EET-1185: SINGLE BOARD COMPUTERS AND APPLICATIONS

Cuyahoga Community College

Viewing: EET-1185: Single Board Computers and Applications

Board of Trustees:
2018-05-24

Academic Term:
Fall 2018

Subject Code
EET - Electrical/Electronic Engineer

Course Number:
1185

Title:
Single Board Computers and Applications

Catalog Description:
An introductory course on Single Board Computers (SBC) with an emphasis on embedded applications. Topics include standard interface devices like keyboards, High-Definition Multimedia Interface (HDMI), Universal Serial Bus (USB), General Purpose Input and Output (GPIO) ports, conventional serial communications. Communicating with external sensors, like Global Positioning System (GPS), infrared transmission and detection, accelerometers, etc., are discussed from the aspect of programming. Lab work includes use of circuit simulation software.

Credit Hour(s):
3

Lecture Hour(s):
2

Lab Hour(s):
2

Requisites
Prerequisite and Corequisite
EET-1100 Introduction to Robotics or EET-1150 Basic Robotics with Math or departmental approval.

I. ACADEMIC CREDIT

Academic Credit According to the Ohio Department of Higher Education, one (1) semester hour of college credit will be awarded for each lecture hour. Students will be expected to work on out-of-class assignments on a regular basis which, over the length of the course, would normally average two hours of out-of-class study for each hour of formal class activity. For laboratory hours, one (1) credit shall be awarded for a minimum of three laboratory hours in a standard week for which little or no out-of-class study is required since three hours will be in the lab (i.e. Laboratory 03 hours). Whereas, one (1) credit shall be awarded for a minimum of two laboratory hours in a standard week, if supplemented by out-of-class assignments which would normally average one hour of out-of-class study preparing for or following up the laboratory experience (i.e. Laboratory 02 hours). Credit is also awarded for other hours such as directed practice, practicum, cooperative work experience, and field experience. The number of hours required to receive credit is listed under Other Hours on the syllabus. The number of credit hours for lecture, lab and other hours are listed at the beginning of the syllabus. Make sure you can prioritize your time accordingly. Proper planning, prioritization and dedication will enhance your success in this course.

The standard expectation for an online course is that you will spend 3 hours per week for each credit hour.

II. ACCESSIBILITY STATEMENT

If you need any special course adaptations or accommodations because of a documented disability, please notify your instructor within a reasonable length of time, preferably the first week of the term with formal notice of that need (i.e. an official letter from the Student Accessibility Services (SAS) office). Accommodations will not be made retroactively.

For specific information pertaining to ADA accommodation, please contact your campus SAS office or visit online at http://www.tri-c.edu/accessprograms/. Blackboard accessibility information is available at http://access.blackboard.com.
III. ATTENDANCE TRACKING

Regular class attendance is expected. Tri-C is required by law to verify the enrollment of students who participate in federal Title IV student aid programs and/or who receive educational benefits through other funding sources. Eligibility for federal student financial aid is based in part on enrollment status.

Students who do not attend classes for the entire term are required to withdraw from the course(s). Additionally, students who withdraw from a course or stop attending class without officially withdrawing may be required to return all or a portion of their financial aid based on the date of last attendance. Students who do not attend the full session are responsible for withdrawing from the course(s).

Tri-C is responsible for identifying students who have not attended a course before financial aid funds can be applied to students’ accounts.

Therefore, attendance is recorded in the following ways:

• For in-person and blended-learning courses, students are required to attend the course by the 15th day of the semester (or equivalent for terms shorter than five weeks) to be considered attending. Students who have not met all attendance requirements for in-person and blended courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

• For online courses, students are required to login at least two times per week and submit one assignment per week for the first two weeks of the semester, or equivalent to the 15th day of the term. Students who have not met all attendance requirements for online courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

At the conclusion of the first two weeks of a semester or equivalent, instructors report any registered students who have “Never Attended” a course. Those students will be administratively withdrawn from that course. However, after the time period in the previous paragraphs, if a student stops attending a class or wants or needs to withdraw, for any reason, it is the student’s responsibility to take action to withdraw from the course. Students must complete and submit the appropriate Tri-C form by the established withdrawal deadline.

Tri-C is required to ensure that students receive financial aid only for courses that they attend and complete. Students reported for not attending at least one of their registered courses will have all financial aid funds held until confirmation of attendance in registered courses has been verified. Students who fail to complete at least one course may be required to repay all or a portion of their federal financial aid funds and may be ineligible to receive future federal financial aid awards. Students who withdraw from classes prior to completing more than 60 percent of their enrolled class time may be subject to the required federal refund policy.

If illness or emergency should necessitate a brief absence from class, students should confer with instructors upon their return. Students having problems with coursework due to a prolonged absence should confer with the instructor or a counselor.

IV. LEARNING OUTCOMES ASSESSMENT

Occasionally, in addition to submitting assignments to their instructors for evaluation and a grade, students will also be asked to submit completed assignments, called ‘artifacts,’ for assessment of course and program outcomes and the College’s Essential Learning Outcomes (ELOs). The artifacts will be submitted in Blackboard or a similar technology. The level of mastery of the outcome demonstrated by the artifact DOES NOT affect the student’s grade or academic record in any way. However, some instructors require that students submit their artifact before receiving their final grade. Some artifacts will be randomly selected for assessment, which will help determine improvements and support needed to further student success. If you have any questions, please feel free to speak with your instructor or contact the Learning Outcomes Assessment office.

V. CONCEALED CARRY STATEMENT

College policy prohibits the possession of weapons on college property by students, faculty and staff, unless specifically approved in advance as a job-related requirement (i.e., Tri-C campus police officers) or, in accordance with Ohio law, secured in a parked vehicle in a designated parking area only by an individual in possession of a valid conceal carry permit.

As a Tri-C student, your behavior on campus must comply with the student code of conduct which is available on page 29 within the Tri-C student handbook, available athttp://www.tri-c.edu/student-resources/documents/studenthandbook.pdf You must also comply with the College’s Zero Tolerance for Violence on College Property available athttp://www.tri-c.edu/policies-and-procedures/documents/3354-1-20-10-zero-tolerance-for-violence-policy.pdf

Outcomes

Course Outcome(s):

Write a report on the advance of technology versus the advance of the human condition in historic and contemporary culture using Word or a similar word processing program and use the program’s spell check and grammar check features.
Essential Learning Outcome Mapping:
Civic Responsibility: Analyze the results of actions and inactions with the likely effects on the larger local and/or global communities. Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):
1. Explain what this means: technology is said to be growing exponentially.
2. Predict where the trend of the human condition (ie: starvation, genocide, terrorism, and torture) will lead in the future since it has not been growing exponentially and has in fact more or less flat lined.
3. Explain how third world countries and the marginalized in the United States can benefit from advancing technology.
4. Explain how computer-based automation is eliminating blue collar jobs and provide thoughts on how gainful employment can result or be restored under these conditions.

Course Outcome(s):
Load and install an operating system on a Single Board Computer (SBC) by a Secure Digital (SD) card or something similar, attach monitor and keyboard/pointing devices, and demonstrate functionality.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Load an operating system using its loader into an SBC, connect a monitor and input devices, and demonstrate that the core of the operating system is function.
2. Demonstrate the operating system's file management system by loading different programs using Universal Serial Bus (USB). Prove the program is laded by execution.
3. Create folders and files and demonstrate SBC functionality by reading/writing and/or executing loaded programs.
4. Download and test a compiler that will control an SBC.

Course Outcome(s):
Learn and demonstrate programming using some structured language.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Demonstrate by programming and displaying the results of an iteration control statement like a 'while' loop.
2. Demonstrate by programming and displaying the results of a selector statement like an "if / else" statement.
3. Demonstrate by programming and displaying the results of a process statement like printing to the monitor or any other testable statement that is part of a process.

Course Outcome(s):
Connect simple input/output devices, like switches and LEDs and write a program that demonstrates they can be read or written to.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Connect simple input/output devices like LEDs and switches using plugs and jacks on an SBC.
2. Explain the concept of current, voltage and resistance (ohms law) and the electrical properties like LEDs and switches and use mathematics to demonstrate current flow and voltage drop(s). Demonstrate with instrumentation like a digital multimeter.
3. Connect an SD card to an internet connected computer and download the operating system for an SBC.

Course Outcome(s):
Design a program that uses the single board computer to interface to advance peripherals and demonstrate communication with the peripheral.
Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Write a program that reads or writes to a simple input/output device. Demonstrate by communication or screen message that the communication was successful.
2. Connect more advanced peripheral devices or a microcontroller board that communicates with peripherals like infrared sensors, etc.
3. Write a program that demonstrates communication with peripheral(s).
4. Write a program that causes an SBC to take some specific action resulting from data obtained from a peripheral.

Course Outcome(s):
Demonstrate mathematical skill in the conversion of English and metric measurements of distance and add and subtract units of distance using fractions.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Convert fractional inches to decimal inches.
2. Convert decimal inches to fractional inches.
3. Convert yards, feet, and inches to metric measurement in meters, centimeters, and millimeters.
4. Convert meters, centimeters, and millimeters to yards, feet, and inches.
5. Convert between measurements of inches, feet, yards, and miles (example, feet to miles).
6. Convert between millimeters, centimeters, meters, and kilometers (example, meters to millimeters).
7. Solve for variables in distance calculations: \( d = \frac{r}{t} \)

Course Outcome(s):
Measure and demonstrate electrical properties of voltage, current, resistance, power and energy. Use algebra to find an unknown quantity using ohms law, power laws, etc.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Demonstrate by solving equations the use of a calculator in Engineering Notation (can use Windows calculator).
2. Explain voltage, current, and resistance using water pressure, water flow rate, and resistance to water flow.
3. Measure voltage, current, and resistance.
4. Explain ohms law and solve for voltage, current, or resistance when given two of the variables.
5. Explain and solve problems for power in direct current circuits using the three power formulas.
6. Explain the relationship between electrical power and energy. Using a residential electric meter reading, convert power usage over time to energy and then calculate the electric bill based on the cost per kilowatt hour.
7. Measure and calculate the power used by a direct current motor like a small robot wheel motor.
8. Explain the energy rating of a battery in milliampere hours (mAH). Using a given current drain, calculate the service time of the battery (how long it can supply power) and given the desired time, calculate the maximum current drain.

Methods of Evaluation:
1. Written reports
2. Connect a single board computer to peripheral sensors and demonstrate communication
3. Write programs that meet the (solve) the problem statement
4. Tests
5. Quizes
6. Homework

Course Content Outline:
1.
2. Matters having to do with the advancement of technology versus the advancement of the human condition
a. The effects of computer-based automation and employment  
b. The importance of continuous education regarding technological advances  

3. Introduction to SBCs  
a. Load an operating system  
b. Connect various input/output devices, like a keyboard and monitor  
c. Testing operating system functionality  
d. Create folders and files  
e. Reading/writing and/or executing loaded programs  
f. Download and test a compiler  

4. Programming using a structured language  
a. Iteration control statement like a "while" loop  
b. Selector statements like an "if" statement  
c. Process statements  

5. Connect input/output devices (other than the monitor and keyboard) to the SBC  
a. Reading switches or similar binary devices  
b. Illuminating light emitting diodes  
c. Current flow in an input/output devices  
d. Voltage drop in an input/output devices  

6. Programming  
a. Display data on a monitor  
b. Connect advanced peripherals like an Arduino controller or infrared device  
c. Communicate with peripheral components  
d. Solve a given problem set by programming a SBC  

7. Mathematics  
a. Engineering notation  
b. Fraction to decimal conversion and decimal to fraction conversion  
c. English to metric conversion  
d. Metric to English conversion  
e. Conversion within units of the metric system  
f. Conversion of units within English system  
g. Distance equation  

8. Electrical/electronic components  
a. Voltage, current and resistance, calculation and measurement  
b. Ohms law  
c. Power dissipation and equations  
d. Energy and its relationship to power  
e. Battery ratings and ability to provide electrical power over time  

Resources  

Resources Other  
None  
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