5G- ENABLED REMOTE ROAD FIXING VEHICLE WITH AUTOMATED DEFECT IDENTIFICATION BY AI VIDEO/IMAGE ANALYTICS

Final phase

ITU AI/ML in 5G Challenge
Smart Transportation

WE ARE

stc
SAUDI ARABIA

ITU
Challenge of
INDIA

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AGENDA

1. Challenge description
2. Solution
3. System design & data set
4. Relevance with automotive industry

REGION INSIGHT

2nd

largest road network in The World with length around **4,320,000 kilometers**.

INDIA

8

Various type of **transportation methods**, lead to different challenges.
Bicycle, Motor Cycle, Car, Tempo, Bus, Train, etc.

4.3M

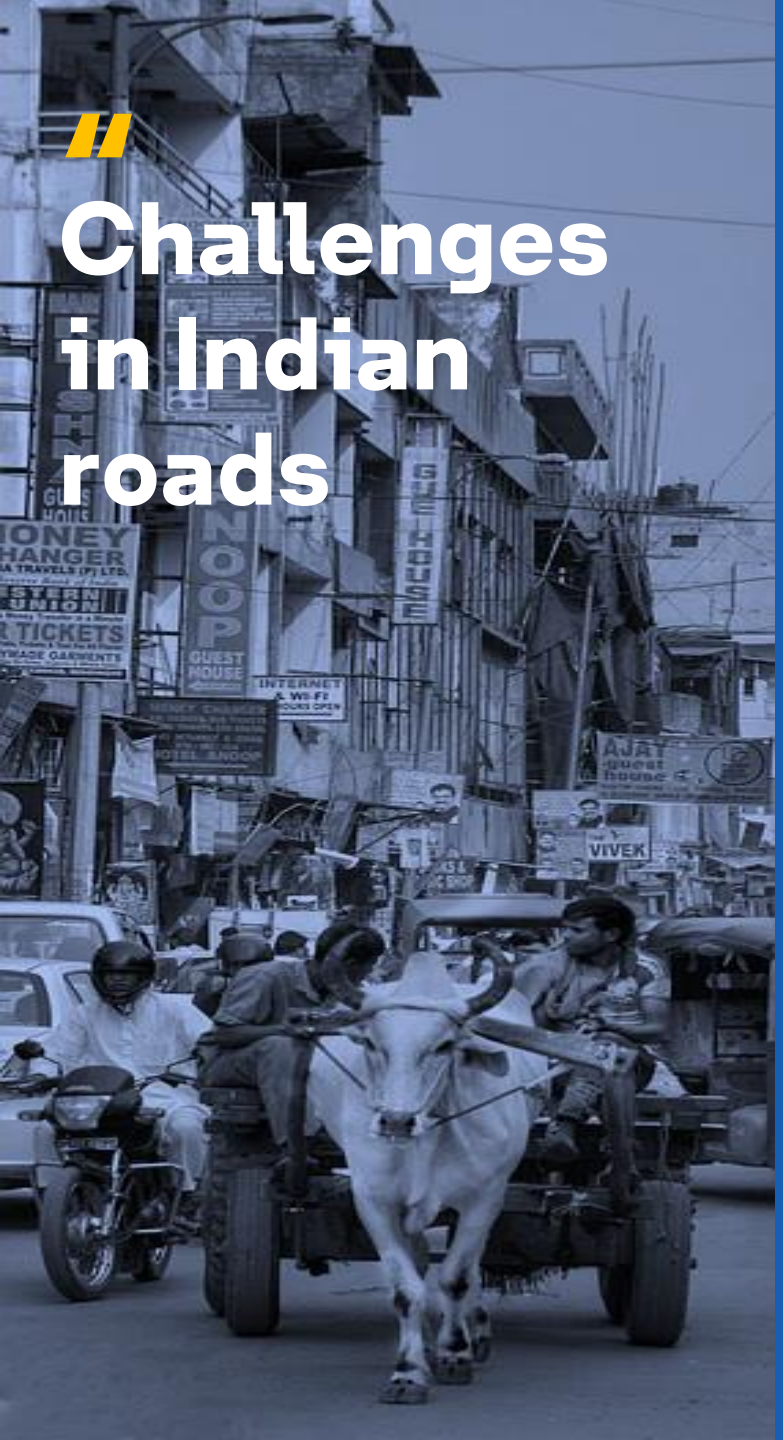
4.3 m road accidents recorded across India in 2019. where the **major cause** of road accidents (driver behavior, road condition, distraction, etc.)

Source:
https://morth.nic.in/sites/default/files/Road_Accidents_in_India_2017.pdf

PROBLEM STATMENT

Road condition

one of the main causes of road safety level around all around the world. This project seeks to improve road condition by address an new techniques for road quality inspection process and instance fixing through emerging technologies.



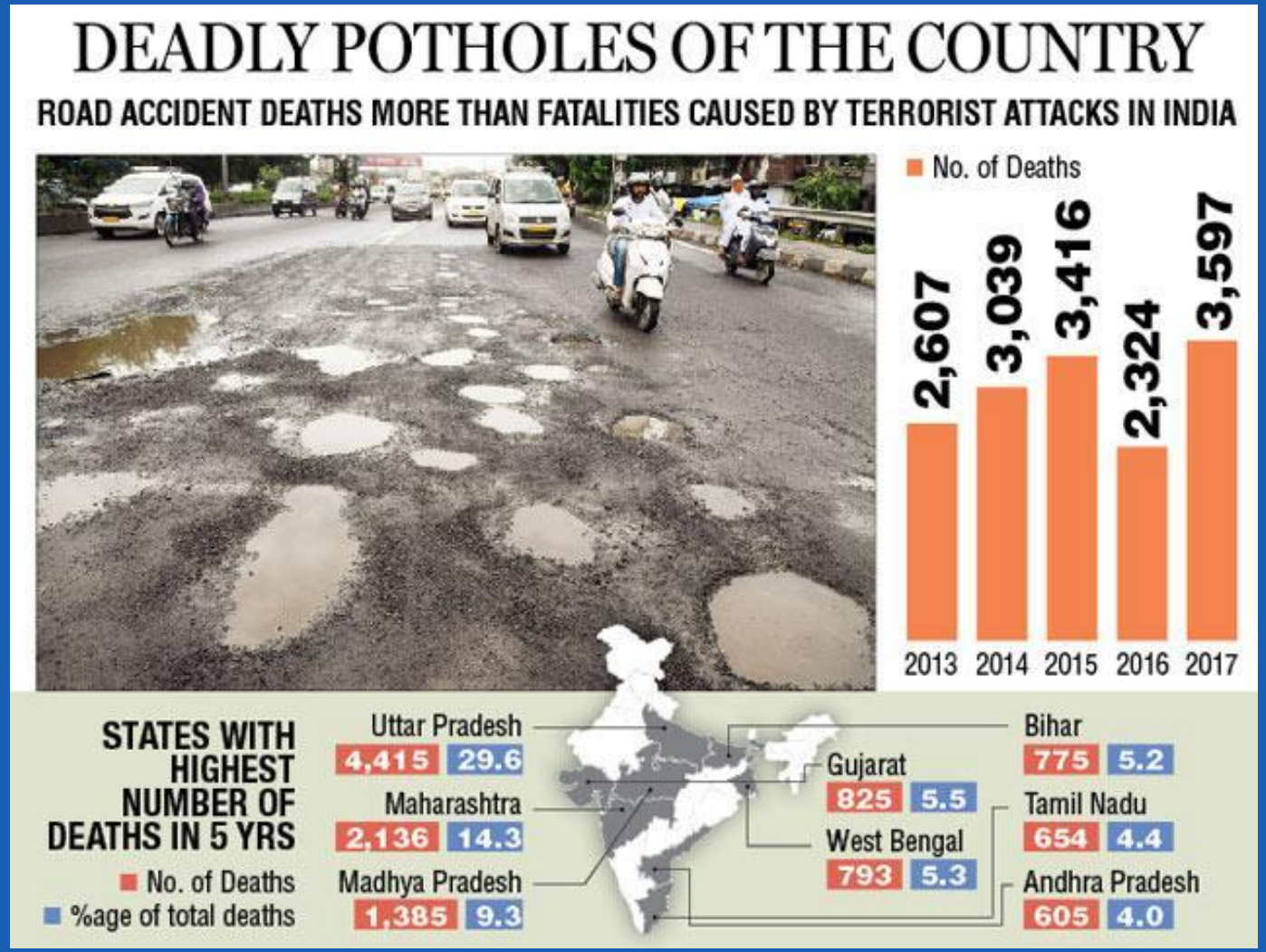
Challenges in Indian roads

India has one of the most pothole stricken road networks. In 2017, potholes killed 3,597 people in India.

Newly surfaced roads with no lane markings are often seen by motorists as a green pass to speed and cut lanes. But most of roads have little or no markings and uneven signage.

Due to hitting a pothole - or taking the wrong measures to avoid one - can also lead to a crash resulting in injuries or worse. A blown tire or broken suspension part can cause you to lose control of your vehicle, as can a split-second decision to stomp on the brakes or suddenly swerve out of your lane to avoid a pothole.

Challenges in Indian roads



Potholes killed 3,597 across India in 2017, terror 803

Source:
https://timesofindia.indiatimes.com/india/potholes-killed-3597-across-india-in-2017-terror-803/articleshow/64992956.cms

Challenges in Indian roads

Cost of challenges

Manual inspection inefficient and reliant on experts

2.8 M Rs

Potholes are a major factor in causing axle & suspension failure, which counts for a third of mechanical issues on Mumbai roads and costs motorists an estimated Rs.2.8 million every year.

50 M Rs

Authorities currently pay out more than Rs.50 million in compensation claims due to poor roads.

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NEW METHODS & TECHNOLGY

Project aims

The project involves the AI to **identify road condition** and using 5G to enable the **remote repair of roads** with the goal of reducing manpower and the expertise needed to fix potholes and road lane painting.

SOLUTION AT GLANCE ARCHITECTURE

Surveillance and monitoring

Fixing road problems

Detection of road defects in real time

Image analytics
By AI/Ml

Data gathering
Image/ video data can be from different sources

Command Control Center
1. Monitoring road condition (Decision making)
2. Remote vehicle control Center
owned/authorized by Gov

Send construction vehicle for identifies places

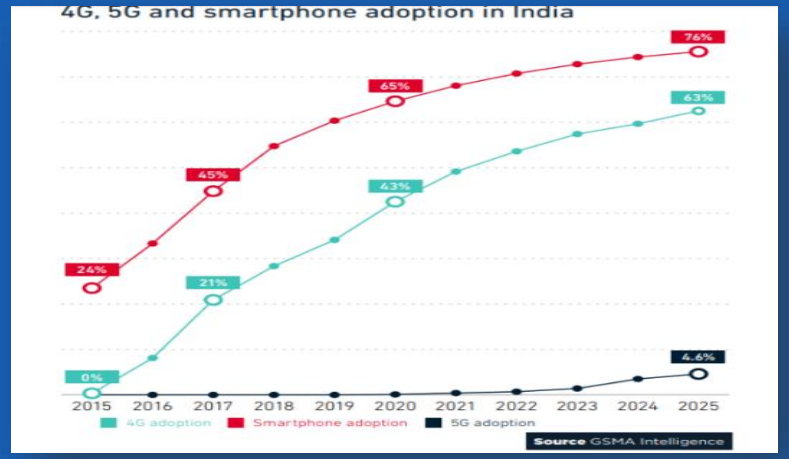
5G

Construction vehicle
With GPS and communication model

SOLUTION AT GLANCE

Usability/Motivation

Over than 1 million trip per day leads to real time monitoring



India 5G coverage plan

HOW 5G AND AI IS BEING USED IN SOLUTION

5G

I. High-definition video feeds from trucks can be sent back and distributed to the local control center via the 5G network and MEC for remote monitoring.
II. Control the vehicle remotely as a result the 5G network's low latency.

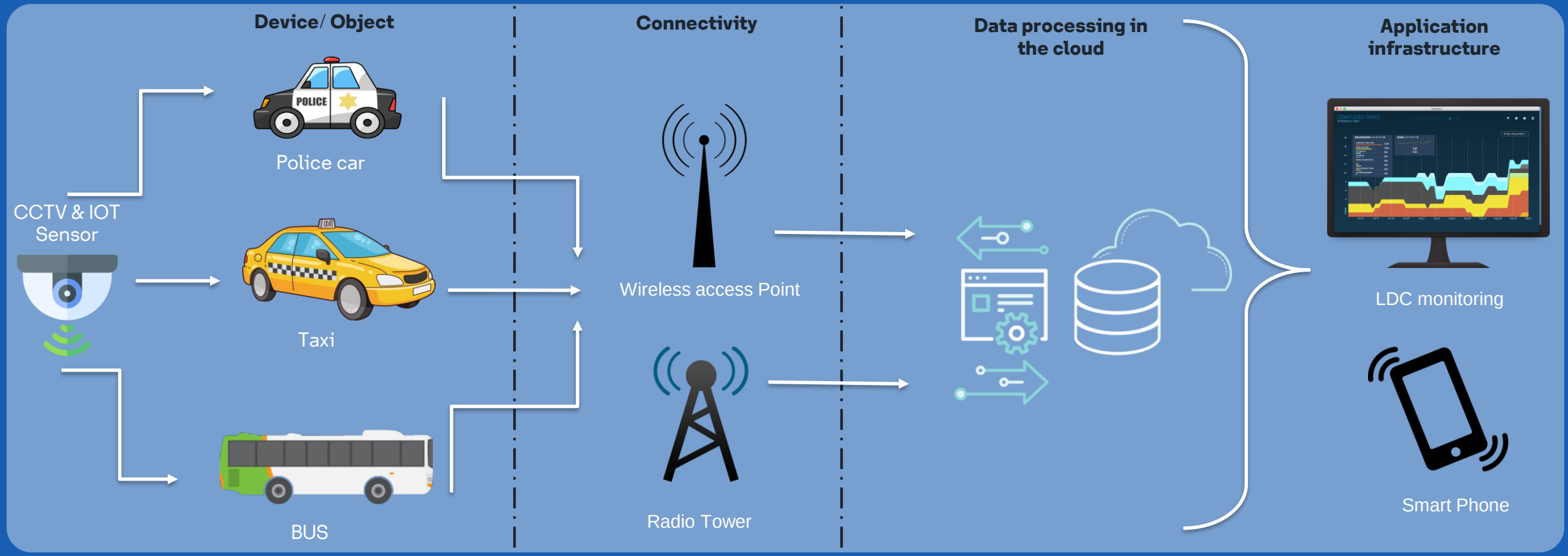
AI

I. To automate manual work of operators who search and select road defects from road laboratories video footage, like cracks, holes and patches.

Source:
https://deepsystems.ai/solutions/road-defects-detection
https://www.gsma.com/greater-china/wp-content/uploads/2020/03/5G-Use-Cases-for-Verticals-China-2020.pdf

SOLUTION AT GLANCE

ARCHITECTURE



GOALS TO BE ACHIEVED

Project aims

1. Work efficiency
2. Visible road lane and good road condition
3. Low car accidences
4. Decrease human risk

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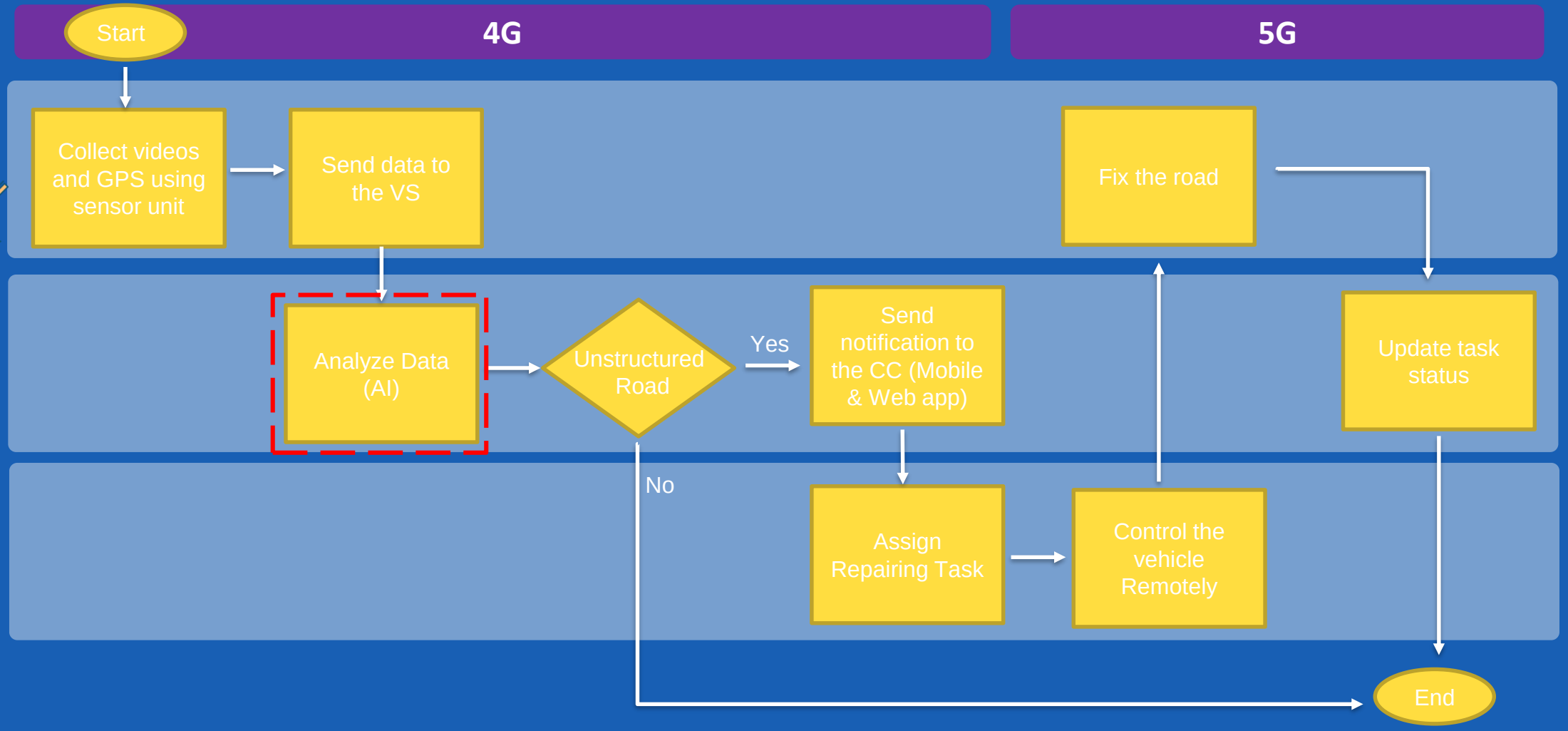
SOLUTION

Flowchart

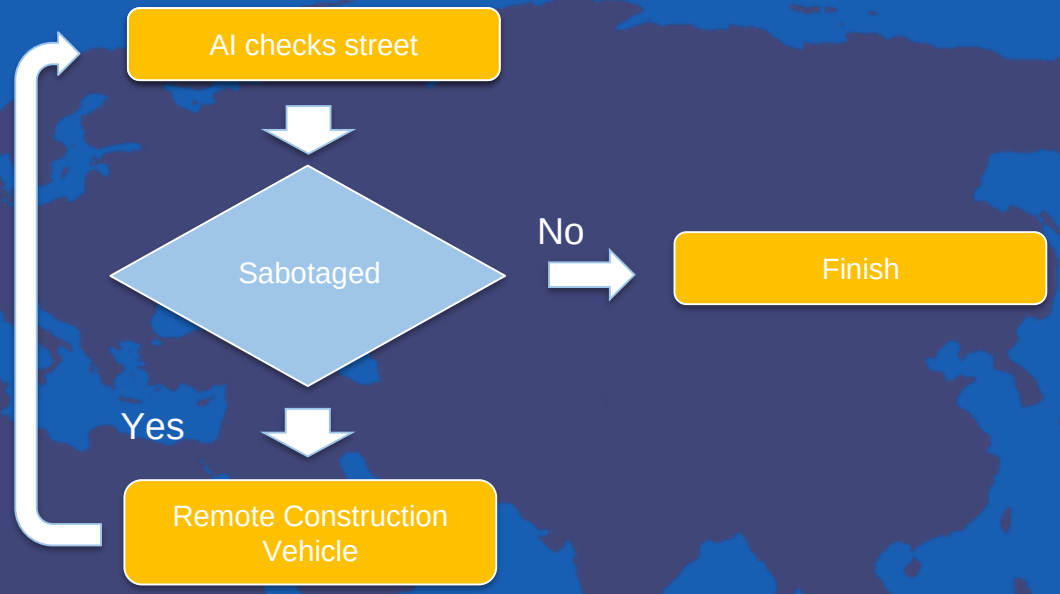
Road

Virtual Server

Control Center



Use case diagram/Flow chart



System Design and Data set

Berkeley DeepDrive

Karlsruhe Institute of Technology

Evaluation Setup & Timeline

Metrics to be used (Quantitative and Qualitative)

Quantitative

# of covered roads	To measure the roads covering by setting the covering baseline and target
% of defects repaired	To measure the percentage of repairing the identified defects
# of vehicles detect road defects in real time	To measure the efficiency of vehicles which will detect the defects and their ability to do the work
% of time consumed in defects repairing	To measure the real time per defect repairing

Qualitative

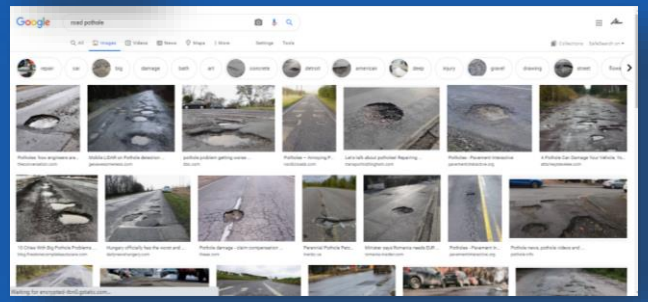
Road color/slop after repairing	To measure the overall work done in repairing defects and compare it with the ideal work
Customer satisfaction survey	To see what customers think of the work done and the solution impact
Focus groups	To see what customers think of the work done and the solution impact
Individual Interview	To see what customers think of the work done and the solution impact

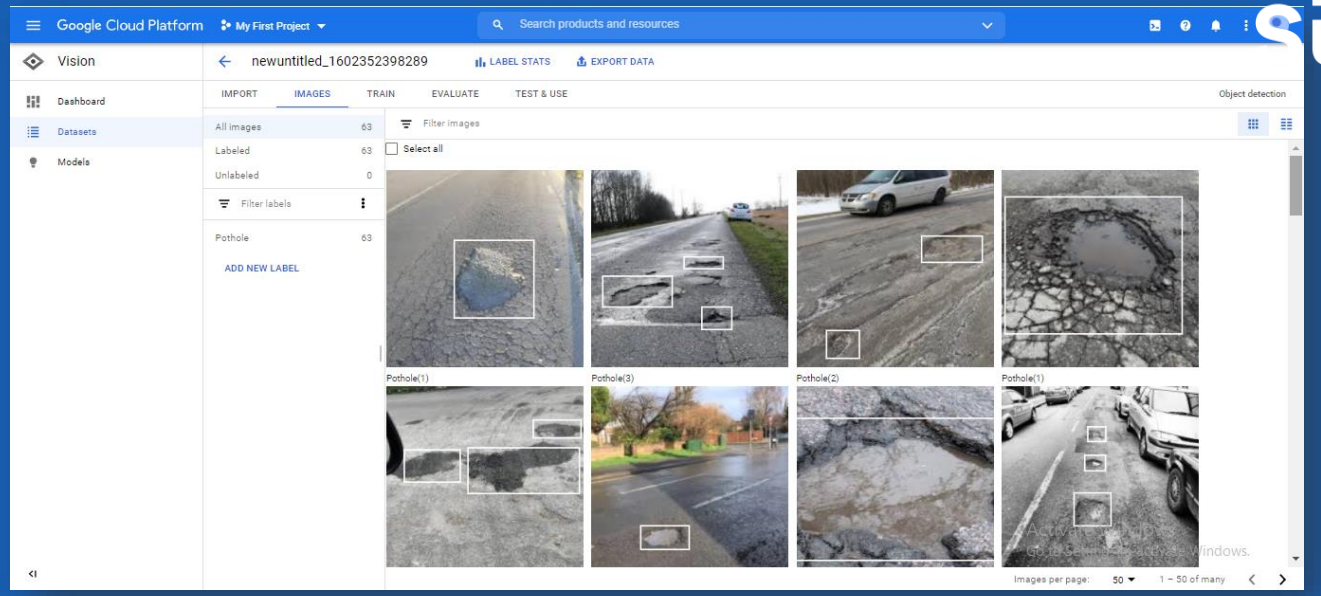
(AI)

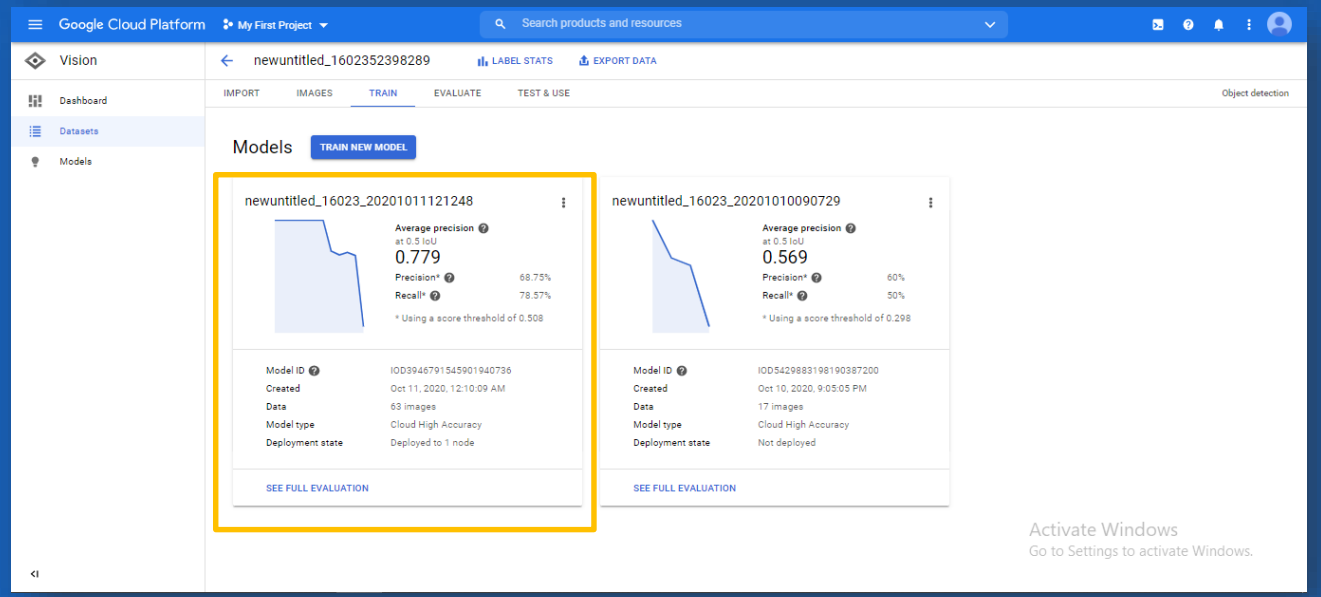
Analyze Data

Google Cloud **Cloud AutoML**

Batch Image Download
Full Screen Capture







(AI)

Analyze Data

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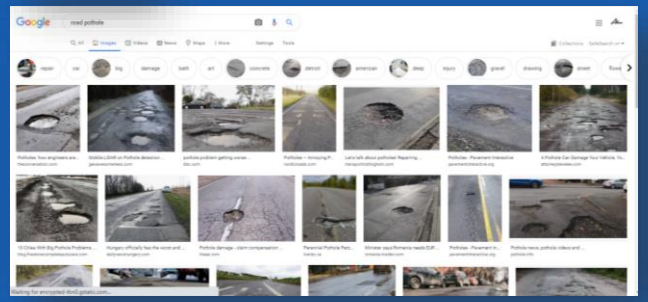
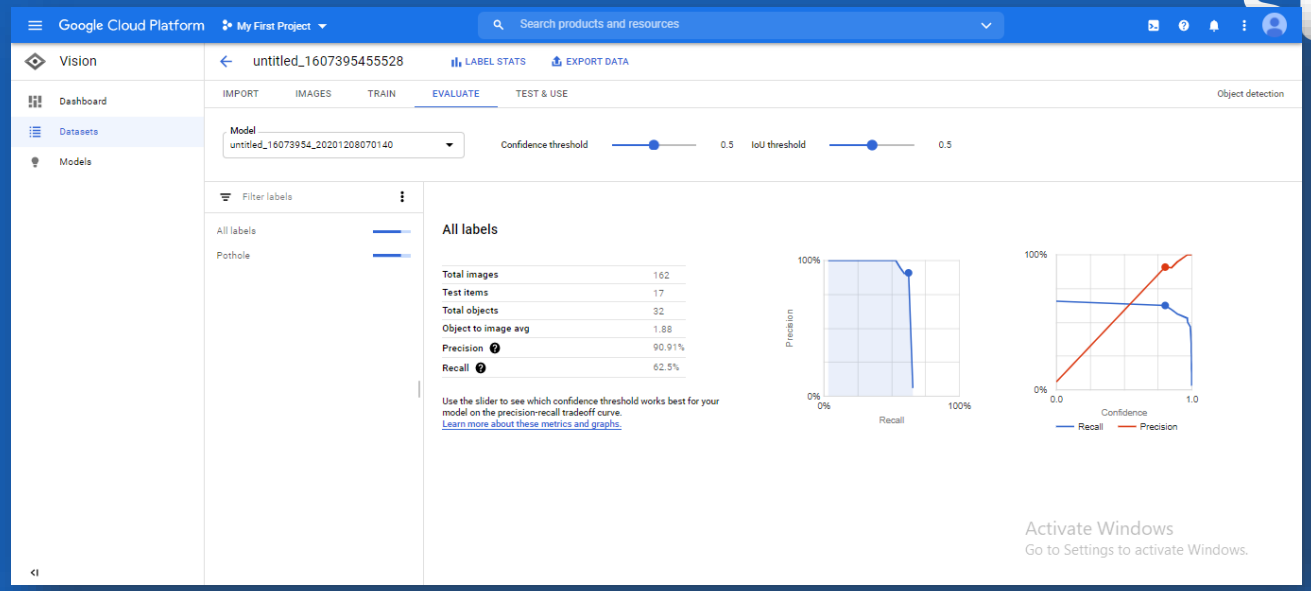
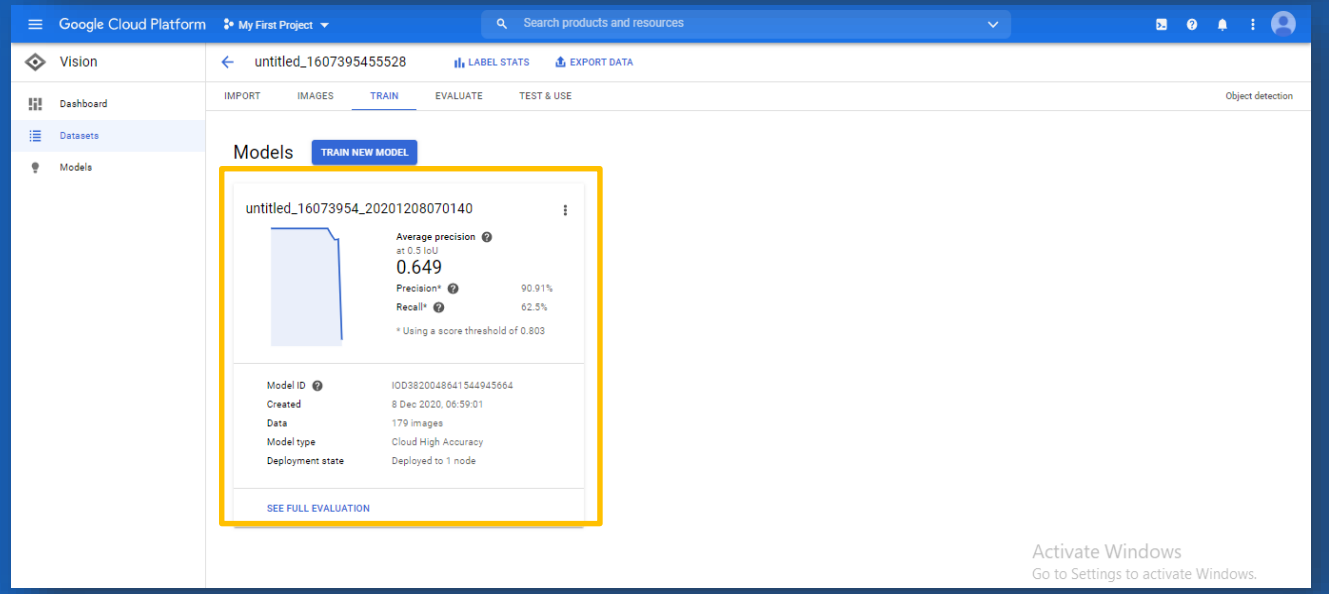
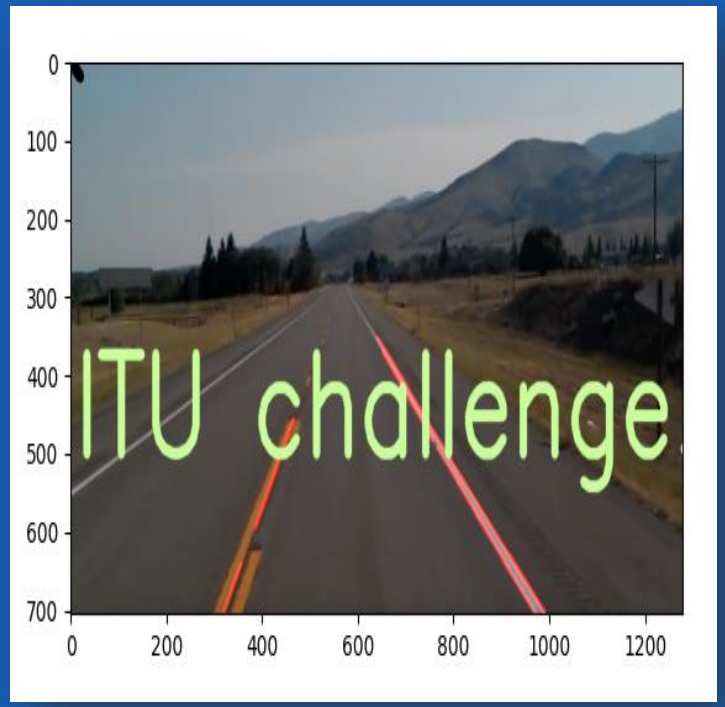


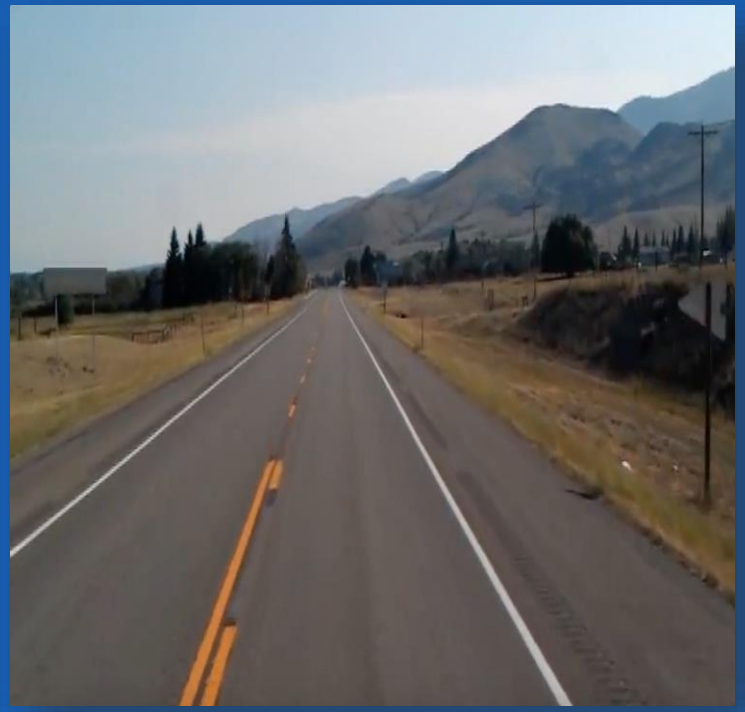




(AI)

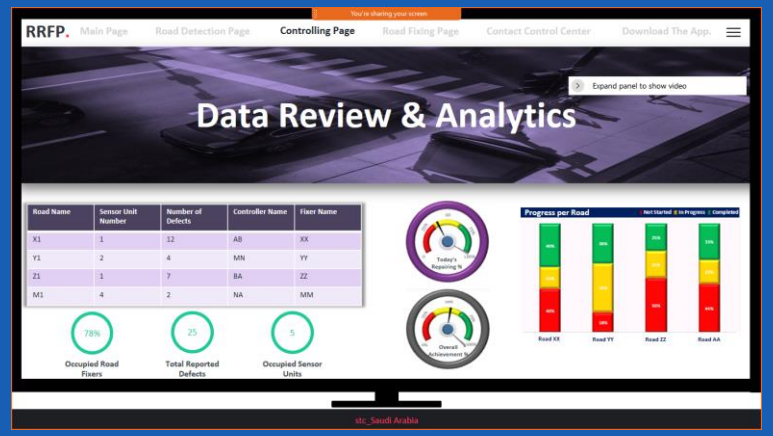
Analyze Data

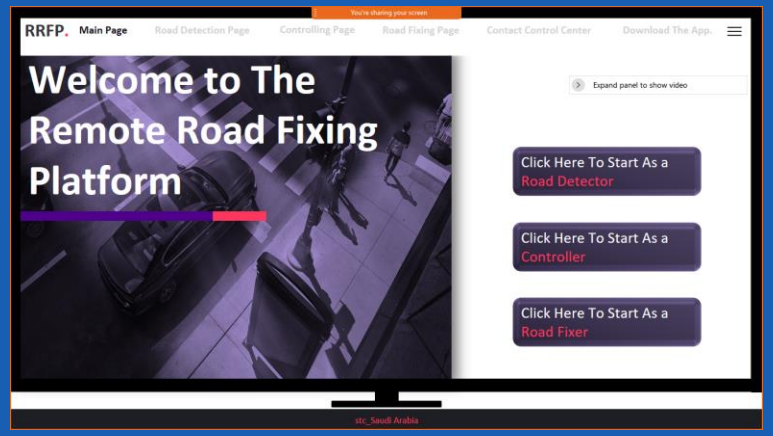


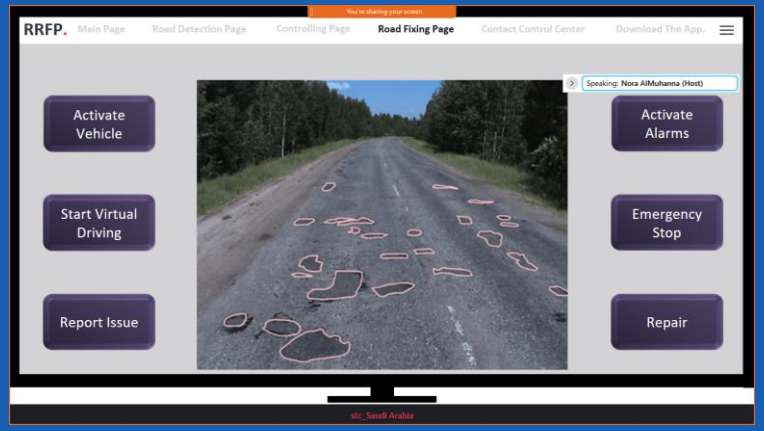


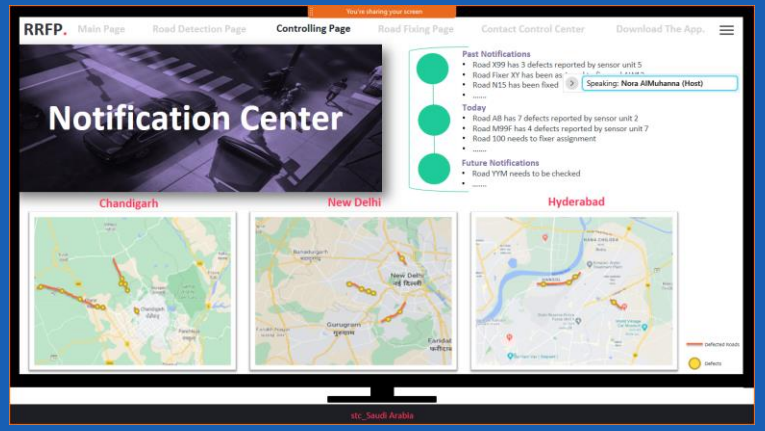
```
# Hello World program in Python

import matplotlib.pylab as plt
import cv2
import numpy as np

def region_of_interest(img, vertices):
    mask = np.zeros_like(img)
    #channel_count = img.shape[2]
    match_mask_color = 255
    cv2.fillPoly(mask, vertices, match_mask_color)
    masked_image = cv2.bitwise_and(img, mask)
    return masked_image
def drow_the_lines(img, lines):
    img = np.copy(img)
    blank_image = np.zeros((img.shape[0], img.shape[1], 3), dtype=np.uint8)

    for line in lines:
        for x1, y1, x2, y2 in line:
            cv2.line(blank_image, (x1, y1), (x2, y2), (255, 0, 0), thickness=5)

    img = cv2.addWeighted(img, 0.8, blank_image, 1, 0.0)
    return img

image = cv2.imread('Road.png')
image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)

print(image.shape)
height = image.shape[0]
width = image.shape[1]

region_of_interest_vertices = [
    (0, height),
    (width / 2, height / 2),
    (width, height)
]

gray_image = cv2.cvtColor(image, cv2.COLOR_RGB2GRAY)
canny_image = cv2.Canny(gray_image, 100, 200)
cropped_image = region_of_interest(canny_image,
                                   np.array([region_of_interest_vertices], np.int32), )

lines = cv2.HoughLinesP(cropped_image,
                        rho=6,
                        theta=np.pi/60,
                        threshold=160,
                        lines=np.array([]),
                        minLineLength=40,
                        maxLineGap=25)

image_with_lines = drow_the_lines(image, lines)
cv2.line(image_with_lines, (0,0), (20,20), (0,0,0), 15)
font = cv2.FONT_HERSHEY_SIMPLEX
cv2.putText(image_with_lines,'ITU challenge!',(10,500), font, 6, (200,255,155), 13, cv2.LINE_AA)
plt.imshow(image_with_lines)
plt.show()
print("Good jop")
```

Platform Demo









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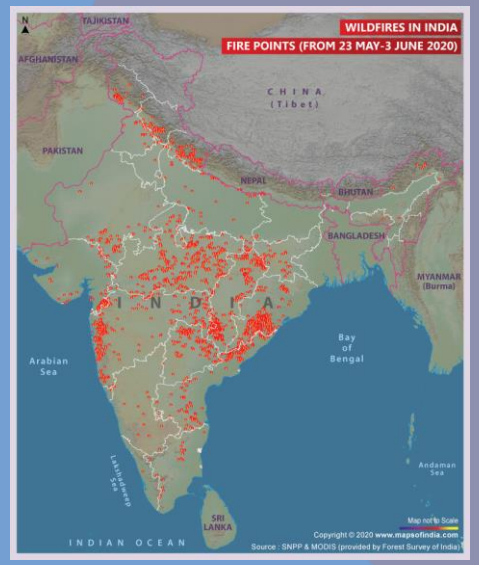
Relevance with Indian automotive industry

How the solution can benefit in a large scale automotive Industry?



Map depicting wildfires in India

Fire points from 23 May -3 Jun2 2020

Remote-control and monitor

Fire Engine Truck

Commercial truck

Source:
https://www.mapsofindia.com/answers/india/is-it-time-for-india-to-condsider-a-national-wildfire-policy-framework/


END
THANK YOU
ITU AI/ML in 5G Challenge
Smart Transportation