Lab 1 – Thought Locker Product Description

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Table of Contents

1 Introduction 3

2 Product Description 4
   2.1 Key Product Features and Capabilities
   2.2 Major Components (Hardware/Software) 5

3 Identification of Case Study 7

4 Product Prototype Description 8
   4.1 Prototype Architecture (Hardware/Software) 8
   4.2 Prototype Features and Capabilities 9
   4.3 Prototype Development Challenges 10

5 Glossary 11

6 References 15

List of Figures

Figure 1: Thought Locker Major Functional Component Diagram 6

Figure 2: Thought Locker Prototype Major Functional Components Diagram 9

List of Tables

Table 1: Thought Locker RWP vs. Prototype Features 10
1 Introduction

Dementia is a progressive neurological disorder that affects millions of people worldwide. In the United States alone, it is estimated that 1 in 10 individuals will be affected by this debilitating disorder, which presents memory and behavioral issues that directly impact the independence of one's daily life (Alzheimer's Disease International, 2020).

Dementia can be categorized into three main sections: mild, moderate, and severe. 50.4% of diagnosed cases are mild, which present various changes in characteristics such as mood, memory problems, and difficulty thinking things through. Although these issues are present in those with mild dementia, they can usually function without the need for outside support. The 30.3% diagnosed with moderate dementia usually retain a caregiver at least part-time as issues advance. Moderate dementia presents its own set of symptoms, including paranoia, anxiety, depression, and worsening memory issues. 19.3% of cases fall into the severe category. These cases require full-time support and are incapable of living independently (Alzheimer's Disease International, 2020).

As the symptoms of dementia worsen, individuals may require increasing levels of assistance from family members or outside sources. However, patients often prefer to maintain their independence as much as possible, particularly in the earlier stages of the disease. This can be challenging for caregivers, who may struggle to balance the needs of their loved ones with their own needs and responsibilities.

Despite the significant challenges posed by dementia, new technologies such as Thought Locker, a mobile assistant designed to help dementia patients maintain their independence by providing reminders, tracking item locations, monitoring movements, and providing analytics that can be shared with caregivers, are tackling the situation. By using Thought Locker, patients
can enjoy greater independence, and caregivers can have greater peace of mind knowing that their loved ones are being monitored and supported.

2 Thought Locker Product Description

The Thought Locker application is a comprehensive mobile application designed to support patients with dementia and their caregivers. It provides a customizable user experience that helps patients develop a sense of independence while giving family members and caregivers the tools to monitor and assist their loved ones.

2.1 Key Product Features and Capabilities

Thought Locker is an application that offers a range of features to support the independence of patients with dementia. The application is compatible with IOS and Android mobile operating systems which leads to a seamless transition between devices owned by the patient and caregiver and the web application. The convenience of the web and being available on the major mobile operating systems leads to a platform that is ready to give the tools to help maintain patient independence and help to support and monitor loved ones.

Thought Locker utilizes various native calendar applications to provide a range of scheduling and tasking notifications throughout the day. The application provides daily reminders of programmed task to be completed by the patient. Through this same notification system, the application will display multiple reminders for late tasks and notify the Caregiver so that the patient remains on schedule and safe. A task manager ensures the patient knows exactly what task need to be done. When they are complete, the patient checks off on it and a notification is sent to the caregiver.

In addition to the calendar application Thought Locker has a feature called Item Finder. Thought Locker uses Bluetooth pairing to locate and track tags which helps to locate misplaced
items. Also, features such as names, pictures and displaying the last known location help ensure the correct item is found. Just tap and the items verified as found. If not, notifications are sent to the caregiver to ensure medications and important items are not overlooked.

Patient safety is extremely important to loved ones of those with dementia. Thought locker utilizes a monitoring system to help put family at ease. Connecting to motion sensing devices, the application gives a noninvasive way to monitor the activity in the patient’s home. This useful feature helps with the remote monitoring feature caregivers have access to. Caregivers have the ability to access analytics which can be helpful for viewing a patient’s activity and progression through dementia.

The application allows family members or caregivers to customize the application for each patient's needs and severity of dementia. A caregiver can give or take permissions to edit task. This feature ensures that the application is tailored to the unique needs of each patient, providing a personalized experience that gives them the most independence while still having a safety net.

2.2  Major Components (Hardware/Software)

The major functional components of the application are organized to support the key user roles of Caregiver and Patient. The functional component diagram utilizes the Caregiver role and the Patient role. Each role displays functions for the respective user (see Figure 1). The major information handling is through a cloud-based database. The application runs on Android and iOS operating systems. The application is available on devices such as smartphones, tablets, and the web with internet access. Limits on certain functions are available when no internet connection is available.
Thought locker provides full application access to caregivers who set permissions for patients. Through caregiver customizations the functionality of the application can be decided based on the caregiver’s assessment of the severity of the dementia. Thought Locker utilizes various Android OS and iPhone OS API’s in order to conduct the geo tagging of items, reminders and calendar events. Bluetooth is the main interface for communication between the geotag and the mobile device.

Thought Locker incorporates AWS as its backend server. For the database and cloud storage, PostgreSQL and MongoDB are used. The application runs on JavaScript and so requires a server environment that can execute that. As a means of version control, Gitlab is used along with Jest for project management. Analytics are stored in a separate database and are open to caregivers.
3 Identification of Case Study

The main users for Thought Locker are individuals with mild to moderate dementia and their caregivers or family members who would like to maintain their independence. As discussed, caregivers and those with mild dementia want to maintain their independence. Caregivers want to gain back valuable time and be able to monitor their loved ones. Thought Locker allows independence through an easy-to-use application that helps to locate lost or misplaced items, remind patients to take their medication or inform them of upcoming important event or appointments, provide patients with the opportunity to immediately contact a caregiver with an urgent need. Integral features allow caregivers to retain analytics to monitor patient habits and help evaluate patient dementia development.

In addition to individuals with dementia and their caregivers or family members, other potential beneficiaries of Thought Locker could include medical facilities, insurance companies/Medicaid, and Alzheimer's research groups. The analytics portion of Thought Locker can prove to be a valuable resource to research groups and understanding the advancement of dementia.

The six users who will be in real-world testing of Thought Locker will be divided into groups consisting of 3 mild dementia patients and 3 moderate. Those patients will be tasked with testing and using the item finding, scheduling, and contacting features, which are designed to help them with their daily routines. In addition, three caregivers will be utilized for testing the caregiver’s role. Analytics, remote monitoring, and permissions will be enabled and tested.

The purpose of Thought Locker is to improve communication and case management for individuals with dementia and their caregivers, provide caregivers with time-saving resources, and allow patients to have more control and input in their daily lives.
As more individuals and caregivers use Thought Locker, their feedback will become essential to improving and expanding the product. Customization of the application for each individual may lead to an optimized product that’s specifically tailored to the individual. Furthermore, expanding the use of Thought Locker to other stakeholders such as medical facilities, insurance companies/Medicaid, and Alzheimer's research groups could provide additional benefits to a broader audience.

4 Product Prototype Description

Thought Locker is designed to alleviate the concerns of families, friends, and caregivers about the well-being of individuals with dementia. By fostering a sense of independence for the dementia patient, the platform aims to reduce stress for all involved. While the prototype of Thought Locker may not include all features and may have limited versions of certain functions found in the complete product, it effectively demonstrates its potential to solve targeted challenges. This is accomplished by providing an overview of its core features and simulating the capabilities planned for the full version.

4.1 Prototype Architecture (Hardware/Software)

The prototype for the Thought Locker will use a similar architecture that the real-world product is built on, however, it will deviate slightly to ensure a functioning prototype can be developed in the allotted time. The prototype will include much of the original functionality with simulated data taking place for very little. The application is programmed in Java as the main programming language to develop the features the prototype holds. To visually display the key components in the Thought Locker prototype, a prototype major functional component diagram (MFCD) has been created, which is shown below.
The application will be compatible with mobile phones with an Android or iOS operating system and the desktop application will be run through computers operated by Linux, MacOS, or Windows operating systems. The prototype will utilize MySQL as a database instead of the anticipated PostgreSQL. The backend server will use Amazon Web Services (AWS) while the essential APIs will be React Native and Google Maps Geolocation. Version control will be through GitLab. There are a few differences between the real-world product and the prototype. The first major difference is the simulation of location data and contact data instead of real-world data. This decision caused several features to be partially implemented and was made for the sake of prototype functionality. Sensor monitoring, item locator and the contact center will be affected. Another major difference is remote access will be removed. The removal of this feature allows the developers to focus on the major functionality of the application which can be added later.
4.2 Prototype Features and Capabilities

A great deal of the complete real-world product features will be implemented and retained however there are some functions that are partially implemented. Table 1 shows the features implemented (green), the features partially implemented, (yellow), and the feature not implemented (red). User management features will be fully implemented. The ability to log in, create and adjust profiles. The calendar as well as in-app notifications will be fully implemented.

Table 1

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<th>Thought Locker RWP vs. Prototype Features</th>
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The features included in the application prototype will highlight full functionality through simulation and fully implemented features. Although partial implementation of features requiring eternal data is limited, users will be able to view these features. Item Locator will have simulated data, showcasing random item locations. Contact data will be simulated however the ability to add and delete contacts will be fully implemented. Features such as remote access have been eliminated from the prototype as they are not necessary at this moment and can be
considered as an added feature in the future. Data management will be simulated as there is additional testing with the market needed.

4.3 Prototype Development Challenges

The Thought Locker is a feature-full application that has since created many obstacles throughout its development and challenges the developers every day. One of our main concerns is creating this app with a strict deadline. The time constraint creates an issue with how far we can develop features. This time constraint also affects the development team in what technologies we can utilize for our product. The fact that we are using new tech creates a learning curve that must be accounted for. Although many of the developers understand Java (the main application language), the APIs and connecting libraries (React) are new and require time to learn. Another major challenge is the ability to tackle multiple mobile systems at the same time. The last major development challenge will be data management and the backend. Most of the development team have limited experience with backend programming. This poses a challenge when going from a local server to a web-based server Mitigation of these problems has been of utmost importance. The development team is split into front-end and back-end teams. Each team is tackling their respective duties and learning what is necessary to deliver a functional prototype.
5 Glossary

Amazon Web Services (AWS): A cloud computing platform that provides a variety of services including computing, storage, databases, analytics, machine learning, networking, mobile, developer tools, security, and enterprise applications.

Android: An open-source mobile operating system based on the Linux kernel and developed by Google.

Application Programming Interface (API): A set of protocols, routines, and tools for building software applications that specify how software components should interact with each other.

Application Server: A software framework that provides an environment for running applications.

Authentication: The process of verifying the identity of a user.

Biometric: unique physical or behavioral characteristics of an individual to identify them.

Bluetooth Low Energy (BLE): a wireless communication technology used for short-range communication between devices.

Caregiver/Family Member: Any person that is able to provide assistance with managing a dementia patient’s symptoms. Their duties consist of transporting patients to and from their commitments, maintaining a patient’s daily routine, and reminding them to take their medications at regular intervals.

Continuous Integration (CI): A software development practice that involves frequently integrating code changes from multiple developers into a shared repository, verifying that the changes do not break the build and that the software continues to function correctly.
**Containerization**: A method of packaging and deploying software applications with all their dependencies into a single unit, called a container, which can run reliably and consistently across different computing environments.

**Database Server**: A computer program or software application that provides database services to other computer programs or clients.

**Docker**: A software platform that allows its users to build, test, and deploy applications in standardized executables resembling containers.

**GeoTag**: A physical tag that emits a Bluetooth signal to assist devices in determining their location.

**GitHub**: An open-source repository service that allows its users to work on a single project simultaneously.

**GitLab**: An open-source repository service that allows its users to work on a single project simultaneously.

**Google Maps Geolocation API**: a service provided by Google that allows developers to determine the location of a device using Wi-Fi or mobile network signals.

**iOS**: A mobile operating system developed by Apple Inc based on the Unix operating system.

**Issue Tracking**: The process of managing and resolving software issues, bugs, and feature requests.

**JavaScript**: Scripting programming language that creates dynamic web page content and mobile applications.

**JavaScript Object Notation (JSON)**: A lightweight data interchange format that is easy for humans to read and write and easy for machines to parse and generate.
**Jest**: Test-runner for JavaScript applications that supports a JavaScript library for creating, running, and structuring tests.

**Jira**: A project management and issue tracking tool developed by Atlassian. It is widely used by software development and project management teams to plan, track, and manage their work.

**MongoDB**: Non-relational document database that provides support for non-relational querying.

**Node.js**: An open-source, cross-platform JavaScript runtime environment that enables the execution of server-side JavaScript code.

**Non-relational Database**: A type of database that doesn't rely on the traditional structure of tables, columns, and rows found in relational databases. Instead, they are designed to handle large and complex sets of unstructured, semi-structured, or structured data.

**Patient**: Any individual suffering from mild to moderate dementia. Their symptoms typically comprise of occasional disorientation, difficulties with making decisions, and short-term memory loss.

**PostgreSQL**: Free and open-source database management system that supports relational (SQL) and non-relational (JSON) querying.

**Programming Language**: A formal language used to communicate instructions to a computer or other machine.

**React**: An open-source JavaScript library that is used to build user interfaces for web and mobile applications.

**Relational Database**: A type of database that stores data in a structured format, using rows and columns to represent data entities and attributes.

**Relational Database Management System (RDBMS)**: A software system that enables users to create, maintain, and manipulate relational databases.
**Repository**: A central location where digital files, usually in the form of software source code, are stored and managed.

**Structured Query Language (SQL)**: A programming language used to manage and manipulate data in a relational database management system (RDBMS).

**Testing Framework**: A set of guidelines, standards, and tools that software developers use to create and run automated tests for their code.

**Version Control**: A system that tracks and manages changes to software code, documentation, and other files over time.
6 References


