Supervisor Node for Vehicle Control

By: **Luca Inghilterra**

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MAIN IDEA

Supervisor Node:

• stores the overall health state of the vehicle;

• structured as a finite state machine;

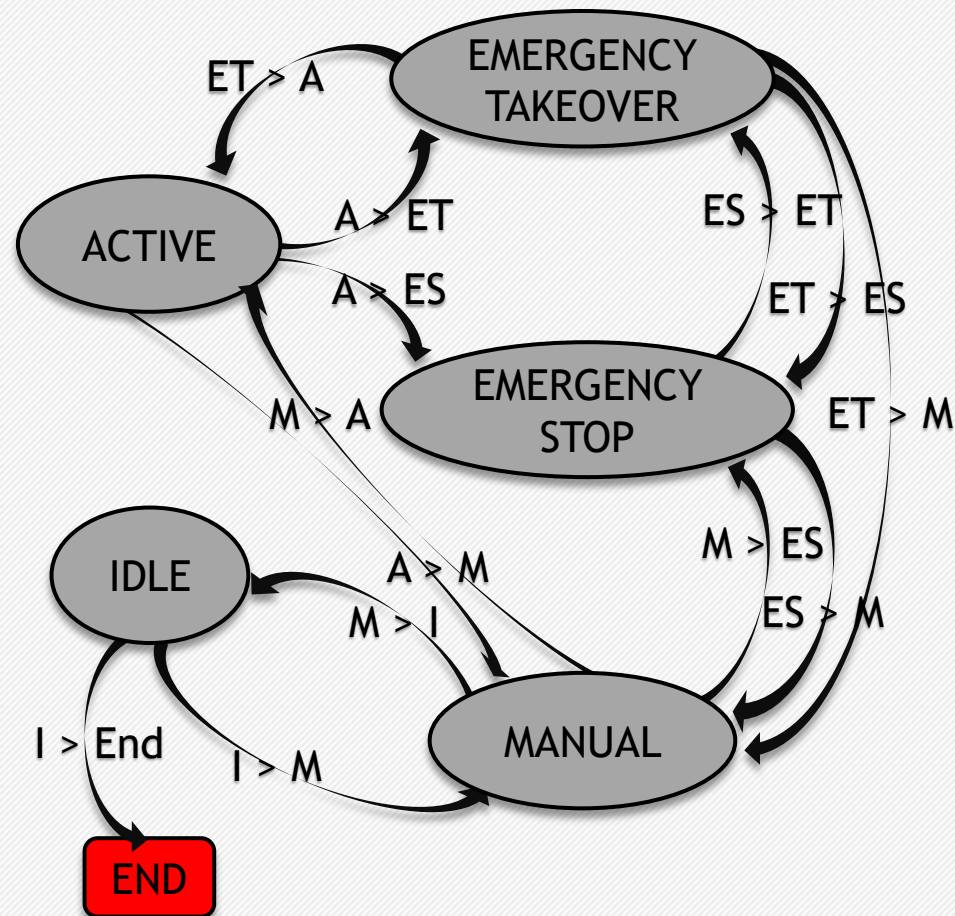• implemented using YASMIN library in ROS2 Foxy.

States:

- Idle (I)
- Manual (M)
- Active (A)
- Emergency Takeover (ET)
- Emergency Stop (ES)

Transitions:

- **(I) ⟷ (M):** service callable from the outside
- **(M) ⟷ (A):** service callable from the outside
- **(A) → (ET):** a common fault occurs
- **(ET) → (A):** the common fault is resolved
- **(ET) → (M):** service callable from the outside
- **(A, M, ET) → (ES):** a severe fault occurs
- **(ES) → (ET):** the severe fault is resolved, and the node entered ES state from A or ET
- **(ES) → (M):** the severe fault is resolved, and the node entered ES state from M
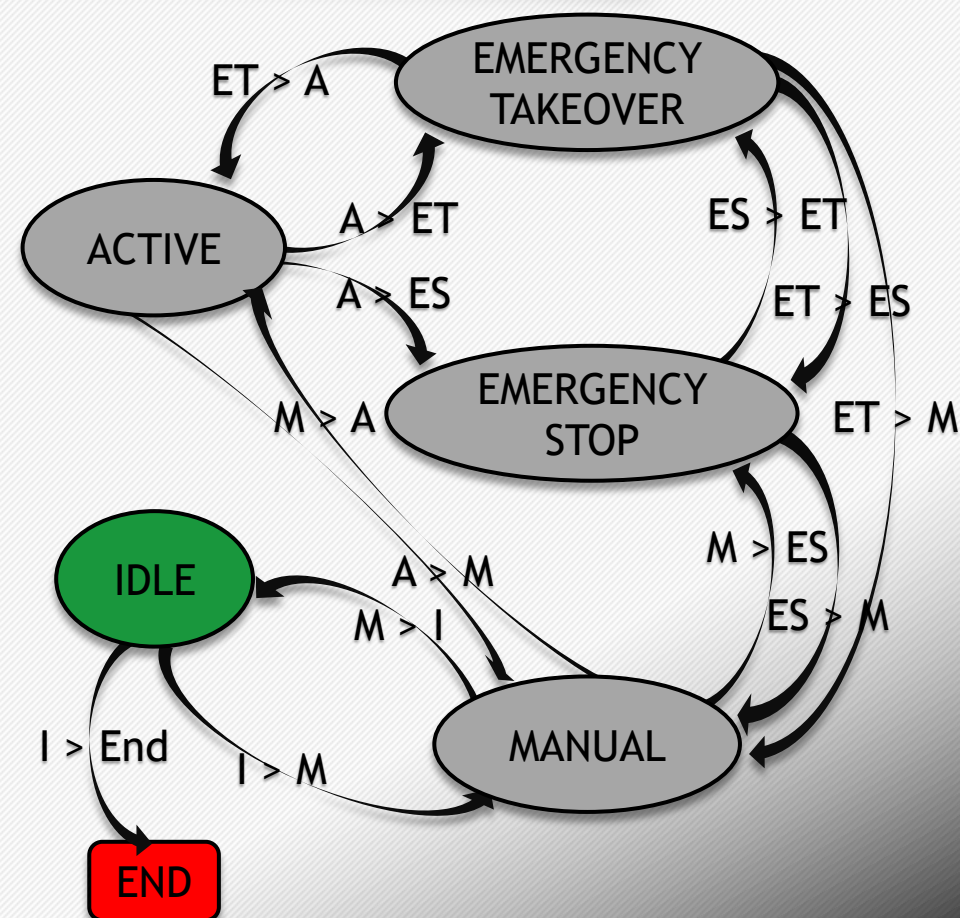
Behaviour:

The node is active and awaits signals from the outside.

Implementation:

- the **transition selection** to MANUAL or to END is awaited with the subscription on *supervisor_node/state_selection* topic (RELIABLE);
- the **current state** is published on *supervisor_node/current_state* topic (RELIABLE, TRANSIENT LOCAL).
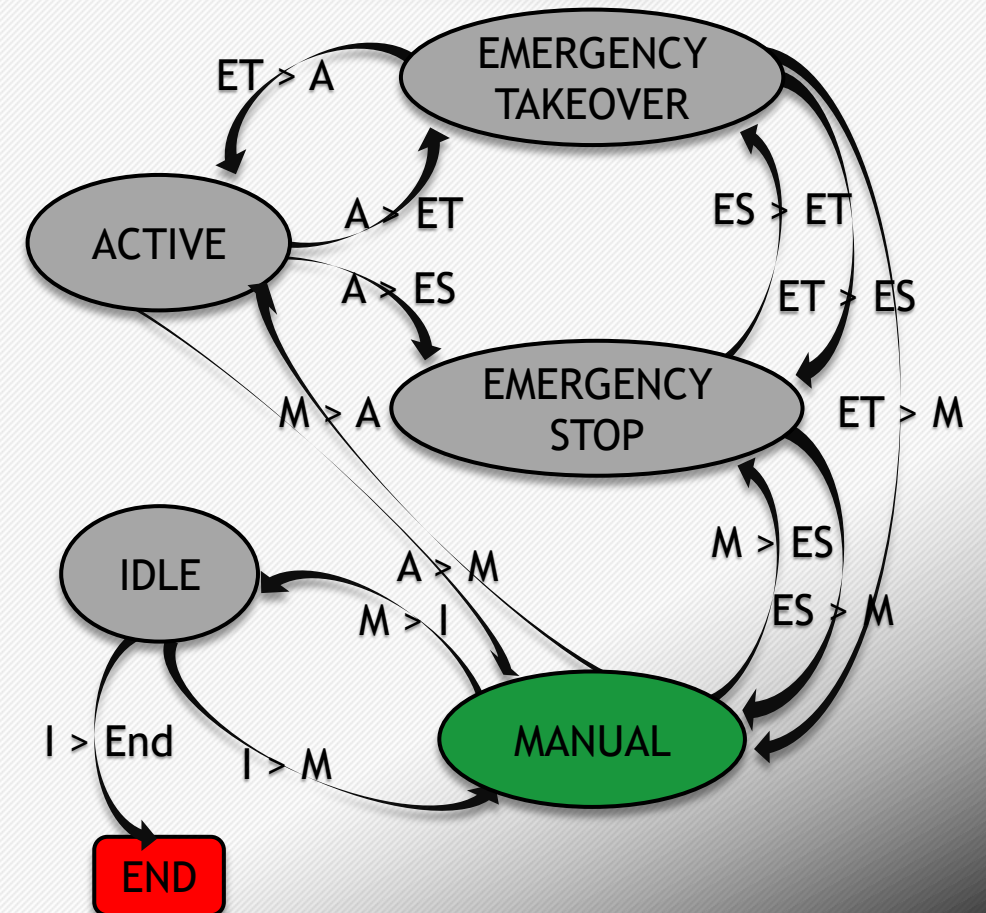
Behaviour:

The vehicle is in manual driving mode:
- no fault checks are performed in this state;
- all driving commands from the primary and secondary stacks are ignored.

Implementation:
- the **transition selection** to ACTIVE or to IDLE is awaited with the subscription on *supervisor_node/state_selection* topic (RELIABLE);
- the **manual commands** sent to the system are notified to the node with the subscription on *supervisor_node/manual_command* topic (RELIABLE);
- the **drivers responses** from sensors or actuators are collected with the subscription on *supervisor_node/general_driver_response* topic (RELIABLE, CHECK LIVELINESS);
- the **current state** is published on *supervisor_node/current_state* topic (RELIABLE, TRANSIENT LOCAL).
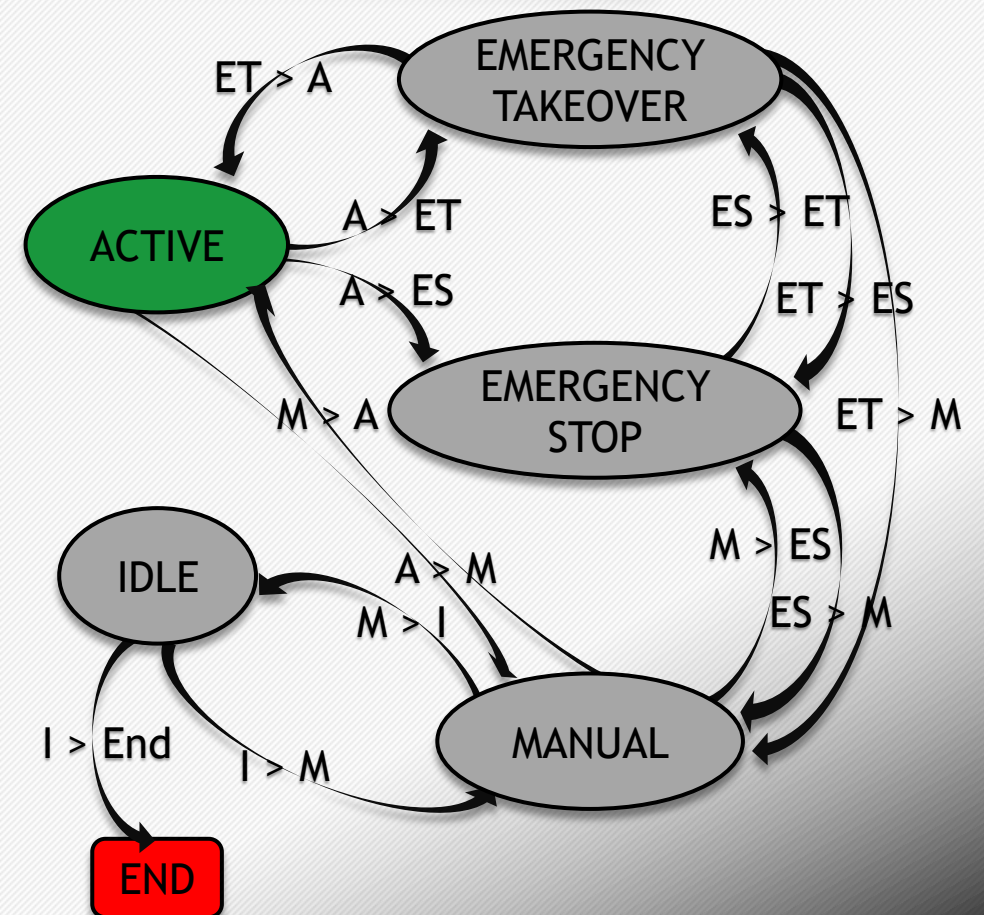
Behaviour:

The vehicle is in autonomous driving mode:
- fault checks are performed in this state;
- control is entrusted to the primary driving stack.

Implementation:

- the **transition selection** to MANUAL is awaited with the subscription on *supervisor_node/state_selection* topic (RELIABLE);

- the control by **primary driving stack** is simulated sending notifications to the node with the subscription on *supervisor_node/primary_driving_stack* topic (RELIABLE, DEADLINES CHECK);

- the **drivers responses** from sensors or actuators are collected with the subscription on *supervisor_node/general_sensor_or_actuator_driver_response* topic (RELIABLE, LIVELINESS CHECK);

- any **common fault** in this state is simulated with the subscription on the topic *supervisor_node/common_fault* (RELIABLE);

- the **current state** is published on *supervisor_node/current_state* topic (RELIABLE, TRANSIENT LOCAL).
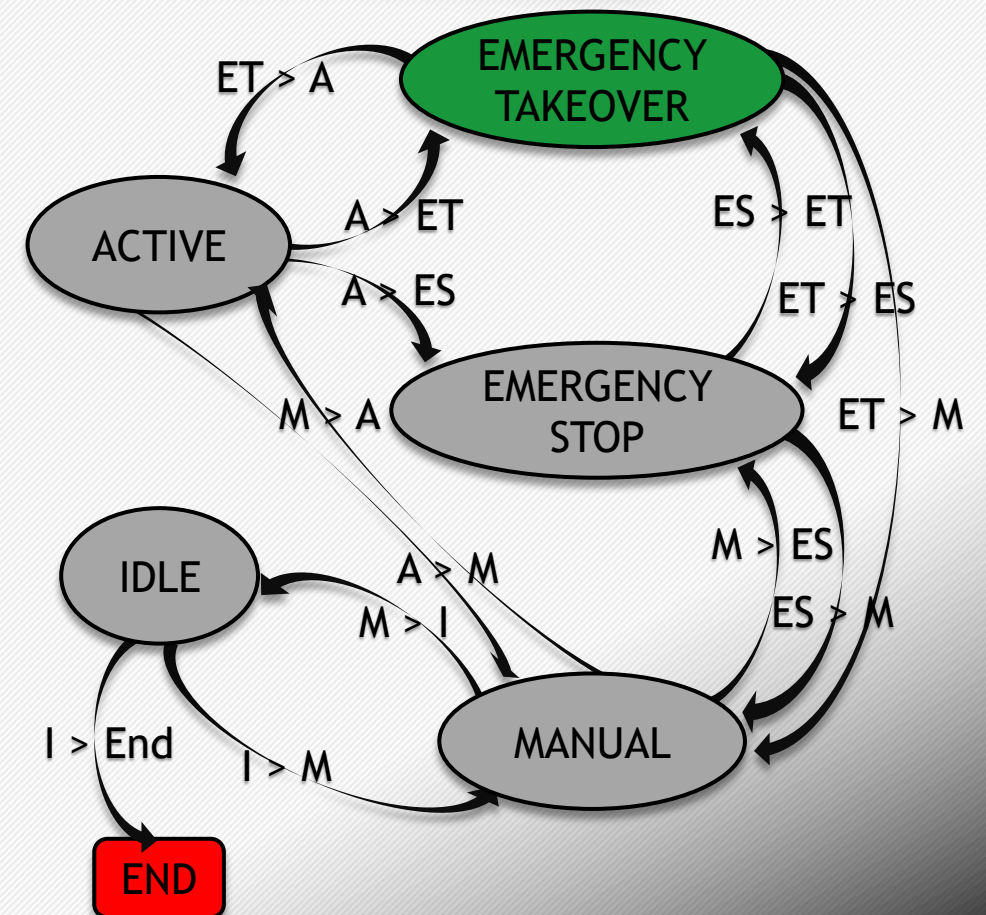
Behaviour:

The vehicle is in a risky state:
- control is entrusted to the secondary driving stack;

Implementation:

- the **transition selection** to MANUAL is awaited with the subscription on *supervisor_node/state_selection* topic (RELIABLE);

- the control by **secondary driving stack** is simulated sending notifications to the node with the subscription on *supervisor_node/secondary_driving_stack* topic (RELIABLE, DEADLINES CHECK);

- the **drivers responses** from sensors or actuators are collected with the subscription on *supervisor_node/general_sensor_or_actuator_driver_response* topic (RELIABLE, LIVELINESS CHECK);

- the **current state** is published on *supervisor_node/current_state* topic (RELIABLE, TRANSIENT LOCAL).
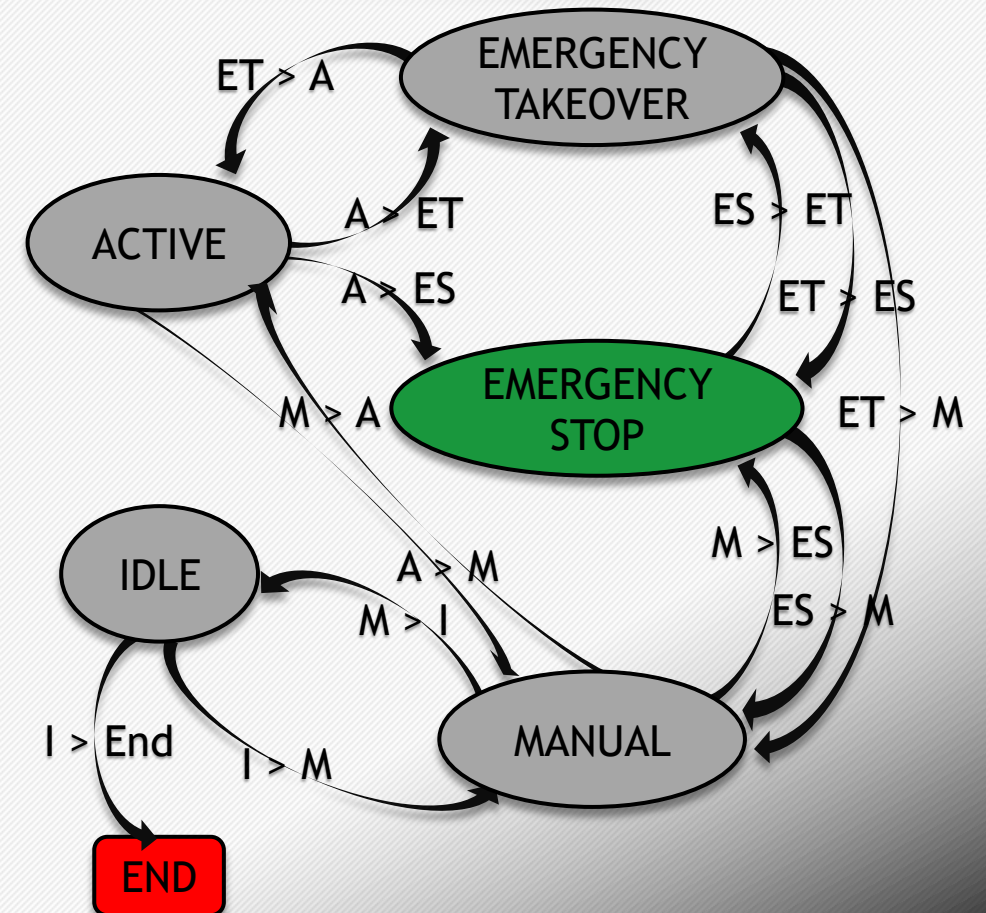
Behaviour:

The vehicle is in a risky state:
- control is entrusted to the secondary driving stack;

Implementation:

- the **current state** is published on *supervisor_node/current_state* topic (RELIABLE,TRANSIENT LOCAL).

Demo time!