Lab 1 – Product Description

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Table of Contents

List of Figures

No table of figures entries found.

List of Tables

No table of figures entries found.

1 Introduction

Litter and illegal dumping remain persistent societal and environmental challenges that affect public lands, waterways, and recreational areas across the United States. Volunteer groups and municipal organizations regularly remove tens of thousands of pounds of waste from rivers, parks, and beaches, yet these efforts remain reactive and inefficient due to fragmented reporting and limited coordination. For example, cleanup initiatives along the San Marcos River alone have documented the removal of more than sixteen thousand pounds of trash during single volunteer events, highlighting both the scale of the issue and the reliance on episodic, laborintensive responses rather than continuous mitigation strategies.

A central contributor to this problem is a communication disconnect between individuals who encounter litter and the organizations equipped to safely and efficiently remove it. Citizens often observe trash in real-time but lack a clear, immediate mechanism to report precise locations or waste characteristics. As a result, reports are delayed, forgotten, or dispersed across emails and social media platforms where they may go unnoticed. Cleanup organizations, in turn, struggle to allocate resources effectively and distinguish between minor debris and hazardous or large-scale dumping. This breakdown leads to inefficient efforts and reduces overall impact. Any effective solution must therefore support live reporting, accurate location data, visual context, and a feedback mechanism that confirms whether reported waste has been addressed.

TrashTag is introduced as a targeted solution to this problem through a mobile based reporting and coordination platform designed to close the gap between public observation and organized cleanup action. The product is prototyped to demonstrate core characteristics essential to addressing the identified challenges, including real-time geotagged reporting, photographic

documentation of waste, and an interactive map that centralizes information for cleanup groups. Through prototyping, TrashTag illustrates how immediate user input can be transformed into actionable data that enables organizations to assess scope, prepare appropriate resources, and verify cleanup completion. By focusing on these essential characteristics, the prototype validates the feasibility of a scalable system that improves efficiency, accountability, and environmental stewardship while remaining accessible to everyday users.

2 Product Description

TrashTag is a web application developed to address the problem of litter and illegal dumping in public and recreational spaces. The product enables individuals to report trash by capturing photographs and location data and submitting that information to a shared system. TrashTag is intended for use by both the public and cleanup organizations, providing a centralized reporting platform that replaces fragmented communication methods. By supporting real-time visibility, the product enables a more organized and data informed approach to waste removal.

2.1 Key Product Features and Capabilities

The solution allows users to photograph trash, automatically capture geographic location, and submit reports that appear on an interactive map. Reports include basic details such as waste type and approximate size, providing cleanup groups with context before responding. Cleanup status updates and basic verification allow users and organizations to confirm when reported trash has been removed, while nearby users may be prompted to validate existing reports to maintain accuracy. TrashTag is significant in its ability to close the feedback loop between reporting and cleanup, improving coordination and reducing duplicated effort. Unlike emails or

social media posts, all reports are consolidated in a single system designed specifically for waste management, ensuring cleanup resources are directed where they are most needed.

2.2 Major Components (Hardware/Software)

The TrashTag solution is supported by commonly available consumer hardware and cloud-based infrastructure. Users access the system through smartphones equipped with a camera, GPS capability, and internet connectivity, while cleanup organizations and administrators may also use standard desktop or laptop computers through a web browser. Structurally, the system follows the CS 410 Major Functional Component Diagram model, separating presentation, application, and data layers. The presentation layer provides a mobile friendly interface for submitting reports and viewing mapped data. The application layer contains the core business logic and application programming interface that processes reports, manages users, and integrates mapping services. The data layer stores report information, images, and metadata in a relational database. Together, these software components form a cohesive system that supports real-time reporting, centralized data management, and coordinated cleanup workflows.

3 Identification of Case Study

This case study demonstrates how the TrashTag product would be used by a small community group as an initial beta-style deployment. The scenario provides a practical example of everyday use and illustrates how TrashTag supports communication between individuals who encounter litter and organizations responsible for cleanup.

The case study involves community members who regularly visit a public riverfront park and a local volunteer cleanup organization. Residents act as reporters by documenting trash they

encounter during normal activities, while the cleanup organization reviews submitted reports, plans cleanup efforts, and updates report status after removal.

In a typical scenario, community members observe trash near a public access area and submit reports using TrashTag. Each report includes a photograph and automatically captured location data, which appears on a shared interactive map. Cleanup volunteers review the reports, assess the scope of the waste, and conduct cleanup using appropriate resources. After completion, the report status is updated to reflect that the trash has been removed, and nearby users may be prompted to verify the cleanup.

Although this case study focuses on a small group, the same workflow can scale to larger environments such as municipalities, universities, and environmental organizations. This example illustrates how TrashTag supports real-time reporting, centralized visibility, and verification, demonstrating its effectiveness in addressing inefficient and disconnected litter reporting processes.

4 Glossary

Illegal Dumping: The unauthorized disposal of trash and other hazardous materials onto private and or public property.

Metadata: Descriptive information within data files such as date, location, and timestamp data in photos to be submitted to Trashtag.

Geotagging: The addition of GPS coordinates to images that enable precise location identification where trash was reported.

Live Real-Time Updates: Live data synchronization displaying trash reports to both users and cleanup organizations instantaneously.

Gamification: The incorporation of game-like mechanics such as rankings to motivate user participation and skyrocket cleanup operations.

5 References

48,000 pounds of litter removed across Virginia on Clean the Bay Day. (2025, June 22). *Chesapeake Bay Foundation*. https://web.archive.org/web/20250622092145/https:/www.cbf.org/news-media/newsroom/2025/virginia/more-than-43000-pounds-of-litter-removed-across-virginia-on-clean-the-bay-day.html

54th San Marcos River rendezvous clean up. (n.d.). *Texas Rivers Protection Association*. Retrieved September 23, 2025, from https://txrivers.org/texas-river-blog/54th-san-marcos-river-rendezvous-clean-up/

Blouin, L. (2016, January 8). *The psychology of littering*. The Allegheny Front. https://www.alleghenyfront.org/the-psychology-of-littering/

Campbell, M. L., Slavin, C., Grage, A., & Kinslow, A. (2016). Human health impacts from litter on beaches and associated perceptions: A case study of 'clean' Tasmanian beaches. *Ocean & Coastal Management*, *126*, 22–30. https://doi.org/10.1016/j.ocecoaman.2016.04.002

Cleaning litter along Arkansas roads costs millions in taxpayer money. (2021, October 28). *Thv11.Com*. https://www.thv11.com/article/news/education/arkansas/litter-costs-arkansas-taxpayers-millions/91-38fe040f-82c7-4698-a34a-d8cf7d77de34

Earth Day. (2025, September 22). *How our trash impacts the environment*. EarthDay.org. https://www.earthday.org/how-our-trash-impacts-the-environment/

Fawaz, M. (2023, March 3). *Hundreds of volunteers will fan out on San Marcos waterways Saturday to clean up trash*. Kut News. https://www.kut.org/energy-environment/2023-03-03/hundreds-of-volunteers-will-fan-out-on-san-marcos-waterways-saturday-to-clean-up-trash

Fire & Ice. (n.d.). *How litter harms humans, animals, and the environment*. Retrieved October 12, 2025, from https://indoortemp.com/resources/how-litter-harms-humans-animals-environment

Garza, A. (2014, March 25). *More than $40 million taxpayer dollars spent annually on Texas litter cleanup*. KTXS. https://ktxs.com/news/abilene/more-than-40-million-taxpayer-dollars-spent-annually-on-texas-litter-cleanup_20160517100457192

How to reduce litter in your parks. (n.d.). *Miracle Recreation*. https://www.miracle-recreation.com/blog/reduce-litter-in-parks/

Lara. (2024, October 10). *The economics of litter*. Keep Texas Beautiful. https://ktb.org/ktb-blog/the-economics-of-litter/

Litter in America: Results from the nation's largest litter study. (n.d.). *City of Hampton*. Retrieved October 12, 2025, from https://www.hampton.gov/DocumentCenter/View/308/litter-factsheet-costs?bidId=

Mendoza, M. (2018, May 31). *San Marcos River litter 2018*. My San Antonio. https://www.mysanantonio.com/news/local/slideshow/San-Marcos-River-litter-2018-181939.php

On this 52nd annual Earth Day, what is the state of litter in Virginia? (2022, April 22). *VPM*. https://www.vpm.org/news/2022-04-21/on-this-52nd-annual-earth-day-what-is-the-state-of-litter-in-virginia

Picking up litter: Pointless exercise or powerful tool in the battle to beat plastic pollution? (2018). *UN Environment Programme*. https://www.unep.org/news-and-stories/story/picking-litter-pointless-exercise-or-powerful-tool-battle-beat-plastic

Thomas. (2024, February 1). *How does littering affect the environment?* Texas Disposal Systems. https://www.texasdisposal.com/blog/the-real-cost-of-littering/

Volunteers gather over 16,000 pounds of trash from the San Marcos River. (2020, April 13). *Corridor News*. https://smcorridornews.com/volunteers-gather-over-16000-pounds-of-trash-from-the-san-marcos-river/