Rakshak

Present by

Tirth V Patel

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SSE Capstone

Team members

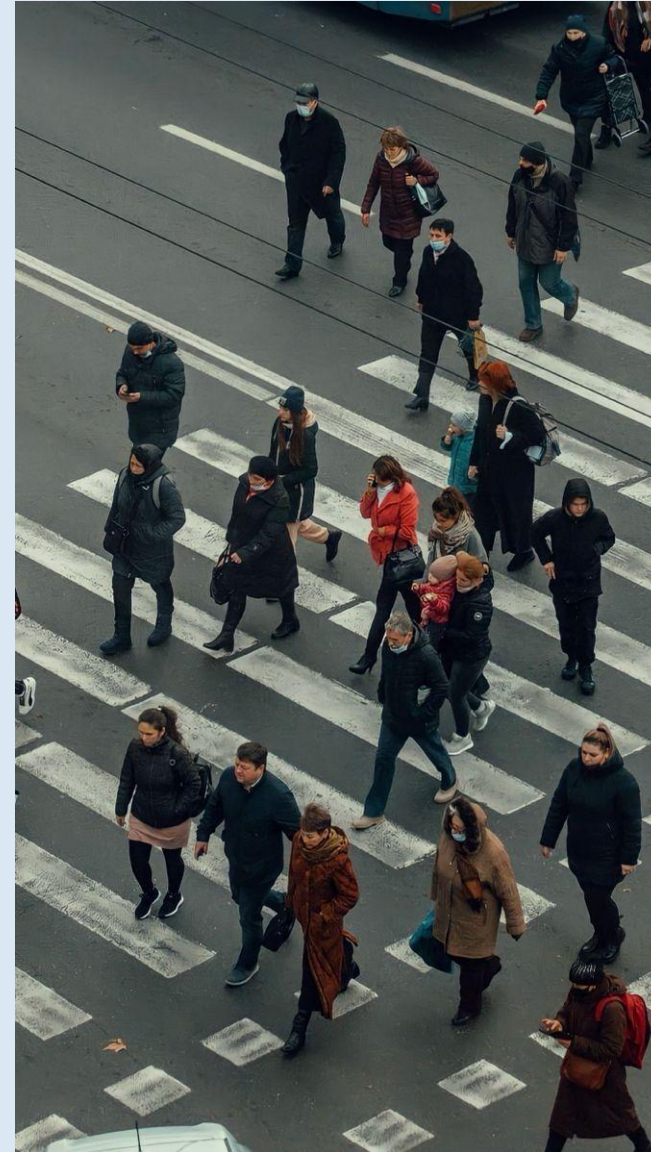Tirth V Patel

- Full Stack Developer
- AI Engineer
- Team Lead
- System Architect

Yi Xu

- Documentation Specialist
- Presentation Lead
- QA Engineer

Imagine This...
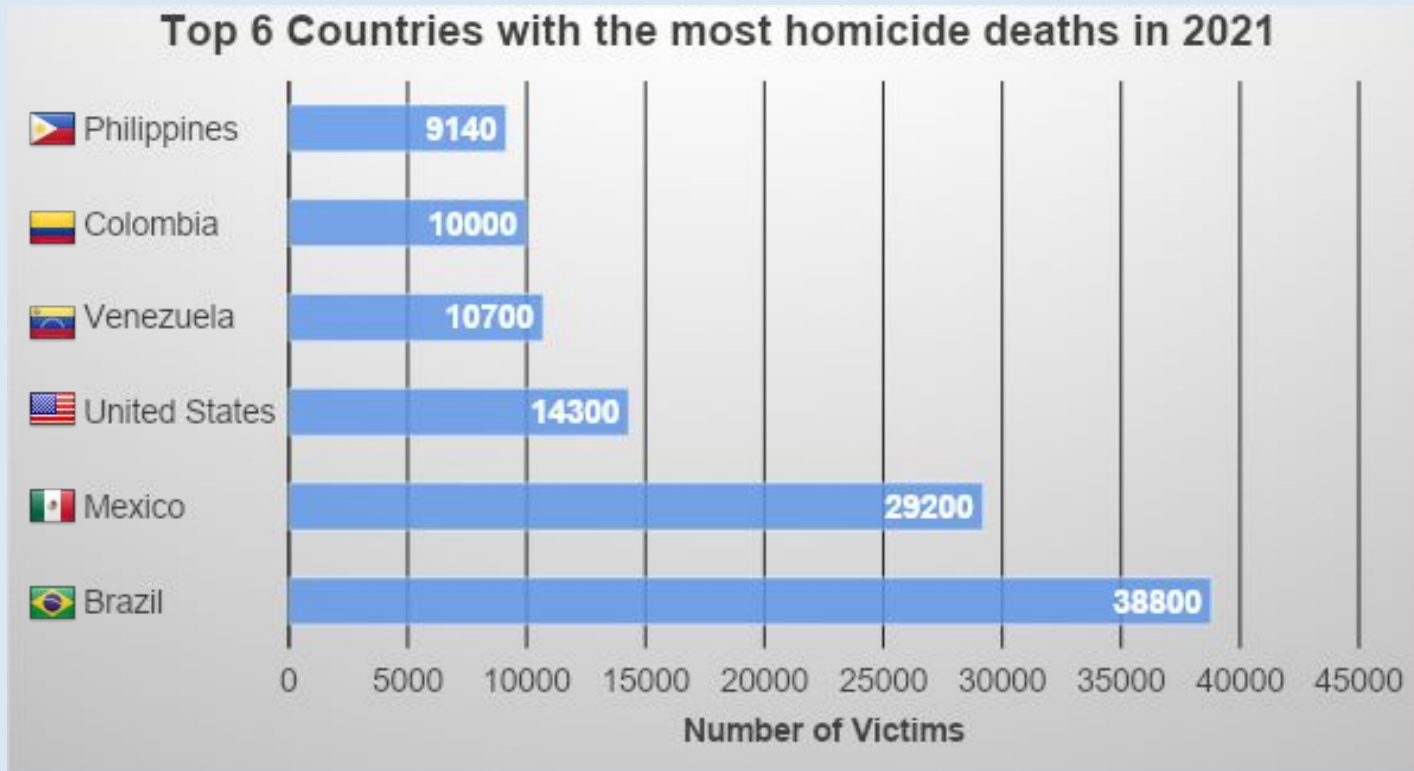
A normal day... until it's not.

Imagine This...

One person watching 20 camera feeds...
A weapon appears on screen —
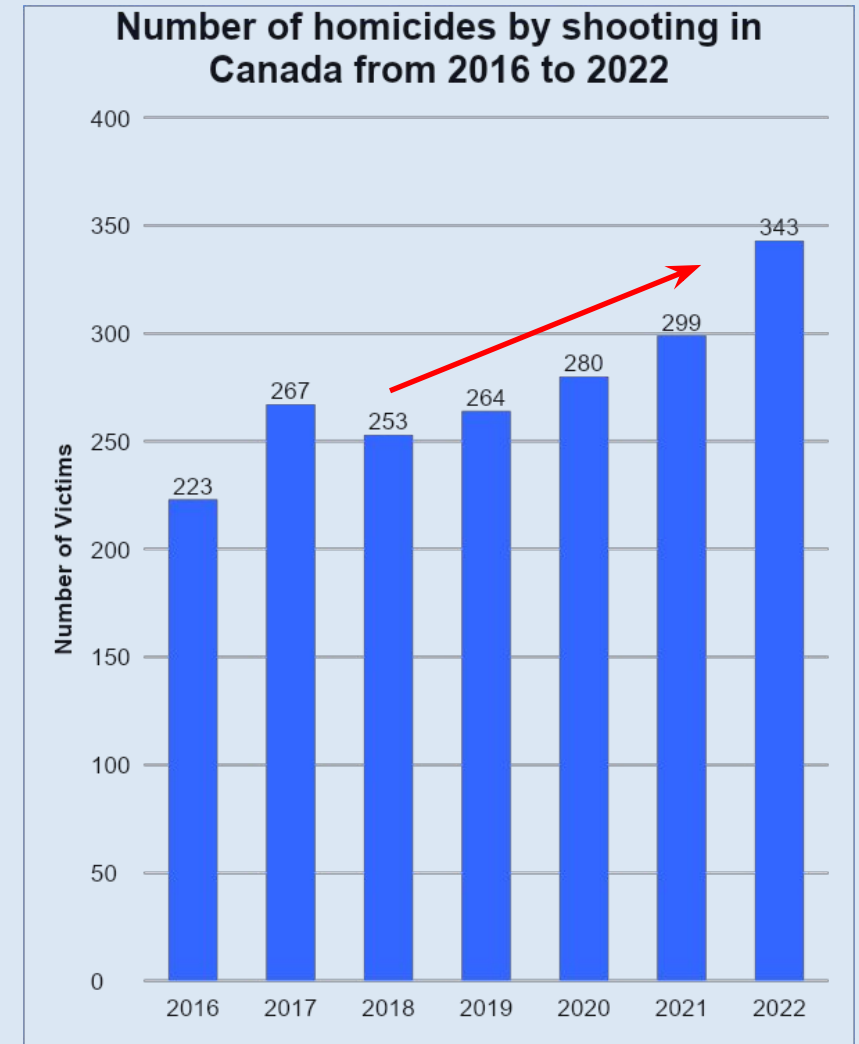*but they never notice it.*

The Scale of the Problem

Real-world problems

Top 6 Countries with the most homicide deaths in 2021

Country	Number of Victims
Philippines	9140
Colombia	10000
Venezuela	10700
United States	14300
Mexico	29200
Brazil	38800

Source: World Population Review

Number of homicides by shooting in Canada from 2016 to 2022

Year	Number of Victims
2016	223
2017	267
2018	253
2019	264
2020	280
2021	299
2022	343

Source: Statistics Canada

What is the Solution?

Rakshak: AI-Powered Real-Time Weapon Detection System

What is the Solution?

Rakshak

- Detects weapons in real-time using advanced AI technology

- Sends instant alerts and emails upon threat detection

- Supports live CCTV video streaming from multiple cameras

- Features a web-based admin dashboard for full control

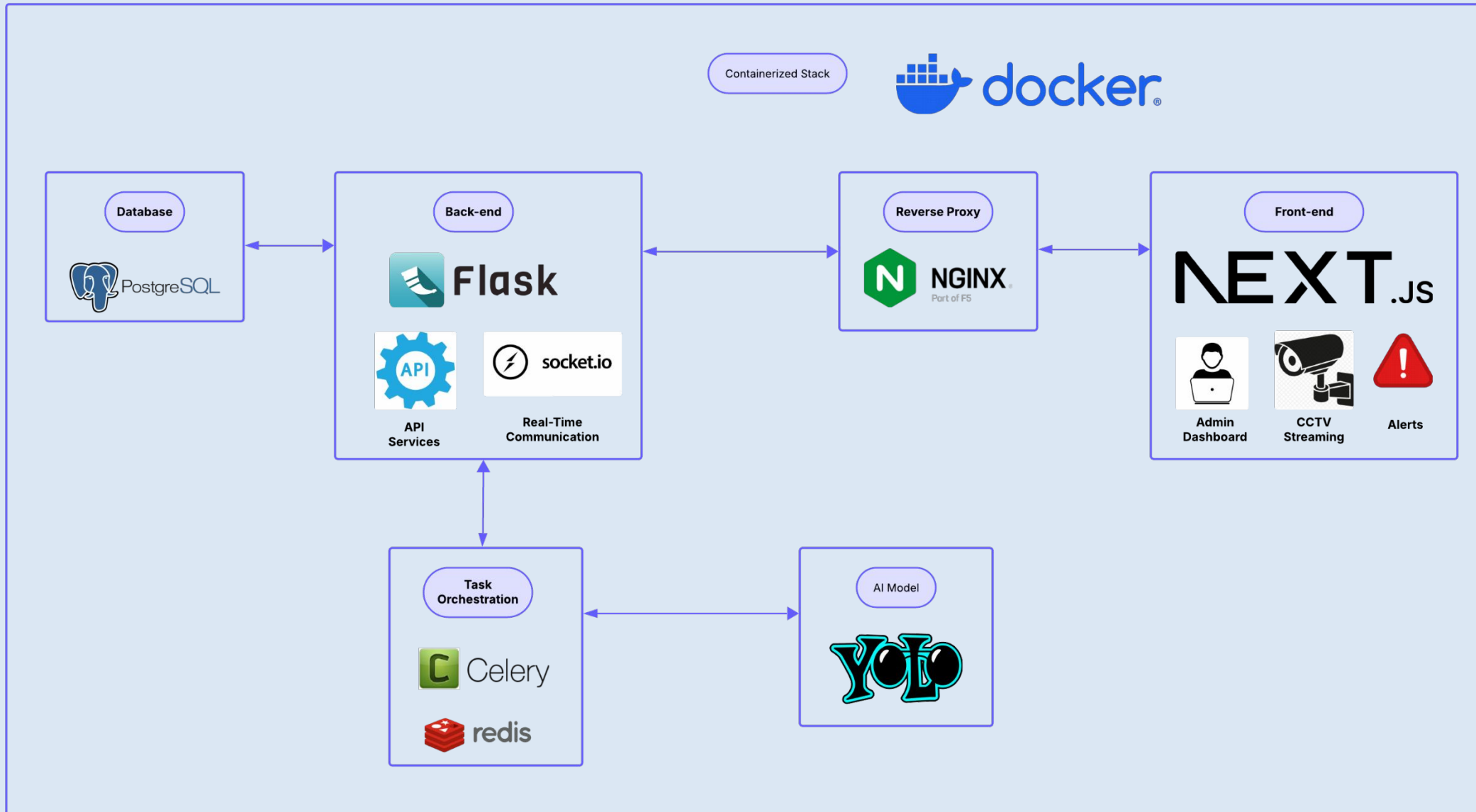- Runs fully on-premises, ensuring privacy and fast response

What Makes Rakshak Different

	Traditional CCTV	Cloud-Based AI	Rakshak
Weapon Detection	❌	✅	✅
Live Streaming	✅	✅	✅
Instant Alerts	❌	⚠️	✅
Privacy	✅	❌	✅
Supports Existing IP Cameras	✅	⚠️	✅
Email Notifications	❌	⚠️	✅
Scalability	❌	⚠️	✅

5 Demo

Tech Stack

Containerized Stack

Database

PostgreSQL

Back-end

Flask

API Services

Real-Time Communication

Reverse Proxy

NGINX
Part of F5

Front-end

NEXT.JS

Admin Dashboard

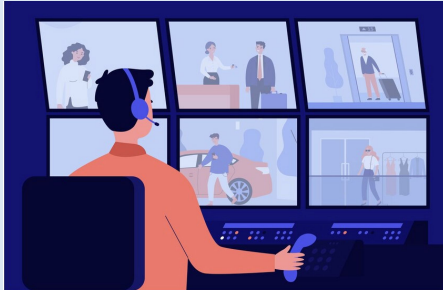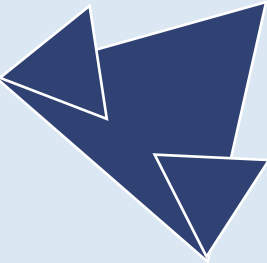CCTV Streaming

Alerts

Task Orchestration

Celery

redis

AI Model

YOLO
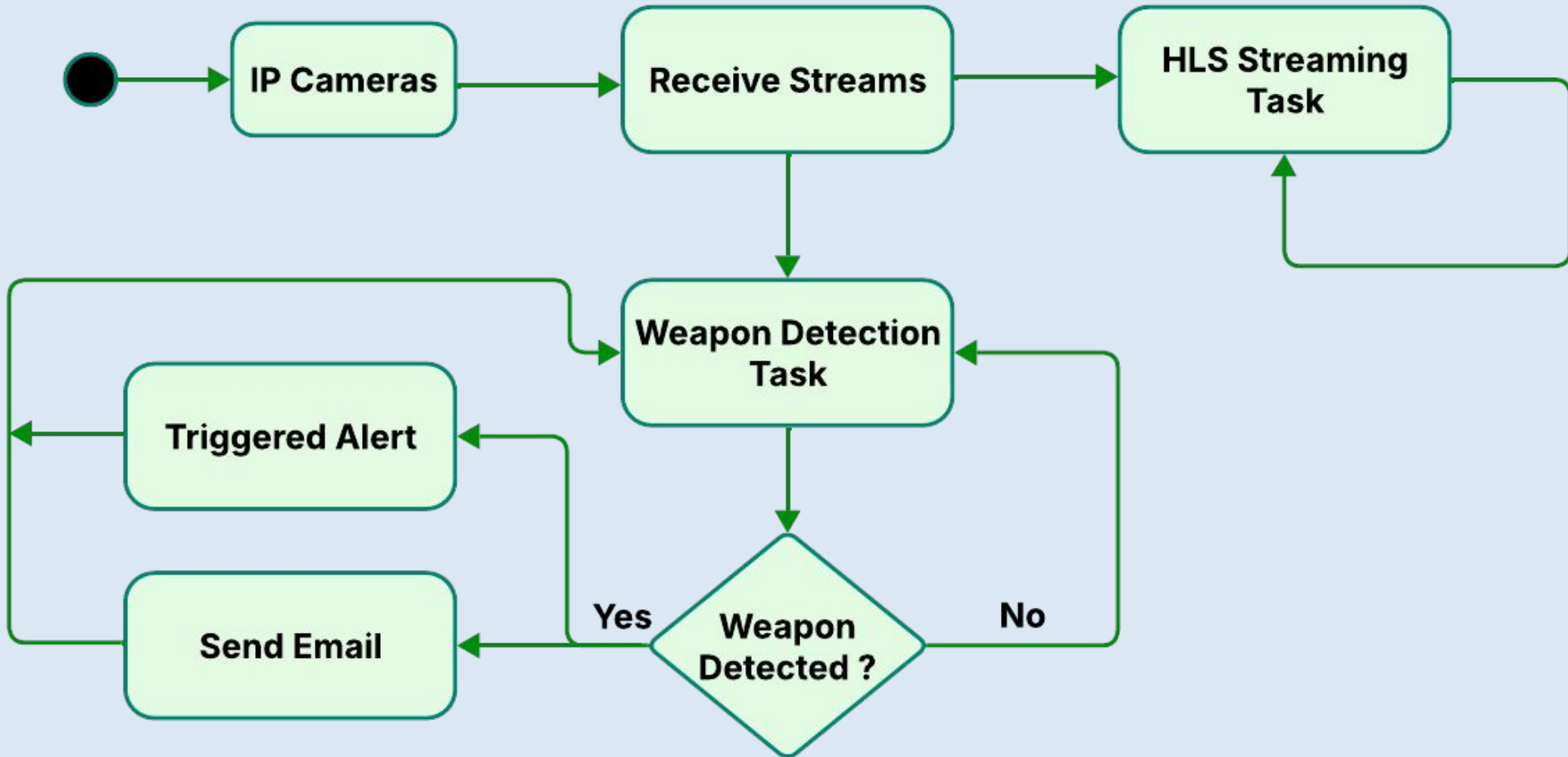
Monitoring Team / Control Room Operators

🚨 **Live dashboard alert**

Includes:
- Image of person holding the weapon
- Camera ID and location
- Time of detection

Role:
- Continuously monitors streams
- Can **immediately assess and escalate**
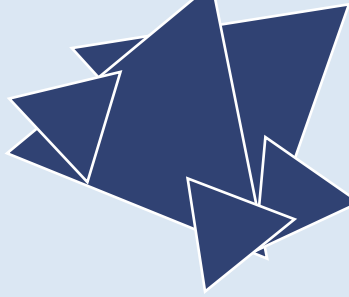
Protective Agencies / Security Teams

✉E **Instant email alert**

Includes:
- Image of person holding the weapon
- Camera ID and location
- Time of detection

Role:
- Respond physically on-site

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AI Development

Early Evaluation

- Started with a pre-labeled weapon detection dataset from Kaggle
- Dataset included common firearm images, but lacked diversity in:
  - Camera angles
  - Lighting conditions
 - Background variations
- Initial performance was limited

Precision	57%
Recall	55%
Result	❌ **Needs Improvement**

AI Development

Current Model Performance

Precision	85%
Recall	79%
Result	Success

Precision-Confidence Curve

Legend:
- automatic-rifle
- explosive
- knife
- pistol
- revolver
- shotgun
- sniper-rifle
- submachine-gun
- **all classes 1.00 at 0.996**

- With high precision and recall, our model can detect weapons accurately in real-world scenarios.
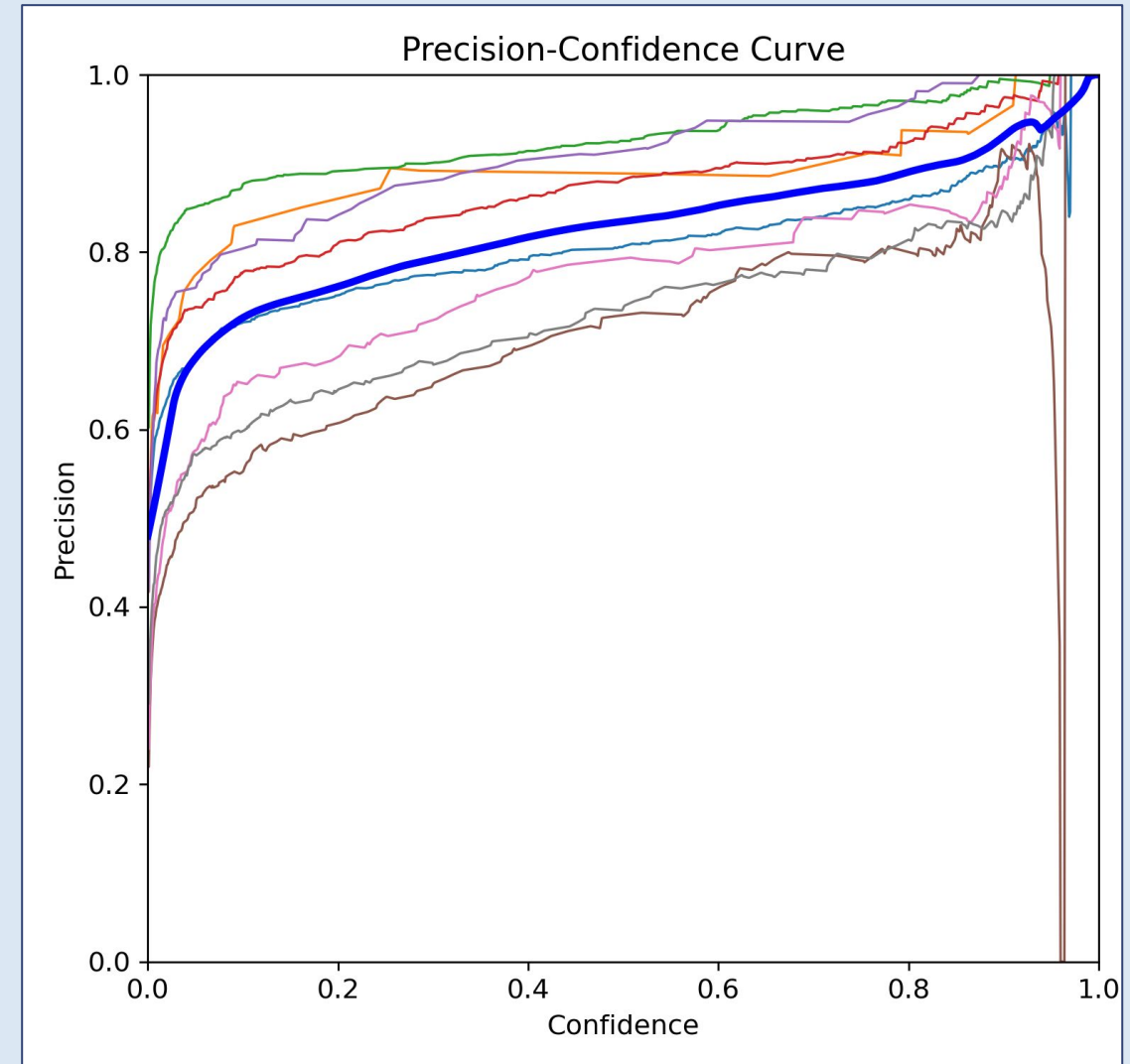
10 **Model Performance Demo**

Applications of Rakshak

- 🏫 **Educational Campuses** – Real-time monitoring in schools & universities

- 🏢 **Corporate Offices** – Enhance entry-point security in large buildings

- 🛍️ **Shopping Malls** – Detect threats in busy public places

- 🏟️ **Event Venues & Stadiums** – Monitor large crowds effortlessly

- 🚈 **Transit & Metro Stations** – Improve safety in public transport zones

- 🏛️ **Government Buildings** – Safeguard sensitive locations

- ➕ **And Many More** – Adaptable to any environment where safety and surveillance are critical

12 Future Enhancements

- Customizable Dashboard

- Fine-Tune & Optimize YOLO Model

13 Conclusion

- In critical moments, hesitation can cost lives.

- What we need is not just smarter technology, but faster response, sharper awareness, and constant readiness.

- Solutions like these aren't just innovations — they're investments in human safety, in peace of mind, and in the value of every life protected.

   Because in a world of rising threats, silence isn't safety — action is.

Special Thanks

- Mr. Adam Tilson, M.A.Sc., P.Eng. – Capstone Facilitator

- Mr. Trevor Douglas, B.A.Sc., P.Eng. – Project Mentor

References

- Statistics Canada. [Table 35-10-0069-01 Number of homicide victims, by method used to commit the homicide](#)
- World Population Review. (2021). Gun Violence by Country 2021. https://worldpopulationreview.com/country-rankings/gun-violence-by-country

Thank you!

Any Questions?