EL DORADO UNION HIGH SCHOOL DISTRICT
EDUCATIONAL SERVICES
Course of Study Information Page

COURSE TITLE	**Internet of Things Fundamentals (IoT Fundamentals)**		
DISTRICT COURSE NUMBER **0458**		4-DIGIT STATE COURSE CODE (COMPLETED BY SILT) **8132**	
Rationale:	Information and Communication Technologies (ICT) have expanded the need for employees who can understand, manage, and support all rapidly emerging, evolving, and converging computer, software, networking, telecommunications, Internet, programming, and information systems. Essential skills for careers in the ICT sector include understanding systems that support the management and flow of data, the ability to work well and communicate clearly with people, and the ability to manage projects efficiently. The ICT sector meets national criteria for high demand, high wages, and high skills and provides students with excellent opportunities for interesting work and good pay. The goal of Internet of Things (IoT), is for students learn about the Internet of Things and how it enables the Digital Transformation along with emerging technologies such as data analytics, artificial intelligence and the increased attention to cybersecurity. The course also introduces the importance of the new Internet Based Networking that uses a software-driven approach and machine learning to be able to connect and secure tens of billions of new devices with ease.		
Course Description that will be in the Course Directory:	Introduction to the Internet of Things (IoT), where people, processes, things, and data are connected via emerging Internet technologies. A variety of networking and computer hardware devices will be integrated into end-to-end systems to solve practical problems.		
How Does this Course align with or meet State and District content standards?	This course is aligned with the Software Systems and Development Pathway from the Information and Communications Technology Industry sector of the Career Technical Education model curriculum standards set by the California State Board of Education in January 2013. This course is currently being reviewed for approval as "a-g" college preparatory electives by the University of California Office of the President.		
NCLB Core Subjects:	*Select up to two that apply:* ☐ Arts ☐ Economics ☐ English ☐ Foreign Language ☐ Geography ☐ Civics and Government ☐ History ☐ Mathematics ☐ Reading / Language Arts ☐ Science X Not Core Subject		
CDE CALPADS Course Descriptors: (See Page 2 for Definitions)	CTE TECH PREP COURSE INDICATORS X Tech Prep (32) (Higher Ed) ☐ Tech Prep & ROP(33) (Higher Ed) ☐ ROP (30) ☐ N/A	CTE COURSE CONTENT CODE ☐ CTE Introductory (01) ☐ CTE Concentrator (02) X CTE Completer (03) ☐ Voc Subject ☐ N/A	INSTRUCTIONAL LEVEL CODE ☐ Remedial (35) ☐ Honors UC-Certified (39) ☐ Honors Non UC-Certified (34) ☐ College (40) N/A

Length of Course:	X Year ☐ Semester	
Grade Level(s):	☐ 9 ☐ 10 X 11 X 12	
Credit:	X Number of credits: **10** X Meets graduation requirements (subject **CTE, Elective**) X Request for UC "a–g" requirements CSU/UC requirement **Elective**	x College Prep
	Cisco is developing an IoT/DevOps type of certificate. As well Students will be entered in to the National Computer Science Society	
Prerequisites:	Students must have completed AP Computer Science Principals or teacher recommendation	
Department(s):	Computer Science/ Information Communications & Technologies (ICT)	
District Sites:	Ponderosa High School	
Board of Trustees COS Adoption Date:	May 12, 2020	
Textbooks / Instructional Materials:	**Basic Text: (Supplied by District Partnership with Sacramento County Office of Education ICT HUB for year 1, after that $350 annually for support from Western Academy Support Training from Cisco Net Academy).** Book 1: Author: Cisco Networking Academy Online Course Title: Introduction to the Internet of Things Publisher: Cisco Date of Publication: 2016 Edition: Book 2: Author: Cisco Networking Academy Online Course Title: Connecting Things Publisher: Cisco Date of Publication: 2016 Edition: Book 3: Author: Cisco Networking Academy Online Course Title: Hackathon Playbook Publisher: Cisco Date of Publication: 2016 **Supplies:** A Raspberry Pi kit from Spark Fun needs to be purchased for all students. PHS has purchased 25 kits to get the class started. We should consider purchasing 10-20 more kits if class has high numbers. • Necessary add-ons will be loaned to students as part of this class. • Students should purchase a Micro SD card 16GB or larger and a USB SD card reader. • Student will want to have an online data storage account (Dropbox, OneDrive, Google Drive). **Supplemental Information:** Free online materials to support student learning. Website: Cisco Networking Academy Online Curriculum (https://www.netacad.com/) Website: Cisco Packet Tracer Simulation-Based Learning Environment (https://www.netacad.com/courses/packet-tracer) Website: Internet of Things (https://www.netacad.com/courses/iot Required Raspberry Pi Starter Kit: Website: Raspberry Pi 3 B+ (https://www.sparkfun.com/products/14644)	
Funding Source:	CTE Incentive Grant Perkins Funds, possibly prop 98 funds	

	Partnerships with Sacramento County Office of Education Internet Hub Grant. ICT Hub will pass through $500 this year to cover your costs of applying, purchasing materials for students, etc.
Board of Trustees Textbook Adoption Date:	

Definitions

CALPADS	California Longitudinal Pupil Achievement Data System
CTE Technical Prep	A course within a CTE technical career pathway or program that has been articulated with a postsecondary education or through an apprenticeship program of at least 2 years following secondary instruction.
Instructional Level Code	Represents a nonstandard instructional level at which the content of a specific course is either above or below a 'standard' course instructional level. These levels may be identified by the actual level of instruction or identified by equating the course content and level of instruction with a state or nationally recognized advanced course of study, such as IB or AP.
Instructional Level Honors, UC Certified	Includes all AP courses.
Instructional Level Honors, non UC Certified	Requires Board approval.
Instructional Level College	Includes ACE courses. Equivalent to college course and content, but not an AP course. Not related to section, but to course.

EL DORADO UNION HIGH SCHOOL DISTRICT

EDUCATIONAL SERVICES
Course Title: Internet of Things

TABLE OF CONTENTS

EL DORADO UNION HIGH SCHOOL DISTRICT

EDUCATIONAL SERVICES

Department: **CTE/Information Communications & Technologies**

Course Title: **Internet of Things Fundamentals (IoT)** Course Number:

Unit Title: **Unit 01: Everything is Connected/Things and Connections**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

CTE Anchor Standards:

2.3 Interpret verbal and nonverbal communications and respond appropriately.
2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
4.1 Use electronic reference materials to gather information and produce products and services.
4.2 Employ technology based communications responsibly and effectively to explore complex systems and issues.
4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.
4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.
4.5 Research past, present, and projected technological advances as they impact a particular pathway.
4.6 Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task.
5.1 Identify and ask significant questions that clarify various points of view to solve problems.
5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.
5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions. 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
5.6 Know the available resources for identifying and resolving problems.
5.7 Work out problems iteratively and recursively.
5.8 Create and use algorithms and solve problems.
5.9 Deconstruct large problems into components to solve.
5.10 Use multiple layers of abstraction.
5.11 Understand the concept of base systems, including binary and hexadecimal.
5.12 Apply the concepts of Boolean logic to decision making and searching.
6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies. 6.4 Practice personal safety when lifting, bending, or moving equipment and supplies.
6.5 Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics.
6.6 Maintain a safe and healthful working environment.
7.7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.
7.8 Explore issues of global significance and document the impact on the Information and Communication Technologies sector.
8.6 Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information.
8.7 Conform to rules and regulations regarding sharing of confidential information, as determined by Information and Communication Technologies sector laws and practices.
8.8 Identify legal and ethical issues that have proliferated with increased technology adoption, including hacking, scamming, and breach of privacy.

9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.
10.1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector.
10.2 Comply with the rules, regulations, and expectations of all aspects of the Information and Communication Technologies sector.
10.3 Construct projects and products specific to the Information and Communication Technologies sector requirements and expectations.
10.4 Collaborate with industry experts for specific technical knowledge and skills.
10.5 Understand the major software and hardware components of a computer and a network and how they relate to each other.
10.6 Understand data sizes of various types of information (text, pictures, sound, video, etc.) and data capacity of various forms of media.
10.7 Understand the SI (metric) prefixes commonly used in computing including, at least, kilo, mega, giga, and tera.
10.8 Understand security concepts including authorization, rights, and encryption.
10.9 Use common industry-standard software and their applications including word processing, spreadsheets, databases, and multimedia software.
10.10 Manage files in a hierarchical system.
10.11 Know multiple ways in which to transfer information and resources (e.g., text, data, sound, video, still images) between software programs and systems.
10.12 Know appropriate search procedures for different types of information, sources, and queries.
10.13 Evaluate the accuracy, relevance, and comprehensiveness of retrieved information.
10.14 Analyze the effectiveness of online information resources to support collaborative tasks, research, publications, communications, and increased productivity.
11.5 Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators.

Pathway Standards

C1.1 Identify the phases of the systems development life cycle, including analysis, design, programming, testing, implementation, maintenance, and improvement.
C1.2 Identify and describe models of systems development, systems development life cycle (SDLC), and agile computing.
C1.3 Identify and describe how specifications and requirements are developed for new and existing software applications.
C1.4 Work as a member of, and within the scope and boundaries of, a development project team.
C1.5 Track development project milestones using the concept of versions.
C1.6 Diagram processes using flowcharts and the Unified Modeling Language.
C2.1 Describe the major purposes and benefits of development, including automation, improving productivity, modeling and analysis, and entertainment.
C2.2 Recognize and prevent unintended consequences of development work: programming errors, security issues, health and environmental risks, and privacy concerns.
C2.3 Develop strategies that target the specific needs and desires of the customer.
C2.4 Analyze customers' needs for development.
C2.5 Determine and document the requirements and alternative solutions to fulfill the customers' needs.
C3.1 Describe and apply the basic process of input, processing, and output.
C3.2 Design effective and intuitive interfaces using knowledge of cognitive, physical, and social interactions.
C3.3 Support methods of accessibility for all potential users, including users with disabilities and non-English-speaking users. C3.1 Describe and apply the basic process of input, processing, and output.
C4.1 Identify and describe the abstraction level of programming languages from low-level, hardware-based languages to high-level, interpreted, Web-based languages.
C4.2 Describe the interaction and integration of programming languages and protocols such as how client-side programming can work with server-side programming to use a query language to access a database. C4.3 Identify and use different authoring tools and integrated development environments (IDEs).
C4.4 Identify and apply data types and encoding.
C4.5 Demonstrate awareness of various programming paradigms, including procedural, object oriented, event-driven, and multithreaded programing.
C4.6 Use proper programming language syntax.
C4.7 Use various data structures, arrays, objects, files, and databases.
C4.8 Use object oriented programming concepts, properties, methods, and inheritance.

C4.9 Create programs using control structures, procedures, functions, parameters, variables, error recovery, and recursion.
C4.10 Create and know the comparative advantages of various queue, sorting, and searching algorithms. C4.11 Document development work for various audiences, such as comments for other programmers, and manuals for users.
C5.1 Identify the characteristics of reliable, effective, and efficient products.
C5.2 Describe the ways in which specification changes and technological advances can require the modification of programs.
C5.3 Use strategies to optimize code for improved performance.
C5.4 Test software and projects.
C5.5 Evaluate results against initial requirements.
C5.6 Debug software as part of the quality assurance process.
C6.1 Identify the basic design elements necessary to produce effective print, video, audio, and interactive media.
C6.2 Describe the various encoding methods of media and trade-offs: vector graphics vs. bitmaps, and bit depth.
C6.3 Use media design and editing software: key frame animation, drawing software, image editors, and three-dimensional design.
C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
C6.5 Analyze the use of media to determine the appropriate file format and level of compression.
C6.6 Integrate media into a full project using appropriate tools.
C6.7 Create and/or capture professional-quality media, images, documents, audio, and video clips.
C8.4 Use data modeling techniques to create databases based upon business needs.
C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.
C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances.
C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.
C9.3 Use hardware to gain input, process information, and take action.
C9.4 Apply the concepts of embedded programming, including digital logic, machine-level representation of data, and memory-system organization.
C9.5 Program a micro-controller for a device or robot.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

Students will demonstrate an understanding of the building blocks, the interconnections and the information flow of an IoT System.

I. Cisco – Introduction to IoT
II. What is the Internet of Things?
III. Cisco IoT – Pre-Test
IV. Getting Started with the Raspberry Pi
    A. Part 1: Installation and Configuration of Raspberry Pi
    B. Part 2: Remote Connectivity
    C. Part 3: Command Line Assignment
    D. Chapter 1 Activities
    E. Chapter 1 Quiz Cisco Connecting Things

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

1. This unit begins with a description of the topic, an explanation of the importance of this topic, possible social applications of this topic, and objectives for the unit.
2. A kinesthetic activity will be used to get students involved in the unit topic. Students are more engaged when they go beyond seatwork to gain familiarity with the scope of a topic. Acting out computing concepts is one way to have students actively engaged in the curriculum.
3. The final unit project is presented at the beginning of the unit so students understand what type of project they will engage in at the end of the unit. Daily assignments help scaffold their knowledge towards gaining the

knowledge needed to complete a particular project. The final project represents a culmination of their new knowledge and provides an opportunity to expand their understandings to a particular socially-relevant problem.
4. Students will use writing to reinforce the literacy component behind computing terms and definitions.
5. Foundational computing topics are connected to the 'pop-technology' students have likely encountered: mobile phones, social networks, blogs, Internet browsing, etc.
6. Real world problems are presented in the context of socially-relevant issues impacting urban communities (housing, safety, poverty, health care, access to equal rights, educational opportunities, improving social services, translation services, transportation, etc.)
7. Students will work on problems that they help define and can individualize—i.e. selecting their own content for websites; creating original, not pre-scripted, problem-solving strategies, etc.
8. Students will work in a variety of collaborative settings including elbow partners, peer-programming, and group research projects. This collaboration encourages conversations around computing topics.
9. Students will communicate their answers in a variety of ways—academic writing, journal entries, writing a letter to a friend or companion, using presentation software, developing graphics or animation, storyboarding, listing algorithms, drawing illustrations, oral presentations, etc.
10. Computing careers will be explored in this unit. Students will be given hypothetical opportunities to act as a professional to take on the behavior and skills to solve a given problem.
.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Formative Assessment: Students will respond in a lab journal to a prompt daily regarding privacy and security implications of a given IoT model. Journals will be evaluated using a standardized rubric.

In-class graded labs demonstrating proficiency with Arduino microcontrollers and Raspberry Pi Single Board Computers integrated in Ethernet and Wi-Fi connected TCP/IP networks built of switches, routers, servers, and firewalls.

Labs will be assessed using a standardized rubric.

Summative Assessments: Weekly quizzes will include open-response questions on the design, configuration, and troubleshooting of end-to-end Internet of Things systems comprised of sensors, actuators, microcontrollers, single board computers, network switches, routers, Wi-Fi devices, and mobile computing devices. Quizzes will be evaluated through multiple choice or rubric format.

Skills Demonstrations: Students submit graded Packet Tracer projects building end-to-end models of Internet of Things systems. Packet Tracer projects will be evaluated using standardized rubrics.

Projects: Students will design and implement an end-to-end IoT prototype, following the Student Hackathon format. Projects will be evaluated using a standardized rubric.

Classroom Discussion: Students will discuss examples of vertical and horizontal markets. Student discussions will be evaluated using a standardized rubric.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments. Interventions may include, but not be limited to:

- Reviews offered through web-based curriculum
- Review of reference materials or tutorials
- Audio-visual supports
- Teacher or peer reviews
- Collaboration with peers and teacher
- Alternative assignments or simulations
- Test/assignment retakes
- Graphic organizers
- Scaffolding/differentiated assignments
- Acceptance of late work with or without penalties
- Modified pacing/requirements for diverse students

EL DORADO UNION HIGH SCHOOL DISTRICT

EDUCATIONAL SERVICES

Department: **CTE/Information Communications & Technologies**

Course Title: **Internet of Things Fundamentals (IoT)** Course Number:

Unit Title: **Unit 02: Everything Becomes Programmable/Sensors, Actuators and Microcontrollers**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

CTE Anchor Standards:

2.3 Interpret verbal and nonverbal communications and respond appropriately.
2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
5.1 Identify and ask significant questions that clarify various points of view to solve problems.
5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions. 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
5.7 Work out problems iteratively and recursively.
5.8 Create and use algorithms and solve problems.
5.10 Use multiple layers of abstraction.
5.11 Understand the concept of base systems, including binary and hexadecimal.
8.8 Identify legal and ethical issues that have proliferated with increased technology adoption, including hacking, scamming, and breach of privacy.

Pathway Standards:

C4.10 Create and know the comparative advantages of various queue, sorting, and searching algorithms.
C6.3 Use media design and editing software: key frame animation, drawing software, image editors, and three dimensional design.
C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

Students will demonstrate an understanding of using sensors, actuators, and microcontrollers Students use sensors and an Arduino microcontroller to read data from the physical world and control actuators. and control actuators.

I. The things and connections that make up the Internet of Things (IoT)
   A. Python Programming
   B. Start Cisco Python Module 1- Automate the Boring Stuff (Ch. 1-2)
   C. Physical Computing with the Raspberry Pi
   D. Present Chapter 2
   E. Chapter 2 Activities

II. Cisco Python Start Module 2 - Automate the Boring Stuff (Ch. 5-6)
   A. Physical Computing
      1. Sense Hat Guided Activities
      2. Pi Camera Fun & Pi Camera Stop Motion

   B. Python Programming
      2. Cisco Python Module 2 Due
      3. Automate the Boring Stuff (Ch. 7-8)

III. Present Chapter 3 Cisco Connecting Things
A. Chapter 3 Activities
B. Chapter 3 Quiz

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

1. This unit begins with a description of the topic, an explanation of the importance of this topic, possible social applications of this topic, and objectives for the unit.
2. A kinesthetic activity will be used to get students involved in the unit topic. Students are more engaged when they go beyond seatwork to gain familiarity with the scope of a topic. Acting out computing concepts is one way to have students actively engaged in the curriculum.
3. The final unit project is presented at the beginning of the unit so students understand what type of project they will engage in at the end of the unit. Daily assignments help scaffold their knowledge towards gaining the knowledge needed to complete a particular project. The final project represents a culmination of their new knowledge and provides an opportunity to expand their understandings to a particular socially-relevant problem.
4. Students will use writing to reinforce the literacy component behind computing terms and definitions. 5. Foundational computing topics are connected to the 'pop-technology' students have likely encountered: mobile phones, social networks, blogs, Internet browsing, etc.
6. Real world problems are presented in the context of socially-relevant issues impacting urban communities (housing, safety, poverty, health care, access to equal rights, educational opportunities, improving social services, translation services, transportation, etc.)
7. Students will work on problems that they help define and can individualize—i.e. selecting their own content for websites; creating original, not pre-scripted, problem-solving strategies, etc.
8. Students will work in a variety of collaborative settings including elbow partners, peer-programming, and group research projects. This collaboration encourages conversations around computing topics.
9. Students will communicate their answers in a variety of ways—academic writing, journal entries, writing a letter to a friend or companion, using presentation software, developing graphics or animation, storyboarding, listing algorithms, drawing illustrations, oral presentations, etc.
10. Computing careers will be explored in this unit. Students will be given hypothetical opportunities to act as a professional to take on the behavior and skills to solve a given problem.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Formative Assessment: Students will respond in a lab journal to a prompt daily regarding privacy and security implications of a given IoT model. Journals will be evaluated using a standardized rubric.

In-class graded labs demonstrating proficiency with Arduino microcontrollers and Raspberry Pi Single Board Computers integrated in Ethernet and Wi-Fi connected TCP/IP networks built of switches, routers, servers, and firewalls.

Labs will be assessed using a standardized rubric.

Summative Assessments: Weekly quizzes will include open-response questions on the design, configuration, and troubleshooting of end-to-end Internet of Things systems comprised of sensors, actuators, microcontrollers, single board computers, network switches, routers, Wi-Fi devices, and mobile computing devices. Quizzes will be evaluated through multiple choice or rubric format.

Skills Demonstrations: Students submit graded Packet Tracer projects building end-to-end models of Internet of Things systems. Packet Tracer projects will be evaluated using standardized rubrics.

Projects: Students will design and implement an end-to-end IoT prototype, following the Student Hackathon format. Projects will be evaluated using a standardized rubric.

Classroom Discussion: Students will discuss examples of vertical and horizontal markets. Student discussions will be evaluated using a standardized rubric.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments. Interventions may include, but not be limited to:

- Reviews offered through web-based curriculum
- Review of reference materials or tutorials
- Audio-visual supports
- Teacher or peer reviews
- Collaboration with peers and teacher
- Alternative assignments or simulations
- Test/assignment retakes
- Graphic organizers
- Scaffolding/differentiated assignments
- Acceptance of late work with or without penalties
- Modified pacing/requirements for diverse students

EL DORADO UNION HIGH SCHOOL DISTRICT

EDUCATIONAL SERVICES

Department: **CTE/Information Communications & Technologies**

Course Title: **Internet of Things (IoT) Fundamentals** Course Number:

Unit Title: **Unit 03 Everything Generates Data/Software is Everywhere**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

CTE Anchor Standards

C5.5 Evaluate results against initial requirements.
C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
C6.6 Integrate media into a full project using appropriate tools.
D3.3 Using simple game development tools, create a game or simulation.
D3.4 Present the game or simulation. Technologies sector issues and problems.
10.1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector.
C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
C8.5 Use queries to extract and manipulate data (select queries, action queries).
C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

Students will demonstrate their abilities to use Python to program a Single Board Computer (Raspberry Pi) to perform more complex embedded program.

I. Start Cisco Python Module 3
II. Automate the Boring Stuff (Ch. 9-10)
III. Explorer Hat Pro Introduction
    A. Motor Control
    B. Explorer Hat Robotics
IV. Present Chapter 4
    A. Chapter 4 Activities
    B. Chapter 4 Quiz

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

1. This unit begins with a description of the topic, an explanation of the importance of this topic, possible social applications of this topic, and objectives for the unit.
2. A kinesthetic activity will be used to get students involved in the unit topic. Students are more engaged when they go beyond seatwork to gain familiarity with the scope of a topic. Acting out computing concepts is one way to have students actively engaged in the curriculum.
3. The final unit project is presented at the beginning of the unit so students understand what type of project they will engage in at the end of the unit. Daily assignments help scaffold their knowledge towards gaining the knowledge needed to complete a particular project. The final project represents a culmination of their new knowledge and provides an opportunity to expand their understandings to a particular socially-relevant problem.

4. Students will use writing to reinforce the literacy component behind computing terms and definitions. 5. Foundational computing topics are connected to the 'pop-technology' students have likely encountered: mobile phones, social networks, blogs, Internet browsing, etc.
6. Real world problems are presented in the context of socially-relevant issues impacting urban communities (housing, safety, poverty, health care, access to equal rights, educational opportunities, improving social services, translation services, transportation, etc.)
7. Students will work on problems that they help define and can individualize—i.e. selecting their own content for websites; creating original, not pre-scripted, problem-solving strategies, etc.
8. Students will work in a variety of collaborative settings including elbow partners, peer-programming, and group research projects. This collaboration encourages conversations around computing topics.
9. Students will communicate their answers in a variety of ways—academic writing, journal entries, writing a letter to a friend or companion, using presentation software, developing graphics or animation, storyboarding, listing algorithms, drawing illustrations, oral presentations, etc.
10. Computing careers will be explored in this unit. Students will be given hypothetical opportunities to act as a professional to take on the behavior and skills to solve a given problem.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Formative Assessment: Students will respond in a lab journal to a prompt daily regarding privacy and security implications of a given IoT model. Journals will be evaluated using a standardized rubric.

In-class graded labs demonstrating proficiency with Arduino microcontrollers and Raspberry Pi Single Board Computers integrated in Ethernet and Wi-Fi connected TCP/IP networks built of switches, routers, servers, and firewalls.

Labs will be assessed using a standardized rubric.

Summative Assessments: Weekly quizzes will include open-response questions on the design, configuration, and troubleshooting of end-to-end Internet of Things systems comprised of sensors, actuators, microcontrollers, single board computers, network switches, routers, Wi-Fi devices, and mobile computing devices. Quizzes will be evaluated through multiple choice or rubric format.

Skills Demonstrations: Students submit graded Packet Tracer projects building end-to-end models of Internet of Things systems. Packet Tracer projects will be evaluated using standardized rubrics.

Projects: Students will design and implement an end-to-end IoT prototype, following the Student Hackathon format. Projects will be evaluated using a standardized rubric.

Classroom Discussion: Students will discuss examples of vertical and horizontal markets. Student discussions will be evaluated using a standardized rubric.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments. Interventions may include, but not be limited to:

- Reviews offered through web-based curriculum
- Review of reference materials or tutorials
- Audio-visual supports
- Teacher or peer reviews
- Collaboration with peers and teacher
- Alternative assignments or simulations
- Test/assignment retakes
- Graphic organizers
- Scaffolding/differentiated assignments
- Acceptance of late work with or without penalties
- Modified pacing/requirements for diverse students

EL DORADO UNION HIGH SCHOOL DISTRICT

EDUCATIONAL SERVICES

Department: **CTE/Information Communications & Technologies**

Course Title: **Internet of Things (IoT) Fundamentals** Course Number:

Unit Title: **Unit 04 Everything Can be Automated/Fog Networks and Cloud Computing**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

CTE Anchor Standards:

2.3 Interpret verbal and nonverbal communications and respond appropriately. 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
4.1 Use electronic reference materials to gather information and produce products and services.
5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions. 5.5 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
5.8 Create and use algorithms and solve problems.
5.12 Apply the concepts of Boolean logic to decision making and searching.
9.7 Participate in interactive teamwork to solve real Information and Communication Technologies sector issues and problems.
10.1 Interpret and explain terminology and practices specific to the Information and Communication Technologies sector.
A6.2 Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
A6.6 Distinguish types of symptoms and which component's issue could exhibit those symptoms: the user, hardware, network, or software.
C1.4 Work as a member of, and within the scope and boundaries of, a development project team.
C3.1 Describe and apply the basic process of input, processing, and output.
C4.9 Create programs using control structures, procedures, functions, parameters, variables, error recovery, and recursion.
C5.4 Test software and projects.
C5.5 Evaluate results against initial requirements.
C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances.
C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

Students will demonstrate an understanding the principal IoT Networking Protocols. Learn how an IoT system distributes computing between Fog and Cloud networks. Learn how to interconnect systems using RESTful APIs.

I. Cisco Python Module 2
II. Due Internet Connectivity - Twitter Present Chapter 5
III. Cisco Connecting Things – Chapter 5 Activities
IV. Cisco Connecting Things – Chapter 5 Quiz
V. Cisco Python Final Exam Due

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

1. This unit begins with a description of the topic, an explanation of the importance of this topic, possible social applications of this topic, and objectives for the unit.
2. A kinesthetic activity will be used to get students involved in the unit topic. Students are more engaged when they go beyond seatwork to gain familiarity with the scope of a topic. Acting out computing concepts is one way to have students actively engaged in the curriculum.
3. The final unit project is presented at the beginning of the unit so students understand what type of project they will engage in at the end of the unit. Daily assignments help scaffold their knowledge towards gaining the knowledge needed to complete a particular project. The final project represents a culmination of their new knowledge and provides an opportunity to expand their understandings to a particular socially-relevant problem.
4. Students will use writing to reinforce the literacy component behind computing terms and definitions. 5. Foundational computing topics are connected to the 'pop-technology' students have likely encountered: mobile phones, social networks, blogs, Internet browsing, etc.
6. Real world problems are presented in the context of socially-relevant issues impacting urban communities (housing, safety, poverty, health care, access to equal rights, educational opportunities, improving social services, translation services, transportation, etc.)
7. Students will work on problems that they help define and can individualize—i.e. selecting their own content for websites; creating original, not pre-scripted, problem-solving strategies, etc.
8. Students will work in a variety of collaborative settings including elbow partners, peer-programming, and group research projects. This collaboration encourages conversations around computing topics.
9. Students will communicate their answers in a variety of ways—academic writing, journal entries, writing a letter to a friend or companion, using presentation software, developing graphics or animation, storyboarding, listing algorithms, drawing illustrations, oral presentations, etc.
10. Computing careers will be explored in this unit. Students will be given hypothetical opportunities to act as a professional to take on the behavior and skills to solve a given problem.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Formative Assessment: Students will respond in a lab journal to a prompt daily regarding privacy and security implications of a given IoT model. Journals will be evaluated using a standardized rubric.

In-class graded labs demonstrating proficiency with Arduino microcontrollers and Raspberry Pi Single Board Computers integrated in Ethernet and Wi-Fi connected TCP/IP networks built of switches, routers, servers, and firewalls.

Labs will be assessed using a standardized rubric.

Summative Assessments: Weekly quizzes will include open-response questions on the design, configuration, and troubleshooting of end-to-end Internet of Things systems comprised of sensors, actuators, microcontrollers, single board computers, network switches, routers, Wi-Fi devices, and mobile computing devices. Quizzes will be evaluated through multiple choice or rubric format.

Skills Demonstrations: Students submit graded Packet Tracer projects building end-to-end models of Internet of Things systems. Packet Tracer projects will be evaluated using standardized rubrics.

Projects: Students will design and implement an end-to-end IoT prototype, following the Student Hackathon format. Projects will be evaluated using a standardized rubric.

Classroom Discussion: Students will discuss examples of vertical and horizontal markets. Student discussions will be evaluated using a standardized rubric.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments. Interventions may include, but not be limited to:

- Reviews offered through web-based curriculum
- Review of reference materials or tutorials
- Audio-visual supports
- Teacher or peer reviews
- Collaboration with peers and teacher
- Alternative assignments or simulations

- Test/assignment retakes
- Graphic organizers
- Scaffolding/differentiated assignments
- Acceptance of late work with or without penalties
- Modified pacing/requirements for diverse students

EL DORADO UNION HIGH SCHOOL DISTRICT

EDUCATIONAL SERVICES

Department: **CTE/Information Communications & Technologies**

Course Title: **Internet of Things (IoT) Fundamentals** Course Number:

Unit Title **Unit 05 Everything Needs to be Secured/IoT Applications in Business**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

CTE Anchor Standards:

A5.1 Follow laws, regulatory guidelines, policies, and procedures to ensure the security and integrity of information systems.

A5.2 Identify potential attack vectors and security threats

A6.0 Diagnose and solve software, hardware, networking, and security problems.

B8.1 Identify and define command network security threats: hackers, crackers, viruses, worms, and Trojan horses

C2.2 Recognize and prevent unintended consequences of development work: programming errors, security issues, health and environmental risks, and privacy concerns.

D7.1 Identify functions of information processing and describe basic network terminology and network security and demonstrate an understanding of operating systems, environments, and platforms.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

Students will demonstrate how IoT technologies are applied in diverse vertical markets: Healthcare, Smart Cities, Smart Grid, and Manufacturing.

I. Internet Connectivity – Everything Else
II. Present Chapter 6
III. Cisco Connecting Things – Chapter 6 Activities

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

1. This unit begins with a description of the topic, an explanation of the importance of this topic, possible social applications of this topic, and objectives for the unit.
2. A kinesthetic activity will be used to get students involved in the unit topic. Students are more engaged when they go beyond seatwork to gain familiarity with the scope of a topic. Acting out computing concepts is one way to have students actively engaged in the curriculum.
3. The final unit project is presented at the beginning of the unit so students understand what type of project they will engage in at the end of the unit. Daily assignments help scaffold their knowledge towards gaining the knowledge needed to complete a particular project. The final project represents a culmination of their new knowledge and provides an opportunity to expand their understandings to a particular socially-relevant problem.
4. Students will use writing to reinforce the literacy component behind computing terms and definitions. 5. Foundational computing topics are connected to the 'pop-technology' students have likely encountered: mobile phones, social networks, blogs, Internet browsing, etc.
6. Real world problems are presented in the context of socially-relevant issues impacting urban communities (housing, safety, poverty, health care, access to equal rights, educational opportunities, improving social services, translation services, transportation, etc.)

7. Students will work on problems that they help define and can individualize—i.e. selecting their own content for websites; creating original, not pre-scripted, problem-solving strategies, etc.
8. Students will work in a variety of collaborative settings including elbow partners, peer-programming, and group research projects. This collaboration encourages conversations around computing topics.
9. Students will communicate their answers in a variety of ways—academic writing, journal entries, writing a letter to a friend or companion, using presentation software, developing graphics or animation, storyboarding, listing algorithms, drawing illustrations, oral presentations, etc.
10. Computing careers will be explored in this unit. Students will be given hypothetical opportunities to act as a professional to take on the behavior and skills to solve a given problem.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Formative Assessment: Students will respond in a lab journal to a prompt daily regarding privacy and security implications of a given IoT model. Journals will be evaluated using a standardized rubric.

In-class graded labs demonstrating proficiency with Arduino microcontrollers and Raspberry Pi Single Board Computers integrated in Ethernet and Wi-Fi connected TCP/IP networks built of switches, routers, servers, and firewalls.

Labs will be assessed using a standardized rubric.

Summative Assessments: Weekly quizzes will include open-response questions on the design, configuration, and troubleshooting of end-to-end Internet of Things systems comprised of sensors, actuators, microcontrollers, single board computers, network switches, routers, Wi-Fi devices, and mobile computing devices. Quizzes will be evaluated through multiple choice or rubric format.

Skills Demonstrations: Students submit graded Packet Tracer projects building end-to-end models of Internet of Things systems. Packet Tracer projects will be evaluated using standardized rubrics.

Projects: Students will design and implement an end-to-end IoT prototype, following the Student Hackathon format. Projects will be evaluated using a standardized rubric.

Classroom Discussion: Students will discuss examples of vertical and horizontal markets. Student discussions will be evaluated using a standardized rubric.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments. Interventions may include, but not be limited to:

- Reviews offered through web-based curriculum
- Review of reference materials or tutorials
- Audio-visual supports
- Teacher or peer reviews
- Collaboration with peers and teacher
- Alternative assignments or simulations
- Test/assignment retakes
- Graphic organizers
- Scaffolding/differentiated assignments
- Acceptance of late work with or without penalties
- Modified pacing/requirements for diverse students

EL DORADO UNION HIGH SCHOOL DISTRICT

EDUCATIONAL SERVICES

Department: **CTE/Information Communications & Technologies**

Course Title: **Internet of Things (IoT) Fundamentals** Course Number:

Unit Title: **Unit 06 Educational and Business Opportunities/Create an IoT Solution**

Content Area Standards (Please identify the source): List content standards students will master in this unit.

CTE Anchor Standards:

C5.2 Describe the ways in which specification changes and technological advances can require the modification of programs.
C5.3 Use strategies to optimize code for improved performance.
C5.4 Test software and projects.
C5.5 Evaluate results against initial requirements.
C5.6 Debug software as part of the quality assurance process.
C6.1 Identify the basic design elements necessary to produce effective print, video, audio, and interactive media.
C6.2 Describe the various encoding methods of media and trade-offs: vector graphics vs. bitmaps, and bit depth.
15 ICT | California Career Technical Education Model Curriculum Standards
C6.3 Use media design and editing software: key frame animation, drawing software, image editors, and three-dimensional design.
C6.4 Develop a presentation or other multimedia project: video, game, or interactive Web sites, from storyboard to production.
C6.5 Analyze the use of media to determine the appropriate file format and level of compression.
C6.6 Integrate media into a full project using appropriate tools.
C6.7 Create and/or capture professional-quality media, images, documents, audio, and video clips.
C8.4 Use data modeling techniques to create databases based upon business needs.
C8.8 Analyze and display data to assist with decision making using methods like cross tabulations, graphs, and charts.
C9.1 Demonstrate awareness of the applications of device development work, including personalized computing, robotics, and smart appliances.
C9.2 Install equipment, assemble hardware, and perform tests using appropriate tools and technology.
C9.3 Use hardware to gain input, process information, and take action.
C9.4 Apply the concepts of embedded programming, including digital logic, machine-level representation of data, and memory-system organization.
C9.5 Program a micro-controller for a device or robot.

Unit Outline: A detailed descriptive summary of all topics covered in the unit. Explain what the students will learn, know and be able to do.

Students will demonstrate an understanding and create an End-to-End case study on how to create an IoT Prototype.

I. Raspberry Pi Exploration
II. Cisco Connecting Things – Chapter 6 Activities
III. Cisco Connecting Things – Chapter 6 Quiz
IV. Final Project – Cisco Hackathon Playbook
V. End of Course Exam
VI. FINAL PROJECT SHOW AND TELL

Instructional Strategies: Indicate how the Instructional Strategies support the delivery of the curriculum and the course goals. Indicate how assignments support the Anchor Standards.

1. This unit begins with a description of the topic, an explanation of the importance of this topic, possible social applications of this topic, and objectives for the unit.
2. A kinesthetic activity will be used to get students involved in the unit topic. Students are more engaged when they go beyond seatwork to gain familiarity with the scope of a topic. Acting out computing concepts is one way to have students actively engaged in the curriculum.
3. The final unit project is presented at the beginning of the unit so students understand what type of project they will engage in at the end of the unit. Daily assignments help scaffold their knowledge towards gaining the knowledge needed to complete a particular project. The final project represents a culmination of their new knowledge and provides an opportunity to expand their understandings to a particular socially-relevant problem.
4. Students will use writing to reinforce the literacy component behind computing terms and definitions. 5. Foundational computing topics are connected to the 'pop-technology' students have likely encountered: mobile phones, social networks, blogs, Internet browsing, etc.
6. Real world problems are presented in the context of socially-relevant issues impacting urban communities (housing, safety, poverty, health care, access to equal rights, educational opportunities, improving social services, translation services, transportation, etc.)
7. Students will work on problems that they help define and can individualize—i.e. selecting their own content for websites; creating original, not pre-scripted, problem-solving strategies, etc.
8. Students will work in a variety of collaborative settings including elbow partners, peer-programming, and group research projects. This collaboration encourages conversations around computing topics.
9. Students will communicate their answers in a variety of ways—academic writing, journal entries, writing a letter to a friend or companion, using presentation software, developing graphics or animation, storyboarding, listing algorithms, drawing illustrations, oral presentations, etc.
10. Computing careers will be explored in this unit. Students will be given hypothetical opportunities to act as a professional to take on the behavior and skills to solve a given problem.

Assessments: Describe the Formative and Summative assessments that will be used to demonstrate learning and mastery of the standards.

Formative Assessment: Students will respond in a lab journal to a prompt daily regarding privacy and security implications of a given IoT model. Journals will be evaluated using a standardized rubric.

In-class graded labs demonstrating proficiency with Arduino microcontrollers and Raspberry Pi Single Board Computers integrated in Ethernet and Wi-Fi connected TCP/IP networks built of switches, routers, servers, and firewalls.

Labs will be assessed using a standardized rubric.

Summative Assessments: Weekly quizzes will include open-response questions on the design, configuration, and troubleshooting of end-to-end Internet of Things systems comprised of sensors, actuators, microcontrollers, single board computers, network switches, routers, Wi-Fi devices, and mobile computing devices. Quizzes will be evaluated through multiple choice or rubric format.

Skills Demonstrations: Students submit graded Packet Tracer projects building end-to-end models of Internet of Things systems. Packet Tracer projects will be evaluated using standardized rubrics.

Projects: Students will design and implement an end-to-end IoT prototype, following the Student Hackathon format. Projects will be evaluated using a standardized rubric.

Classroom Discussion: Students will discuss examples of vertical and horizontal markets. Student discussions will be evaluated using a standardized rubric.

Interventions: Describe methods used to support students who fail to master unit Formative and Summative assessments. Interventions may include, but not be limited to:

- Reviews offered through web-based curriculum
- Review of reference materials or tutorials
- Audio-visual supports
- Teacher or peer reviews
- Collaboration with peers and teacher
- Alternative assignments or simulations

- Test/assignment retakes
- Graphic organizers
- Scaffolding/differentiated assignments
- Acceptance of late work with or without penalties
- Modified pacing/requirements for diverse students