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Robotic Mobile Beamforming Platform

Section 1

	Daniel Luthcke	Russell Hager	Jared Dickman
% Towards Assignment	35%	30%	35%

Daniel Luthcke - Helped with design of diagrams and functional description of project

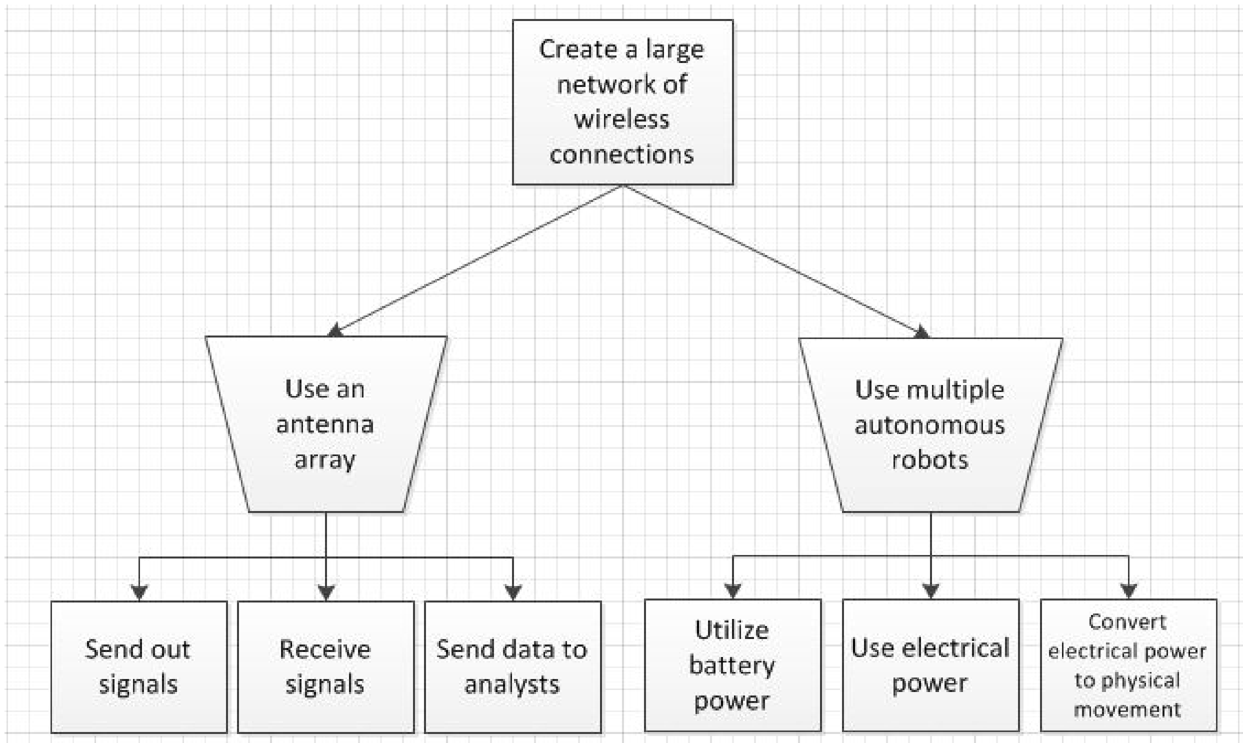
Russell Hager - Helped with design of diagrams and functional description of project

Jared Dickman - Helped with design of diagrams and functional description of project

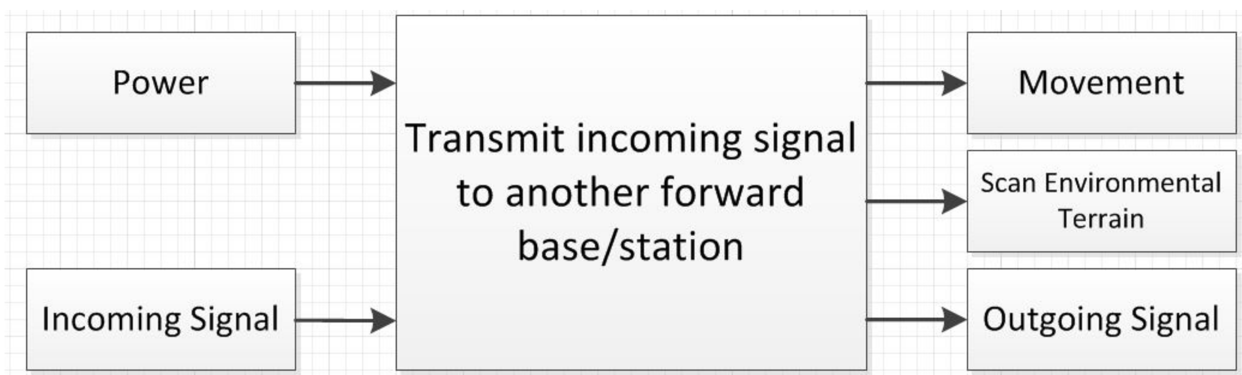
This assignment was done simultaneously as a group.

Section 2

Function Tree



Black Box Diagram



Function Tree Description

The overall function of our project is to create a relatively large network of independent wireless connections, to allow for beamforming across long distances and over various terrains. This is to be accomplished by utilizing an array of antennas and multiple autonomous land-based robots.

The autonomy of these robots is crucial so that they can navigate to their destination on their own, leaving the user free to carry out other operations. The energy consumption of these robots is another non-trivial point, as they will be in the field for a length of time performing some rather power intensive operations. In addition to sending and receiving various radio frequency signals, they will also be left to traverse a multitude of different terrains in just about any weather condition on their own. The user will enter the coordinates for the robot to travel to, and it is expected the robot will have enough power to not only get there and back, but also to complete the assigned beamforming tasks. The robot will be using electrical power supplied from an on-board battery to perform specific physical movements, which will be decided by the autonomous software programmed in. This software will be able to read the current terrain being dealt with and decide the optimal path to continue on to reach the user-set location as quickly as possible.

The antenna array is arguably the most important part of the system, as this is how the actual beamforming tasks are carried out. The pattern constructed by the interference of the signals can change drastically depending on the number of antennas used, as well as the antenna spacing and the phase delay of each antenna, so it is important to select the size of the array very carefully, depending on the specific application it is being used for. A minimum of two antennae is all that is needed for a successful interference pattern, however a more complex pattern can be created and controlled using more antennae. In order for the communication to be successful, a high level of accuracy is needed, and the frequency being transmitted needs to be known to determine proper antenna spacing. Without this information, the signals will just overlap and create an unusable signal on the client side. The accuracy of the phase shift on each signal is also important because without that, the user does not know exactly where the information is being transmitted to. The core functions of the antenna array will be to send signals to and receive signals from other nodes in the network, as well as to send data directly to analysts. Sending and receiving data are crucial parts of any wireless network, and ours is no different. What is different than other systems though is that ours has an incredibly high threshold for reliable data transmission, and making sure that data is analyzed correctly based on accurate data.

Black Box Description

The main inputs in our system are power and an incoming signal, which are then converted to outputs in the form of physical movement, environmental terrain scanning, and an output signal. The power is used directly to read the incoming signal, make the appropriate movements based on the local terrain, and eventually send out a signal to the next node in the network. This node will then take the same inputs, power and a signal, which in this case was the output of the previous node, and itself turn them into outputs in the form of movement and a sending signal. This process will continue until the last node is reached, and the data is then sent for analysis.