

Heli (Leon) Wang

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EDUCATION

**Saint Louis University, Parks College of Engineering, Aviation and Technology,
Saint Louis, MO**

Bachelor of Science in Electrical Engineering, anticipated in 2019

GPA 3.01/4.0

Minor of mathematics department in Math, anticipated in 2018

EXPERIENCE

Referee, Intramural sports, Saint Louis University

Fall 2015

- Helped people negotiate and communicate for scores and balance
- Learned the health safety training
- Cooperated with other referees to run games normally and keep the rules of the game

Professional aspect:


Based on atmel:

- **Familiar with assembly program: arithmetic, shift, jump, rotate instruction**
- **Have used JTAG II debugger in STK500 finished LED lights**
- **Use asc II in LED lights to function the keyboard. The board can do timing and display number 1 through 9.**

Based on circuits design:


- **Have designed circuits like p-type, n-type, mosfet, p-n junction. In detail it will be common emitter/ collector, emitter, base amplifier. Multiple stage amplifier, ac-dc converter.**

Senior design:



IEEE REGION 5 ROBOTICS COMPETITION

Charlie Coleman, Amy Guo, Heli Wang, Roobik Gharabagi Ph. D & Kyle Mitchell Ph. D
Saint Louis University



BACKGROUND

- Institute of Electrical and Electronics Engineers (IEEE)
- Region 5 Student Robotics Competition
 - Sponsored by the Region 5 IEEE Committee.
 - Region 5 includes over 90 students branches in the central United States.

OBJECTIVE

- Design a fully autonomous robot
- Sort cubes into slots with matching letters
- Pick up cubes, identify letters, navigate to mothership
- Drop cube in the correct slot
- Avoid obstacles placed pseudo-randomly throughout the competition board
- Return to starting location when all cubes have been put into their slots
- Achieve in the least amount of time possible

MATERIALS

- Raspberry Pi Model 3
- Raspberry Pi Camera Module
- Custom Claw - 3D printed (Coleman)
- Chassis - Vex (Guo)
- Battery (Wang)
- Voltage Regulator (Wang)
- Replica competition board, mothership, etc..

Project Gantt Chart

	2018				2019			
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Testing								
OCR								
Claw								
Chassis								
Power Supply								
Navigation								
Competition								

METHODS

- OCR for Cube Character Recognition
 - Use image manipulation & OCR libraries such as OpenCV and Tesseract
 - OCR OCR fails if letter is more than ~20 degrees off axis, so rotate image until successful
- Utilize provided JSON file to navigate field
 - Exact cube position is unknown, so explore square until cube is found
- Movement is done using a simple 4-wheeled chassis design
- Use shape recognition to find obstacles
 - Obstacles are circularly symmetrical

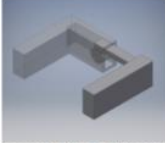


Figure 1. 3D rendering of claw design using Autodesk Inventor




Figure 2. Raspberry Pi Model 3 connected to camera module

RESULTS

OCR has been achieved with good success using the OpenCV and Tesseract libraries. While the letters cannot be identified if they are more than around 20 degrees from their correct orientation, we can fix this problem by rotating the images by values less than 20 degrees and testing at each point. Once we implemented this in the detection code, the only remaining problems are with C & D. When C is upside down it is identified as a D, and vice versa for D. We have yet to find a solution to this problem. Overall, the OCR works as intended in the vast majority of situations, and it should provide a good basis for our design.





Figure 3. Output of the OCR code highlights the shape then returns the character

REFERENCES

- Robert Shapiro, IEEE Region 5 Website, 2018, <http://ieee5.org/>.
- IEEE Region 5 Robotics Competition, 2018, <http://r5conferences.org/competitions/roboticsc-competition/>.
- Kaehler, Adrian, and Gary R. Bradski. *Learning OpenCV 3: Computer Vision in C++ with the OpenCV Library*. 1st ed., vol. 1.1, O'Reilly Media, 2017.

ACKNOWLEDGEMENTS



SAINT LOUIS UNIVERSITY.

We would like to thank the Institute of Electrical and Electronics Engineers for sponsoring the competition and Saint Louis University for funding our project.

SAINT LOUIS UNIVERSITY | PARKS COLLEGE
of ENGINEERING, AVIATION AND TECHNOLOGY

This is a post introducing my senior design project. So far we have built the mothership and the playfield. For the robot we have done the main body part, and the next step is to install the pi into the robot. In software aspect we use raspberry pi as a core to function the letter recognition. In this project I am responsible for the power part and the motor choose. Through discussion and consulting, we choose 7.2v battery and dc motor.

Important class have been taken

- Microprocessor
- Linear system
- Electromagnetic fields
- Electrical circuits I
- Electrical circuits II
- Thermodynamics
- Automatic control system
- Analog integrated circuit design
- Communication systems
- Electromagnetic waves

Heli (Leon) Wang

- **CMOS Integrated Circuits Design**

SKILLS

- Software: Microsoft Word, Excel, PowerPoint. Xplain, atmel
- Programming languages: Familiar with Matlab, familiar with VHDL, familiar with atmel
- Language: Fluent in Mandarin Chinese, fluent in English

Special notes: Personally I don't mind if your company don't sponsor the H1B visa. I can still work 3 years without H1B visa.