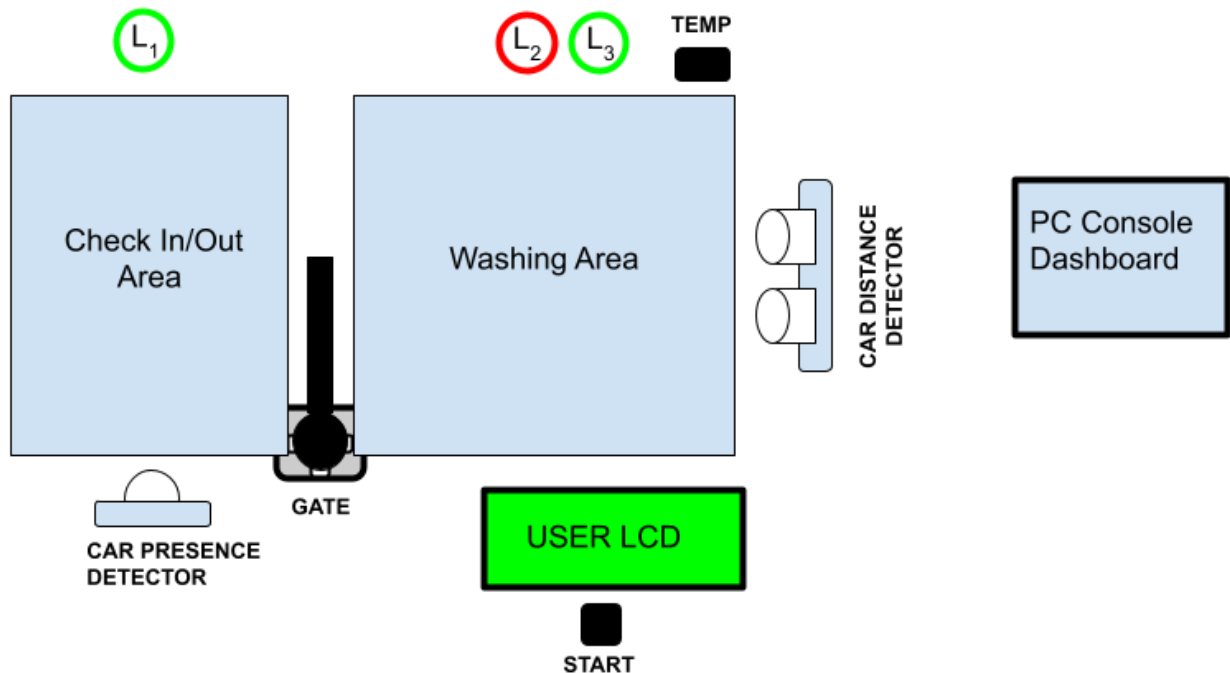


Assignment #2 - Smart Car-Washing System

v0.9 - 20231107

We want to realise an embedded system called *Smart Car-Washing System*. The prototype is meant to simulate a simple smart system for car washing.



Hardware components:

- CAR PRESENCE DETECTOR is a PIR, to detect the presence of vehicles in Check In/Out Area
- CAR DISTANCE DETECTOR is a sonar, to measure the distance of vehicles entering in the Washing Area
- GATE is a servo-motor, simulating a gate, between the Check In/Out Area and the Washing Area
- USER LCD is a I2C LCD, used to interact with users
- START is a tactile button
- L₁ and L₃ are two green leds, L₂ is a red led
- TEMP is an analog temperature sensor

The embedded subsystem is meant to communicate by means of the serial line with a PC, running a PC Console Dashboard (for maintainers).

Description

- The simulated environment involves two main areas:
 - a Check-In/Out Area, welcoming vehicles that aim at being washed (one by one), and
 - the Washing Area, which is where the washing process occurs
- When no one is around, the system is off, sleeping.
- When a vehicle is detected by the CAR PRESENCE DETECTOR in the Check In/Out Area, the light L_1 is turned on and on the USER LCD the message: `Welcome` is displayed.
- After N_1 seconds that a vehicle is in the Check In/Out Area, the gate GATE is opened to allow the vehicle to proceed to the Washing Area and the light L_2 starts blinking with a period equals to 0.1 secs. On the USER LCD the message `Proceed to the Washing Area` is displayed.
- The entrance of a vehicle in the Washing Area is tracked by the CAR DISTANCE DETECTOR: when the measured distance is less than MINDIST for N_2 secs, the vehicle is considered fully entered. The gate GATE is then closed and the light L_2 stops blinking and is turned on. On the USER LCD the message: `Ready to Wash` is displayed.
- When the user presses the button START, the simulated washing process begins and lasts for N_3 secs. During this time, the light L_2 blinks with a period equal to 0.5 secs. On the USER LCD a countdown is displayed—either using numbers or a bar changing dimensions.
- After N_3 secs, the washing process ends: L_2 is turned off, L_3 is turned on, the message `Washing complete, you can leave the area` is displayed on the USER LCD and the gate GATE is opened to allow the vehicle to move away from the Washing Area. In this stage, the leaving process can be considered completed when the CAR DISTANCE DETECTOR measures a distance greater than MAXDIST for N_4 secs. At that point, the gate GATE is closed, L_3 is turned off
- The PC Console Dashboard is meant to be a simple GUI used by car-washing maintainers to monitor the state and functioning of the washing system and intervene if necessary.
 - In particular, It visualises the total number of washes done so far and the current state of the washing machine. To this purpose, during the washing process the temperature is monitored by means of the TEMP sensor, reporting the ongoing value on the PC Console Dashboard.
 - If the temperature becomes greater than MAXTEMP for N_4 seconds, then the washing process is suspended and a message `Maintenance required` is displayed on the PC Console Dashboard, along with the message `Detected a Problem - Please Wait` on the USER LCD.
 - Then, the PC Console Dashboard must provide a button `Maintenance done` to notify that the problem has been verified (and solved) and the washing process can go on.

Develop the embedded software on Arduino + PC connected through the serial line, implementing the Arduino part in C++/Wiring and the PC part in Java or in another favourite language. The Arduino program must be designed and implemented using task-based architectures and synchronous Finite State Machines.

For any aspect not specified, you are free to choose the approach you consider more useful or valuable.

The Deliverable

The deliverable consists in a zipped folder **assignment-02.zip** including two subfolders:

- **src** folder, including
 - two further folders: arduino and pc, the former must contain the Arduino project called smart_bridge, and the latter the sources of the Java (or whatever language/platform) program
- **doc** folder, including:
 - a brief report describing the solution, in particular the diagram of the FSMs and the representation of the schema/breadboard – using tools such as TinkerCad or Fritzing
 - a short video (or the link to a video on the cloud) demonstrating the system