Traffic and Road Monitoring and Management System for Smart City Environment

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IoT on Traffic Law Enforcement to Vehicles with the Use of Accurate Plate Recognition with Violation Checking and Recording System

Main Problem In the Philippines

- Traffic congestion

Photo: pinoytransplant.com

Economic and Environmental impact

- In Economy:
  - ➢Germany had a value of fuel and time wasted total of 21,684 million US Dollars in 2013.
- In Environment:
  - ➢ Vehicle idling creates carbon footprint, and is one of the sources of air pollution.

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How the technology helps to solve the traffic congestion

Photo: https://twitter.com/mmda/ and http://www.sunguide.info

Accurate name plate recognition and internet of things

- The project aims to change the existing system into a smart environment by the use of Accurate Name Plate Recognition (ANPR) integrated with Internet of Things (IoT).

Overall Procedure

- The ANPR system first feeds the images and information into the Raspberry Pi computer. This is done by combining the functions of an IR projector and a Monochrome Camera.
- The computer will then process the images provided by the ANPR system.
- It checks the images for any violations caused by a vehicle.
  - ➢ If a violation is detected, the computer saves the information and records for a case of violation against the vehicle.
  - ➢ If a violation occurs, the Colored Camera's images will be requested as evidence.

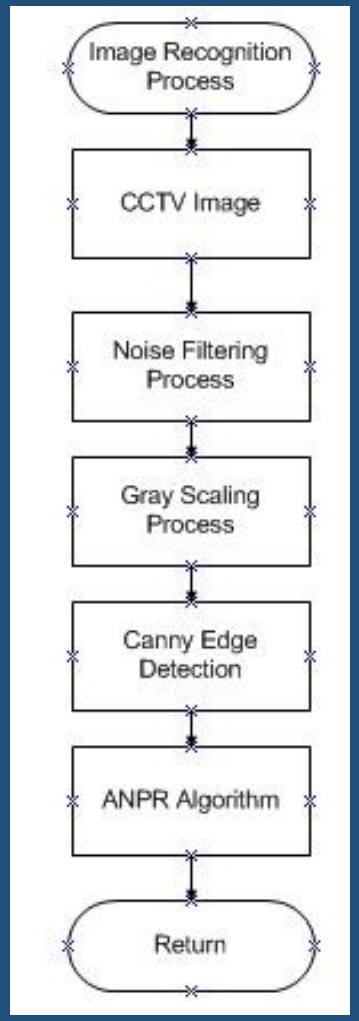
Fig.1.1 ANPR System

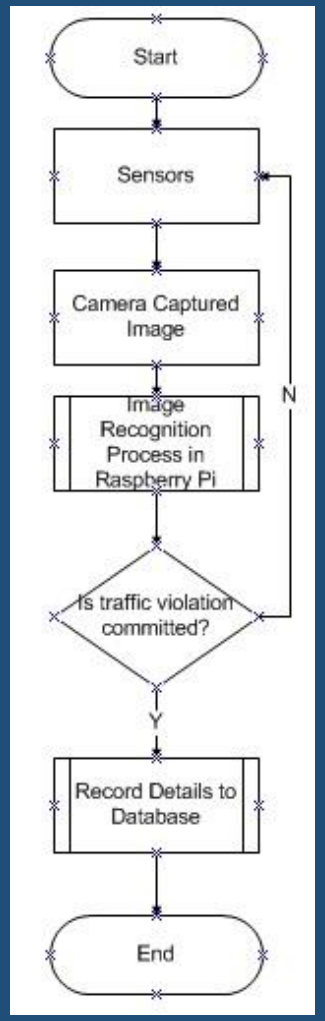
Programming Language

The programming language to be used in constructing the violation detection algorithm will be C++, which will be used by the Raspberry Pi computer in order to process the data provided by the ANPR system.

Flowchart

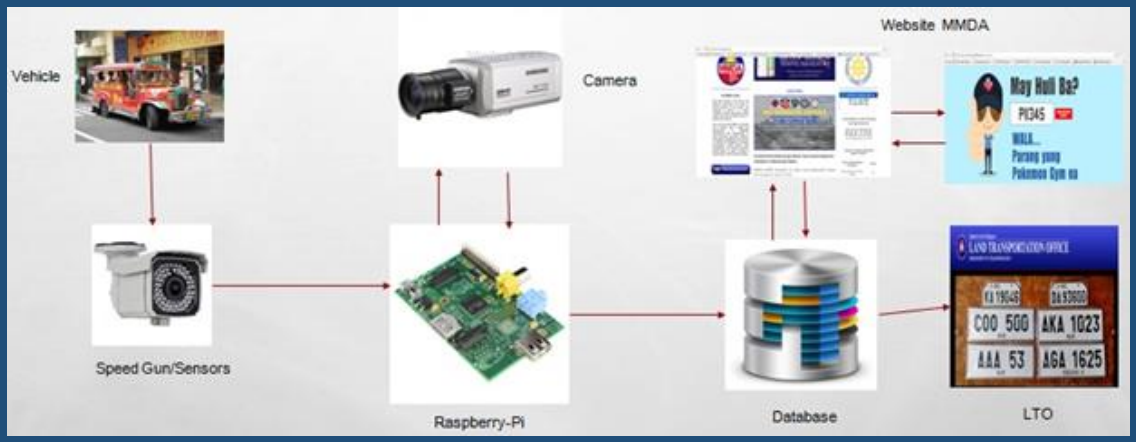
ANPR System's Positioning





IPO Model

Conceptual framework



Road Condition System with Vehicle Velocity and Weather Considerations using Smartphone GIS/GPS Application for Recording, Analysis and Assessment

*Given that **land travel across cities and provinces** is the most popular means among travelers and tourists, the intercity roads serve as a great factor when it comes to the **safety of the people**.*

Common causes of accidents in mountainous regions or remote places

- Road problems
- Over speeding
- Bad weather
- Lack of road signs
- Illumination or street lights during the night.

According to DOTC, out of the 36,000 road fatalities every year in the Philippines, 10% is caused by bad road conditions and ill-maintained roads.

Geographic information system (GIS) - utilized to capture and store information related to locations around the world

- The capabilities of today's mobile phones and Personal Digital Assistants (PDA) gives possibilities of integrating designs and applications for GIS. *(which is a constraint due to the presence of faster desktop computers)*
- The information stored on today's GIS mainly focuses on major routes and roads, **the condition and information for remote locations should still be addressed.**

Road Conditions to Consider

- Wet, or foggy roads
- Sudden tight curves
- Heavy traffic
- Uphill/downhill blind spots
- Motorists' self-discipline

What are its functions?

- **Generate best route** from current location to destination based from **GIS**
- **Generate warning for incoming road problems**, and show recommended driving speed (in Km/hr)

Factors Considered to Perform its Functions

- Weather conditions
- Road topology *(road curves, road inclination angle)*

Scope and Delimitation

- Would consider roads on following regions:
  - *Intercity roads*
  - *Roads directing to provinces*
  - *Accident-prone roads (sharp curve, landslide-prone areas, etc.)*
- Would consider foreseeable weather conditions such as:
  - *Heavy Rain*
  - *Thunderstorm*
  - *Rain Showers*
  - *Cloudy and Fair weather conditions*

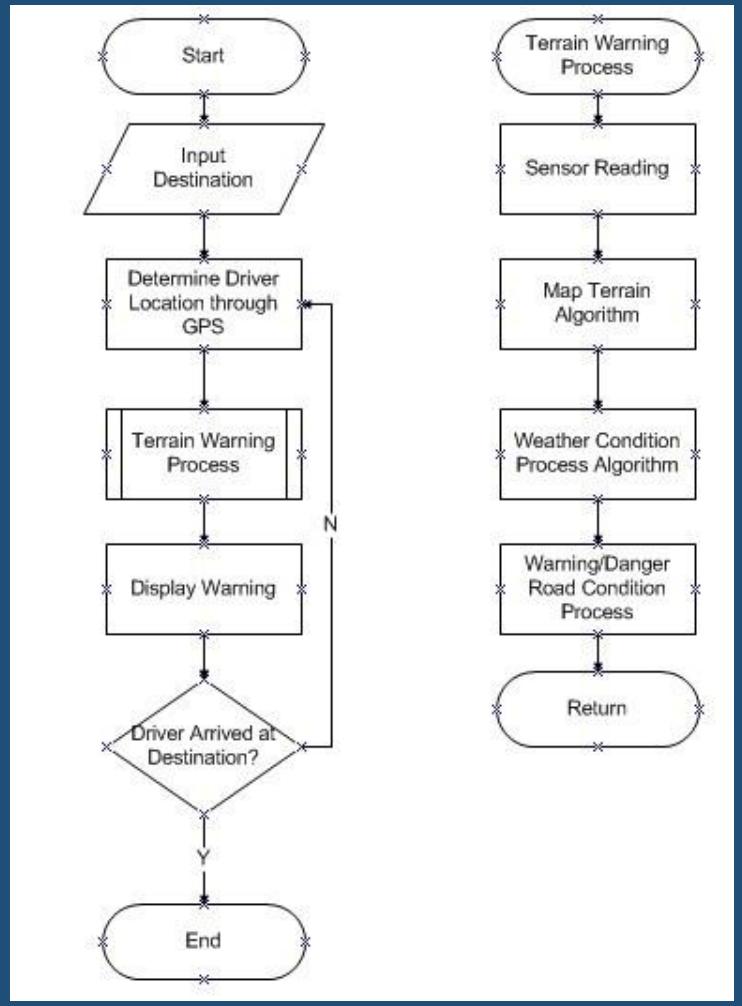
Objectives

- Increase drivers' awareness & safety when driving **through unknown road conditions**
- Decrease risk when driving during **light to severe weather conditions** (rain, thunderstorm)
- Emphasize **safety on mountain roads/highways,** especially on landslide-prone regions
- Consider road conditions at accident-prone remote locations

Overall Procedure

- The user inputs a desired destination on the app
- The GPS feature fetches the driver's location
- En route to the destination, the app continuously checks both terrain and weather condition
- If ever a terrain hazard/weather condition is nearby, displays warning and suggested speed reduction

Flowchart



IPO Model

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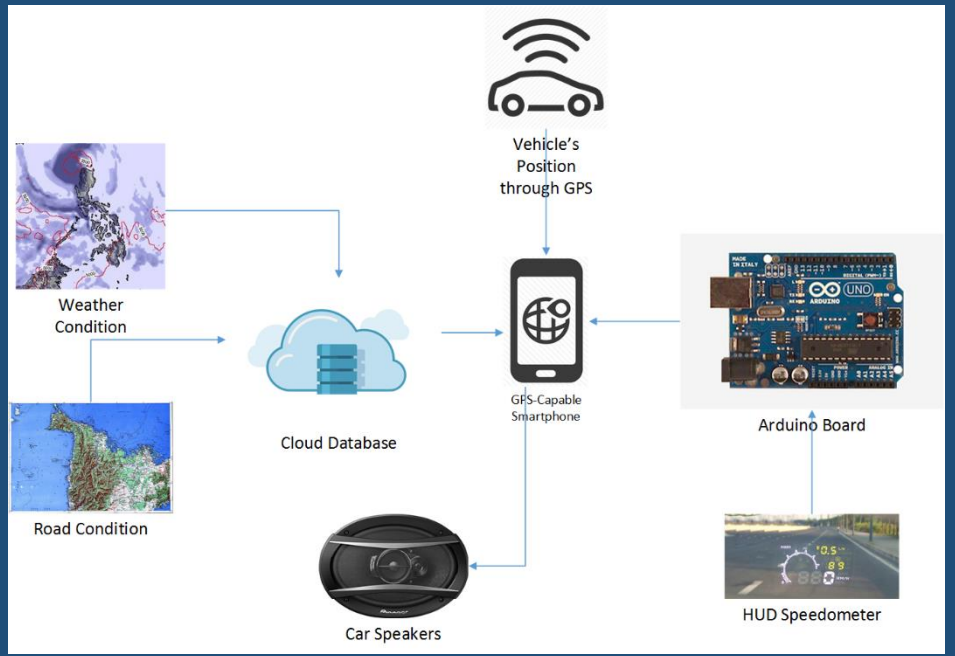


Non-invasive Drowsiness Detection using Face and Eyes Image Processing with Smartphone GPS Reporting and Recording System

Fatality involved in drowsy driving

Photo: http://riyadhconnect.com/ and http://www.dailymail.co.uk/

Statement of the problem

- Vehicular accidents are caused by drowsy drivers due to fatigue and exhaustion, or sometimes due to drunk driving.
- 21% of fatal accidents involved in a drowsy driver
- Drunk driving causes 50% of all the accidents occurring based on a statistic by a U.S State department.

Objectives

- Monitor the heart rate and the eye movement of the driver
- Allow communication between the device and the government agency such as *Pilipinas* 911 to provide assistance to the driver in case of drowsiness.
- Prevent road accidents from happening due to drowsy drivers.
- Notify the driver with recommended speed

How it works

Image from Eyes

- Face detection is done to locate the face and to verify if the person can be seen
- Eye localization is done to locate the coordinates of the Eyes
- An image of the eye is then taken for processing

PERCLOS

- An SVM trained on HOG is used to determine and classify the eye whether it is closed, or not
- A measurement of the eyes being closed over time would be taken

Sensor Reading

- Heart rate is measured in addition to PERCLOS measurement as a means of obtaining whether drowsy or not.
- Also provides a means of checking for false positives in the PERCLOS measurements since the driver also blinks and glances at the side mirrors from time to time.

Drowsiness Algorithm

- PERCLOS data and heart rate data is then analyzed to determine whether the data obtained is considered as a "Drowsy Count"
- A drowsy count is obtained when the threshold from the PERCLOS or Heart rate sensor is crossed

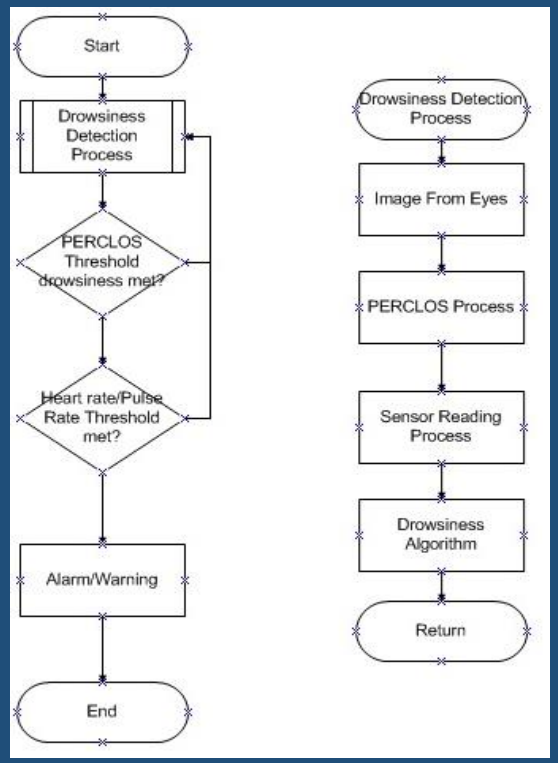
Alarm/Warning Phase

Alarm Turn On

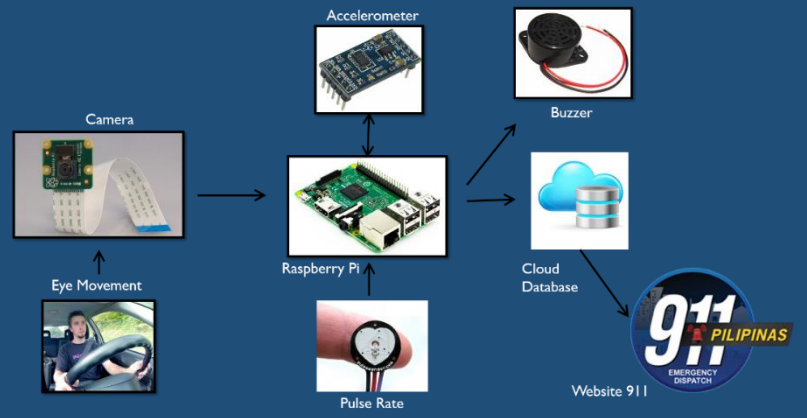
- When the threshold are met, the Buzzer will turn on to signal the driver that he has been detected drowsy and at the same time wake him up.
- It also means that he is advised to find a place to park the car
- The Buzzer would turn off only when the Accelerometer senses that the car is Stationary

PILIPINAS 911

- Responsible Authorities would be then notified of the Drowsy driver where the Information of the regarding the person would be given such as Current Location and Identification details



Flowchart



Conceptual framework

Outcomes

- People who are driving, tired from their work, should be less prone from car accidents
- Enforcers will easily capture reckless drivers.