Project report on

Intelligent Vehicle Damage Assessment & Cost Estimator For Insurance Companies

TEAM ID: PNT2022TMID31968

A.DHEVAK	B.E(CSE) - [731619104012]
B.GOBI	B.E(CSE) - [731619104015]
S.HARIKRISHNAA	B.E(CSE) - [731619104016]
G.SINTHANA	B.E(CSE) - [731619104058]

CONTENTS

INTELLIGENT VEHICLE DAMAGE ASSESSMENT AND COST ESTIMATOR FOR INSURANCE COMPANIES

ABSTRACT

The motor insurance sector loses a lot of money as a result of leakage claims. The gap between the amount actually paid for claims and the amount that would have been paid had all of the best practises in the industry been followed is known as underwriting leakage. These results have been reached using both testing and visual assessment. However, they do delay the processing of claims. By reducing loss adjustment costs, improvements in the First Notice of Loss and the speed with which claims are examined and evaluated might save a lot of money in the automobile insurance claims process. Car damage is automatically identified and classified using advanced picture analysis and pattern recognition technology, a method for automatically locating the damaged area by comparing photos of the automobile from before and after an accident. This project's proposed a CNN model that can recognise a car's damage area. If users upload images, the model can evaluate damage (be it a dent or scratch from an object), and it can also estimate the extent of damage. Insurance firms can handle claims more efficiently as a result. When accepting a car loan, particularly one for a used vehicle, len

1. INTRODUCTION

1.1 PROJECT OVERVIEW

Vehicles are significantly rising in today's globe. Because there are more cars on the road, accidents happen more frequently because individuals are driving them at high speeds. When an accident occurs, the people file a claim with their auto insurance for the necessary funds to repair the car, because to inaccurate claims, the corporation behaves improperly and doesn’t make payments now. This occurs as a result of claims leakage, which is the discrepancy between the sums secured by the firm and the sums that it should have secured in accordance with the claims. Even if the car's damage is easily seen, the claim procedure will take longer than usual in accordance with company policy. Despite the company's best efforts, there is a delay in the claims procedure. Differentiate the suggested approach to perhaps speed up the process of assessing automotive damage. Instead of taking hours to accomplish automotive damage detection if it were visually inspected, a system may perform it in a minute by just providing a picture of a damaged vehicle. The system can determine the analysis of the damage, the position of the damage, and the degree of the damage using machine learning and computer vision.

1.2 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 act

2. LITERATURE REVIEW

2.1 EXISTING PROBLEM

2.1.1. TITLE: Convolutional Neural Networks for vehicle damage detection, 2021

AUTHOR NAME: R.E. Ruitenbeek

Vehicle damage is becoming an increasing liability for shared mobility providers. The high number of driver handovers necessitates the use of an accurate and quick inspection system capable of detecting minor damage and categorising it. To address this, a damage detection model is created that locates vehicle damages and categorises them into twelve groups. To improve detection performance, multiple deep learning algorithms are used, and the effect of various transfer learning and training strategies is evaluated. The final model, which was trained on over 10,000 damage photos, can detect minor defects in a variety of environments, including water and dirt. A performance evaluation using domain experts reveals that the model performs comparably. Furthermore, the model is tested in a specially designed light street, demonstrating how strong reflections complicate detection performance.

2.1.2. TITLE: Deep Learning Based Car Damage Detection, Classification and Severity AUTHOR NAME: Ritik Gandhi1, 2021

Because it is a manual procedure, resolving a claim in the accident insurance sector takes time, and there is a gap between the ideal and real settlement. We are using deep learning models to not only speed up the process, but also to deliver better customer service and boost insurance company profitability. In this paper, we use multiple pre trained models such as VGG 16, VGG 19, Resnet50, and DENSENET to choose the top performing models. We first use the Resnet50 model to determine whether or not the automobile is damaged, and if it is, we utilise the WPOD-net model to identify the licence plate. The YOLO model is used to detect the affected region. Finally, the damage severity is implemented using the DENSENET model. We discovered that transfer learning outperforms fine-tuning after applying multiple models. Furthermore, we present a framework that incorporates all of this into a single application, assisting in the automation of the insurance sector.

2.1.3. TITLE: Car Damage Assessment to Automate Insurance Claim, 2022

AUTHOR NAME: Siddhant Gole

Car damage inspection is an essential stage in claim sanctioning, and the procedure is frequently delayed and erroneous, resulting in claim leakages. Our task is to create a web application connected with a deep learning model that receives user input in the form of photographs of damaged automobiles and assesses the damage to provide a cost report that the firm can use to approve the first reimbursement. To detect and localise the damaged regions, the model employs the MASK R-CNN algorithm in conjunction with Faster RCNN. The device also includes a security module that detects and stores the vehicle's licence plate, body type, and logo data for verification. Our goal is to develop a system that can detect damaged parts of a car using images and generate a cost analysis report that the company can use to sanction the insurance amount. The task would be to develop an end-to-end system for detecting and classifying types of damage via images, as well as to implement a car number plate, body type, and logo detection system to verify car details.

2.1.4. TITLE: Using Machine Learning Models To Compare Various Resampling Methods In Predicting Insurance Fraud, 2021

AUTHOR NAME: Ruixing Ming

Insurance fraud is one of the most prevalent kinds of fraud. In particular, the cost of automotive insurance fraud is significant for property insurance companies and has a longterm influence on insurance businesses' pricing tactics. And Car insurance fraud detection has become required in order to reduce insurance prices. Although predictive models for detecting insurance fraud are widely used in practise, there are few published research on the use of machine learning algorithms to identify insurance fraud, most likely due to a lack of available data. Evaluate 13 machine learning approaches in this paper using real-world data. Predicting insurance fraud has become a big difficulty due to the uneven datasets in this domain. Because our data consists primarily of "non-fraud claims" with a minor number of "fraud claims." As a result, classification models predict fraud poorly; thus, the current study seeks to propose an approach that improves machine learning algorithms' results by using resampling techniques, such as Random over Sampler, Random under Sampler, and hybrid methods, to address the issue of unbalanced data.

2.1.5. TITLE: Evaluation of deep learning algorithms for semantic segmentation of car parts, 2021

AUTHOR NAME: Kitsuchart Pasupa

One of the most significant operations in the auto insurance industry is the evaluation of accident-damaged vehicles. Currently, each fundamental component must be manually examined. It is believed that in the future, a smart device will be able to do this evaluation more effectively. We analysed and compared five deep learning algorithms for semantic segmentation of automobile parts in this work. Mask R-CNN served as the baseline reference method, while the other algorithms were HTC, CBNet, PANet, and GCNet. These five algorithms were used to do instance segmentation runs. HTC's ResNet-50 algorithm was the best for segmentation on various types of cars such as sedans, trucks, and SUVs. On our initial data set, it attained a mean average accuracy of 55.2 when distinct labels were allocated to the left and right sides, and 59.1 when a single label was assigned to both sides. Furthermore, the models from each method were verified for robustness by running them on photos of components in a real-world setting with varying weather conditions such as snow, frost, fog, and different lighting situations. When left and right sides were assigned different labels, GCNet achieved a mean performance under corruption, mPC = 35.2, and a relative degradation of performance on corrupted data, compared to clean data (rPC), of 64.4%, and mPC = 38.1 and rPC = 69.6% when left and right sides were considered the same part.

2.2 REFERENCES

[1]. R.E. Ruitenbeek, Convolutional Neural Networks for vehicle damage detection, 2021

[2]. Ritik Gandhi1Deep Learning Based Car Damage Detection, Classification and Severity, 2021

[3]. Siddhant Gole, Car Damage Assessment to Automate Insurance Claim, 2022

[4]. Ruixing Ming, Using Machine Learning Models To Compare Various Resampling Methods In Predicting Insurance Fraud, 2021

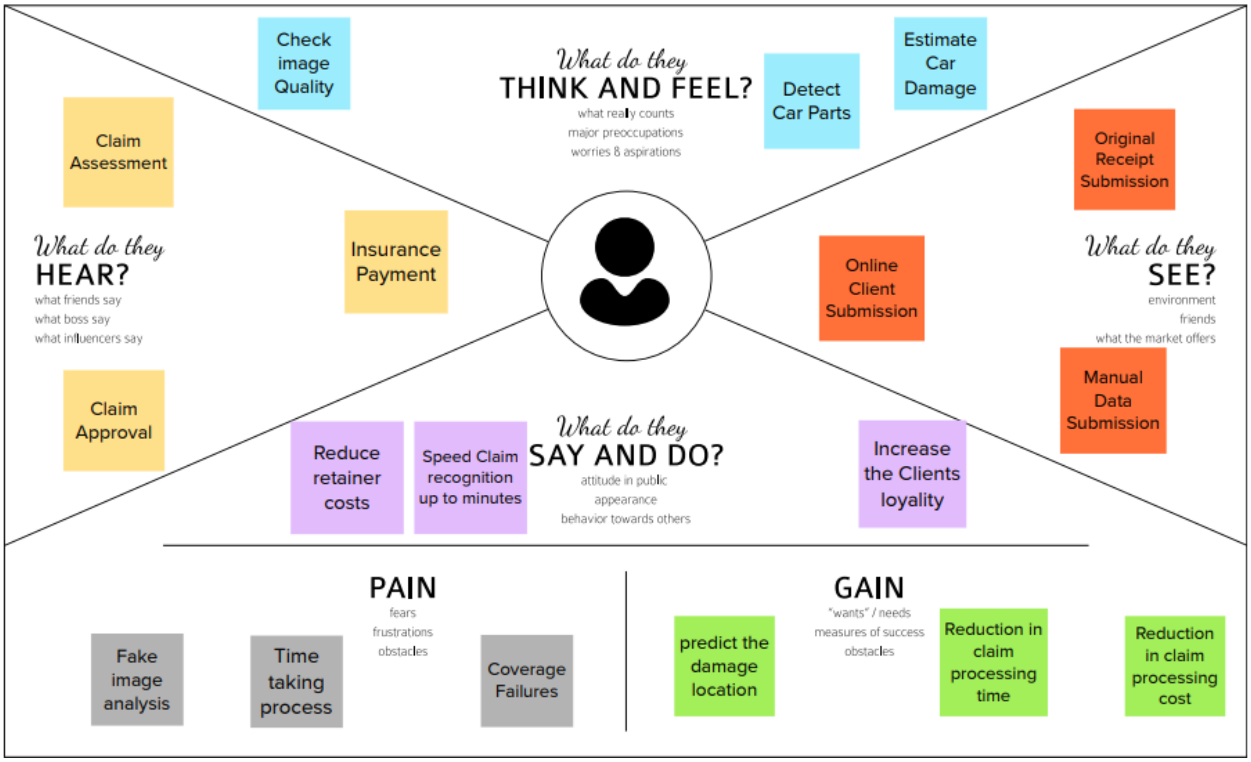
[5]. Kitsuchart Pasupa, Evaluation of deep learning algorithms for semantic segmentation of car parts, 2021

2.3 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.

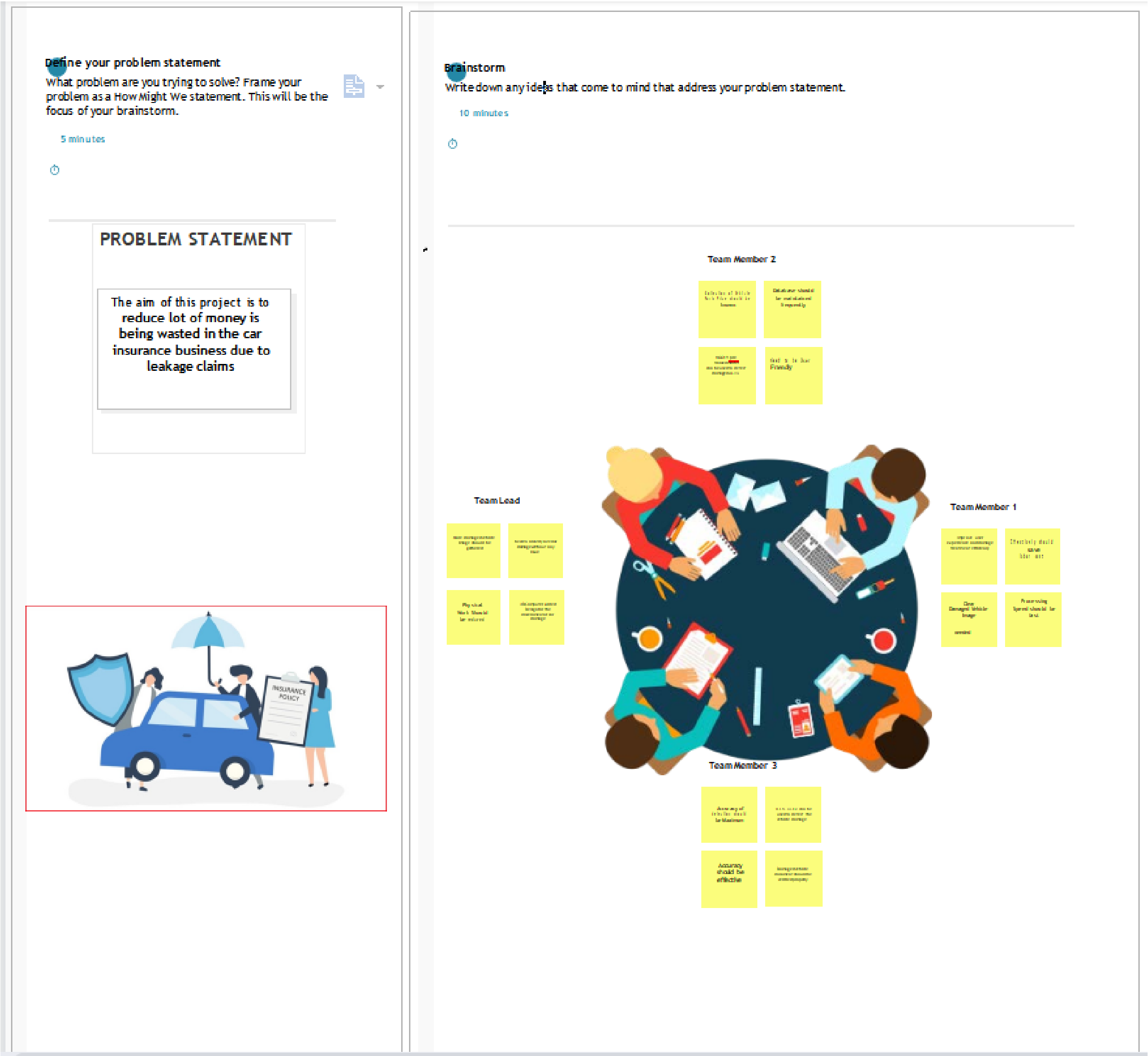
3. IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING

STEP 1 & STEP 2:



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

PROBLEM STATEMENT

The aim of this project is to reduce lot of money is being wasted in the car insurance business due to leakage claims

Brainstorm

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

10 minutes

Team Member 2

- Collection of Vehicle [illegible] should be [illegible]
- Database should be maintained frequently
- [illegible]
- [illegible] Friendly

Team Lead

- [illegible]
- [illegible]
- Physical Work Should be reduced
- [illegible]

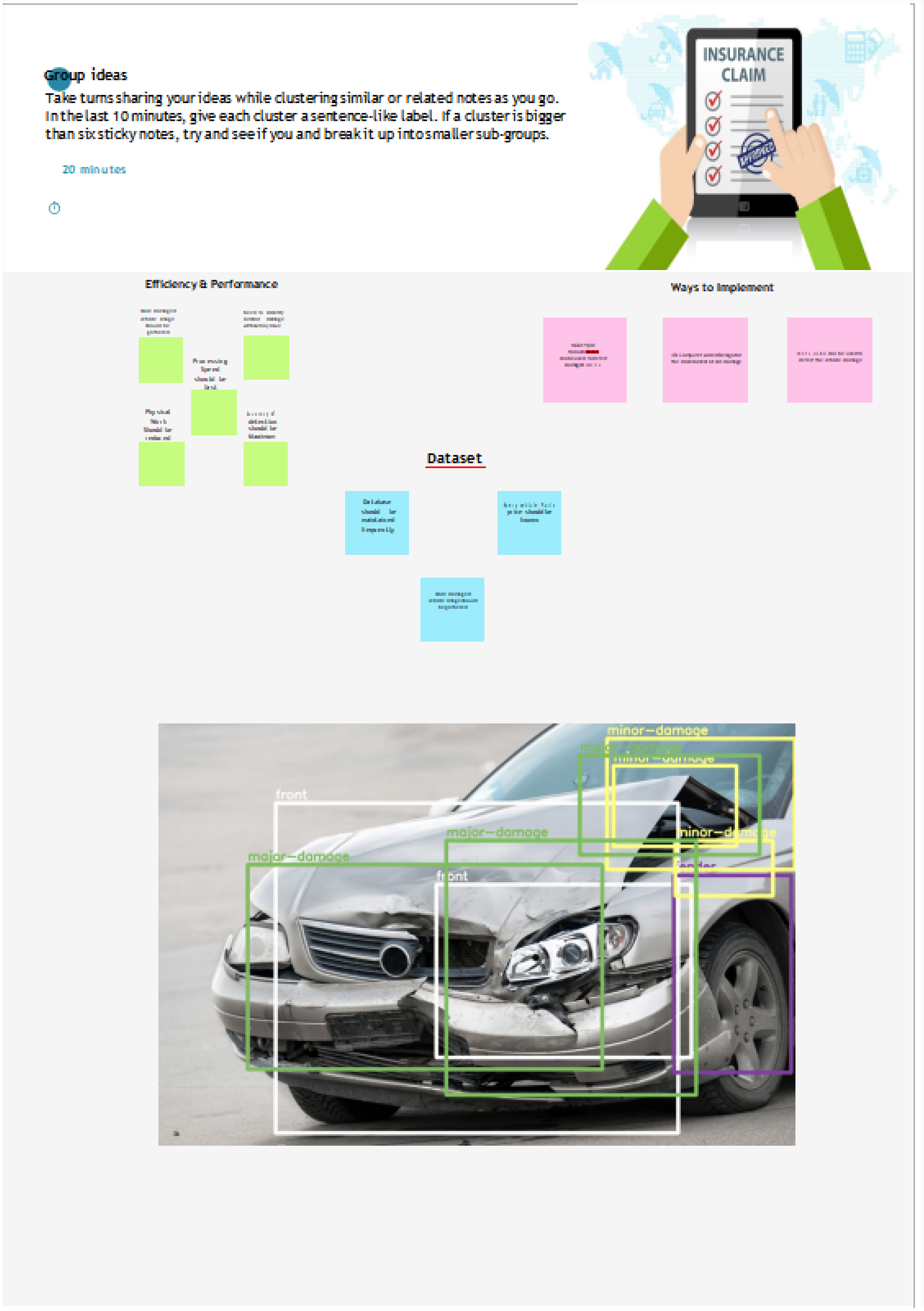
Team Member 1

- [illegible]
- Effectively should [illegible]
- Clear Damaged Vehicle Image [illegible]
- Processing Speed should be [illegible]

Team Member 3

- Accuracy of [illegible] should be Maximum
- [illegible]
- Accuracy should be effective
- [illegible]

STEP 3:



Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Efficiency & Performance

[illegible]

[illegible]

Processing Speed should be fast

Physical Work Should be reduced

Accuracy of detection should be Maximum

Ways to Implement

[illegible]

[illegible]

[illegible]

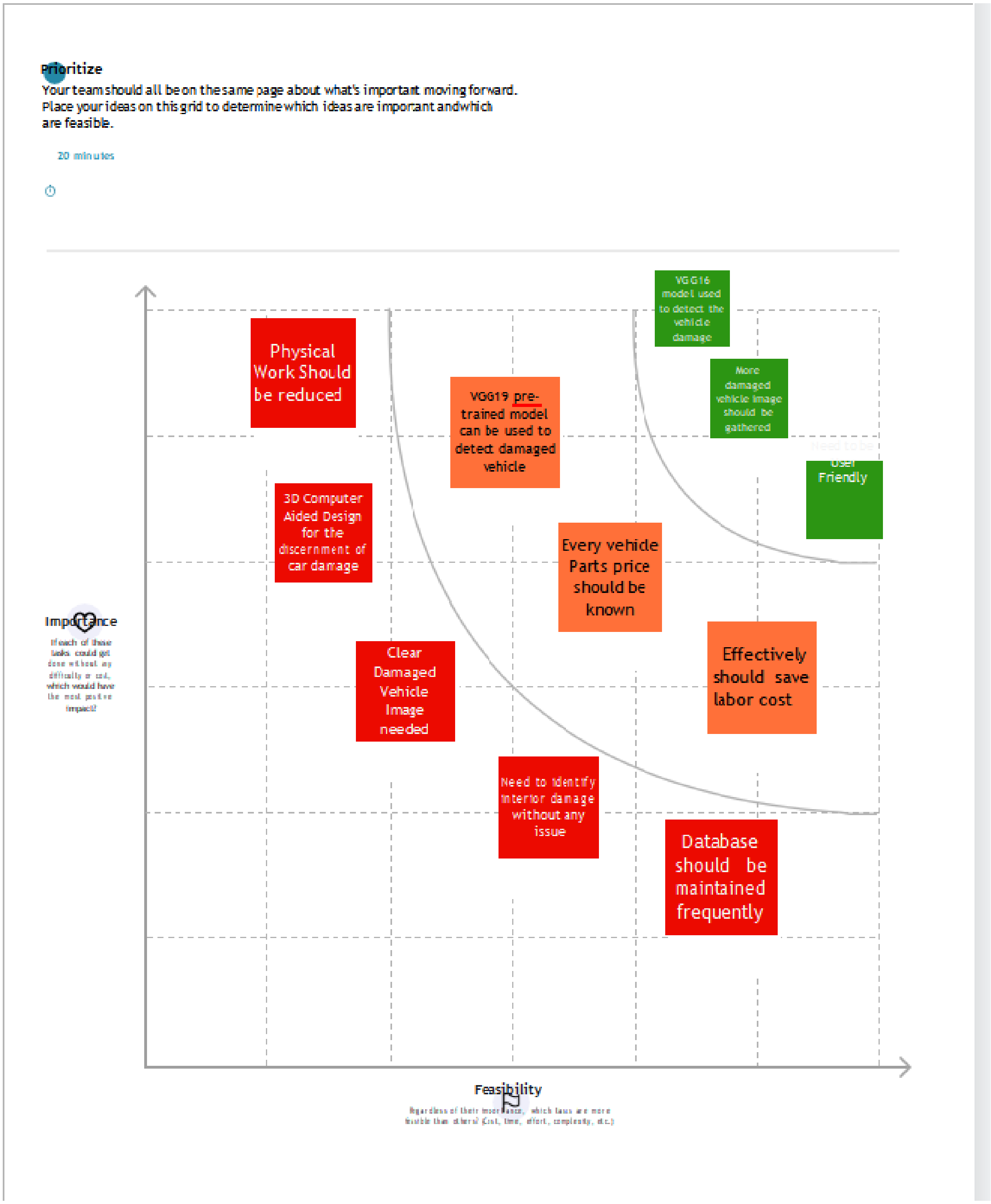
Dataset

Database should be maintained frequently

Every vehicle Parts price should be known

[illegible]

STEP 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 imporant andwhich are feasible.

20 minutes

Physical Work Should be reduced

VGG19 pre-trained model can be used to detect damaged vehicle

VGG16 model used to detect the vehicle damage

More damaged vehicle image should be gathered

Need to be User Friendly

3D Computer Aided Design for the discernment of car damage

Every vehicle Parts price should be known

Clear Damaged Vehicle Image needed

Effectively should save labor cost

Need to identify interior damage without any issue

Database should be maintained frequently

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Feasibility

Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

3.3 PROPOSED SOLUTION

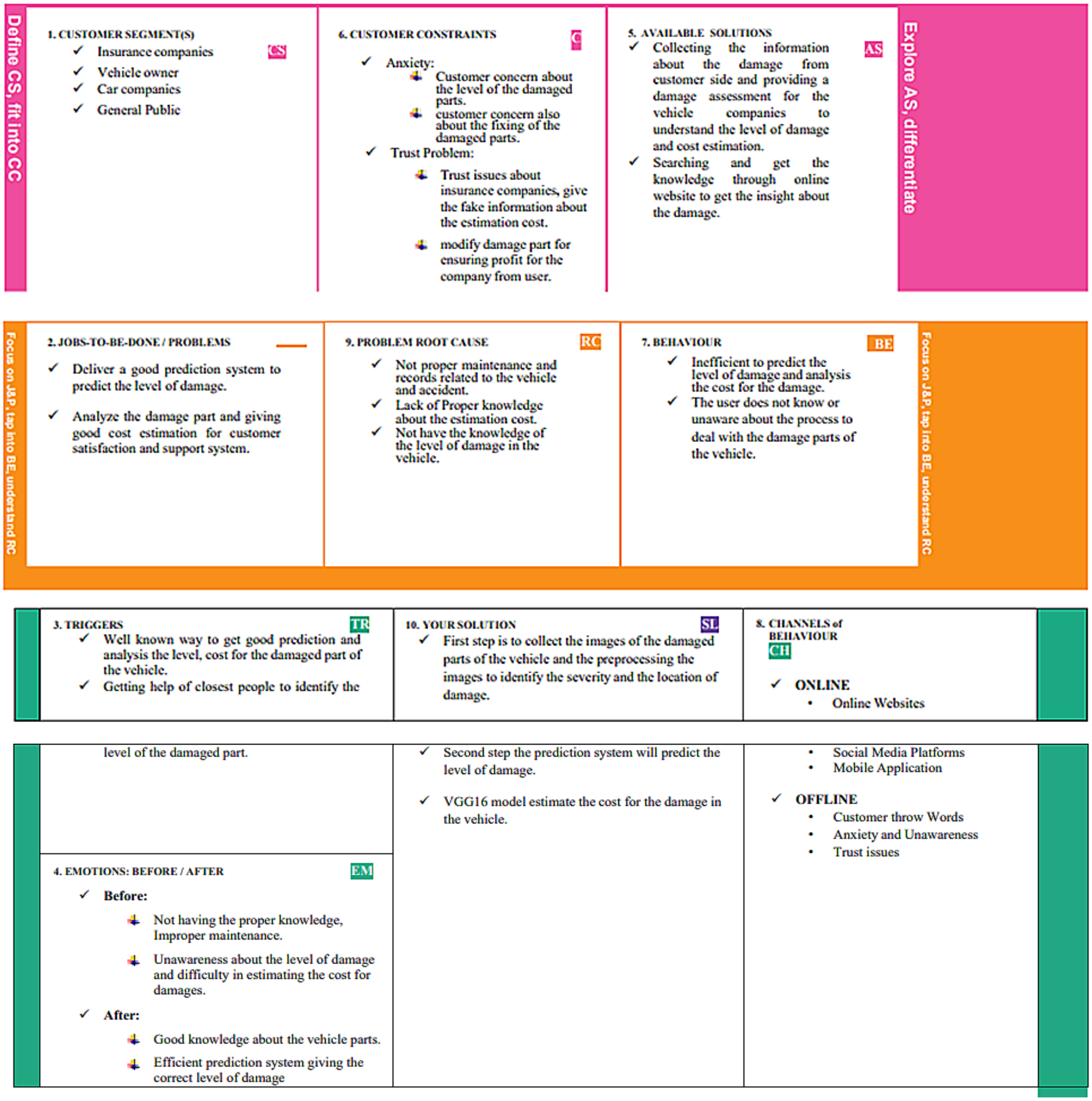
The proposed approach collects photographs of a person's damaged automobile, then utilises those images as input for a deep learning model that use image processing to recognise the elements of the image and determine the percentage of the vehicles” damage. After then, the images are separated into two 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.

S.no.	Parameter	Description
1.	Problem Statement	1. Nowadays lot of money is being wasted in the car insurance business due to leakage claims. It is characterized as the discrepancy between theactual payment of claims madeandthe sum that should have been paid if all of the industry's leading practices were applied. Visualexamination and testing may be used as one of the possible results. However, they impose delays in the processing of claims. There is no easy way of accessing and knowing about the part of thevehicle getting damaged.
2.	Idea / Solution description	1. The aim of this project is to build a VGG16 modelthat can detect the area of damage on a car. Therationale 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 scratch from andestimates the cost of damage. This model can also be used by lendersif they areunderwriting a carloan, especially fora used car.

3.	Novelty / Uniqueness	Intelligent damage determination system can be used to determine the appearance damage of vehicles in small cases. The system completes the whole processof survey and damage determinationthrough four functions. They are: 1. Accident investigation 2. Intelligent image damageassessment 3. Damage result output 4. Vehicle insurance anti-fraud
4.	Social Impact / Customer Satisfaction	1. Then at last it generates a detailed report on analysis of the automobile and use this to claim one’sreimbursement with the insurance company 2. This project can be used to save time for calculating the area and level of the damagequickly such thatthe insurance claimcan bemadeefficiently.
5.	Business Model (RevenueModel)	AI possibilities thatenable you to provide moreclient-based services with better Options for business. Generally, service allows quickunderstanding and assessment of the levelof damage to a car and the location of the damage. It also allows for detecting whether the car is really damaged as a result of a car incident, or is it simply dirty.
6.	Scalability of the Solution	1. It segregates the pictures based on 2 factors which are replace and repair. i.e. if the damage percentage exceeds say 80% then the damaged part has to be replaced, whereas in the other case “Replace” even in this caseit calculates the reimbursement amount based on its damaged percentage

3.4 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%.



Define CS, fit into CC
Explore AS, differentiate
Focus on J&P, tap into BE, understand RC
Focus on J&P, tap into BE, understand RC

1. CUSTOMER SEGMENT(S) CS

- ✓ Insurance companies
- ✓ Vehicle owner
- ✓ Car companies
- ✓ General Public

6. CUSTOMER CONSTRAINTS CC

- ✓ Anxiety:
  - Customer concern about the level of the damaged parts.
  - customer concern also about the fixing of the damaged parts.
- ✓ Trust Problem:
  - Trust issues about insurance companies, give the fake information about the estimation cost.
  - modify damage part for ensuring profit for the company from user.

5. AVAILABLE SOLUTIONS AS

- ✓ Collecting the information about the damage from customer side and providing a damage assessment for the vehicle companies to understand the level of damage and cost estimation.
- ✓ Searching and get the knowledge through online website to get the insight about the damage.

2. JOBS-TO-BE-DONE / PROBLEMS

- ✓ Deliver a good prediction system to predict the level of damage.
- ✓ Analyze the damage part and giving good cost estimation for customer satisfaction and support system.

9. PROBLEM ROOT CAUSE RC

- ✓ Not proper maintenance and records related to the vehicle and accident.
- ✓ Lack of Proper knowledge about the estimation cost.
- ✓ Not have the knowledge of the level of damage in the vehicle.

7. BEHAVIOUR BE

- ✓ Inefficient to predict the level of damage and analysis the cost for the damage.
- ✓ The user does not know or unaware about the process to deal with the damage parts of the vehicle.

3. TRIGGERS TR

- ✓ Well known way to get good prediction and analysis the level, cost for the damaged part of the vehicle.
- ✓ Getting help of closest people to identify the level of the damaged part.

4. EMOTIONS: BEFORE / AFTER EM

- ✓ **Before:**
  - Not having the proper knowledge, Improper maintenance.
  - Unawareness about the level of damage and difficulty in estimating the cost for damages.
- ✓ **After:**
  - Good knowledge about the vehicle parts.
  - Efficient prediction system giving the correct level of damage

10. YOUR SOLUTION SL

- ✓ First step is to collect the images of the damaged parts of the vehicle and the preprocessing the images to identify the severity and the location of damage.
- ✓ Second step the prediction system will predict the level of damage.
- ✓ VGG16 model estimate the cost for the damage in the vehicle.

8. CHANNELS of BEHAVIOUR CH

- ✓ **ONLINE**
  - Online Websites
  - Social Media Platforms
  - Mobile Application
- ✓ **OFFLINE**
  - Customer throw Words
  - Anxiety and Unawareness
  - Trust issues

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT

Framework Creation:

This approach provides a way for evaluating vehicle damage that insurance companies may utilise when processing claims. This module offered a framework for submitting a vehicle's damaged parts and requesting insurance from an organisation. The dataset needed to train the Damage Detection and it has prepared by an admin. In order to make the images useful for training, they were manually annotated; damages were categorised into 7 distinct types such as Door Dent, Bumper Dent, Body Scratch, Broken Windshield, Broken Glass, Broken Lights and Smash By modifying its settings and loading the learned dataset, the model was set up to train on user data.

Object Detection

Employ a specially trained CNN model utilising transfer learning on to identify the object. This model takes different forms of damage into account validation sets such as Bumper Dent, Bumper Scratch, Door Dent, Door Scratch, Glass Shattered, Head Lamp, Tail Lamp, Undamaged, etc. The classification of car damage severity is as follows: Minor Damage which typically involves slight damage to the vehicle that does not impede the vehicle to cause severe injuries. It includes the headlight scratches, dents and digs in the hood or windshield, from gravel or debris, scratches in the paint. Moderate Damage which deals with any kind of damage that impairs the functionality of the vehicle in any way is moderate damage. It involves large dents in hood, fender or door of a car. Even if the airbags are deployed during collision, then it comes under moderate damage. Severe Damage – Structural damages such as bent or twisted frames, broken/bent axels, and missing pieces of the vehicles and in some cases even the destruction of airbags. These types of damages are a big threat to the human life.

Damage Detection:

To locate damaged areas in a picture and create a bounding box around each object found, object localization is used which combines object localisation and classification to provide a bounding box and a class for each item for object detection. Use CNN to generate a convolutional features map from an image to forecast the class and bounding box of an item. If the car is undamaged then it simply detects it and if it’s a damaged one, then there are further localizations made models. The model shows accuracy on the validation set. To automate such a system, the easiest method would be to build a Convolution Neural Network model capable of accepting images from the user and determining the location and severity of the damage. The model is required to pass through multiple checks would first ensure that given image is that of a car and then to ensure that it is in fact damaged. These are the gate checks before the analysis begins. Once all the gate checks have been validated, the damage check will commence. The model will predict the location of the damage as in front, side or rear, and the severity of such damage as in minor, moderate or severe.

Claim Insurance

The procedure of claiming insurance is done by persons who are in need. For access to the company's insurance, the user must register and authenticate. After that, users may access their insurance information and submit an insurance claim request. The request for an insurance claim can be viewed and approved by the insurance company. Once the damaged image has been uploaded and the degree of the damage has been determined, the user may receive insurance only if the firm accepts the damaged image and the condition is greater than 80%.

4.2 NON FUNCTIONAL REQUIREMENTS

Usability

The system shall allow the users to access the system with pc using web application. The system uses a web application as an interface. The system is user friendly which makes the system easy

Availability

The system is available 100% for the user and is used 24 hrs a day and 365 days a year. The system shall be operational 24 hours a day and 7 days a week.

Scalability

Scalability is the measure of a system's ability to increase or decrease in performance and cost in response to changes in application and system processing demands.

Security

A security requirement is a statement of needed security functionality that ensures one of many different security properties of software is being satisfied.

Performance

The information is refreshed depending upon whether some updates have occurred or not in the application. The system shall respond to the member in not less than two seconds from the time of the request submittal. The system shall be allowed to take more time when doing large processing jobs. Responses to view information shall take no longer than 5 seconds to appear on the screen.

Reliability

The system has to be 100% reliable due to the importance of data and the damages that can be caused by incorrect or incomplete data. The system will run 7 days a week. 24 hours a day.

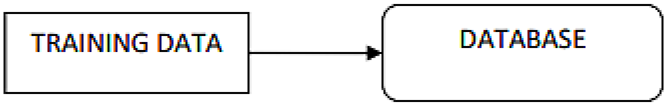
5. PROJECT DESIGN

5.1 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.

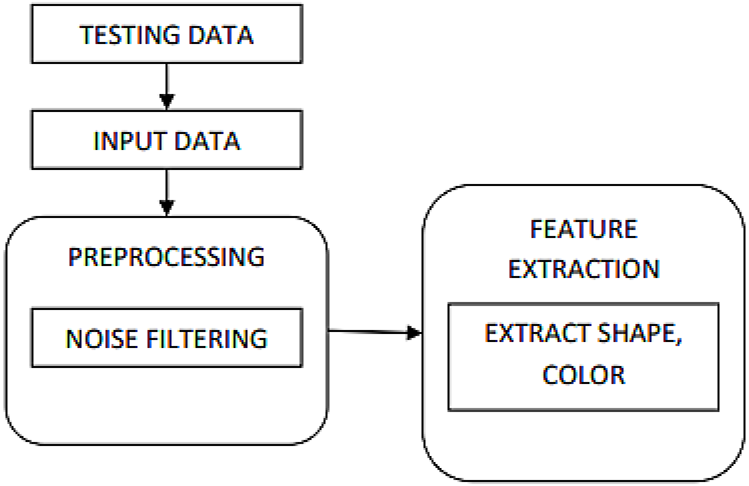
LEVEL 0

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



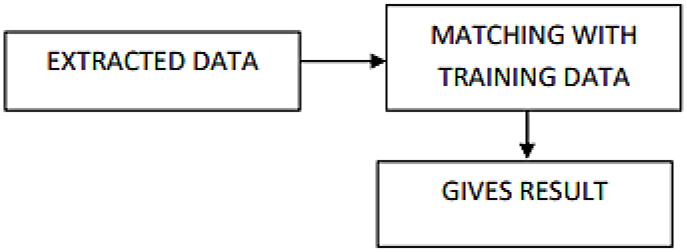
LEVEL 1

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.



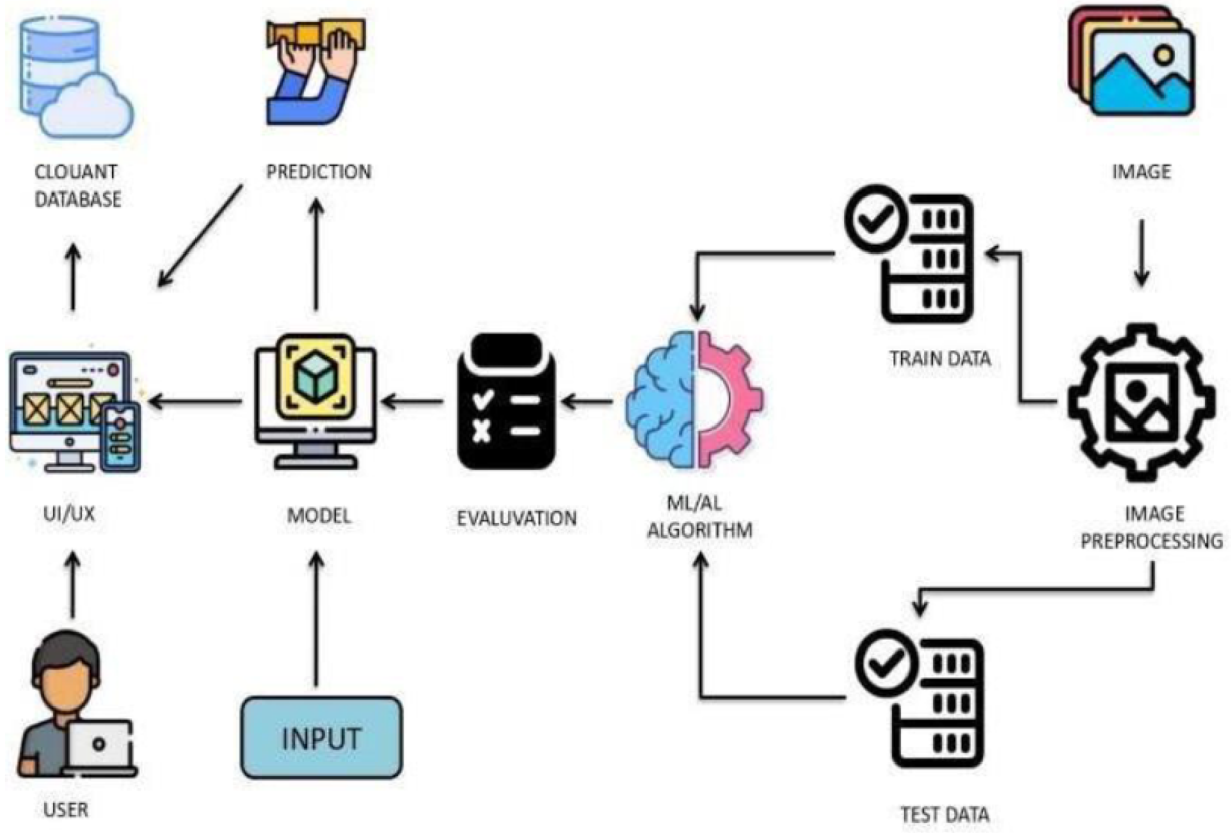
LEVEL 2

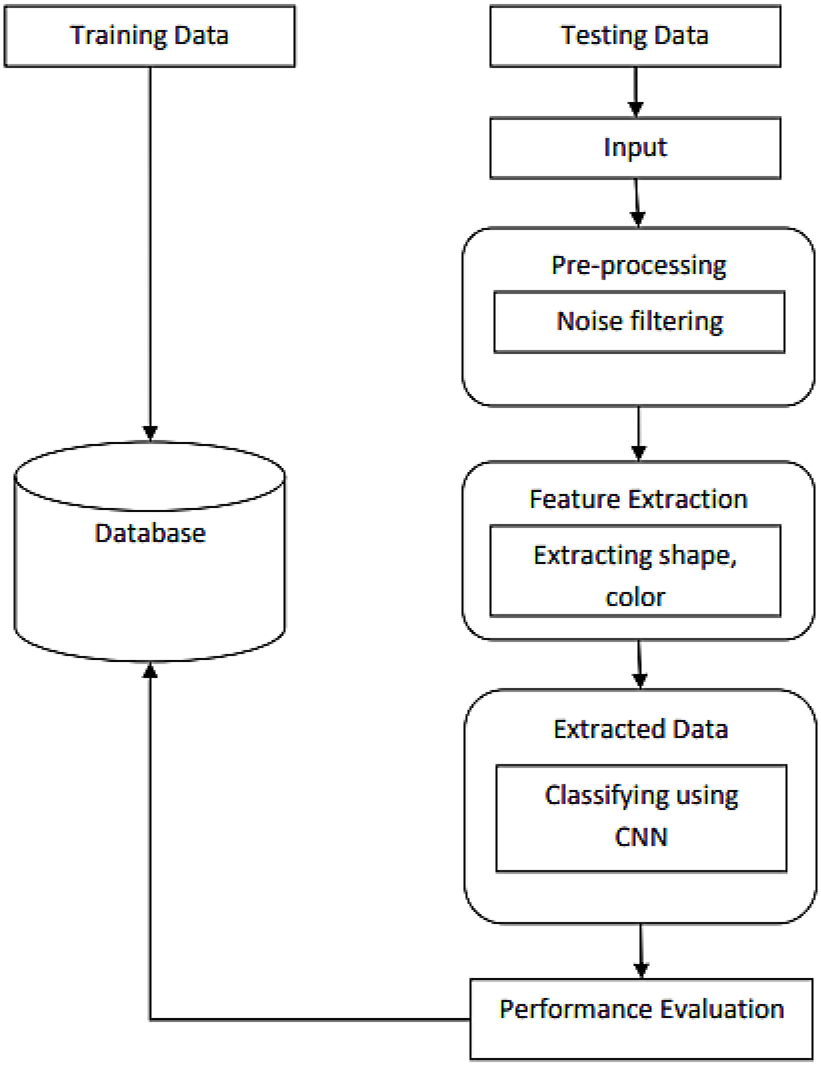
A Data Flow Diagram (DFD) tracks processes and their data paths within the business or system boundary under investigation. A DFD defines each domain boundary and illustrates the logical movement and transformation of data within the defined boundary. The diagram shows 'what' input data enters the domain, '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.



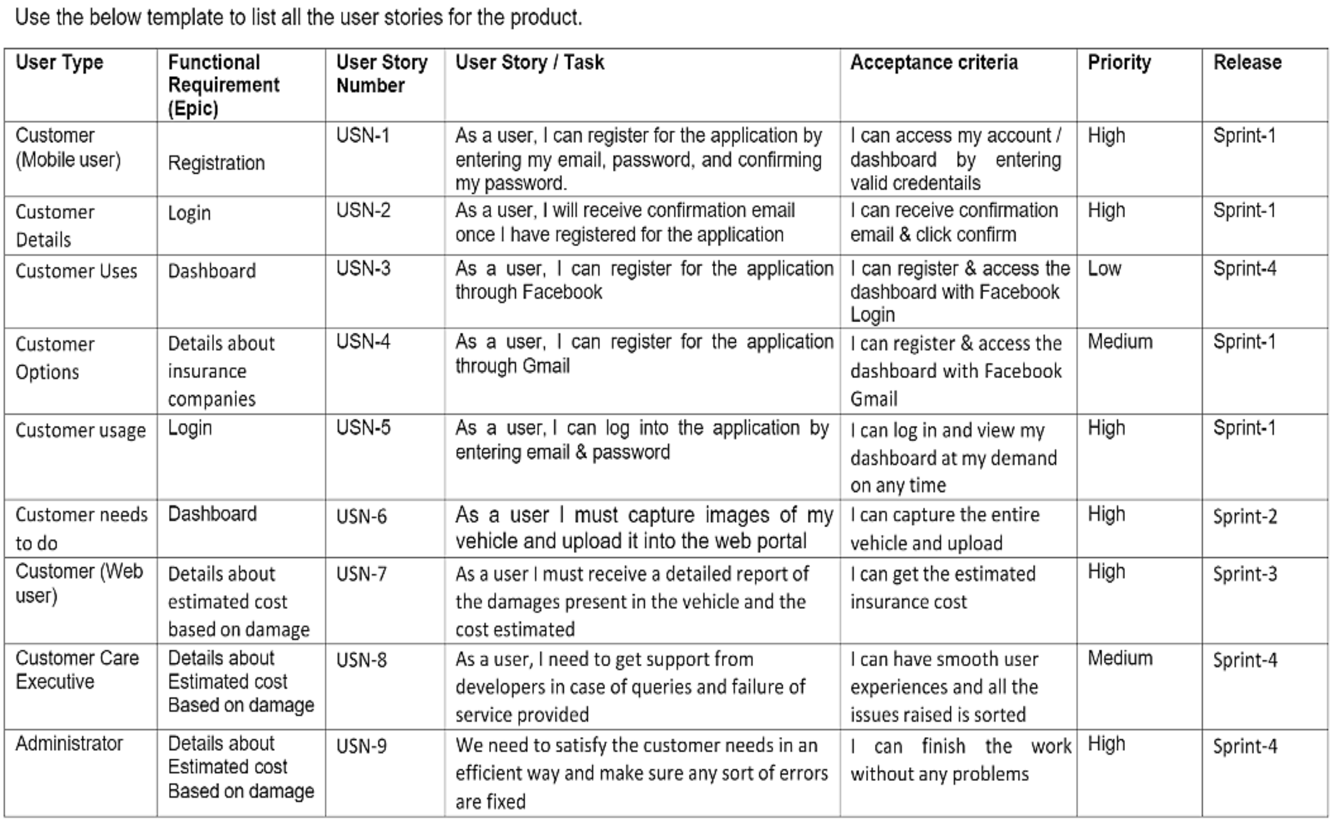
5.2 SOLUTION & TECHNICAL ARCHITECTURE

A system architecture or systems architecture is the conceptual model that defines the structure, behavior, and more views of a system. An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structures and behaviors of the system. System architecture can comprise system components, the externally visible properties of those components, the relationships (e.g. the behavior) between them. It can provide a plan from which products can be procured, and systems developed, that will work together to implement the overall system. There have been efforts to formalize languages to describe system architecture, collectively these are called architecture description languages (ADLs).




Training Data
Testing Data
Input
Pre-processing
Noise filtering
Database
Feature Extraction
Extracting shape, color
Extracted Data
Classifying using CNN
Performance Evaluation

5.3 USER STORIES



Use the below template to list all the user stories for the product.

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 by entering valid credentails	High	Sprint-1
Customer Details	Login	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
Customer Uses	Dashboard	USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-4
Customer Options	Details about insurance companies	USN-4	As a user, I can register for the application through Gmail	I can register & access the dashboard with Facebook Gmail	Medium	Sprint-1
Customer usage	Login	USN-5	As a user, I can log into the application by entering email & password	I can log in and view my dashboard at my demand on any time	High	Sprint-1
Customer needs to do	Dashboard	USN-6	As a user I must capture images of my vehicle and upload it into the web portal	I can capture the entire vehicle and upload	High	Sprint-2
Customer (Web user)	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	I can get the estimated insurance cost	High	Sprint-3
Customer Care Executive	Details about Estimated cost Based on damage	USN-8	As a user, I need to get support from developers in case of queries and failure of service provided	I can have smooth user experiences and all the issues raised is sorted	Medium	Sprint-4
Administrator	Details about Estimated cost Based on damage	USN-9	We need to satisfy the customer needs in an efficient way and make sure any sort of errors are fixed	I can finish the work without any problems	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As an owner of a particular vehicle, I can log into the application by entering email & password.	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G
Sprint-1	User Confirmation	USN-2	As an owner of a particular Vehicle , I will receiveconfirmation email once I have registered for the application.	1	Medium	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G
Sprint-1	Login	USN-3	As an owner of a particular vehicle, I can log into theapplication by entering email & password.	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G
Sprint-2	Data Collection	USN-1	Download the datasetused in intelligent vehicle damage assessment & cost estimator for insurance companies.	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G
Sprint-2	Image Pre Processing	USN-1	Improve the image data that suppresses unwilling distortions orenhances some image features important for further processing, although performing somegeometric transformations ofimages like rotation, scaling, etc.	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G

Sprint-3	Model Building	USN-1	Define the modelarchitecture and adding CNN layer and testing , savingthe model.	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G
Sprint-3	Cloud DB	USN-1	Below are steps that need to follow for creating andusing cloudservice. ● Register & login to IBMcloud ● Create service instance ● Creating service credentials ● Launch cloud DB ● Create database	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G
Sprint-4	Application Building	USN-1	Building a web application that is integrated into the modelwe built. A UI is provided to the user where he has uploaded the image. Based on the savedmodel, the uploaded image will be analyzed and prediction is showcased on the UI.	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G
Sprint-4	Train The Model On IBM	USN-1	Build Deep learning model and computer vision Using the IBM cloud.	2	High	DHEVAK A GOBI B HARIKRISHNAA S SINTHANA G

6.2 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	4 Days	24 Oct 2022	27 Oct 2022	20	29 Oct 2022
Sprint-2	20	5 Days	28 Oct 2022	01 Nov 2022	20	04 Nov 2022
Sprint-3	20	8 Days	02 Nov 2022	09 Nov 2022	20	11 Nov 2022
Sprint-4	20	9 Days	10 Nov 2022	18 Nov 2022	20	19 Nov 2022

Velocity :

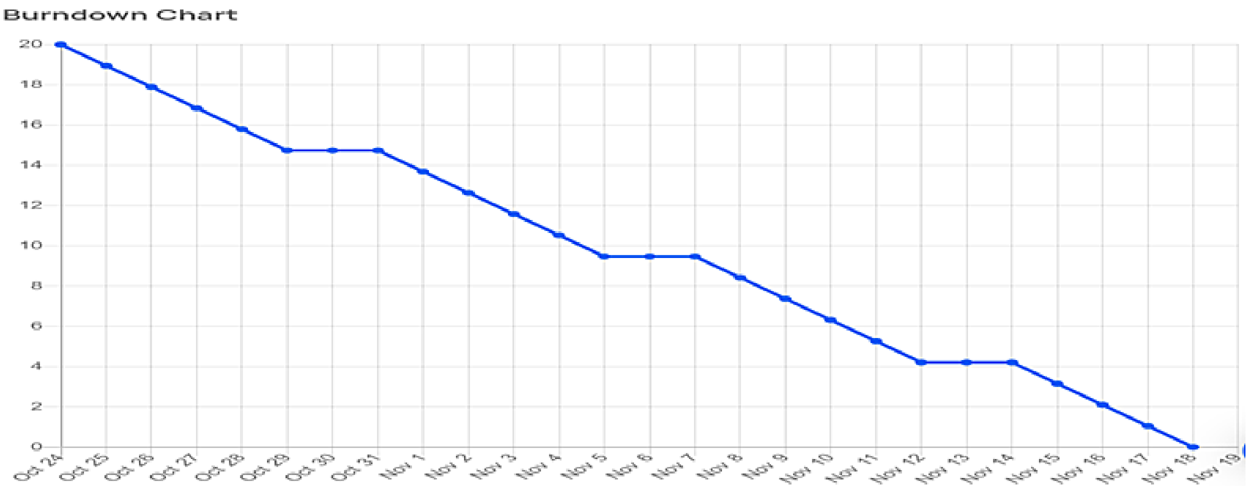
We have a 10-daysprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story pointsper day)

AV= Sprint duration/Velocity

= 20/6

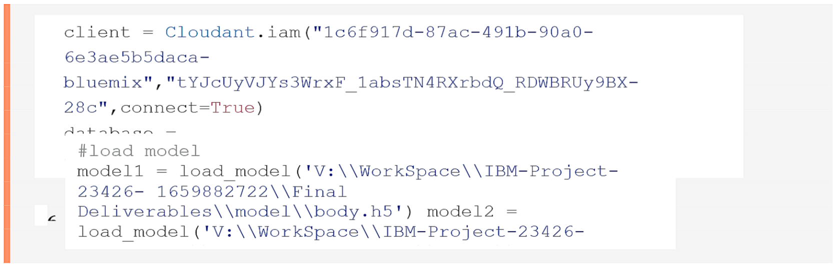
= 3

6.3 REPORTS FROM JIRA



7. CODING & SOLUTIONING

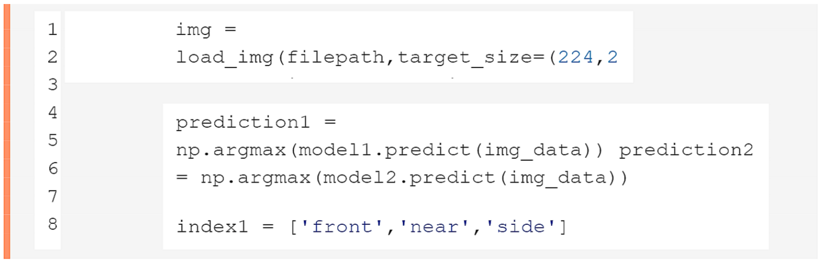
7.1 FEATURE 1



```
client = Cloudant.iam("1c6f917d-87ac-491b-90a0-
6e3ae5b5daca-
bluemix","tYJcUyVJYs3WrxF_1absTN4RXrbdQ_RDWBRUy9BX-
28c",connect=True)
database =
 #load model
 model1 = load_model('V:\\WorkSpace\\IBM-Project-
 23426- 1659882722\\Final
 Deliverables\\model\\body.h5') model2 =
 load_model('V:\\WorkSpace\\IBM-Project-23426-
```

The feature 1 gives access to the trained deep learning models for predicting mulitple damages in various areas in the vechile and connected with the IBM Waston Database for storing the user data.

7.2 FEATURE 2



```
img =
load_img(filepath,target_size=(224,2

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

index1 = ['front','near','side']
```

feature 2 enables the web application to predict the incomming image from the user into the given labels. The code gets the image, convert into pixcels and load into the model. Based on the predicted results, the algorithm will returns the value as the estimated cost.

7.3 DATABASE SCHEMA

8. TESTING

8.1 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.

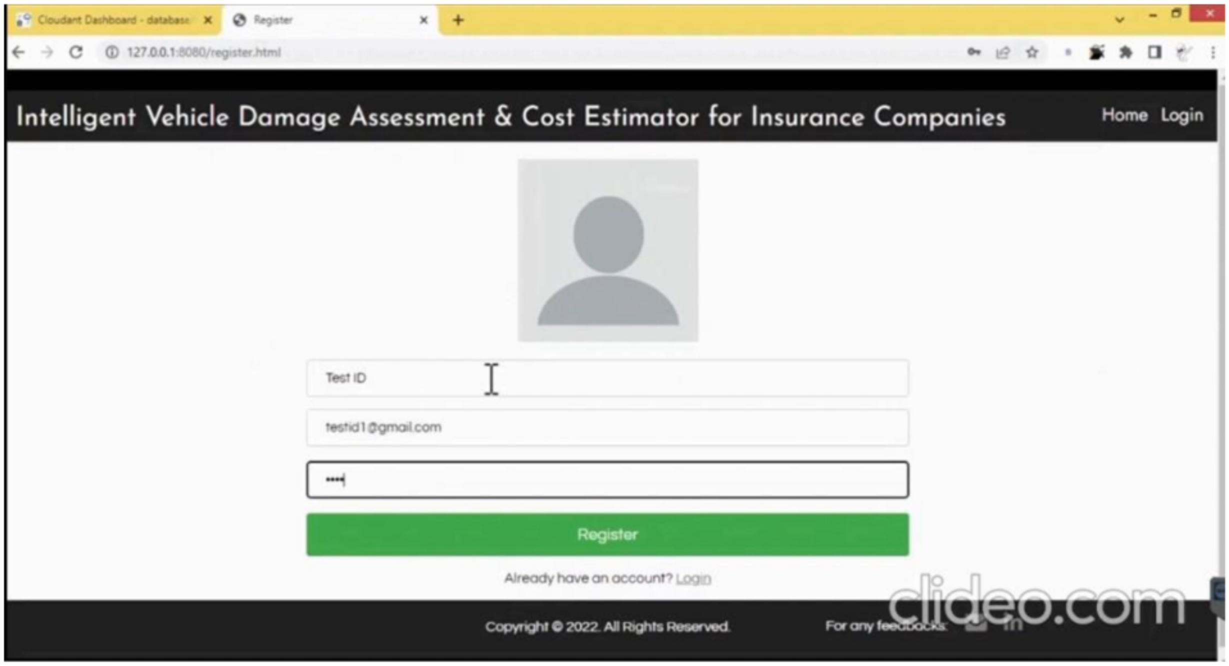
1.User Login and Registration test

2.Database Update Test

3.Prediction Test

8.2 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).


Cloudant Dashboard - database
Register
127.0.0.1:8080/register.html
Home
Login
Register
Already have an account? Login
For any feedbacks:
clideo.com

Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

Test ID

testid1@gmail.com

••••

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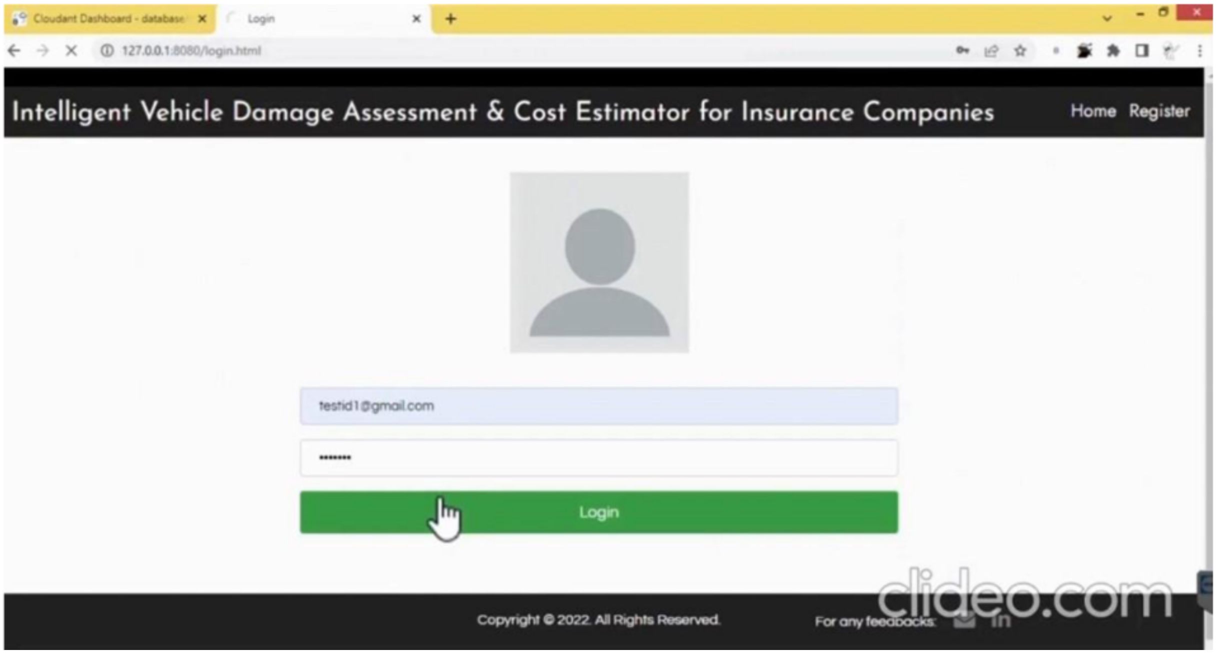
The registeration web page is tested with the already registered user information and hence it shows a message "You are already a member" by which the repeation of user infromation at database is prevented.



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testid1@gmail.com

•••••••

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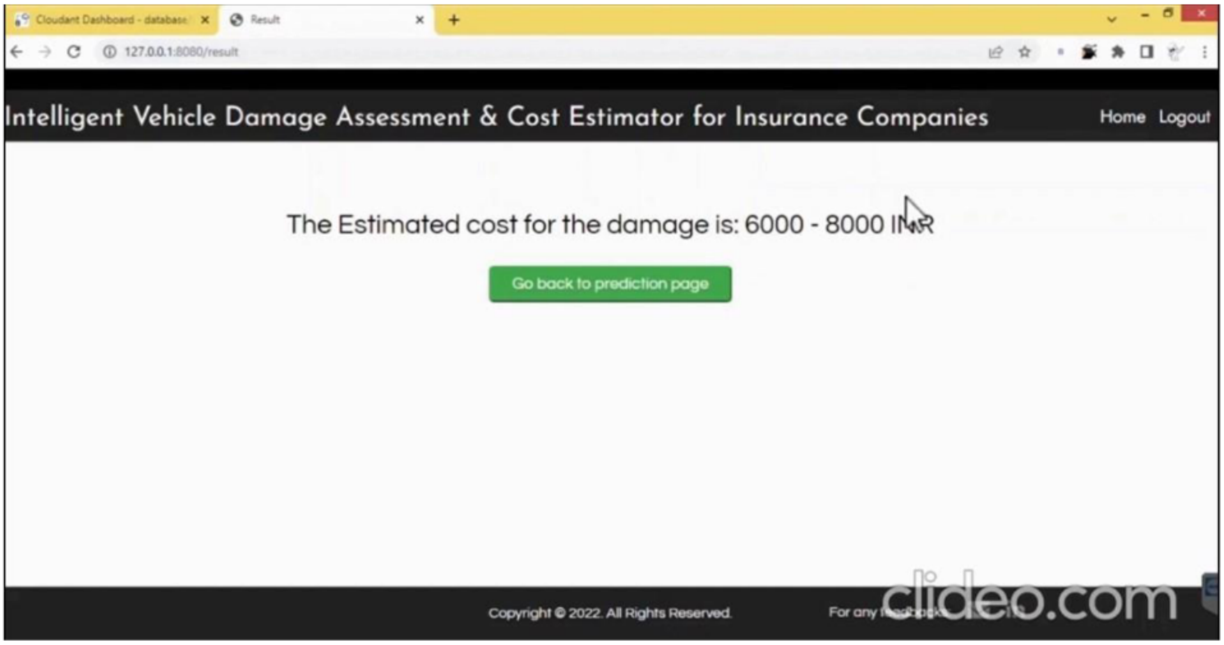
The login web page is tested with the invalid user information to check the invalid login testing into the webpage.



Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

The Estimated cost for the damage is: 6000 - 8000 INR

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The prediction page is given with the test image of a damaged car to check the accuracy of the models.

9. RESULTS

9.1 PERFORMANCE METRICS

The performance of the Cost estimator for insurance companies is tested and assessed with the latency check, which is run over the prediction page. The time taken to load the image and predict the cost based on the damages in the vehicle is checked. The results show that the web application took less than 10s to provide the estimated cost of the given vehicle image. The model is tested with the various damaged car images which is not used during the training and validation of the model which also shows that the model works with the accuracy of about 98% in the overall performance.

- Repair cost optimization, total loss and agreed value
- Quick assessment by phone – without the need for a visit by the professional inspector
- Overseeing the repair of the vehicle
- Establishing the monetary and residual value of vehicles
- Assistance in court
- Accident investigation to check all the data provided on the claim file
- Our reports and dataset are customized and adapted to your workflow, minimizing changes to your processes

The results show that the web application took less than 10s to provide the estimated cost of the given vehicle image. The model is tested with the various damaged car images which is not used during the training and validation of the model which also shows that the model works with the accuracy of about 98% in the overall performance

10. ADVANTAGES & DISADVANTAGES

ADVANTAGE

- Digitalized claim process makes easy to use
- Give the accurate result of the damaged vehicle
- Helps the insurance company to analyze the damaged vehicle and also payment process.

DISADVANTAGE

- It will take more time to claim the insurance in manual process
- Because of incorrect claims, the company behaves badly and doesn’t make payments currently.
- Poor customer support

11. CONCLUSION

In this research proposal, a neural network-based solution for automobile detection will be used to address the issues of automotive damage analysis and position and severity prediction. This project does several tasks in one bundle. The method will unquestionably assist the insurance firms in conducting far more thorough and systematic analyses of the vehicle damage. Simply sending the system a photograph of the vehicle, it will evaluate it and determine whether there is damage of any type, where it is located, and how severe it is.

12.FUTURE SCOPE

In future, The User Interface of the web application can be improved by updating the HTML and CSS codings. The improvement in UI can gives the better user exprience in future, The model's accuracy over various images can increased by trainning with various damaged images. The Image processing methods can be improved to achive higher performance of the model in the future.

13. APPENDIX

SOURCE CODE

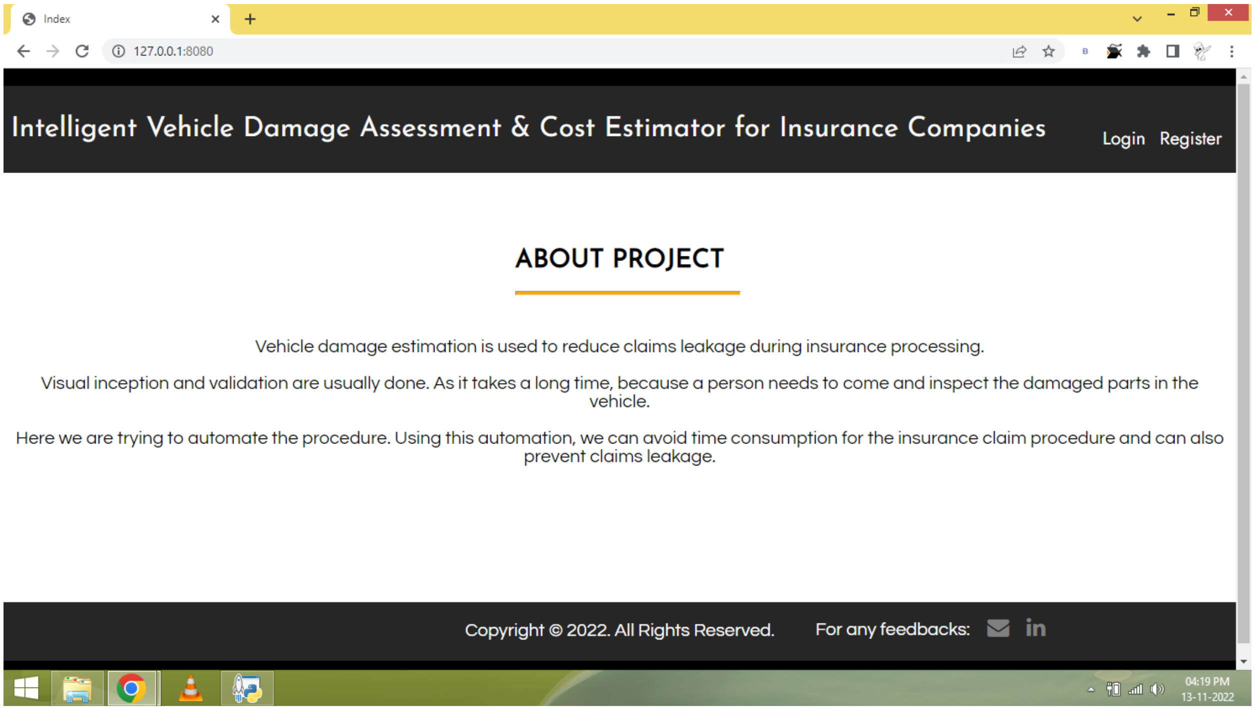
```
from flask import Flask, render_template, flash, request,session
from cloudant.client import Cloudant
import cv2
client = Cloudant.iam("eb55a2b7-ae45-4df8--8d1c-69c5229ffdbe-
bluemix","YzG5FZg9Vs_HScOBZaWyVXm7PpNjbPrmPaPMfHx7w3X9",connect=True)
my_database = client.create_database("database-dharan")
app = Flask(__name__)
app.config.from_object(__name__)
app.config['SECRET_KEY'] = '7d441f27d441f27567d441f2b6176a'
@app.route("/")
def homepage():
        return render_template('index.html')
@app.route("/userhome")
def userhome():
        return render_template('userhome.html')
@app.route("/addamount")
@app.route("/NewUser")
def NewUser():
         return render_template('NewUser.html')

@app.route("/user")
 def user():


        return render_template('user.html')
@app.route("/newuse",methods=['GET','POST'])
def newuse():
    if request.method == 'POST':
         x = [x for x in request.form.values()]
         print(x)
         data = {
```

```
'_id': x[1],
'name': x[0],
'psw': x[2]
}
print(data)
query = {'_id': {'Seq': 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)
        return render_template('goback.html', data="Register, please login using your
details")
else:
    return render_template('goback.html', data="You are already a member, please login
using your details")
@app.route("/userlog", methods=['GET', 'POST'])
def userlog():
        if request.method == 'POST':
          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('goback.html', pred="The username is not found.")
        else:
            if((user==docs[0][0]['_id'] and passw == docs[0][0]['psw'])):
                return render_template("userhome.html")
          else:
                return render_template('goback.html',data="username and password
incorrect")
@app.route("/predict", methods=['GET', 'POST'])
def predict():
    if request.method == 'POST':
        file = request.files['fileupload']
        file.save('static/Out/Test.jpg')
        import warnings
        warnings.filterwarnings('ignore')
        import tensorflow as tf
        classifierLoad = tf.keras.models.load_model('body.h5')
        import numpy as np
        from keras.preprocessing import image
        test_image= image.load_img('static/Out/Test.jpg', target_size=(200, 200))
        img1 = cv2.imread('static/Out/Test.jpg')
        # test_image = image.img_to_array(test_image)
        test_image = np.expand_dims(test_image, axis=0)
        result = classifierLoad.predict(test_image)
        result1 = "
        if result[0][0] == 1:
            result1 = "front"
        elif result[0][1] == 1:
             result1 = "rear"
        elif result[0][2] == 1:
             result1 = "side"
        file = request.files['fileupload1']
        file.save('static/Out/Test1.jpg')
        import warnings
        warnings.filterwarnings('ignore')
        import tensorflow as tf
        classifierLoad = tf.keras.models.load_model('level.h5')
        import numpy as np
        from keras.preprocessing import image
        test_image=image.load_img('static/Out/Test1.jpg',target_size=(200, 200))
```

```
         img1 = cv2.imread('static/Out/Test1.jpg')
         # test_image = image.img_to_array(test_image)
         test_image = np.expand_dims(test_image, axis=0)
         result = classifierLoad.predict(test_image)
         result2 = "
         if result[0][0] == 1:
           result2 = "minor"
         elif result[0][1] == 1:
              result2 = "moderate"
         elif result[0][2] == 1:
              result2 = "severe"
        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('userhome.html', prediction=value)
     if __name__ == '__main__':
app.run(debug=True, use_reloader=True)
```



Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

ABOUT PROJECT

Vehicle damage estimation is used to reduce claims leakage during insurance processing.

Visual inception and validation are usually done. As it takes a long time, because a person needs to come and inspect the damaged parts in the vehicle.

Here we are trying to automate the procedure. Using this automation, we can avoid time consumption for the insurance claim procedure and can also prevent claims leakage.

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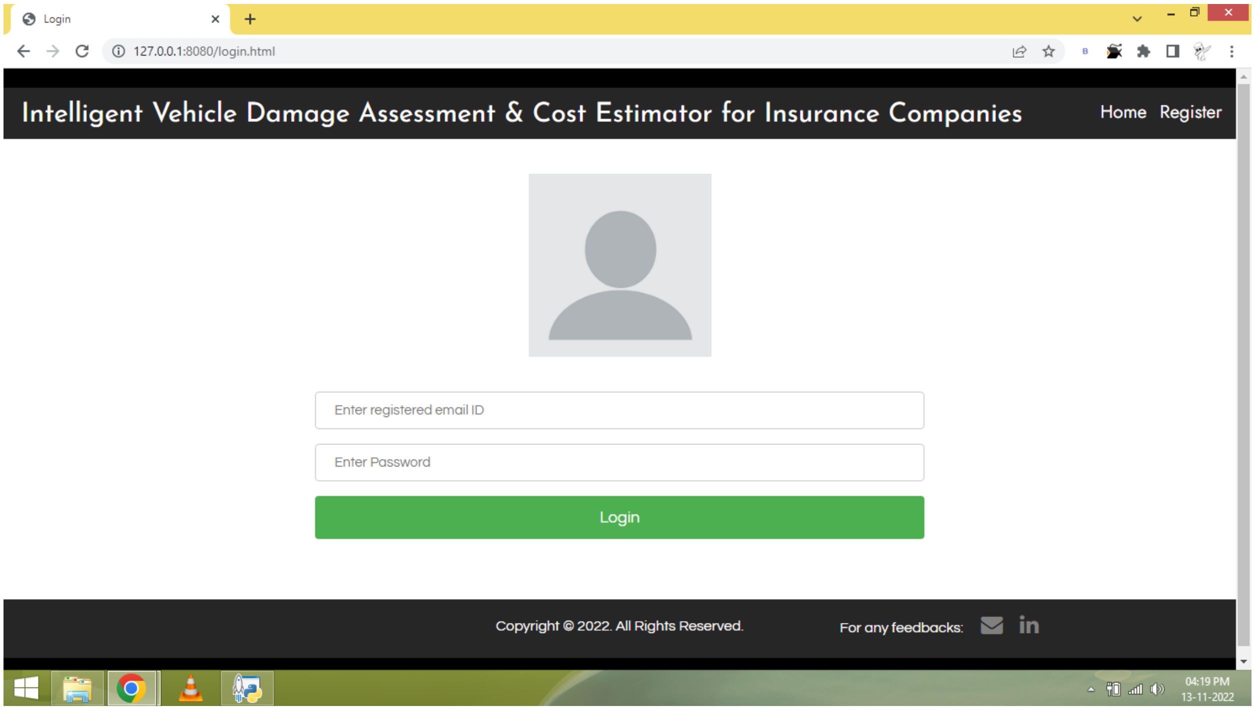

Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

Enter registered email ID

Enter Password

Login

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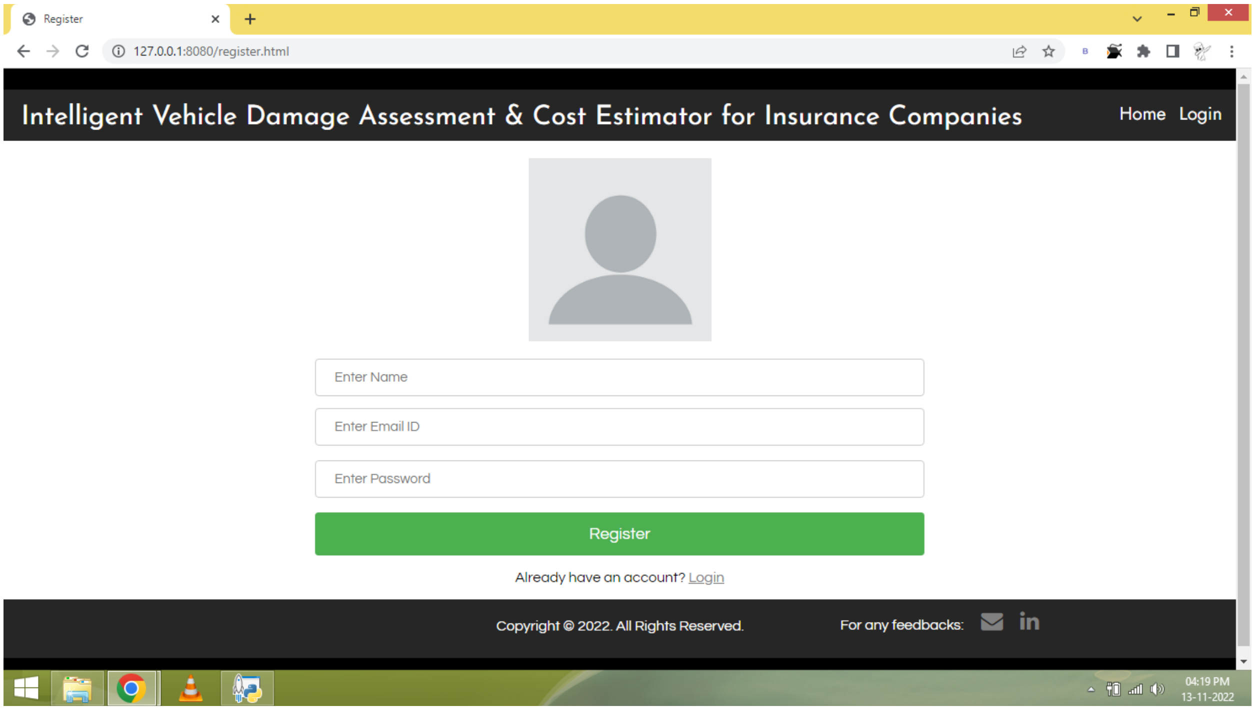

Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

Already have an account? Login

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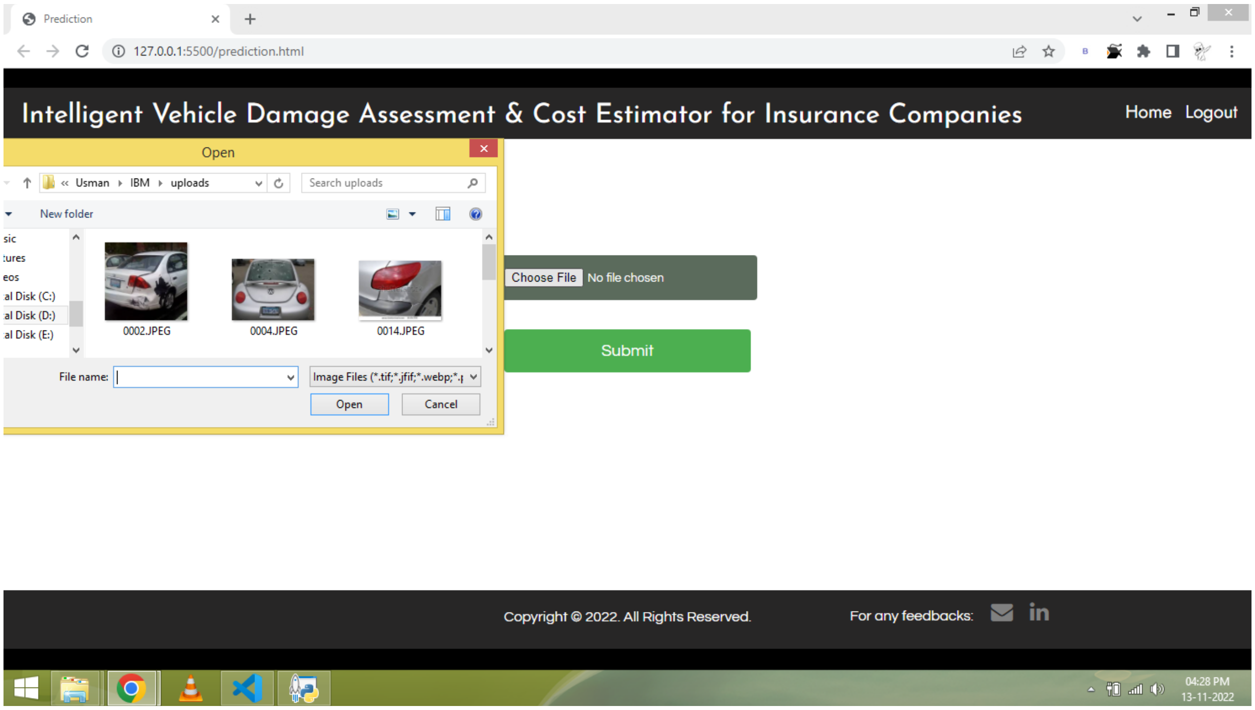
For any feedbacks:



Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

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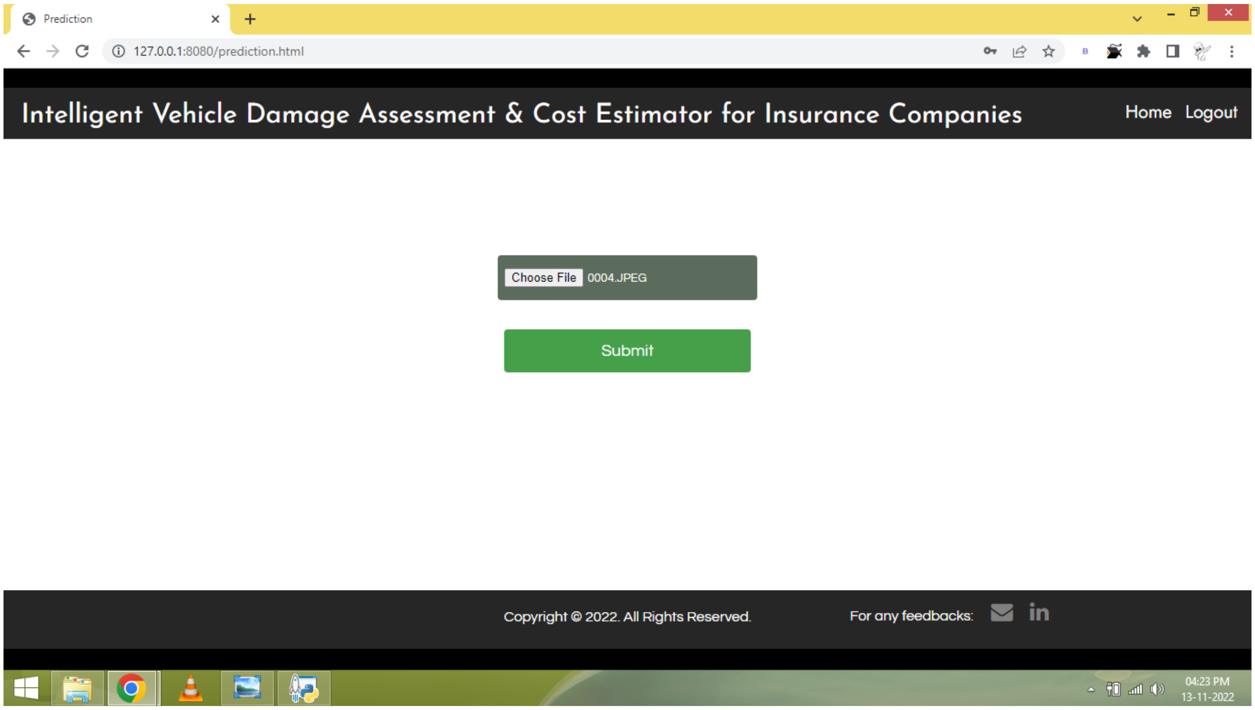
For any feedbacks:



127.0.0.1:8080/prediction.html

Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

Choose File 0004.JPEG

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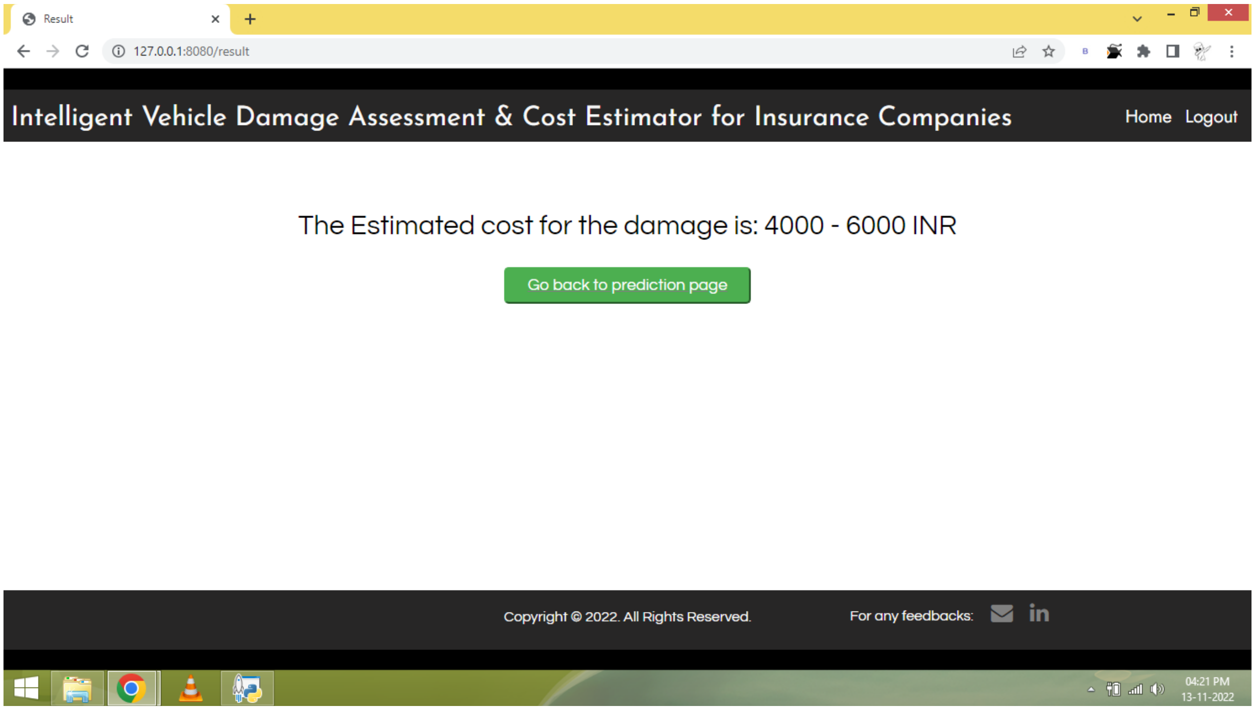

127.0.0.1:8080/result

Intelligent Vehicle Damage Assessment & Cost Estimator for Insurance Companies

The Estimated cost for the damage is: 4000 - 6000 INR

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GITUB LINK:

https://github.com/IBM-EPBL/IBM-Project-9998-1659088443

DEMO VIDEO LINK :

https://www.youtube.com/embed/G_jh4URnxgw

PRESENTATION VIDEO LINK:

https://www.youtube.com/embed/ACuG0TONGiw