Project 2

Human-Computer Interaction

Aalborg University

Ida Taglioni, Janis Ludvigs Berzins-Berzitis, Jonas Litvinas
Malte Juel Breddam, Morten Porsing, Laurynas Lubys

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1 Introduction

The aim of our project is to give users a unique virtual experience of walking around their own designed homes in 3d. We will accomplish this by using the existing in-built smart device sensors. A feature that is accessible in almost every modern smart device will be used - gyroscope (along with other sensors that might compliment the product). Users will be able to experience their preferred designs in a 3d environment, being able to explore it with an additional feeling of Immersion.

1.0.1 Introduction the Problem Area

With the fast and busy lifestyle, it is hard not to think about time efficiency, especially with the tasks that people do not want to spend too much of their resources on. This is why it is important to establish pleasant experiences. Application that we will try to develope will help people to save not only time but expenses too.

1.1 Initial Problem Statement

How can we improve user experience in interior design-centered app's 3d environment using non-traditional mobile sensors?

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2.2.1 Introduction to user experience

A study of user experience[1] is a study of how a user feels when interacting with a system. The field encompasses a whole range of different and seemingly unrelated topics. The most known part of UX is probably the concept of usability which will be discussed later in the chapter, other things makes up UX, such as: Design, Accessibility, System performance, Ergonomics, human factors and more concept. The term user experience was originally coined by Dr. Donald Norman, who was the first to describe the importance of user-centered design. User-centered design is a design concept that lets the users dictate(to a certain degree) what the system should contain and what form it should take. Before user-centered design the general design process looked like:

[1] hereafter referred to as UX

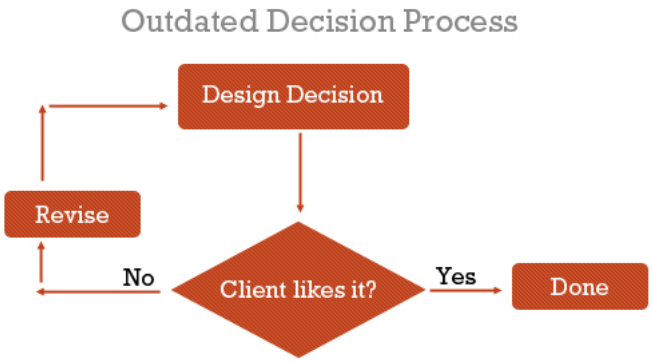

Figure 2.1: old decision process, Jacob Gube 2010

nowhere in the design process is the users a factor, the design was simply made according to how the designers as well as the client felt it should be. making the same kind of chart for a user-centered approach could look like:

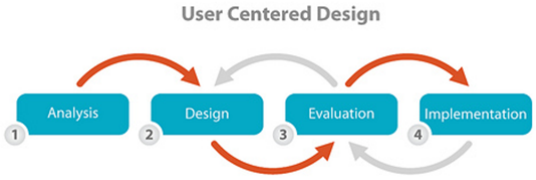

Figure 2.2: a chart of how user-centered design could function, Usabilla 2014

as this chart shows user-centered design can be an iterative process. the grey arrow represents the user feedback, which shows that the users should be involved in the evaluation of a design. This method can be overwhelming if the evaluation is only being done on implemented prototypes.

User Experience and usability is often confused since a large portion of the guidelines for proper usability also applies to giving a good user experience. What sets the user experience apart from usability is the feelings that the user is subjected to while using the site/app/programme. An example of which could be the iBooks app for iPad, which is basically an application for reading and browsing E-books. The layout is simple, it provides an overview of the owned books with a visual representation of the covers which is common for such apps and as such do not set itself apart from the state of the art when it comes to usability, however the user experience is greatly improved simply by changing the background to

resemble a bookshelf, it gives a “cozy” feel to the app, you can almost imagine yourself sitting in front of the fireplace sitting with a good book.

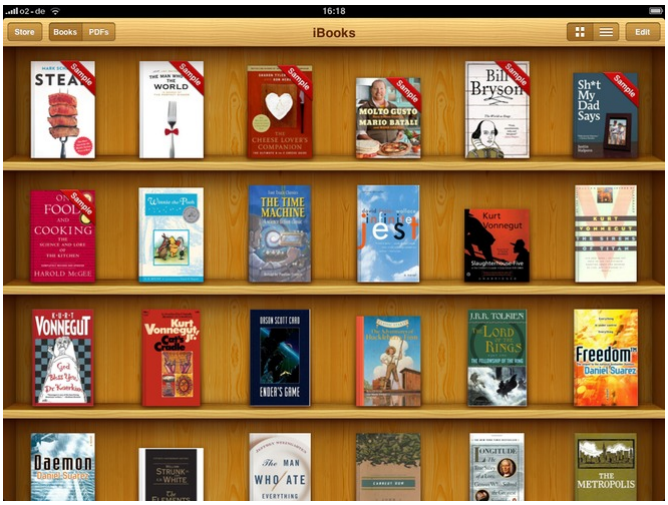

Figure 2.3: Apple iBooks

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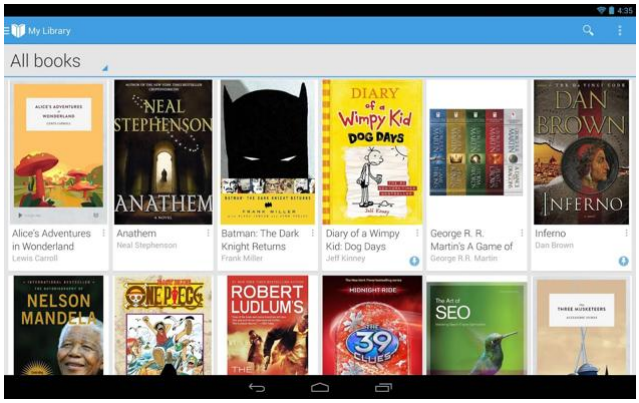

Figure 2.4: Google Play Books

2.2.2 User experience for mobiles

when designing a mobile app with UX focus, the unique challenges of the mobile platform has to be considered. A brief look at two of the most outstanding difficulties:

- Screen size
  as opposed to a traditional computer screen the general mobile platform has a much

more limited amount of screen space. This restriction will force the designers to eliminate as many redundancies as possible so as to not clutter the screen with unnecessary information. [2]

- User input
  user input is according to Giorgio Sardo one of the smartphones weakness. it is mentioned that "Entering text on a mobile phone is hard, and people tend to avoid it if they can"[2]

- Loading times
  Mobile devices are generally slower than a PC or Mac, both when it comes to processing power and internet speed, assuming they're using a mobile network [ref. mobile usability jakob nielsen/raluca budui 2013].

When attempting to improve usability and user experience, for people using a site or a programme on a phone, the optimal way to do so is to make an actual app where you either port the mobile site or the web application so that it can be downloaded and accessed directly from your phone or tablet instead of via the internet browser. Some of the guidelines for optimizing for mobile devices are cutting features, reduce word count and enlarge interface elements to accommodate the "fat finger problem".[ref. mobile usability jakob nielsen/raluca budui 2013] an example of poor simplification used in the book is IKEA [ikea screenshot from the book] where they simplify the mobile site by only showing a single item when browsing for bedframes.

2.2.3 Understanding our Users

Even though have previously analysed out target group, when we want to focus on the user experience, further target group considerations has to be made, that is why this paper will next talk about the concept of understanding the users. Georgi Sardo provides three points that will help with the design process of the app:

- What are your users' digital device skills? Are they used to working with digital devices and software applications?[2]

- What are your users' skills in using your application? Does the application revolve around their professional area?[2]

- Is the application the focal point for your users? Or is their attention limited?[2]

these three points can help develop an app that will be focused on the users needs, which is at its core what UX is all about.

2.3 Interaction Design

A very important part when developing the application to fit a pleasurable user experience is to make sure that it works as flawless as possible, and there are no misinterpretations when using the product. For the artefact that is going to be developed, the "traditional" interaction methods do not cover the functionalities that are needed to cover our initial concept needs. To assure that the alternative interaction is integrated in a convenient manner, knowledge about different sensors and possible combination of two or more to make more intelligent outcomes should be established.

2.3.1 Traditional interaction methods and their replacement

As technology evolves, new ways of interacting with computational devices are constantly built. With that, people's needs also change. The transition from the classical buttons on a cellphone to a touchscreen has made new ways of interaction possible - the delimitation of physical buttons made it available to have any customised graphical interfaces on the screen possible. This made life easier for casual tasks - like zooming a photo using two fingers as multi-touch input, which is much more intuitive than the classical button alternative. The smartphone technology evolved further, where different sensors have started finding their place in smart devices. Soon enough there were devices with GPS, WiFi, Bluetooth, Light sensor, Camera, and other sensors. The implementation of these sensors in the smartphone allowed new forms of interaction, such as video calling, flashlight and screen orientation.

The Accelerometer

The accelerometer is capable of detecting the force and the movement in a three-dimensional space. This feature is most commonly used to adjust the display to match the position that the device is held in by the user (Chong, r.(year?)). If the accelerometer is rotated at the center of the system, however, it will not detect the movement. Accelerometer, along with other sensors is commonly used in the augmented reality concepts (examples 1, 2).

The Gyroscope

A gyroscope is a device that uses Earth's gravity to help determine orientation. Its design consists of a freely-rotating disk called a rotor, mounted onto a spinning axis in the center of a larger and more stable wheel. As the axis turns, the rotor remains stationary to indicate the central gravitational pull, and thus which way is "down."(Ryan Goodrich, 2013). Gyroscope, in comparison to magnetometer and accelerometer, is the physically largest and most expensive sensor, so the possible limitations in the smart devices in-built Gyroscopes have to be considered.

Figure 2.5: iPhone game using a gyroscope sensor

The Magnetometer

The magnetometer can be combined with an accelerometer (to complement in measuring the gravity) to get the input of the 3d orientation the phone is being held in. It can be useful in determining the absolute orientation of directions in the North/East/South/West plane. The issue with the magnetometer is that magnetic interference can disturb its flow, making the device output unpredictable results. http://www.sensorplatforms.com/understanding-smartphone-sensor-performance-magnetometer-2/

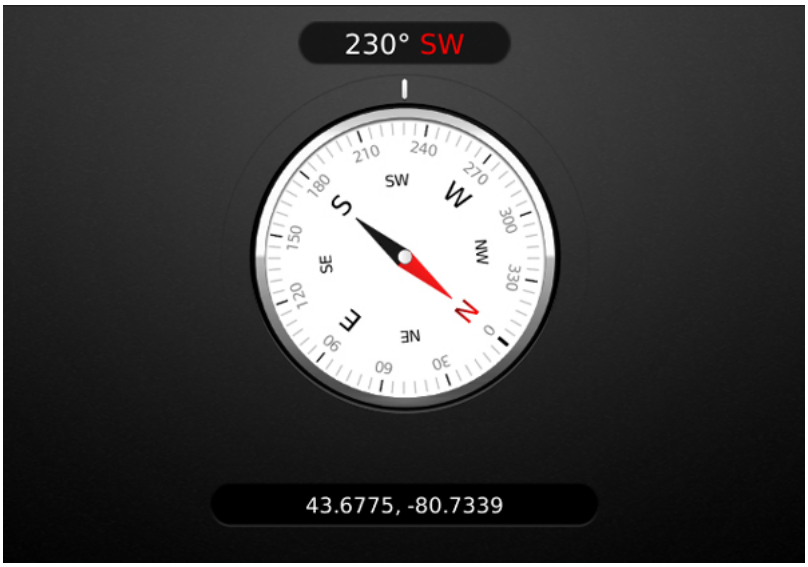

Figure 2.6: a simple compass app that establishes the magnetometer sensor

Combined Sensors (6-axis approach)

Combining accelerometer and gyroscope allows measurement of 6 orientations on X, Y and Z axis, allowing the apps to calculate placement of the device in the 3D environment more accurately.

9-axis approach

Accelerometer, magnetometer, gyroscope could be all combined together for even more valuable user experience. For instance - enabling an online feature with more precise positioning in relation to other users could be considered. The data gathered from accelerometer, magnetometer and gyroscope can accurately position the artefact in the world, including the changes in position and rotation. On top of that, multiple sensors could fill individual sensors blind spots.

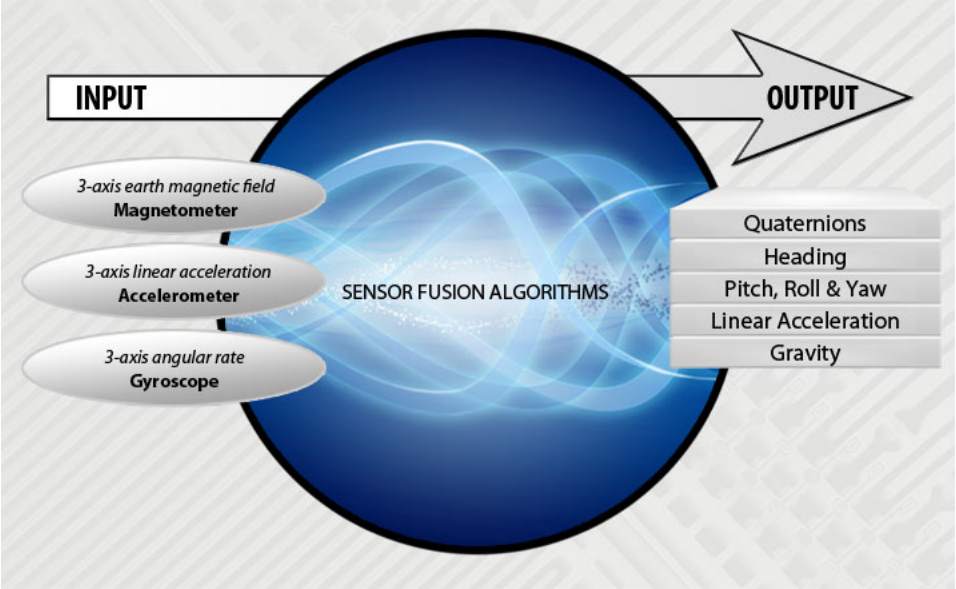

Figure 2.7: uses of sensors

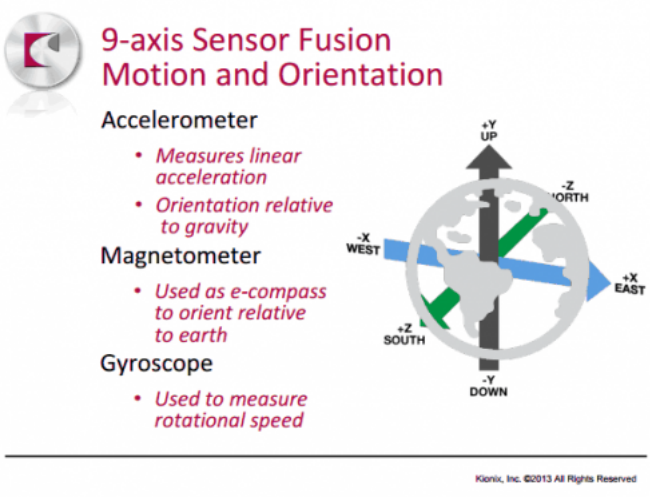

Figure 2.8: uses of sensors

Other sensors

For example it is possible to create an app using microphone as the only input sensor, in one case the creators decided that the phone records sounds and plays it back in theme of The Batman Rises (http://darkknightrises.rjdj.me/).

2.3.2 conclusion

After gaining more knowledge it can be seen that there is a variety of options how to use sensors in apps. Whether it is all of them together or using only few of them, it is mandatory to take all the options into consideration. As the project theme mentions it, the project has to be with non-traditional user interface, meaning that this project should aim for more complex or more "interesting" choices regarding sensors or user input.

2.4 Graphical Design

2.5 Mobile Hardware Considerations

2.6 State of the Art

Bibliography

[1] Chong, J. *Expanding the Functionality of Mobile Applications with Magnetic Gyroscopes* In Kionix, 2015.

[2] Georgio Sardo, `https://msdn.microsoft.com/en-us/expression/cc964299.aspx`