INTERNET OF THINGS AND SMART HOME

PURPOSE
To evaluate each contestant’s preparation for employment and to recognize outstanding students for excellence and professionalism in the field of home technology integration.

First, download and review the General Regulations at: http://updates.skillsusa.org.

ELIGIBILITY
Open to active SkillsUSA members enrolled in programs with computer networking, telecommunications cabling, home theater installation, electronics applications and/or electronics technology as the occupational objectives.

CLOTHING REQUIREMENT
Class E: Contest specific — Business Casual
- Official SkillsUSA white polo shirt
- Black dress slacks (accompanied by black dress socks or black or skin-tone seamless hose) or black dress skirt (knee-length, accompanied by black or skin-tone seamless hose)

These regulations refer to clothing items that are pictured and described at: www.skillsusastore.org. If you have questions about clothing or other logo items, call 800-401-1560 or 703-956-3723.

Note: Contestants must wear their official contest clothing to the contest orientation meeting.

EQUIPMENT AND MATERIALS
1. Supplied by the technical committee:
   a. All necessary information for the judges and technical committee
2. Supplied by the contestant:
   a. Phillips & Flat Screwdrivers (#1 & #2)
   b. Precision (small) screwdriver set
   c. Drill Motor / Wood Drill Bit
   d. Multimeter
   e. Cable tester (Network / Coax)
   f. Laptop computer
   g. Measuring Tape (18’ +)
   h. RJ11/RJ45 crimpers
   i. Coax compression tool (BNC, F&RCA)
   j. Coax strippers
   k. High gauge wire strippers (20-25 AWG)
   l. Diagonal cutters (small)
   m. Needle-nose pliers (small)
   n. 12” Level
   o. Drywall pliers (small)
   p. Zip Ties
   q. Fish Tape / Glow Rods
   r. Stud Finder
   s. Safety Glasses

All competitors must create a one-page résumé and submit a hard copy to the technical committee chair at orientation. Failure to do so will result in a 10-point penalty.

Note: Your contest may also require a hard copy of your résumé as part of the actual contest. Check the Contest Guidelines and/or the updates page on the SkillsUSA website at http://updates.skillsusa.org.

SCOPE OF THE CONTEST
The contest is defined by industry standards as set by the current industry technical committee. The contest will be divided into two parts: general knowledge test and a skilled performance.

Knowledge Performance
The contest will include a written exam assessing general knowledge of residential electronics installation and maintenance including smart house technologies. Written portions may also exist during the skills portion of the contest.

Skill Performance
The skills performance event assesses the ability of the contestant to install, maintain and troubleshoot a variety of devices encountered in a residential setting. A practical problem(s) will be given to evaluate the contestant’s ability to function on a basic entry level.
Contest Guidelines

1. The contests will have several hands-on skill scenarios that demonstrate one’s ability to perform jobs or skills selected from the list of competencies as determined by the SkillsUSA Championships technical committee. Scenarios may include any or several of the following:
   a. Diagnose and service personal residential electronic systems
   b. Diagnose and resolve operational and startup problems
   c. Locate and identify defective modules within residential electronic equipment
   d. Demonstrate ability to use diagnostic utility software and equipment
   e. Install, configure and demonstrate proper operations of devices within the residence

2. The hardware problems will relate to any residential networked systems.

3. Contestants will be awarded points based on their ability to solve the provided problems within the allotted time. Partial points can be awarded for solving partial problems.

4. Competence in the provided tasks is considered when a contestant acquires 75 percent of the available points.

5. Contestants will be provided, as required, manufacturers’ documentation of the devices to be installed and/or serviced.

6. Winners will be determined on the basis of their total scores (regardless of result on certification test), which includes diagnostic procedures, speed, standard industry procedures, accuracy of adjustments and correct component replacements.

7. Specific penalties will be assessed for the failure to properly use anti-static straps at all times when in contact with the computers and for the introduction of computer viruses into the contest computers. Penalties will be assessed at one point per occurrence, and notice of infractions will be communicated to the contestant when they occur.

Standards and Competencies

Networking

RSIM 1.0 — Identify basic networking protocols and their uses and know when/how to apply them

RSIM 2.0 — Recognize and implement methods of network security

RSIM 3.0 — Configure setup and maintain a residential LAN (Local Area Network)

RSIM 4.0 — Configure setup and maintain a secure wireless network

RSIM 5.0 — Identify and define network cabling characteristics and performance
Internet of Things and Smart Home, 2020 • 3

5.2 Cable length limitations
5.3 Protocols
  5.3.1 10BaseT
  5.3.2 100BaseT
  5.3.3 1000BaseT
5.4 Shielded (STP) vs. unshielded (UTP)
5.5 Plenum vs. non-plenum
5.6 Importance of conductor colors

Audio/Video
RSIM 6.0 — Implement, maintain and troubleshoot multi-room audio systems. Identify common interference sources
6.1 Control devices
  6.1.1 Keypads
  6.1.2 Rotary volume controls
  6.1.3 Sliders
  6.1.4 Push button controls
  6.1.5 Touch screen
  6.1.6 Wireless keypads
  6.1.7 Handheld devices
6.2 Differentiate and define single source, multi-source and local source.
  6.2.1 Analog audio system
  6.2.2 Analog CAT5 audio system
  6.2.3 Digital CAT5 audio system
6.3 Proper cable use
  6.3.1 Line level vs. speaker level
6.4 Amplification
  6.4.1 Ohm's Law (e.g., impedance matched or non-impedance matched)
  6.4.2 Watts vs. dB
  6.4.3 Local amplification
  6.4.4 Centralized amplification
6.5 Speaker types
  6.5.1 In wall
  6.5.2 Surface mounted
  6.5.3 Ceiling mounted
  6.5.4 Freestanding
  6.5.5 Fixed
  6.5.6 Animated
6.6 Speaker specifications
  6.6.1 Frequency response
  6.6.2 Efficiency
  6.6.3 Power handling

RSIM 7.0 — Install, configure and maintain a residential home theater system
7.1 Audio components
  7.1.1 Define basics of acoustics (e.g., sound reflection, speaker placement, sound cancellation, sound balance)
  7.1.2 Audio/Video components setup and integration (e.g., digital signal cables and lengths, legacy devices)
  7.1.3 Multichannel surround (e.g., SACD, DVDA, DTS, DTSES, DDEX, DD, etc.) (e.g., crossovers and speaker setup)
7.2 Video components
  7.2.1 Display types (e.g., plasma, DLP, LCD, LCOS, CRT, rear projection, front projection, direct view)
  7.2.2 High-definition resolutions options (e.g., 720p, 1080i, 1080p, etc.)
  7.2.3 Tuner types (e.g., NTSC, PAL, ATSC, QAM, cable card, VSB, NDVBT, DVBS)
  7.2.4 Video processing (e.g., scalers, processors, up-conversion)
  7.2.5 Aspect ratios
  7.2.6 Video setup (calibration e.g., color balance, contrast, brightness, etc.)
  7.2.7 Digital video cable and connector types (e.g., DVI and HDMI — compatibility and interoperability issues)
7.3 Use MRAV (Multi-Room Audio/Video) standards if/when applicable

RSIM 8.0 — Assess, install and configure content management systems and describe their applications in a residential environment
8.1 Describe typical applications and physical connections of sources
  8.1.1 Media servers
  8.1.2 Media PC
  8.1.3 MP3 players
  8.1.4 DVD players
  8.1.5 Satellite
  8.1.6 Cable
  8.1.7 DVR
  8.1.8 Gaming systems
  8.1.9 Satellite radio
  8.1.10 Legacy devices
  8.1.11 Streaming media
8.2 Summarize types of media storage, methods to transfer and backup data
  8.2.1 Memory cards
8.2.2 NAS devices (Network Attached Devices)
8.2.3 Remote storage
8.2.4 Local storage
8.2.5 Frequency of backup
8.3 Other connection considerations
8.3.1 Digital rights management

RSIM 9.0 — Implement, maintain and troubleshoot multi-room video systems.
9.1 Define signal types and their applications
9.1.1 Digital distribution (e.g., analog to IP converters, IP to analog converters, wireless distribution, IEEE 1394)
9.1.2 RF distribution characteristics. Identify and troubleshoot noise and interference. (e.g., splitters and taps, active and passive, attenuators, bidirectional, modulation and filtration, amplification, IR over COAX)
9.1.3 Analog Distribution (e.g., Composite, Component, and SVideo, Balun.)
9.2 Identify cable types and their applications
9.2.1 COAX (e.g., RG-59, RG-6, RG-6 QS, DV, Serial data, CCS, BC)
9.2.2 CAT5/5e/6
9.3 Termination (e.g., RCA, BNC, and F)
9.4 Satellite
9.4.1 Multi-switches
9.4.2 Diplexer
9.4.3 LNB (Low Noise Block Down Converter)

Telephony/VoIP
RSIM 10.0 — Differentiate and describe POTS vs. VoIP delivery. Identify and troubleshoot common issues
10.1 VoIP
10.1.1 Compatibility issues
10.1.2 Whole house distribution of VoIP
10.1.3 Performance and Quality of Service (QoS)
10.2 POTS
10.2.1 Cross talk
10.2.2 Radio interference
10.2.3 Dead ports
10.2.4 REN (Ringer Equivalence Number)

RSIM 11.0 — Describe and define fundamentals of telephone systems.
11.1 Multi-line
11.2 Paging
11.3 Intercom
11.4 Voice messaging/Unified messaging
11.5 Door entry/Gate entry
11.6 PBX
11.7 Key systems
11.8 Telecommunication services (e.g., caller ID, voice mail, rollover)

Security and Surveillance Systems
RSIM 12.0 — Maintain, configure and troubleshoot basic security systems and applications
12.1 Define monitored and notification methods
12.1.1 Phone line
12.1.2 Cellphone
12.1.3 Radio frequency
12.1.4 IP based

RSIM 13.0 — Describe basic security terminology and apply installation procedures and methodologies
13.1 Installation and configuration of security panel
13.1.1 Zone types
13.1.2 Delays
13.1.3 Battery backup and power supply requirements
13.2 Monitoring formats
13.2.1 SIA and Contact ID
13.2.2 4/2 and 3/1
13.3 Define types of peripherals and accessories
13.3.1 Motion sensors
13.3.2 Glass-break detectors
13.3.3 Magnetic contacts
13.3.4 Smoke fire (e.g., smoke detection, heat detection)
13.3.5 Environmental sensors (e.g., carbon monoxide, gas, water, temperature)
13.3.6 Vehicle detection
13.3.7 Photoelectric beam devices
13.3.8 Microwave beam devices
13.3.9 Pressure sensors
13.3.10 Sirens, strobes
13.3.11 Security keypads
13.3.12 Keyfobs
13.3.13 Panic buttons
13.4 Describe security infrastructure types
13.4.1 Wired, 22/4- standard power devices, 22/2- Magnetic contacts, 2 and 4 conductor fire wire (e.g., keypads, sounders, power supplies, smoke and fire detectors), Power supervision relays, Polarity reversal relays, Line seizure, End of line resistors)

13.4.2 Wireless

13.5 Identify access control devices and protocols
13.5.1 Devices (e.g., keypads, card readers, biometric readers, proximity readers, door strikes, electronic deadbolts, magnetic locks)

13.5.2 Protocols (e.g., Weigand)

**RSIM 14.0 — Identify, configure, install, maintain and troubleshoot security and surveillance cameras**

14.1 Camera types
14.1.1 IP
14.1.2 Analog
14.1.3 Hybrid

14.2 Camera specifications
14.2.1 Lens type
14.2.2 Lux rating
14.2.3 Resolution
14.2.4 B&W vs. color
14.2.5 IR illumination
14.2.6 Power consumption

14.3 Camera applications
14.3.1 Indoor/outdoor
14.3.2 Day/night
14.3.3 Fixed vs. animated
14.3.4 Surveillance (e.g., door cams, nanny cams)
14.3.5 Recording (e.g., DVR, triggers – internal vs. external detection)
14.3.6 Sequencing vs. multiplexing

**Home Control and Management**

**RSIM 15.0 — Identify user interfaces and their appropriate applications**

15.1 Device types
15.1.1 Remote controls
15.1.2 Keypads
15.1.3 Touchscreens
15.1.4 Keyfobs
15.1.5 Telephones
15.1.6 Smartphones

15.1.7 Cellphones
15.1.8 PDAs
15.1.9 Web tablets
15.1.10 Personal computers
15.1.11 Laptops

15.2 Describe the importance of simplicity and ease of use as it pertains to the end user

**RSIM 16.0 — Define and recognize control systems that integrate subsystems in the home. Describe their functionality, characteristics and purpose**

16.1 Embedded control systems and personal computer (PC) based control systems
16.1.1 Compatibility and interoperability issues

**RSIM 17.0 — Identify commonly used communication protocols and their application**

17.1 IR
17.2 Serial
17.3 IP
17.4 RF
17.5 Bluetooth
17.6 Contact closure
17.7 Inputs (zones)
17.8 Z-wave and Zigbee
17.9 ASCII
17.10 Proprietary protocols

**RSIM 18.0 — Describe basic HVAC (Heating, Ventilation and Air Conditioning) terminology and install peripheral control devices**

18.1 Control layer
18.1.1 Compatibility
18.2 Communication layer
18.2.1 Compatibility
18.2.2 IP based, wireless, serial and proprietary

18.3 Zones HVAC
18.3.1 Master slave configuration
18.3.2 Microprocessor controlled configuration

18.4 Programmable thermostats
18.5 Importance of referencing manufacturerspecification and compatibility

**RSIM 19.0 — Describe basic lighting terminology and install peripheral control devices**

19.1 Identify lighting control applications
19.1.1 Indoor and outdoor
19.1.2 Centralized and distributed
19.1.3 Dimming
19.1.4 Scenes
19.1.5 Relay/switching
19.1.6 Occupancy/motion sensing
19.1.7 Time- and event-driven
19.1.8 Window treatments
19.1.9 Energy management
19.1.10 Security interface
19.1.11 Lighting connectivity
19.1.12 Motor speed control
19.2 Communication interface/bridge
19.2.1 Power line phase couplers
19.3 Identify lighting control protocols (Open standards)
19.3.1 Z-wave
19.3.2 ZigBee
19.3.3 Powerline carrier (X10 protocol/PLC)
19.3.4 UPB (Universal Powerline Bus)
19.4 Proprietary RF and proprietary low voltage
19.4.1 Recognize compatibility issues

RSIM 20.0 — Identify and install component power protection devices
20.1 Identify whole house protection options
20.1.1 Surge suppression
20.1.2 Power conditioning
20.2 Identify and install point protection
20.2.1 Surge protectors (high voltage and ancillary low voltage devices: e.g., satellite, CATV, etc.)
20.2.2 UPS (uninterruptible power supply)
20.2.3 Power conditioning

Troubleshooting Methodology and Documentation
RSIM 21.0 — Identify and apply the fundamentals of troubleshooting and diagnostics
21.1 Use of testing equipment
21.1.1 Multimeter
21.1.2 Telephone butset
21.1.3 Toner
21.1.4 Signal generation
21.1.5 Cable tester
21.2 Refer to prior documentation
21.3 Demonstrate when to communicate with technical support and what information is relevant
21.4 Troubleshoot common wireless interference issues: infrared, radio frequency, etc.
21.5 Identify demarcation and responsibilities of associated trades and/or utilities

RSIM 22.0 — Given a scenario, demonstrate how to apply troubleshooting skills to integrate subsystems
22.1 Networking
22.2 Audio/video
22.3 Telephony
22.4 Security
22.5 Home control

RSIM 23.0 — List and describe the benefits of verification of installation
23.1 Properly label wires
23.2 Wire mapping
23.3 Importance of documenting work upon completion
23.3.1 Input/output verification for all systems
23.3.2 Document wire placement
23.4 Certification of cable installation

RSIM 24.0 — Deliver appropriate manuals and documentation to the end user upon completion of installation.
24.1 Select, archive and appropriately distribute critical system information: Passwords, access codes, user IDs, credentials, etc.

RSIM 25.0 — Ability to safely measure AC and DC voltages
25.1 Measure AC and DC voltages using a digital multimeter (DMM)
25.2 Measure AC and DC current using a digital multimeter (DMM)
25.3 Measure the resistance of a circuit consisting of resistors using a digital multimeter (DMM)

RSIM 26.0 — Ability to test basic analog and digital circuits and repair them
26.1 Setup and operate test equipment for analog circuits
26.2 Troubleshoot switching power supplies
26.3 Analyze motor and phase control circuits
26.4 Apply logical and systematic approach to troubleshooting analog circuit devices
RSIM 27.0 — Ability to use multimeters and oscilloscopes and interpret results

27.1 Solve basic trigonometric problems as applicable to electronics (prerequisite to AC)
27.2 Identify properties of an AC signal
27.3 Identify AC sources
27.4 Analyze and measure AC signals using oscilloscope, frequency meters and generators
27.5 Analyze, construct and troubleshoot AC capacitive circuits, AC inductive circuits, RLC circuits (series, parallel, complex) series and parallel resonant circuits, filter circuits and polyphase circuits
27.6 Analyze basic motor theory and operation
27.7 Analyze basic generator theory and operation
27.8 Set up and operate oscilloscopes, frequency counters, signal generators, capacitor-inductor analyzers and impedance bridges for AC circuits
27.9 Analyze and apply principles of transformers to AC circuits

Committee Identified Academic Skills
The technical committee has identified that the following academic skills are embedded in this contest.

Math Skills
- Solve practical problems involving percents
- Solve single variable algebraic expressions
- Solve multiple variable algebraic expressions
- Make comparisons, predictions and inferences using graphs and charts

Science Skills
- Plan and conduct a scientific investigation
- Use knowledge of the particle theory of matter
- Describe characteristics of types of matter based on physical and chemical properties
- Use knowledge of physical properties (shape, density, solubility, odor, melting point, boiling point, color)
- Use knowledge of classification of elements as metals, metalloids and nonmetals
- Understand Law of Conservation of Matter and Energy
- Describe phases of matter
- Describe and identify physical changes to matter
- Use knowledge of potential and kinetic energy
- Use knowledge of mechanical, chemical, and electrical energy
- Use knowledge of heat, light and sound energy
- Use knowledge of temperature scales, heat and heat transfer
- Use knowledge of work, force, mechanical advantage, efficiency and power
- Use knowledge of simple machines, compound machines, powered vehicles, rockets and restraining devices
- Use knowledge of principles of electricity and magnetism
- Use knowledge of static electricity, current electricity and circuits
- Use knowledge of magnetic fields and electromagnets
- Use knowledge of motors and generators

Language Arts Skills
- Demonstrate comprehension of a variety of informational texts
- Use text structures to aid comprehension
- Demonstrate knowledge of appropriate reference materials
- Use print, electronic databases and online resources to access information in books and articles

Connections to National Standards
State-level academic curriculum specialists identified the following connections to national academic standards.

Math Standards
- Numbers and operations
- Algebra
- Geometry
- Measurement
- Data analysis and probability
- Problem solving
- Reasoning and proof

Source: NCTM Principles and Standards for School Mathematics. For more information, visit: http://www.nctm.org.
Science Standards

- Understands the structure and properties of matter
- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific knowledge
- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: http://www2.mcrel.org/compendium/browse.asp.

Language Arts Standards

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics
- Students adjust their use of spoken, written, and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and nonprint texts
- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience

Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information)

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit: www.ncte.org/standards.