# INTELLIGENT VEHICLE DAMAGE ASSESSMENT & COST ESTIMATOR FOR INSURANCE COMPANIES

**NALAIYA THIRAN PROJECT BASED LEARNING**
**On**
**PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP**

**A PROJECT REPORT**


| | |
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**BACHELOR OF ENGINEERING**
**IN**
**ELECTRONICS AND COMMUNICATION ENGINEERING**


**HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY**
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(An Autonomous Institution, Affiliated to Anna University, Chennai)
COIMBATORE – 641 032



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**Hindusthan College of Engineering And Technology Approved by AICTE, New Delhi, Accredited with 'A' Grade by NAAC (An Autonomous Institution, Affiliated to Anna University, Chennai) Valley Campus, Pollachi Highway, Coimbatore – 641 032**

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Certified that project report " Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies " is the bonafide work of "AKASH K, AJITH S, DEON PRINE D, JEENA N," who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported herein does not form part of any other thesis or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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**Submitted for Project Viva-Voice conducted on .....**

INTERNAL EXAMINER EXTERNAL EXAMINER

# Project Report Format

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# 1.INTRODUCTION

## 1.1Project Overview

In today’s world, Vehicles are increasing heavily. Because of the increasing number of vehicles, accidents are very common because the people are driving a car very fastly on the road. The people claim the money for repairing the car through vehicle insurance when the accident happens. Becauseof incorrect claims, the company behaves badly and doesn’t make payments currently. This happens due to claims leakage, the claims leakage refers to thedifference between the amounts secured by the company to the amount thatcompany should have will take more time to claim the process according tothe company policy. Although the company does one’s best to speed up the claiming process delay. Differentiate the proposed system that is maybe speed up the car damage that can be checked in the process. Just by sending the image containing a damaged car and can system performs car damage detection in a minute rather than hours if it is inspected visually. The system can utilize machine learning as well as computer vision to decide the damage analysis, location of the damage as well as severity of the damage.

## 1.2 PURPOSE :

A system and method are provided for automatically estimating a repair cost for a vehicle. A method includes: receiving, at a server computing device over an electronic network, one or more images of a damaged vehicle from a client computing device; performing image processing operations on each of the one or more images to detect external damage to a first set of parts of the vehicle; inferring internal damage to a second set of parts of the vehicle based on the detected external damage; and, calculating an estimated repair cost for the vehicle based on the detected external damage and inferred internal damage based on accessing a parts database that includes repair and labor costs for each part in the first and second sets of parts.

# 1. LITERATURE SURVEY

1. Existing problem
2. References

In this literature survey several methods have been proposed for detection of car damage. Srimal et al. [ 4 ] proposed a solution which uses 3D Computer Aided Design for the discernment of car damage from the picture, the system only detects damage at the edge portion only. Detection of the car damage through CAD software requires some knowledge about the software. S Gontscharov et al [ 5 ] ,the proposed system designed by using YOLO(you only look once) algorithm to detect the car damage, Here the multi sensor data fusion technique is allows to locate the portion of damage more accurately and performs detection faster compared to other algorithms which is fully automatic and doesn't require much human intervention. Phyu Mar Kyu et al [ 3 ], the proposed system using deep learning based algorithms are VGG16 and VGG19 damaged car detection in the real world. This algorithm notices the severity of the damaged car based on the location. Finally the author concludes that L2 regularization works greater. Girish N et al [ 2 ], the proposed system uses vehicle damage detection techniques that depend on transfer learning and mask RCNN. The mask regional convolution neural network determines a damaged car by its position and estimates the depth of the damage. A Neela

Madheswari et al [ 1 ], the proposed system uses convolution neural network to accept whether an image contains car damage or not. It takes great opportunities to attempt by classifying the car damage into different classes.

In today's world, Vehicles are increasing heavily. Because of the increasing number of vehicles, accidents are very common because the people are
driving a car very fastly on the road. The people claim the money for repairing
the car through vehicle insurance when the accident happens. Because of incorrect claims, the company behaves badly and doesn't make payments currently. This happens due to claims leakage, the claims leakage refers to the difference between the amounts secured by the company to the amount thatcompany should have secured based on the claims. Still the damage to the car is examined clearly and it will take more time to claim the process according to thecompany policy. Although the company does one's best to speed up the claiming process delay. Differentiate the proposed system that is maybe speed up the car damage that can be checked in the process. Just by sending the image containing a damaged car and can system performs car damage detection.

# Ideation Phase

## Define the Problem Statements

| | |
|---|---|
| **DATE** | **27.09.2022** |
| **TEAM ID** | **PNT2022TMID10090** |
| **PROJECT TITLE** | **Intelligent Vehicle Damage Assessment & Cost Estimator** |
| **MAXIMUM MARK** | **2 Marks** |


| | |
|---|---|
| **Problem Statement (PS):** | **The aim of this project is to build a VGG16 model that can detect the area of damage on a car. The rationale for such a model is that it can be used by insurance companies for faster processing of claims if users can upload pics and the model can assess damage( be it dent from scratch from and estimate the cost of damage. This model can also be used by lenders if they are underwriting a car loan, especially for a used car.** |
| **I am (CIVILIAN)** | **A Civilian, who is aware about Intelligent Vehicle Damage Assessment & prediction to implement nowadays.** |
| **I'm trying to** | **Predicting intelligent vehicle damage assessment and automotive insurance holds significant potential to quickly estimate vehicle damages.** |

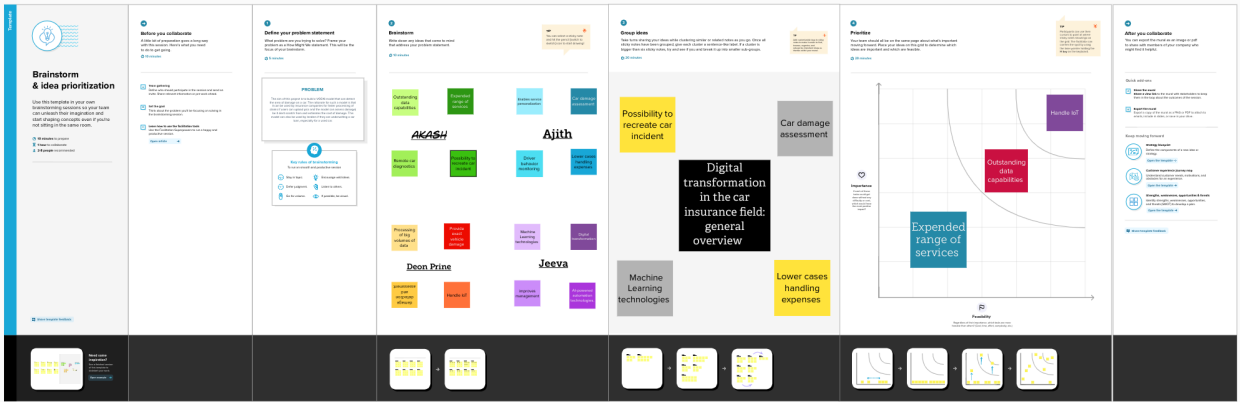
| | |
|---|---|
| **But** | **Traditionally the damage assessment was carried out by multiple parties which were time-consuming, highly prone to human error, leading to inaccurate cost estimations** |
| **Because** | **It also requires analysis and estimation of health damage, medical services, etc. inaccurate and delayed estimates will spoil the relations with customers and the company's reputation** |
| **Which makes me feel** | **Nowadays, a lot of money is being wasted in the car insurance business due to leakage claims.** |

# IDEATION & PROPOSED SOLUTION

## 1.Empathy Map Canvas

## 2.Ideation & Brainstorming

**Intelligent vehicle damage assessment and cost estimator for insurance companies**




## 3.PROPOSED SOLUTION

Define CS, fit into CL

**1. CUSTOMER SEGMENT(S)** CS

Vehicle owner and Insurance companies.

**6. CUSTOMER LIMITATIONS** EG. BUDGET, DEVICES CL

Not good about Insurance knowledge.

Lack of proper Documentation.

**5. AVAILABLE SOLUTIONS** PLUSES & MINUSES AS

We have 24/7 customer support to solve customer problems to get easier application to fill.

Explore AS, differentiate

Focus on PR, tap into BE, understand RC

**2. PROBLEMS / PAINS** ↑ ITS FREQUENCY PR

It requires an or continuous internet connections to be successful. Server did not work properly all the time.

**9. PROBLEM ROOT / CAUSE** RC

The customer face wrong value for vehicle damage. In this app correct estimated value is given or shown.

That can be ratify the problem in our application

**7. BEHAVIOR** ↑ ITS INTENSITY BE

Don't drive a vehicle during a phone call. Don't drunk and drive. Obey the traffic rules. Use headlight during night time. Use seatbelt.

Focus on PR, tap into BE, understand RC

Identify strong TR & EM

**3. TRIGGERS TO ACT** TR

People should obey the traffic rules to avoid accident in national level so it reduces accident

**4. EMOTIONS** BEFORE / AFTER EM

**BEFORE**: Customer can't get the exact damage value insurance.
**AFTER**: Customer easily get the exact value for insurance within 24 hours

**10. YOUR SOLUTION** SL

"AI based intelligent vehicledamage assessment and Cost Estimator for Insurance Companies"

It helps vehicle owner to get correct estimated value for vehicle damage.

**8. CHANNELS of BEHAVIOR** CH

**ONLINE:** The customer Data send through application and Insurance data will send to the server to bank.

**OFFLINE**: The customer should obey the rules correctly

Extract online & offline CH of BE

# 4.REQUIREMENT ANALYSIS

## 4.1Functional requiremen

# PROJECT DESIGN PHASE-II

## SOLUTION REQUIREMENTS

| | |
|---|---|
| DATE | 01 November 2022 |
| TEAM ID | PNT2022TMID10090 |
| PROJECT NAME | Project – Intelligent Vehicle Damage Assessment and Cost Estimator for Insurance Companies |
| MAXIMUM MARKS | 4 marks |

**FUNCTIONAL REQUIREMENTS**

| FR NO | FUNCTIONAL REQUIREMENTS ( EPIC) | SUB REQUIREMENTS (SUBTASK/STORY) |
|---|---|---|
| **FR 1** | User Registration | ✓ Registration through link<br>✓ Registration through form |
| **FR 2** | User Confirmation | ✓ confirmation through message<br>✓ confirmation through mail |
| **FR 3** | User Interface | ✓ user login form<br>✓ user Admin form |
| **FR 4** | Detecting Damage | ✓ Detecting the location where the damages occurs |
| **FR 5** | Database | ✓Stored in cloud for seamless connectivity<br>✓ to store, retrieve, and run queries on Data<br>✓ A DBMS serves as an interface Between an end-user and a database, |

| | | |
|---|---|---|
| | | ✓ The customer should not Worry about their safety through the link |

**NON FUNCTIONAL REQUIREMENTS:**

| | | |
|---|---|---|
| **NFR 3** | Reliability | ✓ Easy to use ✓ Trustworthy<br>✓ High accuracy |
| **NFR 4** | Performance | ✓ The customer know about the process which make them to feel relax about delay claim<br>✓ They provide the customer satisfaction through their performance |
| **NFR 5** | Availability | ✓ know the current process<br>✓ know about queries if they need<br>✓ Apply the claim as their comfort platform |
| **NFR 6** | Scalability | ✓ company know about the customer status<br>✓ customer should not worry about claim<br>✓ make the quick settlement |

# 5.PROJECT DESIGN

## 5.1Data Flow Diagrams

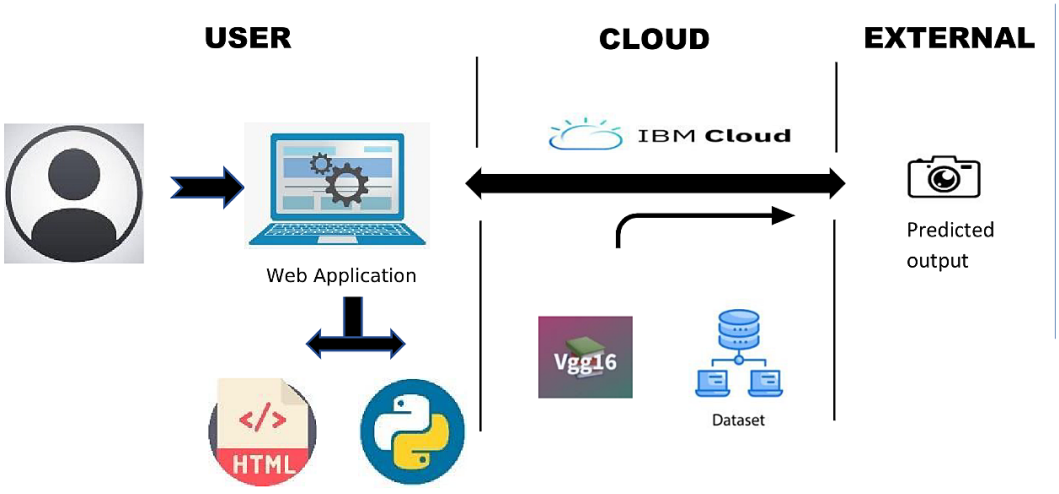
# PROJECT DESIGN PHASE-II

## DATA FLOW DIAGRAM & USER STORIES

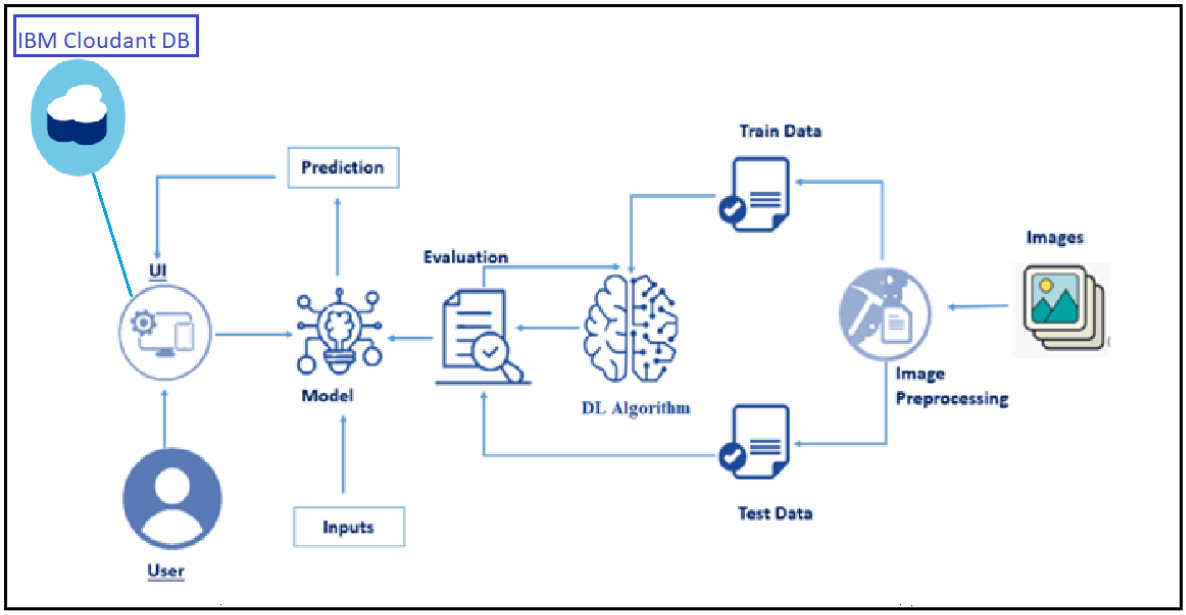
| | |
|---|---|
| DATE | 01 November 2022 |
| TEAM ID | PNT2022TMID10090 |
| PROJECT NAME | Project – Intelligent Vehicle Damage Assessment and Cost Estimator for Insurance Companies |
| MAXIMUM MARKS | 4 marks |

## DATA FLOW DIAGRAM:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a System. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows How data enters and leaves the system, what changes the information, and where data is stored.



## 5.2 Solution & Technical Architecture




# 6.PROJECT PLANNING & SCHEDULING

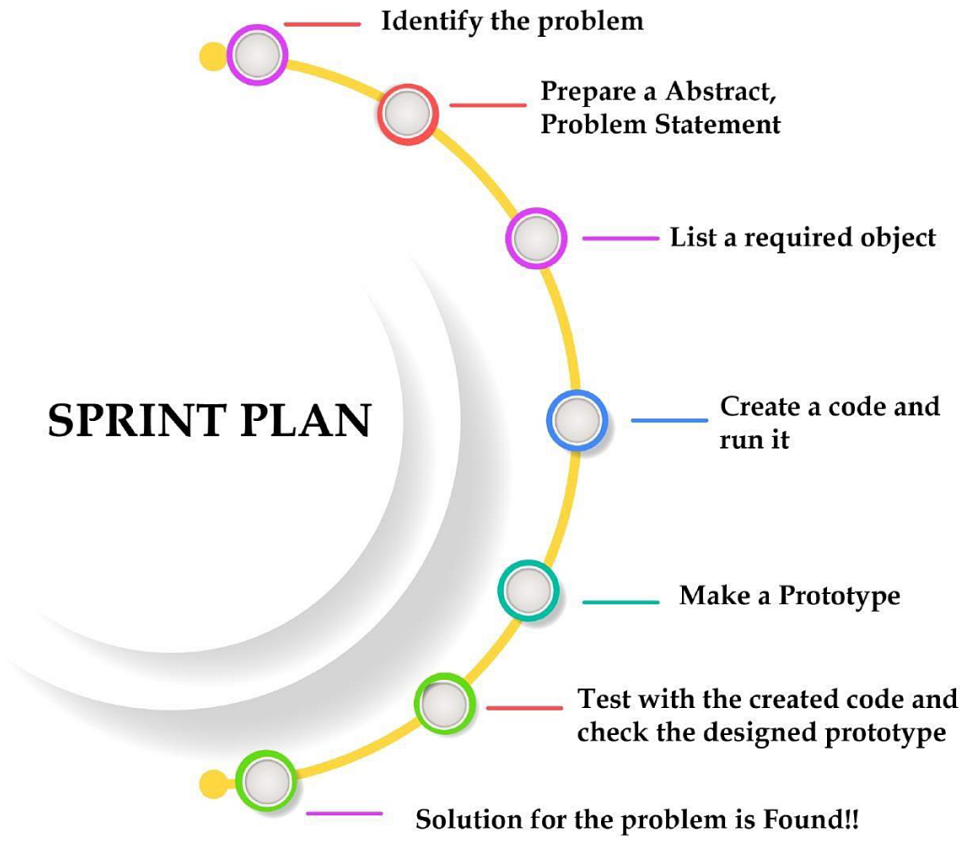
## 6.1Sprint Planning & Estimation2

## Project Planning Phase

### Sprint Delivery Plan

| | |
|---|---|
| Date | 30 October 2022 |
| Team ID | PNT2022TMID10090 |
| Project Name | AI Intelligent Vehicle Damage Assessment and Cost Estimator for Insurance Companies |
| Maximum Marks | 8 Marks |

**Sprint Delivery Plan:**



## 6.2 Sprint Delivery Schedule

| Sprint | Functional Requirement (Epic) | User Story Number | User Story / Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Registration | USN-1 | As a user, I can register for the application by entering my email, and password, and confirming my password. | 2 | High | AKASH AJITH DEON JEEVA |
| Sprint-1 | Login | USN-2 | As a user, I will receive a confirmation Email once I have registered for the application | 1 | High | AKASH AJITH DEON JEEVA |
| Sprint-1 | Dashboard | USN-3 | As a user, I can register for the application through Face book | 2 | High | AKASH AJITH DEON JEEVA |
| Sprint-2 | Details about insurance company | USN-4 | As a user, I can register for the application through Gmail | 2 | Low | AKASH AJITH DEON JEEVA |
| Sprint-1 | repeated logins and logout | USN-5 | As a user, I can log into the application by entering email & password | 1 | Medium | AKASH AJITH DEON JEEVA |
| Sprint-2 | Webpage | USN-6 | As a user I must capture images of my vehicle and upload it into the web portal. | 2 | High | AKASH AJITH DEON JEEVA |
| Sprint-3 | Details about estimated cost based on damage | USN-7 | As a user I must receive a detailed report of the damages present in the vehicle and the cost-estimated | 2 | High | AKASH AJITH DEON JEEVA |

# 7. CODING & SOLUTIONING (Explain the features added in the project along with code)

### 7.1 Feature 1

This paper presents a method and system for automatic damage determination of vehicles based on the shared vehicle four-corner images. By comparing the damage information before and after renting each vehicle, this scheme can effectively save labor cost, realize rapid damage recognition, clear responsibility definition, and improve user experience and damage treatment efficiency.

### 7.2 Feature 2

We are recognizing both the place of damage and the amount of damage as well.So VGG16 is a very good option to base our model after.After investigation it is found that the number of images is not by themselves enough to get a good model.So we have done some image transformation for this purpose

## 8. TESTING

### 8.1Test Cases

| Test case ID | Feature Type | Home Page | Test Scenario | Steps TO Execute | Test | Expected Result | Actual Result |
|---|---|---|---|---|---|---|---|
| LoginPage_TC_001 | Functional | Home Page | Verify user is able to see the Login/Sign up popup when user clicked on My account button | I.Enter URL and click go<br>2.Click on My Account dropdown button<br>3.Verify login/Singup popup displayed or not | Login.html | Login/Sign up popup should display | Working as |
| LoginPage_TC_002 | Functional | Home Page | Verify the UI elements in Login/Sign up popup | I.Enter tJRL and dick go<br>2.Click on My Account dropdown<br>3.Verify login/Singup popup with below UI elements: | Login.html | Application should show below elements:<br>a.email text box<br>b.password text box<br>c.Login button with orange color<br>d. New customer? Create account link<br>e.Last password? Recovery password link | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| LoginPage_TC_003 | Functional | Home Page | Verify user is able to log into application with Valid credentials | I.Enter URL and dick go<br>2.Click on My Account dropdown<br>3.Enter Valid username/email in Email text<br>4.Enter valid password in password text box<br>5. Click On in button | Username:lax@gmail password: lax26 | User should navigate to prediction homepage | Working as |
| LoginPage_TC_004 | Functional | Log in page | Verify user is able to log into application with Invalid credential | 1, Enter URL and click go<br>2.Click on My Account button<br>3.Enter Invalid username/email in<br>Email text box<br>4.Enter valid password in password text box<br>5.Click on •n button | Username:lax password:lax26 | Application should show 'Incorrect email or password ' validation message. | Working as |
| LoginPage_TC_004 | Functional | Log in page | Verify user is able to log into application with Invalid credential | I-Enter URL and click go<br>2.Click On My Account dropdown<br>3.Enter Valid username/email in Email text box<br>4.Enter Invalid password in password text box<br>5.Click on in button | username:lax26@mail password:lax26 | Application should show •Incorrect email or password ' validation message. | Working as |
| | | | | | | | |

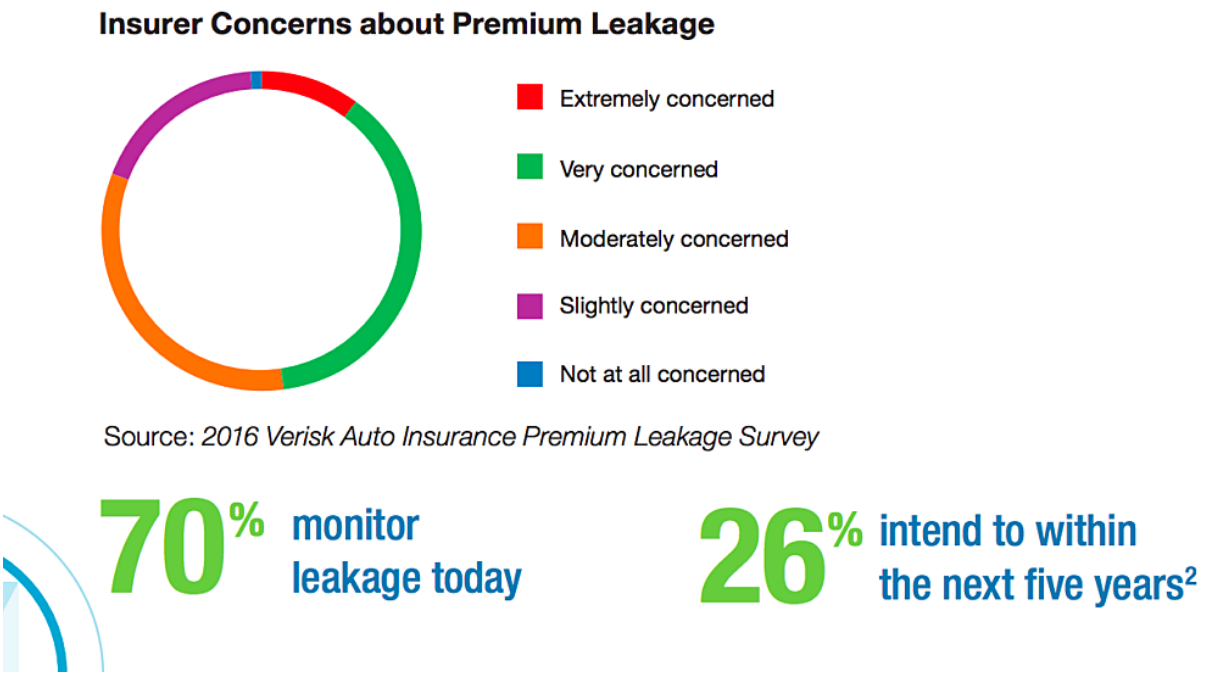
### 8.2 User Acceptance Testing

# The claims process taking too long

According to Verisk, a data analytics company, auto insurers in the U.S. lose $29 billion annually due to errors and omitted information. Though the sources of this claim leakage vary, inaccurate estimation of vehicle damage after an accident is one of them. Therefore, it becomes crucial to improve the accuracy of payout calculations in order to reduce this waste.

However, the process of assessing damage is both effort- and time-consuming with multiple parties involved. While an insurer is obviously responsible for covering the repair cost, the estimation itself is usually done by a body shop. The whole procedure involves experts from both sides, which often results in weeks or months spent on each case.

Apart from being a time sink, manual inspection is also highly prone to human error, which can lead to inaccurate or unfair payouts.




Premium leakage as a major concern for insurers (Image credit)

Machine learning is already being employed across multiple industries to automate the processes that are slowed down by manual, repetitive steps. With advanced algorithms, techniques, and frameworks under the hood, AI tools can accelerate the process of recognizing damaged vehicle parts, assessing damage, making predictions about what kind of repair is needed, and estimating how much it may cost. However, what does it take to implement such a solution?

```
<!DOCTYP
E html>
            <html lang="en">
            <head>
              <title>Home | IBM</title>
              <meta charset="utf-8">
              <meta name="viewport" content="width=device-width, initial-scale=1">
              <link rel="stylesheet"
            href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
              <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
            awesome/4.7.0/css/font-awesome.min.css">
              <script
            src="https://ajax.googleapis.com/ajax/libs/jquery/3.6.0/jquery.min.js"></script
            >
              <script
            src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></scr
            ipt>
              <style>
              .nav.navbar-nav{
               margin-left: 75px;
               }
               .navbar-brand{
                font-size: 22px;
               }
               .footer{
              overflow: hidden;
              background-color: #333;
              position: fixed;
              bottom: 0;
              height: 65px;
              width: 100%;
               }




              </style>
            </head>
            <body style="background-image: linear-gradient(to right, #DECBA4, #3E5151);">
            <nav class="navbar navbar-inverse">
              <div class="container-fluid">
                <div class="navbar-header">
```

## 9.Result

**Thus we have successfully implemented a machine learning based solution for the given problem.**

**1. Thus we have collected data set of images and performed pre processing on them to generate more variation of these images**

**2. We have build a VGG16 based model for predicting the level of damage and the location of damage from the image of the car .**

**3. We have trained the model both on IBM and local machine and have built a flask application for the same**

**4. We have achieved an accuracy of about 90 percentage in the model and have integrated it with the flask application**

**5. We have successfully demonstrated the working of the model in predicting the insurance amount and the level and location of the damage**

## 10.ADVANTAGES & DISADVANTAGES

### ADVANTAGES

**1. So the first and for most advantage is the fact that we can use a ML based solution is that its more consistent than having a human inspect it. There is a lot of possibility for being biased or making errors while estimating the cost of damage.But when it comes to a ml based solution it is sure that the assessment will be consistent across different scenarios and will be based on level and location which is more reliable**

**2. The second advantage is that its very robust and can be handled by anyone.There will not be any scope for confusion and even an untrained employee who has no expertise in automobile can just with a click of picture can estimate the amount of money.**

**3. The third advantage is that it lies as a middle ground between customers and insurance companies.There have been many cases where customers were not satisfied with the estimate made by the insurance company for their damage.they would have expected more money and might have got disappointed due to less coating.So this can lie as a middle ground between customers and insurance company for the sake of proof of estimate quoted by either party.**

**4. This model can be a base for solving some other similar problem where we are required to find the location or the level of damage this gives us scope for future works**

**DISADVANTAGES**

**1. Like the advantages there are a few disadvantages when it comes to a ML based algorithm rather than a traditional method through human inspection.The main one being is that the images that we are to predict upon is very hard to classify and the training and data collection process is hard to perform**

**2. The second thing is that we are not able to judge based on the model of the car.So each car needs different amount of money to mend repairs for the same amount of damage based on which manufacturer made that particular car in the first place.To say as an example consider an Audi car and a Maurithi car. According to our model let us say that both these cars took damage to the front section and the level is moderate.Though they both have same damage we can say that an Audi car will need higher amount of money for the repairs than the Mauriti car**

3. The third and main disadvantage is that the possibility of misclassifiction that can happen in the ML model.Firstly if the damage is severe and the amount predicted by the machine learning model is under the actual value needed for the repairs of the damage this would cause an unhappy customer for the insurance company.While if the estimate is higher than that present then the insurance company that has equipped the model would be at loss.Thirdly it needs an human intervention into the matter as users directly accessing the model might forge the picture uploaded which might lead to false classification

## 10. CONCLUSION

In this proposed project a neural network based solution for car detection; manage the problem of car damage analysis, prediction of car damage location and severity of the damage. This project carries out lot of functions in a one package. The system will definitely help the insurance companies to analyze the car damage a lot more successful and well organized. Simply by send the image of the car, the system will analyze the given image and show if there is any kind of damage to the car along with the location of the damage and also the severity of the damage. In the future, we will continue to explore the innovation of insurance

technology of 'AI + Vehicle Insurance'. We hope that we can use the power of intelligent damage determination system. On the one hand, the owner can take photos by one click to achieve rapid loss determination, price estimation and immediate compensation. On the other hand, it assists insurance companies to achieve rapid and accurate pricing in the process of fixing losses and claims. Finally, by combining the rapid compensation of accident vehicles to relieve traffic pressure, to avoid more serious personal and property losses caused by secondary accidents.

The Image per-processing techniques seem to improve the accuracy of the model greatly and that the have increased the amount of data that can be feed to the system in order to train it. A user can easily register with the application in order to make use of our service that is predicting damage to their vehicle Thus we have turned raw damaged car images and into a machine learning model that can be deployed easily.The use of VGG16 has shown great improvement over traditional options where we had to use CNN from scratch.This imprisonment is

**seen in training times and the impoverished accuracy of the system.**

## 12.FUTURE SCOPE

1. **Currently we have implemented the solution for car damage analysis.Though the number of cars are increasing in India,Bikes are pro dominant in India.There are almost 2 bikes in most of the households. This means that as a future improvement we can implement a similar solution but for predicting bike damage and can the amount of insurance money that can be given to that bike**

**2. Since we are assessing and predicting the damage we can extend similar analysis to all the products which have insurance or where Automation of damage assessment is needed For example in home appliances or in Mobile phones.**

**3. This form of solution can be applied in industries other than insurance companies.Which means in Car rental and bike rental companies where assesment of vehicle damage is needed for various applications.So this solution with much modification can be applied for that purpose**

**4. Improvement can be made in the model itself by adding few more layers for example more dense layers before the prediction layer and the output of the flatten layer which comes after VGG16. Improvement can be made in the data collection and per-processing where in we can do full fledged high quality images of damaged vechicles can be obtained and used for training the model.**

**5. we can use different per-processing techniques on the already present images to improve reliability.For example cosine transform can be applied to increase the speed of training the model and other image processing techniques can be applied to make the model more reliable**

**6. The flask application can be improved where in more features can be added and the application cassessan be made more feature friendly.Improvement can be made by including features that suit particular use case.For example if the solution is going to be used in insurance companies,we can provide the user with the ability to make an invoice to the customer who is trying to claim the insurance. This will come in handy for the user**

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## 14.APPENDIX

In [1]:
```
#from google.colab import drive
#drive.mount("/content/drive/")
```

IMPORTING PACKAGES

In [1]:
```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten
from tensorflow.keras.initializers import RandomNormal
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.losses import CategoricalCrossentropy
from tensorflow.keras.applications import VGG16
import cv2
from tensorflow.keras.models import load_model
import numpy as np

```

IMPORTING TRAINING DATA

In [2]:
```
image_generator=ImageDataGenerator(vertical_flip=False,horizontal_flip=True,shear_range=0.1,zoom_range=0.1,
X_train1=image_generator.flow_from_directory(target_size=(224,224),
                                     directory="C:\\Users\\ASUS\\Desktop\\AI COURSE\\Project\\training1",
                                     class_mode="categorical",
                                    batch_size=10,
                                             subset="training")
```

IMPORTING TESTING DATA

In [2]:
```
image_generator=ImageDataGenerator(vertical_flip=False,horizontal_flip=True,shear_range=0.1,zoom_range=0.1,rescale=1/255,bri
X_train1=image_generator.flow_from_directory(target_size=(224,224),
                                     directory="C:\\Users\\ASUS\\Desktop\\AI COURSE\\Project\\training1",
                                     class_mode="categorical",
                                    batch_size=10,
                                            subset="training")
```

IMPORTING TESTING DATA

In [4]:
```
image_generator_1=ImageDataGenerator(vertical_flip=False,horizontal_flip=True,shear_range=0.1,zoom_range=0.1,rescale=1/255,b
X_test1=image_generator_1.flow_from_directory(target_size=(224,224),
                                     directory="C:\\Users\\ASUS\\Desktop\\AI COURSE\\Project\\validation1",
                                     class_mode="categorical",
                                    batch_size=10,
                                  )
```

```
Found 171 images belonging to 3 classes.
```

INITIALIZING MODEL

In [6]:
```
vgg16=VGG16(include_top=False,input_shape=(224,224,3),weights='imagenet')
for i in vgg16.layers:
  i.trainable=False
```

ADD FLATTEN LAYER

In [ ]:
```
flatten_layer=Flatten()(vgg16.output)
```

ADDING DENSE LAYER

In [ ]:
```
dense32=Dense(32,kernel_initializer=RandomNormal,activation="relu")(flatten_layer)
output=Dense(3,activation="softmax")(dense32)
```

BUILDING MODEL

In [22]:
```
model1=Model(inputs=vgg16.input,outputs=output)
model1.summary()
```

INITILAIZE LEARNING PARAMETERS

In [23]:
```
model1.compile(loss=CategoricalCrossentropy(),
               optimizer=Adam(epsilon=0.001),
               metrics=["acc"])
```

FITTING DATA TO THE MODEL

In [ ]:
```
model1.fit(X_train1,validation_data=X_test1,epochs=5,steps_per_epoch=30,validation_batch_size=30)
```

SAVING THE MODEL

In [45]:
```
model1.save("LevelModel.h5")
```

LOAD MODEL

In [ ]:
```
model = load_model('LevelModel.h5')
```

```
def detect(frame):
    img = cv2.resize(frame, (224, 224))
    if(np.max(img) > 1):
        img = img/255.0
    img = np.array([img])
    prediction = model.predict(img)
    label = ["minor", "moderate", "severe"]
    preds = label[np.argmax(prediction)]
    return preds
```

**(For the second model we can use the same process but with different data set)**

Flask application user interface

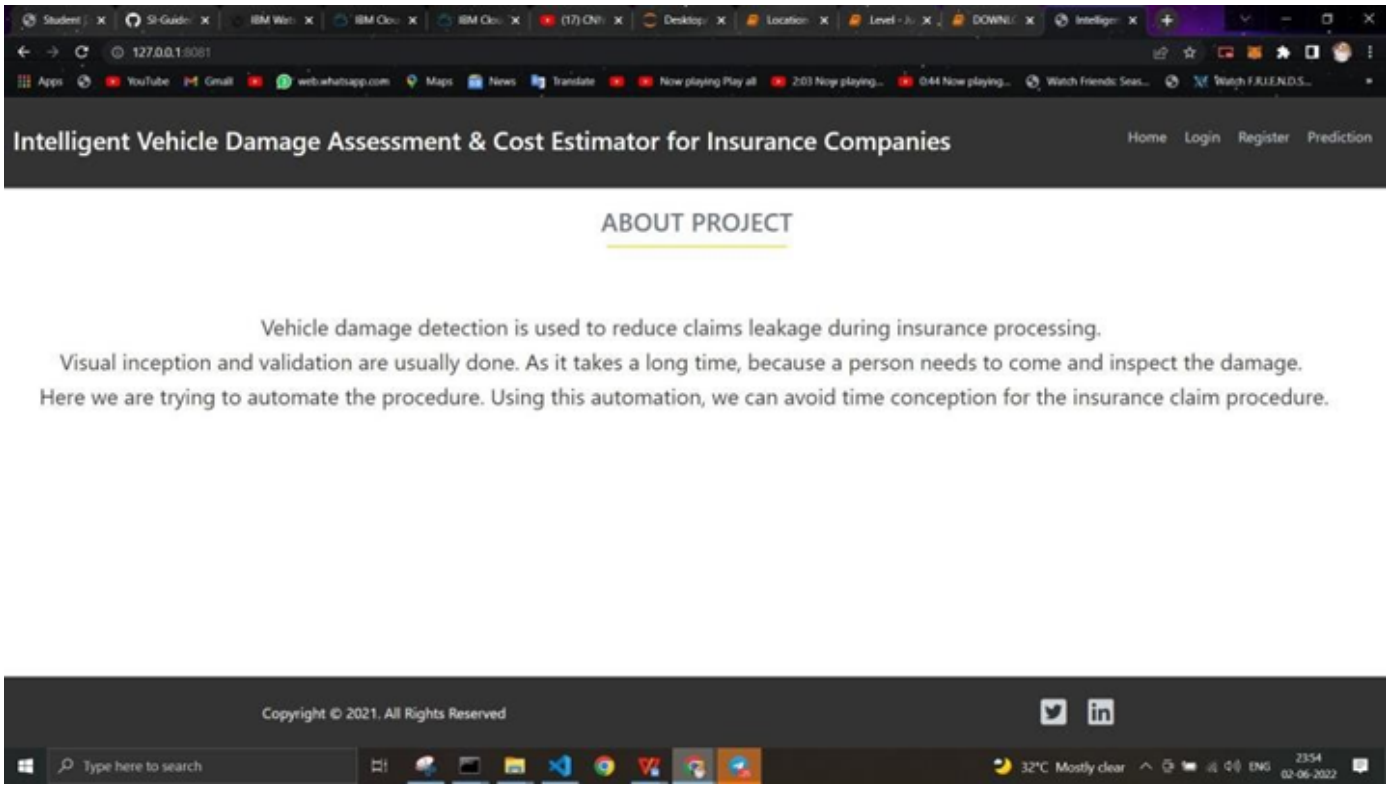
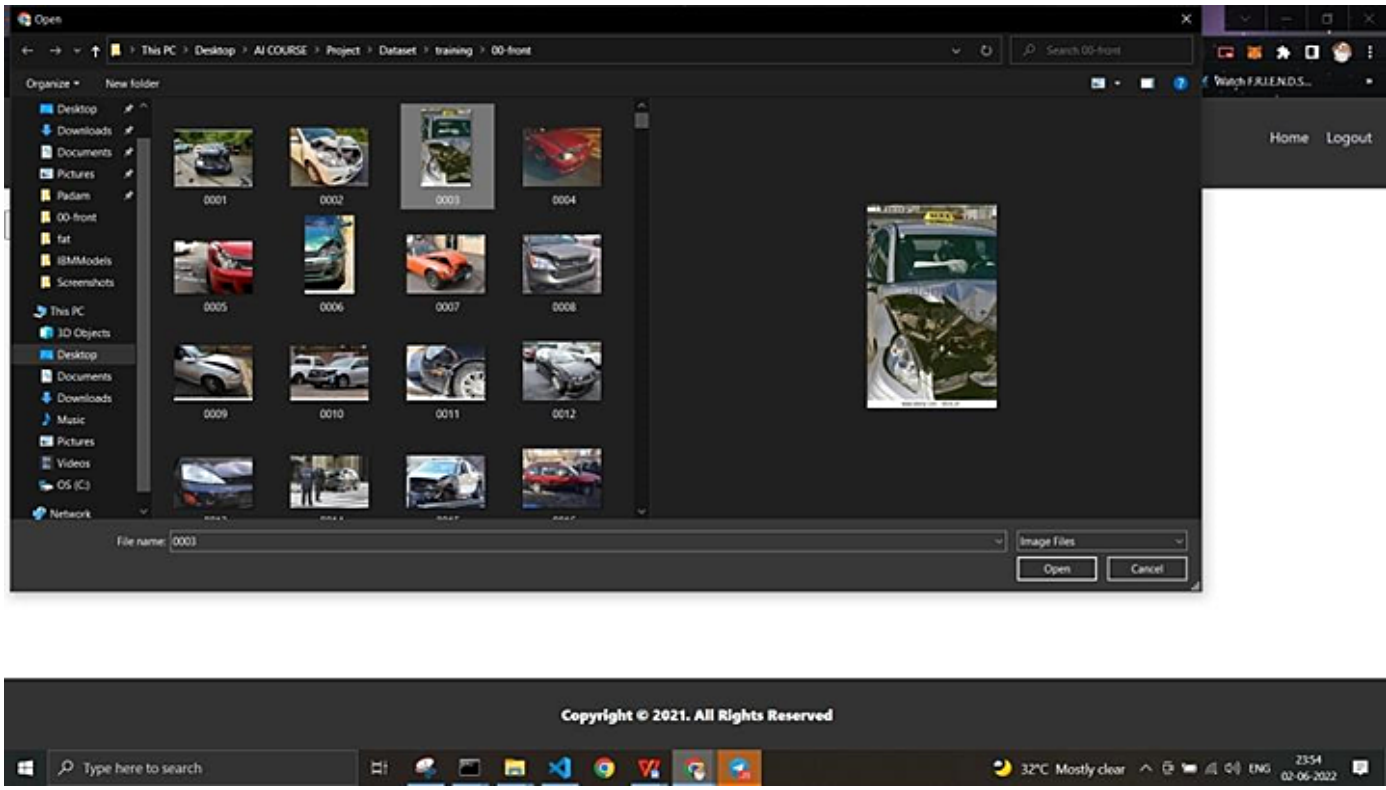
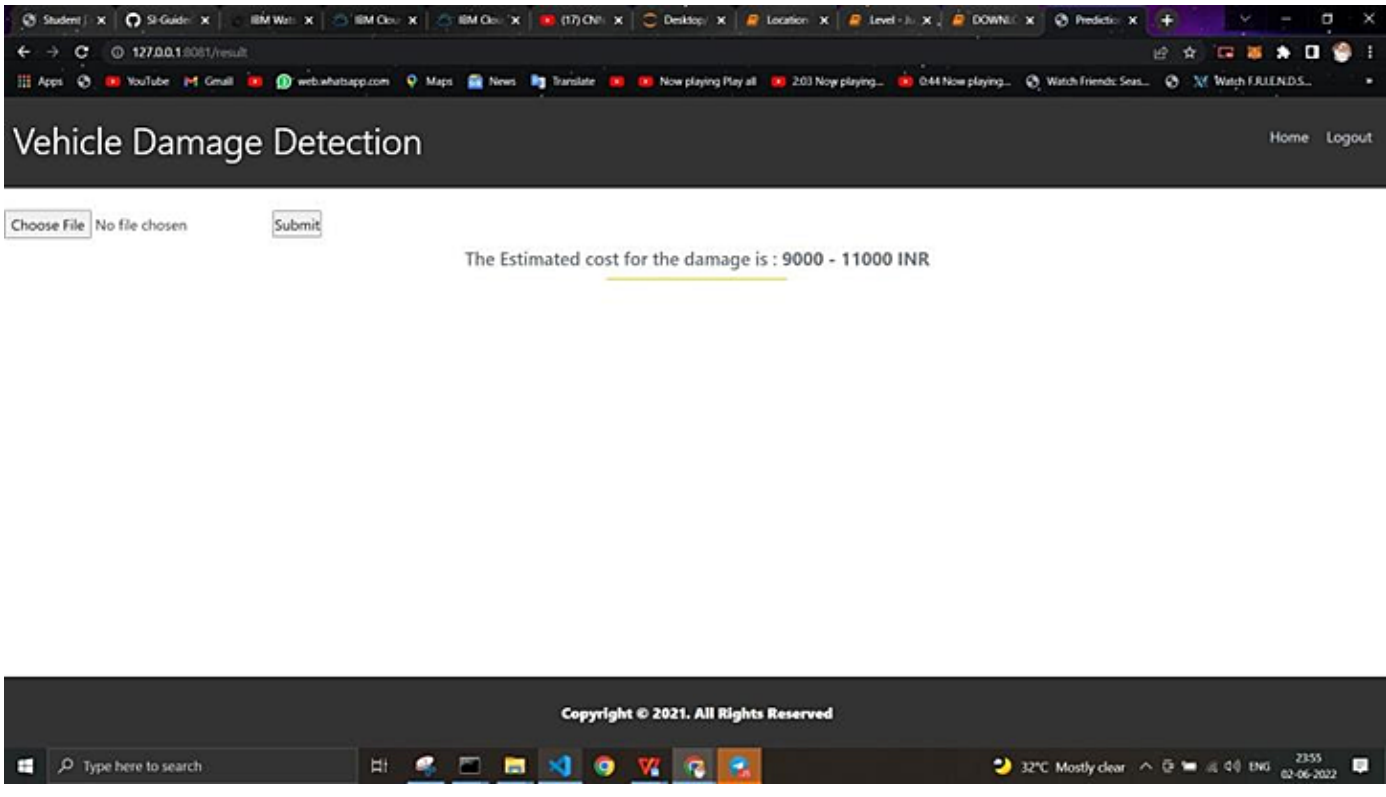



Image choosed

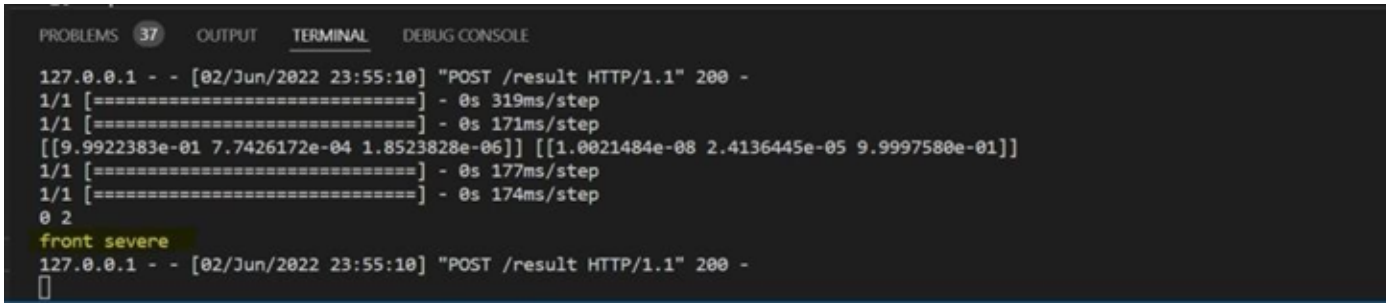



Predicted Estimate for Insurance amount



INPUT => Input give**Output:**n is Front and severely damaged vehicle

OUTPUT=> Output got is “front severe”




.

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**GITUP LINK**

**https://github.com/IBM-EPBL/IBM-Project-34108-1660231745**

**PROJECT DEMO LINK**

**https://www.youtube.com/embed/RdOP-05U0iA**