Department of Computer Science & Engineering
The University of Texas at Arlington

Project Charter
CSE 4317: Senior Design II
Spring 2022

Bin Buddy

Clean Team
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Revision History

Revision	Date	Author(s)	Description
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1 Problem Statement

There have been times when we forget to put out our garbage bins on the curb for the garbage truck to pick up. The Clean Team want to ease the process of taking out one's garbage bins to the curb. Our ultimate goal is to make the trash disposal experience as simple and effortless as possible.

2 Methodology

The Clean Team will be developing a cross-platform progressive web app (PWA), that can help track a garbage truck and inform the user if the truck has passed their home or they still have time to move their trash bins to the curb for the garbage truck to pick up. Additionally, the app will also be able to send reminder notification on a day prior to the scheduled garbage collection day.

3 Value Proposition

The Clean Team does not currently have any external sponsor, but this application is designed to be highly beneficial to waste management companies. The Garbage Route Tracker will provide value for the customers of these companies by making the trash disposal experience better. Residents of the City of Arlington and possibly other cities would benefit from this type of application.

4 Development Milestones

This list of core project milestones should include all major documents, demonstration of major project features, and associated deadlines.

Provide a list of milestones and completion dates in the following format:

- Project Charter first draft - 28 February 2022
- System Requirements Specification - March 2022 (First draft)
- Architectural Design Specification - April 2022 (First draft)
- Detailed Design Specification - June 2022 (First draft)
- Final Project Demonstration - August 2022

5 Background

Trash is something that all people have to deal with. There is a good system in place by the government to help to collect, and dispose of the waste created by the people of the country but the system relies on people acting on time. Our application is meant to help alleviate the burden placed on the people in the trash collection process.

By providing an application that can track and alert people of when a garbage truck will be coming by heir homes, the weekly stress of making sure your trash is taken out is effectively eradicated. By providing for functionality that sends reminders to the consumers phone the consumer can also ensure they do not have to rush early in the morning to take their bins to the curb, and also helps to prevent needing to hold onto trash for several more days.

The business case of this application will be to contact and coordinate with local waste companies to provide data on how efficient the routes their garbage trucks run are as well as providing data about users trash. The data collected can be used to determine how often a route should be run as well as provide immediate information about potential stops and break-downs through an interface accessed by the driver of the truck. Contacting businesses will be done after initial production and testing of the application to ensure the application developed is ready for commercial use.

The application can also be extended to help the average user to categorize their waste. This would allow for the user to sort their trash and look up on what days specific types of garbage are collected. This will assist in making sure that disposal facilities are not receiving incorrect types of waste, as well as preventing potentially hazardous material from being disposed of incorrectly which could have negative environmental impacts. By providing material provided by official government agencies the application can provide a convenient method for users to determine the correct method of disposal.

Our team will be collaborating closely with Dr Shawn Gieser who is our sponsor and Senior Design professor. This idea was born from the stresses he has experienced in the past with waste disposal and our goal is to meet his specification to reduce these stresses.

6 Related Work

Currently, there are a few companies that deliver a product with a similar mission statement, many in international locations. Technoton is a company in Belarus that focuses on the "development and manufacture of GPS tracking devices, fuel level sensors and fuel flow meters" [3]. To begin, this product seems to target more-so the Garbage Collection Service Companies, focusing on vehicle maintenance rather than focusing on Residents. Another issue with this company is that it is not local.

IntelliTrac is another competitor that our product will compete against. IntelliTrac "provides a complete turn key solution for the waste management industry ranging from local government residential waste collection services to commercial services" utilizing "IntelliTrac's Elite GPS Tracker coupled to IntelliTrac's Driver RFID System and Mobile Data Terminal" [2]. Much like Technoton, this product focuses more-so on the driver-side/Garbage Collection Service Company, with their product providing features such as Logging of bin issues such as "Bin not out", Overloaded Contaminated Bins, Missed Bin Collection Job Dispatch and Navigation, Missed Bin Collection Job Dispatch and Navigation, and Driver alerts when approaching households requiring a special service. This product provides the hardware, but lacks the software and community use.

Track Your Truck Fleet Tracking is another competitor we face. Once again, this company seems to focus more on the Waste Management Company side, as this allows the Garbage Collection company to "know where your garbage trucks are in real time, how fast they are going, and what traffic delays they may face." [4]. This company's product states it benefits Garbage Collection Companies by allowing for them to "easily dispatch a new garbage truck when one is broken down, improve routing to eliminate wasted time and fuel, ensure that drivers are held accountable for their whereabouts while on the

job, handle customer disputes with historical or real-time information about vehicle locations, keep customers satisfied with prompt service and safe driving habits, [and] send specialty vehicles to the right locations for large-item pickup" [4].

Advanced Tracking Technologies, Inc. is another competitor based in Houston focusing on GPS tracking in fleet vehicles. The purpose of their product is to allow "business owners and fleet managers can help their drivers improve their habits, reduce insurance costs and save on fuel" [1].

The above companies all Waste Management Company oriented and lacks a clean user interface and focuses on physical hardware/devices for the garbage trucks. Another company that focuses more on the resident/client side is WM, a company that focuses on sustainability. Their product allows for "curbside trash and recycling pickup" [5] for both residents and businesses. This company does have an application and on their website it includes information on how to properly dispose of waste. Rather than being a supplement to Waste Management sided, it seems to be a private company. The application allows users to "view pickup schedule, report a missed pickup, request an extra pickup, view estimated pickup time, view holiday schedule and weather alerts" [5] according to their app description. How our application will contrast from this product is that our product is marketed for waste management companies and residents as well. It is an application where both parties will find the necessary information they need. WM's product lacks real-time location tracking and is an application solely for their own waste management company. Our product differs, as it is meant for multiple waste management companies and can be marketed throughout the United States.

7 System Overview

To help increase the efficiency of Garbage Collection, promote recycling, and making household garbage/recycling management easier, we aim to develop an app that will act as a central location for residents to track their local garbage truck and have access to proper waste management methods.

Our solution will include the following major components:

- Sign Up: Users can create a new account utilizing this page which allows for personal customization features.
- Guest Mode: The user can view the app through guest mode to simply view the location of the garbage truck and local waste management information.
- Driver Mode: The Garbage Collection Service provider can log in utilizing the Driver Mode in order to allow residents to track the garbage truck.
- Log In: The user can log in through any device to access the application.
- Home Page: Central location for navigating through the different features of the application.
- Truck Tracker: Page that will track the location of the garbage truck and show its route on a map.
- Information: A page dedicated to provide users information about local waste management laws/rules, garbage truck routes (what pickup day), how to properly dispose of specific items.
- Account Management: Page that will allow the user to update their personal information.
- Map (Driver Side): Page that will allow the driver to view their route and begin/end their tracking.
- Vehicle Management (Driver Side): Page that will allow for the driver to input vehicle status (ie: under maintenance, out of service, etc.)

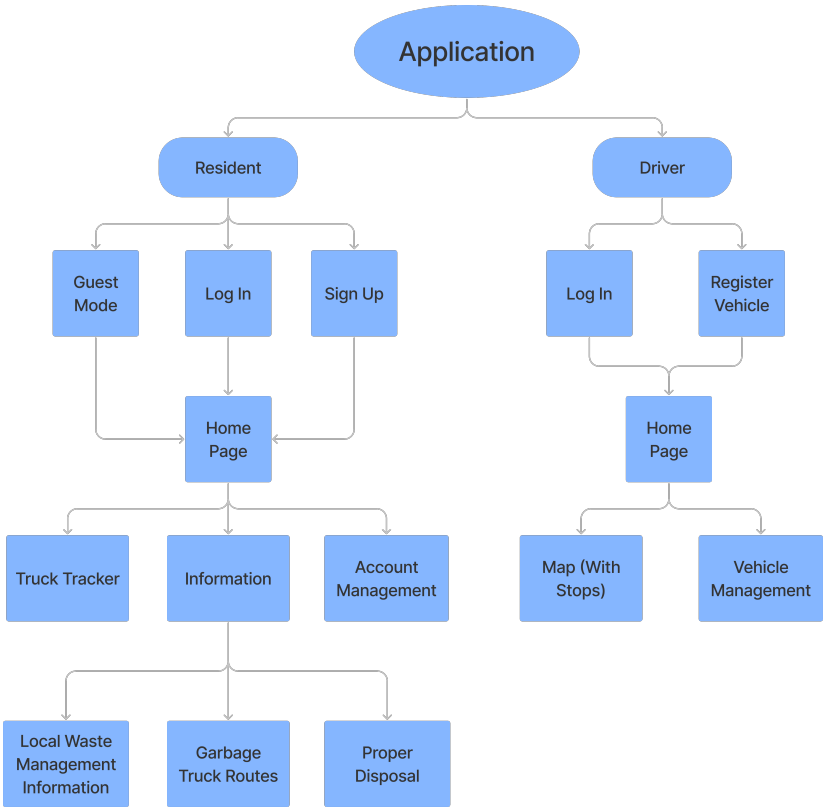

Figure 1: System Diagram

8 Roles & Responsibilities

For PHASE I of this project, we plan on first implementing this product at a local level, specifically focusing on the city of Arlington, TX. With the product goal of making day-to-day lifestyles easier for our users, the primary stakeholders of this project (at this phase) will be the residents of the city of Arlington, TX, and local Garbage Collection Services (ie: Republic Services of Arlington).

Our product will focus on allowing users (the residents) to know the location or ETA of a garbage truck, which will allow the user to manage how much time they have to collect their garbage, and if they, unfortunately, miss the garbage truck, the application will advise the user on ways to properly dispose of their garbage.

Our other stakeholder, Garbage Collection Services, will also benefit from this product by allowing Garbage Collectors to efficiently pick up garbage, as not only would individuals put out their trash promptly but, furthermore, it would reduce the load needed to be picked up. With an informed public, this will reduce the amount of garbage that needs to be picked up, as fewer individuals would stockpile their garbage. In addition, this application can be utilized to further inform users about proper disposal techniques and promote recycling.

For this project, our primary sponsor is Dr. Shawn N. Gieser and under his guidance, the development team will have a better idea in the development phase as he views this product from a user perspective. Implementing scheduled meetings will further enhance the team's understanding of requirements allow for the deployment of a user-friendly application.

The development team consists of Shubhayu Shrestha, Mohammed Ahmed, Amay Kadakia, and Nicholas Soliz. As a team, we will evenly distribute the work that needs to be done to promote an equal contribution within our development team. We will maintain productivity by holding multiple meetings throughout the week, discussing each of our progress and any obstacles we are currently facing. We will work together and help each other if we are stuck. The development team will also implement the scrum method to maintain consistency and organization within the team, with each of us taking turns being the scrum master.

9 Cost Proposal

Our development team has a funding of $800 and will be using a portion of the funding to acquire a few hardware components that would be beneficial to the testing and implementation of the product. The software we are using for development is free, thus our expenses lie solely on a method to run and track the application and position of a moving object. We have decided that the use of a cheap phone with capabilities to access WiFi and a Raspberry Pi will suit our needs. A phone to be tracked using built in GPS and a Pi to run the processes and provide a dedicated computer. A bicycle has been decided as a simple and cheap method to provide a moving, variable speed, vehicle to track. Web hosting will be required, either through Amazon Web Services (AWS) or Heroku, in order to have our website up and running. A domain name will also be necessary once the website is live.

9.1 Preliminary Budget

Item	Category	Cost
Web Hosting	Software	$30
Domain Name	Software	$15

Table 1: Overview of initial costs for application development and testing

9.2 Current & Pending Support

Funding is provided by the CSE department of University of Texas Arlington. Initial and total final investment from UTA is $800. This is the sum total of all expected financial support for this project and we have no intention of reaching out for other sponsors.

10 Facilities & Equipment

The development process for this project will utilize a shared lab space for collaborative programming sessions, weekly in-person meetings, and product testing. Utilizing a lab space will benefit our team's productivity by allowing us to have a quiet workspace and a space where the team can tackle programming issues and further develop detailed design mock-ups as a team.

This project is expecting to use cloud services (ie: Amazon Web Services, Google Cloud, Microsoft Azure) to store user login credentials and server-based computing. The payment cost for the cloud services will be covered by the funding provided to our team. Furthermore, we will also be utilizing a mobile device, that will be purchased for testing purposes, to simulate the driver-side and resident-side user interfaces.

The team will utilize our personal computers to develop our application and hold virtual meetings (if necessary). Utilizing our personal computers allows us to conveniently program in our free time, which ultimately maximizes our development efficiency. Furthermore, utilizing our personal computers will reduce the cost that would add to our budget.

Version control will be done utilizing Azure DevOps, User-Interface mock-ups will be created utilizing Figma, scrum and task-management will be organized utilizing Azure DevOps, and team communication will be held on Discord. The use of these tools comes from a cost and ease of use perspective, as these are tools the team is all familiar with using and are all free to use.

11 Assumptions

The following list contains critical assumptions related to the implementation and testing of the project. Some of the most critical assumptions relating to our project include:

- A suitable method for testing the garbage truck location feature will be completed using another vehicle (ie. A team member's car)
- The application will be developed collaboratively using version control software (ie. Github)
- The application will be run on the user's mobile device which has internet access as well as GPS capabilities
- The application will be utilized in Arlington, TX and will comply with any city and local ordinances regarding waste management
- This project could potentially be used by a local waste management company in the future.

12 Constraints

The following list contains key constraints related to the implementation and testing of the project.

- Final prototype demonstration must be completed by August 12th, 2022
- The customer will only view garbage collection data from the US.
- Use of trash sorting tool is for information purposes only and will not ensure proper disposal of waste, it is the job of the customer to ensure proper disposal.
- Total development costs must not exceed $800
- Material disposal requirements are created by the legal bodies whereupon the burden has been legally and rightfully ordained by the state, municipality or local governing body and not by the application developers.

13 Risks

14 Documentation & Reporting

14.1 Major Documentation Deliverables

These deliverables are major grade components of the course. Completing these documents should generally be the sprint goal during the applicable sprint period. Refer to current and previous course syllabi and schedules to estimate the due dates of these items. Remove this explanatory paragraph from your draft, but leave the heading.

Risk description	Probability	Loss (days)	Exposure (days)
Inexperience with development tools	0.50	18	9
Availability of team members due to time constraints	0.40	20	8
Dependence on mentor	0.20	9	1.8
Delays due to outdoor application testing	0.15	7	1.05
Technical issues due to hardware and/or software	0.15	10	1.5

Table 2: Overview of highest exposure project risks

14.1.1 Project Charter

This Project Charter will be updated every sprint, The first draft is delivered on February 28, 2022 and the final version will be delivered at the completion of this project which is estimated to be August 14th, 2022.

14.1.2 System Requirements Specification

The System Requirements Specification document will be started and maintained starting March 21st, 2022. This document will be updated during every sprint and the final version will be delivered on August 14th, 2022

14.1.3 Architectural Design Specification

The Architectural Design Specification document will be started and maintained starting April 11th, 2022. This document will be updated during every sprint and the final version will be delivered on August 14th, 2022

14.1.4 Detailed Design Specification

The Detailed Design Specification document will be started and maintained during the Phase II of our project which is set to begin June 6th, 2022. This document will be updated during every sprint of PHASE II and the final version will be delivered on August 14th, 2022

14.2 Recurring Sprint Items

14.2.1 Product Backlog

At the end of every sprint the product the backlog will be updated based on the Sprint plans and there will be a group vote to prioritize certain items. Jira Software will be used to maintain and share the product backlog with team members and stakeholders

14.2.2 Sprint Planning

There will be a total of 8 sprints, equally divided into 2 Phases. The Sprint plans will be based on a team discussion and Backlogs.

14.2.3 Sprint Goal

Clean team will discuss the sprint goal according to the customer feedback and backlog from the previous sprint to decide the sprint goal.

14.2.4 Sprint Backlog

The team will collaboratively decide on backlog items. The backlog will be maintained using the Jira collaboration software.

14.2.5 Task Breakdown

Each team member to voluntarily claim a task from the sprint backlog time spent on tasks be documented using Jira.

14.2.6 Sprint Burn Down Charts

The team will be collectively responsible for generating the burn down charts for each sprint. They be able to access the total amount of effort expended by each individual team member using Jira.

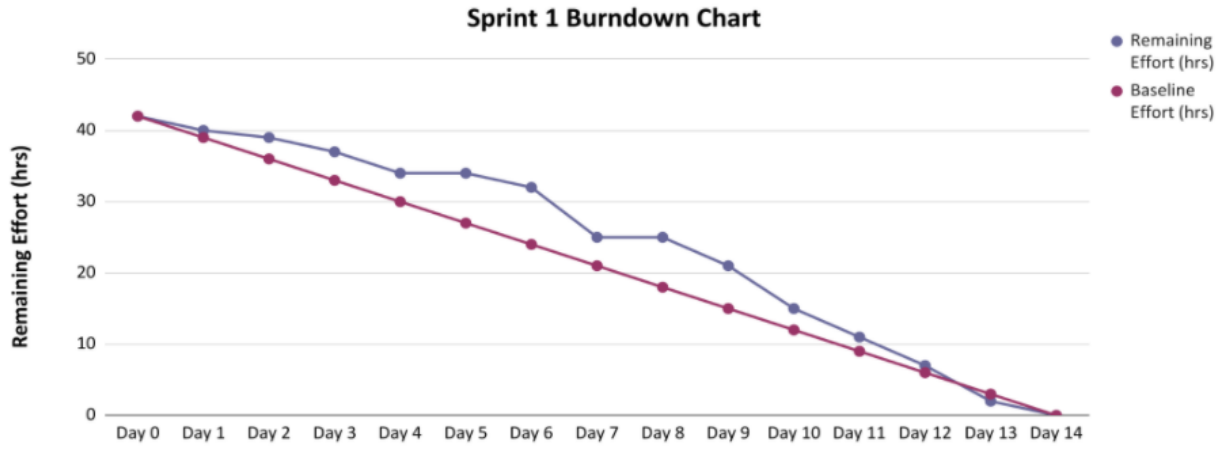

Figure 2: Sprint 1 Burndown Chart

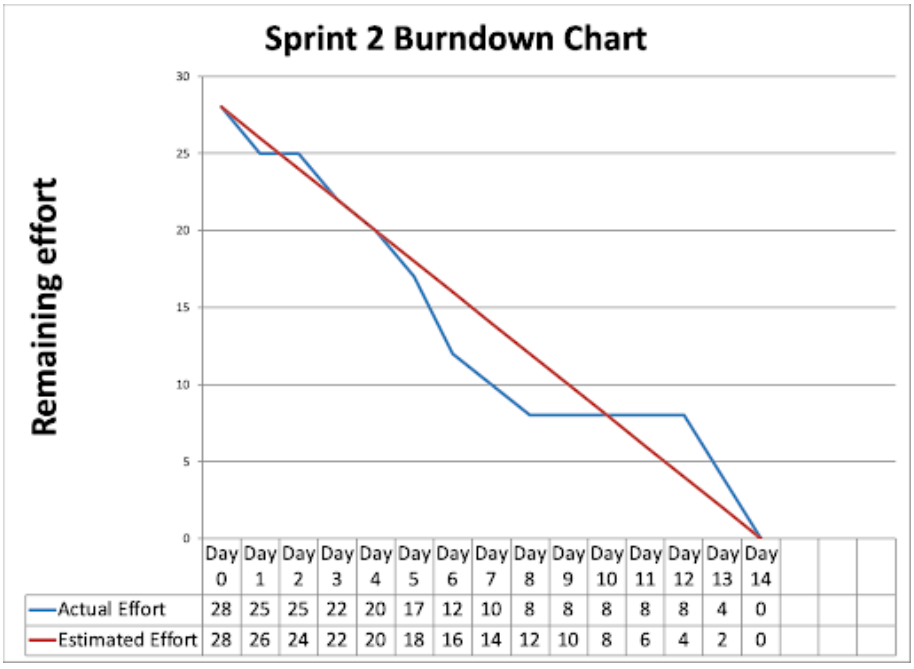

Figure 3: Sprint 2 Burndown Chart

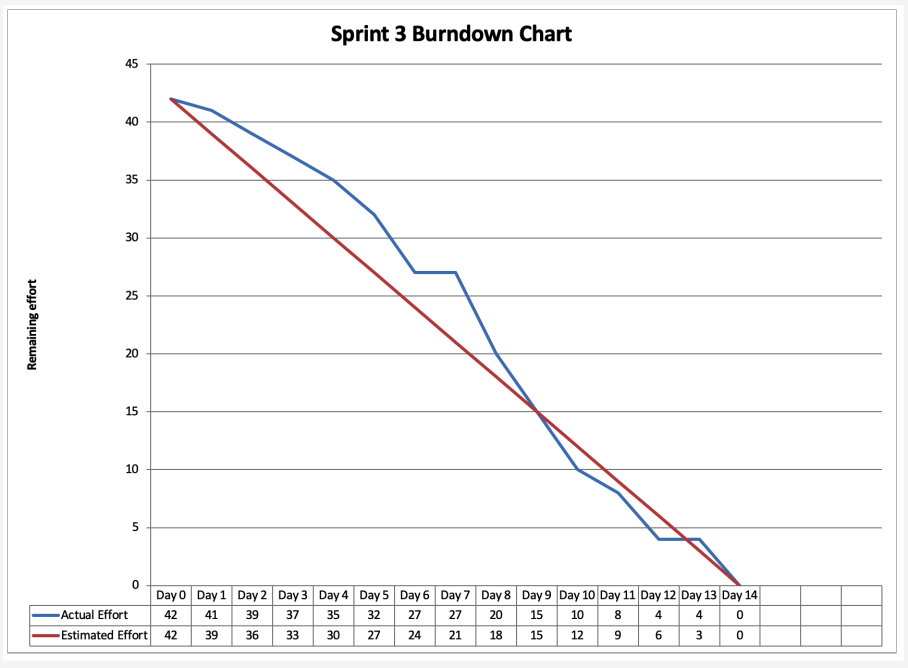

Figure 4: Sprint 3 Burndown Chart

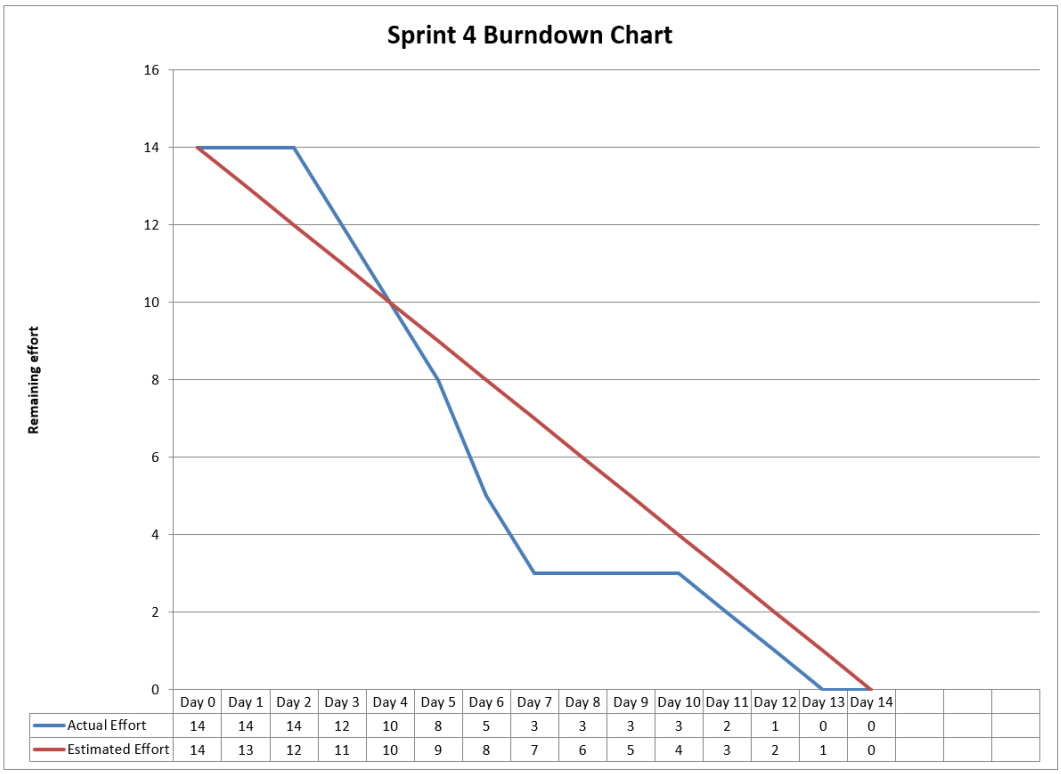

Figure 5: Sprint 4 Burndown Chart

14.2.7 Sprint Retrospective

The team will be collectively responsible for the Sprint Retrospective. This discussion will happen 1 day after each sprint is due. It will be 2 days after each sprint is due.

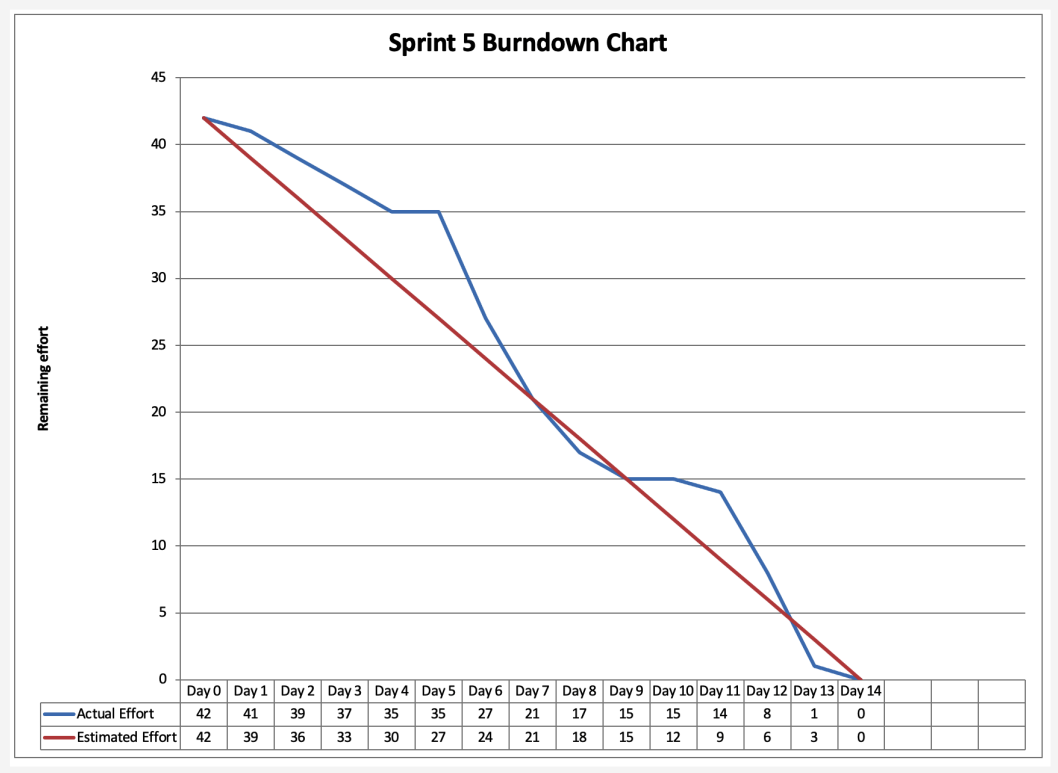

Figure 6: Sprint 5 Burndown Chart

14.2.8 Individual Status Reports

Team members will write a individual report on the tasks that they are working on and also give a detailed report about the tasks that they have completed.

14.2.9 Engineering Notebooks

Engineering notebooks will be checked every two weeks at the end of each sprint. Each individual will be responsible on working on their Engineering notebooks.

14.3 Closeout Materials

14.3.1 System Prototype

After the completion of each weeks tasks, the team will collectively combine the the individual work and handle any errors to deliver a final product without any errors.

14.3.2 Web Page

The project web page will have detailed explanation of this project. It will be accessible to the public. The initial version will be live by May 2nd, 2022. The web page will be updated throughout the project to showcase the progress that the team has made.

14.3.3 Demo Video

At the completion of the project, There will be a demo video showcasing all the features available for the user to use.

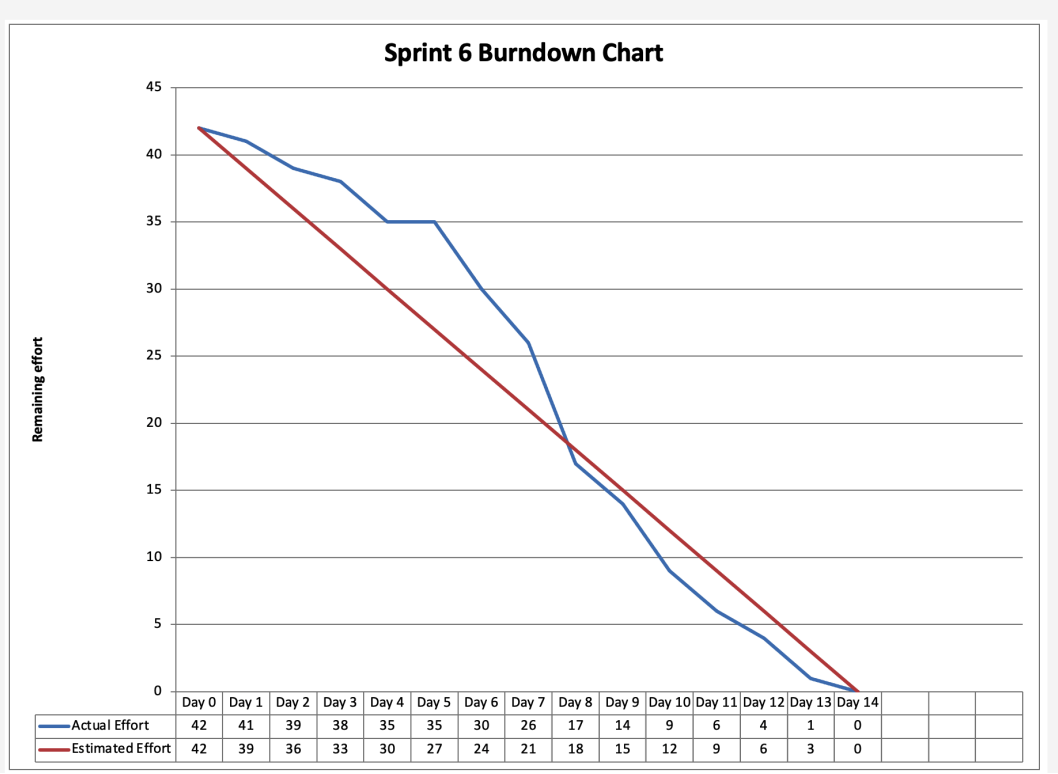

Figure 7: Sprint 6 Burndown Chart

14.3.4 Source Code

Our source code will be maintained utilizing an Azure DevOps . This will allow our team to maintain version control and also allow us to publish different versions of our product to the public. This product will not be open source, but the source code will be provided to the customer. We will be utilizing the MIT licensing and including this in our README file.

14.3.5 Source Code Documentation

Our documentation will focus on organization, clarity, consistency. The team will sort the information in a logical order and include headers and bulleted lists. In order to promote clarity, we will focus on being concise and clear in our documentation, ignoring filler words. Our documentation will stay consistent by maintaining the same organization methods and applying standard coding conventions (ie: file organization, naming convention, commenting code), making it easier for the user to read. This information will be stored in a README file on our Azure DevOps repository, which will also include citation information, licensing information, and our contact information. The documentation will be provided in a plain-text .md file posted on our repository.

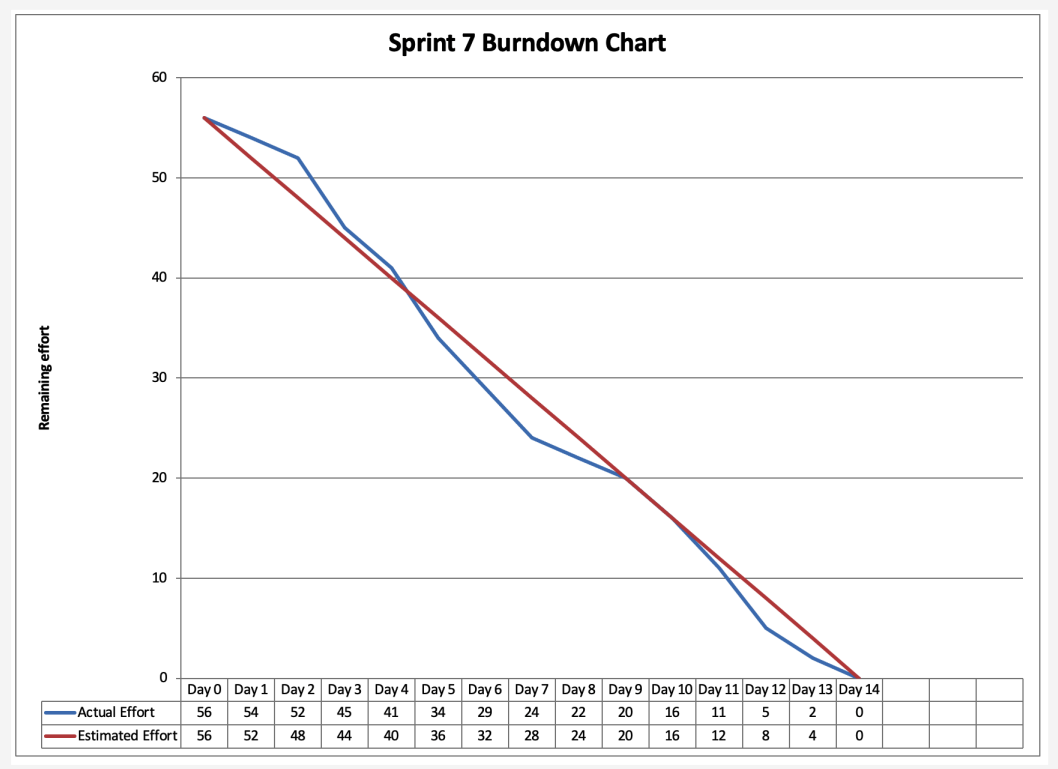

Figure 8: Sprint 7 Burndown Chart

REFERENCES

[1] Inc. Advanced Tracking Technologies. GPS Vehicle Tracking and Fleet Management.

[2] IntelliTrac. Garbage Truck GPS Telematics Solutions.

[3] Technoton. Garbage Truck Monitoring.

[4] Track Your Truck. Waste Management Fleet Tracking.

[5] WM. Who We Are: Leaders in Sustainability Environmental Solutions.

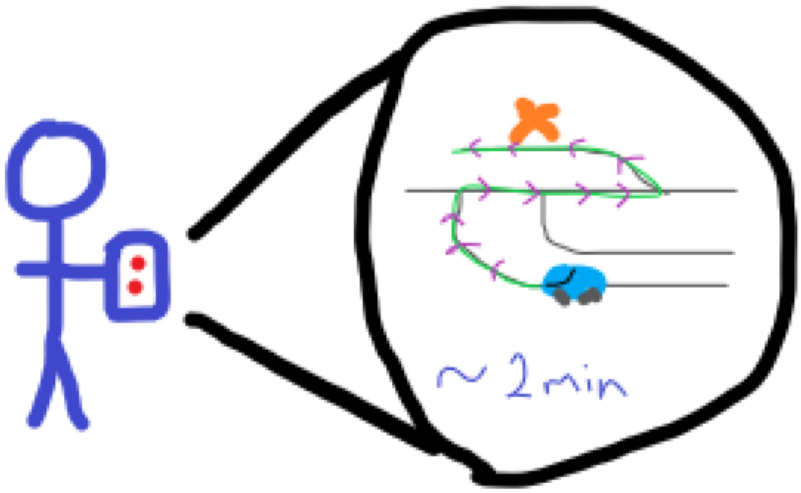

Figure 9: A very High Level Design