10 Years of Growing Curious Minds

4-H leads the way with STEM projects for youth across aerospace engineering and robotics to veterinary science and hydroponics, empowering young people with the skills to lead for a lifetime.

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2017 - INCREDIBLE WEARABLES
2016 - DRONE DISCOVERY
2015 - MOTION COMMOTION
2014 - ROCKETS TO THE RESCUE
2013 - MAPS & APPS
2012 - ECO BOT CHALLENGE
2011 - WIRED FOR WIND
2010 - 4-H2O
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INTRODUCTION

The 4-H National Youth Science Day (NYSD) aims to bring youth together from around the world in an exciting, interactive learning experience that engages them in science, technology, engineering and math (STEM). The event brings together young people, volunteers and educators from the nation’s 110 land-grant colleges and universities to simultaneously complete the National Science Challenge. This year’s exciting theme for NYSD is Incredible Wearables. From watches and eyewear to helmets and virtual reality headsets, wearable technologies are fast becoming the must-have accessory for forward-thinking people around the world. Wearable technologies are now used in industries as diverse as fashion and virtual reality, to sports and health, to entertainment and transportation. Even agriculture is entering the wearable space with bio-metric ear tag sensors that can identify and signal illness in animals (http://quantifiedag.com/about/).

WEARABLE TECHNOLOGIES

In the broadest sense, electronic textiles (e-textiles) represent a field of engineering that combines electronics and computing with textiles and design. Wearable technologies refers to electronic textiles or electronic accessories that can be worn, such as watches, eye glasses, or clothing like a shirt or jacket that contains electronics and a computing device. The field of wearable technologies continues to grow in both quantity and quality. New technologies are being developed and put on the market on a regular basis, including virtual reality and augmented reality devices, clothing and accessories, as well as health monitoring devices that monitor everything from breathing and heart rate to sleeping patterns and the amount of oxygen in the blood. The future of wearable technologies is limited only by the imaginations of those designing them. By studying the field of wearable technologies, youth could develop mechanisms such as exoskeletons, mind-controlled artificial limbs or even樂 the “THING’), a pulse oximeter, and a tilt sensor (which can be used as a pedometer). Details for each of the components will be provided in the challenge section of the Youth Guide to see the different careers that are available in these areas.

THE CHALLENGE

In the 2017 National Youth Science Day challenge, youth will design and build their own low-cost wearable health monitor following the engineering-design process. The challenge will cover components of a small company called the STRATA (not a real company). The THING), a pulse oximeter, and a tilt sensor (which can be used as a pedometer). Details for each of the components will be provided in the challenge section of the Youth Guide. The challenge will touch on three important topics: engineering design, especially optimization of the design solution whereby solutions are systematically tested and refined (NGSS, 2013), wearable technologies, and health monitoring.

The problem that participants will aim to solve is that youth and adults are not staying active enough to lead healthy lives. To help solve this problem, youth will learn to use wearable technology to track fitness and health. There are many devices sold to consumers to positively affect fitness behaviors. For this challenge, the central engineering problem is to: Design a functional wearable device that can record multiple biological signals such that the data can be used to make informed decisions about the wearer’s health.

GOALS, OBJECTIVES AND OUTCOMES

1. Design and build a functional fitness tracking/prototype device.
2. Learn enough about fitness and health data such that they can design, test and utilize a functional product.
3. Learn about human health and how it can be tracked and improved using technology.
4. Understand the vast potential of wearable technology by learning how physiology and technology can work together.

CONSTRAINTS

During the Incredible Wearables challenge, youth must design a device to measure heart rate, oxygen levels, and temperature to create a wearable device that can be sold to consumers to positively affect fitness behaviors. In order for the product to be viable, the device should be small, comfortable, and resistant to the wear and tear of home, recreational and outdoor use.

Size: The device should be small enough to be worn on the body.

Aesthetics: The device should be visually appealing.

Available components: Pulse oximeter, tilt sensor. The THING, power supply, alligator clips, velcro strap, AA batteries and embroidery floss.

Time: 90 minutes to build and run the device.

In order to meet the objectives of the challenge, participants must:

1. Learn to follow the engineering-design process such that they are able to create new technology; and
2. Learn enough about fitness and health data such that they can design, test and utilize a functional product.

The engineering design process is a series of steps that are used to solve a problem. It is important to remember that the process is iterative, which means that engineers can go back and repeat the steps as many times as necessary to solve the problem. The steps do not have to be followed in order; part of the engineering design process is teamwork and open-ended design.

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**KIT COMPONENTS**

In the challenge, youth will use the kit components to build a wearable health monitor. If youth do the full challenge, it will help them to better understand why they are building the health monitor and how much easier it is to track their health data with a device. They will work in groups of up to 10 team members and will need a connected device (computer, smartphone, tablet) to view data from the health monitor.

The components of the incredible Wearables kit include three AA batteries, one piece of 12” x 9” felt and a velcro strip to create a wristband, plus the following:

- **ESP8266/THING**
  - A small computer that also acts as a Wi-Fi router that will “push” sensor data to a website, which can then be viewed online.

- **Pulse Oximeter**
  - A sensor that measures the amount of oxygen in the blood. It measures temperature as well.

- **Tilt Sensor**
  - A sensor that measures when something either tilts, speeds up, or slows down.

- **Alligator Clips**
  - A metal clip with copper wires for making temporary electrical connections.

- **Power Supply**
  - Batteries and holder to power the ESP8266/ The Thing.

**ASSEMBLING THE WRISTBAND**

Youth can assemble the wristband using their creativity or by following the steps below:

1. Peel the backing off the rough side of the velcro and stick it onto the left side of the wristband.
2. Turn the wristband over so that the velcro can’t be seen.
3. Attach the soft side of the velcro onto the right side of the wristband.
4. Now you will have a piece of velcro on each end of the wristband – one on the front and one on the back – which can be stuck together to close the band around your wrist.
FACILITATING YOUR GROUP

Below are different options for completing Full and Short versions of this challenge with youth in groups of 3-6 or 7-10. It would be good to prepare a space for youth to work that allows them to collaborate in groups, build their device, and have their connected computer or tablet on a table so that it is easy to view their information.

NOTE: The internet site will be unique to each team’s sensor. Data will not be publicly accessible.

The roles for a group of 3-6 youth are listed below:

1. Project Managers: Coordinates work for the team, makes sure everyone is involved and keeps the group on task.
2. Lead Engineers: Documents the engineering design process in the group’s Challenge Journal and keeps the engineers on task.
3. Data Analysts: Translates and communicates numbers into plain English for better decision-making.
4. Textile Designers: Creates a structure for the textile design.
5. Biomedical Engineers: Designs solutions to gather biological information through technology, including sensor calibration.
6. Marketing Specialists: Takes pictures and posts about progress in order to communicate about STEM to the public.

If you have 3-6 YOUTH

<table>
<thead>
<tr>
<th>CHALLENGE VARIATION</th>
<th>HEALTH LEARNING</th>
<th>DEVICE LEARNING</th>
<th>BUILD</th>
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<th>COOL DOWN</th>
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<tr>
<td>Full</td>
<td>105 minutes</td>
<td>25 minutes</td>
<td>10</td>
<td>15 minutes</td>
<td>45 minutes</td>
</tr>
<tr>
<td>Short</td>
<td>90 minutes</td>
<td>10 minutes</td>
<td>10</td>
<td>10 minutes</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

If you have 7-10 YOUTH

The roles for a group of 7-10 youth are listed below:

1. Project Managers: Coordinates work for the team, makes sure everyone is involved and keeps the group on task.
2. Lead Engineers: Documents the engineering design process in the group’s Challenge Journal and keeps the engineers on task.
3. Data Analysts: Translates and communicates numbers into plain English for better decision-making.
4. Textile Designer: Creates a structure for the textile design.

If time permits, all of the engineers will get together in one group, the managers will get together in another, and the data analysts will get together in a third group. This is explained further in the data part of the challenge. They will then compare their data and see if the entire team could come up with a new iteration that improves the group’s design.

HOW TO CONNECT THE COMPONENTS

The diagram below provides an overview of the connections between the sensors and the ESP 8266/The THING computer. The components are connected using alligator clips following the diagram below.

HOW IT WORKS

The THING is a powerful, low-cost computer that has built-in Wi-Fi and runs a webserver to read sensor data from the tilt sensor and pulse oximeter and make it readable on a webpage via a browser.
FULL CHALLENGE
(25 MINUTES)

LEARNING OBJECTIVES
1. Framing the engineering design question.
2. Health concepts:
   a. Pulse (heart rate)
   b. Resting pulse
   c. Pulse points on the body

ENGINEERING PROBLEM STATEMENT
Start by explaining that the participants will tackle the challenge of increasing activity levels in youth and adults in order to help people live healthier lifestyles. In order to do this, they will need to design and build a functional, wearable health monitor.

WHY WEARABLES?
It is helpful for youth to discover first-hand why a wearable device is so well suited to increasing activity levels. To do this, show them how difficult it is to monitor their pulse and the number of steps they are walking while doing an activity, by having them attempt to do this. (To manually take a pulse, place two fingers on the inside of the wrist and gently apply pressure until you feel your pulse.) Discuss how the youth could solve this problem, writing down ideas as they go. If needed, steer the conversation so that the youth begin to think about how technology could be a solution to the problem. In all likelihood, they will do this naturally.

ENGINEERING BASICS
Next, introduce the group to the engineering design process, shown on page 9 of their engineering design notebooks. The constraints of the challenge (cost, two sensors, and 25 minutes to build) and an engineering design flow chart are listed on the youth notebooks page. Ask youth to think about and sketch in their notebooks how they might design a health monitor using the two sensors and small computer.

UNDERSTANDING HEALTH
When exercising, it’s helpful to know your heart rate, number of calories you are burning and the distance you have traveled or the number of steps you have taken. Explain that the pulse oximeter sensor measures a pulse as a function of time. Pulse in this case is the number of times the heart beats per minute, so this will give the heart rate. A resting heart rate is the lowest amount of blood the heart is pumping for a person and is usually between 60 and 100 beats per minute. There are a number of areas on the body where pulse can be measured. Have youth measure and record their resting heart rate using their fingers for 30 seconds, and multiply the number by two. For the challenge the youth will use the pulse oximeter to measure their pulse at rest and again during physical exercise as measured by the tilt sensor (the second sensor in the kit). Go to Short Challenge.

IMPORTANT!
It will be important to be sure that all youth are able to participate in a physical exercise to raise heart rate and are not on a medical restriction.
ENGINEERING PROBLEM STATEMENT

In this section, the participants will tackle the challenge of increasing activity levels in youth and adults through the use of a wearable health monitor. Health monitoring in a wearable device is an interesting engineering application that utilizes a sensor that measures biological signals and converts those signals to data that can then be analyzed. Wearable health monitors must be small and unobtrusive and, of course, aesthetically pleasing. The constraints of this project include using low-cost DIY open-source hardware, including a pulse oximeter sensor to measure pulse and a tilt sensor to measure movement.

SHORT CHALLENGE

(10 MINUTES)

LEARNING OBJECTIVES

1. Framing the engineering design question.
2. Health concepts:
   a. Pulse (heart rate)
   b. Resting pulse
   c. Pulse points on the body

ENGINEERING PROBLEM STATEMENT

The constraints and an engineering design flow chart are listed on the youth notebook page. Briefly go over the engineering design process and constraints. In this design notebook, youth should sketch how they might design a health monitor using the two sensors and small computer.

STEP 1

The constraints and an engineering design flow chart are listed on the youth notebook page. Briefly go over the engineering design process and constraints. In the design notebook, youth should sketch how they might design a health monitor using the two sensors and small computer.

DEFINING THE PROBLEM

Optimizing the design solution involves a process in which solutions are systematically tested and refined, and the final design is improved by trading off less important features for those that are more important.

DESIGNING SOLUTIONS

STEP 2

Explain that the pulse oximeter sensor will measure their pulse as a function of time. Pulse in this case is the number of times the heart beats per minute. A resting heart rate is the pulse when a person is not moving and is usually between 60 and 100 beats per minute. Physical exercise will elevate the heart rate. There are a number of areas on the body where a pulse can be measured. Have youth measure and record their resting heart rate using their fingers for 30 seconds. For the challenge, youth will use the pulse oximeter to measure their pulse at rest and again during physical exercise as measured by the tilt sensor (the second sensor in the kit).

PULSE POINTS

- Temporal Artery
- Common Carotid Artery
- Brachial Artery
- Radial Artery
- Popliteal Artery
- Posterior Tibial Artery
- Dorsalis Pedis Artery
CHALLENGE
(10 MINUTES)

LEARNING OBJECTIVES
1. Understand how to create a basic circuit.
2. Understand how The THING interfaces with other wireless devices.

BASIC CIRCUIT
In order for electricity to do any work, it needs to be able to move. Ask the youth, ‘What makes electricity move?’ After this question has been discussed, the following analogy can be given to youth to help them visualize this process (see illustration).

It’s kind of like a blown-up balloon. If you pinch it off there is air in there that could do something if it’s released, but it won’t actually do anything until you let it out. Electricity wants to flow from a higher voltage to a lower voltage. This is exactly like the balloon: the pressurized air in the balloon wants to flow from inside the balloon (higher pressure) to outside the balloon (lower pressure). If you create a conductive path between a higher voltage and a lower voltage, electricity will flow along that path. If you insert something useful into that path like a Light Emitting Diode (LED), the flowing electricity will do some work for you, like lighting up that LED.

So, where do you find a higher voltage and a lower voltage in a battery? Why do batteries have a positive sign on one end and a negative sign on the other end? Here’s something really useful to know: every source of electricity has two sides. You can see this on batteries, which have metal caps on both ends; in batteries, these sides, called terminals, are named positive (+) and negative (−).

We’re finally ready to make electricity work for us! If we connect the positive side of a voltage source through something that does some work such as an LED, and back to the negative side of the voltage source, electricity, or current, will flow.

PART II
DEVICE LEARNING

Conductive material (copper wire)
Battery
A simple circuit with electrons moving through the conductive material.

CAUTION – this will short circuit a battery causing heat and potentially a fire!
STEP 1: CONNECT THE POWER
Open the Power Supply with a screwdriver and insert three AA batteries. Connect the Power Supply to The THING and power it up by sliding the power switch to the 'On' position. You will see the light on the computer turn on, then blink, followed by a solid color.

STEP 2: GET CONNECTED
One of the great things about The THING is that it has the ability to act like a webserver meaning if you connect to it through a standard browser it will display a webpage. Without the batteries installed, insert the white connector from the power supply to The THING.

On their device (laptop, phone, tablet), instruct the youth to open their Wi-Fi connection and select the ‘Incredible Wearables’ network. At this point the youth’s device should connect to The THING. In their browser, instruct the youth to enter the IP address 192.168.4.1. The THING will display the Incredible Wearables monitor website. The screen will not show any data at this point since The THING is not transmitting data.

RUNNING MULTIPLE THINGS
It is possible to have up to four Things running for larger audiences but the SSID must be changed. For example, if you have four groups running the experiment at the same time; each Thing should have a unique identifier or SSID. The default SSID is ‘incredible wearables’ to change the SSID connect a wire from one of the jumping pins (4, 13, or 16) to the ground pin then power up the Thing. If the jumper cable is removed and the Thing is restarted it will revert back to the default SSID (incredible wearables.)

Steps to change SSID:
1. Make sure the Thing is off.
2. Connect jumper wire to desired pin (see below)
3. Turn on the Thing
4. Leave jumper wire connected during the activity
   SSID Default = incredible wearables
   4 — > ground = incredible wearables1
   13 — > ground = incredible wearables2
   16 — > ground = incredible wearables3

START-UP GUIDE
1. Plug in the controller and make sure it’s on.
2. Check for Wi-Fi network (‘Incredible Wearables’), note that this will change to a color pattern.
3. Connect to the Incredible Wearables network.
4. Open a browser and enter 192.168.4.1 into the navigation bar. Hit enter.
5. Do you get a webpage? (If not, take a look at our troubleshooting guide.)
6. Make the connections between the board and the ESP8266/The THING.
7. Connect 5v->3.3v.
8. Connect GND->GND.
11. Restart the controller and check for a pulse. Refresh the browser to continue to generate readings.
12. Connect the tilt sensor to pin4 and GND.
13. Check the tilt switch against the onboard LED. When the switch is closed is the blue light on?

In this part of the challenge youth will experiment and test the connectivity of The THING.
LESS LIGHT PATH LENGTH
LESS ABSORPTION
MORE ABSORPTION
MORE LIGHT PATH LENGTH

CHALLENGE
(15 MINUTES)

LEARNING OBJECTIVES
1. Understand how sensors work.
2. Connect the sensors to The THING.

STEP 1: PULSE OXIMETER
In this part, youth will connect the two sensors to their The THING using alligator clips. Ask them what a pulse oximeter measures. How does the pulse oximeter measure this? The first sensor they will connect is the pulse oximeter, which measures the amount of light that travels through an artery. The amount of light received by the light sensor depends on the amount of blood the light has to pass through, as well as the amount of oxygen in the blood. Since the artery expands each time the heart pumps, the light signal decreases and the pulse can be detected as a change in the sensor's signal, which is then sent back to The THING.

PART III
BUILD

STEP 2: TILT SENSOR
The tilt sensor uses a small metal ball that moves when the sensor is tilted. There is a conductive plate at the bottom of the tilt sensor - when the ball makes contact with the plate it closes the circuit.

In this step, youth will connect the tilt sensor to The THING using alligator clips. Connect the longer leg of the tilt sensor to pin 12 on The THING, and the shorter leg of the tilt sensor to the negative (-) or GND of The THING. Again, have the youth open page 192.168.4.1 in their browser to ensure that the website is displaying data from the tilt sensor as they move it back and forth. Additionally, a blue light on The THING will indicate when the circuit is closed.

In the first step, youth will use the alligator clips to connect the negative (-) terminal from the pulse oximeter to the negative (GND) terminal of The THING. Next, connect the (+) port from the pulse oximeter to the 3.3V port on The THING. Have youth place the pulse oximeter on one of the team members' index fingers. Power on The THING, then open page 192.168.4.1 in their browser and make sure that the website is displaying the pulse data.

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In this step, you will learn how to use sensors to measure changes in light and position.

The tilt sensor uses a small metal ball that moves when the sensor is tilted. There is a conductive plate at the bottom of the tilt sensor - when the ball makes contact with the plate it closes the circuit.

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CHALLENGE: 3-6 YOUTH PER KIT
(45 MINUTES)

LEARNING OBJECTIVES
1. Understand how to view and interpret data.
2. Understand what careers are related to the skills used in this challenge.

In this part of the challenge, youth will complete the build of their health monitor and then begin to collect data for the group for both their resting pulses and their active pulses. The instructions for a group of 3-6 youth are listed first, followed by the instructions for a group of 7-10 youth using one kit. If you have multiple kits with youth divided into groups of 3-6, you should use the instructions for groups of 3-6 youth.

Each team member will collect information for each condition and then calculate an average for the entire team. The pulse oximeter will work best when used on the index finger; however, the tilt sensor may be more efficient on the wrist, arm, or leg. In the first part of the challenge the tilt sensor will be located on the wrist for all the teams. In the second part of the challenge, the youth will optimize their design to determine if there are better places on the body to place the tilt sensor.

PART IV
DATA COLLECTION

STEP 1
It’s now time for the youth to design a way for their health monitor to be wearable. Using their notebooks, have them sketch their initial design. Remind them that the final product should be wearable and aesthetically pleasing. In the notebooks there is a space for them to define the problem and note the constraints of the project. Once they have a good idea of how they will build their project, have them use their drawings as a guide to disconnect the alligator clips at this time, but they may want to record a connection diagram in their notebooks. At this stage, have the youth design the monitor so that the tilt sensor is located on the wearer’s wrist. Please refer to the directions on page 7 to assemble your wristband.

STEP 2
Once the health monitor has been built, it’s time to collect data. In this step have each youth wear the pulse oximeter on their index finger. Ask them to open the web page (IP address 192.168.4.1) on their device and record their resting pulse rate and the number of steps taken for one minute; this information should be written down in their notebooks. Once all the data has been collected for each youth, calculate an average resting heart rate for the entire group (sum all scores/number of scores).
STEP 1
It’s now time for the youth to design a way for their health monitor to be wearable. Using their notebooks, have them sketch their initial designs. Remind them that the final product should be wearable and aesthetically pleasing. In the notebook there is a place for them to define the problem and note the constraints of the project. Once they have a good idea of how they will build their project, have them use their drawings as a guide. It’s OK to disconnect the alligator clips at this time, but they may want to record a connection diagram in their notebooks. At this stage, have the youth design the monitor so that the tilt sensor is located on the wearer’s wrist.

STEP 2
Once the health monitor has been built, it’s time to collect data. In this step have one youth in each subgroup wear the pulse oximeter on their index finger. Ask them to open the web page (IP address 192.168.4.1) on their device and record their resting pulse rate and the number of steps taken for one minute. One youth can be the data analyst who records that information for analysis. One youth will provide the data by using the pulse oximeter and one youth will make sure the device is functioning properly and gathering data. Have the youth enter the number in their notebooks. Once all the data has been collected for each subgroup, ask the whole group to come back together and obtain an average resting heart rate for the entire group (sum all scores/number of scores).

STEP 3
Now it’s time for the youth to optimize their design. First, have them modify their design if needed to place the tilt sensor on other parts of the body (for example the hand, elbow or upper arm). They should choose at least two additional points. Next they should collect a resting average and a moderate movement average for the other two pulse points. Each youth will place the tilt sensor on other parts of the body.

STEP 4
At this stage you will repeat step two, only this time the measurement will have the youth jog in place while their pulse is measured for one minute. Again, have them record their answers in their workbooks.

STEP 5
Have youth share their group (not individual) data regarding their average resting pulse, active pulse, and movement rates, and say what they thought was the most accurate place to put the tilt sensor.
In this part, the youth follow the steps of the engineering design process to build and optimize a wearable health monitor. The monitor provides time-series data concerning pulse rates which can be used to determine the relative level of activity of the wearer. Help guide the youth to reflect and share their learning experiences through the incredible wearables challenge. They can record their reflections in their notebooks before sharing with the group. The most important question for each part is listed first. If you still have time there are additional questions for youth to answer related to each part of the activity listed below.

**PART V**

**COOL DOWN**

**STEP 1**
SHARE WHAT YOU DID. WHAT DID YOU LEARN?
• How could youth and adults use the information your device gathers to make decisions that could improve their health?
• What could you improve about your device to help youth and adults be more active?

**STEP 2**
PROCESS WHAT’S IMPORTANT. WHAT WAS IMPORTANT TO LEARN?
• How did planning your design on paper prior to building the health monitor help you with design issues?

**STEP 3**
GENERALIZE TO YOUR LIFE. HOW WILL IT HELP YOU IN EVERYDAY LIFE?
• What is the benefit of knowing your pulse rate and monitoring your health?

**STEP 4**
APPLY WHAT YOU HAVE LEARNED. HOW WILL IT APPLY TO OTHER SITUATIONS?
• What careers would be related to this challenge? Talk about careers that would use the skills the youth learned in this activity. Use the remaining three steps of the 4-H career pathways and provide a list of opportunities/activities where they could learn, practice and/or experience these skills.
LEARN MORE
To learn more, please visit learn.sparkfun.com

Micro controllers - Arduino, ESP8266
The THING is a small Wi-Fi enabled web server that can do many things as you have already seen. You can learn more about the capabilities of The THING by visiting learn.sparkfun.com.

Programming - Processing, HTML, JavaScript
One of the interesting capabilities of The THING is that it can act as a web server by answering web requests using HTML (HyperText Markup Language) and JavaScript. These can be modified using the Arduino programming language (https:// processing.org/)

Servers - PHP, NodeJS, LAMP
A webserver has the capability to answer web requests from client browsers. Using scripting languages like PHP, NodeJS, and LAMP it is possible to build dynamic web sites and web applications.

Sensors - sparkfun.com, BMP280, ADXL345, MAG3110
Sensors allow The THING to collect external environmental data. These include the BMP280 pressure sensor, ADXL345 triple axis accelerometer, and the MAG3110 magnetometer that can be used like a compass to determine direction.

Data - SQL, JSON, CSV
Data can be gathered, stored and retrieved on standard web servers. These include SQL and JSON as well as CSV. SQL is used to store and manage data. JSON is a way to store data in a plain text format. CSV is a “Comma Separated Values” format that can be read and written to by many different software programs.

Biomed - pulse oximetry, respiration, temp
Pulse oximetry, respiration and temperature are ways to evaluate the health of an individual and can be monitored to look for potential changes in health.

THANK YOU!
Special thanks to SparkFun Electronics for supporting the development of the incredible wearable technology challenge.

GOING FURTHER
The health monitor is a great stepping stone to other DIY electronic projects. The youth may also choose to continue to optimize their health monitors, either esthetically or by investigating other sensors that could be added to The THING. Additional resources are available at Sparkfun.com/NYSD2017

CLOSING STATEMENT
The youth have now had the opportunity to use the engineering design process to build a device to help them monitor their health. They may now know more about wearables, but health monitoring is only one part of wearable technology. There are many other industries such as agriculture and fashion that are working with technology like this to improve lives.
In 4-H, we believe in the power of young people. We see that every child has valuable strengths and real influence to improve the world around us. We are America’s largest youth development organization—empowering nearly six million young people across the U.S. with the skills to lead for a lifetime.

Learn more online at: www.4-H.org  #4HNYSD