

Fly-by-Wire: Towards Scalable, Differentiated Instruction

Project Overview
Team Kickoff Meeting
December 16, 2015



Funded by FIPSE. The contents of this presentation were developed under grant P116F150045 from the U.S. Department of Education. However, those contents do not necessarily represent the policy of the U.S. Department of Education, and you should not assume endorsement by the Federal Government.

Introductions

- Dale Allen, QCC
- Jennifer Dunlap, ACC
- Leslie Gerhat, edX
- Sarah Holsted, BbK
- Luwen Huang, MIT
- Vijay Kumar, MIT
- Chad Lieberman, MIT
- Yashu Kauffman, MIT
- Damian Kiernan, QCC
- Jean Mclean, QCC
- Flora McMartin, BbK
- Jeff Merriman, MIT (remote)
- Josh Morrill (remote)
- Kathy Rentsch, QCC
- Casey Sacks, CCCS
- Dipa Shah, MIT
- Cole Shaw, MIT
- Diane Soderholm, MIT
- Glenda Stump
- Karen Willcox, MIT
- Rebecca Woulfe, ACC
- Deb Zulick, QCC

Today's Meeting Goals

What we hope to
accomplish today.

- | Understand the intervention
- | Solicit input from faculty
- | Agree upon collaborative workflow
(assessment and user interviews)

Agenda

Wednesday Dec 16

10-11am: Introductions & Project Overview

11-12.30pm: Community college perspective (ACC, QCC)

12.30–1.30pm: Lunch

1.30–4pm: FbW logic

Agenda

Thursday Dec 17

9-10am: FbW Technology

10am-lunch: Evaluation

FbW Project Motivation

Pain points in the classroom today & how technology can help.

- Instructors teach multiple sections; heavy workloads
- Students have different backgrounds & levels of ability
- Difficult to track an individual student and give targeted feedback
- Students have work / life commitments outside of school
- Streamline lower-level tasks that take up instructor time
- Assess an entire class' ability and fill in inadequate backgrounds
- Record performance and rapidly deliver targeted feedback
- Can be used outside of the classroom, providing flexibility

FbW Project Objectives

- Develop FbW intervention to enable instructors to provide scalable, differentiated instruction
- Develop instruments to measure impact of intervention
- Conduct quasi-experimental study (QES) on group of > 500* students at ACC and QCC
- Measure quantitative improvement in student outcomes (learning outcomes, time to completion, persistence, retention, etc.)
- Collect qualitative feedback from instructors using the intervention (perceived impact on faculty workload, student interaction, ability to adjust to classroom demands, use of in-class time)

What is a “fly-by-wire” system?



Since the flight-control computers continuously “fly” the aircraft, pilot’s workloads can be reduced.

source: wikipedia



© AIRBUS S.A.S. 2010 - COMPUTER RENDERING BY FIXION -

“Fly-by-wire technology has allowed Airbus to develop a true family of aircraft through the highest degree of operational commonality.”

source: www.airbus.com

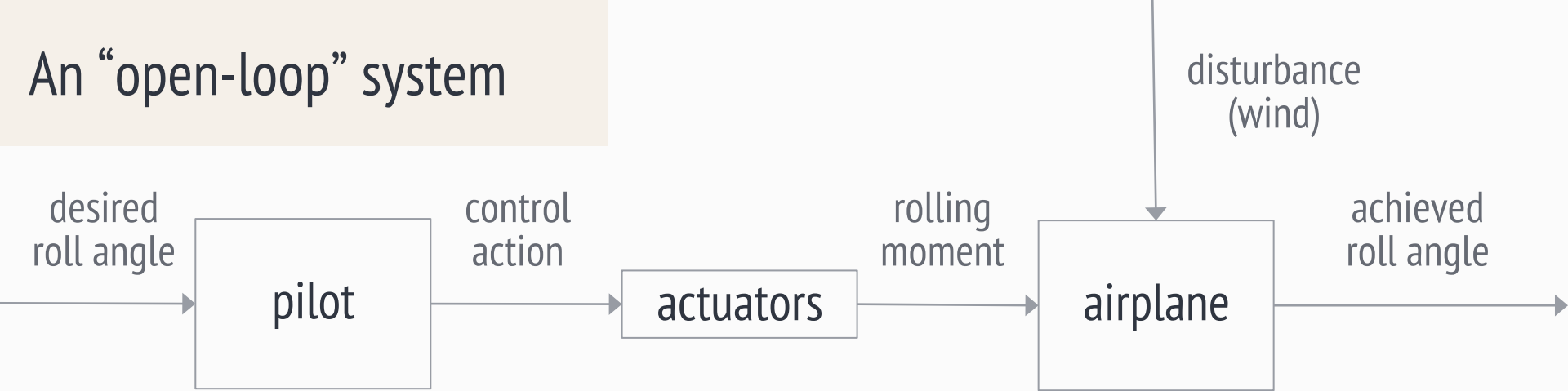
The Aero Analogy in the Classroom

An “open-loop” system



***actuators** are the things that move, e.g. moving surfaces on the wing*

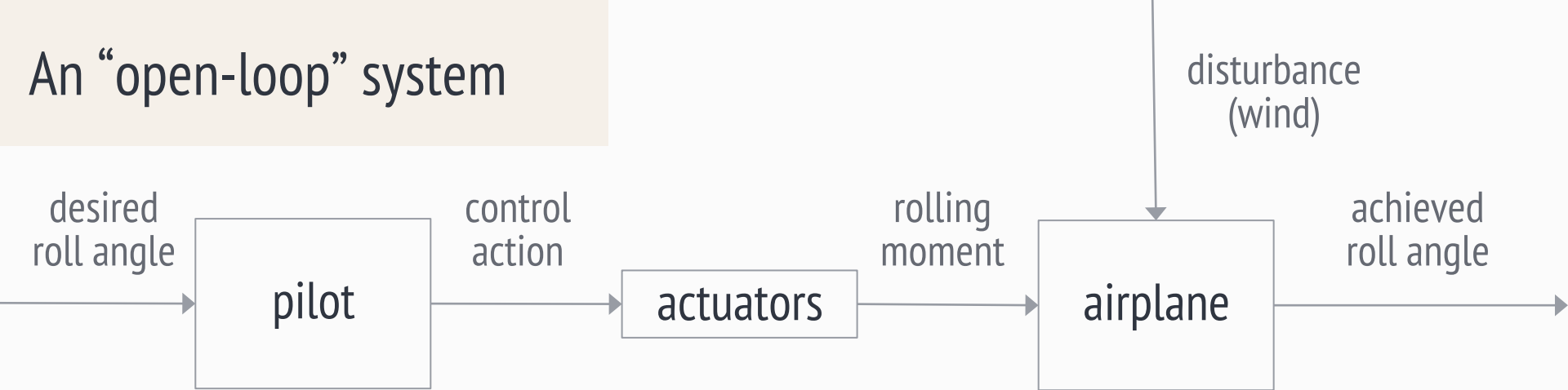
An “open-loop” system



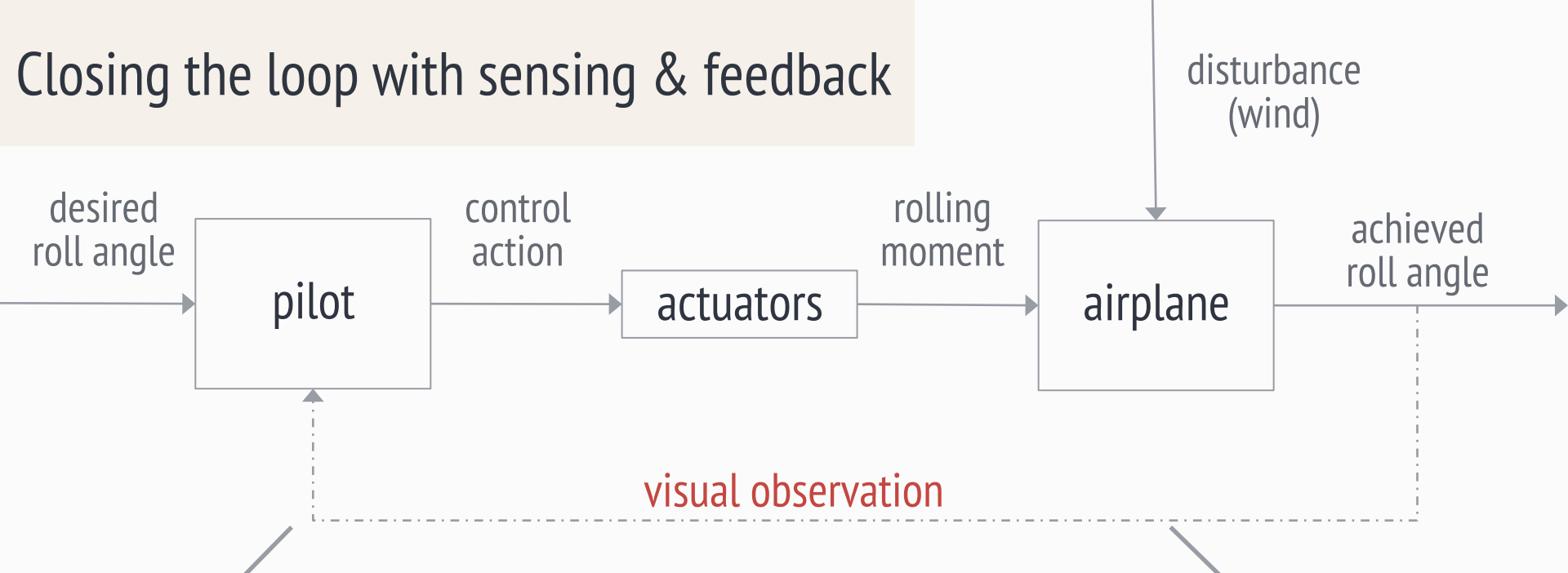
The open-loop system is **vulnerable**

- to disturbances
- to variations in air conditions from day to day
- to variations from aircraft to aircraft

An “open-loop” system



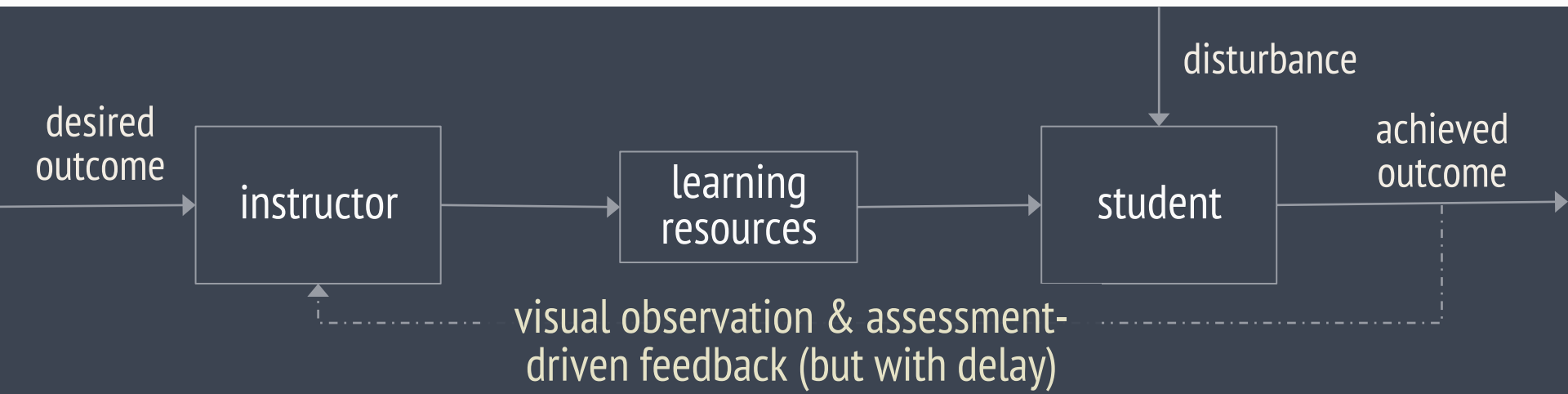
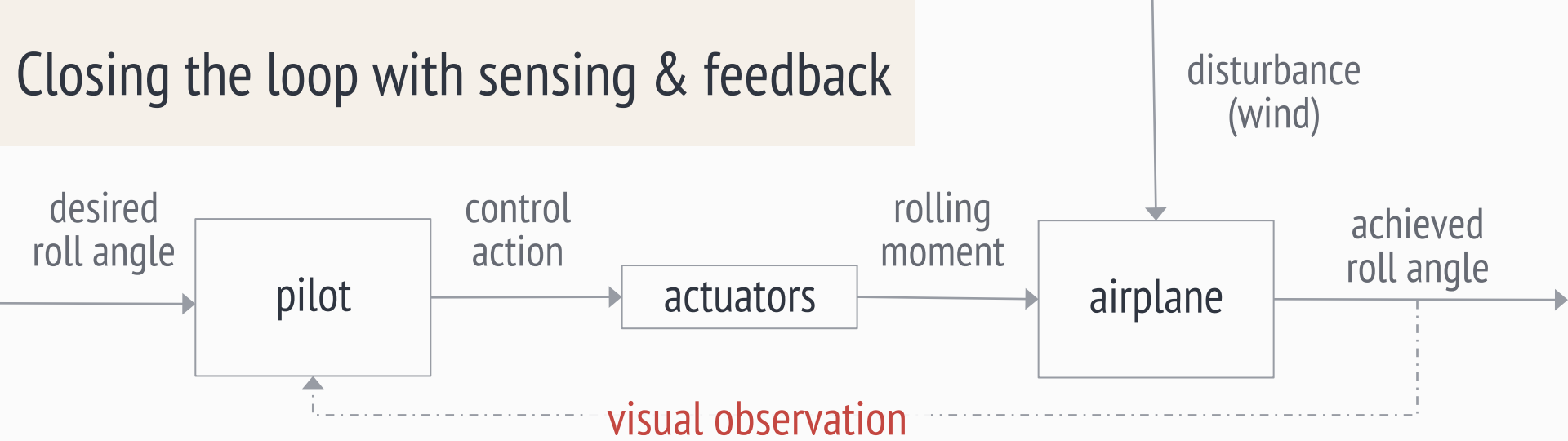
Closing the loop with sensing & feedback



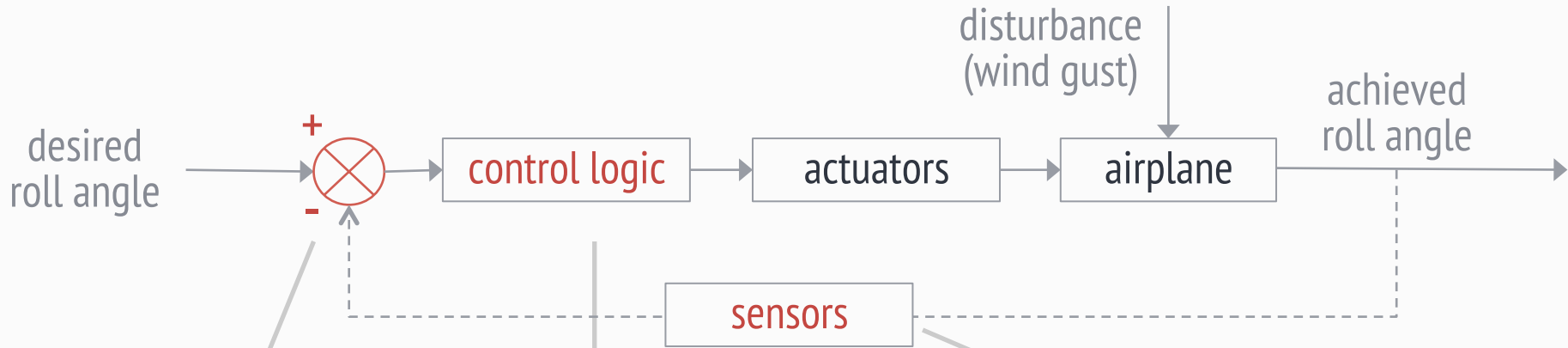
...and **feeds it back** to the pilot, who then adjusts the control action accordingly.

Visual observation **senses** the actual aircraft roll angle...

Closing the loop with sensing & feedback



A digital feedback control system

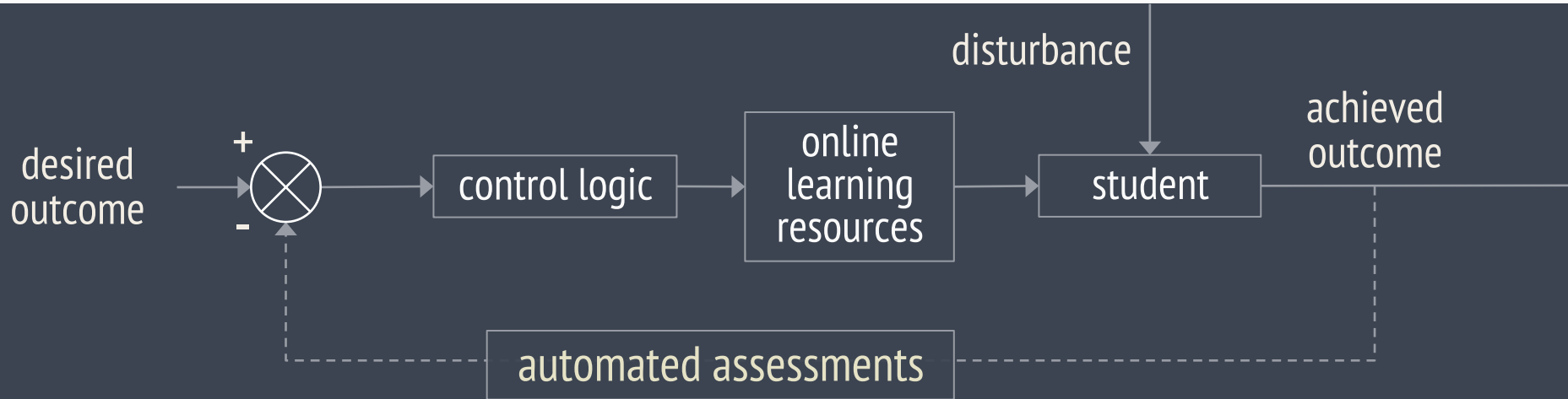
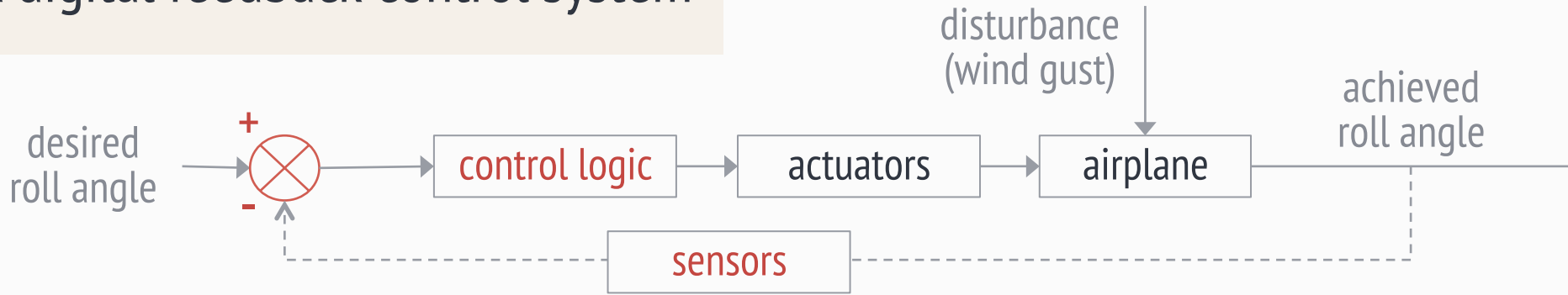


***comparator** compares the desired and the achieved roll angle*

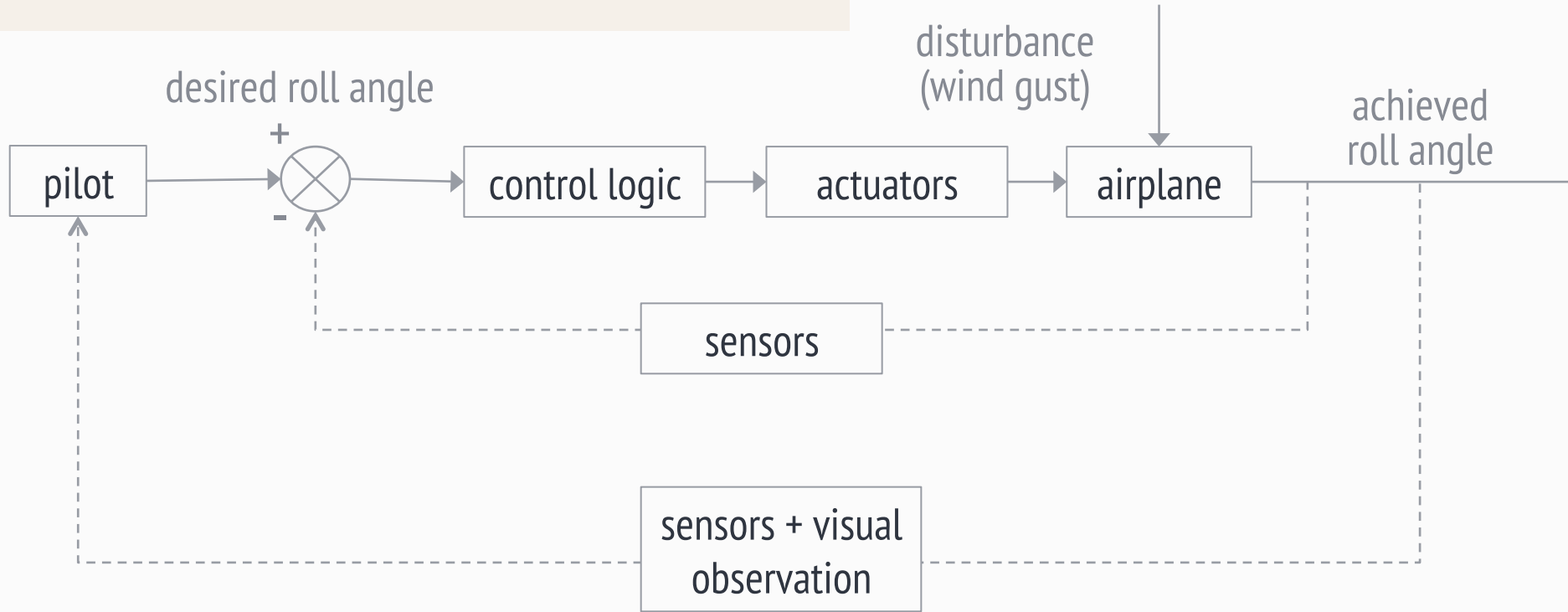
***control logic** determines corrective action as a function of the error*

***sensor system senses** the actual aircraft roll angle*

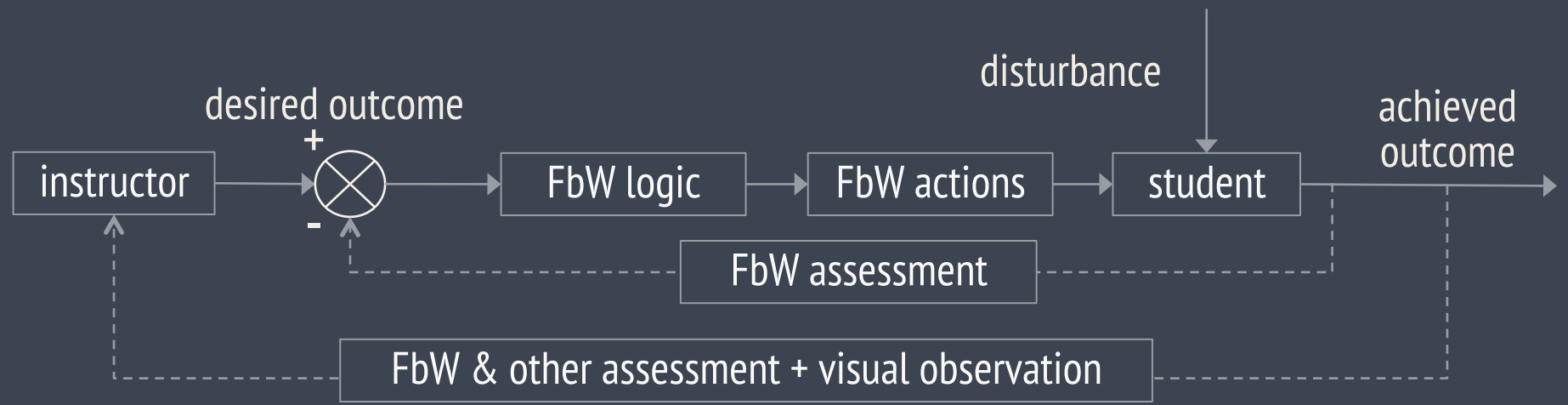
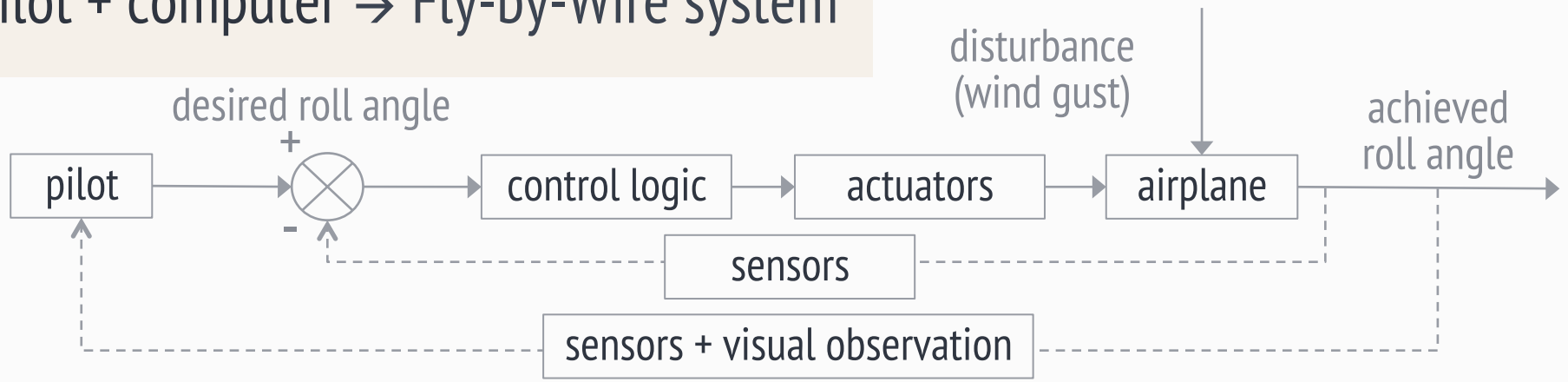
A digital feedback control system



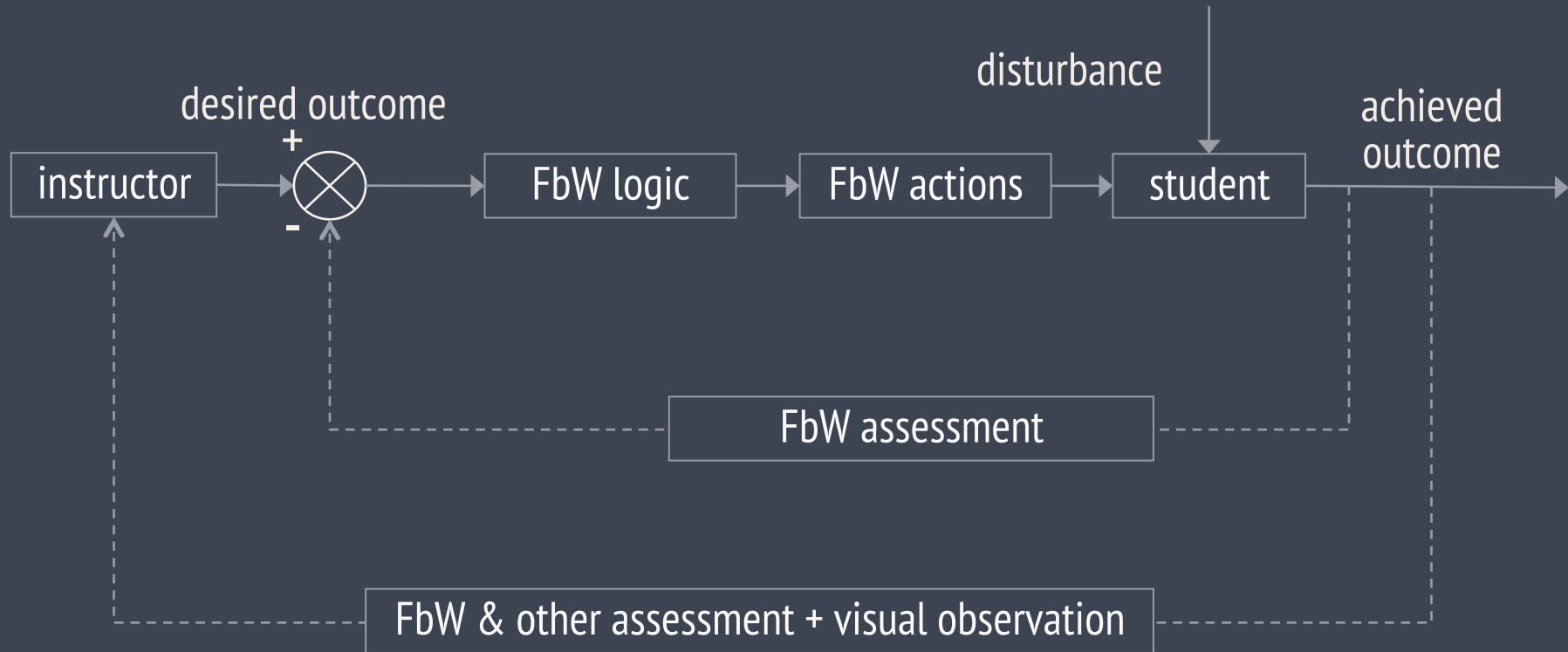
Pilot + computer → Fly-by-Wire system



Pilot + computer → Fly-by-Wire system



Pilot + computer → Fly-by-Wire system



Proposed FbW system for education

FbW is more than just an analogy– it is a structured framework for designing the components of our system

FbW logic

- mapping the relationships among outcomes, and the linkages between assessments and outcomes
- designing and developing the FbW assessments (*sensor system*)
- designing the FbW logic and FbW action reacting to student response (*controller logic, actuators*)

FbW technology

- designing and creating the student-facing and instructor facing apps
- designing and developing the technology to be flexible, modular and open-source

Proposed FbW system for education

Literature:

Assessment and feedback is central to student achievement¹

Targeted feedback is more effective than simple verification²

Rapid feedback is more effective than delayed feedback³

Proposed intervention:

Students take frequent interval assessments on a student app.

The student gets immediate, targeted feedback on assessments.

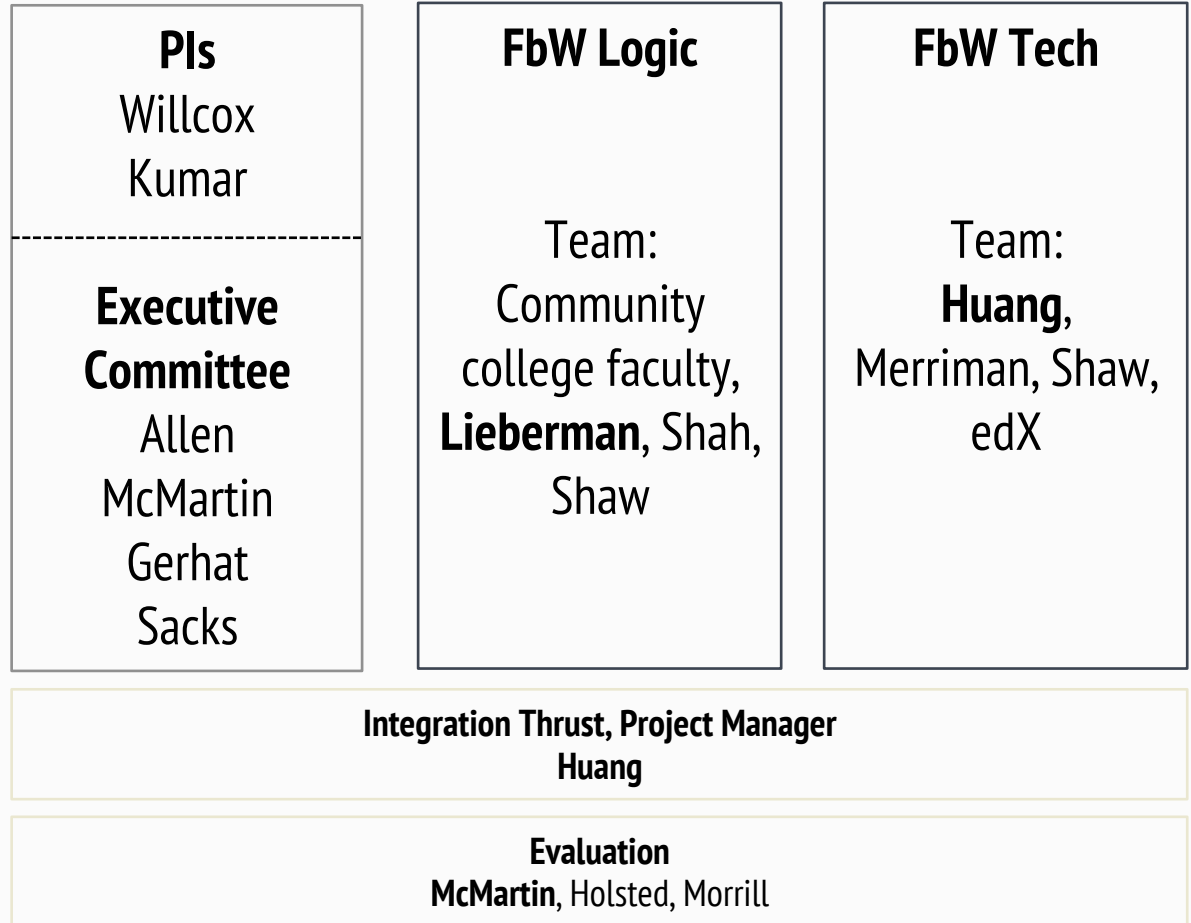
Instructors get info and recommendations on an instructor app and can act upon recommendations.

¹Hattie 1987, Black & William 1998, Gibbs & Simpson 2004

²Shute 2008

³Corbett & Anderson 2001, Mason & Bruning 2001

Project structure



Agenda

10-11am: Introductions & Project Overview

11-12.30pm: Community college perspective (ACC, QCC)

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Fly-by-Wire Intervention

Instructor + Computer

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What is the Fly-by-Wire intervention?

And what it is not.

Technology for blended instruction

Designed to be a
“low-load”
intervention.

- | What is the difference between a FbW class and a regular class?
- | How students do their homework and get feedback
- | How instructors *might* decide to change lesson plans on-the-fly


What do instructors do?

Instructors use the
Instructor App
outside-of-class.

- | Require students to do assessments on the Student App
- | Approve assessments to be served on the Student App
- | Get and act upon recommendations (course correction)

What do students do?

Students use the Student App outside-of-class.

A photograph of a student's workspace. A wooden desk is in the foreground. On the left, a person's hands are typing on a silver laptop. On the right, a person's hand is holding a black smartphone. The background is slightly blurred, showing a window with light coming through. A dark grey semi-transparent box is overlaid on the top right of the image, containing white text.

Take assessments on the app
Get feedback on answers

What FbW is not.

Banishing
misconceptions.

- | **Not** Artificial Intelligence taking over the classroom.
- | **Not** just another “quiz” app.
- | **Not** an in-class question polling tool

What is needed to achieve this?

Project activities for faculty, deans & MIT design team

Years 1 & 2

Design &
Development

- | Logic team and faculty collaboratively create assessments.
- | Technology team holds focus groups, sits in on classes, interviews students and holds usability tests.

In-depth look at next 9 months

Design &
Development

Jan '16

UX interviews

Apr

UX interviews

Sep

UX interviews

CC faculty + students, Huang, Shah

Assessment & logic design

CC faculty, Lieberman, Shah

Development of evaluation instruments

McMartin, Holsted, Morrill

Year 3

Pilot test of QES

- | Conduct trial run of QES to iron out potential issues and practice collecting data.
- | Faculty teach one FbW section

Year 4

FbW intervention in
all sections

| Conduct QES in all sections.

| Faculty teach multiple FbW sections