ESS – Web Engineering 19/20

(Integrated Master in Computer Science and Master in Computer Science)

Assignment

Sidewalk monitoring system

The goal of this assignment is to develop a proof of concept for a passive road safety information system called Sidewalk Proximity Warning System (SPWS). This should allow autonomous vehicles in the neighborhood of crosswalks to receive notifications about the state of the crosswalks and an assessment of whether it is safe to continue the crossing of the crosswalk by the vehicle.

A pedestrian crossing has 3 possible states translated by a luminous traffic light that regulates the access/crossing of the pedestrian crossing: red, green and flashing green, directed to pedestrians.

One of the main objectives of the system is to supplement the light information of the traffic light with information about the presence of a pedestrian in the neighborhood of the crosswalk in order to avoid being run over. A second objective is to register the flow of pedestrians and vehicles in the crosswalk area.

For a notification to occur to an autonomous vehicle, the SPWS must be aware of the presence of a pedestrian. Thus, the pedestrian's mobile device must notify the SPWS when he is in the proximity of a crosswalk. The following scenarios are applicable for notifications:

1. If a pedestrian is in the proximity of a crosswalk then the autonomous vehicle should receive the notification – *Pedestrian alert*.
2. If the vehicle is crossing the crosswalk and no pedestrian is nearby it should receive the notification – *Safe to cross*.

The proof of concept should then include the following components:

A web application - **SPWS** - for monitoring the relevant events on the crosswalk (component 1). This application should provide 3 features:

- For a given crosswalk, allow to view if there are vehicles and/or pedestrians in the neighborhood of the crosswalk. If so, it should also show the number and where they are.
- Keep a record of how many pedestrians and vehicles were detected during the day (for this it may imply that there are unique identifiers for pedestrians and vehicles as well as a crosswalk geo-location).
- Notify vehicles about the state of the traffic light. If there are pedestrians in the neighborhood of the crossing, notify the vehicles about the presence of pedestrians otherwise provide the information that is safe to cross. These notifications should contain always the state of the traffic light.

An application - ***Vehicle*** - in order to simulate the behavior of a vehicle when it approaches and crosses a crosswalk (component 2). This application should be responsible for:

- Simulate vehicle path/movement (geo-referenced route) when approaching and going through the crosswalk.
- Communicate the location of the vehicle to the SPWS when in the neighborhood of a crosswalk.
- If the vehicle leaves the crosswalk, it must stop reporting its location.
- Receive notification about the presence or absence of pedestrians in the neighborhood of the crosswalk and the status of the crosswalk (red, green, yellow).

An application – **Pedestrian** - with the objective of simulating pedestrian movements when crossing a crosswalk (component 3). This application should be responsible for:

- Simulate pedestrian paths/movements (geo-referenced path) when approaching and going through crosswalks.
- Communicate the path taken by pedestrians to the component that implements the business logic as if it were a real-time movement.
- If the pedestrian leaves the pedestrian crossing, he/she must stop reporting his/her location.

Figure 1 shows the diagram of typical components of the solution to be implemented.
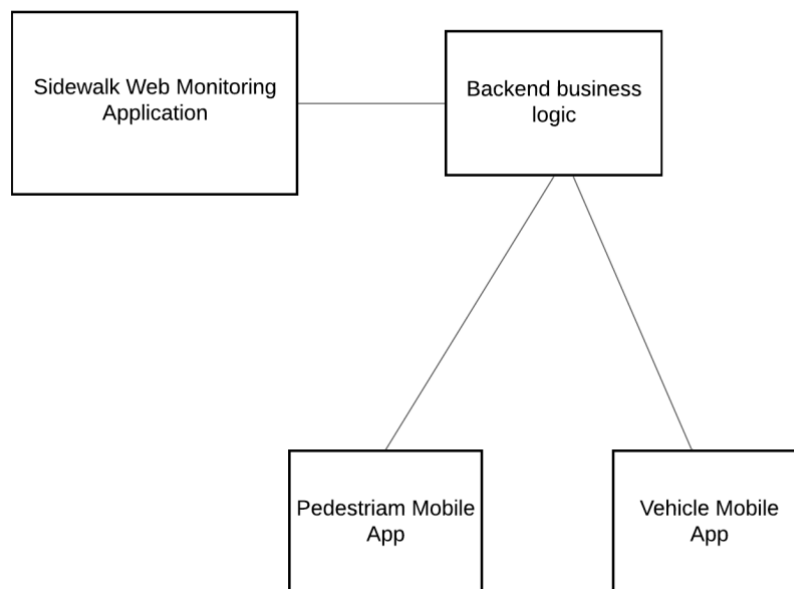
Figure 1 – Standard component diagram for the solution to be implemented

Deliverables

1. WebRatio project for the web application SPWS. This should allow to add/see/edit/delete (CRUD) a crosswalk to the system and to list all crosswalks. A crosswalk should register information about its location, its state for crossing, number of pedestrians and cars in the neighborhood. It should also show the distance of each pedestrian and car to the crosswalk. The application doesn't need to require authentication.
2. Detailed architecture diagram of the implemented solution, identifying the logical components that are part of the solution as well as the responsibilities of each component.
3. Diagrams of behavior of the main functions implemented.
4. Implementation of the solution
   a. Source code of the solution components
   b. Deployment solution source code for the developed solution