

University of Missouri - Kansas City  
CS 5551 FALL 2018

# SMART POLICE

## ADVANCE SOFTWARE ENGINEERING PROJECT FINAL REPORT

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# 1.PROJECT DEPLOYMENT

## 1.1 OBJECTIVE

Purpose of this project to help police and users to find stolen cars and stay safe while car is parked. A lot of cars get stolen nowadays, however it is very difficult to find them right away. Imagine if each driver had an application which will help to identify stolen car right away and report it is location so police can take action accordingly. Also if user gets notified about suspicious person in the car right away, will help to prevent crime and save time.

## 1.2 MOTIVATION

In 2012 in United States, there were an approximately 721,000 car thefts. Property losses due to motor vehicle theft in 2012 were estimated at \$4.3 billion. Our application will help to prevent and identify motor vehicle thefts right away or at least save time to take action. Police departments use various methods of recovering stolen vehicles, such as random checks of vehicles that come in front of a patrol unit, checks of all vehicles parked along a street or within a parking lot using automatic number plate recognition. However there are more drivers on the roads then police, which will make our application more efficient.

## 1.3 HOW IT WORKS

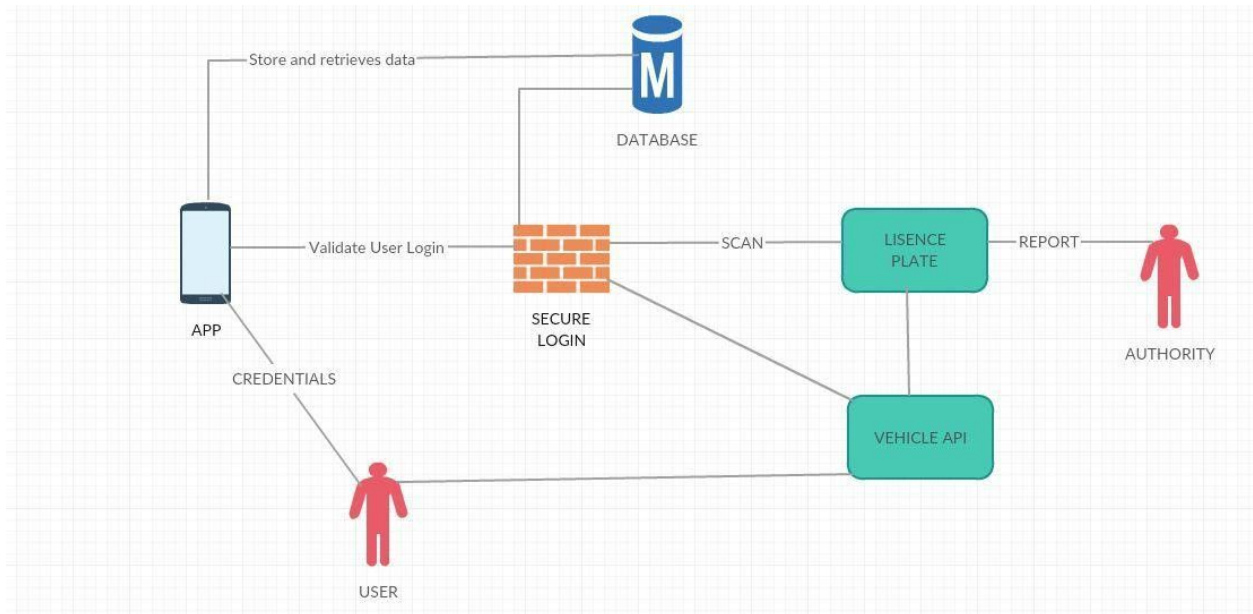
User report his/her car as a stolen on publicly available web application which will save record to our database so users can start searching for stolen car. When stolen car is noticed by users, owner of the car gets notification about location of his car. A;so user can upload his and his family member pictures who might be driving his car, so when car is parked and suspicious person gets into the car user also gets a notification regarding suspicious activity in his vehicle.

## 1.4 DEVICE CONSTRAINTS:

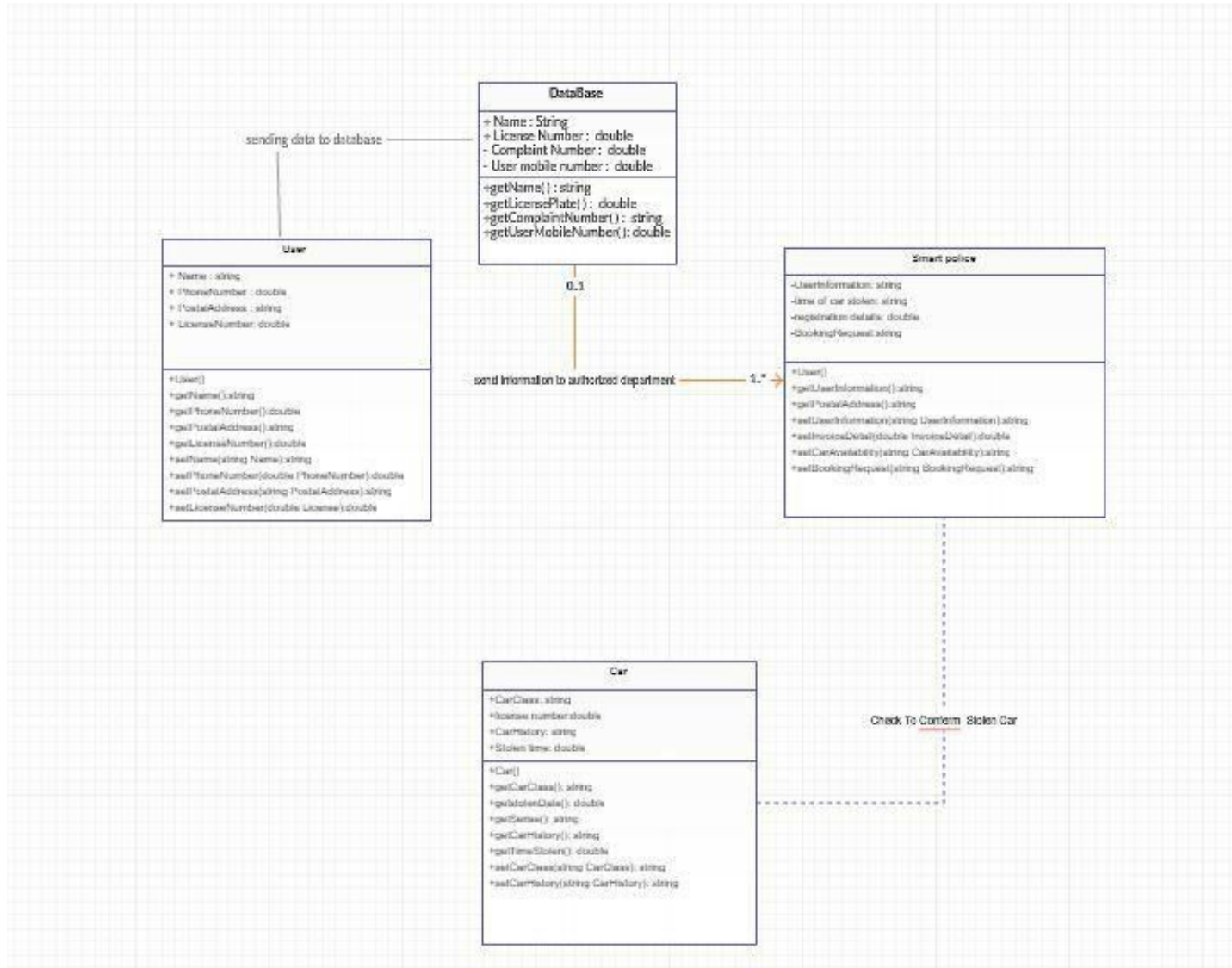
There is Web application which runs on any browser and Android Mobile application.

## 2.UML DIAGRAMS

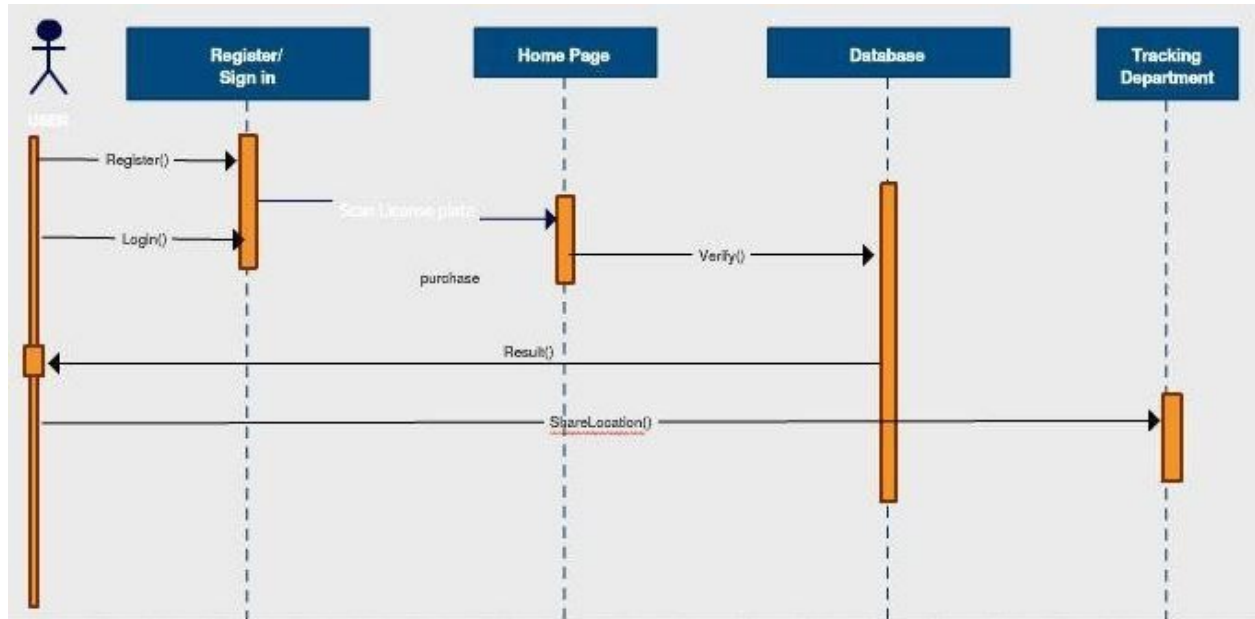
### 2.1 ARCHITECTURE DIAGRAM



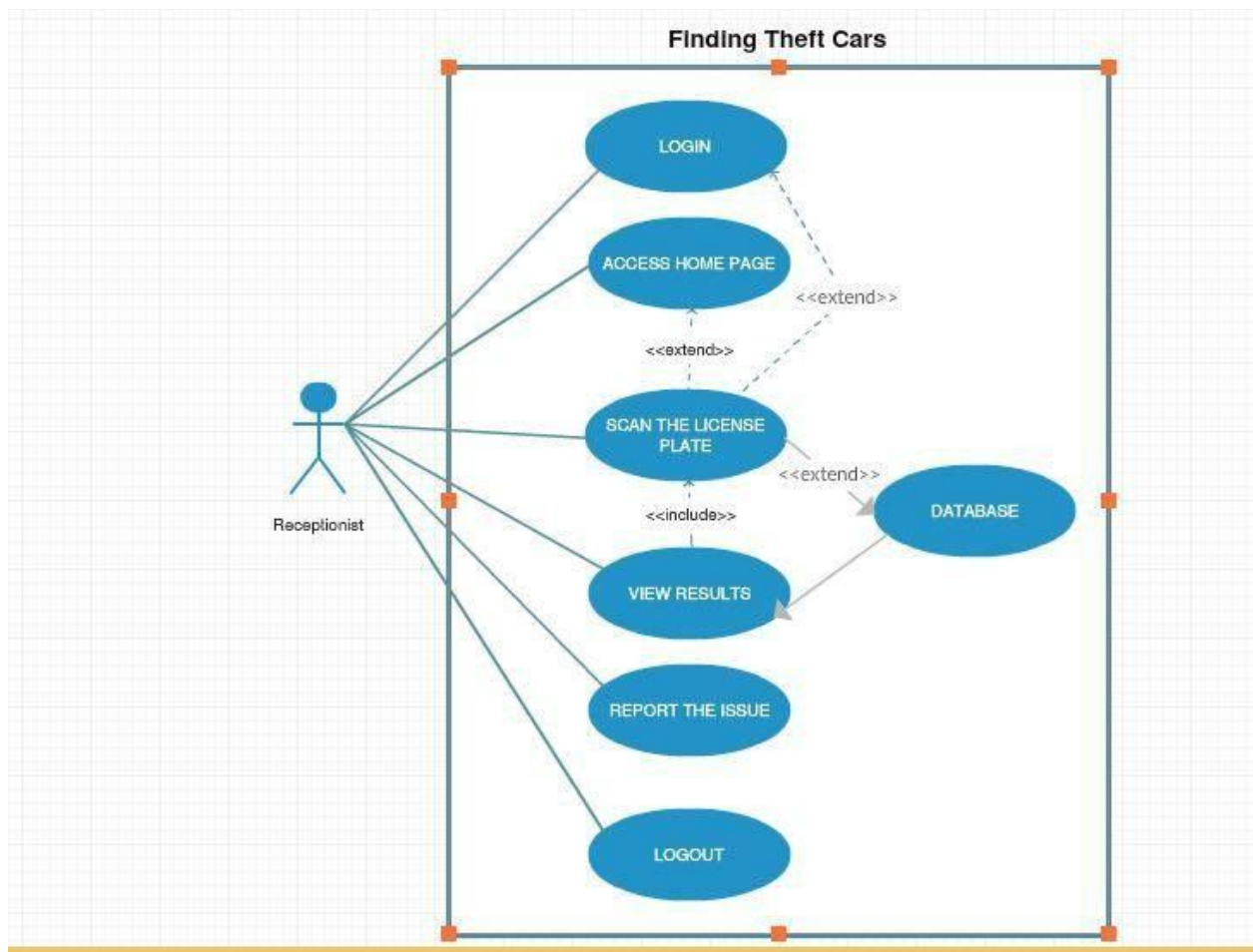
## 2.2 CLASS DIAGRAM



## 2.3 SEQUENCE DIAGRAM



## 2.4 USE CASE DIAGRAM



## 3. PROJECT PLAN

### 3.1 TASKS AND ISSUES

- Create outline of the project
- Choose needed APIs, Databases, Cloud services and IDEs to implement application.
- Create Web application to report car as stolen, which sends data to Mongo DB.
- Create login page with authentication using Firebase database, implement social media login (Facebook Login).
- Create Sign Up page for users who does not have an account which sends records to Firebase database.
- Create server and deploy it to Heroku to be able to connect to databases and Twilio API - for message notification.
- Create license plate and vehicle recognition using OpenAL API, check if car is in Mongo DB and if vehicle is marked as stolen.
- Create Face verification using Cognitive Azure Services Face API.
- Create notification activity using Twilio API and send notification to the user by sending location of the device.
- Create user friendly UI.

### 3.2 BURNDOWN CHART





## 4. INCREMENT REPORTS

### 4.1 GitHub LINKS

GitHub URL:

[Smart Police Project](#)

INCREMENT-1:

[Project Increment 1](#)

### Objectives

The main goal of this application system is to provide the easy way to find the stolen car. Our app contains cameras which will scan the license plates either on the way or even in the parking slots and then it check whether it has any allegations or crime report active on that plate. Then, finally, it is reported to the police, which makes policemen job easy.

### Motivation

If a car is stolen, user will log a complaint about the lost car in the police department. Police will update the stolen license number to the database. If any of car's camera scans the license plate of the stolen car, then the user location is immediately sent to the police department if we could find an evidence of the stole car then the required action will be taken by the department. We would like to create an android application for this showing the login and signup pages in order to access their location.

### Significance

Technology is evolving every day, so creating an interactive web application by reaching our goal within the time frame is our major objective. The key thing of the application is to provide the details of the theft cars and any other related cases on that car We personally take care in building a real-time system that is user-friendly and reachable to everyone and make sure it improves the security system. This app after scanning details of that plate it gives details like is that car theft.

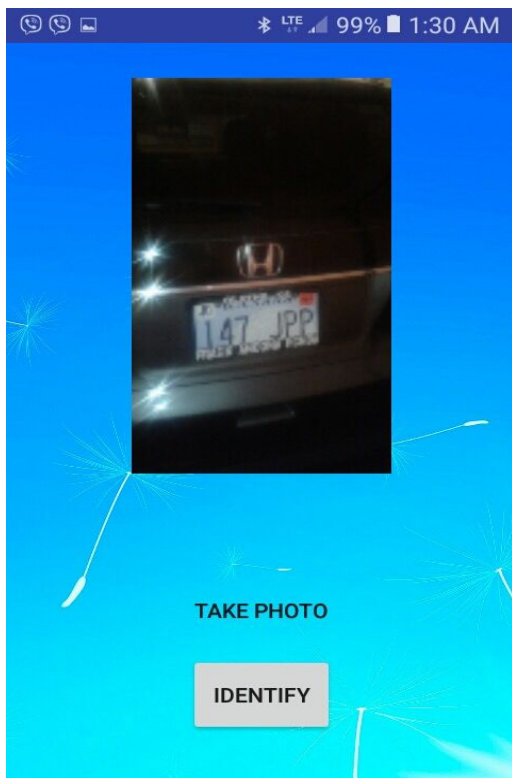
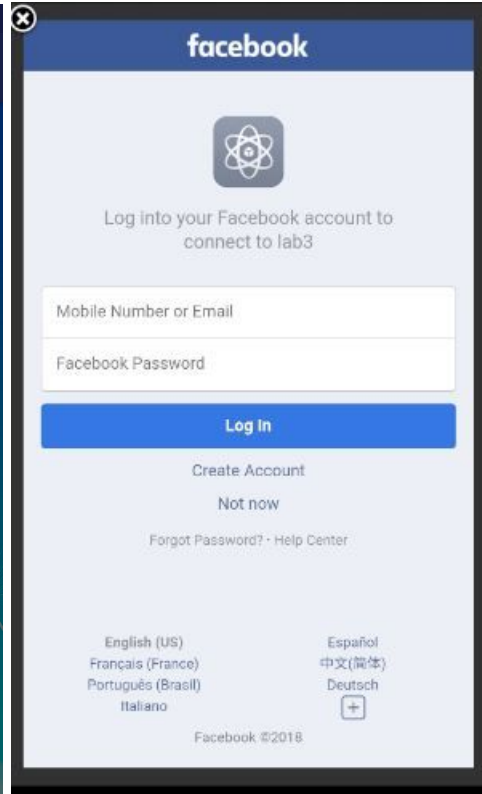
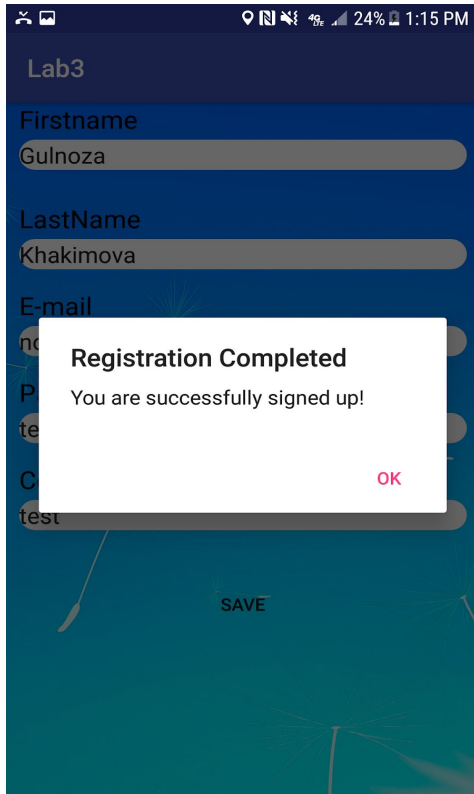
## System Features

In order to implement our application, we will need to work on Android Studio and use different APIs which will help us to scan the license plate. We will be testing our application on the real device with real products.

## OUTPUT

Firstname	
LastName	
E-mail	
Password	
Confirm Password	
SAVE	

Firstname	Gulnoza
LastName	Khakimova
E-mail	nonosha@mail.ru
Password	test
Confirm Password	test
SAVE	



## INCREMENT-2

### Project Increment 2

#### 1.INTRODUCTION

In our day to day life, safety places a major role. Car accidents, our cars been stolen these are some of the common issues nowadays. So, this application mainly focuses on the detection of the vehicle whether it is stolen or not by the license plate.

#### 2.PROJECT GOALS AND OBJECTIVES

##### OVERALL GOAL:

The main goal of this application is to provide a secure and easy way to find the stolen cars using the license plate. In this application where scanning the license plate and getting the information is the major part. For this, we call different APIs to get the information.

##### SPECIFIC OBJECTIVES:
















































The objective of this application is to find whether the car is stolen or whether it has any reports like crash activity happened in the past. In this application, we have a camera from which we get the input and check the image data with the database and get the result of that particular car. Therefore it would be easy to find the stolen car in a very efficient manner.

##### SPECIFIC FEATURES:

Using the camera we can upload the image and find the data easily We can also go through the records round the clock anytime anywhere We can easily identify the car if it was stolen or crashed We can notify the police by updating the data by giving car license number and whether it is crashed or stolen.

As there is too many application which provides you the information about the car whereas our application seemed to be different as it is mobile friendly and easy to access and get the information on a single click. Our application is also seemed to be worth of time as it processes the information and produces data about the car as it is stolen or crashed in minutes so, it would be easy to report to police.

## ZEN-HUB SCREENSHOT

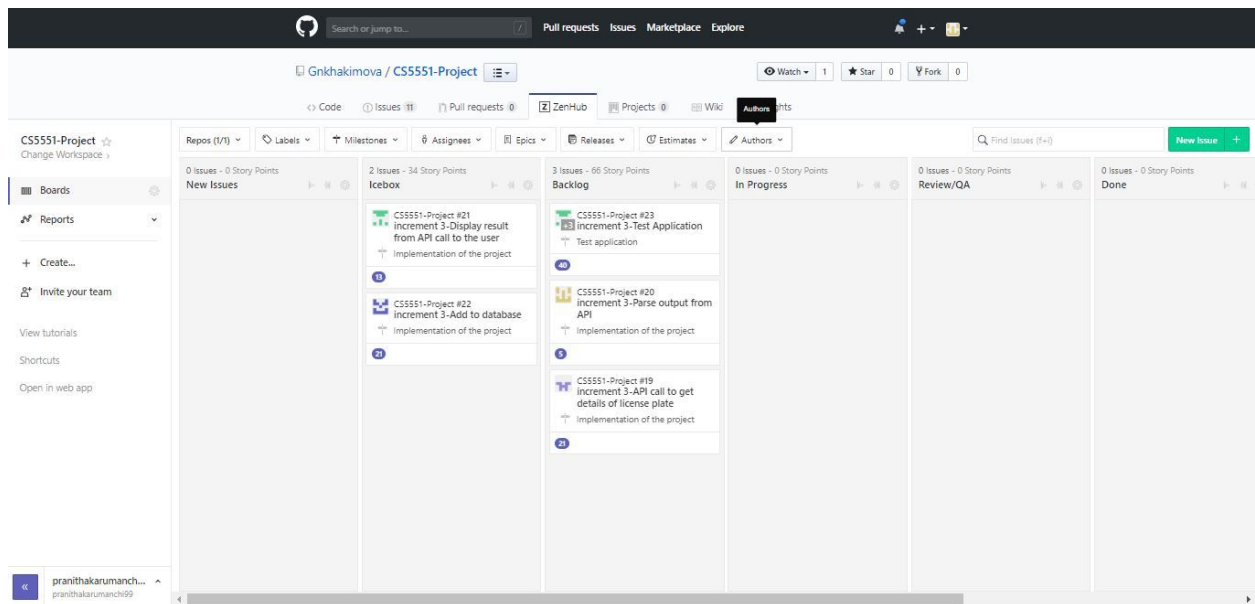
Clear current search query, filters, and sorts			
	Open	21 Closed	
	Author	Labels	Projects
	Milestones	Assignee	Sort
  <b>Increment 2 - cloud deployment</b>	#26 by saikalyan552 was closed 3 minutes ago		
  <b>Increment 1- login page authentication testing</b>	#25 by pranithakarumanchi99 was closed 8 minutes ago		
  <b>Increment 1- Login page result UI</b>	#24 by pranithakarumanchi99 was closed 8 minutes ago		
  <b>Increment 2-License plate reader</b> 	#18 by Gnkhakimova was closed 3 minutes ago  Implementation ...		
  <b>Increment 2-Social Media login</b> 	#17 by Gnkhakimova was closed 3 minutes ago  Implementation ...		
  <b>Increment 2-Register User</b> 	#16 by Gnkhakimova was closed 8 minutes ago  Implementation ...		
  <b>Increment 2-Home page UI</b> 	#15 by Gnkhakimova was closed 3 minutes ago  Create application...		
  <b>Increment 2-Output results UI</b> 	#14 by Gnkhakimova was closed 3 minutes ago  Create application...		
  <b>Increment 2-Design license plate reader UI</b> 	#13 by Gnkhakimova was closed 3 minutes ago  Create application...		
  <b>Increment 1- design Login Page UI</b> 	#12 by Gnkhakimova was closed 7 minutes ago  Create application...		
  <b>Increment-1-Search for Database</b> 	#11 by Gnkhakimova was closed 3 hours ago  Find APIs to get L...		

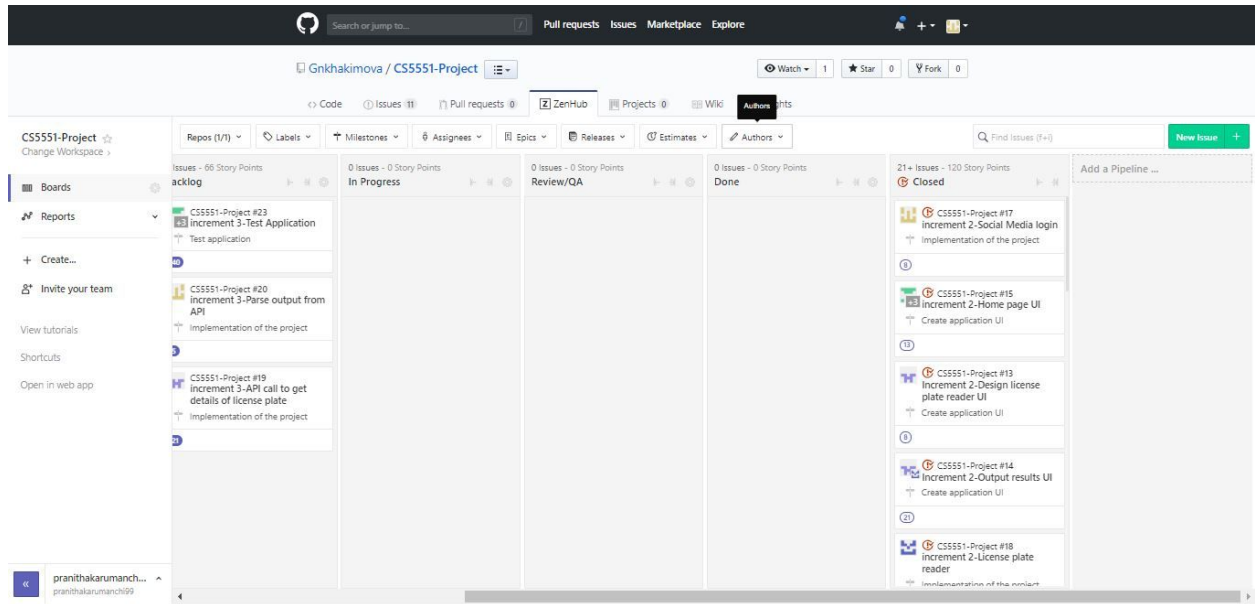
## STORIES

- As a user, we want to login to the page
- We need to take a picture of the license plate
- It displays the result of the license plate
- The user needs to enter license plate details if needed to know whether it is stolen or not
- Now the search is done by license number and displays the result by retrieving data from the database

## PROJECT TIMELINE, MEMBERS AND TASK RESPONSIBILITY

We have created the issues according to the work. The below screenshots are the issues in their respective categorization based on the completion of the work.





## BURN-DOWN CHART

We have created the burndown chart for the issues we created and we also attached milestones for that. Below are the respective screenshots for the burndown chart.



## 4. SECOND INCREMENT REPORT

### EXISTING SERVICES/REST API's USED

**FACEBOOK API:** We gave Facebook as an OAuth login to the users for login into the application. It is the easy way to login for many of the users as it is one of the common social media.

**OpenALPR:** This API is used in the application to get the details of the car by taking the picture of the license plate, it returns Plate number, Model, Year, State and color of the vehicle.

**HEROKU:** It is a pass, it allows us to deploy our application and make calls to get the information available to our application. We create a server using Node.js and added two endpoints for adding and searching license plate. Added MongoDB dependencies to it so our server will have access to our database. We are passing plate number to GET request and getting information if the car is stolen or if it was involved in the car accident. Also, we can add plate number into our database. Since we could not find any open and free APIs to get information about the vehicle we created our own server with example data-sets.

**Clarifai API:** We are using Clarifai to predict image by passing image URL. We are using the General model to perform image recognition and displaying the first three results. We tried to perform person could but is not available within Clarifai yet.

### USER STORIES

- As a user I want to login to the application so that I can access the application.
- As a user I want to use the camera so that I can click the picture.
- As a user, I want to take a picture of the license plate so that it is verified.
- As a user I want to check the result of the car so that I can notify to police as it is stolen.



## IMPLEMENTATION AND DEPLOYMENT

The image displays two screenshots of a web application interface, likely for user authentication and registration.

**Left Screenshot (Login Page):**

- Background: Solid blue.
- Title: **Login** (centered at the top).
- Fields:
  - Username/Email**: A white input field with a blue border.
  - Password**: A white input field with a blue border.
- Buttons:
  - LOGIN**: A blue button with white text.
  - SIGN UP**: A blue button with white text.
  - FACEBOOK LOGIN**: A blue button with white text.

**Right Screenshot (Registration Page):**

- Background: Solid blue.
- Fields:
  - Firstname**: A white input field with a blue border.
  - LastName**: A white input field with a blue border.
  - E-mail**: A white input field with a blue border.
  - Password**: A white input field with a blue border.
  - Confirm Password**: A white input field with a blue border.
- Buttons:
  - SAVE**: A blue button with white text, located at the bottom center.

Firstname  
Gulnoza

LastName  
Khakimova

E-mail  
nonosha@mail.ru

Password  
test

Confirm Password  
test

SAVE

Lab3

Firstname  
Gulnoza

LastName  
Khakimova

E-mail  
nonosha@mail.ru

Password  
test

Confirm Password  
test

**Registration Completed**  
You are successfully signed up!

OK

SAVE

PHOTO

CLARIFAI

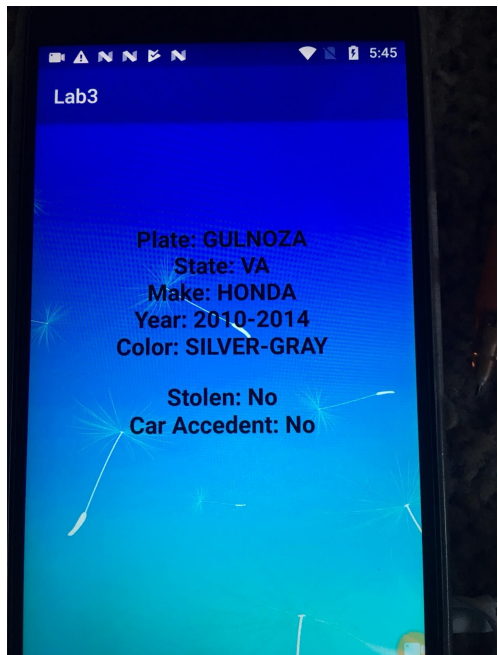
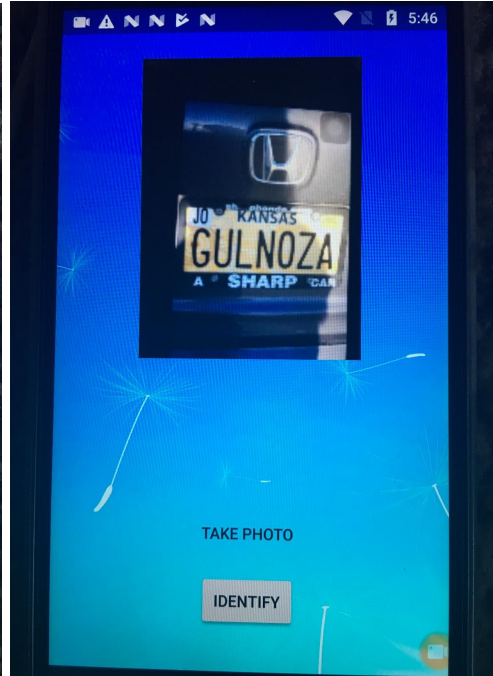
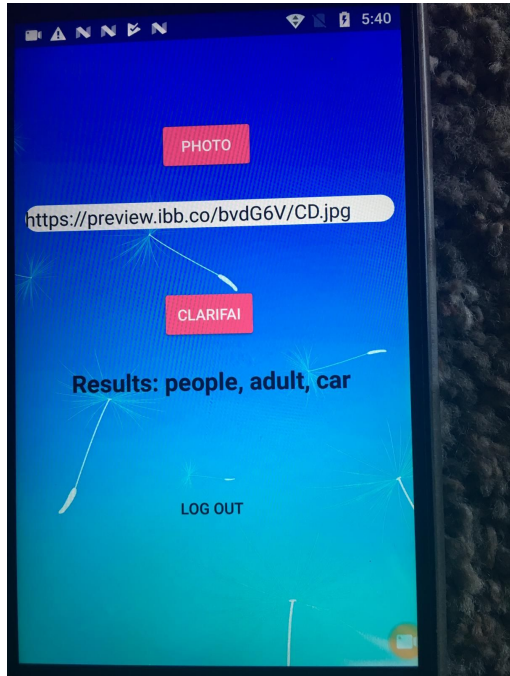
LOG OUT

PHOTO

<https://preview.ibb.co/bvdG6V/CD.jpg>

CLARIFAI

LOG OUT





## PROJECT MANAGEMENT

### Work Completed

The tasks we completed in this increment

- Clarifai API used for getting information about image with passengers in the car.
- Mlab, Mongo DB and Firebase DB are used to store the database.
- Heroku to deploy our application and get access by making calls.

## INCREMENT-3

### [Project Increment 3](#)

#### INTRODUCTION

In these days the car was stolen, cars been crashed are the common problems everyone is facing. So, our application helps the people in finding the stolen cars and it also helps in finding the crashed cars. Which makes work easy for the public and police.

## PROJECT GOALS AND OBJECTIVES

**OVERALL GOAL** The overall goal of this application is to find the stolen car or crashed car and then getting the location of the car. Once after getting the location, it will be sent to the user as a message. For doing all this we use different APIs to get real-time data.

## SPECIFIC OBJECTIVES

The main objectives of this application are to find whether the car is stolen or not and also is it crashed or not. It also obtains the location of the stolen car and then sends the message to the user about that particular car. A user can also enter the details of the car like it is stolen or crashed. So, that one can add information and can also get the information about the car by searching the license plate.

## SPECIFIC FEATURES

The important features like using the camera to click the license plate and find it whether it is stolen or crashed. The location update is also one of the key features, in this application we get the location of the stolen car and is updated to the user.

## STORIES

1. User will login to the application.
2. On begin user use the camera to take a picture
3. Using clarify user get the result
4. If the result shows that car is stolen then it sends the message to an owner
5. Owner gets the car location.
6. If the result shows car is not stolen user goes back to home.

## 4.THIRD INCREMENT REPORT

### EXISTING SERVICES/REST API'S USED

7. For this project we have used OpenAL API to get license plate.
8. Using Heroku we have deployed endpoints.
9. Mongodb : store data and handling data related operations(update,delete,add)
10. To enter text we have created server.
11. Face verification is used to check if the owner is present in the car or not.

12. Our application has two modes online and offline.
13. Online while driving and scanning license plates.
14. Offline to check if the owner is present or not.
15. For face detection, we are using Azure Cognitive Services
16. Face API - which is machine learning API - using two endpoints Detect and Verify
17. Twilio - cloud communication platform used for sending text message regarding the location of stolen car.

The image displays two side-by-side mobile application screens with a blue and purple gradient background. Both screens feature a white rounded rectangle for form input.

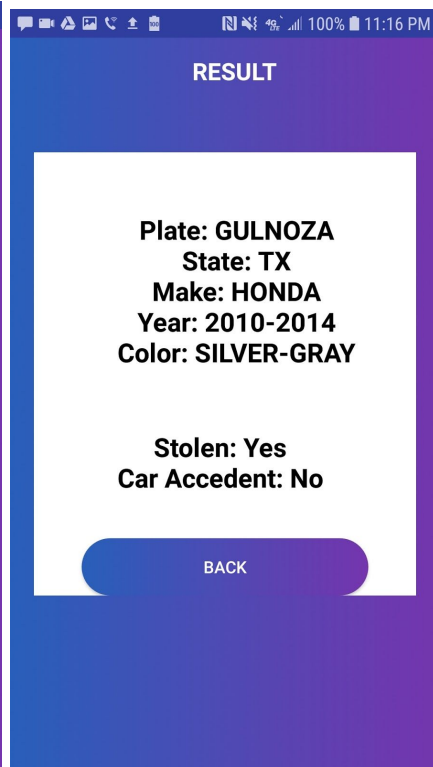
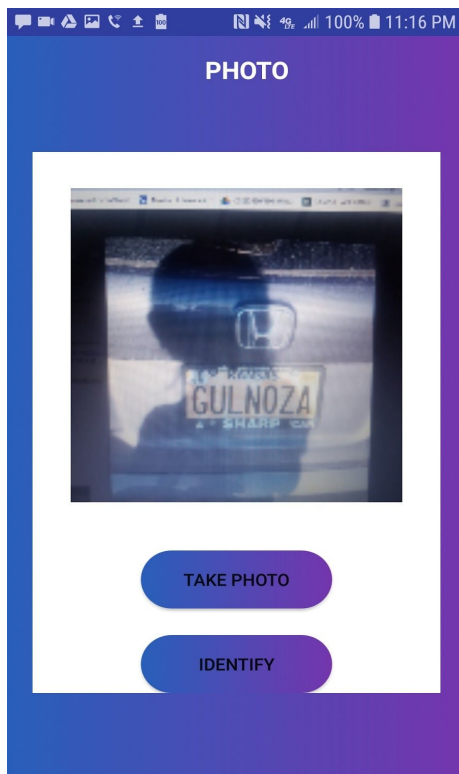
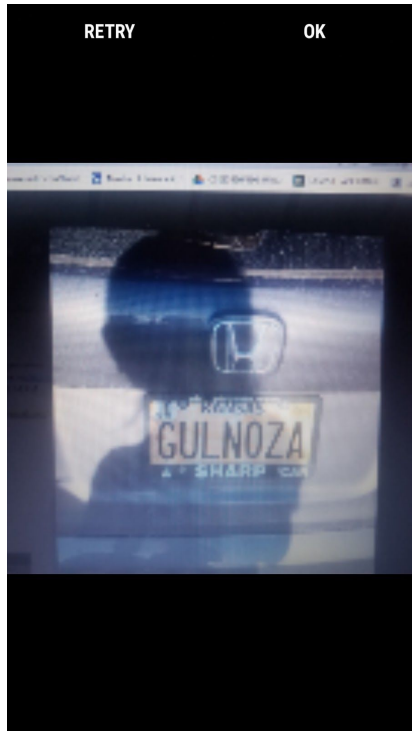
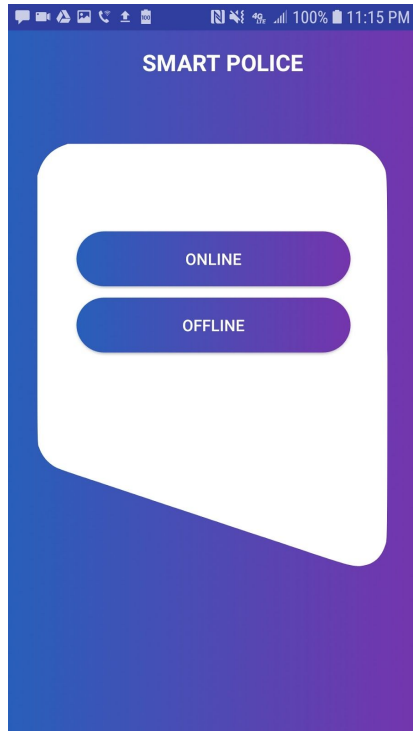
**Left Screen (LOGIN):**

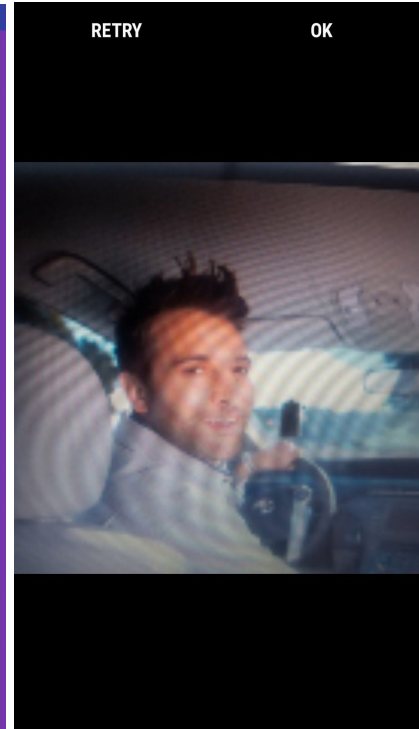
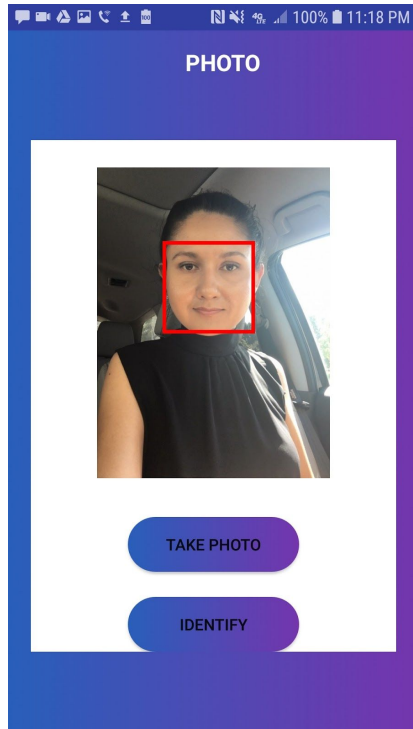
- Header: **LOGIN**
- Form fields:  EMAIL/MOBILE,  PASSWORD
- Checkbox: ☐ REMEMBER ME
- Navigation: A blue circular button with a white right-pointing arrow.
- Footer: A button labeled "Continue with Facebook" and a large purple button labeled **SIGN UP**.

**Right Screen (Sign Up):**

- Header: **Sign Up**
- Form fields:  NAME,  EMAIL/MOBILE,  PASSWORD
- Checkbox: ☐ Agree to Out Terms & Conditions
- Navigation: A blue circular button with a white right-pointing arrow.
- Footer: Text "Already have an Account" and a large purple button labeled **SIGN IN**.







Information Page

LicensePlate

State

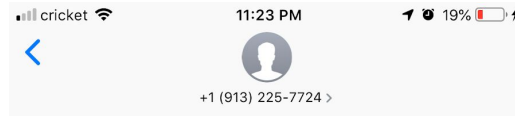
Make

Stolen

Color

Car Accident

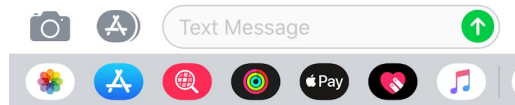




Text Message  
Today 11:22 PM

Sent from your Twilio trial account -  
Suspicious person is in your car.  
Call 911 if needed

Sent from your Twilio trial account -  
Your car was noticed at following  
location:

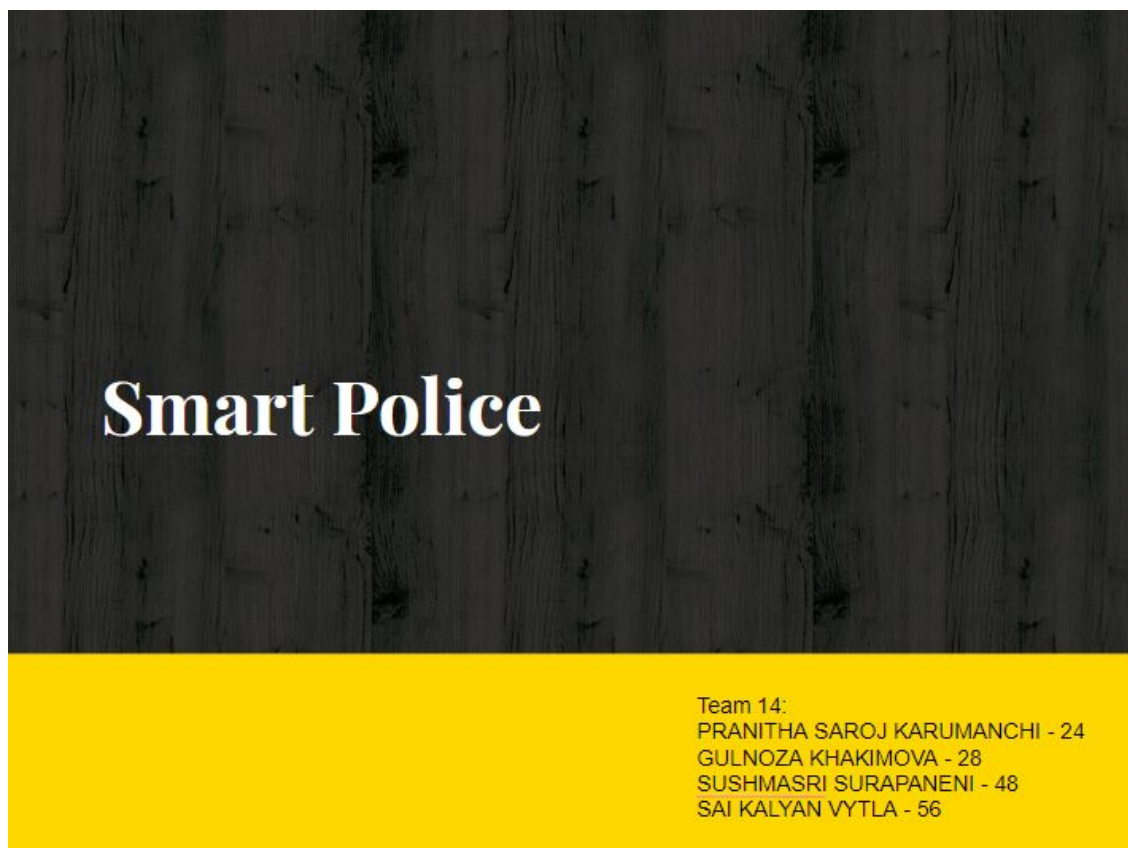


## PROJECT MANAGEMENT

### WORK COMPLETED

18. Used OpenAL API to get license plate.
19. Mongoddb : store data and handling data related operations.
20. Face verification is used to check if the owner is present in the car or not.
21. For face detection, we are using Azure Cognitive Services

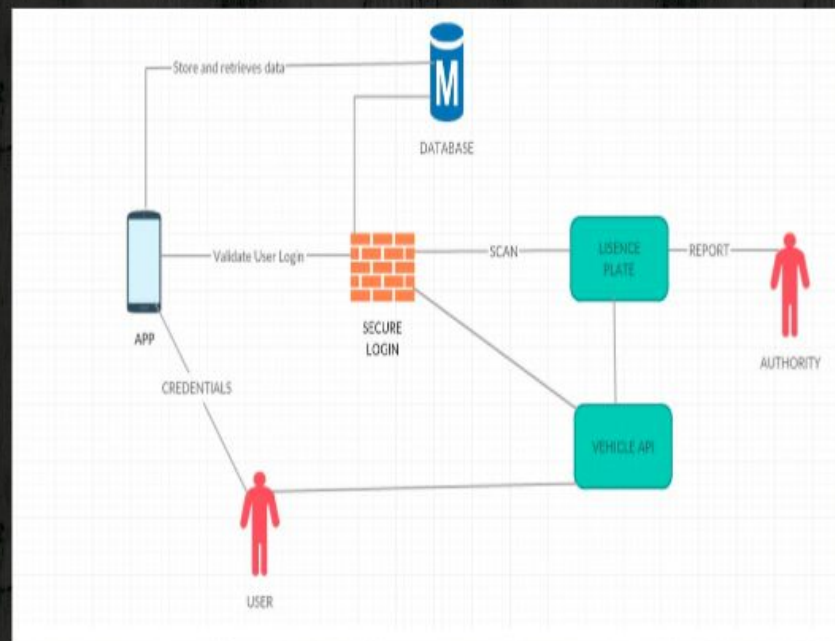
## 4.3 PRESENTATION SLIDES AND YOUTUBE VIDEO LINK PROJECT PRESENTATION



## Motivation

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- The goal of this project is to create an application which will help police and owners to find stolen cars by scanning license plates.
- Applying has two modes:
  - ❖ Online – scans license plate number and return whether vehicle was stolen or not
  - ❖ Offline – camera snaps photo of the person in the car and compares it with owner of the car.
- Then, finally, it is reported to the user, which makes they live more secure.



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## Architecture

## Application Modes

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### Online

Snaps a photo of license plate performs scanning to get plate number, color of the vehicle, plate state, make of the vehicle and year. If stolen car is noticed, owner gets notified.

### Offline

Snaps photo of the person in the car and image gets compared against image of the owner and family member, if identity is less than 70% owner and family member gets notification.

## Technologies used

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### Android and Web Application

Mobile application helps to find stolen cars and report if suspicious person in the car. Web application is used to report if your car has been stolen.



### OpenAL API

Performs license plate scanning to get plate number, color of the vehicle, make etc.



### Azure Cognitive Services

Face API is used to verify that person in the car is owner of the vehicle.



### Firebase, Mongo DB

Database to store data and perform authentication,



### Twilio

User gets message notification when stolen car is noticed



### Heroku

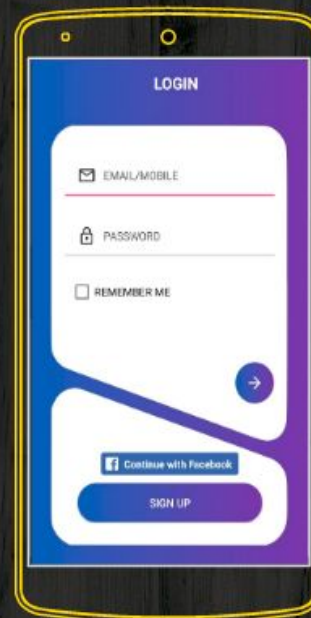
Deployed endpoints to Heroku to be able to access Databases and Twilio





## Web Application

Publicly available web application from where users can mark their cars as stolen.



## Login Page

User can sign up if he does not have an account yet, also Facebook can be used to login.

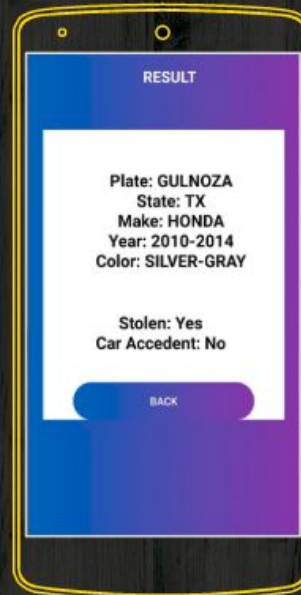
## Main Page

Application has two modes: Online and Offline



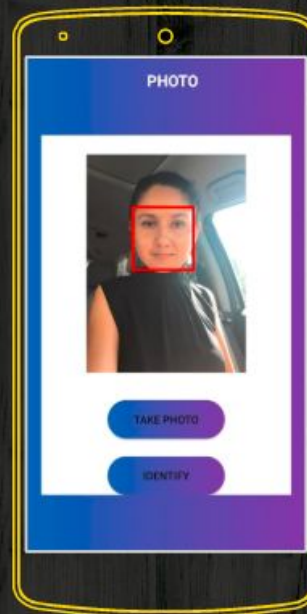
## Online Mode

Stolen car was noticed by application which also returns additional information about the car



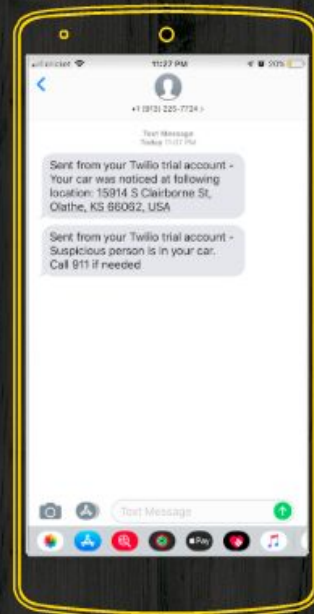
## Offline Mode

Person was noticed in the car and application performed face recognition



## Notification by message

User gets notified when his car noticed or person in the car is not owner.



### 4.4 YOUTUBE LINK

[Smart Police Demo](#)



## 5. TESTING-TEST CASES

CASE	TEST CASE DESCRIPTION	EXPECTED RESULT	ACTUAL RESULT	RESULT
LOGIN	VALID USERNAME AND VALID PASSWORD	SUCCESSFUL LOGIN	SUCCESSFUL LOGIN	PASS
SIGNUP	VALID CREDENTIALS	SUCCESSFUL REGISTRATION	SUCCESSFUL REGISTRATION	PASS
IMAGE	CLEAR IMAGE	GIVES CAR DETAILS	GIVES CAR DETAILS	PASS
URL	VALID URL	PEOPLE PRESENT IN THE CAR	PEOPLE PRESENT IN THE CAR	PASS

CASE	TEST CASE DESCRIPTION	EXPECTED RESULT	ACTUAL RESULT	RESULT
LOGIN	INVALID USERNAME AND INVALID PASSWORD	ERROR MESSAGE SAYING INVALID CREDENTIALS	ERROR MESSAGE SAYING INVALID CREDENTIALS	PASS
SIGNUP	PASSWORD MUST HAVE 8 CHARACTERS	PASSWORD NOT STRONG	PASSWORD NOT STRONG	PASS
IMAGE	IMAGE IS NOT CLEAR	POPUP SAYING RETAKE THE IMAGE	POPUP SAYING RETAKE THE IMAGE	PASS
URL	INVALID URL	POPUP SAYING PLEASE ENTER CORRECT URL ADDRESS	POPUP SAYING PLEASE ENTER CORRECT URL ADDRESS	PASS

## 6. STEPS

### 6.1. Login Page

User gives his details to login into the application. As soon as the data is given it then checks with the database for valid username and for valid password given by the developer. If the given username doesn't match with the developers record then it sends a notification saying invalid username. If the given password is invalid then it sends the notification saying the user entered the wrong password. User can also login into the application using facebook also.

### 6.2. Sign Up Page

If the user is new to the application, user will sign up to the application by giving his/her details. As a developers we have created a database where the user details are stored. Then we have created the collections where the data is stored and retrieved in the login page. Collections are added according to the columns used in the web page. For suppose if we have the name as the text field, we create a collection called name and the data from the user is stored in the collection called name. After the related code is written, we first run the server and then run the html page.

### 6.3. Main Page

In the home page we have two options online mode and offline mode. Use can choose any one according to his requirement. When the user clicks on the online mode he then redirects to page where he has camera access. Camera keeps scanning the license plates while the car is in motion. If the license plate number matches with the records that have stolen car details. Then it immediately sends notification to the authorised department.

Heroku : It is a pass, it allows us to deploy our application and make calls to get the information available to our application. We create a server using Node.js and added two endpoints for adding and searching license plate. Added MongoDB dependencies to it so our server will have access to our database. We are passing plate number to GET request and getting information if the car is stolen or if it was involved in the car accident. Also, we can add plate number into our database. Since we could not find any open and free APIs to get information about the vehicle we created our own server with example data-sets.

### 6.4. Online Mode Page

In online mode user scan the license plate and check whether that car is stolen or not. If the car found to be stolen then user get the location. Here user gets the details of the car like model, color like that. Here we have used mongodb to store data for stolen cars. We deployed the whole application to heroku a cloud platform which we can access the application easily.

An openAL API is used to retrieve the car details like make, color,type and year of manufacturing.

Clarifai API: We are using Clarifai to predict image by passing image URL. We are using the General model to perform image recognition and displaying the first three results. We tried to perform person could but is not available with in Clarifai yet.

### 6.5. Offline Mode Page

In offline mode if any person enter the car other than user than a snapshot is taken using camera. Then it check similarity if it is less than 70% then the user will get

The sms with alert message. Face verification is used to check if the owner is present in the car or not. For face detection, we are using Azure Cognitive Services

- Face API - which is machine learning API - using two endpoints Detect and Verify
- Twilio - cloud communication platform used for sending text message regarding the location of stolen car.

## Responsibilities

1. Pranitha Saroj Karumanchi -Mongo, Mlab, UML diagrams, Web application.
2. Gulnoza Khakimova - OpenAL API - license plate scanning, Azure Cognitive Services - Face Verification API, Node.js and deployment of endpoints to Heroku, Twilio messaging API, Mongo DB integration, Firebase DB integration for authentication, Facebook authentication, Converting longitude and latitude to address using Geocoder, functionality of Android application etc.
3. Sushmasri Surapaneni - Worked on location,Integration of pages, Wireframes.
4. Sai Kalyan Vytla - UI, Test cases, User stories, text to speech application.

## References

1. <https://www.twilio.com/docs/usage/api>
2. <https://docs.microsoft.com/en-us/azure/cognitive-services/face/overview>
3. <https://mlab.com/login/?r=%2Fdatabases%2Fproject123%2Fcollections%2Fsmart#indexes>
4. <https://firebase.google.com/>
5. <https://www.heroku.com/>

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