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 10ths 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
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\textsuperscript{th}s of a degree:
\begin{align*}
\text{error} &= \text{goal} - \text{heading} \\
\text{But: return value must be between } &-1799 \text{ and } 1800
\end{align*}
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?
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?