Train barrier

1 Working principle

The system is based on the hybrid automaton models of a gate, controller and a train made by Thomas A. Henzinger. Liberties have been taken with regard to the model. The differences will be discussed later on.

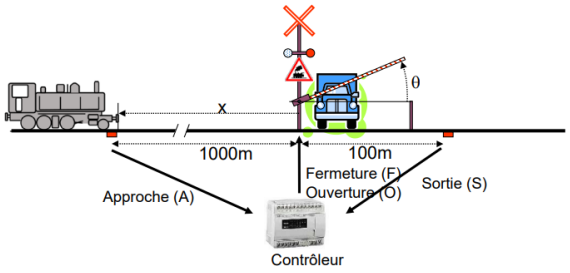

Figure 1: Schema of the system (taken from Mr. 's lecture)

Model is based on the communication between three different systems : the train, the controller and the barrier. The train communicate its position to the controller and when it is estimated that the train is near enough to the intersection, the controller will command the barrier to close. When the controller detect that the train has passed the intersection, it will command the barrier to reopen. Then the controller will communicate with another train and the cycle is repeated.

2 Model

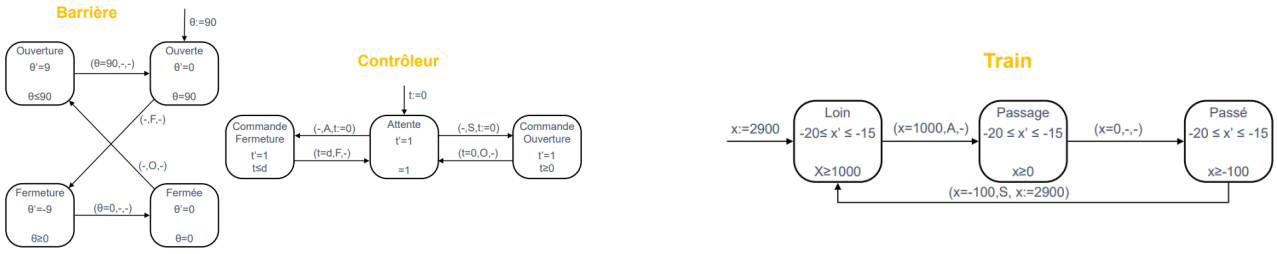

Figure 2: Example of a model of the controller and the train (taken from Mr. 's lecture)

In the model, it is considered that in the vicinity of the intersection (from 1 km before the intersection to 150 m after), a sensor measures the position of a train when it is at least 1 km away from the intersection. The assumption is that each train is at least 1,150 km away form the following one. Thus when the train is 150 m past the intersection, the sensor stops measuring its position. When the following train is in the vicinity of the intersection, its position is in turn measured by the sensor.

Contrary to the figure 2, The apparition of a train (1 km away from the intersection) is randomized and its speed is considered constant in each state but can vary between states. Thus, the transitions of the controller automaton are executed according to the state of the train automaton instead of the validation of a timed guard. Besides in the model, the controller automaton have one supplementary state whose the function is to impose on the train controller to wait 2 sec after the train has passed the intersection, so as to be sure that the train is far enough before opening the gate. The opening/closing speed of the barrier is also considered to be constant.