https://bit.ly/CSAAPTbotsAI

BENEDICTINE SCHOOLS
OF RICHMOND

CSAAPT: The Future of Physics EDU with AI (chatBots and Robots)

October 11, 2025

VCU STEM Building 216

1:30pm - 2:30pm

SAINT GERTRUDE HIGH SCHOOL

BENEDICTINE COLLEGE PREPARATORY

Addressing the Elephant in the Room About Physics AI in 2 Slides

(Not why I’m on crutches)

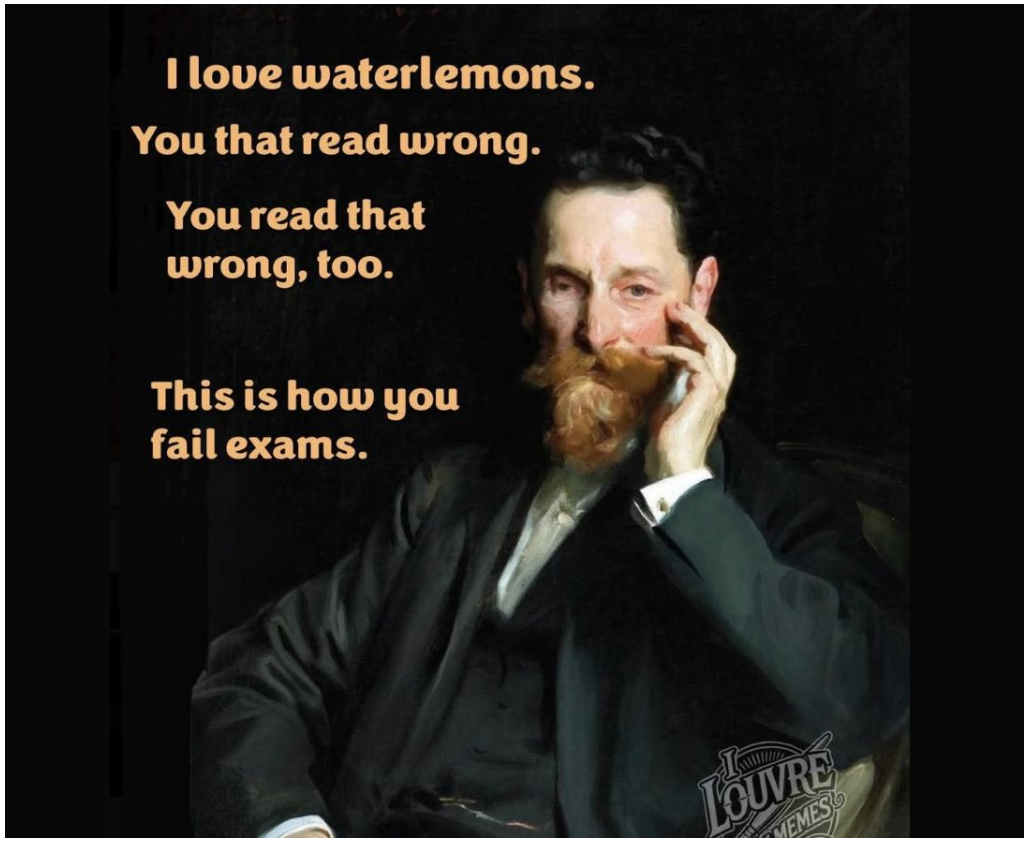
LLMs (Large Language Models): Past vs Current

Early AI Could NOT DO MATH:

- Relied on PATTERN RECOGNITION (finished sentences)
- Gave confident but wrong answers

Current AI Improved BUT:

- Still makes mistakes in long derivations or unit conversions



LLMs don’t “do math” → they predict text that looks like Math

LLMs: Mistakes Still Happen → How to Ensure Accuracy

Common Mistakes for Physics Educators:

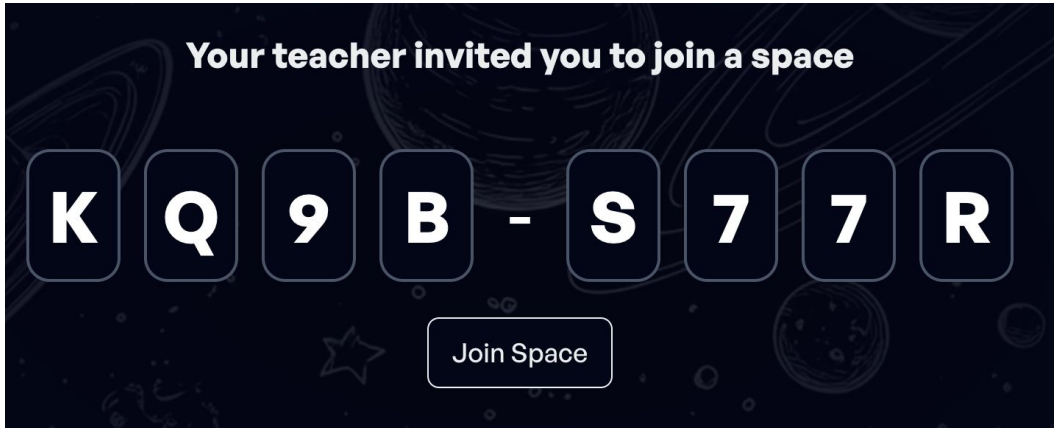
- Arithmetic and Algebra Slips
- Physics Formula Slips
- Units and Decimal Precision Errors

Ensure Accuracy:

- **Verify Independently**: Calculator, Spreadsheet, Python translation
- **Ask for Steps**: Formulas and Units Identified
- **Treat AI as a 1st Draft** or Template

The WHY of Physics → The Key to Authentic and Effective Instruction

Let’s Start with ChatBots



Why AI and ChatBots?

- Use Real People/Celebrities who are NOT YOU in your chatbots
  - Students know the chatBot is FAKE, but still want to go in there to investigate what they say
  - School AI Example: TAYLOR SWIFT teaches Kinematics with School AI
  - Be careful → if there’s something recent about these celebrities it will not pick up (aka THE GIG IS UP)
- MagicSchool AI Emergency Sub Plans least popular → most popular

AP CSP Big Idea 1: Creative Development chatBot

chatBot Link:
https://student.magicschool.ai/s/join
then **ooSvrQ**

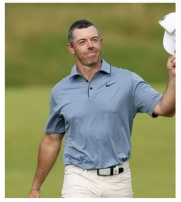
https://student.magicschool.ai/s/join?joinCode=ooSvrQ

Avatar: Mrs. Eileen Malick

AP CSP Big Idea 5: Impact of Computing chatBot

chatBot Link:
https://student.magicschool.ai/s/join
then **o9q2kw**

https://student.magicschool.ai/s/join?joinCode=o9q2kw

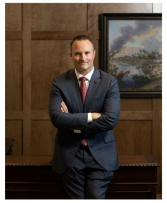


Avatar: Mr. Rory McIlroy

AP CSP Big Idea 2: Data chatBot

chatBot Link:
https://student.magicschool.ai/s/join
then **JgScZg**

https://student.magicschool.ai/s/join?joinCode=JgScZg



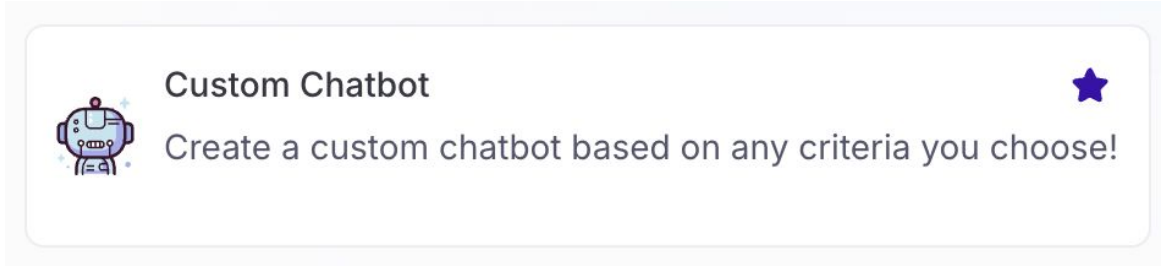
Avatar: Mr. Jesse Grapes

Prompt Template

Your **prompt** is the brain of your chatbot. The clearer and more specific it is, the better your bot will perform.

- **Start with a Clear Role:** Begin with "You are..." or "Act as...".
  - *Example:* "You are a patient AP Computer Science Principles instructor named Mrs. Malick specializing in **Big Idea 1: Creative Development** Exam Weight 10–13%: When developing computing innovations, developers can use a formal, iterative design process or a less rigid process of experimentation, and will encounter phases of investigating and reflecting, designing, prototyping, and testing. Collaboration is an important tool at any phase of development."
- **Define the Goal:** State precisely what the bot should help students achieve.
  - *Example:* "...Your goal is to help beginner AP Computer Science Principles students understand and correctly answer random questions from Big Idea 1: Creative Development."
- **Specify Tone and Style:** How should the bot sound?
  - *Example:* "Be friendly, patient, and encouraging."
- **Set Constraints/Rules:** Tell the bot what *not* to do or what to *always* do. This is crucial for keeping it on topic.
  - *Example:* "ALWAYS provide gentle corrections, explaining *why* it's incorrect. After the 3rd wrong answer give the answer and an explanation of why it's correct"
- **Guide Initial Interaction:** Tell the bot how to start the conversation.
  - *Example:* "Start by asking the student: 'Hello! I am Mrs. Malick's Avatar who will be teaching you about Big Idea 1 so you will be well prepared when she returns.'"
- **Include Level Adaptation:** If applicable, instruct the bot to tailor its responses based on student input.
  - *Example:* "If answers are less than 2 words, politely ask for sentences for clarity."

Template of a chatBot



Step 1: Choose a customizable chatBot option in MagicSchool AI or School AI

Step 2: Prompt → attach objectives or AP Section

"You are a professional Irish golfer AP Computer Science Principles instructor named Rory McIlroy specializing in Big Idea 5: Impact of Computing: Computers and computing have revolutionized our lives. To use computing safely and responsibly, we need to be aware of privacy, security, and ethical issues."

"Your goal is to help beginner AP Computer Science Principles students understand and correctly answer random questions from Big Idea 5: Impact of Computing."

"Be polite and give relaxed positive reinforcement and quote some examples of your wins in golf."

"ALWAYS provide corrections with comparisons to aspects of Golf, explaining why it's incorrect. After the 3rd wrong answer give the answer and an explanation of why it's correct and remind students to use the same practices in golf to become a champion."
"Start by asking the student: 'Welcome AP Comp Sci! I am Rory McIlroy who will be teaching you
about Big Idea 5 so you will be well prepared when Mrs. Malick returns.'"

"If answers are less than 2 words, give a golf term to ask for sentences for clarity."

The FUTURE of PHYSICS EDU (AI is NOT the CORE)

Inquiry-Based Learning

Engagement

Authentic Science

Evidence-Based Reasoning

Real-World Connection

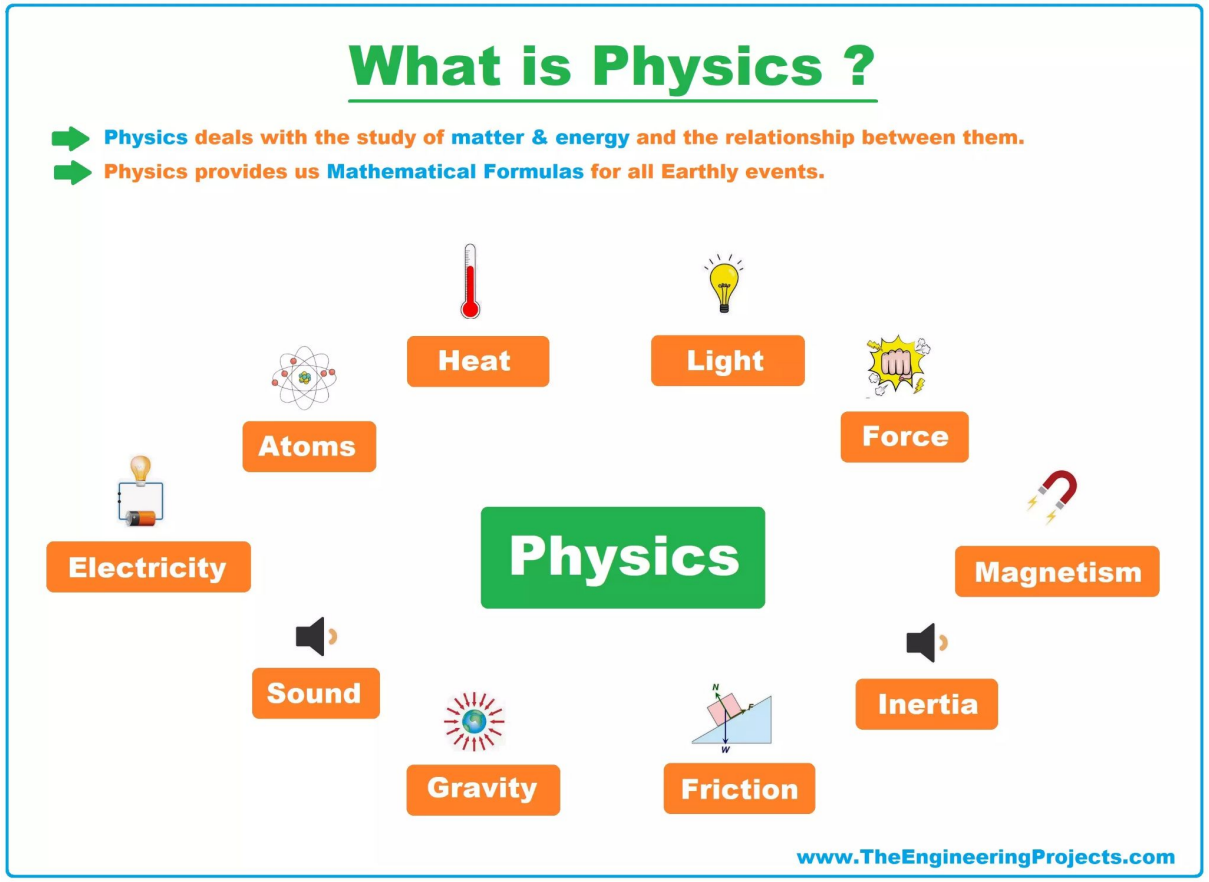
* PocketLab Hand On Data Collection Conference 9-25-25

PHYSICS is the CORE

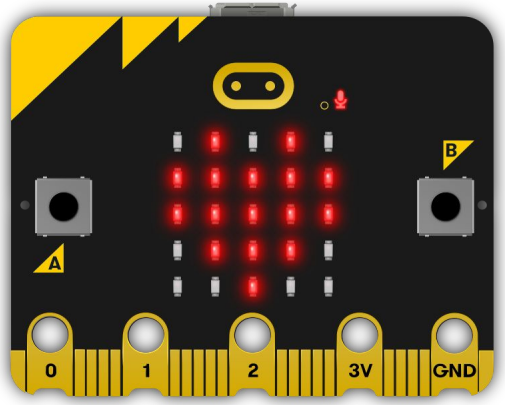
PHYSICS uses DATA to understand Laws of Nature:

- We will focus on **Quantitative Data (Numerical)** rather than qualitative (descriptive)
- Gathering REAL DATA through Robotics

MODERN PHYSICS used large datasets and computational tools



AI creates the TEMPLATES / TABLES



BBC Microbit V2 (Link to Amazon) is ~~$21~~ *argh tariffs* $25

MicroBits + BirdBrain Finch 2.0 Robots (Link to Finch 2.0) $159 (microbit v2 included)

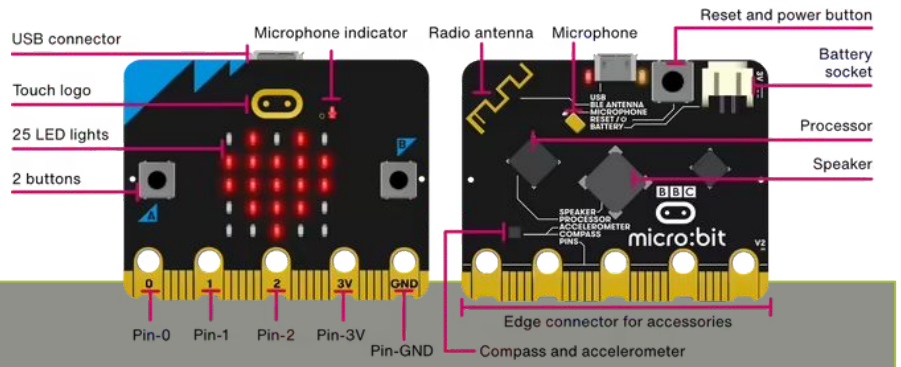
Teknikio BlueBird V1.8 (Link to Teknikio) is $32

ROBOTICS does the CORE with Real World Data

Why AI and TINY ROBOTS?!?

1. Tiny Robots are INEXPENSIVE (5-10 sensors for less than $40)
2. Tiny Robots are lightweight, travel easily, and do not take up much space
3. Tiny Robots are a group PASS (When a teacher asks “Where is your Pass?” You show them the robot :-)
4. Tiny Robots are easy to program/code (many in multiple languages)
5. AI has improved and there are more products customized for Educators and Safe AI for Students

The HOW is the Data Collection with Robots is Computer Science



All sensor readings on a micro:Bit are all on a BINARY scale:

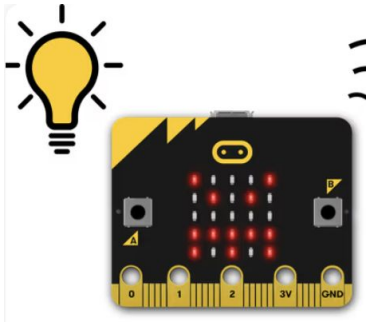
- Attain DATA through CODE
- Some use Percentages of Binary Data 0 to 100
- These ranges are essential for **AI** in creating templates/charts

BINARY Representation of Numbers

from 0 to 255 (8 bits)
00000000 11111111

from 0 to 1023 (10 bits)
0000000000 1111111111

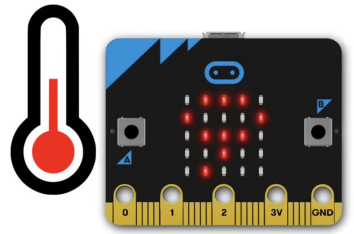
LIGHT DATA with the micro:Bit



micro:Bit version 2.0:

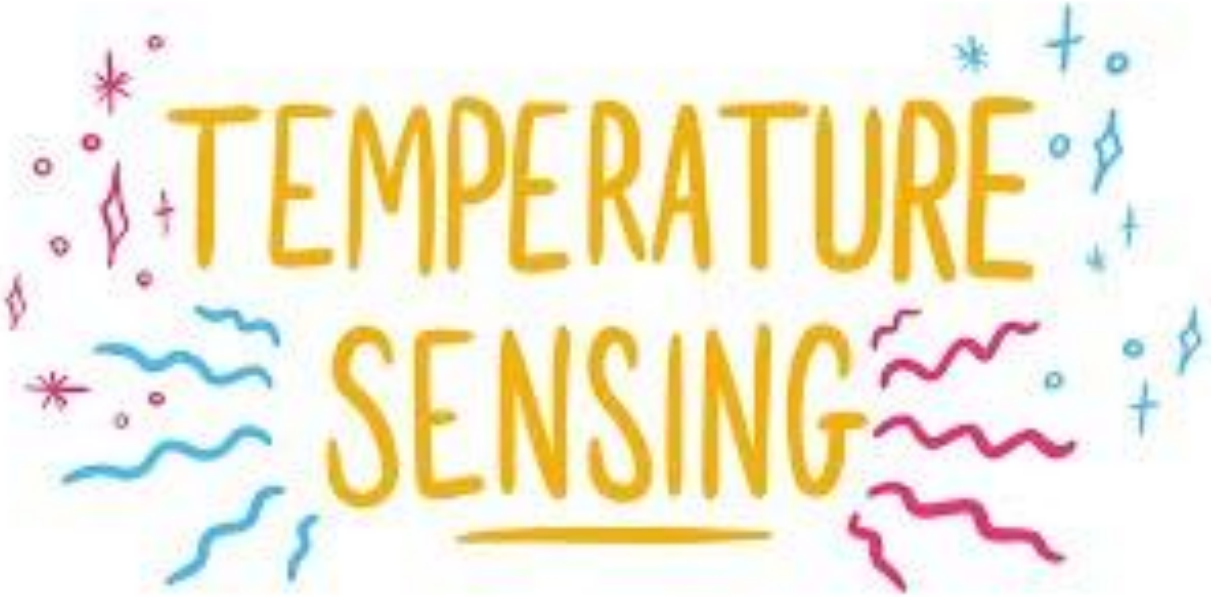
- Light Sensor using the LED display for Light Levels on a 0-255 scale
- Measures “general” Lux (not Lumens)
- Once you have your micro:Bit light data reading you can calibrate or convert to Lux

TEMPERATURE DATA with the micro:Bit



micro:Bit version 2.0:

- Temperature Sensor using the Processor for Temperature Levels on a default degrees Celsius (°C) range -40°C to 105°C
- You can either have students code to degrees Fahrenheit (°F) or conversion formulas after measuring



COMPASS DATA with the micro:Bit

micro:Bit version 2.0:

- Digital Compass using the magnetometer to detect magnetic fields and magnetic north
- micro:Bit has a compass calibration program where you tilt to fill screen
- Can also detect magnet magnetic fields

SOUND DATA with the micro:Bit

micro:Bit version 2.0:

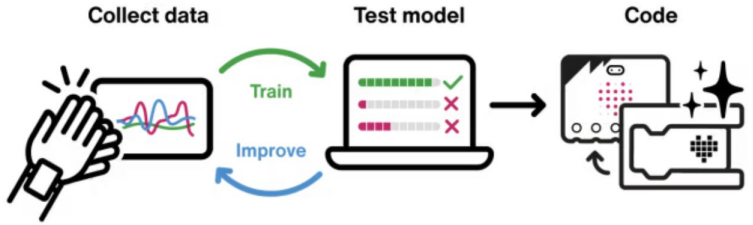
- Version 2 has a built-in Microphone Sensor (and speaker) detecting sound on a 0-255 scale
- Measures “general” sound levels
- Once you have your micro:Bit sound data reading you can calibrate or convert to Decibels (dB)

ACCELERATION DATA with the micro:Bit

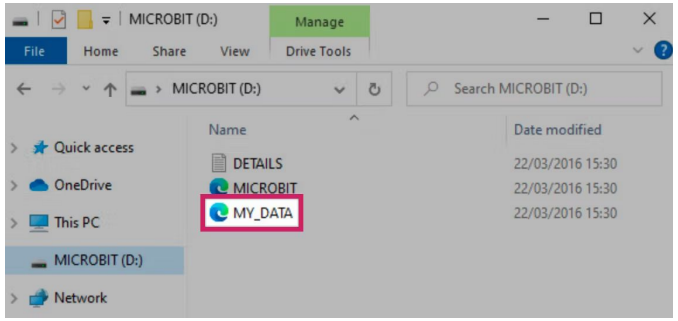
micro:bit | CreateAI

micro:Bit version 2.0:

- Version 2 has an Accelerometer (motion sensor) detecting movement/orientation
- Use with in combination with the Processor for micro:Bit CreateAI for XYZ Acceleration Data

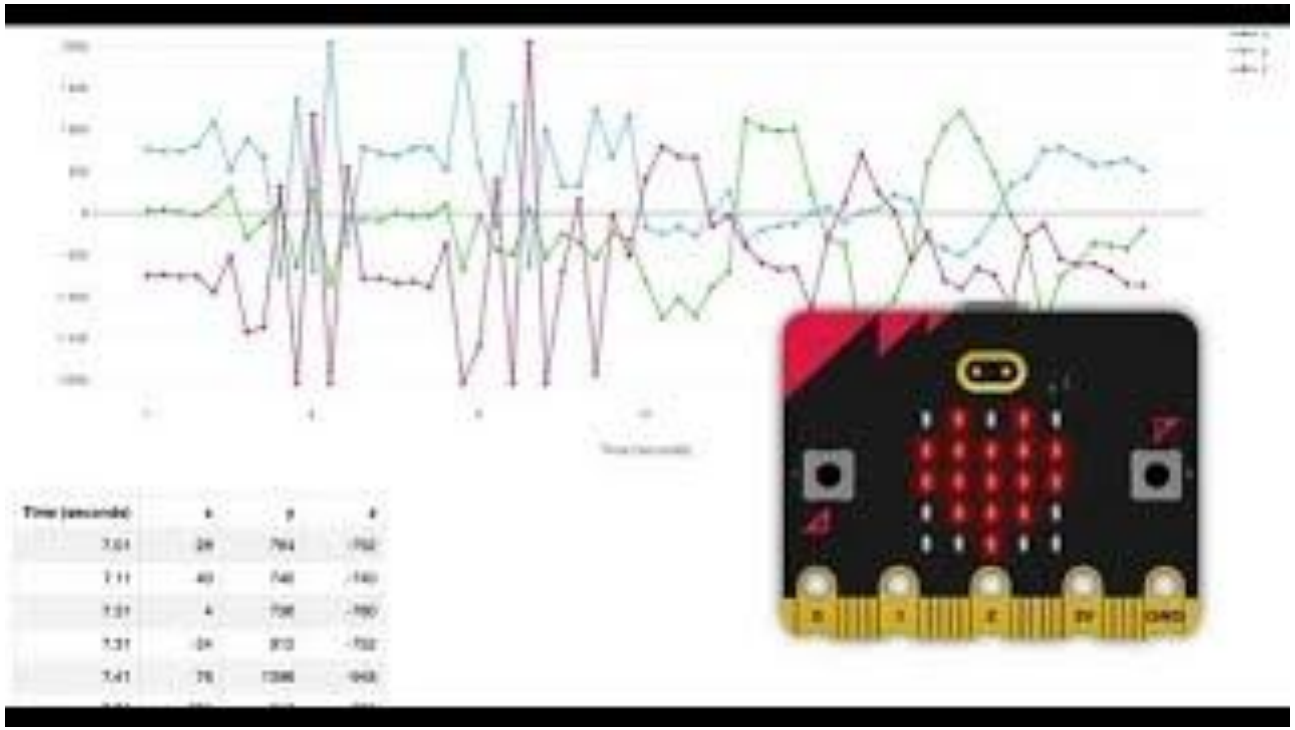


DATA LOGGING with the micro:Bit



micro:Bit version 2.0:

- Data Logging for Data which can be collected, stored, and retired for analysis
- Data is stored even with power loss and can be visually be retrieved in graphs and tables on spreadsheets



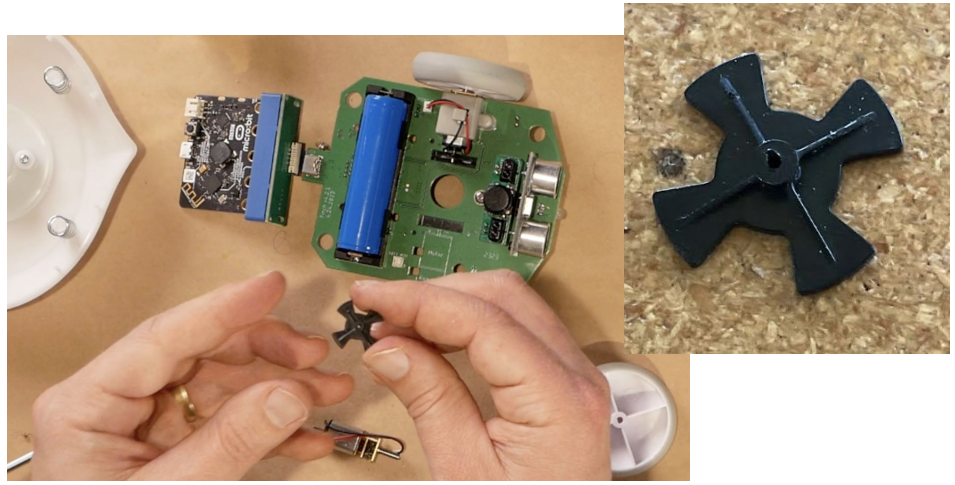
The HOW is the Data Collection with Robots is Computer Science

All sensor readings on a BirdBrain Finch robots are all on a BINARY scale for 8 bits:

- Finches come with BBC micro:Bit attached (so all the (5) sensors covered before)
- Additional 4 sensors on the Finch

1 Wheel Encoders
2 Line Tracking Sensors
3 Distance Sensor
4 Light Sensors
5 Compass
6 Accelerometer
7 Buttons

WHEEL ENCODING DATA with the Finch



Finch version 2.0:

- Wheel Encoders using 2 Encoder Sensors for the wheels for Distance Data in centimeters (cm) for a R and L wheel
- Use **EDUCATORACCESS** as the Passcode
- 1 wheel = 5 cm distance/revolution
  - 99 spins/revolution so 792 encoder ticks/revolution*

    * Dr. Tom Lauwers Text 9-29-25

LINE TRACKING DATA with the Finch

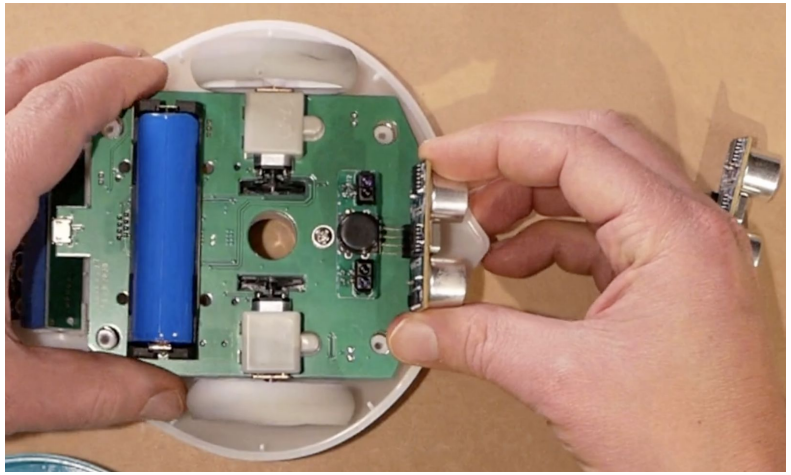
Finch version 2.0:

- Line Tracking Data using 2 Line Tracking Sensors using infrared radiation and measure the radiation reflected scale 0 - 100 (%)
- Use **EDUCATORACCESS** as the Passcode
- Black line = low reflection
- White line = high reflection

DISTANCE DATA with the Finch

Finch version 2.0:

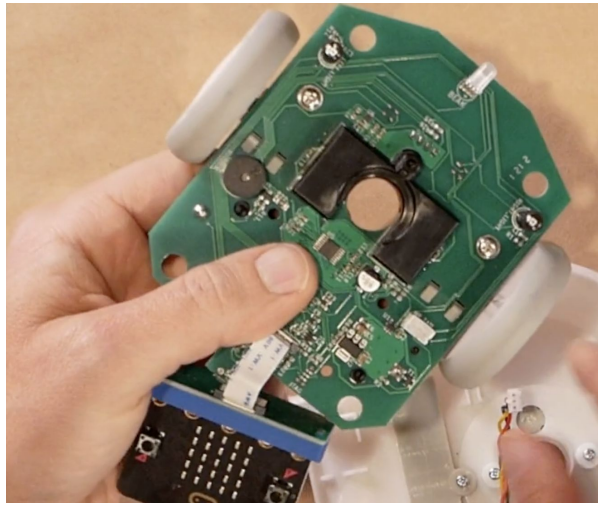
- Distance Data using distance sensors for detecting obstacles with BOOLEAN (True/False) also with infrared radiation and measure the radiation reflected
- Obstacle = True
- Clear = False



LIGHT DATA with the Finch

Finch version 2.0:

- Light Data using light sensors for light detection scale 0 - 100 (%)
- Measures “general” Lux (not Lumens)
- Once you have the finch light data and your micro:Bit light data reading you can better calibrate or convert to Lux



AI with the Finch in Python

AI with the Finch in Python:

1. Basics of Machine Learning
2. Finch Activity 1: Image Recognition
3. Finch Activity 2: Audio Recognition
4. Finch Activity 3: Pose Recognition
5. Finch Activity 4: Position Recognition

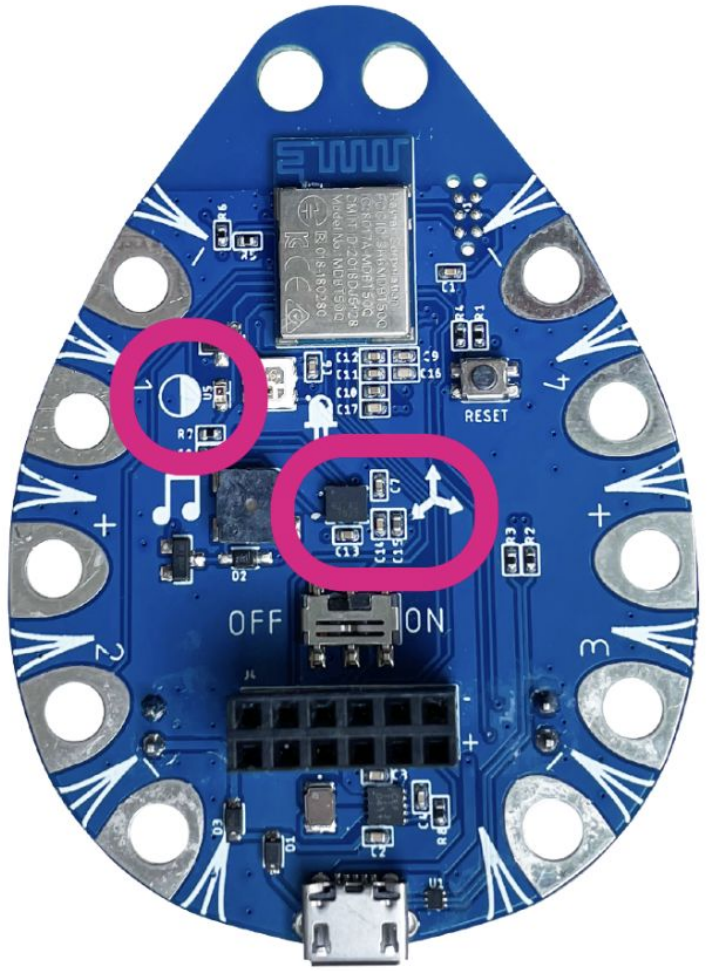
Teknikio BlueBird

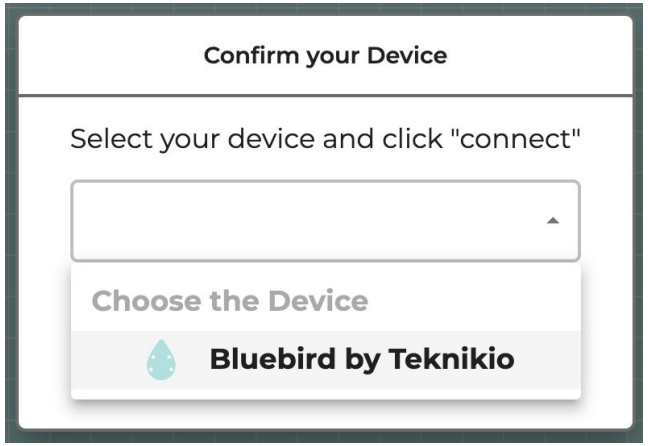
Bluebird by Teknikio:

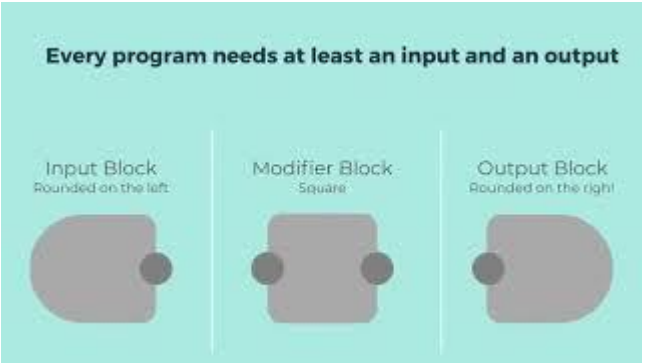
Teknikio Coding Blocks are very unique

Sensor Inputs:

- Light Sensor
- XYZ Accelerometer
- Internal Temperature Sensor



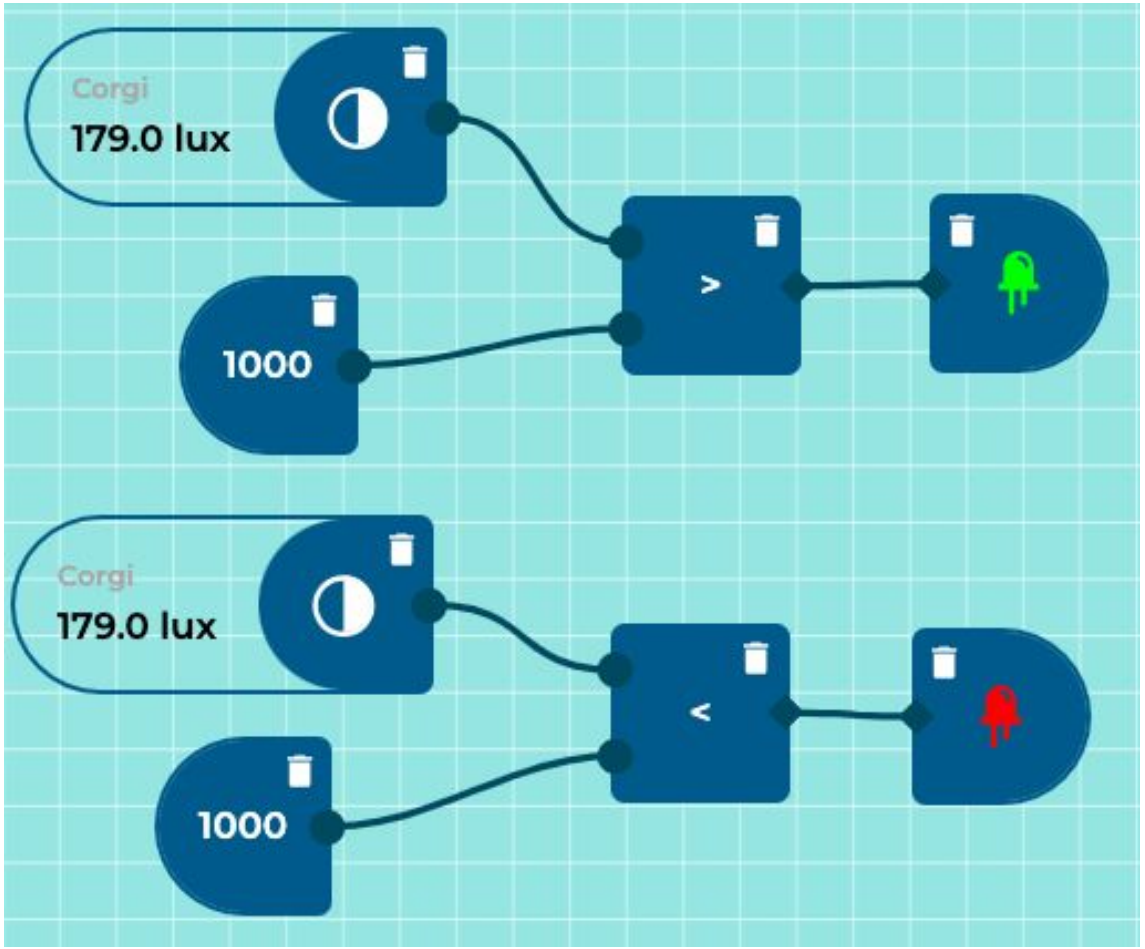




LIGHT DATA with the BlueBird

Teknikio BlueBird:

- Light Data using light sensors for light detection scale 0 - 2000 lux
- Measures actual lux*
- You could use these actual Lux readings for Data conversions from other Light Data

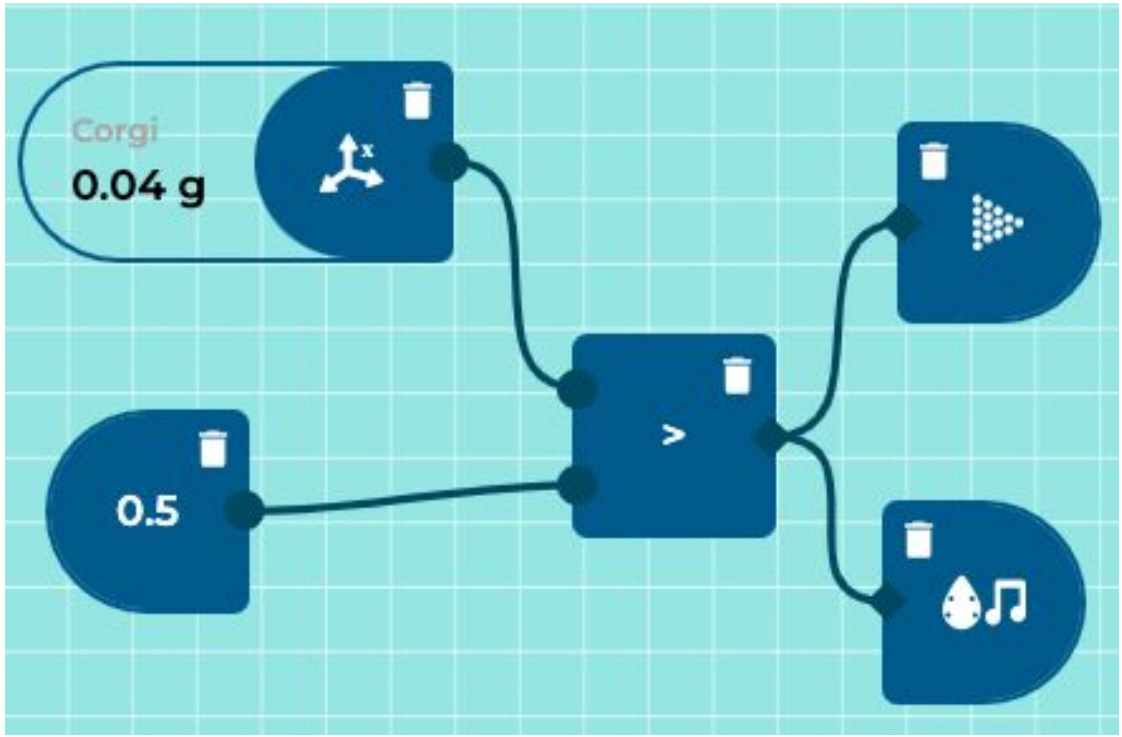


*Deren Guler email 9-29-25 lux scaled to 2000 so graphs are more readable

XYZ ACCELERATION DATA with the BlueBird

Teknikio BlueBird:

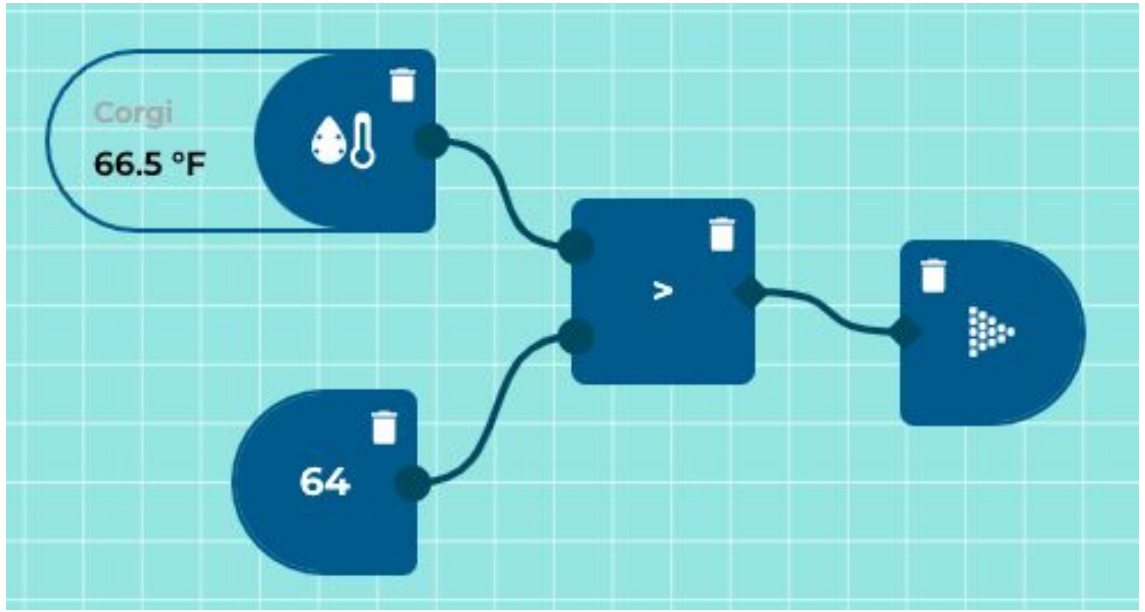
- Acceleration Data using Acceleration sensors scale 4 g to -4 g
- Measures g-force (9.8m/s^2 or 10 m/s^2)
- You could use these values to practice graphing on an XYZ axis



TEMPERATURE DATA with the BlueBird

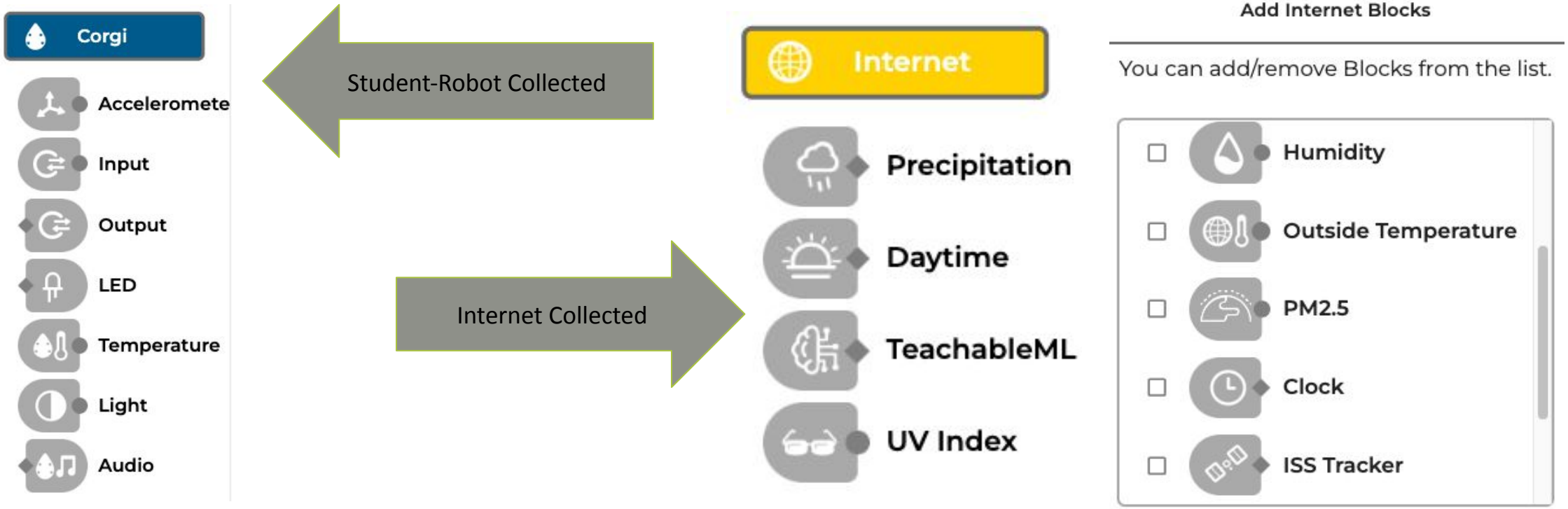
Teknikio BlueBird:

- Temperature Data using Internal Temperature Sensor (processor + accelerometer combo)
- Measures Ambient Temperature
- defaults to degrees fahrenheit (^{o}F)
- You could use these values to calibrate or convert micro:Bit temperatures which use the Processor



There are also Internet Capabilities based on your location…

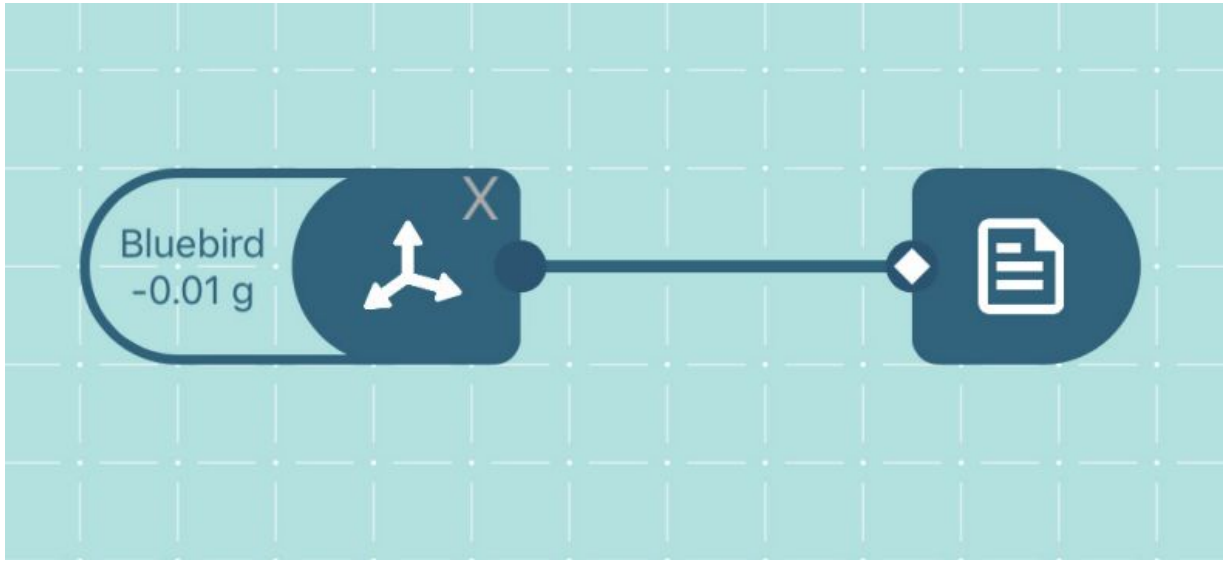
So you can compare student-collected data with Internet-based data



DATA LOGGING with the BlueBird

Teknikio BlueBird:

- Data Logging using any Sensor to a Data
- Exports Data to a *.json file or *.csv file
- Logs data every 30 seconds and timestamped in file



So Where is the AI ?!?

Remember AI Creates Templates and Tables
(You now have the ranges to make Labs/Lessons)

Template Prompt to AI

Create a SUBJECT Lab/Worksheet for GRADE and CLASS
Using the SENSOR NAME Sensor capabilities of the microbit version 2.0 which defaults to UNITS OF MESUREMENT range LOW - HIGH RANGE

Comparing the MEASUREMENTS of WHAT IS BEING MEASURED for VARIABLES TO WHAT IS BEING COMPARED/MEASURED

They should log in multiple instances of data and create a chart on determining the HYPOTHESIS or MAX/MIN

Example Prompt to AI

Create a Physics Lab/Worksheet for 9th grade high school girls Using the Temperature Sensor capabilities of the microbit version 2.0 which defaults to Celsius range -40 degrees to 105 degrees

Comparing the field temperatures of 5 different fields for different sports of football, baseball, soccer, lacrosse, and field hockey

They should log in multiple instances of data and create a chart on determining the field with different temperatures

Examples of Physics Activities using Robots

(Triggering) LAB: Window Height Based on Free Fall Balls

(Not really a robot) LAB: Are Matchbox RC Cars Really Going 65 mph?

LAB: Measuring Sound Levels with the micro:Bit

LAB: Measuring and Predicting Athletic Field Temperatures with the micro:Bit

(Robots used as Timers) LAB: Marble Rolling Acceleration Spreadsheet and Walk, Jog, Run Graphing Velocity Spreadsheet

LAB: Magnetism Go To Church

NEXT PHASE: DoD STEM LABS using Robots (but they are shut down :-(

Physics AI Generated Examples Template w/out Robots

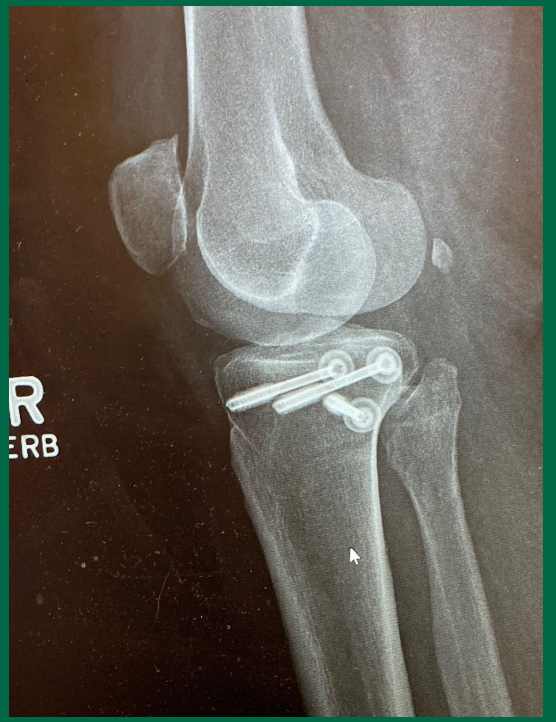
Prompt: Create 10 word problems and answers for 14 year old Physics girls which are easy to solve and have answers ending in .0 or .5 for 12.2 First law of Thermodynamics: Thermal Energy and Work

Section Learning Objectives

By the end of this section, you will be able to do the following:

- Describe how pressure, volume, and temperature relate to one another and to work <the rest of the objectives>…

NOTE: Because of LLMs (2 elephant in the room slides) you STILL HAVE TO CHECK YOUR ANSWERS



Eileen Malick

emalick@saintgertrude.org

804-708-9500

saintgertrude.org | benedictinecollegeprep.org

12829 River Road Richmond, Virginia 23238

VCU Computer Science Industrial Advisory Board

BENEDICTINE SCHOOLS OF RICHMOND