LAB 1 LOAD.IN PRODUCT DESCRIPTION

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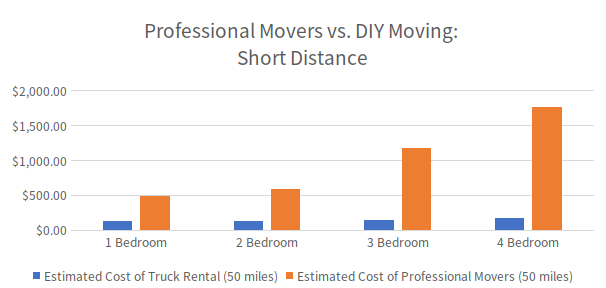
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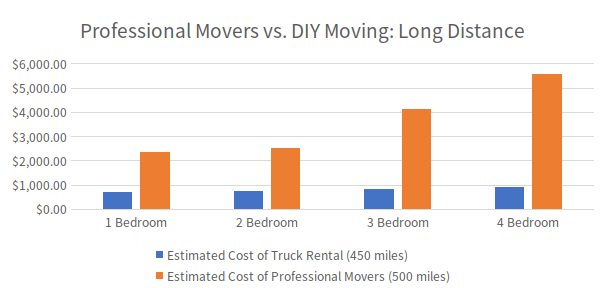
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1. **INTRODUCTION**

American’s move quite frequently throughout their lifetimes. The average American moves about twelve times in their lifetime. In the year 2019 alone, about 31 million Americans moved, according to Wood, T. (2020). For Americans, and first time movers particularly, moving comes with a lot of issues. First off moving is a costly endeavor. In the United States the average cost of an intrastate move is around $980. A state-to-state move is priced at even more than that at $4,100.





*Figure 1 Professional Movers vs. DIY Moving*

This represents a source of Load.In’s problem identification: using professional movers in America is expensive, especially if the move is state-to-state. The average American household income for 2019 was $68,703 according to the United States Census (2020). With this data presented we can calculate that the cost of a state-to-state move is about 16.7% of an American’s yearly gross income; simply put that is an enormous chunk of an American’s income. For most Americans this makes using professional movers impractical due to the high cost. As mentioned earlier moving comes with many issues. Cost was mentioned, but the next one is just as equally important; packing the boxes in the truck. Knowing how to properly, efficiently, and safely pack boxes in a moving truck will determine if a move is cost efficient and safe. An inefficiently packed truck will determine if the mover will have to make unnecessary trips, if the truck is prone to tipping, and also the protection of the belongings inside the boxes. If a mover places too many boxes on one side of the truck then that side is prone to tipping over more than if the truck weight was equally distributed. The same concept applies to if the mover places too much weight near the door of the truck; this would cause the smaller weighing objects to be crushed when the mover brakes the truck due to the force of all the boxes moving forward when the brakes are applied. This weight distribution concept is very important to understand in terms of what the problems are here. Improper packing can not only cause damage to the movers goods but possibly accidents and or death on the road. The final factor is time. Time is probably the most important factor here. Moving a household takes great amounts of time, from planning, packing, adjusting, reevaluating, loading, unpacking, and repeating this process all over again.

The aggregation of these issues that moving entails can be summed up by saying that for Americans, moving is very expensive, time consuming, stressful, and dangerous. In order to aid in solving these issues Load.In, a software application, is the solution that maximizes savings, time consumption, safety, and alleviates the stress of a do it yourself move. Load.In provides a service that allows movers to plan, catalogue, and gather expertise on moving more efficiently and safely. Load.In provides the user the ability to capture photographs of their boxes and items, produce a 3D model of those boxes and items through photogrammetry, acquire expert tips, advice, and tricks relating to packing, and provides a bit by bit packing solution which guides the mover through each step in the moving process.

1. **Load.In Product Description**

Load.In is a mobile application which can be operated by anyone in order to facilitate a move. Load.In’s chief goal is to maximize the savings, reduce time consumption, and reduce the stress of a move. The application will generate a three dimensional plan of loading as well as unloading of the truck. The load/unload plan will provide a few suggested truck sizes paired with the associated cost and trip amounts for each truck. These suggestions will be tailored to maximize savings and time. Load.In will then provide expert tips and suggestions on how to perform the pre-move tasks and plan to move. Load.In’s process begins with the user taking pictures of their items to be packed. This will allow the application to generate three dimensional models of user’s items and create an efficient plan of how the items should be loaded. This load plan will take in consideration size, shape, and fragility of the items and boxes. Furthermore, Load.In will provide an important feature that will catalogue the items in the boxes, and catalogue the boxes inside the truck. This will provide the user with knowledge of each item and each box inside of the truck at all times.

Load.In will not leave the rental truck companies outside of the loop. Load.In will acquire analytics from and partner with rental companies in order to provide money saving deals and information to the user in order to make the best possible decisions. Load.In will trace data to include truck sizes, move distances, duration of move, trip amounts, and much more. Load.In will provide this data to rental companies in order to aid rental companies with making decisions such as how many vehicles should exist at a certain location, how many of a certain truck size is needed, and much more. This data will also allow rental companies to tailor advertisements and discounts to a certain area.

Load.In is the hub for a “do it yourself move”. It is the pivot point that movers will use in order to save money, time, and reduce their stress. Load.In will provide expert plans, tips, and answers to questions that a user might have all without having to pay for the price of an expert mover.

**2.1 Key Product Features and Capabilities**

Load.In will provide many features and capabilities that will aid users in simplifying a move. The chief feature that Load.In will provide is the three dimensional loading plan that will be generated to each user’s needs. This three dimensional loading plan will be produced using software photogrammetry practices. Using a smartphone camera, the user will take pictures of their items to be packed. Each picture taken will be aggregated into the loading algorithm. Once all of the user’s boxes and items have been photographed the loading algorithm will then take into consideration fragility, size, weight, and importance, and then generate a loading plan. The loading plan will calculate all these things and produce the safest, most cost effective, and time saving plan. The plan will entail a few truck size options and where each truck can be rented from. For each truck that is chosen a new plan will be generated taking into account the size of that truck along with the gas costs and cost of the truck. The load plan will have redundancies in order for the user to repeat steps or change their mind at any time. This is important as not every plan is set in stone. The plan will be a breathable feature that can adapt to any changes.

The next and probably what will be an unsung hero, is the catalogue feature Load.In will have. After the user takes a picture of their item, the application will record the item in a database. Load.In will keep track of where each item is in each box. The user will have access to this information at all times throughout the move. This will also provide the ability to retrieve important items without having to scour through boxes and hoping to find said item. Furthermore, Load.In will provide a cost estimation tailored to each user’s move. This estimation will be calculated by the information the user provides such as truck size, amount of items, and distance traveling. The cost estimation will provide a comparison to professional movers. The application will do this by scraping the web and storing data pertaining to truck sizes, costs, availability, and much more. Load.In will also use third party API’s to gather this same data that is acquired through web scraping.

The process begins with packing items, in order to aid in that process Load.In. will provide expert tips through a FAQ, live chat, and chatbot. These services will work in tandem in order to keep fragile items safe and make packing difficult items easier. The chatbot will be an automatic reply system when a user requires help packing any items. The live chat will be serviced by an expert packer who will be on call ready to answer any questions a user might have. The FAQ will consist of frequent questions that come up when moving and will be community driven. Each of these services will be able to be toggled back and forth from in order to provide a seamless experience.

Load.In will then aggregate this information and create analytics related to the moves. The key analytics will be start and end locations, total amount of trips, time over the whole move, cost, most frequently inquired about items, cost of gas, cost of truck, cost of miscellaneous items, time spent loading, and time spent unloading. All this data will be kept only until the move is completed. Any personally identifiable information will be destroyed upon move completion. It will never be shared, copied, or sold to anyone internally or externally. The data that will be stored and analyzed will be specifics of a user’s inventory, how many fragile items were packed, the weight of each truck and the move as a whole, the dimensions of each box, and the dimensions of each item in each box. This data will be important in the application generating predictive analytics. These analytics will be able to paint a picture as to where people are moving, where are they moving from, what they are moving, and much more.

The final feature of Load.In is the feedback option that the user can provide. Feedback is important, it aids in making the application better, smarter, and will benefit the users as a whole. The features of the feedback functionality will be the ability to leave a message of anything the user wants to say or comment on. The user will be able to rate their move on a five star rating. A feature that the user doesn’t directly input but will aid in feedback is the heatmap. The heatmap will track clicks on the application as well as when the application is opened and closed. The heatmap will be able to track what features are being used the most. An example of this is whether the chatbot, FAQ, and or live chat is being used the most. This will help the application become more helpful to the user as feedback is processed.

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

The Load.In application will function as a mobile application. The user will be provided a GUI with unlimited interaction. Each function will communicate with an AWS database and produce an output for the user to see. A majority of the functions will be accessible through the Load.In interface. There will be some functionality that will only be accessible by administrators such as data analytics. Those features will be accessible on the website only.

The hardware requirements are the Amazon RDS, which is a relational database. Amazon Lambda which will be used to perform the web scraping will also be used. The software will contain user authentication, data storage , algorithms, and third party API connections.

Load.In will perform as an Android application. Hardware requirements will be fine with most android smartphones. The smartphone is the chief tool here. The bulk of the work is done by the smartphone.

The Load.In website client will be compatible with most current browsers. The website will require very little hardware requirements as the browsers will handle most of the overhead. The site will provide analytics for admins. The web API will be programmed in Java and will utilize AWS Elastic Beanstalk and Spring MVC with Tomcat. These are both industry standards. The vendor data acquisition will be done through AWS Lambda as that allows a lightweight seamless integration to our database. The vendor data acquisition will be run on time schedules so that data remains up to date.

The final part of the software will be the database. The database will be implemented on the cloud and will ingest large amounts of data. This data includes users profiles, analytics, rental data, cost estimates, and much more. The database will make or break the software and thus needs a lot of time and attention.

1. **Identification of Case Study**

Load.In is being developed for the “do it yourself” mover. These kinds of movers are all over the United States. The first time mover, the single parent mover, these kinds of people need help moving and cannot afford to spend thousands of dollars on expert movers to do the job. The case study for Load.In will be a single family of about 3 people moving less than 25 miles away from their current location. The family needs to move about 2,200 square feet of house. Their move will of course require a rental truck from a name brand rental company. Furniture will be required to move such as a bed, couch, and dining room table. Load.In will have to be able to accurately determine the cost of the move, allow other people to collaborate with the move on their own smartphone devices, and save the user money in relation to paying professional movers. Weirdly shaped items will be discarded from this case study in order to get a good baseline for the application. The application has to be able to be scaled up and down and that is why this size of a move has been determined for a good case study.

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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