

**Randolph Township Schools
Randolph High School
App Development Honors Curriculum**

"Every great developer you know got there by solving problems they were unqualified to solve until they actually did it." - Patrick McKenzie

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Randolph Township Schools
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App Development Honors Curriculum

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Mission Statement

We commit to inspiring and empowering all students in Randolph schools to reach their full potential as unique, responsible and educated members of a global society.

**Affirmative Action Statement
Equality and Equity in Curriculum**

The Randolph Township School district ensures that the district's curriculum and instruction are aligned to the state's standards. The curriculum provides equity in instruction, educational programs and provides all students the opportunity to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

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**EDUCATIONAL GOALS
VALUES IN EDUCATION**

The statements represent the beliefs and values regarding our educational system. Education is the key to self-actualization, which is realized through achievement and self-respect. We believe our entire system must not only represent these values, but also demonstrate them in all that we do as a school system.

We believe:

- The needs of the child come first
- Mutual respect and trust are the cornerstones of a learning community
- The learning community consists of students, educators, parents, administrators, educational support personnel, the community and Board of Education members
- A successful learning community communicates honestly and openly in a non-threatening environment
- Members of our learning community have different needs at different times. There is openness to the challenge of meeting those needs in professional and supportive ways
- Assessment of professionals (i.e., educators, administrators and educational support personnel) is a dynamic process that requires review and revision based on evolving research, practices and experiences
- Development of desired capabilities comes in stages and is achieved through hard work, reflection and ongoing growth

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Course Description

This course is an elective to be taken within the course sequence of the computer science pathways program. Students will have the opportunity to explore the principles behind the development of mobile applications for Android and/or iOS using the Java and Swift programming languages, respectively. During the first semester, students will explore the functionality of the integrated development environments available for working with their particular mobile platform, as well as learning the basic control structures and syntax available within their selected programming language. For the majority of the course, students will develop small applications specific to certain functionality categories, including basic user interfaces, incorporation of digital media, drawing and animation, incorporation of built-in mobile phone sensors, social media integration, and web/Bluetooth connectivity. Lessons will be taught in conjunction with a course-long app development project, culminating with possible submission to the Apple App or Google Play stores and/or developer conferences. In the final weeks of the year, students will have the opportunity to perform independent research into extended areas of relevance, including augmented and virtual reality and eSports.

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Curriculum Pacing Chart

| SUGGESTED TIME ALLOTMENT | UNIT NUMBER | CONTENT - UNIT OF STUDY |
|---------------------------------|--------------------|---------------------------------|
| 2 weeks | I | App Development Software Basics |
| 5 weeks | II | Programming Language Basics |
| 4 weeks | III | User Interfaces |
| 4 weeks | IV | Digital Media |
| 3 weeks | V | Drawing and Animation |
| 4 weeks | VI | Sensors |
| 4 weeks | VII | Social Components |
| 3 weeks | VIII | Data Storage |
| 3 weeks | IX | Connectivity |
| 4 weeks | X | Independent Study |

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Unit I: App Development Software Basics

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| TRANSFER: Evaluate, test, and use app development tools available for mobile devices. | | |
| STANDARDS / GOALS: Computer Science Teachers Association K-12 Computer Science Standards (CSTA): 3A-CS-01 Compare levels of abstraction and interactions between application software, system software, and hardware layers. 3A-CS-03 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. 3A-AP-14 Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables. 3A-AP-17 Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. 3B-AP-16 Demonstrate code reuse by creating programming solutions using libraries and APIs. 3B-AP-20 Use version control systems, integrated development environments (IDEs), and collaborative tools and practices (code documentation) in a group software project. 3B-AP-24 Compare multiple programming languages and discuss how their features make them suitable for solving different types of problems. | ENDURING UNDERSTANDINGS Integrated Development Environments (IDEs) consolidate basic tools needed to write and test software. Mobile applications are composed of a variety of components with their own distinct properties and behaviors. Complicated functions are comprised of simpler coding mechanisms. | ESSENTIAL QUESTIONS • How do IDEs simplify the app development process for a programmer? • How can distinct components with built-in functionality be customized for novel apps? • How do IDEs display, and allow customization of, common app behavior for programmer use? |
| | KNOWLEDGE Students will know: An IDE consolidates the processes needed to write, compile, and execute code. | SKILLS Students will be able to: Install and/or access the MIT App Inventor, Android Studio, and/or XCode IDEs. Characterize tradeoffs in versatility vs. flexibility when selecting an Application Programming Interface (API). Create and execute an app to display text on a device screen. |

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Unit I: App Development Software Basics

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| <p>NJSLS – Technology:</p> <p>8.1.12.C.1 Develop an innovative solution to a real-world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.</p> <p>8.1.12.D.5 Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs.</p> <p>8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.</p> <p>8.2.12.C.4 Explain and identify interdependent systems and their functions.</p> <p>8.2.12.E.2 Analyze the relationships between internal and external computer components.</p> <p>8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).</p> <p>NJSLS – 21st Century Life and Career Skills:</p> <p>9.3.IT-PRG.6 Program a computer application using the appropriate computer language.</p> <p>9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products.</p> | <p>An emulator may be used in place of a physical device to test and experience app functionality.</p> <p>App development IDEs incorporate pallets, where components with built-in functionality may be accessed.</p> <p>“Screens” or “scenes” represent visual layouts of APIs, and themselves do not incorporate or define the functionality of those interfaces.</p> <p>VOCABULARY: Integrated Development Environment (IDE), Application Programming Interface (API), pallet, component, emulator, screen, scene</p> | <p>Select an emulator with which to test applications in accordance with chosen API levels.</p> <p>Connect an applicable physical device to the computer for the purposes of app testing and experience.</p> <p>Explore the different sections of an IDE pallet for characterization of built-in component functionality.</p> <p>Differentiate a screen/scene from the section of an IDE where behavior may be coded.</p> |
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Unit I: App Development Software Basics

ASSESSMENT EVIDENCE: Students will show their learning by:

- Modifying the “default” apps present in their IDE to display alternate text.
- Connecting an emulator or selected physical device to their computer and running a user-created app.

KEY LEARNING EVENTS AND INSTRUCTION:

- Students create their first project in their selected IDE.
- Students identify and describe the common threads among elements in different sections of the IDE pallet.

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| SUGGESTED TIME ALLOTMENT | 2 weeks |
| SUPPLEMENTAL UNIT RESOURCES | CodeAcademy.com – What is an IDE? Mashable.com – A Beginner’s Guide to Integrated Development Environments Stackify.com – Top IDEs: 51 Powerful Dev Environments for Streamlined Development |

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Unit II: Programming Language Basics

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| TRANSFER: Manipulate variables and algorithms for use in programming. | | |
| STANDARDS / GOALS: CSTA: 3B-AP-10 Use and adapt classic algorithms to solve computational problems. 3B-AP-12 Compare and contrast fundamental data structures and their uses. 3B-AP-13 Illustrate the flow of execution of a recursive algorithm. 3B-AP-14 Construct solutions to problems using student-created components, such as procedures, modules and/or objects. 3B-AP-16 Demonstrate code reuse by creating programming solutions using libraries and APIs. NJSLS – Technology: 8.1.12.C.1 Develop an innovative solution to a real-world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community. 8.2.12.C.4 Explain and identify interdependent systems and their functions. | ENDURING UNDERSTANDINGS Programs store data in variables and algorithms are used to manipulate that data. The manner in which computer programs process data can be customized by using selection and repetition structures. Advanced applications involve several components interacting with one another, accounting for their inherent attributes and behaviors. | ESSENTIAL QUESTIONS • Why are variables advantageous and, at times, required for data manipulation within an app? • How are computer programs designed to make decisions based on user input and interaction? • How can computer programs simplify repetitive processes? • How can components in one portion of an application communicate and further interact with other components? |
| | KNOWLEDGE Students will know: | SKILLS Students be able to: |
| | Variables are locations in memory where data is stored. | Create descriptive variable names based on intended functionality or type of stored data. Differentiate situations where the cost to store additional data is outweighed by a variable's utility. |

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Unit II: Programming Language Basics

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| <p>8.2.12.E.2 Analyze the relationships between internal and external computer components.</p> <p>8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).</p> <p>NJSLS – 21st Century Life and Career Skills:</p> <p>9.3.IT-PRG.6 Program a computer application using the appropriate computer language.</p> <p>9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products.</p> | <p>Algorithms are sequences of steps in a well-defined order that have an eventual end.</p> <p>Arithmetic expressions are evaluated according to their precedence rules and the associativity of the operators used in an expression.</p> <p>Many tasks require user-input to the computer, which may be solicited in a variety of ways.</p> <p>Programs make decisions based on the results of Boolean expressions.</p> | <p>Classify processes as algorithms based on whether they stop, have a sequence of well-defined steps, and are required to be executed in a set order.</p> <p>Evaluate the output of arithmetic expressions based on precedence and associativity within a programming language.</p> <p>Develop a simple temperature-conversion application incorporating arithmetic operations.</p> <p>Discuss different types of user-input to an app, including text, touch, and alternatives.</p> <p>Write programming code that utilizes the values of “true” and “false” logical expressions.</p> <p>Write programming code that incorporates the if, else-if, else, and nested if selection statements.</p> |
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Unit II: Programming Language Basics

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| | <p>Programs can solve problems that require repeated operations using repetition structures.</p> <p>User-defined methods are used to perform customized tasks within a program.</p> <p>Built-in language components incorporate pre-defined methods and attributes.</p> <p>VOCABULARY: variable, algorithm, precedence, associativity, Boolean, conditional statement, nesting, loop, sentinel, method, function, procedure, return, parameter</p> | <p>Write programming code that utilizes repetition structures, including while, for, and nested loops, as well as break, continue, and sentinel-based statements.</p> <p>Write programming code for user-defined methods, including functions (that return a value), and procedures (that do not return a value).</p> <p>Write programming code that declares and calls methods.</p> <p>Access and modify the attributes of built-in application components.</p> <p>Write programming code that incorporates built-in component methods and, when applicable, pass those functions the correct parameters.</p> |
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Unit II: Programming Language Basics

ASSESSMENT EVIDENCE: Students will show their learning by:

- Creating a simple temperature-conversion app.
- Developing a guess-the-number game app.

KEY LEARNING EVENTS AND INSTRUCTION:

- Students write an app to make clothing recommendations based on weather conditions.

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| SUGGESTED TIME ALLOTMENT | 5 weeks |
| SUPPLEMENTAL UNIT RESOURCES | Lynda.com – Programming Foundations: Fundamental Course ComputerScience.org – Guide to Programming Languages |

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Unit III: User Interfaces

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| TRANSFER: Design a user interface as the link between the physical and digital worlds. | | |
| STANDARDS / GOALS: CSTA: 3A-AP-17 Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. 3A-AP-21 Evaluate and refine computational artifacts to make them more usable and accessible. 3A-AP-22 Design and develop computational artifacts working in team roles using collaborative tools. 3B-AP-15 Analyze a large-scale computational problem and identify generalizable patterns that can be applied to a solution. NJSLS – Technology: 8.1.12.C.1 Develop an innovative solution to a real-world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community. 8.2.12.C.4 Explain and identify interdependent systems and their functions. 8.2.12.E.2 Analyze the relationships between internal and external computer components. 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). | ENDURING UNDERSTANDINGS User interfaces serve as the means by which an app and its user interact. The input, manipulation, and output of text is very important in computer programming for interfacing with the user. Only a portion of the processes undergone within an app happen visibly to the user. KNOWLEDGE Students will know: Many user interface components incorporate textual properties for communication with the app user. Several user interface components exist for accepting and customizing user input. | ESSENTIAL QUESTIONS • How can an app be designed to give a reasonable response regardless of how a user interacts with it? • Why is it essential that programs read and write text? • What types of background processes within an app happen out of view or without confirmation from the user? SKILLS Students will be able to: Incorporate components to display text output to the app screen. Manipulate the text of application components under certain conditions. Use event handlers to signal user responses, and thus select sections of code for execution. Compare text-based user entries with expected input. |

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Unit III: User Interfaces

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| <p>NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language. 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products.</p> | <p>User interfaces may incorporate several non-visible components that signal the user under programmable conditions.</p> <p>Separate screens, or views, can be incorporated into an app with distinct user interfaces.</p> <p>VOCABULARY: user interface, program flow, screen/view, escape sequence, event handler, non-visible component</p> | <p>Differentiate between input components based on intended use of user selections.</p> <p>Design conditional statements to allow applications to respond reasonably to varied user input.</p> <p>Construct user interface elements that display under distinct, non-initialization conditions.</p> <p>Create separate app screens for organization of different application stages.</p> |
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Unit III: User Interfaces

ASSESSMENT EVIDENCE: Students will show their learning by:

- Creating a survey app on a topic of their choosing.
- Creating a grade calculation app.

KEY LEARNING EVENTS AND INSTRUCTION:

- Students will develop a simple trivia app on the unit's concepts.

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| SUGGESTED TIME ALLOTMENT | 4 weeks |
| SUPPLEMENTAL UNIT RESOURCES | Lynda.com – Android Development Essential Training: The User Interface Course Developer.Android.com – User Interface & Navigation |

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Unit IV: Digital Media

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| TRANSFER: Evaluate the strengths and limitations of digital media. | | |
| STANDARDS / GOALS: CSTA: 2-IC-21 Discuss issues of bias and accessibility in the design of existing technologies 2-AP-16 Incorporate existing code, media, and libraries into original programs, and give attribution. 3A-DA-09 Translate between different bit representations of real-world phenomena, such as characters, numbers, and images. 3A-DA-11 Create interactive data visualizations using software tools to help others better understand real-world phenomena. NJSLS – Technology: 8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements). NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language. | ENDURING UNDERSTANDINGS Visual media exists in several forms that can be utilized in apps to both display and capture information. Sound is a critical tool in app creation for both enhancing the app experience and for user feedback. The ability to utilize speech-to-text and text-to-speech can enhance an app in many ways. Apps are used worldwide; tools exist to translate app content into multiple human languages. | ESSENTIAL QUESTIONS • How can visual media be used within an app? • Why is it important to incorporate sound into an app? • When is it appropriate to use speech-to-text and text-to-speech in app development? • Can automated language conversion tool meet the needs of users? |
| KNOWLEDGE Students will know: | | SKILLS Students will be able to: |
| Visual media consists of video and still images. Apps can play sound via the device's speaker. | | Display both video and images within an app. Create an app that allows the user to take photos and videos. Incorporate the use of sound as a feedback mechanism within an app. Develop apps capable of playing sound files. |

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Unit IV: Digital Media

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| 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products. | <p>Like other sources of input, sound can be captured and stored using a device's microphone.</p> <p>Text-to-speech conversion can enhance the usefulness of apps.</p> <p>Translators may help users understand the language in which an app was originally developed.</p> <p>VOCABULARY: video recorder, camera, image picker, player, sound player, sound recorder, speech recognizer, text to speech, Yandex translate</p> | <p>Create an app that utilizes a device's microphone to record sound.</p> <p>Design an app that will speak text content as well as display it.</p> <p>Build into an app the capacity to convert spoken word into displayed text.</p> <p>Use tools that translate content into multiple human languages.</p> <p>Assess the limitations of translators.</p> |
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Unit IV: Digital Media

ASSESSMENT EVIDENCE: Students will show their learning by:

- Develop an app that utilizes video, photos, or both.
- Create an app that will record and play sound.
- Incorporate into one of their existing apps either speech-to-text, or speech recognition.

KEY LEARNING EVENTS AND INSTRUCTION:

- Students will research different tools for speech-to-text, and speech recognition.

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| SUGGESTED TIME ALLOTMENT | 4 Weeks |
| SUPPLEMENTAL UNIT RESOURCES | Lynda.com – Learning Microsoft Cognitive Services for Developers Course Lynda.com – Android Development Essential Training: Create Your First App |

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Unit V: Drawing and Animation

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| TRANSFER: Designing for touch input by the user is essential for app development. | | |
| STANDARDS / GOALS: CSTA: 3A-AP-18 Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs. NJSLS – Technology: 8.2.12.C.4 Explain and identify interdependent systems and their functions. 8.2.12.E.2 Analyze the relationships between internal and external computer components. NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language. 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products. | ENDURING UNDERSTANDINGS Physical, real-time interaction with an app allows users to create shapes on a screen. A base layer, two-dimensional area can be adjusted to scale from a small area to the limits of the screen. Existing images may be utilized in apps to aid touch interactions with the user. KNOWLEDGE Students will know: A ball is the most common indicator used for user input location. | ESSENTIAL QUESTIONS • How can a touch screen be utilized to allow for free drawing of shapes? • Why is an understanding of coordinate systems necessary for interactive app development? • When is it appropriate to use an image for user interaction? SKILLS Students will be able to: Program a “ball” to follow a user’s finger movement. Utilize a mirroring effect as a means of user input and draw. Ensure that the ball is constrained by x number of pixels from each edge of the screen. Develop an app where the ball will encounter a restricted area on the screen such as an image or text block. |

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Unit V: Drawing and Animation

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| | <p>A canvas is an area of varying size and can be defined in terms of positive-x and positive-y coordinates.</p> <p>A previously created image, known as a <i>sprite</i>, can be utilized for both user movement and for animation purposes.</p> | <p>Define a canvas area in an app that is $\frac{1}{4}$, $\frac{1}{2}$, and full screen.</p> <p>Utilize a background color to fill the canvas area.</p> <p>Identify background images that will scale to fill the canvas by using width and height dimensions.</p> <p>Replace a ball in a previous app with an image sprite to aid finger location to draw on a screen.</p> <p>Design an app that will animate an image sprite to randomly move across the screen.</p> <p>Create an app that will animate an image sprite based on user defined parameters.</p> <p>Design an app that has an image sprite interact with a user-controlled image sprite.</p> |
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Unit V: Drawing and Animation

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| | VOCABULARY: ball, pixel, canvas, interval, coordinate plane, Image Sprite, width, height, Paint Color, interval, properties, degrees, collisions | |
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ASSESSMENT EVIDENCE: Students will show their learning by:

- Designing an app that allows the user to free draw on some area of the screen with different colors.
- Incorporating into an app a defined space that allows users to add a signature.

KEY LEARNING EVENTS AND INSTRUCTION:

- Research the size of interactive screens and screen size limitations.
- Identify how color pickers defines color and utilize that information to create colored backgrounds.
- Animate ImageSprite(s) for both predefined movement as well as reactive movement.

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| SUGGESTED TIME ALLOTMENT | 3 Weeks |
| SUPPLEMENTAL UNIT RESOURCES | Lynda.com – Interactive Animations with CSS and JavaScript Course |

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Unit VI: Sensors

TRANSFER: Analyze a current technology and the resources used to identify the trade-offs in terms of availability, cost, desirability and waste.

| STANDARDS / GOALS: CSTA: 3A-CS-01 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects. 3A-CS-02 Compare levels of abstraction and interactions between application software, system software, and hardware layers. 3A-CS-03 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. 3A-NI-06 Recommend security measures to address various scenarios based on factors such as efficiency, feasibility, and ethical impacts. NJSLS – Technology: 8.2.12.C.4 Explain and identify interdependent systems and their functions. 8.2.12.E.2 Analyze the relationships between internal and external computer components. NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language. 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products. | ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
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| | KNOWLEDGE Students will know: | SKILLS Students will be able to: |
| | Current electronic devices can use a host of internal and external sensors. | <ul style="list-style-type: none"> • What are the types and capabilities of sensors that can be used for electronic devices? |
| | Non-visible components of a device can measure and sense various different parameters. | <ul style="list-style-type: none"> • What are the non-visible capabilities of a device that can be utilized to aid app functionality? |
| | External components can be added to a device to provide additional capabilities. | <ul style="list-style-type: none"> • How can devices and apps be enhanced by adding external components? |
| | KNOWLEDGE Students will know: | SKILLS Students will be able to: |
| | Non-visible components measure various parameters. | Program an app to record information and possibly use data from accelerometer and orientation sensors. |
| | Specialized components enable transfer of information in and out of a device. | Pass data from the following to be used in an app: clock, location sensor, gyroscope sensor, and proximity sensor. |
| | | Incorporate into an app the ability to scan a barcode as well as use the Near Field Sensor to transfer information out of a device. |

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Unit VI: Sensors

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| | <p>External components exist that can be added to a device to provide additional, specialized capabilities.</p> <p>VOCABULARY: accelerometer, barcode, gyroscope, near field, pedometer, proximity sensors</p> | Research an external device and program it to be utilized as part of an app. |
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ASSESSMENT EVIDENCE: Students will show their learning by:

- Creating an app that utilizes at least two to three non-visual components of a device.
- Incorporating at least one external component in to a new or existing app.

KEY LEARNING EVENTS AND INSTRUCTION:

- Research the capabilities of various internal and external components.
- Identify all the non-visual components and capabilities of a particular device.

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| SUGGESTED TIME ALLOTMENT | 4 Weeks |
| SUPPLEMENTAL UNIT RESOURCES | TurboFuture.com – 10 Free Accelerometer Apps for iPhone and iPod Touch Lynda.com – Programming the Internet of Things with iOS Course Lynda.com – Android Development: Building Battery-Conscious Apps |

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Unit VII: Social Components

TRANSFER: Transfer information in a meaningful form from within an app to within another app, to another device, and as a presentation via social media.

| STANDARDS / GOALS: CSTA: 3A-IC-24 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices 3A-IC-27 Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. 3A-IC-29 Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users. 3B-DA-05 Use data analysis tools and techniques to identify patterns in data representing complex systems. NJSLS – Technology: 8.2.12.C.4 Explain and identify interdependent systems and their functions. 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language. 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products. | ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
|--|--|--|
| | KNOWLEDGE Students will know: | SKILLS Students will be able to: |
| | Elements of a phone's contacts may be used within apps for enhanced functionality. | <ul style="list-style-type: none"> • What reasons are there for accessing phone contacts from within distinct apps? |
| | Files and messages may be shared among different apps installed on a phone. | <ul style="list-style-type: none"> • In what cases should apps communicate with one another? |
| | Data stored within an app may be arranged and exported for sharing purposes to services outside the app. | <ul style="list-style-type: none"> • Why might app developers want to include social sharing functionality within their apps? |
| | The name, phone number, email, and picture attributes of a phone's contacts may be accessed from within a created app. | Program an app to access a list of all contact email addresses on a phone. |
| | Files and messages shared among apps may come from app components or internal phone storage. | <p>Communicate information about the status of a created app to a second device.</p> <p>Generate information within one app that is then communicated to, and displayed within, a distinctly separate app.</p> |

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Unit VII: Social Components

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| | <p>A device's camera can be used to capture and edit images.</p> <p>Inclusion of social components within an app can result in increased exposure and marketing for the app.</p> <p>VOCABULARY: social component, file path, contact, picker component, consumer key, consumer secret</p> | <p>Design an app to take and store photographs.</p> <p>Create an app that can share captured photographs for editing purposes in a separate app.</p> <p>Share some functionality of a created app via social media.</p> |
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ASSESSMENT EVIDENCE: Students will show their learning by:

- Promoting/introducing their app through a selected social media outlet.
- Communicating with a friend or classmate through an app they have designed.

KEY LEARNING EVENTS AND INSTRUCTION:

- Designing a succinct set of information to be transmitted externally from within a created app.
- Taking a photograph and exporting it to an image-editing app.
- Incorporating twitter functionality into an app.

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| SUGGESTED TIME ALLOTMENT | 4 weeks |
| SUPPLEMENTAL UNIT RESOURCES | Lynda.com – Ionic 4.0 Essential Training Course Lynda.com – Mobile Testing with Appium Course |

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Unit VIII: Data Storage

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| TRANSFER: Create digital artifacts by collecting, manipulating, and presenting data stored within a mobile application. | | |
| STANDARDS / GOALS: CSTA: 3A-CS-01 Compare levels of abstraction and interactions between application software, system software, and hardware layers. 3A-DA-09 Translate between different bit representations of real-world phenomena, such as characters, numbers, and images. 3A-DA-10 Evaluate the tradeoffs in how data elements are organized and where data is stored. 3A-AP-15 Justify the selection of specific control structures when tradeoffs involve implementation, readability, and program performance, and explain the benefits and drawbacks of choices made. 3B-CS-01 Categorize the roles of operating system software. NJSLS – Technology: 8.2.12.C.4 Explain and identify interdependent systems and their functions. 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language. 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products. | ENDURING UNDERSTANDINGS Files may be generated and modified on mobile devices. Data may remain or be lost when an app is closed depending on how it is stored. | ESSENTIAL QUESTIONS • What uses could apps have for generating text-based files? • What is persistent data and when should persistent data be used over conventional variable storage means? |
| | KNOWLEDGE Students will know: Text may be written to files with information regarding current app status. Persistent data, in contrast to more conventional variables, is retained when an app is closed. | SKILLS Students will be able to: Incorporate app components to read and write text from a file. Develop a mobile game that logs all successfully completed game scores in a text file. Discuss the tradeoffs between using persistent data to retain information, and the additional storage requirements. Design a mobile game that stores a high score as persistent data. |

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Unit VIII: Data Storage

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| | VOCABULARY: persistent data, data tags, file reading/writing, append | |
| ASSESSMENT EVIDENCE: Students will show their learning by: <ul style="list-style-type: none">• Generating a file within a gaming app of all completed game scores.• Storing and displaying a “high score” indicator within a game and using persistent data to ensure it remains when the app is closed. | | |
| KEY LEARNING EVENTS AND INSTRUCTION: | <ul style="list-style-type: none">• Classifying stored information based on whether or not it is required to persist.• Differentiating when a file should be appended rather than overwritten. | |
| SUGGESTED TIME ALLOTMENT | 3 weeks | SUPPLEMENTAL UNIT RESOURCES |

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Unit IX: Connectivity

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| TRANSFER: Define and utilize the multiple antenna within a mobile device for connections to outside the device. | | |
| STANDARDS / GOALS: CSTA: 3A-CS-01 Compare levels of abstraction and interactions between application software, system software, and hardware layers. 3A-CS-03 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. 3A-DA-12 Create computational models that represent the relationships among different elements of data collected from a phenomenon or process. NJSLS – Technology: 8.2.12.C.4 Explain and identify interdependent systems and their functions. 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games). NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language. 9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products. | ENDURING UNDERSTANDINGS It is often necessary to have an app that can connect to external devices and equipment without using a cellular network. Bluetooth technology relies on industry-agreed-upon protocols that allow for short distance connection and information transfer. Several different Wi-Fi standards have been created and utilized in mobile devices for added functionality and cost savings. Utilizing the Web to connect apps with information and other apps provides users with a familiar feel that aids use. | ESSENTIAL QUESTIONS <ul style="list-style-type: none"> • What types of connections can be made to nearby devices? <ul style="list-style-type: none"> • How is Bluetooth designed and controlled? <ul style="list-style-type: none"> • How can Wi-Fi be leveraged to aid users and apps? <ul style="list-style-type: none"> • When is it most useful to utilize web protocols in and among apps? |
| | KNOWLEDGE Students will know: Connecting to other devices can be accomplished through several different means. | SKILLS Students will be able to: Compare the features of Bluetooth and Wi-Fi connectivity. Incorporate use of both Bluetooth and Wi-Fi antennas within a device. |

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Unit IX: Connectivity

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| | <p>Data can be transferred to and from a device using Bluetooth.</p> <p>Switching between cellular and Wi-Fi networks is a critical cost-saving feature that should be utilized whenever feasible.</p> <p>Wi-Fi networks have a variety of speeds and capabilities.</p> <p>Existing Web commands and protocols can be utilized to speed app development and roll-out.</p> <p>VOCABULARY: cellular, Bluetooth, Wi-Fi, Web</p> | <p>Program an app to play sounds to an external player.</p> <p>Program an app to print or project information to an external device using Bluetooth protocols.</p> <p>Utilize a device's ability to seamlessly switch between cellular and Wi-Fi networks for increased functionality.</p> <p>Provide users a visual or auditory warning that they are switching to a cellular-based connection and may incur financial charges if they continue to use an app.</p> <p>Program an app to identify a Wi-Fi network's speed and bandwidth capabilities and adjust functionality if needed.</p> <p>Create an app that uses web-based protocols for cross-platform functionality.</p> |
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Unit IX: Connectivity

ASSESSMENT EVIDENCE: Students will show their learning by:

- Playing audio or video to an external Bluetooth device.
- Printing information through both Wi-Fi and Bluetooth connections.

KEY LEARNING EVENTS AND INSTRUCTION:

- Researching Bluetooth and Wi-Fi protocol standards and communicating their appropriate use.
- Identify other connectivity technology that might be on the horizon.

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| SUGGESTED TIME ALLOTMENT | 3 Weeks |
| SUPPLEMENTAL UNIT RESOURCES | Lynda.com – Internet of Things with Python and Raspberry Pi Course Lynda.com – Angular: Progressive Web Apps Course |

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Unit X: Independent Study and Final Projects

| TRANSFER: Develop a novel application of the student's design. | | |
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| STANDARDS / GOALS: CSTA: | ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
| 3B-CS-01 Categorize the roles of operating system software. 3B-AP-08 Describe how artificial intelligence drives many software and physical systems. 3B-AP-16 Demonstrate code reuse by creating programming solutions using libraries and APIs. 3B-AP-17 Plan and develop programs for broad audiences using a software life cycle process. 3B-AP-19 Develop programs for multiple computing platforms. 3B-AP-20 Use version control systems, integrated development environments (IDEs), and collaborative tools and practices (code documentation) in a group software project. 3B-AP-22 Modify an existing program to add additional functionality and discuss intended and unintended implications (e.g., breaking other functionality). 3B-AP-24 Compare multiple programming languages and discuss how their features make them suitable for solving different types of problems. 3B-IC-27 Predict how computational innovations that have revolutionized aspects of our culture might evolve. | <p>Novel applications often result from seemingly-minor tweaks to existing concepts.</p> <p>Applications often incorporate virtual or augmented-reality elements to enhance the user experience.</p> <p>Google and Apple provide resources for developers to distribute applications through their respective app stores.</p> <p>eSports has grown into a billion-dollar business in the last few years and is still on an upward trend.</p> | <ul style="list-style-type: none"> • What elements of existing applications would you change if given the opportunity? • What challenges exist in the development of virtual environments? • How does digital enhancement of the real world enhance the user experience? • What avenues exist for distributing and/or marketing innovative applications? • How can programming skills be leveraged but in terms of game development as well as support of the competitions and tournaments? |

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Unit X: Independent Study and Final Projects

| NJSLS – Technology: 8.2.12.C.4 Explain and identify interdependent systems and their functions. | KNOWLEDGE Students will know: | SKILLS Students will be able to: |
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| <p>8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).</p> <p>NJSLS – 21st Century Life and Career Skills: 9.3.IT-PRG.6 Program a computer application using the appropriate computer language.</p> <p>9.3.IT-PRG.7 Demonstrate software testing procedures to ensure quality products.</p> | <p>Innovative applications can result from minor, yet significant differences to existing concepts.</p> <p>Attribution must be included for open-source code used in new contexts.</p> <p>Virtual reality (VR) consists of an experience taking place within a simulation, while Augmented Reality (AR) consists of modification of the surrounding environment with computer-generated components.</p> <p>Apple and Google offer resources for prospective developers to distribute their novel apps.</p> | <p>Model an application after existing software, with select desired modifications.</p> <p>Incorporate existing code/algorithms for novel purposes.</p> <p>Research virtual and/or augmented reality technology for inclusion in a novel app.</p> <p>Explore developer career opportunities and preparation programs.</p> |
| | | <p>Research the process of becoming an Apple/Android Developer.</p> <p>Identify the opportunities offered to an Apple/Android Developer for application distribution.</p> |

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Unit X: Independent Study and Final Projects

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| | <p>eSports requires new game development as well as back-end tracking of competitor statistics and real-time tracking of live, online competitions and tournaments.</p> <p>VOCABULARY: virtual reality (VR), augmented reality (AR), eSports</p> | <p>Research current trends in game development.</p> <p>Write an app to track competitor rankings and past statistics.</p> <p>Analyze how individual competitors utilize aspects of a game to achieve success.</p> |
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ASSESSMENT EVIDENCE: Students will show their learning by:

- Presenting on a selected extension topic on which they have performed research.
- Developing a novel application.

KEY LEARNING EVENTS AND INSTRUCTION:

- Students will walk through and decide whether to pursue application to developer conferences and/or Google Play/Apple App Store distribution channels.

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| SUGGESTED TIME ALLOTMENT | 4 weeks |
| SUPPLEMENTAL UNIT RESOURCES | Lynda.com – Unity: AR Visualization 01 Basic Concepts Course Lynda.com – Unity and Vuforia: Trying on Watches in Augmented Reality Course Lynda.com – Introduction to AR with Unreal and Xcode for Developers Course |

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APPENDIX A

App Development IDEs:

MIT App Inventor – <https://appinventor.mit.edu/explore/>

Android Studio – <https://developer.android.com/studio>

XCode – <https://apps.apple.com/us/app/xcode/id497799835?mt=12>

Java – <https://www.java.com/en/>

Developer Resources:

Android – <https://developer.android.com/>

Apple – <https://developer.apple.com/>

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APPENDIX B

Opportunities exist for interdisciplinary units with courses such as Physics, Business, Technology, Robotics, or other science and mathematics courses and electives.

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APPENDIX C

App Development is a choice course in the Computer Science and Programming Pathway, typically following AP Computer Science A. The complete sequence of courses, with both required and choice selections, is both below and available at <https://www.rtnj.org/domain/1185>.

| Course | Credits | Recommended Year |
|---|----------------|-------------------------|
| AP Computer Science Principles (required) | 5 | 9th |
| Programming with Python & Java Honors (required) | 5 | 10th or 11th |
| AP Computer Science A (required) | 5 | 11th, or 12th |
| Robotics (choice) | 5 | 10th, 11th or 12th |
| App Development Honors (choice) | 5 | 10th, 11th, or 12th |
| Total Credits Needed for Pathways Distinction: 20 | | |