Android OS User Interface for a Mobile Foreman App

CS-E5220 - User Interface Construction

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Table of contents

Introduction

In the current project, our team continues exploring the interaction design of the project management application for a construction team. The current project's task is to design an interactive user interface (UI) for a specific platform. Aside from the emergence of the mobile platforms and their capabilities, our team chose mobile platforms because of the convenience of carrying a mobile device in the construction working environment. Specifically, we decided to design a mobile application UI for the Android operating system (OS).

Why Android OS?

We decided to concentrate on the Android OS because it is the leading mobile OS if we consider the number of users worldwide at the moment [2] and in our opinion it would be beneficial to explore and to learn Google material design principles and Android interaction design guidelines. For some of our team members this knowledge is highly important for the further professional specialization in development.

Who is the user?

The application's scope of use will be limited only for the user that plays the role of a foreman, who is a team leader in the industries such as construction, manufacturing, and repair. A foreman is a supervisor of the construction workers team, her role in the industry hierarchy stays above the workers' but below the managers' [1]. The main task of a foreman is to determine the priorities for the work to be done by the workers, sometimes taking into account the worker's own initiative but mostly following the orders of the managers. The foreman monitors the situation in the team, especially the quantity of available workers and also available tasks. The foreman prioritizes the tasks and assigns them to specific workers. If there are issues in the project, the foreman can re-assign the tasks to other workers of pass them even to another team [1]. We decided to name the application "Mobile Foreman", just to give it a specific name indicative of the platform and the function.

User tasks

The role of a foreman is quite limited in a construction place. Main task of the foreman is to be able to monitor the list of tasks and list of workers, to be able to assign (or reassign) the tasks to the workers. The foreman is not allowed to create new tasks, to change the deadline of a task, to make changes in the worker's list (to hire new workers / to fire anyone of existing workers / to make changes in the workers shifts). If there is such a need, a foreman can send an request to the manager to create a new task. According to the identified user tasks, we specified the requirements for the application in the next section.

User requirements

- The application must provide the opportunity for the user to see the list of available tasks.
- The application must provide the opportunity for the user to see who is assigned to the task (or to see if the task is not assigned to anyone yet).
- The application must provide the opportunity for the user to see the deadline of the task.
- The application shall show to the user the mark (i.e the "check" symbol) of the task which is already completed before the deadline.
- The application must provide the opportunity for the user to sort available tasks:
  - according to the vicinity of the deadline (urgency),
  - according to the completeness before the deadline,
  - first to show the tasks which are not assigned yet.
- The application must provide the opportunity for the user to assign the task to the workers.
- The application shall show to the user the list of workers who are available at the moment (the moment of assigning the task).
- The application shall show to the user if the available workers already have the tasks assigned to them.
- The application must provide the opportunity for the user to see the list of workers, their shifts and assigned task (if there are such).
- The application must provide the opportunity for the user to see the personal profile of each worker.
- The application shall show the user the name of the worker, her shift, currently assigned tasks and their deadlines.
- The application must provide the opportunity to the user to see the history of the accomplished tasks.
- The application must provide the opportunity for the user to go back from the current activity to the previous activity.
- The application must provide the opportunity for the user to go back to the main screen from any current activity. This is also enforced by the Android OS guidelines (see Background Concepts)

- The application must provide the opportunity for the user to undo the previous step (in the task assignment process) or edit the choice of task assignment.

In the design of interactive UI for Mobile Foreman application we will make an effort to realize all the functions according to the user requirements.

Background concepts

For platform specific research, we still followed Nielsen's 10 Usability Heuristics for User Interface Design, however our key focus was design principles of Android OS and best practices for interaction and user interface construction for Android. All the materials were taken from the official web-site http://developer.android.com. In this section we will outline the main principles and ideas for our UI design of mobile foreman app.

Android design principles

There are many design principles for Android that are designated to make the users happy, engaged, and feel their uniqueness. User are given the opportunity to customize screens of the applications, while engaging with them simply using short and pointed phrases. Mainly, Android is about making the user's life easy, keeping everything that is useful in one place [3].
These design principles are rather general and abstract, they summarize the big idea of Android that can be applied in more specific situations and details of UI and interaction. Out of many general design principles we would take some that are more directly relevant to foreman project in this research paper:

Only show what is important at a time

In the menu we will show only options that are important at the moment for the user. We will not overwhelm the user with extra information and opportunities. We will teach the user as she progresses through the app. We will break the tasks in smaller chunks and will give feedbacks [3].

I should always know where I am

We will let the user feel confident while using the app and changing the screens. So that the user will find the way while travelling from one screen to another and will be always able to find the way back [3].

Best practices for interaction and engagement

The Android best practices for user interaction and engagement [3] are used to design effective navigation in the app. The guidelines suggest that we plan our application screen by screen and think how the relationships between screen will be organized. It is useful to make a diagram of screen relationships in order to visualize how each screen will be reached from another. From this

diagram it will be possible to design the use of simple buttons, lists and full screens that will represent each batch of data that will be important for the user while using the application [3].

The application must provide descendant and lateral navigation for the user to get access to every screen. There are parent screens (usually collections: lists, grids, carousels) from where users can access the child screens (for example, object from the list). When using a list, and upon necessity, the white spaces should be used efficiently. That is, providing textual description of an item in the list might be useful, as long as the information fits in the stated parameters of the list. When choosing the list design pattern for an app, it is important not to make the lists too deep so the user could reach of item with one click [3].

In order to provide consistency of navigation and show the important actions it is necessary to design and add an action bar in all the screens of the application.

Methodology

To be able to cater for all the user needs defined in the Introduction, we underwent through different steps to reach the final prototype that we present in the results. We began the Cognitive Walkthrough process [6] by first defining what type of Foreman we want to target as a user, followed by researching what a typical construction foreman does. The first part of the walkthrough (refer to Appendix A for an overview of the process) was already addressed by the previous report (the Command Line Interface) and the Introduction part of this report. Next, we started with planning the application screens and their relations based on the user needs, as well as on benchmarking with the current solutions for similar applications, begin with a low fidelity prototype, perform user testing on it, refine the prototype and come up with a wireframe, and perform another user testing and cognitive walkthrough. These steps are detailed next.

Application planning

First we will plan the screen relationships in the app. We will create the list of screens that will be available in our application and then make the diagram of their relationships. We will define the contexts necessary to enable the users to discover and view the data used in the application. We are going to determine the set of screens needed to allow the end user to navigate to and interact with the data.

List of screens

In the Mobile Foreman application, we will let the user view, save, edit the information about tasks and construction workers that are organized in lists. Below is an exhaustive list of screens that covers these use cases.

- Home or "Launchpad" screen for viewing the tasks, the list of workers, and the help section (with cards “Tasks”, “Roster”, “Help”)
- List of tasks
- Task detail view (which the user can edit assigning the tasks to the workers and marking the task as “done”)
- List of workers with their names and shifts also marked if they are assigned some tasks to.
- Worker detailed view
- Help screen (preferences, help-related issues)

Screens relationships

Now we can define the directed relationships between screens; an arrow from one (parent) screen to another (child) screen means that the child screen should be directly reachable via some user interaction in the parent screen. Once we define both the set of screens and the relationships between them, we can express these in concert as a screen map, which shows all of our screens and their relationships:

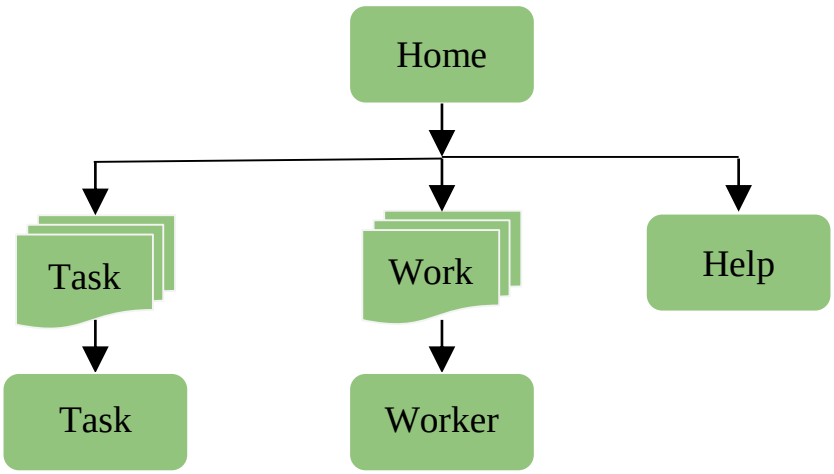

Figure 1. Screen relationships.

Evaluation and Benchmarking

For evaluation of the application screen plan and user interface elements we used benchmarking of the several best team project management applications on the market. We also tested the wireframe of the app with 4 people.
We have chosen Trello and Asana apps as an inspiration for Mobile Foreman app because they were highly recommended by online business thematic media [4] .

Figure 2. Trello cards screen. Source: Google Play, Trello

For the home screen of Mobile Foreman, we were inspired to use cards like in Trello, the cards are organized on the screen imitating a nice dashboard. The foreman cards will be "Tasks" (list of tasks) and "Roster" (list of workers).

When creating the design of the tasks screen and other screens of the app we were inspired by the Asana application (see Figure 3). We liked how clean and clear the design of the tasks list was. We liked how the deadline was also present on the tasks list so the user will instantly see the deadlines of the present tasks as an overview without urging to get the independent task view.

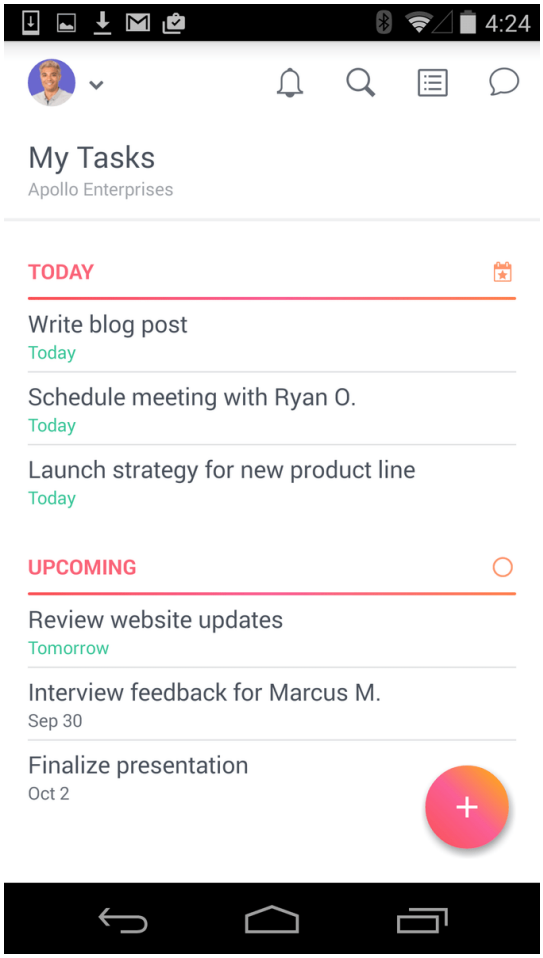

Figure 3. Asana tasks screen. Source: Google Play, Asana app.

Low-Fidelity Prototype

After having a small idea of what we need, we began making low-fidelity prototypes using pen and paper, such as the one shown in Figure 4. The complete interactive mockup could be seen by following this link: https://popapp.in/projects/582e52b3e8e516da19372c32/preview

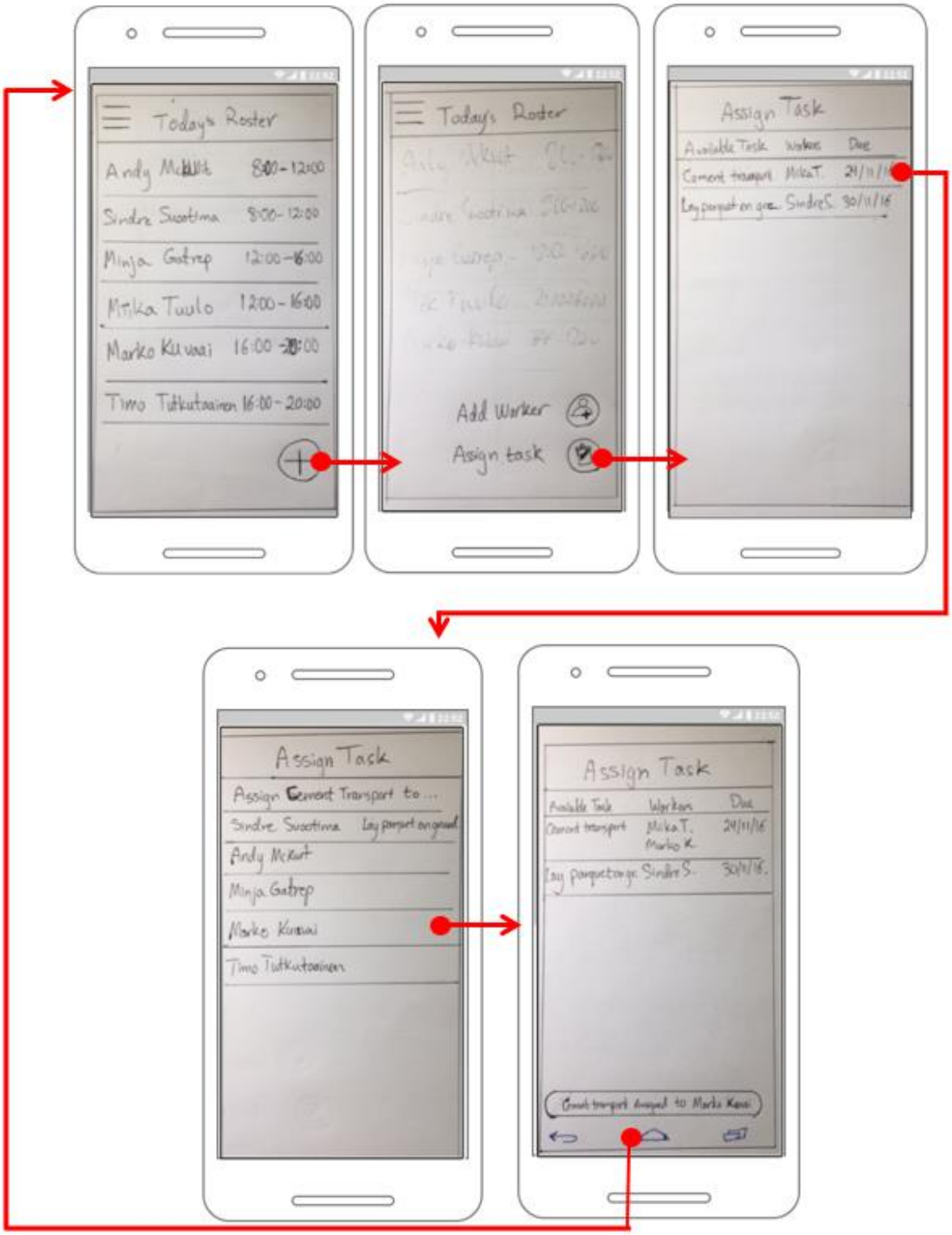

Figure 4. Low-Fidelity prototype made on paper, then made interactive using POP app

This prototype was developed with an app called Prototype on Paper (POP), which is convenient for quick low-fidelity prototyping. As apparent, the general Android guidelines were used in the early prototypes (such as the navigation pane, the action button, and the toast message). However, in addition to some missing functionality, the main page at the moment did not have much functionality and the other than showing the roster. The action button needs to be pressed to get to where users can be assigned. After some feedback and agreement with the rest of the team, we had to move to an improved prototype that is shown in the Results and Analysis section.

User testing

In the very early stages, we tested the UI of mobile foreman with 4 people. They are not connected to the construction industry however, they were able to understand the structure of the app because it is similar to organizers and task planners that private individuals may use for themselves. Also because the design was inspired by existing apps for teams and for individual use. We got positive feedback from the users. We have got a suggestion to add a visual mark in the roster for each worker that has a task assigned to her so that it will be instantly visible without the need to go to the worker's individual screen to see her details. It will make the foreman to allocate workers to the tasks much faster.

After we came up with the updated design presented in the next section, we performed Cognitive Walkthrough as suggested in the course material and in [5]. The main results of the cognitive walkthrough process are presented in the Results and Analysis section. A more detailed process of the cognitive walkthrough performed can be referred to in the Appendix A: Cognitive Walkthrough Process.

Results and Analysis

We designed the mockups of the application using Balsamiq, since it is simple to use yet effective. Figure 5 shows the main screens of the Mobile Foreman application. For a more detailed and interactive mockup, please refer to the attached document titled "Mobile Foreman Android Mockup.pdf"

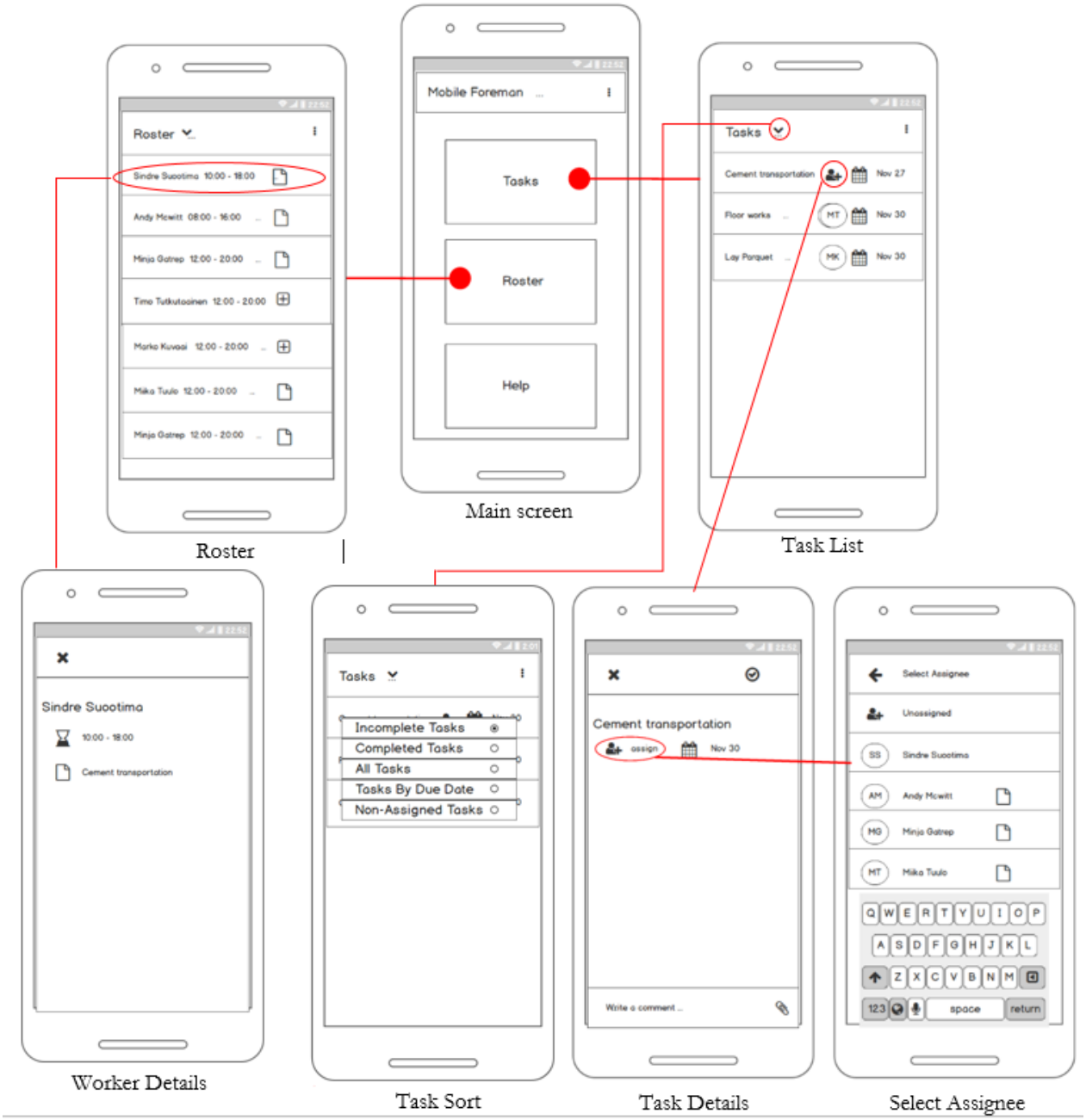

Figure 5. The main parts of the Mobile Foreman interface

On the main screen there are three cards: Tasks, Roster, and Help. The Tasks card leads to the list of tasks. In the list of tasks each task has the icon that shows if the task is assigned to anyone and also its deadline. It makes the user quickly check the list of tasks and spot the task which should be assigned. If the user chooses any task there will be a task view from which the user can assign the task to anyone who is available from the roster or change the assignee. The user can sort the

tasks (see screen "Task sort") according to various parameters. The roster screen shows the list of workers with the names of the workers, their shifts and marks if they have any assigned task or not. The "document" icon means that the worker already has the task assigned to her, the "plus" icon means that there is no tasks assigned to the worker, so she is free. The user can go back from the task view to the previous activity pressing the **X**- button. When selecting the assignee for the task, if there is no need to select, the user can go back pressing the arrow in the top left corner of the screen. In order to go back from other screens, the user should use the back button provided by all Android devices (mostly at the bottom-left corner of the screen).

Cognitive Walkthrough

We performed our work conforming with the cognitive walkthrough, and we briefly present the answers to these questions here, keeping in mind that the actual answers are provided from the interactive interface attached with this report.

- **Question 1: Will the users be trying to produce whatever effect the action has?**

  We made sure to define a set of actions based on what a construction foreman does. These include: View Workers' roster (or Task list), assign a task to a worker (or a worker to a task), and mark a task as done.

- **Question 2: Will users be able to notice that the correct action is available?**

  Based on the feedback we provide in the next section, they were able to do that for most of the important tasks. Some actions, however, we not straightforward for them, such as the "mark as done", and we indicate that in the next section as well, along with other feedback.

- **Question 3: Once users find the correct action at the interface, will they know that it is the right one for the effect they are trying to produce?**

  We ensured this while designing the interface and we confirmed it after the user testing. The users found clear what an action would do and what would they expect at the end of it. such as assign a task or a worker or sort the list of workers or tasks in a certain way.

- **Question 4: After the action is taken, will users understand the feedback they get?**

  We carefully designed the visual feedback to the user, which in this case is actually a vital Android design guideline, and which typically includes "toast messages" that appear for a certain time after the action is taken.

User Needs and Feedback

During performing Cognitive Walkthrough based on the mockup in the attached pdf, we got useful feedback, which we were able to achieve because we asked the test users to be stricter. We did that by asking them to scrutinize our design and emphasize on the down sides, so we asked for one positive points but two negative points, while also leaving the room for general comments and suggestions for improvement. The detailed feedback is presented in Appendix B: User Feedback. The general feedback and the significant parts that we needed to improve, to which we will reflect on in the Discussion section, is shown here:

- Get rid of the landing page, perhaps start with one of the pages. The "Help" section is on the same level as "Tasks" and "Register" but it is not used as often.
- Probably have tabs that you could navigate through by swiping.
- Allow assigning the task to more than one worker immediately.
- Add user onboarding.
- Some actions (like marking the task as done are not clear).

Discussion and Conclusion

Discussion

What adds to the complication of designing an interface for what we thought is a simple app is that it is hard to get from the users what they want to see in the system. Hence, simple questions about what they want to see is still not so effective. Hence, a cognitive walkthrough was a vital step in making us understand what we need to do. We asked the questions in the Cognitive Walkthrough section to the user while having the interactive interface, and we observed where they were trying to perform their actions and whether they were going where they should immediately. This process indeed made us better understand which parts of our design were fine and which ones needed refinement.

Despite having a mockup that serves for developing the minimum viable product for the Mobile Foreman, there are a lot of improvements to be done on the design based on the user feedback. We will take the improvement suggestion into consideration, classifying them into urgent improvements (like fixing the "mark a task as complete") and secondary "good-to-have" ones (like assign a task to many). We also reflect on the main points of the user feedback that was presented in the Results section (User Needs and Feedback):

General Feedback	**Our Reflections**
Get rid of the landing page, perhaps start with one of the pages.	Good catch. Initially we thought of that. The argument was to have the landing page where the foreman chooses what to go to in the beginning. But it is good to know what the users exactly expect.

The "Help" section is on the same level as "Tasks" and "Register" but it is not used as often.	True. We hypothesized that we have to make it the Help section the same size as the other sections so the users would not ignore it. Still, apparently they do not see the need to go to it unless they face a problem later, so it is better to have a small help icon that can be found at any stage. Will implement that in the future.
Probably have tabs that you could navigate through by swiping.	Good idea. This is also one of the Android design patterns. We have it in our plan (and actually it was proposed by some of our members) but there was no quick way to prototyping through Balsamiq. We will definitely implement this in the future.
Allow assigning the task to more than one worker immediately.	We agree and already began implementing it. (this could be seen from the current mockup, although it is not fully functional but we enabled clicking on the circles next to each worker name to turn that circle into a checkbox (the same style as google's Inbox app).
Add user onboarding.	This is a nice suggestion. We tried to have the same effect in the help page (please check the attached interactive mockup) but a user onboarding at the beginning is always a good guidance, since they might not go to the help page first.
Some actions (like marking the task as done are not clear).	Good one. That's why it was useful to do user testing to catch these points. Although the information about this was in the help section, it was not enough (Yes, we confirmed that people barely check the Help section). As an immediate solution, we want to tackle this through user onboarding. For the future, we have to redesign this action and make it clearer.

Future Improvements

The future improvements for Mobile Forman are numerous. Since this is a design for a platform specific application, we discussed ways to make use of the device capabilities to provide a better experience for the user. This is a key difference between the web-based responsive app and the platform-specific app. The latter makes use of the device sensors and processing power to come up with a more robust solution for the experience of the user. Thus, we thought of some of useful functionality based on trends in the market industry, including Tieto's solutions of tracking teammates to know where they are in the office and whether they are busy. We thought that this would be a good fit for Mobile Foreman, where a foreman could see where each worker is in real time, and know whether they are busy with the task or available for handling another one. This could be done using indoor positioning technology, such as beacons which connect to the mobile device via Bluetooth.

Conclusion

It was quite difficult to design a mobile app for the first time. With lack of experience in native mobile development and mobile interaction, specifically on Android OS, it was complicated to grasp all the specifications and design guidelines and apply them in the user interface design. While working on UI design for Mobile Foreman we had to ask many questions, including:

- Which screens do we include?
- How will they be connected with each other?
- Which type of interaction will the user be involved into?
- How Android - specific elements will be placed in our app and which functions will they hold?
- Which value each of the elements will bring to the user?
- How to make the app light and clean and the interaction smooth and easy?

Mobile apps development is not only about the design of the screen, visual elements and colors, but also it contains a huge portion of interaction. Using mobile app seems to be more personal and closer to the user than using the web-site with the computer. When using the web-site there is always something between the user and the web-site. Usually it is the mouse or almost every time the cursor of the mouse (even when a touchpad is used). But the mobile app provides the interaction right under the user's finger. The essence of Material Design for Android platform is that everything on the screen is an object [3]. So the user interacts directly with these objects, changes them, takes them and moves them around, using the energy of her fingers generated by the warmth of human body. The interaction with mobile app is more direct without any middleman therefore more intuitive and personal. To recreate this type of interaction, it takes a lot of effort, and we were able to experience that with this assignment.

All in all, we were able to achieve what we planned for in the beginning of the project, and come up with an interactive UI. Not only is it ready to go for real user testing, but also we were able to perform basic testing with user representatives at two different stages. We can confidently test this user interface for the main minimum viable product functionality, which is to view different available tasks and workers, assign a task to workers, and mark a task as complete. Nonetheless, we are aware that the interface has some drawbacks, thanks to the user feedback, which drives us to enhance the design later. Several lessons were learnt and tools were experimented with. Perhaps the one take-away that the team values is that this process is iterative and requires a journey with the user.

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Appendix A: Cognitive Walkthrough Process

In line with the guidelines provided in [6], we performed our cognitive walkthrough using these questions, which are taken from the document:

“

Table 1.

Overview of the Cognitive Walkthrough Process

1. Define inputs to the walkthrough [section 2.2]
    - Who the users are
    - Sample tasks for evaluation
    - Action sequences for completing the tasks
    - Description or implementation of the interface
2. Convene the analysts [section 2.1]
3. Walk through the action sequences for each task [section 2.3]
    - Tell a credible story, considering...
        - Will the user try to achieve right effect?
        - Will the user notice that the correct action is available?
        - Will the user associate the correct action with the effect they are trying to achieve?
        - If the correct action is performed, will the user see that progress is being made toward solution of their task?
4. Record Critical Information [section 2.4]
    - User knowledge requirements
    - Assumptions about the user population
    - Notes about side issues and design changes
    - The credible success story
5. Revise the interface to fix the problems [section 4.2]

”

Appendix B: User Feedback

We wanted the users to scrutinize our design and give us a harsh feedback so that we could enhance our design, so we specifically asked them to give us two negative comments for every one positive comment, and we asked for suggestions for improvement.

Test User	**Positive Feedback**	**Negative Feedback**	**Comments/Suggestions**
Federico	● Provides all necessary information for managing the tasks and workers	● Why is there is a launching screen with the cards? Does not seem useful enough ● Moving between the pages is not trivial	● Eliminate the launch screen with cards ● Swiping through tabs would be a nice idea (to move through pages).
Daniel	● According to the Android design standards	● The mark as done button is not straightforward. ● Foreman should focus either on workers or on tasks, better to have them in the launch screen	● Launch screen should be better organized like a dashboard, the cards are not enough ● User on-boarding would be useful.
Stefano	● Easy to interact with the screens	● The system does not suggest the workers who are on the shift, it could be more useful to have this function. ● Some actions are not clear (such as mark a task as done)	● Should provide an opportunity for foreman to assign tasks to workers who are on the shift right at the moment. ● Maybe enable switching the tasks.
Thomas	● Clean and minimalistic design	● I did not get the function of the roster. ● You should be able to undo some actions like deleting a task or marking it as done.	● You should enable more gestures to have a swifter way for actions (make use of tap and hold).