Car Theft Tracker Software Proposal Document

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1 Introduction

1.1 Purpose of this document

The purpose of this document is to present a detailed description of the Car Theft Tracker System. It will explain the purpose and features of the system, the interfaces of the system, what the system will do, the constraints under which it must operate and how the system will react to external stimuli. This document is intended for both the stakeholders and the developers of the system.

1.2 Scope of this document

Our system serves the police to ease the finding of stolen vehicles excluding motorcycles. Moreover, benefits the citizens to find their own cars and that by attaching a camera to police cars and the public transportation buses which will capture the plate licences every certain interval of time depending on an equation:

Time = M * speed of the car with camera device

where [M] is a constant value will be determined experimentally.

Also it will be captured according to a distance (d) that will be determined later on. This documentation will be delivered on 16th of January, 2017.

1.3 Overview

Our system will be in Egypt during daylight under normal weather conditions for capturing images of vehicle license plates while the vehicles are in motion using a camera. The system is a real-time system(online). The system will be focusing on all types of vehicles excluding motorcycles. All kinds of plate are segmented and recognized including new and old licence plates.The camera will be attached to the police's cars and public transportation buses. Phase one, will be segmenting one object at a time. Our aim is to solve the following

challenges which are segmenting the plates itself and then recognizing the color of the license plates to know the type of car plate that is recognized in case of new plates. In addition, optical character recognition of license plate characters.

1.4 Business Context

Our system ease the process of finding stolen vehicles for both the police, and vehicle owners. Similar systems already exist.

2 General Description

2.1 Product Functions

Our system aims to find stolen vehicles. It is available for the police department as it helps and ease the finding of stolen vehicles by attaching a camera to the police cars and public transportation buses.This camera captures images of vehicle scenes on the road, then the captured images are sent to the cloud server for pre-processing then perform segmentation and optical character recognition.

2.2 Similar System Information

Our proposed system is a system to track and find stolen vehicles. There are similar systems which have the same functionality as ours but the differences are that our system is intended for the Egyptian Arabic numbers and characters in licences plates(new/old) but for Academic App is for just arabic numbers. Moreover, the VaxALPR is just for english characters (1)(2)(3)(4)(5)

System	Features	Algorithms and technique
Academic App	presenting a simple technique for automatic Arabic number plate recognition, a recognition system for the NEW Egyptian license plate .	Threshold (To avoid unnecessary segmentation) Sobel method for edge detection Neural Network for recognition
Market Application (VaxALPR)	Measuring using real outdoor video VaxALPR recognizes the license plates of the vehicles around it given location and speed. applying the algorithm on each frame in the video and the result plate number was checked if it was one of the valid plate configurations otherwise it was ignored	Region of interest configuration OCR
Our Proposed System	get the current coordinates, current time, current date, detects/recognizes license plates found in the captured image. generates reports periodically that contain all of the details mentioned above (approximate current coordinates, current time, current date, and the recognized plate number).	using Region Growing algorithm (segmentation), Fuzzy algorithm and using sequential search

2.3 User Characteristics

Our system is available only for police department to use in-order to help the police to locate and find stolen vehicles.

2.4 User Problem Statement

Our system is enhance the accuracy of the segmentation of the vehicles plates while in motion and to recognize the vehicles plates.

2.5 User Objectives

Our system allows the police to find and locate stolen vehicles through attaching a camera to their cars and public transportation buses. Then the processing takes place on the cloud server. If a vehicle was already reported stolen and recognized after the recognition process is finished on the cloud server then an alarm with a generated report is sent to the police that contains vehicle license plate numbers, approximate current coordinates, and time-stamp.

2.6 General Constraints

Due to the heavy processing and big data we used Google cloud server.

3 Functional Requirements

3.1 Capturing Images

Capture images by camera every certain interval of time with a processing chip in real time for vehicles on road while they are in motion then send the captured images with date , time and current location to Google cloud server. Time interval for capturing images will be calculated using a certain equation which is Time = M * speed of the car with camera device. Distance = d (to be determined).

where [M] is a constant value will be determined experimentally.

Also it will be captured according to a distance(d).

3.2 Image Redundancy

Images are compared with each other with regard to current time, and current coordinates. If the images match each other and there is no noticeable difference between the time of each image and their coordinates then the image is discarded else it's sent to Google cloud server.

3.3 Image Enhancement

Image enhancement will take place first. Image is converted to grayscale then GuassianBlur is applied to the newly converted-to grayscale image then Adaptive Threshold is applied. This functional requirement is important to guarantee accuracy for segmentation.

3.4 Image Segmentation

The image will be segmented using Region Growing algorithm. The algorithm starts from a seed point and determines a maximum size for segmentation of the license plate using threshold algorithm.

3.5 Image Recognition

Image will be recognized; its Arabic characters, numbers and its color in case of new licence plates to segment the vehicle's type using feature extraction which will be recognized using Scale Invariant Feature Transform (SIFT), Speeded Up Robust Features (SURF). So, if the segmented licence plate is a new licence plate, then the color of the plate which determines the type of the vehicle licence plate would be recognized first then the characters and numbers of the plate will be recognized. And if the segmented plate is from the old licence plate, then it's Arabic characters and numbers will be recognized by pattern recognition. Moreover, to confirm on the recognition of the SURF or SIFT, we will be using fuzzy to train and test the system/classifier.

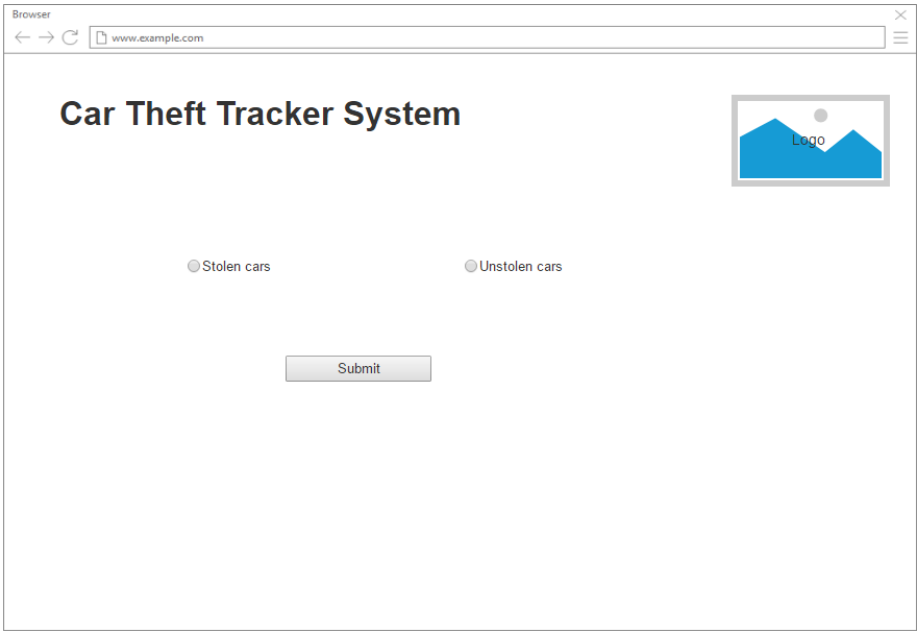
3.6 Data Redundancy

The plate number will be searched in the database if the state of the car found to be stolen and it is not exist with the same date ,time and location in the database, so it will be stored in the database then an alarm will be sent to the police, which then generates a report with the approximate location, time and date. Also it found to be not stolen and it is not exist in the database ,it will be also stored in the database with its current time , date and location.

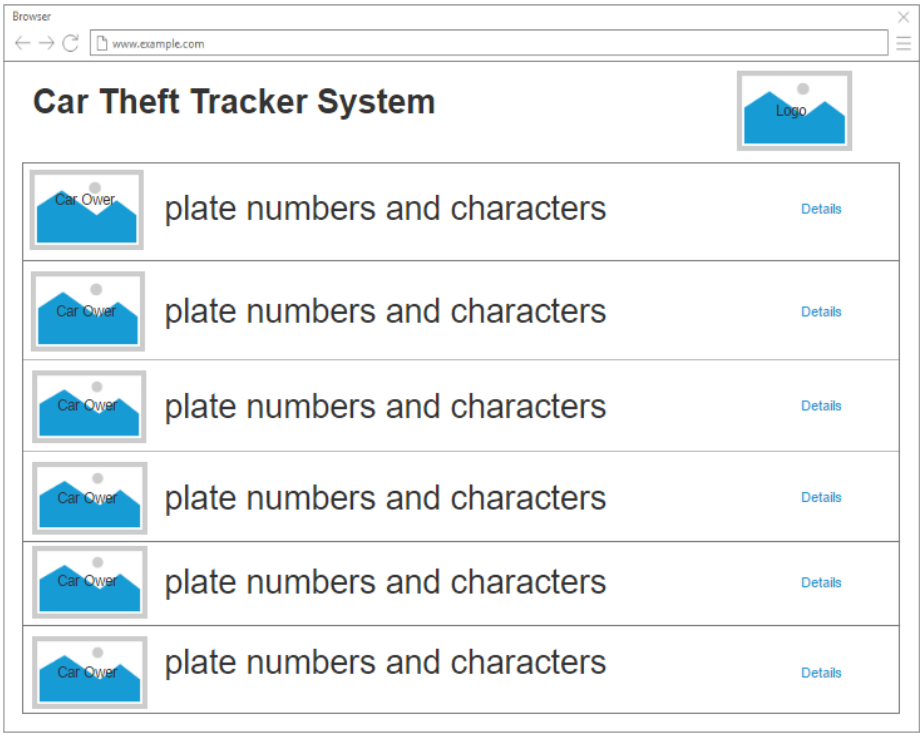
4 Interface Requirements

4.1 User Interfaces

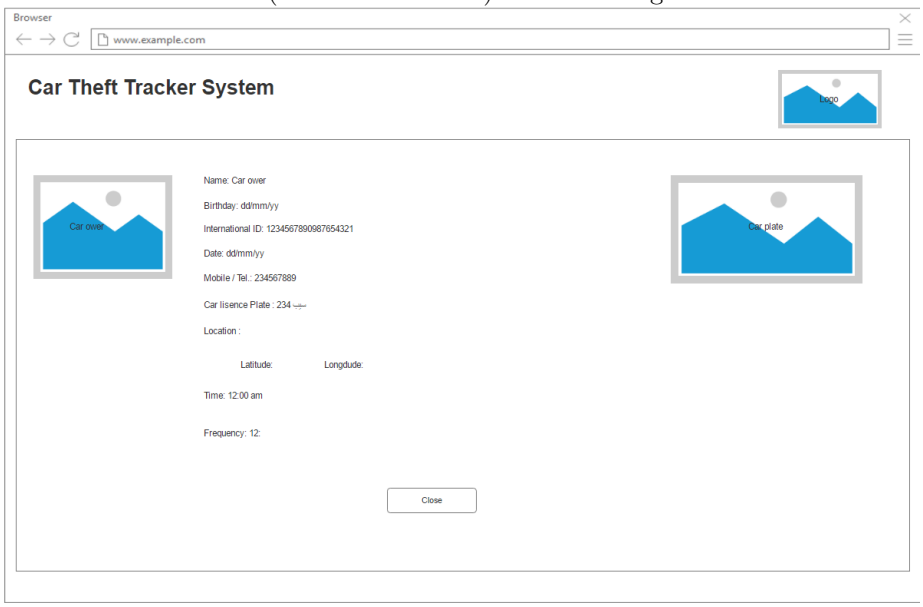
4.1.1 GUI



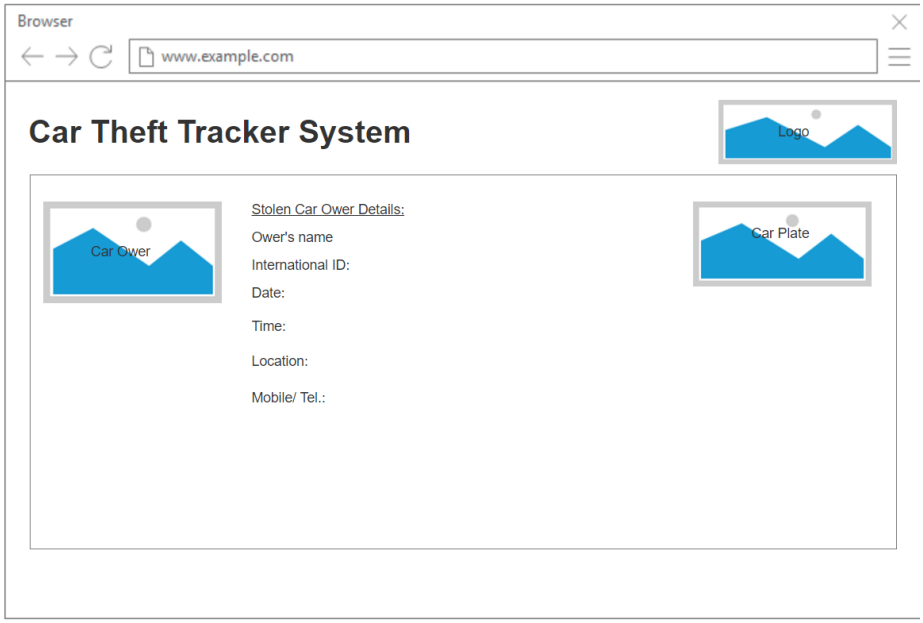
Home page is where the police office to show the reports of the stolen cars or not.



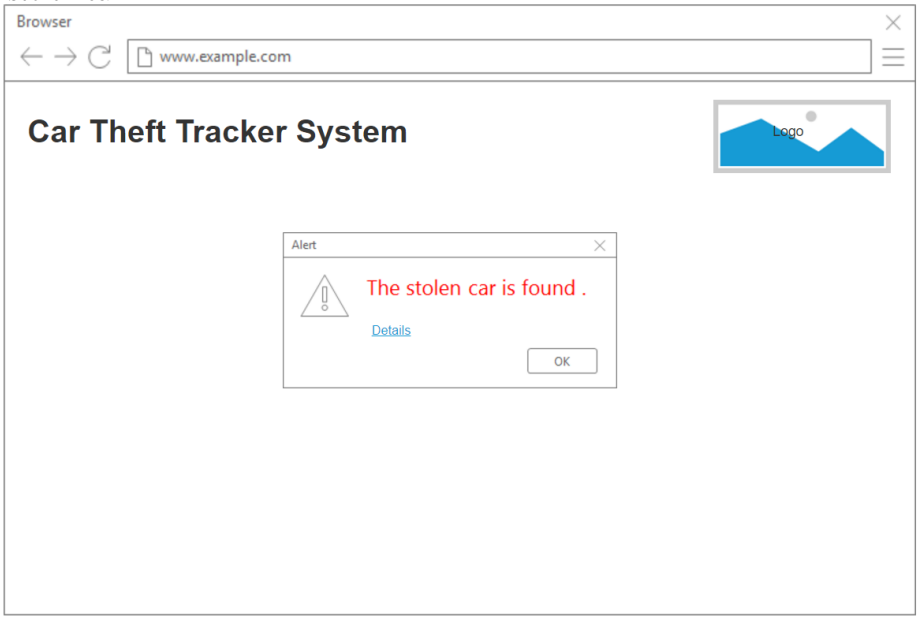
This is the list of the cars (stolen or unstolen) with the image of the car owner.



If the officer chose the unstolen cars , it will show the report with details of the unstolen car.



If the officer chose the stolen cars , it will show the report with the details of the stolen car.



This will appears if the system discover a stolen car found on the road and had been captured.

4.1.2 API

Google Maps is a Web-based service that provides detailed information about geographical regions and sites around the world. In addition to conventional road maps, Google Maps offers aerial and satellite views of many places. In some cities, Google Maps offers street views comprising photographs taken from vehicles. Our parameters will be the coordinates (latitude and longitude).

5 Other non-functional attributes

5.1 Security

Images captured and reports generated will only be accessible by police department for privacy and security concerns.

5.2 Portability

The application runs partly on a chip attached to a camera but then the images captured are sent to Google cloud server for most of the processing.

5.3 Resource Utilization

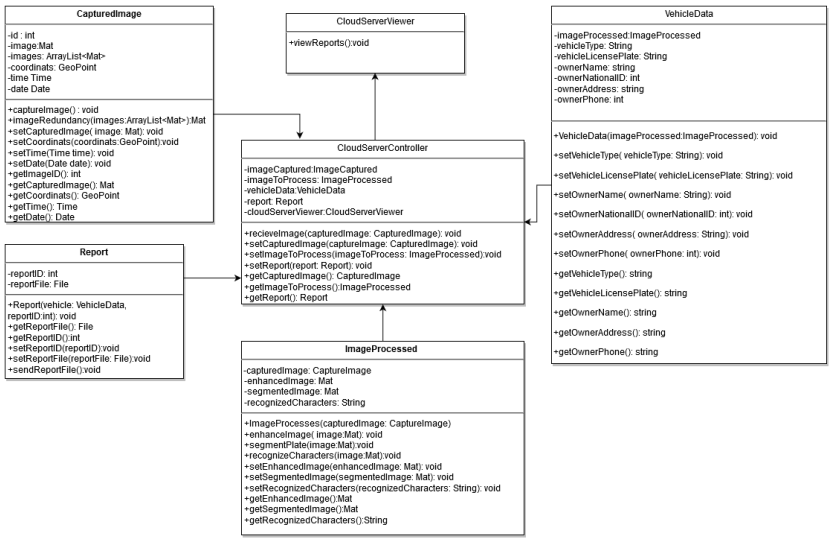
Heavy processing takes place on Google cloud server.

5.4 Serviceability

The system provides generated reports with details about the output for the police station.

6 Preliminary Object-Oriented Analysis

6.1 Class descriptions



6.1.1 Class name

CapturedImage, CloudServerViewer, VehicleData, CloudServerController, ImageProcessed, Report.

6.1.2 Purpose:

-CapturedImage Class : its purpose to get the captured image with its coordinates (longitude and latitude) and its captured time. CloudServerViewer Class : its purpose is to view the reports for the police officers.
VehicleData Class : its purpose is to get and set the vehicle's data.
CloudServerController Class : its purpose is to get the captured image and send it to be processed and get the reports. ImageProcessed Class : its purpose is to enhance the image, segment the plate license and recognize the plate's characters and numbers.
Report Class : its purpose is to get and set the report.

6.1.3 Collaborations:

CapturedImage, ImageProcessed, VehicleData and Report classes interact with CloudServerController. CloudServerController get captured image from CapturedImage class then passes it to ImageProcessed class for image enhancement, segmentation and recognition, then CloudServerController passes the object from ImageProcessed to VehicleData, the CloudServerController the object

of VehicleData class to the constractor of an object of type report class. Finally the controller passes the data to CloudServerViewer in order to view the data.

6.1.4 Attributes:

CapturedImage:
-ID
-Image
-Coordinates
-Time
-Date

Report:
-ID
-ReportFile

ImageProcessed:
-CapturedImage
-EnhancedImage
-SegmentedImage
-RecognizeCharacters

CloudServerController:
-ImageCaptured
-ImageToProcess
-VehicleData
-Report
-CloudServerViewer

VehicleData:
-ImageProcessed
-VehicleType
-VehiclelicensePlate
-OwnerName
-OwnerNationalID
-OwnerAddress
-Ownerphone

6.1.5 Operations

: CapturedImage
+captureImage() : void
+imageRedundancy(images:ArrayList¡Mat¿):Mat
+setCapturedImage(image: Mat): void
+setCoordinats(coordinats:GeoPoint):void

+setTime(Time time): void
+setDate(Date date): void
+getImageID(): int
+getCapturedImage(): Mat
+getCoordinats(): GeoPoint
+getTime(): Time
+getDate(): Date

CloudServerController
+recieveImage(capturedImage: CapturedImage): void
+setCapturedImage(captureImage: CapturedImage): void
+setImageToProcess(imageToProcess: ImageProcessed):void
+setReport(report: Report): void
+getCapturedImage(): CapturedImage
+getImageToProcess():ImageProcessed
+getReport(): Report

Report
+Report(vehicle: VehicleData,reportID:int): void
+getReportFile(): File
+getReportID():int
+setReportID(reportID):void
+setReportFile(reportFile: File):void
+sendReportFile():void

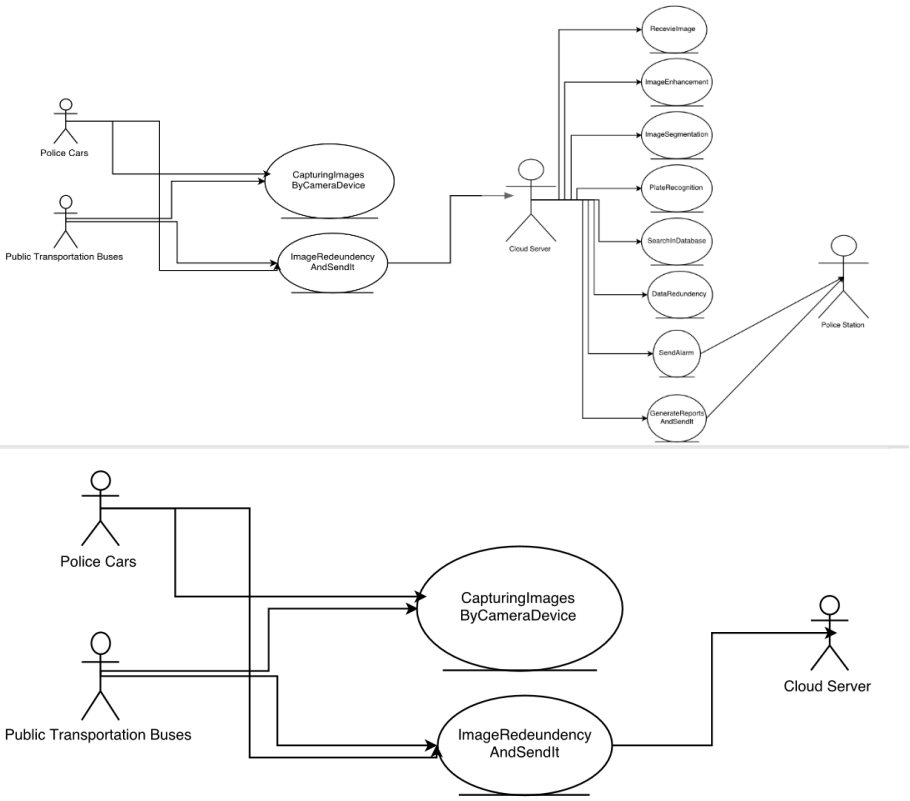
ImageProcessed
+ImageProcesses(capturedImage: CaptureImage)
+enhanceImage(image:Mat): void
+segmentPlate(image:Mat):void
+recognizeCharacters(image:Mat):void
+setEnhancedImage(enhancedImage: Mat): void
+setSegmentedImage(segmentedImage: Mat): void
+setRecognizedCharacters(recognizedCharacters: String): void
+getEnhancedImage():Mat
+getSegmentedImage():Mat
+getRecognizedCharacters():String

VehicleData
+VehicleData(imageProcessed:ImageProcessed): void
+setVehicleType(vehicleType: String): void
+setVehicleLicensePlate(vehicleLicensePlate: String): void
+setOwnerName(ownerName: String): void
+setOwnerNationalID(ownerNationalID: int): void
+setOwnerAddress(ownerAddress: String): void
+setOwnerPhone(ownerPhone: int): void
+getVehicleType(): string

+getVehicleLicensePlate(): string
+getOwnerName(): string
+getOwnerAddress(): string
+getOwnerPhone(): string

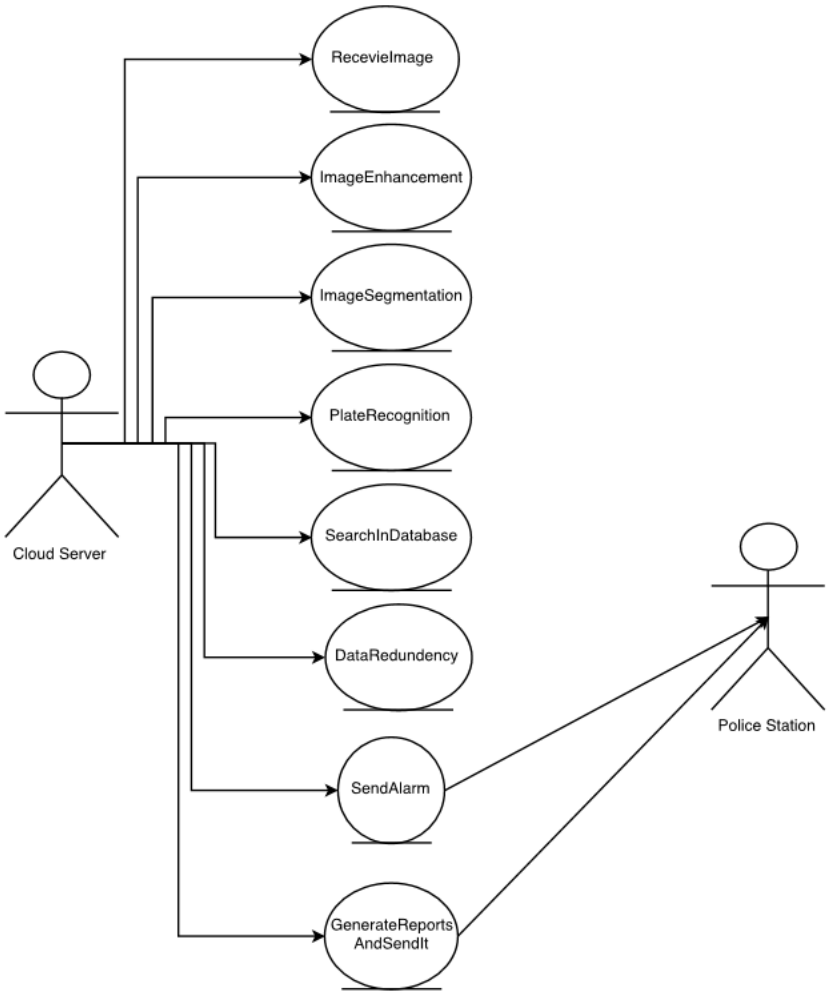
CloudServerViewer
+viewReports():void

7 Operational Scenarios



1)Capturing Images:
The camera attached to the police cars and the public transportation buses which would capture images while car is in motion.

2)Image Redundancy:
Images are compared with each other with regard to current time, and current coordinates. If the images match each other and there is no noticeable difference between the time of each image and their coordinates then the image is discarded else it's sent to Google cloud server.



1)Receive Image: The cloud server will receive the captured image that will be process on it some operations like enhancement, segmentation and recognition.

2)Image Enhancement: The captured image will first be enhanced using grayscale,gaussian and adaptive threshold.

3)Image Segmentation: The enhanced image will then be segmented using the region growing algorithm which detects a seed point within the license plate number to extract the licence plate and determine a maximum size for detection of the license plate using threshold algorithm.

4)Plate Recognition: The segmented plate will be recognized its Arabic characters, numbers and its color if it is a new licence plate to detect the car's type using feature extraction will be recognized using Scale Invariant Feature Transform (SIFT), Speeded Up Robust Features (SURF). So if the car segmented to be the new licence plate, the color of the plate which determine the type of the

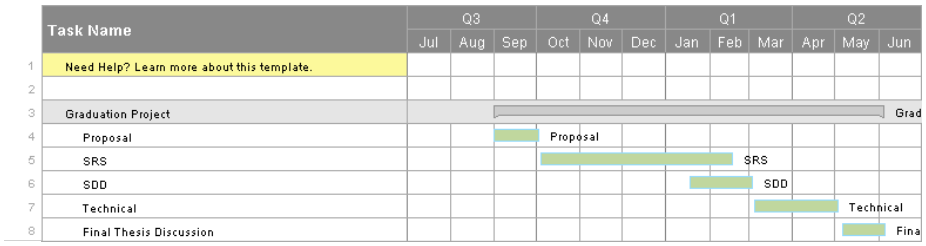
car would be recognized first then the characters and numbers of the plate will be recognized. And if the segmented plate is from the old licence plate, then it's Arabic words and numbers will be recognized as pattern recognition. Moreover, To confirm on the recognition of the SURF or SIFT, we will be using fuzzy to train and test.

5)Data Redundancy The plate number will be searched in the database if the state of the car found to be stolen and it is not exist with the same date ,time and location in the database, so it will be stored in the database then an alarm will be sent to the police, which then generates a report with the approximate location, time and date. Also it found to be not stolen and it is not exist in the database ,it will be also stored in the database with its current time , date and location.

6)Send Alarm: An alarm will be sent to the police station if the car found to be stolen.

7)Generate Report: The generated report will include the details of the car owner and the car itself as the following: - owner's name. - owner's national ID. - current time. - current location. - owner's mobile or telephone. - plate image and owner image. and send it to the police station.

8 Preliminary Schedule Adjusted



9 Preliminary Budget Adjusted

Budget Item	Cost
Camera device	- LE
Chip	- LE

10 References

References

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[2] J. Sharma, A. Mishra, K. Saxena, and S. Kumar. A hybrid technique for license plate recognition based on feature selection of wavelet transform and artificial neural network. In *Optimization, Reliabilty, and Information Technology (ICROIT), 2014 International Conference on*, pages 347–352, Feb 2014.

[3] T. Sirithinaphong and K. Chamnongthai. Extraction of car license plate using motor vehicle regulation and character pattern recognition. In *Circuits and Systems, 1998. IEEE APCCAS 1998. The 1998 IEEE Asia-Pacific Conference on*, pages 559–562, Nov 1998.

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[5] A. Zidouri and M. Deriche. Recognition of arabic license plates using nn. In *2008 First Workshops on Image Processing Theory, Tools and Applications*, pages 1–4, Nov 2008.