

Exploring Internet of Things (IoT) with Microsoft Materials

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Abstract

IoT refers to connecting the Internet to the real world through devices. These could be with sensors or with actuators. IoT devices are already being utilized in the form of refrigerators and fitness trackers among other things. Currently there are 30 billion devices connected, and it is estimated that 80 ZB of data will be collected by 2025. We will introduce the informative Microsoft materials that provide the concept and hands-on practices of Internet of Things and share what we learned this semester.

Active devices (billions)

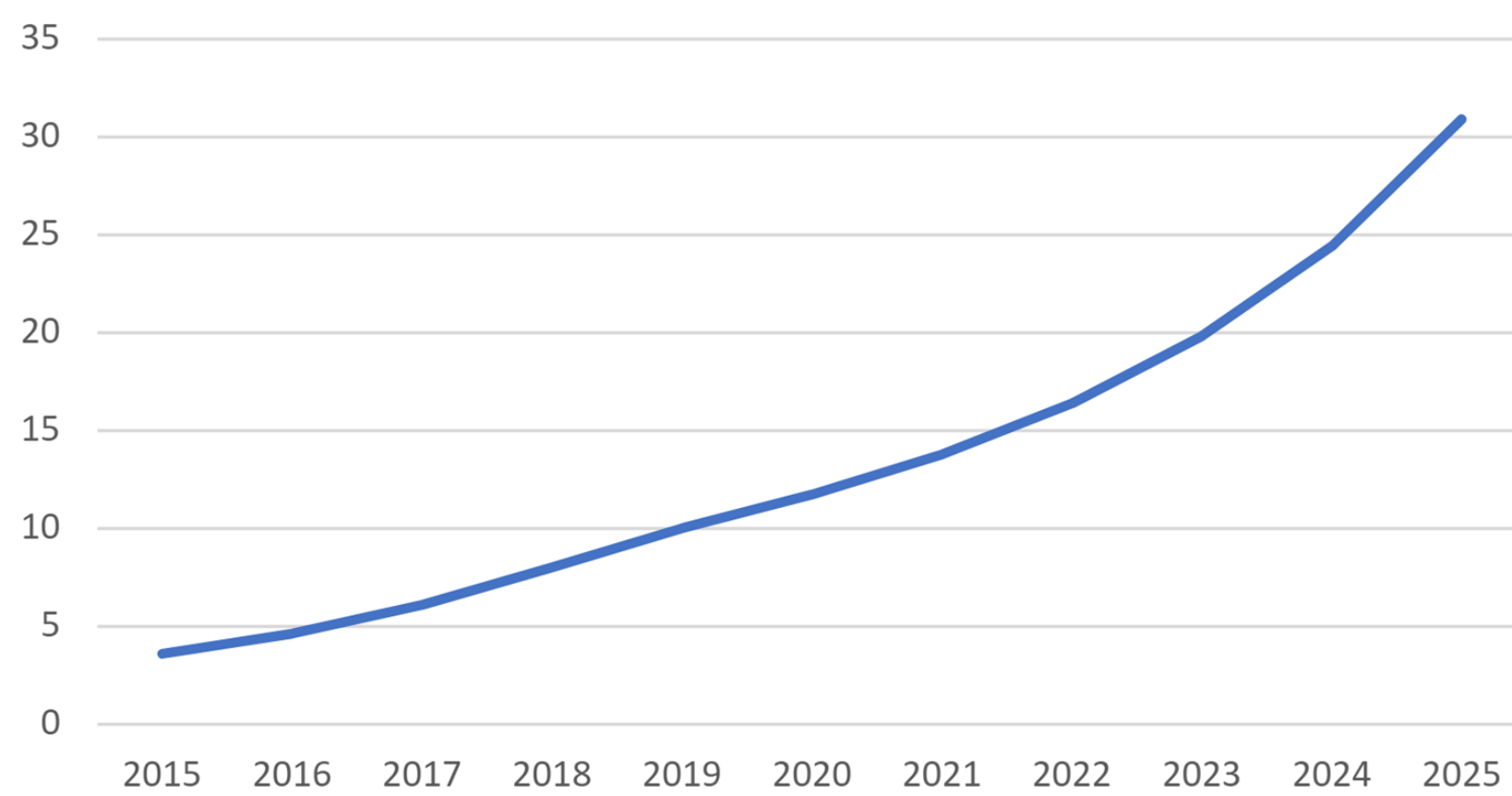


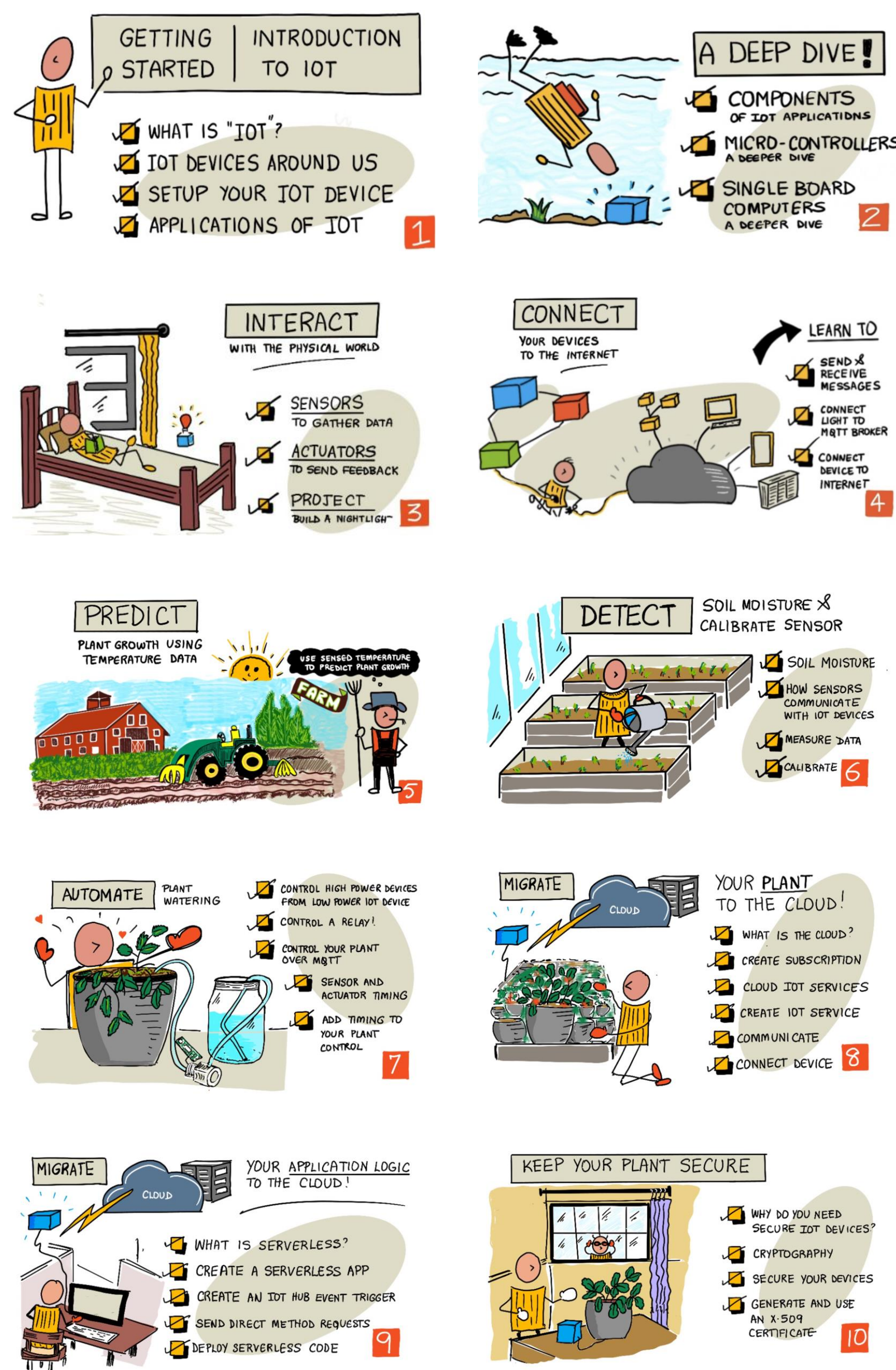
Figure 1: Graph of data generated by IoT devices
Figure copied from [1]

Introduction

IoT devices have impacted multiple industries for the better. In offices, IoT devices manage the lighting and heating in order to reduce cost and carbon emissions. In retail, IoT devices measure the temperature of cold storage in order to determine if a product is outside the required temperature range. IoT is also being used in areas called Smart Cities to measure air pollution in order to determine the best routes for cycling and jogging for residents. We have found the Microsoft materials with 22 lessons [1], we summarize the 22 lessons for your understanding. We have also purchased the Raspberry Pi and the Wio terminal kits for the learning. We have learned up to 6 lessons, we now share what we have learned.

Overview of Materials

- Concept, components, and connectivity: lessons 1 - 4
- Prediction, detection, and automation: lessons 5 - 10
- Location: lessons 11 - 14
- Fruit quality detection with AI & ML: lessons 15 - 18
- Object detection (stocks): lessons 19 - 20
- Speech recognition and language translation: lessons 21 - 24



Figures copied from [1]

Lessons 1,2: Components

We explored devices including Raspberry Pi and Wio terminal kits for 22 lessons. Microcontrollers are small computers that consist of CPU, Memory, and input/output connections like Arduino [Figure 3]. The microcontroller can perform one task at a time. Single board computers are devices that consist of all the components of a computer on a small board like Raspberry Pi [Figure 2]. They can perform multiple complex tasks at the same time. Sensors are the devices that connect to the physical world and send information to IoT devices. Actuators are the opposite to sensors as they take information from IoT devices and convert it into actions in the physical world.



Figure 2: Raspberry Pi [2]



Figure 3: Wio Terminal [3]

Figures copied from [1]

Lessons 3,4: Connectivity

An IoT device connects to the cloud through a broker that uses a publish/subscribe messaging structure. IoT devices publish telemetry messages and subscribe to the commands. The cloud service (Microsoft Azure) subscribes to all the telemetry messages and publishes commands. The broker, like the MQTT, is responsible for receiving all messages from publisher clients, filtering them, and then sending the messages to the designated receivers.

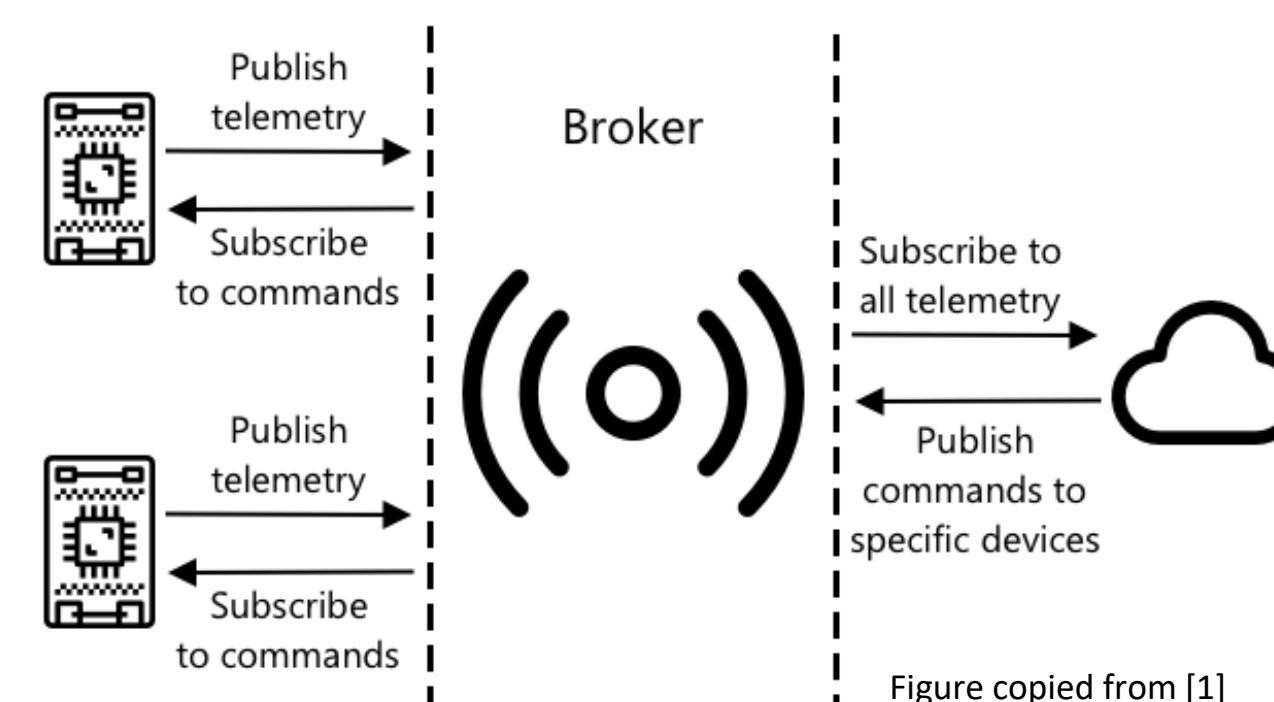


Figure copied from [1]

Lessons 5,6: Smart Farm

Digital Agriculture changed the way we farm. Now we use tools to collect, store, and analyze data which allows farmers to use fertilizers, pesticides, and water more efficiently. IoT devices measure the soil moisture to make sure that soil is not too wet or too dry [Figure 4]. The device can measure with a resistive or capacitive sensor. The device then calibrates the data in order to predict the moisture values.

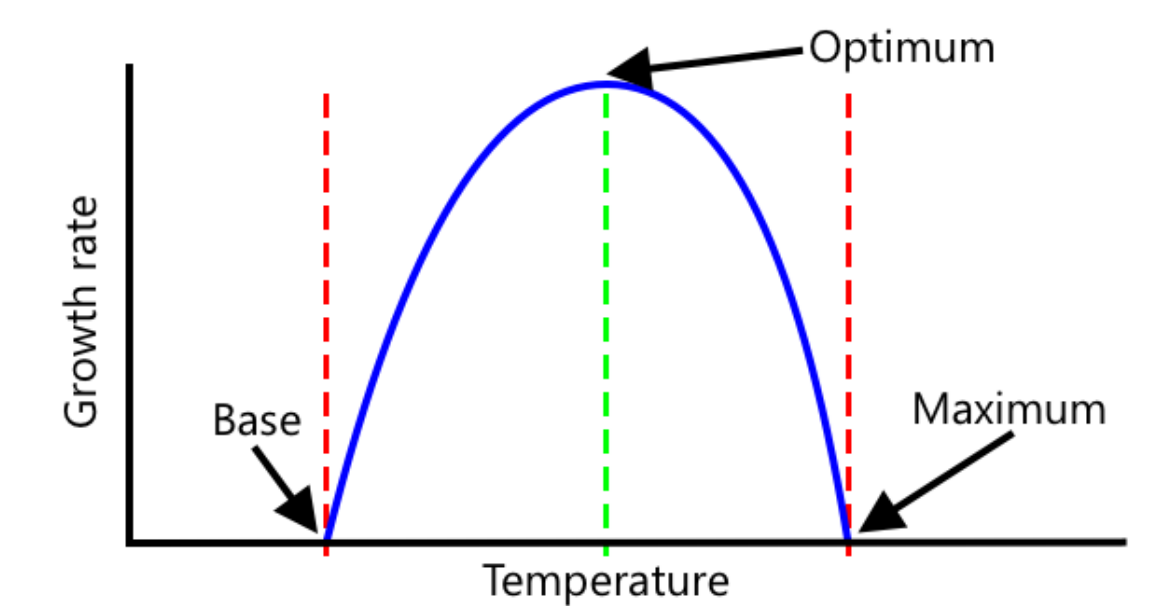


Figure 4: Types of Plant Temperatures [1]

Past Research

- Smart Home using Internet of Things (IoT), College of Science poster celebration, 2020.
- Implementing Smart Farm Prototype with Internet of Things, College of Science poster celebration, 2021.

Acknowledgment

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References

- [1] Microsoft, "IoT-For-Beginners", <https://github.com/microsoft/iot-for-beginners>
- [2] Seed-Studio, "Raspberry Pi 4 Starter Kit", <https://www.seedstudio.com/iot-for-beginners-with-Seed-and-Microsoft-Raspberry-Pi-Starter-Kit-p-5004.html>
- [3] Seed-Studio, "Wio Terminal Starter Kit", <https://www.seedstudio.com/iot-for-beginners-with-Seed-and-Microsoft-Wio-Terminal-Starter-Kit-p-5006.html>