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# **Engineering Technology (ENGR 101)**

## **FSM: Alarm Clock and Traffic lights**

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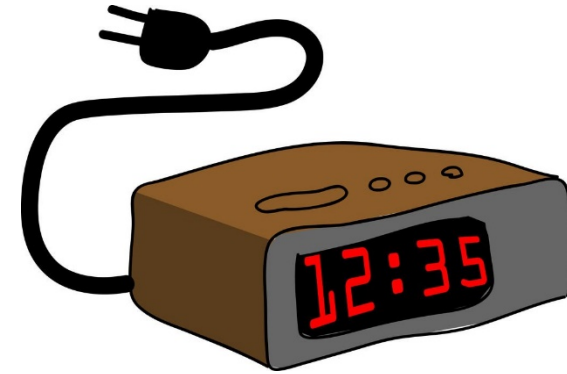
# Admin

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- Lab 6 due date is May 27, 19:00 (Xiamen Time)
- 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](https://ecs.wgtn.ac.nz/Courses/XMUT101_2021T1/XMUT101CourseOutline)

# Example: Alarm Clock

- What are possible states?
- What are the inputs?
- What are the actions?
- What control the transitions?



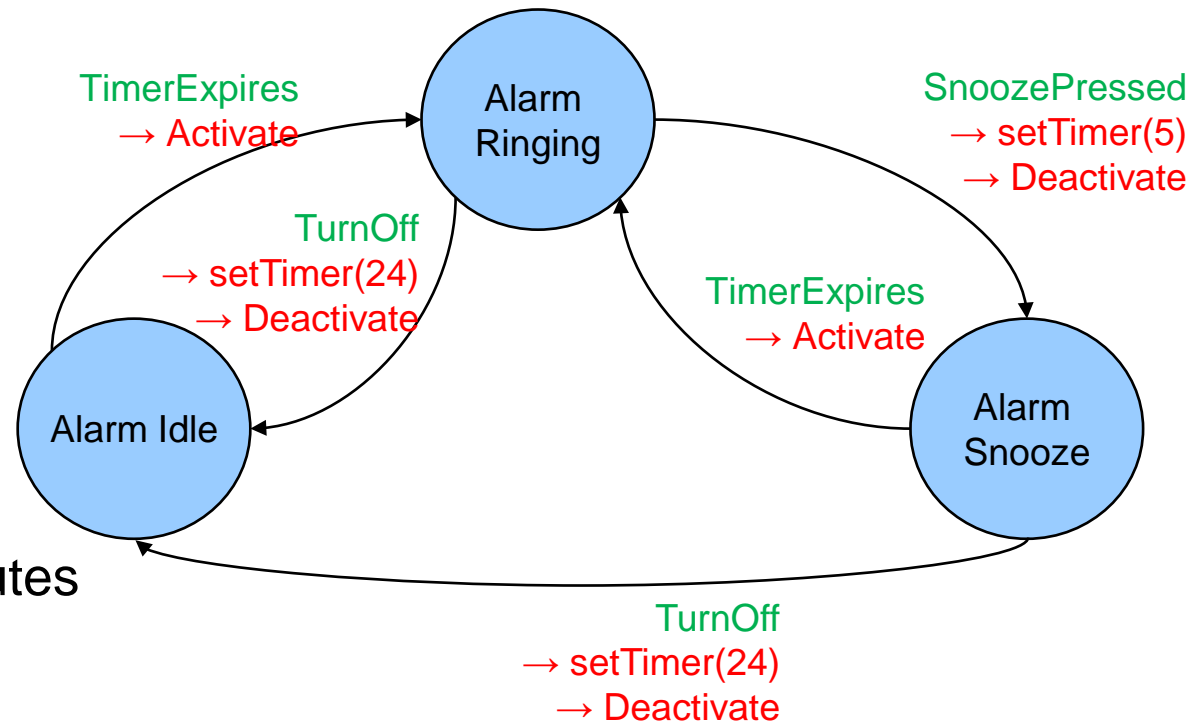
Picture is from:  
<https://www.instructables.com/>

- Sensors:

- TimerExpires
- SnoozePressed
- TrunOff

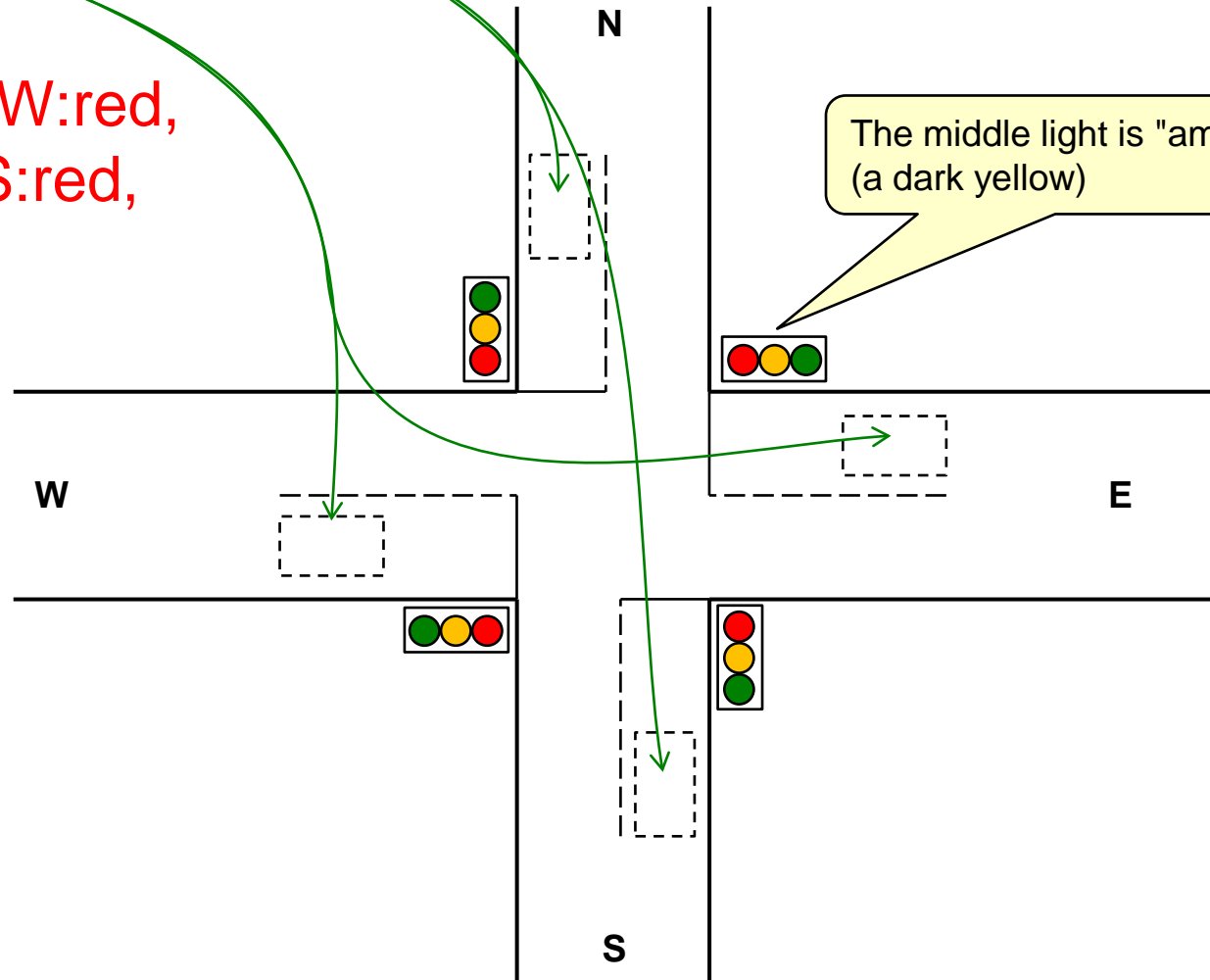
- Actions:

- **Activate** to turn on the alarm
- **setTimer(n)** to reset the timer in minutes
- **Deactivate** to turn off the alarm



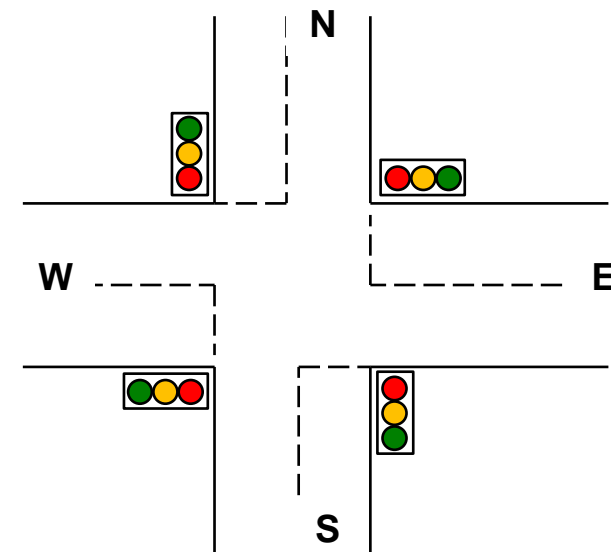
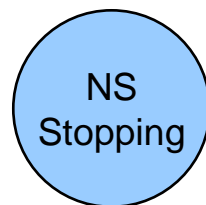
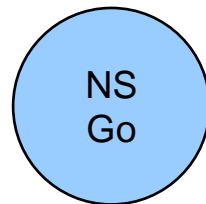
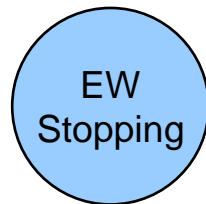
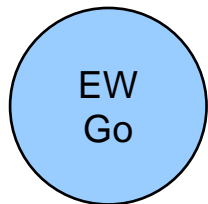
# Example: Traffic light controller

- Sensors: `carEW`, `carNS`,  
`timer`
- Actions: `EW:grn`, `EW:amb`, `EW:red`,  
`NS:grn`, `NS:amb`, `NS:red`,  
`setTimer(n)`
- States?
  - what are the different conditions where the Arduino should act differently?
  - eg:  
should it always change the lights when a car drives up?



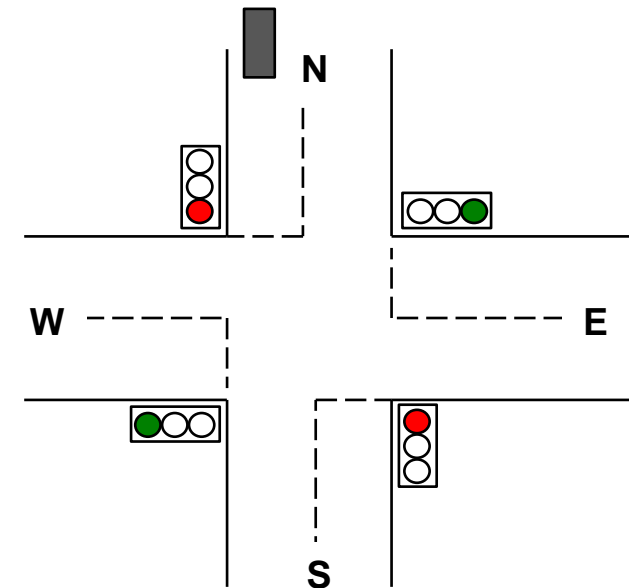
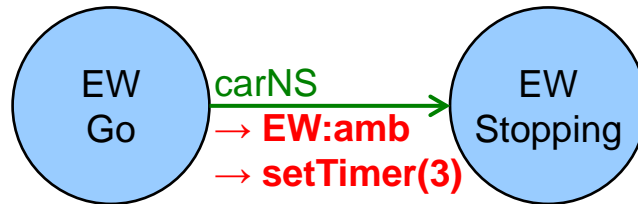
# States for Arduino sketch for traffic light

- Cars going East-West (and cars stopped North-South)      EW-Go
- Cars going North-South (and cars stopped East-West)      NS-Go
- Cars Stopping East-West (amber) (and cars stopped N-S)      EW-Stopping
- Cars Stopping North-South (amber) (cars stopped E-W)      NS-Stopping



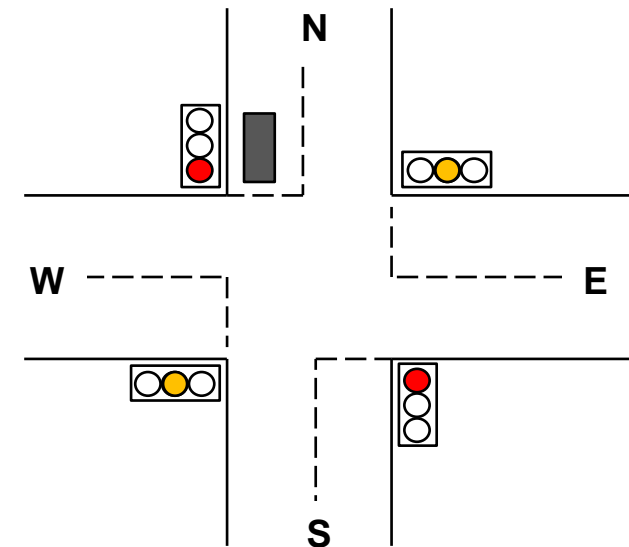
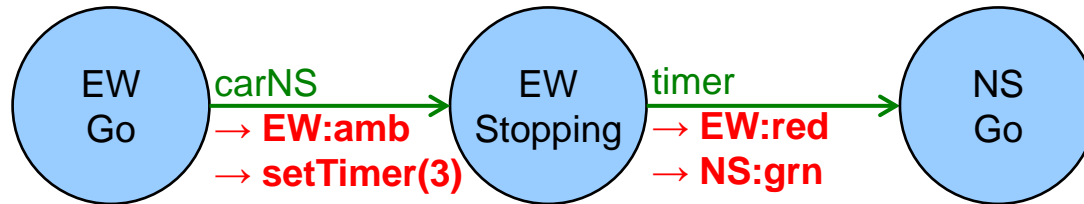
# States for Arduino sketch for traffic light

- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)



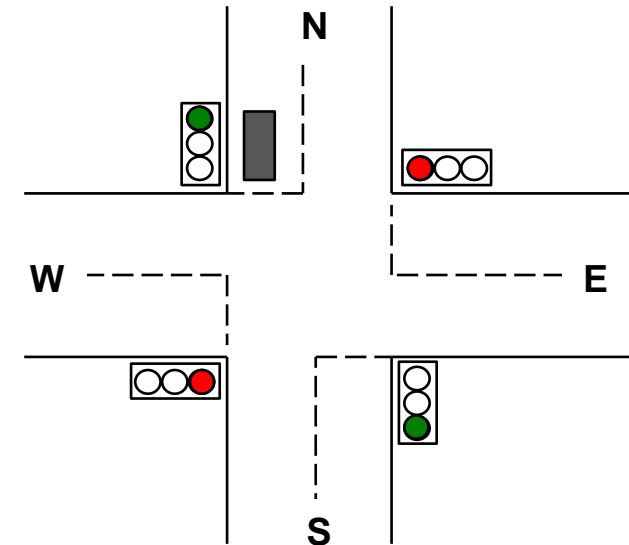
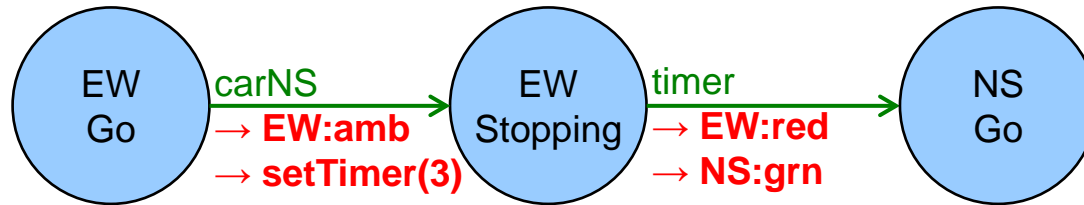
# States for Arduino sketch for traffic light

- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)



# States for Arduino sketch for traffic light

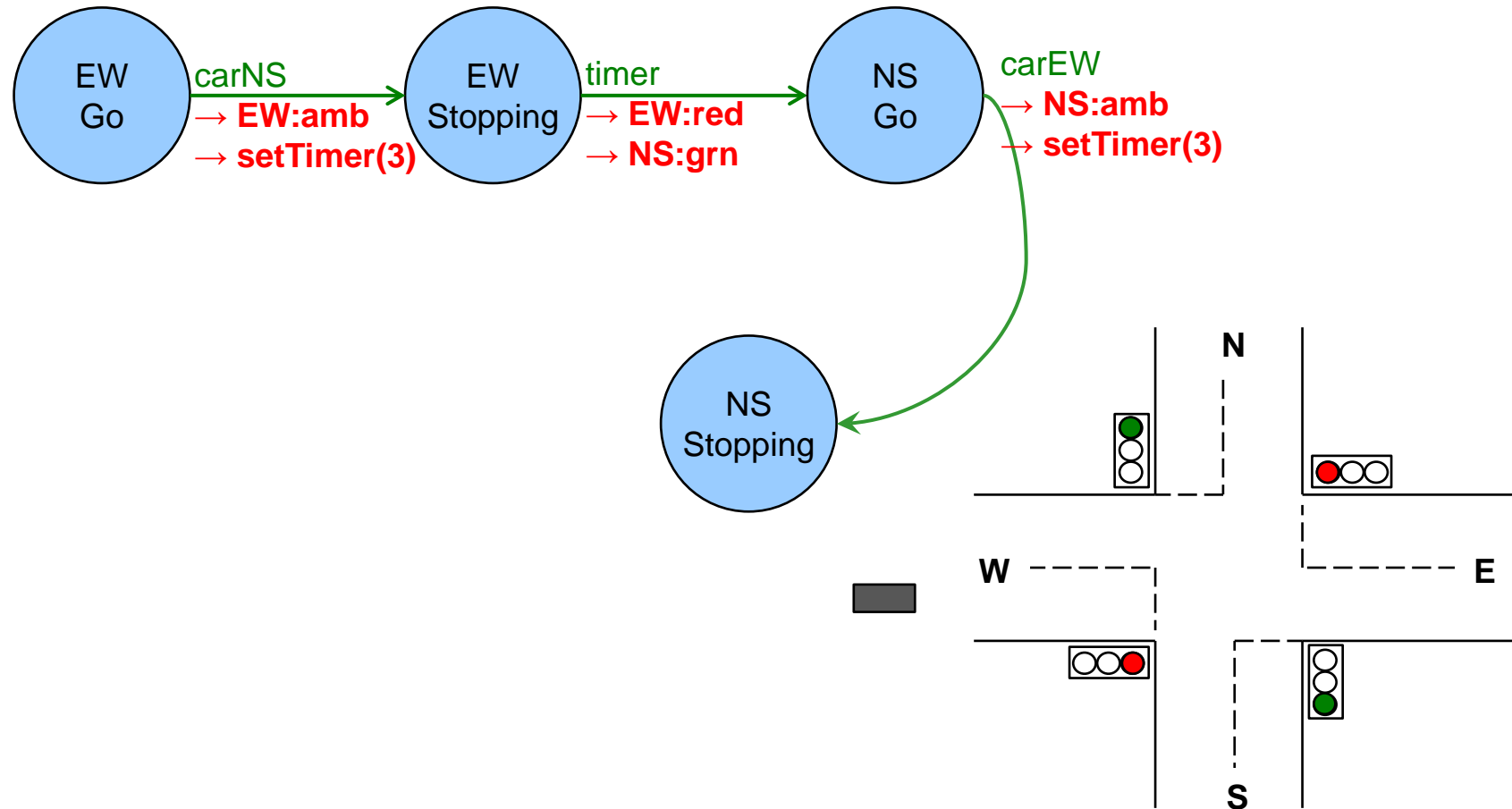
- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)





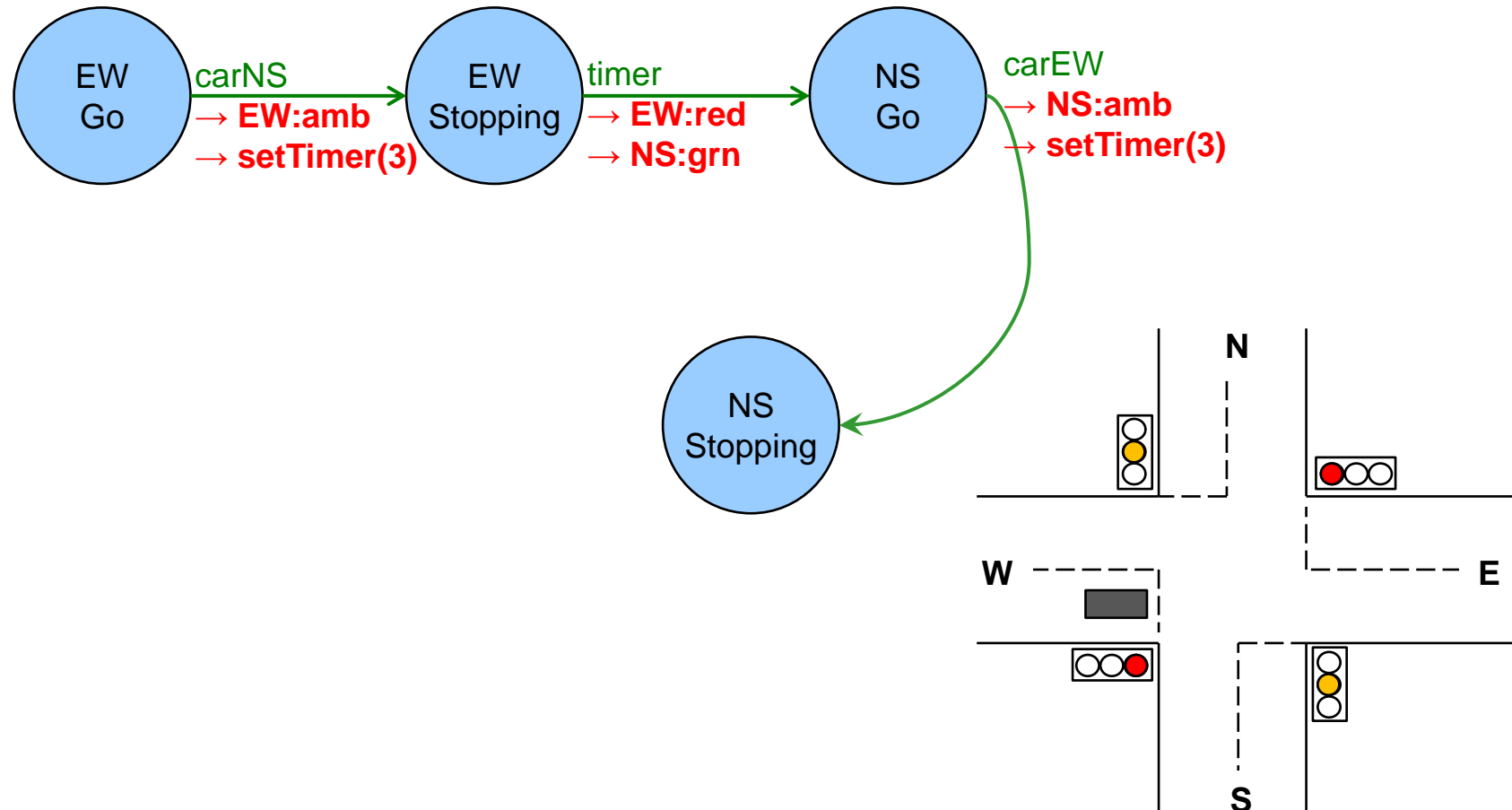
# States for Arduino sketch for traffic light

- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)



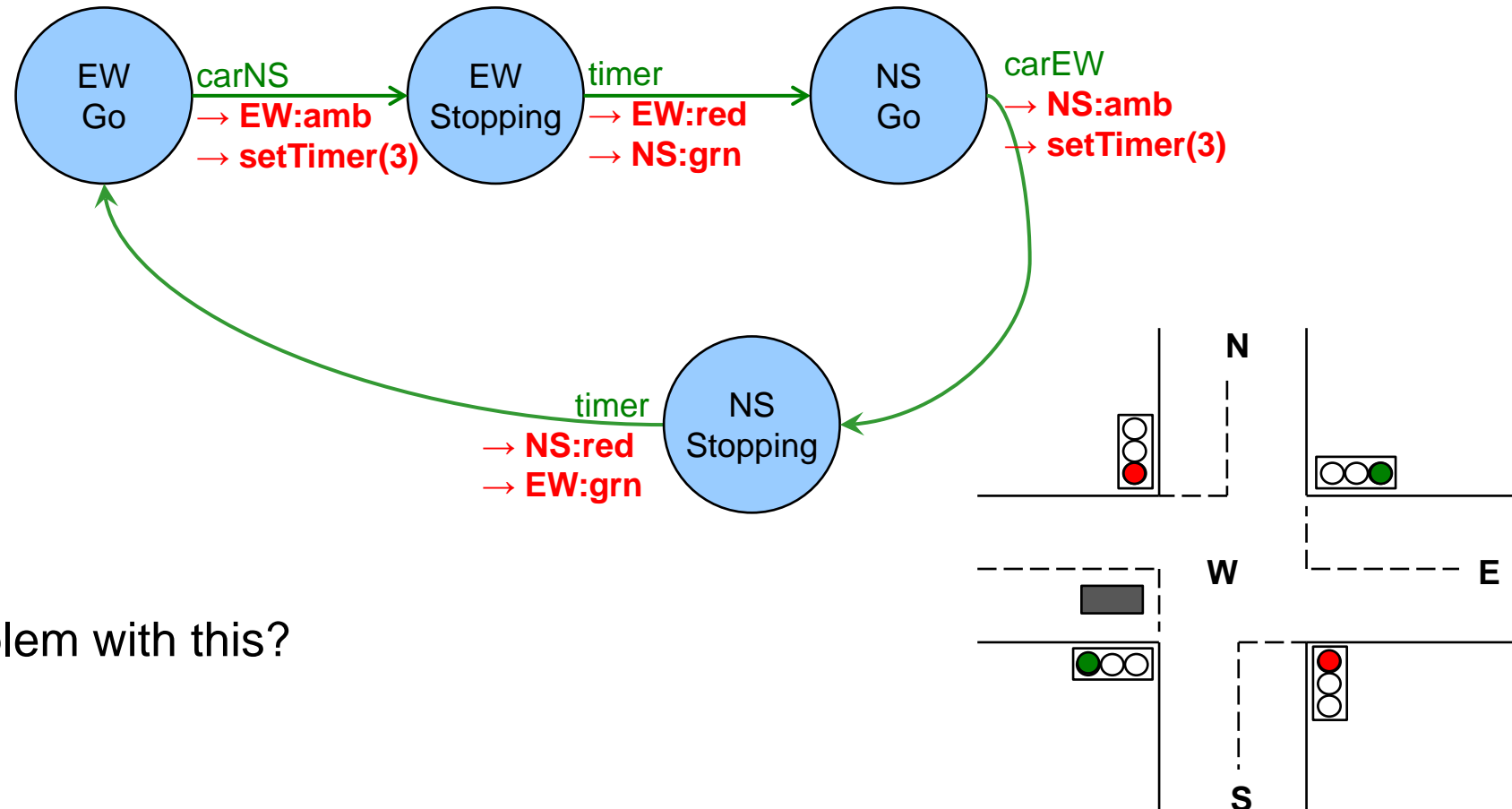
# States for Arduino sketch for traffic light

- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)



# States for Arduino sketch for traffic light

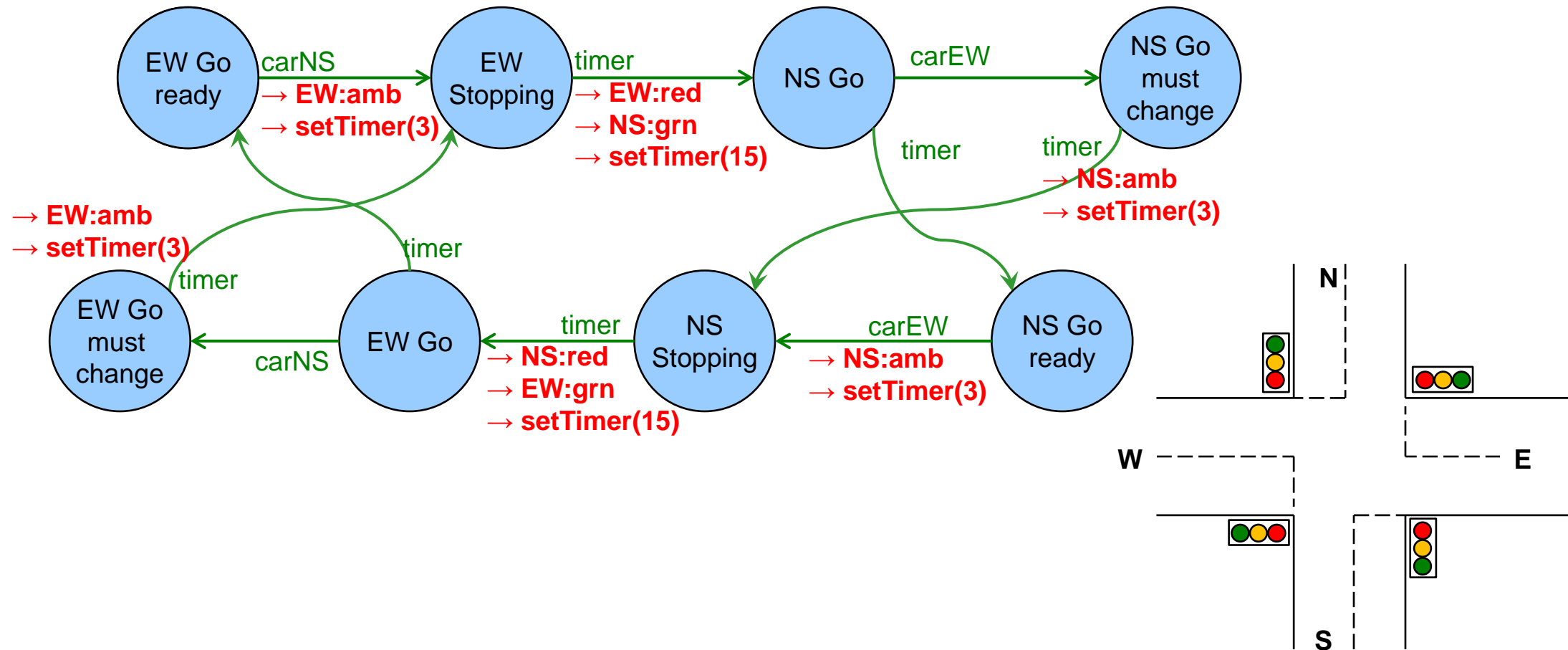
- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)



- What's the problem with this?

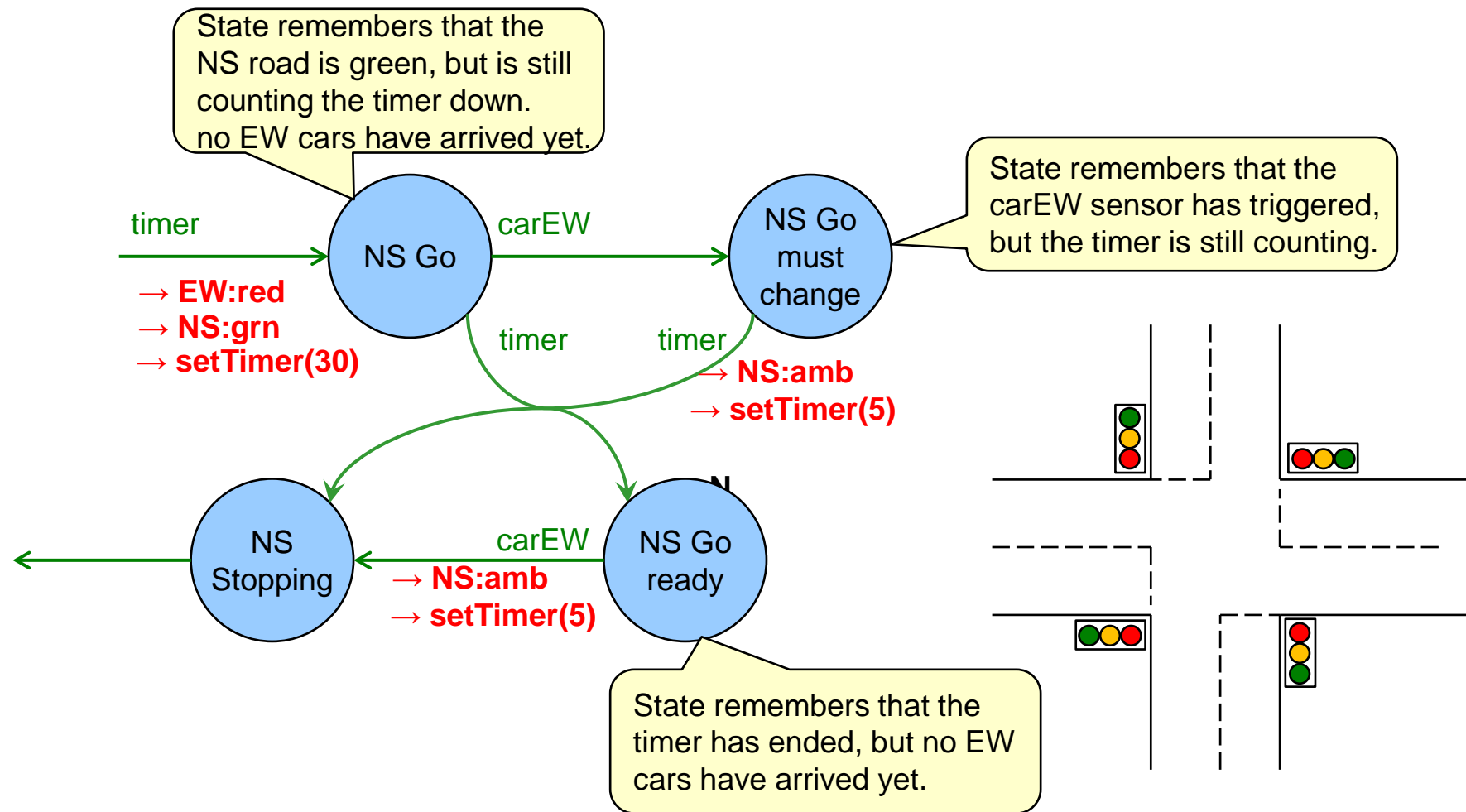
# States for Arduino sketch for traffic light

- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)



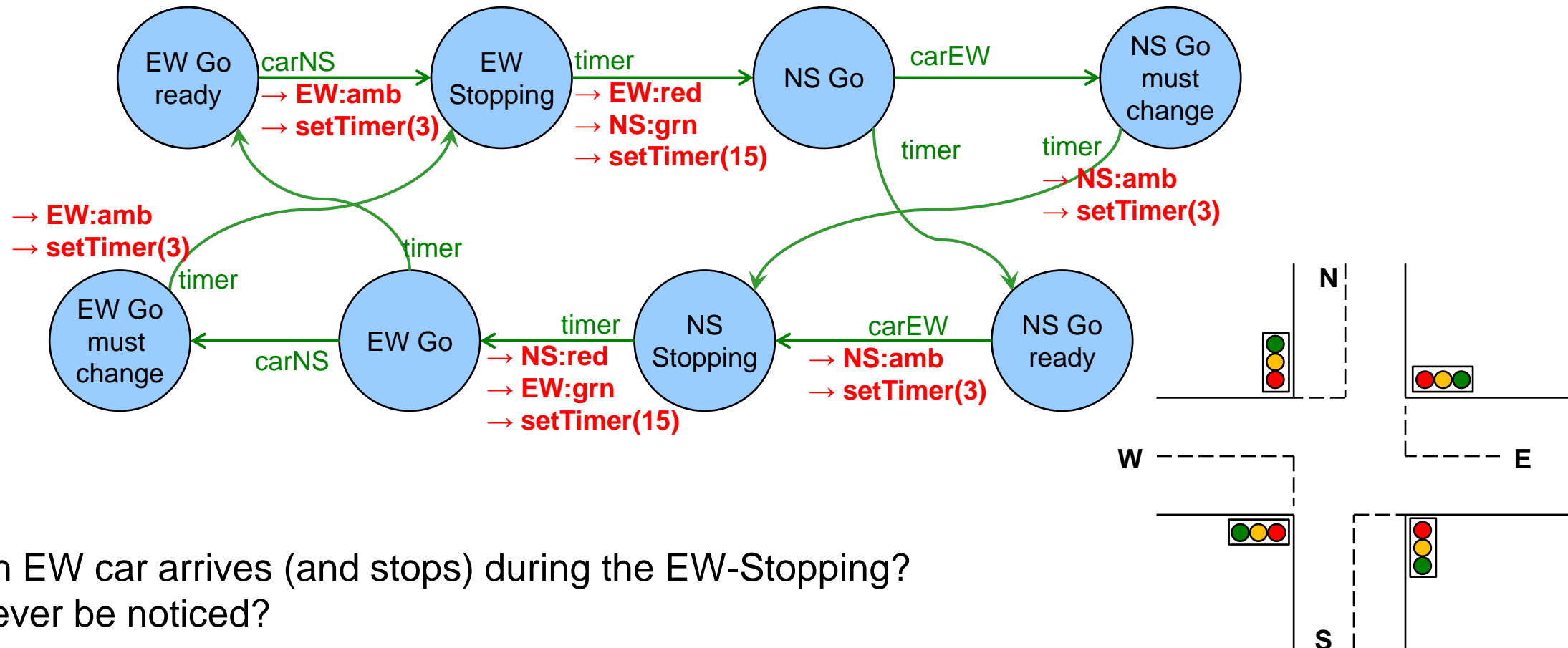
# States remember sensor values.

- Sensors: carEW, carNS, timer
- NS Go represents the state in which the N-S roads have the green.



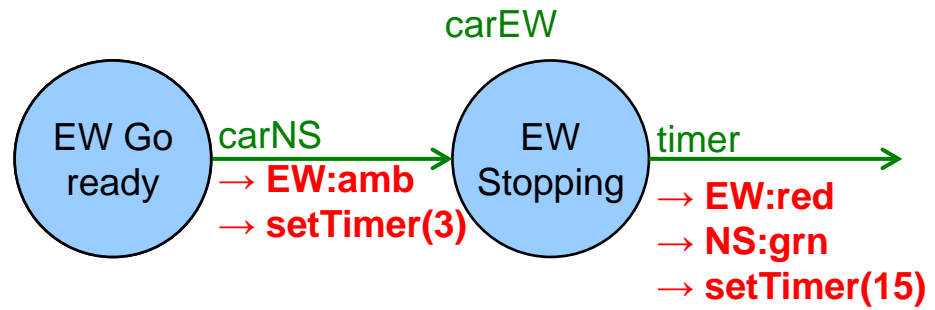
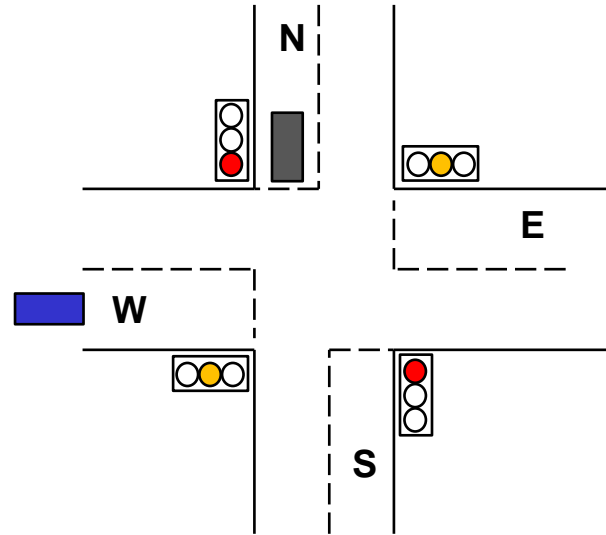
# States for Arduino sketch for traffic light

- Sensors: carEW, carNS, timer
- Actions: EW:grn, EW:amb, EW:red, NS:grn, NS:amb, NS:red, setTimer(n)

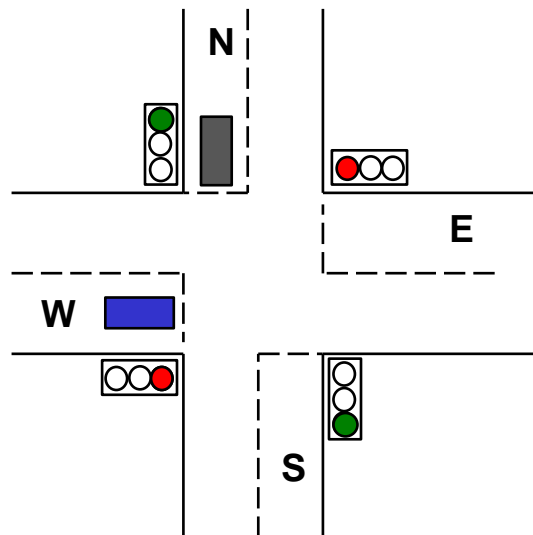


- What if an EW car arrives (and stops) during the EW-Stopping?  
Would it ever be noticed?

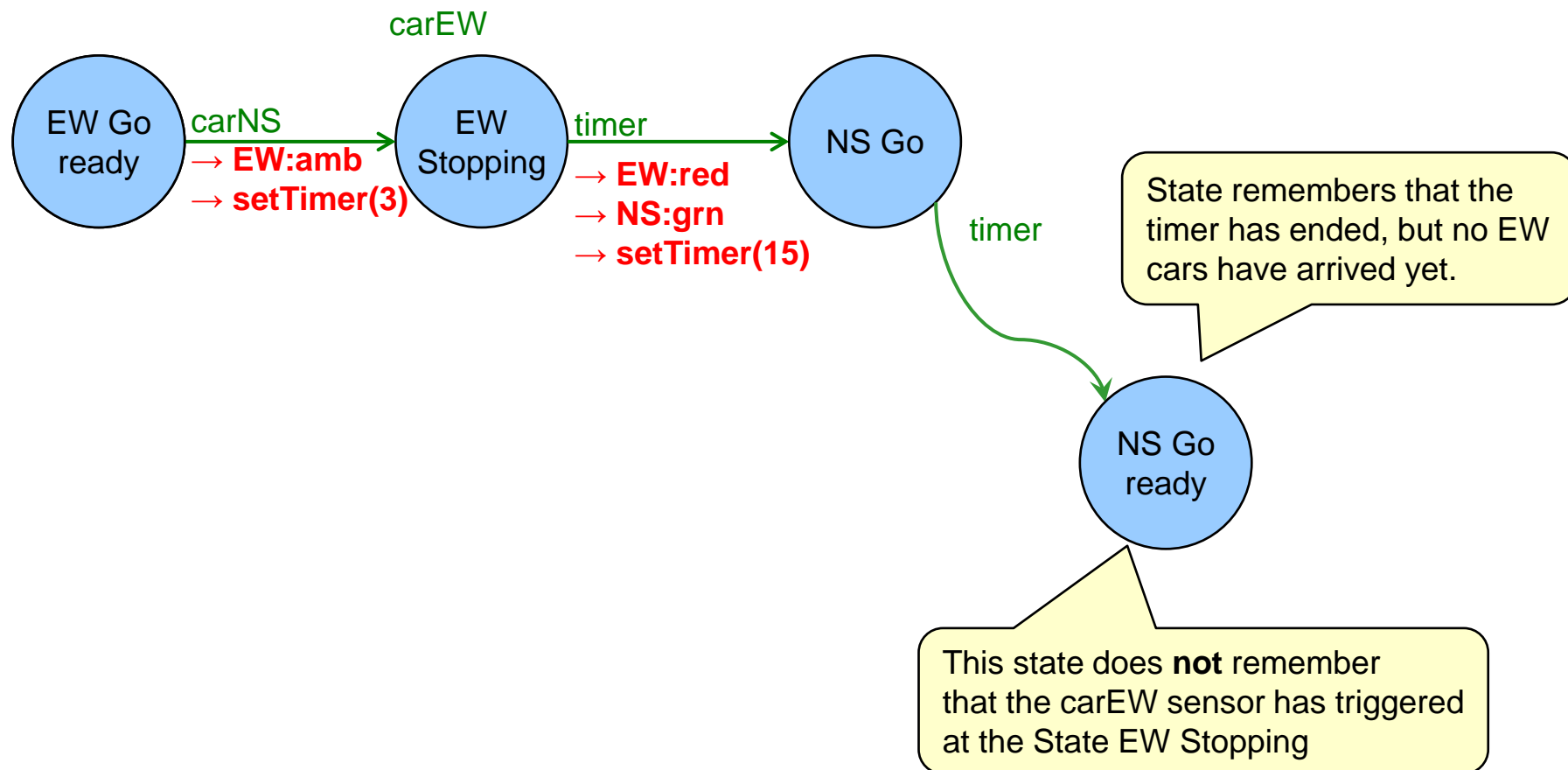
# States for Arduino sketch for traffic light



# States for Arduino sketch for traffic light

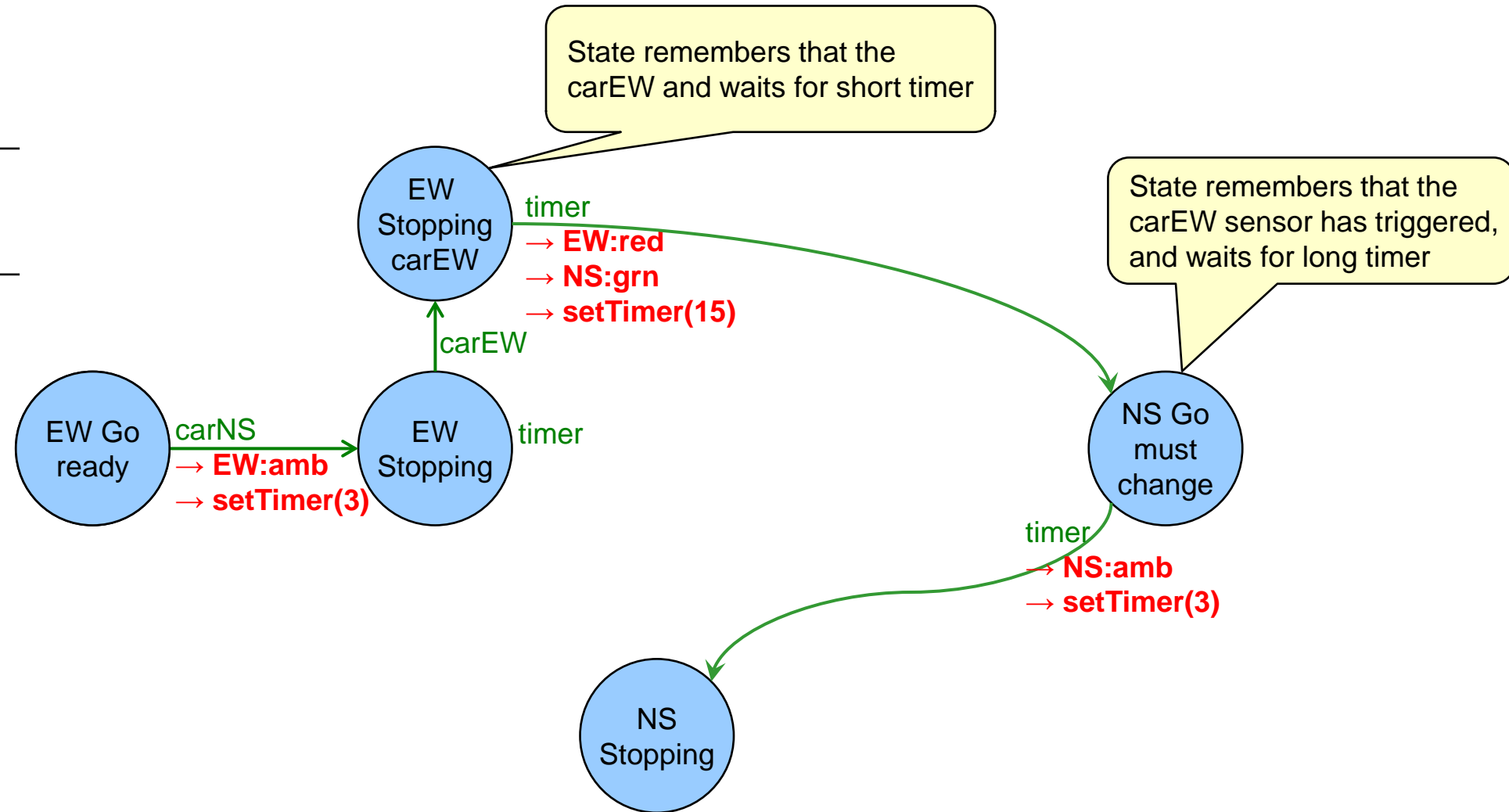
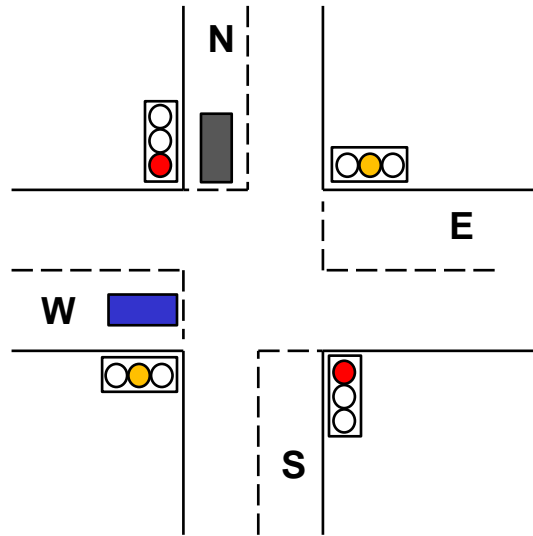


To remember the carEW sensor, we need to define new states.



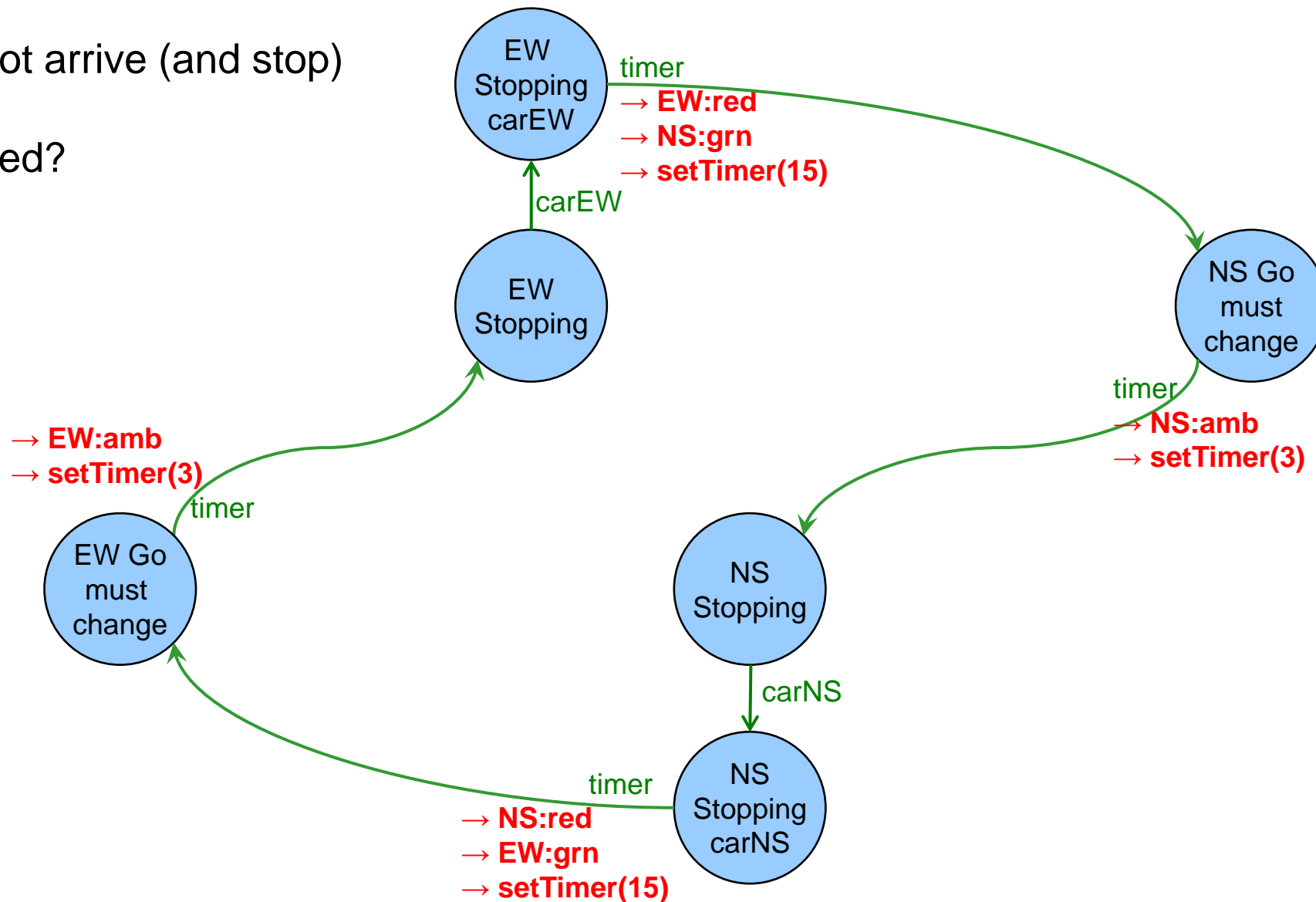
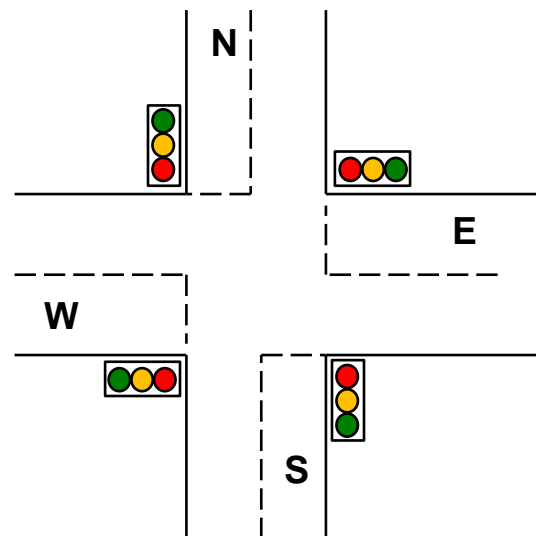


# States for Arduino sketch for traffic light



# States for Arduino sketch for traffic light

What if an EW car does not arrive (and stop) during the EW-Stopping?  
Would timer ever be noticed?



# traffic light controller for Lab 7

Always need ONE sensor on each transition.

