

Lab 1 – Load.In Product Description

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1 Introduction

Do it yourself (DIY) movers lack the knowledge to handle the logistics of their move. Professional movers ease the physical burden of moving and handle some logistics for you, but their costs can be too expensive (Wood, 2020). DIY movers save money, but it leads to a decrease in efficiency as the DIY movers do not have the same knowledge and experience as the professional movers do in handling all the different aspects of moving. DIY movers must estimate costs, keep an inventory of everything, pack all their items, and load the moving truck efficiently and safely. The last being an extremely important aspect of moving. Weight distribution is an important part of truck safety when transporting items, an improperly loaded moving truck could result in damaged items or a car accident.

Market research has shown that nearly 70% of movers choose to do it themselves (Wood, 2020). This is primarily a result of the high costs that professional movers incur. For example, a four-bedroom household to move within the state they currently live would cost nearly \$2000, and if the move is out of state that cost nearly triples. These prices are not affordable for most Americans and therefore so many choose to DIY move. Further market analysis has also shown that there is a shift in the market towards software-based solutions for helping with the moving process.

This is where Load.In comes in, Load. In uses computer vision to create 3D models of all your items and creates an AI generated loading and unloading plan of how to properly load and unload the moving truck. Load. In also handles all the logistics behind a DIY move. This fills in the knowledge gap that DIY movers lack and provides logistical help for the DIY mover. DIY movers with the help of Load.In will pay the normal costs of a DIY move, but now will have the expertise of a professional mover.

Load.In's loading and unloading plans are a crucial aspect of the product. A 3D model of the moving truck, all the mover's items, and instructions of how to load the truck properly will be generated. This will guide the user on how to load their moving truck while accounting for important aspects such as weight distribution, fragility, size, and importance of the item. Users will search the load plan to find items, should they need to know the location once they load the moving truck. It will provide tips and tricks for properly packing different materials or items in app to help the mover. Load.In's time and cost estimates are important features that help the user understand how much time and money they will spend total on their DIY move.

2 Product Description

Load.In is an application that will assist DIY movers by providing 3D modeled loading instructions and full logistical support for the move. Users will take photos of the packed boxes, other items, and any furniture they will be moving. Load.In then uses these pictures to create 3D models of all the items and the moving truck to give the user a full visualized plan of how to load the truck properly. Load.In will keep an inventory of all the items to reduce stress of tracking items on the user. The application will provide time and cost estimations for the move based on number of items and truck size which will aide users in keeping their moving costs low. Load.In users will also have expert tips and live help to assist with any issues they have during the entire move process. The goal of Load.In is to deliver a product that allows user to have the expert knowledge and experience of a professional mover without having to pay the high costs that they charge.

2.1 Key Product Features and Capabilities

2.1.1 Load Plan

The load plan is a big feature of Load.In. After the user takes photos of all items, they are moving a 3D model of each item will be generated with accurate dimensions. The 3D models are used in combination with a 3D model of the rental truck to generate the load plan for this move. It breaks the load plan down into separate instructions to ensure the user understands how and where to load every item on the moving truck. This is revolutionary, as this is one selling point that professional movers have, they possess the knowledge and experience to load a truck properly, now with Load.In every user can load the truck like a professional.

2.1.2 Move Inventory

The move inventory is a list of all items that are on the truck. Items are added to the move inventory when they are entered into the loading plan. Users can add the contents of cardboard boxes so they can keep track of important items or documents that are already packed, during the move process.

2.1.3 Rental Estimation

Load.In will provide users with time and cost estimates based on the number of items they have and the size of the rental truck. Once Load.In has all the 3D models generated for the load plan, the user can then choose which truck they would like to rent. When they go to do this the application will provide the costs, the number of trips, and the total time required to complete their move based on the different truck options available. This gives the user the

ability to customize their move to what works best for their needs and provides all the logistical information they need.

2.1.4 Expert Tips

Load.In will feature an expert tips section that provides helpful information from expert packers and movers. Should a user need help on how to pack something fragile or needs information about different aspects of moving they can head to the expert tips section for useful and relevant information.

2.1.5 Chatbot and Live Help

The chatbot that Load.In features will be available to help users easily find solutions from the Expert Tips section or if there is no answer the chatbot will redirect to a live expert to assist the user with their inquiry.

2.1.6 Vendor Synchronization

As mentioned earlier Load.In will offer users the ability to see rental truck prices and availability. Load.In will pull this data from 3rd party rental companies. These rental companies will have access to the rental management dashboard that Load.In features where they can see analytics regarding their truck rentals done through the application.

2.1.7 Move Analytics

Load.In will have move analytics to look for ways to improve the product. Things such as location data, costs, and inventory data will be analyzed and used to improve the application. Through analysis of move distances and costs of things such as fuel and rentals. Load.In can

improve its time and costs estimates for future users. Load.In will also feature a post move feedback system. The feedback from users after they finish their move will be crucial for improving the application and improving the AI used for generating the load plans.

2.1.8 Heat Map

The heat map will see where on the application users visit the most. This information can help developers identify problem areas of the interface where users run into issues or are driven away by the user interface. The heat map will be valuable for developers to have an insight into how users are using the application and where the application's user interface can be improved.

2.2 Major Components (Hardware/Software)

2.2.1 Database

Figure 1 seen below is the Major Functional Component diagram for Load.In. This diagram shows how the application will work and how it will interact with all the different components. The most important component of Load.In is the database. We will create a relational database using Amazon Relational Database Service (RDS). MySQL and Amazon Lambda will handle the database and connections to the back end. The data base will be important for data storage and for the algorithms that will be needed for Load.In, to work properly and generate a load plan.

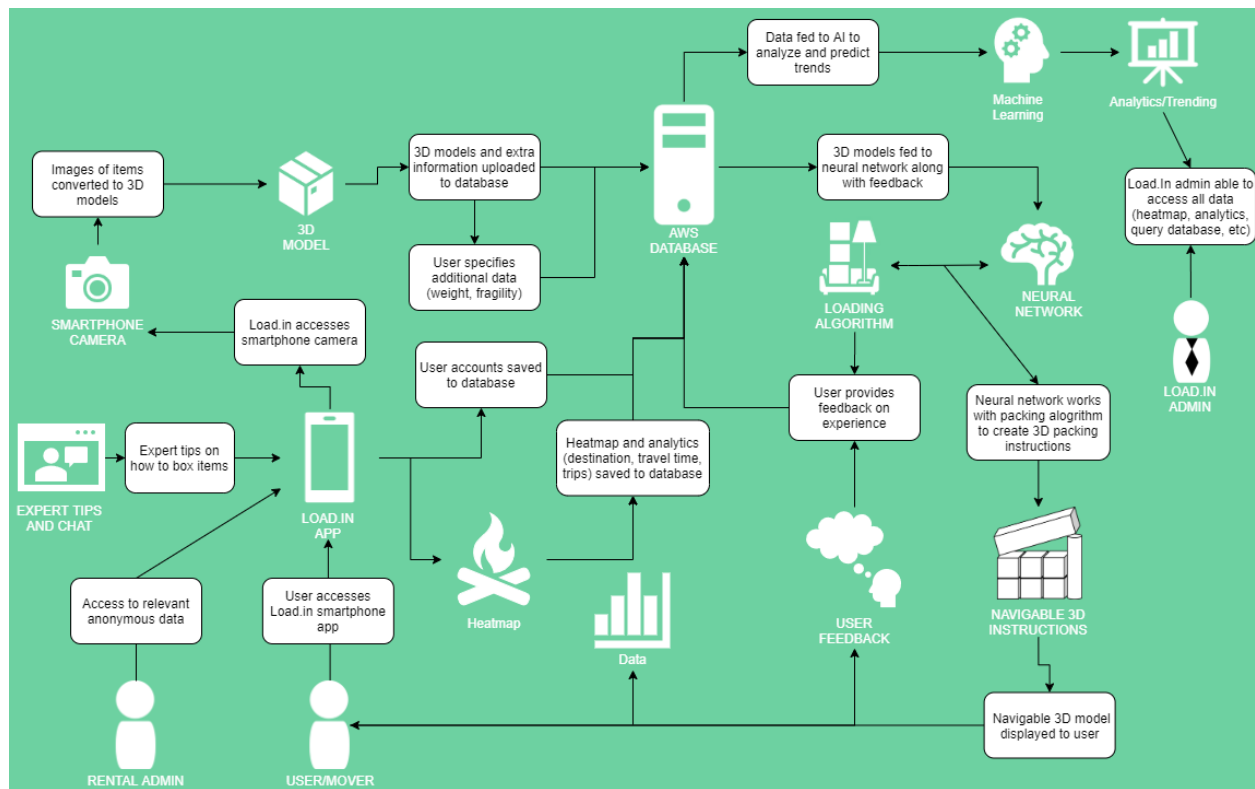


Figure 1 Load.In Major Functional Components Diagram

2.2.2 Smartphone Client

Load.In itself, will be an Android application that will require access to the user's smartphone camera. The user's smartphone will handle some of the workload for the system, photos taken for the move will stay locally on the user's phone, this will require the user to have some available storage on their smartphone to use Load.In. All other components will require a stable internet connection from the smartphone to be functional.

2.2.3 Website Client

The website client for Load.In will serve a few purposes but will not be used for moving itself. The first purpose of the website client will be to serve as an information tool about

Load.In. Secondly it will serve as an analytics tool for administrators. The client will display all the current analytical data for the administrators to look at and use. The website will have very little hardware requirements and will work on any updated browser.

2.2.4 Web API

The Web API for Load.In will be created using Java and will use Amazon Web Services Elastic Beanstalk (AWS Elastic Beanstalk) and Apache CXF with Tomcat.

2.2.5 Web Application

We will create the web application using Java and will use AWS Elastic Beanstalk and Spring Model-View-Controller (Spring MVC) with Tomcat.

2.2.6 Vendor Synchronization

Vendor synchronization for Load.In will also be created using Java and will use AWS Lambda. The vendor synchronization will operate on a timed schedule. It will bring in data from 3rd party vendors such as rental truck companies to provide availability details to the user.

3 Identification of Case Study

Load.In is being developed for those that are moving across the country that want to DIY their move. The application will work whether the distance is across the town or across the country. For our case study the focus will be on a family of three moving across their current city of residence. The average house size in the United States is 2,200 sq ft from the US Census Bureau (2019). The family will use a rental truck to move as their already owned vehicles are not large enough to move the family's possessions. For the case study we want to see some larger items such as furniture to get an idea of how well the 3D model generation and load plan works. Load.In for this case study is expected to estimate the costs for the move, estimate the time to complete the move, generate 3D models for all items, and generate a 3D modeled load plan for loading the rental truck. The goal is to ensure that Load.In can complete a relatively basic cross city move and display the ability to be scaled up in the future for a bigger sized move or a move over longer distances. In the future the technology behind Load.In could be used for bigger DIY moves or even for large scale industrial loading and unloading.

4 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.

5 References

- Andrew, P. (2020, January 26). *Is Your House the “Typical American Home”?* Hsh.
<https://www.hsh.com/homeowner/average-american-home.html>
- CADCode Systems. (n.d.). *Optimizing & Machining / CADCode Systems*. CADCode.
Retrieved September 20, 2020, from
<https://www.cadcode.com/category/categories/optimizing-machining>
- Collins, T. (2018, April 20). *A Look into Photogrammetry and Video Games*. Medium.
<https://medium.com/@homicidalnacho/a-look-into-photogrammetry-and-video-games-71d602f51c31>
- Dube, E. (2020, September 20). *Optimizing Three-dimensional Bin Packing through Simulation*.
Semantics Scholar. <https://www.semanticscholar.org/paper/OPTIMIZING-THREE-DIMENSIONAL-BIN-PACKING-THROUGH-Dube/bb9986af2f26f7726fcef1bc684eac8239c9b853#references>
- Economy Moving & Storage, LLC. (2015, January 4). *How to properly pack and load a moving truck- Movers Cincinnati*. YouTube.
<https://www.youtube.com/watch?v=rjmofUZOdwo&feature=youtu.be>
- Knoblauch, M. (2019, May 8). *One in ten Americans would prefer a week in jail over moving*.
New York Post. <https://nypost.com/2019/05/08/one-in-ten-americans-would-prefer-a-week-in-jail-over-moving/>
- Nat and Friends. (2017, April 18). *Google Earth’s Incredible 3D Imagery, Explained*.
YouTube. https://www.youtube.com/watch?v=suo_aUTUpps&feature=youtu.be
- The American Institute of Stress. (n.d.). *The Holmes-Rahe Stress Inventory* PDF. Retrieved
September 20, 2020, from <https://www.stress.org/wp-content/uploads/2019/04/stress-inventory-1.pdf>

The Top 5 Moving Mistakes Across America. (2019, August 13). Article.
<https://www.article.com/blog/top-5-moving-mistakes/>

US Census Bureau. (2019, October 10). *Historical Households Tables.* The United States
Census Bureau. <https://www.census.gov/data/tables/time-series/demo/families/households.html>

Wood, T. (2020, January 6). *Moving Industry Statistics.* MoveBuddha.
<https://www.movebuddha.com/blog/moving-industry-statistics/>