



# **INTELLIGENT VEHICLE DAMAGE ASSESSMENT & COST ESTIMATOR FOR INSURANCE COMPANIES**



## **A PROJECT REPORT**

**Submitted by**

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Project Name	Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

## INTELLIGENT VEHICLE DAMAGE ASSESSMENT & COST ESTIMATOR FOR INSURANCE COMPANIES

### **Abstract:**

Analysis of the damaged vehicle that can be automatically claiming insurance that takes human resource, time and effort. Image processing and machine learning techniques are analyzing the vehicle damage in the proposed solution. In Advanced solution helps to speed up the claiming process sufficiently. Consider a situation, if a person is driving a car, they met an accident the vehicle owner can take a few photos of the damaged car from a mobile phone that can be send to the insurance company and can just upload the photos to the system. The system can analyze the damage, severity of the damage as well as location of the damage. In this proposed project the insurance company can machine-driven the car damage analysis process without the need for humans to analyze the damage done to the car. Therefore, it is a very challenging task for quality of computer vision techniques and also Machine learning technologies.

Keywords: - *Car Damage Detection, Prediction, Deep Learning, Machine learning, CNN, VGG16*

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# INTRODUCTION

## Project Overview

In today's world, it can observe that the number of vehicles we use is quickly expanding; let's agree that there isn't a single street without a car. As a result, an increase in the number of automobiles on the road may lead to an increase in the percentage of accidents occurring nearby; additionally, the number of accidents occurring nearby would be significant; the accidents would not be particularly serious, but the automobile would be damaged, prompting people to file insurance claims.

The whole idea focuses on this question: how can a customer claim insurance more quickly? To keep the procedure quiet, a machine learning model is developed that utilizes image processing to categorize the photographs and calculate the percentage of damage to the car.

The user will be able to get payment based on the model's outcomes. Because the ML model would be exclusively responsible for this procedure, it would be faster than the manual approach. Analyze the damage in a fraction of the time it takes people and with minimal human interaction.

## Purpose

Today's world is seeing a substantial increase in automobiles. Because there are more automobiles on the road and more people are driving them at high speeds, accidents happen more frequently. When an accident happens, the parties involved submit a claim with their auto insurance to obtain the money needed to repair the vehicle since, according to false claims, the company acts inappropriately and withholds payments.

## LITERATURE SURVEY

### Existing problem

In this literature survey several methods have been proposed for detection of car damage.

Smiral proposed a solution which uses 3D Computer Aided Design for the discernment of car damage from the picture, the system only detect damage at edge portion only. Detection of the car damage through CAD software requires some knowledge about the software.

S Gontscharov, 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, the proposed system uses deep learning-based algorithm 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 work greater.

Girish N, the proposed system uses vehicle damage detection technique depends on transfer learning and mask RCNN, the mask regional convolution neural network determines a damaged car by its position and estimate the depth of the damage.

A Neela Madheswari, the proposed system uses convolution neural network is use to accept that image contains a car damage or not. It takes as great opportunities to attempt by classifying the car damage into different classes.

### References

- [1]. A.Neela Madheswari, J.haripriya, G.Kiruthika, R.M.Meyammai Mahendra Engineering college, India, exterior vehicular damage detection using deep learning, department of computer science and engineering.
- [2]. Girish N, Mohammed Aqeel Arshad, car damage detection using machine learning. International journal of advances research in computer and communication engineering, Vol. 10, issue 8, August 2021 DOI 10.17148/IJARCCCE.2021.10808.
- [3]. Phyu Mar Kyu, car damage detection and classification, faculty of information technology king Mongkut's institute of technology ladkrabang Bangkok, Thailand [62606003@kmitl.ac.in](mailto:62606003@kmitl.ac.in).
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damage identification in vehicle bodies using adaptive sensor data processing," Procedia Technology, vol. 15, pp. 586–594, 2014. 2nd International Conference on System-Integrated Intelligence: Challenges for Product and Production Engineering.

[6]. Y.J. Cha, J. Chen, and O. B'uy'uk'ozt'urk, Output-only computer visionbased damage detection using phase-based optical flow and unscented kalman lters," Engineering Structures, vol. 132, pp. 300, {313, 2017

## Problem Statement Definition

In existing system, the procedure of making an insurance claim for an automobile is laborious, and there is a delay before the first reimbursement is authorised. Insurance firms lose millions of dollars each year due to claim leakage as a result of the expansion of the vehicle sector and the daily rise in the number of accidents. The discrepancy between the company's actual spending and what they should have really spent is known as claim leakage. Ineffective claim processing, erroneous payments, human error such as a lack of quality control or poor customer service or even claim fraud may be to blame for this. Auditing closed claim files is the only way to find claim leakage.



Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Company agent	Check vehicle parts with good price	It is difficult to identify the price of every part	There is no all brands and parts on the site	Uncomfortable to give insurance to the user
PS-2	Insurance Holder	Claim insurance for my accidental car	I'm facing defaulting to give a proper bill to the company	Site has not all the brand and spare part	In problem

## IDEATION & PROPOSED SOLUTION

### Empathy Map Canvas

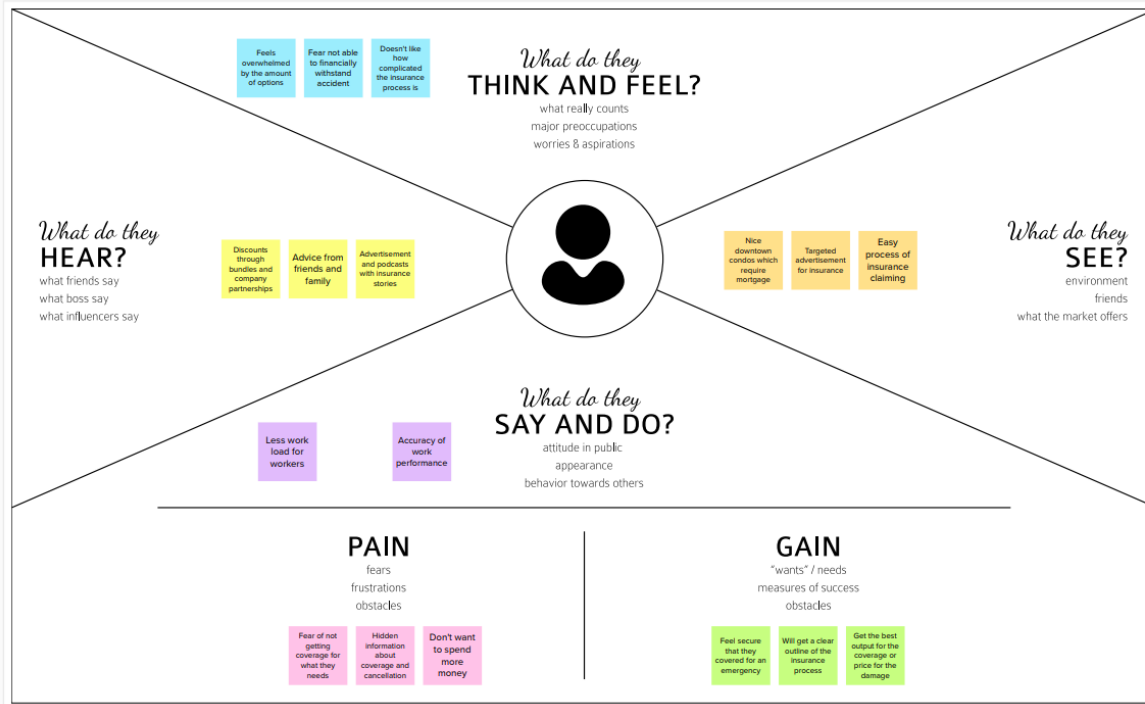
Edit this template  
Right-click to unlock

# Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Intelligent Vehicle Damage Assessment and Cost Estimator for Insurance Companies





# Ideation & Brainstorming

## Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- 10 minutes to prepare
- 1 hour to collaborate
- 2-8 people recommended

[Share template feedback](#)

**Before you collaborate**

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

10 minutes

**Team gathering**

1 Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

2 Set the goal

3 Think about the problem you'll be focusing on solving in the brainstorming session.

4 Learn how to use the facilitation tools

5 Use the Facilitation Supplement to run a happy and productive session.

[Open article](#)

**1 Define your problem statement**

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

5 minutes

**How might we [your problem statement]?**

**Key rules of brainstorming**

To run an smooth and productive session

- Stay in topic.
- Encourage wild ideas.
- Defer judgment.
- Listen to others.
- Go for volume.
- If possible, be visual.

**2 Brainstorm**

Write down any ideas that come to mind that address your problem statement.

10 minutes

**TIP**

You can attach a sticky note and fix the pencil (stick to directly) to start drawing!

**How to use the template**

The template is designed to help you brainstorm and prioritize ideas. It includes a section for defining the problem statement, a section for brainstorming ideas, and a section for prioritizing ideas. The template is divided into four quadrants: Problem Statement, Brainstorming, Prioritizing, and Collaborating. Each quadrant contains a set of questions and a set of sticky notes to help you think through the process.

**Need some inspiration?**

Use a virtual session of this template to brainstorm and prioritize ideas.

[Open example](#)

**After you collaborate**

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

**3 Group ideas**

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

20 minutes

**TIP**

Add a sentence-like label to each cluster of sticky notes to make it easier to find, share, update, and integrate important ideas as they evolve over time.

**4 Prioritize**

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

**Importance**

If each of these ideas had a high priority, which one would you want to focus on first?

**Feasibility**

Regardless of their importance, which ideas are most feasible to implement (cost, time, effort, complexity, etc.)

**5 After you collaborate**

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

**Quick add-ons**

5 Share the mural

6 Export the mural

**Keep moving forward**

7 Strategy blueprint

8 Customer experience journey map

9 Strengths, weaknesses, opportunities & threats

## Proposed Solution

The proposed approach collects photographs of a person's damaged automobile, then utilizes those images as input for a deep learning model that use image processing to recognize the elements of the image and determine the percentage of the vehicles' damage. After then, the images are separated into two groups: replace and repair. When the damage percentage is less than 80, the damaged part must be replaced; however, in the other case, the compensation amount is set depending on the damage percentage. Finally, it generates a comprehensive analysis report on the vehicle that is used to ask the insurance company for payment.

Project team shall fill the following information in proposed solution template.

S. No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Insurance firms frequently losses because they are unable to accurately estimate the cost of damaged automobiles and they are unable to calculate the cost of damaged cars precisely, insurance companies regularly incurred losses.
2.	Idea / Solution description	Car damage is automatically identified and classified using Deep Learning and pattern recognition technology.
3.	Novelty / Uniqueness	Automated calculator for the cost of filing an insurance claim.
4.	Social Impact / Customer Satisfaction	Vehicle's damage analysis used to get compensation, submit the created report and Process that saves time and money.
5.	Business Model (Revenue Model)	The Proposed method was implemented using the Convolutional Neural Network feature extraction and damage detection / localization than pre-trained model VGG16.
6.	Scalability of the Solution	It can be used by insurance companies for faster processing of claims and can also be used to underwriting a car loan, especially for a used car.

## Problem Solution fit

There is no systematic approach to receive a rapid answer from an insurance company. A week of waiting is required. The proposed solution should enable consumers to contact with the insurance

provider and receive payments both online and offline. After uploading the damaged image and determining the extent of the damage, the user may obtain insurance only if the company approves the damaged image and the condition is more than 80%.

Project Title: Intelligent vehicle damage assessment and Cost Estimator for Insurance Companies

Project Design Phase – I Solution Fit Template

Team ID: PNT2022TMD26786

Define CS, fit into CL	Explore AS, differentiate	Focus on PR, tap into BE, understand RC	Extract online & offline CH of BE
<b>1. CUSTOMER SEGMENT(S)</b> <ul style="list-style-type: none"> <li>Commercial working people travelling from one point to another</li> <li>Basically belonging to 18+ years old</li> <li>Person whose vehicle experienced some accident or damage in the vehicle</li> <li>A Customer with valid insurance policy to claim</li> </ul>	<b>5. AVAILABLE SOLUTIONS</b> <ul style="list-style-type: none"> <li>Cost estimation done by manual calculations</li> <li>Using slow processing algorithms to detect the damage</li> </ul> <b>Pros</b> <ul style="list-style-type: none"> <li>The estimated values stays within the customer and bank agent</li> </ul> <b>Cons</b> <ul style="list-style-type: none"> <li>Estimated cost varies frequently</li> </ul>	<b>7. BEHAVIOR</b> <ul style="list-style-type: none"> <li>The customer has to upload the images of the car after an accident</li> <li>The application will instantly evaluate the damages and displays the claim amount the customer</li> </ul>	<b>8. CHANNELS of BEHAVIOR</b> <div>ONLINE</div> <ul style="list-style-type: none"> <li>Webpage can be accessed to estimate damage using input image</li> <li>Quick access of the artificial intelligence-based algorithm for damage assessment</li> </ul> <div>OFFLINE</div> <ul style="list-style-type: none"> <li>Reach out to the respect insurance agent or the corresponding bank to proceed further with the insurance payment protocols</li> <li>Validate the estimate cost with the cost provided by the firm</li> </ul>
<b>2. PROBLEMS / PAINS</b> <ul style="list-style-type: none"> <li>The main problem will be time consumption in assessing the damage cost and damage percentage</li> <li>To address such an issue it is very important to provide accurate damage percentage and unified cost for that damage</li> <li>Failed to provide perfect value for damage by the insurance companies</li> </ul>	<b>6. CUSTOMER LIMITATIONS</b> <ul style="list-style-type: none"> <li>Troubled network connection might lead to inaccessible of certain features</li> <li>Inproper images or blurred images might affect the accurate performance of the application</li> </ul>	<b>8. PROBLEM ROOT / CAUSE</b> <ul style="list-style-type: none"> <li>Deviation or variation from the company calculated cost and the actual cost</li> <li>Rapid development in the AI field paved way to many advance methodologies of estimation</li> </ul>	<b>9. YOUR SOLUTION</b> <ul style="list-style-type: none"> <li>Accurately estimate the damage percentage</li> <li>Predict the region of damage with respect to the vehicle</li> <li>Use fast processing algorithm for functionality</li> <li>Interactive and user-friendly solution to make it easily accessible for the user</li> <li>Eliminating human error while estimation</li> </ul>
<b>3. TRIGGERS TO ACT</b> <ul style="list-style-type: none"> <li>Technologies advancement in the field of predictions and estimation</li> <li>Colleagues and society demanding instant insurance claim</li> <li>Customer wanting to be independent without falling into false traps</li> </ul>	<b>4. EMOTIONS</b> <div>Before</div> <ul style="list-style-type: none"> <li>Delay in insurance claim</li> <li>Unable to claim an accurate amount for vehicle damage</li> </ul> <div>After</div> <ul style="list-style-type: none"> <li>Customers felt independent</li> <li>Received their insurance claims at an instant</li> </ul>		

## REQUIREMENT ANALYSIS

### Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User details	Users are required to register their personal details. like name, age, date of birth, driving license, car number etc.
FR-4	User requirements	The user simply inputs vehicle damage images. The software will instantly generate an accurate reading of the based on the image detection analysis in a readable format familiar to the customer. It compares the information already given and states the defect percentage and cost in that vehicle damage image.

### Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	<b>Usability</b>	More efficient for the frequent users. users can easily understand what the application does and feel satisfied with the system.
NFR-2	<b>Security</b>	<ul style="list-style-type: none"><li>AI powered vehicle damage assessment and cost estimator for insurance company should contain more security in which our data which entered or maintained should be more security.</li><li>With the help of the username and password it provides more security in which it can access more securable and the data are private.</li></ul>

NFR-3	<b>Reliability</b>	This application must perform without failure in 90 percent of use cases during a month.it is more reliable.
NFR-4	<b>Performance</b>	This application supporting 1,050 users per hour must provide 5 seconds or less response time in a desktop browser, including the rendering of text and images, over an LTE connection. The performance of this application is effective and efficient.
NFR-5	<b>Availability</b>	The web dashboard must be available to user's 99.9 percent of the time every month during business hours EST. Users can access anytime and anywhere.
NFR-6	<b>Scalability</b>	The application must be scalable enough to support 10,000 visits at the same time while maintaining optimal performance and efficient to retrieve image in large scale thus improving scalability.

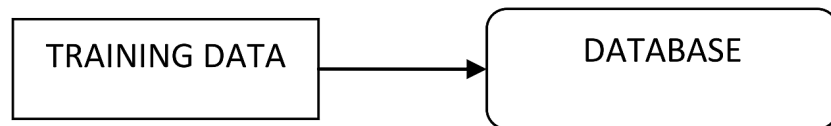
## PROJECT DESIGN

### Data Flow Diagrams

A two-dimensional diagram explains how data is processed and transferred in a system. The graphical depiction identifies each source of data and how it interacts with other data sources to reach a common output. Individuals seeking to draft a data flow diagram must identify external inputs and outputs, determine how the inputs and outputs relate to each other, and explain with graphics how these connections relate and what they result in. This type of diagram helps business development and design teams visualize how data is processed and identify or improve certain aspects.

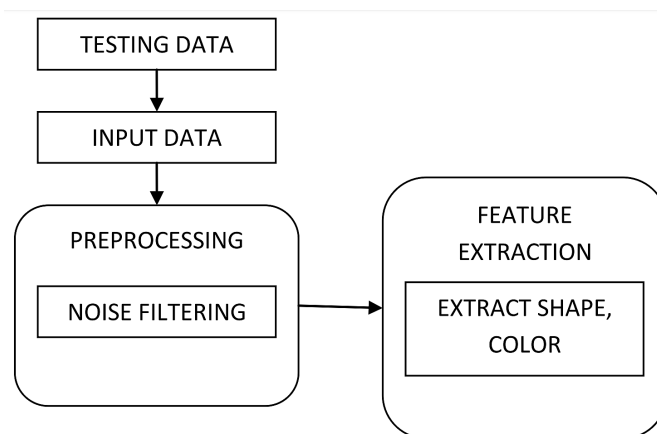
#### LEVEL 0

The Level 0 DFD shows how the system is divided into 'sub-systems' (processes), each of which deals with one or more of the data flows to or from an external agent, and which together provide all of the functionality of the system as a whole. It also identifies internal data stores that must be present in order for the system to do its job, and shows the flow of data between the various parts of the system.



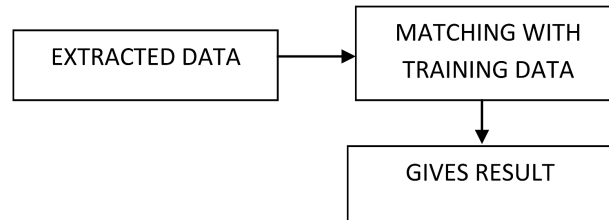
#### LEVEL 1

The next stage is to create the Level 1 Data Flow Diagram. This highlights the main functions carried out by the system. As a rule, to describe the system was using between two and seven functions - two being a simple system and seven being a complicated system. This enables us to keep the model manageable on screen or paper.

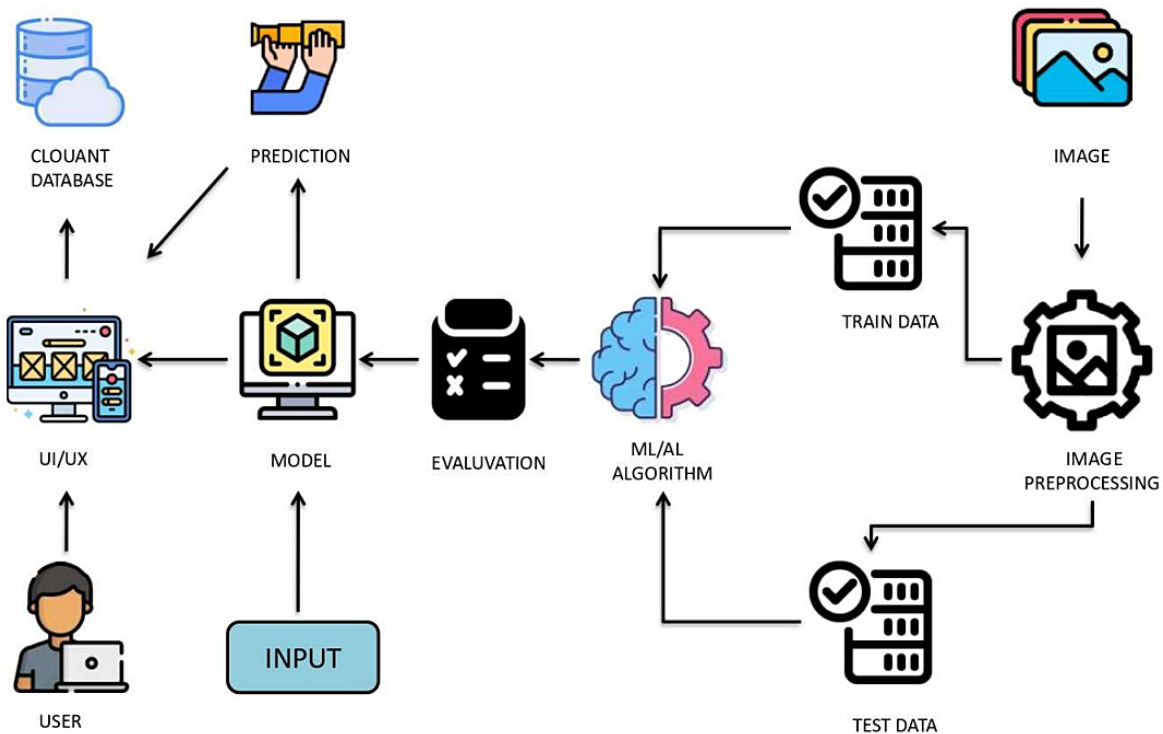


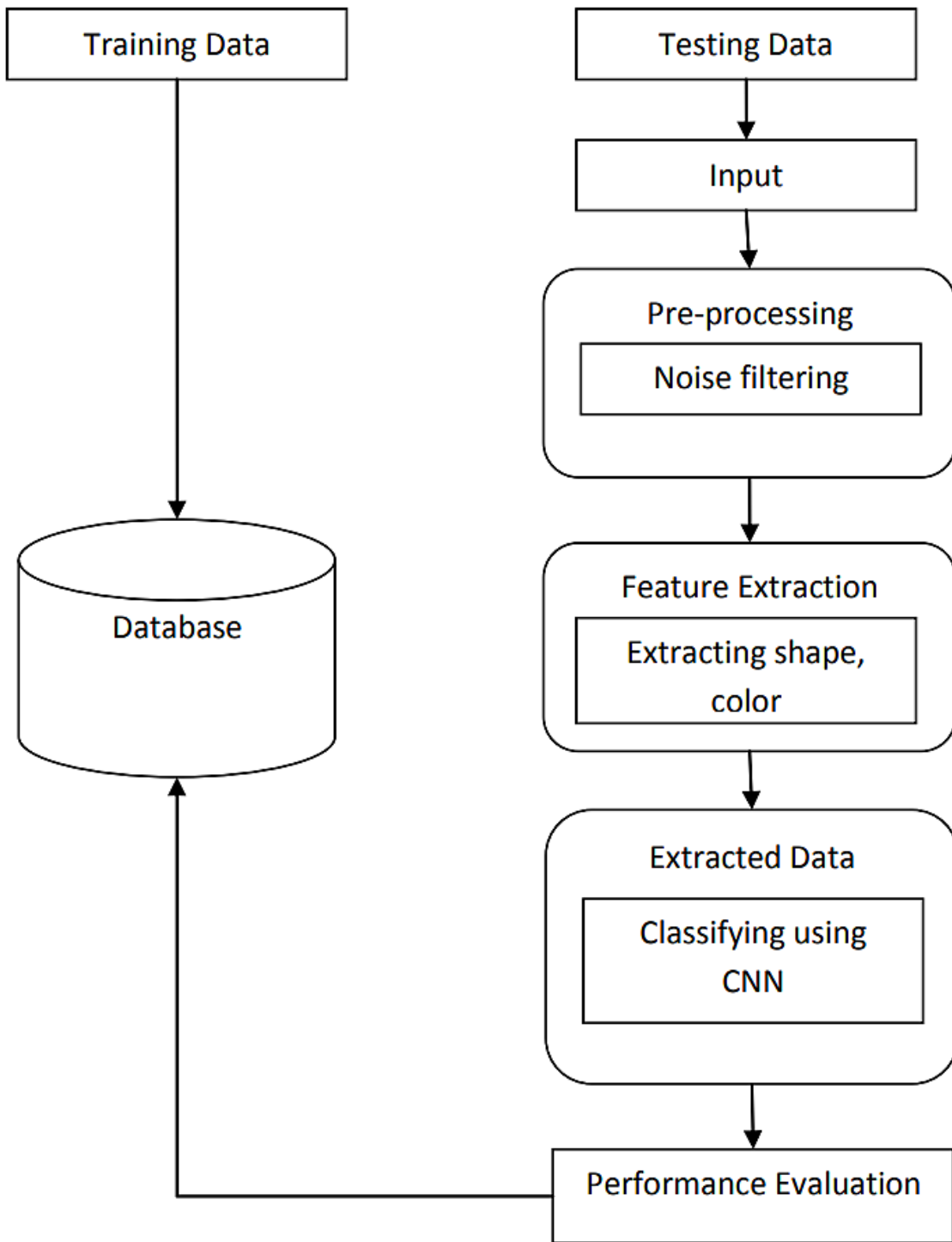
## LEVEL 2

A Data Flow Diagram (DFD) tracks processes and their data paths within the business or system boundary under investigation. A DFD defines each domain boundary and illustrates the logical movement and transformation of data within the defined boundary. The diagram shows 'what' input data enters the domain, 'what' logical processes the domain applies to that data, and 'what' output data leaves the domain. Essentially, a DFD is a tool for process modelling and one of the oldest.



## Solution & Technical Architecture







## User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					
Customer (Web user)						
Customer Care Executive						
Administrator						

## PROJECT PLANNING & SCHEDULING

### Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration, Dashboard	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	20	High	Ravi Kishan (M2)
Sprint-2	Page work, Admin panel	USN-2	As a user, I will receive confirmation email once I have registered for the application	20	High	Sagar (Team lead), Ravi Kishan
Sprint-3	Portal, services	USN-3	As a user, I can register for the application through Facebook	20	Low	Sagar, Saurav(M3)
Sprint-4	Delivery of final code	USN-4	As a user, I can register for the application through Gmail	20	Medium	Sagar, Ravi Kishan, Saurav
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	20	High	Ravi kishan

### Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	5 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	16 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint).

Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

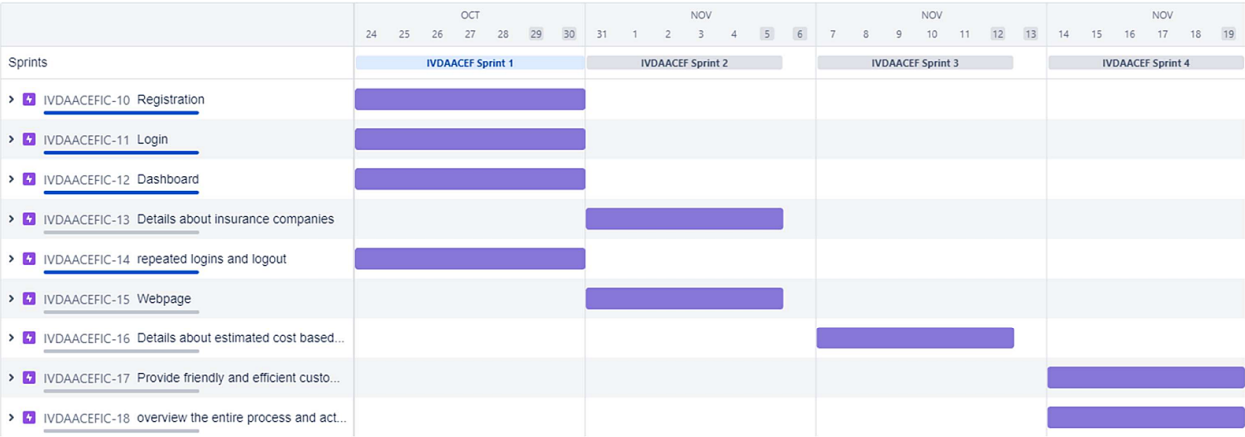
$$AV = \text{Sprint duration} / \text{Velocity}$$

$$\Rightarrow 20/6 = 3$$

### Reports from JIRA

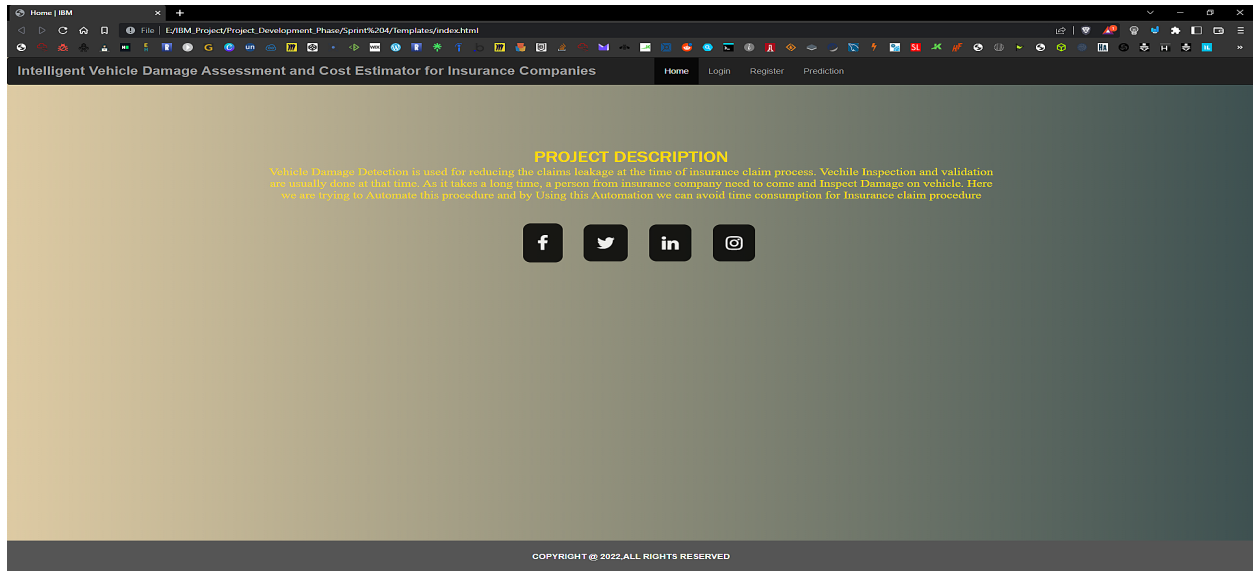
Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



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

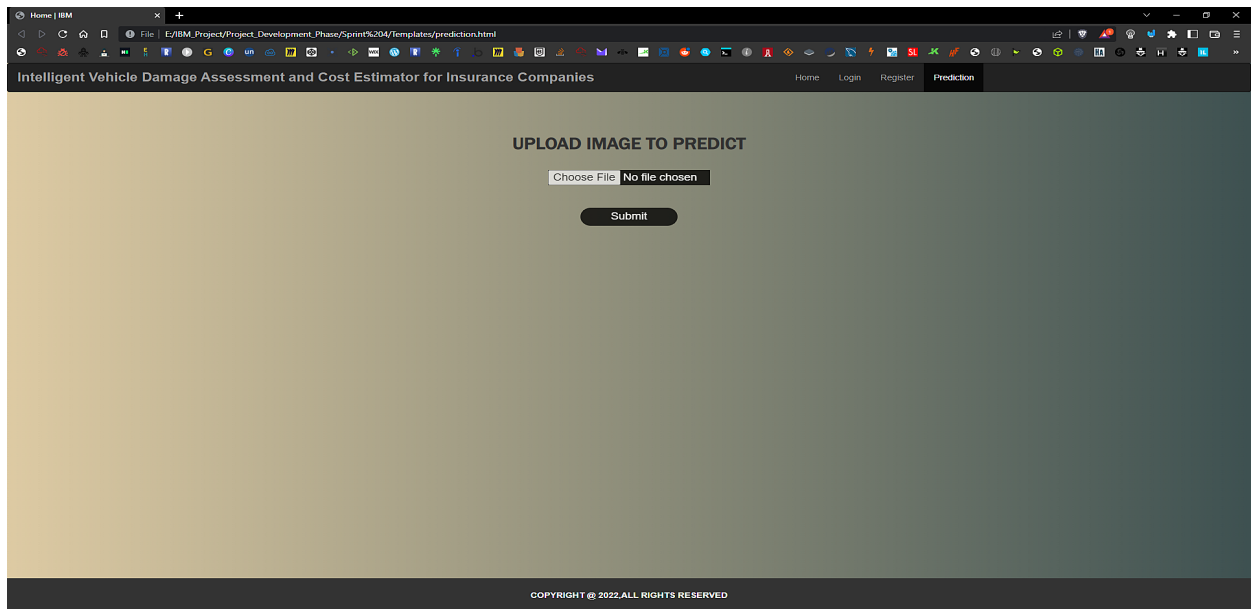
## Feature 1



## Dashboard

Dashboard is the main page of project. User can login and they can use all the given services.

## Feature 2



## Prediction page

A user can predict their cost of damage parts in car. User also can create a bill or invoice form this page.

## TESTING

### Test Cases

A test case has components that describe input, action and an expected response, in order to determine if a feature of an application is working correctly. A test case is a set of instructions on “HOW” to validate a particular test objective/target, which when followed will tell us if the expected behavior of the system is satisfied or not. Characteristics of a good test case:

- Accurate: Exacts the purpose.
- Economical: No unnecessary steps or words.
- Traceable: Capable of being traced to requirements.
- Repeatable: Can be used to perform the test over and over.
- Reusable: Can be reused if necessary.

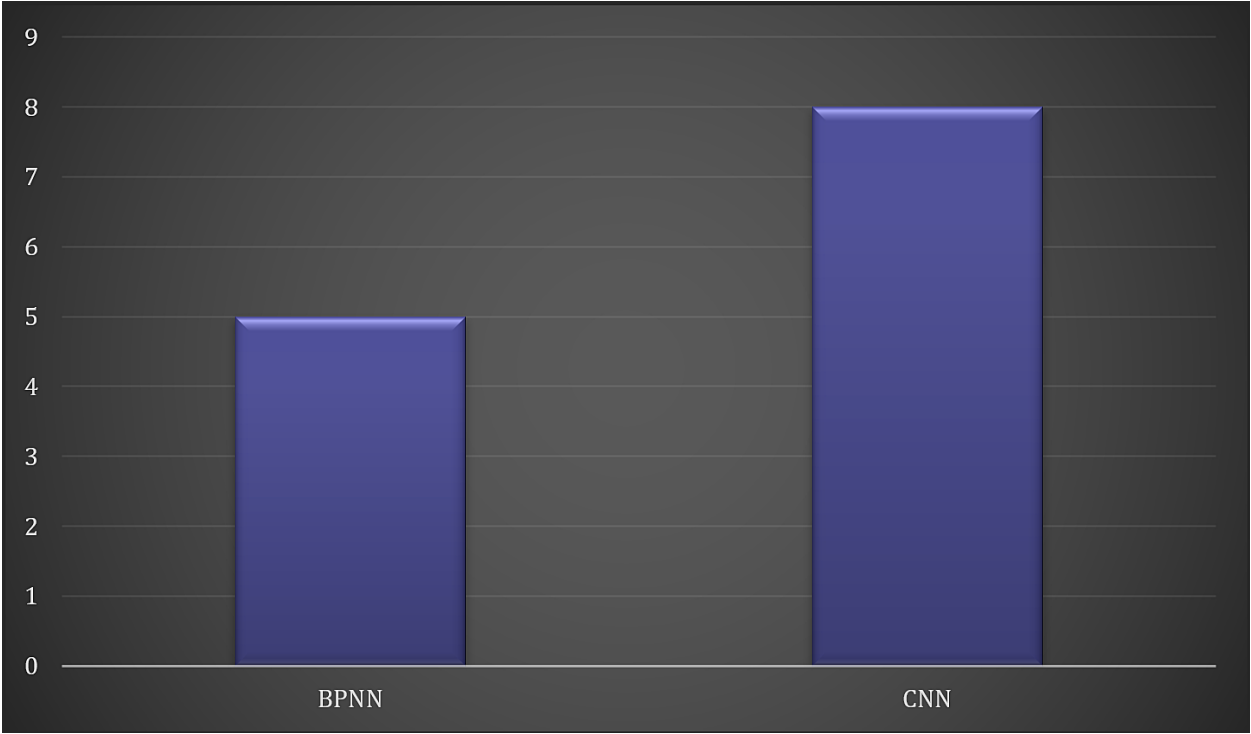
S no.	Scenario	Input	Excepted output	Actual output
1	User login	User name and password	Login	Login success.
2	Upload Image	Upload damaged vehicle image as a input	Detecting object and analyze for claim insurance	Details are stored in a database.

### User Acceptance Testing

This sort of testing is carried out by users, clients, or other authorised bodies to identify the requirements and operational procedures of an application or piece of software. The most crucial stage of testing is acceptance testing since it determines whether or not the customer will accept the application or programme. It could entail the application's U.I., performance, usability, and usefulness. It is also referred to as end-user testing, operational acceptance testing, and user acceptance testing (UAT).

RESULTS

Performance Metrics



Algorithm Accuracy Level

## **ADVANTAGES & DISADVANTAGES**

### **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.

### **FUTURE SCOPE**

In future work, need to use several regularization methods with a big dataset in our next work. Anticipate the cost of a car damaged component more accurately and reliably if we have higher quality datasets that include the attributes of a car (make, model, and year of production), location data, kind of damaged part, and repair cost. This study makes it possible to work together on picture recognition projects in the future, with a focus on the auto insurance industry. The study was able to accurately validate the presence of damage, its location, and its degree while eliminating human bias. These can be further enhanced by adding the on-the-fly data augmentation approaches.

We will add more features like car selling, insurance claim, old car collection and car modification. It will help customer to find all the services on the same application.

## APPENDIX

### Source Code

#### *App.py*

```
import re
import numpy as np
import os
from flask import Flask, app, request, render_template
from keras import models
from keras.models import load_model
from keras.preprocessing import image
from tensorflow.python.ops.gen_array_ops import concat
from keras.applications.inception_v3 import preprocess_input
import requests
from flask import Flask, request, render_template, redirect, url_for
from cloudant.client import Cloudant

client = Cloudant.iam('5ece5257-e0a3-455a-85cb-bae7e5b9af61-bluemix', 'pU-Fdv1N3p-9FKVtJanxAyl-3jivVCf8WjLElGDpxNgR',
                      connect=True)
my_database = client.create_database('my_database')

model1 = load_model('Model/level.h5')
model2 = load_model('Model/body.h5')

app = Flask(__name__)

@app.route('/')
def index():
    return render_template('index.html')

@app.route('/index.html')
def home():
    return render_template('index.html')

@app.route('/register.html')
def register():
    return render_template('register.html')
```



```

@app.route('/afterreg', methods=['POST'])
def afterreg():
    x = [x for x in request.form.values()]
    print(x)
    data = {
        '_id': x[1],
        'name': x[0],
        'psw': x[2]
    }
    print(data)

    query = {'_id': {'$eq': data['_id']}}

    docs = my_database.get_query_result(query)
    print(docs)

    print(len(docs.all()))
    if (len(docs.all()) == 0):
        url = my_database.create_document(data)
        response = request.get(url)
        return render_template('login.html', pred="Registration Successful, Please login using your details")
    else:
        return render_template('register.html', pred="You are already a member, Please login using your details")

@app.route('/login.html')
def login():
    return render_template('login.html')

@app.route('/afterlogin', methods=['POST'])
def afterlogin():
    user = request.form['_id']
    passw = request.form['psw']
    print(user, passw)

    query = {'_id': {'$eq': user}}

    docs = my_database.get_query_result(query)
    print(docs)

    print(len(docs.all()))

```

```

if (len(docs.all()) == 0):
    return render_template('login.html', pred="The Username is not found")
else:
    if ((user == docs[0][0]['_id'] and passw == docs[0][0]['psw'])):
        return redirect(url_for('prediction'))
    else:
        print('Invalid User')

@app.route('/logout.html')
def logout():
    return render_template('logout.html')

@app.route('/prediction.html')
def prediction():
    return render_template('prediction.html')

@app.route('/result')
def res():
    if request.methods == "POST":
        f = request.files['image']
        basepath = os.path.dirname(__file__)
        filepath = os.path.join(basepath, 'uploads', f.filename)
        f.save(filepath)

        img = image.load_img(filepath, target_size=(256, 256))
        x = image.img_to_array(img)
        x = np.expand_dims(x, axis=0)

        img_data = preprocess_input(x)
        prediction1 = np.argmax(model1.predict(img_data))
        prediction2 = np.argmax(model2.predict(img_data))

        index1 = ['front', 'rear', 'side']
        index2 = ['minor', 'moderate', 'severe']

        result1 = index1[prediction1]
        result2 = index2[prediction2]
        if (result1 == "front" and result2 == "minor"):
            value = "3000 - 5000 INR"
        elif (result1 == "front" and result2 == "moderate"):

```

```

        value = "6000 - 8000 INR"
    elif (result1 == "front" and result2 == "severe"):
        value = "9000 - 11000 INR"
    elif (result1 == "rear" and result2 == "minor"):
        value = "4000 - 6000 INR"
    elif (result1 == "rear" and result2 == "moderate"):
        value = "7000 - 9000 INR"
    elif (result1 == "rear" and result2 == "severe"):
        value = "11000 - 13000 INR"
    elif (result1 == "side" and result2 == "minor"):
        value = "6000 - 8000 INR"
    elif (result1 == "side" and result2 == "moderate"):
        value = "9000 - 11000 INR"
    elif (result1 == "side" and result2 == "severe"):
        value = "12000 - 15000 INR"
    else:
        value = "16000 - 50000 INR"

    return render_template('/prediction.html', prediction=value)

if __name__ == "__main__":
    app.run(debug=False, port=8080)

```

### **flask.py**

```

from flask import Flask
app = Flask(__name__)
@app.route("/")
def hello_world():
    return "<p>Hello, World!</p>"
    app.run(debug=False, port=8080)

```

### **index.html**

```

<!DOCTYPE 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"></script>
<style>
.nav.navbar-nav{
margin-left: 75px;
}
.navbar-brand{
font-size: 22px;
}
.footer{
overflow: hidden;
background-color: #555;
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">
<a class="navbar-brand" href="#"><b>Intelligent Vehicle Damage Assessment and Cost Estimator
for Insurance Companies</b></a>
</div>
<ul class="nav navbar-nav">
<li class="active"><a href="#">Home</a></li>
<li><a href="login.html">Login</a></li>
<li><a href="register.html">Register</a></li>
<li><a href="prediction.html">Prediction</a></li>
</ul>
</div>
</nav><br><br><br><br>

<div class="container">
<center>
<h2 style="font-family:'Franklin Gothic Medium', 'Arial Narrow', Arial, sans-serif;color:
#ffd700;">PROJECT DESCRIPTION<hr3E</h2>
<br>

```

<p style="font-size:20px;font-family: 'Times New Roman', Times, serif;">Vehicle Damage Detection is used for reducing the claims leakage at the time of insurance claim process. Vechile Inspection and validation are usually done at that time. As it takes a long time, a person from insurance company need to come and Inspect Damage on vehicle. Here we are trying to Automate this procedure and by Using this Automation we can avoid time consumption for Insurance claim procedure</p><br>

<a style="color:white;  
padding: 22px;  
background-color: black;  
opacity: 85%;  
border-radius: 12px;  
margin-left: 25px;  
margin-bottom: -20px;" href="https://www.facebook.com" class="fa fa-facebook"></a>

<a style="color:white;  
padding: 20px;  
background-color: black;  
opacity: 85%;  
border-radius: 12px;  
margin-left: 25px;  
margin-bottom: -20px;" href="https://www.twitter.com" class="fa fa-twitter"></a>

<a style="color:white;  
padding: 20px;  
background-color: black;  
opacity: 85%;  
border-radius: 12px;  
margin-left: 25px;  
margin-bottom: -20px;" href="https://www.linkedin.com" class="fa fa-linkedin"></a>

<a style="color:white;  
padding: 20px;  
background-color: black;  
opacity: 85%;  
border-radius: 12px;  
margin-left: 25px;  
margin-bottom: -20px;" href="https://www.instagram.com" class="fa fa-instagram"></a>

</center>

</div>

<div class="footer">

<p style="color:white;  
margin-top: 20px;  
text-align: center;"><b>  
COPYRIGHT @ 2022,ALL RIGHTS RESERVED</b>

```
</p>

</div>
</body>
</html>
```

### **Register.html**

```
<!DOCTYPE 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"></script>
  <style>
    .nav.navbar-nav{
      margin-left: 180px;
    }
    .navbar-brand{
      font-size: 22px;
    }
    .footer{
      overflow: hidden;
      background-color: #333;
      position: fixed;
      bottom: 0;
      height: 65px;
      width: 100%;
    }
    input[type=text], input[type=password] {
      width:500px;
      padding: 12px 20px;
      margin: 8px 0;
      display: inline-block;
      background-color: black;
      opacity: 65%;
      color: white;
```

```
border: 1px solid #ccc;
box-sizing: border-box;
border-radius: 10px;
}
```

```
button {
background-color: #04AA6D;
color: white;
padding: 14px 20px;
margin: 8px 0;
border: none;
border-radius: 10px;
cursor: pointer;
width: 250px;
}
```

```
button:hover {
opacity: 0.8;
}
.imgcontainer {
text-align: center;
}
```

```
img.avatar {
border-radius: 50%;
}
```

```
.ayya {
padding: 16px;
}
label{
margin-left:-400px;
}
```

```
</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">
<a class="navbar-brand" href="#"><b>Vehicle Damage Detaction</b></a>
```

```
</div>
<ul class="nav navbar-nav">
  <li><a href="#">Home</a></li>
  <li><a href="login.html">Login</a></li>
  <li class="active"><a href="register.html">Register</a></li>
  <li><a href="prediction.html">Prediction</a></li>
</ul>
</div>
</nav><br><br><br><br>

<div style="margin-top:-55px;" class="container">
  <form action="index.html" method="post">
    <div class="imgcontainer">
      
    </div>
    <center>
      <div class="ayya">
        <label for="uname"><b>Name :</b></label><br>
        <input type="text" placeholder="Enter Username" name="uname" required><br>

        <label for="psw"><b>Email id :</b></label><br>
        <input type="text" placeholder="usermail@gmail.com" name="mail" required><br>

        <label for="psw"><b>Password :</b></label><br>
        <input type="password" placeholder="Enter Password" name="psw" required><br><br>

        <button type="submit">REGISTER</button><br><br>
      </div>
    </center>
  </form>
</div>
<div class="footer">
  <p style="color:white;
    margin-top: 20px;
    text-align: center;"><b>
    COPYRIGHT @ 2022,ALL RIGHTS RESERVED</b>
  </p>
</div>
```



```
</body>
</html>
```

### **Login.html**

```
<!DOCTYPE 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://cdn.jsdelivr.net/npm/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"></script>
  <style>
    .nav.navbar-nav{
      margin-left: 180px;
    }
    .navbar-brand{
      font-size: 22px;
    }
    .footer{
      overflow: hidden;
      background-color: #333;
      position: fixed;
      bottom: 0;
      height: 65px;
      width: 100%;
    }
    input[type=text], input[type=password] {
      width:500px;
      padding: 12px 20px;
      margin: 8px 0;
      display: inline-block;
      background-color: black;
      opacity: 65%;
      color: white;
      border: 1px solid #ccc;
      box-sizing: border-box;
```

```
border-radius: 10px;
}
```

```
button {
background-color: #04AA6D;
color: white;
padding: 14px 20px;
margin: 8px 0;
border: none;
cursor: pointer;
width: 250px;
border-radius: 10px;
}
```

```
button:hover {
opacity: 0.8;
}
.imgcontainer {
text-align: center;
}
```

```
img.avatar {
border-radius: 50%;
}
```

```
.ayya {
padding: 16px;
}
label{
margin-left:-400px;
}
```

```
</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">
```

```
<a class="navbar-brand" href="#"><b>Login Page</b></a>
```

```
</div>
```

```
<ul class="nav navbar-nav">
```

```
<li><a href="#">Home</a></li>
<li class="active"><a href="login.html">Login</a></li>
<li><a href="register.html">Register</a></li>
</ul>
</div>
</nav><br><br><br><br>

<div style="margin-top:-55px;" class="container">
  <form action="index.html" method="post">
    <div class="imgcontainer">
      
    </div>
    <center>
      <div class="ayya">
        <label for="uname"><b>USERNAME</b></label><br>
        <input type="text" placeholder="Enter Username" name="uname" required><br>

        <label for="psw"><b>PASSWORD</b></label><br>
        <input type="password" placeholder="Enter Password" name="psw" required><br><br>

        <button type="submit">LOGIN</button><br>
        <label>
          <input type="checkbox" checked="checked" name="remember"> Remember me
        </label><br>
      </div>
    </center>
  </form>
</div>
<div class="footer">
  <p style="color:white;
margin-top: 20px;
text-align: center;"><b>
  COPYRIGHT @ 2022,ALL RIGHTS RESERVED</b>
</p>
</div>

</body>
</html>
```

### Prediction.html

```
<!DOCTYPE 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"></script>
  <style>
    .nav.navbar-nav{
      margin-left: 280px;
    }
    .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">
      <a class="navbar-brand" href="#"><b>Intelligent Vehicle Damage Assessment and Cost Estimator
for Insurance Companies</b></a>
    </div>
    <ul class="nav navbar-nav">
      <li><a href="#">Home</a></li>
      <li><a href="login.html">Login</a></li>
      <li><a href="register.html">Register</a></li>
      <li class="active"><a href="prediction.html">Prediction</a></li>
```

```

</ul>
</div>
</nav><br><br><br><br>

<div style="margin-top: -45px;" class="container">
  <center>
    <h2 style="font-family:'Franklin Gothic Medium', 'Arial Narrow', Arial, sans-serif;"><b>UPLOAD
IMAGE TO PREDICT</b></h2><br>
    <form action="prediction.html">
      <input style="background-color:black;
        opacity: 78%;
        color: white;
        font-size: 18px;
        width: 250px;"
        type="file" id="myFile" name="filename">
      <br><br>
      <input style="background-color:black;
        opacity: 78%;
        color: white;
        font-size: 18px;
        border-radius: 18px;
        width: 150px;" type="submit">
    </form>
    <br>
    <h2 style="font-family:'Franklin Gothic Medium', 'Arial Narrow', Arial, sans-serif;" > <b> </b></h2>
  </center>
</div>
<div class="footer">
  <p style="color:white;
    margin-top: 20px;
    text-align: center;"><b>
    COPYRIGHT @ 2022,ALL RIGHTS RESERVED</b>
  </p>
</div>

</body>
</html>

```

### **Logout.html**

```
<!DOCTYPE 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"></script>
  <style>
    .nav.navbar-nav{
      margin-left: 180px;
    }
    .navbar-brand{
      font-size: 22px;
    }
    .footer{
      overflow: hidden;
      background-color: #333;
      position: fixed;
      bottom: 0;
      height: 65px;
      width: 100%;
    }
    button{
      background-color: black;
      width: 150px;
      border-radius: 10px;
    }

  </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">
      <a class="navbar-brand" href="#"><b>Intelligent Vehicle Damage Assessment and Cost Estimator
for Insurance Companies</b></a>
    </div>
    <ul class="nav navbar-nav">

```

```

    <li class="active"><a href="#">Home</a></li>
    <li><a href="login.html">Login</a></li>
    <li><a href="register.html">Register</a></li>
    <li><a href="prediction.html">Prediction</a></li>
  </ul>
</div>
</nav><br><br>

<div style="margin-top: 80px;" class="container">
  <center>
    <h3 style="font-size: 42px;font-family: 'Franklin Gothic Medium', 'Arial Narrow', Arial, sans-serif;">Successfully Logged Out !</h3><br>
    <b style="font-size:25px;">Login for More Information</b><br><br><br><br>
    <button><a style="color:white;" href="login.html">LOGIN</a></button>

  </center>
</div>
<div class="footer">
  <p style="color:white;
    margin-top: 20px;
    text-align: center;"><b>
    COPYRIGHT @ 2022,ALL RIGHTS RESERVED</b>
  </p>

</div>
</body>
</html>

```

## GitHub & Project Demo Link

<https://github.com/IBM-EPBL/IBM-Project-28757-1660116483>

<https://www.youtube.com/embed/uEUlgnMhV5g>