

Overview

Goal:

Develop a platform to assist 911 call operators in collecting information, reasoning about that information (context and correlation) across multiple data sources and then displaying it in a way that integrates with their current workflow.

Call Queuing & Information Collection

911 Caller Queue				
Emergency	Call Duration	Caller Role	Previous	Incident
Allergic Reaction	1m 32s	Victim	3	0
Emergency	Call Duration	Caller Role	Previous	Incident
Hit and Run	3m 9s	Bystander	0	0
Emergency	Call Duration	Caller Role	Previous	Incident
Possible Gunshots Nearby	2m 41s	Witness	2	0
Emergency	Call Duration	Caller Role	Previous	Incident
Car Accident, Blocked Intersection	3m 14s	Victim	0	0
Emergency	Call Duration	Caller Role	Previous	Incident
Car in Ditch, Possible Drunk Driver	6m 28s	Witness	0	0

Figure 1: Operator Queue view showing differing priority calls – High to Low

Problem:

911 call-takers are overwhelmed with multiple simultaneous calls, each with varying levels of emergency severity.

Solution:

- Chatbot pre-fetches meaningful data: name, address, number, role in incident, emergency details.
- Analysis is performed on this data in real time, correlating the instance with other active and previous calls.
- Priority Queue uses the caller role and severity of the emergency to prioritize calls shown to the dispatcher.
- Demonstrates the ability to collect relevant, baseline information in a decoupled manner from the call.

Call Details		
Call Details	Previous Calls	Related Incidents
Priority 1. Threat to life in progress Call Duration 3m 46s Call Start Time 14:56 Emergency Car Accident Caller Name Robert Swank Phone Number 616-781-5719 Emergency Description So, uh, I was in a car accident and uh, there's a lot of blood like everywhere. I think its coming from my leg... I can't move my leg and I'm stuck		
Location 618 Washington Way Grand Rapids, MI Latitude, Longitude: 42.938165, -85.592380 	Transcript What is your name? Robert Swank What is the address you are calling from? I'm on East Paris, I think What is the phone number you are calling from? 616-781-5719 What is the nature of your emergency? Car Accident Can you describe the details of your emergency? So, uh, I was in a car accident and uh, there's a lot of blood like everywhere. I think its coming from my leg... I can't move my leg and I'm stuck	

Figure 2: Caller Details view showing data collected about the emergency.

Emergency Duplication

Problem:

When accidents occur, multiple individuals will call 911 regarding the same instance. An example would be a multiple car pileup off the freeway. One victim may be incapacitated, but another victim may call 911. Bystanders may also call, but with less relevant information than victims and witnesses.

Solution:

- Analyze call for keywords describing the emergency
- Emergencies are grouped together if the location, time, and keywords are similar.
- More complex contextual analysis can be performed to correlate calls.
- For instance, calls from nearby locations and time spans by witnesses of a fire, spotting a man in black hoodie running away, and possible arson may be connected.

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Figure 3: Related Incidents view demonstrating multiple calls regarding the same incident (duplication)

Caller History

For callers that can not talk at the moment or experiencing other problems, knowing information like a history of allergic reactions can help the call-taker make an informed decision.

Call Details	Previous Calls	Related Incidents																																																
Priority 1. Threat to life in progress Call Duration 5m 58s Call Start Time 13:42 Emergency Allergic Reaction Caller Name Jane Miller Phone Number 616-895-4938 Emergency Description So, I'm like, majorly allergic to peanuts and one of my friends thought it'd be funny to see what happens when I eat one. So, I'm like, totally having problems breathing and I can't find my epine	<table border="1"> <tr> <td>Emergency</td> <td>Call Duration</td> <td>Previous</td> <td>Incident</td> </tr> <tr> <td>Allergic Reaction</td> <td>10m 32s</td> <td>2</td> <td>0</td> </tr> <tr> <td>Caller Role</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Injured</td> <td></td> <td></td> <td></td> </tr> </table> <table border="1"> <tr> <td>Emergency</td> <td>Call Duration</td> <td>Previous</td> <td>Incident</td> </tr> <tr> <td>Traffic Accident</td> <td>8m 23s</td> <td>1</td> <td>3</td> </tr> <tr> <td>Caller Role</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Witness</td> <td></td> <td></td> <td></td> </tr> </table> <table border="1"> <tr> <td>Emergency</td> <td>Call Duration</td> <td>Previous</td> <td>Incident</td> </tr> <tr> <td>Allergic Reaction</td> <td>12m 42s</td> <td>0</td> <td>0</td> </tr> <tr> <td>Caller Role</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Injured</td> <td></td> <td></td> <td></td> </tr> </table>	Emergency	Call Duration	Previous	Incident	Allergic Reaction	10m 32s	2	0	Caller Role				Injured				Emergency	Call Duration	Previous	Incident	Traffic Accident	8m 23s	1	3	Caller Role				Witness				Emergency	Call Duration	Previous	Incident	Allergic Reaction	12m 42s	0	0	Caller Role				Injured				
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Figure 4: Caller Details Previous Calls view.

Technical Details

Figure 5: System Overview Diagram

Modular Components:

- Amazon Lex chatbot asks a handful of 911-related questions and gathers the data
- Deployment of chatbot through both Facebook Messenger and Twilio SMS
- Python scripts parse the call transcript received from Lex to develop meaningful fields for context and correlation (queuing, duplication, history)
- Amazon Lambda container with scripts and dependencies that sends JSON object via HTTP to web server
- Web application implemented using the MEAN framework
 - Call data stored in MongoDB NoSQL database instance
 - REST API implemented using the ExpressJS library
 - Web application front-end developed using AngularJS
 - NodeJS web server

Future Work

The 911 cognitive bot is best suited as a mobile application. Facebook Messenger and Twilio SMS platforms do not support audio-to-text capabilities with Lex, while an Android or iOS app has documentation for this support. Also, contextual data from the device like GPS location and images from the accident would be efficiently acquired through a mobile application.

Acknowledgements

We would like to acknowledge and share our appreciation to Motorola Solutions & Jehan Wickramasuriya for their patience and guidance in development efforts throughout the semester. We would also like to thank Mike DeKam, a 911 dispatcher, for helping us understand how 911 works and invaluable insights.