Internet of Things

Amount of time demo takes: 5 minutes

Try this at home!

Lesson's Big Ideas

- Internet of things refers to the idea of objects (devices/sensors/etc.) being connected, and controlled, through a wireless internet network.
- As more and more devices are becoming reliant on the Internet, the Internet of Things is changing the way we work and our personal habits.
- Your smart phone, video-doorbell, and smart-thermostat are all common examples of devices connected through the Internet of Things.
- The Internet of Things helps users in all sorts of fields including healthcare, transportation, manufacturing, agriculture, consumer electronics, etc.
- Smart Home devices use speech recognition technology to adapt your voice into a digital command.

Materials

While other groups performing this demonstration may have different devices, Mind Trekkers use the following to demonstrate this idea:

- iPad (full size - these are the ipads compatible with the Google home app)
- Google Home mini
- Lamp
- Smart Light Bulbs (Lumiman) (2 - 1 in lamp that is connected to devices, 1 for showing students)

SAFETY!

- Be careful with the smart LEDs. They may be warm to the touch after use. They are fragile and could break if mishandled.

Setup Instructions

1. Ensure the ipad and Google home are connected to the WiFi created by Mind Trekkers' Jetpack MiFi device (usually kept at the promotions table)
2. Plug in lamp with smart LED

3. Power Google Home device

Background Information

- Devices can connect and communicate with each other through the use of electromagnetic waves. Radio waves (a type of EM wave) are commonly used for a lot of devices we use every day, such as microwaves, WiFi routers, Bluetooth, and much more.
- Communications between devices need to include (taken from How Stuff Works):
    - "An alert to the system that it's issuing a command"
    - "An identifying unit number for the device that should receive the command"
    - "A code that contains the actual command, such as "turn off.""
- Mesh Networks - ZigBee and Z-Wave protocols create what is called a "mesh" network. This means that devices connected to this network don't need to communicate through a central hub so signals can be passed through devices in whichever way is easiest, even around obstacles. A WiFi network is not considered a mesh network as devices need to communicate through the central hub/device.
- Modern smart home devices were beginning to be developed as early as 1975 when X10 (an early version of transmitting that worked through existing electrical wires) was developed in Scotland.
- Voice recognition works by analyzing audio waves that are created when you speak, into a digital code, that is analyzed and predictive technology generates what the device believes you said, thus initializing the command you gave to the device.
    - Ex:
        - You say, "Hey Google, turn on the lights"
        - Google wakes up after hearing "Hey Google"
        - Google will analyze the wave pattern
        - Google computes that you said "Turn on the lights"
        - Google will then execute the command, turning on the lights
    - This conversion is called "analog-to-digital conversion"
    - Word recognition is possible to databases of vocabulary that have been developed over time.

Instructional Procedure

1. Ask students if they have smart devices such as Alexa, Google Home, etc.

in their homes. Ask about their familiarity with Internet of Things (IoT)
    a. There is an additional smart bulb in the demonstration bin that you can show students.
2. Using both the Google Home application and voice commands through the Google Home itself, allow the students to turn the smart LED on/off and change it's color. You can also allow them to ask the Google Home (appropriate questions).
    a. Examples:
        i. "Hey Google, turn on Smart Bulb"
        ii. "Hey Google, increase brightness of Smart Bulb by 25%"
        iii. "Hey Google, turn Smart Bulb blue"
        iv. "Hey Google, what is the capital of Nebraska?"

Tips & Tricks

- Make sure students are phrasing voice commands correctly, beginning with "Hey Google".

Assessment Questions

- Do you have a smart device in your house? What do you use it for?
    - Common answers may include a Google home or Alexa device that is used to turn on lights, play music, set timers or reminders, etc. Many students may also have smart thermostats or video-security systems. Homes are adopting this technology at an extremely quick pace!
- Why do you think you need to start your command with "Hey, Google" or "Alexa?"
    - The device needs to register that you are about to say a command which it needs to analyze.
    - Google now has "continuous conversation" software that allows you to respond to a Google home device with an additional command without saying "Hey Google" within 8 seconds of a response from the Google Device, allowing for easier interactions with the device
        - Ex:
        - You: "Hey Google, what is the weather outside?"
        - Google: "Today should be sunny with a high of 80 degrees."
        - You *(within 8 seconds)*: "Put sunscreen on my shopping list" *(no "Hey Google" necessary for this command)*

- What are some ways companies are using this (IoT) technology?
    - Agriculture: sensors can monitor and communicate data about water/nutrient levels in crops and adjust watering/fertilizing patterns
    - Company Buildings: shutting off lights in inactive portions of the building save on energy costs. Buildings can also be secured and monitored from a centralized location.
    - Transportation: self-driving vehicles interact with other vehicles and signals around them to keep themselves on the road, and their passengers safer. GPS devices can also recommend different directions based on traffic patterns to get drivers where they need to go faster.
    - This list is much more expansive and ever-growing! Feel free to do some research on areas that interest you personally.

Careers & Real-World Applications

- The internet of things usually makes our lives easier, and typically saves users (both personal and companies) money and time.
- There are concerns though over the security and privacy of the data collected by the devices. Additionally there are concerns over the need for consistent Internet connectivity and the lack of capabilities of services if an internet connection goes down.
- Voice recognition technology is improving. When pairing this technology with artificial intelligence, devices are quickly learning to assist us more effectively.
- Related Careers:
    - Cybersecurity Specialist
    - Software Engineer
    - Internet Installation Technician

Clean Up

- At the end of each day:
    - Turn off all devices and carefully repackage them in their packaging. The Smart LED can remain in the lamp.
    - Charge ipad and Jetpack as necessary
    - Turn off Jetpack at end of each day
- At the end of the event
    - Follow end of day steps. Additionally:

- Return the iPad and Jetpack device (and charging cords) to the Mind Trekkers promotions table.
- Place the lamp and extra bulbs in the demonstration bin
- Follow additional instructions provided in the “Mind Trekkers Demo Clean Up” Google Form.

References

- How Stuff Works “How Smart Homes Work”
- How Stuff Works “How Speech Recognition Works”
- Google “Behind the Mic: The Science of Talking with Computers”
- Search Customer Experience TechTarget “Voice Recognition (Speaker Recognition)”
- Intel “Internet of Things Applications Across Industries”

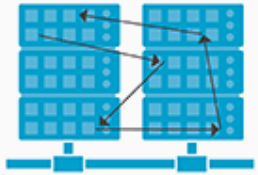
Related ISTE Standards

- 1D - Empowered Learner - “students understand the fundamental concepts of technology operations…..”

Voice recognition

ANALOG AUDIO

ANALOG-TO-DIGITAL CONVERSION

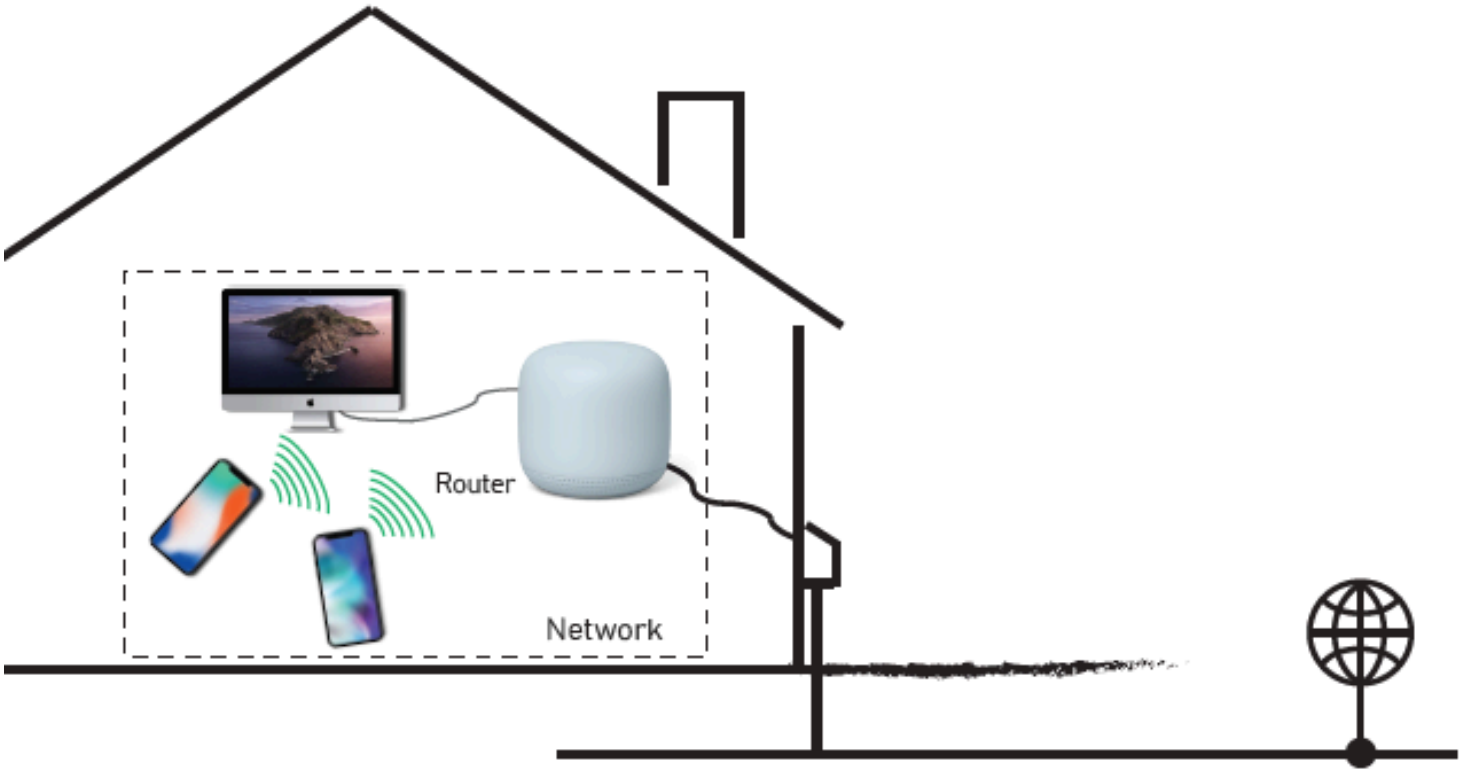


PATTERN RECOGNITION

HOW DOES YOUR HOME INTERNET WORK?

Devices, such as your phone and your computer are able to send and receive packets of information from the internet. In order to do that, these packets need to know how to make their way from your home to the outside world.

A **network** connects multiple devices and allows users to share data between each other. These networks can exist anywhere and can be connected to using a cable or wirelessly through WiFi. When you connect to WiFi, your device will talk to the router. A **router** is a piece of hardware that is responsible for making sure the data you send go to the right place. To make sure you get your data as fast as possible, your router will determine the shortest path that your data packets will take.



TRADITIONAL NETWORK

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MESH NETWORK

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