

Cerebro Real-time Security

Motivation

Actual CSU Email

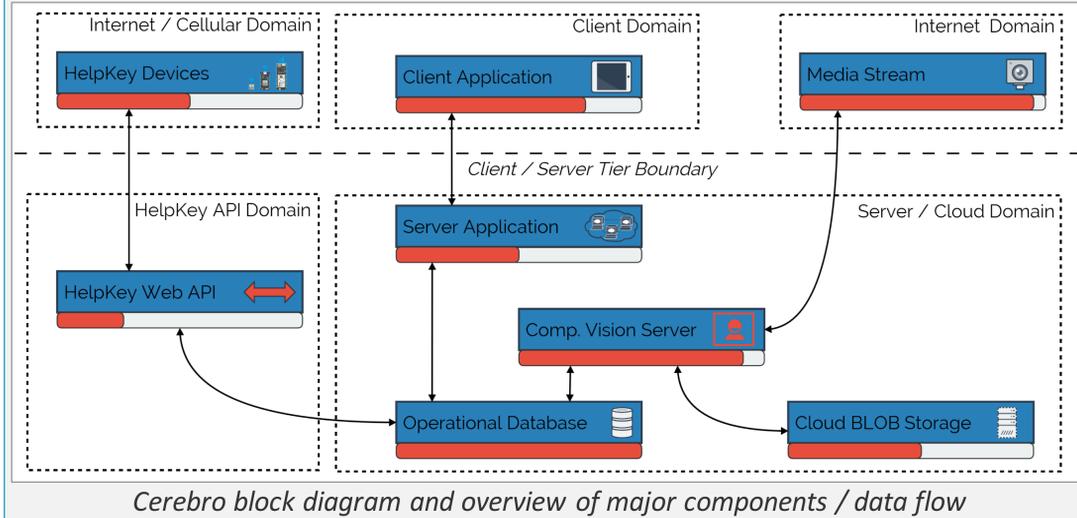
The following is a message from Cleveland State University on Feb 24th
 "A robbery was reported today to the Cleveland Police Department at approximately 7:20 pm on East 24th Street between Euclid and Prospect Avenue. "
 "A female CSU student had her cell phone taken from her while she was talking on it."
 "She was pushed to the ground while the suspects attempted to unsuccessfully take her purse. "
 "One suspect was wearing an orange hoodie. The second suspect was wearing a white or gray hoodie or jacket. "
 "Both suspects ran east on Euclid Avenue. **No further information is available at this time.**"

What is Cerebro?

Overview

Cerebro uses an **innovative human detection and recognition algorithm**, based on a Computer Vision Machine Learning algorithm, to detect humans in the video streams of hundreds or thousands of cameras within a specified area. Using this algorithm, **crimes can be detected in real time**. As a crime is committed, the suspect is tagged in the system, and **they are then tracked from camera to camera as they attempt to flee**. **Their location is reported to police in real-time**, and is displayed on tablets in police cruisers as both video and as a pins on a map interface. Using this, **police can track the suspect, update information about the chase, and apprehend the suspect both quicker and more efficiently than ever**.

System Architecture – Software Solution



Solutions

Cerebro Solutions

Hardware

Software & Data

HelpKey

CV Algorithm

Applications

Cerebro HelpKey - Hardware Solution

Our HelpKey device is an internet-connected, GPS-enabled board capable of delivering distress calls to the Cerebro server.



Cerebro HelpKey Prototype Boards

- Security in 3, 2, 1
- 3 User Holds Button
 - 2 GPS API Request Made
 - 1 Cerebro Initiates Chase at Loc.
- Guaranteed request delivery in < 3 seconds

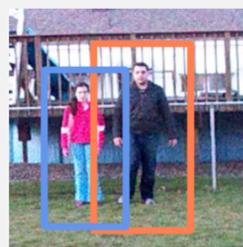
Technology and Innovation

Computer Vision Algorithm

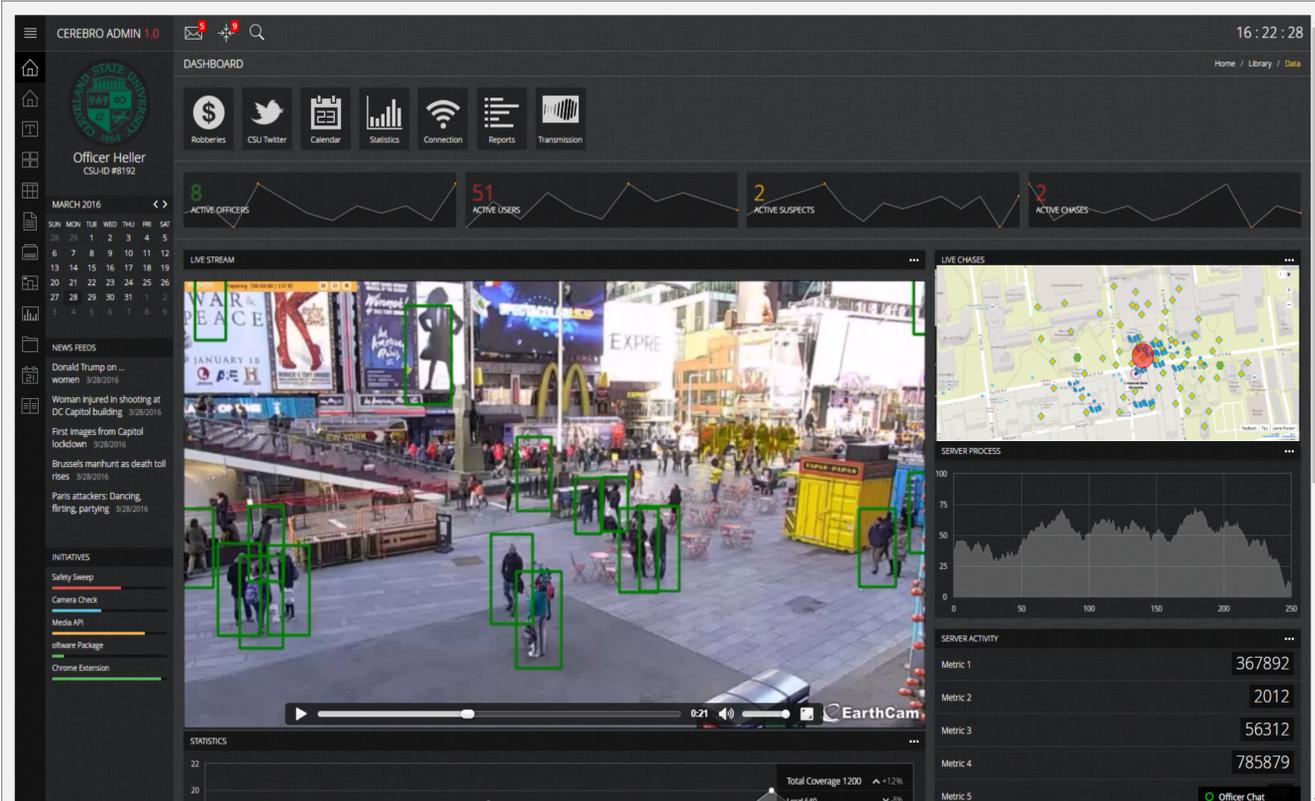
Our proprietary algorithm makes detecting and tracking unique humans **fast, efficient, and accurate**:

1. Individuals are detected using a **Histogram of Oriented Gradients** and a pre-trained **Support Vector Machine** which identifies humans in video frames.
2. Certain **key identifying features** such as **location, RGB pattern, and unique feature vectors** are extracted for every detected person and stored in our cloud database.
3. In successive frames, the detected people are compared to the previously detected ones in order to **find matches and track them over multiple cameras**.
4. Using this data, individuals cannot escape from local police, as they are tracked from camera to camera – having **their location reported in real-time**.

We plan to improve our algorithm by continuing to make use of **state-of-the-art artificial intelligence techniques** and by re-training the Support Vector Machine on a recently acquired **dataset of over 3 million unique pictures** of people.



Front-end Application



Real-time Feedback

Using the mobile application on police tablets (developed by our team), police can add suspects to a chase, initiate a chase, view camera feeds, and perform many other tasks which **give them eyes in nearly every corner of the city**.

Acknowledgements

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| <p>Organizations</p> <ul style="list-style-type: none"> Parker Hannifin Corporation (Dr. Joseph Kovach) Cleveland State University EECS/ME Departments | <p>Individuals</p> <ul style="list-style-type: none"> Dr. Sunnie Sun Chung (CSU EECS Department) Dr. Pong P. Chu (CSU EECS Department) Dr. Majid Rashidi (CSU ME Department) |
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