
Engineering Technology (ENGR 101)

FSM more examples and implementation

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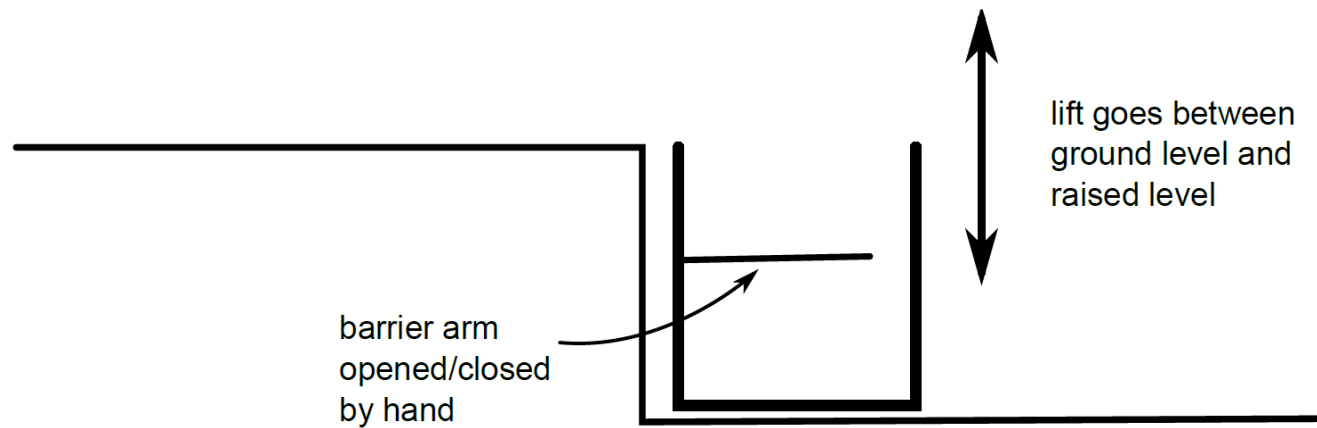
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Admin

- Lab 7 has been released
 - Due date is June 8, 19:00 (Xiamen Time)
 - This lab is in groups.
- Students who have not submitted their lab projects
 - Assignments 12% of final grade
 - Labs & project 38% of final grade
 - https://ecs.wgtn.ac.nz/Courses/XMUT101_2021T1/XMUT101CourseOutline

Example: Wheelchair lift

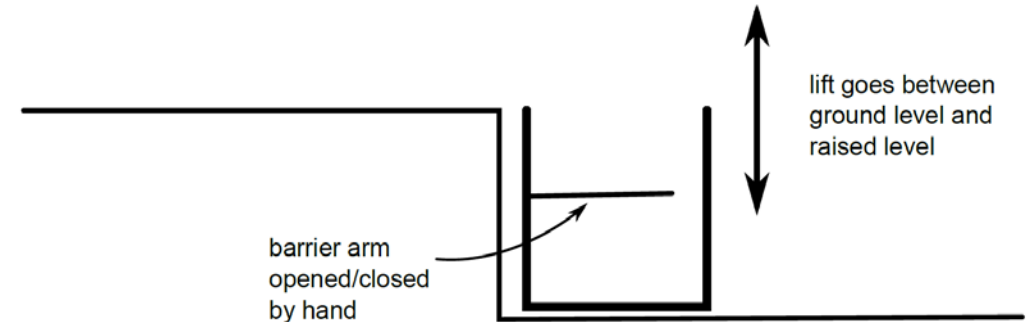
- The wheelchair lift has a barrier arm in front of the platform.
- When the barrier arm is closed, the lift will immediately start moving to the other level.
- The lift will lock the barrier arm while the lift is moving, and only unlocks the arm (allowing the rider to get off) when the lift reaches the other level
- If the lift detects an overload, it will sound a warning buzzer, and will not move when the barrier arm is closed



Example: Wheelchair lift

- Sensors:

- **atGround** when the lift arrives at ground level
- **atRaised** when the lift arrives at the raised level
- **barrierClosed** when the barrier arm is closed
- **overload** when a rider gets on the lift, taking the load above the limit.
- **withinload** when a rider gets off the lift, bringing the load below the limit

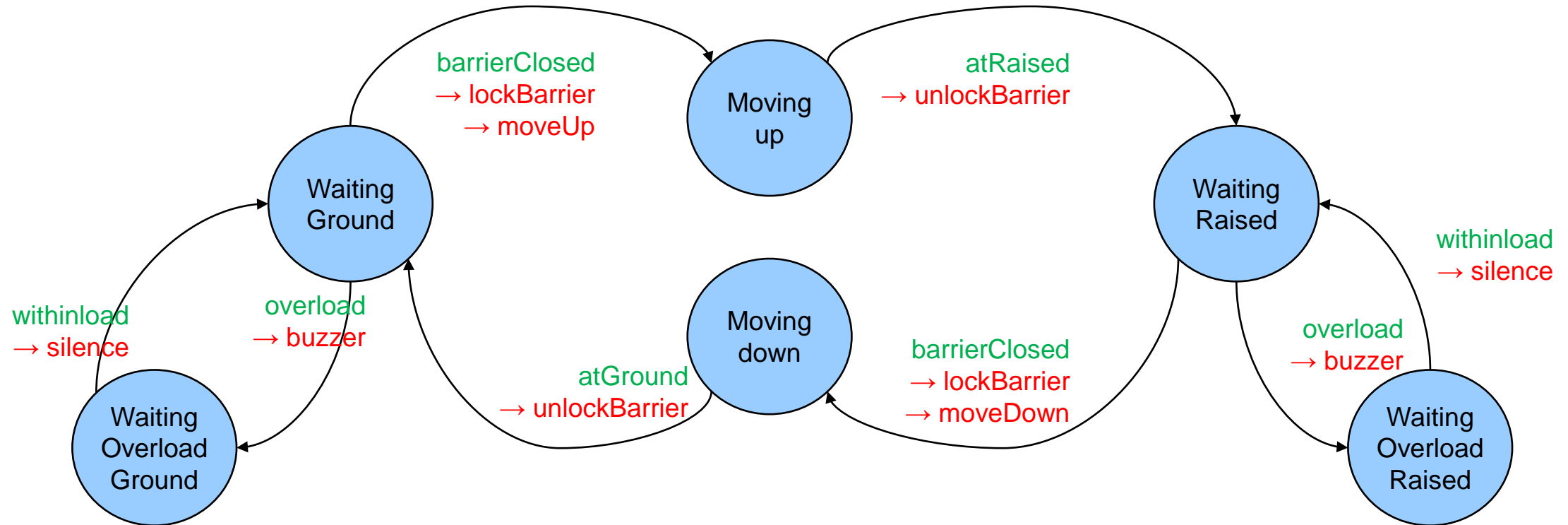
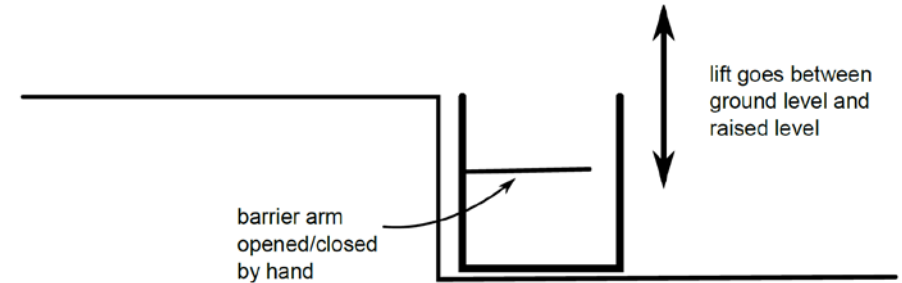


- Actions:

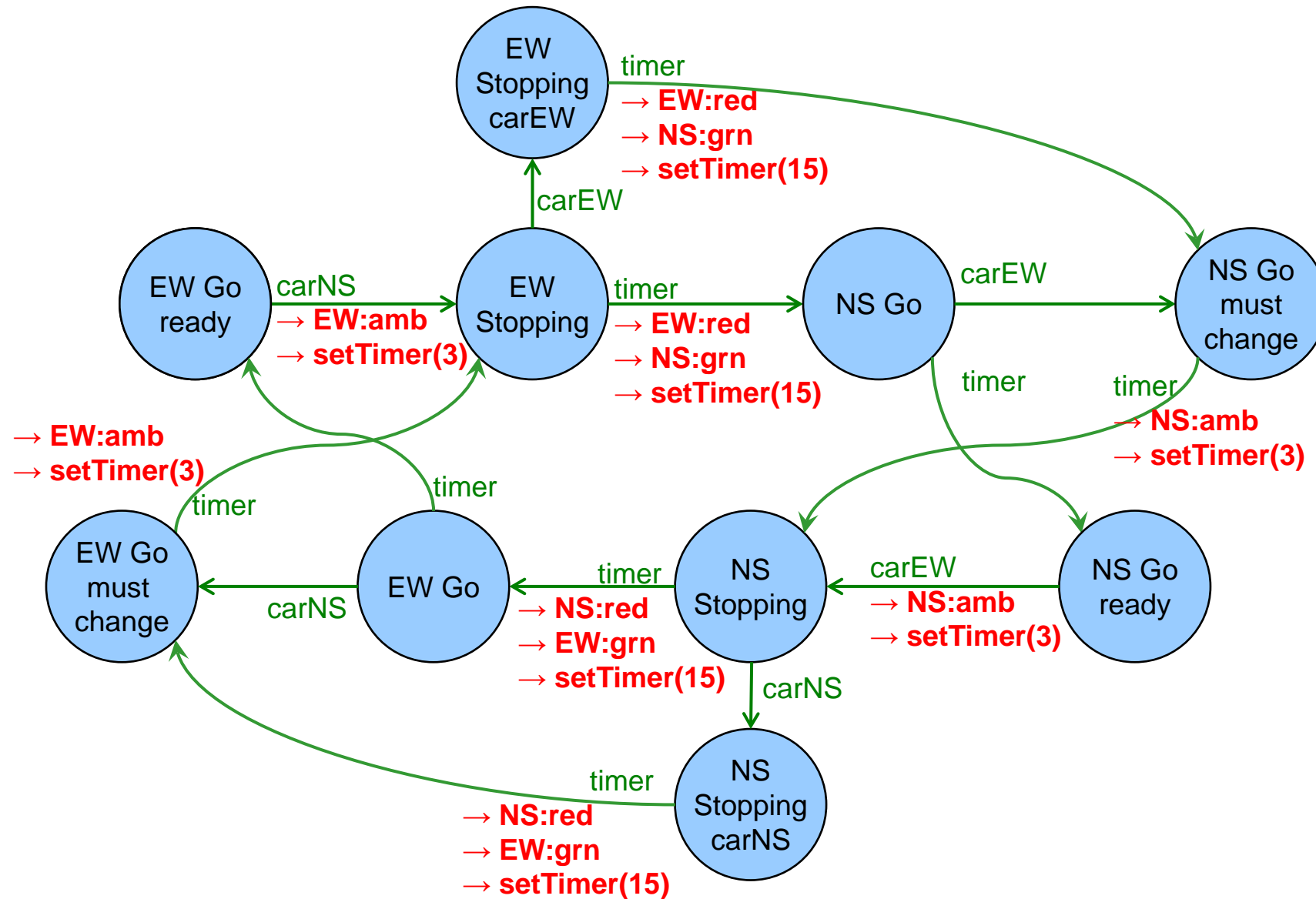
- **moveUp** to make the lift start moving up
- **moveDown** to make the lift start moving down
- **lockBarrier** to lock the barrier arm
- **unlockBarrier** to unlock the barrier arm
- **buzzer** to turn on the overload warning buzzer
- **silence** to turn off the overload warning buzzer

Example: Wheelchair lift

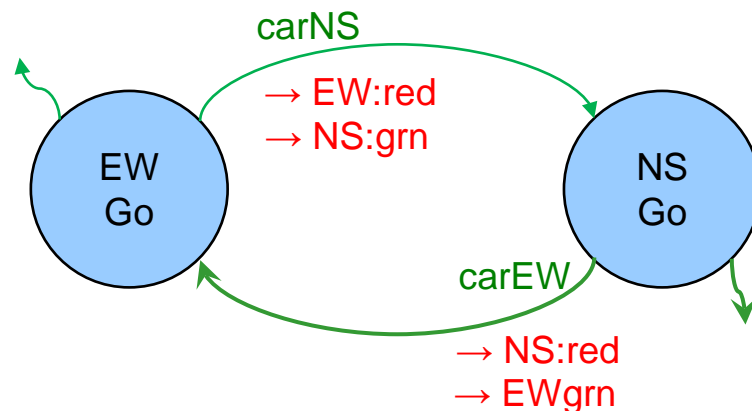
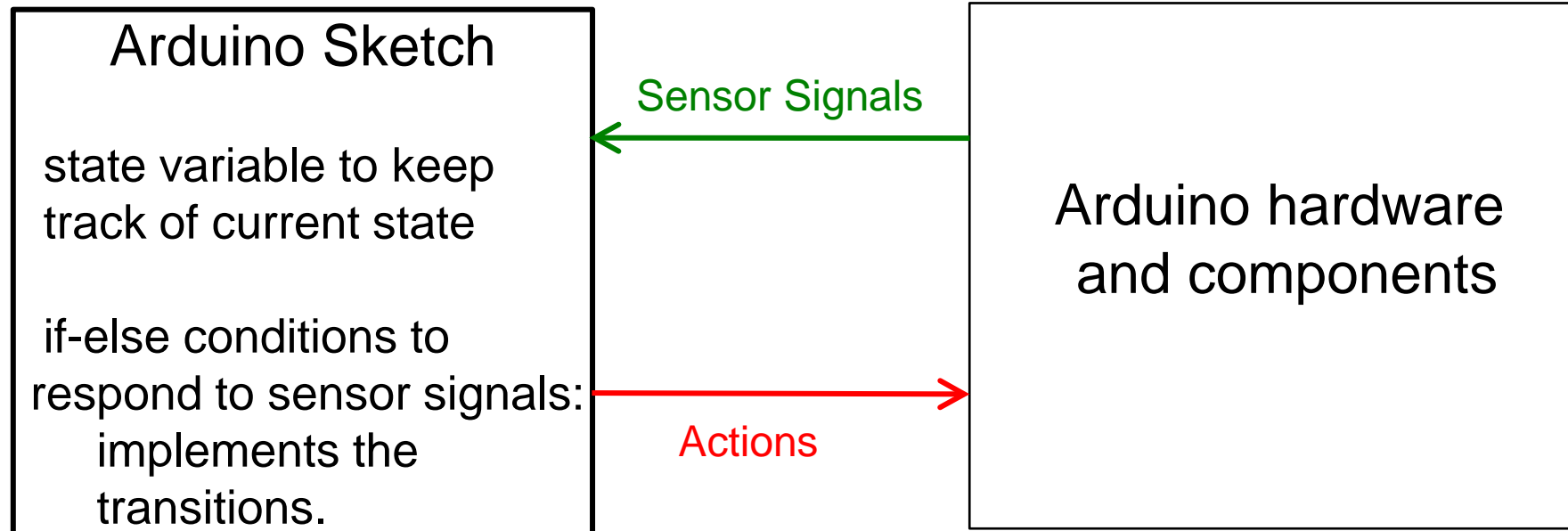
- Sensors:
 - atGround, atRaised, barrierClosed, overload, withinload.
- Actions:
 - moveUp, moveDown, lockBarrier, unlockBarrier, buzzer, silence



Traffic light controller for Lab 7



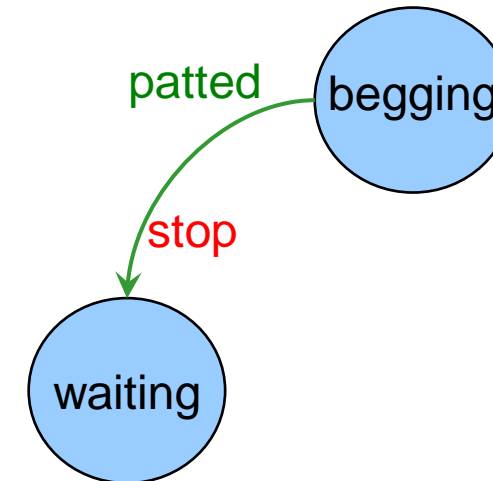
Implementing FSM Controllers



Implementing FSM Controllers

Program for controller:

- Global variable for current state
- **if-else** statements for implementing the transition function
 - given a sensor
 - depending on current state
 - choose transition for the sensor in that state
 - invoke actions on the system,
 - change the value of the current state



```
if (state == "begging"){
  if (patted == HIGH){
    // stop the toy from begging
    State = "waiting";
  }
}
else ...
```

One of these for every arrow in diagram

How does the action get done?

Implementing FSM Controllers

```
String state = "EW Go"; //the current state
:
void loop(){
    :
    int carNS = readCarNS();
    int carEW = readCarEW();
    if (state == "EW Go"){
        if (carNS == HIGH){ // transition out of EW Go state
            turnEWred();
            turnNSgreen();
            state = "NS Go";
        }
    }
    else if (state == "NS Go"){ // transition out of NS Go state
        if(carEW == HIGH) ){
            turnNSred();
            turnEWgreen();
            state = "EW Go";
        }
        if else(timerExpired == true))
        :
    }
    else if
    :
}
```

HIGH or LOW

```
void turnEWred(){
    digitalWrite(redEW, HIGH);
    digitalWrite(yellowEW, LOW);
    digitalWrite(greenEW, LOW);
}
```

