Human Computer Interaction and Design

Course: COMP1649

Submitted To

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Contents

1. Introduction

Designing a high fidelity prototype for the users to give them smart online shopping facilities is the main aims of this coursework. To do this, some factor need to be considered such as cognitive psychology, current market product research, Design principle etc. As a designer, Understanding user's psychology to interact with the proposed system will be challenging.

This coursework will help me to design such way where I need to think deeply how actually users interact with the system.

2. Assumption

By using this system users will be able to purchase grocery product. To design the system prototype, I assume some factors which is provided below:

- ➢ The smart object could be connected with the device through Bluetooth or other means
- ➢ The device should be connected with the internet.
- ➢ The system is going to design for a certain mobile users.
- ➢ Before order the product the user will interact with smart object trough scanning or voice.
- ➢ Different users will be able to use the system.

3. Background

The term smart home refers to such kinds of home that could be monitoring and controlling through internet connected smart device (Tech Target, 2019). Basically a smart device means an electronic device that is connect with other network and operate some interactivity. Smart home and devices are becoming more popular and people want to renovate their home for many reasons such as safety, efficiency, function, comfort and style (Vivnt, 2019). Experts say, Smart home are becoming more popular

day by day. According to the report of Swedish research firm Berg, 63 million American residences will be qualified as smart home by 2022 (Time USA, 2019). So, there is no chance to talk about the future of smart home.

3.1 Processes and Frameworks for the Interaction Design

3.1.1 Framework

A framework is nothing but a structure of achieving goal accurately in optimistic way. It provides a set of ideas and focus on that problem is trying to be solved. Framework helps a designer to design a solution with quality, rapidly and the best possible way (Conley, 2016).

3.1.2 User Centered Design

User centered design establishes based on user and user needs. It's an iterative process with four distinct phases (Interaction Design foundation, 2019). Designer uses some tools, techniques and methods to understand the user needs. In first phase, designer works in a team and try to clarify the user context of the upcoming system that is going to be designed. Then they are moving for the requirements of the system. After getting the requirements the design team makes the solutions and at last stage the team evaluates the developed solution outcomes against the user context of the system and requirements (Usablity.gov, 2019).
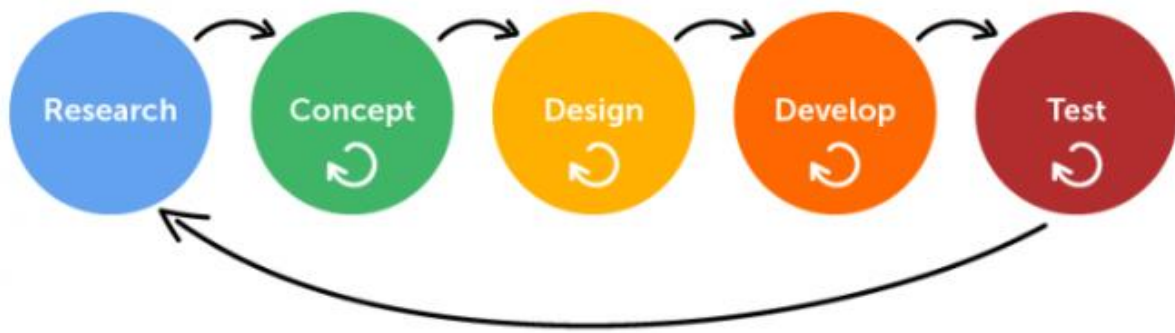
Figure 1: User Centered Design Process (Justinmind, 2019).

3.1.3 Goal-Directed Design

According to Alan Cooper's Interaction Design booklet, Goal-Directed Design focuses on the patterns of behavior where different users express to desire different things. This framework works with six steps with helping personas to deliver right product in first iteration.
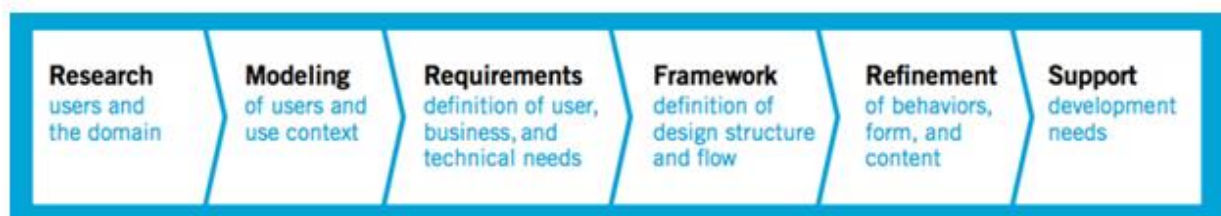
Figure 2: Goal Directed Design process (Researchgate, 2019).

It also works with end users reviewing and stakeholder's interview, literature reviewing, detailed descriptions, researches and reviewing the domains (Keli Amann, 2009). The framework turns aims into activities. The main difference between aims and activities is: Aims means what's goals actually the end users trying to achieve and activities refers to helping them to achieve their goals with achievements.

3.1.4 Lean UX

Lean UX established on Toyota manufacturing model which works like agile development methodology and aims to provide value rather than waste (UX Planet, 2019). The main difference between this framework and other is assumptions, which are the main tenets of Lean UX (JUSTINMIND, 2019). Beside this, Lean UX aims to response as soon as possible and get feedback from the stockholder which help to make quick decisions and deliver the product quickly (Interaction Design Foundation, 2019).
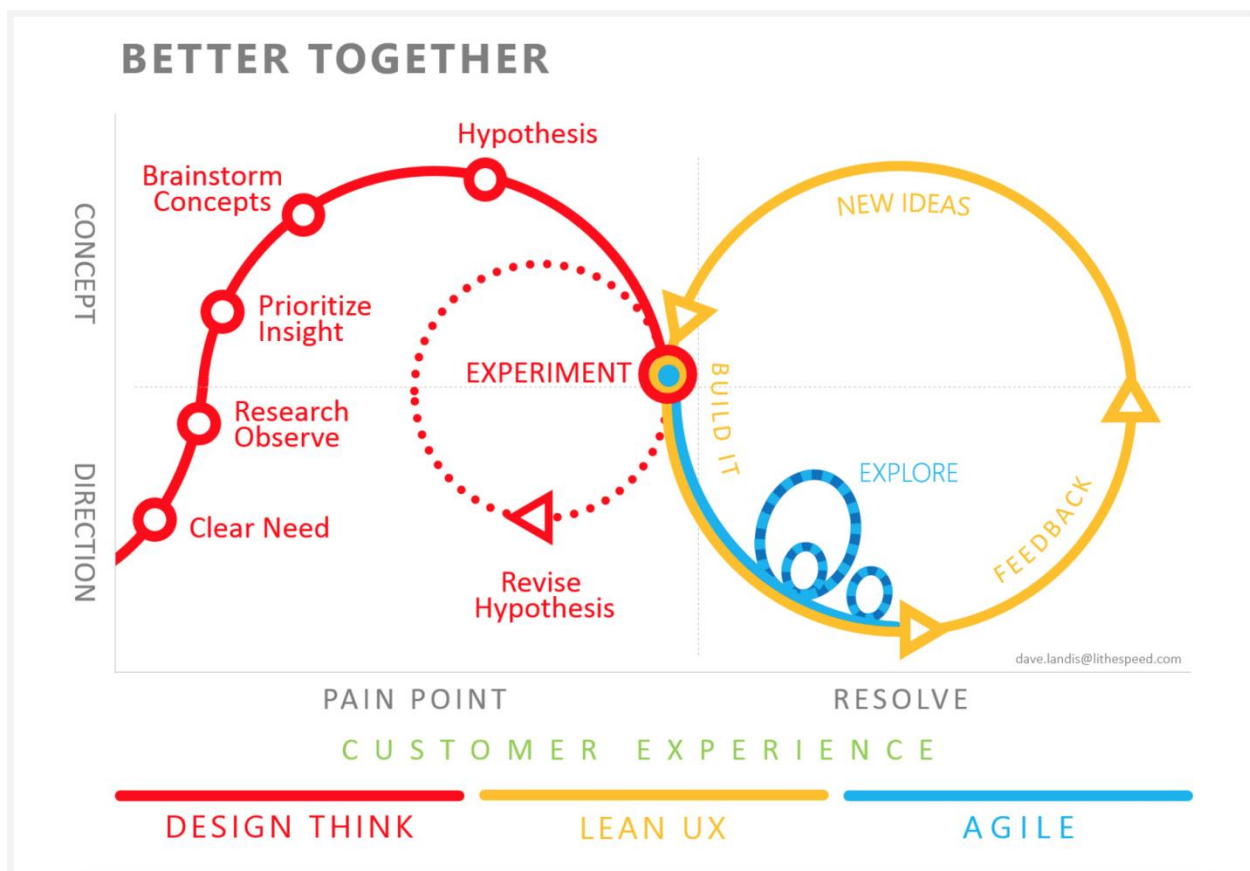

Figure 3: Lean UX design Process by Dave Landis (UX Planet, 2019).

3.1.5 Chosen Framework and Justification

As I mentioned that a framework helps to develop a solution easily, faster and better way. So, it's very easy to create a solution following a framework. In this scenario I am going to use Lean UX framework. The scenario has a connection with smart object and smart home which want to develop a solution where the user will get online supermarket services through the solution. Beside this, users will be able to interact with the system through different mode such as voice, text etc. There are no specific requirements of the scenario. Develop a solution based on the assumption is the main tents of the Lean UX. Apart from this Lean UX with agile methodology which helps to develop a solution quick and faster. So I select the Lean UX framework for this scenario.

3.1.6 Discussion on the Design process

Design process broke down the full project into different chunks which help to make a project successful and most accurate (Online Design Teacher, 2019). By using this process one can define the necessary steps and remember the ideas which are needed to tackle a project. To design this system, Lean UX design process is going applied. The steps of the process are:
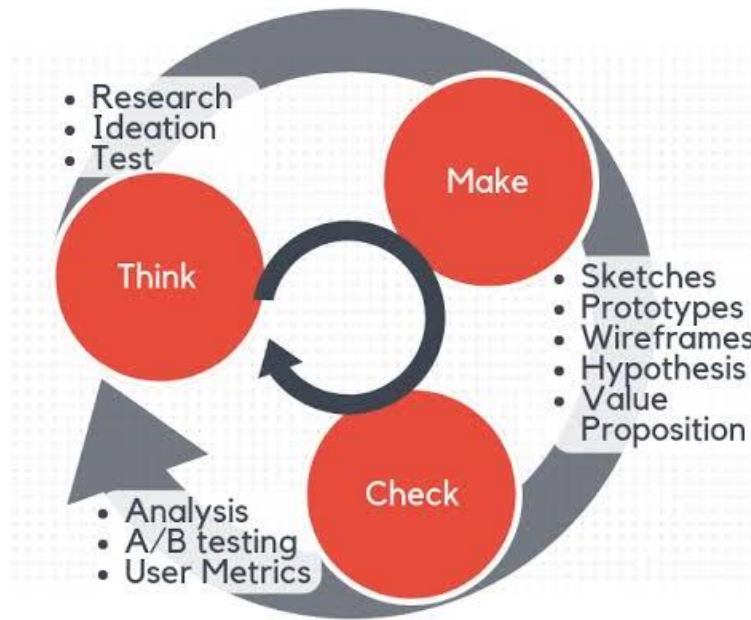
Figure 4: Working flow of Lean UX design Process (syndicode.com, 2019).

Think: In this section designer is going to make an assumption in particular problem area based on the research. It helps to make mental model, ideation and sketches.

Make: Minimum Valuable Product (MVP) is the main focused in this stage. Creating prototypes, wireframes, Hypotheses and Deploying codes helps to achieve the target of this section.

Check: Last section of lean UX where the MVP is being tested with the audience. A/B testing, site analysis, validate and verification are also carry out in this section. After that the entire process is going to start again.

I am going to discuss Participatory Design and Design Thinking in the appendix part of the coursework.

3.2 Cognitive Phycology

Cognitive phycology means understanding how people take the input and process information including thinking, remembering, learning, problem –solving, reading, writing and talking (Rogers, 2017).
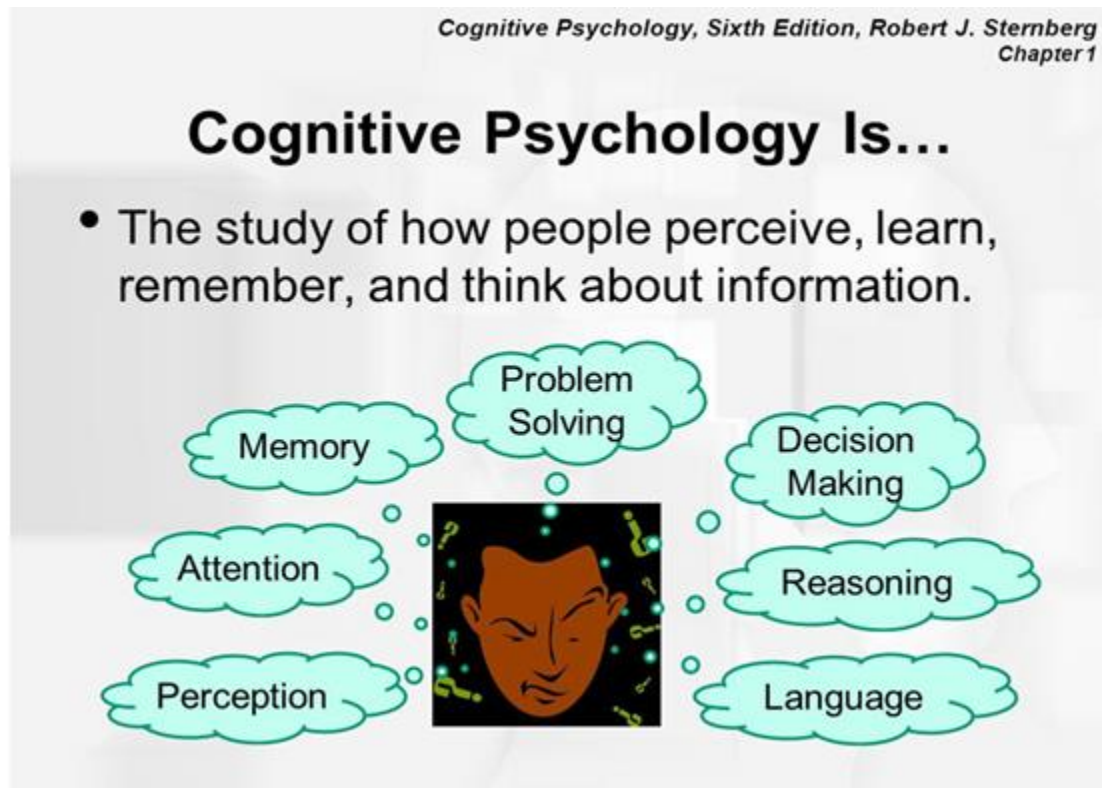

Figure 5: Processes of Cognitive Psychology (Sternburg, 2016).

Different users interact differently with the same UX based on their cognition. Cognitive psychology helps a designer to understand the user's ability, limitations and how users can interact with the design easily which helps to make a design effective, robust, and visually attractive.

3.2.1 Cognitive Process:

There are different kinds of cognitive processes. I am going to discuss some of them.

3.2.2 Attention

In cognitive psychology, attention refers how a person acquires information from the range of possibilities. Auditory and /or visual senses are involved with attention (Roges, 2015).
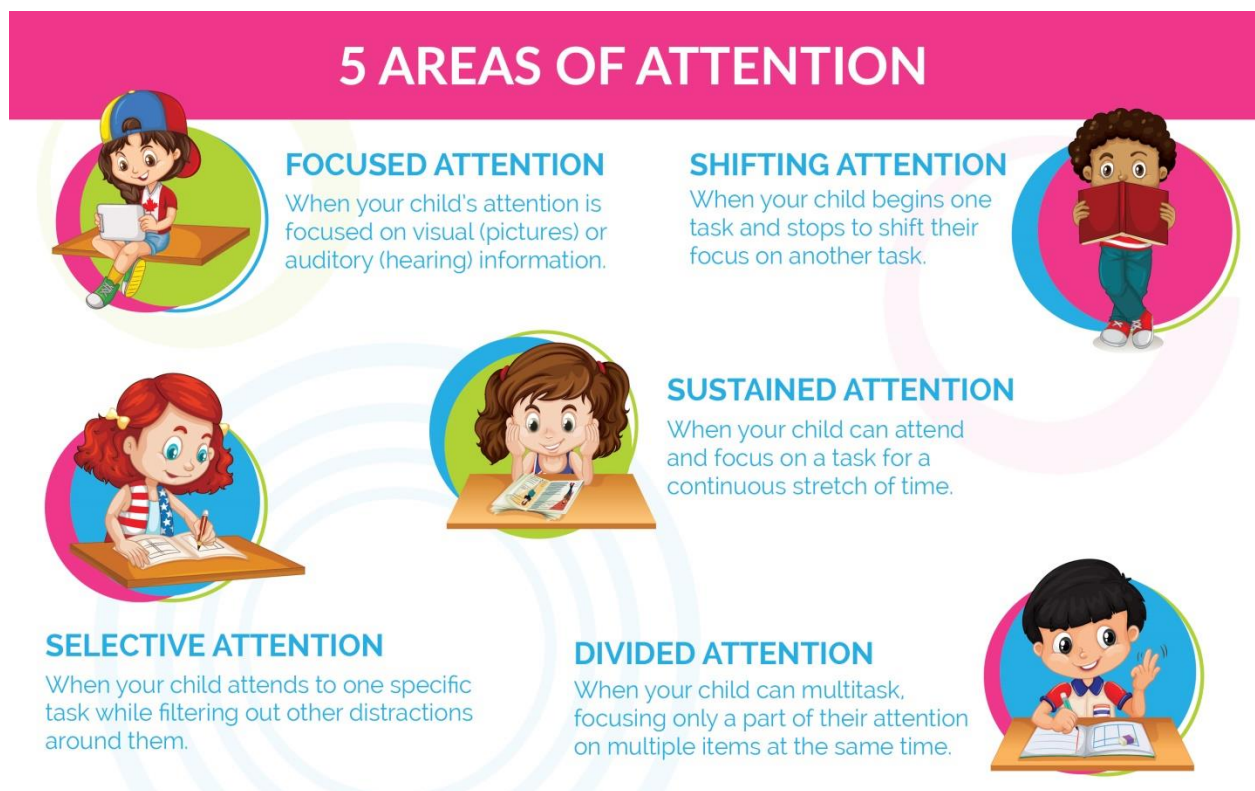

Figure 6: Areas of attention (ilslearningcorner, 2019).

By dividing attention to perform one more task at the same time is known as multi-tasking. It affected on users memory. As a designer consuming times for performances issue should be considered.

Attention is one of the most consideration factors in design field. Great interface make easier to use the system by holding attention. To grab user attention some factors must be considered such as color, text font, size, meaningful icons, popup message etc.

As my system is going to provide online supermarket services, so the digit (price) should be highlighted. It will help user to take attention about the product price. Beside this a pop up message can be used to ensure that the user order right product with desire quantity.

3.2.3 Memory

According to Sternberg (an American psychologist) memory refers to draw our previous experiences in order to use that information in the present. It involves with recall and recognition from vast amount of information (Simplypsychology, 2019). In example, most of the time we need not read information in log in page as we have experience to use same page in several times.
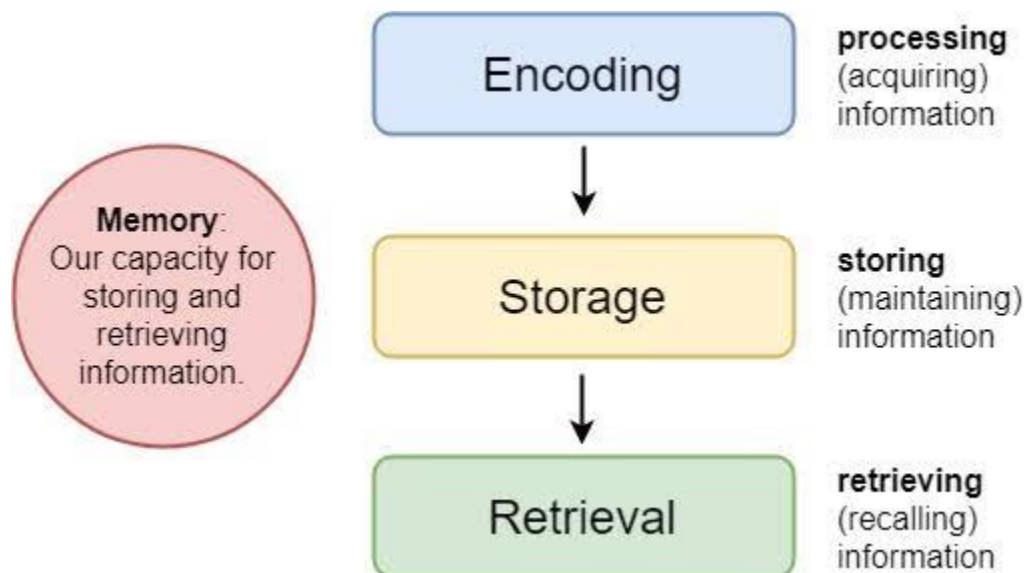

Figure 7: Working process of memory (simplypsychology, 2019).

Using users less memory is more important in terms of great interface design. Common icon need to be used in smart home object system so that the user can recognize and use the system very easily.

According to this theory, I will use common icons, meaningful colors to design Smart object applications. It will help user to re

3.2.4 Perception

In cognitive psychology perception means how anyone acquires information through different sense of organ such as ears, eyes, etc. from the environment. It is slightly different and complex process based on different persons sensory information (Roges, 2015).
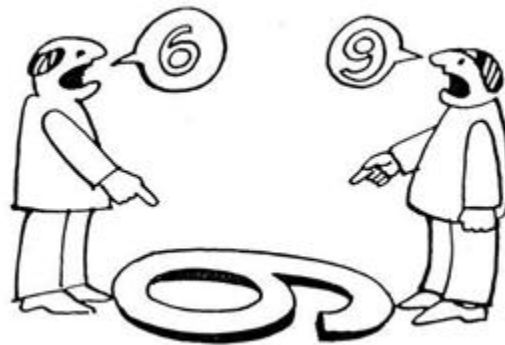

Figure 8: Perception (ruralhealthit.com, 2019).

Clear visual representation in system is the most considerable thing in terms of reduces confusion among users. It helps users to take action quickly. By following this process a design can be make more users friendly and effective to interact.
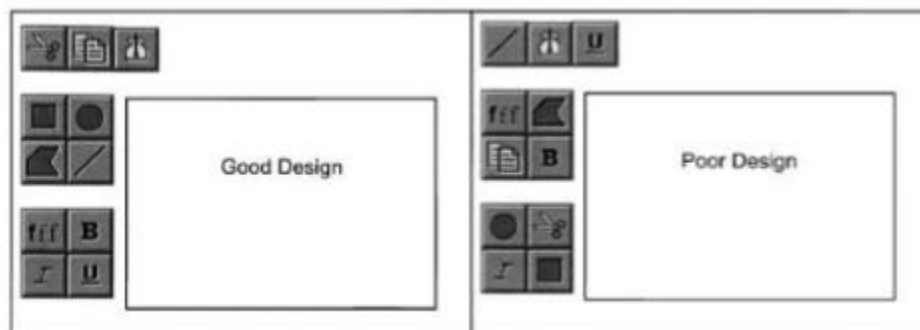

Figure 9: Design quality based on Visual perception (httpsciencedirect, 2019).

In order to make smart home object it should be considered to use same category icon, button etc. (preview, next, ok, cancel) in same align. Using appropriate color will also make the design greater.

Learning and problem solving process is going to be discussed in appendix.

3.2.5 Framework

3.2.6 Mental model

Mental model refers an explanation which users make a conceptual model in his mind to use a particular system. It is a natural to make an explanatory model within short time to response unfamiliar situation said Don Norman (Hartson, 2012).
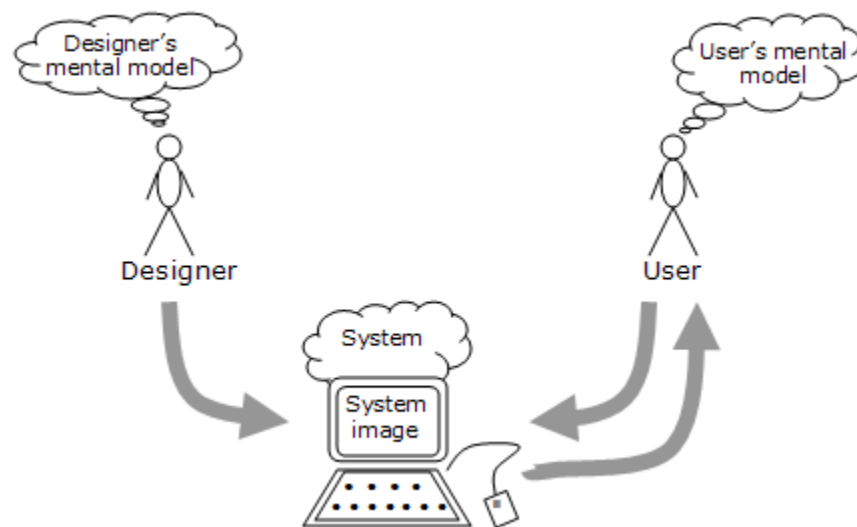

Figure 10 : Process of Mental model.

The main principle of this model is assumption. User makes a mental model with assumption of the system functions if the system is unknown to him.

3.2.7 External Cognition

In Cognitive psychology, External cognition means to the process of information between internal cognition and human mind perception as well as manipulating external representations (Interaction Desion Foundation, 2019). It creates design user flows which reduce using user memory.

External Cognition can be used such three ways:

- ➤ **Externalizing Memory Loading:** Various strategies can be developed to reduce memory based on externalizing. As an example, we can develop a system where we can store person contact number along with birthdate, email; appointment and more information which will easy to handle information with reduce use of memory.
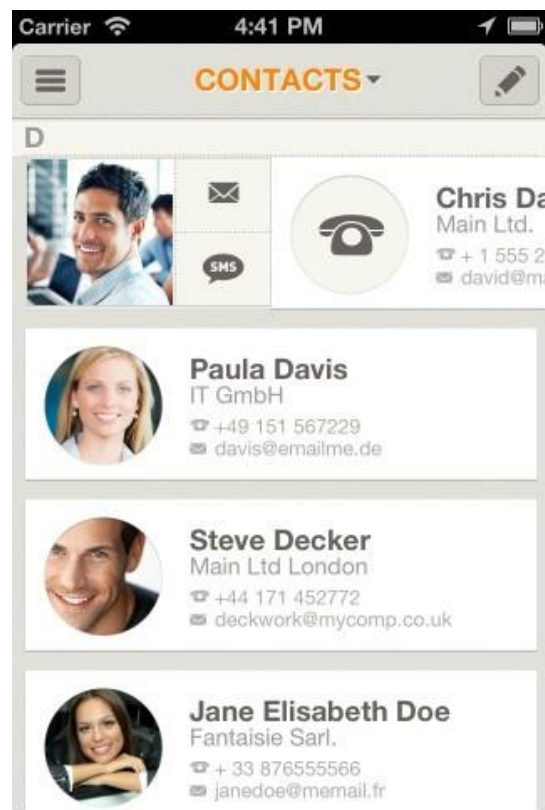
Figure 11 : Reducing Memory Loading through externalizing (Interaction Design Foundation, 2019).

Computational Offloading: It defines use of some tools when working with computational problems and is hard to do with our brain. Using calculator rather than pen and paper is the good example of computational Offloading.

Figure 12 : Computational Offloading

> **Annotations and Cognitive Tracing:** Modification or changes of external representations is involved with annotations and manipulation of external representation to from new information entails cognitive tracing.

Figure 13 : Way of Annotations and Cognitive Tracing works.

I will discuss Theory of Action and Distributed Cognition in appendix section.
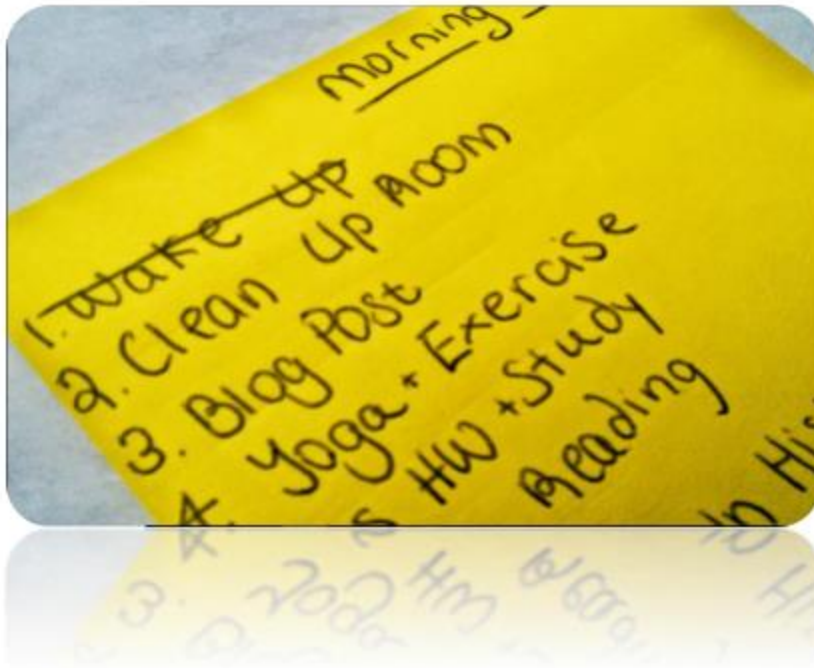
3.3 Interaction Design Theory:

3.3.1 Different Interaction Mode:

3.3.1 Voice

Interacting with voice is totally different from other interaction mode. This is not surprisingly that user want to get a feel like communicating with other through using voice interaction (Interaction Design, 2019).

3.3.2 Touch

Touch means the enable of device surface which recognize the contact with the surface. It is a condition of the view chain of importance that depends exclusively on the user interaction with the devices (neonode, 2019).

In this device most of the time user will uses this interaction modes.

3.3.3 GUI

Graphical User Interface (GUI) is a process of interaction with some interactive components.it could be icons, button and many more.

In Online Supermarket Application voice and touch interaction mode is going to be used.

3.3.5 Types of interaction:
3.3.6. Instructing

Instructing refer to provide instruction what should do user after completing one task. In online supermarket system if anyone wants to log in, he/she must complete their registration.

3.3.7 Conversing

Conversing render such kinds of design when users uses the system he/she will feel just like conversation with others. As user used to conversation with others, conversing helps to interact with system in familiar way. In smart object after providing instruction, user will get a response on the application.

3.3.8 Manipulating

This interaction type involves how the user manipulates and capitalize object on the real world.

3.3.9 Exploring: Exploring helps to feel the user movement of virtual and physical movements (Usablity, 2016).

4. Design Process:

4.1 Interaction Design Research

Research in interaction design helps to gathering accurate, relevant and sufficient data in order to establishing requirements and of evaluation. Various techniques can be followed to collect data along with market research, questionnaires, interviews, and observation (Rogers, 2014). I am going to discuss some of these techniques.

4.1.1 Product Researches

The process of analyzing and collecting information from market which could be about target market, existing product or as a market whole is known as market research. It helps to gather accurate data and can make a comparison among the related product (Entrepreneur, 2019). Related products are also observed for online supermarket.

4.1.2 User Researches

The way of understanding user needs, experiences, behaviors and motivations is known as user research. It could be gain in different ways, such as asking some question based on specific products, review, demand to the product etc. it's very helpful and effective way to deliver the product whatever the user want. To make online supermarket application this process is being taken to produce better product.

4.1.3 Interviews

According to Kahn and Cannell, interview means to conversation with a purpose. It's an effective way to get qualitative richer data from the users about system values, Weakness and Strengths (Rogers, 2014).

Some interviews are taking to in order to get feed of the current online shop application.

4.1.4 Identification of User:

Region: Different user has different demand based on different region. Statics shows that people of North America and Europe use most of the Smart Home Market. Hence, I also make my solution based on these regions.
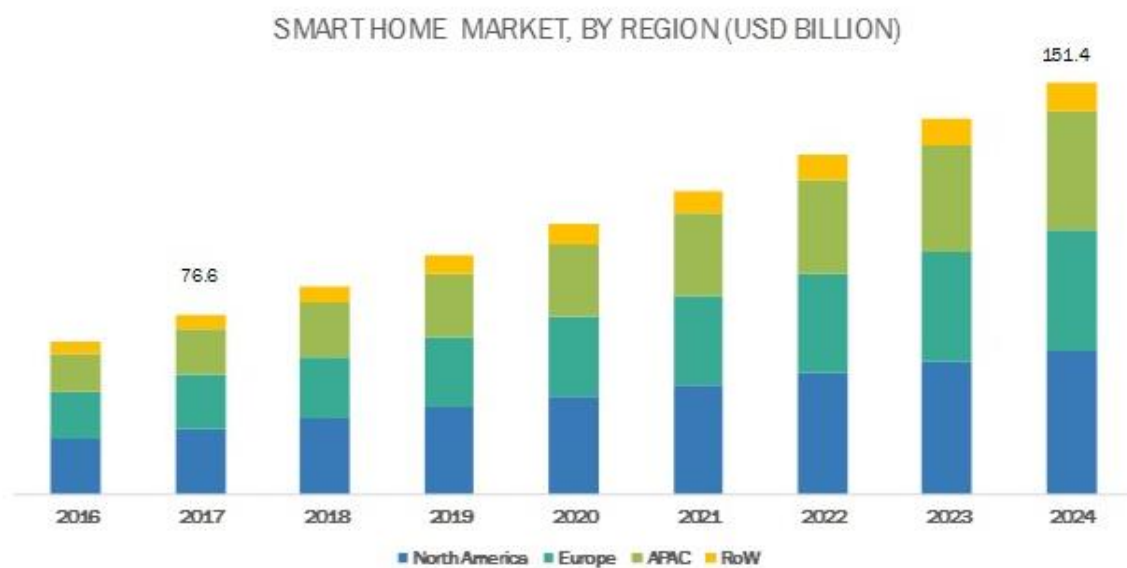
SMART HOME MARKET, BY REGION (USD BILLION)

North America | Europe | APAC | RoW

Figure 14 : Smart Home Market User Based on Region (WindoorExpo, 2019).
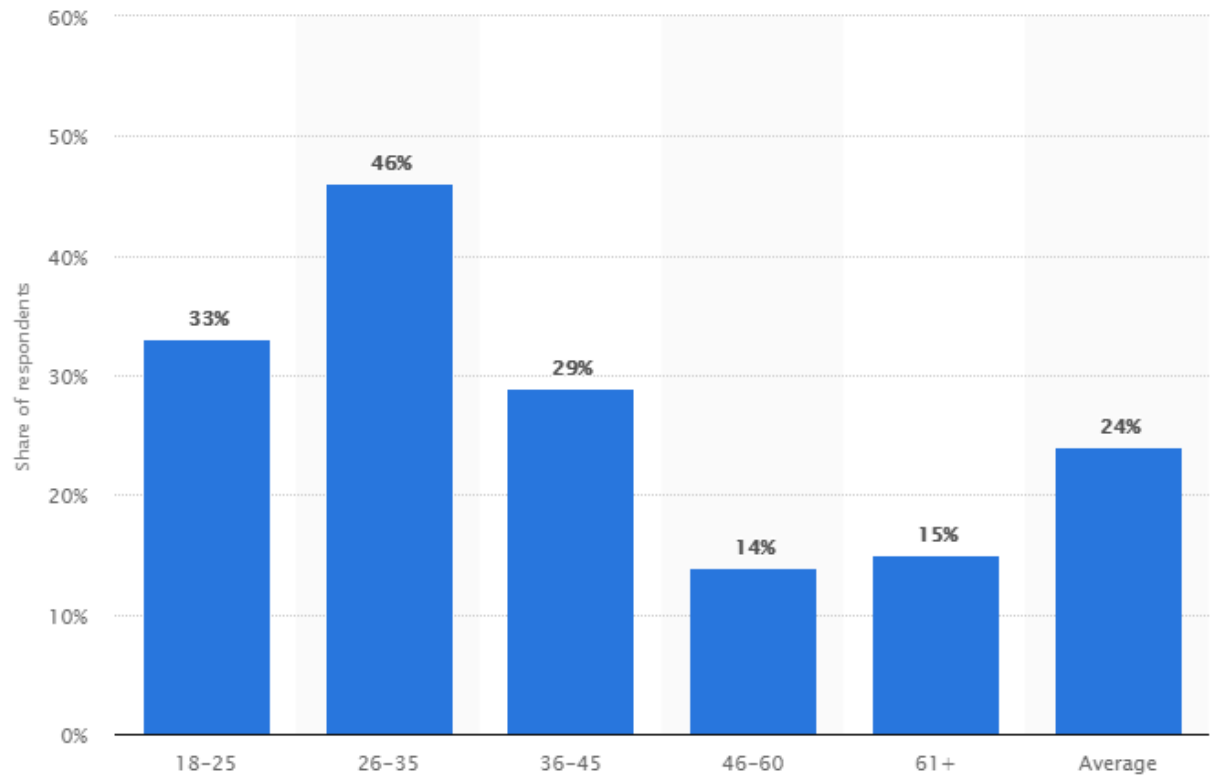
Age:

Figure 15 : Smart Device user based on Age (statista, 2019)

4.1.5 Chosen device for Application

According to the statics it is clearly revealed that most of the user uses mobile interface to control smart home device. I am also going to design mobile interface for the solution.
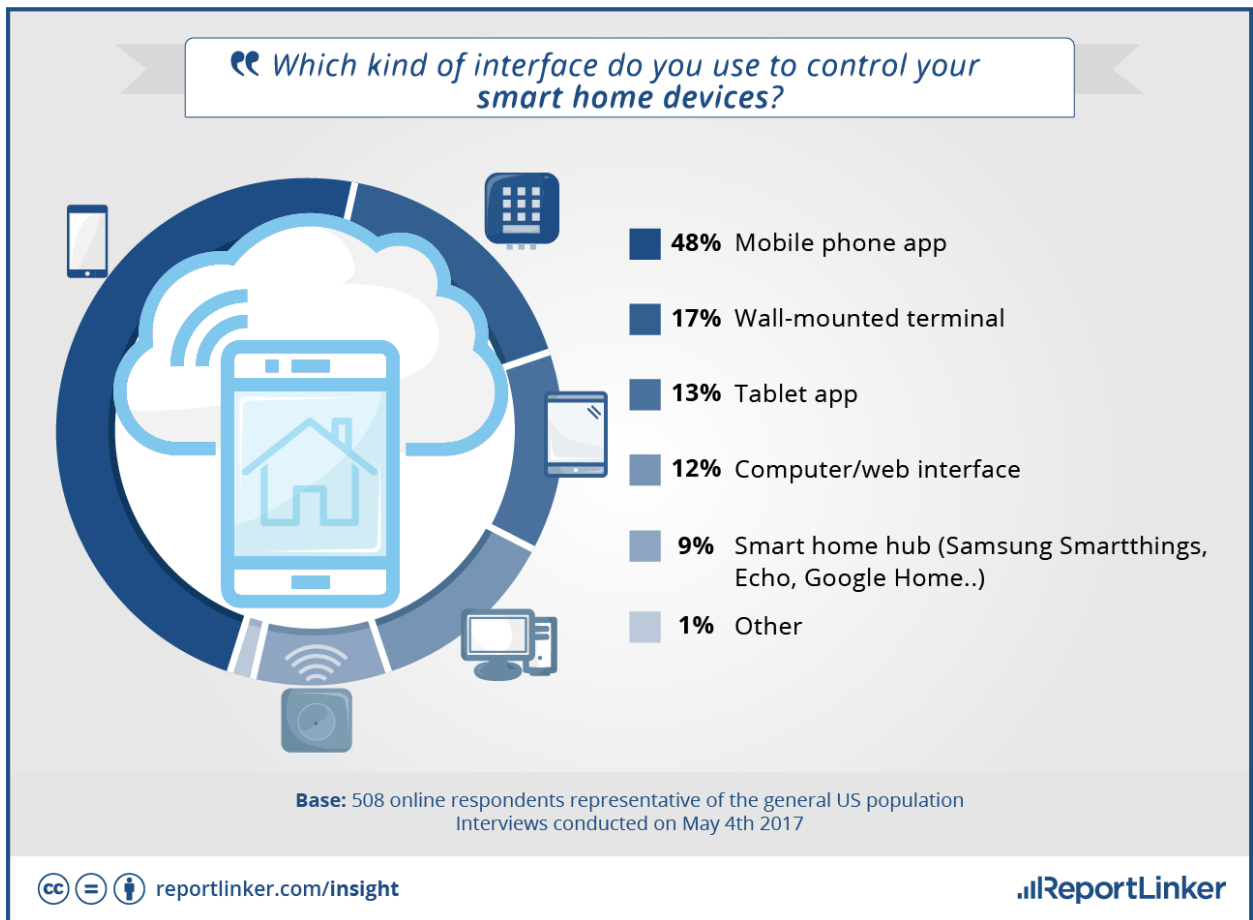
❝ Which kind of interface do you use to control your smart home devices?

- **48%** Mobile phone app
- **17%** Wall-mounted terminal
- **13%** Tablet app
- **12%** Computer/web interface
- **9%** Smart home hub (Samsung Smartthings, Echo, Google Home..)
- **1%** Other

Base: 508 online respondents representative of the general US population
Interviews conducted on May 4th 2017

(cc)(=)(i) reportlinker.com/**insight**

.il**ReportLinker**

Figure 16 : Using interface to control Smart home object (ReportLinker, 2019).

4.1.6 Chosen OS for mobile application:

Choosing Operating system is one of the most important factors for a solution. I am going to design for android Operating System.
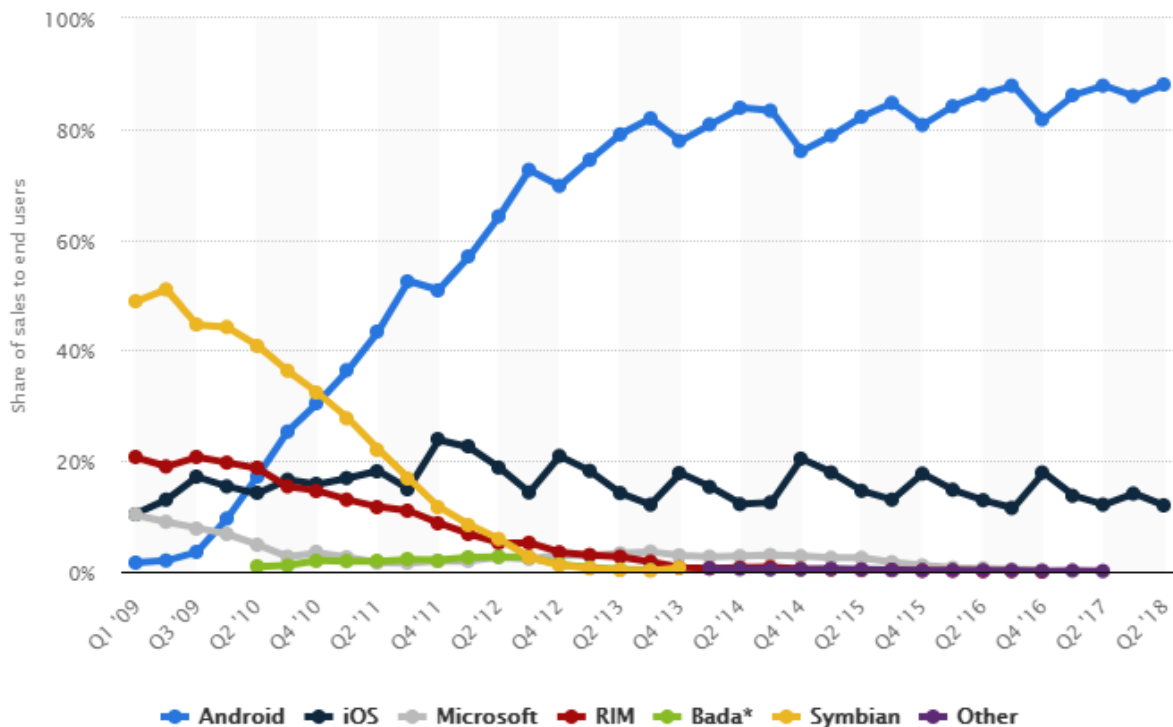

Figure 17 : Operating System share in mobile market (Statista, 2018).

4.1.7 Primary Persona:

Linda A. Elizabeth

Goals
- Build a strong Hotel reputation.
- Lead the Full Organization.

Frustrations
- Poor communication with hotel staffs.
- Conflict with the manager's fora different opinion.

Bio

Linda A. Elizabeth is vice president of marketing and sales for Sleep Well Hotels. She directs all marketing and sales strategies, overseeing the growing hotel chains loyalty program, consumer and field marketing activities, advertising, public relations, and e-commerce. Since joining Sleep Well in 2008, Elizabeth has implemented a number of measures to increase market share and expand Sleep Wells brand recognition. Under Elizabeth guidance, Sleep Well has increased investments in its sales programs which has increased revenue by over 50 percent. She has also overseen the launch of several mobile initiatives including the Smartphone reservation application. She has been honored with a number of awards including London Highway Motel Associations Best Economy Motel Marketing Award (BEMMA) three years in a row.

Age: 36
Work: vice president of marketing
Family: Married.
Location: London,United Kingdom
Character: Friendly

Personality

Introvert	Extrovert
Thinking	Feeling
Sensing	Intuition
Judging	Perceiving

Motivation
- Incentive
- Fear
- Growth
- Power
- Social

Preferred Channels
- Traditional Ads
- Online & Social Media
- Referral
- Guerrilla Efforts & PR

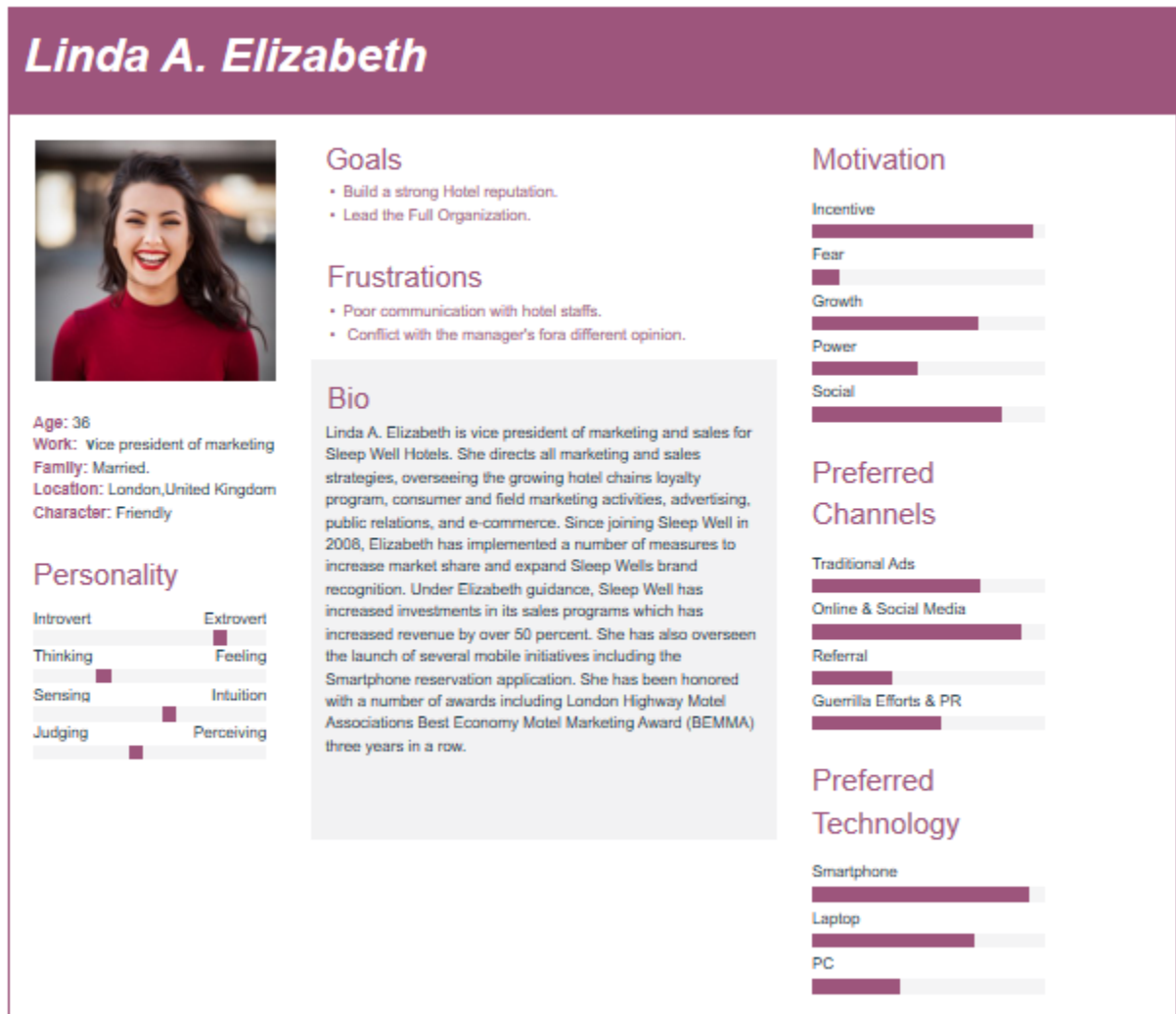**Preferred Technology**
- Smartphone
- Laptop
- PC

Figure 18 : Primary Persona.

4.1.8 Primary User Scenario

Lindra A. Elizabeth is 36 years of old married lady lives in London who is currently working in an organization with the designation of vice president of marketing. She remain busy all the day and haven't enough to go to market and collect daily necessary for her family. So, online supermarket will be the best solution for her. By using this system she can manage his work and shopping easily.
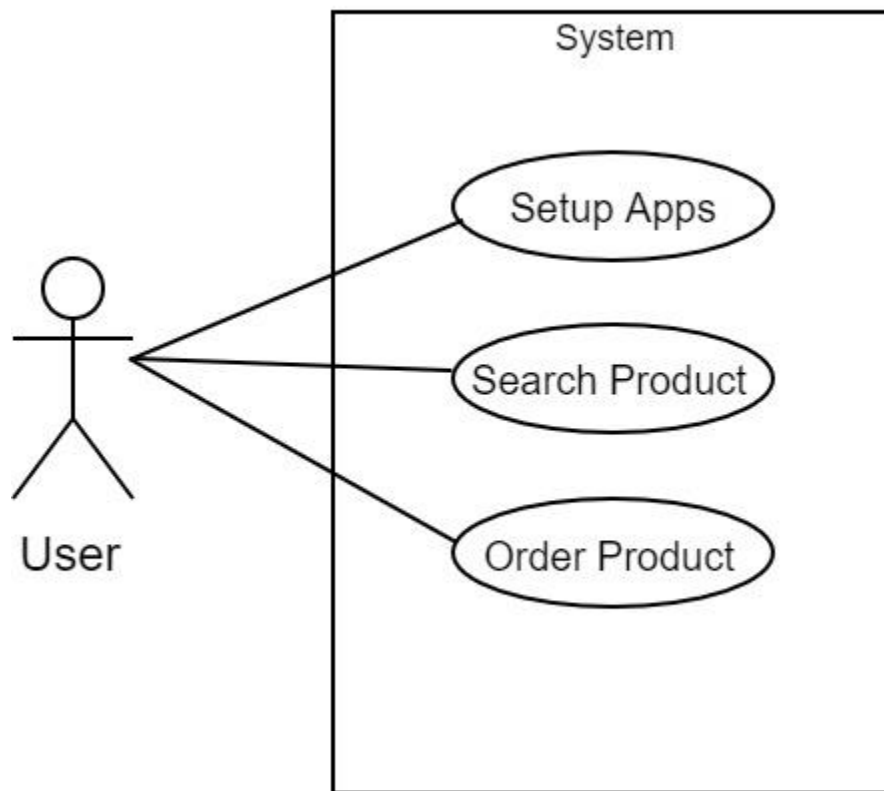
4.1.9 Essential Use case Diagram

Figure 19 : Essential Use case diagram.

4.1.10 Functional Requirement

- User need to connect smart object through Bluetooth.

- Application need to connect internet.

- User will complete registration before order product.

- User must be logged in when order product.

- User will be able to identify product.

- User will be able to order product.

- User will be able to use the system in different mode such as voice or scan.

4.1.11 Non-Functional Requirement

- User will be able to recover their password if they forgot it.

- Providing message dialogue box so that user can easily understand what is going on with him.

4.1.12 HTA (Hierarchical Task Analysis)
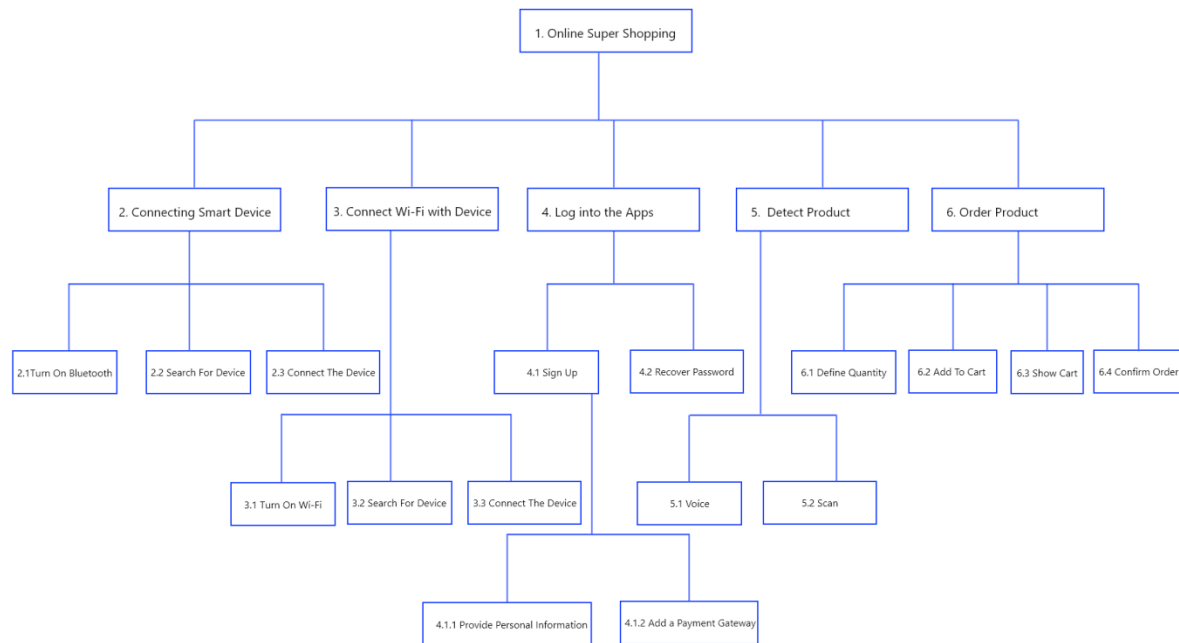
Figure 20 : Hierarchical Task Analysis

4.2 Conceptual Design

In interaction Design research (3.1) section, it is discussed about the platform, region, OS for the Super Shopping application. In this part, what principle is chosen to develop the application and how it's applied in the application is going to discussed.

4.2.1 Design Principle

To make a design great, productive and frustration free user interface, it is necessary to follow design principle. For Online Super Shopping application, Ben Shneiderman's 8 golden rules and Jakob Nielsen's 10 Usability Heuristics for User Interface Design is followed to design online super shopping application. Following these rules some factors need to consider which is going to discuss below:

4.2.1 Functionality:

Functionality means what can actually do the user by using the system. Aims of the system will turn into functionality which is essential for a system.

Figure 21: Functionality of a system.

Apps Specification Guide:

- Smart object will take input from user.
- Online shopping application will detect what will input into the smart object and order product.

4.2.2 Content: Content should be everything actually what we see in the screen of an application. It could be varies type such as image, text, icons, input etc.
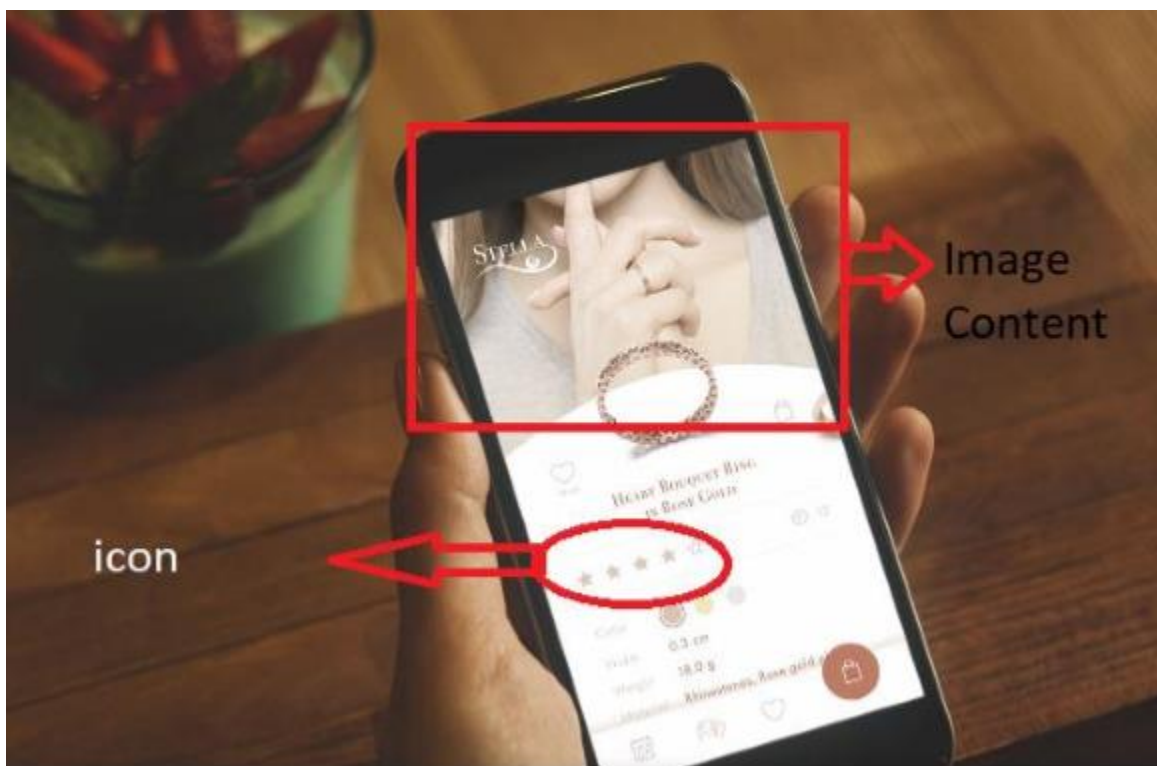
Figure 22 : Content in an application.

Apps Specification Guide:

- Using photo for the product identification.
- Text should be used taking information log in.
- Using icon for connecting with the Bluetooth and Wi-Fi.

Context: Content incorporates the conditions and states of utilizing the device. It helps a designer to symbolize the services in the application.

Figure 23 : Different contest in application.

Apps Specification guideline:

- User should go back in previous option.
- Allow icons in the apps that user can switch from one page to others.

4.2.3 Usability: Usability means how user easily the user can use the application.it helps a user to use the system without any hesitation. Adding content like Icons, images and color increase the usability of an application.

Figure 24 : Usability.

Apps Specification guideline:

- For Individual actions and activities appropriate icons, button should be used for the Online Smart Shop application.
- Providing message for the user so that they can take action easily.
- Touch should be sensitive for the online smart shopping apps.

4.2.4 Consistency: Consistency refers to maintain a sequence throughout using a function of an application. It is not necessary to maintain the same design to remain consistence, it could be different design but important things need to remember that the user does not lost in the interface.
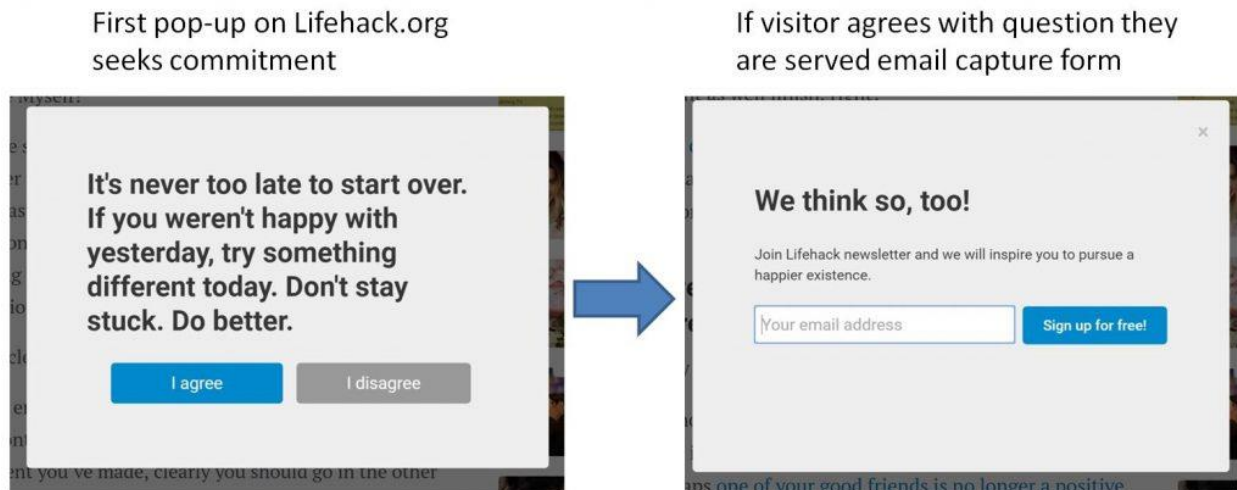
Figure 25 : Consistency of a system (conversion-uplift, 2019)

Apps Specification guideline:

- Try to remain all pages same layout.
- Trying to input related information ne after one.

4.2.5 Help: It means providing instruction for the user so that they can use the application easily. T could FAQ, Message dialogue before taking any action, Video tutorials etc.
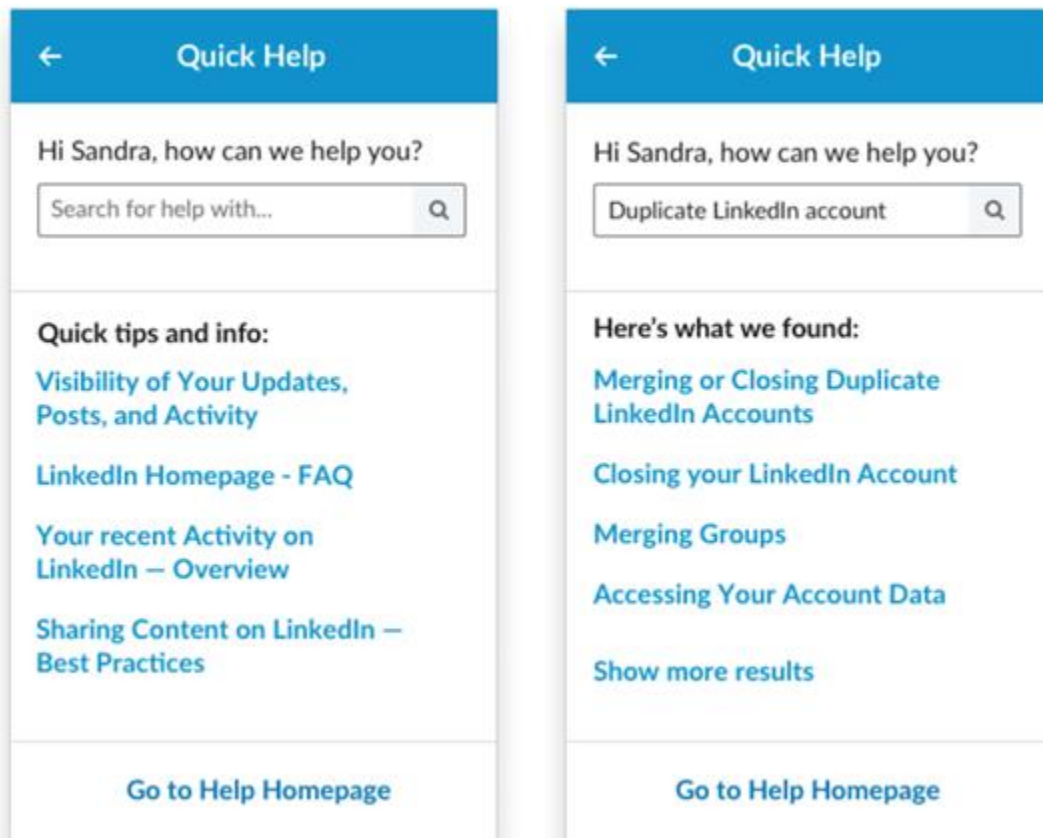
Figure 26 : Providing information to the user.

Apps specification guideline:

- Remain Guideline for the user.

4.2.6: Ideation Process

Ideation concentrate on generating possible solution idea based on a particular problem domain. In online Super shopping one of the most important factors for the user is providing shipping address. It could be implement in the application in varies ways. Possible ideas are provided below:

Idea-1: User can input shipping address when he is getting registered. The application database will store the data and for every order the application will collect permission to use that data.

Idea-2: User will input shipping address every times when he is going to place an order.

Idea-3: As the user will use the application through internet, the application can track location and get permission access to provide data when he is going to place an order.

Above these three ideas **idea-1** is going to implement in Online Super Shopping application. As the user feels boring to input shipping address every time and tracking Location via internet has a chance to provide incorrect data.

4.2.7: Idea of the system:

The application is going to prototyping will work with connecting with a smart device. The smart device will be connected with the application through Bluetooth and the application will be able to work through internet. The user will provide instruction on the smart device and the application will detect it and place the particular product. Some sketch of the assumption is provided below.
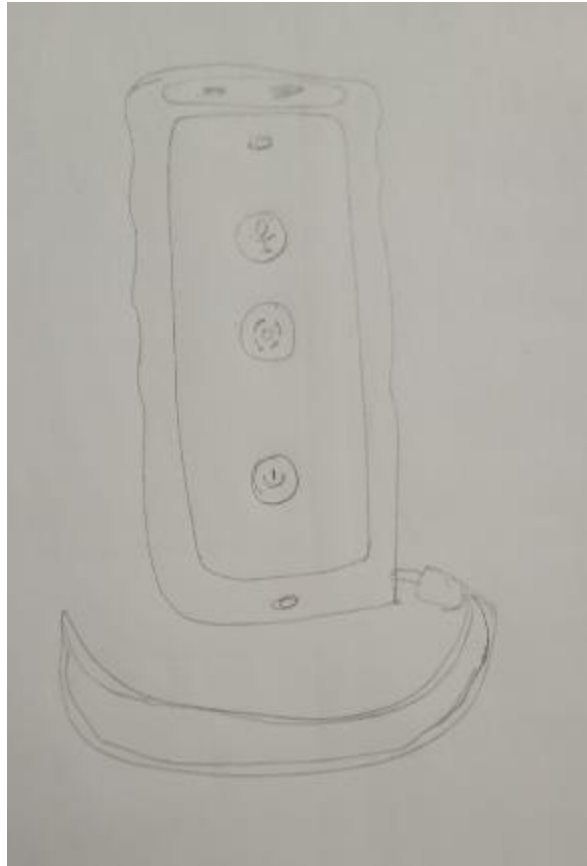
Figure 27: Smart Object.
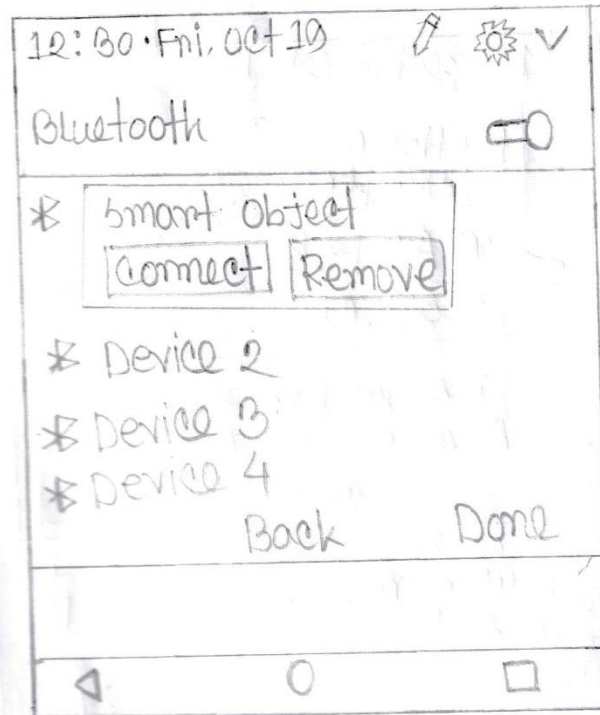
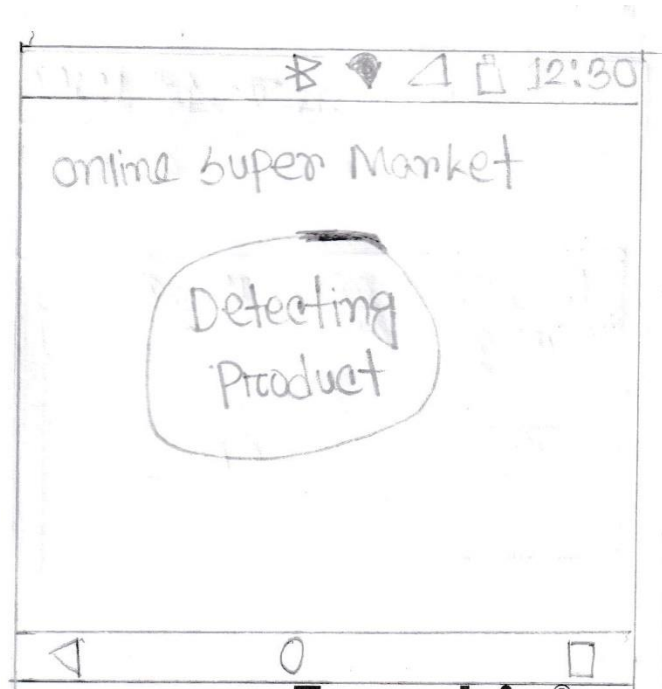**Figure 28: Connecting with Smart Object.**
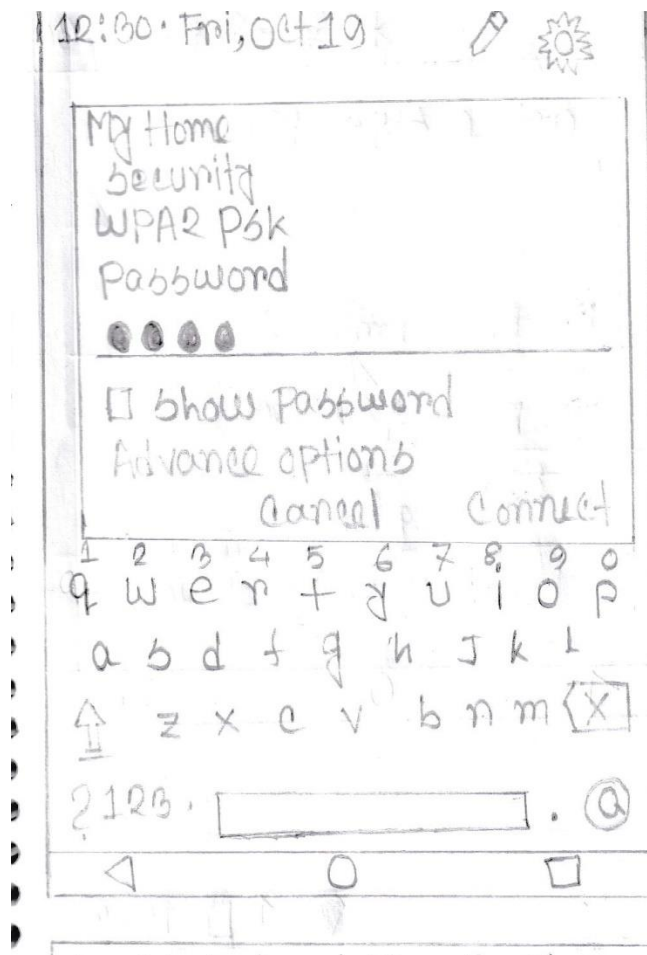
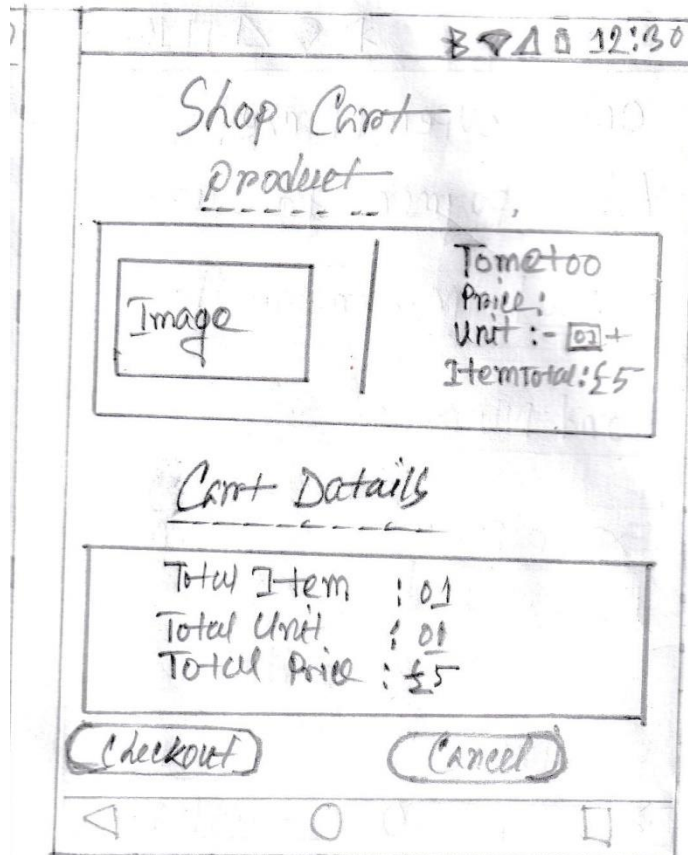Figure 29: Connect with Internet.

Figure 30: Detecting Product

Figure 31: Order Product.

5. Prototype

Prototype link:https://xd.adobe.com/view/f40d855d-7f30-49be-6dba-1bc9c91e498c-823c/

To make this prototype some necessary things such as selecting device, Operating system, design principle, methodology is going to used which is discussed background and design process part of the coursework. I have chosen android 7 version for designing a prototype. It would be updated if I find a chance to update in further. Beside this some things need to consider designing a prototype which is going to discuss below.

5.1 Layouts: Layouts refers how elements are represented in the system. In online supermarket application elements and contents are set in correct so that a user can use the application with this clear and focused layout.
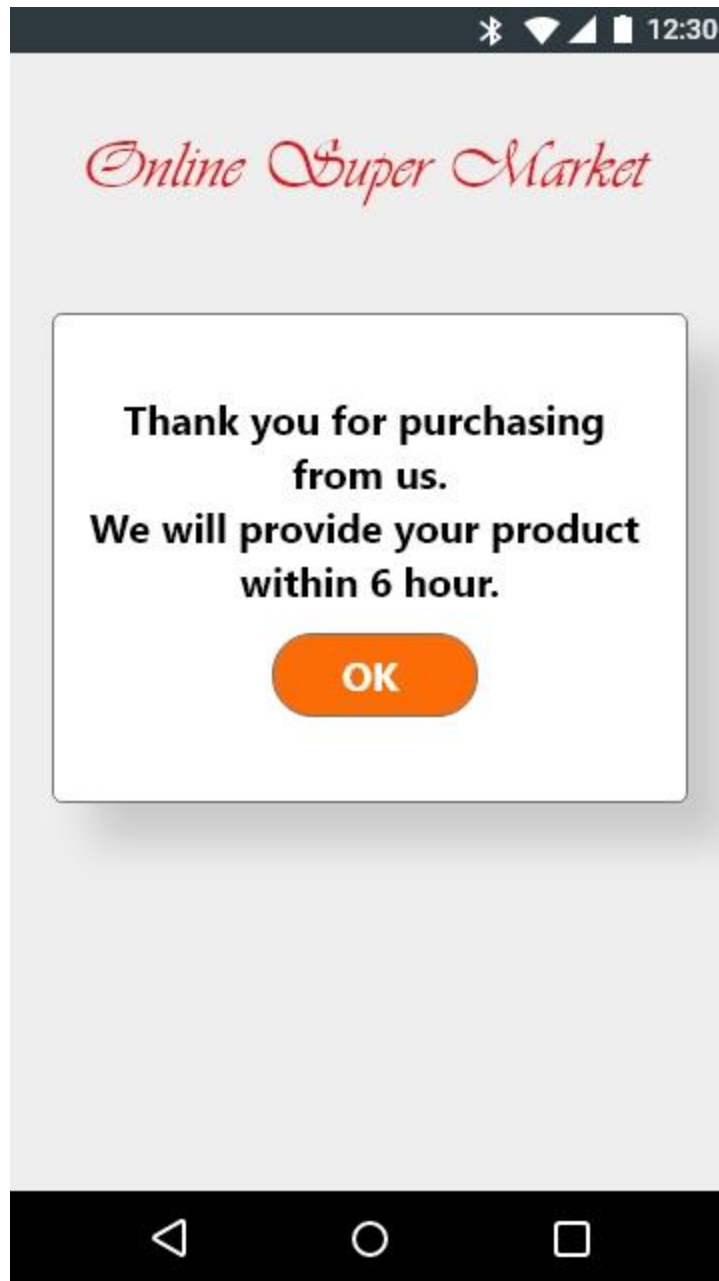
Figure 32: Using Layouts

5.2 Navigation: Navigation helps a user to move one page to another easily which increase the application efficiency and make ensure the user flow. To complete this design ambiguous navigation bar is being used.

Figure 33: Using Navigation

5.3 Button: The essential part of an application which is necessary to take action in the application. It is also remarkable that the button size and color should be designed such way the user can focused easily and take action.
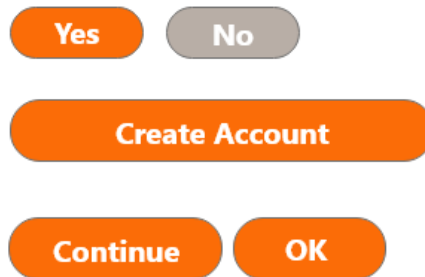

Figure 34: Using buttons

5.4 Color: Color makes attractive the interface and helps user to interact. It is very essential not only the users perspective but also designer thinking. In this application colors are being used thinking about the user perspective.

Figure 35: Using colors.

5.5 Icons: Icons helps the user to identify the operation that is going to perform. There are many common icons that are always using most of the time to perform same

operation in the same platform. In this prototype, I am also using the common icons that the user needs not to use more memory and can understand by watching icons.
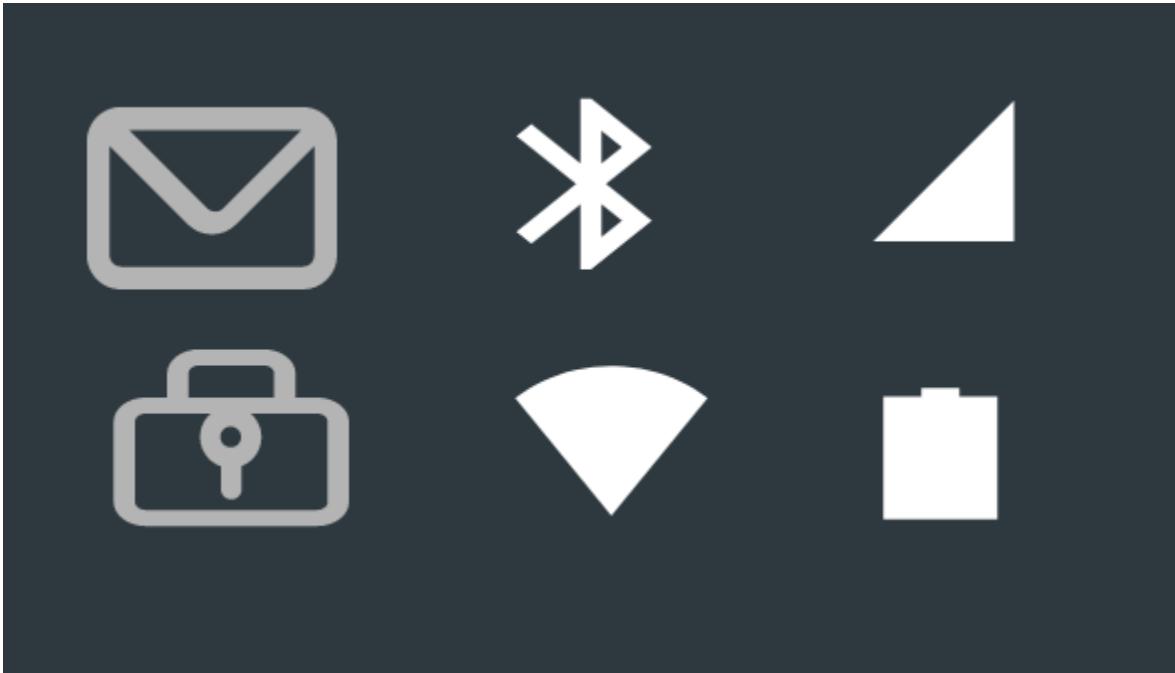
Figure 36: Using icons.

5.6 Low Fidelity Design

In conceptual Design (section 4.2) provide a clear indication what is going to be designed. In that section some basic sketch is also be designed. In this part, sketch is going to converting wireframe. I attached some figure of this progress.

Figure 37: Connecting smart object through Bluetooth.
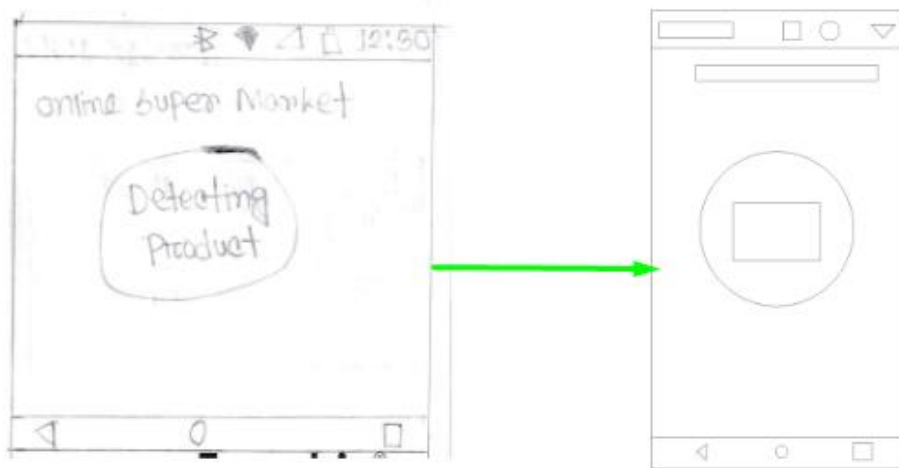
Figure 38: Detecting Product.
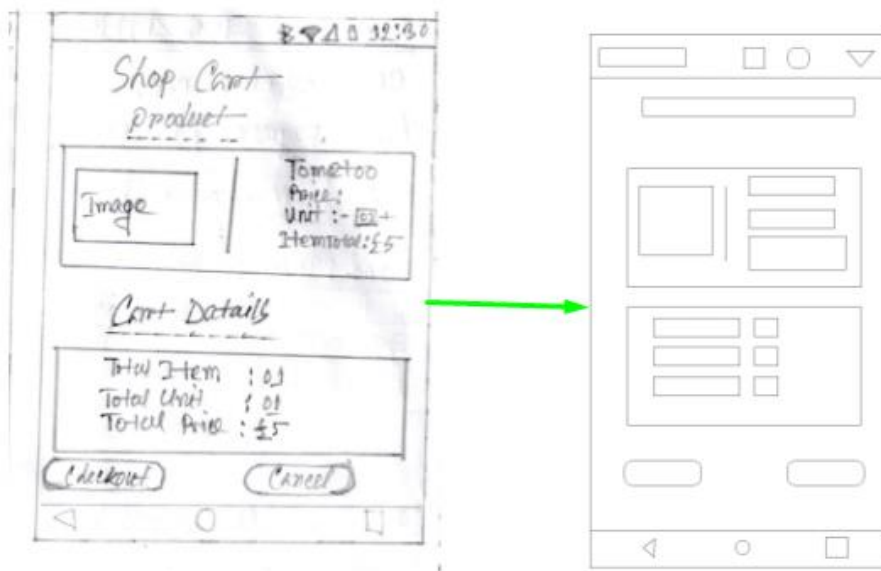
Figure 39: Order Product.

5.7 High Fidelity Design:

High fidelity prototype interacts with one page to another and performs some functionality. Some image of high fidelity design is provided below.
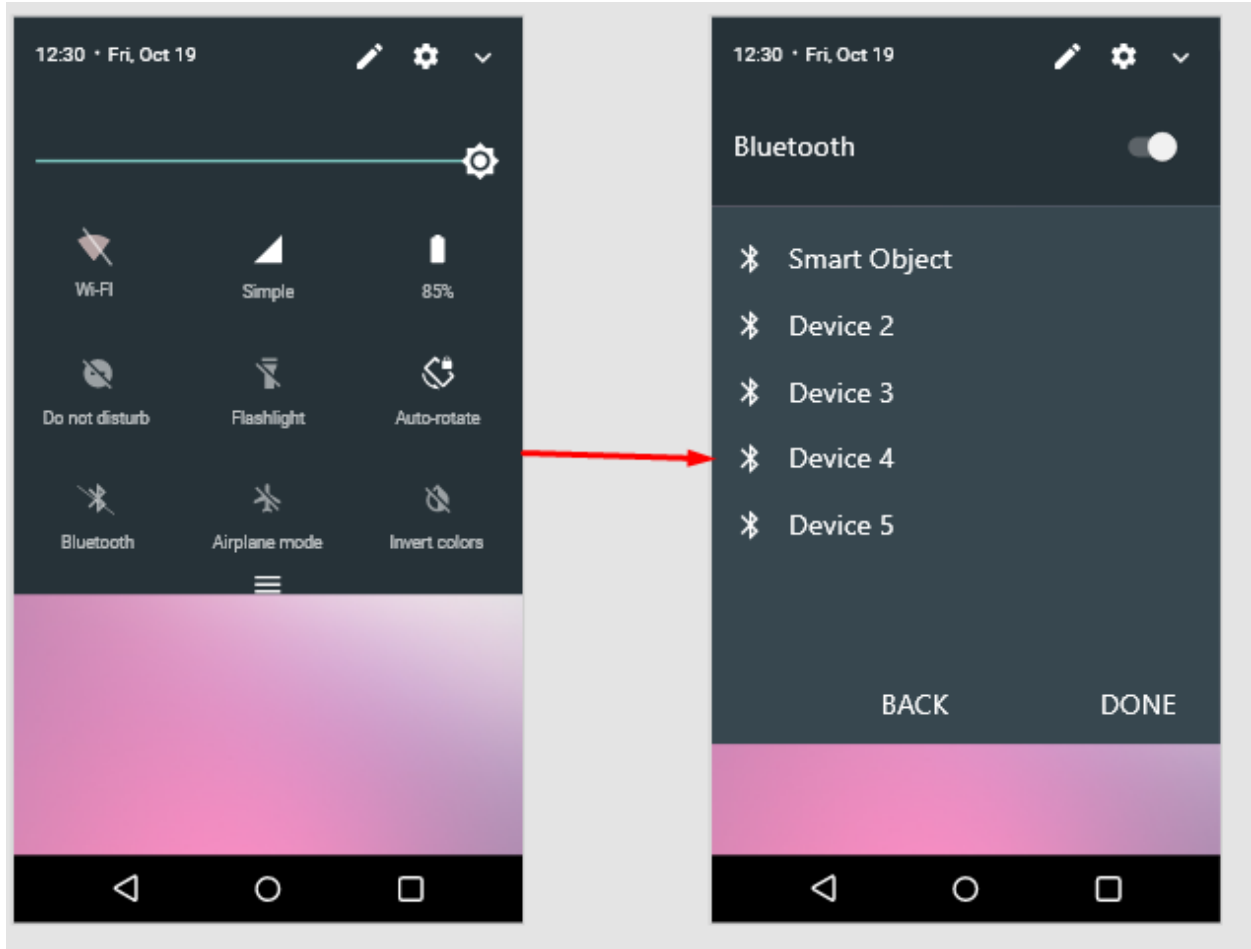
Figure 40: Searching device through Bluetooth
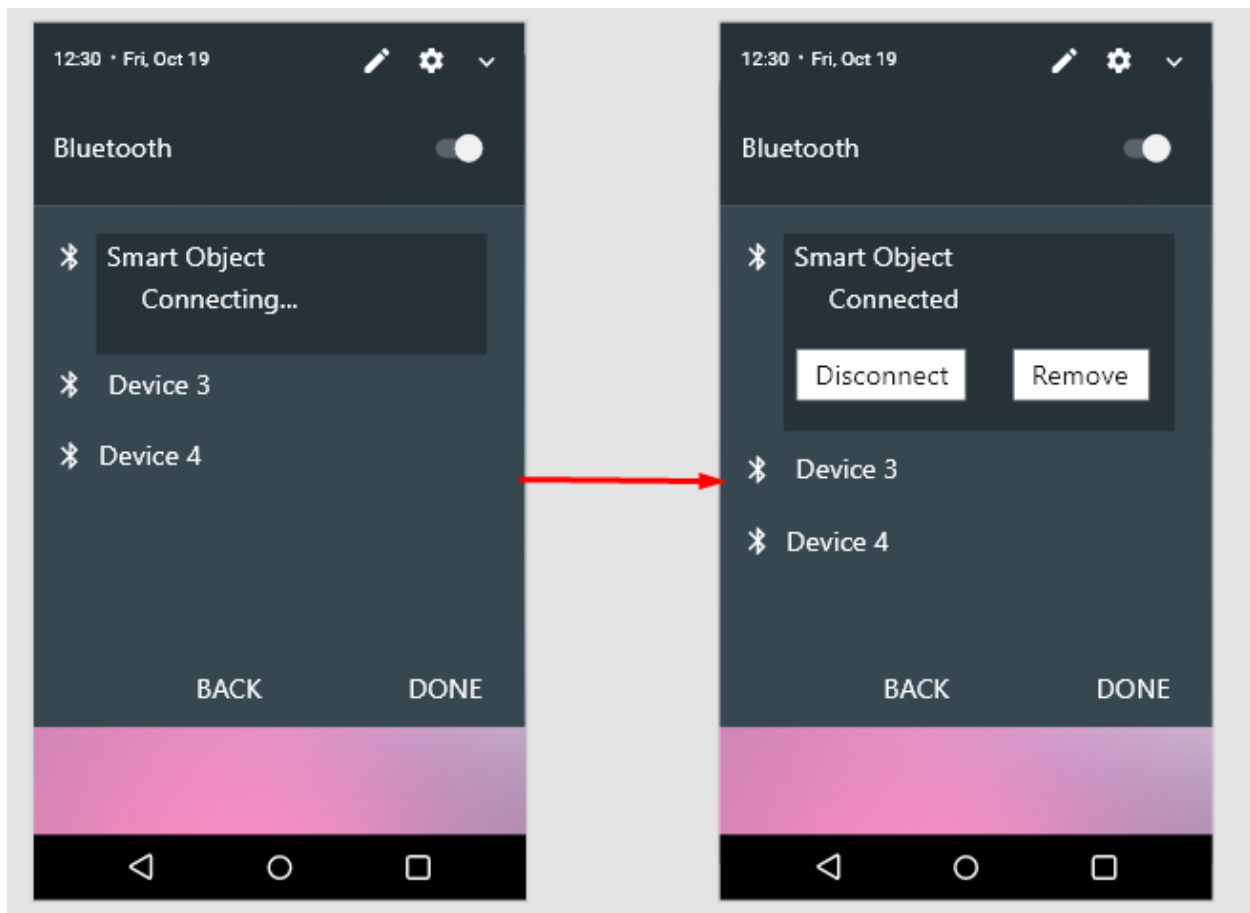
Figure 41: Connecting Smart Object through Bluetooth.
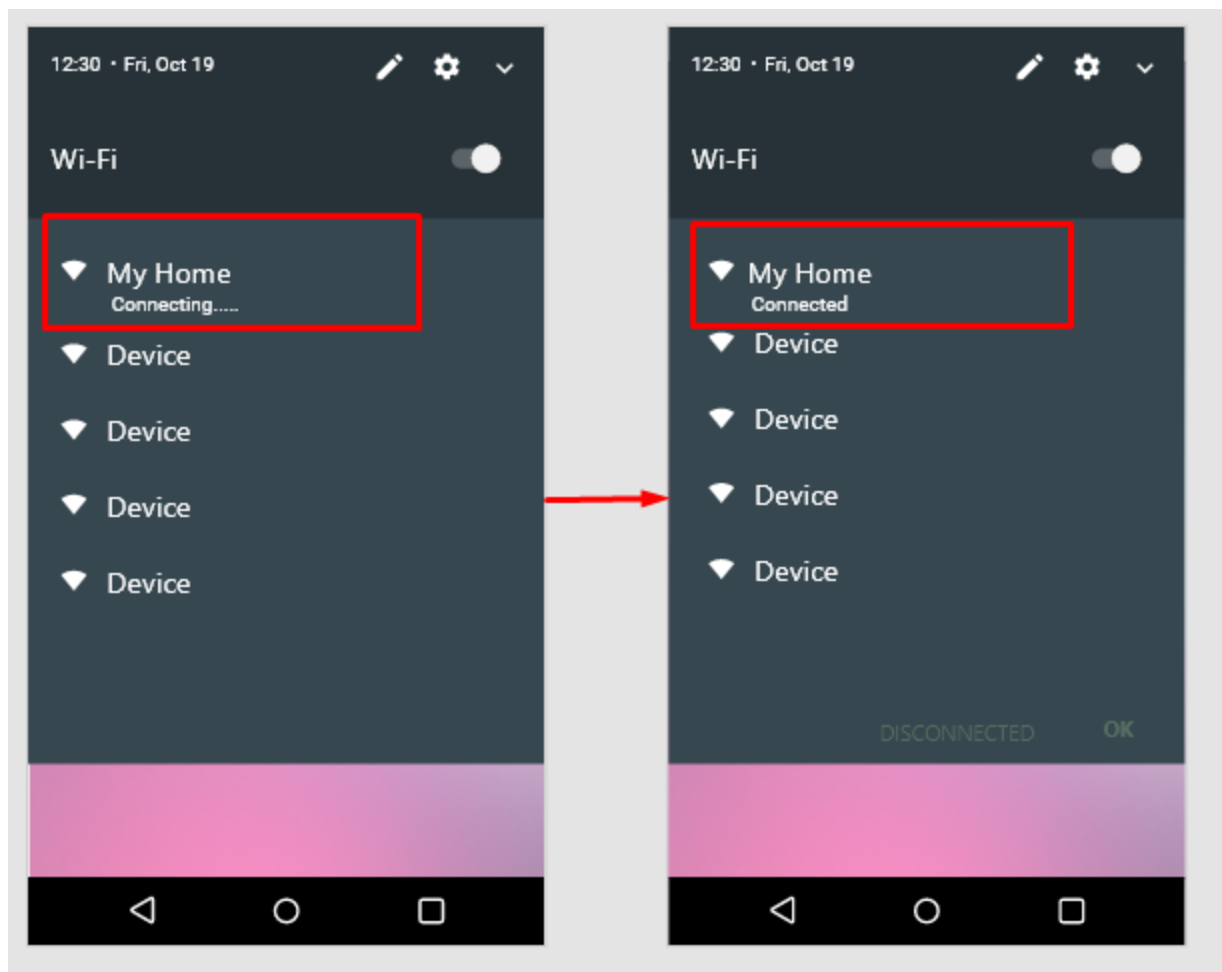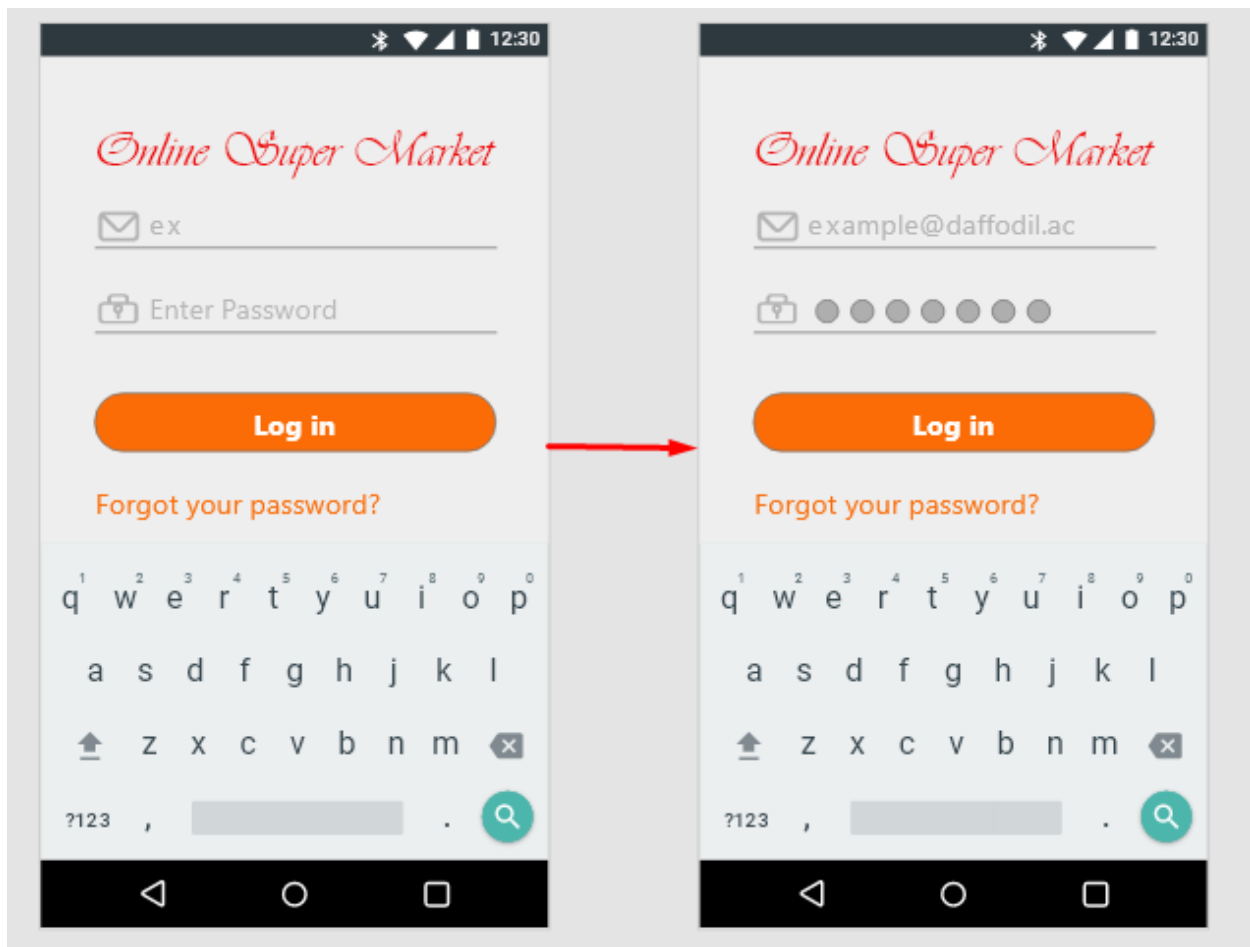
Figure 42: Connecting Wi-Fi.

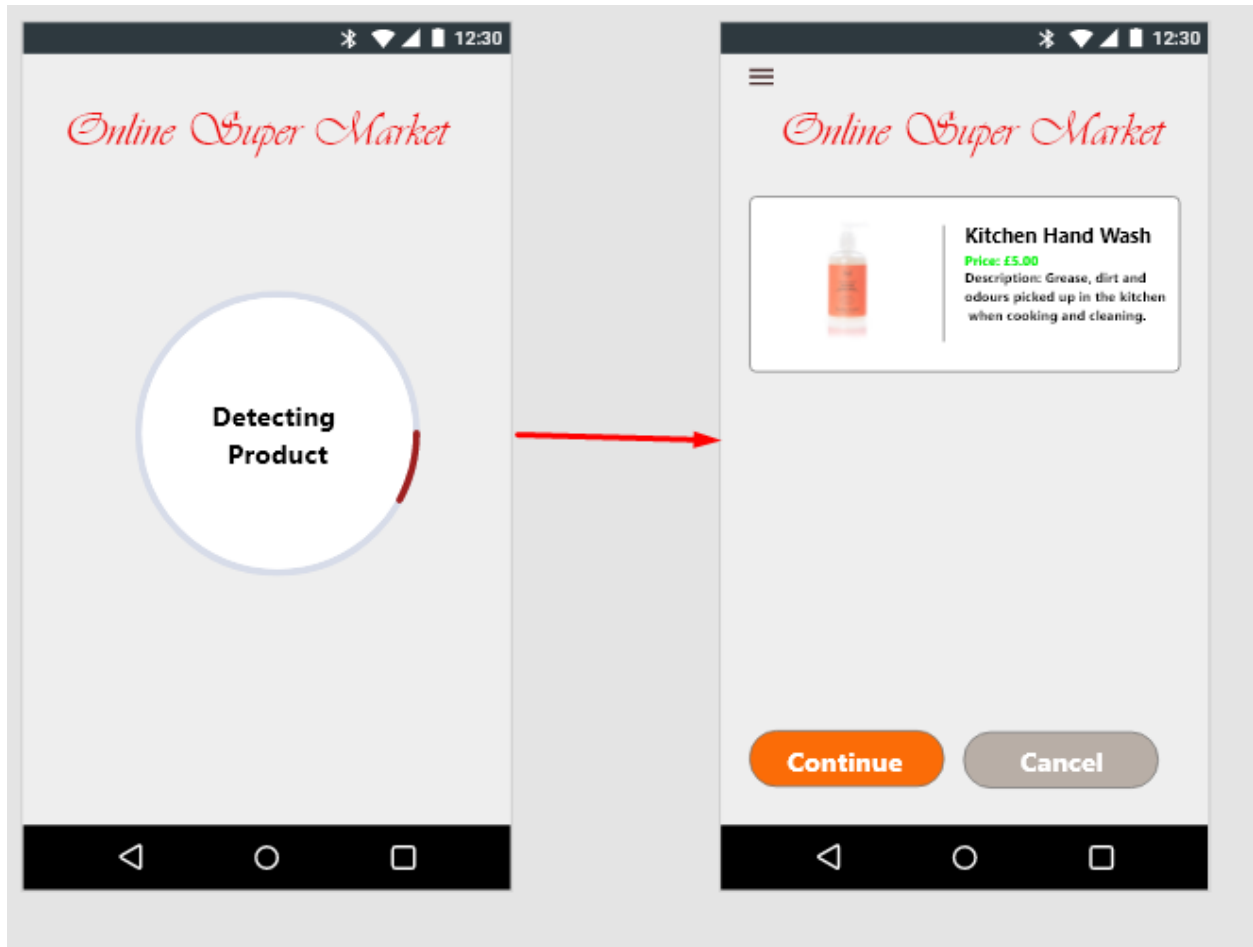**Figure 43: User Logged into the Application.**

Figure 44: User Scan product code for order.
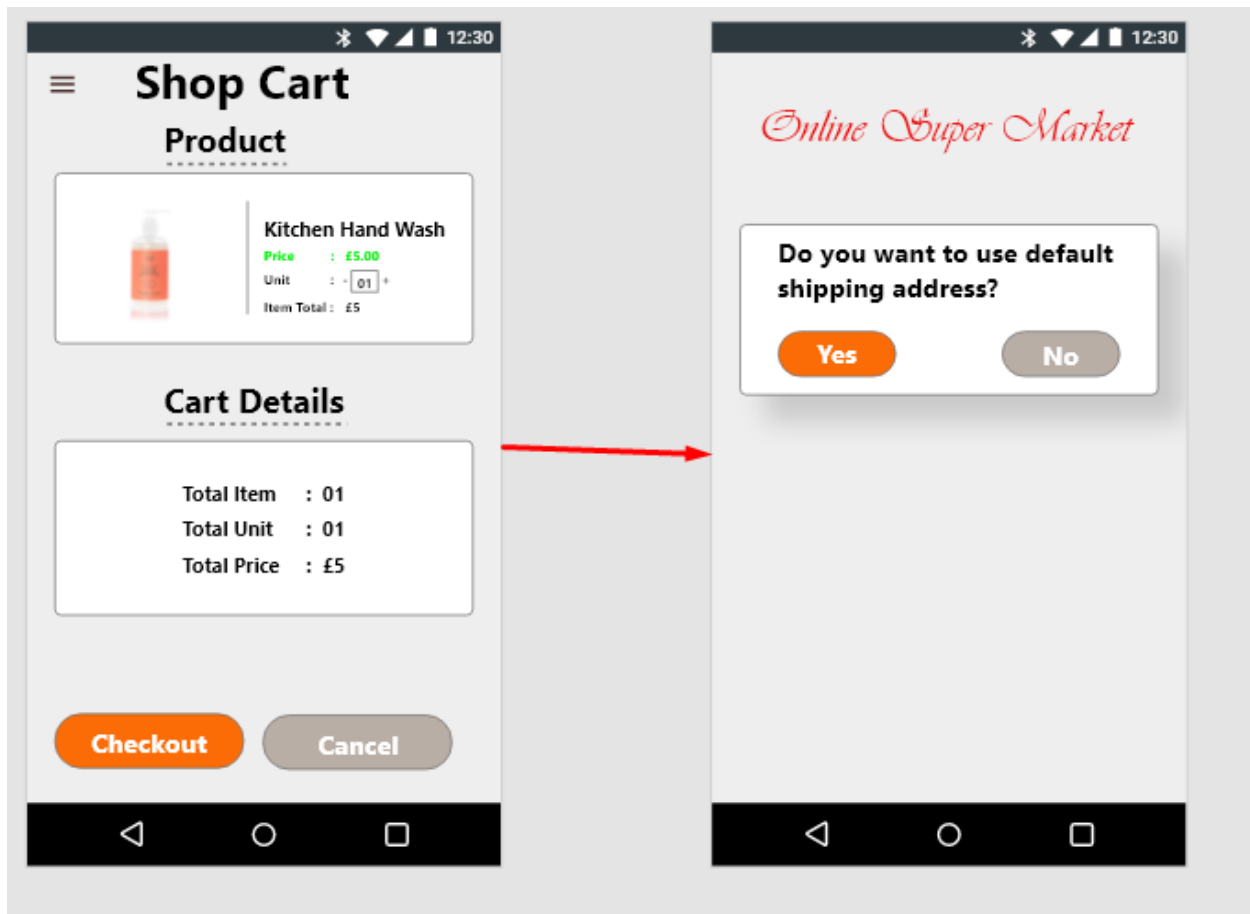
Figure 45: Detecting Product.
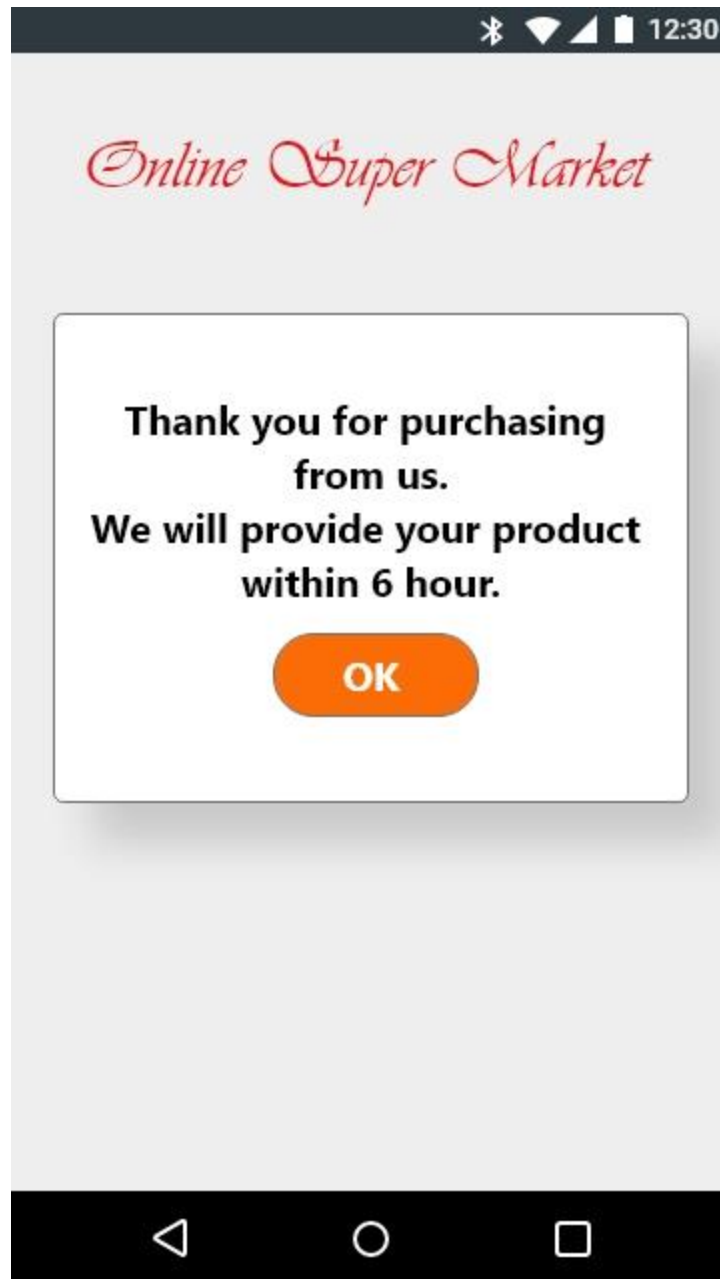
Figure 46: Order Product.

Figure 47: Order confirmation message.

Rest of the processes is attached in **Appendix A.**

6. Research Study

Online Smart Shopping is created focus on some factors such as what actually user needs user's ability and their limitations which is regarded as User Experiences. In this application one of main feature is to order the product. To accomplish it user need to follow some steps.

Step-1: User need to input voice or scan the product with smart object.

Step-2: Identify the product with right quantity.

Step-3: Add to cart.

Step-4: Input shipping address.

Step-5: confirm Payment.

Step-6: Confirm order.

This feature is basically created based on the assumption and interaction design research (which discussed in 4.1).

To ensure that the feature fulfills usability anyone can measure usability using following method. The method is created based on **System Usability Scale (SUS)** method. On the contrary anyone also can check user experiences of the application; the framework is created based on the **HEART** framework.

The Frameworks are included in the **Appendix B**.

7. Conclusion

The smart device helps user for shopping conjunction with online supermarket application. The user can interact with the application via voice and scanning. Throughout the prototype, user can see ideal and proper interaction of the application.

While developing the prototype I have leant many things along with some design methodology, cognitive psychology, design process and tools especially Adobe Xd. Beside this this coursework helps me to think with the users mind.

The prototype could be more interactive in future. Representing the interaction between smart device and application by implementing cognitive psychology, design process and design principle which I have learnt from this course.

References

Conley, C. (2016) 'How to Make a Design Framework to Structure Your Project', 09 August.

conversion-uplift (2019) *conversion-uplift.co.uk*, [Online], Available: conversion-uplift.co.uk/commitment-and-consistency-for-conversions/ [2019].

design thinking (2019) *design thinking*, [Online], Available: https://www.interaction-design.org/literature/topics/design-thinking [10 Oct 2019].

design-thinking (2019) *design-thinking*, [Online], Available: https://barkleyconsultinggroup.com/what-we-do/design-thinking/ [1 Oct 2019].

distribution-cognition (2019) *distribution-cognition*, [Online], Available: https://blogs.ubc.ca/socialapproaches/distribution-cognition/ [22 Mar 2019].

Entrepreneur (2019) *https://www.entrepreneur.com*, Oct, [Online], Available: https://www.entrepreneur.com/encyclopedia/market-research.

Hartson, R. (2012) *The UX Books*.

https://www.sciencedirect.com/topics/computer-science/participatory-design (ed.) (2012) 'Participatory Design', in *Participatory Design(second edition)*, Rex Hartson, Partha S. Pyla.

httpsciencedirect (2019) *https://www.sciencedirect.com/*, [Online], Available: https://www.sciencedirect.com/ [18 Oct 2019].

Human Computer Interaction (2019) *Human Computer Interaction*, [Online], Available: http://adrianomescia.com/communication-doesnt-necessarily-require-interaction/ [01 Nov 2019].

ilslearningcorner (2019) *https://ilslearningcorner.com*, [Online], Available: https://ilslearningcorner.com/2016-05-5-areas-of-attention-is-my-child-developmentally-ready-for-sustained-attention-focus-and-multitasking/ [15 Oct 2019].

Interaction Design (2019) *https://www.interaction-design.org*, [Online], Available: https://www.interaction-design.org/literature/article/google-s-heart-framework-for-measuring-ux [2019].

Interaction Design (2019) *interaction-design.org*, [Online], Available: interaction-design.org/literature/article/how-to-design-voice-user-interfaces [02 Nov 2019].

Interaction Design Foundation (2019) *https://www.interaction-design.org/*, [Online], Available: https://www.interaction-design.org/literature/article/a-simple-introduction-to-lean-ux [07 Oct 2019].

Interaction Design foundation (2019) *Interaction Design foundation*, 16 September, [Online], Available: https://www.interaction-design.org/literature/topics/user-centered-design [16 September 2019].

Interaction design foundation (2019) *Interaction design foundation*, [Online], Available: https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process [11 Oct 2019].

Interaction design foundation (2019) *Interaction design foundation*, [Online], Available: https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/gulf-of-evaluation-and-gulf-of-execution [11 Aug 2019].

Interaction design foundation (2019) *Interaction design foundation*, [Online], Available: https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/gulf-of-evaluation-and-gulf-of-execution [11 Oct 2019].

Interaction Desion Foundation (2019) *https://www.interaction-design.org*, [Online], Available: https://www.interaction-design.org/literature/topics/external-cognition [2019].

Justinmind (2019) *https://www.justinmind.com*, [Online], Available: https://www.justinmind.com/blog/ucd-vs-ux-whats-the-difference/ [05 Oct 2019].

JUSTINMIND (2019) *https://www.justinmind.com*, [Online], Available: https://www.justinmind.com/blog/complete-guide-to-lean-ux/ [06 Oct 2019].

JUSTINMIND (2019) *https://www.justinmind.com*, 12 Oct, [Online], Available: https://www.justinmind.com/blog/complete-guide-to-lean-ux/ [12 Oct 2019].

Keli Amann (2009) *Sakai*, 10 Sep, [Online], Available: https://confluence.sakaiproject.org/display/UX/Goal-Directed+Design#targetText=Goal%20Directed%20Design%20is%20a,%2D%2D%20in%20short%2C%20most%20situations.&targetText=We%20will%20therefore%20be%20conducting,development%20or%20even%20design%20begins. [05 Oct 2019].

learning process (2019) *learning process*, [Online], Available: https://www.dreamstime.com/process-learning-components-image117882060 [10 Oct 2019].

Mark perry (2013) *Mark perry*, [Online], Available: https://www.sciencedirect.com/topics/computer-science/distributed-cognition [03 Feb 2019].

neonode (2019) *www.neonode.com*, [Online], Available: https://www.neonode.com/solutions-2/touch-interaction/?fbclid=IwAR1SpjXuxkCUP7pr8joZ9SAQYWcTDx50nRQRJ7VxmA66EblWkvV_sf43B7Q [2019].

Online Design Teacher (2019) *https://www.onlinedesignteacher.com*, [Online], Available: https://www.onlinedesignteacher.com/2015/11/the-design-process_44.html [13 Oct 2019].

Participatory Design (2019) *Participatory Design*, [Online], Available: https://uxpajournal.org/ucd-method-assistive-switch-devices-accessibility/ [01 Nov 2019].

press book (2019) *press book*, [Online], Available: https://opentext.wsu.edu/psych105/chapter/7-4-problem-solving/ [11 Sep 2019].

Problem solving process (2019) *problem solving process*, [Online], Available: https://www.vwgconsulting.co.za/2014/05/12/essentials-of-a-problem-solving-culture/ [09 Sep 2019].

ReportLinker (2019) *https://www.reportlinker.com*, [Online], Available: https://www.reportlinker.com/insight/smart-automation-comes-home.html [24 Oct 2019].

Researchgate (2019) *https://www.researchgate.net*, 05 Oct, [Online], Available: https://www.researchgate.net/figure/The-Goal-Directed-Design-process-Cooper-et-al-2014-p23_fig9_320353022 [05 Oct 2019].

Rogers, S.P. (2014) *Interaction Design*, 3rd edition.

Rogers, P.S. (2014) *Interaction Design*, 3rd edition.

Rogers, S.P. (2017) *Interaction Design*, 4th edition.

Roges, S.P. (2015) *Interaction Design*.

Roges, S.P. (2015) *Interaction Design* , 3rd edition.

ruralhealthit.com (2019) *(ruralhealthit.com*, [Online], Available: ruralhealthit.com [18 Oct 2019].

simplypsychology (2019) *https://www.simplypsychology.org*, [Online], Available: https://www.simplypsychology.org/memory.html [2019].

Simplypsychology (2019) *simplypsychology.org*, [Online], Available: https://www.simplypsychology.org/memory.html [17 Oct 2019].

Statista (2018) *https://www.statista.com/*, 24 Oct, [Online], Available: https://www.statista.com/statistics/266136/global-market-share-held-by-smartphone-operating-systems/ [24 Oct 2019].

statista (2019) *https://www.statista.com/*, [Online], Available: https://www.statista.com/statistics/799584/united-states-smart-home-device-survey-by-age/ [2019].

Sternburg, R.J. (2016) *Cognitive Psycology*, Available: https://www.slideshare.net/jtneill/psychology-102cognitive-processes [15 Oct 2019].

syndicode.com (2019) *syndicode.com*, [Online], Available: https://syndicode.com/uiux-design/ [2019].

Tech Target (2019) *IOT Agenda*, 13 Oct, [Online], Available: https://internetofthingsagenda.techtarget.com/definition/smart-home-or-building [13 Oct 2019].

Time USA (2019) *https://time.com*, [Online], Available: https://time.com/5634791/smart-homes-future/ [13 Oct 2019].

Usabilitygeek (2019) *https://usabilitygeek.com*, [Online], Available: https://usabilitygeek.com/how-to-use-the-system-usability-scale-sus-to-evaluate-the-usability-of-your-website/ [01 Nov 2019].

Usablity (2016) *https://usability2016.wordpress.com/2016/02/20/interaction-design-interaction-types/#targetText=Some%20of%20the%20common%20interaction,as%20if%20having%20a%20conversation.*, [Online], Available: https://usability2016.wordpress.com/2016/02/20/interaction-design-interaction-types/#targetText=Some%20of%20the%20common%20interaction,as%20if%20having%20a%20conversation. [2019].

Usablity.gov (2019) *Usablity.gov*, 16 September, [Online], Available: https://www.usability.gov/what-and-why/user-centered-design.html [16 September 2019].

UX Planet (2019) *https://uxplanet.org*, [Online], Available: https://uxplanet.org/lean-ux-how-to-get-started-bb3771697e2 [05 Oct 2019].

UX Planet (2019) *https://uxplanet.org*, [Online], Available: https://uxplanet.org/the-evolution-of-ux-process-methodology-47f52557178b [13 Oct 2019].

Vivnt (2019) *https://www.vivint.com*, 13 Oct, [Online], Available: https://www.vivint.com/resources/article/home-improvement-101 [13 Oct 2019].

WindoorExpo (2019) *https://service.windoorexpo.com*, [Online], Available: https://service.windoorexpo.com/en/exhibition-news-view-2500.htm [24 Oct 2019].
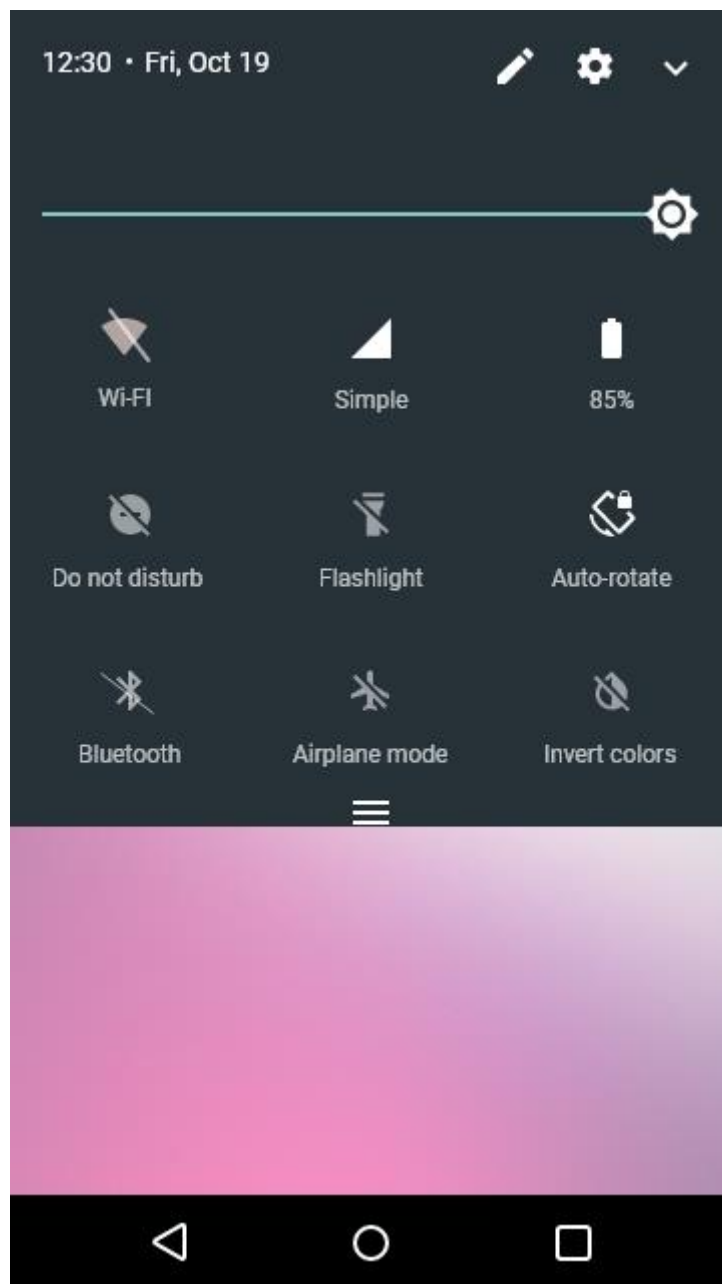
Figure 48: Smart Object.
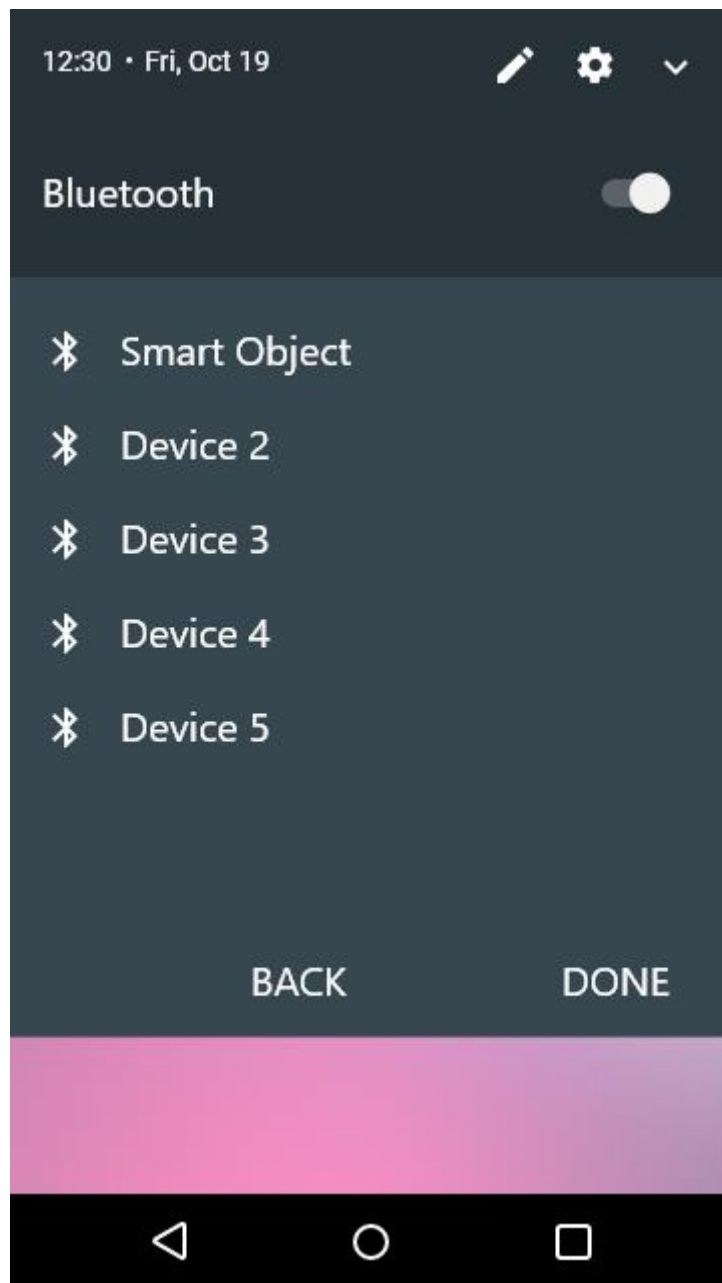
Figure 49: Notification Bar of the device.

Figure 50: Searching Devices.
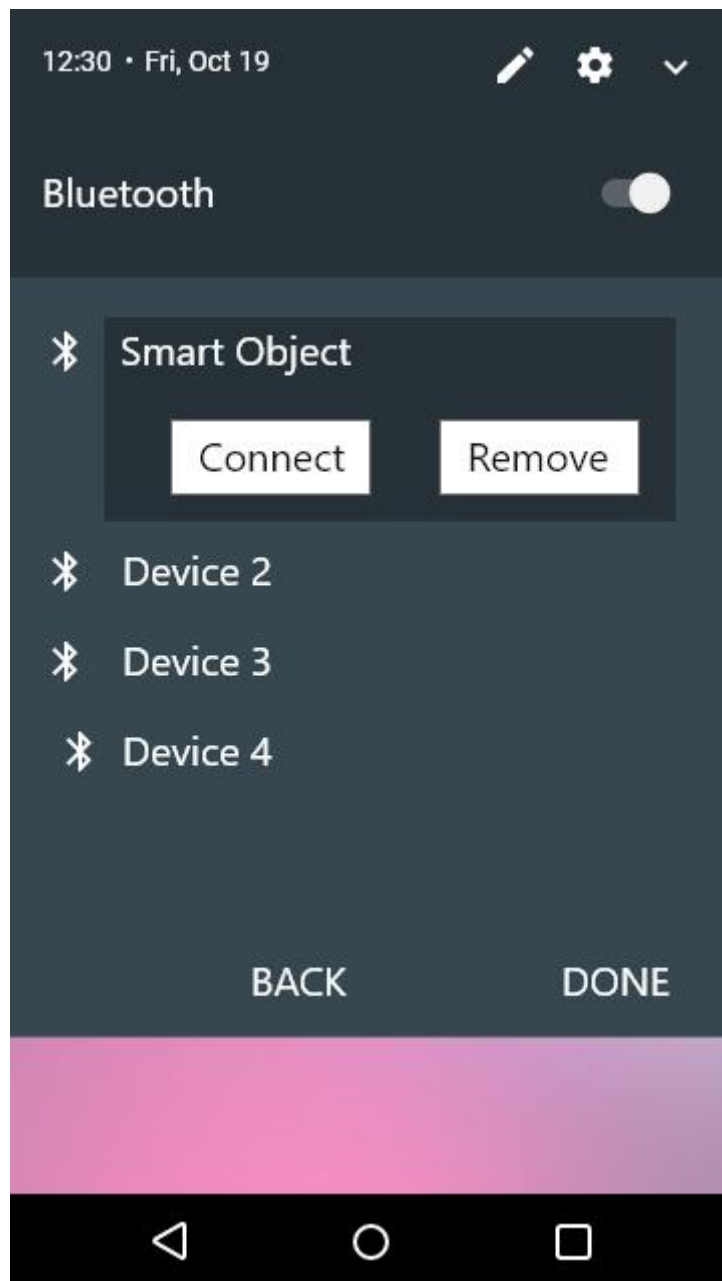
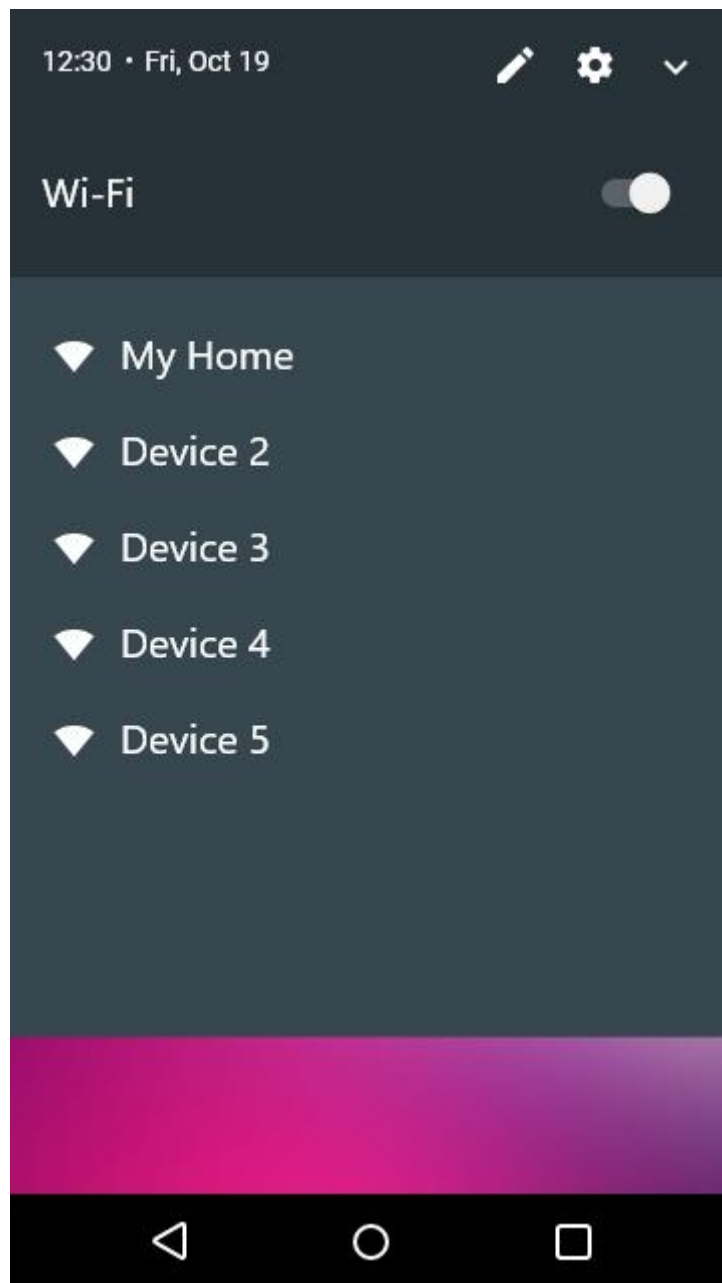**Figure 51: Connecting With Smart Object.**
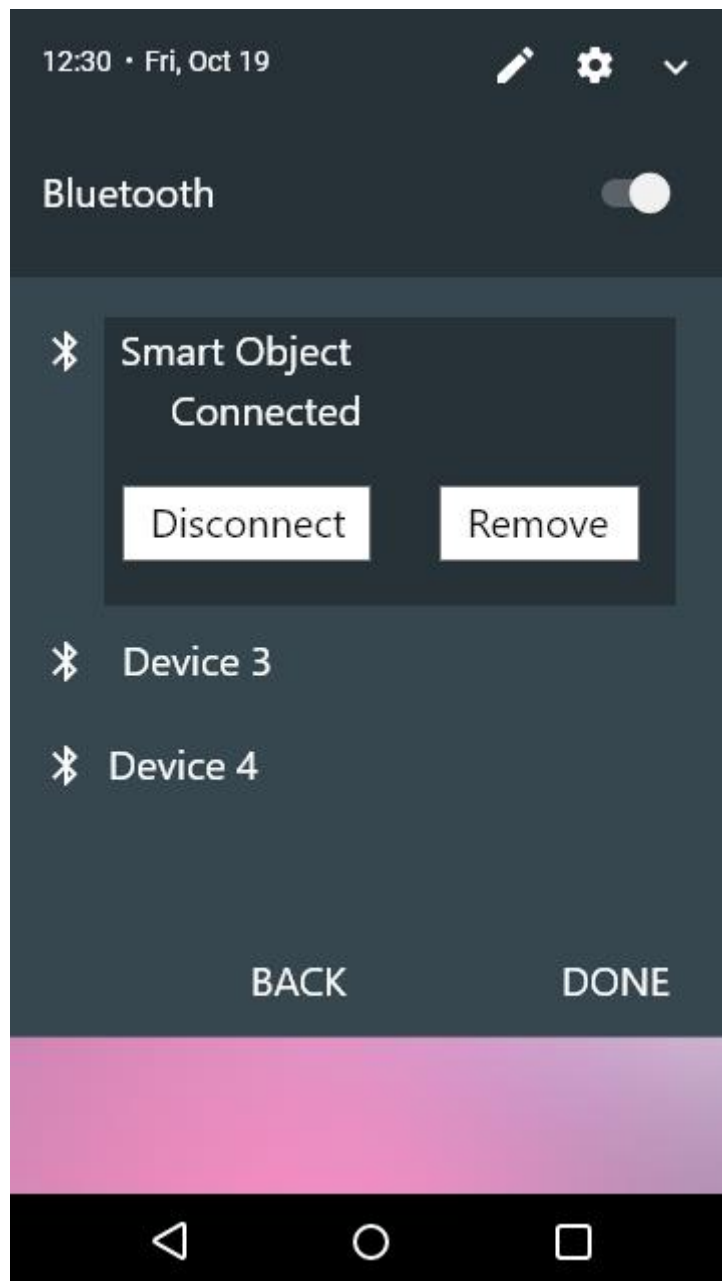
Figure 52: Connected with device.

Figure 53: Searching for Wi-Fi.
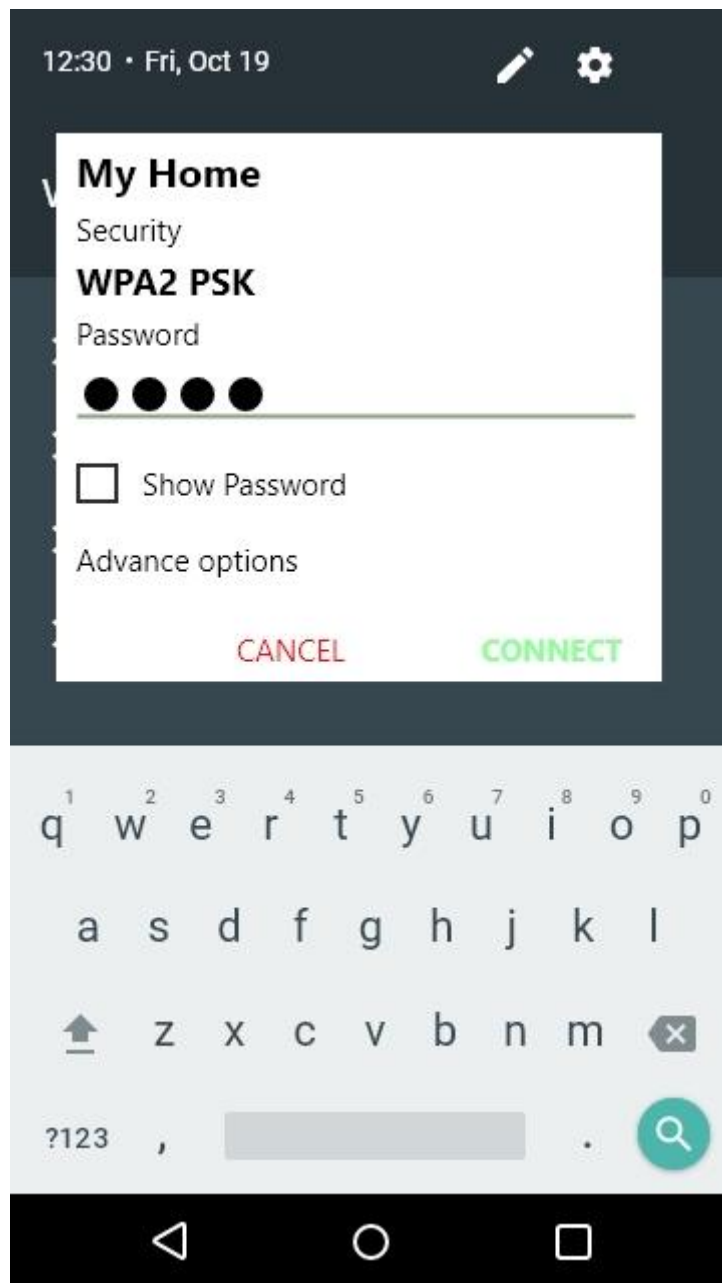
Figure 54: Input Password for Wi-Fi connection.
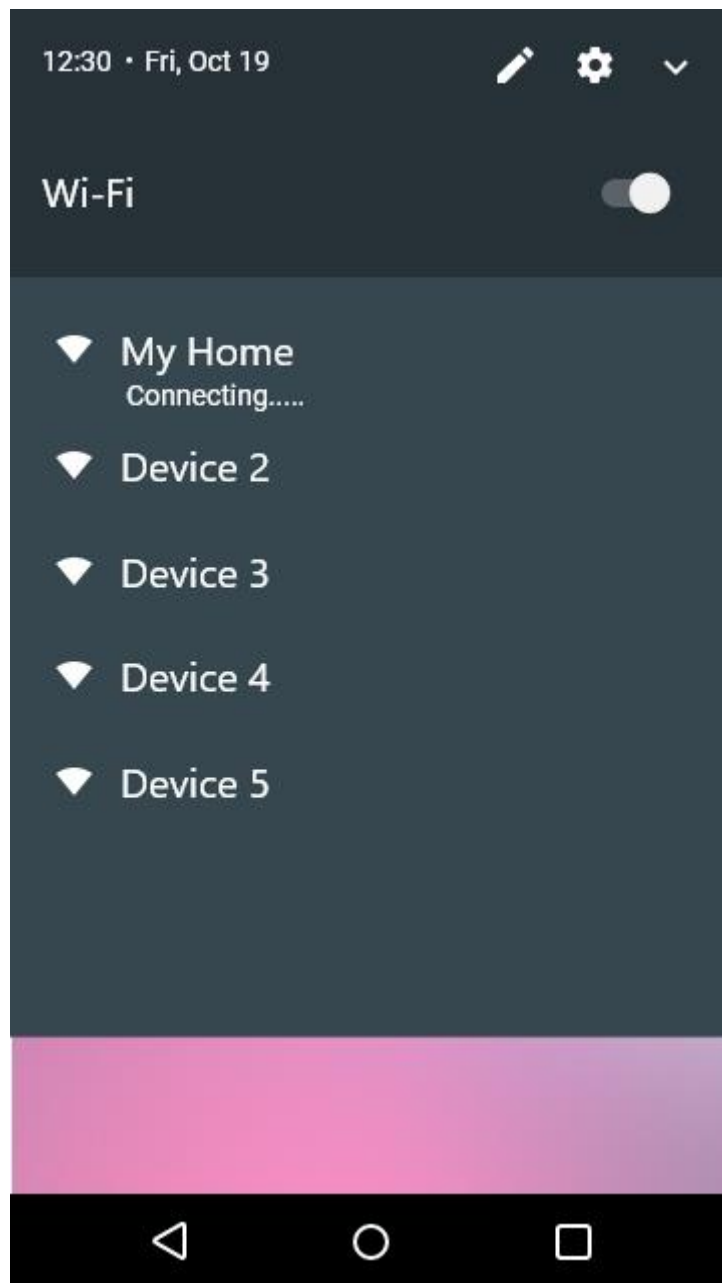
Figure 55: Connecting Wi-Fi.
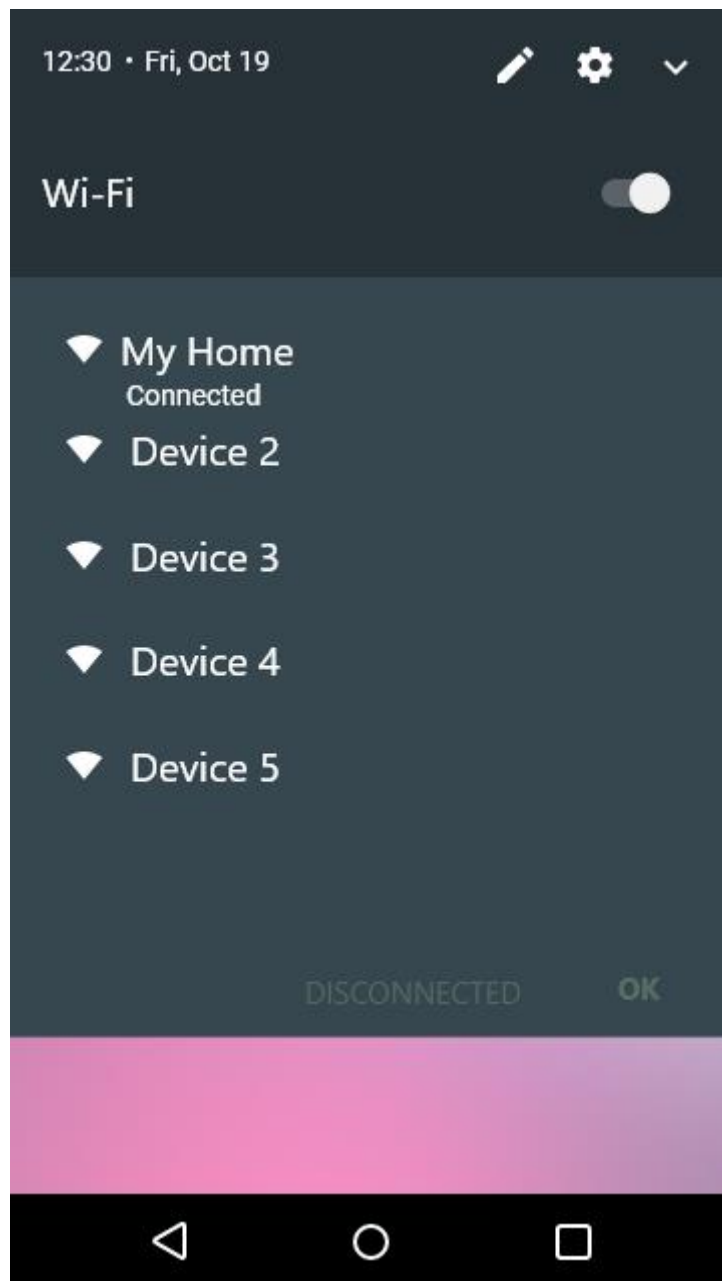
Figure 56: Connected Wi-Fi.
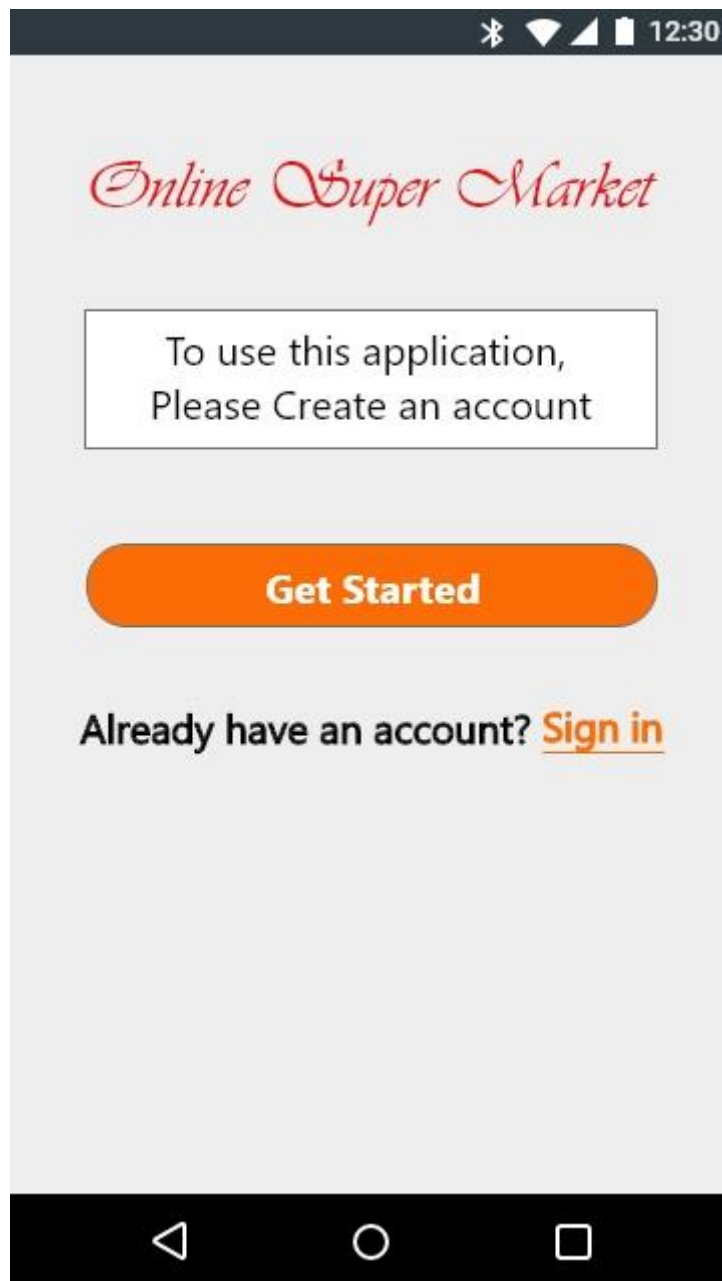
Figure 57: Apps Starting Page.
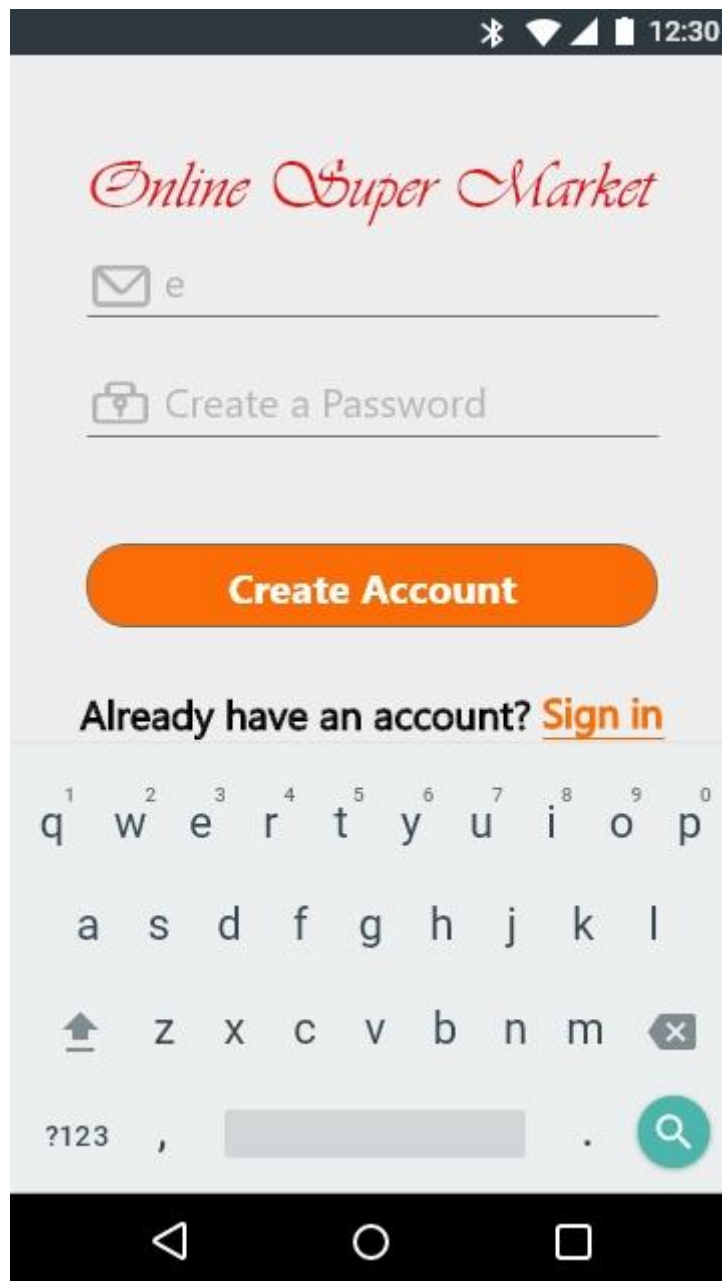
Figure 58: Input User information for registration.

Online Super Market

Shipping address

Full Name

Phone Number

House Number

Street Number

Town / City

Continue   **Back**

Figure 59: Providing Shipping Address of User.

Figure 60: Payment Gateway Page.
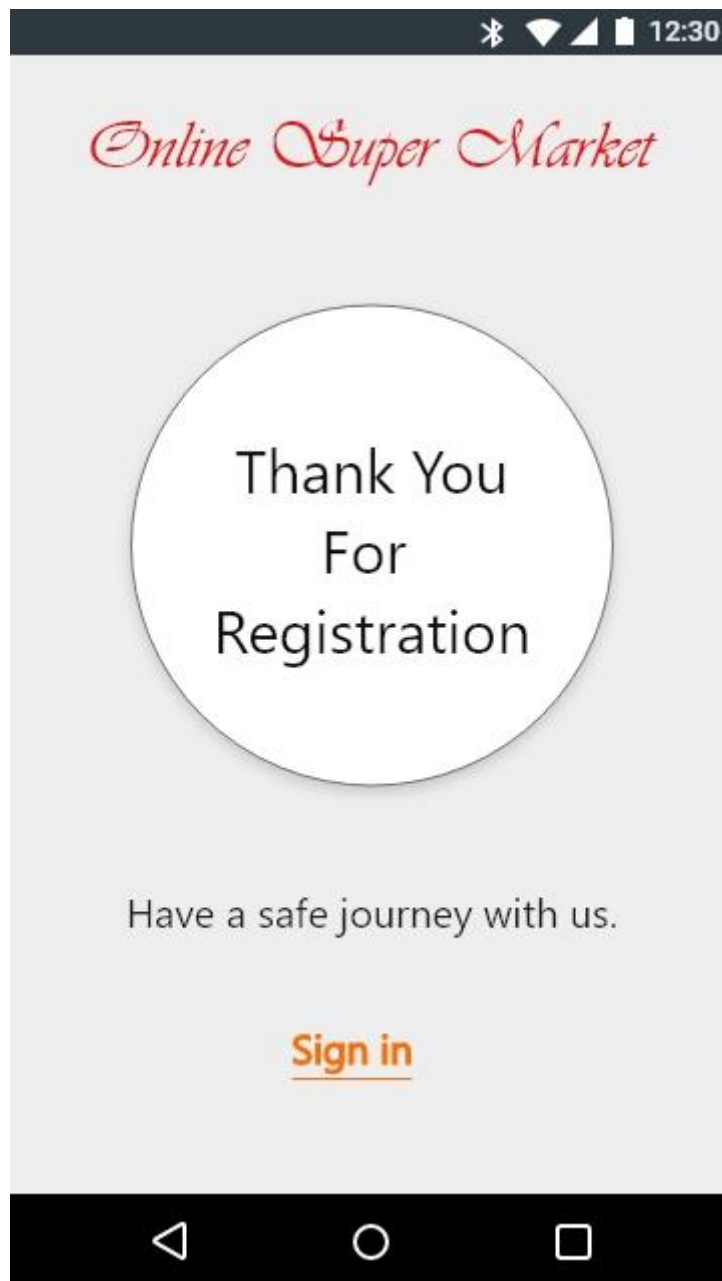
Figure 61: Registration thanking message.
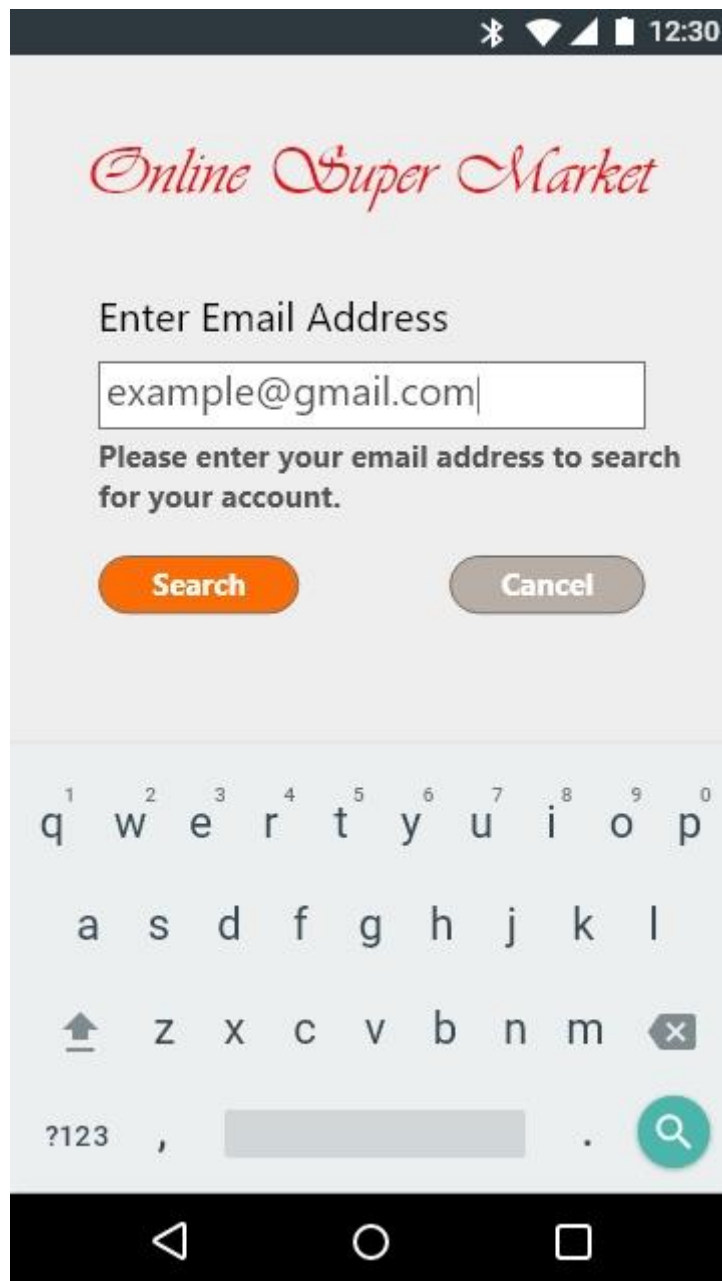
Figure 62: Reset Password.
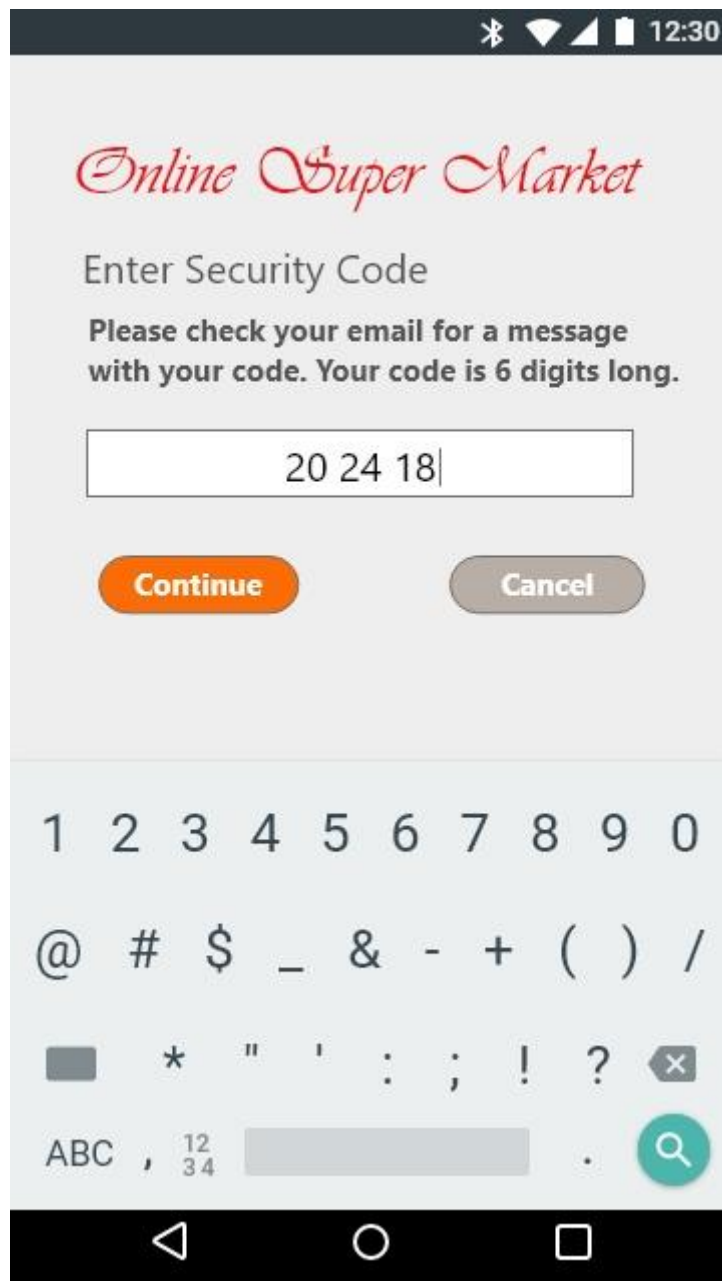
Figure 63: Input Security Code from email.

Figure 64: Entering New Girlfriend.

Figure 65: Password reset confirming message.

For Usability Test:

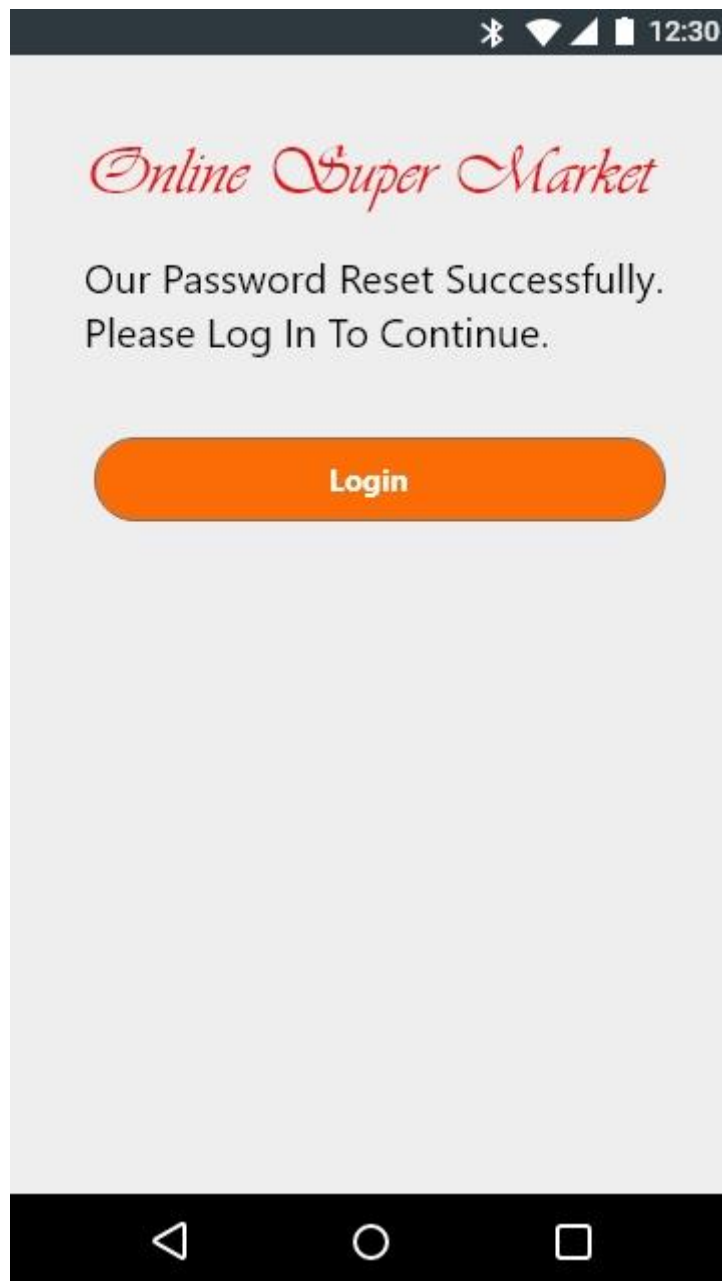To usability check 10 statements are defined for the user and they will answer these questions after using the system. The answer will be in a range of scale.

S-1: I think that the system is complex to use.

S-2: I think that user can learn this system easily.

S-3: I think that user needs to help a technical person to use the system.

S-4: I think that the user will use this system frequently.

S-5: I think I need to learn many things before using the system.

S-6: I think I feel confident to use the system.

S7: I think the system is full of inconsistency

S8: I think that the function is well integrated

S-9: I think it's very complicated to understand the next step.

S -10: I think it's very easy to remember to use

The answer range will be look like:

S-1: I think that the system is complex to use

The answer will be look like

To calculate usability based on the answer

- Subtract 1 from the score of odd number statement.
- Subtract their value from 5 of even number statement.

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- Take the new values and sum of these values and multiply with 2.5.

Now you will get a score between 1- 100.

Category

C-1: If the score is 80.3 or above, you can recommend the system to use your friend.

C-2: If the score is 68 or near about, you can say ok but need to improve.

C-3: If the score 51 or below this, you recommend to take priority in usability and fix is too fast (Usabilitygeek, 2019).

For User Experience Test:

To measure the User Experience anyone can follow the following method which is created based on the **HEART** method.

It's very easy to measure user experience with small scale. To take user experience, many strategies can be followed along with asking questions, talk to them and observe user. HEART matrix is basically works with 5 things Happiness, Engagement, Adoption, Retention and Task Success.

Figure 66 : HEART Framework (Interaction Design, 2019).

Participatory design:

Participatory design is user involvement in the development of working practices. Participatory design is a democratic (social and technological) process in which human work involves designing systems, based on the argument that consumers should be involved in designing their use, and in particular that all stakeholders, including consumers, may have, the same thing. Opinions in interoperability design (https://www.sciencedirect.com/topics/computer-science/participatory-design, 2012).
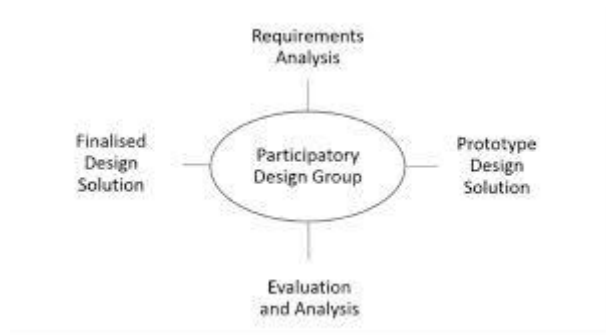
Figure 67: Participatory Design.

(Participatory Design, 2019)

Participatory design is a way of focusing on the principles of design, not design. The term is used in many areas, for example, software design, city design, architecture, landscape design, product design, stability, image design, planning, and medicine as a way of creating knowledge and cultural, emotional, spiritual and environmental for its residents and users. It is not. This is a way to create a platform.

Design Thinking:

Design Thinking is a systematic process that provides a way to solve problems. It can be very helpful in resolving conflicts that are described in detail or unknown by understanding the needs of the affected human, recovering from human-centric problems, developing multiple perspectives in the debate, and use a variety of methods in the model and experiment (Interaction design foundation, 2019). Design thinking gives us a way of thinking outside the box and solving problems well. These allow designers to prototype, research, and create the products and services necessary to find new ways to meet users. Intellectual capital has become popular in recent years as the focus of many international companies and institutions such as Google, Apple, and Airbnb (design thinking, 2019).

Empathize
Understand the perspective and needs of your end-users

Ideate
Explore a wide variety of ideas through intense (and fun) brainstorming

Test
Take your prototype to end-users and use observation and feedback to refine prototypes or ideas

Define
Use insights to define the real problem to be solved

Prototype
Transform your ideas into a physical form to create a tangible representation of your solution
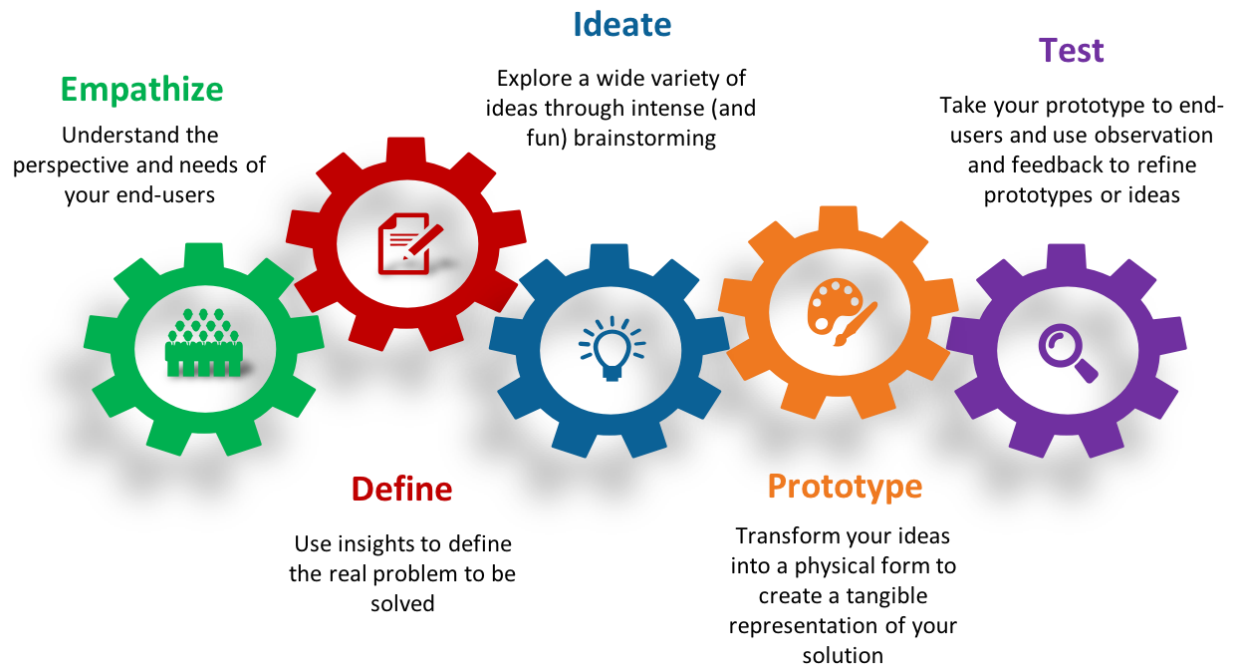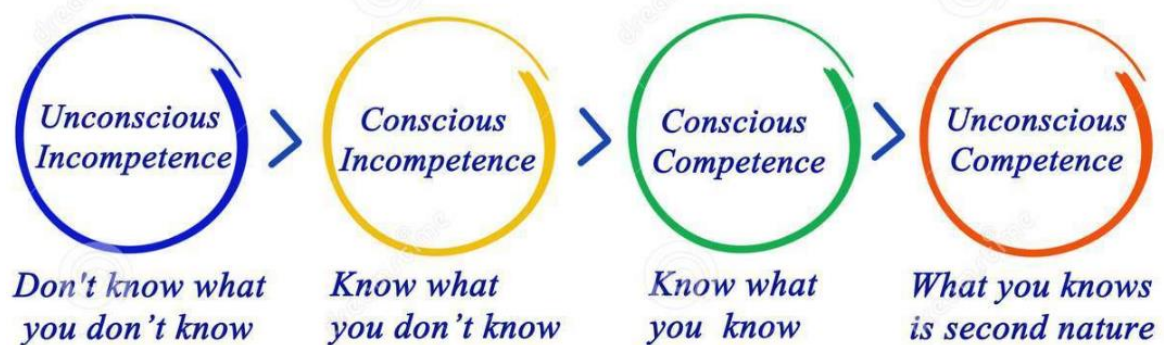
Figure 68: Design Thinking (design-thinking, 2019)

<u>**Appendix D**</u>

Learning:

Learning is focused on learning and learning styles, effectively use their minds and support the process of understanding, thinking, learning and memory. Learning is how a computer system uses a computer to understand a subject, topic, or subject that helps the user to collaborate.

Process of Learning

Unconscious Incompetence — Don't know what you don't know

Conscious Incompetence — Know what you don't know

Conscious Competence — Know what you know

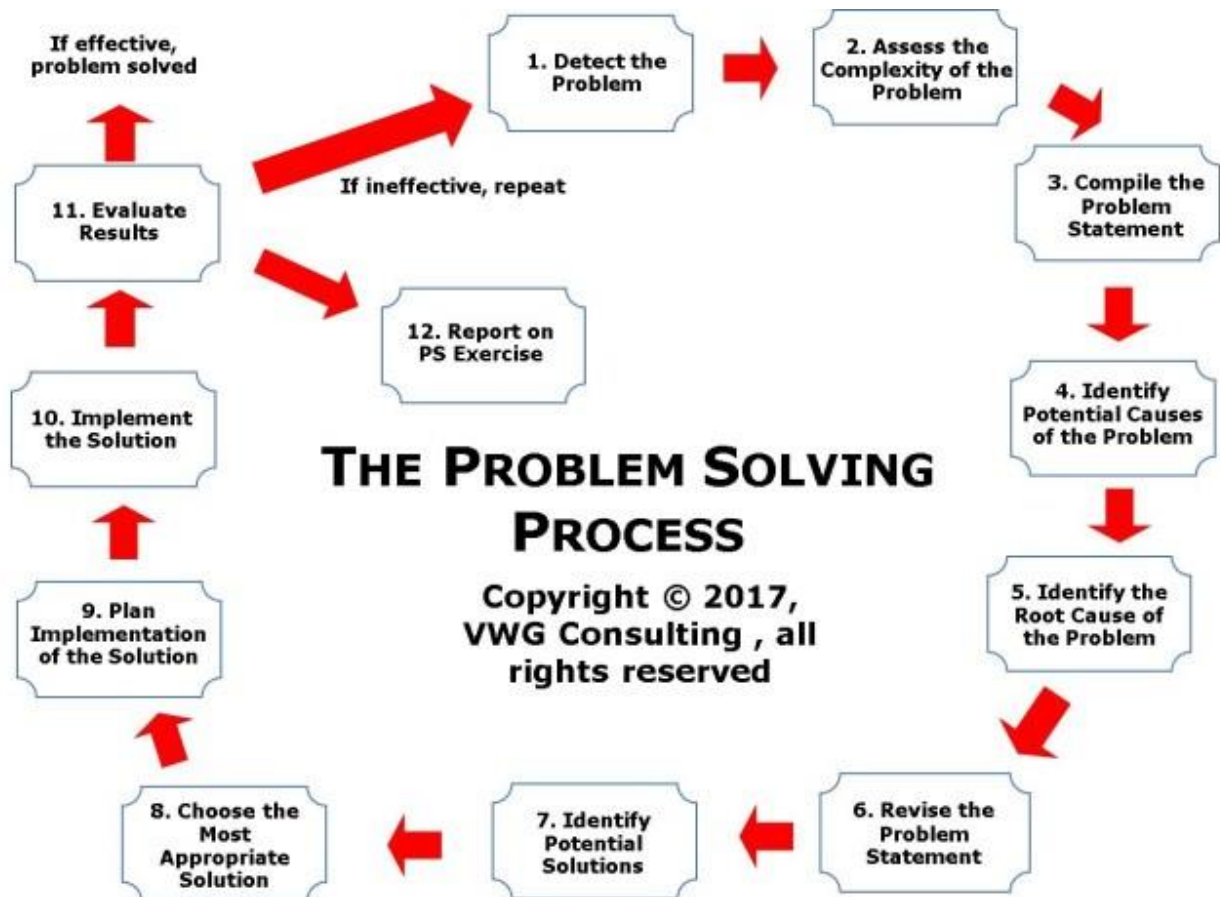Unconscious Competence — What you knows is second nature

 (learning process, 2019)

Experimental Learning Theory (ELT) provides a comprehensive view of the learning process and we know about the nature of learning, growth, and development as a whole. Examples of the adult learning and development process (University of Leicester, 2019).

In this image, as a designer, I noted the teaching method to make the app very friendly. So allow for large text, use the voice of the people and instruct the user step by step.

Problem solving:

The section plays an important role in problem-solving. Here people know what will happen and how it will be. Interaction designers can choose the best option for their users to use or easily customize. Algorithm, Heuristics, Trial-and-Error and Insight are the many types of strategies for the problem-solving section (press book, 2019).

THE PROBLEM SOLVING PROCESS

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rights reserved

1. Detect the Problem
2. Assess the Complexity of the Problem
3. Compile the Problem Statement
4. Identify Potential Causes of the Problem
5. Identify the Root Cause of the Problem
6. Revise the Problem Statement
7. Identify Potential Solutions
8. Choose the Most Appropriate Solution
9. Plan Implementation of the Solution
10. Implement the Solution
11. Evaluate Results
12. Report on PS Exercise

If effective, problem solved

If ineffective, repeat

(Problem solving process, 2019)

In this case, the order of the psychology course. Thus, the use of books and applications will also guide beginners using basic techniques and provide additional information such as users who only know the system level.

Appendix E

Theory of Action:

The theory to the development of the structure theory gulf of execution and gulf of the evolution of the development and, in the case thrown out by the user to simplify the methods used. The method is as follows.

Distributed Cognition:

The distribution cognition is an area of knowledge that supports knowledge learning but is divided into object, art, and environment. Using distributed computing, system analysis can bring together all of the physical components that have the opportunity to work (Mark perry, 2013).
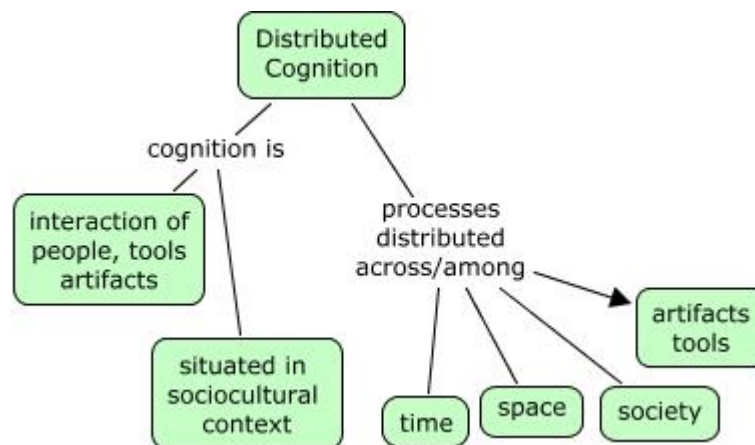
(distribution-cognition, 2019)

Distributed cognition helps to create a dialogue about a person's success in one's life and in human life.