

# AIoT Smart EyeWear for Law Enforcement

## CONCEPT AND DESIGN DOCUMENT

# Team : OptiCops

### Team member :



**Jagadish J S**  
B.E. MCT

- CAD Design
- PCB Design



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- Business
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- AI and ML
- Embedded Programming



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- Hardware fabrication
- IoT

# PROBLEM IDENTIFICATION

News

## Thoothukudi: Outrage after father, son die in police custody

Deaths of P Jayaraj and his son J Bennix in police custody in India, have caused an outcry against custodial deaths.



According to the 2018 National Crimes Record Bureau data, Tamil Nadu accounted for the second highest deaths in custody, but not a single police personnel was arrested, said Amnesty India [File: AFP]

The death of a father and son in police custody in the southern Indian state of Tamil Nadu has caused outrage after the victims' family accused the police of torturing the duo in custody.

P Jayaraj, 59, and his son J Bennix, 31, were imprisoned by police last Friday in Thoothukudi district for violating coronavirus lockdown orders in the state. The police accused them of opening their mobile phone shop beyond the 8pm limit.

The police claim Bennix complained of chest pain and Jayaraj suffered from high fever while they were lodged inside the sub-jail of Kovilpatti. They were taken to Kovilpatti government hospital where both of them died within hours of each other, the police said.

But family members say the duo were subjected to torture in custody. They also accuse the police of sexually assaulting the victims.

## Madras high court: Police corrupt; lack moral courage to act against miscreants

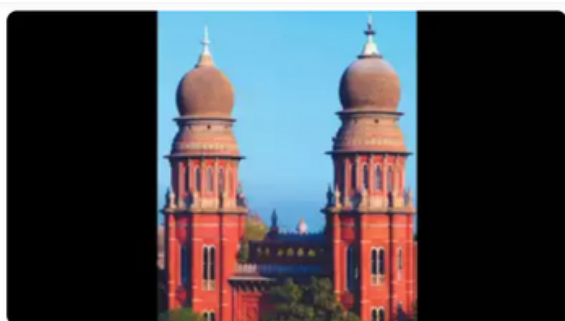
TNN / Updated: Jun 25, 2022, 11:16 IST

23 PTS

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In all cases where receipt of mamool is traced, criminal cases should be registered against the police officers who received it. Effective monitoring of these offences is warranted, the court said

CHENNAI: Police officials lack moral courage to control miscreants and offenders as they receive 'mamool' one way or the other, the Madras high court said, adding that the home secretary should take effective steps to control the menace.

"It is not as if the higher officials are unaware of these offences. However, there is an attempt to minimise such crimes being committed. For instance, receiving mamool, which is a corrupt activity, no criminal case has been registered against such police officials under the Prevention of Corruption Act. Mostly departmental actions alone are initiated, and, on some occasions, only minor punishments are imposed," Justice S M Subramaniam said on Friday.

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Business News News India Manipur Human rights body orders probe into excessive force used against students, asks for interim compensation

World Cup Live India in commanding position against Australia, 182/4 in 40 overs

ETPrime

## Manipur: Human rights body orders probe into excessive force used against students, asks for interim compensation

### Synopsis

The commission took up the case based on two complaints filed by Ningthoujam Jit Singh, of Singjamei Okram Leikai and one Mukul Phukon of Assam, Shivsagar, subject matter of complaints being inhuman and brutal abuse by the armed forces and security forces to the peaceful students/protestors as alleged.



### Manipur Human Rights Commission

(MHRC) asked the [Imphal West SP](#) to submit a report as to who gave the command to use [excessive force](#) against students staging [rallies](#) in Imphal.

The commission also asked the Commissioner (Home) to inform it how much interim compensation could be provided to the injured students on or before the next date.

## TN Cop Suicide Spotlights Need to Address Mental Health Issues in Police Force

Why police officers struggle with mental health and what can be done to help

SOUNDARYA ATHIMUTHU

Published: 23 Jul 2023, 12:52 PM IST

FIT

5 min read

On 7 July, Coimbatore range DIG Vijayakumar died by suicide, and days later, on 10 July, a cavalry policeman in Chennai allegedly took his own life. The consecutive alleged suicides have cast a spotlight on the need to address mental health issues in police force in Tamil Nadu.

The Quint reached out to police officers and mental health professionals to understand the issues faced by these officers, and how to address them effectively.

Dr. Lakshmi TK, senior psychologist, psychotherapist, and Founder of Mind Care India said, "Recognising and rectifying the shortcomings in mental health support systems for police officers is not only crucial for their individual welfare but also pivotal in upholding the integrity of law enforcement and nurturing a harmonious relationship with the public they serve."

# PROBLEM DEFINITION

44%<sup>1</sup>

Citizens fear police



49.6%<sup>2</sup>

of police officers suffer health problems, especially heart issues



80<sup>3</sup>

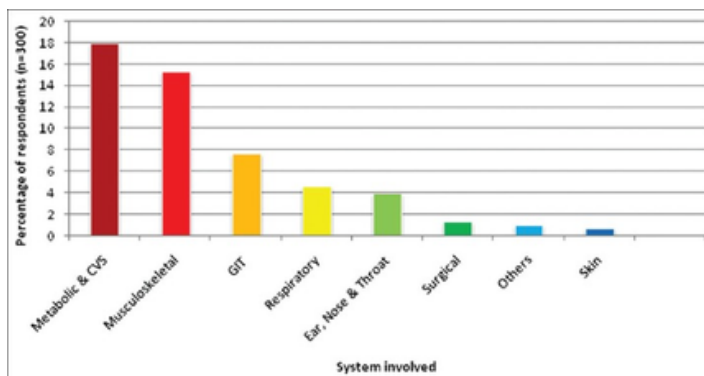
India's rank in Corruption perception index



1,782<sup>4</sup>

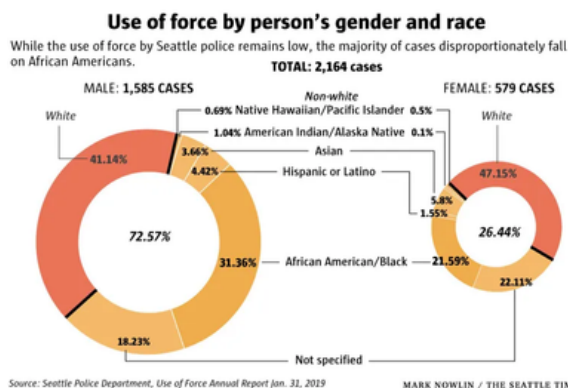
Fake encounter cases

- India ranks **80th out of 198** nations in the corruption perception index, indicating that there is still much that can be done to reduce the various kinds of corruption that exist there.

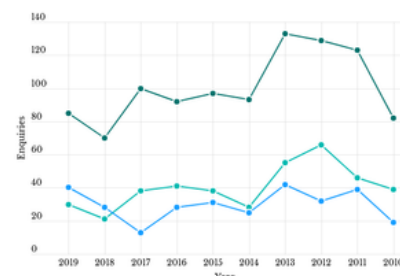


- Health complaints were reported by around half ( $n = 149$ , **49.6%**) of the participants with the morbidity risk of **0.71** per person.
- Between **2000 and 2017**, there were **1,782** occurrences of allegedly fraudulent encounters by the police, per data from **India's National Human Rights Commission**.

- From 2000-2020, **1888** custodial deaths have been reported all around the country.



Enquiries Ordered for Deaths in Police Custody, Year-wise 2010-19



Source: Crime In India reports, 2010-19, National Crime Records Bureau



<sup>1</sup> Status of Policing in India Report 2018 - Centre for the Study Developing Societies (CSDS)

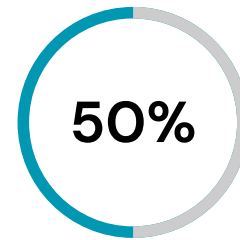
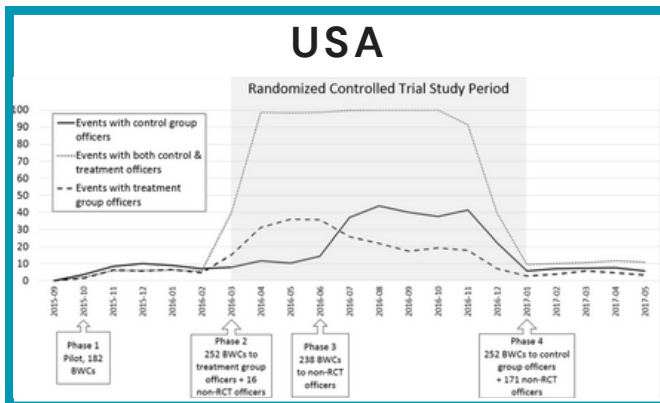
<sup>2</sup> Protect the Protector: Morbidity and Health Behavior among Police Personnel in National Capital Region of India. Indian J Occup Environ Med. PMID: PMC6176699

<sup>3</sup> Corruption Perception Index 2023, Transparency International

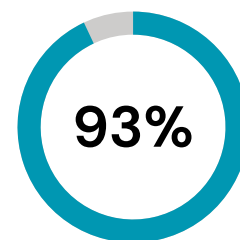
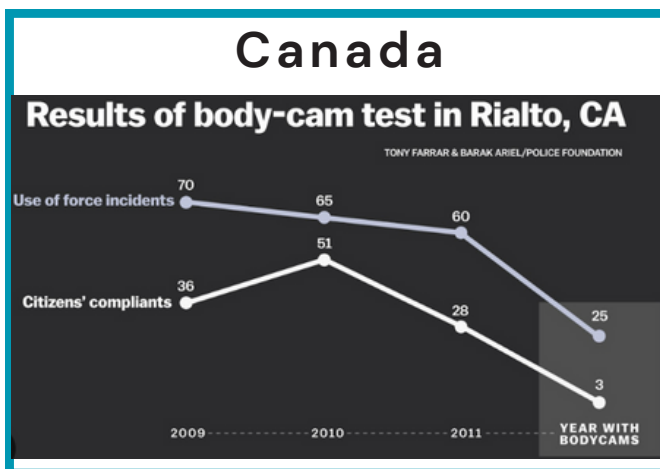
<sup>4</sup> Fake Encounter Killings - Allegations of Excessive Use of Force by Security Forces' (NHRC)

# PROBLEM VALIDATION

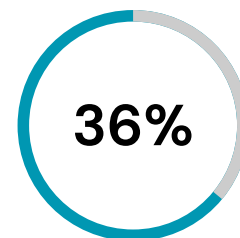
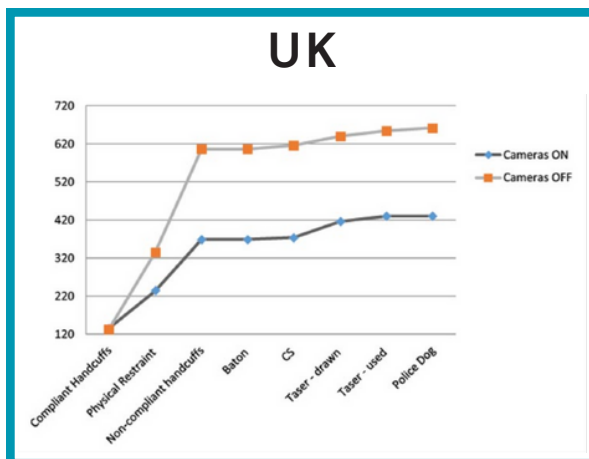
## Survey



**Decrease in number of attacks by police**



**Overall reduction in complaints filed against officers**



**Decrease in physical aggression from public**

## Survey results

**Usage of BWC's have proven results in:**

- Reduction in use of force.
- Decrease in assaults and complaints on police.
- Increase in early guilty pleas.

# PROPOSED SOLUTION

## Objective

To develop an AIoT smart glass for police officers that provides,



- Face Recognition technology to swiftly identify potential threats



- Real-time location tracking to ensure safety

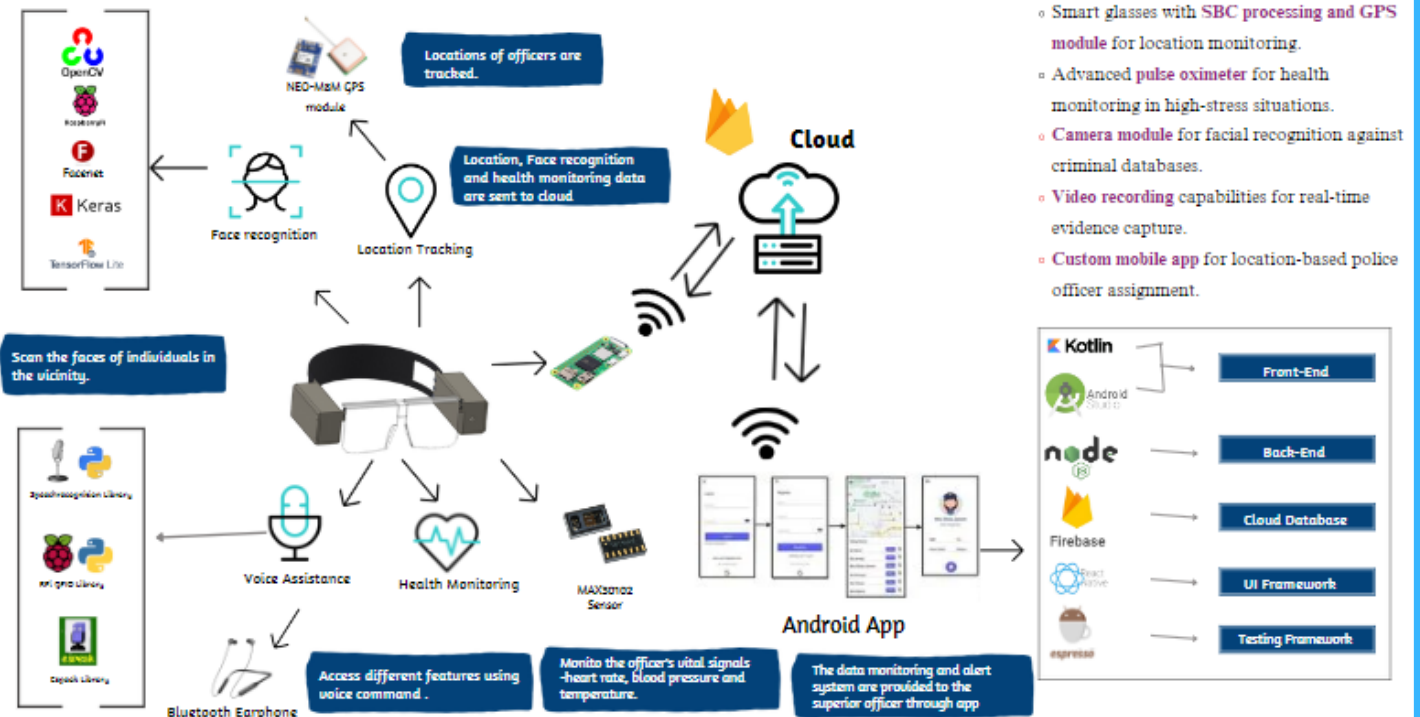


- Video recording acts as real-time evidence



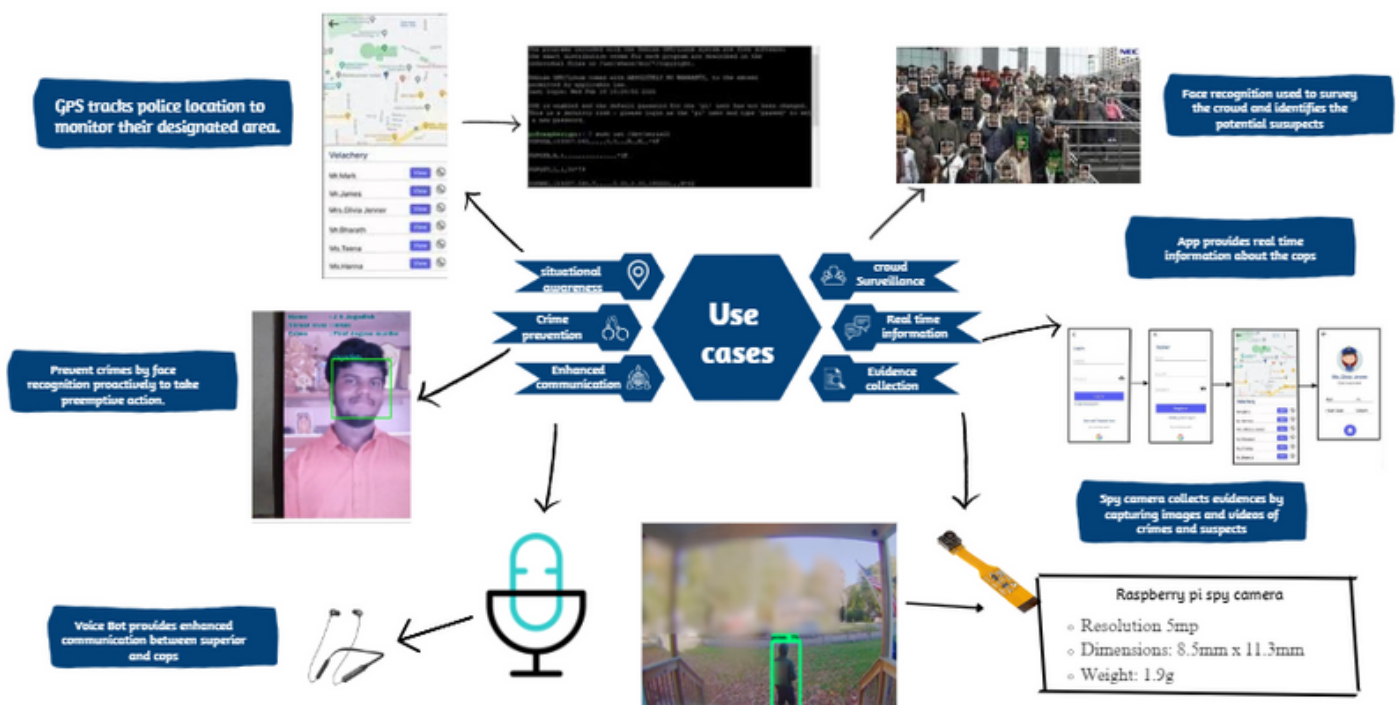
- Health monitoring enables real-time health tracking

## Idea with tech stack





# SOLUTION



## Calculation

### BOOST CONVERTER :

- Input voltage = 3.7v
- Output voltage = 5v
- Input current = 3.7A
- Efficiency = 98% = 0.98
- Output current =  $\frac{\text{Input power} \times \text{Efficiency}}{\text{Output Voltage}}$   

$$= \frac{(3.7v \times 3.7A \times 0.98)}{5v}$$
**= 2.683A**

### TOTAL LOAD CURRENT :

- RPI Zero 2 W - 0.8A
- Camera - 0.28A
- Earphones - 0.02A
- MPU9250 - 0.00483A
- Touch sensor - 0.0001A
- GPS Module - 0.045A
- MAX30102 - 0.0572A
- TOTAL - 1.207A**

### BATTERY LIFE :

- Battery capacity = 2.68Ah
- Load current = 1.207A
- Battery life =  $\frac{\text{Battery capacity (Ah)}}{\text{Load current (A)}}$   

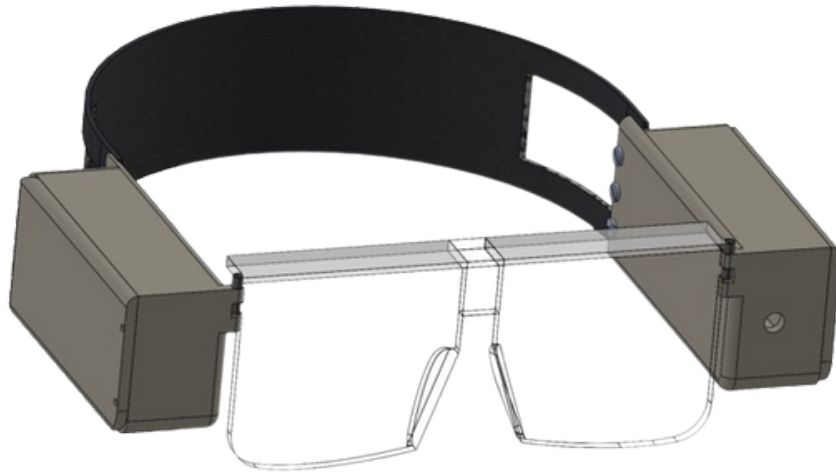
$$= \frac{2.68Ah}{1.207A}$$
**= 2.22 hrs**

### VIDEO STORAGE :

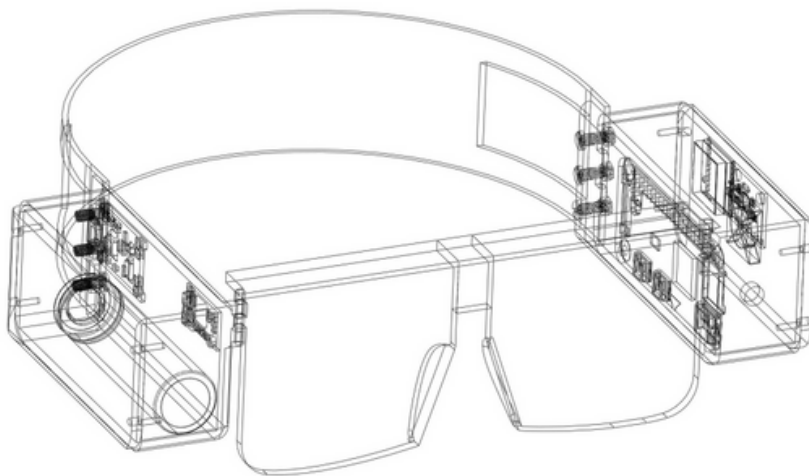
- Bitrate per second =  $1280 \times 720 \times 8 \times 30$   

$$= 221.184MBps$$
- Storage needed for 12 hours =  $221.184 \times 3600 \times 12 / 8 \times 10000000$   
**= 12616.7MB = 12.61GB**

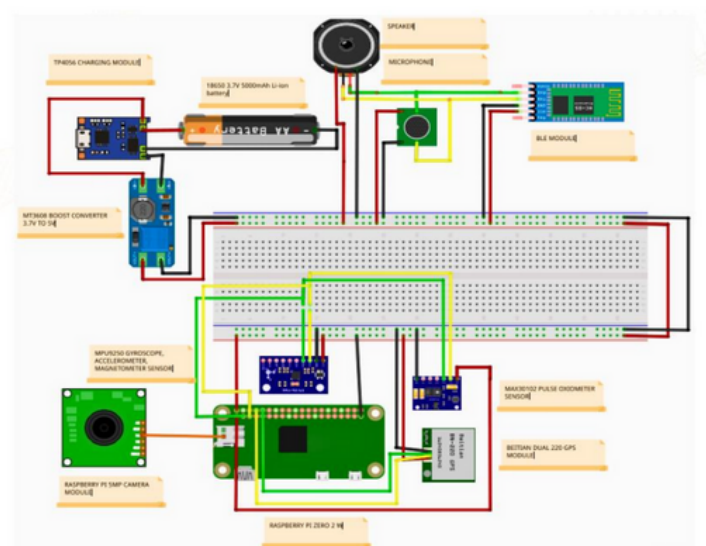
## PROTOTYPE (DESIGN)



## CAD Model (SolidWorks)



## Transparent view (SolidWorks)



### Circuit diagram (Fritzing)

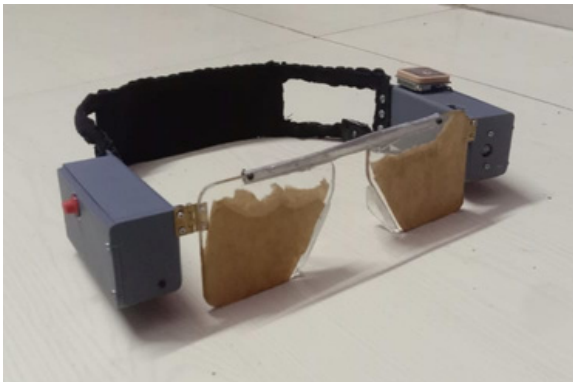
# PROTOTYPE (FABRICATION)



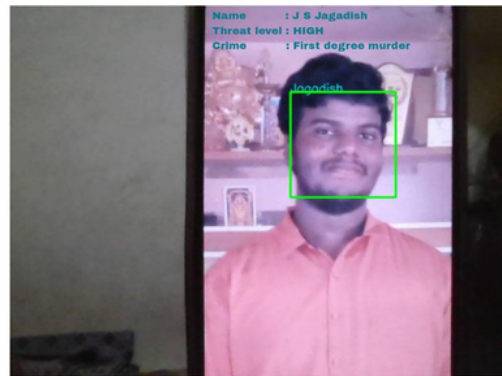
**3D Printed ABS temples**  
**40% infill**



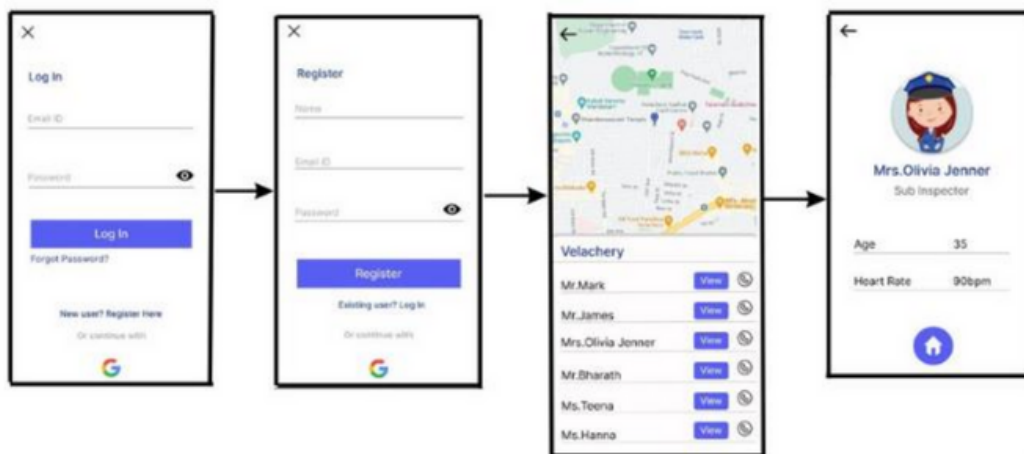
**Polycarbonate lenses**



**Completed prototype**



**Face recognition**



**Mobile application**

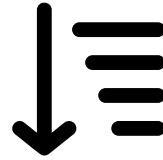


# OUTCOMES

## Benefits :



Reduction in **use of force**



Decrease in **assaults** and **complaints** on police



Increase in early **guilty pleas**



Officer **wellbeing** and **situational awareness**

## Feedbacks :

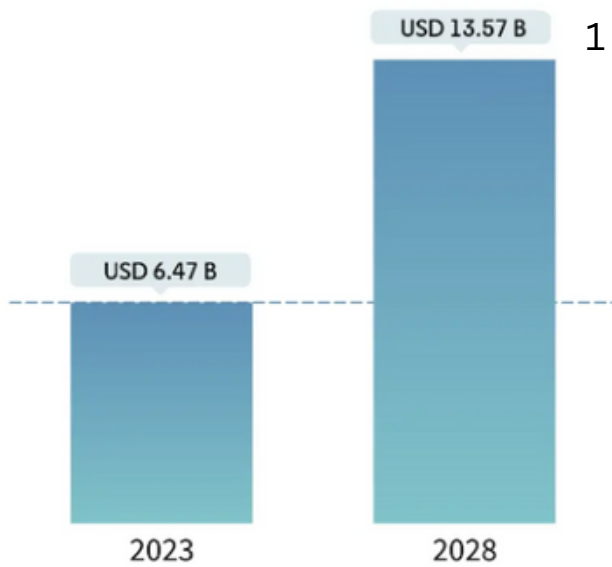
“ I have reviewed the Opticops project and would like to share my observations and recommendations. The device is impressively user-friendly and has the potential to be a valuable tool for State Police forces. I believe it can significantly enhance their real-time monitoring, ground surveillance, and crisis management capabilities, as well as improve their ability to capture essential, in-situation evidence. I recommend further assessing its future scope within police organizations, conducting on-ground performance tests to understand functional requirements, and carrying out trials to evaluate its performance. Additionally, exploring its usefulness within Defense organizations could be worthwhile ”.

**-Major Kirit Prasad**

“ BWC's are stepping into Indian police sector recently and is deployed for traffic police for now. I feel it is necessary to record audio and video of police conversations as they help in providing transparency and for evidence collection. It'll be definitely useful for police personnel like us. We use FRS but it takes a long time to identify, the feature the glasses provide is advanced to my view. We police officers go through a lot, the addition of health monitoring provides a unique advantage. It'll be better to add more health parameters like pressure. I would also suggest to test it in field for better you to better understand organization needs .

**-Vimalan,  
Sub-Inspector (Tirunelveli)**

# MARKET RESEARCH



**6.47**

Billion USD in 2023  
(Global)

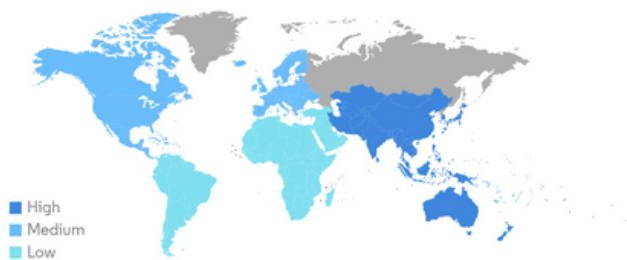
**15.96%**

CARG from 2023-28

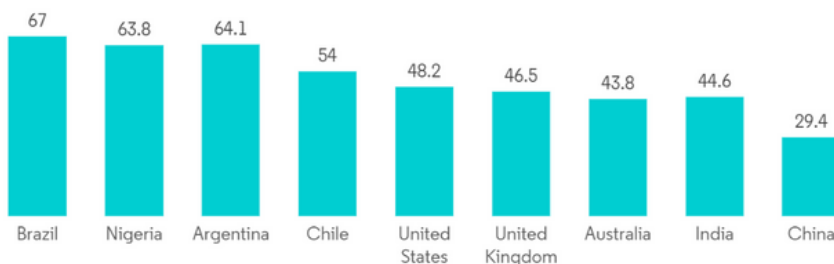
**ASIA-PACIFIC**

Fastest growing market

Wearable and Body-worn Cameras Market - Growth Rate by Region



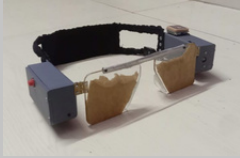


Crime Index, By Major Countries, 2022



- According to RCMP, between 10,000 and 15,000 body-worn cameras would be issued to contract and federal law enforcement personnel
- Growing crime rate aid in implementing advanced technologies such as body-worn cameras.

# MARKET RESEARCH

## Competitors

	Opticops	Motorola	Kingstop
Product			
Audio and video recording	✓	✓	✓
IoT sensors and cloud	✓	✓	
Health and location monitoring	✓		✓
AI assistant and face recognition	✓		

## Body Worn Camera Market Leaders

1 Axon Enterprise, Inc.

2 GoPro, Inc.

3 Garmin Ltd

4 Sony Corporation

5 Xiaomi Inc.

\*Disclaimer: Major Players sorted in no particular order

### Market Concentration















- **47%** of general-purpose law enforcement agencies had acquired body-worn cameras.
- **60%** of local police departments and **49%** of sheriffs' offices had fully deployed their body-worn cameras.

# BUSINESS AND APPENDIX

Lean Canva model

Idea Title: AIOT smart Eyewear for Law Enforcement

<b>PROBLEM</b>  <ul style="list-style-type: none"> <li>BWC may endanger officer focus &amp; Field limits may miss crucial events.</li> <li>Real-time tracking absence hinders monitoring.</li> <li>Lack of police health monitoring.</li> </ul>	<b>SOLUTION</b>  <ul style="list-style-type: none"> <li>AIOT smart eyewear with camera, ensures accurate evidence collection even in critical situations.</li> <li>GPS module in glass for real time location tracking of police</li> <li>Pulse oximeter, a sensor to detect and display the police's heart rate in beats per minute (BPM).</li> </ul>	<b>VALUE PROPOSITIONS</b>  <ul style="list-style-type: none"> <li>Enhanced Evidence Collection(Camera)</li> <li>Swift threat identification(Face Recognition)</li> <li>Live Location Tracking(GPS module)</li> <li>AI based Risk Management</li> <li>Health monitoring.(Pulse Oximeter)</li> </ul>	<b>CUSTOMER RELATIONSHIP</b>  <ul style="list-style-type: none"> <li>Training programs</li> <li>Proactive Maintenance and Support</li> <li>Regular check-In meetings</li> <li>Partnership and Collaboration.</li> <li>Feedback &amp; services.</li> </ul>	<b>CUSTOMER SEGMENTS</b>  <ul style="list-style-type: none"> <li>District Police forces</li> <li>VIP security</li> <li>Traffic Police</li> <li>Govt. Railway Police</li> <li>Coastal Security Police</li> <li>Private security sector</li> </ul>
<b>EXISTING ALTERNATIVES</b>  <p>BWC Companies,</p> <ul style="list-style-type: none"> <li>AXON Body 3</li> <li>Motorola Solutions</li> </ul>	<b>KEY ACTIVITIES</b>  <ul style="list-style-type: none"> <li>Hardware and software development.</li> <li>Manufacturing.</li> <li>Marketing &amp; Sales.</li> <li>Data analysis.</li> <li>Testing and quality control.</li> </ul>	<b>KEY RESOURCES</b>  <ul style="list-style-type: none"> <li>Hardware components &amp; Software development tools.</li> <li>Supply chain partners.</li> <li>Data storage and analysis</li> <li>Manufacturing facilities</li> </ul>	<b>CHANNELS</b>  <ul style="list-style-type: none"> <li>Law enforcement conferences.</li> <li>Government e-Marketplace (GeM)</li> <li>e-Commerce sites.</li> <li>Through Government Schemes.(Start up India, Digital India etc.)</li> <li>Law enforcement conferences. (ICCC)</li> <li>Law enforcement outreach</li> </ul>	<b>KEY PARTNERS</b>  <ul style="list-style-type: none"> <li>Training Academics(SVPNPA,National Academy of Administration(Mussoorie) ).</li> <li>Distribution Partners(Jharkhand police tenders, GeM).</li> <li>Hardware suppliers(Samsung)</li> </ul>
<b>COST STRUCTURE (PROTOTYPE)</b>  <p><b>Pricing</b></p> <p>Device: Rs.45,000 Subscription model: Rs.20,000/Year</p>		<b>REVENUE STREAM</b>  <ul style="list-style-type: none"> <li>Product sales</li> <li>Maintenance and Support Services</li> <li>Upgrades and Add-ons</li> <li>Subscription model</li> </ul>		

## Appendix

- Exploring the potential for body-worn cameras to reduce violence in police-citizen encounters. Policing (Oxford), 12(1), 66-76. <https://doi.org/10.1093/polic/paw057>, White, M., Gaub, J. E., & Todak, N. (2018).
- Do the Effects of Police Body-Worn Cameras on Use of Force and Complaints Change Over Time? Results From a Panel Analysis in the Milwaukee Police Department, Bryce E. Peterson <https://orcid.org/0000-0003-1303-2696> bpeterson@urban.org and Daniel S. LawrenceView all authors and affiliations, Volume 48, Issue 6, <https://doi.org/10.1177/0093854820970583>.
- Face recognition for criminal identification: An implementation of principal component analysis for face recognition, AIP Conference Proceedings 1891, 020002 (2017); <https://doi.org/10.1063/1.5005335>, Nurul Azma Abdullaha), Md. Jamri Saidi, Nurul Hidayah Ab Rahmanb), Chuah Chai Wenc), and Isredza Rahmi A. Hamidd)
- <https://www.mordorintelligence.com/industry-reports/wearable-and-body-worn-cameras-market>.
- <https://nij.ojp.gov/topics/articles/research-body-worn-cameras-and-law-enforcement>