

Executive Summary

What is Street Ops?

Street Ops is a portable revolutionary device that harnesses the brilliance of Computer Vision, Embedded Systems and Geospatial mapping to curtail the adversities that pedestrians and drivers face. The Automobile Safety System would be fundamentally used by the heavy-vehicle drivers, who transport goods over long geographic distances and are required to maintain control of the vehicle during the night. The drowsiness caused due to sleep deprivation might lead to untimely accidents which would not only affect the driver, vehicle and the goods but might also cause unforeseen effects on the innocent pedestrians and other drivers on the road. As the system has other features like a pot-hole detector and traffic-sign identifier even in low visibility, it would assist any driver in general. The techniques adopted during the making of the project leverage the use of cutting-edge technologies like Neural Networks and Image Processing.



Business Model

01

Marketing

- Social Media campaign
- Subsidized premium rates while buying insurance
- Signing up with cab aggregators and Corporate fleets

02

Operations

- Component Procurement.
- Contract assembling and packaging
- Installation support
- Provision of call and online support

03

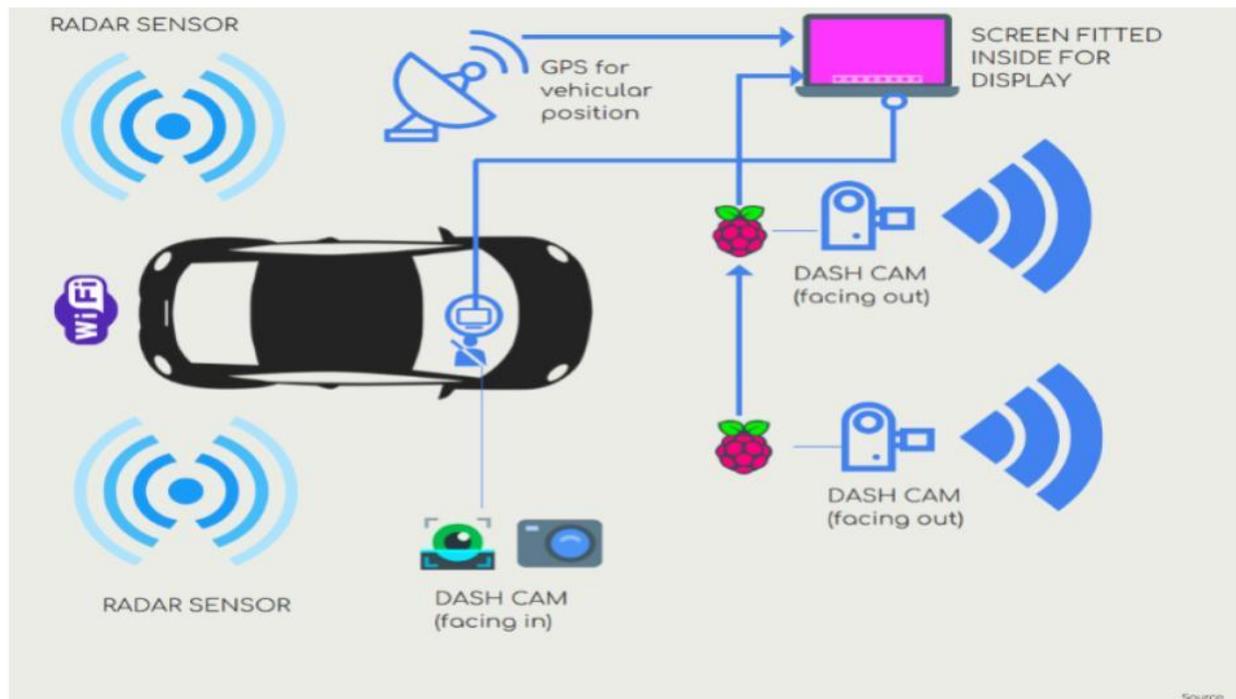
Sales

- E Commerce
- Automobile dealers and OEM
- Insurance bundle

04

R & D

- Prototype and testing
- Modular design to add more safety features



“It is usually impossible to know when you have prevented an accident.”

— Mokokoma Mokhonoana

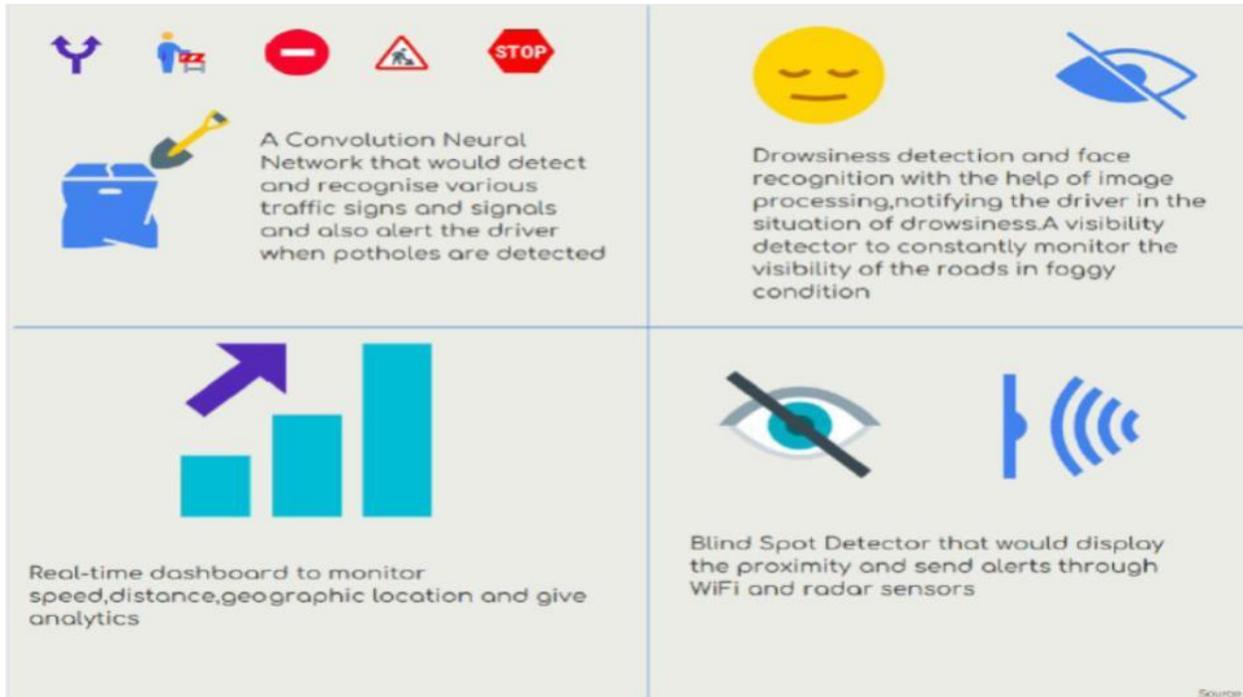
There is an HD monitor connected to a microcontroller RPi4 which is placed just beside the driver's seat as illustrated in the figure. Dash Cams are installed to capture the real-time video that would be further used to alert the driver in case of accidents. A dashcam has a higher resolution as compared to other cameras and it works flawlessly even in dark and hazy conditions. The entire system is connected to the main processor through WiFi modules. In addition to that dash-cams also have an inbuilt GPS which makes geographical tracking way easier.

Over 85% of the accidents are attributed to errors in human judgment. There are air-bags, seat-belts & pre-tensioners. These safety measures are an attempt to minimize the damage caused after the accidents have happened, but there is no single unitary system that prevents accidents before happening.

“You're more likely to die from drowsy driving than from texting while driving, distracted driving or drunk driving combined” - CSI Research Center

According to a study by Central Road Research Institute (CRRI) on the 300-km Agra-Lucknow Expressway, *exhausted drivers who doze off account for 40% of road accidents.*

The effects of drowsiness will make your steering, braking, acceleration below-par, blur your vision and abject your reaction time. Drowsiness during driving could prove to be extremely fatal. Street Ops decodes the puzzle of drowsiness detection through Image Processing. The Dash Cam fitted in front of the driver constantly monitors the movements of his eyelids. The video captured by the camera is sent to a powerful microcontroller *Raspberry Pi 4* that performs some computational operations on it. Drowsiness detection would be done by using a *Haar Cascade Classifier* in Image Processing. The classifier would make landmarks on your eyes and continuously monitor the movement of eyelids. If the eyelids are shut for a prolonged period of time, then an alarm would be played to grab the attention of the driver and wake him up. A vigilant driver ensures the safety of pedestrians as well.



'The area around the vehicle that cannot be directly seen by the observer is called the blind-spot'. Countless accidents and close calls are a result of the inability of the driver to comprehend if there is another vehicle in its vicinity. Although adjusting mirrors can reduce accidents, it's far from a foolproof solution to this untrackable lacuna. It's impossible to evade something you can't see. Street Ops comes to the rescue to devise a mechanism to avert untimely accidents due to blind-spot. Two radar sensors are fitted at the back of the vehicle to make sure that the entire area, which is unseen by the rearview mirror, is captured. Radar Sensors were originally developed for object detection. Radar sensors enable a user to measure the distances of an object from the sensor and also the relative speed. The sensor generates a narrow beam which is modulated constantly within a small range. At the instant where another vehicle is within the blind-spot, the radar sensor, which is connected to the micro-controlled RPi4 sends the readings via a WiFi module called 'NodeMCU'. If the distance is close enough then the system alerts the driver to slow down. Thus, by utilizing the power of embedded systems and radar sensing, innumerable mishaps can be prevented.

Poor visibility during hazy environmental conditions paves a way for accidents. Shoddy lighting conditions blurs a driver's vision and makes it burdensome for the driver to identify traffic signals accurately. To get around this obstacle, Street Ops makes sure that these traffic signs are identified correctly even during the foggiest environmental conditions. Image processing techniques are used to determine if the visibility of the roads is good enough for the driver, else it alerts the driver to halt the vehicle. For recognizing traffic signs and signals, a particular form

of Neural Network called ‘Convolutional Neural Network’, which has the prowess of extracting intricate details from the images is used. The details include horizontal and vertical edges, patterns and spatial relationships between pixels that can’t be articulated by humans. The intricate details are extracted using operations like max-pooling, Convolution, Fourier Transform, Softmax Activation, Edge detection, and motion blur detection. The entire process is divided into training, testing and validation phases. The hyperparameters of the model would be tuned by great precision to obtain the best accuracy possible. Neural Network architectures capture the video frames which are in the form of images and the object detection algorithm works on it to extract the areas of interest. Then the image classification algorithm helps in distinguishing between the various traffic signals.

Feature	SteertOps	Bosch	Tata ELXSI	DST
Drowsiness	Yes	Yes	Yes	No
Sign & Signal	Yes	Only Sign	No	No
Blindspot	Yes	No	No	Yes
Pothole	Yes	No	No	No
Visibility	Yes	No	No	No

The pothole detector detects the presence of potholes on the roads that even the government is unaware of. This feature could potentially help in revitalizing the substandard conditions on Indian roads. There have been instances where the government carries out repair operations to mitigate the severity of potholes. These operations particularly happen in metropolitan cities. In areas, in the outskirts of metropolitan cities, such instances often get unnoticed. Ignorance regarding maintenance in suburban areas causes the residents to pay a huge price during monsoon seasons. While the government aptly has the resources to rehabilitate the impaired roads, pin-pointing out the exact location is still a cumbersome task. Street Ops could be a vital channel through which the government could get data regarding the meager road conditions. Once the camera in Street Ops detects a pothole, it sends the GPS coordinates to the main server whilst notifying the driver about the pothole in front of the vehicle. The spatial data in the form of GPS coordinates are collected on the server over time. After plotting the data and carrying out data visualization over a tool like Tableau, authorities can identify the regions where the density of potholes is above a threshold and these regions could be classified as high alert regions where repair operations should be carried out right away. This assists the government in formulating necessary policies, allocating resources and maintaining a timeline for road repairs.

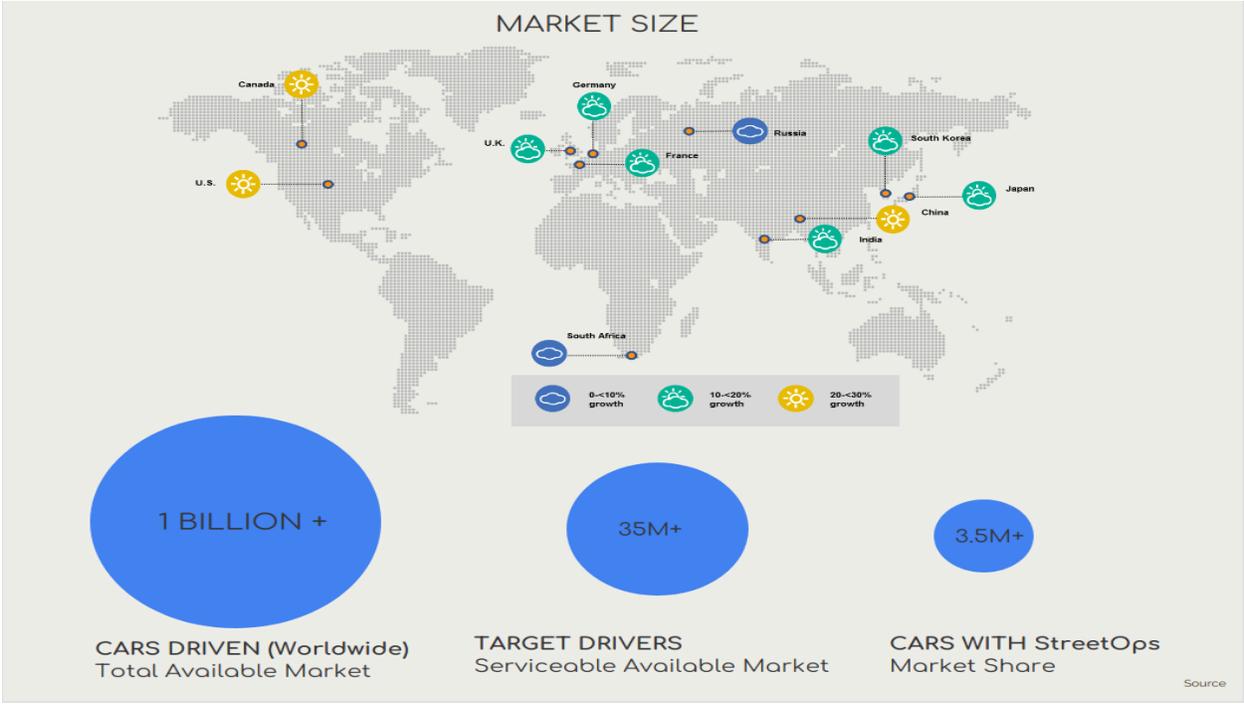


The HD display also shows real-time analytics of the driver's journey and plans out the shortest route from source to the destination while taking into account various traffic conditions and gives a rough estimate of the time required for the journey. This feature is quite ubiquitous with transportation applications. This system is meant for drivers' safety and this utility is just the icing on the cake.

MAJOR STAKEHOLDERS

The Automobile Safety would be fundamentally used by the heavy-vehicle drivers, who transport goods over long geographic distances and required to maintain the control of the vehicle during the night. The drowsiness caused due to sleep deprivation might lead to untimely accidents which would not only affect the driver, vehicle and the goods but might also cause unforeseen effects on the innocent pedestrians and other drivers on the road. As the system has other features like pot-hole detection, which can also be used by two-wheeler drivers, who are a major victim to these accidents, especially during monsoon, as they need to maintain a proper balance of their vehicle. It also has a traffic-sign identifier, which even in low visibility, would

assist any driver in general. The techniques adopted during the making of the project leverage the use of cutting-edge technologies like Neural Networks and Image Processing.



Street Ops empathically touches human lives by providing them an unprecedented safety system. The algorithm and design-thinking behind Street Ops is truly an engineering marvel.