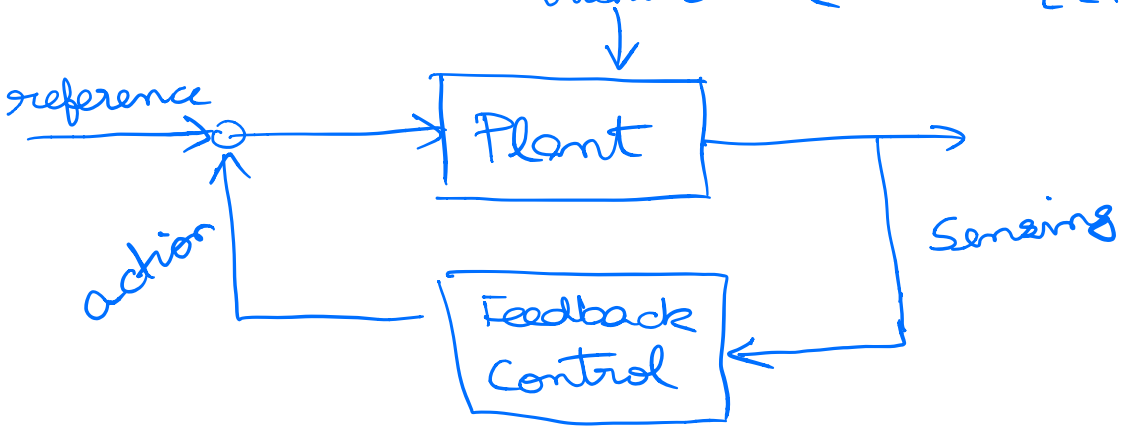
ELL 333
Multivariable Control
23.07.2019

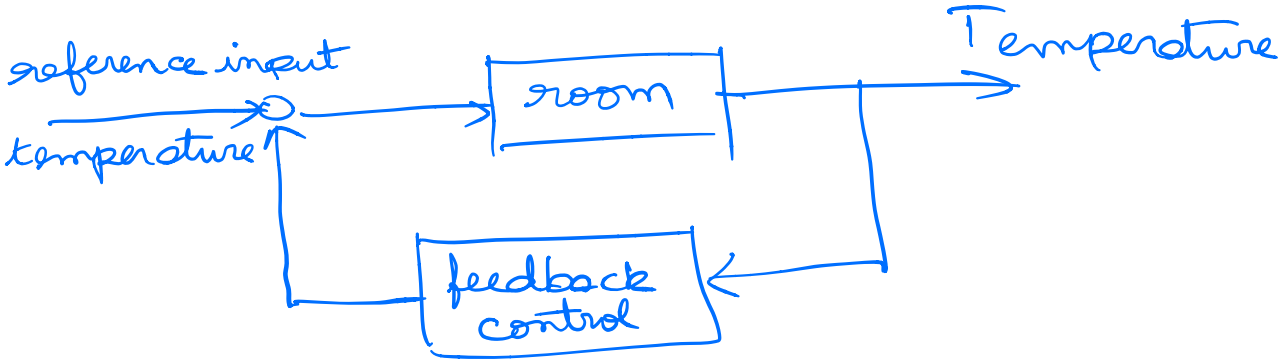
What's to be covered in this course?

"Control" familiar from ELL 225 / ELP 225



Example of a control system?

- air conditioner

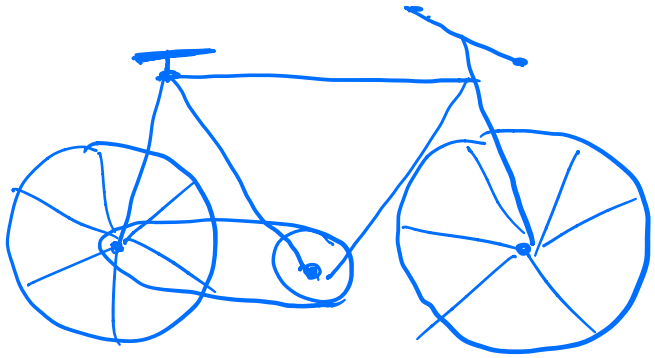


Example of a "multivariable" control system?

- could mean multiple inputs or multiple outputs

basic idea: techniques to handle multivariable control systems → matrix-based methods

Example for this setting: Bicycle



Can this be viewed as a control problem?

Control objective: steering angle
turn
balancing
speed

↳ bicycle should stay upright

Why does it not fall down?

- we keep on moving
- gravity can make it fall

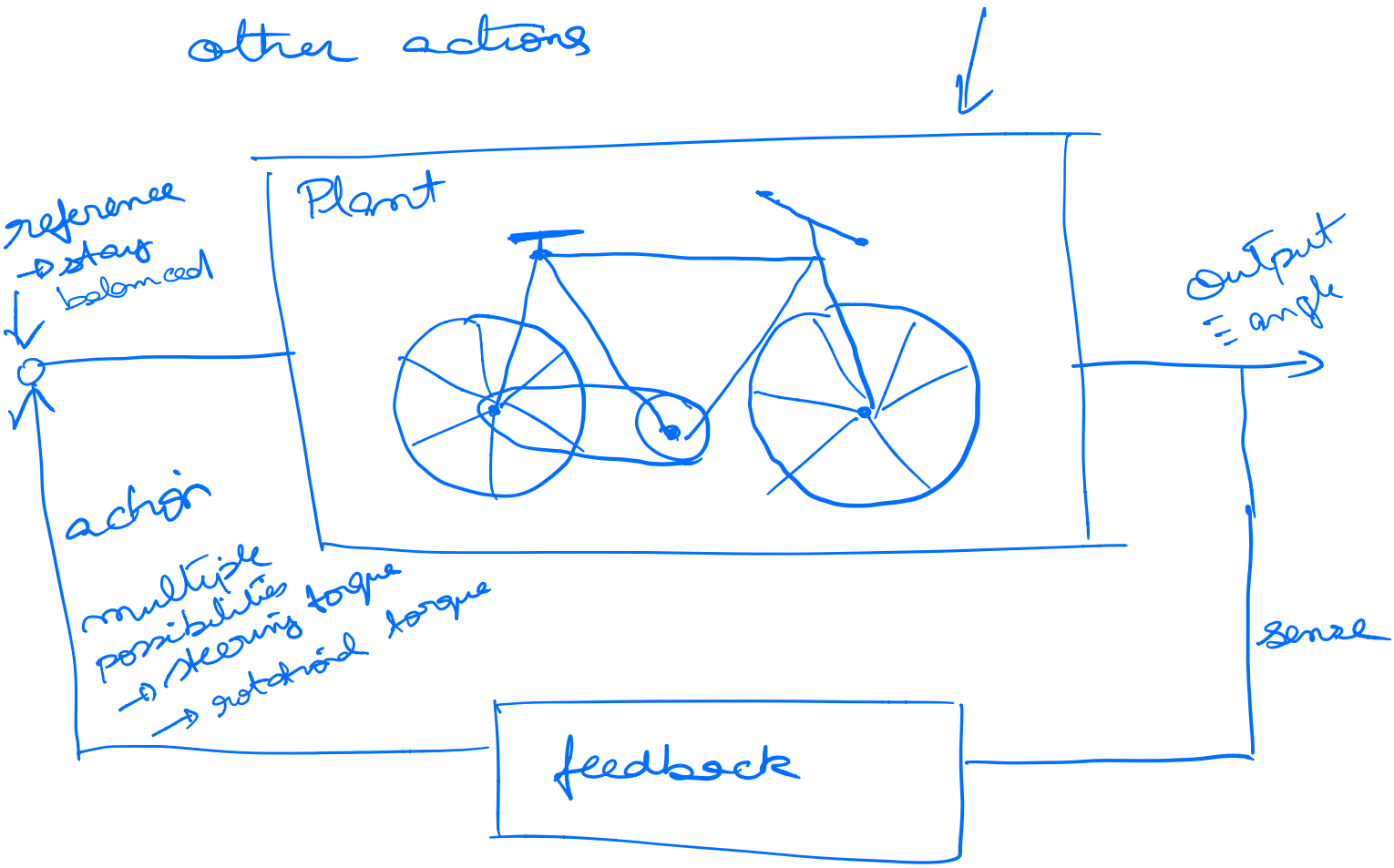
There is some sensing going on —
What are we sensing?

- angle should be sensed
- is there something else that needs to be sensed?
  → speed of bicycle.
- angular velocity

If falling, what is done

- shift weight
- brakes? / increasing speed + foot down
- steer the handle

other actions



We want to know

- Dynamics & stability
  - **Model** of how it works
- Control of these dynamics as per specification
  - Can these dynamics be controlled?
  - How to control, if it can be done?
  - Is this the best way to control?
    - notion of optimality.

Would like to get to the "Kalman Filter."

Grading policy

Major : 36%.

2 Minors : 40%. (20%. each)

Quizzes: 24%. (best 6/12)
(in class)

Audit Pass: 55%.

Books

- Astrom & Murray
  Feedback Systems

- B. Friedland
  Control System Design