Public Monitoring System

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Outline

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3. Engineering
   - Deliverables
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   - Results

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Motivation

- In recent years, safety has become an important priority and as a result, there is a rise in interest in surveillance and security.

- Cities have incorporated surveillance cameras into public areas to decrease crime rates.

- These cameras are not capable of notifying the police for car crashes and violent altercations.

Business Deliverables

1. Market sizing for such application
   - Total available market
   - Addressable market
2. Ecosystem
   - Competition
   - Device Partners
   - Stakeholders
   - Evolution
3. Funding
   - State & federal grants
   - City funding special projects
4. Margins
   - Typical cost of installation vs. market price point

Business Solution

- Voice of the consumer
- Pricing Strategy
- Generated Revenue

Voice of the Consumer: Trends

- Oak Brook, IL
- Evanston, IL
- Skokie, IL
- Schaumburg, IL
- Lombard, IL
- Peoria, IL
- Bradley University
  Police Department

Voice of the Consumer: Trends

- License Plate Recognition (LPRs)
- Public desire & need
- Legality of images and audio

Pricing Strategy

- Best Quality vs Best Price

- Premium Pricing

- Tiered Pricing Plan
  - Menu prices - Software Only
  - Hardware at Cost

- Cloud Management Fees

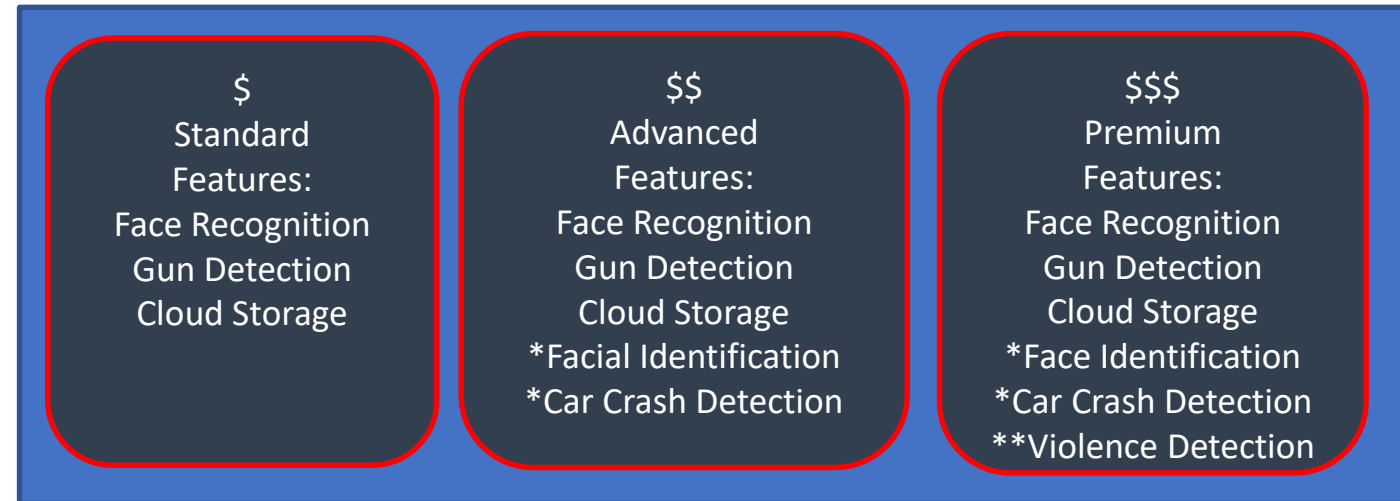- Installation & Servicing Fees are case by case

$ Standard Features:	$$ Advanced Features:	$$$ Premium Features:
Face Recognition Gun Detection Cloud Storage	Face Recognition Gun Detection Cloud Storage *Facial Identification *Car Crash Detection	Face Recognition Gun Detection Cloud Storage *Face Identification *Car Crash Detection **Violence Detection

Figure 1: Pricing Strategy

Financial Projections

10 Year Projection

- Unit Sales: Avg. 10 units/purchase
- Service Sales
  - **5** starting clients
  - **10%** client growth
- Year 1: **$820k** in sales
- Year 10: reaches **$10.4 million**

Table 1: Sales Projections

Sales	Year 1	Year 2	Year 5	Year 10
# of New Clients	5	6	7	12
Client Drop-Offs	-	-	1	2
Cumulative Client Base	5	11	30	79
Unit Sales				
Cameras	50	53	61	78
Cumulative Installed Came	100	153	326	679
Total Unit Revenue	$ 17,000	$ 18,000	$ 21,000	$ 27,000
Service Sales				
Cloud Storage Managemer	$ 12,000	$ 18,300	$ 39,154	$ 81,467
Subscription Revenue	$ 700,000	$ 1,400,000	$ 3,800,000	$ 10,200,000
Late Fees	$ 3,000	$ 4,000	$ 10,000	$ 26,000
Total Services Revenue	$ 800,000	$ 1,500,000	$ 3,900,000	$ 10,400,000
Total Sales Revenue	$ 820,000	$ 1,520,000	$ 3,930,000	$ 10,430,000

Suggested Solutions

- VOC Concerns
  - Educational Promotion
- Legal Issues
  - Speak with experts
- Incoming Competitors
  - First Mover Advantage

Engineering Deliverables

1. Scanning and Monitoring
   - Image recognition – face, incident, anomalies
   - Audio recognition – gun shot, chaos, fights
   - Connect to law enforcement agencies
   - Data Servers to store video streams

2. Data Analytics Platform
   - Index data streams from monitoring system
   - User friendly interface to query, generate reports and triggers
   - Provide heat maps on third party mapping tools
   - Provide data privacy and security

Technical Solution

- System Overview

- Node Architecture

- Hardware Specs

- Software

System Overview
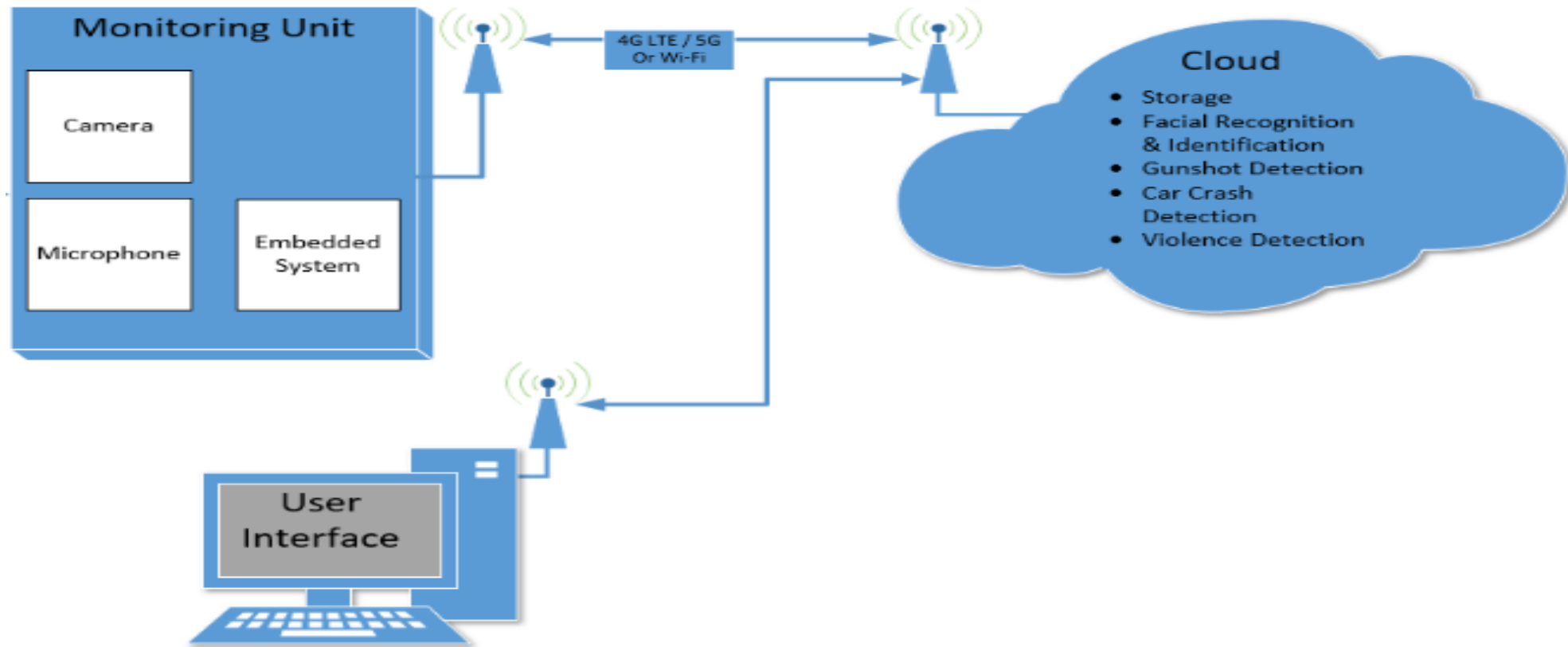
Figure 2: System Overview

Node Architecture
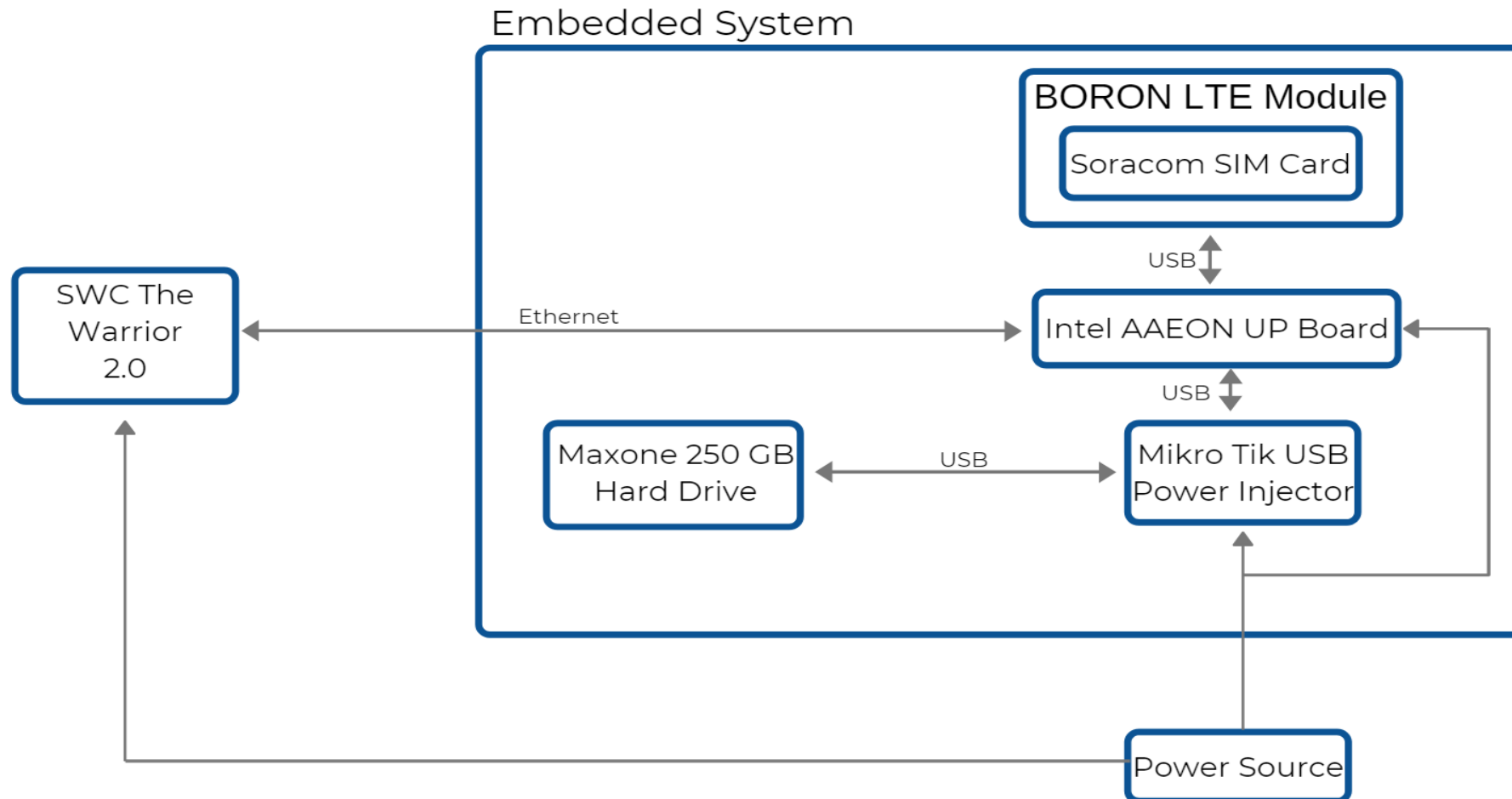
Figure 3: Node Architecture

Hardware

- SWC The Warrior 4.0
  - 1920x1080 resolution
  - H.265 video encoding
- Raspberry Pi 3 Model B
- Nvidia GTX 1080 Ti
  - RAM: 11GB
  - 3584 CUDA cores
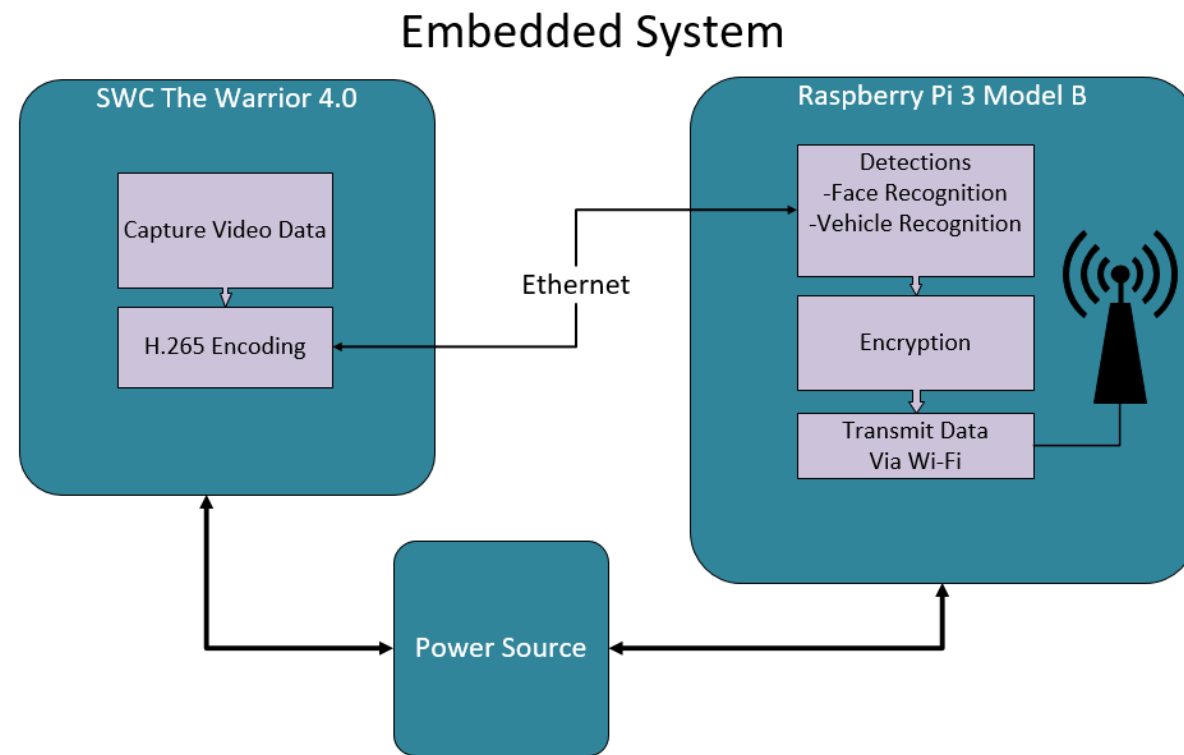
Figure 4: Prototype Architecture

Software

- Python
  - OpenCV - Face Recognition & Identification
  - PyTorch - Object Detection
  - Tensor Flow - Violence Detection
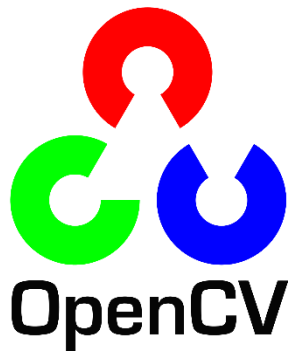
Haar Cascades & LBPH
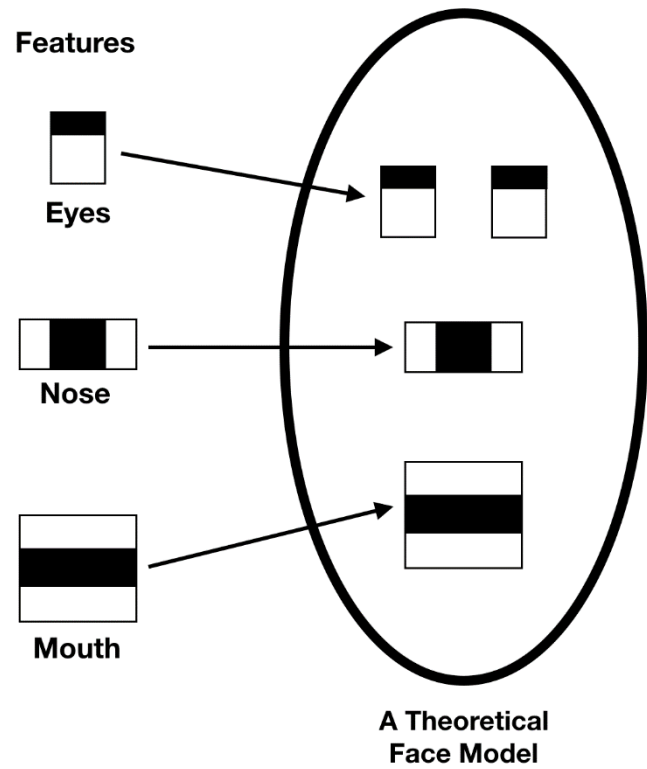
Figure 5: Haar Cascade Classifier
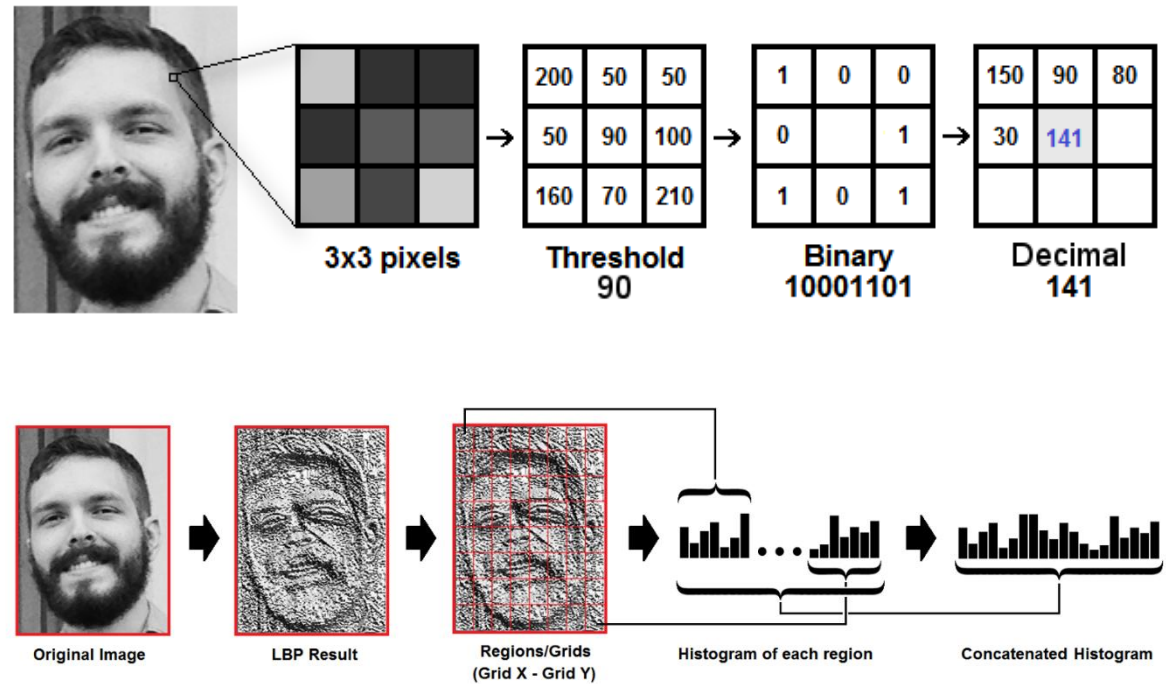
Figure 6: LBPH Flow

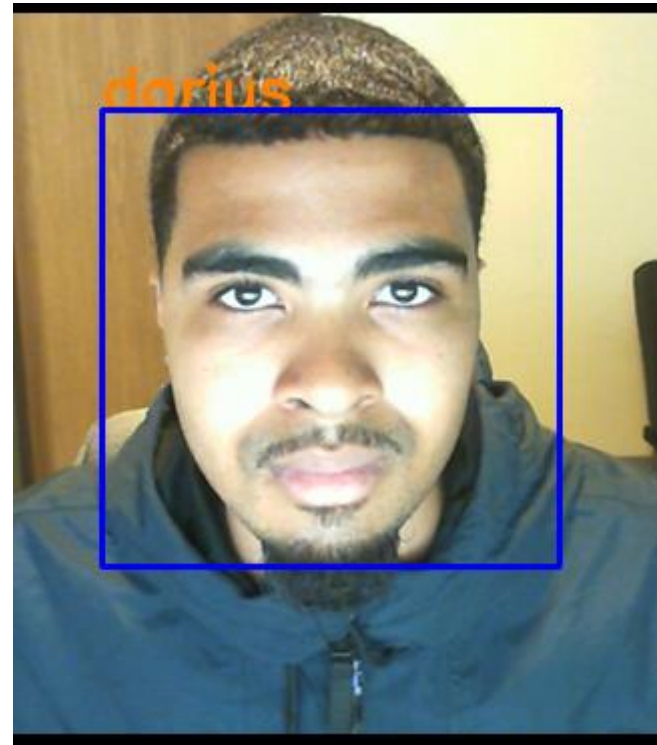# Results – Face Detection & ID
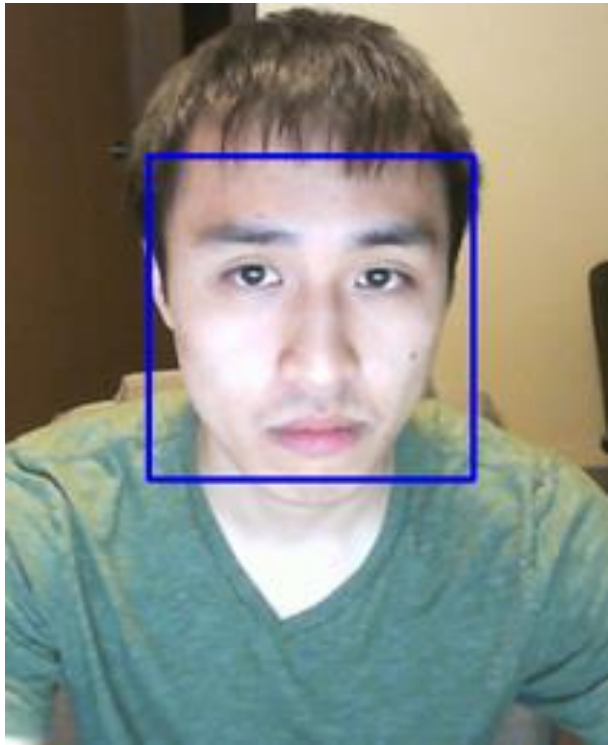
Figure 7: Face Recognition

Figure 8: Face Identification

You Only Look Once (YOLO v3)

- Operates in real-time
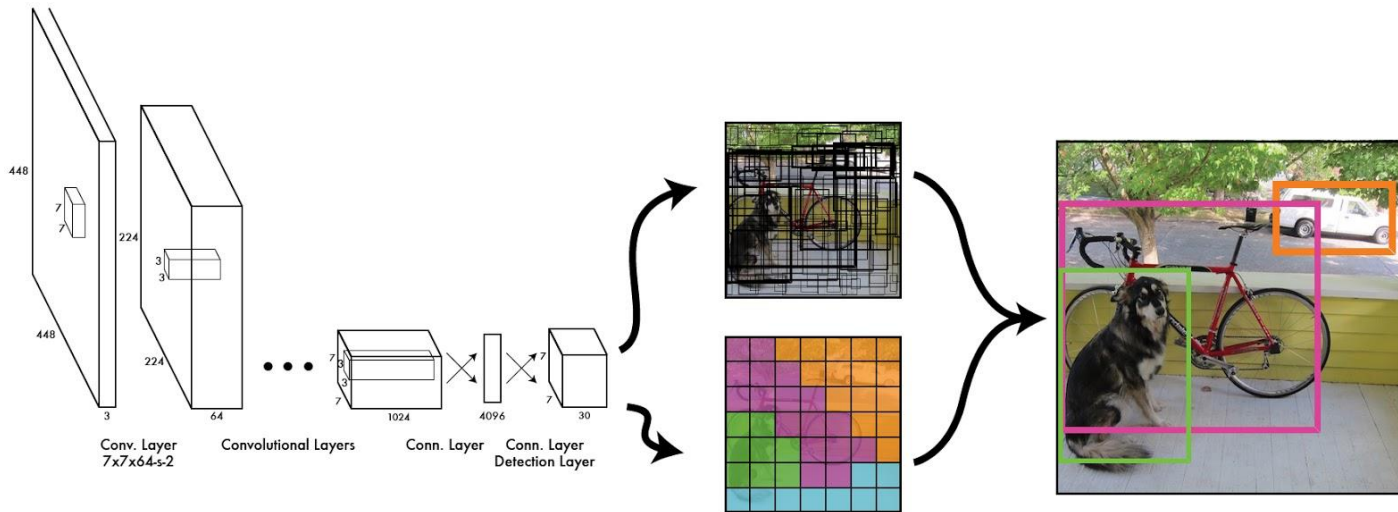- Indexing videos with labels
- Trained on COCO dataset

Figure 10: Object Detection at Intersection

Figure 9: YOLO v3 Architecture

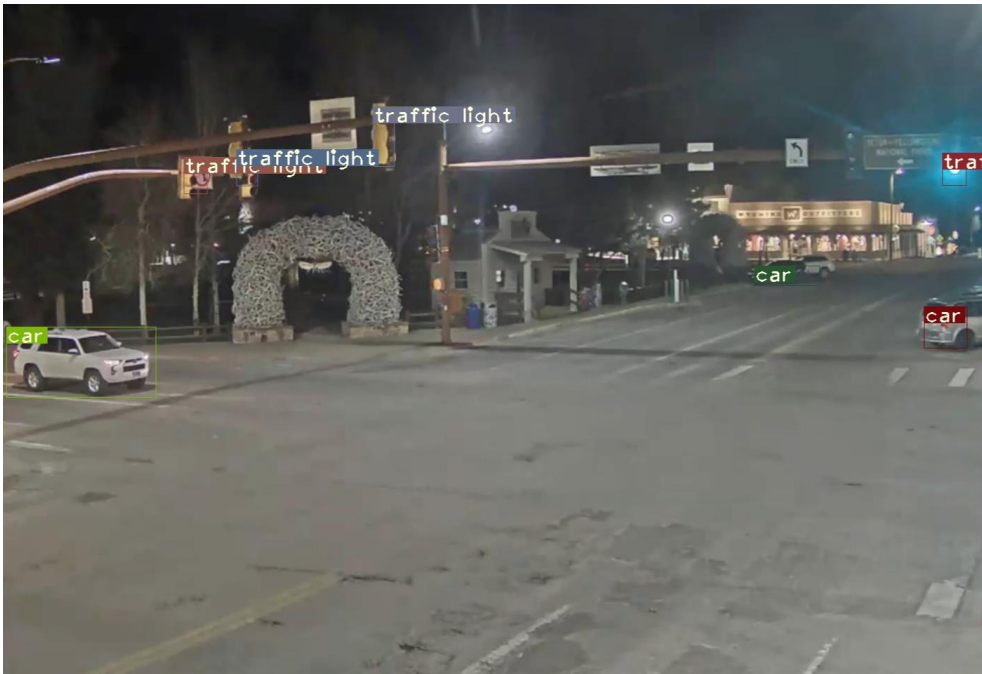# Results-Object Detection

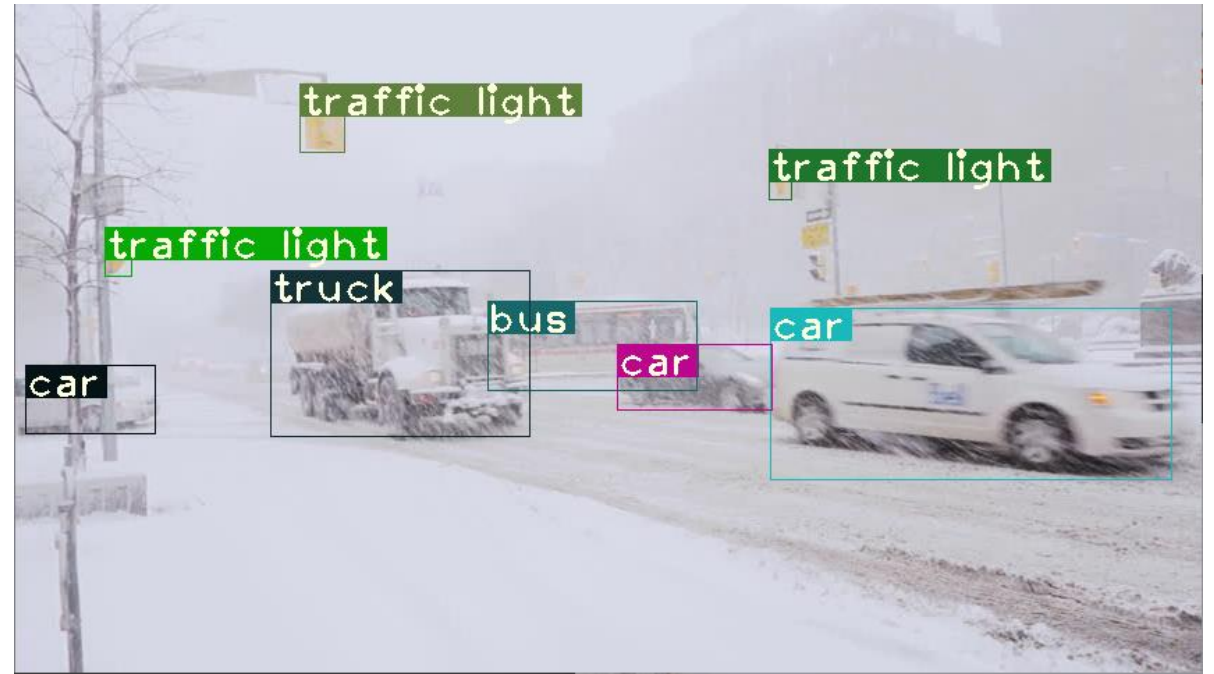Figure 11: Detection at Night

Figure 12: Detection with Snow
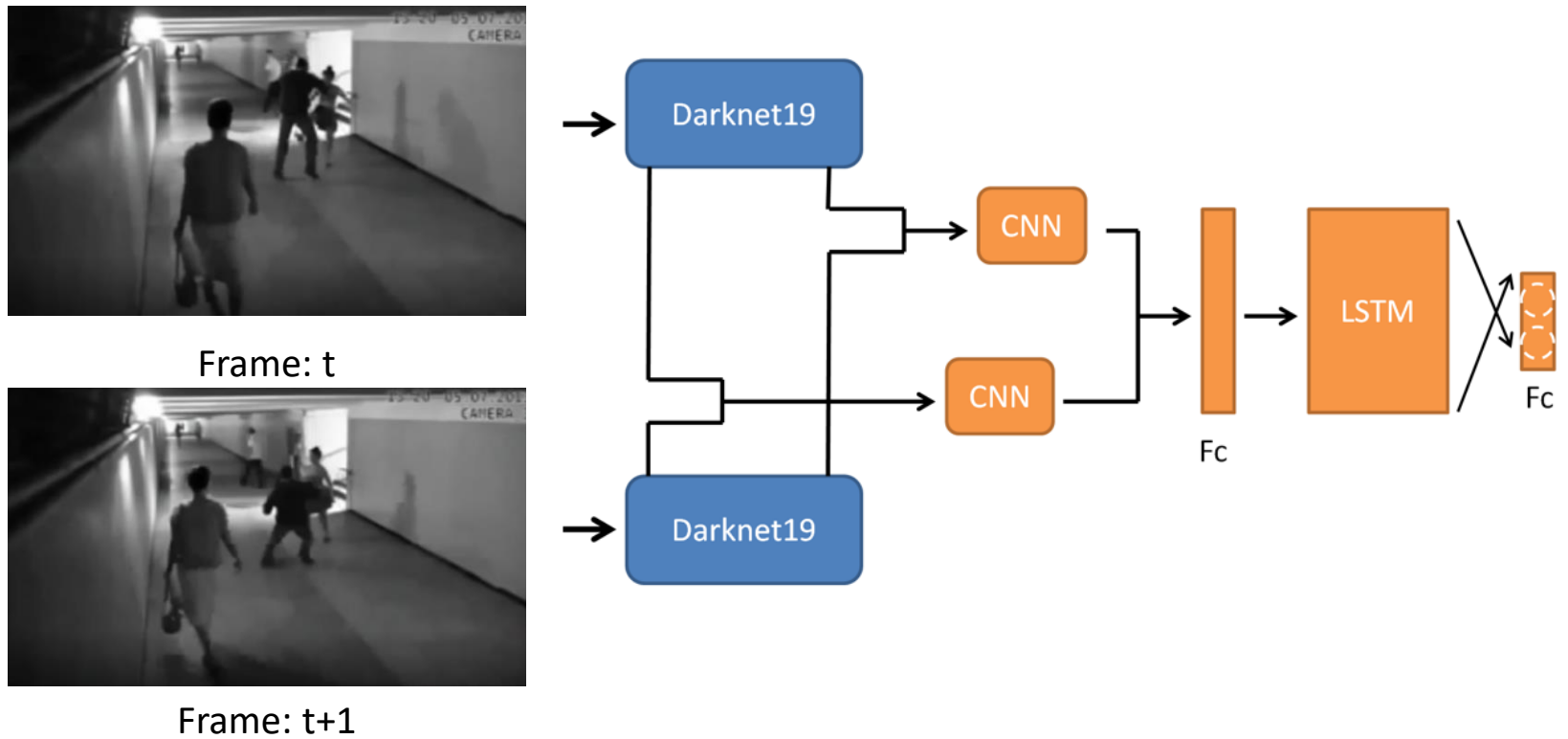
Convolutional & LSTM Neural Networks

Figure 13: Violence Detection Model

Results – Violence Detection

Figure 14: Violence Detection Output

Conclusion

- Our team conducted an extensive research to produce a feasibility study

- Engineering point of view - Researched technologies for public monitoring system

- Business point of view – Collected data and information that influenced system design and possible product opportunities