LoRa Network Summer Virtual Academy

Q Project at UC Merced

Network Division
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Purpose and Justification

Communication through the internet is at a high demand. More people and devices look to connect to each other through different means, and one of those is LoRa and The Things Network. The goal of the LoRa network academy is to give students a hands on experience with this new and growing technology. The topics will include the basics of LoRa, the Internet of Things, building a LoRa device, The Things Network, and ultimately: students will be able to use this technology to send and receive messages and understand the process behind it.

Statement of the Problem or Need:

The Internet is a necessity in this generation, but many people don't understand how it works. WiFi is a term that is often mistaken to mean internet, but is actually just a component that lets us connect devices to the internet. Today, we see even more devices connected to the internet: fridges, door locks, lights. Not all of this happens through WiFi. This is called Internet of Things (IoT), a collection of devices that can communicate over the internet without human-computer interaction (webopedia.com). In a somewhat older Forbes article, IoT is predicted as 1 of 7 things that will fully mature in the next 15 years, and we see this currently (forbes.com).

A growing community of IoT devices happens to be through a website called The Things Network. This website allows people to find and connect to devices on the internet, but with a different communication called LoRa (designnews.com). Unlike WiFi, LoRa (LOw-cost-Long-Range) allows for low power sending and receiving. On top of this, what makes LoRa special is its range. WiFi communicates in a way that you can only send and receive signals in short distances, which is why every home needs a router. With LoRa, communication happens over a longer distance, but with the cost of only sending and receiving one message at a time. Even with this drawback, there are many new opportunities with LoRa that are not possible from WiFi. The use cases of the LoRa network is endless. Its applications in the sustainable world allow for sensor data such as weather, temperature, water sensors, and more, to be collected seamlessly and without extra material. It aids in many farming and agricultural industries right now even as we speak!

The Internet was created right here in California, and it's only right to continue the progressive learning of new technologies here. LoRa is a technology that has been around for less than a decade, the future is promising for this growing area. It is possible that LoRa will be

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the next normal name, allowing simple appliances to communicate without human interaction over long distances. Creating a summer training for students where they get to learn this new technology hands on allows them to get ahead of the game. Not only will they understand how communication over the internet happens better, but they will know how to use a new technology that can help them become career ready.

Logistics:

Weekly topics with milestones. Mondays are for introduction/workshop, Wednesdays students report their progress and/or another part of the workshop, and Fridays are for deadlines. 24/7 office hours via chat through google hangouts or a messaging system setup during orientation.

WEEK 0: Orientation

Students will be required to attend one of multiple orientation workshops, which will introduce them to this academy and will be clear on our expectations for them during this virtual academy.

Project Deliverables and Beneficiaries:

1. Week 1: What is LoRa? What is The Internet of Things? (2-4 Hours)

Deliverables: Students will learn about the basics of the LoRa protocol and the Internet of Things. This will involve seeing how the wireless technologies work when sending and receiving signal waves, and how changing these waves promote shorter or longer ranges. The Internet of Things will be used as motivation for the future of this technology, and how devices can communicate with each other without human-computer interactions.

Beneficiaries: Students will gain useful insight as to how the Internet works and the differences between different technologies, mainly WiFi vs. LoRa. The topic of Internet of Thing (IoT) will also continue to show up through education in STEM fields relating to computer science.

2. Week 2: Building a LoRa receiver and/or gateway. (2-3 Hours)

Deliverables: Students will build a receiver that can send out and receive LoRa signals. It is possible that we will also involve gateways, which are the backbone of The Things Network. Gateways allow receivers to send messages, so the more gateways in a location the better connected that area can be.

Beneficiaries: Students will use their knowledge from Week 1 to build a receiver that can communicate with LoRa's protocols. This hands-on experience helps instill how the hardware to wireless communication happens in real life.

3. Week 3: Connecting to The Things Network. (1-2 Hours)

Deliverables: Students that are working with gateways will be able to register their gateway with The Things Network. Students that are working with receivers will also learn the process. All students will then learn how we can use the community driven network of gateways to communicate over large areas.

Beneficiaries: Students will learn about a new and growing community as well as contribute to the growth of this network.

4. Week 4: Sending and receiving messages through LoRa and The Things Network. (1-2 Hours)

Deliverables: Students will use all prior knowledge from Weeks 1, 2, and 3 to deploy their LoRa receivers. The final project of this virtual academy will involve successfully sending and receiving a message.

Beneficiaries: Students will understand the entire basics of how their message was sent through LoRa. This motivates future ideas, projects, or careers paths related to LoRa and IoT.

5. Week 4 (Closing statements): All students receive certification of completion from Q Project at UC Merced. Top students received a special certification for going above and beyond.

Instructional Cost:

Item	Vendor	Price	Quantity	
Dragino LoRa IoT Development Kit V2 915MHZ Lora Gateway LG01-N LoRa Shield LoRa GPS Shield for Long Range Irrigation Systems	Amazon	$167.99	5	$839.95

Dragino LoRa Bee Module 915MHZ Ultra Long Range RF Wireless Transceiver SX1276 for Arduino, Built-in Temperature Sensor Low Battery Indicator, Low Power Consumption	Amazon	$20.50	5	$102.5
RAK2245 Pi HAT & Raspberry Pi 3B+ & WisNode LoRa & 16G TF Card(with Software Image) to Quick Start a LoRaWAN Application 915MHz	Amazon	$223.00	5	$1,115.00
RAK811 Breakout Board (Include RAK811+Antenna Small and				

Open Source Development Board,915MHz, Quickly Test LoRa Module, 3.3V, SMA + IPX	Amazon	$15.73	5	$78.65
RAK833 LPWAN Gateway Concentrator Module - SPI - US915	RakWireless	$199.00	5	$995
Subtotal				$3,131.10
Taxes				$281.80
Total				**$3,412.90**

Estimated Cost For Students:

Item	Vendor	Price	Quantity	
Dragino LoRa Bee Module 915MHZ Ultra Long Range RF Wireless Transceiver				

SX1276 for Arduino, Built-in Temperature Sensor Low Battery Indicator, Low Power Consumption	Amazon	$20.50	20	$410.00
RAK811 Breakout Board (Include RAK811+Antenna Small and Open Source Development Board,915MHz, Quickly Test LoRa Module, 3.3V, SMA + IPX	Amazon	$15.73	20	$314.60
RAK833 LPWAN Gateway Concentrator Module - SPI - US915	RakWireless	$199.00	20	$3,980
Subtotal				$4,704.60
Taxes				$423.42
Total				**$5,128.02**

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Total Cost:

Instructional				$3,412.90
Estimated For Students				$5,128.02
Total				**$8,540.92**

Sources

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