Pay As You Drive

Research Report

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Abstract

The purpose of the Pay As You Drive project is to develop a mobile application for the Android & iOS platforms that will, first and foremost, track driving habits of a user whilst travelling on a journey. Driving habits are recorded and used for motor insurance purposes, whereby a user pays a monthly insurance price based solely on how much and how well/poorly they drive. The application allows the user to view their past journey, control their profile details and vehicles through the app, and finally create and monitor insurance claims within the application.

Pay As You Drive is designed with a Peer 2 Peer business approach, whereby users are nodes in a network. Each month the nodes are billed for their driving, and this money is gathered into one central money pool. In the event of an accident, fire or theft to their motor vehicle an insurance claim can be made, and if approved, a transfer takes place from the money pool to the users wallet.

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Section 1 - Introduction

The following academic literature is a research document related to a fourth year project based around creating a mobile application for a new motor insurance approach called Pay As You Drive.

Section 2 - Project Scope

The idea for this project is to create a unique motor insurance experience, combining a modern peer 2 peer insurance design with a personalised motor insurance tracking approach.

The project can be categorised into 2 sections:

Mobile Application

A mobile application operating on Android and iOS that monitors all factors relevant to car insurance whilst the user is driving. These factors will then determine how much the user owes towards insurance costs at the end of the month. The application will measure driving traits such as distance travelled, speed, dangerous driving and types of roads being driven on (see section 3.2 for more details). The mobile application also allows for making motor insurance claims.

Development of the mobile application will be developed for both iOS and Android simultaneously using a javascript based language called React Native. React Native uses one codebase to develop for both platforms. The mobile application will also integrate both Google's Firebase and SQLite into the backend to make up all database requirements.

Blockchain Ledgers

This project will also implement a modern motor insurance approach called Peer 2 Peer (P2P) insurance. P2P insurance is a decentralized scheme where customers are categorised into different insurance policies by their insurability score, and all monthly insurance funds across the ledger are pooled into one fund. All claims and expenses are deducted from the 'pool' to serve the customers needs.

Section 3 - Research Outcomes

3.1 - React Native vs Native (iOS vs Android)

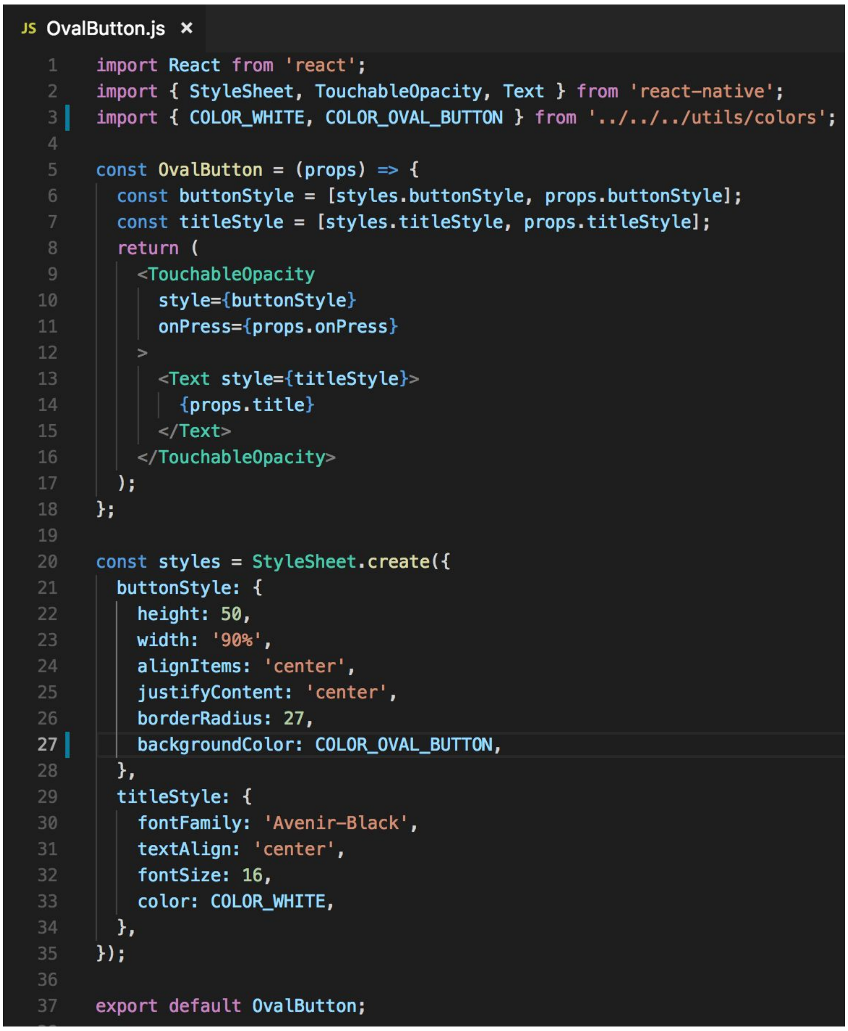
“With the rise of React Native popularity and the growing number of popular mobile apps (such as Facebook, Instagram, Pinterest, Uber, Discord, SoundCloud, Skype…) being partially or completely rewritten in React Native, the question arises: **Should mobile developers use React Native for mobile development instead of going full native with Java or Swift?**” (Trnka, 2019)

3.1.1 - React Native

To make the decision to develop in React Native, first a look at the development environments, layouts and styles is necessary.

React Native is a javascript based language developed by Facebook to allow develop users to user React capabilities alongside native platform features.

React Native is used to develop for both Android, iOS and UWP by using backend javascript scripts to work cross-platform. Designing with React Native uses JSX which is a type of web development style similar to using HTML and CSS.



```
import React from 'react';
import { StyleSheet, TouchableOpacity, Text } from 'react-native';
import { COLOR_WHITE, COLOR_OVAL_BUTTON } from '../../../utils/colors';

const OvalButton = (props) => {
  const buttonStyle = [styles.buttonStyle, props.buttonStyle];
  const titleStyle = [styles.titleStyle, props.titleStyle];
  return (
    <TouchableOpacity
      style={buttonStyle}
      onPress={props.onPress}
    >
      <Text style={titleStyle}>
        {props.title}
      </Text>
    </TouchableOpacity>
  );
};

const styles = StyleSheet.create({
  buttonStyle: {
    height: 50,
    width: '90%',
    alignItems: 'center',
    justifyContent: 'center',
    borderRadius: 27,
    backgroundColor: COLOR_OVAL_BUTTON,
  },
  titleStyle: {
    fontFamily: 'Avenir-Black',
    textAlign: 'center',
    fontSize: 16,
    color: COLOR_WHITE,
  },
});

export default OvalButton;
```

Fig. 1 React Native

Fig. 1 shows the coding style of React Native, with sections like 'styles' showing the web development styling similarities of CSS, and the structuring of JSX tags in a format similar to HTML.

Having a single codebase allows for easier maintenance and future changes, simultaneously making changes to both platforms, as well as no need for expertise in both Android or iOS app development. However, Android and iOS have very different development guidelines and styles, such as Human Interface Guidelines by Apple and Material Design by Google. This is a downfall by using React Native, but allows for a single style across both platforms that is consistent and unique.

Another cross-platform programming option is Flutter by Google. This is a very recent release based on a languaging style called Dart. Flutter offers very similar capabilities as React Native, but due to being a recent option it does not have the community, support and library options that React Native can offer.

3.1.2 - Native

To be able to choose one single mobile application platform, the argument of iOS vs Android, then research brings up an often bias and complicated debate that even market statistics can make unclear.

Market Share

Fig. 2 (GlobalStats, 2019) shows the statistics of Android vs iOS in late 2018. Fig. 2 supports the idea of using cross-platform development approaches such as React Native, as Ireland is split 58% to 42% which is very close to being evenly split, so developing for one platform would drastically reduce potential customers.

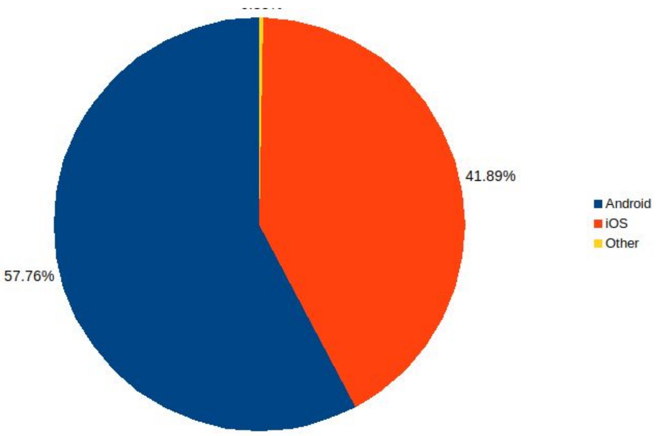


Fig. 2 Ireland iOS v Android Market Share (GlobalStats, 2019)

Deploying to Store

Something to look at when deciding on which platform to develop for is the ease and cost of deploying the mobile application to the relevant App Store.

For Android's Play Store the developer needs to pay a once off registration fee of $25 and fill in information through the Developer Console, and also deployed through the same console using a very beginner-friendly wizer (Martin, 2019).

For iOS's App Store there are more requirements and rules to publish. The developer needs both an Apple ID and a Distribution Provisioning Profile, then submit the application through iTunes Connect. Required certificates are:

- Distribution Certificate
- Push Notification Certificate
- Mobile Provisioning Certificate

There is a higher chance of publisher rejection on the App store due to the much stricter rules and guidelines (Martin, 2019).

3.2 - Motor Insurance Approaches

3.2.1 - Peer to Peer Insurance (P2P)

"Peer-to-Peer (P2P) insurance is a risk sharing network where a group of individuals pool their premiums together to insure against a risk." (Frankenfield, 2019)

The idea of P2P insurance is to remove the relationship between an insurer and the policyholder, allowing the insurer to keep the premiums that it doesn't pay out in claims. The approach changes how customers and big insurance firms interact.

A leading example is Insurtech's company Guevara. The idea behind Guevara was:
"It grouped customers together, who pooled premiums and received refunds if any capital remained unclaimed at the end of the year. It also created an app that collected data from the scene of an accident." (Verdict, 2019)

Guevara had P2P pools that had two ways to enter:

1. A user could be invited into a pool by friends or family.
2. A user could enter profile details and Guevara would create a risk analysis that would recommend a pool to the user.

Guevara CEO, Kim Miller, called it "Carmunism" (The Digital Insurer, 2019).

3.2.2 - Traditional Insurance

Traditional insurance such as insuring motorists will group drivers by their characteristics under the same coverage. An insurance company would assess the risk of insuring the driver by looking at age, driving history, medical disabilities etc. to group the driver into the best suited insurance plan that covers the cost of insuring the individual and an assurance that if something were to happen to the motor vehicle there would be covered.

The remaining unclaimed excess within a group would then be considered revenue by the insurance company.

3.2.3 - What separates this project from the rest?

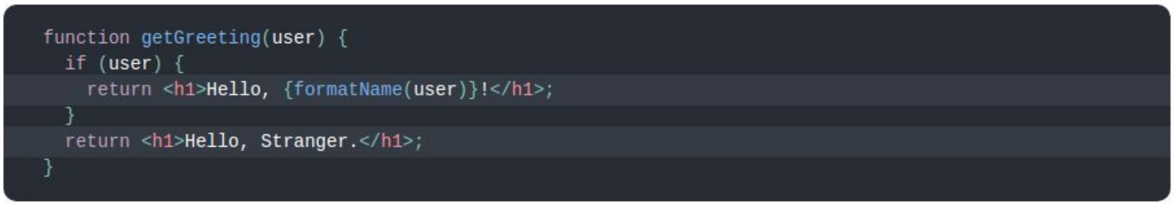
The idea for this project is to create a new and alternative option to motor insurance by including two main features that separate Pay As You Drive from traditional insurance options:

- **Non-discriminatory** - traditional insurance takes into consideration many personal factors (like those mentioned in section 3.2.2) that discriminate against groups. For example, in Ireland the cost of motor insurance for young adults is excessively more expensive than for adults over the age of 30 (for example). The application aims to only measure insurance cost based on how poorly or well the motorist drives.
- **Peer 2 Peer network** - as mentioned in section 3.2.1 the Pay As You Drive project wants to utilise smart contract technology in a peer 2 peer format, an approach that is very different to a majority of insurance options currently existing.

Section 4 - Technologies

4.1 - JSX

Introduced in React language, JSX is the UI design tools used in React Native.



```
function getGreeting(user) {
  if (user) {
    return <h1>Hello, {formatName(user)}!</h1>;
  }
  return <h1>Hello, Stranger.</h1>;
}
```

JSX uses a combination of Javascript type code with a web development type approach similar to HTML, and stylised similar to CSS.

JSX is what allows React Native to develop for two platforms from one code base, mapping what is known as components to the device, irrelevant of its native layouts (React.js, 2019).

4.2 - User Geolocation Tracking

The main functionality of the app is based around monitoring a user whilst driving, storing their habits to analyse and calculate insurance bills. Google maps is the most popular and community supported geolocation service providing map information and tracking services. Google Maps API has a comprehensive suite for mobile application development, and specifically with React Native through supported react native community libraries.

The expected Minimum Viable Product for the project will collect and monitor the following data from users:

Distance - The idea of ‘pay per mile’ requires tracking of the distance travelled by the user.

Speed - Safe drivers essentially pay less in insurance per month and will be tracked. This is combined with the type of road currently on and their location to calculate the acceptable speed compared with the current speed of the driver.
Location - Location will be tracked to monitor what kind of road the user is on, for example a highway is much safer and less damaging to a car than a single lane dirt road.
Aggressiveness - This is tracking the smoothness of the driving, collecting data such as abrupt braking or sharp corners at high speeds.

4.2.1 - React-native-maps

github.com/react-native-community/react-native-maps
React native maps is a react native package that provides Google Maps API for React Native. The Google Maps API gives access to location tracking, specifically using the `watchPosition` method to react to user movement.

Google Maps API constantly monitors longitude and latitude and can be used to monitor speed, distance and location.

4.2.2 - React-native-geolocation

github.com/react-native-community/react-native-geolocation
Geolocation module returns an object such as:

```
Object {
        "coords": Object {
         "accuracy": 347.6700134277344,
        "altitude": 0,
        "heading": 0,
        "latitude": 52.8279772,
        "longitude": -6.9349665,
         "speed": 0,
  },
        "mocked": false,
        "timestamp": 1573302050037,
}
```

When initial render of the screen occurs, <MapView> will require ‘initalRegion’ to focus the map on a certain area. Using the above Object the map can be focused on the user location as:

```
Object {
        initialRegion: Object {
        "latitude": 52.8279772,
        "longitude": -6.9349665,
        “latitudeDelta”: 0.01
        “longitudeDelta”: 0.01
  },
}
```

‘latitudeDelta’ and ‘longitudeDelta’ decide the region ‘Zoom’ area of the <MapView>.

Using the `react-native-google-directions` library the distance travelled can be measured constantly in time intervals. With a known time Distance can be calculated as
`Distance = Speed x Time`.

Each journey started by the user will use `timestamp` as a unique ID within the database as an identifier.

4.2.3 - Offline Capabilities

In the case where a user has poor or no internet access the monitoring of driving data needs to be stored locally until an internet connection is restored and the data can be added to the database.

4.3 - Backend Structures

4.3.1 - Firebase

Firebase is described as Backend-as-a-Service (BaaS), originally developed by Firebase in 2011 and acquired in 2014 by Google. The aim of Firebase is to supply all the Backend tools needed to quickly and securely develop high-quality apps.

Realtime Database is considered a NoSQL type cloud database, where data across all clients would be updated in ‘real time’, while staying available offline. The information is stored in JSON so both computer and human readability is easy, sharing one cloud based database across both Android and iOS.

As well as a database service, Firebase offers Authentication and Cloud Storage that relate to mobile application development.

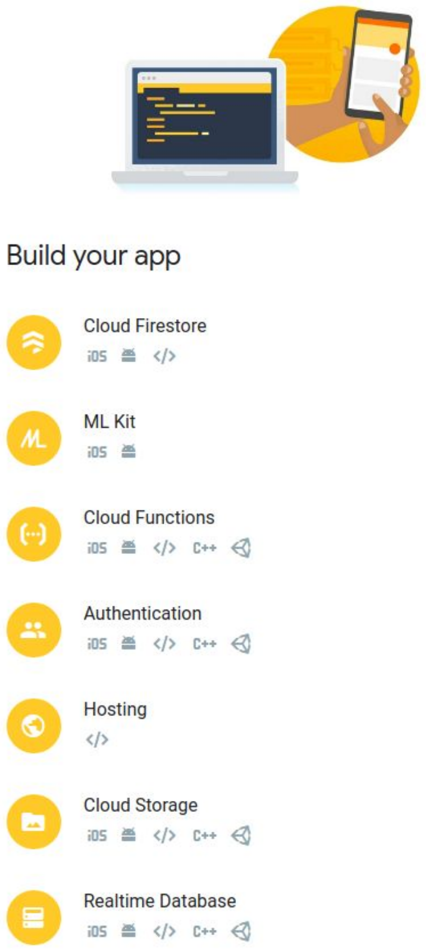


Fig. 3 Firebase applications (firebase.google.com/docs, 2019)

4.3.2 - SQLite

“SQLite is a C-language library that implements a small, fast, self-contained, high-reliability, full-featured, SQL database engine.” (SQLite org, 2019)

SQLite is a light-weight database software that is ideal for mobile application development. The software works on both iOS and Android.

The use of SQLite works well in an offline scenario where the data being collected is stored locally on the mobile device until the device connects to the internet again.

4.4 - Blockchain Ledgers

Blockchain is a system made up of an ever growing number of 'blocks' that are all interconnected with cryptography, each storing the hash of the previous block in the sequence, as well as a ledger of data and a time stamp. The design of blockchain is to create a system to record any kind of 'transaction' made between parties in a way that is verifiable and tamper-proof.

Blockchain is used in many real-world scenarios such as cryptocurrency ledgers and smart contracts, and there is now a growing number of startups using blockchain in the insurance market.

Hyperledger Fabric describes Blockchain as:

*"In general terms, a blockchain is an immutable **transaction ledger**, maintained within a **distributed network of peer nodes**. These **nodes each maintain a copy of the ledger** by applying transactions that have been **validated by a consensus protocol**, grouped into blocks that include a hash that bind each block to the preceding block." (Hyperledger Fabric, 2019)*

4.4.1 - Hyperledger Fabric

Hyperledger Fabric is the leading open source Distributed Ledger Technology (DLT), founded through the Linux foundation. Under the idea of open governance, Fabric has been steered by a vast community.

Fabric differs from alternatives because it allows for the writing of 'smart contracts' in general purpose languages such as Java, Node.js or Go, not constrained by Domain Specific Languages (DSL).

Fabric uses permissions in its peer node networks, instead of the anonymous networks such as Ethereum or Bitcoin, where nodes know the existence of other nodes and can have underlying agreements so as to settle any disputes. This setup is well suited to this project as anonymity can cause mistrust between peers in the same pool.

Smart Contracts or “chain code” as referred to by Fabric is the business logic of a blockchain application, enforcing its trust and security from the blockchain.

4.4.2 - Node.js

Hyperledger Fabric allows development in Java, Node.js and Go. This project will use Node.js SDK for development.

Node.js is a Javascript runtime, designed specifically to build scalable network applications, and so well suited to developing a Fabric peer nodes network.

Section 5 - Related Applications

5.1 - By Miles

https://www.bymiles.co.uk/

A similar motor insurance scheme to this project is by a company called 'Miles Car Insurance' based in the UK.

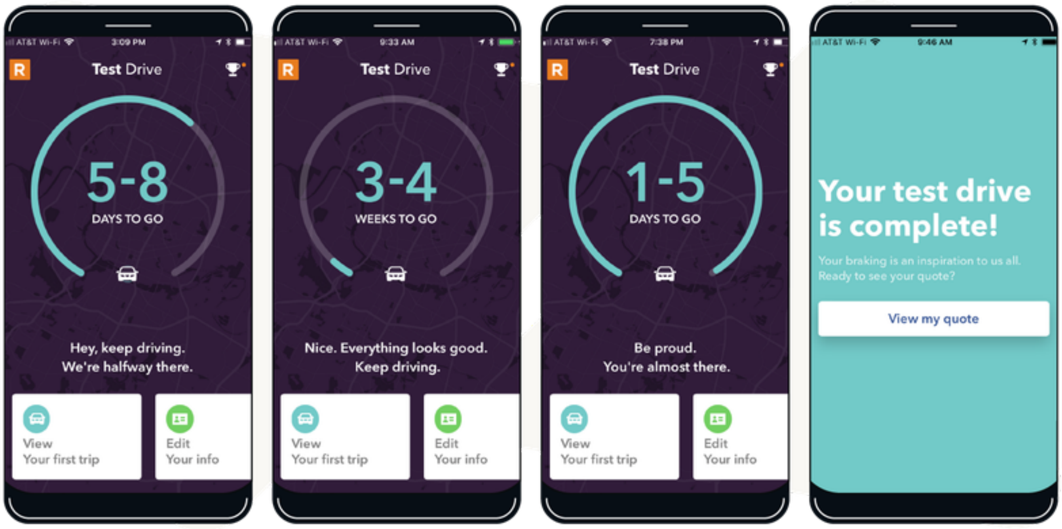
"By Miles offers a form of pay-as-you-go car insurance, where you pay per mile you drive. The less you drive, the less you pay." (Wheal, 2019)

By Miles charges a yearly, upfront, payment to cover vandalism and theft of the car, as well as a monthly payment that is calculated by the amount of miles you drive in that month. Once enrolled with By Miles the customer is sent a 'Miles Tracker' to plug into your car (powered by the cigarette lighter within a car). The 'Miles Tracker' only tracks distance travelled by the customer, not how they drive.

Similarities	**Differences**
A pay-as-you-drive monthly payment	Peripheral (IoT device) within the car to monitor driving stats, opposed to monitoring by mobile application
Monitors distance travelled	Does not monitor how the driver drives, not tracking speed, aggressiveness or type of roads
	Traditional Motor Insurance Approach

5.2 - Root Insurance

Fig. 4 Root insurance (Root Co., 2019)



Hey, keep driving.
We're halfway there.

Nice. Everything looks good.
Keep driving.

Be proud.
You're almost there.

Your test drive is complete!

Your braking is an inspiration to us all.
Ready to see your quote?

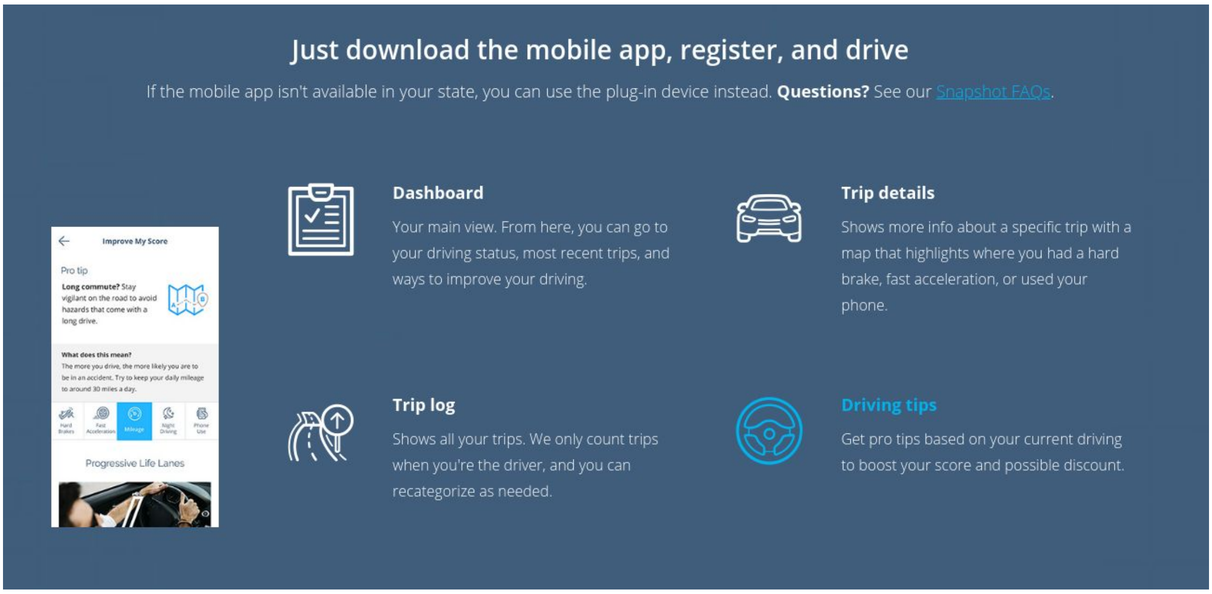
Root Insurance is a startup company that recently received $100 Million dollars in funding (Juang, 2019). The idea is tracking how a customer drives using a mobile application, and after a certain amount of time the data is analysed and a quote for the customer is worked out (Root Co., 2019).

The idea is meant to be more personalised to the driver as the application will analyse their specific driving habits.

Similarities	Differences
Mobile Application on both Android and iOS	Uses a 'Test Drive' to calculate the drivers insurance plan
Tracks driving habits such as speed and distance travelled	Traditional Motor Insurance Approach

5.3 - Progressive Insurance

Progress Insurance is a company founded in 1937 that in adopting modern approaches to motor insurance. The idea is to use traditional motor insurance coverage with monthly/yearly charges similar to other companies, except by tracking the driver the company offers discounts and rewards for safe driving at the time of billing.



Just download the mobile app, register, and drive

If the mobile app isn't available in your state, you can use the plug-in device instead. **Questions?** See our Snapshot FAQs.

Improve My Score

Pro tip

Long commute? Stay vigilant on the road to avoid hazards that come with a long drive.

What does this mean?
The more you drive, the more likely you are to be in an accident. Try to keep your daily mileage to around 30 miles a day.

Dashboard
Your main view. From here, you can go to your driving status, most recent trips, and ways to improve your driving.

Trip details
Shows more info about a specific trip with a map that highlights where you had a hard brake, fast acceleration, or used your phone.

Trip log
Shows all your trips. We only count trips when you're the driver, and you can recategorize as needed.

Driving tips
Get pro tips based on your current driving to boost your score and possible discount.

Fig. 5 Progressive insurance (progressive.com, 2019)

Similarities	**Differences**
Mobile Application on both Android and iOS	Normal insurance payments offering discounts for safe driving
Continuously monitors driving habits	Traditional Motor Insurance Approach

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