CSCI 1106
Lecture 11

Threads, Interference, and Other Topics

Announcements

• Today’s Topics
  – Threads and Interference
  – Dealing with Interference
  – A home-made Wait block
  – Sensor blocks
  – Multiconditional Wait blocks
  – Project report reminder
The Multithreaded Approach

Interfering Threads

- Question: What happens if multiple threads try to control the motors at the same time?
- *Interference* occurs when a thread violates another thread’s assumptions
  - E.g., Only it has control of the motors
- Or *interference* occurs when interaction between threads causes a program to misbehave
- Question: How do we prevent this?
Preventing Interference

• Only one thread controls a given actuator
  – I.e., only one thread may control the motors
• Threads must coordinate their behaviours
  – E.g., both threads may control the motors but not at the same time
• How do threads coordinate?

Coordinating with Variables

• Recall:
  – Variables are used to store program state
    • Numbers, text, logical values
  – Variables are visible by all threads
• Idea:
  – Use a logical variable to indicate when it is safe to manipulate the motors
    • Create a logical variable called busy
    • If busy is true, the motors are being used by another thread
    • If busy is false, it is safe to access the motors
  – The hard part is figuring out how to do this
A Solution to Interference

Example of a home-made Wait block!

A Home-Made Wait Block
Why Do We Need Sensor Blocks?

• View the measurements that a sensor is reporting when debugging a program
• Keep track of previous measurements to compare against future measurements  
  — E.g., Finding a minimum/maximum measurement
• Create multiconditional Wait blocks

Multiconditional Wait Blocks

• A Wait block polls a sensor until a threshold is reached
  
  - Below threshold
  - Threshold
  
  A sensor is
  
  Polling

• Idea: Combine measurements from multiple sensors
  
  - A sensor is below threshold
  - All sensors are above threshold
  
  A sensor is
  
  Polling

  - Below threshold
  - Above threshold
A Multiconditional Wait Block

More Than Sensors

- Idea: Can use more than sensors in such a construct
  - Variables
  - Timers
  - Rotation sensors

- Question: How would this construct change if you wanted to break out of the loop if *either* of the sensors is above threshold?
Another Multiconditional Wait Block

Project Report Reminder

- Report is aimed at peers, TAs, & instructor
- Please use the provided template
- Due Monday, October 22, 8:35am (in class)
- One submission per group
- The report **must** be submitted in
  - Hard (paper) copy (in class)
  - Soft (electronic) copy on the moodle site
- Grade rubric available in project specification
- **No late submissions**