Smart Search and Rescue

Development of AI-Enabled National Portal for Efficient Search of Missing People

About Project

India ranks amongst the top countries in human trafficking. In 2022, around 6,622 trafficking victims were reported. A study by NCRB (National Crime Records Bureau, India) in 2020 suggests that conservatively about 600 women and 180 children go missing every day. According to some other agencies, the numbers are much higher. All agencies working in this field recognize the fact that today, human trafficking in India is a well-organized crime that requires a well-organized solution.

Our project focuses on reducing issues related to human trafficking by incorporating modern technologies in the pipeline. After doing extensive research on the existing tools and techniques, we came up with a solution to solve this major issue. We are going to build a website which will use image recognition, NLP and DNA mapping techniques to find the identity of the trafficked individuals.

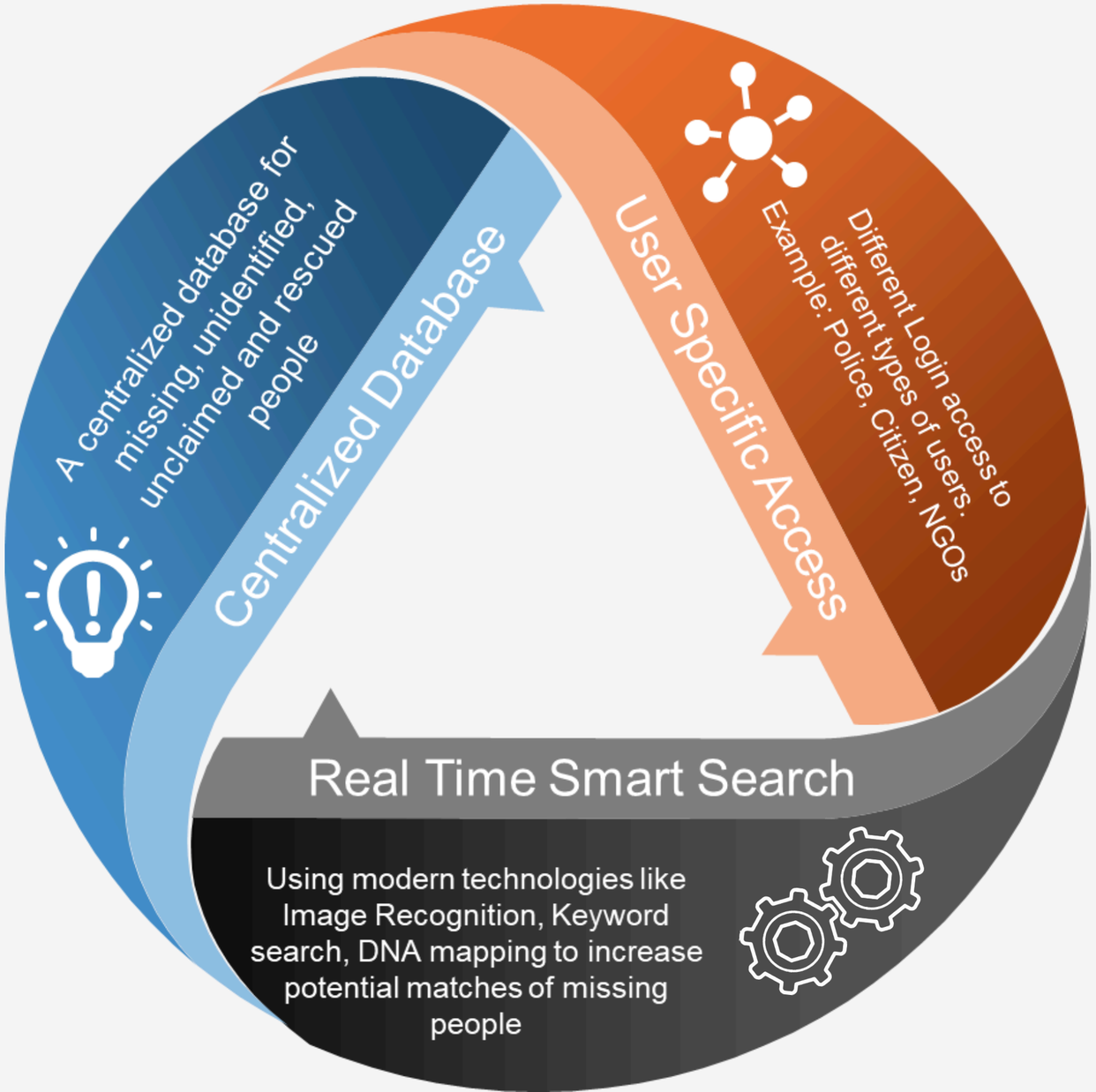
Problem with Current System

1. **No centralized national database** for missing/trafficked persons
2. Data is **scattered** across various government and NGO databases.
3. Lack of **coordination** between different **states** and agencies.
4. **Incomplete** and **inconsistent data** hampers search and rescue efforts.

Challenges Faced by Law Enforcement

1. Difficulty in accessing comprehensive data quickly.
2. **Delayed identification** and rescue due to fragmented information.
3. Lot of **paperwork**: Police departments have to send the data of missing persons to 9 different units including DCRB, Gumshuda cell, Doordarshan, nearby districts

Our AI Enabled Portal



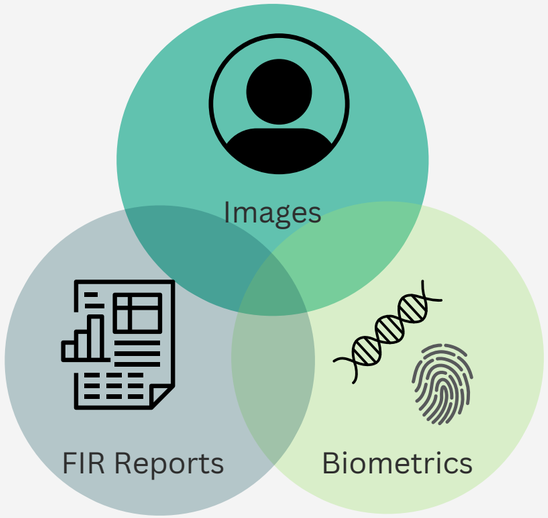
Solution Approach

Data Sources and Types

Data Sources

Our solution approach leverages multiple data sources to create a comprehensive and robust database for the efficient search of missing persons. Key contributors include police agencies, NGOs, and citizens. Police provide official reports and investigative data essential for legal and procedural accuracy. NGOs offer grassroots-level insights and rescue operation data, while citizens contribute firsthand reports about missing individuals, enriching the database with diverse information.

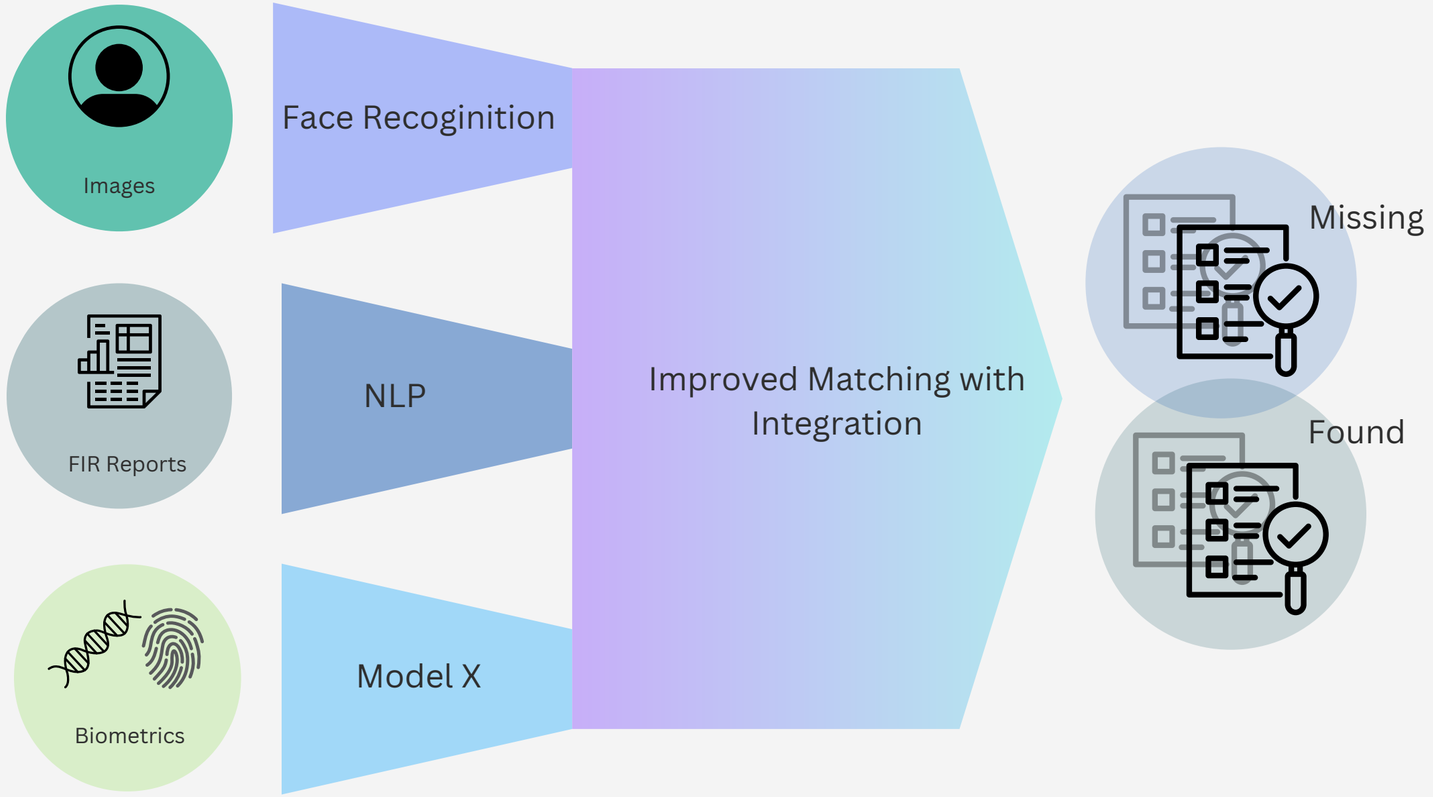
Types of Data



The types of data we utilize are diverse and complementary. Images enable effective facial recognition, crucial for identifying missing persons. FIR reports provide detailed contextual information, enhancing the search and matching process. Additionally, biometric data such as fingerprints and genetic information increase the accuracy and certainty of identifications, particularly in complex cases where visual data alone may be insufficient.

Solution Approach

AI/ML



The AI/ML pipeline is integral to our project, utilizing advanced algorithms to identify and match missing and trafficked persons accurately. By processing diverse data types—such as facial images, FIR reports, and biometrics—our AI system swiftly recognizes patterns and performs real-time matching against a comprehensive database. This enhances search efficiency and match precision, ensuring more victims are found and rescued quickly. The continuous learning capability of our AI models allows for ongoing improvements, adapting to new data and trafficking methods, thus significantly boosting the portal's effectiveness in combating human trafficking.

Data Security

Handling and securing personal data and police documents are paramount in this project. The security aspects and various types of user access levels of our portal will be designed through collaboration with experts from **C3iHub** (Cyber Security and Cyber Security for Cyber-Physical Systems) at IIT Kanpur. Considering the database can grow significantly, research is being done on developing a scalable solution that will enable fast queries from the database as well as accessing necessary data for executing the AI-based search algorithms on the database.

Helping in search and identification using facial recognition

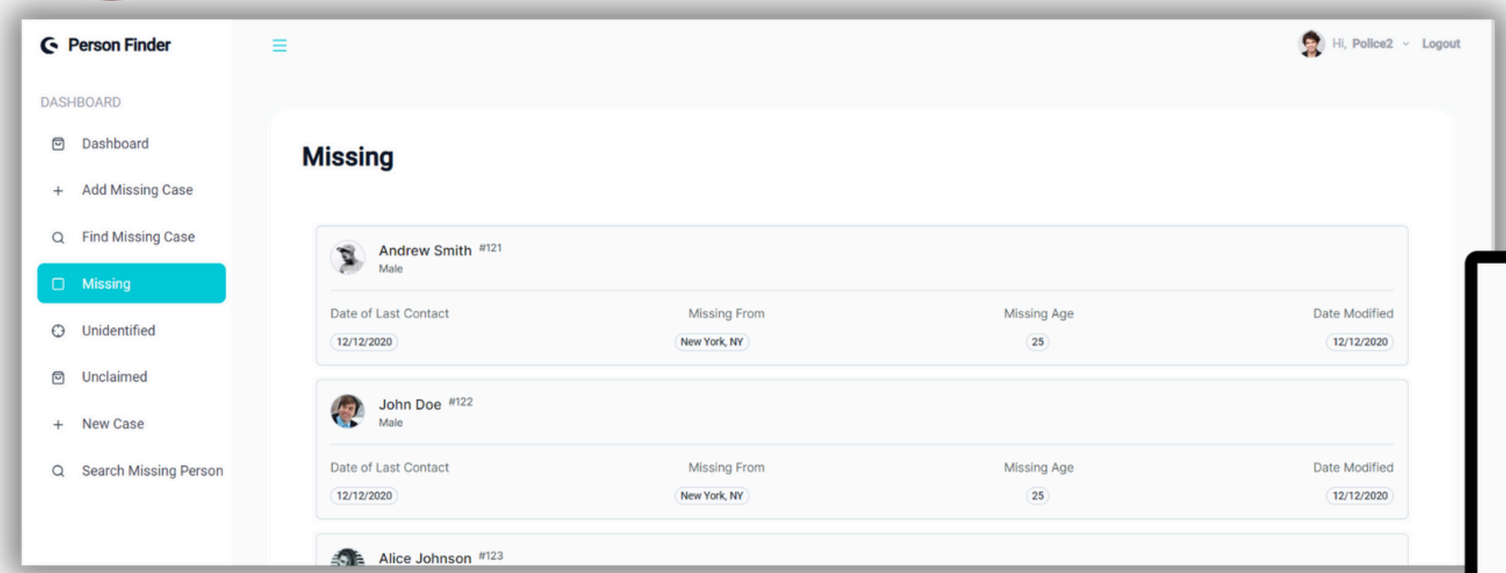
We are building a portal (based on our research) that will have multiple elements such as:

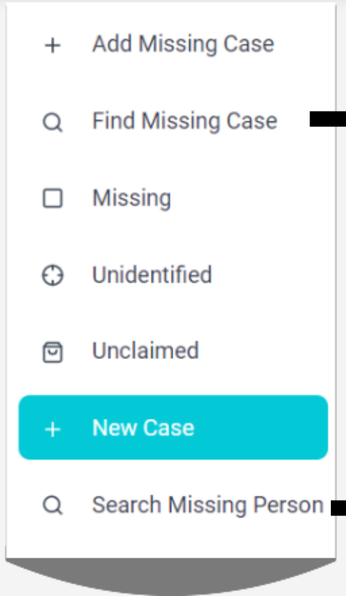
- Registration section for the institution (e.g. - Police, NGOs, etc.)
- Dashboard which will contain tabs like - Missing Cases, **Rescued**, etc. For the user, a dedicated section will be provided to upload the image and other details of the lost person

Rescued People

Our portal helps identify people who have been rescued after long periods, such as 5-10 years, and may not remember their identity or origin. We use facial recognition and DNA mapping to search through the missing person reports available on our platform.

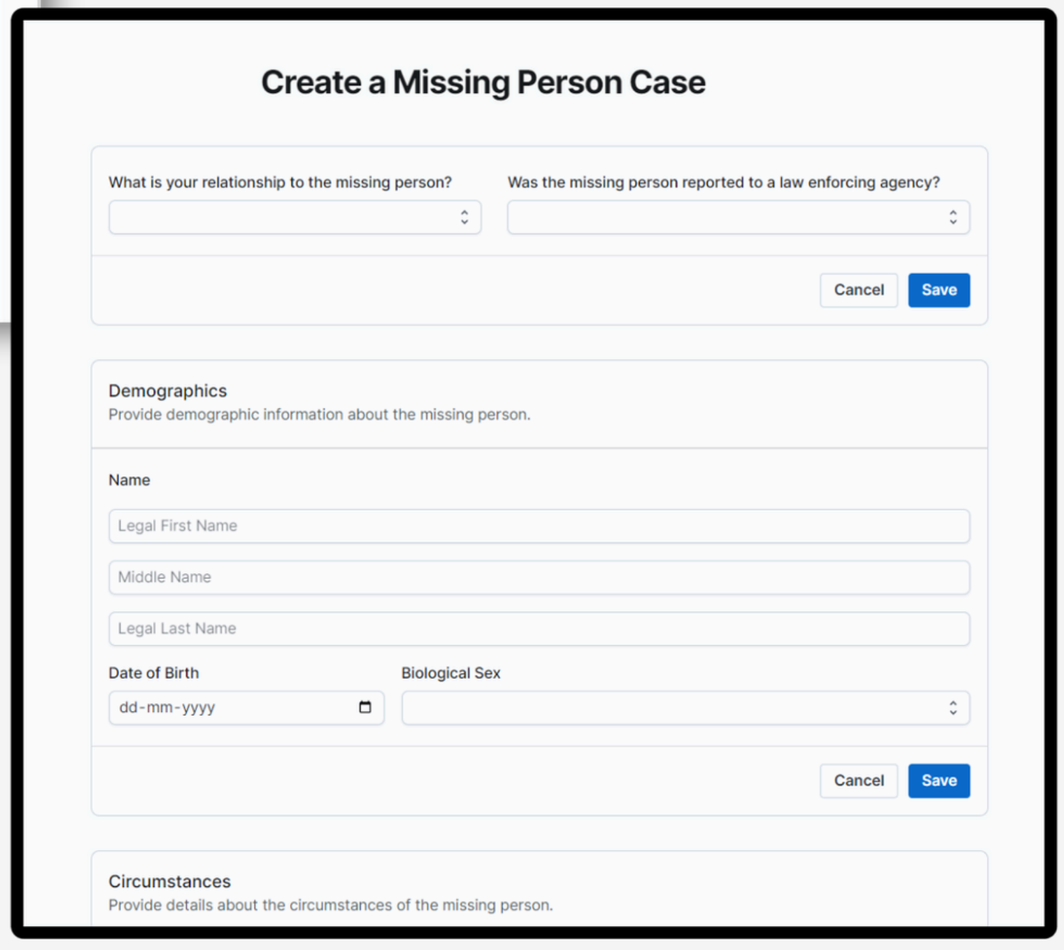
Portal



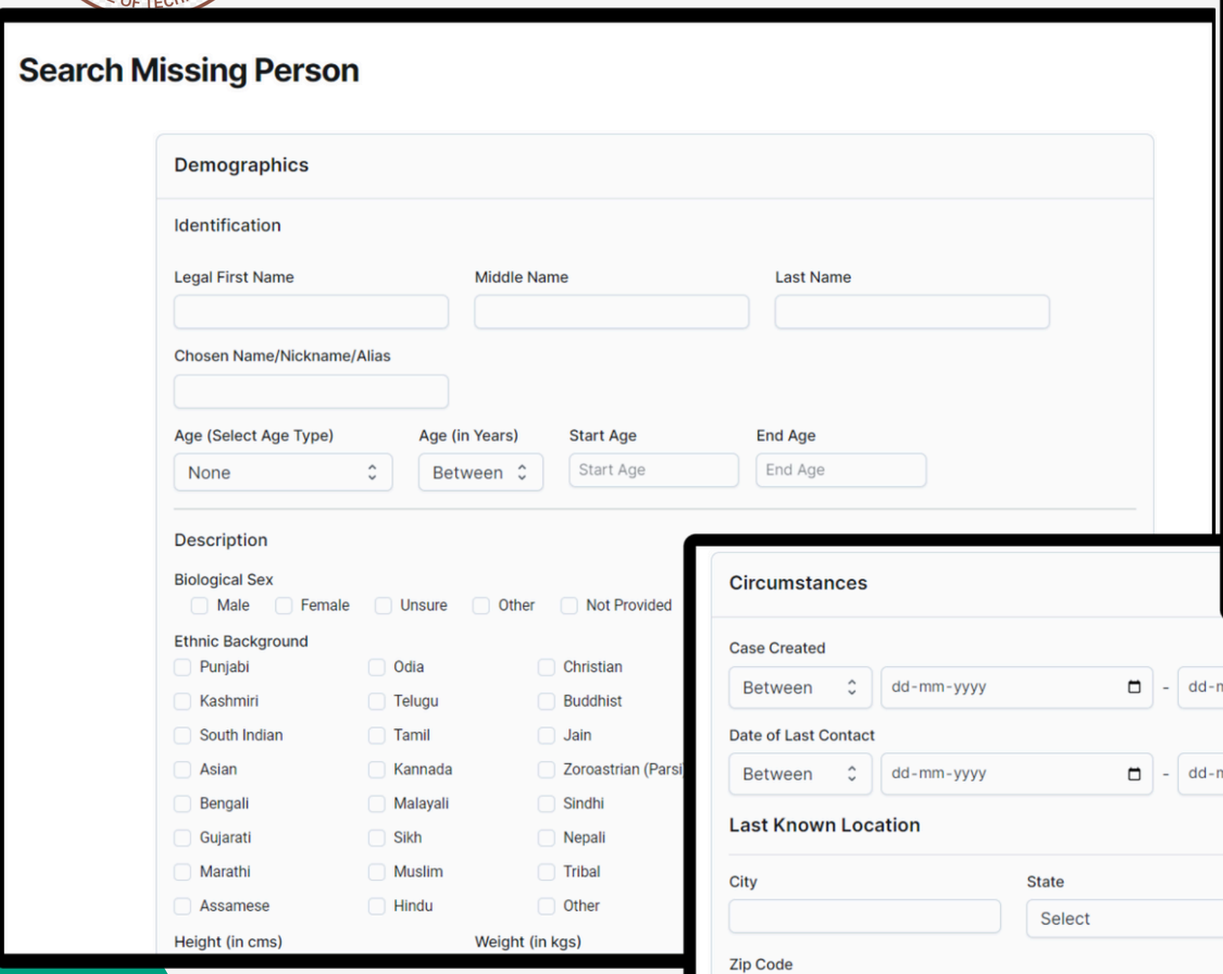


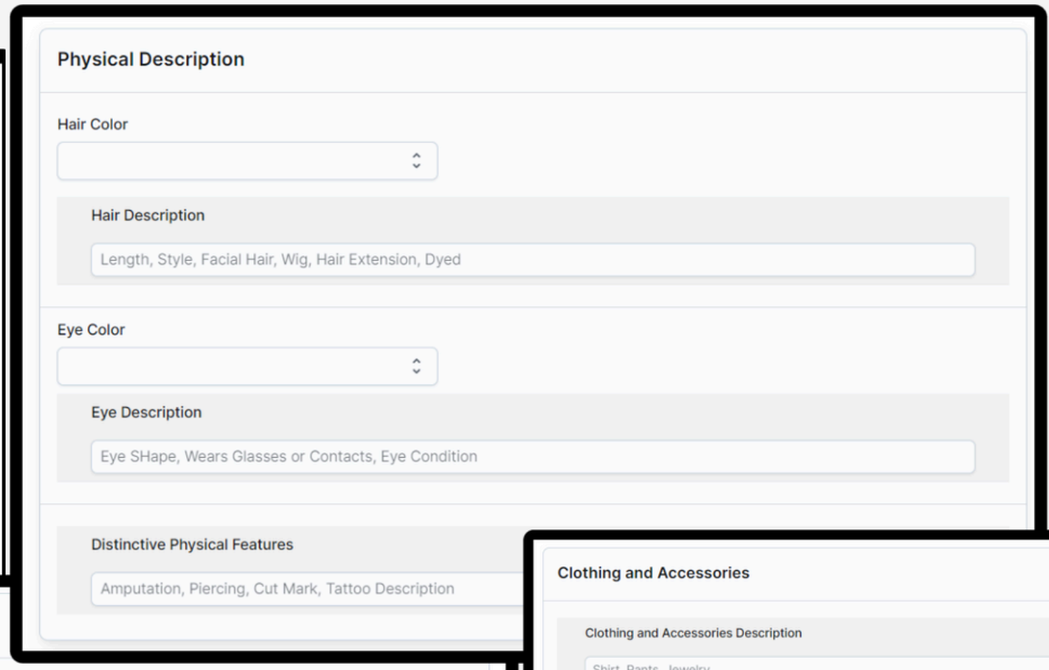
The biometric, and face recognition features will only be accessible to Professional users and not to citizens

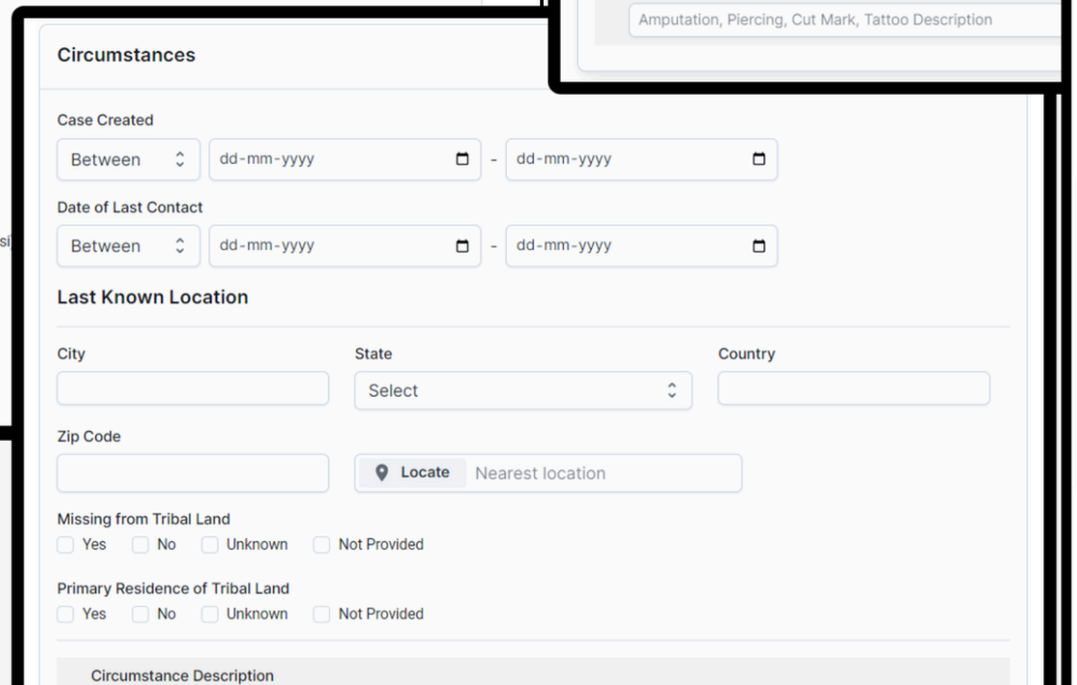
This will be accessible to all. images on next page

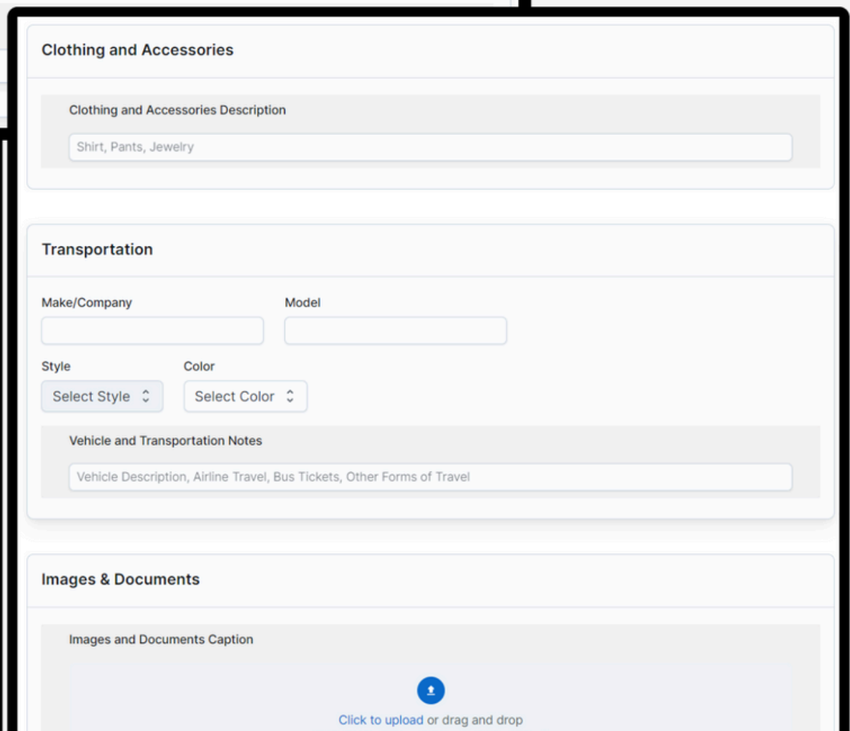


Portal







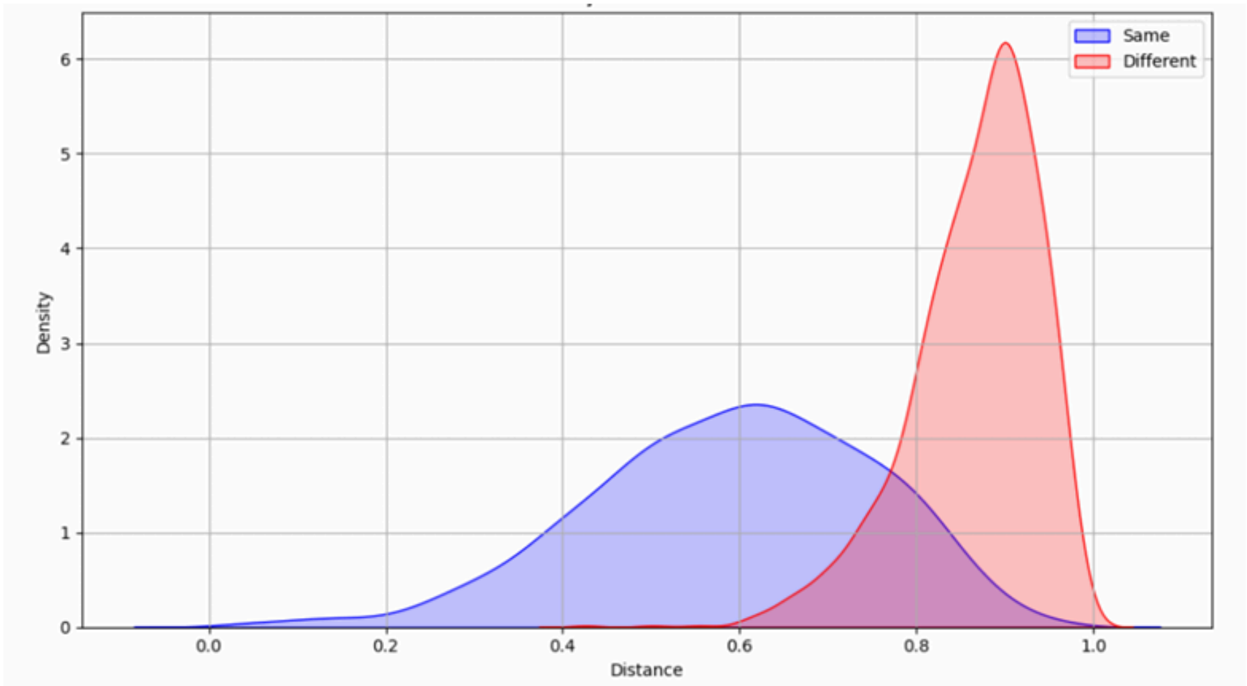


we can filter out based on any of the fields

Model results: Facial Recognition

1. **Model Used:** VGG-Face

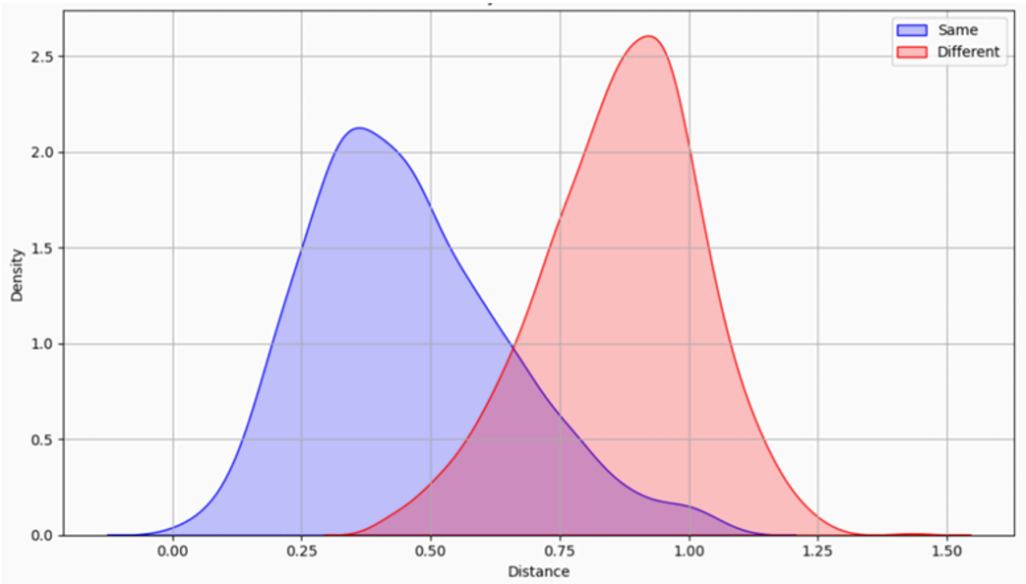
Threshold set: 0.75




```
True +ve, true -ve, false +ve, false -ve:  1018 1109 126 206
VGG Face on Indian celebrities: d2 Dataset
Precision: 0.8898601398601399
Recall: 0.8316993464052288
F1_score: 0.4298986486486487
Accuracy:  0.8649857665717772
Total pairs tested: 2459
```

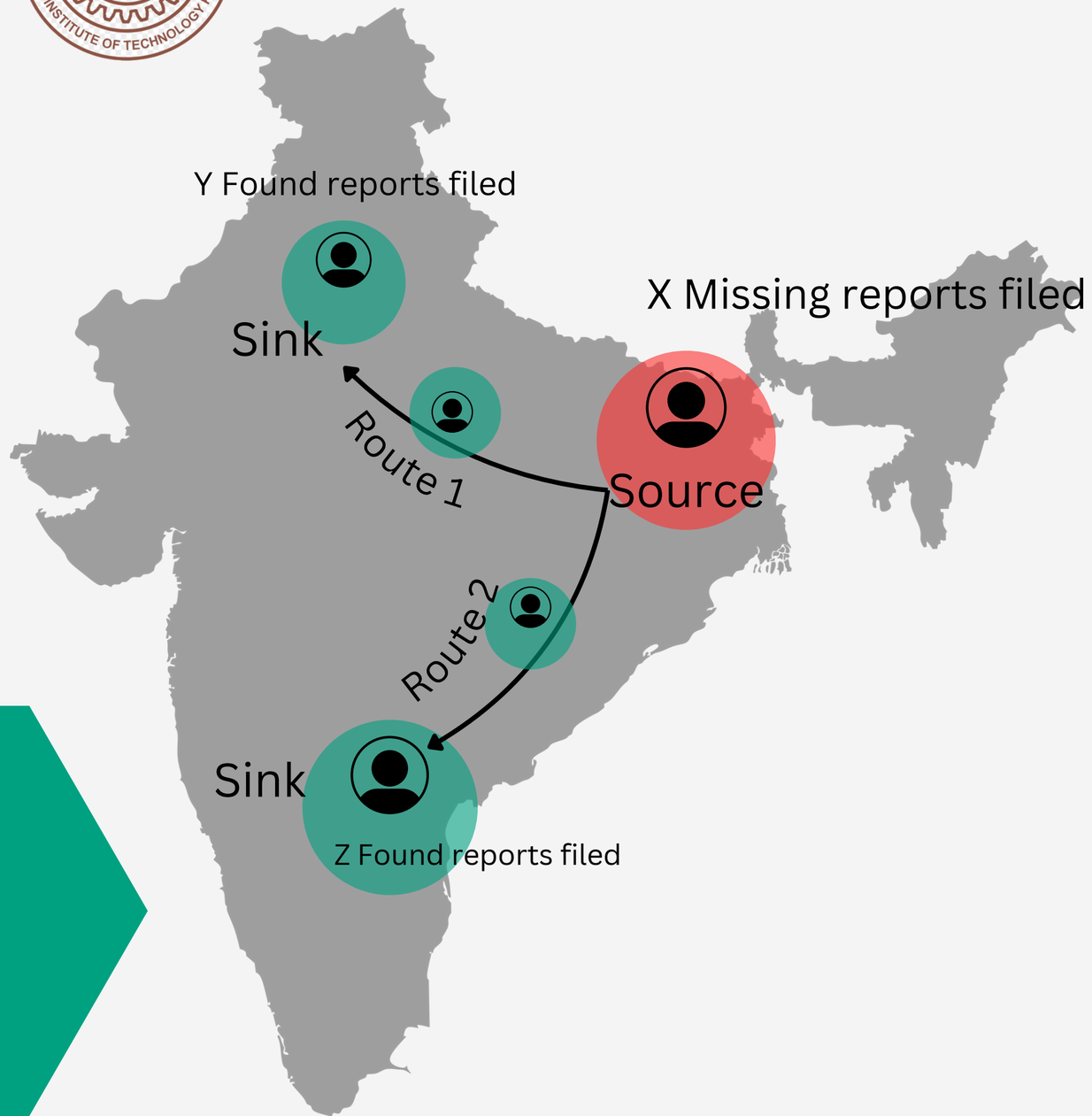
2. **Model Used:** Facenet

Threshold set: 0.66




```
True +ve, true -ve, false +ve, false -ve:  1029 1098 112 195
Facenet on Indian celebrities: d2 dataset
Precision: 0.901840490797546
Recall: 0.8406862745098039
F1_score: 0.4350951374207188
Accuracy:  0.8738701725554643
Total Pair Tested:  2434
```

Route Identification



Route identification is a critical component of our project, aiming to uncover and map the pathways used for trafficking humans from source to sink locations. By aggregating and analyzing the vast amounts of data collected through our portal—from images and FIR reports to biometric information—we can identify patterns and routes commonly used by traffickers. This large-scale impact enables law enforcement and NGOs to understand the geographical and logistical aspects of trafficking operations better. By pinpointing these routes, we can disrupt trafficking networks, enhance preventive measures, and strategically deploy resources to vulnerable areas, ultimately reducing the incidence of human trafficking and improving rescue and rehabilitation efforts for victims.

What we need?

Our models, currently trained on images of Indian celebrities, show promising results. However, real-time images of missing persons differ significantly in quality and noise.

To improve model accuracy, we need FIR reports of missing people from the police department. This real-time data will help us simulate matches and enhance the model's efficiency in identifying potential matches.

What we have.

Recently, we received a project grant under R&D Cohort III of C3iHub, IITK from DST (Department of Science and Technology), Government of India.

We have a team of qualified Individuals and the guidance of 2 professors:
Prof. T.K. Guha (AE, IITK) & Prof. Soumya Dutta (CSE, IITK)

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Pratham Sharma
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Gargi Sarkar
Jenil Dobariya
Shaurya Agarwal

Thank You