Project Pitch for Keogh’s Port of Long Beach

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Basic Understanding of The Problem

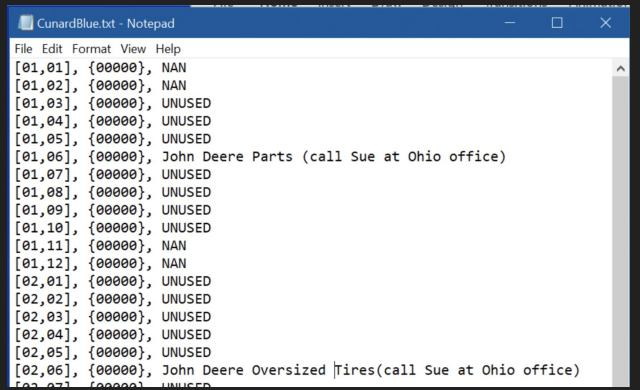
1. Loading/Unloading: The primary challenge in loading and unloading is the moving the containers efficiently and accurately using a single crane. We want to be able to move either: [1]
    a. From the truck to the ship
    b. From the ship to the truck
    c. To/from the buffer if needed
2. Balance: The second main issue is maintaining the ship's stability by ensuring that containers are optimally distributed on the ship. [1]

Our Understanding of The Problem: Loading & Unloading

Our Understanding of The Problem and Solution

Objective: Develop a software solution to optimize loading and unloading of containers to maximize operational efficiency at Mr. Keogh's port. By reducing container transfer times, to increase daily throughput of ships, enhancing profitability. [1]

Manifest



- The manifest is represented as a .txt file with: [1]
  - Grid Position
  - Weight in kilograms
  - Description of the position
- The current crane operator gets the transfer list and the manifest and has to work out a sequence of moves through the software [1]

Our Understanding of The Problem and Solution

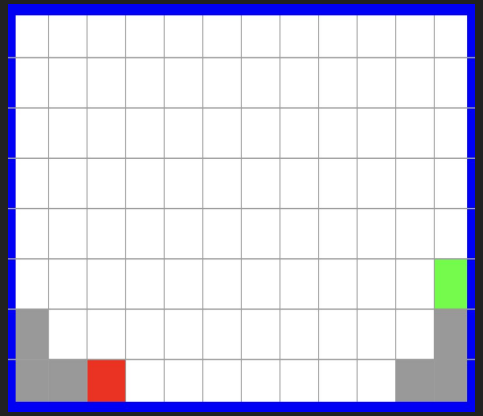
Operations

- All containers are identical, allowing uniform handling procedures. [2]
- The crane has an operator-controlled XY plane movement, with container weight displayed upon pick-up. [1]
- Movement costs include time-based crane maneuvers: 1 minute per cell, 2 minutes for any transfer to/from the truck and an additional 4 minutes for moves between the buffer and ship. [2]
- The buffer zone serves as temporary container storage during transfers and must be cleared before the ship departs. [1]
- The truck holding area must be empty before the ship sails. [1]
- If a truck fails to arrive, a Long Beach-provided temporary truck transfers the container, with minimal impact on operations. [2]
- Operators only sign in; they do not sign out—sign-in timestamps mark the end of previous shift. [2]

Our Understanding of The Problem and Solution

Software and Animations

- The software should allow the crane operator to input information from the transfer list into the program. [1]
- The software should be able to handle power outages and resume from where it last stopped. [1]
- The solution provides a list and an animation of suggested moves and an estimated completion time. [1]
- The animation can be a simple grid representation of the field with illuminated squares showing the target and source of container. [1]



Our Understanding of The Problem and Solution

Log File

- The log file format should be plain ASCII text, accessible in standard text editors like Notepad and each description should not be longer than 256 characters. [1]
- Logs should include timestamps for each recorded action, with entries such as sign-ins, container movements, manifest updates, and shift changes. [1]
- Log entries are not editable, comments can be added if necessary. [2]

Our Understanding of The Problem: Balancing The Ship

Our Understanding of The Problem and Solution

Objectives:

- Legal Weight Balance: Ensure the weight difference between the port (left) and starboard (right) sides is less than or equal to 10% in order to legally permit the ship to depart. [1]
- Minimize Moves: Since normally few containers need to be repositioned due to low variance in weights, efficiency is critical. [1]
- Container-specific Constraints: There are no specific restrictions regarding their exact placement on the ship, allowing them to be positioned flexibly as long as the total weight distribution is within the legally defined balance threshold. [2]

Our Understanding of The Problem and Solution

- The system reads and analyzes the manifest to identify the weight distribution across the port and starboard sides. [1]
- If unbalanced, the system calculates the fewest moves needed to meet the legal threshold, and guides the operator. [1]
- The movement costs will be determined similar to the loading/unloading operation. [1]

Our Understanding of The Problem and Solution

SIFT Operation (Emergency Balance):

- When legal balance is unachievable, the operator can initiate SIFT to arrange containers by weight and move them onto the ship accordingly. [1]
- The system will guide the operator through the SIFT protocol [3]
  - All containers are sorted by weight in the buffer, and the heaviest container is assigned to specific slots starting from row [01,06], filling each row symmetrically.
- After balancing, the system updates the manifest to reflect any changes in container positions, ensuring compliance with maritime regulations. [1]
- The revised manifest is saved and ready to be emailed to the captain, signaling the ship’s clearance to depart. [1]

The Environment

Our Understanding of the Environment

Port Environment:

- Port Location: Located in Long Beach, not subject to harsh weather and maritime conditions. [1]
- Infrastructure: Single port setup that can only accommodate one ship at a time. Each ship has has a single bay with 8 x 12 grid layout. [1]

Technological Environment:

- Hardware Constraints: Operating on basic, cost-effective PCs that can run a chrome browser, notepad, and calculator applications. [1]

Our Understanding of the Environment

Working Environment:

- Three eight hour shifts covering round the clock operations to ensure continuous cargo loading. [1]
- High volumes of container traffic, with a goal of handling about one ship a day. [1]
- Ship contains 8 rows and 12 columns bay area and is adjacent to a 4 x 24 buffer zone. [1]
- Bright and Noisy crane operator booths with operators managing crane movements and communications. [1]

Our Understanding of the Environment

Staff Factors:

- Staff education: All onsite workers have at least a high school diploma. [1]
- Language: Workers can read and speak basic English. [1]
- There is a need for clear information due to impact of shift work on operator alertness and performance. [2]

Regulatory Environment:

- Compliance: Operations are governed by maritime law requiring ships to be balanced within legal definitions. Ships cannot sail with containers that exceed the boundaries of the grid. [1]

Stakeholders

Primary Stakeholders

- **Mr. John Keogh**: He profits from loading and unloading ships, and balancing ships. The greater efficiency of the software in the operations at the port will allow him to make more money. [1]
- **Crane Operators**: They will be users of the software and will follow the ordering of how the software tells them to load and unload, or balance the ship. They will also be the one to email the manifest to the Captain of the Ship.[1]
- **Truck Drivers & Truck Companies**: Will be responsible for bringing the containers to the port between the holding and loading areas as suggested by the software.[1]
- **Captain of the Ship**: Will be responsible for receiving the manifest, which is generated by the software system, and his job depends on it being 100% correct. [1]
- **Shipping Company:** Is responsible for coordinating the ships to and from the port. [2]
- **Head Office:** Responsible for coordinating with the truckers, to make sure they are in the holding area, and take care of a flat tire situation, so the containers are ready to be moved.[1]

More Stakeholders

Secondary Stakeholders:

- **FBI and Insurance Companies**: They are responsible for protecting the legal rights and trusting the correctness of the log that is generated by the software. [2]
- **Local Government:** The government enforces export controls laws and regulations, which will be enforced by the Customs Protocol Services affecting what inputs go into the software.[2]
- **Customs Protocol Services**: They are involved with ensuring the containers that get to be exported or imported comply with legal regulations by the government, which controls inputs and outputs to our software system. [2]

Indirect Stakeholders:

- **IT and Support Staff :** Will be responsible for maintaining the software system if there is an issue, or making it better and more efficient. [2]

Assumptions

Assumptions: Part 1

- Container Specifications: All containers are of a standard 44 size, eliminating the need for custom adjustments based on container dimensions. [1]
- Disabilities: All employees will be fully able-bodied, with no limitations impacting their physical ability to work in the port environment. [2]
- User Proficiency: Users have basic computer skills but minimal technical expertise, requiring a user-friendly and intuitive interface. [2]
- Manifest Consistency: The manifest must follow a set standard format and will be updated through an emailed file that gets downloaded onto their computer. [2]
- Power Interruptions: Power cuts last no more than 2 minutes, during which time the system should pause and automatically resume upon restoration. [1,2]

Assumptions: Part 2

- Lighting Conditions: Adequate lighting in operator areas is assumed, requiring displays with high contrast and glare resistance [1]
- Network Connectivity: Reliable fast ethernet is available in the operator cab; the system must maintain performance even with potential network fluctuations [1]
- Single Ship Focus: At any given time, the system will handle operations for one ship, reflecting the port's current infrastructure [1]
- Security of the Cabin: Someone is always in the cabin by law 24/7, even if there are no ships, so it is safe. [1]

Assumptions: Part 3

- Shift Patterns: The port operates on three shifts, and the system must seamlessly transition between shifts without data or operation loss. [1]
- Language Proficiency: Operators may have different levels of English proficiency; the system will use clear and simple language. [2]
- Regulatory Compliance: It is assumed that all operations must comply with maritime laws and safety regulations without exception. [1]
- Emergency Procedures: In case of an emergency, standard operational procedures are assumed to be followed by all port personnel. [1,2]
- The crane operator will always submit an error free manifest to the ship captain. [1]

Inputs/Outputs

Inputs to the System

- Manifest File: Structured text file detailing the container grid layout with weights and positions. [1]
  - NAN: Represents spot that cannot be used
  - UNUSED: Represents a vacant spot
- Transfer list: An unstructured file detailing container(s) to load/unload. Human interpretation required for entries. [1]
- Weight Sensors: Inputs the weight of the containers from the manifest file. [1]

Inputs to the System

- Operator commands : User input for selecting and confirming container to move. [2]
- System clock: Used for time-stamping log entries. [2]
- Comments on Log file: Operators will occasionally add notes in the log for investigative purposes. [2]
- Power status: Power outage tracking for system auto-recovery. [2]

Outputs from the System

- Optimized move sequence: A step-by-step list detailing the order and location to move containers. [1]
- Estimated time to load/unload or balance the containers. [1]
- Real-Time Crane Movement Guide: Simple grid-based animation of move sequence for operator guidance. [1]
- Balance status Indicator: Real time display which shows whether the current container arrangement meets the legal weight balance requirement. [1]
- Optimized Balance Sequence: A step-by-step list of suggested moves to achieve the balance requirement or begin SIFT. [1]

Outputs from the System

- Updated Manifest File: An updated manifest file, which is automatically saved to the desktop, after the completion of operations, renamed with an outbound suffix after loading/unloading or balancing. [2]
- Log File: A plain-text log detailing each move and operation, saved with timestamps for legal and audit purposes. [2]
- User Notifications: Pop-up reminders to email the captain once the manifest is ready, and alerts for completion of loading/unloading cycles. [1][2]

Scenarios

Scenario 1, Part 1:

- Jordan Dave is a port operator
- He only has a high school diploma
- Jordan has been working there for about 7 years

Scenario 1, Part 2:

- Jordan is overseeing a shipment involving high value electronics
- The shipment is high priority, and any delay could impact the ship’s departure time
- Unfortunately, customs has flagged a container in the ship for security inspection

Scenario 1, Part 3:

- Jordan immediately contacts customs to understand why there’s an inspection and how long
- Jordan immediately logs the delay in the tracking system
- Jordan consults the system to figure out what other containers he can load in the meantime

Scenario 1, Part 4:

- Unfortunately, the inspection takes longer than expected
- This delay is causing congestion on the dock as new shipments arrive
- Jordan must find a way to manage space while ensuring loading continues efficiently
- Jordan decides to reassign some lower priority containers to the holding area to free up space

Scenario 1, Part 5:

- Jordan informs the crane operator of the new loading order
- The crane operator is able to adjust the sequence of containers properly

Scenario 1, Part 6:

- Customs clears the flagged container and Jordan brings it to the loading area
- The crane operator loads the container immediately and is able to put it on the ship

Scenario 1, Part 7:

- Jordan updates and finalizes the manifest, sending it to the ship’s captain
- The ship departs with only minimal delay

Scenario 2: Part 1

- Aaron Mathews works in the head office
- In charge of managing communication to the truck companies.
- He has been working there for 5 years.
- He has a bachelor's’ degree in management.

Scenario 2: Part 2

- It is 7:00am PST, and Aaron goes through all his email notifications from each company to receive containers from.

- His customers trucking companies are from all over California.

- He makes a phone call to each trucking company to tell them what time to reach the port by and logistics based on what the schedule tells him is open.

Scenario 2: Part 3

- Aaron knows what the companies the contents of the containers came from that each truck company will need to be loading.

- He also scheduled a time for them to reach the port by. Today there was a container to load from Walmart, from Target, and a load from Qualcomm

- He adds this to a transfer list, and sends this to the Port of Long Beach, so that it can be read by the crane operator.

When Queen Maria arrives at 11am Tuesday
Unload, all Ferrari Car Parts and Taiwanese Semiconductors
Load, Qualcomm container, Target container, Walmart container

(**this transfer list is for demonstration purposes only**)

Scenario 2: Part 4

It is 8am and the trucking company West Coast Transport, begins to start the vehicle with a Walmart container from Riverside, CA towards Long Beach, CA. They are scheduled to be there before 10am.

However, the truck driver realizes 1 mile into the trip that the tire pressure begins to decrease and that there is a flat tire.

Scenario 2: Part 5

The truck driver calls Aaron in the head office about the flat tire, to ensure he is aware of the situation.

Since this is a situation where the container would be loaded, Aaron says that the head office cannot call for backup during loading situations.

Scenario 2: Part 6

- After hearing the news about the container, Aaron notifies the crane operator by email and phone call to not include the Walmart container coming from West Coast Transport since it cannot reach in time.

- Once the ship arrives, then the crane operator performs all the unloads, and then ignores the last load because he is aware that the Walmart container would not make it to the Port of Long Beach that morning

Scenario 2: Part 7

The ship Queen Maria sets off to sea with everything it was supposed to except the Walmart container.

Scenario 3: Part 1

- Bob Smith has been working for Mr.Keogh for the past 20 years
- He has an associates degree in liberal arts

Scenario 3: Part 2

- Mr. Smith starts his shift by checking in through security
- He begins by climbing the ladder
- Once he reaches the top, he waits for the previous employee to exit

Scenario 3: Part 3

- He downloads the manifest onto the computers hard drive
- Once he receives the transfer list he opens our software

Scenario 3: Part 4

- After opening the software he logs his name into the software correctly
- He selects the load and unload operation
- He enters the location where the manifest is stored

Scenario 3: Part 5

- The manifest is loads in and shows the list of all containers currently on the ship, in which there are none
- He looks at the transfer list and sees that he needs to load 1 “Walmart” and 1 “Stater Bros” containers

Scenario 3: Part 6

- He enters the name “Walmart” into the load description box and enters “1” for the quantity
- He enters the name “Stater Bros” into the load description box and enters “1” for the quantity
- He checks over his work to make sure there are no errors before hitting continue

Scenario 3: Part 7

- An illustration an 8 x 12 grid of the ship, a 4 x 24 grid of the buffer zone, and a truck icon appears on the screen
- The illustration at the top of the screen shows “step 1/2”
- The illustration shows a load operation with the truck illuminated as source and a square at (01,01) illuminated as target
- He makes an announcement “Truck carrying Walmart container proceed to the truck loading area”

Scenario 3: Part 8

- He performs the load operation “Walmart” container from the truck loading zone
- He moves the container into position (01,01) on the ship
- He clicks next at the bottom of the screen to move to the next part

Scenario 3: Part 9

- An illustration an 8 x 12 grid of the ship, a 4 x 24 grid of the buffer zone, and a truck icon appears on the screen
- The illustration at the top of the screen shows “step 2/2”
- The illustration shows a load operation with the truck illuminated as source and a square at (01,02) illuminated as target
- He makes an announcement “Truck carrying Stater Bros container proceed to the truck loading area

Scenario 3: Part 10

- He performs the load operation “Stater Bros” container from the truck loading zone
- He moves the container into position (01,02) on the ship

Scenario 3: Part 11

- He clicks finalize manifest
- Manifest automatically is updated
- Notification of the file location with the updated manifest is displayed on the screen

Scenario 3: Part 12

- He exits out of the load/unload section and clicks the balance section
- He inputs the location of the updated manifest
- He clicks the balance button below

Scenario 3: Part 13

- An illustration an 8 x 12 grid of the ship
- The illustration at the top of the screen shows “step 1/1”
- The illustration shows an illuminated square at (01,02) as the source and an illuminated square at (01,07) as the target
- He moves the container from (01,02) to (01,07)
- He clicks update manifest

Scenario 3: Part 13

- Notification that the manifest has been updates appears
- He drafts a new email with the updated manifest and send it off to the captain
- He sends the email

Maintenance Plan

Maintenance Plan

- We propose a yearly maintenance and update plan, ensuring the software remains compatible with updates in the manifest or process changes. [2]
- Occasional check-ins will address any issues, with support available to resolve technical concerns promptly. Automated alerts for system errors, logged for follow-up and maintenance review. [2]
- Scheduled data backups and recovery processes to ensure continuity post-outages. [2]

Training and Documentation

Training and Documentation

- Our goal is to make the software intuitive enough for users with basic computer skills to use without extensive training. [1]
- A simple onboarding process, including a PDF guide and a yearly refresher meeting if required. [2]
    - Online PDF guide will explain in full detail how exactly the software works.
- One-time, in-person, onboarding meeting to ensure all operators are familiar with the software’s basic functionality. [2]

Acceptance Testing

Acceptance Testing

We will have a final deliverable on or before November 23rd, 2024.

- Two weeks before the acceptance test, Mr. Keogh will provide five scenarios (scripts and data files), of which any two will be tested live.
- Mr. Keogh may provide up to three additional scenarios without notice, which will also be tested live.
- The software should be able to resume operation after power outages, continuing from the last action without loss of data.
- Logs must record all container moves, user commands, weight adjustments, SIFT executions, and manifest updates with accurate timestamps.

Acceptance Testing - Transportation Problem

- The system must generate an optimized container movement sequence in under 5 seconds for manifests containing up to 100 containers.
- All required container movements must be completed in under 10 minutes for a typical load/unload operation.
- Manifest updates must be completed and saved within 5 seconds of a container movement.
- The system will prompt the operator with a reminder to email the updated manifest after operations are completed.
- If a test reveals that the solution is more than 5% less efficient than a manual approach, the project will be deemed a failure.

Acceptance Testing - Balancing Problem

- The balance adjustment algorithm must calculate an optimized sequence within 5 seconds for up to 100 containers.
- The system should maintain a maximum weight difference of 10% between the port and starboard sides to comply with legal balance requirements.
- The software should provide visual feedback on the balance status and any potential discrepancies in real-time.
- If any test reveals that a manual balancing approach could yield a solution more than 5% more efficient than the system’s output, the project will be considered a failure.

Compliance with Regulations

Compliance with Regulations

- The software will follow compliance protocols for accurate logging and secure data handling. [1]
- The log file is non-editable but allows operators to append notes as needed, ensuring an accurate record for legal and investigative reviews by authorities like the FBI and insurance companies. [2]
- Logs will be securely stored and only accessed for annual reviews or specific investigations. [1]

References

[1] Problem_overview_by_Mr_Keogh (https://www.dropbox.com/scl/fi/jmmuz02s9fzh2w4sgub4v/Problem_overview_by_Mr_Keogh.pptx?rlkey=ol9yff8pxh79gjlykepego2zb&e=2&dl=0)

[2] Interview with Mr.Keogh on October 12th, 2024

[3] Email with Mr.Keogh on October 29th, 2024

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