



# First Responders Direct

CS 3398 Software Engineering – Fall 2023  
Texas State University

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# Introduction

## Overview

First Responders Direct (FR Direct) is a sophisticated software solution designed to dramatically improve the efficiency and effectiveness of emergency response operations. This system's core purpose is to ensure first responders reach emergency locations as quickly and safely as possible. By leveraging advanced technology integrations, such as real-time data interfacing with local Computer-Aided Dispatch (CAD) systems and the Google Maps API, ERCS aims to optimize route planning, traffic management, and overall coordination of emergency vehicles.

## Purpose

The primary goal of FR Direct is to minimize response times for emergencies by intelligently managing and coordinating the movement of first responder vehicles. This involves dynamic route optimization, traffic light control, and real-time traffic updates, all working in concert to clear paths and reduce transit delays for emergency responders.

# Requirements

## 1. Functional Requirements:

1.1 User: (non-applicable)

1.2 System:

### 1.2.1: Local CAD System

The system shall establish a real-time interface with the local Computer-Aided Dispatch (CAD) system to acquire the address of the emergency location, the first responder available, and their unique first responder identification number as it becomes available.

### 1.2.2: Google Maps API

1.2.2.1: The system shall obtain the fastest route to the emergency location from the API.

1.2.2.2: The system shall analyze the traffic along the route and adjust the traffic lights accordingly.

1.2.2.3: The system shall take the estimated time of arrival at any given light as a factor in determining when to control the traffic lights.

1.2.2.4: The system shall retrieve and update in real-time the estimated time of arrival (ETA) at the emergency location for each first responder vehicle from the API and utilize this data for route optimization and coordination.

1.2.2.5: The system shall optimize the routes of multiple first responder vehicles in real-time to prevent route collisions and ensure the fastest possible arrival at the emergency locations.

### 1.2.3: First Responder GPS

1.2.3.1: The system shall integrate with the GPS units on first responder vehicles to receive and display the fastest route acquired from the Google Maps API.

1.2.3.2: The system shall provide real-time traffic updates to the first responder's GPS units to ensure the quickest possible navigation, considering current road conditions.

1.2.3.3: The GPS system on the first responder vehicle shall provide an indicator of the current and upcoming traffic light colors along the route, allowing drivers to anticipate and adjust their speed accordingly.

1.2.3.4: The system shall display the estimated time of arrival at the emergency location on the first responder's GPS. This display shall be updated in real time based on traffic conditions, route changes, and other relevant factors.

### 1.2.4: Traffic Light Timing Assurance

The system shall ensure robust real-time control of traffic lights along the emergency route to prevent any failure or delay that could hinder the rapid transit of first responders or the safety of civilians.

## 2. Non-Functional Requirements:

### 2.1 System:

2.1.1: The system shall only work in areas that have smart traffic lights which can be controlled remotely.

2.1.1.1: Control and regulate traffic automatically

2.1.1.2: Turn lights green for approaching emergency vehicles

2.1.1.3: Prevent holdups

2.1.2: Real Time Processing (expensive)

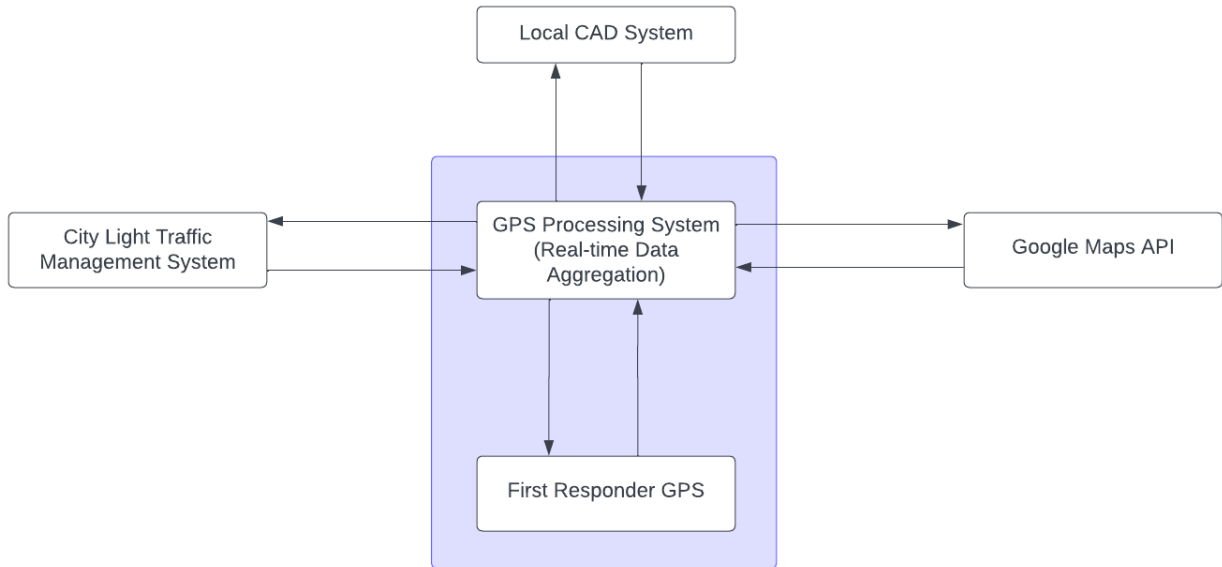
2.1.2.1: Reduced latency to reduce the time it takes to receive insights from data, which can be critical in situations where timely action is required.

2.1.2.2: Improved decision-making to make better decisions by providing timely up to date information.

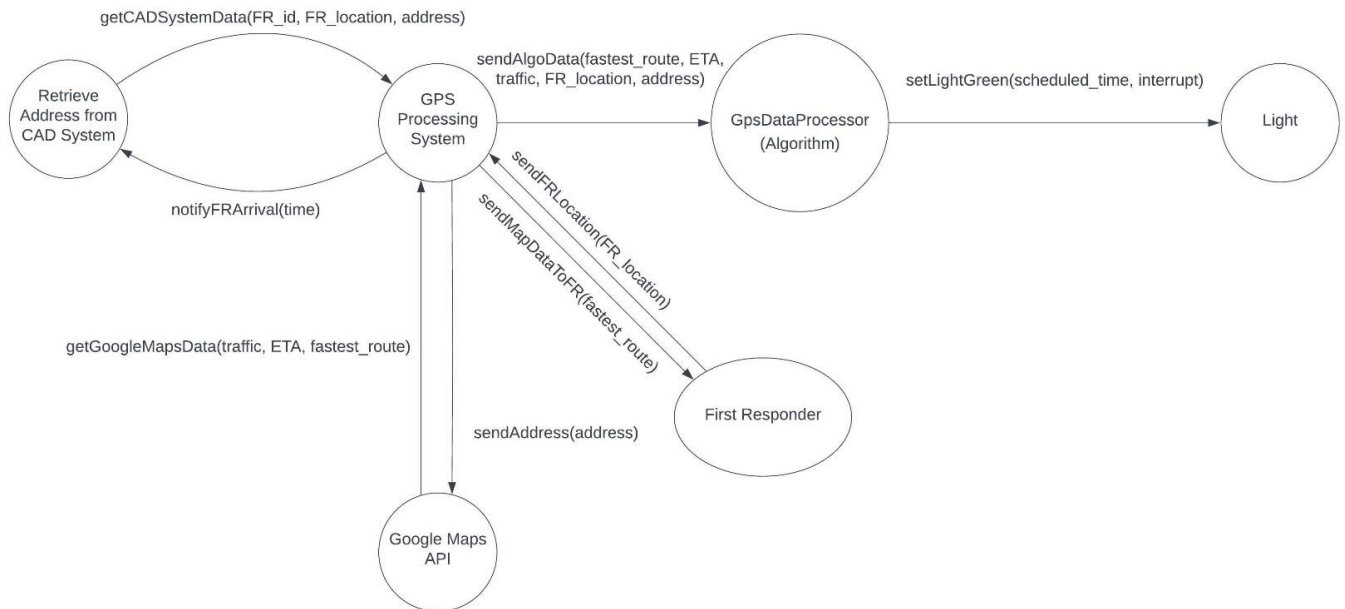
2.1.2.3: Increased efficiency of operations by automating tasks and identifying potential problems early on.

### 2.2 User: (non-applicable)

# Architecture



# Detailed Design



# Testing

Requirement	Test
2.1.1.2: Turn lights green for approaching emergency vehicles	1
1.2.1: Retrieving the Emergency Location from Local CAD System	2
1.2.2.5: The system shall optimize the routes of multiple first responder vehicles in real-time to prevent route collisions and ensure the fastest possible arrival at the emergency locations.	3

## Test Case #: 1

Name: Traffic Light Control and GPS Integration

Description: Assuming a first responder will be passing a light at noon, the light should be green for a specified amount of time (interrupt).

Input Data: 12:00 pm and 5s, 10s, 15s, 1 min, 2 min interrupt

Procedure:

- 1) Safely stand at an intersection
- 2) Is the light green at noon?
- 3) Did the FR vehicle pass the light within each interrupt value?
- 4) Does the light go back to working as it originally was?

Result/Status: If the light changes to green and the FR vehicle passes through the individual interrupt value, it passes. Otherwise, it fails

Remarks: None

## Test Case #: 2

Name: Test emergency location retrieval from CAD System

Description: This test ensures the system correctly interfaces with the local CAD system to acquire emergency locations.

Input Data: Address of an emergency location (3398 Cool St, San Marcos, TX)

Procedure:

- 1) Inject 3398 Cool St, San Marcos, TX into the CAD system.
- 2) Do we see 3398 Cool St, San Marcos, TX inside the CAD system.
- 3) Observe testing UI and see if all unit tests about getting the CAD system data pass (all green).

Result/Status: It passes if we observe all the tests as passed inside the testing UI.

Otherwise, it fails.

Remarks: None

## Test Case #: 3

Name: Safely Handle Route Collision

Description: Can it handle route collision between two first responders at the same intersection when both FRs are meant to go through that intersection at noon?

Input Data: 12:00 pm

Procedure:

- 1) Safely stand at an intersection

2) Is the light green at noon?

3) Did ONLY FR1 go through?

Result/Status: It passes if the light turned green and only FR1 went through safely.  
Otherwise, it fails.

Remarks: What is FR2s alternative route?