Lab 1 – Load.In Product Description

Chris Miller

Old Dominion University

CS 410

Professor Janet Brunelle

11 December 2020

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# **1. Introduction**

According to Wood, T. (2020) the average American moves almost 12 times in their lifetime. In 2019 nearly 31 million people moved which is nearly %10 of all Americans moving every year. Moving costs, a lot of money, the average cost of an interstate move is $4,100 and an in-state move is $980. For many, this means that hiring professional movers is just not feasible because of the high cost. Moving comes with many difficulties in addition to just the cost, from the packing of boxes and loading them onto the truck, to the potential loss or misplacement of important items when a move is finished. The final cost to most movers, and potentially the most valuable, is time. Moving yourself takes large amounts of time, from packing boxes to loading trucks, and then unloading and unpacking.

All these problems culminate in one large issue for Americans, moving is either extremely expensive, or extremely time consuming and tedious. To help solve these issues, an application for planning a “do it yourself” move is a solution that cuts costs and saves time for the mover. Load.In looks to solve these problems by providing a platform for movers to plan, catalogue and gain expert knowledge on how to move more efficiently. Load.In allows the user to take pictures of their boxes and through photogrammetry produce 3D models of those items, access expert tips and tricks on how to pack and load different items and provides a step-by-step packing solution to guide the mover through every step of the process, all without ever worrying about where any given item has gone.

**2. Load.In Product Description**

Load.In is a mobile application that can be used by any person, or group of people to plan a move. Load.In aims to help reduce the cost of a user’s move as well as decrease the time and headache that comes with a move. By taking pictures of their item’s users will have a 3D generated plan of both loading and unloading their vehicle. This plan will also contain suggestions on what rental truck sizes will be the most efficient for moving the user’s items. This process will begin with the ability to access expert tips on how to pack items into boxes. Whether a user needs help with packing fine china, or a ceramic vase, Load.In will have different tips and tricks on how to begin packing for a move. The next step in the process is to take pictures of your items to be packed. This will allow Load.In to generate 3D models of the items and create a plan on how to load them, based on the size, shape, and fragility of these different boxes. Another key component is that because all the boxes are being catalogued a user will never have to worry about where important items are, as the app will have what box is located where inside the truck, as well as the contents that are contained within said box.

Regarding rental truck companies, Load.In will act as a powerful ally in analytics gathering and partnership to provide deals and information to the customers. By tracking data such as truck sizes, and move distances, Load.In can provide rental truck companies with data on how large a fleet should be at a given location, as well as how many of each truck size is needed and when. In addition to analytics gathering Load.In can provide a platform for these companies to advertise directly to users who need their service. When your load plan is generated, you can see an advertisement for the local rental company that has the exact truck size you need.

Load.In is looking to be an all-in-one solution to a do it yourself move. Keeping track of items, generating a plan to load and unload the truck, and providing tips on how to pack makes the lives of the users so much simpler. By cutting out the expensive costs of professional movers, Load.In provides a middle ground where movers save both time and money that would otherwise be lost from having professional movers, or doing the move completely by yourself.

**2.1 Key Product Features and Capabilities**

Load.In will provide several different capabilities for users to simplify their move. The biggest feature will be the 3D load plan generated on the app. This will work through photogrammetry, accessing a user’s smartphone camera and taking pictures of the items to be packed. With each picture the app will determine whether an accurate model can be generated, and if not, it will have the user take another picture. Once all the items are photographed and modeled the algorithm will take these 3D models and prepare the loading plan. This algorithm considers the fragility of items as well as weight and size to determine the safest and most effective way to pack the items. This will generally mean that things like furniture are packed first and other items stacked on top of them. The load plan will suggest a truck size and point the user to where such a truck can be rented. If the user specifies a truck size or chooses a different truck the plan will be regenerated for that new vehicle. The load plan is meant to be a step-by-step manual on how to load and unload the truck. It will specify location and order of how to pack items to keep them safe and make the job faster.

With the user taking pictures of all their items, Load.In will maintain a log of all the items. This means that the user will never have to worry about which box has which items. The utensils you packed will be labeled as designated by the user, meaning they can take that box straight to the kitchen in their new home. This inventory means that not only is there no worry about misplacing items, but the important items that you may need right away, such as a computer will be easy to find and unpack. In addition to the log of items, Load.In will have a cost estimation, generated from the information the user provides. By taking the load plan, the truck size, and start and end locations of the move, the app will calculate and estimated total cost for the move. This allows users to have a tangible number showing just how much money they saved over hiring professional movers. Load.In is looking to synchronize with rental truck vendors to provide the best estimates and deals to its users. This will be done through scraping the web and pulling in data from these third parties to gather truck sizes, costs, and availability. With all of these factors, Load.In will be able to show a tangible cost benefit to the user over hiring professional movers.

In order to help a user begin boxing their items Load.In will also provide expert tips and have a live chat. These two services will help with packing difficult are fragile items to keep them safe. The chatbot and live help will be used to either guide a user to articles about the topics they want help with or provide live service help to the user. This could be for questions as to how the app itself works, or something as simple as should you stack plates vertically or horizontally. The tips and chatbot are there to improve the user experience and help answer questions when they arise without having to wait long periods for live customer service.

Load.In will use all this data that users are generating to generate analytics on moves throughout the country. The important pieces of information that Load.In will gather include location data, meaning a move’s start and end locations, and the total amount of trips and time it took a user to complete that move. Data on the move itself will be collected, including the cost of gas, the cost of renting the truck, the cost of any other supplies such as boxes, as well as the time spent loading and unloading the truck. The specifics on a user’s inventory will be kept until the move is completed, and the less personal data will continue to be stored. Data such as how many fragile items were packed, the weight of the entire move, the dimensions of the different items or boxes will be stored. All this data will be used to generate predictive analytics about the overarching meaning of these statistics. Generating predictions on where people are moving from and to, how far they are moving, and how much they are moving will all be valuable assets that can be either sold or used to make a more efficient service to Load.In users.

The final functions of Load.In will be to gather feedback from the user. This will be rating their move and different details of the app itself. Giving feedback on how a move was will help the product be improved for future users. Another way in which Load.In will work to improve is using a heat map to track what users are accessing the most. It will track clicks on the app as well as when the app is closed so we know exactly what features are being used the most or the least, and what needs to be improved upon.

**2.2 Major Components (Hardware/Software)**

Figure 1 is an illustration of the Load.In Major Functional Component Diagram. This illustration is representative of how the Load.In application will function, with each user using a mobile device which displays a GUI to interact with specific functions. Each function will in turn communicate with a remote AWS Database and produce an output which will be presented to the user. Most of these functions will be accessible through the Load.In app, however some will be reserved for admins to access things like analytical data on the website rather than the app itself.

The hardware that is required for Load.In to function will start with a relational database known as Amazon RDS. This is compatible with MySQL and Amazon Lambda which will be used for connections on the back end of the system. The software will be composed of a back-end API, user authentication, data storage, and algorithms in order to get the Load.In app to function for each user. The data storage and algorithms will be a large part of the components as there is both a large amount of data to be collected as well as many different algorithms being used to generate all of the information we hope to provide to the users.

Diagram

Description automatically generated

Figure 1 Load.In Major Functional Components Diagram

Load.In will run as an application on Android smartphone devices ensuring the device allows access to the smartphone’s camera. Many of the important hardware requirements will be covered by most Android smartphones. The goal is to do as much of the job locally on a user’s smartphone as possible. This means storing the photos locally, requiring more memory from the user. The other components needed to run Load.In will include a stable internet connection, either through wi-fi connectivity or cellular.

The Load.In website client will be needed for applications outside of the specific move plan solution that is intended for the customer. The website will be designed to work on current browsers and require very little in terms of the hardware on a computer as it really is just an information site, and an analytical display for admins. The web API will be worked on in Java and will take advantage of both AWS Elastic Beanstalk and Spring MVC with Tomcat. The vendor synchronization will also be worked on in Java and take advantage of AWS Lambda. The goal is to have the vendor synchronization work on a timed schedule so that it brings data from vendor sites in a timely manner.

The most important part of the Load.In system will be the database. This will be run on the cloud and needs to store large amounts of data, including user profiles, analytics on the moves of the user, rental company information, and cost estimates. The database is the backbone of Load.In, much of the functionality and value comes from the database running smoothly.

**3.** **Identification of Case Study**

Load.In is being developed for people moving all over the country. Whether it is a move just across the street or a move 3,000 miles across country the goal is for the app to be useful in either situation. The case study for Load.In will be to look at a single family of 3 with a dog moving less than 20 miles across town. They need to move approximately 2,200 square feet which is the average house size US Census Bureau (2019). This move will also need a rental vehicle as it is too large just to fit in the family vehicles. A few of the mandatory items involved in the move will be furniture to get a more accurate picture of a typical move. Load.In will need to accurately tell the costs of this move and allow friends or family to collaborate through the app on the move. Really tricky or odd shaped items will be left out of this case study, meaning that the expert tips will not be necessary for determining the effectiveness of the app. The final goal for the Load.In case study is to have the app work well for a common local move but be able to see that it can both scale up and scale down to larger moves, whether in terms of distance or in terms of the amount of items being moved.

1. **Glossary**

**Algorithm** - A finite sequence of well-defined, computer-implementable instructions, typically to solve a class of problems or to perform a computation.

**Analytics** - The analysis of data, typically large sets of business data through mathematics, statistics and computer software.

**Artificial intelligence** - The capacity of a computer, robot, or other programmed mechanical device to perform operations and tasks analogous to learning and decision making in humans, as speech recognition or question answering.

**Chat-bot** - An automated software designed to imitate human interactions and provide information to the user.

**Equilibrium** - A state of balance due to the equal action of opposing forces, in this case weight within a moving truck.

**Heat map** - A representation of data in the form of a map or diagram in which data values are represented as colors.

**Machine learning** - a field of computer science that aims to teach computers how to learn and act without being explicitly programmed. More specifically, machine learning is an approach to data analysis that involves building and adapting models, which allow programs to "learn" through experience. Machine learning involves the construction of algorithms that adapt their models to improve their ability to make predictions.

**Packing problems** - Are a class of optimization problems in mathematics that involve attempting to pack objects together into containers. The goal is to either pack a single container as densely as possible or pack all objects using as few containers as possible.

**Photogrammetry** - Photogrammetry is the science and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring, and interpreting photographic images and patterns of electromagnetic radiant imagery and other phenomena.

**Professional movers** - Professionals who move all your belongings for you from one place to another.

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