

The UPAAL model represents a smart Autonomous Vehicle (AV) system designed to perform weeding, crop protection, and observation roles in an agricultural setting. The system comprises several subsystems, including the RoleManager, Communication System, Vision System, Driving System, Status System, Weeding System, and Crop Protection System. The RoleManager coordinates role assignments and transitions, enabling the AV to switch between observer, weeder, and crop protector tasks as needed. The Vision System captures and analyzes images to detect weeds and diseases, providing positional data for identified targets. This information is communicated to other AVs via the Communication System. The Driving System uses the positional data to navigate the AV accurately. The Weeding System executes weeding operations, while the Crop Protection System manages disease treatments by applying appropriate measures like spraying pesticides. The StatusSystem monitors the status of the environment around the AV, detecting diseased plants and weed. State diagrams within the model depict the behavior of each subsystem, illustrating transitions between states triggered by events such as data reception or condition flags. This model offers a comprehensive framework for simulating and verifying the real-time operations of a multifunctional smart AV system in agriculture.

## Subsystems

