PACIFIC AMERICAN SCHOOL

Robotics I 2017~2018

Tue & Fri: 1:20~3:00. Room C11

www.oz.nthu.edu.tw/~g9561701

Instructor: Ms. Liu **Class Telephone**: (03) 571-7070 #311

Course Description

Welcome to Robotics I! This project-based course introduces students to designing and building robots with the LEGO Mindstorms EV3. Students will apply concepts from math, physics, and computer programming. We will begin with an introduction to the EV3 environment and test the sensors for sensitivity with introductory puzzles that students program their robots to achieve. Then we will apply ideas of rotational motion and mechanical advantage in exploring gear ratios. Students will also explore wireless communication between robots and study the design of advanced examples provided by Lego. Projects will become increasingly complex through the year, culminating in the student's own creative designs.

Required Materials

1. Engineering Notebook, pencil, eraser, loose-leaf paper and graphing paper, folder or binder, and stapler.

Technology Requirement

1. Bring a laptop to every class.
2. Install the Education Software https://education.lego.com/en-us/downloads/mindstorms-ev3
3. LEGO Mindstorms EV3 Education Core Set 45544 (Required) https://education.lego.com/en-us/products/lego-mindstorms-education-ev3-core-set-/5003400
4. LEGO Mindstorms EV3 Education Expansion Set 45560 (Helpful but not strictly needed) https://education.lego.com/en-us/products/lego-mindstorms-education-ev3-expansion-set/45560

References

1. LEGO Engineering web page http://www.legoengineering.com/
2. http://www.lego.com/en-us/mindstorms/learn-to-program
3. Gary Garber. Learning LEGO Mindstorms EV3. Packt publishing. 2015
4. Yoshihito Isogawa. The LEGO® Technic Idea Book: Simple Machines. 2010
5. Yoshihito Isogawa. The Lego Power Functions Idea Book, Vol. 1: Machines and Mechanisms. 2015

Objectives

The learning objectives for this course are based on the Level 3 Standards of the Computer Science Teachers Association (CSTA), the Next Generation Science Standard (NGSS), and the ITEEA standards for Technological Literacy (ITEEA).

1. (ITEEA) Students will develop an understanding of the characteristics and scope of robotics.
2. (ITEEA) Students will develop the abilities to apply the engineering design process.
3. (ITEEA) Students will develop and understanding of the impact of robotics in the society.
4. (NGSS) Analyze a challenge to specify qualitative and quantitative criteria and constraints for solutions that account for design needs and requirements.
5. (NGSS) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
6. (NGSS) Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

7. CT.L2-01. Use the basic steps in algorithmic problem-solving to design solutions (e.g., problem statement and exploration, examination of sample instances, design, implementing a solution, testing, evaluation).
8. CT.L2-03. Define an algorithm as a sequence of instructions that can be processed by a computer.
9. CT.L2-07. Represent data in a variety of ways including text, sounds, pictures, and numbers.
10. CT.L3A-01. Use predefined functions and parameters, classes and methods to divide a complex problem into simpler parts.
11. CL.L3B-01. Use project collaboration tools, version control systems, and Integrated Development Environments (IDEs) while working on a collaborative software project.
12. CL.L3B-03. Evaluate programs written by others for readability and usability.
13. CPP: Computing Practice and Programming
14. CPP.L2-04. Demonstrate an understanding of algorithms and their practical application.
15. CPP.L2-05. Implement problem solutions using a programming language, including: looping behavior, conditional statements, logic, expressions, variables, and functions.
16. CPP.L3B-03. Classify programming languages based on their level and application domain.

Classroom Behavior Expectations

Failure to comply with the policies may result in parent conferences and/or Administrative referral. Please refer to the Student Handbook for existing guidelines.

1. Be prepared at the bell. Stationary, books, laptops, and homework should be out and ready.
2. Remain in your assigned seat and stay on task.
3. No electronics or another course's material during class.
4. Raise your hand before speaking and speak English. Respectfully listen while others are speaking. Be courteous to classmates, faculty and staff at all times.
5. Restrooms are to be used before and after class. If a student needs to leave class, he/she must have a hall pass. Stay in the classroom during breaks.
6. Students are not allowed in lab rooms when teachers are not present.
7. Keep your work area neat and tidy. Pack up your books and stationery, remove eraser crumbs from the tabletops, and push your chair in before leaving your desk. Do not write on the tables.
8. Walk, do not run, in the lab area. Follow directions and ask permission before using classroom equipment.
9. The classroom trashcan is for wastepaper only. Please do not throw in food or food containers.
10. If you have questions outside of class, please ask them during the afterschool Advisory Period. For other times, make an appointment. If coming to C11 during study hall, please use library voices, have minimal conversation, and pre-gather your questions so they can be discussed altogether. Please do not ask question during the teacher's lunch time.
11. Clean up your work station before leaving.

Course Requirements

1. Students are expected to take notes during class, participate fully in class work, review notes at home, read the textbook, and work through examples.
2. Keep an agenda book recording assignment due dates, listed on the board and class website.
3. In case of absence, students are responsible for checking the class website for announcements and new assignments, as well as reviewing a classmate's lecture notes. Missing work must be turned in within one week of the student's return.
4. An unexcused absence on a test day will result in a loss of 7 points in the make-up test. To be excused from the late test penalty, a note from the doctor or parent/guardian explaining a valid reason for absence is required on the day of return. The make-up test must be taken within one week of return.
5. Homework should be turned in on time, at the start of class. Students whose grades fall below C- or who repeatedly miss homework assignments will be asked to come for extra help at least once per week in the afterschool Advisory Period (3:10~4:10).
6. Academic honesty is expected of all students. Homework must be completed independently.

Grading (Category percents are subject to change.)

Students work individually or in pairs. Only one grade is given per team for project work. Lack of contribution will affect your grades.

Engineering Notebook 30%

- Maintain a process journal. For every class, date the page, take notes, and document the activity, your rough ideas, plans, and observations.
- All work is due at the start of class. Late work receives a score of zero.

Project Report 30%

- Keep a folder with a table of contents at the front and collate all your reports in order.
- The project report includes: Title, Group Members and Their Roles, Problem Statement and Idea for Solution, Variables, Picture of Robot, Bill of Materials/Building Instructions, Setup and Procedures, Program Block Diagrams, Data, Analysis, Reflection, Conclusion, References.
- You may discuss ideas with other teams, but you must not email/copy/paste any code from other students! If you collect data together, each team must record the data themselves and make the charts themselves. Integrity and honesty are mandatory.

Demo 30%

- Demonstrate that your robot meets the puzzle requirements.
- Participate actively in class.

Participation 5%

- Clean up your work station before leaving.
- This score will be affected by noncompliance with classroom behavior expectations, such as arriving to class late or unprepared, sleeping during or disrupting the lesson, or being off task.

Speaking English 5%

- 5 points will be deducted for each occurrence of non-English casual conversation inside or outside the classroom.
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Course Outline

Quarter 1

Introduction

- Build the chassis and attach all the sensors
- How to control steering
- Investigate each sensor: ultrasonic, color, gyroscope
- Programming Introduction

Quarter 2

Investigate

- Programming and control
- Line tracking
- PID Controller. Camera Stabilizer
- Triangulation and Infrared Beacon, robot soccer
- Data Logging
- Camera Stabilizer
- Maze Challenge

Quarter 3

More Advanced

- Communication between robots. Robot explorers.
- Gyro Boy and other impressive Lego examples
- Ball launcher

Quarter 4

Creative Project Design your own robot