

Wide Awake: Mobile app that predicts home fire and notifies the elderly when smoke/fire is detected – Assessment 3B

Patricia La Madrid
20002594

Western Sydney University, Australia
20002594@student.westernsydney.edu.au

INTRODUCTION AND BRIEF RECAP

Wide Awake is a fire prediction smartphone app that notifies users through a fire alarm, specifically the elderly and their carers, if the sensor and camera detect smoke or perceive the occurrence of fire in an elderly's house. This app serves as a warning alert system for future fires and allows users to prevent fires from happening. Furthermore, it will be released on both iOS and Android to help senior citizens be fire ready.

Motivation

The primary motivation behind Wide Awake app is the fire safety of the elderly. Should fires occur in their homes, older people whose ages range from 60 years or more (Cassidy et al., 2021, Salman et al., 2022) have greater possibilities of succumbing to death or having injuries due to poor health, whether mental or physical, or other behavioral reasons (Karemaker et al., 2021). It is therefore of paramount importance to maintain safety measures that can effectively help the elderly avoid death or injury by fire in their own houses (Karemaker et al., 2021). To be useful to senior citizens, fire alarms in their homes should be working properly and installed in the living room or bedroom where fires usually happen (Cassidy et al., 2021). Smartphones can help the elderly but they are usually designed for younger people; thus, senior citizens may have difficulty in navigating/using the user interface of such gadgets (Awan et al., 2021). The elderly can be confused and/or baffled by new technologies due to age-related problems, physical abilities, memory decline, mental models, cognitive or sensory functions, and the design of smartphone apps may not have considered their needs or requirements (Awan et al., 2021). The features of the Wide Awake app are the following: 1) Fire-and-smoke-detection which is based on video camera through the use of YOLOv2 model with Convolutional Neural Network that has a

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faster speed in image processing (Saponara et al., 2021) and sends real-time alert to the elderly, their carers, and the fire emergency department if the fire or smoke detected is not yet made known to them by the elderly for more than 2 minutes since the fire/smoke started; 2) Voice command feature can be activated on the Settings by the elderly to alert them using an alarm sound and voice that there is a fire/smoke in their house, 3) Audio detection feature detects sound of something being burned. This is similar to Google Nest feature as previously explained in 3A (Google Nest, n.d.); 4) Global positioning statement (GPS) – tracks the location of the elderly; 5) Messaging feature – sends the elderly six customised fire related questions per day to know their condition inside their homes. This is like the Snug Safety app feature explained in 3A as well (Snug Safe, n.d., Snug Safety, n.d.); and 6) Fire risk assessment (similar to Fire Guard app feature (Fire Guard, n.d.)) and prevention tips for evaluating their homes and pointers on how to avoid fire. Overall, this project aims to design a home-fire prediction smartphone app for the elderly using sensor and camera aided by Artificial Intelligence to protect the elderly from fires in their homes.

SCENARIO DESCRIPTION

Included in this report are four scenarios for the user interface of the elderly which include: 1) Fire Alert when there is a real fire, 2) Fire Alert when there is a false alarm, 3) Daily Check-in feature, and 4) Fire Risk Assessment and prevention tips. The user interface of the carer is different from the user interface of the elderly. In the scenarios described below, the elderly-user is assumed to be a female senior citizen named Maria.

Scenario 1: Fire Alert – Real Fire Occurrence

In this scenario, the user receives a notification of a fire in his house. She is alerted of imminent danger so she needs to evacuate; she has to go to the nearest exit, then proceed to the nearest emergency assembly area where she determines if there is a real fire or just a false alarm. If the fire is real and she arrives at the assembly area in less than two minutes, she calls the fire service. Otherwise, if it took her a longer time to get there, the app automatically calls the fire service. The elderly also checks the triggered alarm in her house to know the smoke level and temperature of the area where the fire is.

Scenario 2: Fire Alert – False Alarm Occurrence

This scenario is similar to scenario 1 with respect to the receipt of a fire notification by the elderly until she

reaches the nearest emergency assembly area. The difference lies in the scenario that when she checks the status of the fire, there is no actual fire so she tests the sensor and camera to find out if these are functional. If these are not working, she calls the sensor and camera technician.

Scenario 3: Daily Check-in feature

In this scenario, the elderly receives notification for daily check-in every 7:00 AM. She has to press the check-in button to answer six questions regarding fire safety in her home and she is reminded to keep a fire-safe environment at all times. She has to answer all the questions on or before 11:30 AM each day; if she fails to do so, somebody from the Wide Awake app will call her.

Scenario 4: Fire Risk Assessment and Prevention Tips

In this scenario, the user clicks the MORE tab for her to go to Fire Risk Assessment and Prevention Tips. If she finds the Fire Risk Assessment Page, she has to answer various General Fire Safety Questions and Process Fire Safety Questions. General Fire Safety Questions deal with Means of Detection, Means of Escape, and Management. On the other hand, Process Fire Safety Questions are focused on Ignition and Fuel. She can answer the questions with N/A, Unknown, Yes, No, or 0 Findings. If she completes answering the questions, the Status Page will appear showing how completely she answered the questions, date of creation and last date the Risk Assessment Page was modified. For the Fire Prevention Tips, she gets information on how fires can be prevented.

WIREFRAME/DESIGN CONCEPTUALISATION

The accessibility of mobile applications to senior citizens present challenges that need to be addressed like the difficulties faced by older people about user interfaces and the suggested remedies to these issues (Dodd et al., 2017). The fact remains that older people have requirements that differ from those of the younger users. and these need to be considered to make these interfaces acceptable and usable to the elderly (Dodd et al., 2017).

Scenario 1: Fire Alert – Real Fire Occurrence

Figure 1.1 in the appendix shows a fire alert with a simple interface with visible large font size text, large icons, and soft colours. The push button menu or navigational box design is focused on intuitive control elements showing icons that represent the action (Dodd et al., 2017) that are seen on Figures 1.2 to 1.10 of the appendix. The blue glow highlight lets the elderly know what tab she is located (Li and Luximon, 2020). That tab/navigational box/push button menu includes Overview, Layout, Sensor and Camera, Contacts, Daily Check-in and More. The wireframing of these screens are intended for the elderly; thus, they should be simple and easy to navigate (Yusof et al., 2014), have flat menu-structure to enhance the senior citizen's navigation behaviour (Ziefle and Bay, 2006), and menu components that are easily understood with familiar and larger icons, clear fonts and bigger text (Abdullah and Abdul Hamid, 2019, Hoehle et al., 2016, Leung et al., 2011). Older people are likely to suffer

vision problems from overly bright colors (Azir Rezha et al., 2014) so softer colors should be used for senior citizen apps (Abdullah and Abdul Hamid, 2019). Lorenz and Oppermann (2009) explained that for readability, bright gray or orange should be used as the background color and black or white for the font color because they are the most suitable colors for senior citizens. In order that the elderly can manage to reach a safe place away from the burning home, consistent flow of steps should be used as guide, no need for password, and text/sentences are short and easy to comprehend. As a summary, the following guidelines are used from Li and Luximon (2020) to these wireframes: 1) visual design – clear and visible buttons/fonts/icons for menu components, readable texts, big titles, and use of proper colours 2) ease of understanding – simple and insightful icons, menus, and content, 3) navigation and interaction – users are able to know their location in the interface.

Scenario 2: Fire Alert – False Alarm Occurrence

Figures 2.1 to 2.10 of the appendix shows this scenario. These wireframes have been developed considering the user, and that is the elderly. As in scenario 1, it is easy to navigate, simple, easily understood with familiar icons, softer colours, and large font size for text (Yusof et al., 2014), consistent flow of steps as guide, no need for password, and text/sentences are not lengthy but easily understood. The guidelines used for these wireframes are similar to the guidelines used in Scenario 1.

Scenario 3: Daily Check-in feature

Figures 3.1 to 3.10 of the appendix presents this scenario. In this wireframe, the elderly cannot miss important steps to follow because the texts are written in large letters/font; the instructions are clear and simple which can readily be understood by any reader even the elderly, and softer colours (Yusof et al., 2014). The following guidelines are used from Li and Luximon (2020) to these wireframes: 1) visual design – readable texts for the content, clear and visible fonts/buttons/icons for menu components, large font for the titles, and use of proper colours, 2) ease of understanding – simple and meaningful icons, content and menus, 3) navigation and interaction – users are able to know their location in the interface, this feature creates a habit for the elderly,

Scenario 4: Fire Risk Assessment and Prevention Tips

Figures 4.1 to 4.10 of the appendix displays this scenario. In this interface, the letters are big, the texts can readily be understood, the questions are simple, soft colours are used (Yusof et al., 2014) and percentages of completion of the questions asked are presented on the Fire Risk Assessment itself so the elderly gets to know how relevant and complete her answers are to the questions. In the Prevention Tips, the letters are also in big font, information on how to prevent fire are shared to the elderly in simple language. The following guidelines are used from Li and Luximon (2020) these wireframes: 1) visual design – readable texts for the content, clear and visible fonts/buttons/icons for menu components, large font for the titles, and use of proper colours, 2) ease of understanding – simple and meaningful icons, content and menus, 3) navigation and interaction – users are able

to know their location in the interface, provides tutorials for the navigation of the app 4) support for habits - this feature creates a habit for the elderly to check and respond to daily messages from the app to ensure her safety.

DESIGN RATIONALE

This project intends to make the mobile application elderly-friendly; thus, matching the app's design interface with the elderly's needs, requirements, or expectations. Their preferences on what should appear on the user interface cannot be ignored. Such matters include: the length and size of the text; graphics; kinds, locations and size of icons; and color schemes for contents and background. Behind these considerations are reasons given by researchers which usually point to older people's mental and physical state including their poor or failing vision due to old age.

The following elements are used in Wide Awake's implementation and they are the following:

1) Simplicity - relates to easy recall of undertakings to be done (Abdul Razak et al.). The design of the app is easy to understand, plain (Sulaiman and Sohaimi, Yusof et al., 2014, Abdullah and Abdul Hamid, 2019, Ziefle and Bay, 2006, Norman, 1995), use of minimum words as much as possible (Sulaiman and Sohaimi, Lorenz and Oppermann, 2009) and the commands used are simple, not complex, to avoid confusion on the part of the user (Abdul Razak et al.). For the elderly, usage of long-term memory which is linked to previous experiences is more helpful than short-term memory which is related to discovering something different/new (Abdul Razak et al.). Thus, user interface should apply graphics or functions that the elderly can relate to or identify with (Abdul Razak et al.). Using pictures, photographs and a combination of both for menu icon for the elderly proved that even with decreasing ability to see, many old people are inclined to read the menu label so the menu label should use simple icons that could readily be understood by the user (Restyandito et al., Li and Luximon, 2020). Highlighted in this design are important menu buttons that could help the elderly as they are represented by simple familiar pictorial icons labelled with text in large font size appropriate for the elderly's vision (Restyandito et al.). Due to poor or declining visual ability, older adults prefer the following: black and bigger font of text; colored text and graphics to highlight significant data; soft color which brings joy to the elderly using the application; and clear and large graphics, buttons and icons so that senior citizens can click them error-free (Abdullah and Abdul Hamid, 2019, Azir Rezha et al., 2014).

2) Learnability – The user interface is designed based on the ability of the user to understand how the mobile phone functions/operates (Ji et al., 2006, Norman, 1995). A study had been conducted on how older people navigate mobile interfaces while they determine usability challenges at the same time (Li and Luximon, 2020). Results showed that the respondents/participants had better chances of understanding the contents rather than

the menus and icons of the navigation design and this finding can be a valuable consideration in the development of elderly-friendly mobile application (Li and Luximon, 2020, Dodd et al., 2017).

3) Consistency - The design of the user interface is dependable, meaning, it would not create any confusion when the elderly uses her mobile phone (Ji et al., 2006, Norman, 1995). In one study intended to find out the accessibility of social media mobile application interface for the elderly, results showed that what can be seen could easily be dealt with as compared with mental or intellectual issues (Chang et al.). Proposed guidelines by the research would focus on color schemes, size of font, space and button of app (Chang et al.). Cognitive issues still needed further study for the necessary guidelines (Chang et al.).

4) Structure Principle - The user interface is structured clearly, where similar/related things are arranged together and those that are not connected are not put together (Ji et al., 2006). Also, reliable models that are obvious and can easily be identified are used (Ji et al., 2006). Brightness, colour, and font are primarily considered in the design of the app since they influence the success and effortless smartphone usage of senior citizens (Preeyanont, 2017). It need not be emphasized that as people grow old, they may have impaired eyesight or distorted vision; thus, viewing contents on the screen might take much longer time or even result in wrong interpretations (Preeyanont, 2017).

Overall, the author of this paper desires to create an app that can protect old people and spare them from injuries, near-death experiences and even death itself when the monster known as fire visits their homes.

CONCLUSION AND FUTURE WORK

Using wireframes is an effective method to determine guidelines and summarize content in the process of designing mobile apps. To help the elderly protect himself when a fire occurs in his home or in his neighbourhood, an assessment of the tasks and wireframes of our proposed app has been made. We conclude that the app can be of great value to the elderly as its development/design considered the needs and requirements of older people, the user. The age, mental capacity, physical condition, and the environment of the user as well as his limited knowledge of current technologies and his experience thereof played important roles in coming up with this app.

Future advancement of technologies can still enhance the design and use of Wide Awake app.

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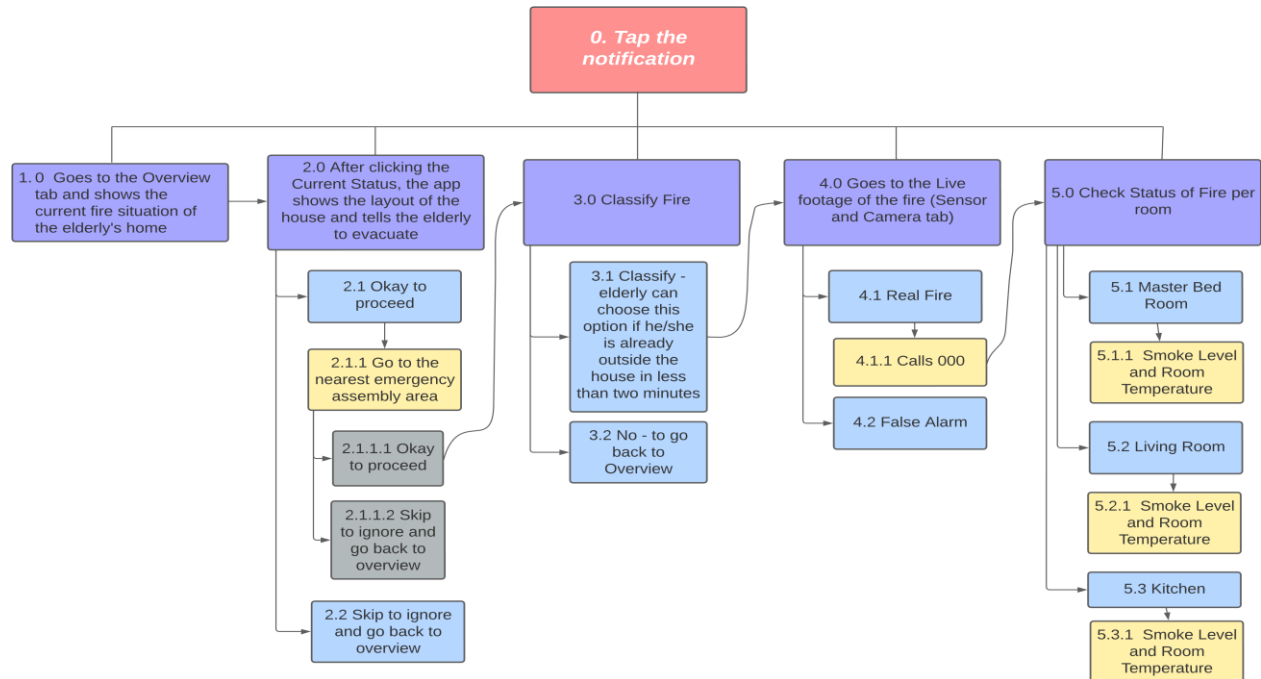
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Appendix

Hierarchical Task Analysis

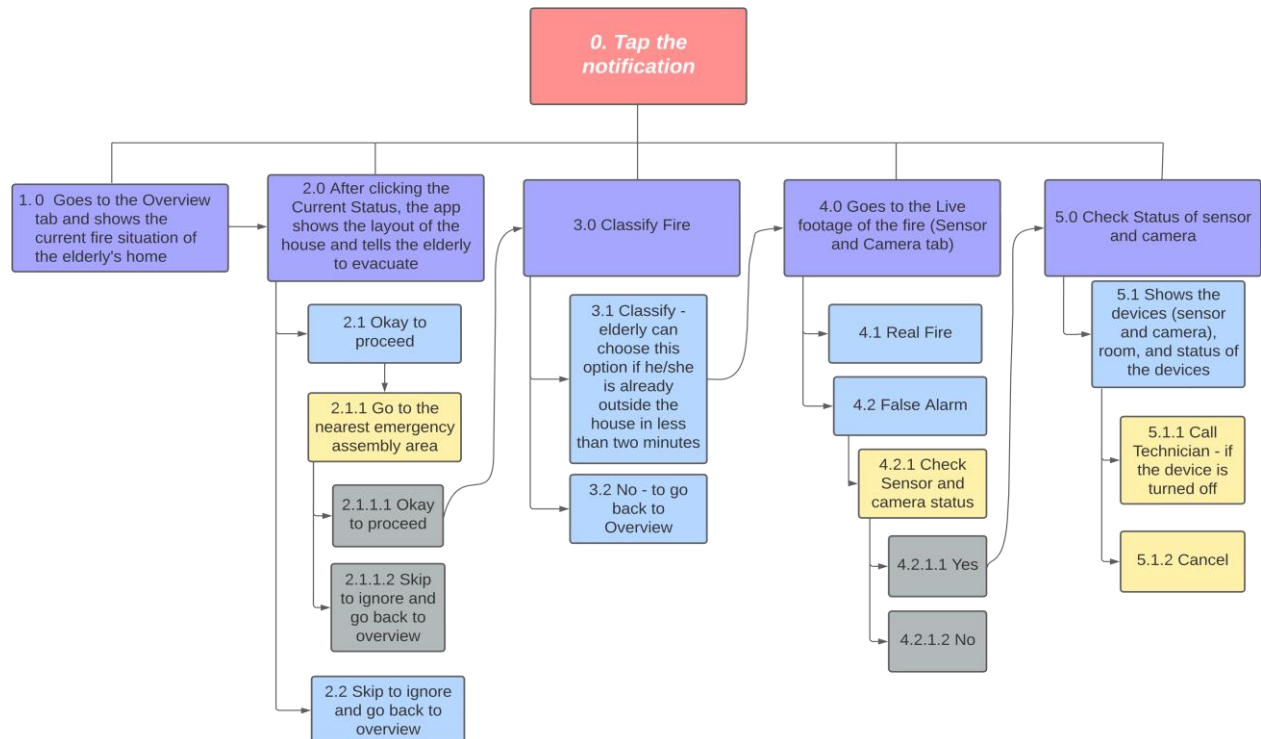
Scenario 1: Fire Alert – Real Fire Occurrence

Figure 0.1:



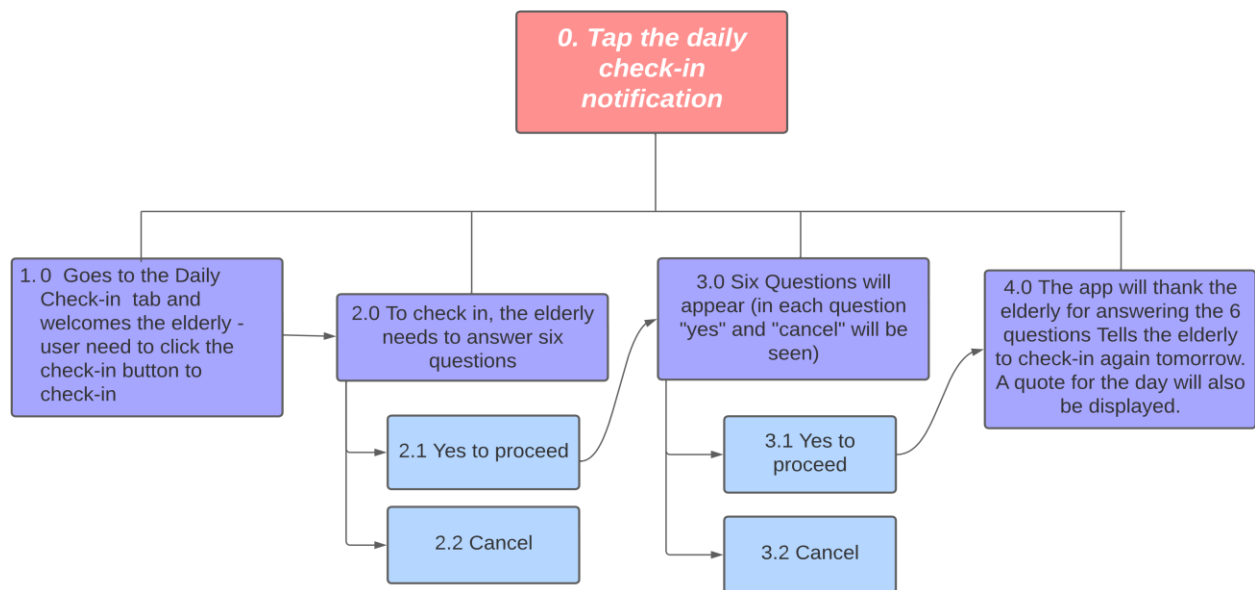
Scenario 2: Fire Alert – False Alarm

Figure 0.2:



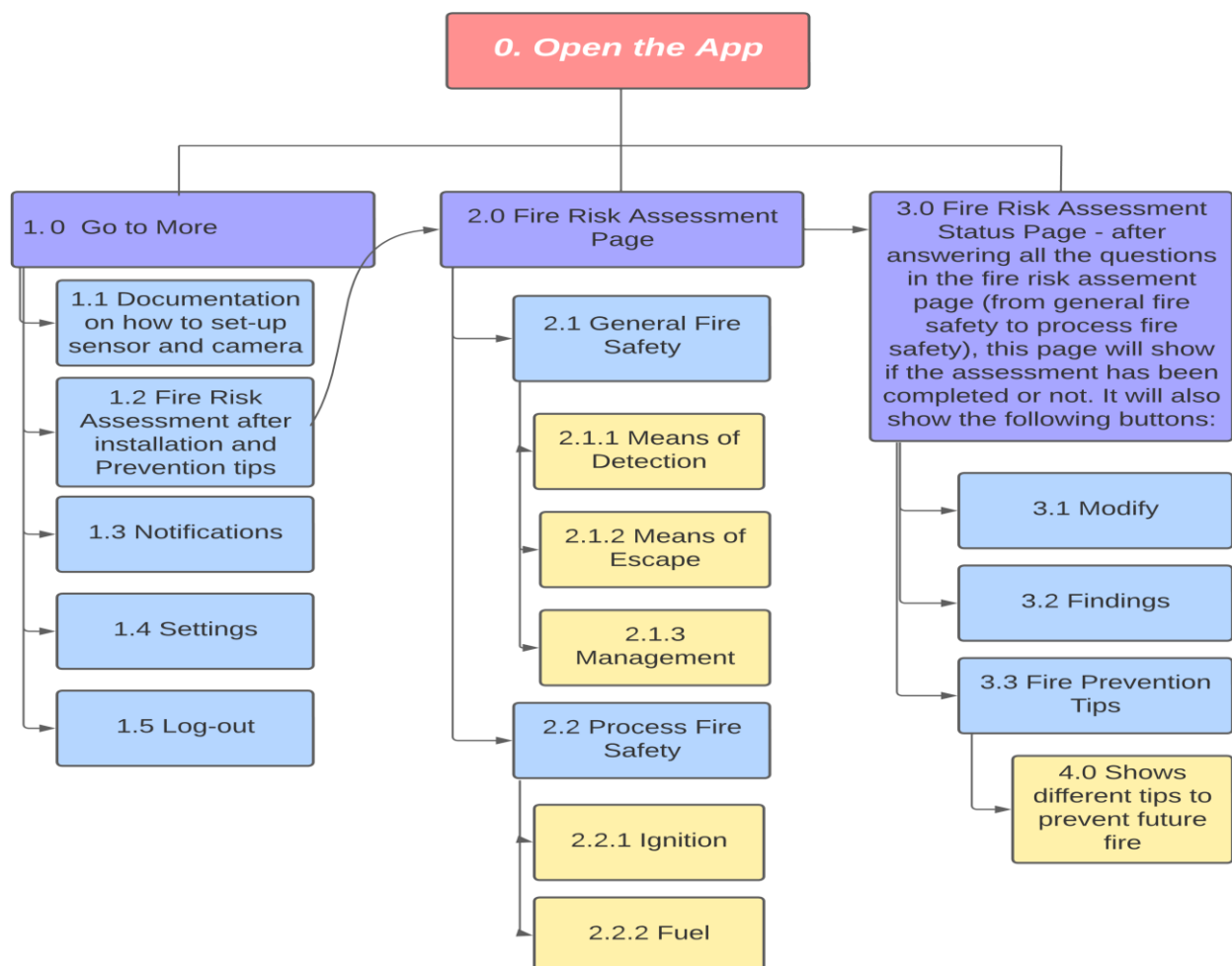
Scenario 3: Daily Check-in Messaging Feature

Figure 0.3:



Scenario 4: Fire Risk Assessment and Fire Prevention Tips

Figure 0.4:



Wireframes

Scenario 1: Fire Alert – Real Fire Occurrence

Figure 1.1, Figure 1.2, Figure 1.3:

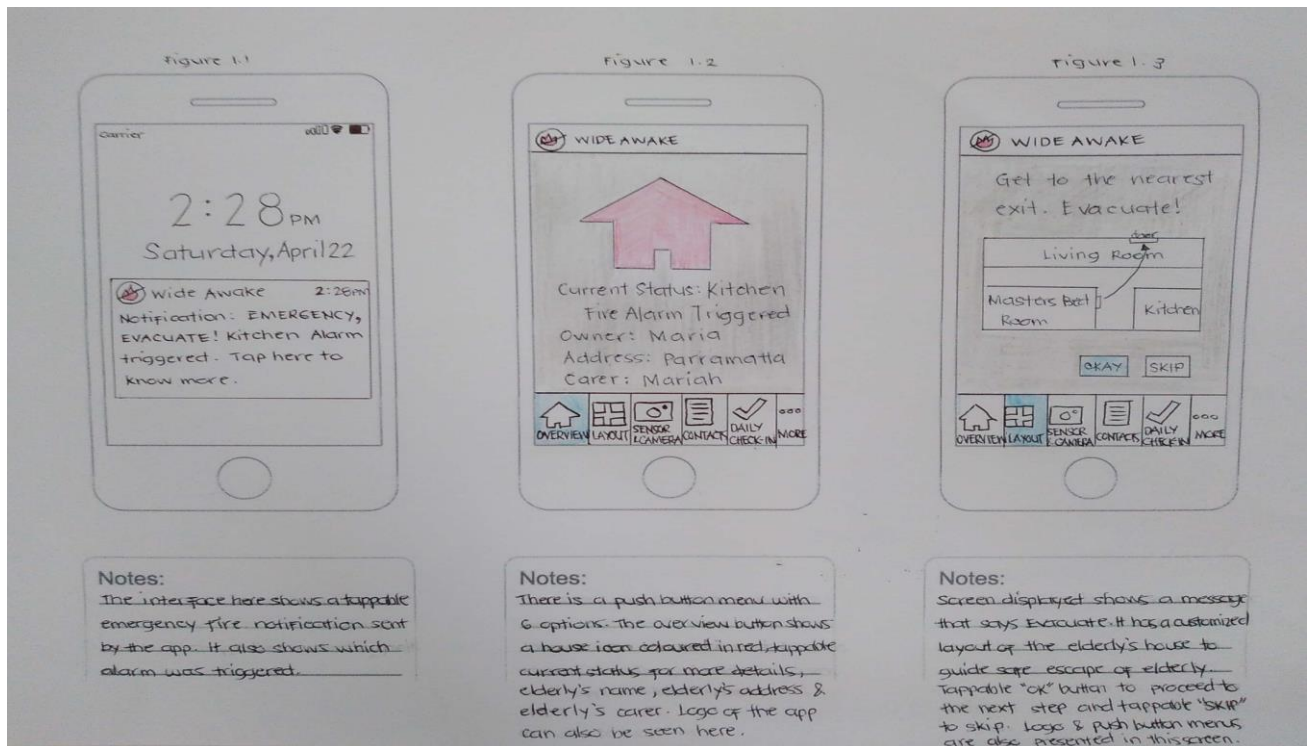


Figure 1.4, Figure 1.5, Figure 1.6:

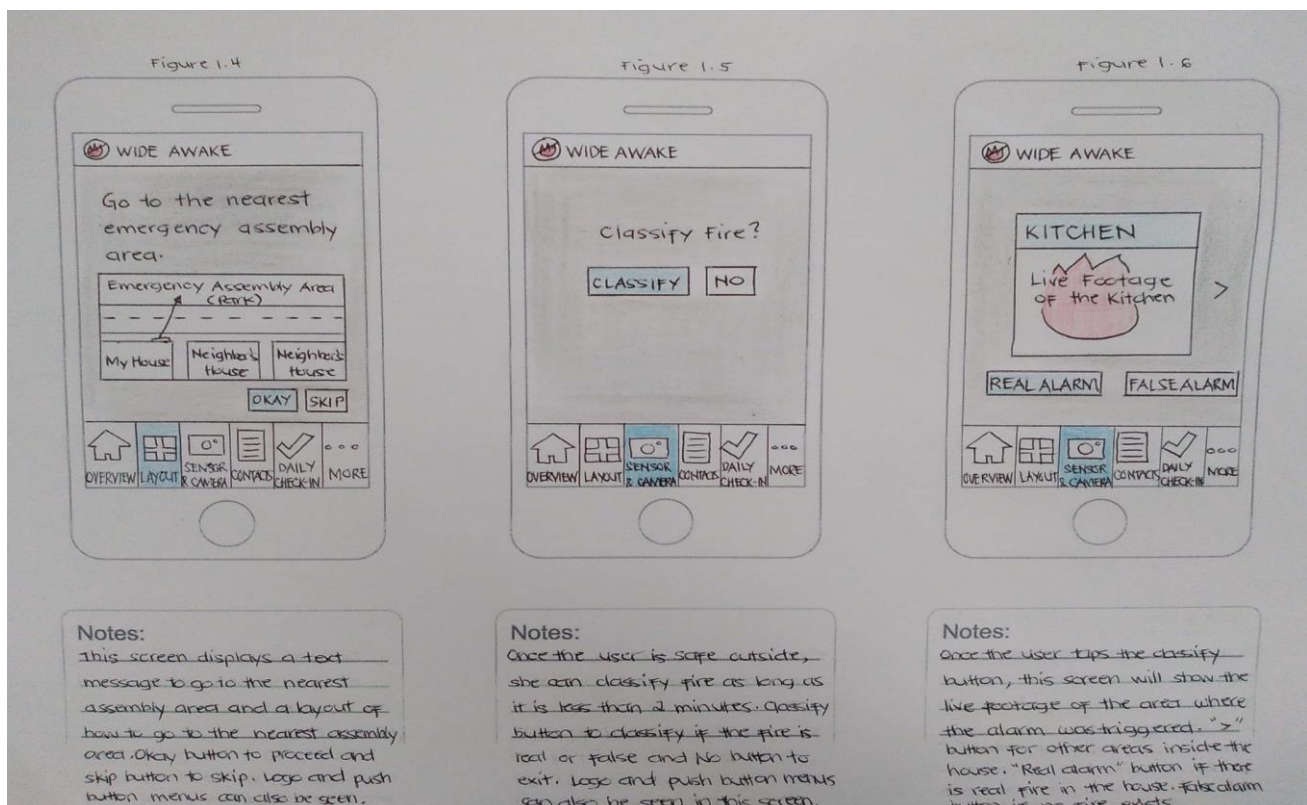
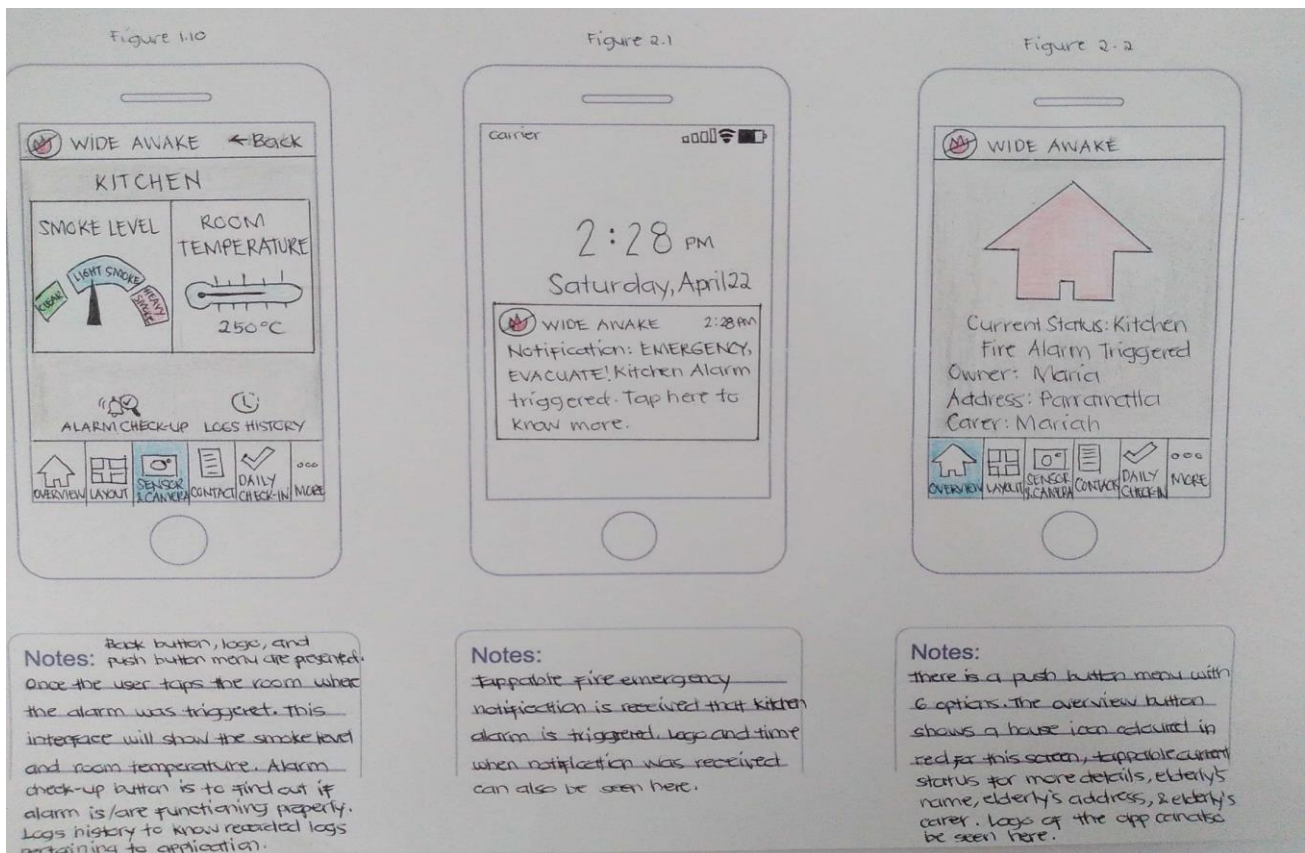
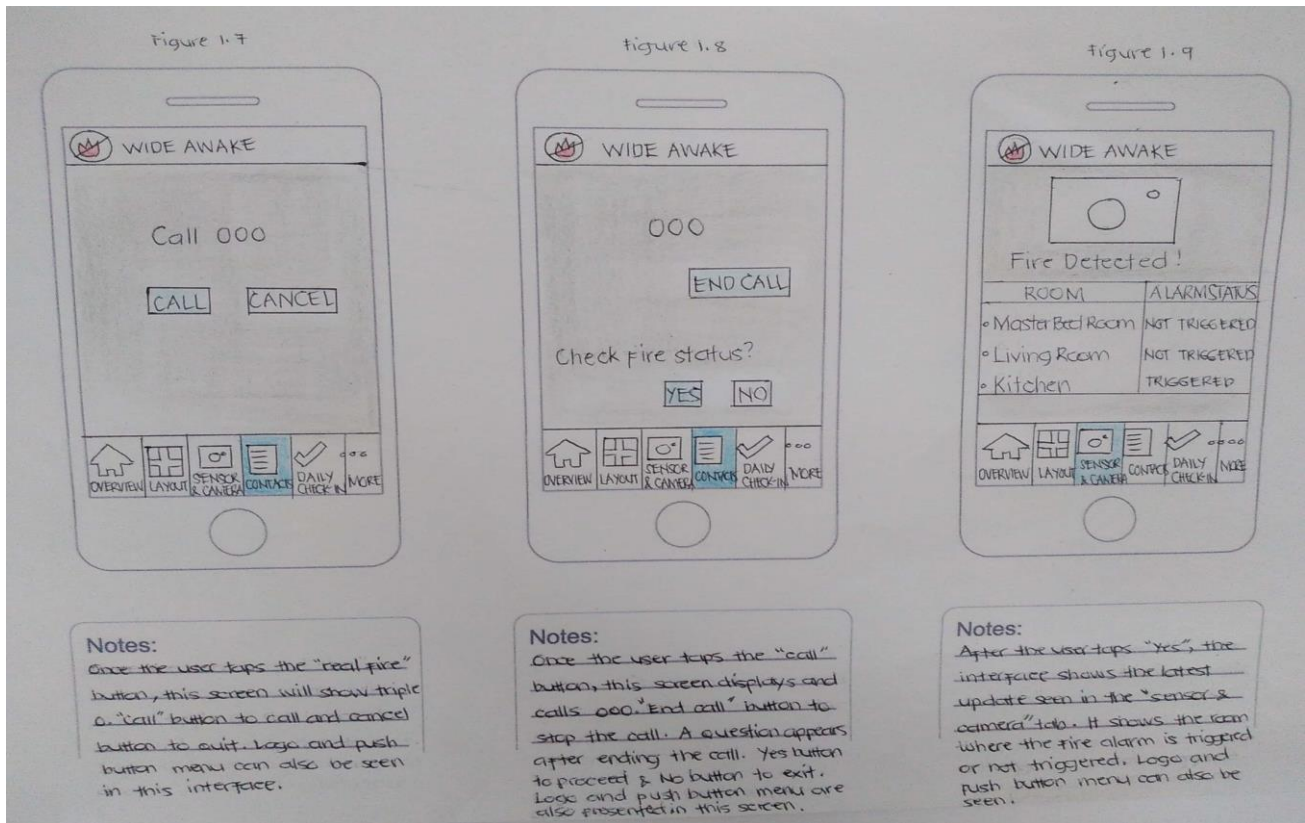


Figure 1.7, Figure 1.8, Figure 1.9, Figure 1.10:



Scenario 2: Fire Alert – False Alarm

Figure 2.1, Figure 2.2:

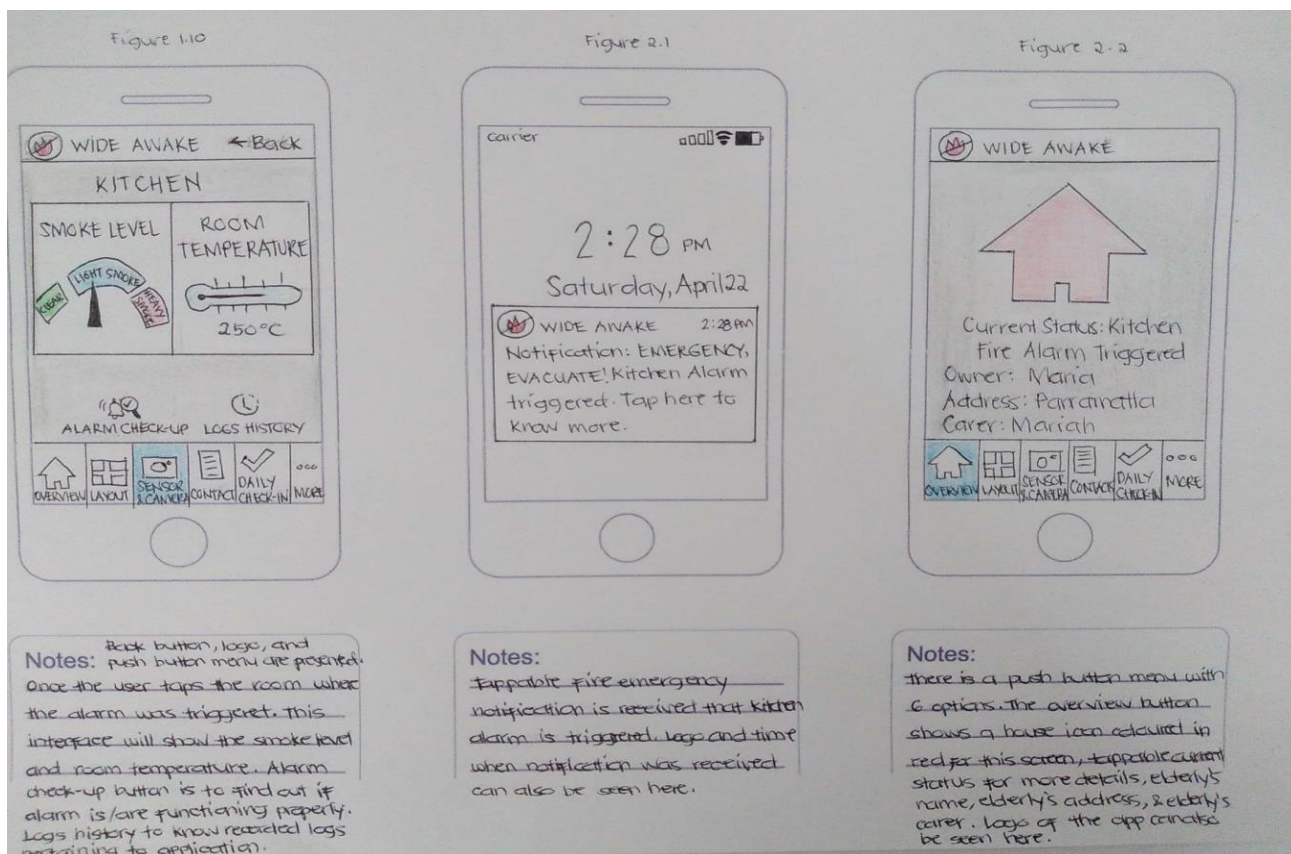


Figure 2.3, Figure 2.4, Figure 2.5:

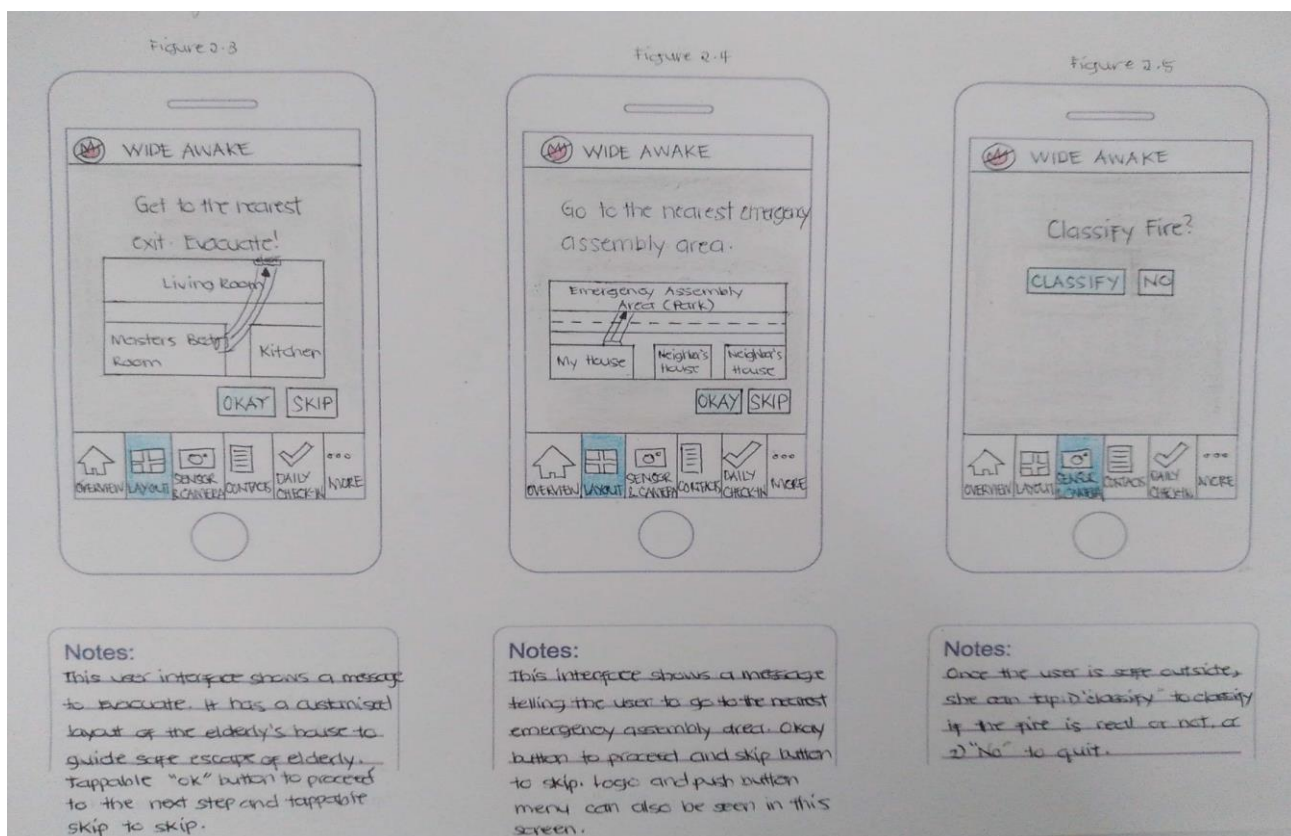


Figure 2.6, Figure 2.7, Figure 2.8:

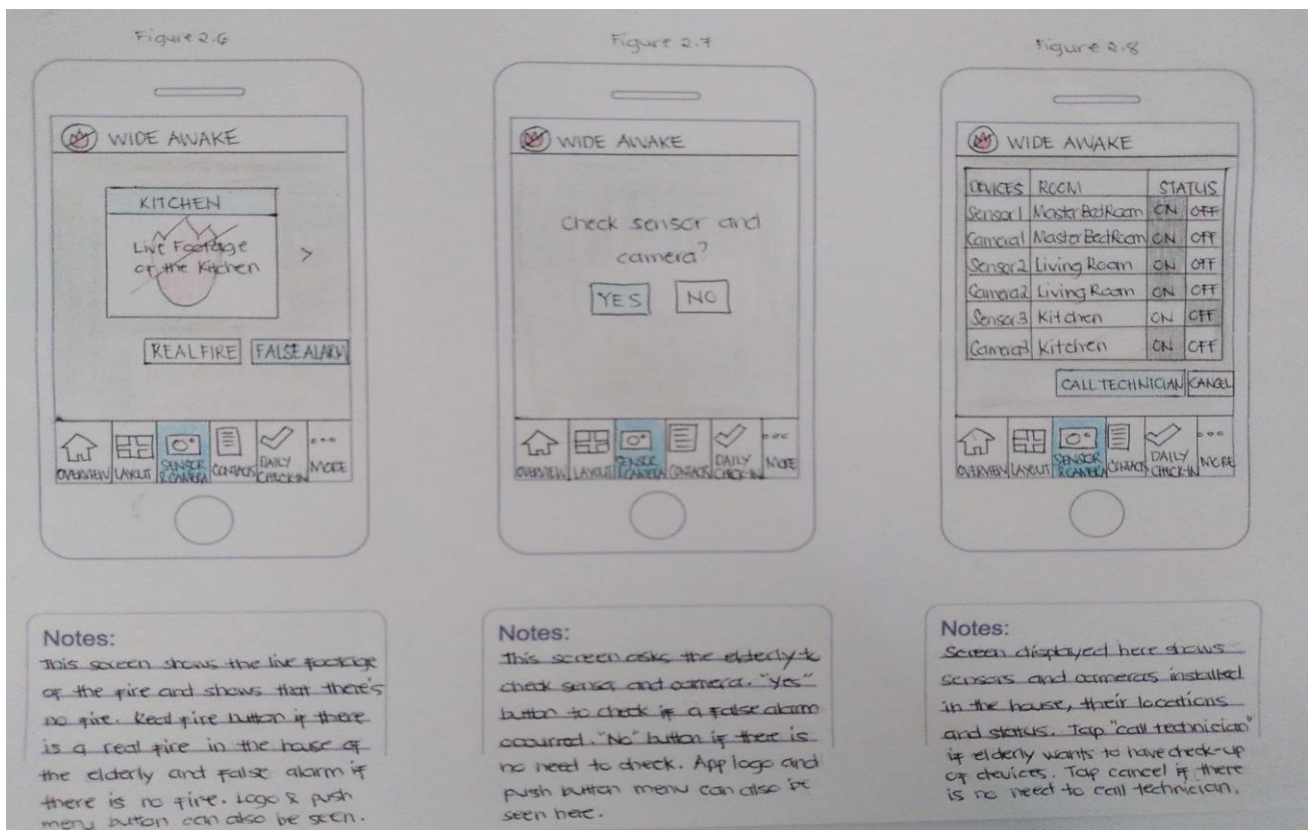
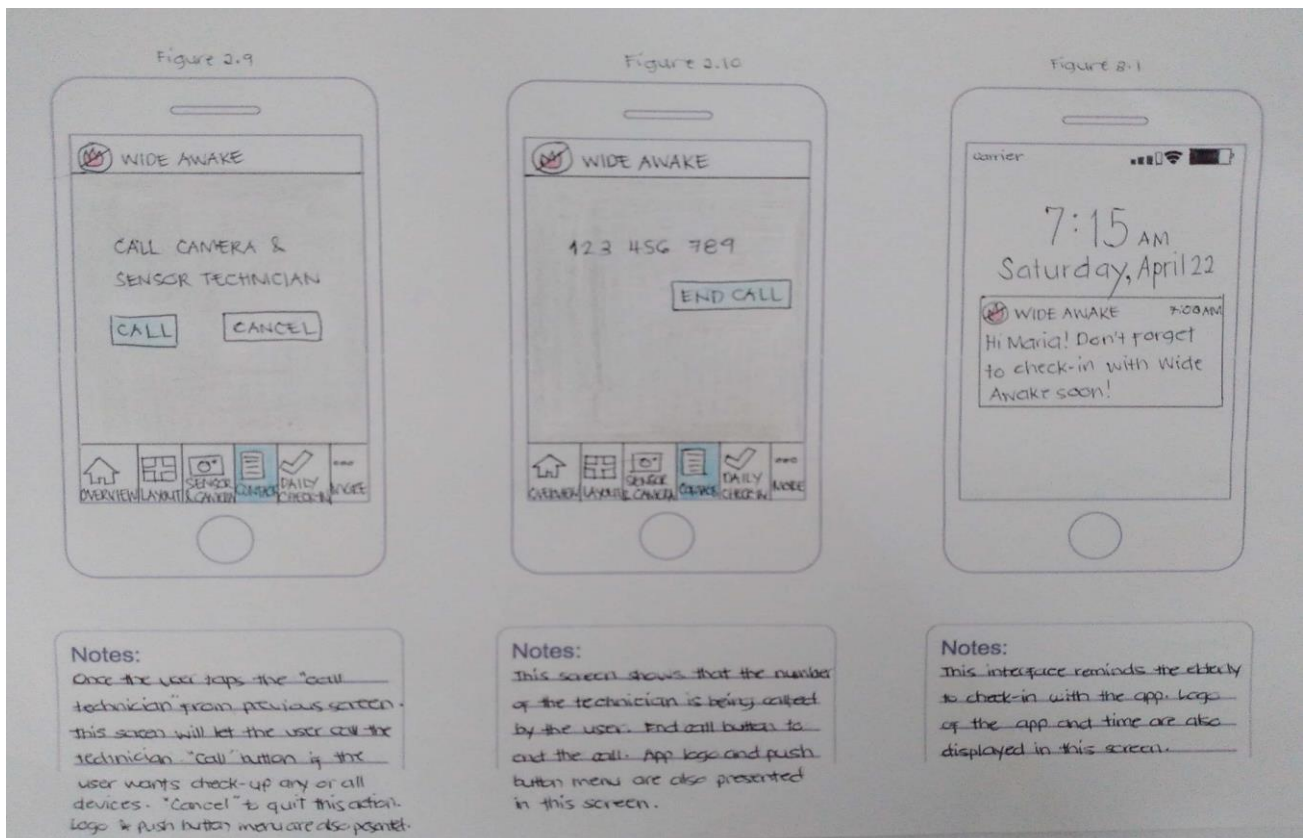


Figure 2.9, Figure 2.10:



Scenario 3: Daily Check-in Messaging Feature

Figure 3.1, Figure 3.2, Figure 3.3, Figure 3.4:

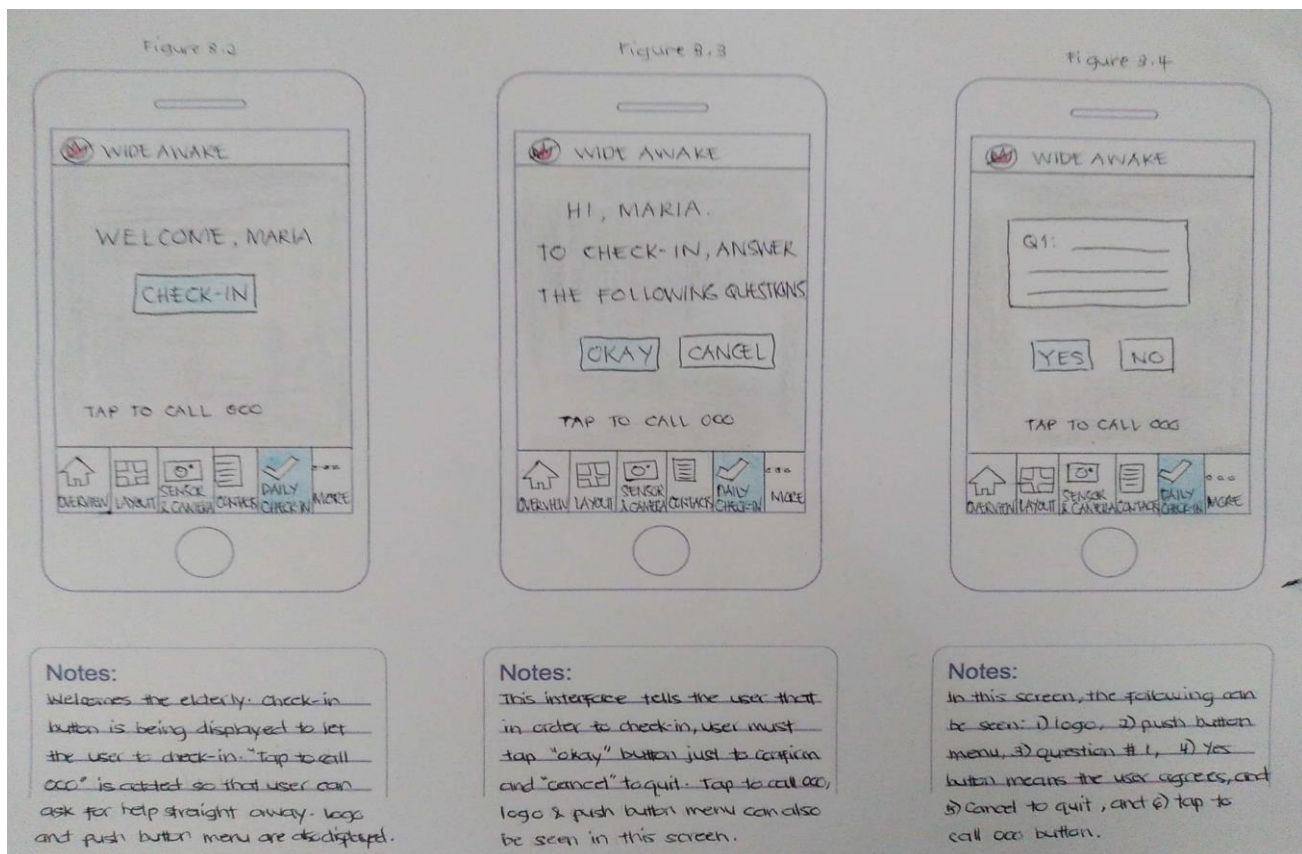
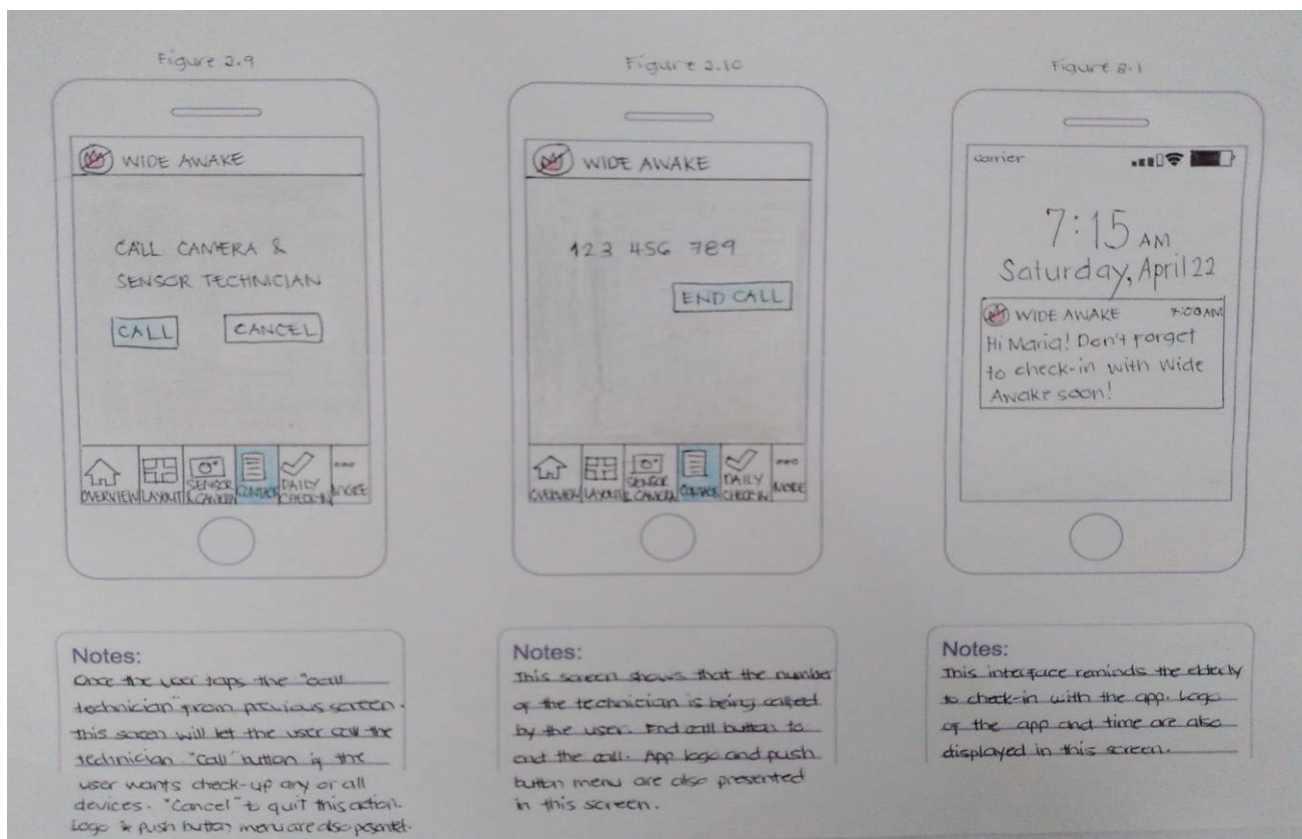


Figure 3.5, Figure 3.6, Figure 3.7:

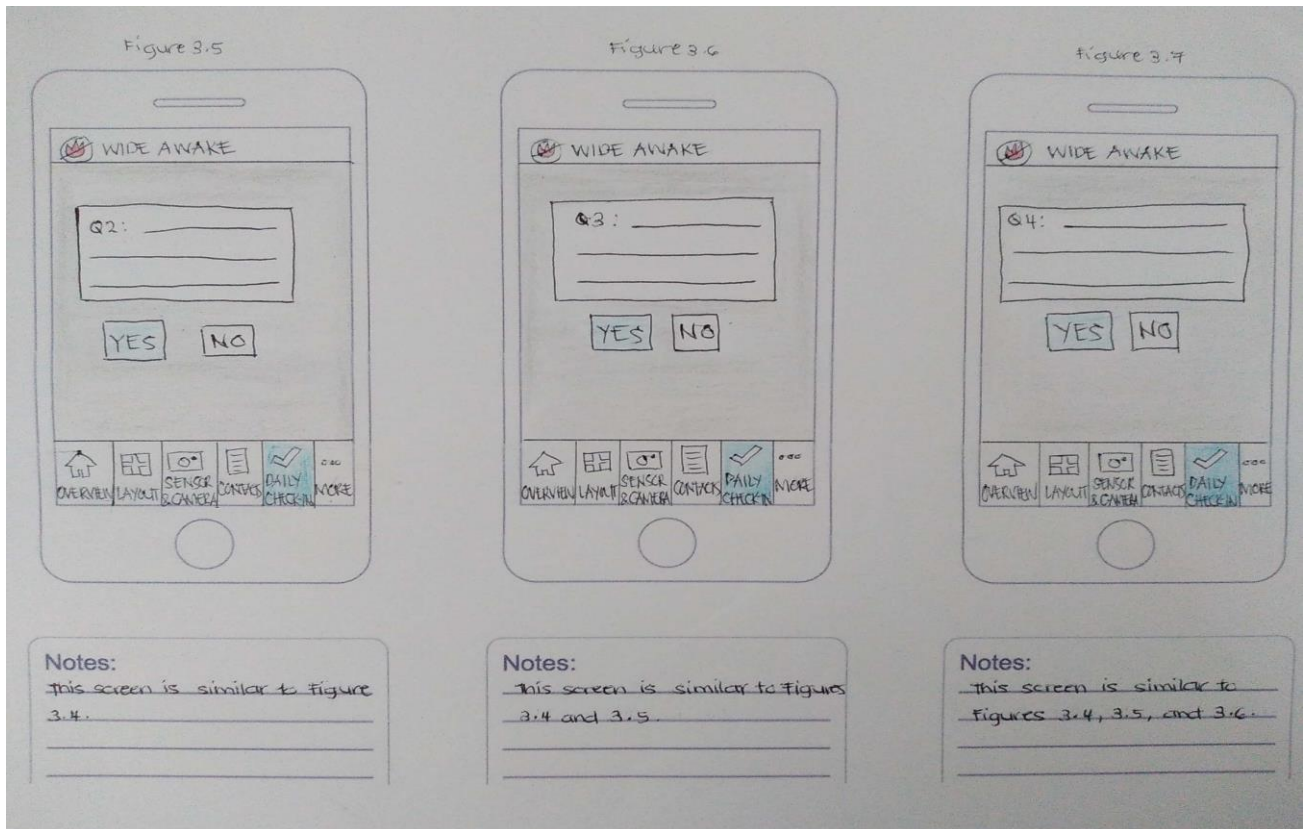
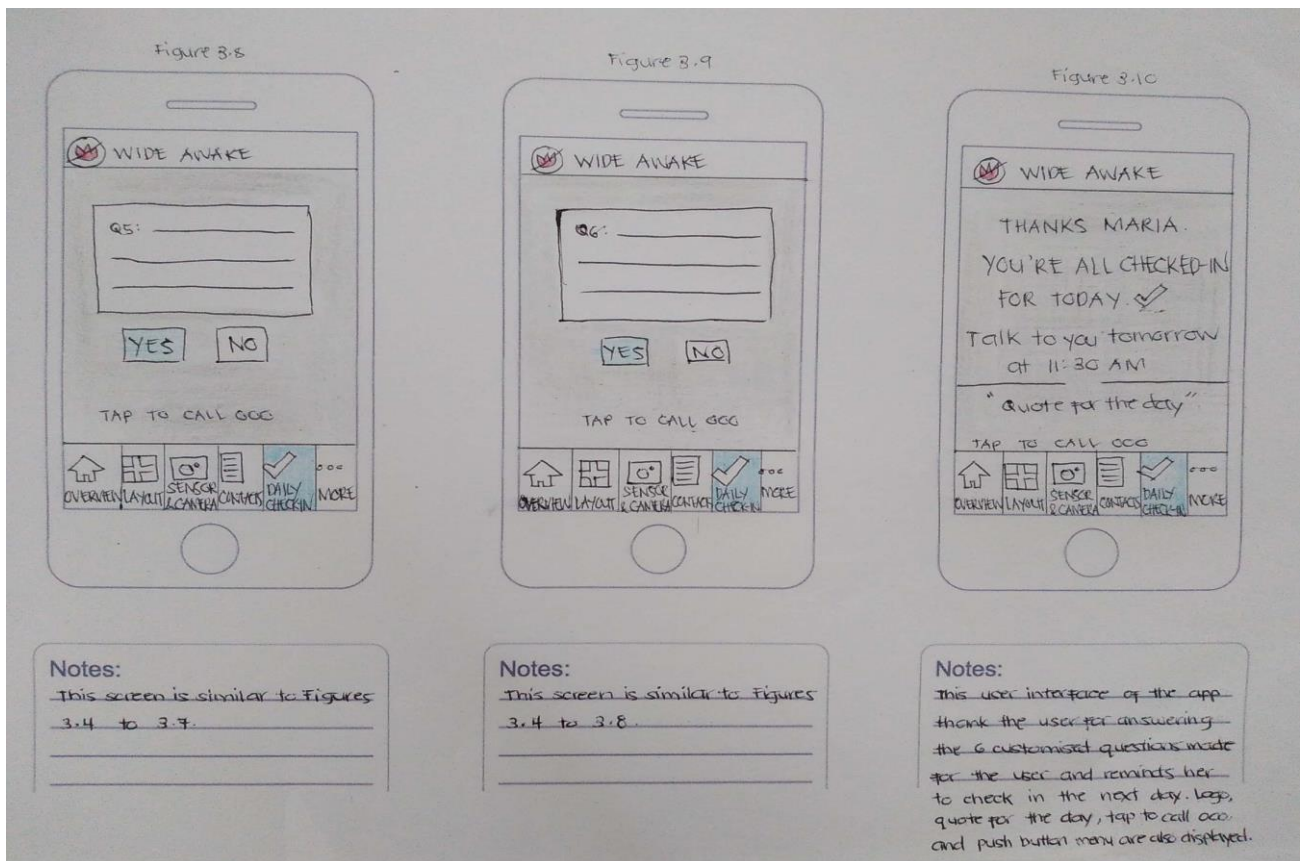


Figure 3.8, Figure 3.9, Figure 3.10:



Scenario 4: Fire Risk Assessment and Fire Prevention Tips

Figure 4.1, Figure 4.2, Figure 4.3:

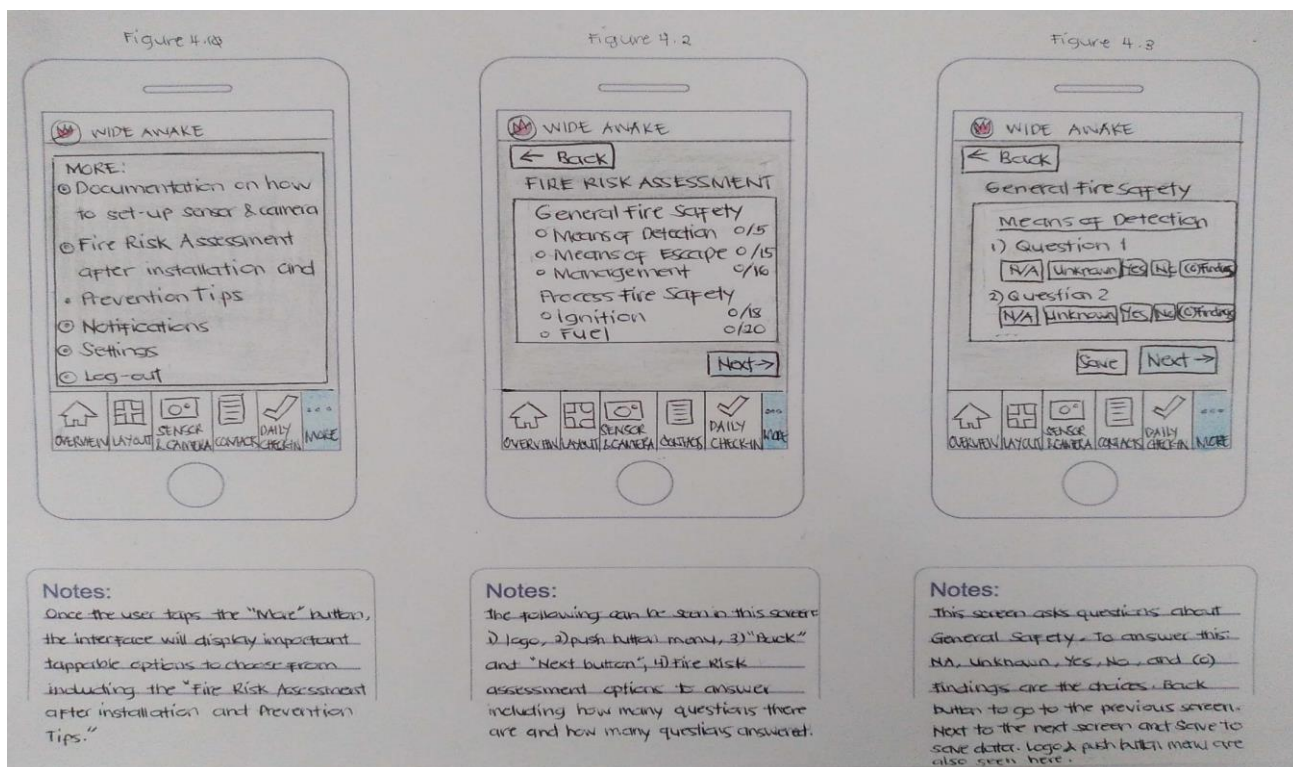


Figure 4.4, Figure 4.5, Figure 4.6:

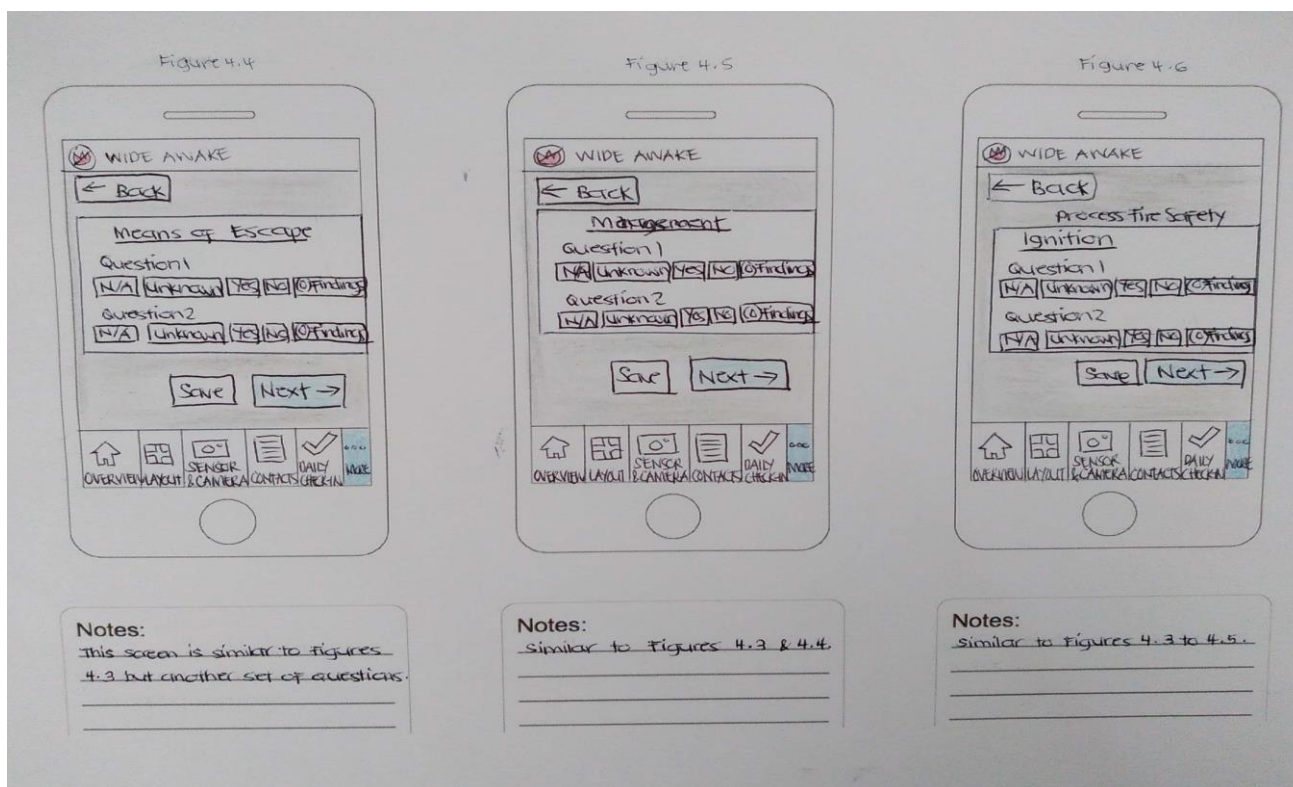


Figure 4.7, Figure 4.8, Figure 4.9:

