

# VCC Vision Centric Challenge 2016 - "Mosaic"

A Robofest ([www.robofest.net](http://www.robofest.net)) Challenge for Advanced High School and College Students  
Lawrence Technological University, Southfield, Michigan

V1.22 3-26-2016 (Changes after 1-13-16 Official Version are in red)

Computer vision gives robots the ability to see. In order to promote research & development on computer vision and autonomous mobile robotics, we challenge college students as well as talented high school students with the following Vision based Robot Competitions during the Robofest 2016 season.

## Team Age Divisions

- Senior (Advanced High School): maximum 3 members per team
- College: maximum 2 members per team

## Challenge Synopsis

Due to the camera's limited field of vision, the robot can see only a portion of a numerical digit or alphabet letter pattern on a mosaic comprised of 15 pieces of colored paper on the floor. The mosaic will be arranged in 5 rows and 3 columns. The robot must move to read all paper colors necessary to identify the digit or letter represented. For example, Figures 1 and 2 represent the number '2' and the letter 'A', respectively. See Appendix A for all the digit patterns and Appendix B for all the letter patterns to be used for the challenges. The robot must report (display) the recognized digit or letter after spinning twice (~720 degrees) on the field.

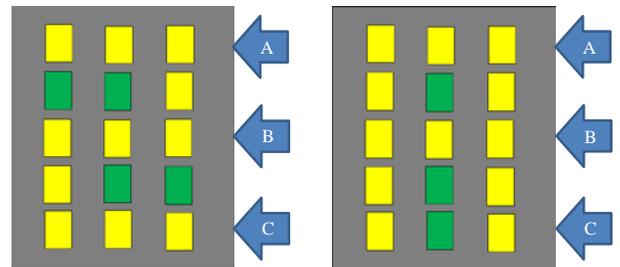


Figure 1

Figure 2

## Challenge Field Setup Description

Two different letter size color papers, for example: [www.officedepot.com/a/products/170719/Neenah-Astrobrights-Bright-Color-Paper-8](http://www.officedepot.com/a/products/170719/Neenah-Astrobrights-Bright-Color-Paper-8), will be taped on a large mat. The colors of papers are unknown until the day of competition. The size, material, and color of the mat are also unknown until the competition day. The mat with colored papers will be placed on the floor of which the color is unknown. The gaps between columns ( $a, b, c, d$  in Figure 3) will be between 5 4" and 10". The gaps between rows ( $x, y, z$  in Figure 3) will be between 5 4" and 12". When installing papers, we assume some errors. For example,  $|a - a'|$  can be up to 1".  $|x - x'|$  can also be up to 1". Lighting conditions on the course are unknown and dynamic.

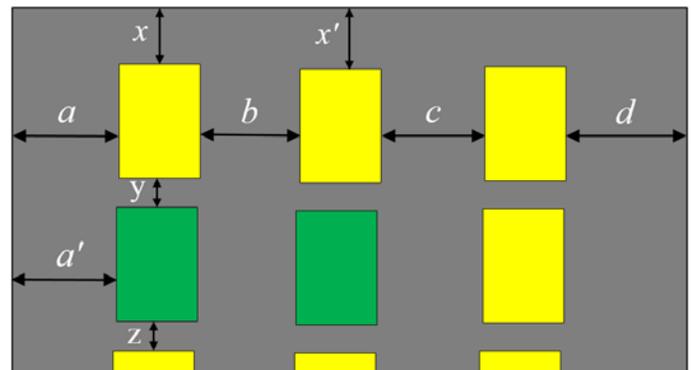


Figure 3 (upper portion of Figure 1 is enlarged)

## Rule Differences between Advanced High School and College

	Senior	College
Target Characters	Numerical Digits only	Digits AND Letters (Alphanumeric Characters)
Starting Locations	A in Figure 1	A, B, or C in Figure 1 and 2
Variations of characters?	Yes, only for breaking ties	Yes. See Appendix C for examples

## Competition Rules

- There will be 3 rounds. For each round there will be at least 30 minutes work-time after unveiling a sample course with (1) two color papers, (2) background mat, and (3) exact starting location. Note that the size of gaps between papers will be completely unknown.

- For each round, each robot has a maximum of **2** minutes to report the character. All robots will be impounded (quarantined) before starting each “round”.
- The Judge will start the robot. Teams are **NOT** allowed to touch the robot after impounding. The team must provide verbal or written instruction to the Judge indicating how to start the robot. Note that Judges will not calibrate the vision system. Robots must be calibrated before impounding or have a means of dynamic calibration.
- The winner will be decided by the number of successful rounds. To complete a successful round, the robot must first spin twice (~720°) on the field and then display the identified character to the Judge.
- If multiple teams tie for the number of successful rounds, the teams will rerun with more difficult patterns until a winner is decided.
- The robot will be considered off course and disqualified from that round if the robot leaves the mat *field* completely. (see Q3 in FAQ)
- Team members cannot have any interaction with the robot. For example, giving sound or visual signals to the robot is not allowed.

### Robot Requirements

- Must be completely autonomous. (No remote control by human driver or remote computer is allowed)
- Any robot platform with a single camera is allowed to enter the competition. You may use any other sensors such as a digital compass.
- Any programming language can be used.
- Width: must be less than 2ft.
- Length: less than 3ft.
- Height (including camera): maximum 2ft.
- Camera angle: no restriction. You may use motors to move the camera. Wide angle lens can be used.
- Weight: no limit.

**Prize:** Winners receive trophies. Each high school team member of the winning team receives \$2,000 LTU renewable scholarship. Monetary prizes (cash gift cards) for college students - 1<sup>st</sup> place: \$200, 2<sup>nd</sup> place: \$100, 3<sup>rd</sup> place: \$50

### Competition Date

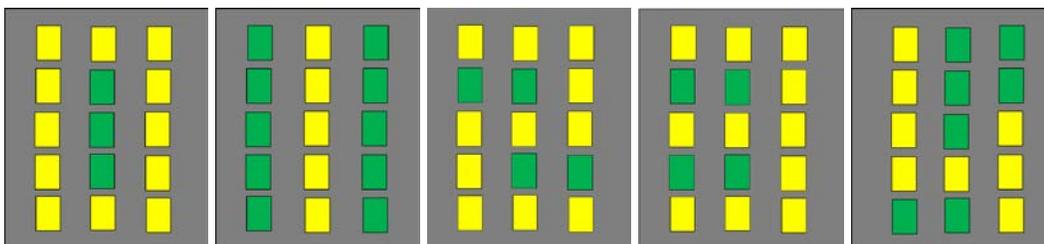
- Saturday, May 14, 2016, 8:00am ~ 4:30pm
- Practice field will be setup on May 13, 2016.

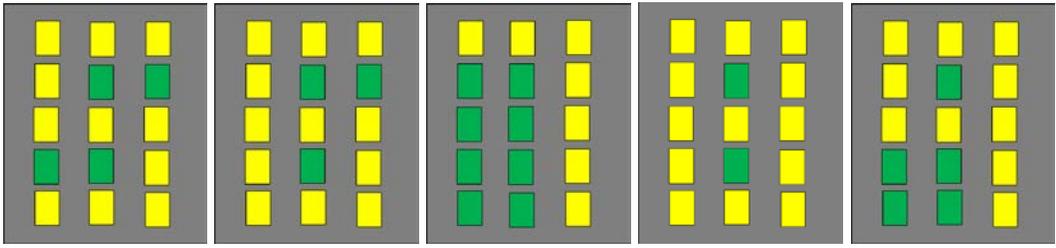
**Questions regarding rules, registration, or L2Bot lease:** Contact Prof. Chung at [cchung@LTU.edu](mailto:cchung@LTU.edu)

### Misc. Info

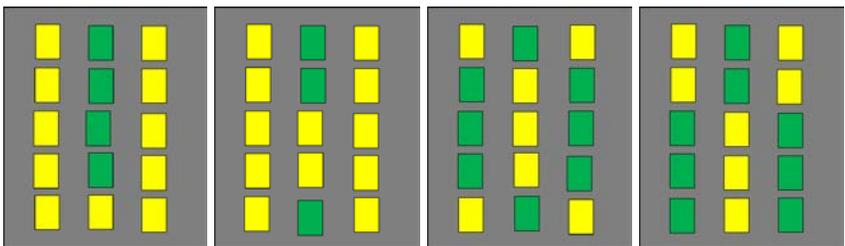
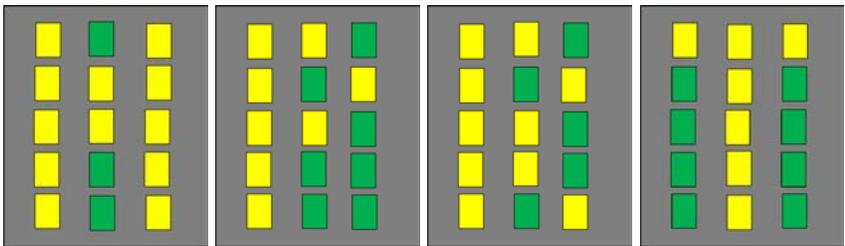
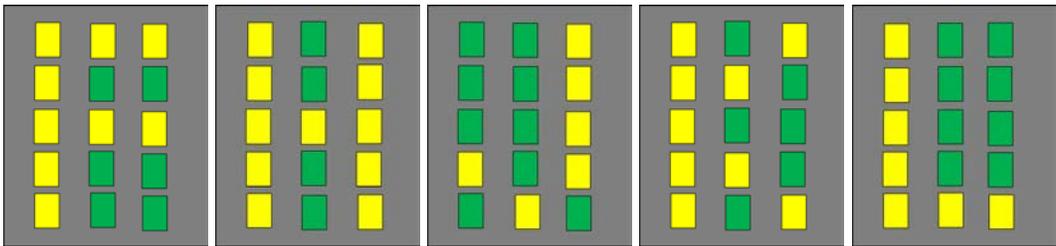
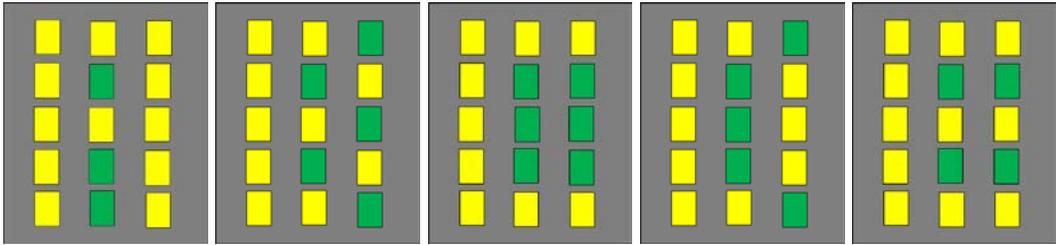
- Go to [www.robofest.net/index.php/current-competitions/vision-centric-challenge](http://www.robofest.net/index.php/current-competitions/vision-centric-challenge) for more info and possible rule updates
- The event is open to the public. Admission is free. Parking is free

### Appendix A – Digits (0~9)

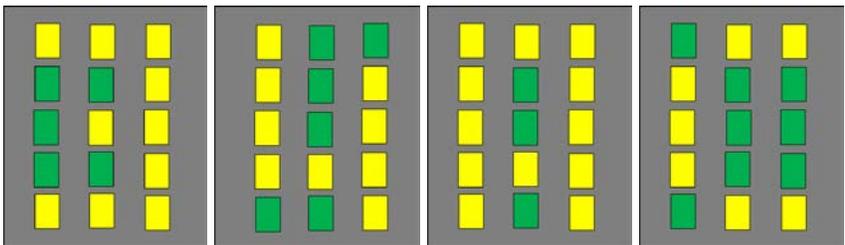




**Appendix B – Letters (A, B, C, D, E, F, H, J, K, L, M, P, R, T, U, W, X, Y)**



**Appendix C – Some examples of possible variations (3, 4, A, C)**



Note: Since starting locations (side) are fixed, number 7 and letter L patters will not be the same.

## FAQ (updated 3-26-2016)

Q1. Can teams decide orientation of the robot when it starts? [Yes. Teams can explain the judge how to orient the robot.](#)

Q2. Can robot expand its dimension larger than the specified max values? [No.](#)

Q3. Must be the robot on the field (mat), all the time? [No, the following 3 cases are acceptable:](#)

- [The entire robot can be on the field.](#)
- [Half on the field and halfway off the field.](#)
- [Entire robot can be off the field, but the distance between the edge of the field and the robot side facing the field should be less than 4ft.](#)

Q5. What is the maximum field (mat) size? [65.5" x 127" \(166.37cm x 322.58cm\)](#)

Q6. What is the minimum field (mat) size? [41.5" x 79" \(105.41cm x 200.66cm\)](#)