



DesignNews

Understanding Sensors and Data Analysis Using the Arduino Nano 33 BLE Sense

DAY 4 : Introduction to Arduino Science Journal

Sponsored by

DigiKey



Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
- If you have technical problems, click “Help” or submit a question asking for assistance.
- Participate in ‘Attendee Chat’ by maximizing the chat widget in your dock.



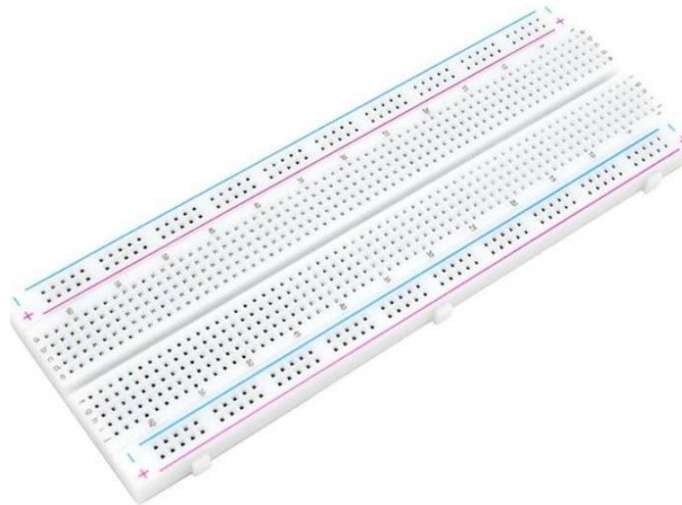
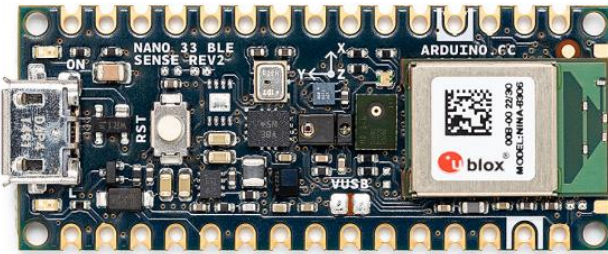
Dr. Don Wilcher

Visit 'Lecturer Profile' in your console for more details.

Course Kit and Materials

Solderless Breadboard

Arduino Nano 33 BLE Sense Board



Adafruit Parts Pal Kit



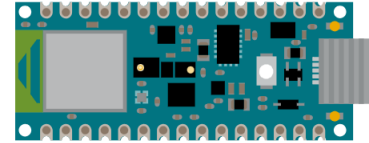
I2C OLED Display



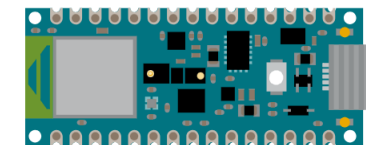
https://www.amazon.com/HiLetgo-Serial-128X64-Display-Color/dp/B06XRBYJR8/ref=sr_1_6?crd=1VC2UTZ2P8NWF&keywords=i2c%2Boled&qid=1700192985&sprefix=l2c%2B%2Caps%2C108&sr=8-6&th=1

Agenda:

- What Is The Arduino Science Journal?
- Obtaining the Arduino Science Journal App
- Inventory of Smartphone Onboard Sensors
- Lab: Connecting the Arduino Nano 33 BLE Sense board to the Arduino Science Journal

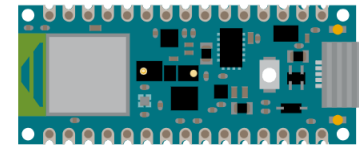


Research Perspective



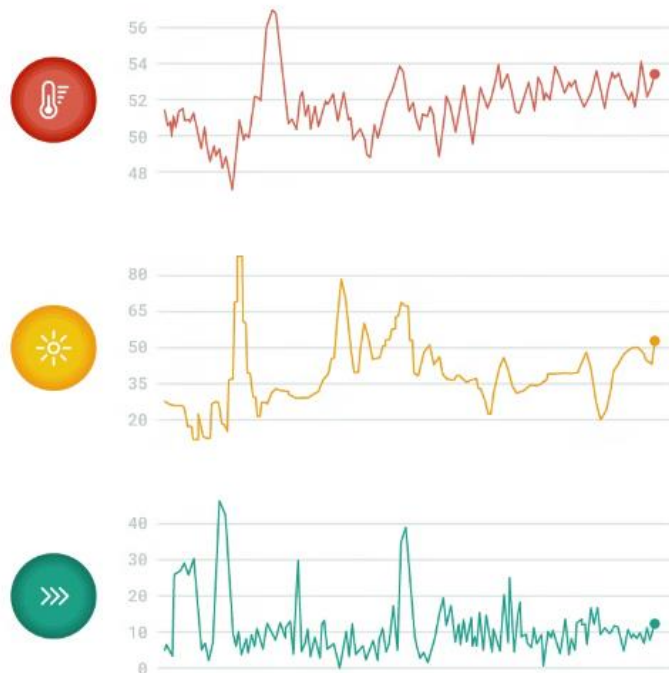
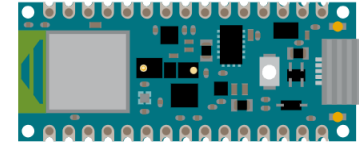
“The Internet of Things, which has been quietly building and evolving over the past decade, now impacts many aspects of society.” (Chua & Storey, 2023).

What Is The Arduino Science Journal?



- The Arduino Science Journal is a free mobile app that allows data to be collected and analyzed.
- A smartphone or tablet can be used with the Arduino Science Journal to collect and analyze data.
- The Arduino Science Journal allows various science and technology experiments.
- Observational and complex scientific investigations can be explored with Arduino Science Journal.
- Industrial applications in monitoring electrical current and machine vibration can be achieved with the Arduino Science Journal.
- Originated from Google as the Google Science Journal App.
- Allows the creation and sharing of data journals amongst STEM professionals, hobbyists, Citizen Scientists, and educators.

What Is The Arduino Science Journal?...



Harness the power of sensors

Motivate students to learn about topics like physics, math, chemistry and biology in a fun, easier to understand and connected to the real world way. With the help of either built-in sensors students can experience and play with their surroundings in a easy and hands-on way. **Record properties like light, movement and sound, and experience the world of science at first hand!**

<https://www.arduino.cc/education/science-journal>

What Is The Arduino Science Journal?...

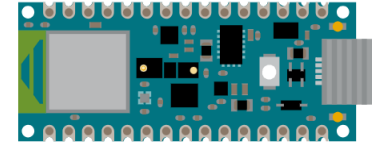
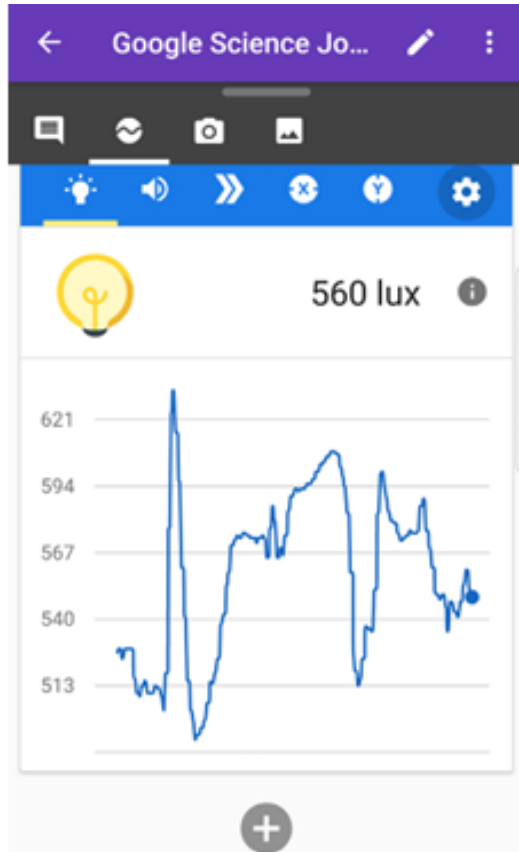


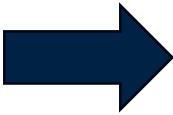
Diagram courtesy of Google

Originated from Google

Diagram courtesy of Arduino



Moved to



Question 1

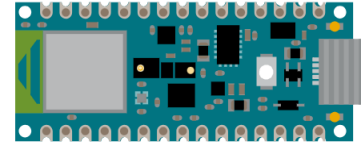
Which company originated the Science Journal concept?

- a) Google**
- b) Arduino**
- c) Microsoft**
- d) Renesas**



What Is The Arduino Science Journal?...

Monitoring environmental conditions



Bard AI
inquiry-based
responses



How can Arduino Science Journal be used in industrial environments?

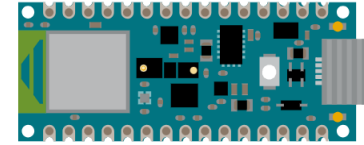


The Arduino Science Journal can be used in a variety of ways in industrial environments to improve efficiency, safety, and product quality. Here are some specific examples:

1. Monitoring environmental conditions:

- **Temperature and humidity monitoring:** The Arduino Science Journal can be used to monitor temperature and humidity levels in industrial settings, such as warehouses, factories, and data centers. This data can be used to ensure that products are stored and manufactured under optimal conditions.
- **Air quality monitoring:** The Arduino Science Journal can be used to monitor air quality levels in industrial settings, such as factories and mines. This data can be used to identify and address potential hazards, such as high levels of dust or fumes.
- **Noise level monitoring:** The Arduino Science Journal can be used to monitor noise levels in industrial settings, such as factories and manufacturing plants. This data can be used to identify and address potential hearing hazards.

What Is The Arduino Science Journal? . . .



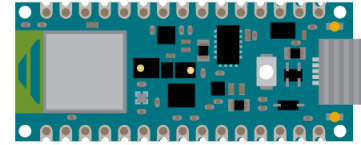
Monitoring machinery and equipment

Bard AI
inquiry-based
responses

2. Monitoring machinery and equipment:

- **Vibration monitoring:** The Arduino Science Journal can be used to monitor vibration levels in machinery and equipment. This data can be used to identify potential problems, such as worn bearings or loose parts, before they cause major breakdowns.
- **Pressure monitoring:** The Arduino Science Journal can be used to monitor pressure levels in machinery and equipment. This data can be used to ensure that equipment is operating safely and efficiently.
- **Current monitoring:** The Arduino Science Journal can be used to monitor current levels in machinery and equipment. This data can be used to identify potential electrical hazards.

What Is The Arduino Science Journal?...



Quality control and data logging

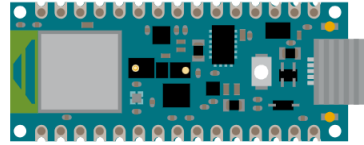
Bard AI
inquiry-based
responses

3. Quality control and data logging:

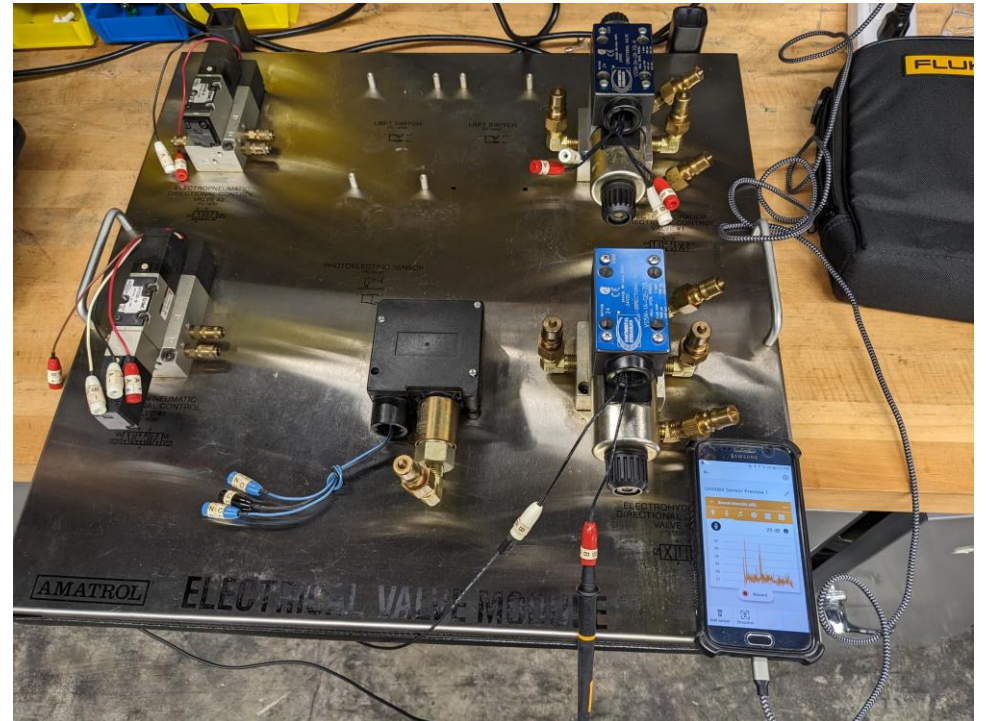
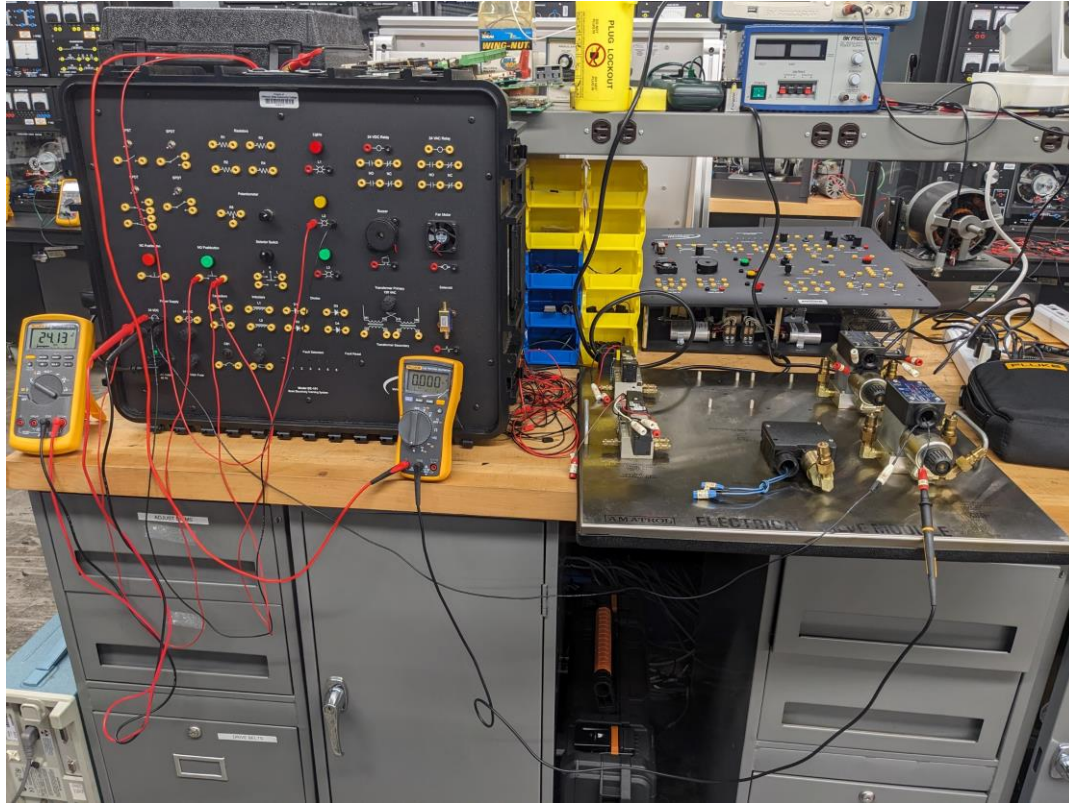
- **Product testing and inspection:** The Arduino Science Journal can be used to collect data during product testing and inspection processes. This data can be used to identify and correct defects, and to ensure that products meet quality standards.
- **Process monitoring and control:** The Arduino Science Journal can be used to monitor and control industrial processes. This data can be used to optimize production processes and improve product quality.
- **Data logging and analysis:** The Arduino Science Journal can be used to log data from a variety of sensors and devices in industrial environments. This data can be analyzed to identify trends, patterns, and anomalies.

In addition to these specific examples, the Arduino Science Journal can also be used to develop custom solutions for a wide range of industrial applications. With its flexibility and ease of use, the Arduino Science Journal is a valuable tool for industrial engineers and technicians.

What Is The Arduino Science Journal?

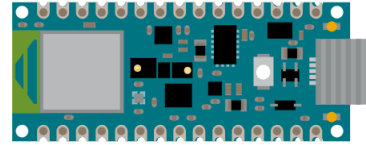


Product Testing and Inspection Example

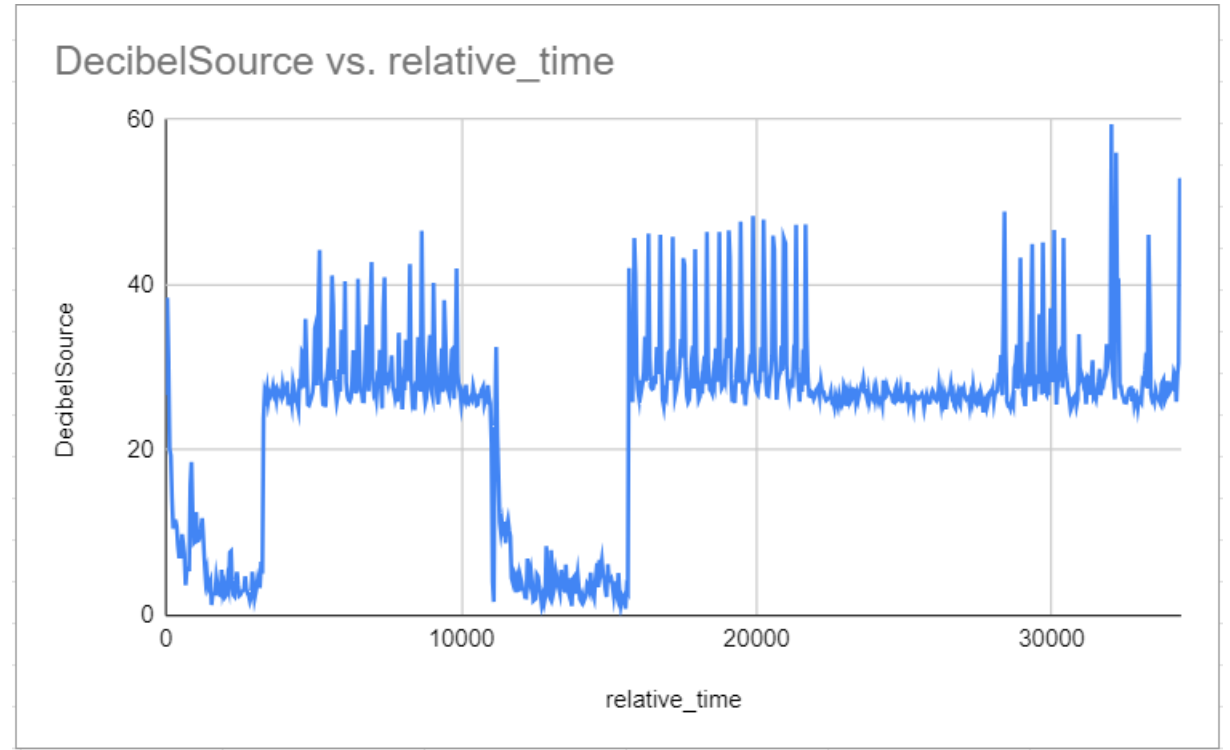
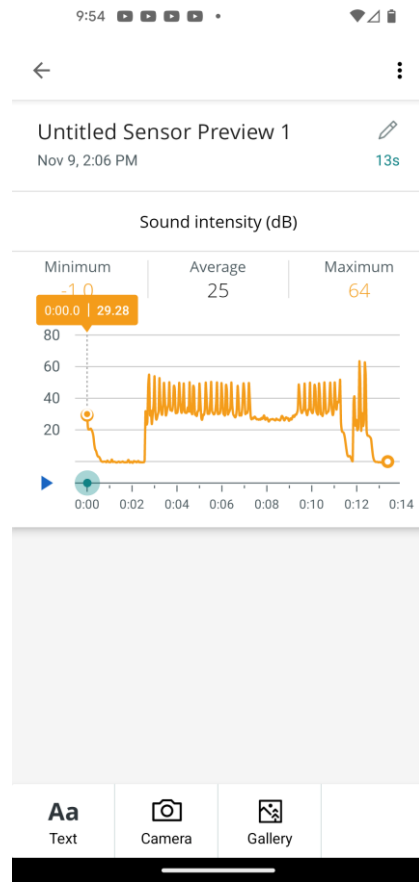


Product Testing and Inspection of Hydraulic Directional Control Valve Setup

What Is The Arduino Science Journal?...



Product Testing and Inspection Example



Product Testing and Inspection of Hydraulic Directional Control Value Setup

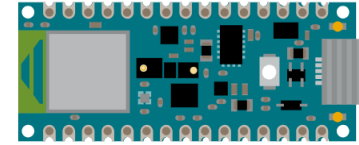
Question 2

In reviewing slide 14, which AI-suggested industrial environment application is being demonstrated?

- a) Product Testing and Control**
- b) Product Testing and Monitoring**
- c) Product Testing and Inspection**
- d) Product Testing and Vibration**



Obtaining the Arduino Science Journal App



ARDUINO.CC PROFESSIONAL STORE

Q Search on Arduino Education

SIGN IN

EDUCATION SOLUTIONS CLOUD CERTIFICATIONS RESOURCES INSPIRATION LABS BLOG REGISTER KIT

AGES 10+

Arduino Science Journal

Shape your students future: Reason with data, think like a real scientist! A fun science classroom in your pocket.

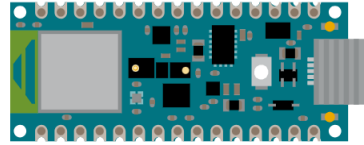
Download on the App Store

GET IT ON Google Play

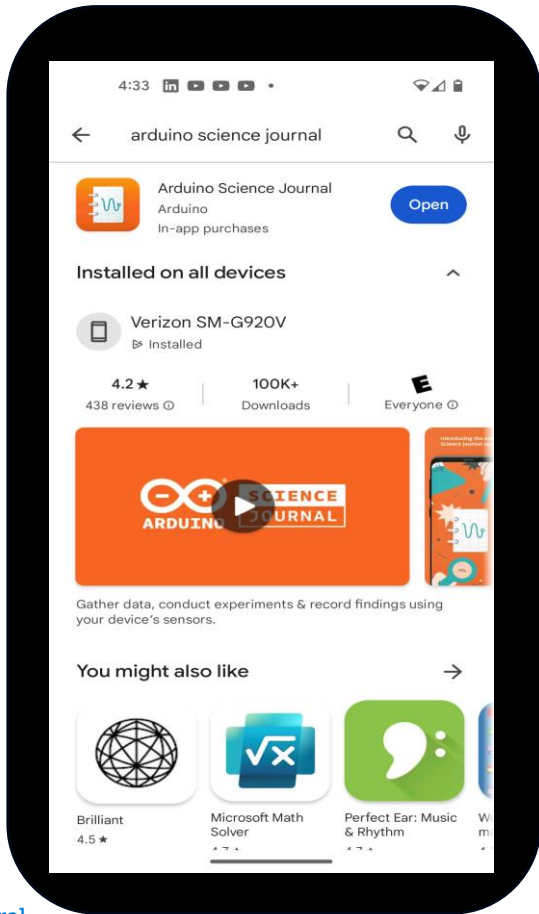
The screenshot shows the Arduino Education website's landing page for the Arduino Science Journal app. The page features a navigation bar with links to ARDUINO.CC, PROFESSIONAL, and STORE. A search bar and a SIGN IN link are also present. Below the navigation, there are links for EDUCATION, SOLUTIONS, CLOUD, CERTIFICATIONS, RESOURCES, INSPIRATION LABS, and BLOG, along with a REGISTER KIT button. The main content area is a large banner with a dark background and colorful illustrations of a smartphone, a tablet, and an Arduino board. The banner includes the text 'AGES 10+', the app title 'Arduino Science Journal', and a description: 'Shape your students future: Reason with data, think like a real scientist! A fun science classroom in your pocket.' At the bottom of the banner are two buttons: 'Download on the App Store' and 'GET IT ON Google Play'.

<https://www.arduino.cc/education/science-journal>

Obtaining the Arduino Science Journal App



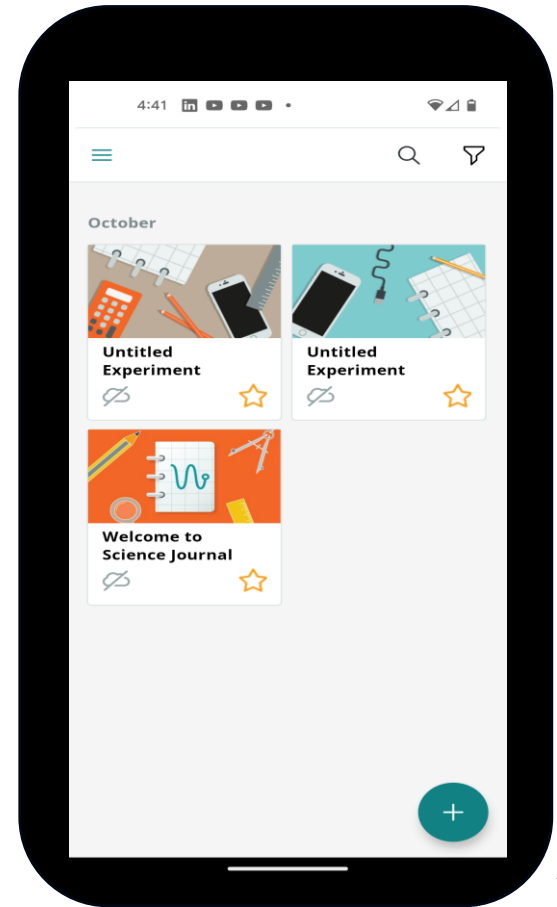
Google Playstore View



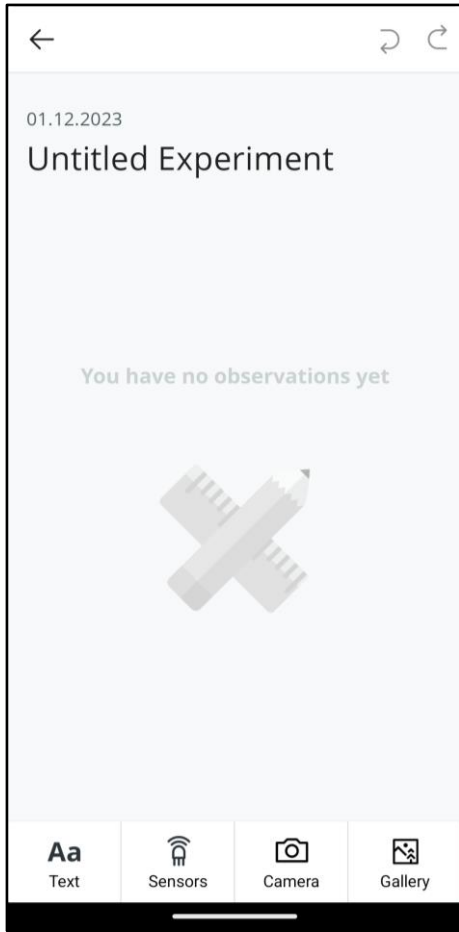
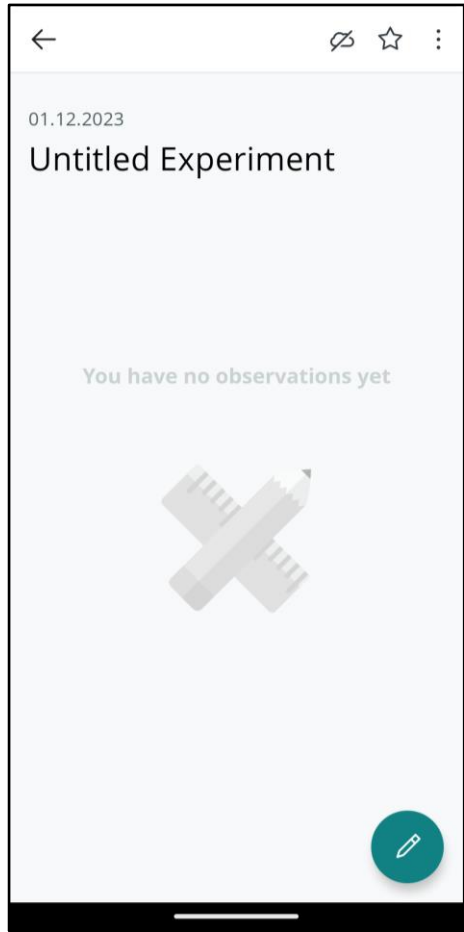
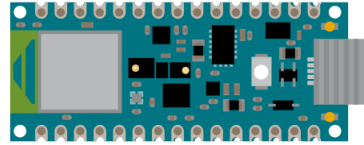
Splash Screen



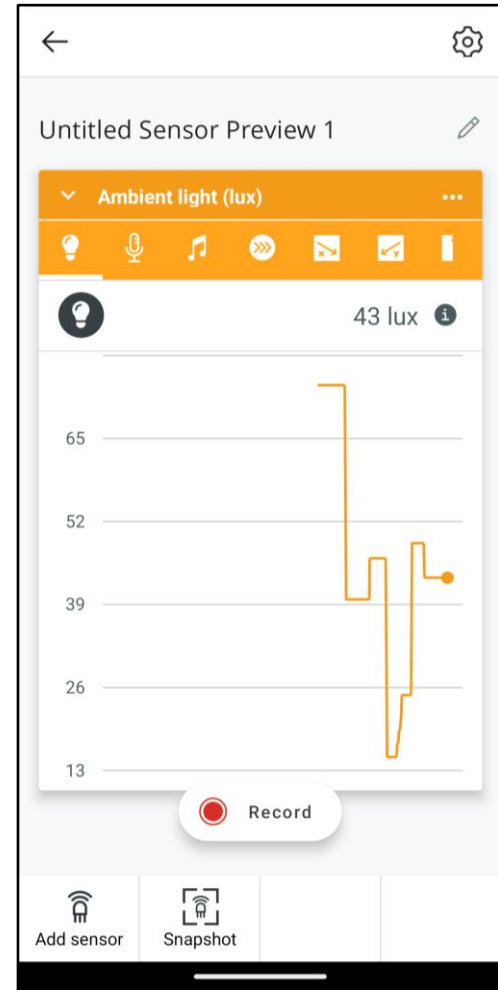
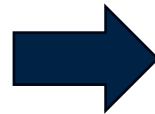
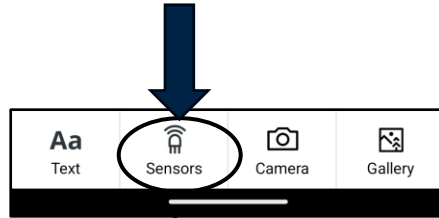
Start Screen



Inventory of a Smartphone Onboard Sensors. . .



Click Sensor Icon



Panel known as a Sensor Card

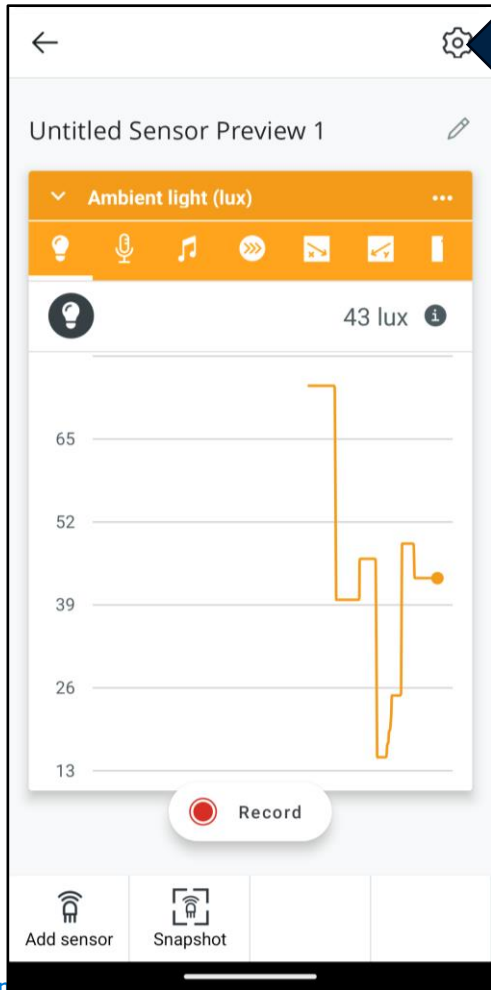
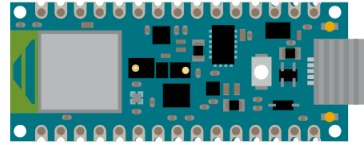
Question 3

After creating a name for the Untitled Experiment, clicking the Sensors icon will go to _____.

- a) Panel Card**
- b) Screen Plotter**
- c) Sensor Card**
- d) Display Panel**

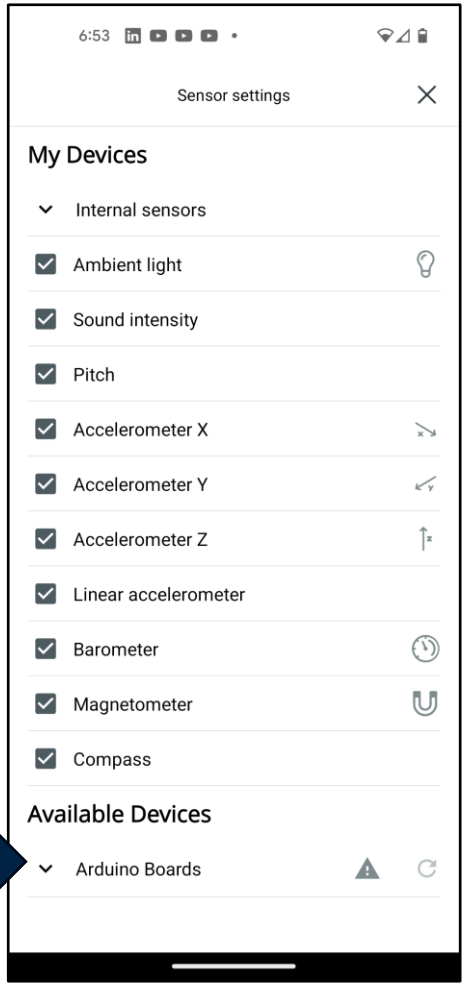


Inventory of a Smartphone Onboard Sensors...



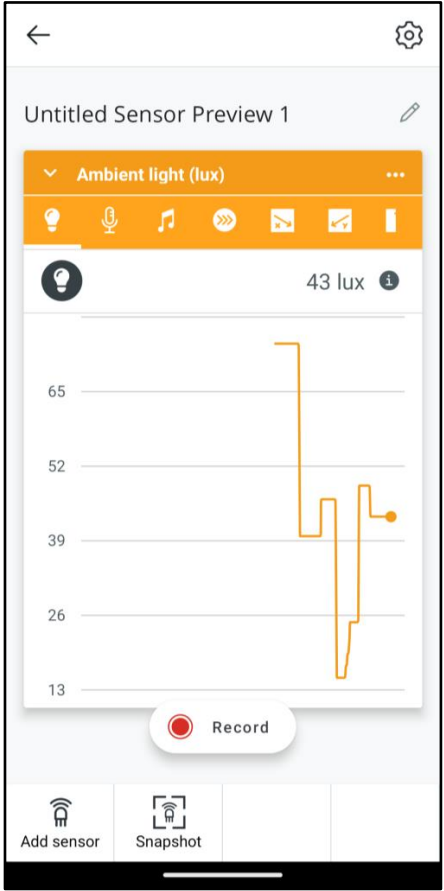
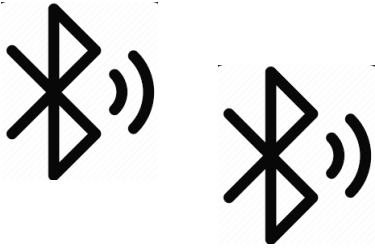
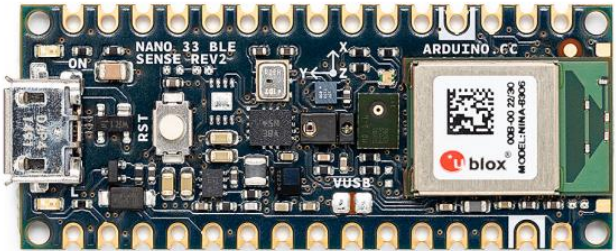
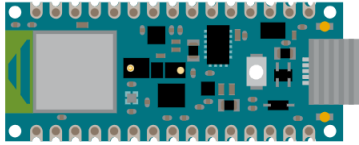
Click Gear Icon
My Devices will appear on the screen

Arduino Boards availability will be displayed on the Device Inventory List

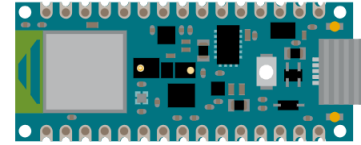


A list of sensors on the mobile device will be displayed.

Lab: Connecting the Arduino Nano 33 BLE Sense to the Arduino Science Journal



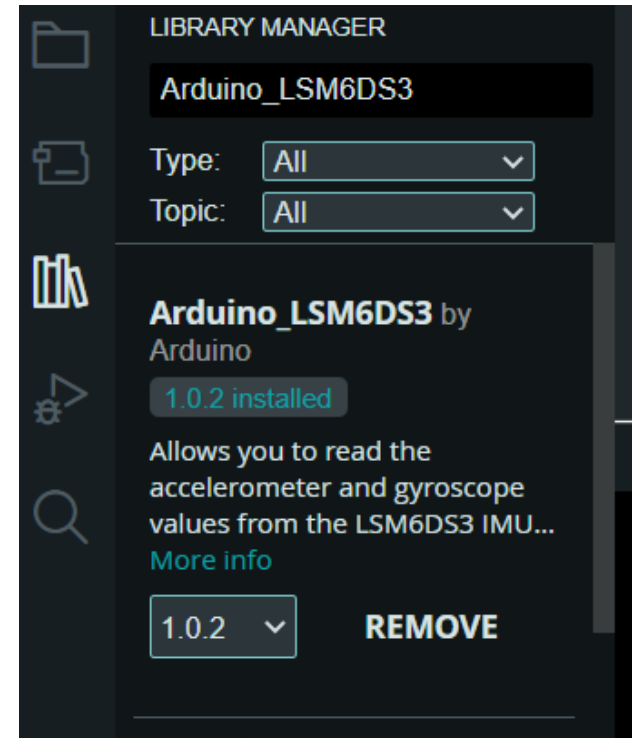
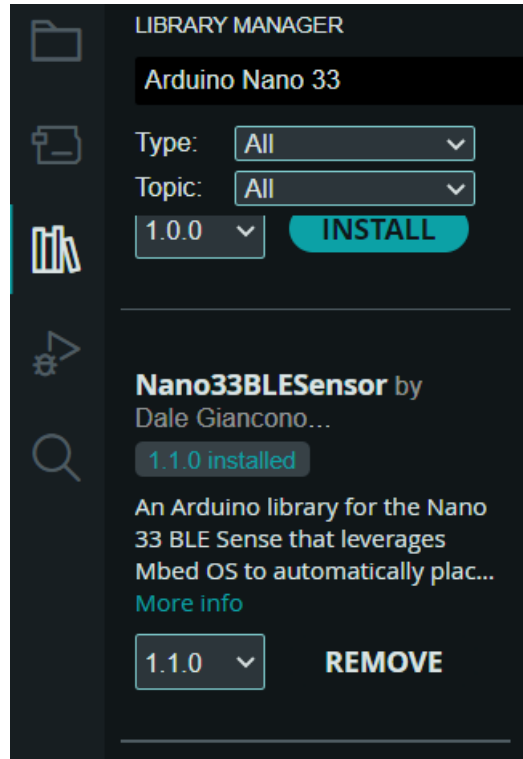
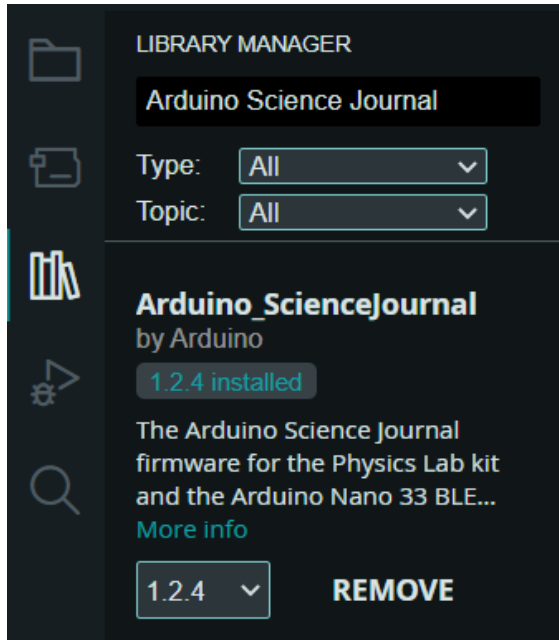
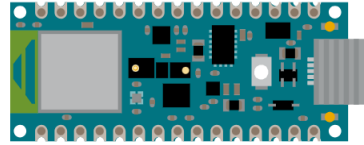
Lab: Connecting the Arduino Nano 33 BLE Sense to the Arduino Science Journal



Lab Objectives:

- Participants will learn to install the Arduino Science Journal, the Arduino LSM6DS3, and the Nano33BLESense libraries onto the Arduino IDE.
- Participants will learn to Upload the Arduino Nano33BLESense firmware to the Arduino Nano 33 BLE Sense board.
- Participants will learn to connect to the Arduino Nano 33 BLE Sense board with a smartphone
- Participants will learn to select the External Sensor using the Arduino Science Journal app.
- Participants will learn to display the External Sensor's readings on the Arduino Science Journal Sensor Card.

Installing the Arduino Science Journal Library and Supporting Libraries

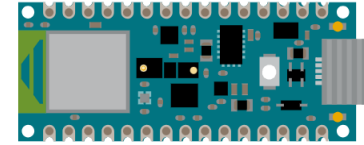


The latest version of the Arduino Science Journal library is 1.2.4.

The latest versions for the specific libraries.



Installing the Arduino Science Journal Library and Supporting Libraries



File>Example>Arduino Science Journal>Science Kit> Nano33BLESenseFirmware

Upload the
Nano33BLESense
firmware to the
Arduino Nano 33
BLE Sense board

The screenshot shows the Arduino IDE interface with the Nano33BLESenseFirmware.ino file open. The code in the editor includes functions for writing temperature and humidity values to BLE characteristics, and a function for reading and processing humidity data. The output window at the bottom shows the upload progress, reaching 100% completion in 13.528 seconds.

```
Nano33BLESenseFirmware | Arduino IDE 2.2.1
File Edit Sketch Tools Help
Arduino Nano 33 BLE
Nano33BLESenseFirmware.ino LowPower.cpp LowPower.h
228     temperatureCharacteristic.writeValue(temperatureCalibrated);
229   }
230   if (doHumidity) {
231     float humidity = HTS.readHumidity();
232     float dp = temperature - ((100.0 - humidity) / 5.0);
233     float humidityCalibrated = 100.0 - (5.0 * (temperatureCalibrated - dp));
234     humidityCharacteristic.writeValue(humidityCalibrated);
235   }
236 }
237 if (pressureCharacteristic.subscribed()) {
238   float pressure = BARO.readPressure();
239   pressureCharacteristic.writeValue(pressure);
240 }
Output
[=====] 95% (79/83 pages)
[=====] 96% (80/83 pages)
[=====] 97% (81/83 pages)
[=====] 98% (82/83 pages)
[=====] 100% (83/83 pages)
Done in 13.528 seconds
Ln 1, Col 1 Arduino Nano 33 BLE on COM5
```

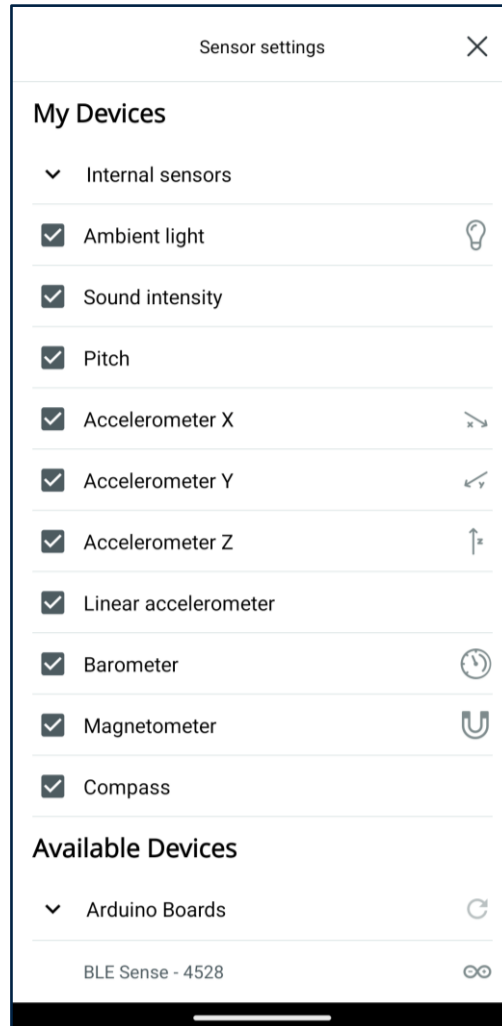
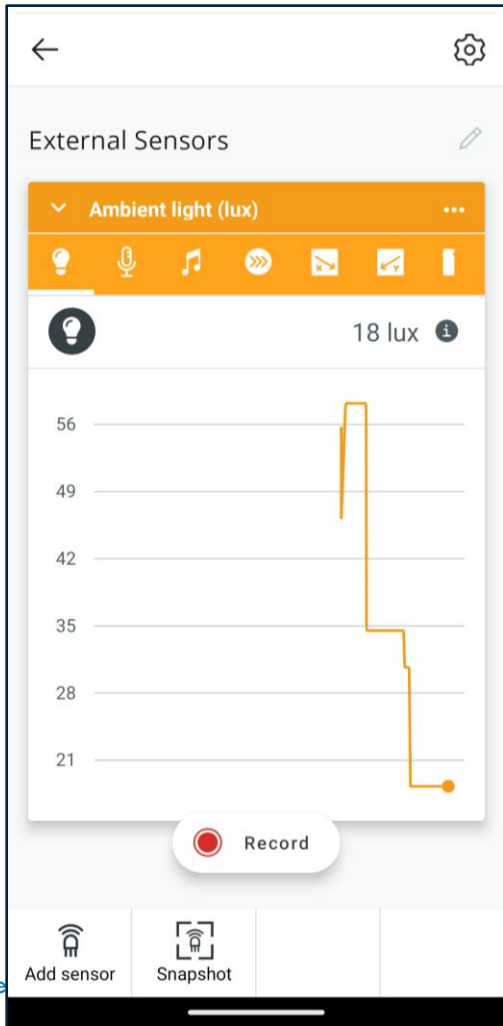
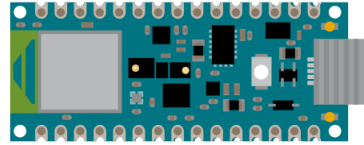
Question 4

The libraries to install onto the Arduino IDE for the Arduino Science Journal are_____.

- a) Arduino Science Journal, Arduino Nano33BLESensor
- b) Arduino_ScienceJournal, Nano33BLESensor, and the Arduino_LSM6DX
- c) Arduino ScienceJournal, Nano_33BLESensor, and the Arduino_LSM6DX
- d) Arduino_ScienceJournal, Nano33BLESensor, and the Arduino_LSM6D3

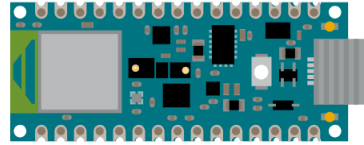


Connecting to the Arduino Nano 33 BLE Sense board



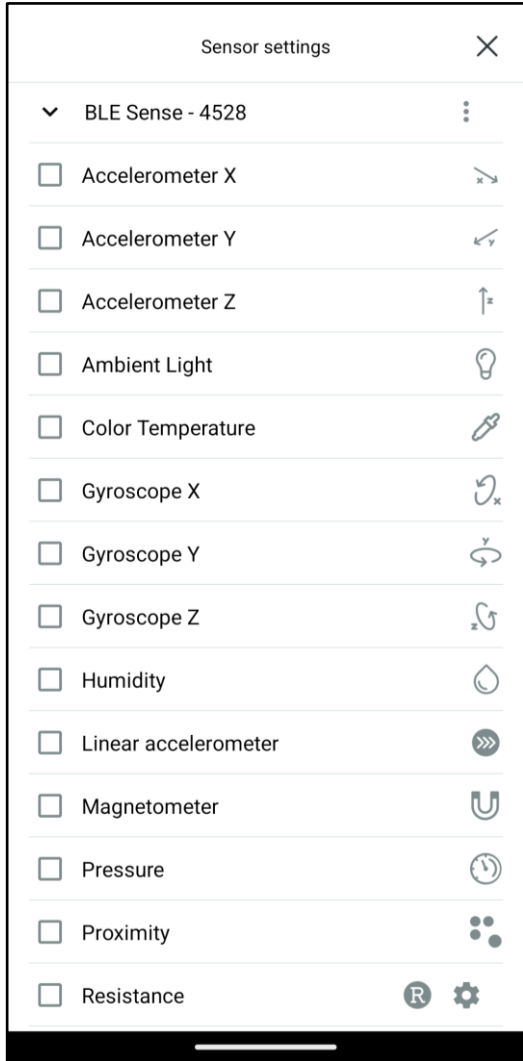
Obtaining
Arduino Nano 33
BLE Sense board
sensors

Connecting to the Arduino Nano 33 BLE Sense board

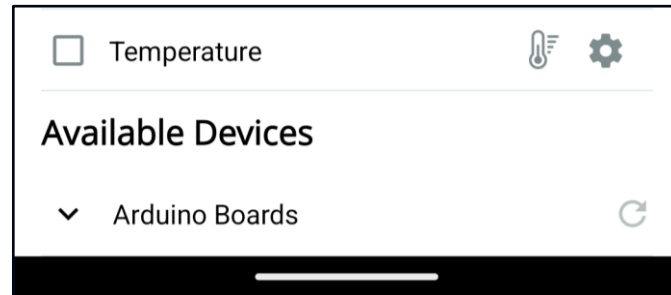


Available Arduino Nano 33 BLE Sense board sensors

1



2

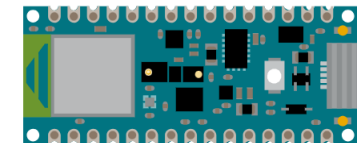


Lab Exercise: Let's Display the Ambient Temperature of a Room in Fahrenheit (° F)!

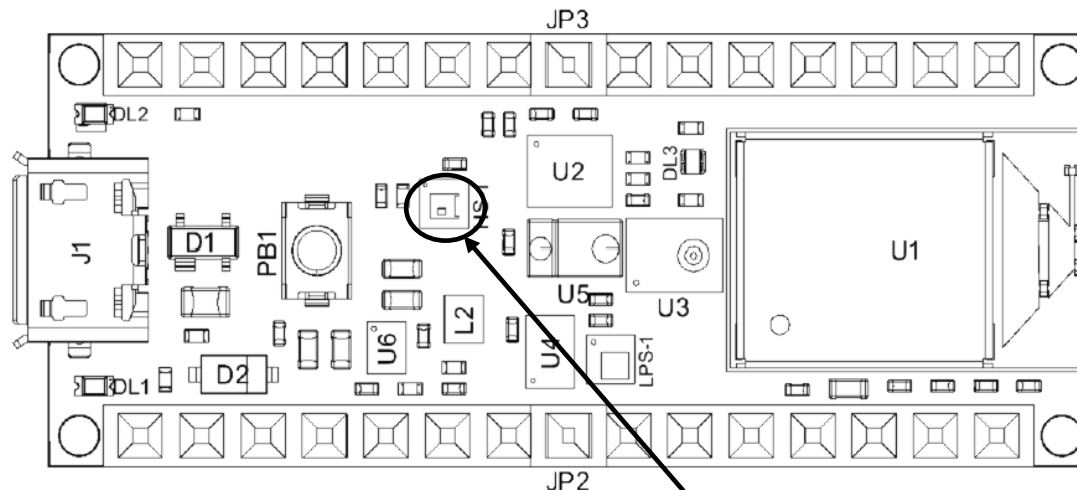
What is an Arduino Nano BLE Sense?...

Functional Overview

Top of Board



Original Board

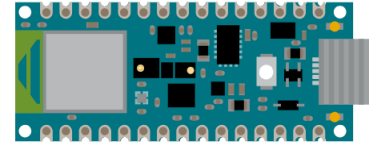


Location of the Humidity & Temperature Sensor

Illustration courtesy of Arduino.cc

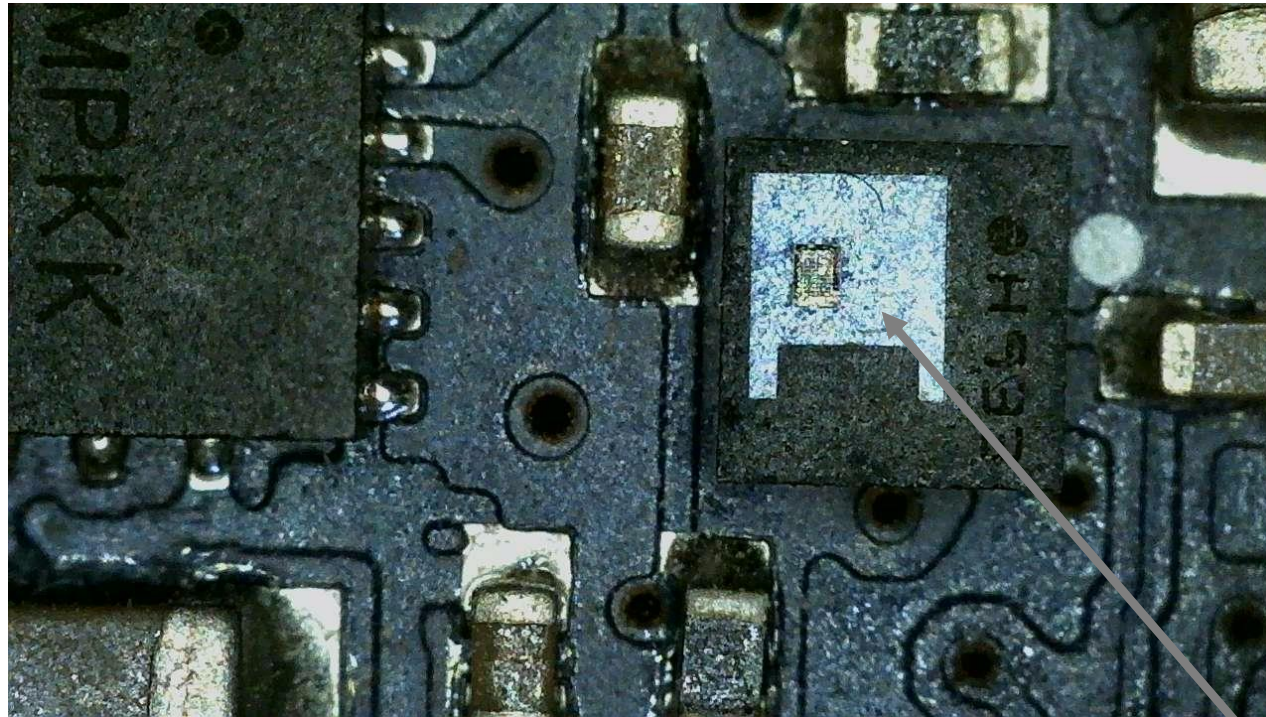
Ref.	Description	Ref.	Description
U1	NINA-B306 Module Bluetooth® Low Energy 5.0 Module	U6	MP2322GQH Step Down Converter
U2	LSM9DS1TR Sensor IMU	PB1	IT-1185AP1C-160G-GTR Push button
U3	MP34DT06JTR Mems Microphone	HS-1	HTS221 Humidity Sensor
U4	ATECC608A Crypto chip	DL1	Led L
U5	APDS-9660 Ambient Module	DL2	Led Power

What is an Arduino Nano BLE Sense?...



Top of Board

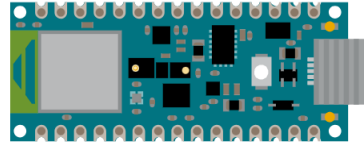
Temperature Sensor location on the Arduino Nano 33BLE Sense board



picture courtesy of the lecturer

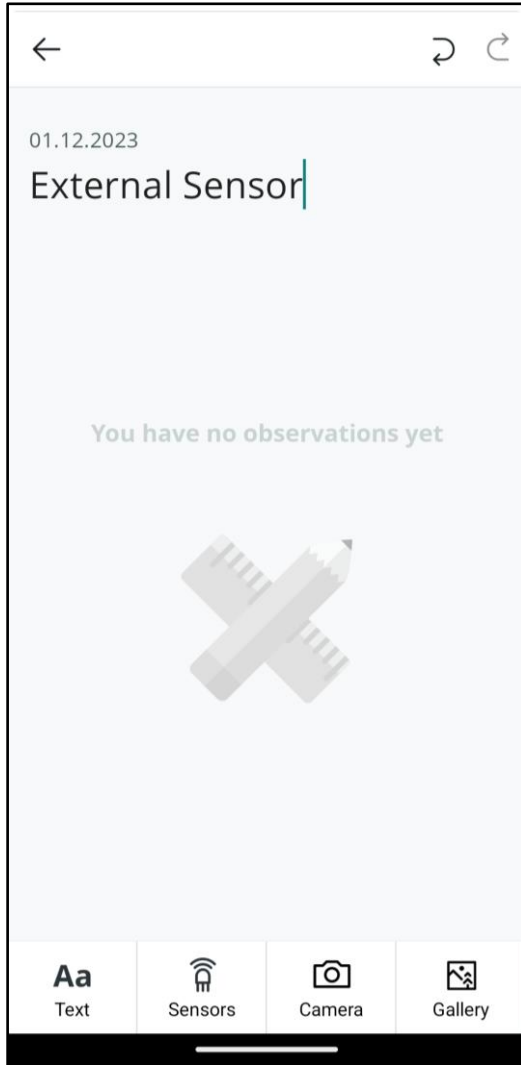
HTS221 Humidity & Temperature Sensor

Connecting to the Arduino Nano 33 BLE Sense board

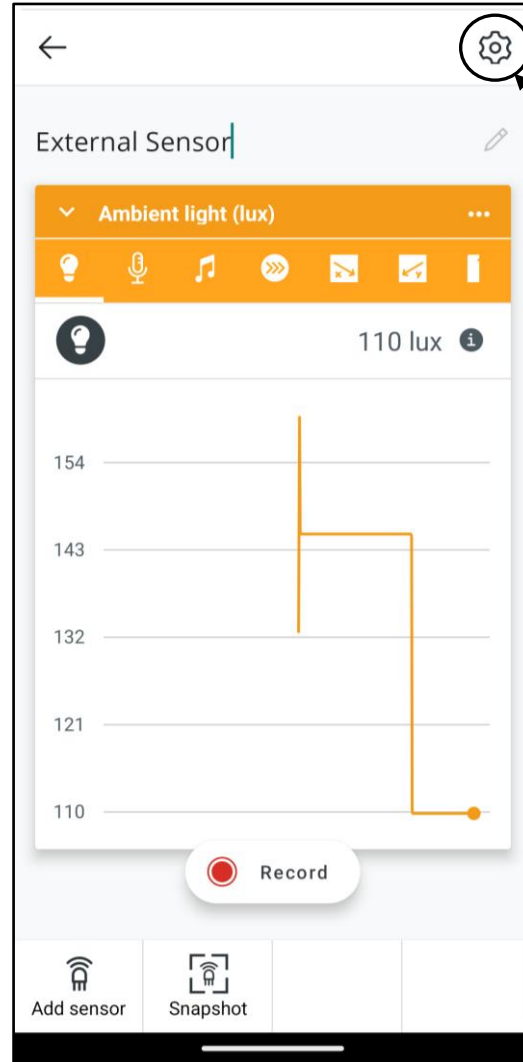


Name Untitled Experiment as External Sensor

1

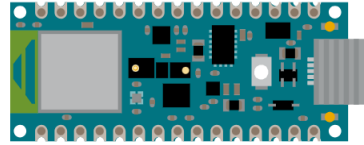


2



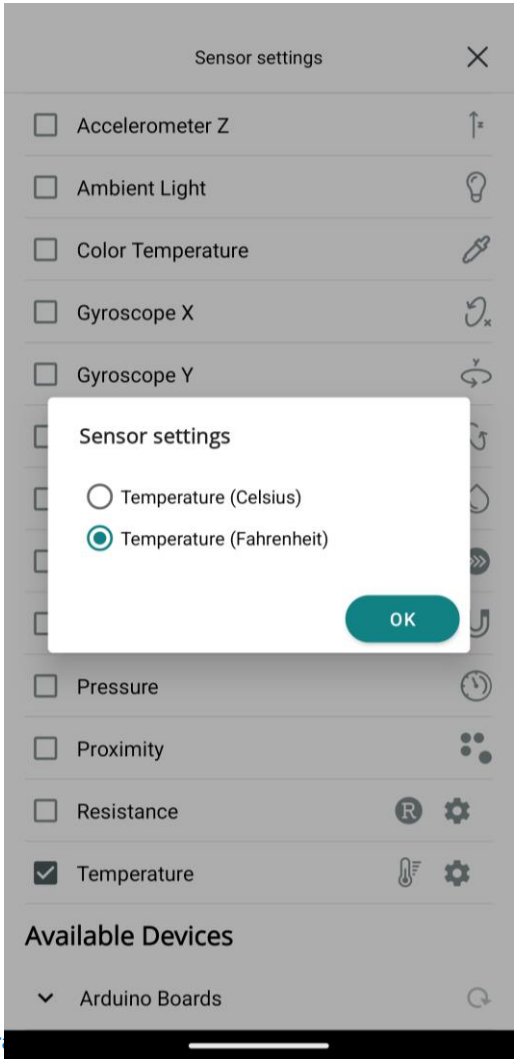
Select Gear Icon (Setting) to obtain Temperature Sensor

Connecting to the Arduino Nano 33 BLE Sense board

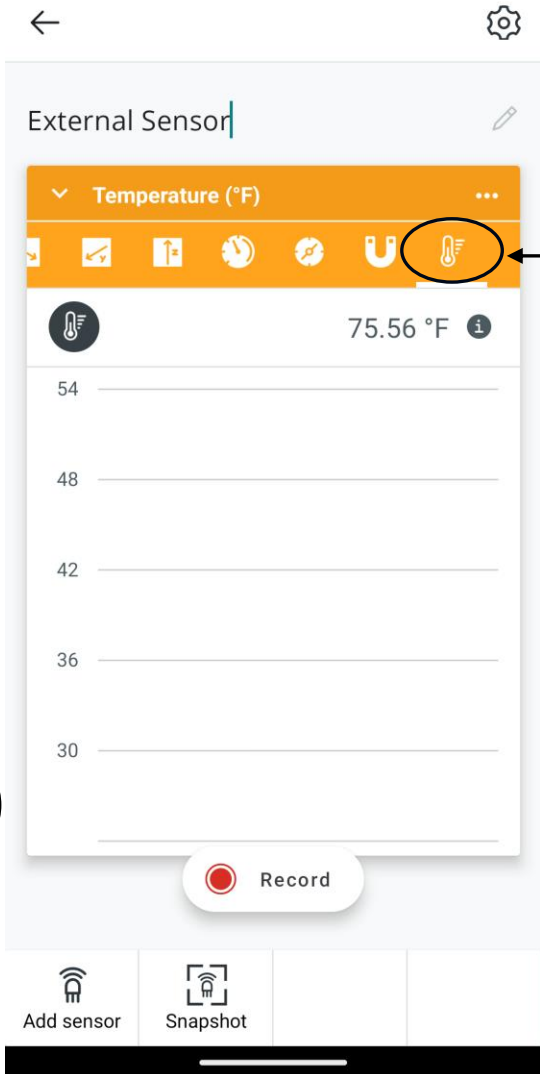


Select measurement unit

1



2

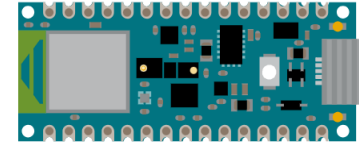


Arduino Nano 33 BLE Sense Temperature Sensor Icon added to Sensor Card

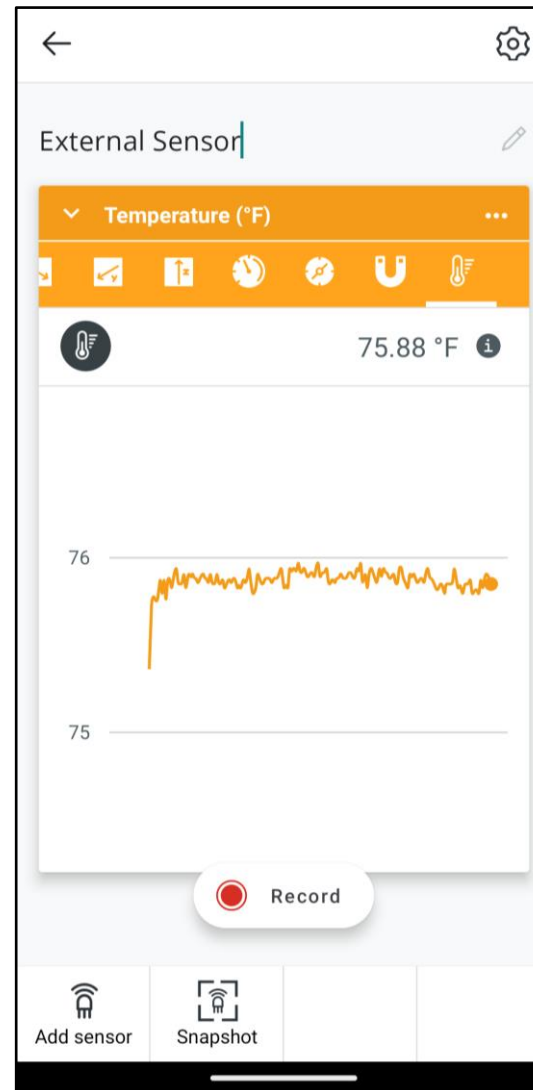


Click the Temperature Sensor Icon to refresh card. Temperature reading and plot will appear on the Sensor Card.

Connecting to the Arduino Nano 33 BLE Sense board



The Ambient Temperature of a Room value and plot displayed on the Sensor Card.



Question 5

What is the part number for the Temperature Sensor?

- a) THS221**
- b) HTD221**
- c) HTS222**
- d) HTS221**



Thank you for attending

Please consider the resources below:

Arduino. (n.d.). *External sensors*. Retrieved November 5, 2023, from <https://science-journal.arduino.cc/sj/module/getting-started-2/lesson/external-sensors>

Chua, C.E., & Storey, V.C. (2022). A tutorial on prototyping internet of things device and systems: A gentle introduction to technology that shapes our lives. *Communications of the Association for Information Systems*, 51(34), 327-364.

<https://www.researchgate.net/publication/360263045> A Tutorial on Prototyping Internet of Things Devices and Systems A Gentle Introduction to Technology that Shapes Our Lives



DesignNews

Thank You

Sponsored by

DigiKey

