# Collegiate ROBOFEST 2010

# Vision Robot Challenge

## Using a vision-centric Robot, L2Bot

V1.3 1-27-10 Official Version (Significant changes in red)

Using computer vision as the main sensory modality of autonomous mobile robotics projects has the following advantages: (1) Low cost (compared to expensive laser scanners), (2) Richness of information (3) Low power consumption (compared to laser scanners), (4) Retrieving 3D information with stereo vision.

In order to promote research on computer vision and autonomous mobile robotics, we challenge college students (undergraduate and graduate students), as well as talented high school students with the following Vision Robot Competitions during Robofest 2009-2010 season.

### When & Where:

- Warm-Up/Judges Training at Lawrence Tech in Michigan on Feb. 13th, 9:00 AM to 1:00 PM, Cafeteria, Buell Mgt. Bldg.
- High school qualifying competitions in Winter/Spring 2010 in Michigan (Belleville, Southfield, and Grand Rapids.)
- College qualifying competition at Lawrence Tech on April 24, 2010.
- **World Championship on May 8, 2010 at Lawrence Tech in Michigan.**

Check out details on all of the above at www.robofest.net

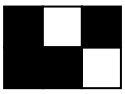
### Team Divisions

- Advanced High School: max. 3 team members
- College: One member per team, harder problem will be given

### Challenge Synopsis

Recognize and read the mission data represented in a simple 2D barcode placed by a judge on the floor. The mission data barcode includes the number of landmarks and first turn direction, left or right. Then the robot needs to completely navigate through all the landmarks and return home and stop.

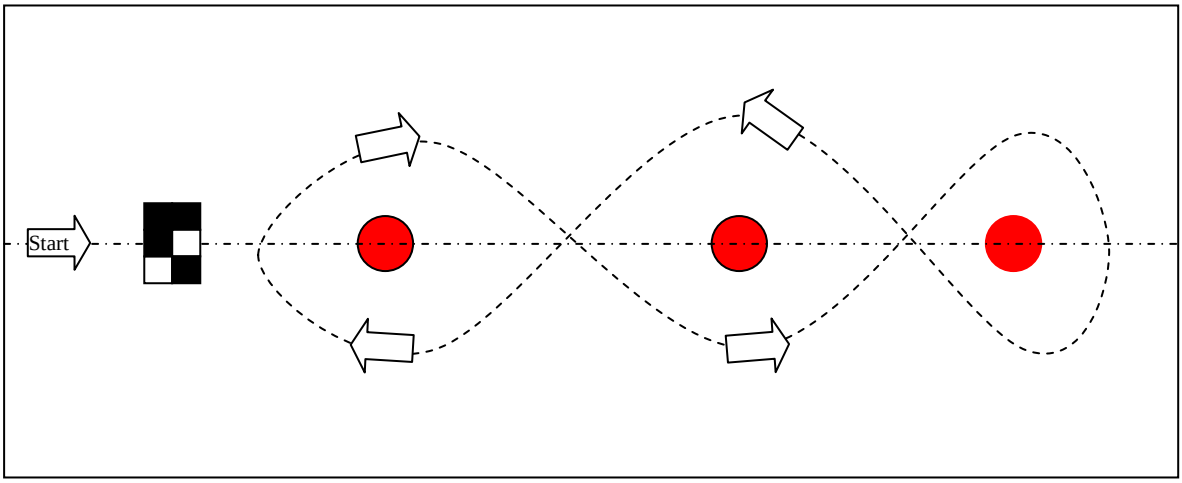
### 2D Barcode



We are using a binary system. Black tile is 1 and white tile is 0. First row represents the number of landmarks in binary. The second row represents the first direction to turn. 110 is left and 011 is right. For example, the left 2D barcode represents 5 landmarks and “left turn”.

### Challenge Course

The exact color, size, and shape of the landmarks are unknown. The size of the competition area is unknown. Unknown number of 5x8 carpets will be used for making the rectangular area. Floor color where carpets will be located will be different from the color of carpets. The light condition on the course is unknown and dynamic. A bright light on the course may be turned on and off during the mission at unknown location. See a sample course below.



- The starting position, the barcode, and all the cones will all be placed on a straight line
- The cones will be at least 3 feet apart, and with enough clearance from the end/sides of the course for the L2bot to pass through.

### Competition Rules

- A robot has 2 chances to run. For each run, each robot has a maximum of 3 minutes. The winner will be decided by the **best** time of the two runs.
    - If the robot does not complete the whole course the number of cones circled will be recorded, and used to gauge success.
        - The last cone will be counted twice, as the robot passes it on the way forward, and then on the way back
    - The judge will make a final determination if two students had similar runs
- For the successful navigation, the L2Bot must maintain at least one wheel inside the rectangle area, that is, if both two **front** wheels are off the carpet, the run is disqualified. **Rear caster wheel does not count.**
- Robot must not touch or misplace landmarks, the judge will make a determination if a disqualification occurs
- To finish the run, the robot must return to the barcode, with any part of the robot touching, or going over the 2D barcode.
- The robot is "on the clock" while it's moving, the timer starts when the student runs their program, and stops when the robot finishes the course
    - If a disqualification occurs during the run, the timer is stopped while the robot is being returned to the start position
- The robot must restart from the start point if any disqualification occurs
- A "restart" back to the starting position may be called by the judge, or by the student if they feel the robot is not progressing well through the course

### Robot Requirements

- Must be autonomous (no remote control by human driver or remote computer is allowed)
- Only the L2Bot provided by LTU is allowed to enter the competition. Must use the motors, width, length, battery of the original L2Bot.
- If battery voltage is greater than 12V, it will be replaced with the battery provided by the organizer
- Any laptop (notebook) with a serial port can be plugged to the L2Bot platform. You may use a USB-serial adaptor.
- Only one onboard camera (webcam or camcorder) can be used. The use of purchased vision system such as COGNEX is not allowed. No other sensors are permitted. Using sound sensor on the laptop is NOT allowed.
- The method to mount a camera depends on the team.
- Weight: no limit
- Any programming language can be used.

**Prize**: Winner Trophies; Possible cash prizes for college students; High school team members of the winning team receive $2,000 LTU renewable scholarships at the World Championship.

### Questions

- To purchase or lease an L2Bot? Send an email to CJ Chung at chung@LTU.edu
- Detail rules and judging: Prof. Gary Givental – ggivental@gmail.com

### Misc. Info

- Go to www.robofest.net/collegiate for more info and possible rule updates
- The event is open to the public. Admission is free. Parking is free.
- Did you know that Lawrence Tech alum, **Ronald Knockeart** , BSEE'63, is the Inventor of the laser bar-code scanner? http://www.ltu.edu/alumni/fun_facts.asp
- It is encouraged for college students to introduce adaptability to your system. Use new techniques such as artificial neural networks to train the robot or other computing algorithms inspired by nature!