**PROJECT PROPOSAL**

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| **Date of proposal:** 10 September 2022 |
| **Project Title:** Driver Attention Detection – A Safety System for Ride-hailing Services |
| **Group ID (As Enrolled in LumiNUS Class Groups):** Group 7  **Group Members (Name, Student ID):**   1. Hwang Sion, A0249263Y 2. Prerak Agarwal, A0116711R 3. Santi, A0249294R 4. Zhang Junfeng, A0249266U |
| **Sponsor/Client:** *(Company Name, Address and Contact Name, Email, if any)* |
| **Background/Aims/Objectives:**  Year by year, chances of getting car accident have been drastically heightened and Singapore has been more dangerous in recent few years. Since 2020, cases of car accidents which cause injuries has been increased by 8.9%. Especially, there was huge surge in number of car accidents that resulted in fatalities. Between 2020 and 2021, annual increase of number of fatal accidents increased from 80 to 100 (EvlanovaAnastassia, 2021).    *Figure 1. Year by Year motor vehicle casualties/fatal accident rate* (EvlanovaAnastassia, 2021)    *Figure 2. Top 5 Reasons for Car Accidents in Singapore* (ShayedAmeer, 2020)  One of the biggest causes of the car accident in Singapore is ‘Failing to keep proper lookout’. There can be multiple external causes of distraction like phone, people sitting next to you, other cars passing by, and failure to lookout for slippery road etc. Internal causes also exist, like fatigue due to prolonged driving.  The objective of this project is to develop a system that helps to improve the safety of drivers on the road, especially private hire car drivers who drive for long hours of the day at a stretch. The system, relying on computer vision capabilities and built using deep learning techniques, should be able to detect signs of drowsiness and/or distraction in drivers in real-time and alert them automatically in such cases.  The idea behind developing such a system is to improve the safety of drivers who spend a major part of their day driving, with the intention being that such a system could eventually be incorporated as a feature in the drivers’ apps of ride-hailing services such as Grab, Gojek, etc., among others. |
| **Project Descriptions:**  This project aims to build a safety system using computer vision to alert drivers in real-time if they are showing signs of drowsiness and/or distraction while driving. Most drivers of ride-hailing services already position their smartphones in front of them while driving and use them for navigation. Keeping this in mind, the idea for our safety system is to continuously monitor the video live-feed from the front camera of the driver’s smartphone for signs of drowsiness and/or distraction. If the computer vision model detects such signs, an alert would be issued to the driver immediately. The goal for this project is to prove its feasibility as a potential safety feature to be incorporated in the drivers’ apps of ride-hailing services (such as Grab, Gojek, etc.).  **Design considerations for our safety system:**   * The safety system should monitor the driver’s video live-feed and issue alerts in real-time.   + To address this issue, we will have to ensure that the drowsiness/distraction detection model is not very computationally heavy when performing predictions, and that appropriate pre-processing steps are applied to the incoming video live-feed to reduce the model’s input size yet not lose important information from the video frames. * The safety system should not violate any privacy concerns arising from the continuous monitoring of the driver’s video live-feed.   + To address this issue, we will have to ensure that the safety system, once implemented, is able to run entirely locally on the driver’s device without the need for any of the video data to be transmitted to any other device/server over the internet. As such, as part of our project, we also aim to test our system’s overall performance by implementing and running it on a Raspberry Pi. * The live-feed video frame from the front camera of the driver’s smartphone may include people other than the driver (such as the passengers). In such a scenario, only the driver’s face should be considered by the computer vision model to detect signs of drowsiness and/or distraction.   + To address this issue, our safety system will have to incorporate a facial recognition model that first recognizes and locates the driver’s face in the video frame and then provides that information to the second model, which then uses that information to detect signs of drowsiness/distraction in the driver. This facial recognition model could be trained for each specific driver using the images they provide to the ride-hailing service at the time of sign-up.   **Datasets for driver drowsiness/distraction detection:**   * To train the drowsiness/distraction detection model, we intend to use multiple open-source and licensed datasets that are available on the internet. A few such datasets are listed below:   + University of Texas at Arlington – Real-Life Drowsiness Dataset (UTA-RLDD): <https://sites.google.com/view/utarldd/home>   + National Tsing Hua University – Driver Drowsiness Detection Dataset: <http://cv.cs.nthu.edu.tw/php/callforpaper/datasets/DDD/>   + University of North Carolina at Chapel Hill – Drowsy Driving Dataset: <https://www.cs.unc.edu/~abyrnes1/dataset.htm>   + State Farm Distracted Driver Detection Dataset: <https://www.kaggle.com/competitions/state-farm-distracted-driver-detection/data>   + Distracted Driver Dataset: <https://heshameraqi.github.io/distraction_detection>   **Technology Stack**   * Python * Keras * TensorFlow (CNN, RNN) * OpenCV * Raspberry Pi   **Model development:**   * The goal of this project is to explore different ML and pattern recognition techniques for the development of the model. We intend to build a few different types of models for this use-case and then compare & contrast the performance of each of these models in the context of this safety system and the design considerations listed above.   **Safety system workflow:**  The overall workflow of our safety system would be as elaborated in the diagram below.    Drowsiness/distraction detection model then detects signs of drowsiness and/or distraction in the driver’s behaviour.  Facial recognition model first detects and locates driver in the video frame.  \* This model can be trained for each individual driver using the facial images provided at the time of sign-up with the ride-hailing service (after receiving consent for the activation of the safety system). References Evlanova, A. (2021, April 27). Retrieved from valuechampion: https://www.valuechampion.sg/probability-car-accident  Shayed, A. (2020, March 31). Retrieved from https://carro.sg/blog/5-reasons-accidents-singapore/ |