Tracking With Chips

Inventory Asset Management System

(RFID chips)

MIS 4060 Final Project

Winter Semester 2021

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Team Charter Information

Team Name: Tracking-with-Chips

Project Description:

Tracking-with-chips will be designing an inventory management and asset tracking software and technology system. The technology will be a tracking chip that will monitor and feedback live data to the system using RFID and LTE Wi-Fi chips. The chips will also monitor temperature, excelerations, wifi mapping location in warehouse, and quantity within a pallet or crate. The system will allow users to receive data from individual chips to query information stored on a server in the warehouse. This information will include data mentioned above as well as receiving dates, on-hand/committed quantities, prices, etc. The software will be compatible with mobile devices for easy access on the go.

The objectives of this project are to:

- Establish a system to efficiently and effectively manage inventory
- Create technology to accurately and timely relay pertinent information
- Manage and track inventory status of time sensitive, perishable, and fragile inventory

Location of Project:

Oakland University, Michigan, USA

Estimated time to complete:

Project start date: January 27th, 2021

Project end date: June 1st, 2021

Team Members:

Name	Phone	Email
Nathan Smiley	(734) 752-5518	nsmiley@oakland.edu
Forrest Dixon	(231) 340-0998	fcdixon@oakland.edu
Elizabeth LaCoursier	(586) 746-6124	ejlacoursier@oakland.edu

Skills and Knowledge Inventory:

Forrest Dixon

- Experienced in SQL database language
- Experienced in Website design
- Experienced in operations and warehouse management/supply
- Experienced in networking and cyber security

Nathan Smiley

- Experience in coding languages including SQL, Python, VBA, and HTML
- Knowledge in data analytics software such as Qlik Sense and Alteryx
- Experience with RPA coding inside Automation Anywhere
- Familiarity with cybersecurity processes and program management
- Experience with SQL database design
- Experience in SAP creating data entries for organization of a corporate general ledger

Elizabeth LaCoursier

- Experienced in programming in database languages:
    - VBA Programming and Microsoft SQL
- Experienced with developing web application:
    - Java and HTML
- Experienced in data analytics platform:
    - Qlik Sense
- Experienced in Microsoft 365 applications:
    - Microsoft Access, Microsoft Excel, Microsoft Outlook, Microsoft PowerPoint, Microsoft Word, Microsoft Windows and Microsoft Visio

Agreed Upon Meeting Times and Location:

Meeting location will be virtual.

Meeting time will be Monday and Wednesday nights from 6pm-7pm.

Communication methods:

- Google Docs to share documents and work
- Google meets to video and voice chat
- Text message group chat for quotations and meetings set up
- Other tools and programs can be used as needed and agreed upon by the group

List of Team Rules and Expectations:

1. Meeting times will be set in the group chat, agreed upon by all group members, and will be kept on schedule.

2. Group members will notify each other if they will be late or unable to attend the scheduled group meetings.

3. Each group member will be designated a portion of the project that will be c completed on Google Docs by a certain date and time.

4. Each group member will review each assignment before submitting it and all group members will agree to submit it once it is reviewed and approved.

5. All team members will contribute equally to each assignment within the project.

6. If any group member is not contributing equally, other group members will reach out to them and let them know and see how they can resolve the issue.

Roles and Responsibilities:

Forrest Dixon-Software and Network Manager

- Responsible for software integration and validation
- Responsible for software analysis and quality assurance
- Responsible for server and network integrity.

Nathan Smiley-Project Manager

- Responsible for team coordination and product architecture
- Responsible for software development and test planning

Elizabeth LaCoursier-Operations and Supply Chain Manager

- Responsible for operations and inventory analysis
- Responsible for marketing and resource management

Code of Ethics:

Ethics is a moral philosophy that we all agree to adhere to in our group. We in the group understand that we are mutually going to work together and strive to each set standards that we all follow. We will have integrity and be professional with each other in the group text messages and Google Meet. We will be inclusive, considerate, respectful, and our experiences in different fields will be our strengths in the project.

- Strive to do a good job on each assignment and help others do the same on the project.
- Show respect to all members of the group and have mutual respect within the group.
- Make sure to have professional integrity with each other and embrace standards of integrity, respect, and responsibility.
- Help each other out throughout the project and be understanding of each other's needs.
- Cultivate an environment that fosters ideas, community, and being helpful.

Signatures:

We all agree to adhere to the rules and regulations of the group.

Nathan Smiley	1/27/2021
Forrest Dixon	1/27/2021
Elizabeth LaCoursier	1/27/2021

Scope Statement

Project Objective

Tracking with Chips is a modern and state of the art management information software and hardware tracking chip package. The chips will be modular and capable of LTE Wi-Fi and RFID transmitting (RFID can be used with aftermarket mobile scanning devices). The data these chips will transmit to the software will be temperatures, location, and assigned quantities, and dates and times such as received and expiration times. Tracking with chips is ideally suited for warehouse logistics and inventory management needs, but is also useful and adaptive to many other industries including food production, server and technology monitoring, and company vehicle tracking. Tracking with chips will be created for our company with a heavy influence of marketing to the public as well as other companies that could benefit from this technology. Tracking with chips is estimated to decrease product and inventory tracking costs by at least 10% as well as reduce product waste by more than 15% per year. This project will start March 1st and run 8 months, until October 1st. The total cost for this project would be $1.8 billion and suggested retail prices would be a company’s monthly subscription of $20 per month for software licensing as well as $5/tracking chip purchased.

Product Scope Description

Prototype and field test an inventory management system using RFID and LTE tracking chips with the ability to scale in size based on the logistics and management requirements of each customer. Hardware chips will be used to track package shipments assets including acceleration, location, and temperature. Information will then be documented and uploaded into a database for recording. Then employees will be able to access and track projects at work on any device connected to the company's server. This will help cut cost in inventory/time management.

Deliverables

- Asset tracker firmware
- Asset tracker hardware
- Database for inventory management
- Inventory GUI
- Testing results

Milestones

- Develop business and marketing plan - March 15th
- Complete chip hardware prototype - March 28th
- Complete IS management software - March 28th
- Complete chip software development - May 15th
- Complete database development and integration - June 30th
- Final Inspections and testing - September 20th
- Deliverable technology for customer - October 1st

Technical Requirements

- Chip Battery lasting more than 3 years
- Database able to completely integrate with any industry DBMS
- Database structure able to scale
- Accurate sensors providing temperature, acceleration, location, and RFID
- Algorithm to accurately determine motion
- Interface for data reporting
- Accurate and flexible communication via LTE and GPS

Limits and Exclusions

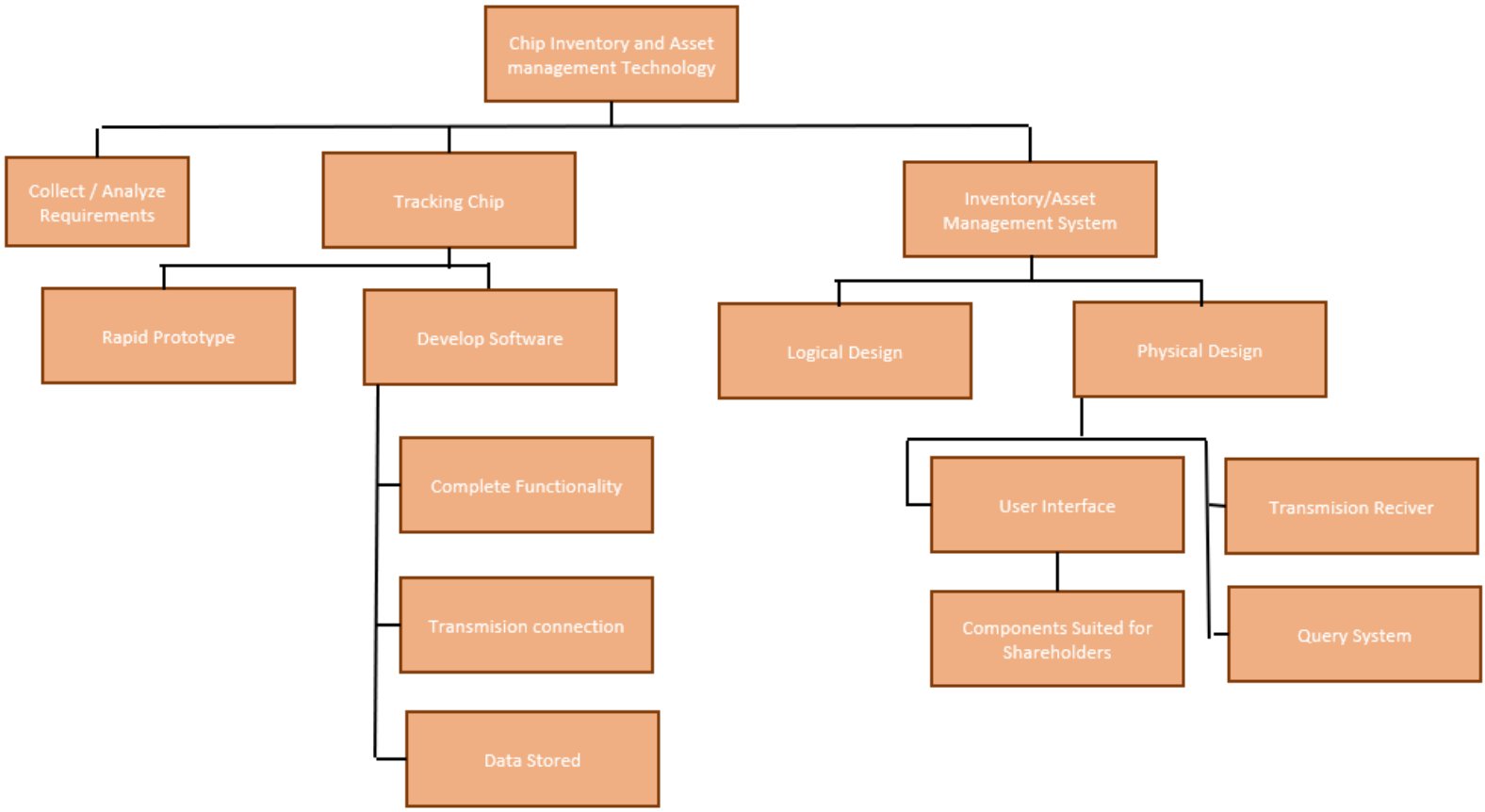
- Server hardware to host database system not included
- Communication over LTE can be not reliable depending on the location
- GPS can be spotty in some warehouse locations
- Temperature limit must be between 60C and -20C
- Database structured for a median operation scale
- Exclude RFID scanners from hardware provided

Customer Review

- Possible stakeholders include all possible warehouse companies who choose to utilize our hardware, active employees for said companies who interact with our hardware on a daily basis, employees in charge of data management for assets collected, third-party companies in charge of database server setup, and all internal employees involved in the creation of the asset trackers.

Work Breakdown Structure

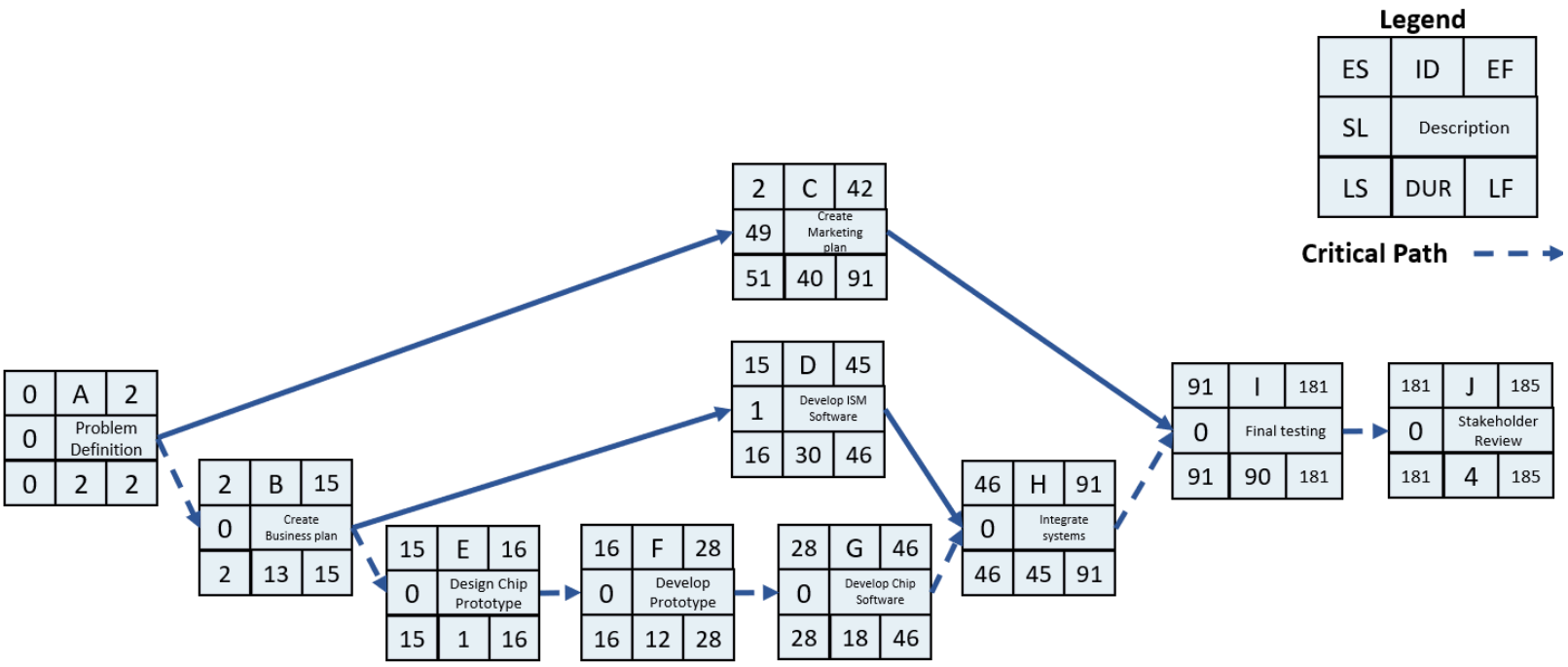
Work Breakdown Structure



Coded Work Breakdown Structure

1. Chip Inventory and Asset Management Technology
    - 1.1 Collect / Analyze Requirements
    - 1.2 Tracking Chip
        - 1.2.1 Rapid Prototype
        - 1.2.2 Develop Software
            - 1.2.2.1 Complete Functionality
            - 1.2.2.2 Transmission Connection
            - 1.2.2.3 Data Stored
    - 1.3 Inventory / Asset Management System
        - 1.3.1 Logical Design
        - 1.3.2 Physical Design
            - 1.3.2.1 User Interface
                - 1.3.2.1.1 Components Suited for Shareholders
            - 1.3.2.2 Transmission Receiver
                - 1.3.2.2.1 Query System

Project Network Diagram



Cost Analysis

Net Present Value of Project

Cost Savings seen as Increase to Profit		
Average profit per unit shipped in 2020	$	8.93
Percent increase in profits to		10%
Average Profit Increase per unit	**$**	**0.89**

Expected unit sales in 5 years			
Number of units shipped in 2020	$	2.54	billion
Average unit volume growth rate		32%	
unit volume expected in 5 years	**$**	**3.34**	**billion**

Estimated 5 year profit Increase			
Average Profit Increase per unit	$	0.89	
unit volume expected in 5 years	$	3.34	billion
Total increase to profits in 5 years	**$**	**2.98**	billion

Original cost of Project	**$**	**1.80**	billion

Net Present Value		Y0	Y5
Required Rate of Return	10%		
Cash Outflows		$ 1,800,000,000	
Cash Inflows			$ 2,980,000,000

Net Present Value	**$50,345,543**

[1]

[1] FedEx profit and sales data retrieved from Statista reports. Source:
https://www.statista.com/statistics/878581/fedex-ground-total-annual-package-volume/
https://www.statista.com/statistics/878602/fedex-ground-average-yield-per-package/

Return on Investment of Project

Over the course of 5 years, this project is expected to return cash flows of 2.98 billion dollars, excluding the initial year of investment. The initial cash outflow for this project is expected to be 1.8 billion and the overall net profit increase is expected to be 1.18 billion. In summary, ROI is expected to be 65.7%.

For comparison, an individual's investing in the stock market at the beginning of the year 2015 would have seen a return of 23.30% (21,917 - 17,776 / 17,776)[2] over the course of 5 years (2015 - year end 2020). The project is expected to yield a higher rate of return over the course of 5 years and would be a better investment for the company.

Summary of Project Feasibility

The project ROI and NPV noted above suggest a good reason to follow through with the project. Financially the company would benefit as well as efficiencies would increase for handling packages and orders. Also, lost and late delivered packages would decrease leading to increased customer satisfaction and potentially increased sales and revenue in the years to come. These estimates are based off of a cost reduction of 10% which is an approximate estimate. As long as the cost is reduced by more than 6% the project will ultimately be profitable, however, to earn a ROI greater than the stock market the cost reduction must be greater than 7.4%.

[2] Stock market data retrieved from DJIA website for the periods of 1/1/2015 to 12/31/2020. Source: https://www.marketwatch.com/investing/index/djia/charts

Risk Analysis

Risk Assessment Form

Risk Event	Likelihood	Impact	Detection Difficulty	When
Failure of database server	1	5	1	Any point after hardware is online
Hardware failure regarding chips	2	3	3	Any point during project
Network communication issue	3	4	2	After deployment on location
Improper data management	1	4	3	Any time after data has been recorded and stored
Changes in operation sizing	3	2	2	At any point during customer negotiations or post implementation

Risk Response Matrix

Risk Event	Response	Contingency Plan	Trigger	Who is responsible
Failure of database server	Mitigate: Utilize backup storage methods to prevent data loss upon catastrophic failure	Maintain a smaller scale database backup to keep record	Database server fails to record data	Software engineers with customer IT (owning the server hardware)
Hardware failure regarding chips	Mitigate: mass produce chips with option to buy post initial sale in case some die	Have inventory of replacement chips ready to sell	Asset tracker chips do not accurately record or transmit data	Project engineers
Network communication issue	Avoid: Test communication in customer location before sale	Discuss possible solutions with customer to improve connection	Network connection with chips is faulty	Deployment team in unison with customer IT team
Improper data management	Avoid: discuss proper database software usage with customer	Deploy a database software specialist to help teach software use to customer	Data is stored or manipulated incorrectly by user	Customer IT and possibly post-sale help team
Changes in operation sizing	Avoid: Thoroughly discuss implementation with customer pre-deployment	Maintain flexibility in sizing to fit a wide range of operations	Customer asks for a larger or smaller sizing in product	Customer engagement team

Risk Management Summary

The majority of the risks identified in this project are post implementation. To counter this, the team will implement avoidance/mitigation plans to counter any identified threats. In addition, due to the nature of the majority of risk-taking place on the customer end, a post-deployment team will be trained to assist customers with any issues that may occur in the field. The usage of these avoidance measures will help to identify and minimize risks before they materialize.

The biggest identified threats can be broken down into three main categories. One being issues with implementation into a workplace due to customer specifications, another being hardware issues with the asset trackers themselves, and the third being issues with data storage and management. The first issue can lead to a couple different issues including the customer changing the sizing of the required operation. This would change the amount of chips required as well as database hardware that can handle a larger amount of data storage. In addition, a customer may have issues with network connectivity in locations where LTE is sporadic. To combat both of these issues, the team must maintain good communication with prospective customers throughout the entire design and implementation process to best meet their needs. The second potential risk of hardware issues does not have as much of an impact on the overall success of the project as it can be mitigated by thorough testing of the chips before deploying them to a customer. In addition, to cover any failed chip, a backup inventory must be kept to sell replacements to customers. This is not too much of an issue as the individual units themselves are relatively inexpensive. The third main category of issue is the largest and hardest risk to address. Due to the nature of the data storage and management being handled by the customer themselves, the majority of this risk falls on the customer. With the possibility of an issue stemming from improper data management being so high, the best way to address this is by avoidance. Before fully deploying a system to a customer, our team will train the customer on our database software and how to best address any possible issues that may occur post-deployment. To provide a contingency plan in case the customer does face an issue with the data storage that cannot be addressed themselves, we will have a maintenance team on staff to work with the customer as a support staff.

Project Kickoff

The kickoff meeting will include all stakeholders and project teammates. The main purpose of the kickoff meeting will be to establish the scope of the project, present the expected timeline, and communicate all requirements of the project between all parties to make sure everyone is on the same page.

Conduct Establishment

The first order of business will be establishing the project rules and policies and relating them back to the organization mission statement. This will set the tone for expectations are requirements of all parties and how accountability will be addressed.

Planning and Establishing a Schedule

The order to address in the kickoff meeting will be establishing a plan and timeline in coordination with the stakeholders. This will help to define the process of how the project will be carried out, and will set dates for project milestones.

Tracking Progress

Progress will be tracked through the established timeline. Any deviation from the timeline will be communicated promptly with all stakeholders, and a contingency plan will be presented to manage any setbacks.

Managing Changes to Plan

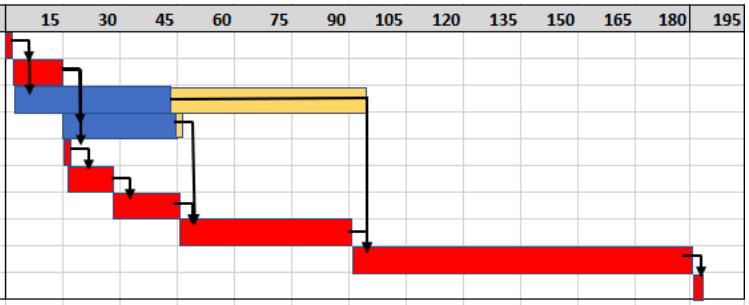
Any change to the established plan whether that be timing or requirements will be communicated between all parties and kept to a minimum to avoid deviation from the established plan. This meeting will help to establish the level of slack associated with each portion of the project and margin for change.

Stakeholder Communication

This meeting will establish lines of communication between each stakeholder party and the relationship therein. All modes of communication will be established at the kickoff meeting.

Project Schedule

ID	Code	Duration	Task Name	ES	EF	LS	LF	SL
A	1	2	Collect/Analyze Requirements (Problem ID)	0	2	0	2	0
B		13	Create Business Plan	2	15	2	15	0
C		40	Create Marketing Plan	2	42	51	91	49
D	1.3	30	Develop ISM System	15	45	16	46	1
E	1.2	1	Design Chip Prototype	15	16	15	16	0
F	1.2.1	12	Develop Prototype	16	28	16	28	0
G	1.2.2	18	Develop Chip Software	28	46	28	46	0
H		45	Integrate Systems	46	91	46	91	0
I		90	Final Testing	91	181	91	181	0
J	1.3.2.1.1	4	Stakeholder Review	181	185	181	185	0



Key

Critical Path

Slack

Project Closure

Project Closure Checklist

Customer approval
Product deployment team verifying proper implementation of the system
Database software training with customer
Staff reviews
Support plan and team developed for post-deployment help
Backup inventory of chips created
Project financing closed
Post-project meeting scheduled
Final invoice and billing sent
Support planning and options discussed with customer

Retrospective: Lessons Learned

- Final project objective was met
- Project was created with enough flexibility to handle the customer's sizing
- Project timeline was met with no deviation from initial scheduling
- Risk mitigation team was developed to handle possible data issues
- Backup inventory was created to replace any hardware failures
- Implementation was successful
- Customer approval
- Project contributed to the organization mission statement
- Code of conduct was followed

Considerations for the future:

- Network connectivity issues could prove to be an issue for other prospective customers chips may need to be fitted with Wi-Fi
- RFID chips may not be needed as barcode scanners are an industry standard-helping to cut cost
- Consider implementing our own database hosting servers to mitigate risk of data becoming corrupted or lost by customer management