracking the completion of tasks and services.

1.3 Scope of the work

The scope of our project are drivers and users who use roads, in addition of garages owners.

1.4 Importance of the work

iDrive match driver and garage needs! this project derives its importance from being a user-friendly application that meets the needs of the driver and the garage, since the features provided by the application are almost daily needed by the driver, such as searching for the shortest roads and following up if the road is in crisis and others.

Figure 2: iDrive matching driver needs!

It is important to mention that the application helps the driver to identify the problems he faces through a diagnostic system that takes information about the problem faced by the driver and suggests the necessary service to solve his/her problem, so that the driver can later choose the service and garage that he prefers or the one closest to him/her.

Drivers usually encounter sudden problems on their way, and the problem is more difficult when they do not know where to ask for help, iDrive allow user to order service from a specific garage, so that the garage sends staff to help the customer, and at the same time the customer can track the garage staff to make sure they are in their way to him, so that this process is reliable. It also facilitates the work of garages by scheduling the services it provides and its customers needs, on the other hand, it provides an easy way for the driver to search and book the services he/she needs.

1.5 Organization of the report

The next chapter (Constraints and earlier work) will focus on the main problems encountered while working on this project and will mention previous work that helped us build this project.Next comes the (Literature Review) chapter, which introduces and explains some of the related work, and shows how this work differs.Then the fourth chapter (Methodology) we will talk about our methods to build this project and discuss it in detail. How we collect the needed data, and technologies we used and finally the application and website design and how it works.
Then the final design of the project will be be displayed.The chapter that follows is (Future work), which includes the ideas that we aspire to add to our project in future . The last chapter is (Conclusion and Recommendations) which will summarise the ideas of projects and will also contain some recommendations related to our work. The last chapter is (References).

2 Constraints and earlier work

2.1 Constraints

-Limited Time:
This project was completed during pressure from exams, course projects and work. Also, we needed to learn the skills and new programming languages which we did not know before, this required a long time that we spent on self-learning of many new things related to this field, and then we had to apply what we learned.
Which requires a lot of time, work and effort and sometimes becomes exhausting.

-Difficulties we faced in finding a suitable MAP API:
Firstly, we tried to use google map API, then figure out that this API need money. Then we had to search about alternative. We finally find TomTom API it took a huge effort from us to learn and search about it from its documentation.

-The Nature of the project:
It is noteworthy that the mechanism of our project was related to car and road issues that we did not have much experience and information about, which took us a lot of time and effort to search on the Internet , and a great effort to provide a meeting with experienced technicians to obtain sufficient information to build this project.

2.2 Standards/ Codes

– Responsiveness
The interface is designed to be responsive to different screen sizes.
– User-friendly
The design and colors of the application and website are well chosen to make them attractive.
– Re-usability
In react and react-native we reuse many of components to serve several ideas. – Portability
The application can be used on the web browser or mobile in both systems Android and IOS.

2.3 Earlier Work

Our primary reliance on this project was the experiences we learned in software, java, web programming and Algorithms courses. But we also went through a rather long self-learning period learning new languages and frameworks Which we used. As will as searching about map api and reading its documentation and learning how to use it.

3 Literature review

The idea of having an application that meet the driver and garage needs is a desirable thing at these days.
There are several driver assistance apps, but what's new in our project? Our project, in addition to providing maps, tracking the route and finding directions, these ideas were linked with the services provided by the garages to suit the needs of the driver.
So that the driver can see the nearest garages to his location on the map and thus see the services provided and the possibility of booking the service in the garage or ordering any of them for driver location, which is the most important thing that the driver can track the garage staff when they are on their way to the driver's location, so the driver will make sure that he / she will get the service.
It also provides a smart diagnostic system to find out what car problem and what service you need. Which ask driver several questions then suggest a simple solution that can user make by himself, or suggest a service needed. Then when driver go to map he can see garages that support his car type and provide service needed.
Another point that this benefit the garage as an advertisement to its services, and help it to schedule its services and works.

4 Methodology

4.1 Overview

Firstly, we divide the project as several tasks, worked in parallel, completed the parts and then test and linked them together.
In our project, we contracted with several garages, where each garage support specific type of car.So that each garage provides several services classified for three types:
- Maintenance Services.
- Electrical Services.
- Car Washing Services.
So drivers and garages can interact with each other, driver can get its needs from map and garages.

4.2 Data Collection

To accomplish this application, we first read several articles to learn about the main services that cars need, how to distinguish them in terms of type and type of car. Then we interviewed several experts and garage owners to obtain sufficient information to build a diagnostic system and add services and sufficient information about them, in addition to information on the mechanism of booking service appointments in the garages and distinguishing between services that the driver can request for his location and others that require the presence of the driver for the garage.

4.3 Technologies

4.3.1 Database

To store users and garages information we chose MYSQL database. And here are the strength points of MYSQL database:
1. Its scalability and flexibility.
2. Its high performance.
3. It has robust transactional support.
4. It has strong data protection.

4.3.2 UI Design

• Mobile Application
– React Native
React Native is a commonly used JavaScript-based mobile application framework, it is used to build applications for both Android and IOS (Budzi´nski, 2020).
Benefits of React Native:
1. Cross-platform development:
By using React Native, the same code can be used to build applications for both, Android and IOS which saves time and cost.
2. Large community of developers:

React Native is an open-source framework that makes it accessible to everyone, this helps the developers to share their experience, learn new things and get feedback from other community members.
3. Great performance:
The React Native applications performance is very close to native applications, they take advantage of using the graphics processing unit (GPU). This makes them much faster than cross-platform hybrid technologies (D'Ambra, 2018).
- react-native-webview:
It is used when you want to render web page to your mobile app inline.

- react-native-safe-area-context
It provides a flexible API for accessing device safe area inset information. This allows you to position your content appropriately around notches, status bars, home indicators, and other such device and operating system interface elements.

- react-native-neat-date-picker.

- expo-image-picker
It provides access to the system's UI for selecting images and videos from the phone's library or taking a photo with the camera.

- Axios
which is a popular library is mainly used to send asynchronous HTTP requests to REST endpoints.

@react-navigation/native
Is a standalone library that enables you to implement navigation functionality in a React Native application.

– Expo
It is a tool-chain that helps to build apps using React Native. It provides a 18 set of tools that simplify the development and testing of React Native app and arms you with the components of users interface and services that are usually available in third-party native React Native components (Kruhlyk, 2018)

• Website
- React React is an open-source front-end JavaScript library for building fast and interactive user interfaces or UI components.(da-14, 2021).
Benefits of React: 1. Fast re-rendering High performance: React uses virtual DOM, which is a virtual representation of the document object model. When changes occur, at first all the changes are applied to the virtual DOM, then by using a special algorithm the minimal scope of important DOM operations are calculated. At last, the real DOM tree is up-dated and this guarantees to consume minimal time, better user experience andd higher application performance.

2. Code stability
React uses the downward data flow in order to ensure that any change in child structures will not cause updating to its parents. So changing an object, will just update its state, after that, only particular components will be updated. This increases the code stability.
Socket.IO
Is a library that enables low-latency, bidirectional and event-based communication between a client and a server.

4.3.3 Backend

-Spring boot JAVA
The Spring Framework provides a comprehensive programming and configuration model for modern Java-based enterprise applications - on any kind of deployment platform.
Benefits of Spring Boot:
1- Avoiding complex XML configurations.
2- Database Transaction.
3- There is an embed Tomcat.

We used MVC design pattern to achieve this which help us to came with the best result.

4.3.4 API

We used Springboot to create a RESTful API for communication between the mobile app and the Backend and database. An API which stands for Application Programming Interface is used mainly when you need to integrate other service outside your project. We used JpaRepository, which is a JPA (Java Persistence API) specific extension of Repository. It contains the full API of CrudRepository and PagingAndSortingRepository. So it contains API for basic CRUD operations.

4.4 Expert System

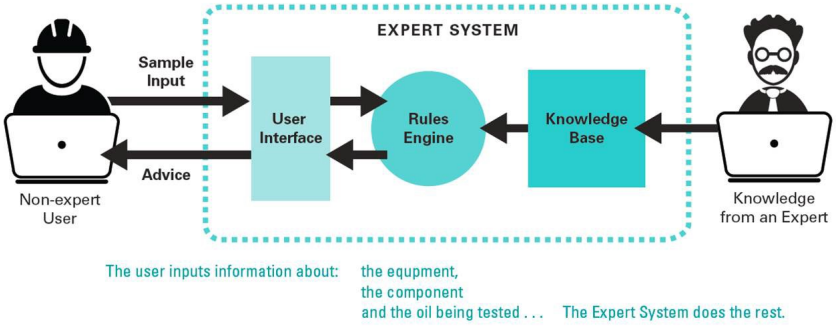
- A knowledge base (KB) is a technology used to store complex structured and unstructured information used by a computer system.
An expert system contains its knowledge usually in the form of a database or knowledge-base. By decoupling the knowledge from the actual software algorithm, an expert system can navigate through the database of facts to determine classifications and make decisions. The database is typically created by a human expert, and as such, the extent of knowledge that an expert system contains is typically confined to that of the human providing the content.

Knowledge base contains and stores all expert knowledge, the knowledge is defined as sequence of rules which represents the information from that expert. Depending on the rules, the system can apply backward/forward chaining algorithm and get inference or conclusion, hence, get all required information. Each rule has an array of premises as operands or preconditions. When the algorithm starts running, the preconditions that

much satisfied in order for the conclusion to be valid.
When a conclusion is deemed valid, it's attribute will be added to the current list of assertions from the original query.

When a rule triggers, the knowledge base will be scanned again to check for and additionally satisfied rules and add those, as well, to the current assertion list.

Forward chaining is the process of traversing through the knowledge-base from top to bottom, seeking a rule by which all attributes are satisfied. For example, if every single one of a rule's attributes exist within the set of the user's input, then that rule triggers, thus providing a conclusion. If no rule is found with all of the attributes present from the user, then no conclusions are added.



- A Decision Tree is a tree-like graph with nodes representing the place where we pick an attribute and ask a question.
For decision tree, it stores all sequenced questions to be asked to the driver who faces the problem. The application starts asking the questions to get information according to the decision tree and stores the answered in the assertion list to be sent to algorithm. Each question has question attribute to be distinguished from other questions, question text and a key to the next question.

4.5 Application And Website Design

4.5.1 Landing Page

On website the first page is landing page, which let user browsing about our project, User can see (about iDrive) section, and overview of the main services and features that iDrive support. Which are using map feature, Car Repair using diagnose system and many services supported by garages services.

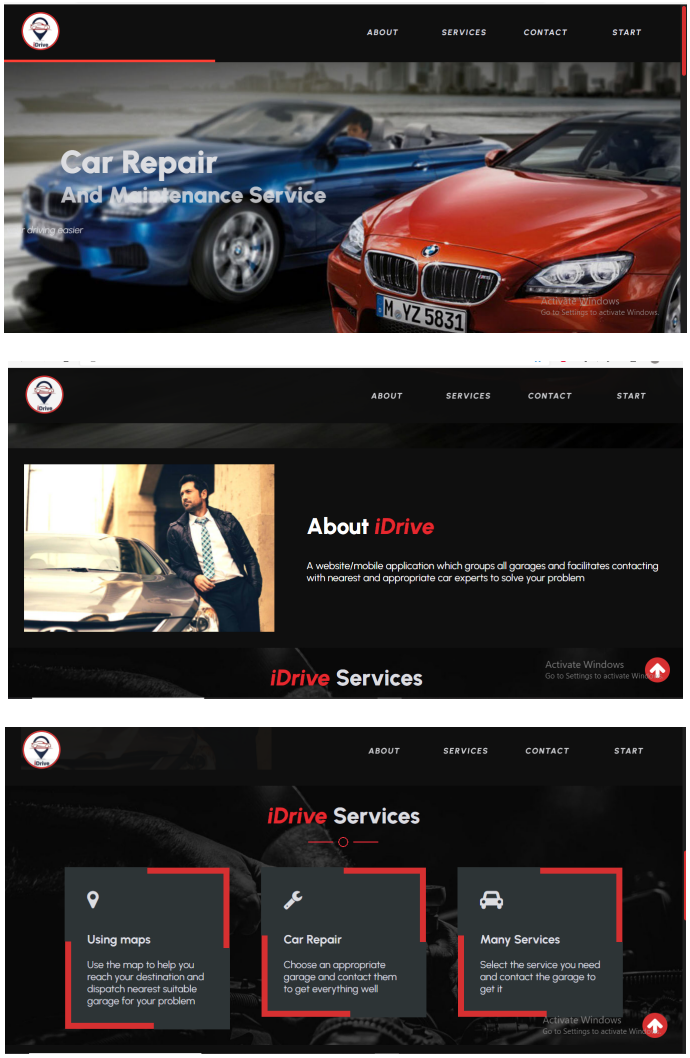


Figure 3: Landing Page

4.5.2 Contact

When click contact on navigation bar in top of screen. User will see the footer and some information about iDrive to contact them.

Figure 4: Contact iDrive

4.5.3 Sign up

First screen in application is the sign up screen, user can sign up as driver or garage. In website user can signup as garage only.

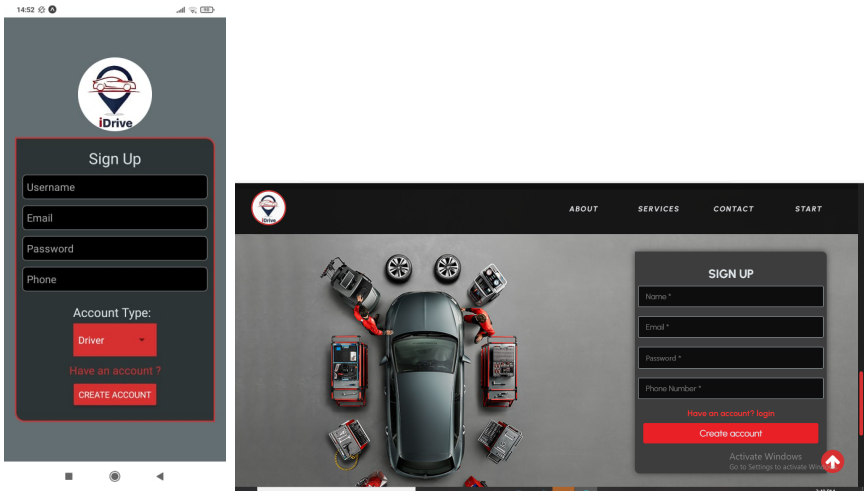


Figure 5: Sign up

When user sing up as garage,there will be another screen to set garage start and end time, garage location and supported car type :

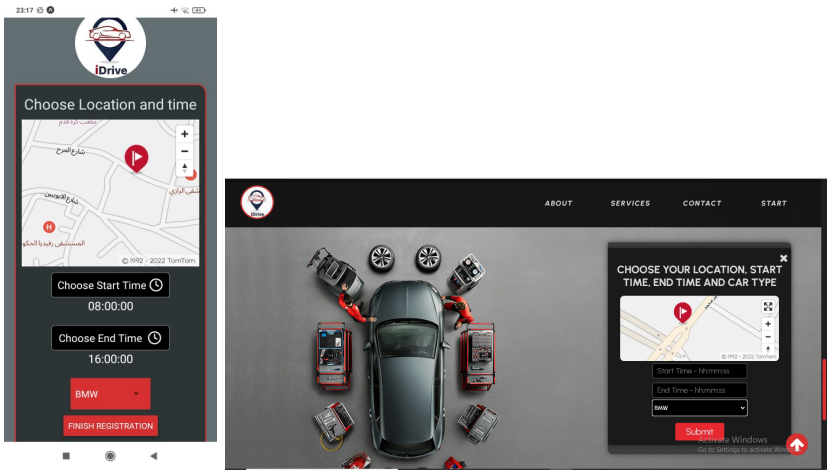


Figure 6: Garage sign up - step2

4.5.4 Login

-at mobile application user can login as driver or garage

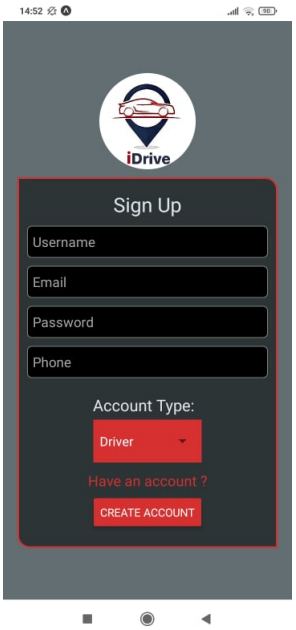


Figure 7: Mobile Login

- at website user can login as administrator or garage

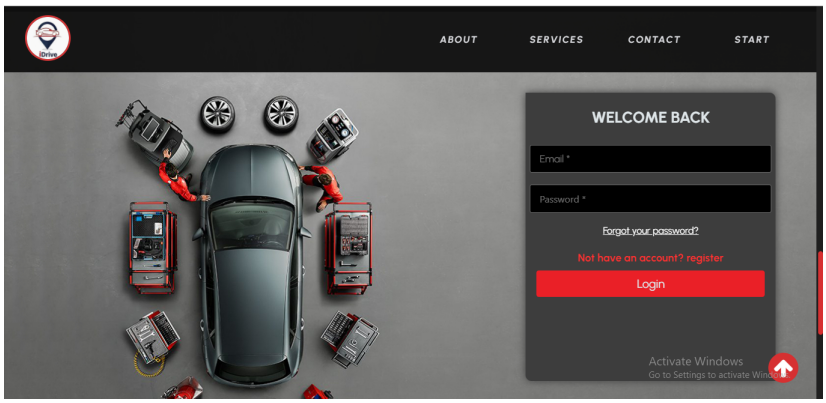


Figure 8: Garage Web Login

- When password is forgotten, user can reset it, using verification number sent to user's email.

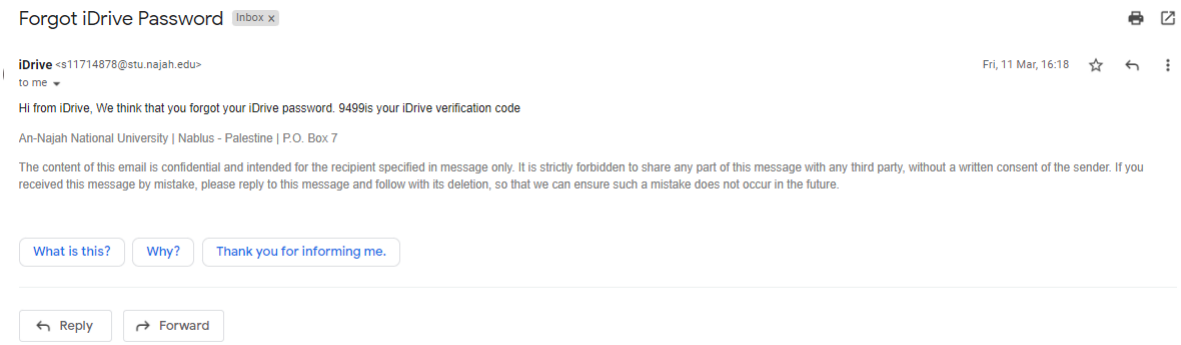


Figure 9: Reset password by verification number

4.5.5 Home Screen

After login/sign up to the application user will see the home screen, which contain a buttons to main 3 features:
1- Diagnose system (will not appear in garage account)
2- Available Services
3- Available Garages

Figure 10: Home Screen

4.5.6 All Services Available

Driver can see all services available in different garages at specific date, services are filtered in three types:
-Maintenance services
-Electrical services
-Car Washing

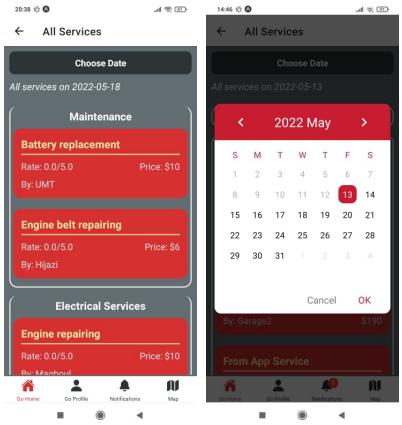


Figure 11: iDrive Services

4.5.7 All Garages

user can see all garages included in iDrive, and search about garage by its name:

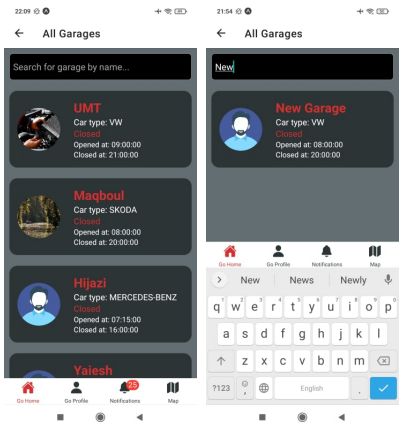


Figure 12: iDrive Garages

4.5.8 Garage Profile

In this screen garage can easily manage its work By:
- Edit profile
-See Ordered/Booked Services
-Access its services
-Access its customers

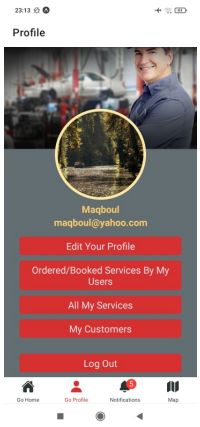


Figure 13: Garage Profile

4.5.9 Edit Profile

Each of garage and driver can edit their information:
-Garage can edit its name, password, phone Number, Capacity, its supported car type, start and end time:

-Driver can edit its name, password and phone Number:

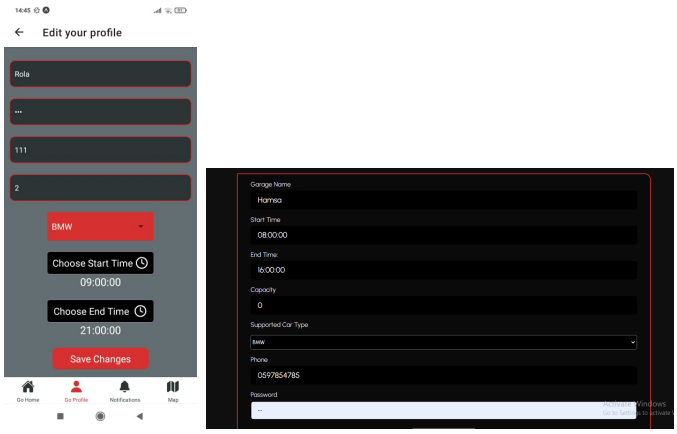


Figure 14: Garage Edit profile

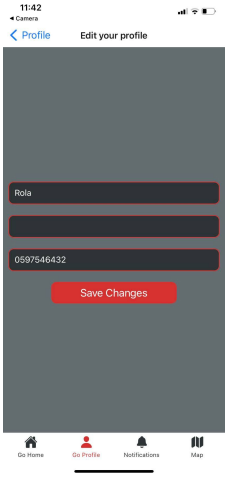


Figure 15: Driver Edit profile

4.5.10 Ordered/Booked Garage Services

Garage can see list of its ordered/Booked Services, when staff finish with any task it can be marked as done. This will give garage the opportunity of tracking its work

Figure 16: Ordered/Booked Garage Services

4.5.11 Garage Services

Garage can see list of its Services filtered by service three types
- Maintenance
- Electrical
- Car washing

Garage can edit any of its Services by pressing on it:

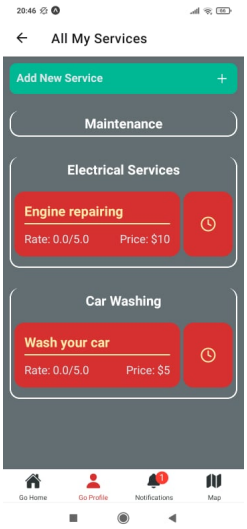


Figure 17: All Garage Services

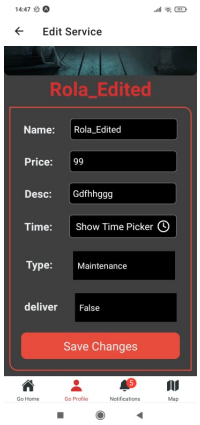


Figure 18: Edit Garage Services

Or can add new service:

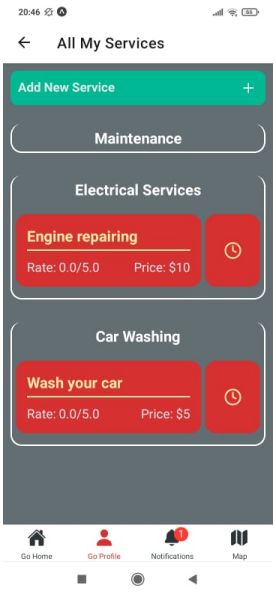


Figure 19: All Garage Services

In service, garage can edit any of its services or add a new service:

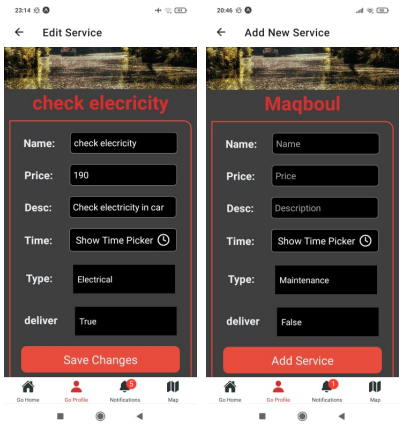
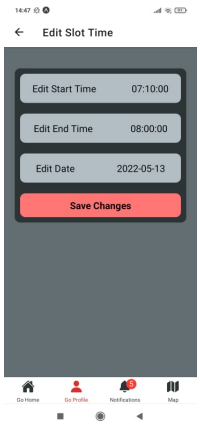
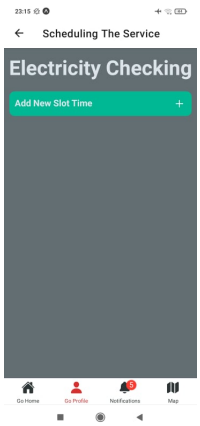


Figure 20: Garage Edit profile

In service, garage can edit any of its slot times or can add new slot times to it:





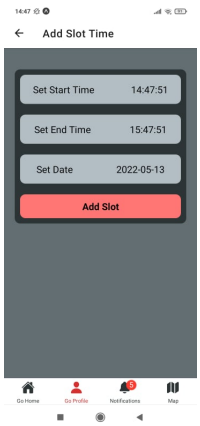


Figure 21: Garage Edit profile

4.5.12 Garage Profile Screen From Driver Account

Driver can see garage information including: name, email, phone number, start and end time supporting car type and if garage open or closed now, location and its Services

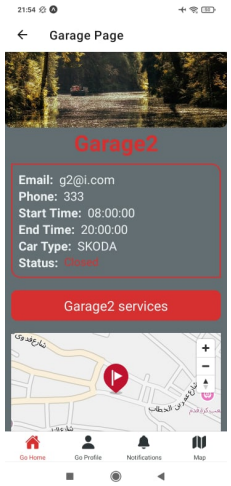


Figure 22: Garage Profile Screen From Driver Account

4.5.13 All Garage Customers

Garage can see list of his customers with some information about him like:
- Driver name, email and phone number.
- which service did he book/order and its type and date .
- Which slot time if its a booked service .

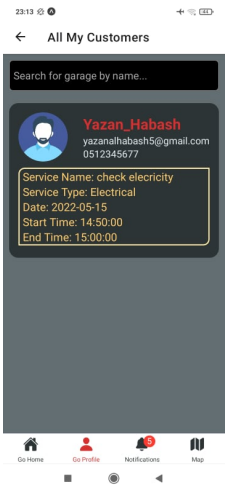


Figure 23: All Garage Customers

4.5.14 Book/Unbook Service

After choosing a specific service in specific date user can see more information about this service like name of supporting garage, service price, description, rating and available slot times on the chosen date, then user can choose available slot time to book. if slot time reserved by other user the button will be disabled. Driver can also unbook service.
driver can rate service as feedback to it.

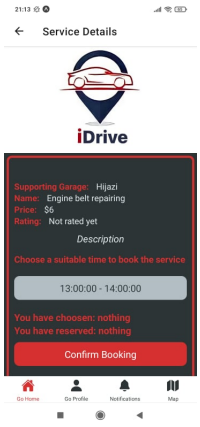


Figure 24: Book/Unbook Service

-when driver book a service, garage will be notified, and when press on notification application will navigate to user Info screen.

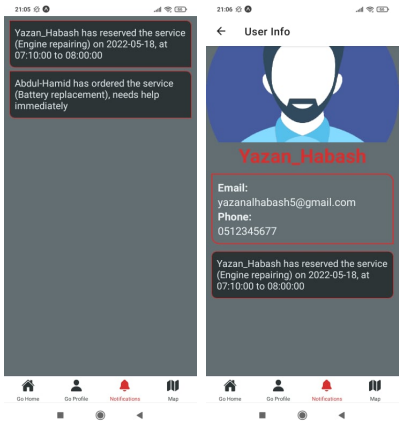


Figure 25: Garage get notified when driver book a service

4.5.15 Order/Unorder Service

If a service can be delivered to driver location, there will be an order/unorder button

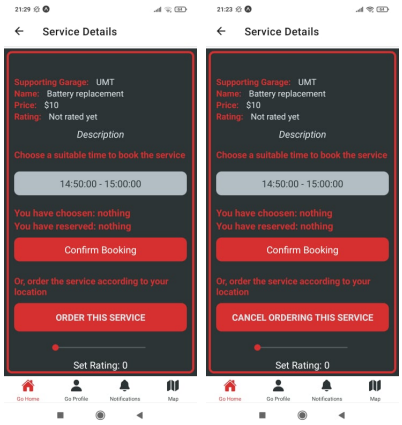


Figure 26: Customer Order A Service

When driver order a service, garage will be notified, and can see customer location on map
-garage can notify user when its staff is on way, user will get a notification where the

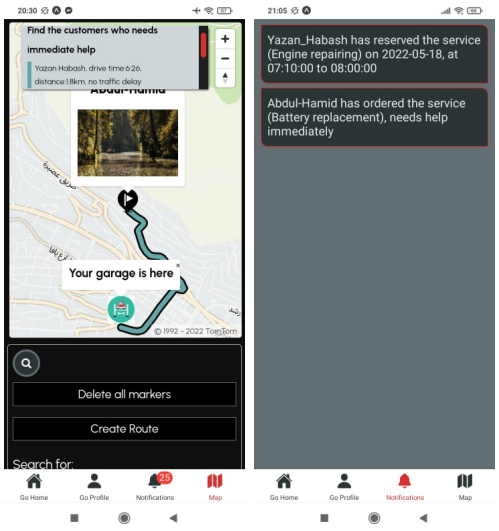
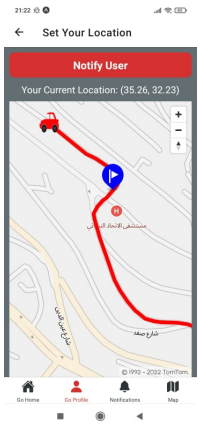


Figure 27: Customer Order A Service

garage staff is, so driver can track the staff and make sure that they are on their way to him:



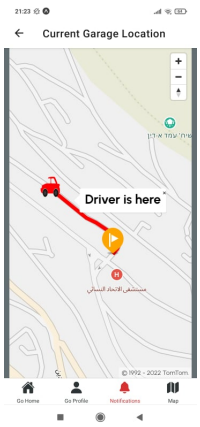


Figure 28: Tracking garage staff when order a service

4.5.16 Map

Map is one of the most important features in application, firstly user can search about specific location, create route between places and see the directions between them.

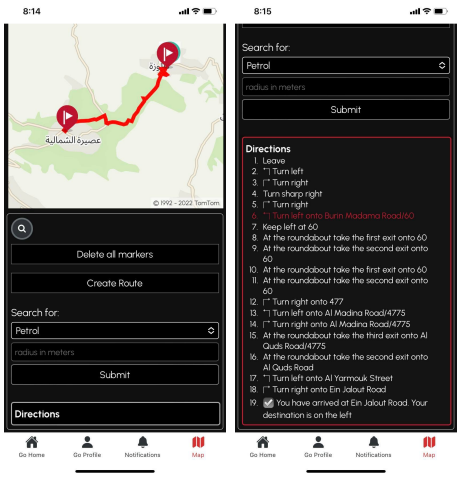


Figure 29: Create route and get its directions on map

- driver can also see the closest petrol/diesel stations, hotels and hospitals which surrounds its location by specific radius:

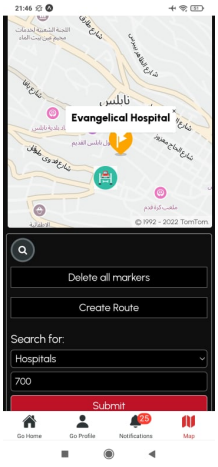


Figure 30: Nearest Hospital

- driver can also see all iDrive supported Garages on map, when driver press on garage popup, the app will navigate to garage profile.

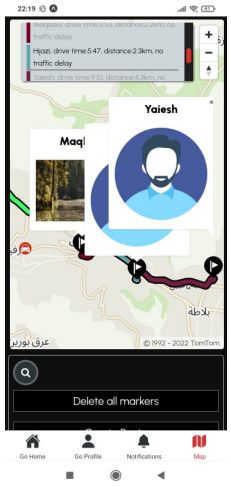


Figure 31: Garages popup on map

- Through submit button driver can see a route between him and all garages, each route has a different color, each route has an estimated time and distance.
Routes are listed in a popup view sorted by estimated time.

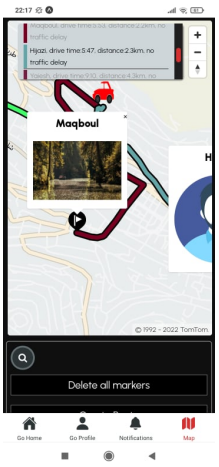


Figure 32: All garages on map sorted by least estimated time

- On other side, garage can see all customers locations-those ones who order a service to their locations and draw a route to them-:

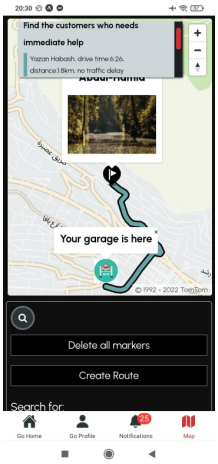


Figure 33: Customer's popup on map

4.5.17 Expert User

Expert user is an expert in the field of car that can update the diagnostic system by adding questions that are asked to the driver, tracking its sequence and arrangement, and adding the rules that the problem is inferred and the diagnosis depends on it.

The expert user page shows an interface to edit the diagnosis system information, including editing the decision tree to tune the arrangement of questions to be asked and inserting new questions. When the expert insert a new question, he should to type the question text and attributes in the specific fields, then writing the question choices, each choice has its next question id, so when driver choose a choice in a question, the system knows which next question will be asked later.

In contrast, the knowledge base section displays an interface to edit it. User can write a new rule by entering its premises/conditions and its value one by one, then add the rule conclusion which will be showed to the user if all the preconditions of that rule was satisfied. According to the forward chaining algorithm, rules can trigger other rules so the system can get more inferences, hence, new results.

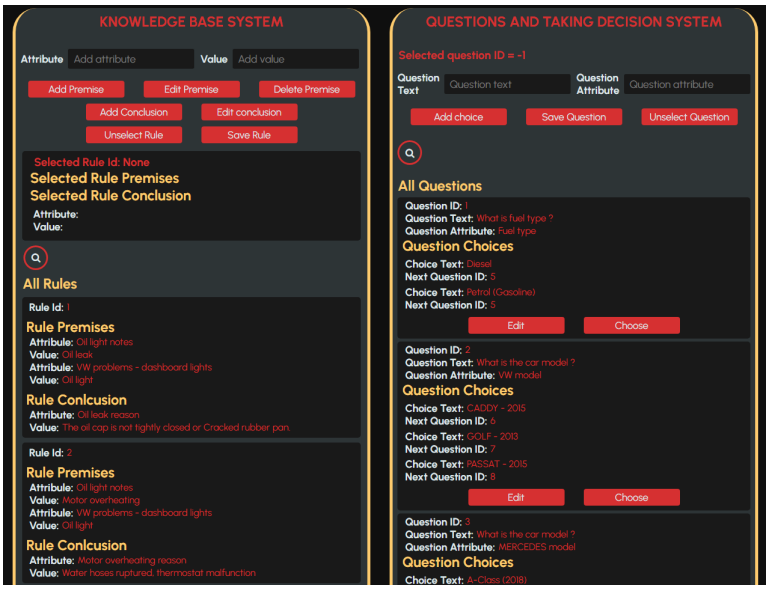


Figure 34: Expert System Interface

4.5.18 Diagnose System

In general drivers can't recognise their car problem. Driver can answer several questions to let expert system diagnose the problem and suggest a solution that either a driver make it himself, or get this service from specific garage.

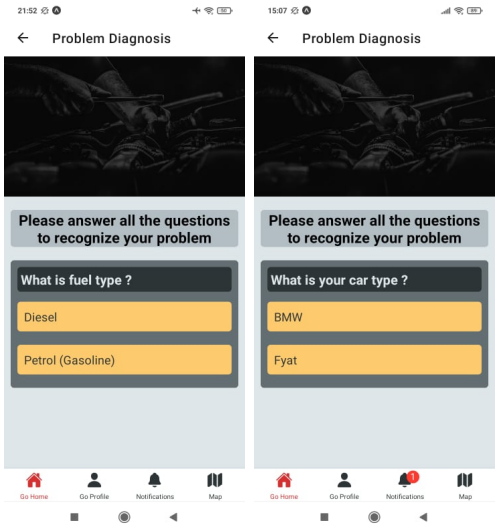


Figure 35: iDrive Diagnose Questions

- A result of the questions asked to the driver, provides him with an initial solution to the problem he is facing and provides him with its causes and type (maintenance or electrical troubles) and a button when pressed, a map containing all the garages that support a possible solution to this problem according to the type of the driver's car

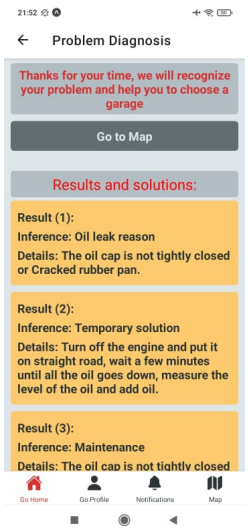


Figure 36: Expert System Result

5 Future Work

We are thinking of developing our project so that it also serve drivers of trucks, motors and other vehicles. Another thing we are thinking of is to make an online purchase feature to let driver buy car accessories or even buy a car or another vehicle!
We also look for an agreement with taxi offices to serve customers and facilitate the idea of taxi requesting.
Add an audio assistant to read the directions on the road.

6 Conclusions and Recommendation

6.1 Conclusion

The exploitation of technical knowledge to meet the needs of drivers and garages owners was our main goal. So that we tried as much as possible to meet driver and garages owners needs. Through providing best use of map and connect it with garages. And By get the best use of the services that garages provide which let user book/unbook or order/unorder any of these services.
Through this project, we gained great experience about using springboot with REST Full APIs, in addition to greate knowledge in react and react native development.

6.2 Recommendation

Before starting to work on the project, we spent a lot of time learning react and react native languages, in addition to the time we wasted searching about TomTom API. Therefore, gaining this experience before planning to work on project is an essential thing and we advise other students to do it before starting their project.
One of the most important things that helped us in this project is choosing the project idea a while before the scheduled semester of the graduation project, and therefore the pre-planning of the idea is very important, which helps students focus on their work.

7 References

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