Fund a Classroom Grant Application
Due August 26th

The Fund a Classroom Grant is designed to be a smaller (between $300 and $1000) grant that is easier to apply for and get than the larger grants Pinellas Education Foundation offers. You will each need to complete a single grant application and turn it in to me electronically by Due August 26th

This is the actual application from Pinellas Education Foundation
(Complete this part of the assignment)

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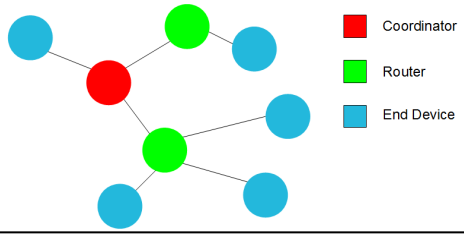
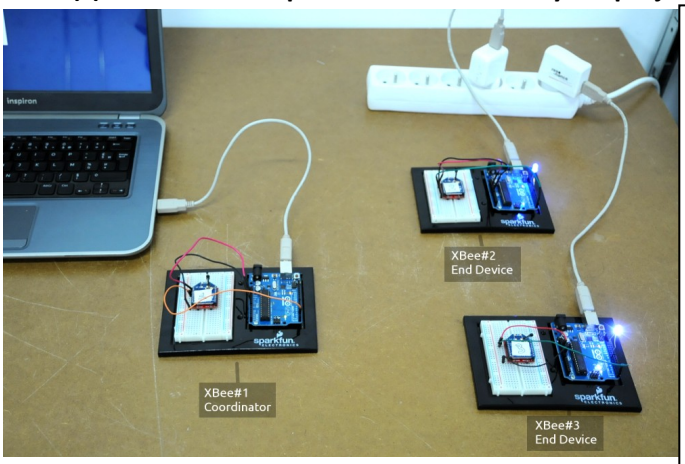
1. At least 2 Images (5MB max document size) (these should represent the theme of your project)



This is the **mesh network**. It utilizes a series of routers, end devices, and a coordinator to communicate messages across the devices (Like a game of whisper).



For our proof-of-concept, we will use the Xbee 2mW PCB Antenna (Series 2) in addition to Arduino boards to create a mesh network that will communicate various sensor data gathered.

2. Goal: (between 150 and 500 words)
(State your goals for the request clearly. Try not to use educational jargon)

The goal of this project will be to successfully create a mesh network between at least 3 Xbee devices and utilize the network created to integrate with Arduino Leonardo boards to communicate sensor data across the devices. Arduino is a type of open-source (which means the documentation and code is available for everyone to use) electronics prototyping platform which can be thought of as an integrated computer on a circuit board which can accept various sensor inputs and provide outputs, such as displaying text on a LCD screen. This goal will be broken down into two stages, first to successfully set up the mesh network and second to start communicating the sensor data. The first stage will involve integrating the Xbee device with the Arduino board, setting up the mesh network, and sending a string of text "Hello World" across the routers. The second stage will be to use Arduino ultrasonic sensors (measures how far away objects are) and communicate sensor data from one Arduino board to the others using the mesh network. The potential application of the second stage could be to build a series of 3 Arduino controlled robots. The first one in the series would have the ultrasonic sensor and would continuously move straight, with the robots behind also moving straight. As soon as the first robot detects an obstacle, it would send a message to the robots behind it to stop and turn around. This would utilize the mesh network, as only the first robot would be gathering the sensor data, and would use the Xbee devices to communicate the data to the robots following it.

3. What will be done with students: (between 150 and 500 words)
(Give a detailed description of activity/project and state your planned timeline for implementation. Is it a one-time activity or permanently integrated? How does the grant connect to your current curriculum? Try not to use educational jargon)

The project will involve acquiring 3 Arduino Leonardo boards (with built in Xbee pins for easy configuration) and 3 Xbee series 2 modules. These modules will allow the students to set up a mesh network between all 3 devices, communicating data from one device to multiple other devices. The first step into this project, which is expected to be completed by the end of August, is to use the Xbee program to configure and test a simple point to point communication, with one device sending data to another wirelessly. This point to point communication is the simplest form of wireless communication, and is not considered a mesh network, but will serve as a nice introduction to the Xbee modules. The next step after this, to be completed by the middle of September, is to successfully configure a mesh network between 3 Arduino boards with the Xbee devices, and send a string of text "Hello World" from one device to the end device, but transferring through a coordinator (see diagram above). This will truly set up a mesh network between all the devices, as the message will be sent from one device, to a coordinator, that will route the message to the end device. The next step in this project will be to build 3 small-scale MakeBlock robots, powered by the Arduino boards. We will have to use bread boarding to break out the wires for the DC motors powering the robots, to attach to the Arduino Leonardo board. The end goal with these robots is that the first robot will have an ultrasonic sensor attached to it, with the other two robots lacking this sensor. All three robots will be programmed to travel in a square path, unless the first robot detects an obstacle in the way. In that case, the first robot will stop, and use the mesh network to communicate to the other robots. The other robots will stop as well, and travel the opposite way away from the obstruction. This proof of concept will successfully use the mesh network to communicate sensor data from one sensor to all the other microcontrollers. This final step will take much longer time, and will be broken down into smaller stages and goals, but will be planned for completion by the end of January. This project has potential to be integrated into future robotics projects as well, as wireless data communication is changing from a futuristic idea to an achievable goal. This project will also tie into our curriculum, as we are exploring more efficient ways of sensor data communication between devices, and this project has the potential to offer a solution.

4. Benefit: (between 150 and 500 words)
(What are the expected outcomes? How many students and teachers will benefit from this request? Try not to use education jargon)

The students will continue learning about open source platforms and developing their Arduino skills as well as learn the basics of networking and the Internet of Things. The first few steps will involve the students learning about the basics of networking, and configuring the various network addresses correctly between the Xbee devices to set up the mesh network. This will be valuable not only in this

situation, but in any computer networking classes that the students might take. The students will also be working with the open source platform Arduino, furthering their knowledge of the platform. Throughout the project, the students will be learning the basics of the Internet of Things concept. This concept states that everyday devices will have Internet connectivity, allowing them to send and receive data wirelessly. This concept is similar to the proof of concept that will be demonstrated, with the robots sending and receiving sensor data, albeit at a smaller scale.

5. Please describe your students:
(ESE, low/high performers, etc.) I will complete this section.

6. Detailed inventory list

Item	Quantity	Unit Cost/Total Cost
XBee 2mW PCB Antenna - Series 2	3	$25.95/$77.85
DFRobot Leonardo with Xbee Socket (Arduino Compatible)	3	$19.90/$59.70
MakeBlock Starter Robot Kit (No Electronics Version)	3	$79.99/$239.97
Ultrasonic Sensor - HC-SR04	3	$3.95/$11.85
Dell Venue Tablet/Laptop	3	$145/$435
Breadboard Classic	3	$9.95/$29.85
Total		**$854.22**

7. Budget Narrative: (between 150 and 250 words)
(explain what you are buying and how it fits into the project)

To complete this project, the primary components we will need to buy are the Xbee series 2 modules and the DFRobot Leonardo boards. The advantageous aspect of these specific boards is that they come with an Xbee Socket, so we don't have to individually breadboard out the Xbee chip or buy a separate Xbee USB adapter. To complete the later stages of the projects, we will need the MakeBlock starter robot kits. We will be making the three robots for our proof of concept project out of the MakeBlock hardware platform, and controlling them with the same Leonardo Arduino boards. To control the DC motors, we will need to use breadboards to utilize the DC MakeBlock motors with the Leonardo. The Dell Venue tablets/laptops will be used to run XTCU (the program which configures the Xbee devices) and the Arduino IDE. Finally, the ultrasonic sensor will be used as the sensor input data that will be transmitted using the Xbee devices from Leonardo board to board wirelessly.

You do not need to complete the following, but keep it in mind as you work. As a final project and as part of your EOC, you will need to complete a major project "portfolio" with the following format. Keep format in mind as you work, you will need to complete it during the year.

One of the goals of Robotics Application Capstone #9410140 is for every student to create a complete project report document, one that could be used as part of a skills portfolio. This journal will be a detailed report on the student's senior capstone project from concept to completion. The basic format is below, with detailed instructions in the metrics.

The terms "low quality", "satisfactory quality", and "high quality" are used in the metric as a qualitative measure of the components. Every project is different and it would be inappropriate to give minimum word counts or page counts as a measure of quality. In this case it is up to the teacher to determine whether the submission is low, satisfactory, or high quality for that individual project. Remember that this is a senior year, capstone class and this is the student's capstone paper for their 4-year robotics program.

Section 1: **Design, Drawings, and Specifications**

- Drawings, photos, scans
- Descriptions of project
- The "why" of the project
- Sensor and actuator mapping
- General parts list

Section 2: **Goals, Tasks and Rationale**

- Primary goals
- Secondary goals
- Road blocks to goals
- Steps to overcome roadblocks
- Timeline for project

Section 3: **Budget Planning, Proposal, and Report**

- Detailed parts list
- Cost of parts, itemized
- Money source planning
- Budget timeline
- Expense tracking

Section 4: **Daily Activities and Progress**

- Daily entries
- Goals
- What you did
- What is next
- Picture or drawing

Section 5: **Results and Conclusion**

- Finished pictures
- Reflections on goals
- Extension/application
- Primary learning

- Code