Car Damage Detection System

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Abstract

In this project , I have proposed the idea of making an car damage detection system which can be used to detect the damage portion of the cars from the provided video or image.With the increasing number of vehicles on the road, the demand for efficient and automated car damage detection systems has become imperative.The proposed Car Damage Detection System contributes to the automotive industry by providing a rapid and reliable method for assessing vehicular damage, facilitating insurance claims, and expediting repair processes.

1.Problem Statement :

The problem statement is to automate the damage detection for the insurance companies. Currently, the evaluation of vehicular damage often relies on human expertise, leading to delays in insurance claims and repair procedures.The system should be capable of automatically analyzing images of cars and accurately pinpointing regions that exhibit damage.The primary objectives are to reduce the reliance on manual inspection, expedite the insurance claims process, and facilitate quicker car repair assessments.

2.Market/Costumer/Need Assessment :

The market requires a system that can rapidly and accurately identify damaged areas, reducing the time and resources currently spent on manual inspections.Insurance companies are seeking tools that can streamline the claims process. A car damage detection system that provides quick and reliable damage assessments contributes to faster claim processing, improving overall customer satisfaction and operational efficiency.A reliable car damage detection system minimizes human error and ensures that damages are consistently identified, providing a more trustworthy and standardized evaluation.

3.Target Specifications :

The following system can provide the insurance companies and mechanics with some techniques which can boost their sales.It will suggest to them the damages portion of the car and help the mechanic to identify them quickly.This system can also be helpful in implementing in the cctv cameras so that it can recognises damaged and abundant cars from the roadside and inform to the municipal corporation.Also it can be used to detect

accidents on road and can inform to the nearby hospital as well to the highway helpline number.

4.External Search :

The sources which I have used as reference for analyzing the need of such a system for insurance companies ,mechanics and for accident detection.

- understanding the customer behaviour for insurance company
- Annual report 'Road accidents in India'
- Determining Fault by Location of Damage
- A study on Understanding Changing Trends of Customer Behaviour and hence the Market

4.1 Benchmarking :

Complete the detection and marking process for a standard set of images within a specified time frame, ensuring real-time or near-real-time performance.The benchmarking process aims to evaluate the performance of the Car Damage Detection System (CDDS) based on key metrics such as accuracy, speed, adaptability, and user satisfaction. Successfully detect and mark damages across a diverse set of car models and under various lighting and environmental conditions, ensuring adaptability to real-world scenarios.

4.2 Applicable Patents :

- **US-10817956-B2 - Image-based Vehicle Damage Determining Method and Apparatus, and Electronic Device**
- **Enhanced Accident Detection based vehicle condition**
- **Enhanced car damage detection model**

4.3 Applicable Constraints :

- Data Collection from insurance companies
- Access the cctv road footages
- Improving the product
- Convincing the insurance companies to use our model
- Improving live damage detection

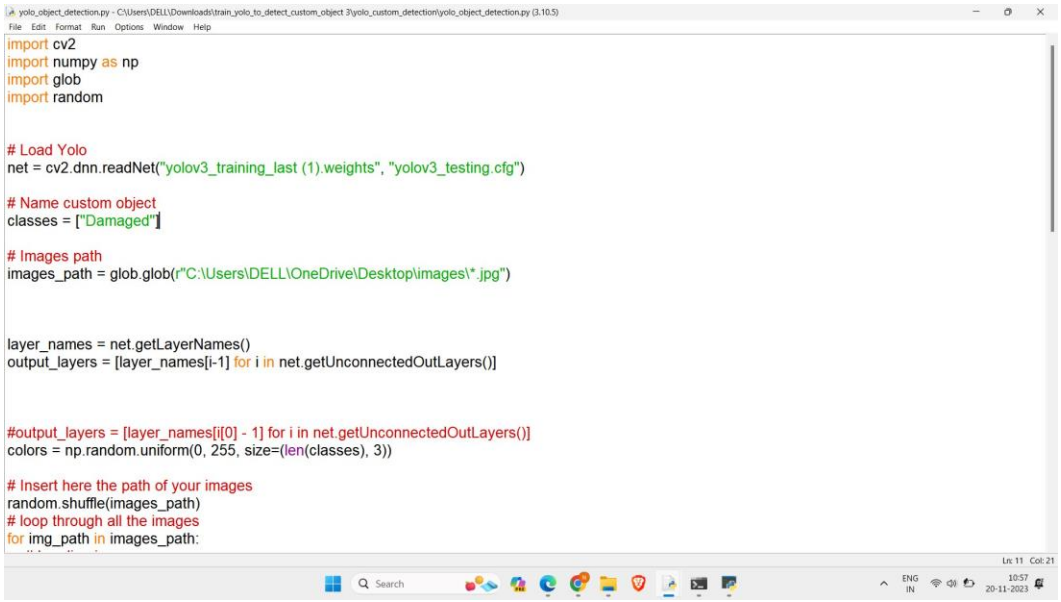
4.4 Applicable Regulations :

- Data protection and privacy regulations(Customers)
- Govt Regulations for small businesses
- Employment Laws
- Antitrust Regulations
- Regulations against false advertising

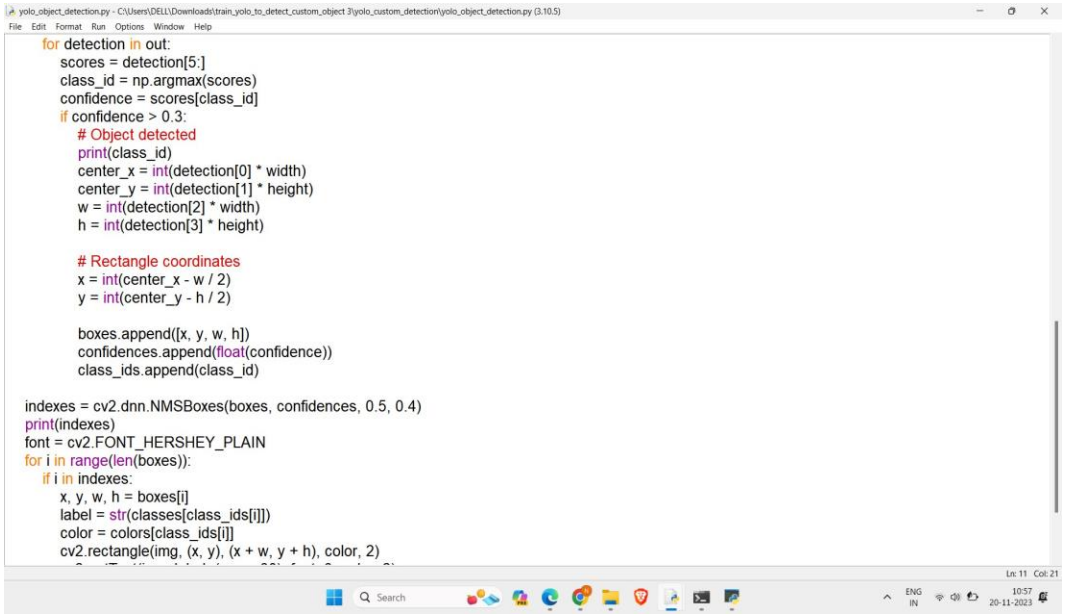
5.Business Opportunity :

Utilize the existing car damage detection system to extend capabilities for live road accidents detection. Incorporate real-time monitoring of traffic cameras, dash camsDevelop a mobile application that connects to the system, providing real-time updates to drivers involved in accidents. This feature can guide them through the post-accident process, including capturing essential information for insurance claims., and other sources to identify accidents as they occur.Collaborate with insurance companies to incorporate the system into their claim processing workflows. Automated and accurate damage assessments expedite the claims process, reducing administrative overhead, and improving customer satisfaction.

6.Code Implementation :



```
import cv2
import numpy as np
import glob
import random


# Load Yolo
net = cv2.dnn.readNet("yolov3_training_last (1).weights", "yolov3_testing.cfg")

# Name custom object
classes = ["Damaged"]

# Images path
images_path = glob.glob(r"C:\Users\DELL\OneDrive\Desktop\images\*.jpg")



layer_names = net.getLayerNames()
output_layers = [layer_names[i-1] for i in net.getUnconnectedOutLayers()]



#output_layers = [layer_names[i[0] - 1] for i in net.getUnconnectedOutLayers()]
colors = np.random.uniform(0, 255, size=(len(classes), 3))

# Insert here the path of your images
random.shuffle(images_path)
# loop through all the images
for img_path in images_path:
```



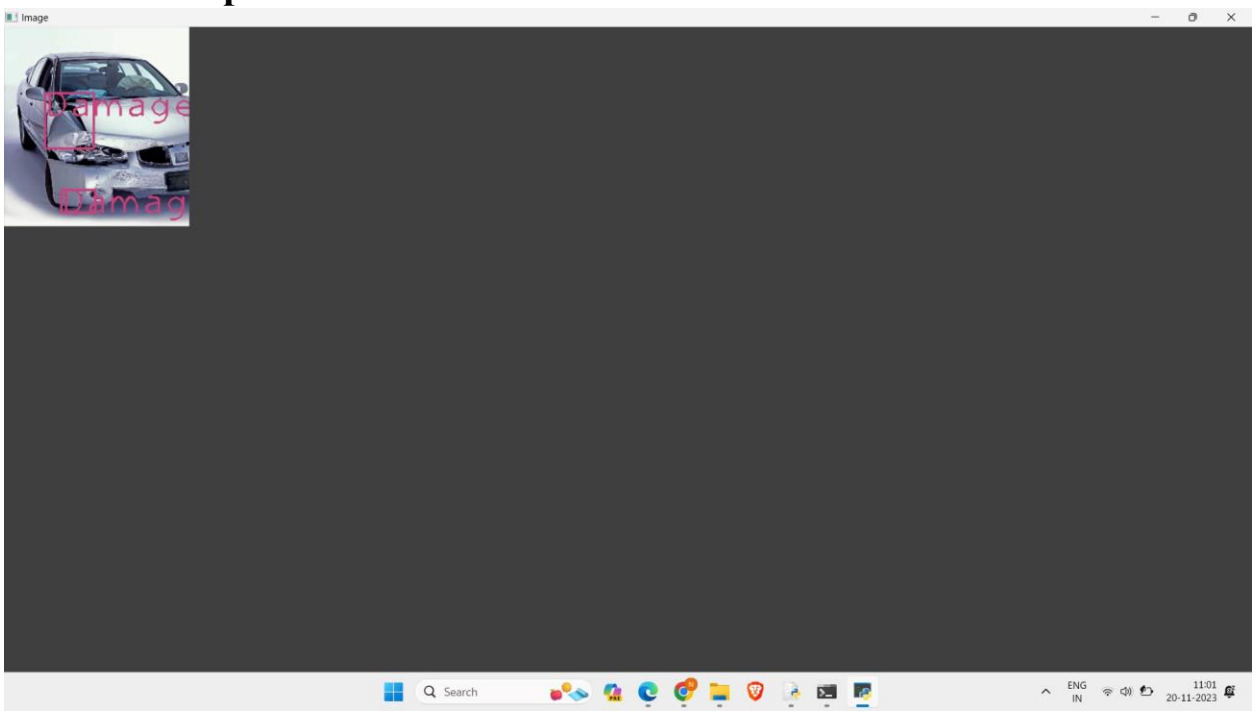
```
    for detection in out:
        scores = detection[5:]
        class_id = np.argmax(scores)
        confidence = scores[class_id]
        if confidence > 0.3:
            # Object detected
            print(class_id)
            center_x = int(detection[0] * width)
            center_y = int(detection[1] * height)
            w = int(detection[2] * width)
            h = int(detection[3] * height)

            # Rectangle coordinates
            x = int(center_x - w / 2)
            y = int(center_y - h / 2)

            boxes.append([x, y, w, h])
            confidences.append(float(confidence))
            class_ids.append(class_id)

indexes = cv2.dnn.NMSBoxes(boxes, confidences, 0.5, 0.4)
print(indexes)
font = cv2.FONT_HERSHEY_PLAIN
for i in range(len(boxes)):
    if i in indexes:
        x, y, w, h = boxes[i]
        label = str(classes[class_ids[i]])
        color = colors[class_ids[i]]
        cv2.rectangle(img, (x, y), (x + w, y + h), color, 2)
```

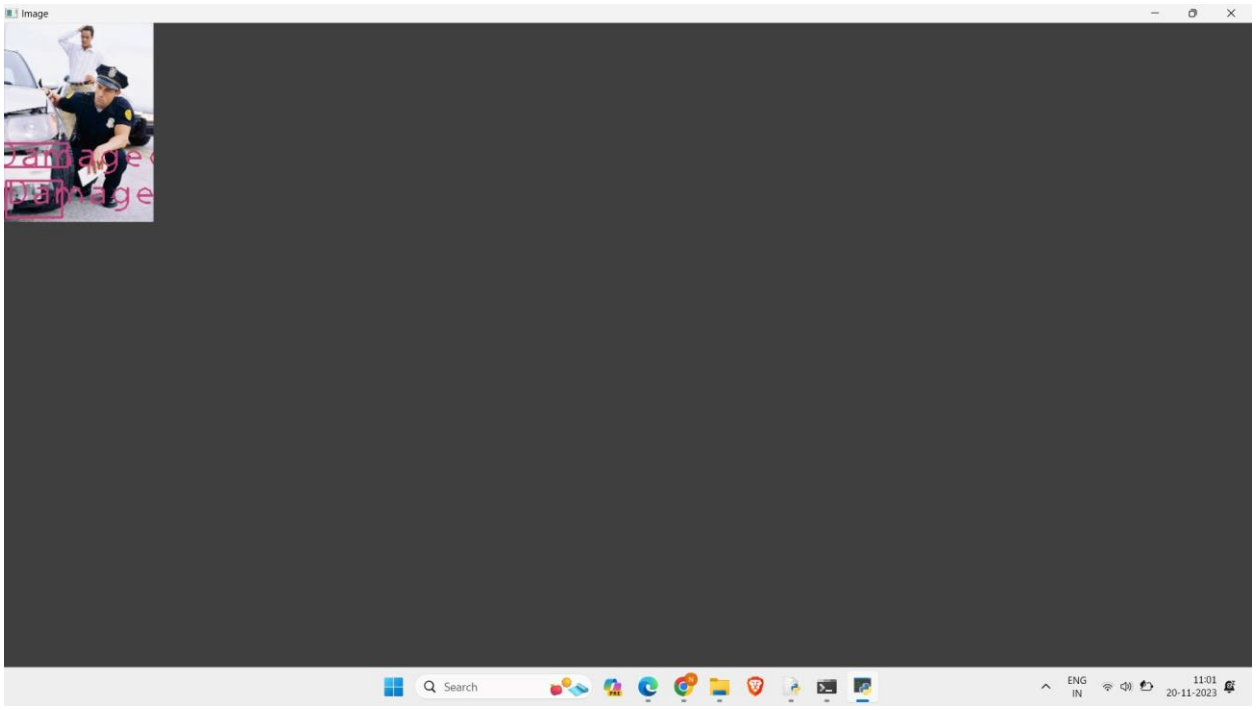
6.1 Code Explanation :

The YOLO model is loaded with pre-trained weights, and the script processes a set of car images, resizing them for efficient analysis. For each image, the script detects objects using YOLO, filters detections based on confidence scores, and applies Non-Maximum Suppression to refine bounding box predictions. Bounding boxes are then drawn around

detected objects, representing damages, and the class labels are displayed. The script provides a visual representation of the detection results, allowing users to assess and refine the system's performance. The user can navigate through the images, and the script ensures the windows are closed after processing all images. The system is designed for car damage assessment, with potential applications in insurance claims and repair processes.

6.2 Outputs :

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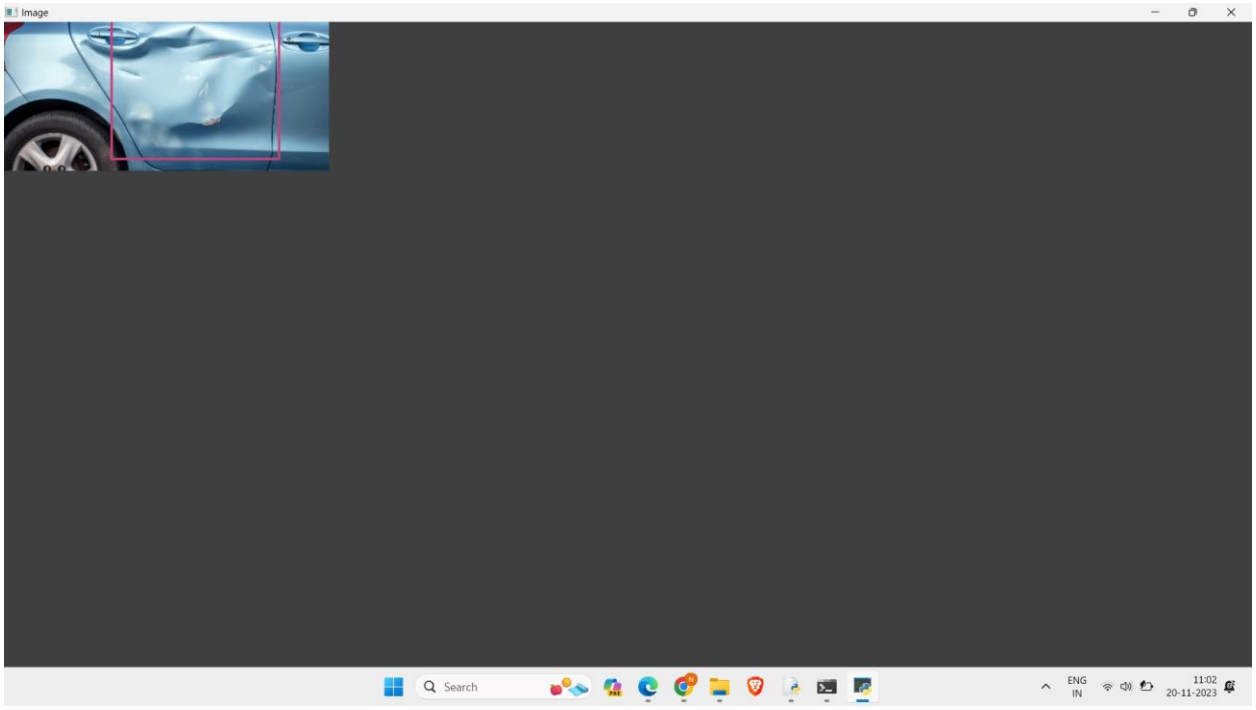
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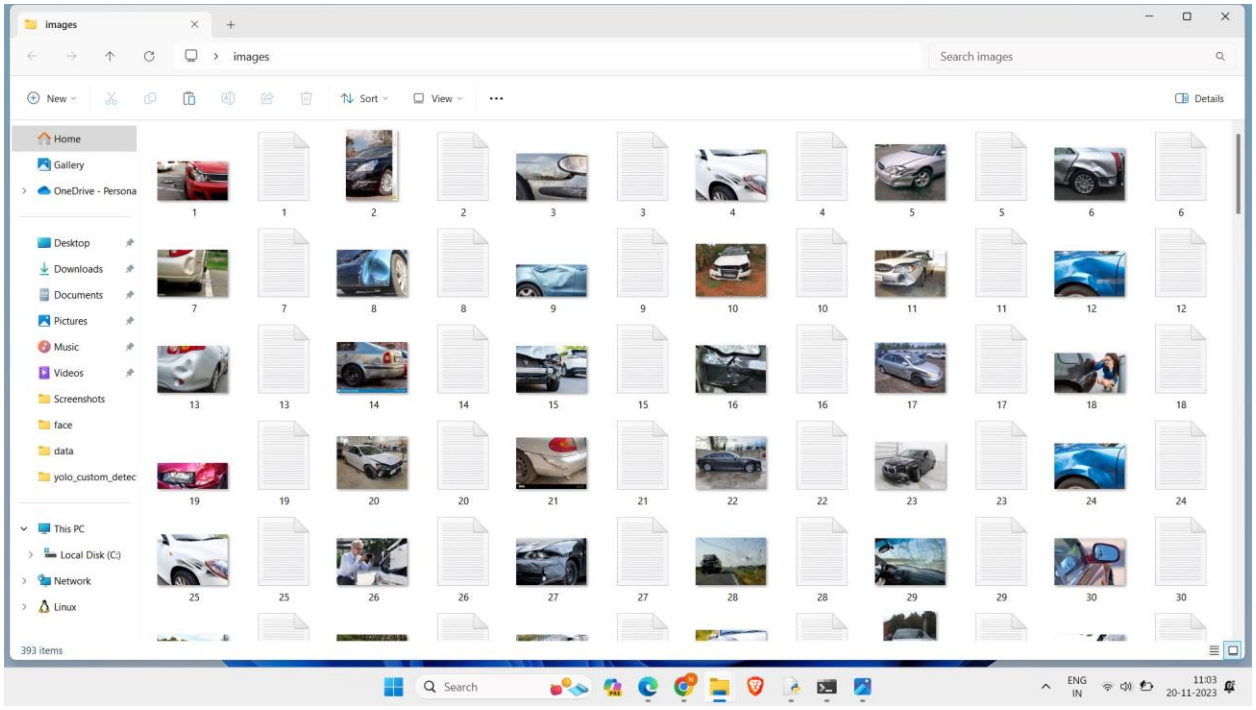
6.3 Dataset :



7 Feasibility :

Feasibility - The market requires a system that can rapidly and accurately identify damaged areas, reducing the time and resources currently spent on manual inspections.Insurance companies are seeking tools that can streamline the claims process. A car damage detection system that provides quick and reliable damage assessments contributes to faster claim processing, improving overall customer satisfaction and operational efficiency.A reliable car damage detection system minimizes human error and ensures that damages are consistently identified, providing a more trustworthy and standardized evaluation.

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accidents on road and can inform to the nearby hospital as well to the highway helpline number.

8 Monetization :

Monetization : Utilize the existing car damage detection system to extend capabilities for live road accidents detection. Incorporate real-time monitoring of traffic cameras, dash camsDevelop a mobile application that connects to the system, providing real-time updates to drivers involved in accidents. This feature can guide them through the post-accident process, including capturing essential information for insurance claims., and other sources to identify accidents as they occur.Collaborate with insurance companies to incorporate the system into their claim processing workflows. Automated and accurate damage assessments expedite the claims process, reducing administrative overhead, and improving customer satisfaction.

10 Financial Equation :

We can launch our product for both departments as well as for insurance companies.

Let’s consider the price of our product be 1000 for getting our graph.

Let total profit = Y

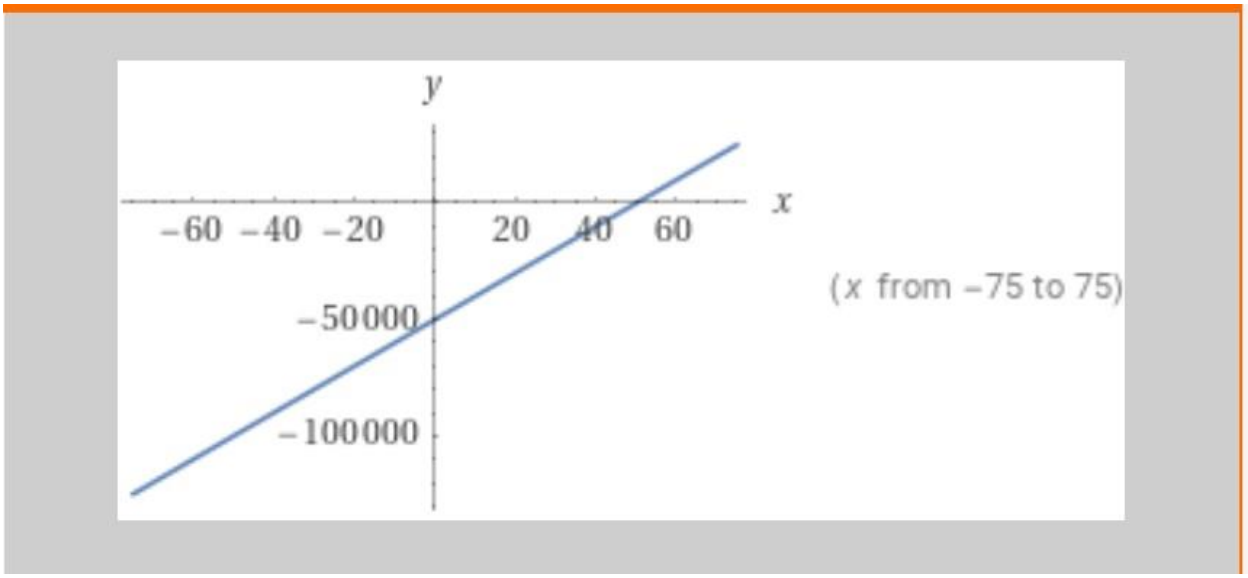
Price of our product , m = 1000

Total role as a function of time = x(t)

Let total production and maintenance cost , c = 50,000

$Y = m\,x(t) - c$

$Y = 1000\,x(t) - 50{,}000$



Profit over 1 year = 1000 * (1 + 0.1)^1 - 50000 = -44100

9 Final Product Prototype :

The final product is an innovative software solution with seamless integration into a mobile app, designed to enhance trust and efficiency in the automotive industry. The software leverages cutting-edge computer vision technology for real-time car damage detection and estimation of repair costs. Additionally, a prototype extends this system to roadside CCTV installations, enabling live accident detection and automatic ambulance dispatch based on the extent of vehicle damage.

- Mobile App Integration: The software integrates with a user-friendly mobile app, allowing users to capture and upload images of their damaged vehicles for instant assessment.
- Real-time Damage Detection:Using computer vision algorithms, the system analyzes uploaded images, accurately detecting and marking physical damages on vehicles.

- Repair Cost Estimation: The software calculates estimated repair costs based on the detected damages, providing users with transparent and reliable cost assessments.
- Trust-Building Mechanism: By providing detailed and automated damage assessments, the software enhances customer trust in both mechanics and insurance companies, offering a transparent and fair evaluation process.
- Roadside CCTV Accident Detection:

The prototype extends the capabilities to roadside CCTV installations for live accident detection. The system can recognize the intensity of collisions and determine the damaged percentage of vehicles involved.
Automatic Emergency Response:

In case of accidents detected by roadside CCTV, the system initiates an automatic emergency response, calling for an ambulance to the specific location based on the severity of the collision.

10. Conclusion :

In conclusion, the developed system represents a transformative solution in the automotive industry, seamlessly integrating advanced computer vision technology with mobile app connectivity and roadside CCTV installations. The system's capability to detect and mark physical damages on vehicles in real-time, coupled with the estimation of repair costs, addresses a critical need for transparency and efficiency in the assessment process. This not only fosters trust among customers but also streamlines operations for mechanics and insurance companies.