INTELLIGENT VEHICLE DAMAGE ASSESSMENT AND COST ESTIMATOR FOR INSURANCE COMPANIES

ABSTRACT

Nowadays, a lot of money is being wasted in the car insurance business due to leakage claims. Claims leakage Underwriting leakage is characterized as the discrepancy between the actual payment of claims made and the sum that should have been paid if all of the industry's leading practices were applied. Visual examination and testing have been used to may these results. However, they impose delays in the processing of claims. 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, lenders may also consider this model.

1. INTRODUCTION

PROJECT OVERVIEW

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 practices 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 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.

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.

2. LITERATURE SURVEY

1. Assessing Car Damage with Convolutional Neural Networks

Authors: Harit Bandi, Suyash Joshi, Siddhant Bhagat, Amol Deshpande.

Publication: IEEE 2021 (ICCICT)

Description:

This paper deals with estimating car damage, primarily with auto insurers as their key potential customers. For this purpose, three distinct Transfer Learning approaches are used which detect the presence of damage, location, and severity of the damage. The basis for algorithms used lies in Convolutional Neural Networks, customized to optimize accuracy. Each approach is analyzed and varying degrees of accuracy were achieved across different models deployed ranging from 68% to 87%. Accuracy as high as 87.9% was obtained in this paper. This research fine-tunes a number of existing approaches and opens doors for collaboration in image recognition, particularly for the car insurance domain.

2. Deep Learning Based Car Damage Classification and Detection

Authors: Mahavir Dwivedi , Malik Hashmat Shadab, SN Omkar, Edgar Bosco Monis , Bharat Khanna, Satya Ranjan Samal, Ayush Tiwari, Aditya Rathi.

Publication: Advances in intelligent systems and computing, Springer, Singapore.

Description:

In this paper, they worked on the problem of vehicle damage classification/ detection which canbe used by insurance companies to automate the process of vehicle insurance claims in a quick fashion. The recent advances in computer vision largely due to the adoption of fast, scalable and end to end trainable Convolutional Neural Networks makes it technically feasible to recognize vehicle damages using deep convolutional networks. They manually collected and annotated images from various online sources containing different types of vehicle damages. Using CNN models pretrained on ImageNet dataset and using several other techniques to improve the performance of the system, we were able to achieve top accuracy of 96.39%, significantly better than the current results in this work. Furthermore to detect the region of damage they used state-of-the-art YOLO object detector and achieved a maximum map score of 77.78 % on the held-out test set, demonstrating that the model was able to successfully recognise different vehicle damages. In addition to this, the paper also proposes a pipeline for a more robust identification of the damage in vehicles by combining the tasks of classification and detection.

3. Damage Assessment of a vehicle and Insurance Reclaim.

Authors: Vaibhav Agarwal , Utsav Khandelwal , Shivam Kumar, Raja Kumar , Shilpa M

Publication: IJCRT 2022

Description:

In this paper, under damage analysis of a vehicle in general and insurance reclaim, a system has been designed using CNN and image classification which takes the input from a user as an image to test the severity of damage, which happens in a sequence of two steps. First being the image classification, here the input provided by the user is processed by the neural network to identify the car that if the car is damaged or not. and later on the second step, the flattened input obtained as the output in step 1 is applied for object detection to identify the region and severity of damage, where region might be rear, front or side and severity is divided into minor, moderate and major. The R-CNN network identifies the severity of damage and a report is filed and sent to the user and the insurance firm. The user will be able to get payment based on the models outcome with minimal human interaction.

4. Vehicle Damage Classification and Fraudulent Image Detection IncludingMoiré Effect Using Deep Learning

Authors: Umer Waqas, Nimra Akram, Soohwa Kim, Donghun Lee, Jihoon Jeon

Publication: 2020 IEEE Canadian Conference on Electrical and Computer Engineering (CCECE)

Description:

This paper proposes deep learning based methods for classification of car damage types - MobileNet to classify the vehicle damage into three categories which include medium damage, huge damage and no damage. The severity of damage from medium to huge is decided by the amount of damage present on the vehicle. The damage categories are based on common damage types such as broken lamp or bumper, shattered glass, dents on front or rear etc. However, in real-time applications automation comes with various obstacles. User can upload the fake images instead of taking a picture of vehicle in real-time. Fake images include taking screenshots from devices, downloading image from internet, capturing images from other devices screens and using some image editing tools to cover damage. In this paper a hybrid technique is also proposed to handle these kinds of fraudulent images. Metadata analysis and image editing software signatures detection is performed in order to verify if image is edited or it is a screenshot. Moiré effect detection is proposed to identify if the image is taken from other device screen such as taking a picture of a car with mobile phone from a computer screen.

5. Car Damage Assessment based on VGG Models:

Authors: Phyu Mar Kyu, Kuntpong Woraratpanya

Publication: IAIT 2020

Description:

This paper explores deep learning-based algorithms, VGG16 and VGG19, for car damage detectionand assessment in real-world datasets. These algorithms detect the damaged part of a car and assess its location and then its severity. Initially, we discover the effect of domain-specific pre- trained CNN models, which are trained on an ImageNet dataset, and followed by fine-tuning, because some of the categories can be fine-granular to get our specific tasks. Then they applied transfer learning in pre-trained VGG models and use some techniques to improve the accuracy ofour system which results in better performance of VGG19 than VGG16. All of the above, their pre-trained VGG models not only detect damaged part of a car but also assess its location and severity.

6. A Unified Framework of Intelligent Vehicle Damage Assessment basedon Computer Vision Technology

Authors: Xianglei Zhu , Sen Liu, Peng Zhang, Yihai Duan

Publication: 2019 IEEE 2nd International Conference on Automation, Electronics and Electrical Engineering (AUTEEE)

Description:

The main contribution of this paper is it proposes a framework of intelligent vehicle damage assessment algorithm including the three parts to provide a unified solution for the actual application of intelligent loss assessment. The experiment here shows that this proposed methodhas better accuracy. The proposed algorithm makes use of advanced computer vision technology (object detection, image segmentation, image classification), offers accurate estimated repair price based on photos provided by users and greatly saves loss costs of insurance man. The algorithm includes the identification of vehicle parts, damage position and damage type and degree classification. RetinaNet is used for the identification of damaged parts, and the results are processed with disjoint set and the identification accuracy is improved. Mask R-CNN is adopted for the identification of vehicle parts, the damaged parts are determined by the method of sampling, and the time complexity is greatly reduced. In addition, Inception is applied for the classification of damage types and the last layer is revised to be suitable for multi-label classification.

7. Front-View Vehicle Damage Detection using Roadway SurveillanceCamera Images

Authors: Burak Balci, Yusuf Artan, Bensu Alkan and Alperen Elihos

Publication: 5th International Conference on Vehicle Technology and Intelligent Transport Systems

Description:

In the damaged vehicle detection problem using roadway cameras, the presence of symmetry is an important indicator in differentiating between damaged and non-damaged vehicles. Therefore, this paper proposes a method that combines vehicles' frontal image information with a term that computes the similarity of the left and right halves of the vehicles' front view image. Adding symmetry information substantially improves prediction performance in this task. In this paper, they proposed a deep learning based method on the damaged vehicle detection problem from front view roadway camera images. Single shot multi box (SSD) object detector is utilized to extract a tight region of the front side of the vehicle. Next, InceptionV3 convolutional neural network (CNN) based novel feature extraction approach is used to derive feature vectors, which are used by a linear support vector machine (SVM) classifier to determine damaged/non-damaged class of the vehicle.

8. Yet Another Deep Learning Approach for Road Damage Detection using Ensemble Learning

Authors: Vinuta Hegde, Dweep Trivedi , Abdullah Alfarrarjeh , Aditi Deepak, Seon Ho Kim, Cyrus Shahabi

Publication: 2020 IEEE International Conference on Big Data (Big Data)

Description:

An automated solution for road damage detection and classification using image analysis is nowadays timely needed for smart city applications. In this paper, they designed deep learning approaches based on one of the state-of-the-art object 5558 detection approaches, namely YOLO.To increase the accuracy of the trained models generated by YOLO, they presented three approaches using ensemble learning. One approach uses multiple transformed images of the testimage to ensemble the final output. The other approach ensembles multiple trained models and averages predictions from these trained models. The third approach combines the latest two approaches. All these three approaches were evaluated using the public image dataset provided by the 2020 IEEE Big Data Global Road Damage Detection Challenge. This paper's approaches wereable to achieve an F1 score of up to 0.6

PROBLEM STATEMENT DEFINITION

According to a data collected in 2018, The Average insurance Payment period for small-scale automobile insurance cases is 11.8 days, while the claim period for investigation, damage assessment and claim collection accounts for 9.94 days. Secondly, the accident party’s long waiting time at the accident site, slow payment process, unreasonable fixed price and other issues, to a certain extent, reduce customer satisfaction with the insurance company. Hence Intelligent damage determination system can be used to determine the appearance damage of vehicles in small cases.

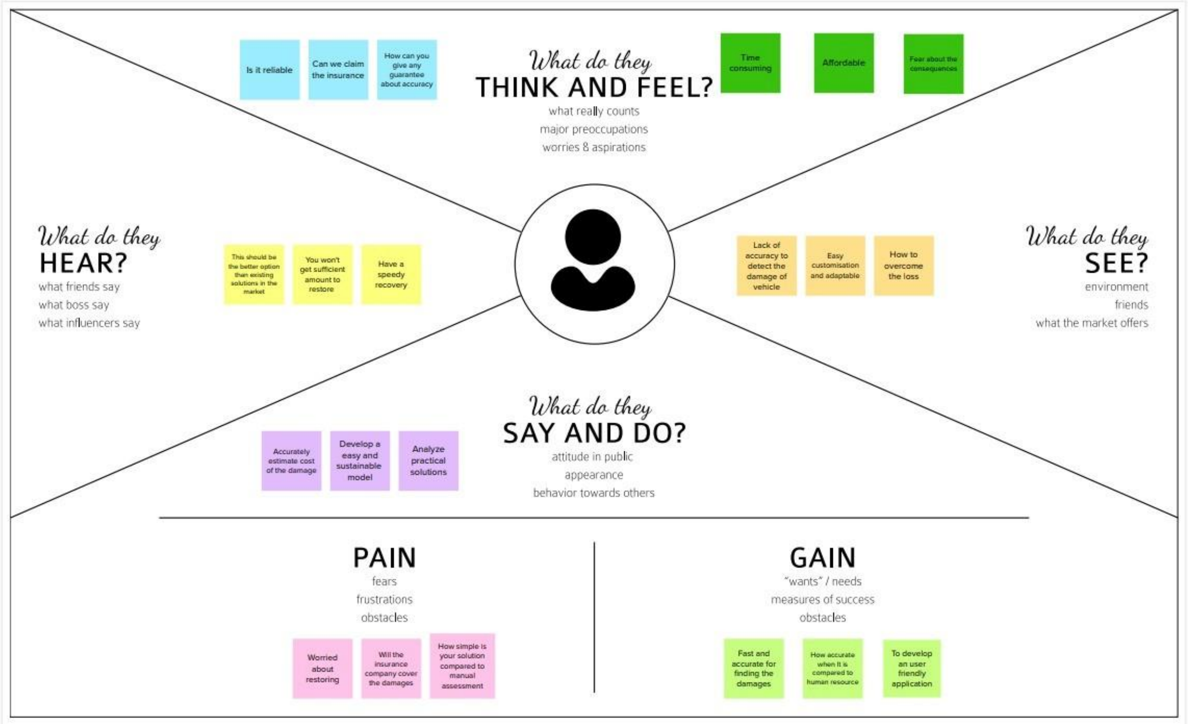
3. IDEATION & PROPOSED SOLUTION

Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

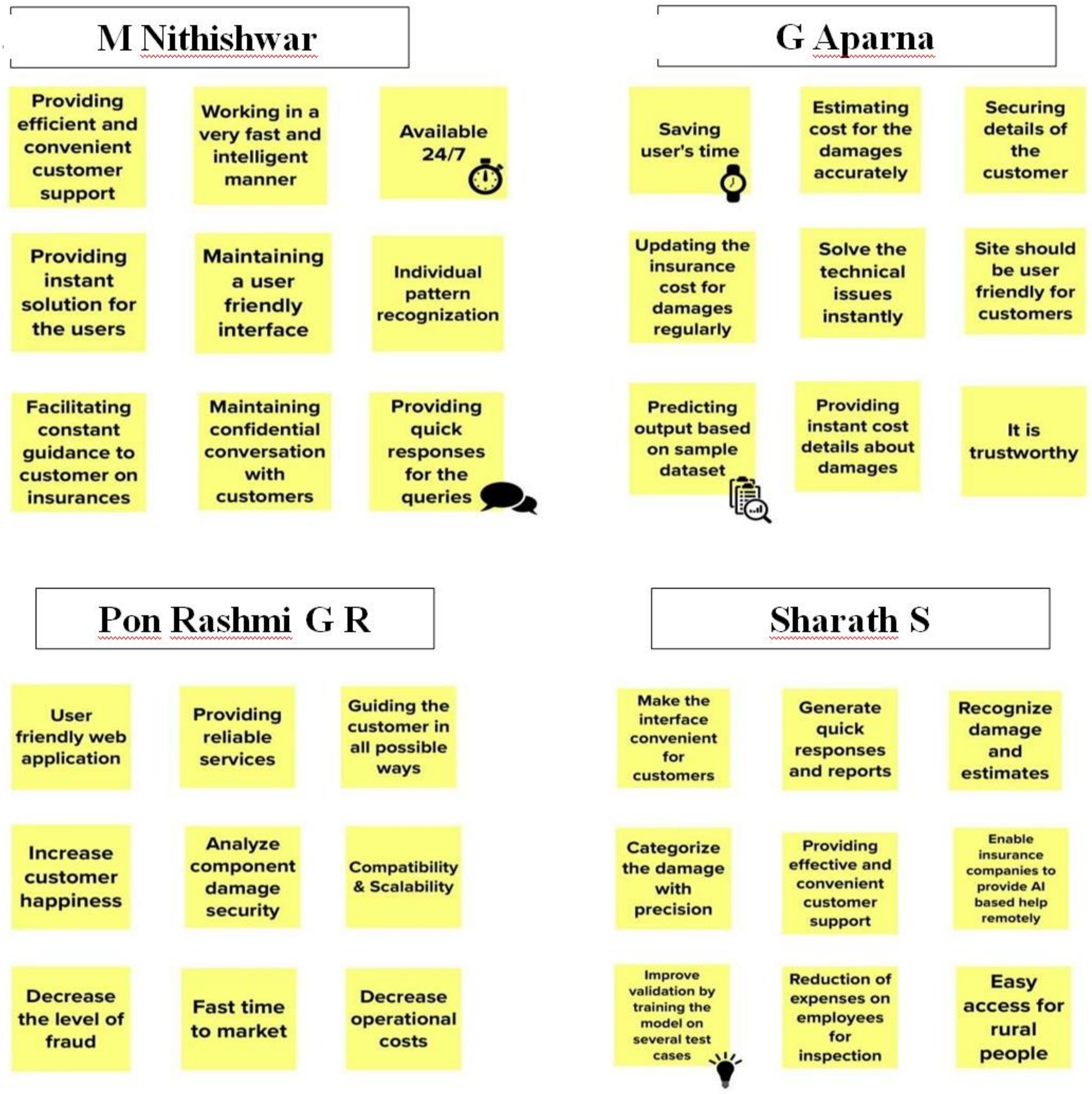
It is a useful tool to helps teams better understand their users.
Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

EMPATHY MAP:



What do they THINK AND FEEL?
what really counts
major preoccupations
worries 8 aspirations
Is it reliable
Can we claim the insurance
How can you give any guarantee about accuracy
Time consuming
Affordable
Fear about the consequences
What do they HEAR?
what friends say
what boss say
what influencers say
This should be the better option than existing solutions in the market
You won't get sufficient amount to restore
Have a speedy recovery
What do they SEE?
environment
friends
what the market offers
Lack of accuracy to detect the damage of vehicle
Easy customisation and adaptable
How to overcome the loss
What do they SAY AND DO?
attitude in public
appearance
behavior towards others
Accurately estimate cost of the damage
Develop a easy and sustainable model
Analyze practical solutions
PAIN
fears
frustrations
obstacles
Worried about restoring
Will the insurance company cover the damages
How simple is your solution compared to manual assessment
GAIN
"wants" / needs
measures of success
obstacles
Fast and accurate for finding the damages
How accurate when it is compared to human resource
To develop an user friendly application

Brainstorm & Idea Prioritization



M Nithishwar

- Providing efficient and convenient customer support
- Working in a very fast and intelligent manner
- Available 24/7
- Providing instant solution for the users
- Maintaining a user friendly interface
- Individual pattern recognization
- Facilitating constant guidance to customer on insurances
- Maintaining confidential conversation with customers
- Providing quick responses for the queries

G Aparna

- Saving user's time
- Estimating cost for the damages accurately
- Securing details of the customer
- Updating the insurance cost for damages regularly
- Solve the technical issues instantly
- Site should be user friendly for customers
- Predicting output based on sample dataset
- Providing instant cost details about damages
- It is trustworthy

Pon Rashmi G R

- User friendly web application
- Providing reliable services
- Guiding the customer in all possible ways
- Increase customer happiness
- Analyze component damage security
- Compatibility & Scalability
- Decrease the level of fraud
- Fast time to market
- Decrease operational costs

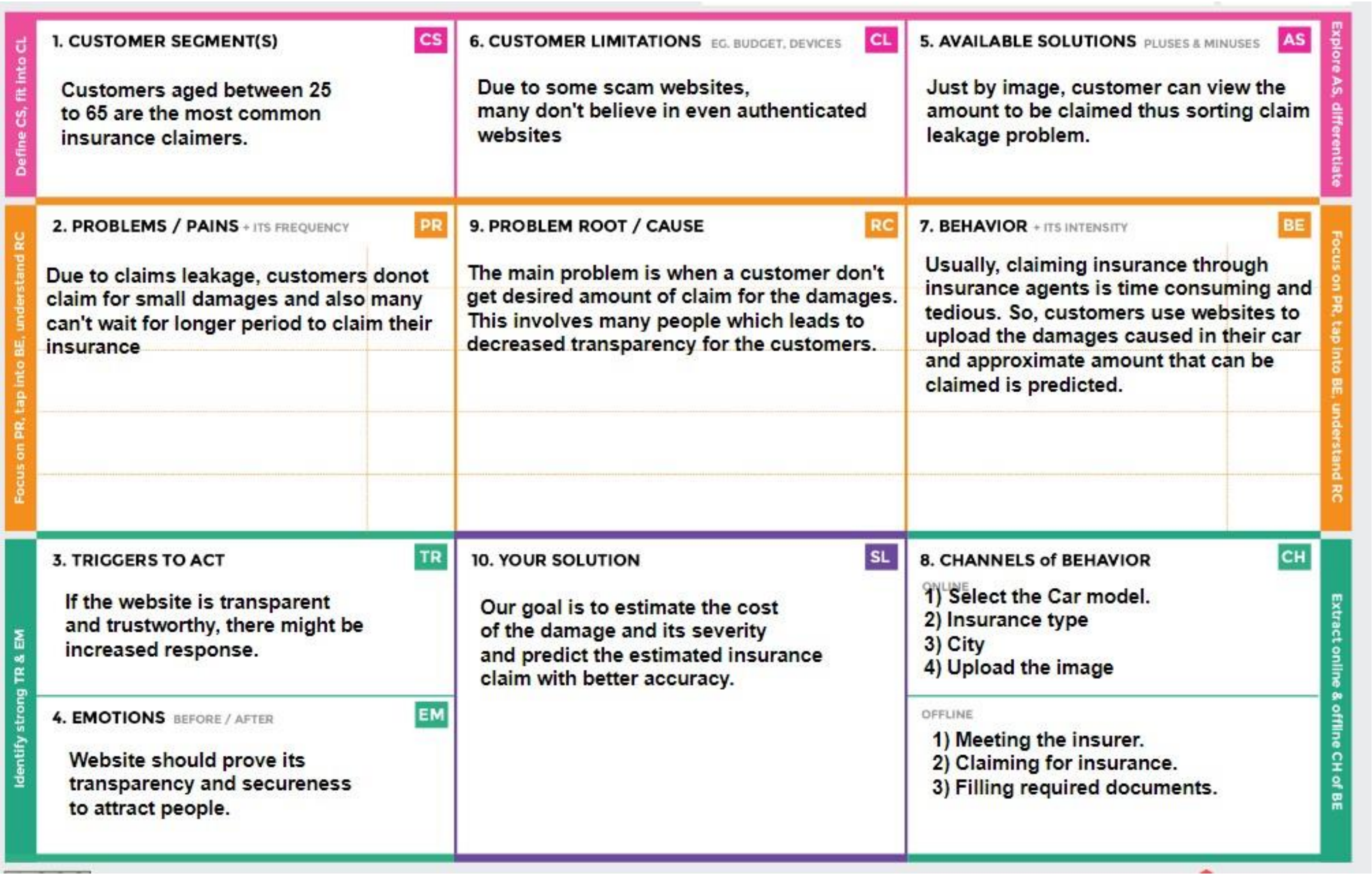
Sharath S

- Make the interface convenient for customers
- Generate quick responses and reports
- Recognize damage and estimates
- Categorize the damage with precision
- Providing effective and convenient customer support
- Enable insurance companies to provide AI based help remotely
- Improve validation by training the model on several test cases
- Reduction of expenses on employees for inspection
- Easy access for rural people

PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	1) Major disadvantage is the loss adjustments cost and some improvements in First Notice of Loss. 2) The speed with which claims are examined and evaluated might save a lot of money in the vehicle insurance claims process but actually it is quite a slow process. This should be resolved.
2.	Idea / Solution description	1) This can be used to determine the appearance damage of vehicles in all cases using VGG16 model that can detect the area and level of damage of the car. 2) It overcomes all the difficulties faced earlier and also works in good speed.
3.	Novelty / Uniqueness	1) Good Accuracy 2) Computer Vision can be used to implement Intelligent Vehicle Damage Assessment & CostEstimator for Insurance Companies. 3) The algorithms can learn the parts of vehicle and estimate the severity of damage using photos. 4) It avoids Vehicle insurance anti-fraud.
4.	Social Impact / Customer Satisfaction	1) The Damaged part is taken as pic and shared in the website which evaluates the parts, damage severity, etc.. 2) Inputs like car model, insurance policy istaken into account for better accuracy. 3) The Insurance Claim is estimated and connected with the insurers with good transparency level and accuracy.
5.	Business Model (Revenue Model)	This also reduces human power in evaluating those. Always manual process is time consuming and requires plenty of trainings and employees employed in it. We can overcome this.
6.	Scalability of the Solution	1) Good Speed and Accuracy 2) Quickly Evaluate and offers precise claimestimates. 3) Save costs because of less human power.

PROBLEM SOLUTION FIT


Define CS, fit into CL
Focus on PR, tap into BE, understand RC
Identify strong TR & EM
Explore AS, differentiate
Focus on PR, tap into BE, understand RC
Extract online & offline CH of BE

1. CUSTOMER SEGMENT(S) CS

Customers aged between 25 to 65 are the most common insurance claimers.

6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES CL

Due to some scam websites, many don't believe in even authenticated websites

5. AVAILABLE SOLUTIONS PLUSES & MINUSES AS

Just by image, customer can view the amount to be claimed thus sorting claim leakage problem.

2. PROBLEMS / PAINS + ITS FREQUENCY PR

Due to claims leakage, customers donot claim for small damages and also many can't wait for longer period to claim their insurance

9. PROBLEM ROOT / CAUSE RC

The main problem is when a customer don't get desired amount of claim for the damages. This involves many people which leads to decreased transparency for the customers.

7. BEHAVIOR + ITS INTENSITY BE

Usually, claiming insurance through insurance agents is time consuming and tedious. So, customers use websites to upload the damages caused in their car and approximate amount that can be claimed is predicted.

3. TRIGGERS TO ACT TR

If the website is transparent and trustworthy, there might be increased response.

4. EMOTIONS BEFORE / AFTER EM

Website should prove its transparency and secureness to attract people.

10. YOUR SOLUTION SL

Our goal is to estimate the cost of the damage and its severity and predict the estimated insurance claim with better accuracy.

8. CHANNELS of BEHAVIOR CH

ONLINE

1) Select the Car model.
2) Insurance type
3) City
4) Upload the image

OFFLINE

1) Meeting the insurer.
2) Claiming for insurance.
3) Filling required documents.

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

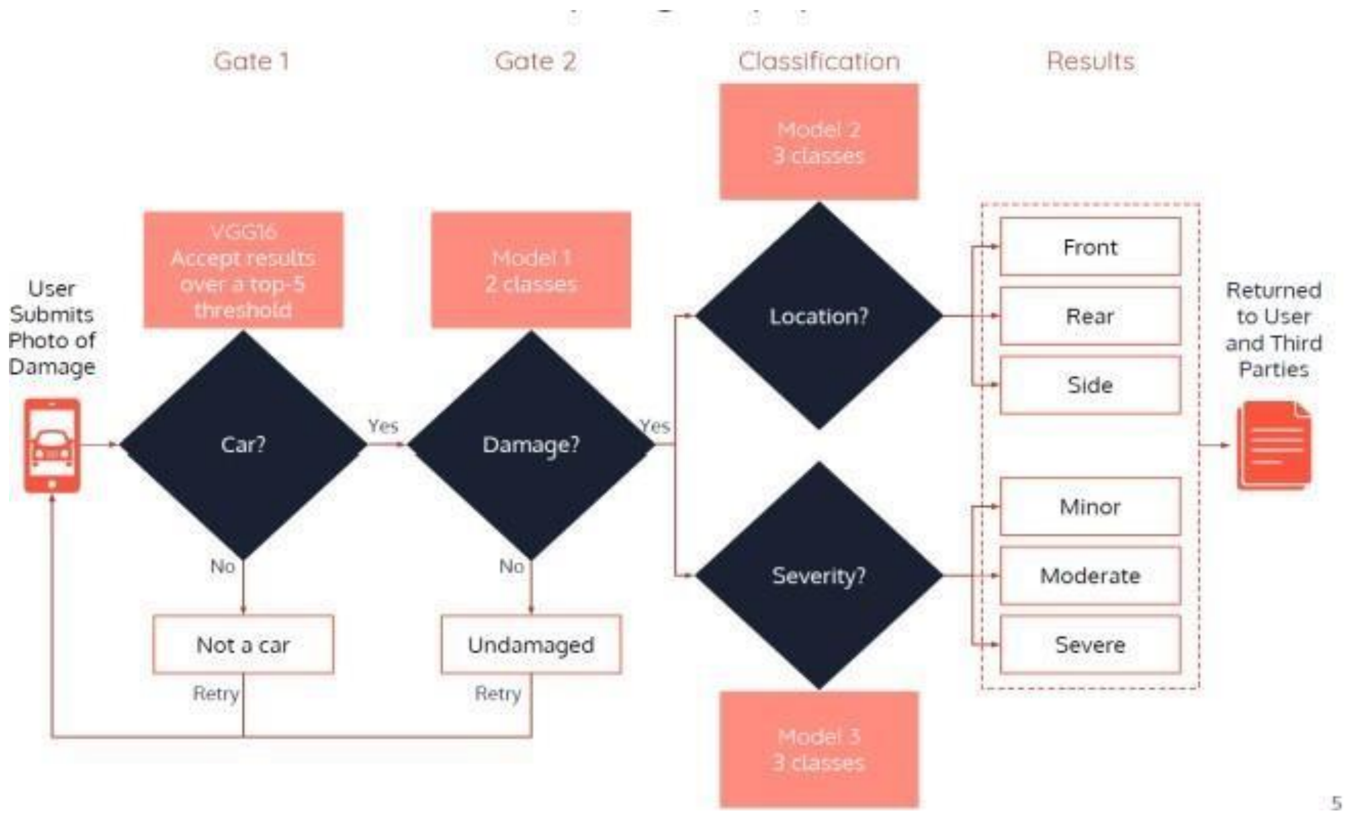
The information is refreshed depending upon whether some updates have occurred or not in the application. The system shall respond to the member in not less than two seconds from the time of the request submittal. The system shall be allowed to take more time when doing large processing jobs. Responses 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

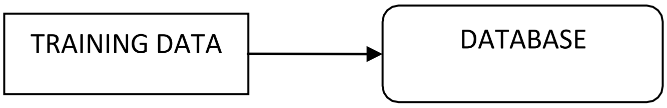
5.1 DATA FLOW DIAGRAMS



- ❖ The Project is Based AI Intelligent Vehicle Damage Assessment and Cost Estimator for Insurance Companies.
- ❖ It is application is use for claim insurance for damaged vehicle to pay a correct amount.
- ❖ We have best customer support the user.
- ❖ Application is user-friendly interface to all users.
- ❖ It give exact estimated value for the damaged vehicle.
- ❖ This model can also be used by lenders if they are underwriting a car loan, especially for a used car.

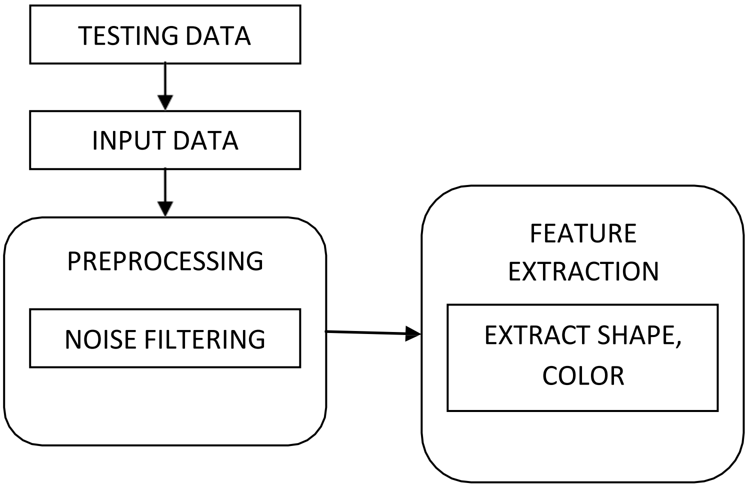
LEVEL 0

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.



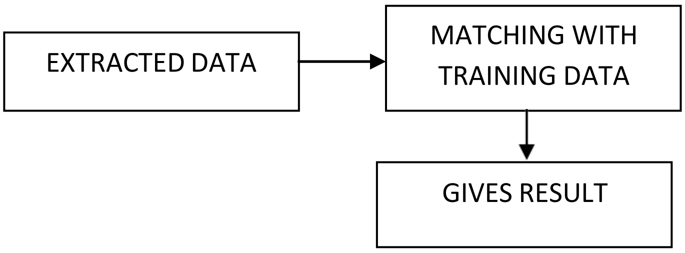
LEVEL 1

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.



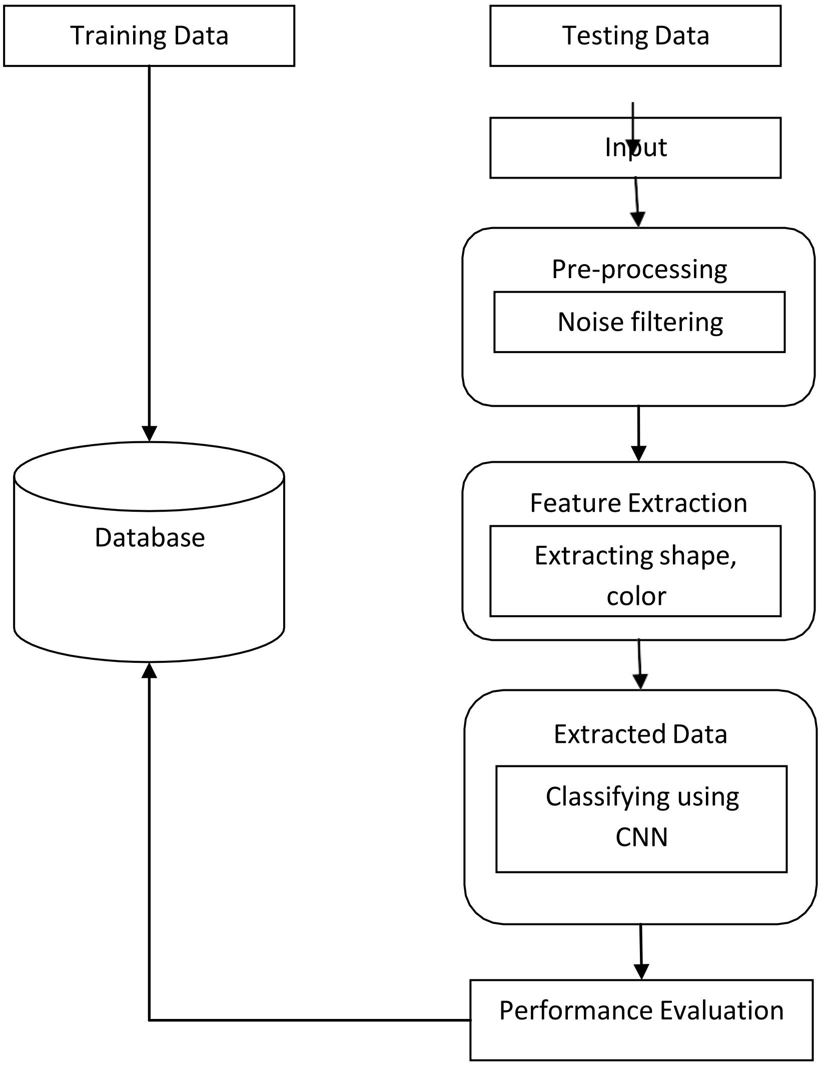
LEVEL 2

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

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

6. PROJECT PLANNING & SCHEDULING

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data collection (Dataset)	USN-1	As a user, I will download a dataset of gestures for this project.	2	High	Aparna Sharath
Sprint-1	Image Preprocessing	USN-2	As a user, I will import necessary libraries for configuration of image datagenerator and apply them to test and train datasets.	2	High	Pon rashmi
Sprint-2	Model Building	USN-3	As a user, I can import necessary libraries and models of CNN and add Dense layers.	2	Low	Sharath Aparna
Sprint-2	Model Building	USN-4	As a user, I will train, save and test the model.	2	Medium	Nithishwar Pon Rashmi
Sprint-3	Application Building	USN-5	As a user, I create html front pages (CSS for styling web page and JS to connect back end).	1	High	Nithishwar Pon Rashmi Sharath
Sprint-3	Application Building	USN-6	As a user, I use python flask for building back end(for server side scripting).	2	High	Nithishwar Pon Rashmi
Sprint-3	Application Building	USN-7	As a user, I'm going to run the application by combining both front end and back end.	2	High	Aparna Nithishwar PonRashmi
Sprint-4	Train the model on IBM	USN-8	As a user, register for IBM cloud.	1	Medium	Aparna Sharath Nithishwar PonRashmi
Sprint-4	Train the model on IBM	USN-9	As a user, train the model on IBM and integrate it with the flask application.	2	High	Sharath Nithishwar

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)

$$AV = \frac{\textit{sprint duration}}{\textit{velocity}} = \frac{20}{10} = 2$$

Where

Average Velocity - Story points per day

Sprint Duration - Number of days (Duration) for Sprints

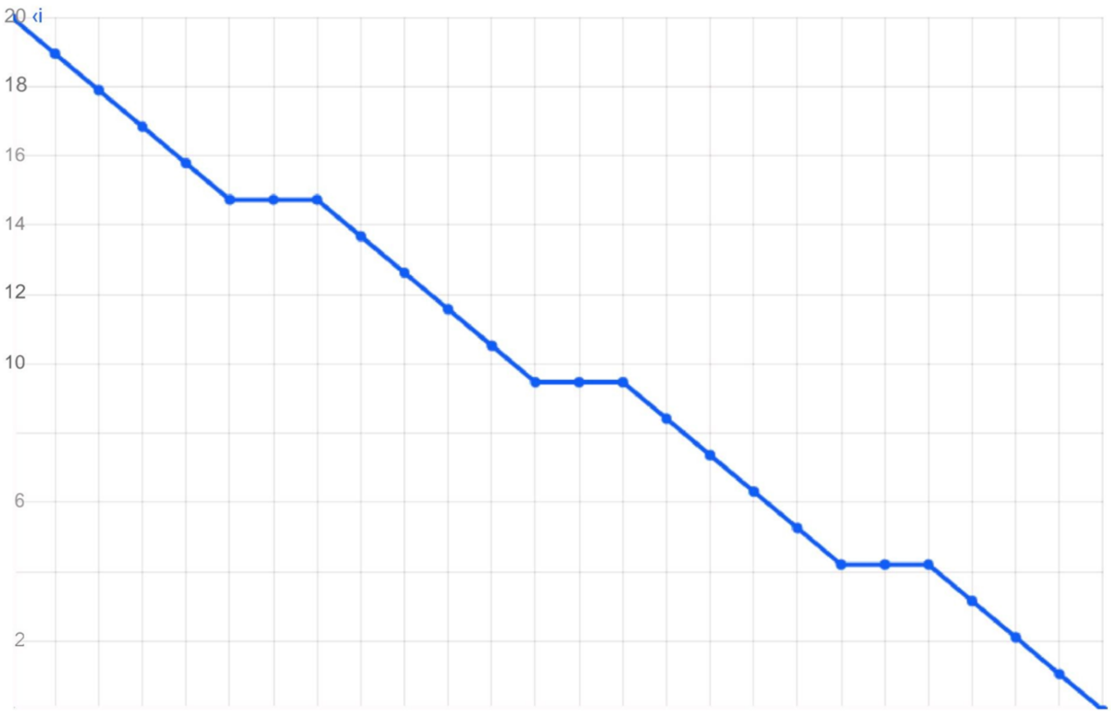
Velocity - Points per Sprint

A=20/5=4

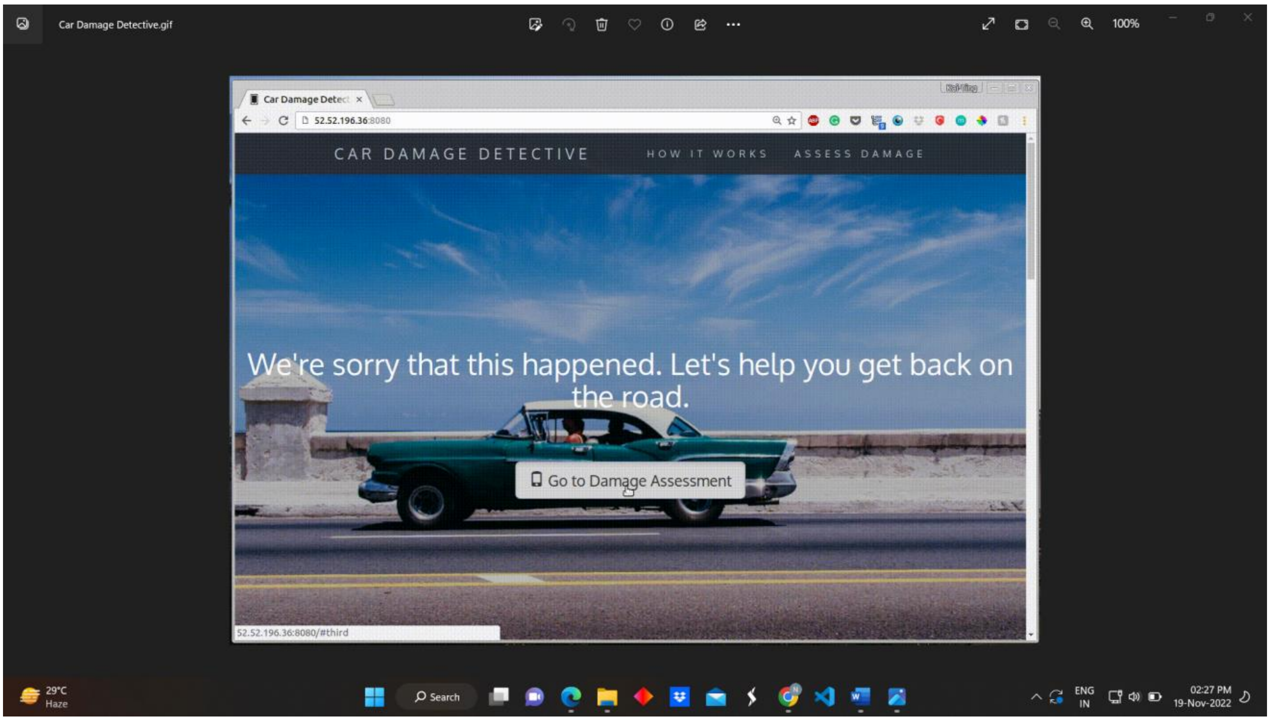
Average Velocity is 4 points per sprint.

Burndown Chart:
A burndown 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.

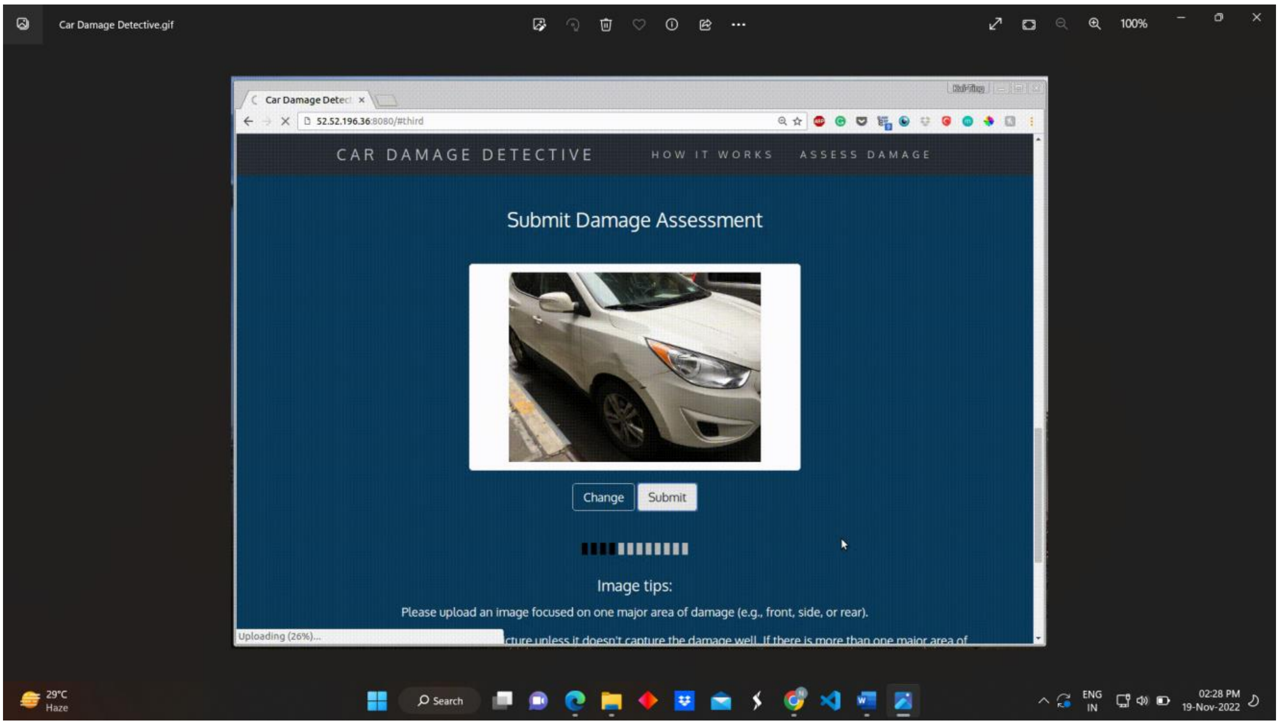
Burndown Chart:



7. APPLICATION BUILDING



We're sorry that this happened. Let's help you get back on the road.



Submit Damage Assessment

Image tips:

Please upload an image focused on one major area of damage (e.g., front, side, or rear).

cture unless it doesn't capture the damage well. If there is more than one major area of

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.

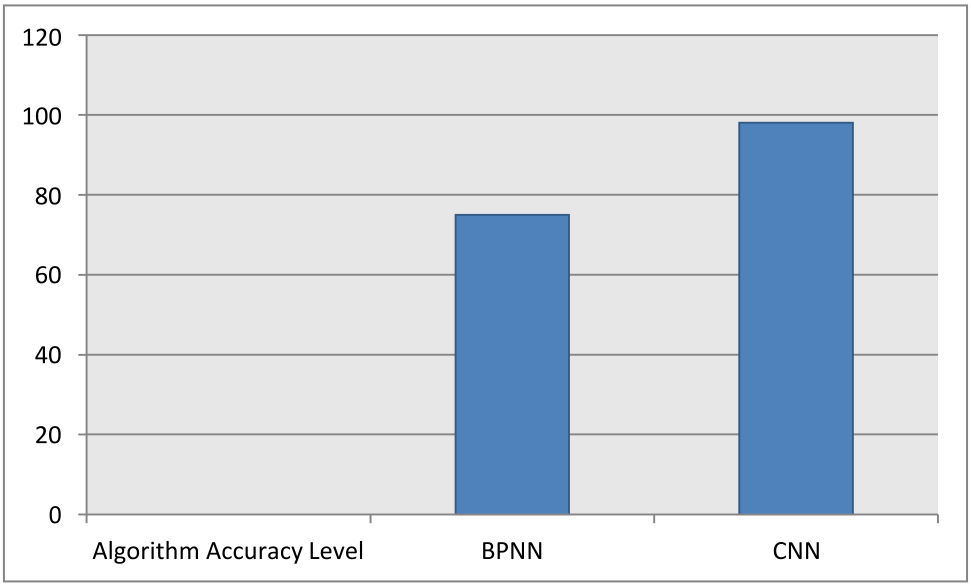
S.NO	**Scenario**	**Input**	**Excepted output**	**Actual output**
1	User login	User name and password	Login	Login success.
2	Upload Image	Upload damaged vehicle image as a input	Detecting object and analyze for claim insurance	Details are stored in a database.

- **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



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

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.

FUTURE SCOPE

In future work, need to use several regularisation 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.

APPENDIX SOURCE CODE

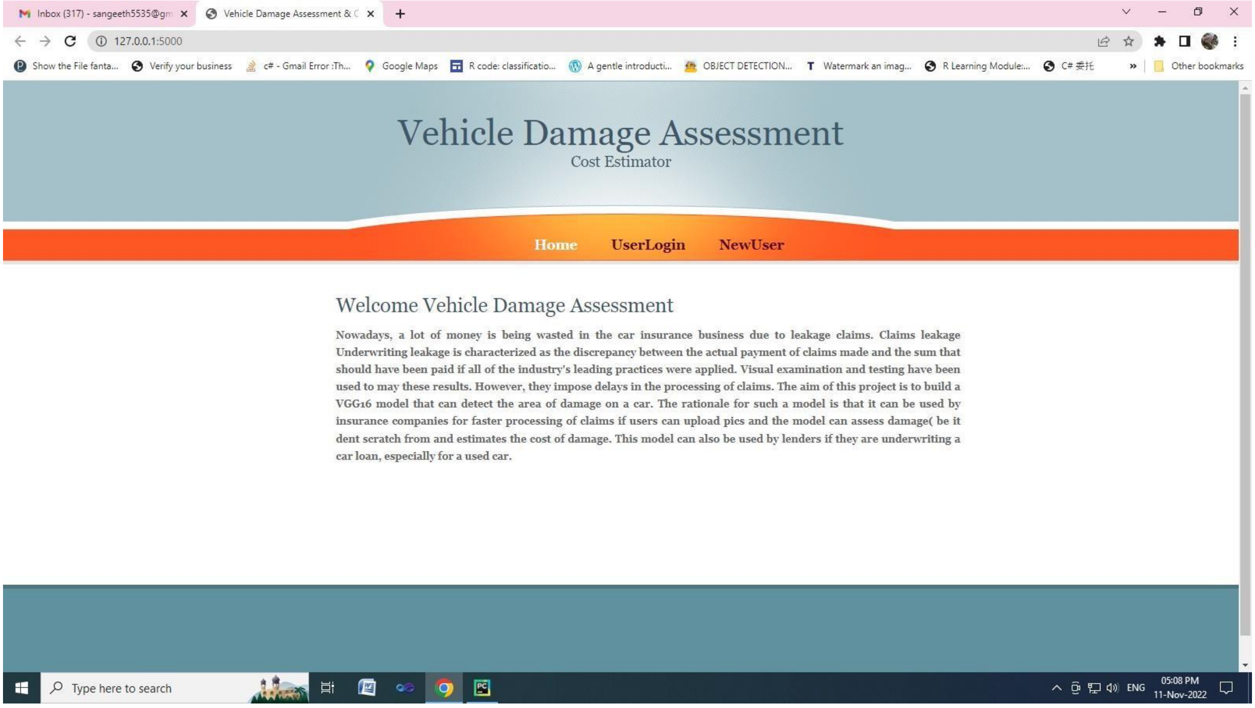
```
from flask import Flask, render_template, flash, request,session
from cloudant.client import Cloudant
import cv2
client = Cloudant.iam("eb55a2b7-ae45-4df8-8d1c-69c5229ffdbe-
bluemix","YzG5FZg9Vs_HScOBZaWyVXm7PpNjbPrmPaPMfHx7w3X9",connect=
True)
my_database = client.create_database("database-dharan")
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="user name 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)
```

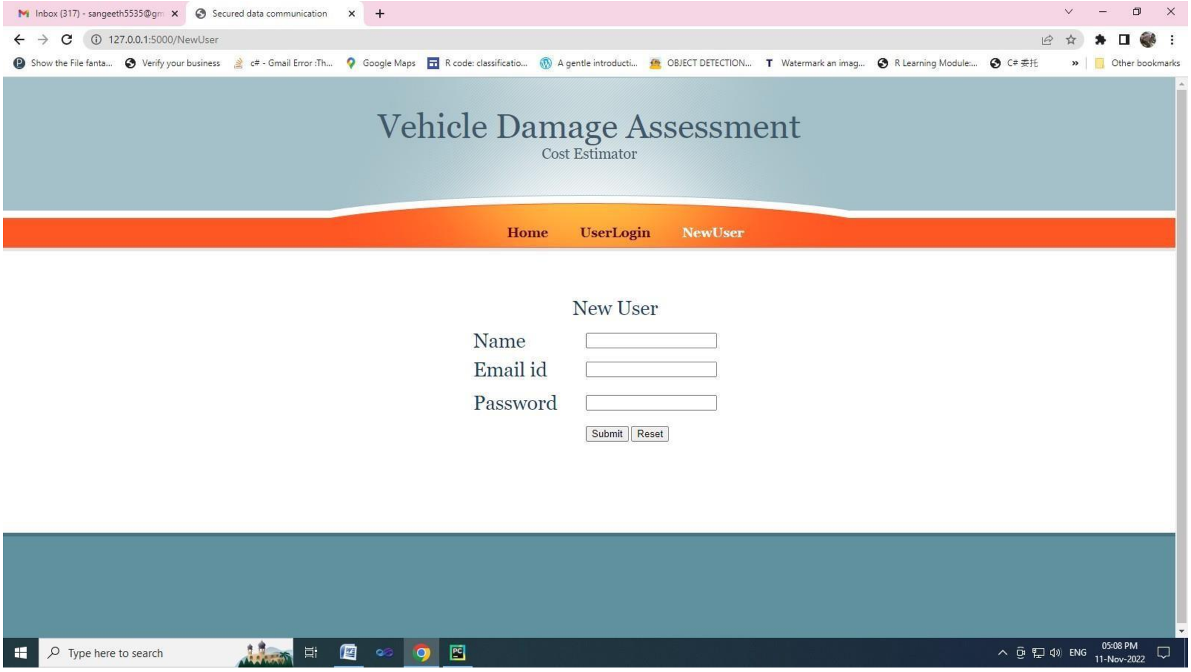


Vehicle Damage Assessment

Cost Estimator

Welcome Vehicle Damage Assessment

Nowadays, a lot of money is being wasted in the car insurance business due to leakage claims. Claims leakage Underwriting leakage is characterized as the discrepancy between the actual payment of claims made and the sum that should have been paid if all of the industry's leading practices were applied. Visual examination and testing have been used to may these results. However, they impose delays in the processing of claims. The aim of this project is to build a VGG16 model that can detect the area of damage on a car. The rationale for such a model is that it can be used by insurance companies for faster processing of claims if users can upload pics and the model can assess damage(be it dent scratch from and estimates the cost of damage. This model can also be used by lenders if they are underwriting a car loan, especially for a used car.

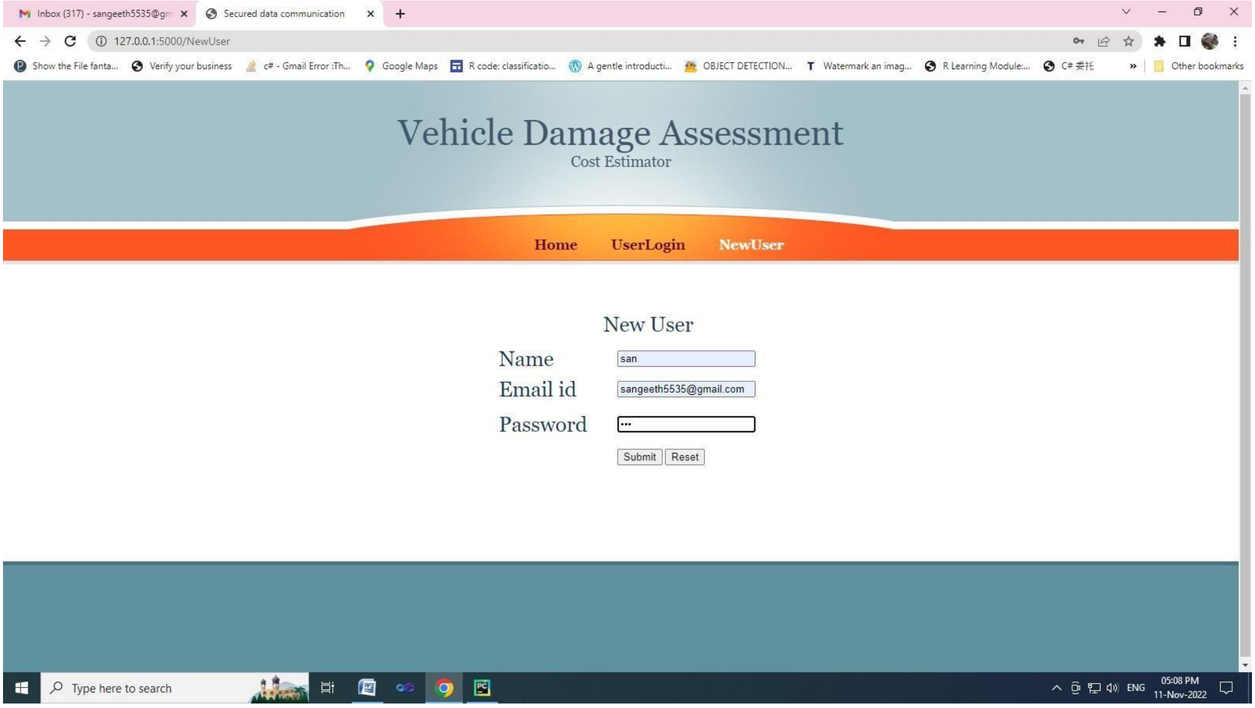


Vehicle Damage Assessment

Cost Estimator

New User

Name
Email id
Password



Vehicle Damage Assessment

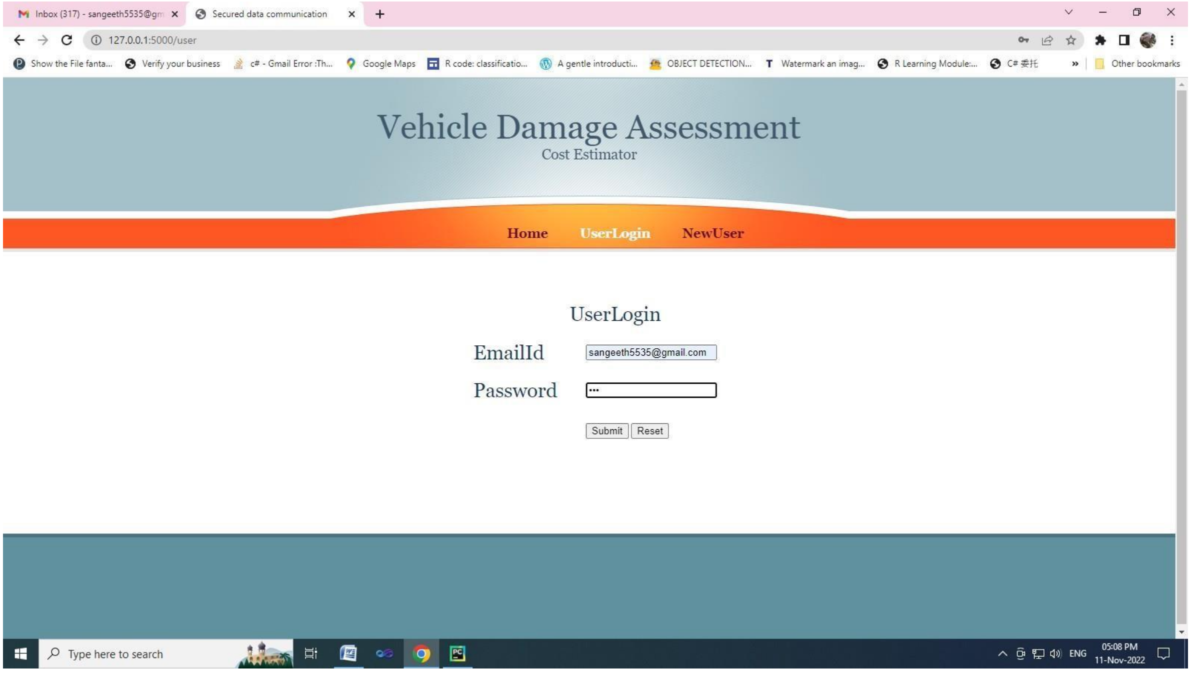
Cost Estimator

New User

Name: san

Email id: sangeeth5535@gmail.com

Password: •••



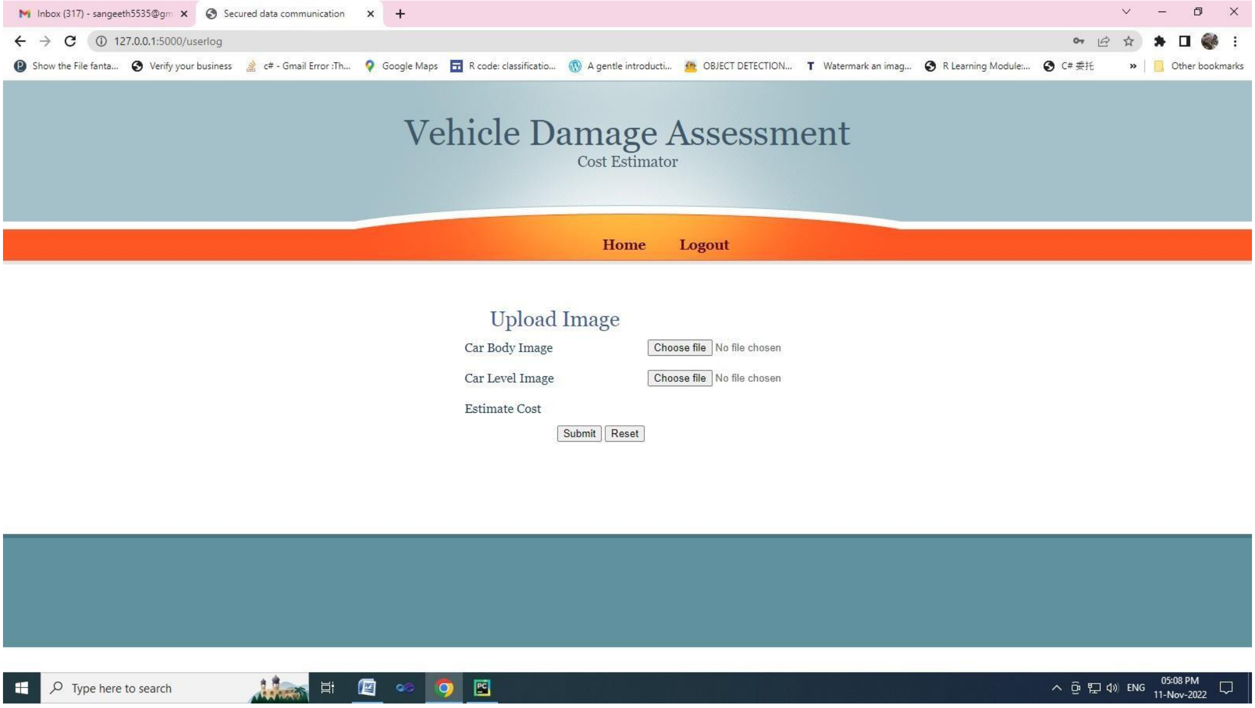
Vehicle Damage Assessment

Cost Estimator

UserLogin

EmailId: sangeeth5535@gmail.com

Password: •••


Inbox (317) - sangeeth5535@gm
Secured data communication
127.0.0.1:5000/userlog
Show the File fanta... Verify your business c# - Gmail Error :Th... Google Maps R code: classificatio... A gentle introducti... OBJECT DETECTION... Watermark an imag... R Learning Module:... C# 委托 Other bookmarks
Type here to search
ENG 05:08 PM 11-Nov-2022

Vehicle Damage Assessment
Cost Estimator

Home Logout

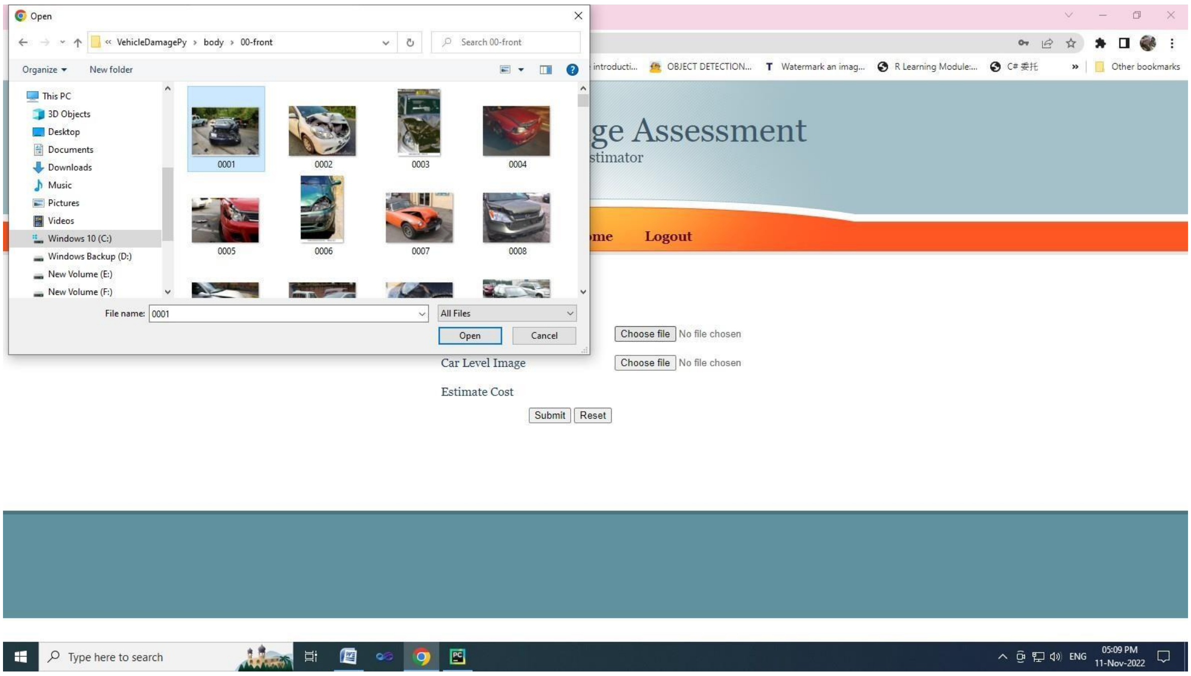
Upload Image

Car Body Image Choose file No file chosen

Car Level Image Choose file No file chosen

Estimate Cost

Submit Reset



File name: 0001

All Files

Open Cancel

ge Assessment
stimator

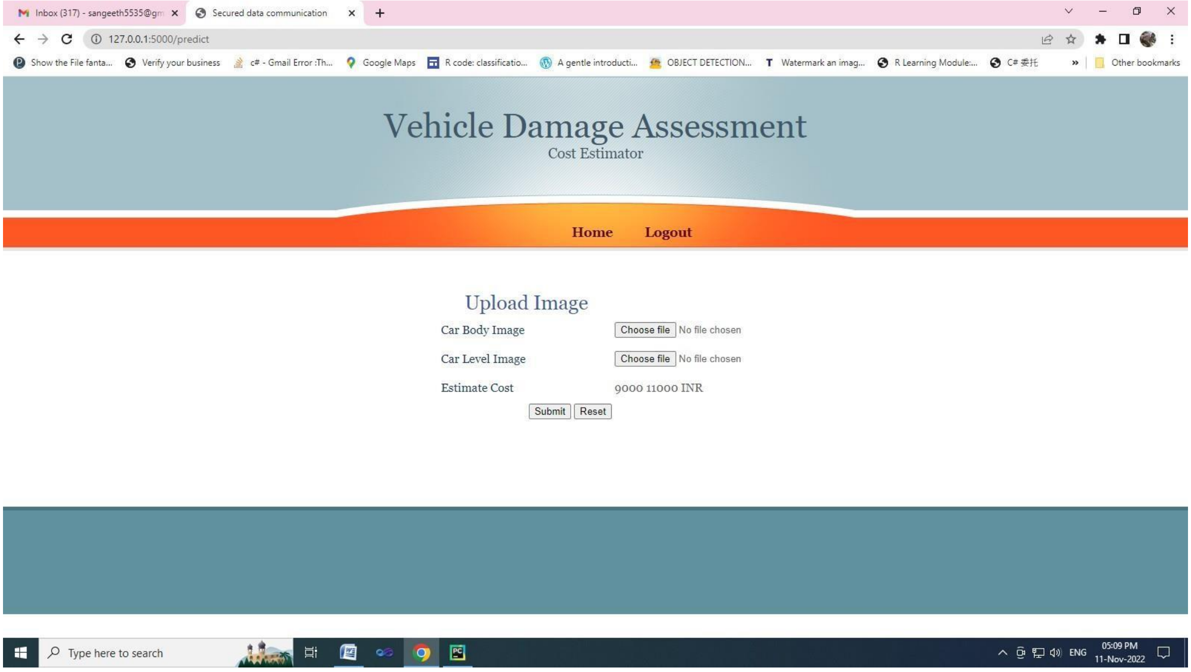
me Logout

Choose file No file chosen

Car Level Image Choose file No file chosen

Estimate Cost

Submit Reset



Vehicle Damage Assessment

Cost Estimator

Upload Image

Car Body Image Choose file No file chosen

Car Level Image Choose file No file chosen

Estimate Cost 9000 11000 INR

Submit Reset

GITHUB & PROJECT DEMO LINK

https://github.com/IBM-EPBL/IBM-Project-36945-1660299157