Aalto University

Shipping App for Rural Micro-Entrepreneur

Managing drone-based last-mile delivery

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Abstract

This report describes the design and the prototype of a Mobile Application for rural micro-entrepreneur. It has been developed in the form of an Android Application so everyone can use it through an android smartphone. The goal of this simple application is to provide a registered user with a comfortable and very intuitive application for managing drone-based last-mile delivery for Namibian people. The tool is implemented in such a way that it is easy enough to use by users with different skills and knowledge. This report assumes that users have access to an Internet connection.

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Introduction

1.1 Background

Namibia is well known for its gemstone production. The stones are mined in very remote areas of the country where infrastructure is minimal. Certain types of minerals are mined in huge commercial mines but others are mined by individual entrepreneurs in rural areas of the country with lacking access to their buyers and means of transportation. The current logistics of selling the gemstones work through a middle man. Local entrepreneurs mine the stones and sell them to a middle man who drives around the country in a 4x4 vehicle. This presents some issues. First of the transportation can't be quite called reliable. Secondly and most importantly the local miners can't get a fair price for their stones as they are selling to one middle man that just decides about the price because he knows there is no other option to sell the stones for the entrepreneurs. This way he can pick whatever price he wants to get as much profit from selling those stones as possible.
As a result, there is a need to fix this problem by providing fairer access to buyers and transportation of the stones. This could be done by a marketplace platform that would also take care of the delivery. To make sure the pricing is fair the stones would be sold directly from the miners and buyers could be forced to bid against each other on the price. In any way, the miners would now have access to more buyers and fair price for their stones as a result.
The second part is the delivery. It's tightly tied to the marketplace as the marketplace would be needed for the whole thing to make sense. In this project and proposal, we focus on the logistics part and how to make

the gemstone delivery easily accessible for the miners.

Users

There are multiple users the whole project needs to consider. Mainly entrepreneurs selling the stones, buyers buying them and then also probably staff handling the drones and backend of the logistical operations for the delivery to work smoothly.

2.1 Who are they?

Let's focus on the entrepreneurs for now. They are entrepreneurial people living in rural areas of Namibia. Their means of making money is mining and selling gemstones of various types. The types are not determined yet in the scope of the project. They don't have the time or means to travel personally to the cities to sell the stone directly to the buyers. They need sales to make a living for their families. They live in areas where infrastructure is lacking on many levels. Mobile internet is one area where the supporting infrastructure is present. But anyway their connection is likely limited as well as access to electricity. Powering a phone though is quite easy with local solar production. Their experience with technology is limited but they are quite familiar with using cheaper smartphones for their daily communication needs. They are also familiar with more advanced tech from users perspective so introducing drones is not going to bring problems in terms of using the devices to move stuff around. We can assume an understanding of touchscreen UI but the app should be as simple as possible anyway to avoid confusion and long times to achieve their goals.

2.2 User goals

The main goal of our miners is to sell their gemstone production for a fair price. This means reaching their buyers rather directly to be able to get competitive pay for the stones. On top of the sale itself, they need a way to deliver those stones to the buyers and receive payments for the stones. They want to do all of this in a way that introduces as little of extra work as possible.

2.3 Challenges

One of the challenges is to make the user interface easy and simple enough for the users to use because their experience with technology is quite limited. The instructions should be clear enough. The part about 'help' is much important. The user interface should perfectly meet with the user's need. In other words, it should fulfil all the requirements of the user. User experience research is quite important to face this kind of challenge.

Second, the user interface should run fluently and follow some logic. It should follow some visual design tips to make it clear and visual friendly enough.

Last but not least, the design should follow the proper guidelines.

Application

3.1 Proposed UI

Link to prototype: https://projects.invisionapp.com/prototype/ck41ojinr0027am01ql7ucy72/play

In our proposed UI we have focused on the delivery part. More research would be needed and welcomed to develop a proper solution as the delivery can't be simply taken apart from the marketplace as it doesn't make sense on its own. That being said we did ignore the marketplace part completely in the UI. As a result, we have included more features and steps in the process than would likely be needed if it would be part of a bigger service. More on that in future potential section. The prototype was built using InVision [1] studio as a prototype of an Android app.As such the base for our UI became the Google Material Design guidelines [2]. To make the app easy to use we followed Nielsen's heuristic rules. Their application is shown later. Standards and guidelines are a great starting point and have been used extensively but as mentioned by Peter Hornsby [3] they shouldn't be used as dogma because it creates the danger of falling into thinking they can be used always without the possibility to break them. Guidelines that were followed during the process are mentioned in the appropriate section. Mainly we were focusing on showing possible solutions to different parts of the expected flow and fulfilling the requirements of the users.

3.2 Key features

As suggested in the context description the main focus of our proposed app is delivery of gemstones by drones. The control of this service is going to be done by mobile app. The app needs to have at least the following:

- Ordering the delivery service;
- List of pending orders;
- Tracking option for the delivery

Outside of those main features there are supporting features making sure that the user tasks can be accomplished. But for the sake of simplicity, it is a key to keep the number of features as low as possible. With adding features the complexity of the UI necessary rises and slows the operation of the app for the user [4]. As a step in that direction, we decided to ditch the slide in from side menu where was originally the user profile and manual in favour of simplifying the app by merging things and throwing away redundant stuff.

3.3 Basic Flow

At the following link, is it possible to watch the basic flow of the application: https://www.youtube.com/watch?v=j9pVLWevEV4&t=75s

Opening the app after sign in user lands on the list of current and historical orders with the possibility to create a new order and switch to tracking view or support page. As shown in the diagram 3.1, the app has essentially four basic screens accessible from the top navigation. Order list, tracking, support and profile settings.

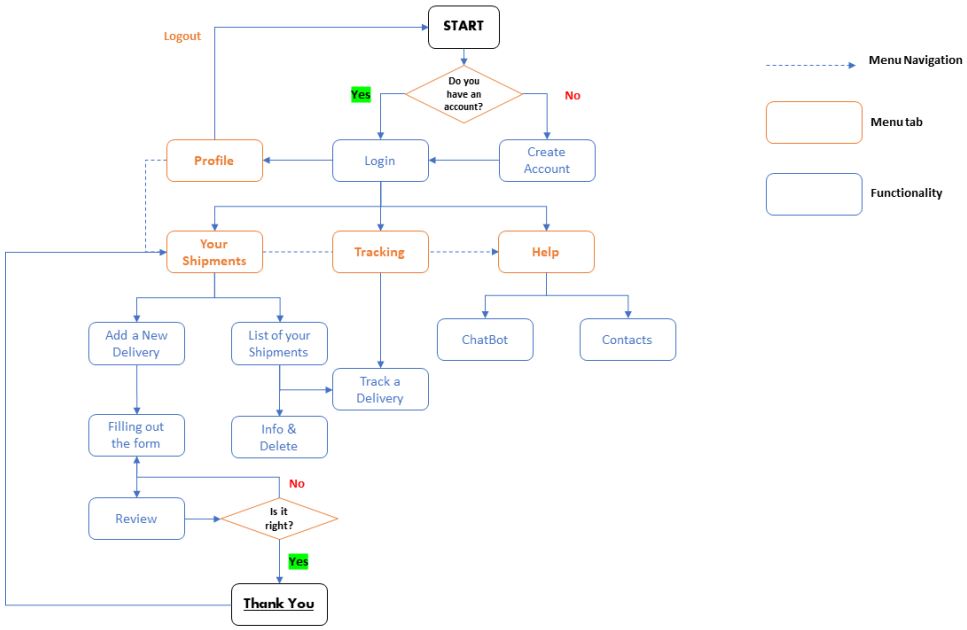

Figure 3.1: *Flow chart*

Order list (Figure 3.2) provides serves as a home page where users can see their pending deliveries as well as the history of deliveries. From there they can access details of each delivery and tracking information of flying drones. Deliveries that are still in the future can be cancelled from the detail.

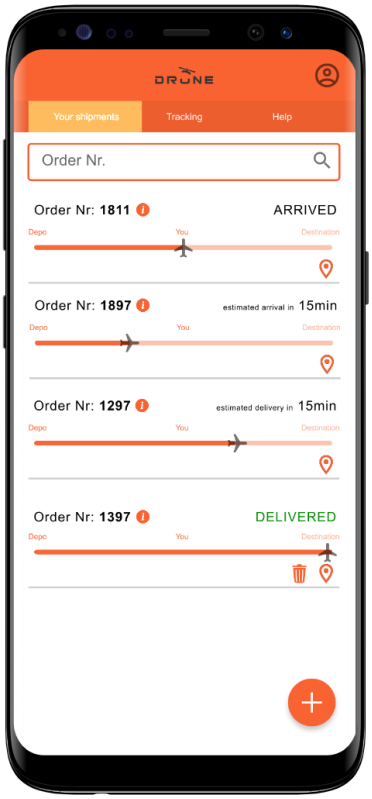

Figure 3.2: *Your shipments list*

Ordering new delivery is done via the plus button and then by following a five-step process (Figure 3.3, 3.4, 3.5, 3.6, 3.7) to fill all necessary details. This five-step process could be simplified depending on the context of the whole platform and more information about how the service would work.

Payment method could be dropped if the delivery is part of the marketplace service. Selecting notifications could be dropped from the process as well as it could be set just once in settings. If connected to marketplace the delivery address fill could be likely dropped as well as it would get the info from the order automatically.

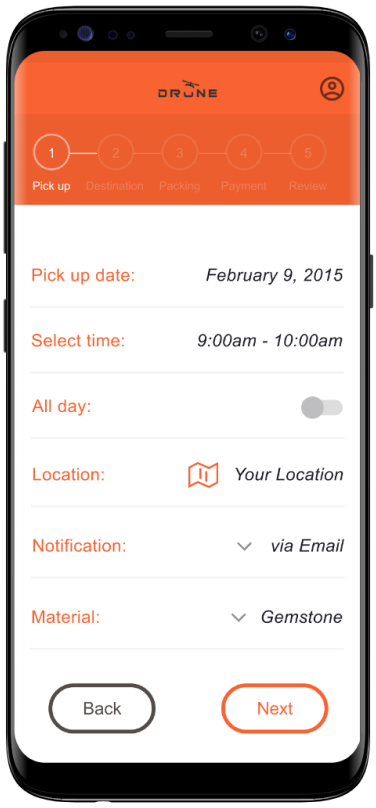

Figure 3.3: *Pick-up*

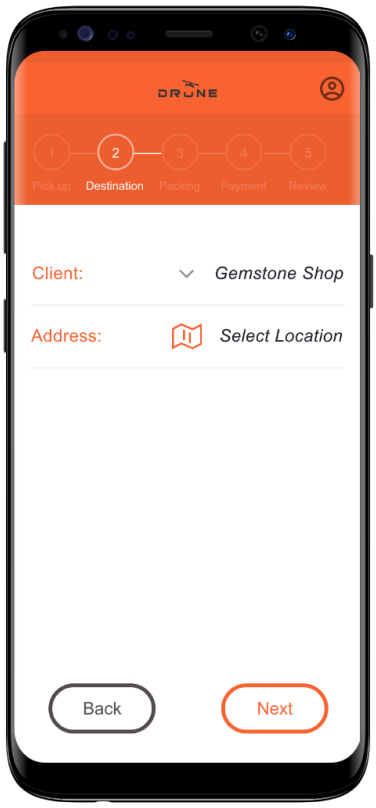

Figure 3.4: *Destination*

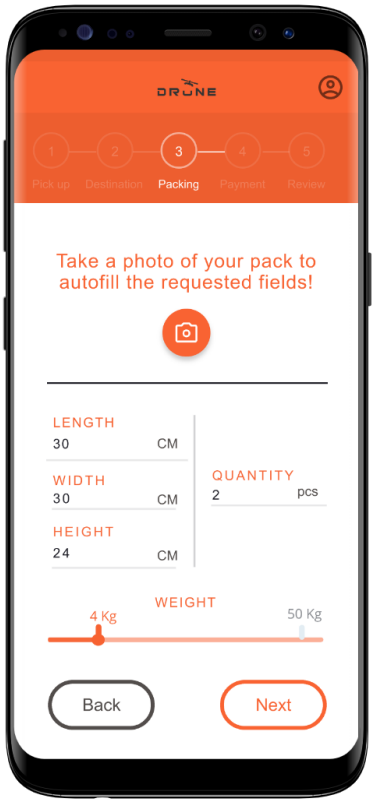

Figure 3.5: *Packing*

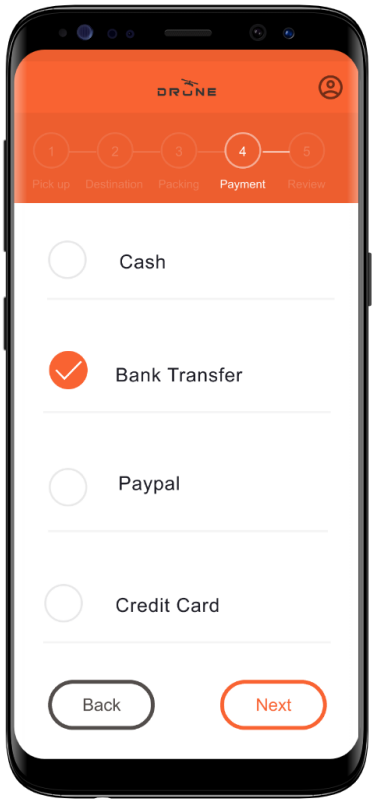

Figure 3.6: *Payment*

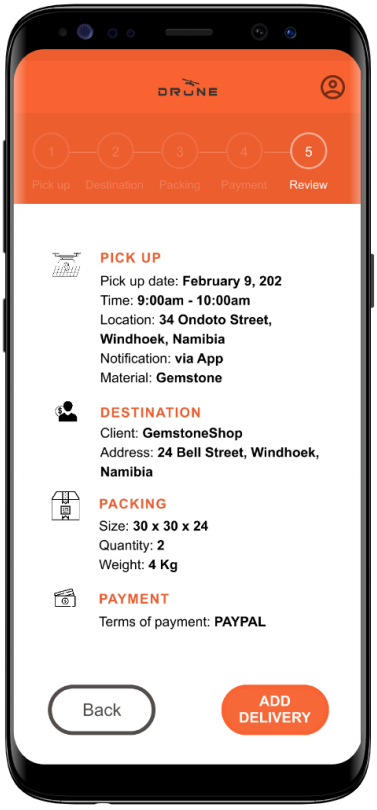

Figure 3.7: *Final review*

Tracking page (Figure 3.8) provides information about where the drone is currently flying and can be accessed either by the menu and submitting the id of the delivery or by clicking at the location icon at the delivery in the list of deliveries.

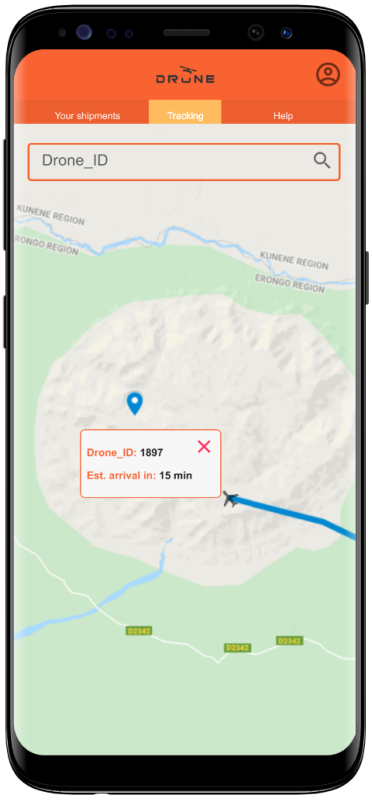

Figure 3.8: *Tracking page*

Guidelines

This chapter of the document describes the guidelines that are implemented. They are taken from Smith and Mosier guidelines [5] and grouped according to their specific functionalities. Most relevant guidelines used during the process are listed below. But the most interesting is making sure that the user doesn't need to fill the same data multiple times. It is taken even a step further by providing autofill of data based on image recognition in the package description. Next place with interesting usage of guidelines is the list of deliveries. Couple rules are explaining the ordering and visual representation of the state in which the delivery is at any moment.

4.1 Data entry

- *1.0/1 Data Entered Only Once:* User need to enter any specific data only once during their experience with this application;
- *1.0/6 Defined Display Areas for Data Entry:* To create a new delivery, User has to follow a well defined forms that follow well established UI patterns for inputs;
- *1.0/7 Consistent Method for Data Change:* User can always make a "step back" to change the previous data entered (e.g. in the form to add a new delivery the "back" button allows users to change their data);
- *1.0/12 Feedback for Completion of Data Entry:* if User makes an error, it is immediately notify (e.g. wrong login data or wrong registration data);

- *1.3/1 Adequate Display Capacity:* User has always enough space to insert its data (e.g. in the "packing" phase of adding a new delivery, it has enough space to insert the size of the pack);
- *1.4/1 Combined Entry of Related Data:* User is supposed to go through 5 different phases when adding a new delivery; but there is just one explicit entry action at the end of the five steps;
- *1.4/3 Minimal Use of Delimiters:* in the packing phase (where User has to insert the length, weight and width of the pack) all the sizes are asked in centimeters (users need just to enter the numeric values);
- *1.4/22 + Familiar Units of Measurement:* as said above, centimeter (or pieces for the number of pack) is the chosen unit of measurement which should be familiar with the users;
- *1.6.1/1 Automated Data Plotting:* User can autofill the data required in the packing phase just by taking a photo of its pack.

4.2 Data Display

- *2.0/1 Necessary Data Displayed:* whatever data a User needs, it is shown in the application;
- *2.0/13 + Consistent Wording:* in the "Your shipments" menu, every word has a specific and crucial meaning which can help user to understand more about his shipments;
- *2.0/14 + Consistent Wording Across Displays:* the same dictionary is used in all the pages and functionalities;
- *2.1/7 + Separation of Paragraphs:* in the "review" phase of the add-delivery functionality, all the data are well separated from each other;
- *2.1/12 + Sentences Begin with Main Topic:* in the "review" phase of the add-delivery functionality, the main topic is put near the beginning of the sentence (e.g. Pick-up near the pick-up information data);

- *2.1/20 + Single-Column List Format:* the list of shipments is displayed as a single column;
- *2.1/23 + Logical List Ordering:* the list of shipments is ordered with a double system. First of all, the orders "delivered" are placed at the bottom of the page; then the "active" orders are ordered according to the expected arrival time (ascending order);
- *2.6/26 Color Coding for Data Categories:* each category has a specific color (e.g. delivered orders labels are written in green);
- *2.6/27 + Easily Discriminable Colors:* as stated above, the green is always understood as "well done" idea;
- *2.7.1/1 User Selection of Data for Display:* in the "tracking" section, User can select which drone to track by typing its Order_Nr.

4.3 Sequence control

- *3.1.3/10 Explanatory Title for Menu:* "Your shipments", "Tracking", "Help" are the three titles for the three main functionalities. They well-explain what User is going to find;
- *3.1.3/21 Logical Ordering of Menu Options:* as stated above, the Menu Options are placed in a logical order because a User first of all has to add a shipment, then he can track it and finally he could ask for help in the "Help" section;
- *3.3/5 REVIEW Option:* the last phase of the add-delivery functionality is the review phase in which a User can see all the data he has previously entered;
- *3.3/7 END Option:* users are always allowed to logout and close the application (e.g. end with escape characters).

4.4 User guidance

- *4.0/1 Standard Procedures:* all the procedures in the application can be labeled as "standard" since they follow a logical order;

- *4.0/3 Separate LOG-ON Procedure:* log-on / log-in procedure MUST be completed before a user can select among any menu/functionalities;
- *4.1/1 Indicating Status:* in the "Your shipments" section, each order status is constantly updated when an event happens;
- *4.1/8 External Systems:* the map in the "Tracking" section can be seen as an external service offered by Google Maps, so User must obtain information by it without any kind of problems;
- *4.4/8 + Standard Display Location for Prompting:* all the prompts are shown in the same position of the screen (e.g. login error / account creation error);
- *4.2/7 + Identifying Multi Page Displays:* when a User is going to add a new delivery, he is informed at which phase he is and how many phases are left to be completed (e.g. "Pickup-Destination-Packing-Payment-Review" Menu);
- *4.2/10 + Indicating Item Selection:* for example, if a user specified a specific notification method (e.g. email), it is shown with the possibility to change it using a vertical items bar;
- *5.3/6 Sender Identification:* when a delivery is added, the system notifies the User with a "Delivery created, Thank you!" prompt message;

Results

The aim of this chapter is to evaluate in a "tangible way" the user interface showed in the previous chapters. To do this, it is useful follow the Nielsen's Ten (reformed 1999) Heuristics [6]. The following table helps to evaluate the UI according to different parameters:

Rule of Thumb	**Is this rule being applied? How so?**	**Is this rule violated? How so?**
1. Visibility of system status	No	Yes, because this parameter cannot be evaluated on this prototype of the application
2. Match between system and the real world	Yes, since all the application is a digital imitation of a real world customer-consumer experience	No
3. User control and freedom	Yes, since user has always the control on the next step. He is also free because of the menu bar to change always the section. And again: thanks to the permanent "Profile Button" user can go to the profile page and then quit the application though the log-out button	No
4. Consistency and standards	Yes, since all functionalities and commands are clear and easy to be executed	No
5. Error prevention	No	Yes, since the user is not helped in preventing errors but he is just notified when the error occurs
6. Recognition rather than recall	Yes, because all the information are always shown to the user. In fact he does not need to remember any extra information	No
7. Flexibility and efficiency of use	Yes, because an expert user can speed up the interaction using for example the "camera functionality" thanks to which it is possible to autofill the "size form" of the "packing section"	No
8. Aesthetic and minimalist design	Yes, the visual layout is very basic and it puts in evidence just the strictly needed information	No
9. Help users recognize, diagnose and recover from errors	Yes, because if the user inserts some wrong data, a message will be shown to him. For example, during the sign-up operation, if the user inserts a wrong password, a popup is shown saying how the password is requested	No
10.Help and documentation	No	Yes, because of the simplicity of the whole application, documentation is not provided

Conclusions

6.1 Take-over from individual preliminary ideas

Each of the team members was tasked with sketching the core of the app according to their ideas and best knowledge. We decided on this approach to get different points of view on the whole thing. Each of us focused in the end on different part as seen in the individual assignments. After meeting together and discussing the suggestions we picked **Matteo Rizzi**'s proposal as a base for the final prototype. **Jin Zhongyuan**'s proposal correctly pointed out the need to have settings for the size and weight of the package to be delivered as well as an easy way to do it. **Aobo Cui**'s proposal brought a search panel and status of the delivery. **Ondra Brem**'s proposal showed the correct way of selecting the location and showing where the drone is as well as the idea of showing the range of the service when picking pickup location. After putting everything together Ondra suggested a better way of visualizing the list of deliveries and their status.

6.2 Limitations and future potential

The main limitation is in research that would be needed to correctly understand the context for which the app is being developed. Secondly, the marketplace integration seems to be quite an obvious choice with the information available and as such, it is the logical next step in the research and design phase. From a platform standpoint, the limitations are that we know nothing about the service, it's business model, the technology used or logistics how the drones would be operated. Also,

there is limited knowledge about the users themselves and what shape and size do their gemstones poses. This both would be crucial information for actually developing the app and service further.

The main potential of the service is in the marketplace part that would allow the miners to access buyers directly and as such create a fairer opportunity for selling the stones for them compared to the current situation.

Appendix Flowchart Diagram

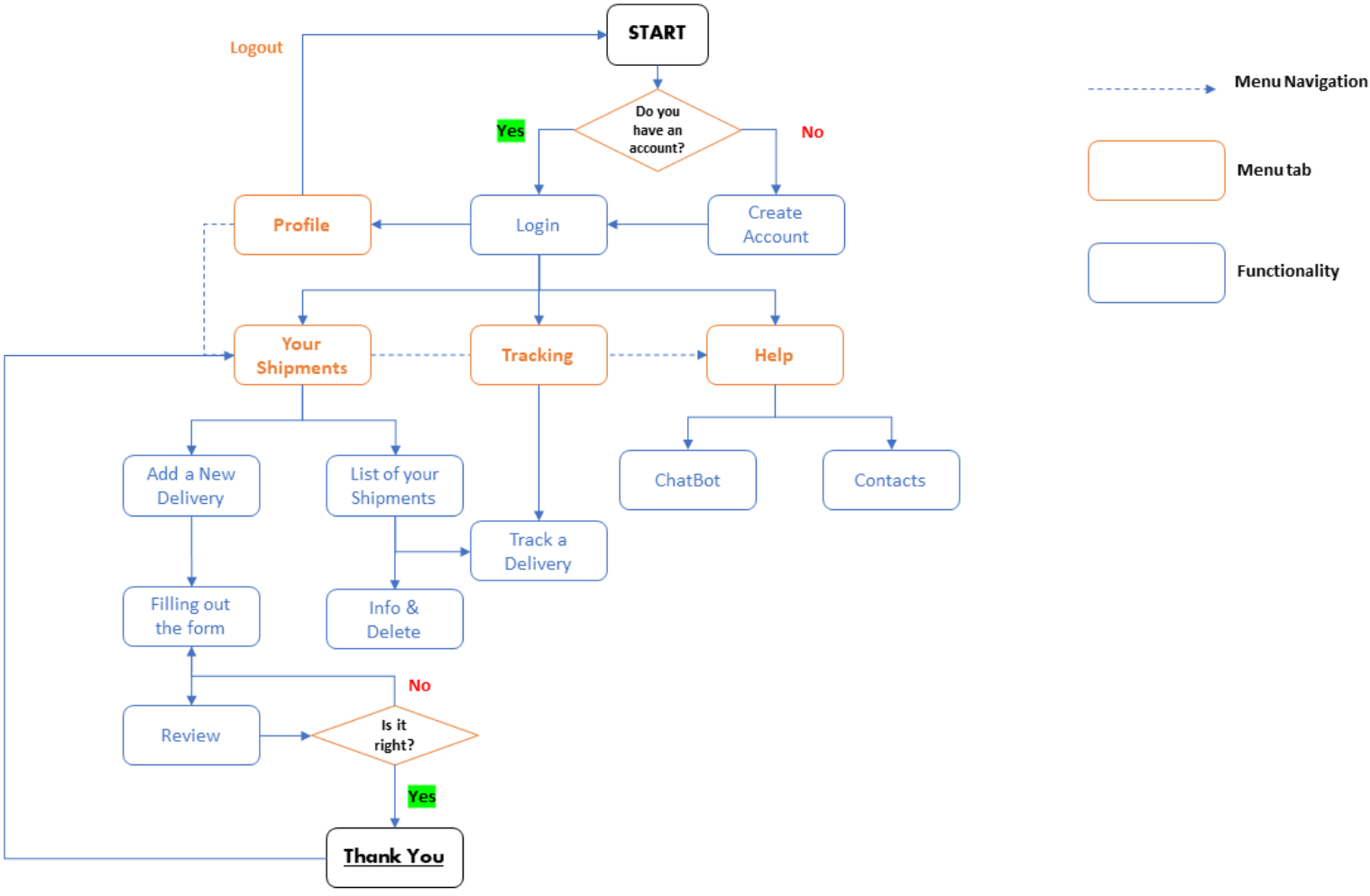

Figure A.1: *Flowchart diagram of the Application*

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[1] *InVision*. https://www.invisionapp.com/. Accessed: 2019-11-19.

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