SMART INDIA HACKATHON 2019

TRAFFIC SURVEILLANCE USING UAVS

MINISTRY CATEGORY: INDUSTRY PERSONNEL (MATHWORKS INDIA PVT LTD)

PROBLEM STATEMENT: AERIAL TRAFFIC MONITORING USING UAVS

PROBLEM CATEGORY: ROBOTICS AND DRONES - SOFTWARE

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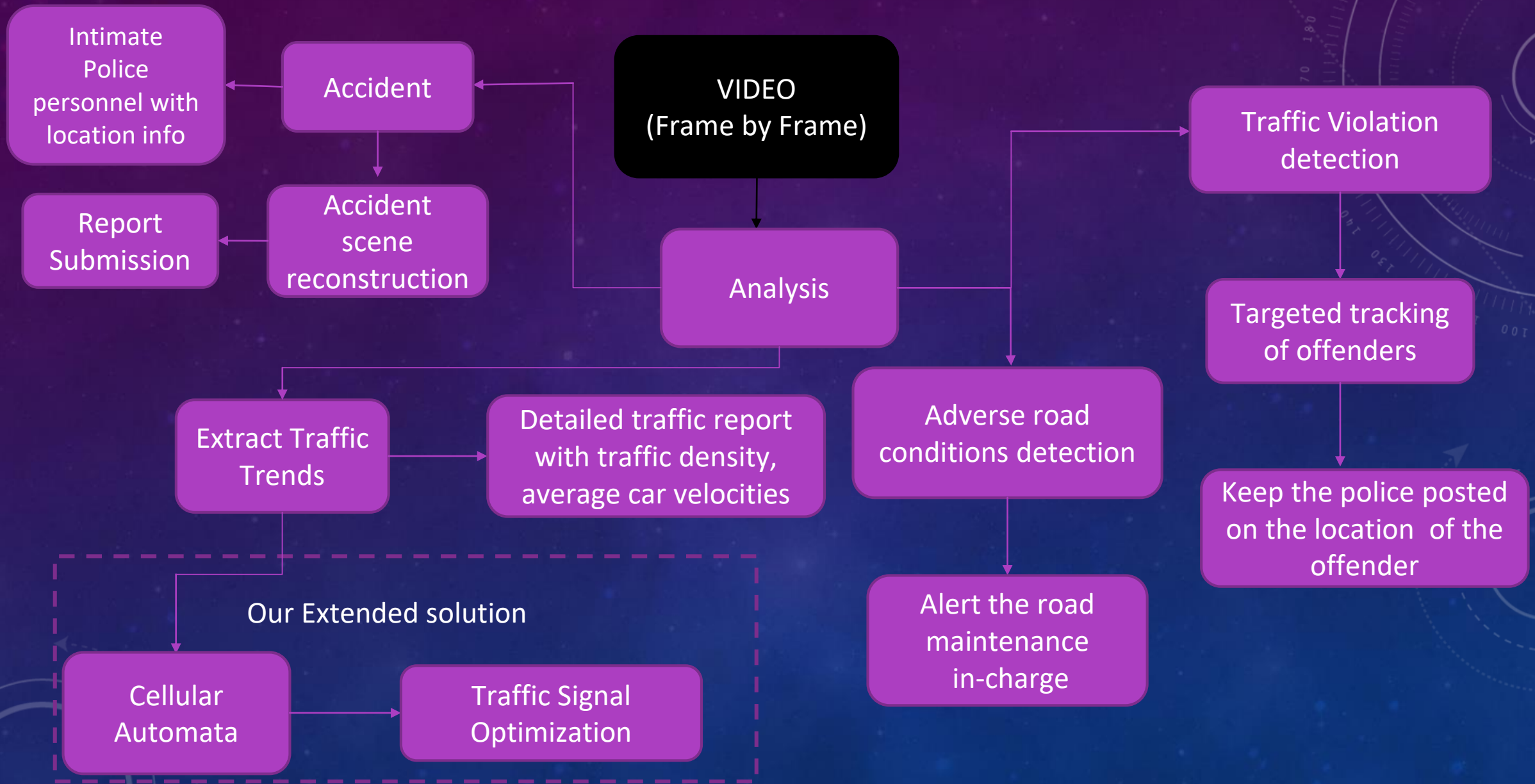
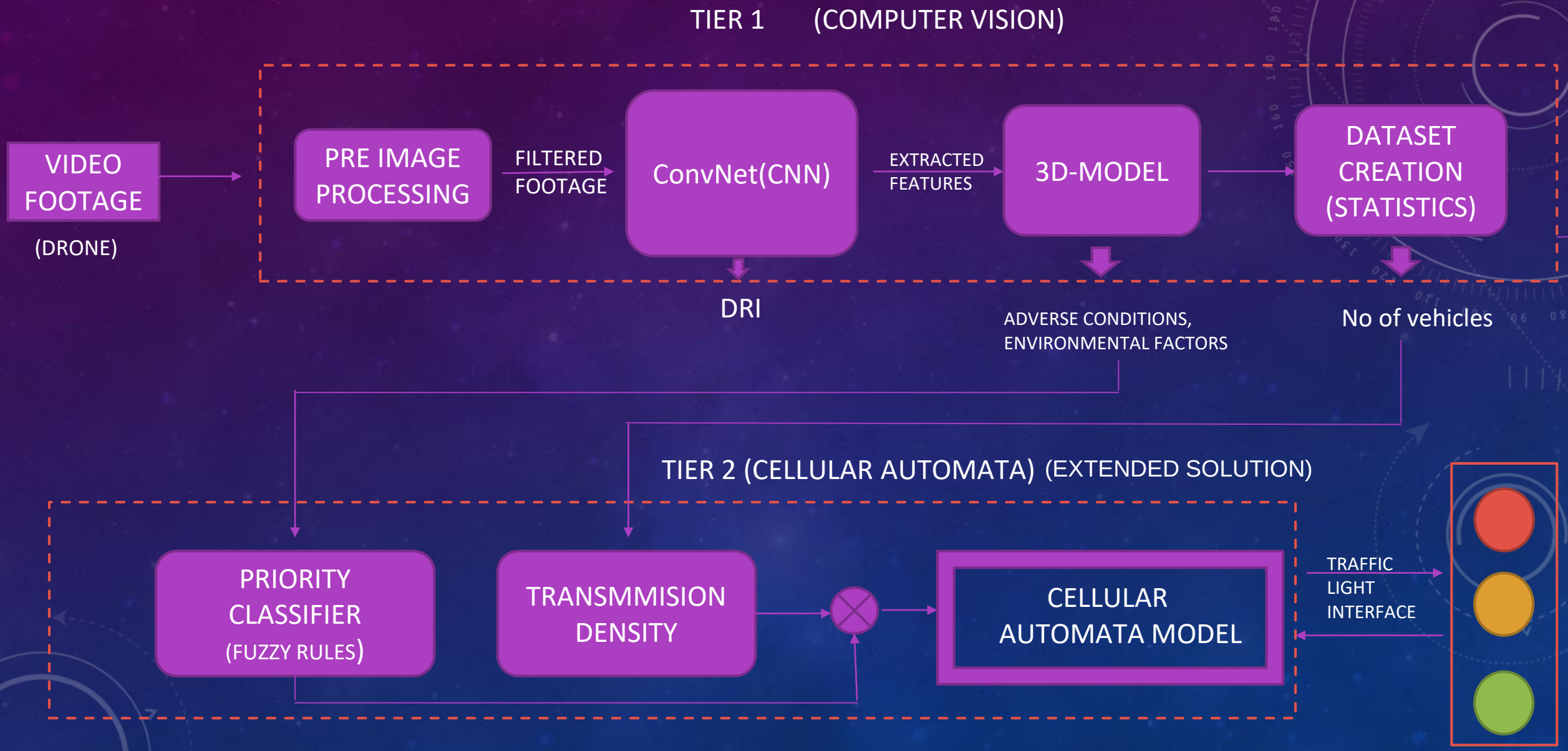
PROPOSAL:

We propose a two tiered complete Traffic Surveillance and Management software package that surveys the field of view via COMPUTER VISION and incorporates FUZZY ALGORITHM based on CELLULAR AUTOMATA (CA) to provide statistical analysis of the traffic situation , road conditions , optimisation for phase shifting (signal change) of the LSE (aka traffic lights), traffic rule violation detection and targeted tracking of offenders.

FLOWCHART:


VIDEO
(Frame by Frame)
Analysis
Accident
Intimate Police personnel with location info
Accident scene reconstruction
Report Submission
Traffic Violation detection
Targeted tracking of offenders
Keep the police posted on the location of the offender
Adverse road conditions detection
Alert the road maintenance in-charge
Extract Traffic Trends
Detailed traffic report with traffic density, average car velocities
Our Extended solution
Cellular Automata
Traffic Signal Optimization

TECHNOLOGY STACK:



SOLUTION

Tier 1
(Computer Vision)

The incoming video footage from the drone is fed in the software package which follows the system of DRI (Detection ,Recognition ,Identification)

CONVNETS & DEEP LEARNING : Along with CV To analyse and identify the composition of traffic (types of vehicles)

FRAME TO FRAME ANALYSIS

Using frame to frame analysis, the instantaneous velocity of each vehicle and transmission density is calculated using MoG (Mixture of Gaussian) algorithm and Kalman filters.

STEREO VISION: Two cameras are used to take two images at slightly different viewpoints which are then processed to identify same points in both images. The depth map information obtained is utilized to **detect an obstacles like Potholes** and can also be used for fast **accident scene reconstruction**.

Tier 2
(Cellular Automata And Fuzzy Controls)
(EXTENDED SOLUTION)

- Now the numerical dataset created from the footage analysis containing the count of vehicles, traffic density, vehicle velocities and physical dimension of the lanes and physical entities is fed as input to the CELLULAR AUTOMATA (CA) model.
- At the first level, Priority of each street based on pausing coefficient is computed at each moment based on fuzzy rules.
- In the second level , Real velocity of vehicles of every street is calculated at specific moments and then type of transmission density of vehicles is evaluated.
- Once the above two factors are integrated in to the CELLULAR AUTOMATA model , the Weighted Priority of each street will be calculated momentarily and updated at frequent intervals, this will be used to control the phase shift (signal change) of Light Signalling Equipment (LSE) at each intersection.

USE CASE:

- Our proposed system can be implemented in all types of scenarios and surveillance measures.
- Apart from traffic surveillance since the module also offers real time traffic optimisation techniques it can also be used to regulate traffic flow in case of unexpected situations.
- Due to its mobility it can be used to follow fleeing suspects or offenders with ease and without being detected.

DEPENDENCIES:

- Since all the software used for implementation(Matlab, OpenCv python) are available open source or on subscription basis, our idea package can be implemented without any additional resources.

SCOPE:

- As our algorithm requires only a camera for its implementation, subject to availability of additional sensors and improved technologies, further efficiency and functionality can be extracted from the package to broaden its scope and application.