CELESTINI PROJECT INDIA 2018
TAKE-HOME EXAM
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Problem: Analytics and alerts on women safety using mobile microphones and public cameras.

A system for women's safety must strive towards a preventive solution rather than a merely assistive measure in case of a casualty. Our solution aims at providing both preventive as well as casualty assistance methods to safeguard a woman's modesty in the form of an application with the ability to pair with available fitness bands to trigger the alert (SOS) system using data from the phone's microphone and public cameras.

1. Blacklisting of unsafe roads:
   We intend to classify the roads in a city as **safe and unsafe** depending on the following factors:
   a. Survey of the general public.
   b. Number of street lights per kilometre of road.
   c. Area type - The level of safety and security in an area varies from a residential area with a good number of houses to an industrial or isolated area.
   d. Distance of the nearest Police Control Room from the road or situation of a PCR on the road itself.
   e. History of crimes on and around the road in question.
   f. Average number of pedestrians on that particular road at different times throughout the day. We intend to gather this data through public cameras.
   g. Number of public cameras on the road - A road with a significant number of public cameras with regular monitoring is naturally better than one with no cameras.

   Using these factors, we intend to create our own dataset and depending on the generated dataset the appropriate machine learning model would be selected. We aim to use Google Maps API within our app to provide the user with the safest route by avoiding the roads that have been classified as unsafe.

2. Suspicious behaviour detection:
   A surveillance and security system for automatic detection and warning of detected events includes a unit for observing behavior in an area under surveillance, a unit for

processing an output of observed behavior from the unit for observing, and includes a pattern recognition module for recognizing whether the observed behavior is associated with predefined suspicious behaviors. Any malicious person can be recognised by some characteristic features and body language. On detection of suspicious behavior, the individual in charge of monitoring the surveillance would be notified of the potential threat and would be advised to keep track of the activities of the suspicious individual in question.

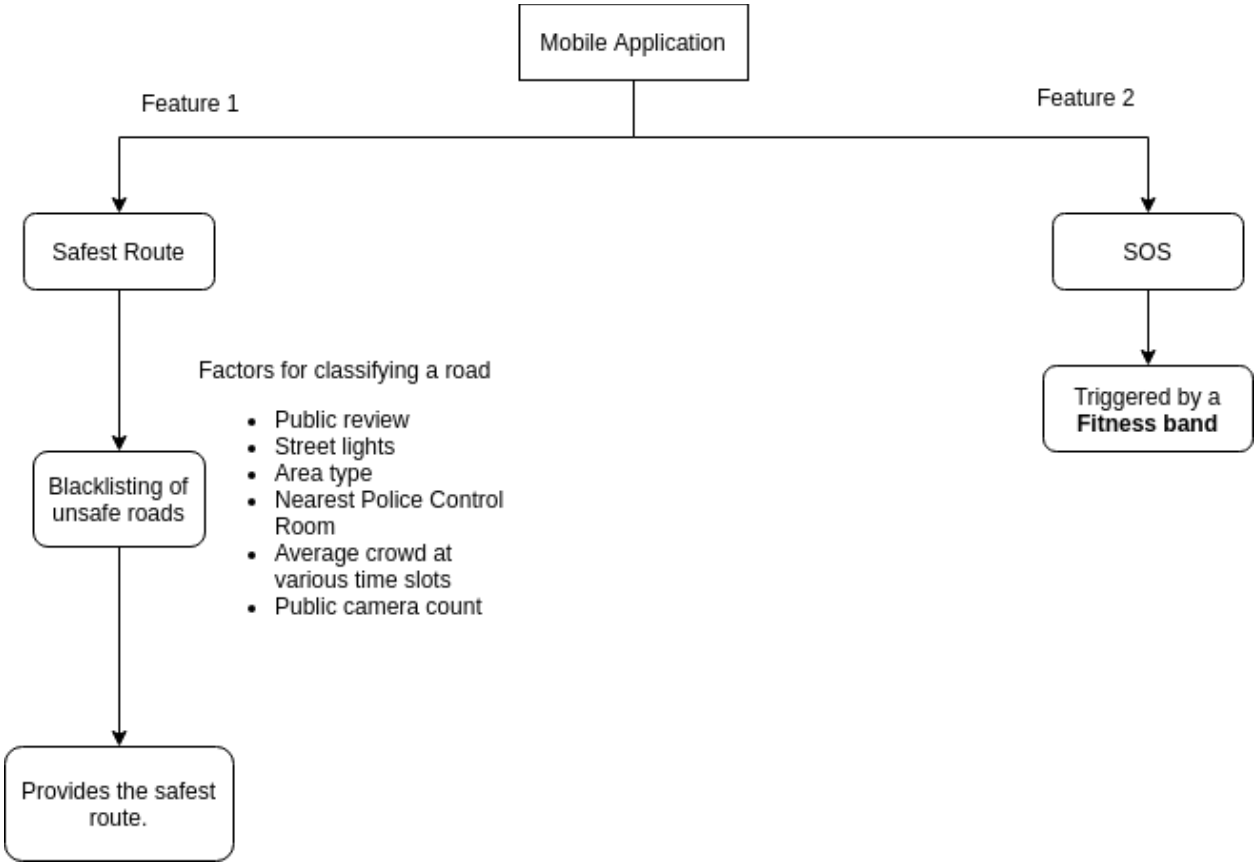
3. SOS Alert System:
   Our app would constantly monitor and analyse the input from the microphone in the user's phone using real-time sentiment analysis and would trigger the SOS Alert System in case the learning model recognises signs of struggle, distress, misbehavior on the potential assailant's part and any form of high-pitched scream. The user can even use a fitness band paired with her phone to manually trigger the system in case she feels she is in a situation where she might be at risk. We would like to provide the user with the ability to choose the kind of gesture she wants to use to trigger the system. The user's live location would be sent to her emergency contacts which she can choose from within the app upon registration. The sentiment analysis model would classify the level of threat into 5 distinct levels based on the voice data from her phone's microphone and the current level of threat determined by the model would be displayed to the emergency contact from within their copy of the app. The emergency contact would then have the option to call the police from within the app.
   We have already worked in the field of sentiment analysis to detect depression using Convolutional Neural Networks (CNN) successfully with an F1 score of 0.93 and published a research paper on the same. Hence, we would be using CNN for sentiment analysis for threat level detection.

   http://ssrn.com/abstract=3363837

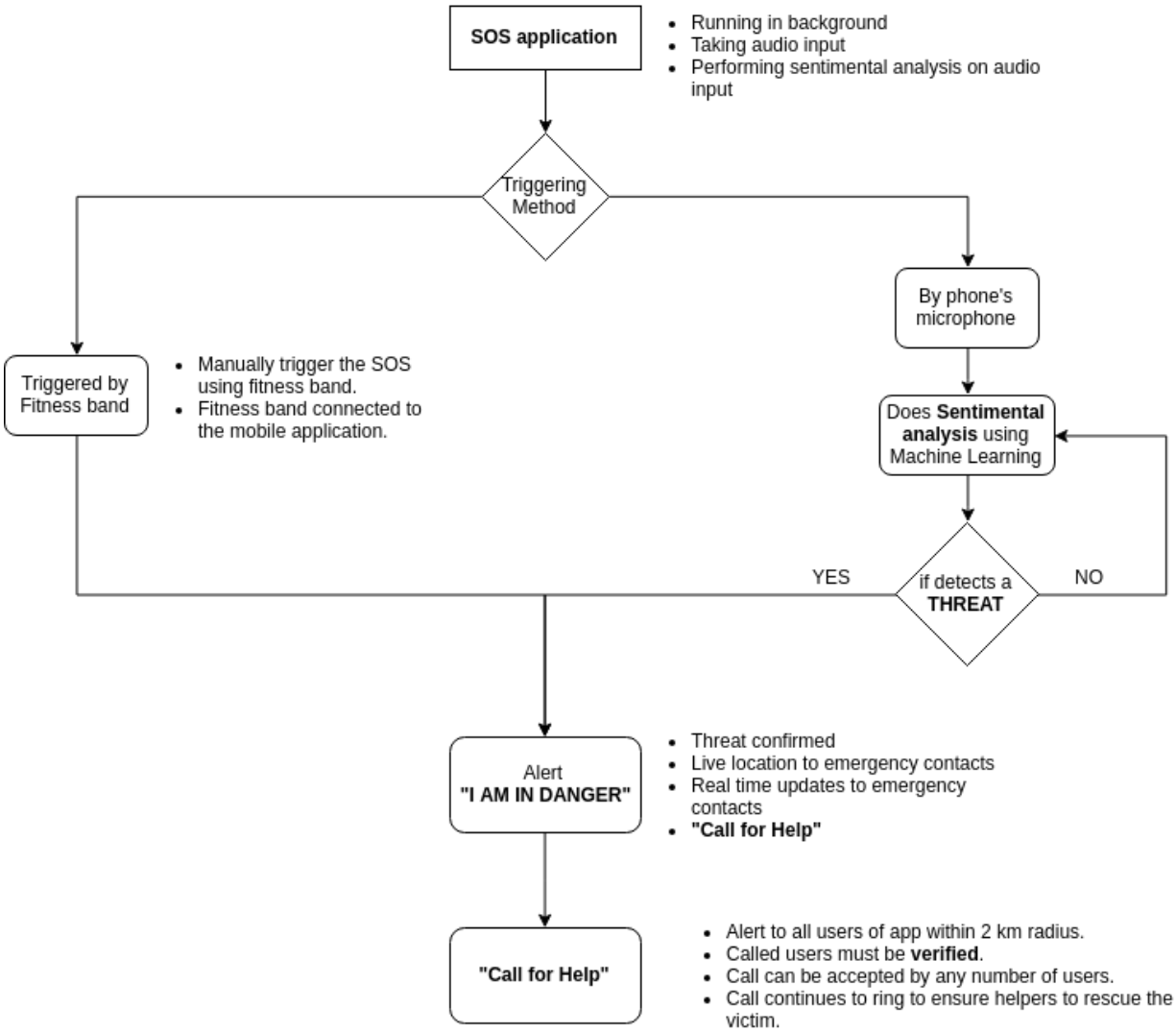
   In addition to notifying the emergency contacts, the app would also invoke the "**Call for help**" feature which would send an alert to all the users of the app within a 2 km radius from the location of the mishap. In order to prevent the misuse of this feature, only verified users who have passed a number of identity tests within the app would be alerted in case of an SOS Alert in their vicinity. The users who have been alerted will have the option to either accept or reject the request for help and when accepted by even one individual, the victim would be notified that help is on the way.

Cloud data storage and architecture:
The learning models of all three systems would be stored on the cloud through Google Firebase and the analysis of data would be undertaken by these models on the cloud itself to protect the privacy of our users. The only data we would have access to would be the registration details of our users.

Basic Model of the Application



SOS Alert System



The "emergency contact" user

- Can access the live location in the application itself.
- Option to contact the nearest Police Control Room.

Key Challenges:

1. Research and creation of datasets for blacklisting of unsafe roads and suspicious behavior detection.
2. Selection of appropriate machine learning models for blacklisting of roads and suspicious behavior detection due to current unavailability of data and scarcity of public cameras in the country.
3. Sentiment analysis using the phone's microphone might not work as well in a noisy environment as it would in a relatively quiet environment.