Georgia CTAE

Embedded Computing (11.42700) (2021)

Adopted 2021

Demonstrate employability skills required by business and industry. IT-EP-1	1. **Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.** IT-EP-1.1 2. **Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.** IT-EP-1.2 3. **Exhibit critical thinking and problem-solving skills to locate, analyze and apply information in career planning and employment situations.** IT-EP-1.3 4. **Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.** IT-EP-1.4 5. **Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team-work skills.** IT-EP-1.5 6. **Present a professional image through appearance, behavior, and language.** IT-EP-1.6
Explain Embedded Computing (EC) and the Internet of Things (IoT). IT-EP-2	1. **Define the basic terminology of EC/IoT.** IT-EP-2.1 2. **Create a glossary of basic EC/IoT terminology.** IT-EP-2.2 3. **Compare and contrast microprocessors and microcontrollers.** IT-EP-2.3 4. **Research and report on popular microcontrollers and EC/IoT platforms (e.g., Arduino, Raspberry Pi).** IT-EP-2.4 5. **Explore the implications of artificial intelligence as it relates to EC and IoT** IT-EP-2.5
Demonstrate a working knowledge of basic networking protocols for industry, homes, and the internet including	1. **Compare and contrast Radio Frequency (RF) networking technologies, (e.g., Wi-Fi, Bluetooth, BLE, Zigbee, Z-Wave) including speed, power requirements, and popularity in industry and personal devices.** IT-EP-3.1

speed, power requirements, and popularity in industry and personal devices. IT-EP-3	2. **Explain advantages and disadvantages of wireless networking compared to wired networking.** IT-EP-3.2 3. **Demonstrate a working knowledge of serial networking technologies used by microcontrollers (e.g., I2C, RS-232, RS-422, RS-485, SPI, master/slave).** IT-EP-3.3
Develop and investigate interfacing circuits. IT-EP-4	1. **Explain the difference between a source and a sink.** IT-EP-4.1 2. **Identify the differences between analog and digital circuits.** IT-EP-4.2 3. **Describe the function of a pull-up resistor.** IT-EP-4.3 4. **Calculate the current draw of series and parallel circuits.** IT-EP-4.4 5. **Build an operational LED circuit with a switch to turn it on/off, giving examples of why this is helpful in an IoT scenario.** IT-EP-4.5 6. **Research and report the current and voltage I/O limitations of the embedded platform/microcontroller used in the class** IT-EP-4.6 7. **Discuss the characteristics of digital input and output ports on a microcontroller.** IT-EP-4.7 8. **Demonstrate an understanding of signal conversion from analog to digital and digital to analog for sensors.** IT-EP-4.8
Classify and categorize multiple kinds of sensors. IT-EP-5	1. **Classify and explain examples of the following kinds of sensors: temperature, distance, light, sound, contact, pressure, position – GPS (Global Positioning System), encoders, potentiometer, gyro, and accelerometer.** IT-EP-5.1 2. **Explain the basic functioning principles of the sensors above and their possible uses.** IT-EP-5.2
Manipulate, connect, and examine performance aspects of motors. IT-EP-6	1. **Demonstrate an understanding of stepper motors.** IT-EP-6.1 2. **Demonstrate an understanding of servomotors.** IT-EP-6.2 3. **Describe the operation of brushed motor controller.** IT-EP-6.3 4. **Explain brushless motors and their advantages over older (brush) motors.** IT-EP-6.4 5. **Demonstrate an understanding of pulse width modulation (PWM) control of motors.** IT-EP-6.5 6. **Demonstrate programmatic control of a motor under variant conditions.** IT-EP-6.6

Investigate and draw connections within the context of programming as it relates to Embedded Computing/Internet of Things. IT-EP-7	1. **Explain the importance of code documentation in professional code design.** IT-EP-7.1 2. **Identify and create EC/IoT applications with industry standard programming languages.** IT-EP-7.2 3. **Analyze the process of software development for an embedded application.** IT-EP-7.3 4. **Compare and contrast interpreted and compiled applications.** IT-EP-7.4 5. **Define real-time programming and interrupt-driven programming.** IT-EP-7.5 6. **Analyze and explain common data types for IoT and embedded applications including Integer, Floating Point, Byte, Boolean, Char, and Pointer types.** IT-EP-7.6 7. **Design and diagram a finite state machine (automata) using real-world examples (e.g., Traffic signal, vending machines, assisted GPS on smartphones, various radio/connectivity states).** IT-EP-7.7
Interpret debugging techniques in hardware and software. IT-EP-8	1. **Gather, organize, and interpret data to identify simple bugs in EC/IoT applications.** IT-EP-8.1 2. **Use proper debugging methods, including systematically changing, then checking, one variable or algorithm at a time. Demonstrate use of selective variable watching and daemon print statements for debugging use as well.** IT-EP-8.2 3. **Evaluate use of breakpoints, interrupt, main loop, event driven, and race condition in EC/IoT applications.** IT-EP-8.3 4. **Demonstrate understanding of why infinite loops are bad programming design.** IT-EP-8.4 5. **Prove how to debug an actual program using a debugging tool and explain the reasons behind the steps taken.** IT-EP-8.5
Compare, contrast, and utilize Cloud Service features. IT-EP-9	1. **Define Security/Privacy concerns of EC/IoT applications.** IT-EP-9.1 2. **Explore available cloud-based application program interfaces (APIs).** IT-EP-9.2 3. **Develop an application that connects with one or more cloud-based services/storage solutions (e.g., Twitter, IFTTT [If This Then That], Dropbox, Google)** IT-EP-9.3
Design an embedded computing application that solves a current	1. **Design, develop, and debug an embedded computing application interfacing to an external sensor, switch, LED, or other device.** IT-EP-10.1

problem (e.g., robotics, art-Botics, visual and kinetic art). IT-E-10	2. Design, develop, and debug an external application on a PC or mobile device accessing data from a remote embedded computing device. Upload to online career portfolio. IT-EP-10.2
Organize personal online career portfolio for specific career interests. IT-EP-11	1. Review and update résumé to reflect new knowledge and skills master and additional work experience. IT-EP-11.1 2. Organize folders within the portfolio to reflect specific careers of interest, including résumé, targeted cover letter, and artifacts relevant to the specific career. IT-EP-11.2 3. Update all current items in the portfolio. IT-EP-11.3 4. Identify and upload additional industry-appropriate artifacts reflective of mastered skills throughout this course. Write and include a reflective entry for each artifact discussing steps taken, problems encountered and how they were overcome, and other pertinent information about the learning. IT-EP-11.4 5. Polish all entries in the online career portfolio to ensure accuracy and professionalism as expected from employers. IT-EP-11.5 6. Conduct a job search and share the appropriate folder with the potential employer. IT-EP-11.6
Explore how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, entrepreneurship development, and competitive events. IT-EP-12	1. Explain the goals, mission, and objectives of Future Business Leaders of America (FBLA) and/or Technology Student Association (TSA) and/or SkillsUSA. IT-EP-12.1 2. Explore the impact and opportunities a student organization (FBLA, TSA, SkillsUSA) can develop to bring business and education together in a positive working relationship through innovative leadership and career development programs. IT-EP-12.2 3. Explore the local, state, and national opportunities available to students through participation in related student organizations (FBLA, TSA, SkillsUSA) including but not limited to conferences, competitions, community service, philanthropy, and other student organization activities. IT-EP-12.3 4. Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development. IT-EP-12.4 5. Explore the competitive events related to the content of this course and the required competencies, skills, and knowledge for each related event for individual, team, and chapter competitions. IT-EP-12.5