# Groups

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# Today: Project 2

Group work for today:

- First circuit
- Essential software pieces
  - Reading compass heading
  - Computing compass error
  - Computing compass derivative
  - Displaying heading or error with LEDs (4 minimum)
  - Displaying rotational velocity with LEDs (5 minimum)

As you complete one or two tasks, show them to Di or Josh

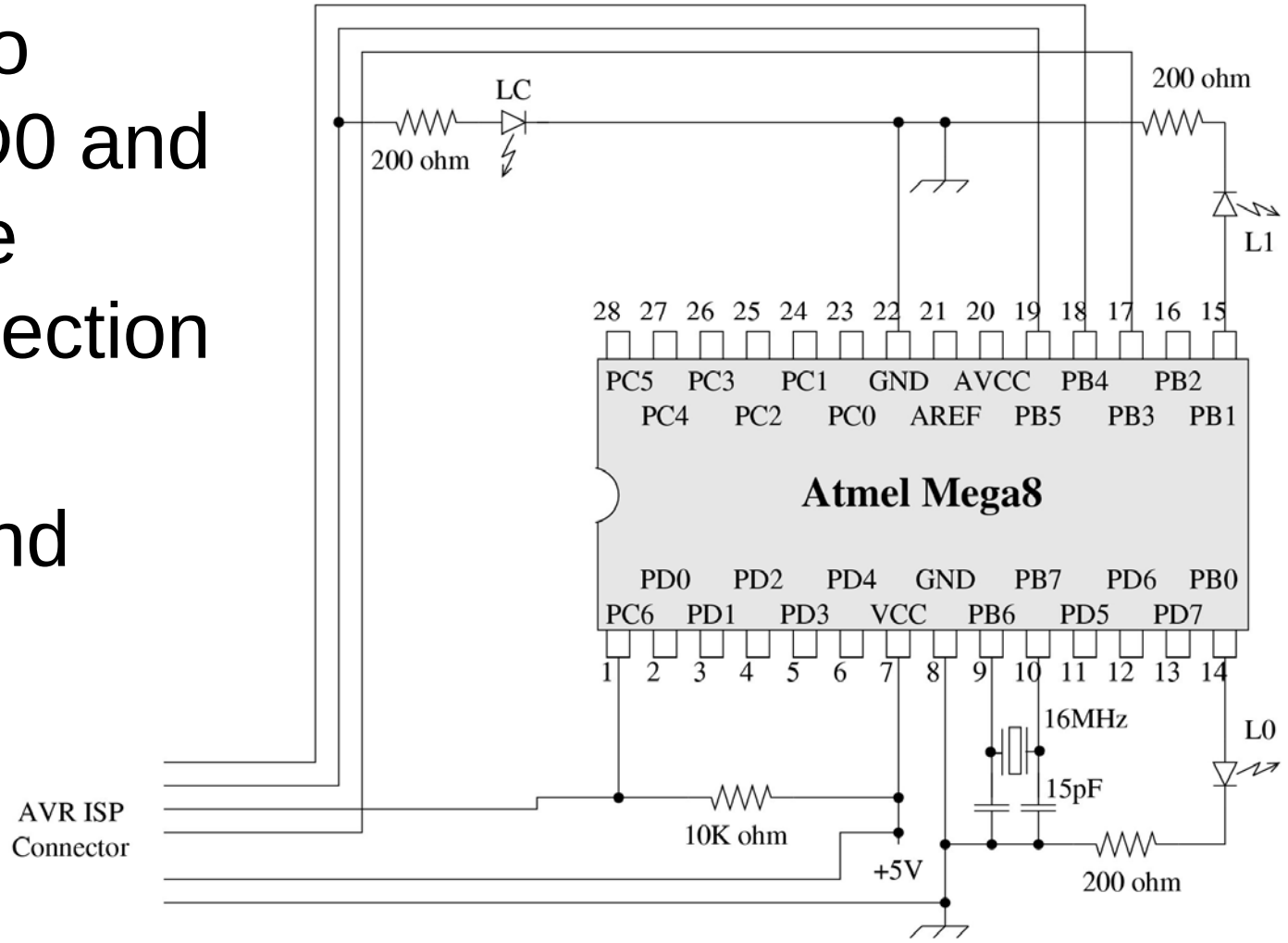
# First Circuit

Pieces you need to assemble (after drawing a circuit diagram):

- Atmel with crystal
- Programming interface
- LEDs
  - Circle of LEDs for displaying heading or heading error
  - Line of LEDs for displaying heading velocity

# Circuit Starting Point

- Remember to reserve PD0 and PD1 for the serial connection to the heli
- PB0, PB1, and PB2 are available



# Reading the Compass

int16_t get_heading(void)

- Returns the heading in 10$^{th}$s of a degree: values between -1799 and 1800

# Reading the Compass

- Your atmel sends: ‘c’  (1 character)
- The heli responds with:

  “cDDDD\n\r”

  – There are always 4 decimal digits
  – Value is between 0000 and 3599

# Reading the Compass

int16_t get_heading(void)

- Ask for the heading from the heli
- Translate the characters received from the heli into a number between 0 and 3599
- Translate this number to one that is between -1799 and 1800
  - Note: the heading that is represented must be the same after this transformation

# Computing Error

int16_t compute_error(int16_t heading, int16_t goal)

Returns the heading error in $10^{th}$s of a degree:

error = goal - heading

But: return value must be between -1799 and 1800

# Computing Velocity

int16_t compute_derivative(int16_t heading_current,
int16_t heading_last)

Returns the heading velocity in 10$^{th}$s of a degree per second:

- As with the error computation, you must handle the “wrap-around” cases

# Displaying Orientation

void display_orient(int16_t theta)

Display either an absolute heading or a heading error using a set of LEDs

- At minimum, you need to use 4 LEDs for this
- How do you decide when to turn on each of the LEDs given theta?

# Displaying Velocity

void display_derivative(int16_t velocity)

Display the rotational velocity using a set of LEDs

- At minimum, you need to use 5 LEDs for this
- How do you decide when to turn on each of the LEDs given theta?