Through an ambassador program with the US Department of Defense STEM consortium (DoDSTEM), 30 Educators from 13 States received databot™ 2.0 kits plus training sessions.

The following presentation provides background on the databot™ 2.0 product and highlights a number of activities conducted by these DoDSTEM* ambassadors in the Spring 2022 semester.

DoDSTEM does not endorse or sponsor any commercial product, service, or activity including databot™.*

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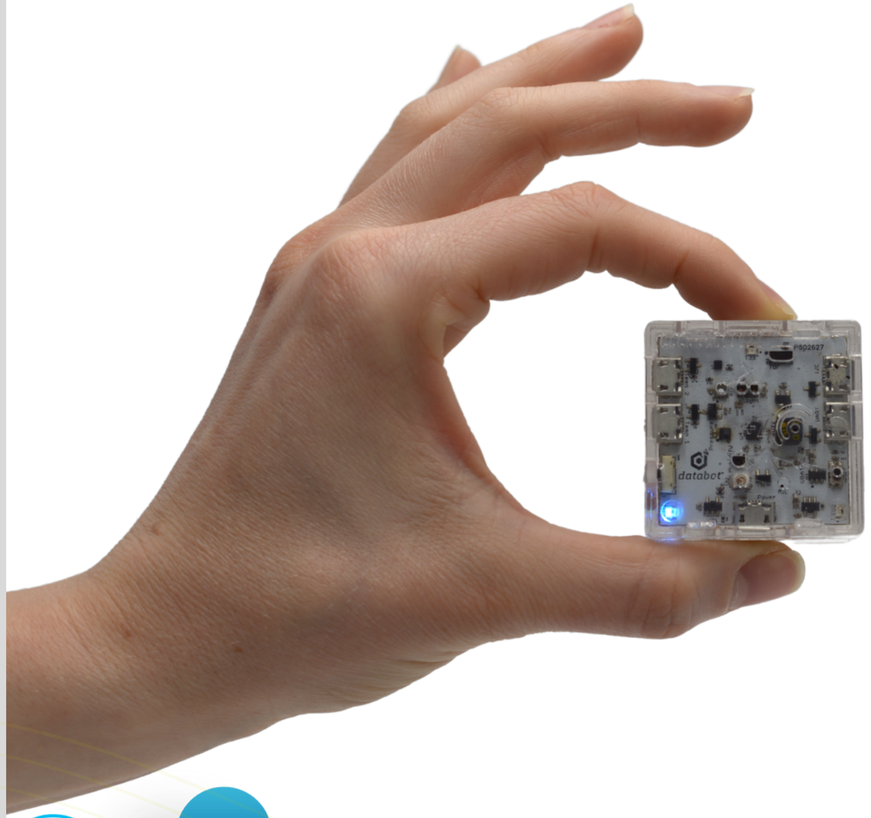
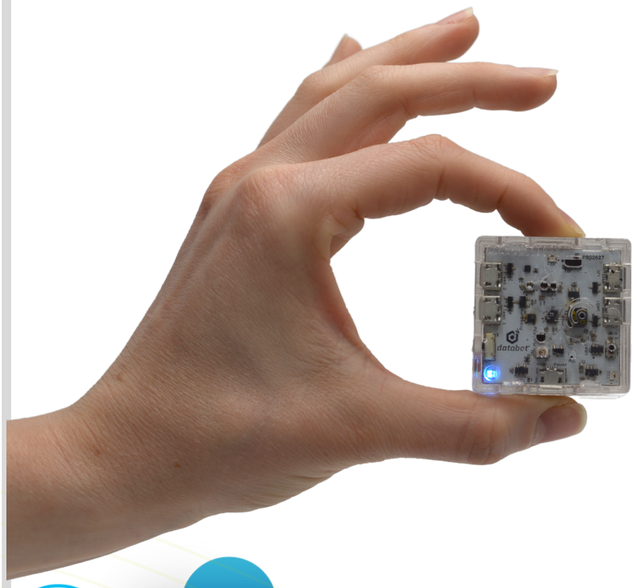
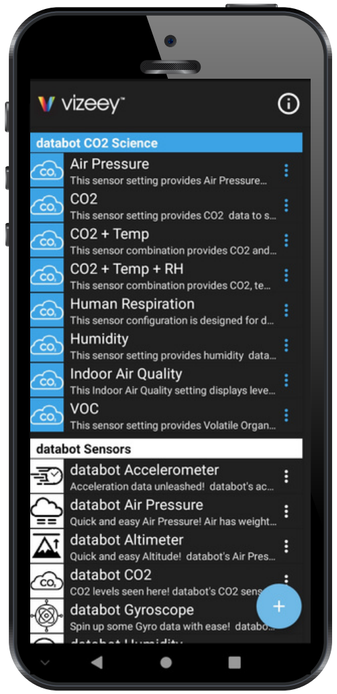
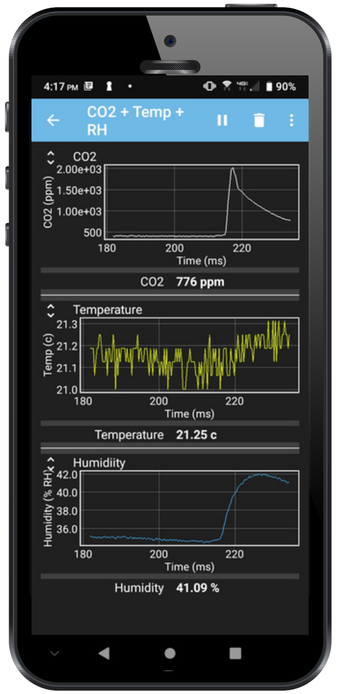


Phenomenon Based Education with databot™







"An incredibly tough and versatile device for teaching science and physical computing."

Kit Contents

- databot™ 2.0
- Soft Storage Case
- External Temperature Probe
- Charge & Programming Cable
- Lanyard

42.5 mm x 42.5 mm x 20 mm
34 grams

11.5 mm x 11.5 mm x 5 mm
(4.5" x 4.5" x 2.5")

Highlights

- Easily stored
- Small, tough, portable for field and classroom use
- Great for remote learning engagement

70 cm (27")
-55 to +125 C range

45 cm (18")
Easily added and removed.

15 cm (6")

What is databot™?

42.5 mm x 42.5 mm x 20 mm
Weight 34 grams

Teach Chemistry, Physics, Life Science, Earth Science, Environment, AI, Coding, Math, Data Science and more with ONE device!

databot™ is a friendly and engaging product for exploring science, data, and technology. Most important feature? EASY TO USE.

- 16 sensors - one device
- External temperature probe,
- 4MB of onboard storage
- Bluetooth wireless connection to Smart Devices
- WiFi Enabled for IOT
- Arduino-based device for physical computing challenges

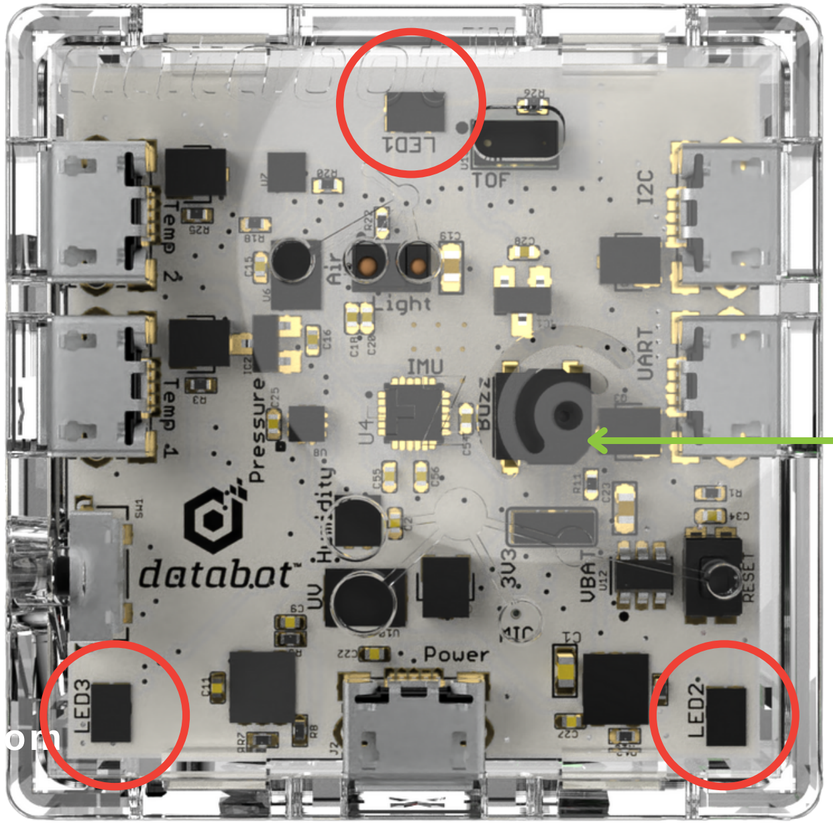
- External Temperature Probe
- Humidity
- UV Index
- Ambient Light
- Color
- Gesture
- Proximity (250 cm and 10 cm)
- CO2
- Volatile Organic Compounds
- Air Pressure
- Altimeter
- Accelerometer
- Gyroscope
- Magnetometer
- Sound

databot™ 2.0
I/O & Physical Design

2.0 supports two simultaneous external temperature probes.

Single, long press, on and off switch.

Recharge, power, and programming.



Low profile, micro usb connections. Pinouts provided for integration and hacking projects.

I2C & UART for external sensors and robotics integration.

Tone generator

ESP-32 reset (recessed)

3 Programmable RGB LEDs

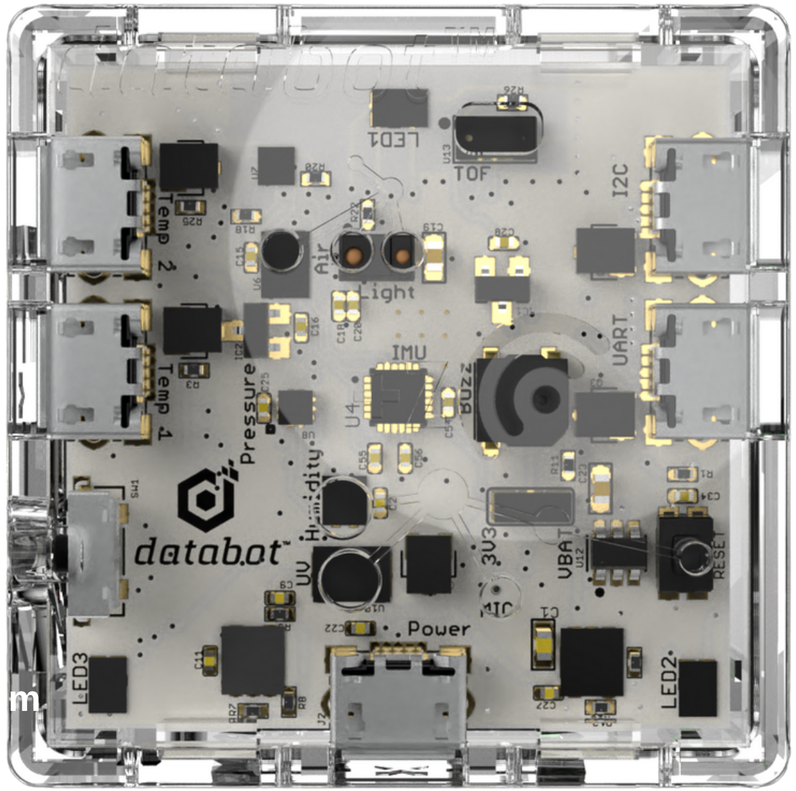
Meet databot™ Sensors

- Proximity (2.5M)

- External temperature probe.

- Air Pressure
- Altimeter

- UV Index
- Humidity



- Ambient Light
- Color

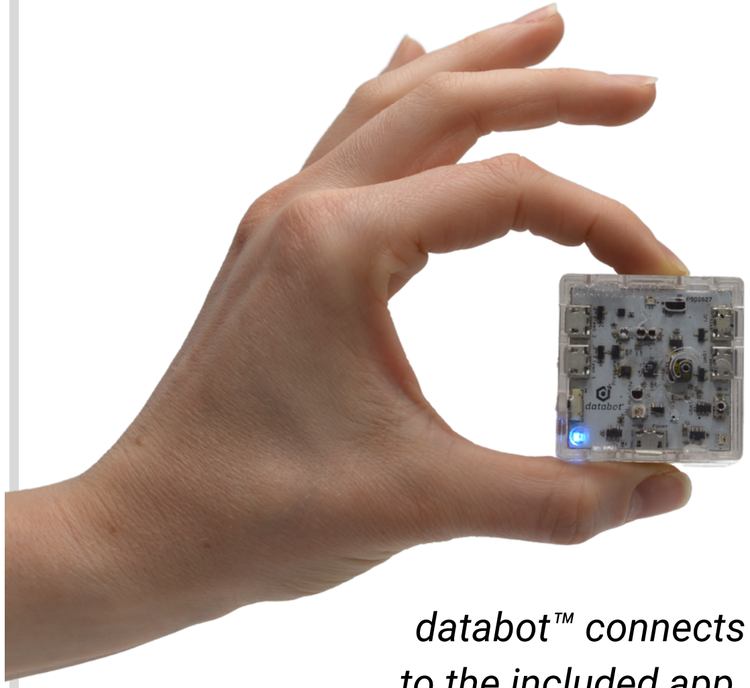
- Gesture
- Proximity (10 cm)

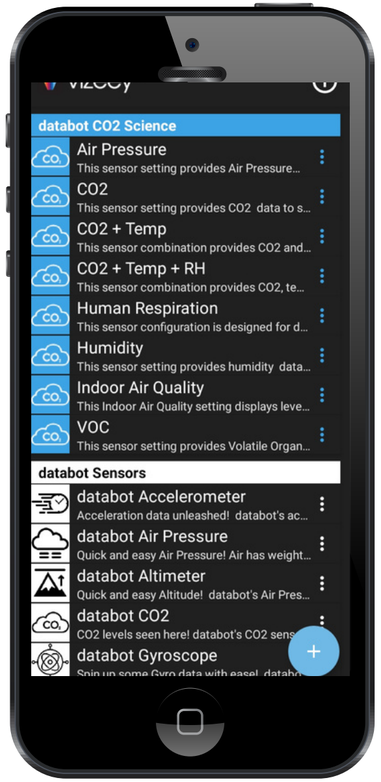
- CO2
- VOCs

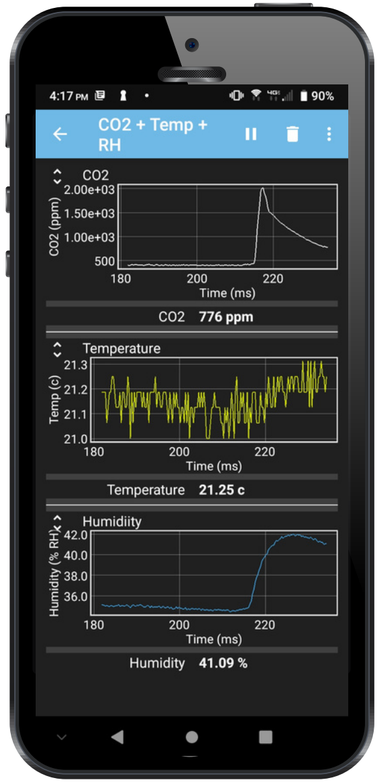
- Accelerometer
- Gyroscope
- Magnetometer

- Sound

How to use databot™



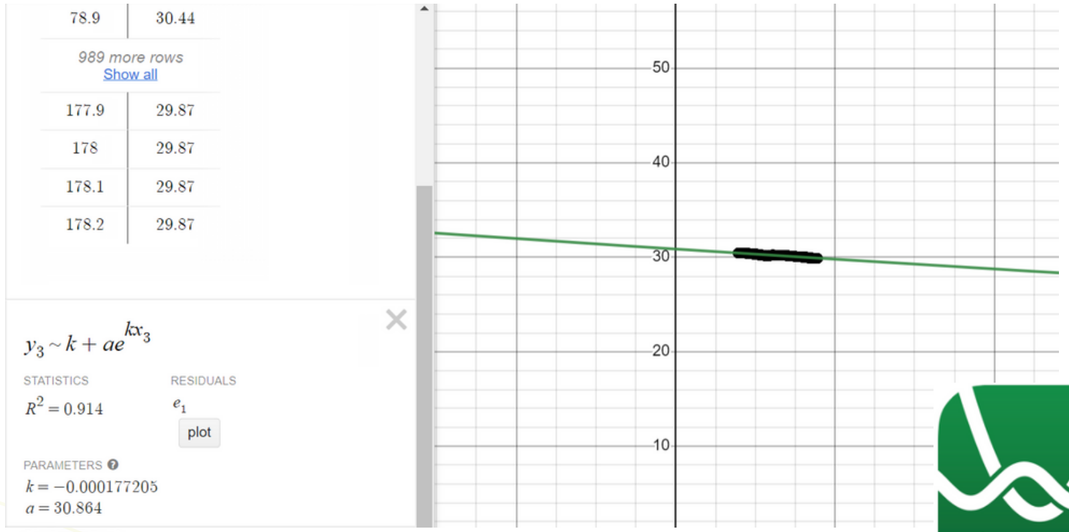


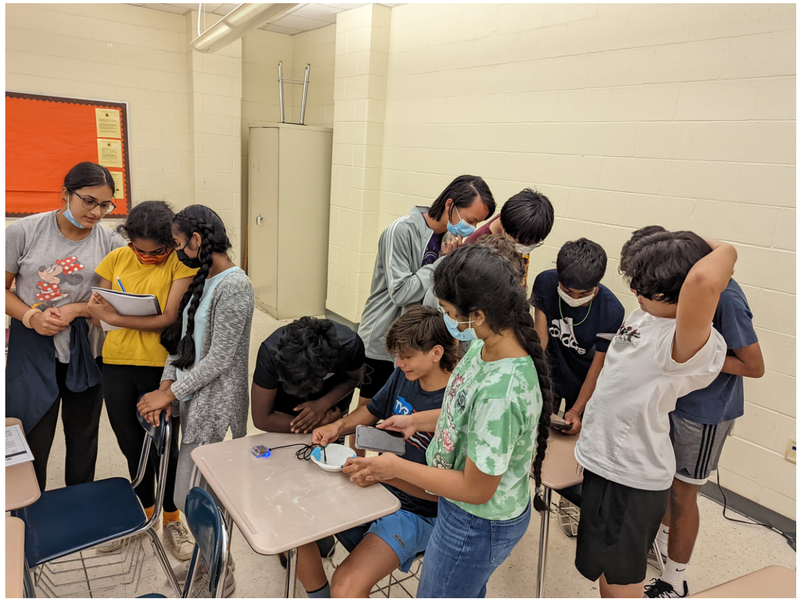


databot™ connects wirelessly to the included app, Vizeey™, to easily visualize, record, and study activity data. Export data to other programs in seconds.

Applied Math Activity: Newton's Law of Cooling

Tyler Erb, Math Teacher
Charlotte-Mecklenburg Schools
DoDSTEM Ambassador





Students gathered temperature data from heated bowls of water using the databot™ temperature probe. They then mapped the data using desmos to see how live data compared to Newton's Law of Cooling.

Applied Math Activity: Bungee Jumping Barbies

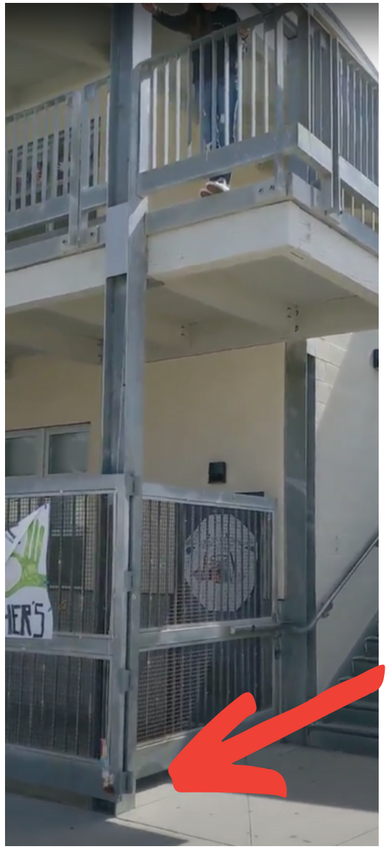
Genevieve Esmende, Math Teacher
San Diego ISD
DoDSTEM Ambassador

Grades: 8th or 9th grade
Time: 60 minutes
Subject: Math
Topics: Scatter Plot, Line of Best Fit, Linear Regression, Linear Equations

Add rubber bands.

Drop Test & Record Altitude changes with databot™

Repeat and plot data from each drop using desmos.



WOW! Inches to spare!!

Apply the Data
Predict the rubber bands required to give Barbie a thrilling ride from a 30' balcony **AND** survive.

Applied Math: Catapult Quadratics

Taren Long, Math Teacher
St. Mary's County, MD
DoDSTEM Ambassador

Students design a catapult, launch databot™ and use the accelerometer data to capture a precise time of flight. Using time and distanced travelled, students create a quadratic function to model the path of the databot.

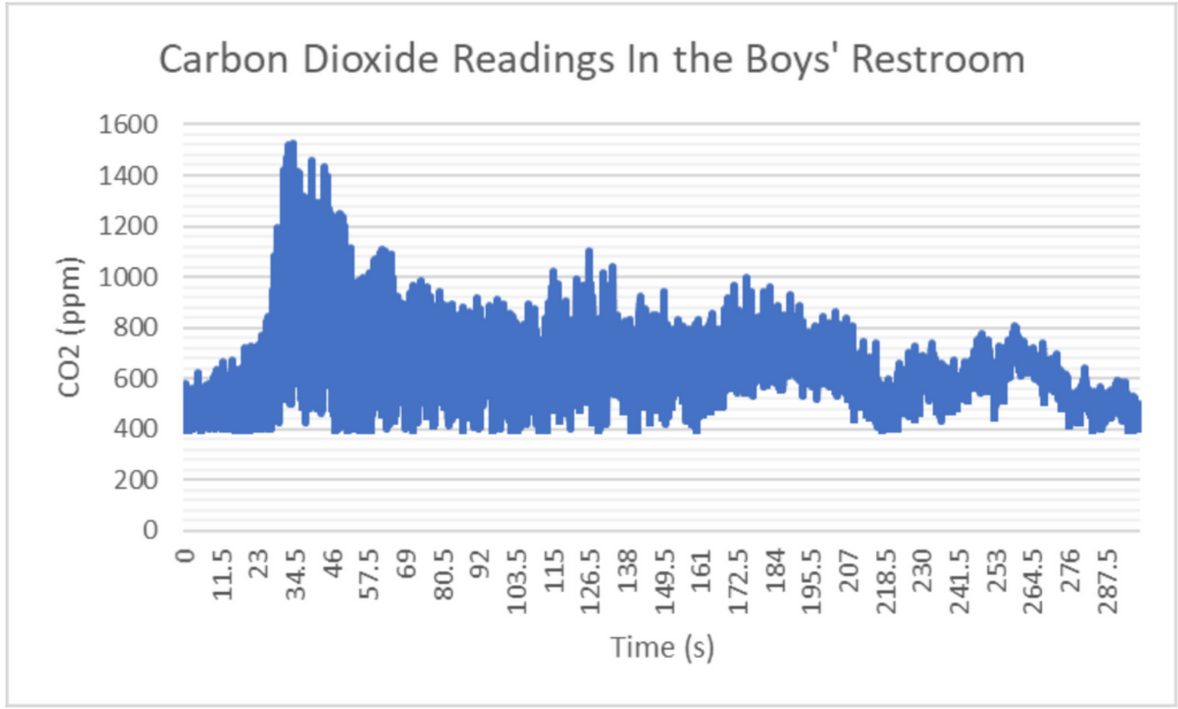
School Wide Air Quality Study

Patty Brunet, Chemistry
Anaheim Union HS District
DoDSTEM Ambassador

LOCATION CHOICES

Media Center	Counseling Center	Gym	300 or 400 Bldg Hallway
Marquee	Girls' Restroom (200 Bldg)	Boys' Restroom (200 Bldg)	Quad
Classroom	Between Pool and Locker Room	Basketball Courts Behind Gym	Near Attendance Window

Using databot™ and Vizeey™, students collected CO2 levels in parts per million (PPM) at different times of the day throughout the school. They exported the data for averaging in a spreadsheet then aggregated these averages through a Google form. Patty also partnered with DataClassroom to model and visualize the data with students.



Unusual CO2 levels
detected in Boy's Restroom

Jonte Lee, STEM Educator
DC Public Schools
DoDSTEM Ambassador

As a community service project, Jonte and his students tested a series of databot™ experiments in the Spring of 2022 and shared feedback, suggestions for improvement, and pictures and videos of students in action. The next slides are images and survey results from his student's databot™ explorations.

Experiments Conducted

1. Illuminance
2. Altitude & Air Pressure
3. Sound Intensity
4. Linear Acceleration
5. UV Index
6. Drone Challenge
7. Indoor Air Quality

Exploration: Illuminance

Jonte Lee

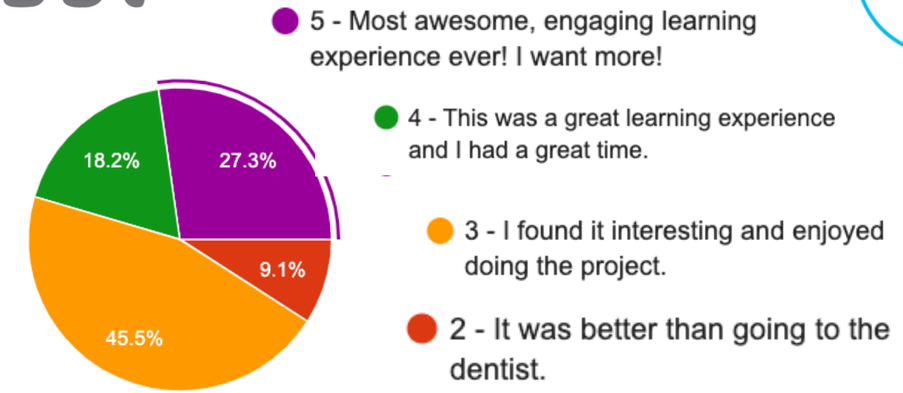
"My favorite part was collecting the data."

"Something i learned is that light is measured in Lux."

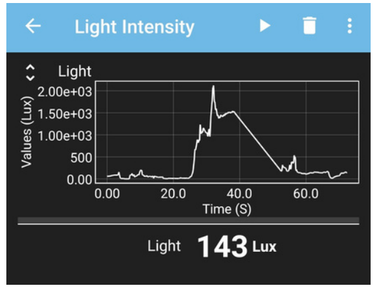
"My favorite part of the experiment was seeing the ambient light difference from the sun and lights in the building."

"I learned that the illuminance varies on how far away you are from the light source."

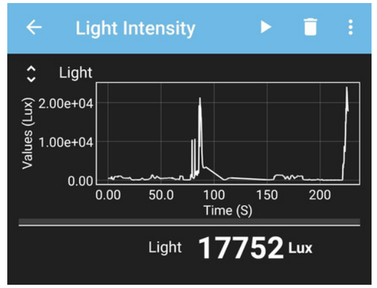
"My favorite part of the activity was finding the the brightest and dimmest spot because I never have done that before."



Illuminance when the distance is 100 cm from the light source.



Illuminance when the distance is 20 cm from the light source



Exploration: Altimeter

Jonte Lee

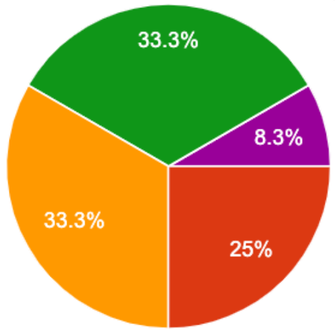
"The purpose of this activity was to calculate the current altitude based on the air pressure."

"One thing I learned is how the Altimeter uses the air pressure to determine the altitude."

"My favorite part was looking up the altitude of the school and then comparing it to the current altitude because you got to see real data against data that was already taken."

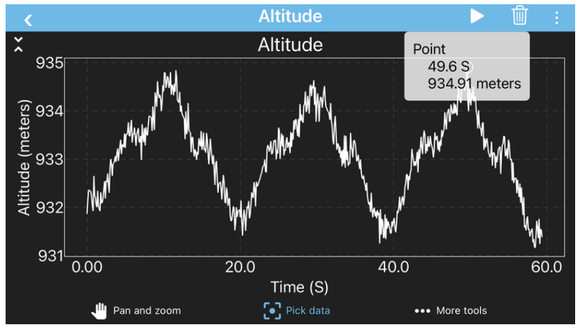
"I learned that when the altitude increases the air pressure decreases as there is less air above us."

"My favorite part was trying to find my altitude on google maps."



- 5 - Most awesome, engaging learning experience ever! I want more!
- 4 - This was a great learning experience and I had a great time.
- 3 - I found it interesting and enjoyed doing the project.
- 2 - It was better than going to the dentist.
- 1 - Not fun at all.

Students learn how air pressure is used to calculate altitude, calibrate for their local altitude, then conduct experiments to determine the accuracy of the altimeter by going up and down stairs.



Exploration: Sound Intensity

Jonte Lee

"The purpose of this activity was to check sound intensity with the databot. It is used to convert sound waves to digital data."

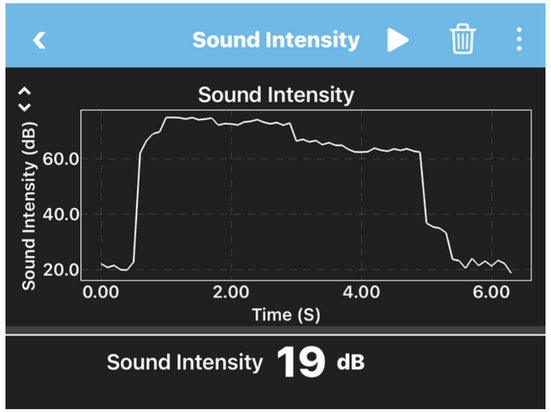
"Something I learned from this experiment is that the higher the amplitude the louder the noise."

"My favorite part of the activity was screaming and changing the sound of my voice to create the different patterns of the graphic display."

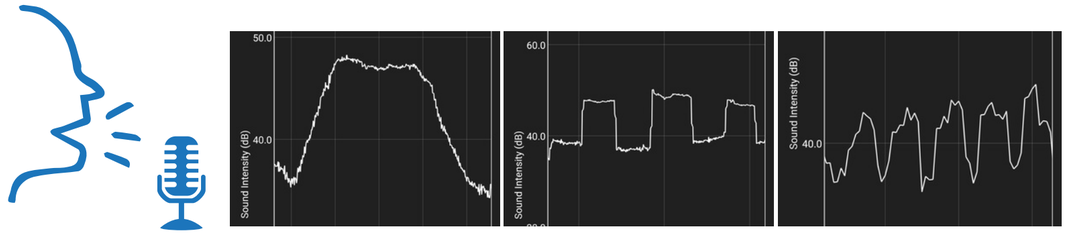
"I learned that a higher amplitude does not always guarantee a change in frequency.."

"I enjoyed creating the different waves using different sounds because my ability to make different noises to make different waves was cool and interesting to me."

"I learned that the sound sensor is actually used in smartphones, microphones, video cameras, etc."



Students explore amplitude by trying to match data graphs using their voices, then use data analytics to predict intensity changes based on distance from the source.



Round mound *Square waves* *Triangular spikes*

Exploration: Acceleration

Jonte Lee

"This activity used the databot to calculate our acceleration based on different movements. We ran, danced, and even leaped to see change in acceleration."

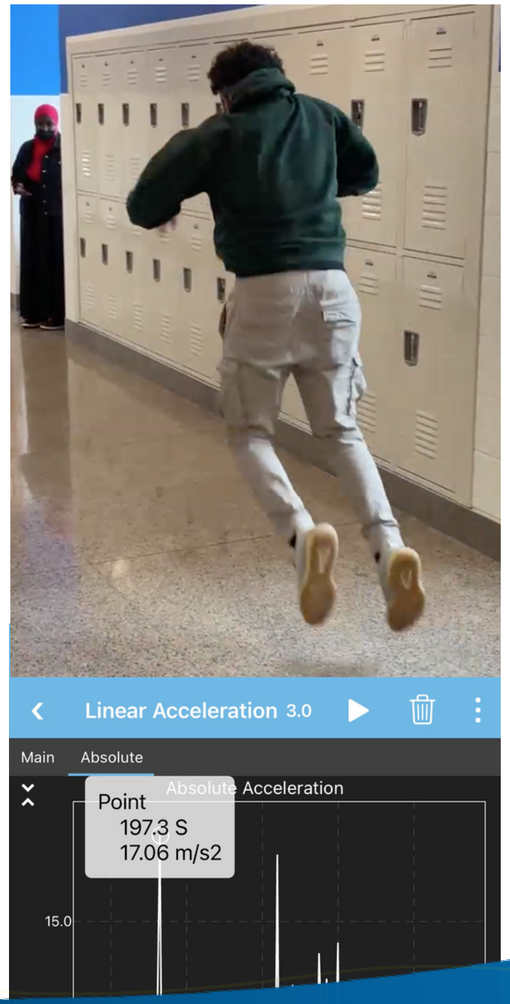
"I learned that the highest rate of acceleration I could achieve was me running or leaping including, acceleration rates being able to increase and decrease in certain directions and at different speeds."

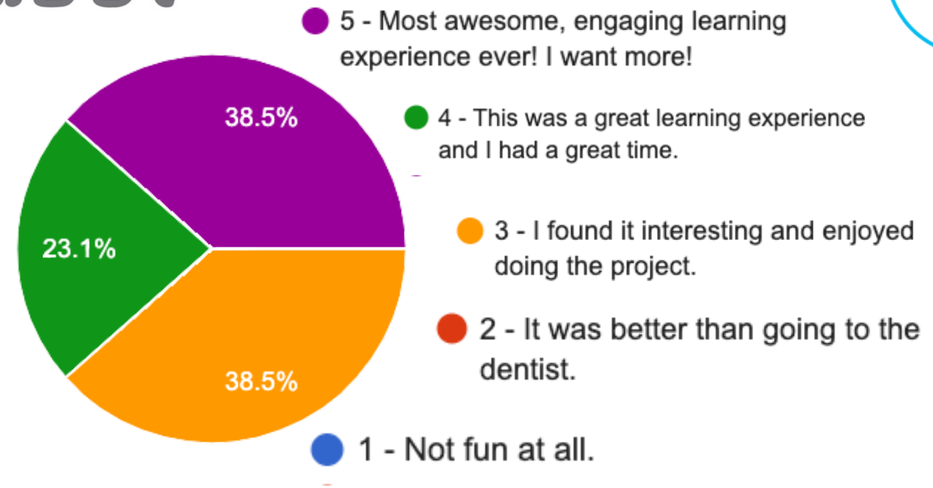
"My favorite part of this exercise is when we I saw my friend do the moon walk."

"I learned that all accelerometers work through mass that moves when you run or change direction."

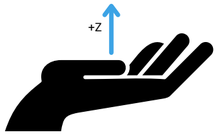
"This activity's purpose was to measure the acceleration, the change of the speed or direction."

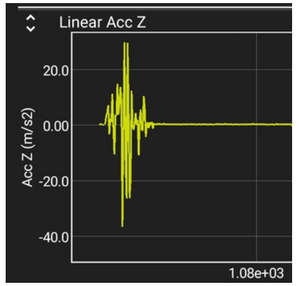
"I learned what the cartesian coordinates are."

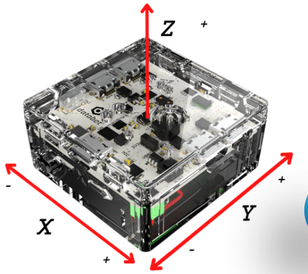




Students explore acceleration and 3D geometry through matching acceleration patterns on the x, y, and z axes. Then, using an absolute acceleration value, students attempt jump, cavort, twist etc. in a timed challenge to reach the highest acceleration level.







Exploration: Ultraviolet Radiation

Jonte Lee

"The activity had us to go to a window or and open space with sunlight then to go outside in the sun to see if the UV stayed the same. The purpose was to see if it stayed the same, then it's a bad sign because sunlight is harmful and building are supposed to protect you from that."

"I learned that the UV index determines how much sun protection you need to go outside."

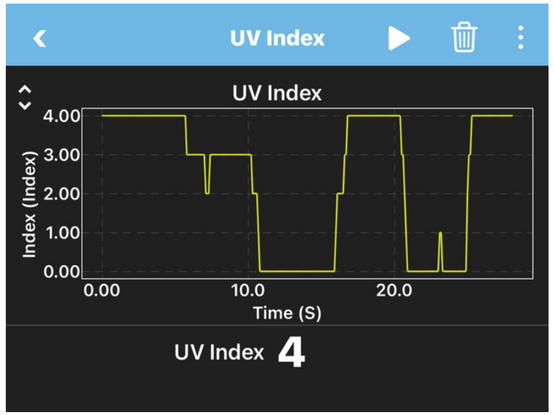
"My favorite part was collecting the data."

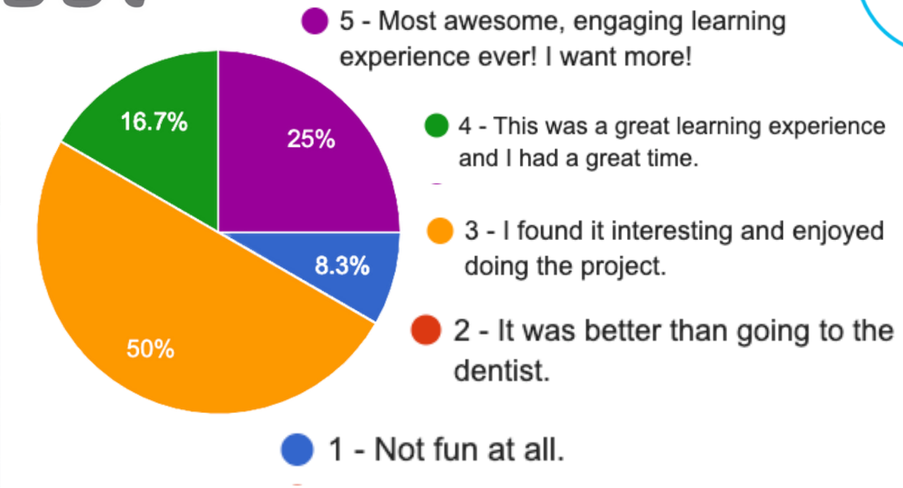
"I learned that UV is different from light that can be seen with the human eye because it has longer wavelengths and is invisible to the human eye."
."

"We tested the UV light from the sun by angling the databot to a certain point that showed the UV levels."

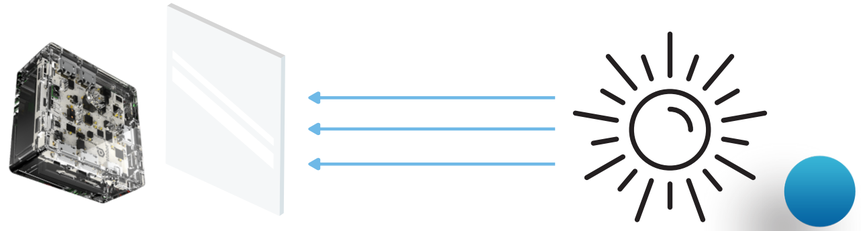
"I learned about the UV in my city. The UV was strong."

"My favorite part of the activity was being outside to get the UV data. I liked being outside."





Students explore the Global Solar UV Index levels and learn the dangers involved with UV ray exposure. They use online tools to find the UV index for their area, then test it themselves. Additionally, they test for materials that block UV rays seeking a material that will cut the index reading in half.



Exploration: Drone Challenge

Lesson Learned: Piloting drones require practice!

Jonte Lee

"We flew the drones around in our school and collected data. The purpose of this activity is to measure the height of the ceilings in our school."

"I learned more about altitude with this because at the drone flew up the altitude became higher and as it got lower the altitude became lower."

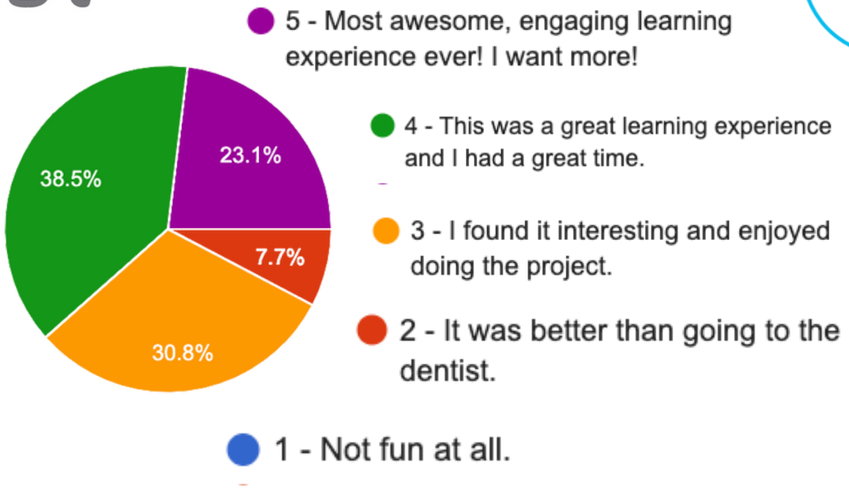
"The purpose of the activity was to use a drone to measure the height of the ceiling using altimeters."

"We were not able to complete the activity because we did not have enough time to work with the drone."

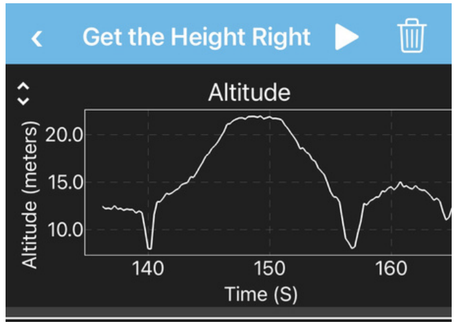
"The databot ran smoothly yet the Tello app for the drone was quite confusing so it was difficult to master the drone and determine the proper height."

"We were not able to calculate anything because of technical difficulties involving the drone."

"My favorite part was flying the drone because it was fun to watch the data change."



The Drone Master series pairs databot™ with drones (usually Tello) to conduct data collection and flight challenges. In this challenge, Get the Height Right, students work together to use sensors to measure the height of room ceilings.



Exploration: Indoor Air Quality

Jonte Lee

"Checking out the environmental conditions across the school to see if we are safe!"

"I learned about the different factors of air quality and how the level of CO2 determines whether air is okay to breathe."

"This activity measured different factors of air quality to let us know whether a room was safe to be in according to the air quality."

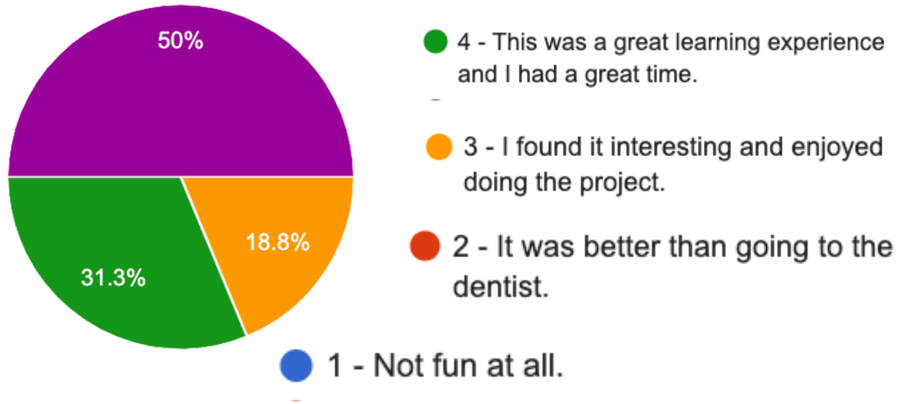
"I learned all the different factors that play a part in air quality."

"Roaming around gathering data samples made me feel like a real scientist - fun!"

"I learned that most classrooms without the air purifier had bad air quality."

"My favorite part of the activity was analyzing the data and finding out if a room was safe to breathe in."

"We had to each room in the school and check the air quality by going in the middle of the classroom and looking at the data that was being received from the data bot. The purpose of this activity was to check which classrooms would be the safest against Covid and which would not."



databot™ has a server mode that provides a real time dashboard for indoor environmental monitoring displaying values for humidity, CO2, VOCs, temperature, air pressure, and light. In this activity students take readings in different areas of the school to determine the overall air quality level.

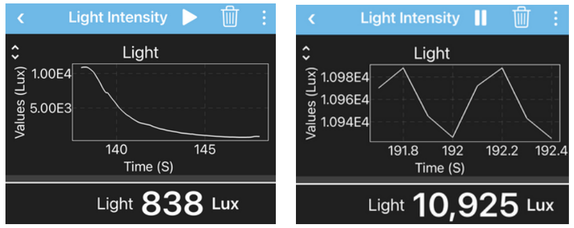
Indoor Air Quality

Other Activity Examples

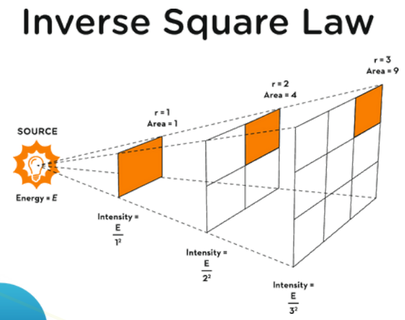
Does distance from the light source affect illuminance?

Distance from Sensor to Light Source (cm)

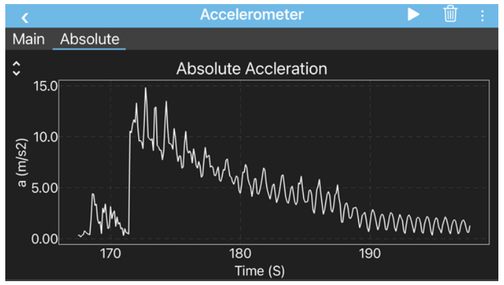
20 40 60 80 100



Applied Math

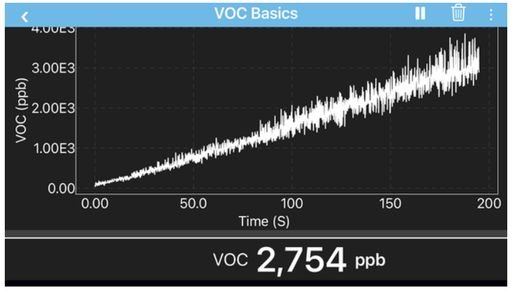


What does acceleration look like on a pendulum as it releases its energy? Where does the energy go?



Physics
Law of Conservation of Energy

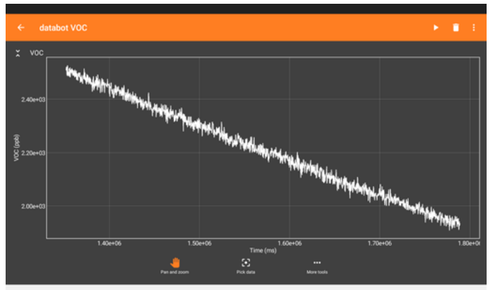
Volatile Organic Compounds An example of off-gassing from a substance.



Chemistry

databot™ in a jar with vinegar.

"Scrubbing" the air of VOCs using a chemical reaction.



Chemistry

Add baking soda and watch the reaction take place.

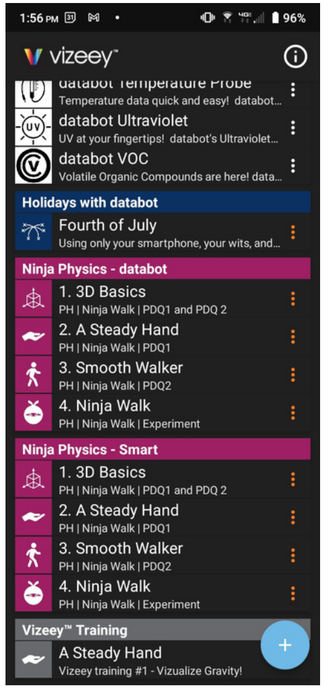
How to Use databot™ - Vizeey™ Smart App

Download on the App Store

GET IT ON Google Play

1. Download and Install Vizeey™

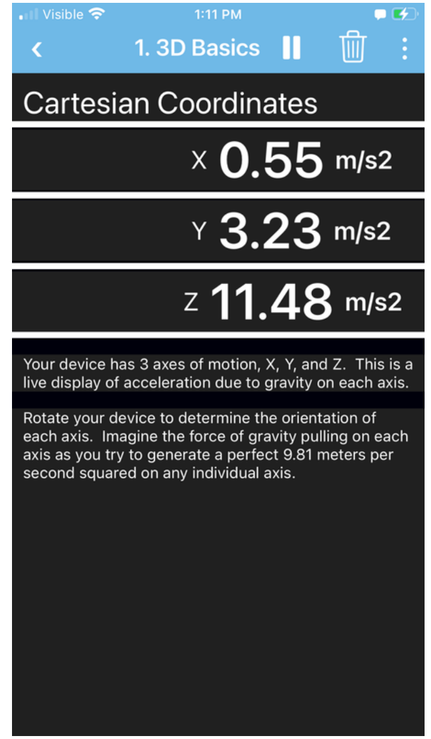
2. Look for the + sign and select add experiment from QR Code.



Ninja Walk

3. Scan the QR Code

4. Select 3D Basics to try it out! Then download the full lesson plan to explore further.



TRY IT: Download the complete Ninja Physics lesson plan here. No hardware is required, just the free app and a smart device.

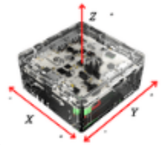
https://databot.us.com/databot-ninja-physics/

databot™

Activities

ACCELEROMETER

databot Sensor Starters



Grades: 6 & Up
Time: 15 Minutes - PDQ 1 & 2
Subject: Physics, Technology
Topics: Acceleration, Speed, 3D Geometry

Meet the Accelerometer

The accelerometer senses motion and it is one of the most widely used sensors in the world. Think of all the devices that you know of that move. Cars, planes, trains, drones, game controllers, washing machines, and even your smart phone. How does your phone know to change orientation when you rotate it sideways? The accelerometer!

What Does it Measure?

The accelerometer measures acceleration, a change in speed or direction. You have no doubt experienced acceleration. For example, when a driver presses on the gas in a car it accelerates as it changes from zero to 10 mph to 20 mph and more. As the vehicle accelerates you will feel yourself pressed back into the seat. Acceleration is different than speed. Once a car reaches and holds a certain speed, say 60 mph, you are no longer accelerating as your speed is constant.

How Does it Work?

There are different types, but all accelerometers work through the use of a "mass" that moves when acceleration takes place. Just as your body is pressed back into the seat when you accelerate in a car, a mass within the accelerometer moves when accelerating. Using mechanical or electrical means to measure this movement, the sensor converts it to numbers that represent the force of acceleration.

What Are the Units for Acceleration?

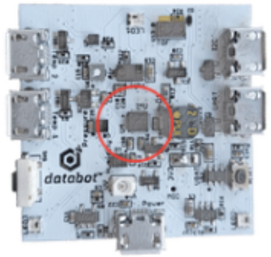
Acceleration is a "change" in speed or direction over time. Speed is distance over time such as miles per hour (mph) or kilometers per hour (kph). In physics we frequently use the units meters per second (m/s). Now, for acceleration, we add in the rate of change, which is also in seconds, so we end up with meters per second "per second" to express acceleration. This is expressed as meters per second squared or m/s2 in the units shown in Vizeey™.

What You Will Need/Prep

- databot™ 2.0 & a smart device (iOS or Android).
- Read the Vizeey™ Fast Start Guide and install Vizeey™ if you haven't already.
- Scan the QR code for Linear Acceleration if you don't have it already.

Where Does it Live?

The accelerometer is one sensor in a module called an intertial measurement unit (IMU) located in the center of the databot™ PCB. Look for the label IMU on your databot™!

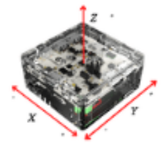


Important Terms

Acceleration: The rate of change in speed or direction. An object moving at a constant speed and direction has zero acceleration.
Accelerometer: A sensor that detects acceleration - changes in speed and direction.
Speed: The rate of change of position of an object in any direction.
Cartesian Coordinates: Describes position in three dimensions (3D) using the Cartesian coordinates X, Y, and Z.

ACCELEROMETER

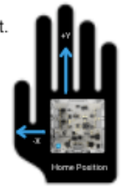
PDQ1 : 3D Thrills with databot™



Using the databot™ accelerometer it is possible to read changes in speed and direction! First, in order to understand reading "direction" - familiarize yourself with the orientation of databot™ using the 3D Cartesian Coordinate system of X, Y, and Z axes. The accelerometer reads forces across these 3 axes. Depending on what direction you move, you will see the force of acceleration on a particular axis.

1. Tap on Linear Acceleration in Vizeey™ to load the experiment & use these icons to start and to pause the experiment in the Main View:

2. Hold databot™ in the palm of your hand in the "home" position shown. You should see close to 0.0 m/s² on each axis as you hold still. Shake it to equalize the scales on the three axes - your goal is a scale of -20 to +20 on each axis. Stop, erase your data, restart as you practice until you get it.



3. Next, move databot™ forward, backward, sideways and up and down. Move with fast, uneven movements that accelerate.

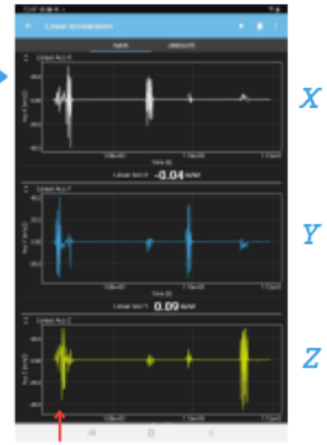
4. Watch the data visualization of acceleration and verbally say each axis as you move. Try to match the graph image shown to the right.

Shake it up!

Each axis "auto-scales based on the highest and lowest value of x, y, and z.

Start by shaking databot™ on each axis so that you get each axis to display an equal range of -20 to +20 m/s2.

This will match the 3 displays for easier comparison.



Shake | Movement on each axis.

PDQ2 : Hop, Skip, Run, Race or Jump

In this PDQ, acceleration from the x, y, and z axes is all combined into one awesome value that represents your total acceleration. With databot™ held tightly against your body, what is the highest rate of acceleration you can achieve?

1. Tap on Linear Acceleration in Vizeey™ to load the experiment & use these icons to start and to pause the experiment:

2. Swipe left to the Absolute View.

3. Set up a Vizeey™ "Timed Run" for 10 seconds.

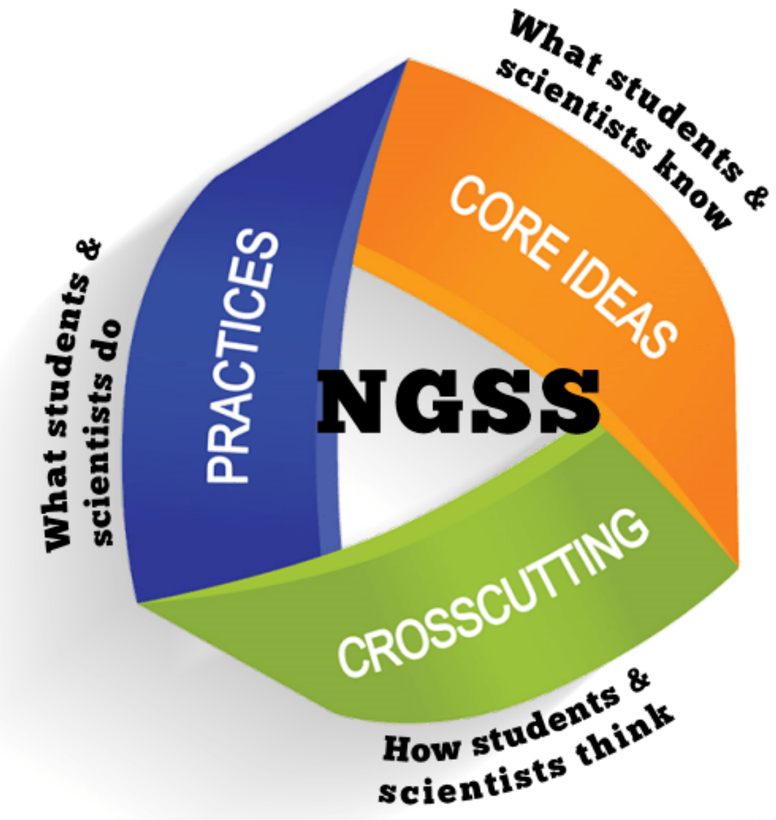
4. Start the countdown!

5. Hold databot™ snugly against your body holding it in your hand and placing it over your heart.

6. Now leap, cavort, run and move in your best effort to achieve a high rate of acceleration. After your ten second recording use the Vizeey™ "Pick Data" tool to identify your peak acceleration!

Mastering the NGSS 4th Practice

The Next Generation Science Standards (NGSS) are an impressive body of work developed to guide science education for the 21st century.
One of the three cornerstones of the NGSS are the eight Science and Engineering Practices that are identified as essential for all students to learn.

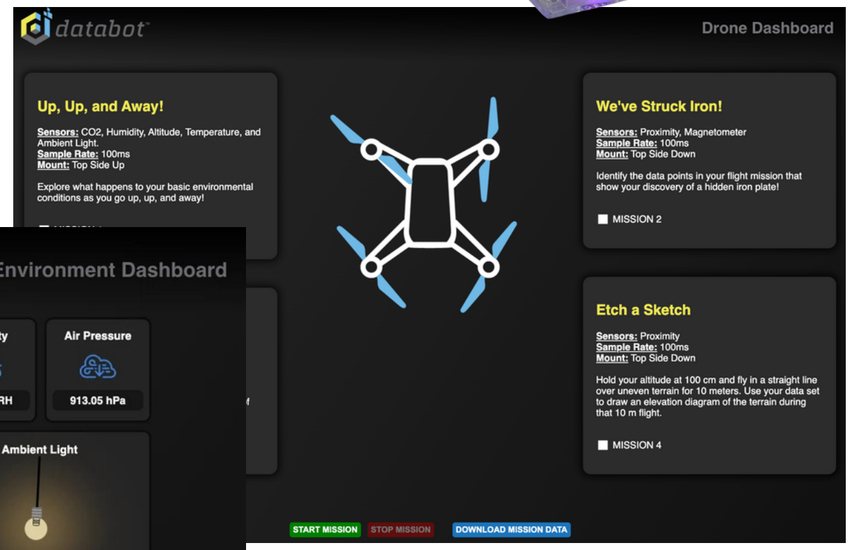


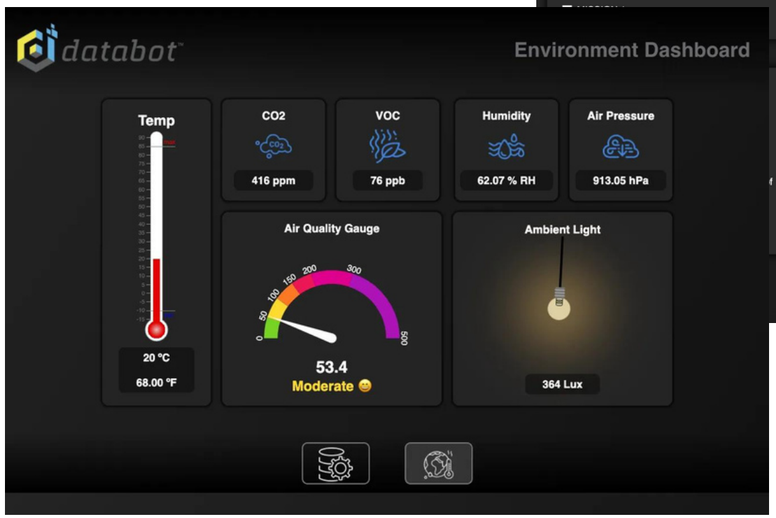
Importantly, the **4th practice is Analyzing and Interpreting data**. Whenever students are conducting data oriented activities such as those using databot™, they are applying this practice – an invaluable skill that can be applied to careers of the 21st century. The more comfortable we make our students with data today, the more successful they will be tomorrow.

More Ways to Use databot™ - Server Mode

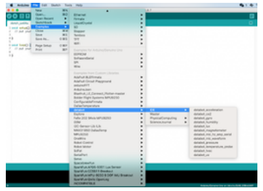
Using Server Mode databot™ serves up a local network and live data for browser accessed dashboard that provide on-board data storage configurations, drone missions, environmental monitoring, and more.

Other modes enable databot™ to connect wirelessly to other devices and stream serial data or connect to coding environments.

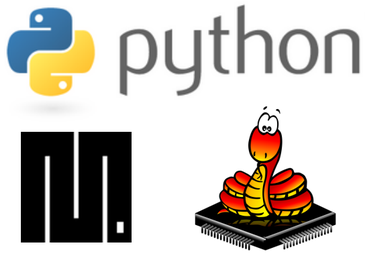




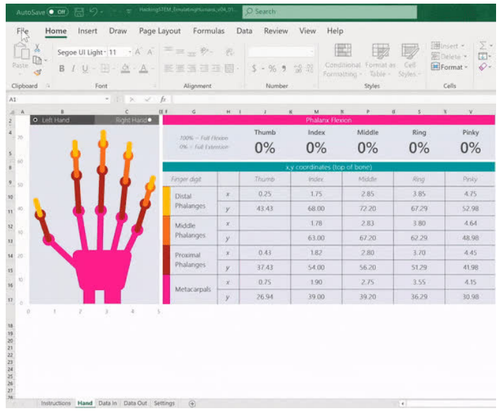
Using databot™ - Arduino and Other Platforms



databot™ is built on Arduino and will show up as an ESP-32 in the Arduino software. Connect to databot™ and learn to change its behavior using this software.



Load MicroPython on databot™ and take command at the hardware level using the complete technical details, pinouts, and sensor data sheets provided by databot™.



Data Streamer from Microsoft enables live serial data streaming directly into Excel.

Any software accepting .CSV data imports or serial data streaming can be connected.

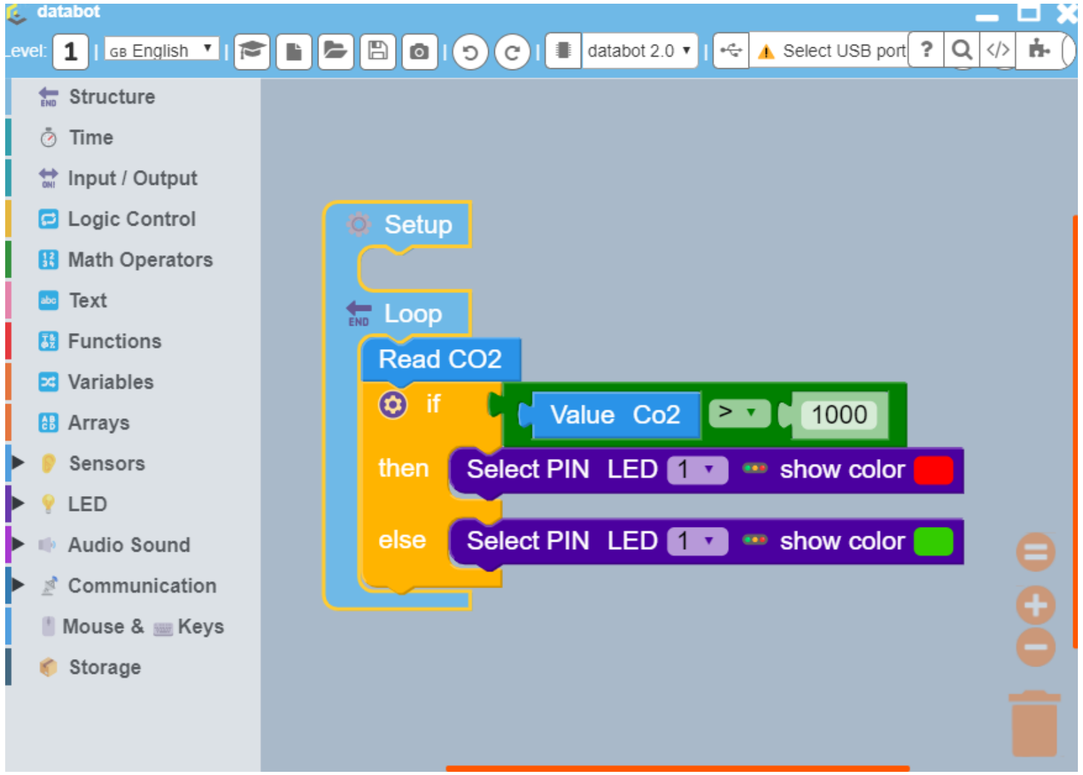
Rich experiences in applied mathematics and data science are possible using popular tools like desmos and GeoGebra.

databot™ is also an awesome tool for **physical computing** - code it to respond to sensor data and it will flash brilliant LEDs and squawk, beep, and chortle using the onboard tone generator. A great way to begin coding for robotics with one simple device.

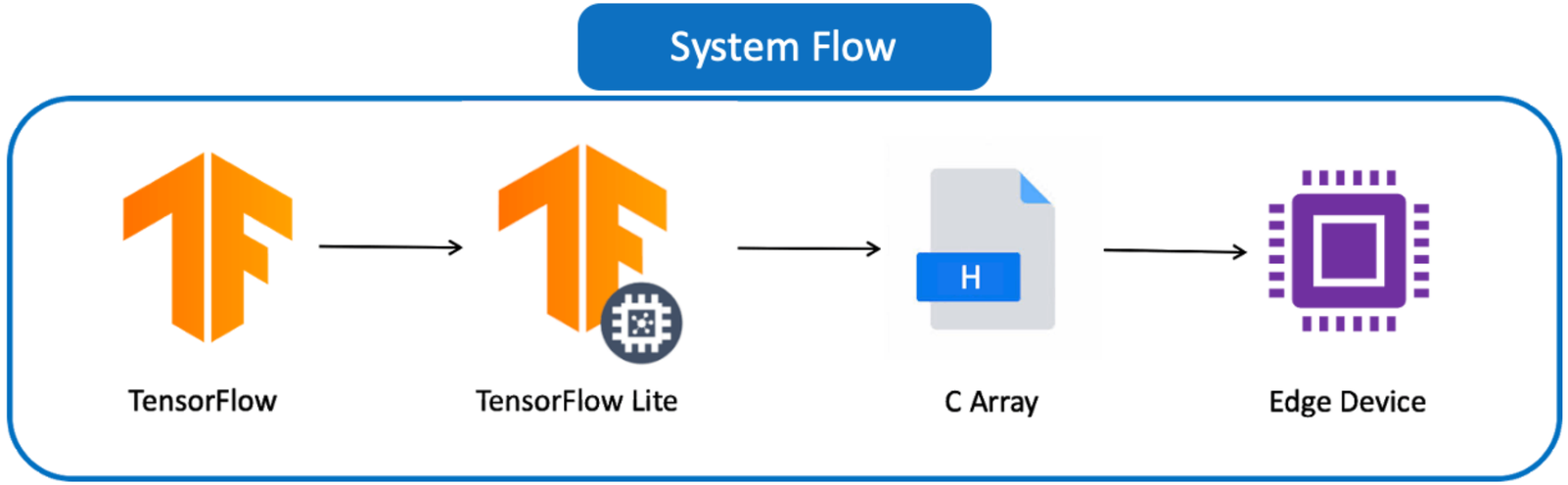
More Ways to Use databot™ - Physical Computing

dataBlockly™

dataBlockly provides a free, drag and drop coding environment for physical computing with databot™ 2.0. Combine sensors, light, sound and your imagination to code imaginative projects.



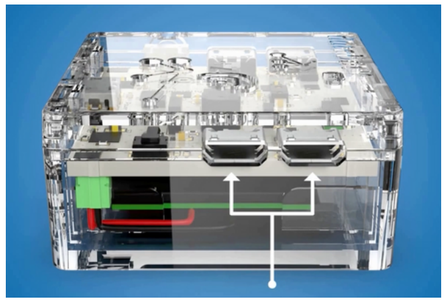
More Ways to Use databot™ - Machine Learning



Using existing Edge computing software solutions, machine learning modules can be designed and deployed directly to databot 2.0 acting as an Edge device.

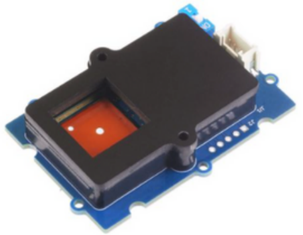
databot™ 2.0 Expansion Using the Grove System

Grove is an open source, low-cost, toolset developed to facilitate modular exploration of electronics. The system includes a variety of 3.3v sensors that can be easily added to databot 2.0 using our custom MicroUSB - Grove connector cable.



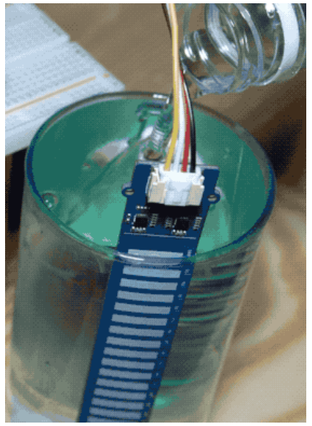
pH Sensor
$17.50

- Electricity
- Soil Moisture
- Turbidity
- Heart Rate
- Electromyography (EMG)
- Fingerprint

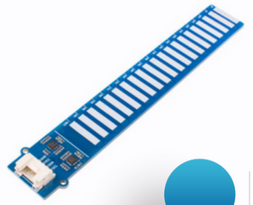


Formaldehyde Sensor
$54

- Gas: O2
- Gas: MQ2 Combustible Gas, Smoke
- Gas: MQ3 Alcohol Vapor
- Gas: MQ5 LPG, Natural Gas, Town Gas
- Gas: MQ9 Carbon Monoxide, Coal Gas, Liquefied Gas

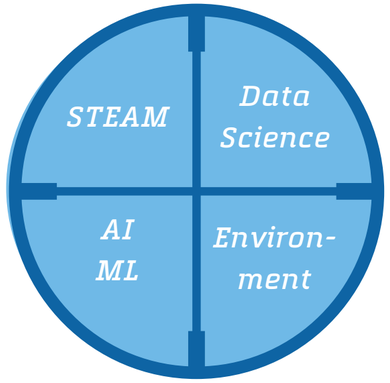


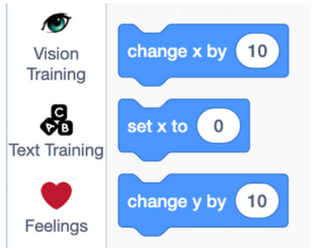
10 cm Water Level Sensor $7.60



databot™ - Product Roadmap - What's Next?

We create technology and brilliant activities that empower students everywhere to think deeply, explore with passion, and solve our planetary scale challenges.
Our subject focus is on four big ideas: STEAM, Data Science, AI/ML, and Environment.





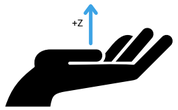
For grades 4+, an AI enabled Scratch environment integrated with databot™ physical computing attributes.

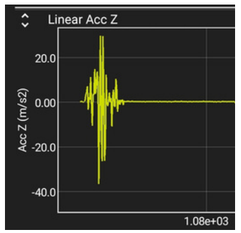
AI4ALL

Activity development supporting popular tools for math & data analysis. Specific data analytics activity extensions are in development.

Big Ideas in Data Science

Expand and enhance the databot™ CO2 Science series.





Expand science and math activity library; support cross-curricular development PD projects in NC.

databot™ Use Cases: One Device, Many Applications!

Amazing versatility

STEM Programs

- Engaging Activities
- Camp Format Curriculum Available
- Easy to learn and manage
- Integrates with existing materials like LEGO, VEX, and other systems
- Tough and versatile

Career & Technical Education

- Coding - Arduino IDE, Python
- Design Challenges
- Open Hardware - Electronics
- Data Science
- Physical Computing
- IOT

Science Education

- Grades 4-12
- Hands-on experiments
- Robust data visualization tools
- Easy-to-implement and train
- Classroom tough

Math Education

- Data literacy
- Applied Mathematics

Higher Education

- Highly versatile for science studies
- Open Arduino hardware for EE
- Computer Science

Visit https://databot.us.com/blog for Case Studies in Classroom, CTE, and Remote Learning

databot™ 2.0 Product Configurations

Single - The Classic!
$179.99

Twin Pack - 2 'bots!
$350

Class Pack - 10 'bots!
$1,750

Welcome to the databot™ family!

For more information:

contact@databot.us.com