

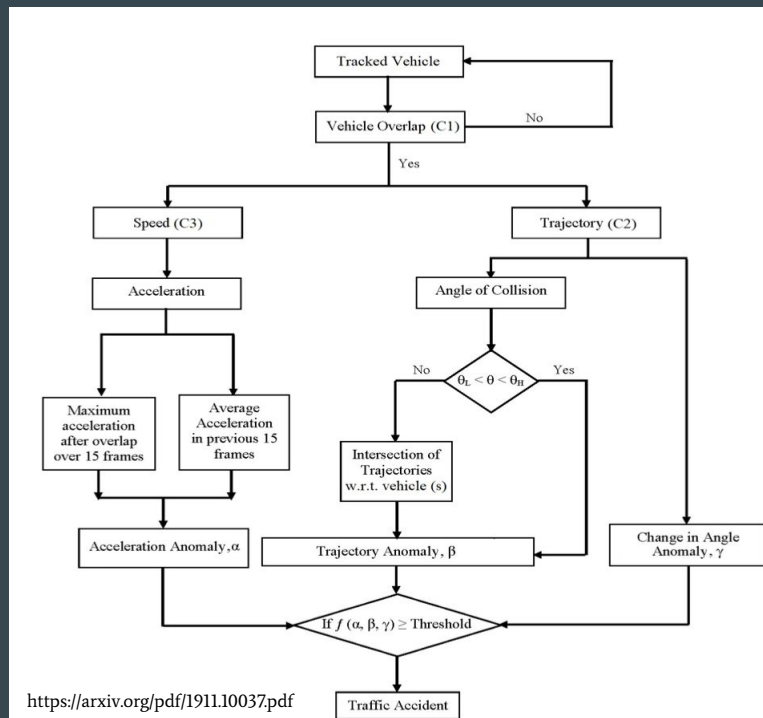
Accurate Crash Detection

- Computer vision algorithm based on object detection
 - Track vehicle positions and speeds to identify crashes
- False positives are 99% accurate (as low as possible)
- False negatives are 75% accurate



Technical Challenges

- We need **lots** of intersection camera data
- Our main feature is inherently an edge case
 - Crashes are not common in training data
- Outdoor environments are very unique
 - Sunny day, cloudy day, precipitation, etc.
- Environments can change very quickly



Dynamic Rerouting

- Reroute traffic once crash is detected
- Consider severity of crash, road layout, traffic
- Alert the use of potential traffic boards and other resources



Dynamic Rerouting Challenges

- Need to figure out how large a crash is relative to road
- Consider different types of road layouts



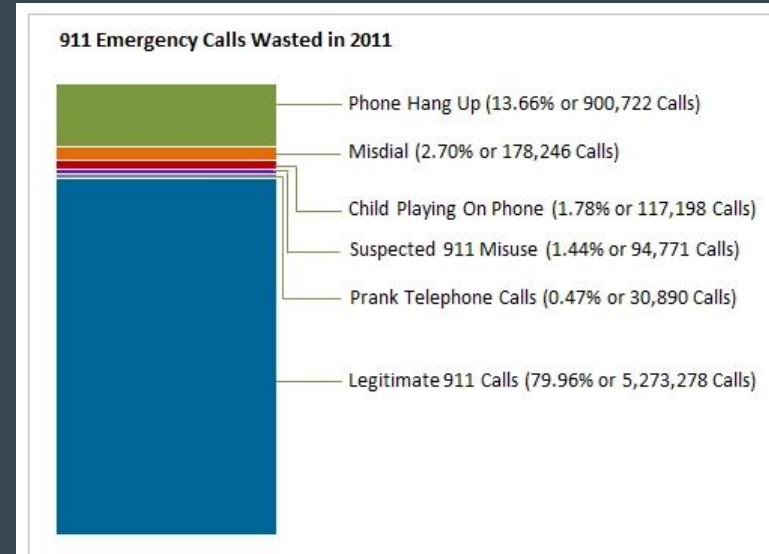
Emergency Alert System

- Connect to 911/Emergency Operators
- Within 5 seconds of crash transmit
 - Location information
 - Number of Cars Affected
 - Lane Closures



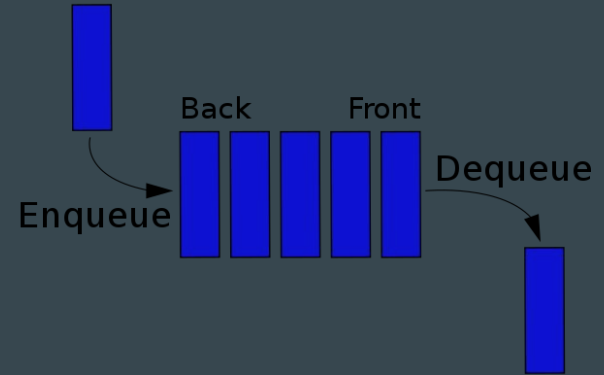
Emergency Alert System Challenges

- False positives \approx 0%
 - Waste of police resources
 - Unnecessary lane closures
- Discerning severity of accident
- Deciding what emergency services are needed
- Figuring out the format of message
 - Voicemail
 - Text Message



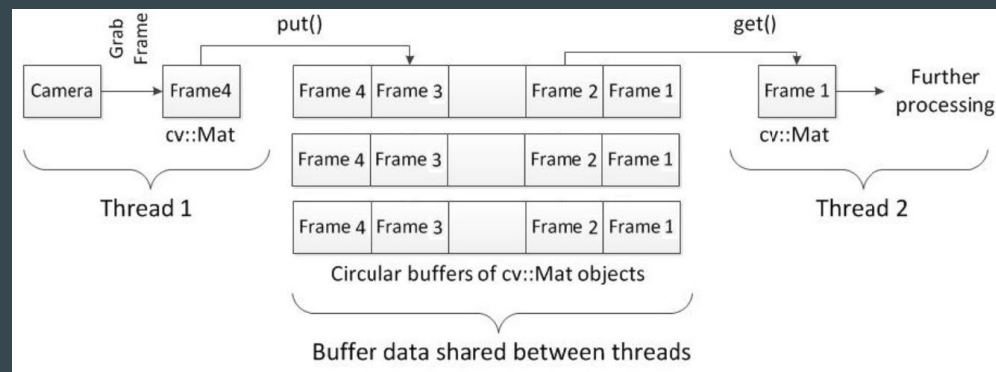
Video Logging of Crashes

- Live buffered camera recording
- Queue based technique for capturing relevant video when accidents are detected
- Crash videos should contain footage before the incident and after
- Uploaded to a web server for easy accessibility.



Video Logging Challenges

- Inherently a multithreaded design
 - Congest / process video
 - Manage queue data structure
 - Uploading footage while maintaining the data structure
- Memory considerations
 - Not necessarily “system critical”
 - Managing resources / cleaning up resources
- Signal based communication between accident detection module and video logging modules



From opencv.org

Solution Approach

- Convolutional Neural Network training for vehicle detection
- Algorithm based on speed and location of vehicles to detect crash
- Use WiFi to facilitate communication
- Simulate traffic networks with hardware (breadboard LEDs, transmitter, receivers)
- Buffered video recording through opencv
- Web server needed

Testing, Verification and Metrics

- Heavy reliance on traffic camera video datasets
- Splitting test data between training and classification
- Object detection: computer vision based
- Collision detection: small “dataset” -> challenge
- System is “fed” these video datasets as live images

Schedule

Smart Traffic Light

Company Name
Project Lead

Project Start:

Display Week:

TASK	ASSIGNED TO	PROGRESS	START	END	Feb 7, 2022							Feb 14, 2022							Feb 21, 2022							Feb 28, 2022							Mar 7, 2022							Mar 14, 2022							Mar 21, 2022							Mar 28, 2022							Apr 4, 2022							Apr 11, 2022							Apr 18, 2022						
					M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S							
Phase 1 Title																																																																																	
Research Crash Detection Algorithms	Jonathan	0%	2/6/22	2/13/22	██████████																																																																												
Researching Rerouting Algorithms	Goran	0%	2/6/22	2/13/22	██████████																																																																												
Research Message Transmission	Arvind	0%	2/6/22	2/13/22	██████████																																																																												
Phase 2 Title																																																																																	
Implement Crash Detection	Jonathan	0%	2/13/22	3/6/22	██████████																																																																												
Implement Rerouting Algorithms	Goran	0%	2/13/22	3/4/22	██████████																																																																												
Message Transmission Handling	Arvind	0%	2/13/22	2/27/22	██████████																																																																												
Breadboard Setup	Arvind		2/27/22	3/4/22	██████████																																																																												
Breadboard Setup Part II	Goran		3/11/22	3/16/22	██████████																																																																												
Phase 3 Title																																																																																	
Signal Handling Detection/Routing/Traffic	Goran		3/11/22	3/25/22	██████████																																																																												
Wifi Communication Breadboard	Arvind		3/16/22	3/23/22	██████████																																																																												
Breadboard Capable of Message Transmission	Arvind		3/24/22	3/31/22	██████████																																																																												
Set Up Web Server/Live Video Buffer	Jonathan		3/11/22	4/1/22	██████████																																																																												
Data Collection	Jonathan		3/11/22	3/25/22	██████████																																																																												
Phase 4 Title																																																																																	
Signal handling Breadboard/Modules	Jonathan		4/1/22	4/8/22	██████████																																																																												
Buffered Camera Recording on Crash	Arvind		3/26/22	4/2/22	██████████																																																																												
Interim Demo	NA		4/4/22	4/6/22	██████████																																																																												
Adjustments based on Feedback	Jonathan, Arvind, Goran		4/7/22	4/18/22	██████████																																																																												
Final Presentation	NA		4/19/22	4/24/22	██████████																																																																												

Next Steps

- Begin training Neural Network for reliable traffic camera vehicle detection
- List out hardware components and AWS credits we need to purchase
- Questions?

