WANDERING ROBOT
(ZOIDBOT)
PURPOSE AND REQUIREMENTS

• Build a robot that could wander in a room and avoid obstacles
• Real world application: mine detection vehicle, self-driving car
• Traverses a room
• Continuously sense objects in the 4 primary directions
COMPONENTS

- HCS12 SSMI board
- 4 Infrared Red sensors
- 2 DC motors
- Actobotix chassis and connectors
- Battery pack
- Pulse-Width Modulation (PWM)
- A/D Conversion
PHYSICAL SET UP
PHYSICAL SET UP
SIDE 1
PHYSICAL SET UP
SIDE 2
PHYSICAL SET UP
TOP
IMPLEMENTATION

• **Variables**
  - \( \text{FIR} = \text{Input from front IR sensor} \)
  - \( \text{LIR} = \text{Input from left IR sensor} \)
  - \( \text{RIR} = \text{Input from right IR sensor} \)
  - \( \text{BIR} = \text{Input from back IR sensor} \)

• **Constants**
  - \( \text{Tr} : \text{Rotate time} \)
  - \( \text{Tb} : \text{Back up time} \)
  - \( \text{Ts} : \text{Stop time} \)
  - \( \text{N} : \text{Max number of rotations} \)

• **7 states**
  - \( \text{S0} : \text{Stop} \)
  - \( \text{S1} : \text{Forward} \)
  - \( \text{S2} : \text{Reverse} \)
  - \( \text{S3} : \text{Swerve right} \)
  - \( \text{S4} : \text{Swerve left} \)
  - \( \text{S5} : \text{Rotate right} \)
  - \( \text{S6} : \text{Rotate left} \)
STATE DIAGRAM

STATE S0:
- If N > 4, go to S2
- If previous state = S1 & IBIR, go to S0
- If IR, go to S1
- If N = T0, go to S5

STATE S1:
- If IR, go to S0
- If (IR & LIR), go immediately back to S1

STATE S2:
- t >= T0 & (LIR & RIR), go to S2

STATE S3:
- If IR & RIR, go to S4

STATE S4:
- Immediately go back to S1

STATE S5:
- Max N iterations

STATE S6:
- t <= T0, go to S6
- Max N iterations
STATE “STOP” PSEUDOCODE

• Do nothing for Ts
• If no previous state
  • Go forward (S1)
• If previous state == S1
  • Back up (S2)
• If previous state == S2
  • Check RIR and LIR, then turn right or left
  • Default: turn left
STATE “FORWARD” PSEUDOCODE

- Set PTT for motors to go forward
- If just FIR
  - Set previous state == S1
  - Go to S0
- If FIR and RIR are detecting less than 6 cm
  - Swerve left
- If FIR and LIR are detecting less than 6 cm
  - Swerve right
STATE "SWERVE"

• If right swerve
  • Set PTT for left wheel moving faster than right wheel
  • Hold for brief time
  • Switch back to S1

• If left swerve
  • Set PTT for right wheel moving faster than left wheel
  • Hold for brief time
  • Switch back to S1
STATE "ROTATE" PSEUODOCODE

• If rotate right
  • Set PTT for only right wheel moving
  • Hold for Tr
  • Check FIR
    • If no object
      • Go to S1
    • If object & N < 4
      • Keep rotating, increment N

• If rotate right
  • Set PTT for only left wheel moving
  • Hold for Tr
  • Check FIR
    • If no object
      • Go to S1
    • If object & N < 4
      • Keep rotating, increment N
TIMING DIAGRAM

Vcc
	right motor

left motor

front IR sensor

left IR sensor

right IR sensor

back IR sensor
WRAP UP

• Robot uses IR sensors to navigate in a space
• Avoids obstacles in the process
• Uses PWM, IR sensors, DC motors, and A/D conversion

• Questions?