“Attention” Technical Documentation

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Overview

Attention is an application that improves focus while driving a vehicle by warning the driver when they take their eyes off the road for too long periods of time. This can also be reversed, warning the driver when they look at their device for too long instead. Attention uses the built-in camera to detect the user’s face, and a timer to decide when to sound the warning signal. The time before warning depends on vehicle speed and driver distraction level.

External Dependencies

Attention depends on the OpenCV[1] computer vision library for face and eye detection. In order to use the OpenCV functionality, the OpenCV Manager package must be installed on the user’s device. If the package is missing Attention will prompt the user to install it upon start, redirecting to the corresponding page on Google Play Market. If Google Play Market is not installed on the device, the OpenCV Manager must be installed manually. more information can be found on the OpenCV documentation website[2].

When developing Attention, the OpenCV SDK for Android must be added as a library module.

The AGA SDK is also needed, for accessing vehicle signals.

Classes and their Responsibilities

Camera

Contains the bulk of the face and eye detection code. Extends Observable, and notifies its Observers with a boolean on each camera frame, true if a face was detected, false otherwise. Based on an eye detection sample by Roman Hošek[3].

CameraActivity

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[1] http://opencv.org/

[2] http://docs.opencv.org/doc/tutorials/introduction/android_binary_package/O4A_SDK.html#running-opencv-samples

[3] http://romanhosek.cz/android-eye-detection-updated-for-opencv-2-4-6/

Creates and composes all components for face/eye detection and the warning signal: Camera, CombineSignals and SignalTimer. Takes care of starting, stopping and destroying components when entering or exiting the application.

CombineSignals

Uses an AutomotiveManager to read signals from the vehicle. Extends Observable and notifies its observers with an integer between 1 and 9 derived from vehicle speed and driver distraction level. Priority increases from 9 to 1. When the vehicle is stopped or in reverse gear, the lowest priority signal (9) is sent to the Observers. Sends -1 on error.

SignalTimer

Runs a timer in a separate thread and plays a warning signal when the timer runs out. Implements Observer and observes a Camera object and a CombineSignals object. When the signal from CombineSignals changes, the starting time and the time remaining is adjusted as appropriate. When running in “Eyes-on-Road” mode, the timer is reset when a face is detected. When running in “Eyes-off-Device” mode, it is reset when a face is no longer detected.

StartPage

Responsible for the startpage that is shown on application startup. Creates an AutomotiveManager to show information about vehicle signals. Starts a CameraActivity when the start button is pressed.

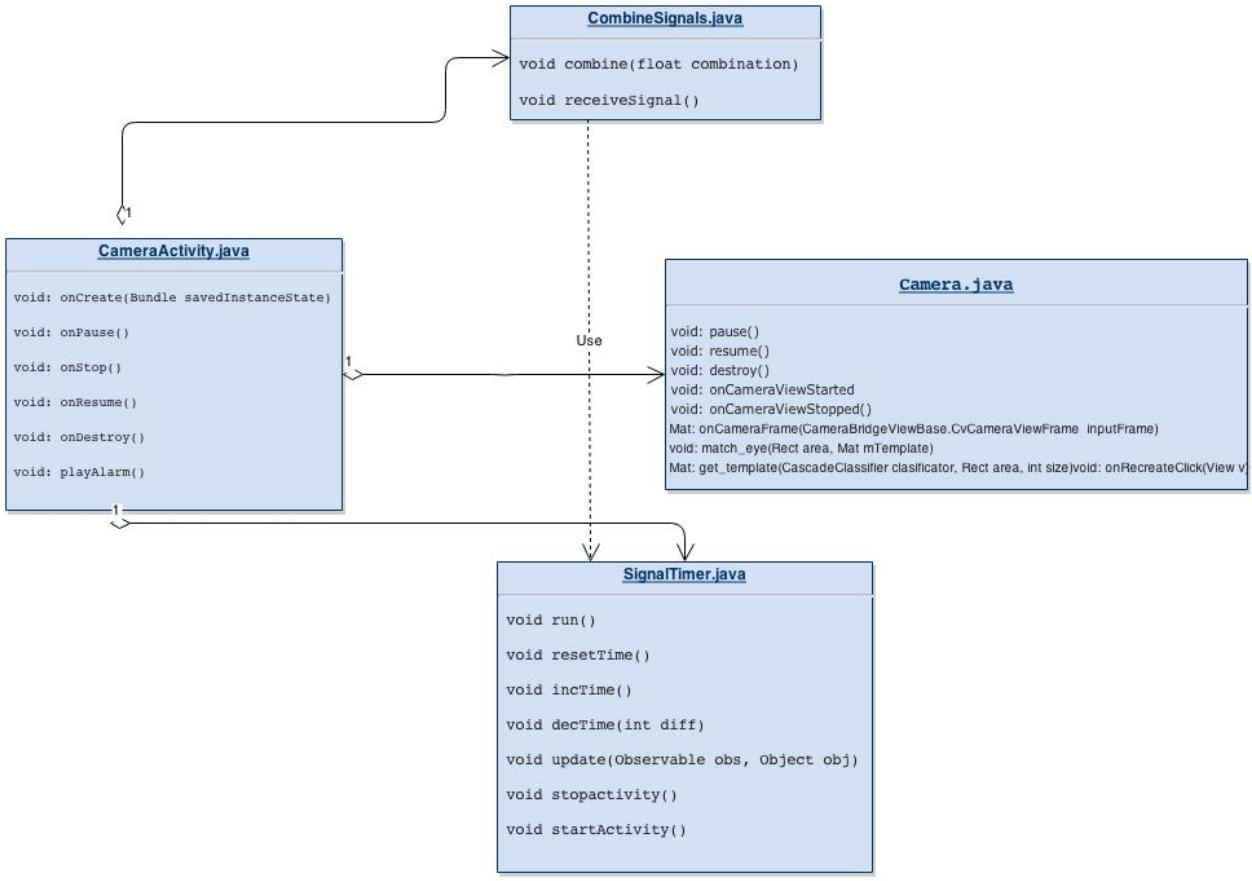
InvalidSpeedException

Thrown by SignalTimer if CombineSignals sends an error code.

Future Additions

Things we wanted to implement, but had to leave out due to insufficient time:

- Option to adjust time before warning
- Option to change camera (front/back/external)
- Option to change mode (“Eyes-on-Road”/”Eyes-off-Device”)
- Option to change alarm signal and volume
- Statistics



UML diagram for the “Attention” application