

Passive Direction of Arrival System

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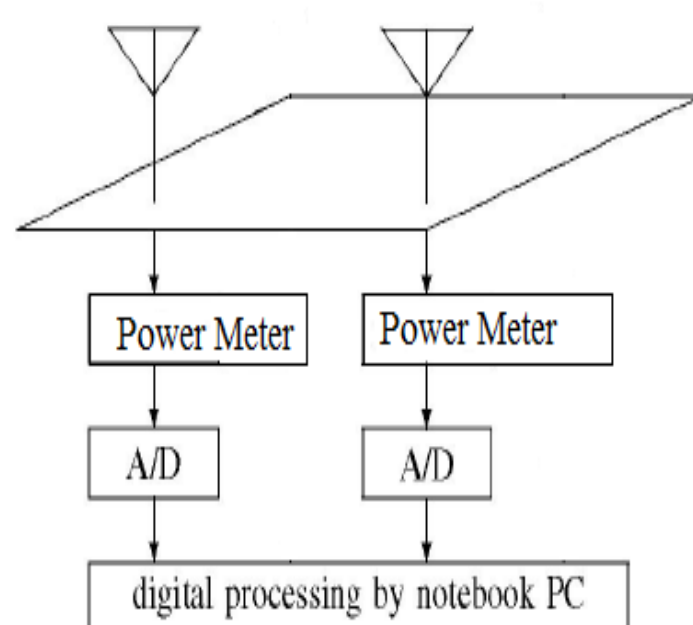
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Introduction and Background

The aim of the project is to design and build a two antennas system which will detect the direction of a single incoming signal whose frequency is within a specified frequency range.

This system consist four main components:

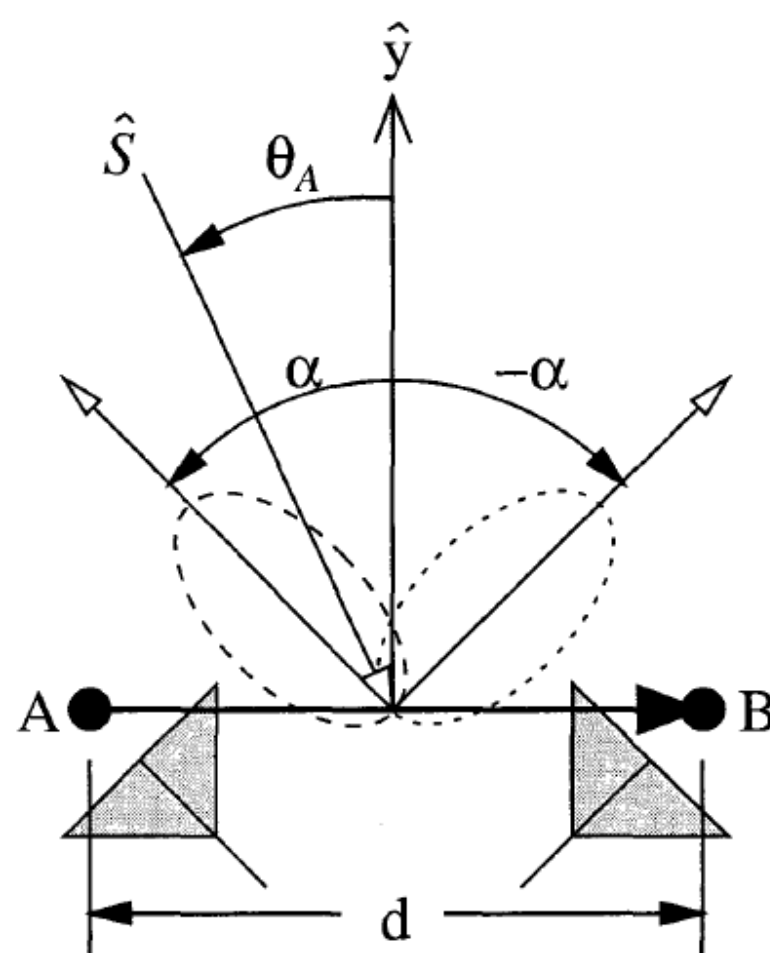
- Patch antennas
- Power Detectors
- Data Capturing Circuit
- Software part



Significance

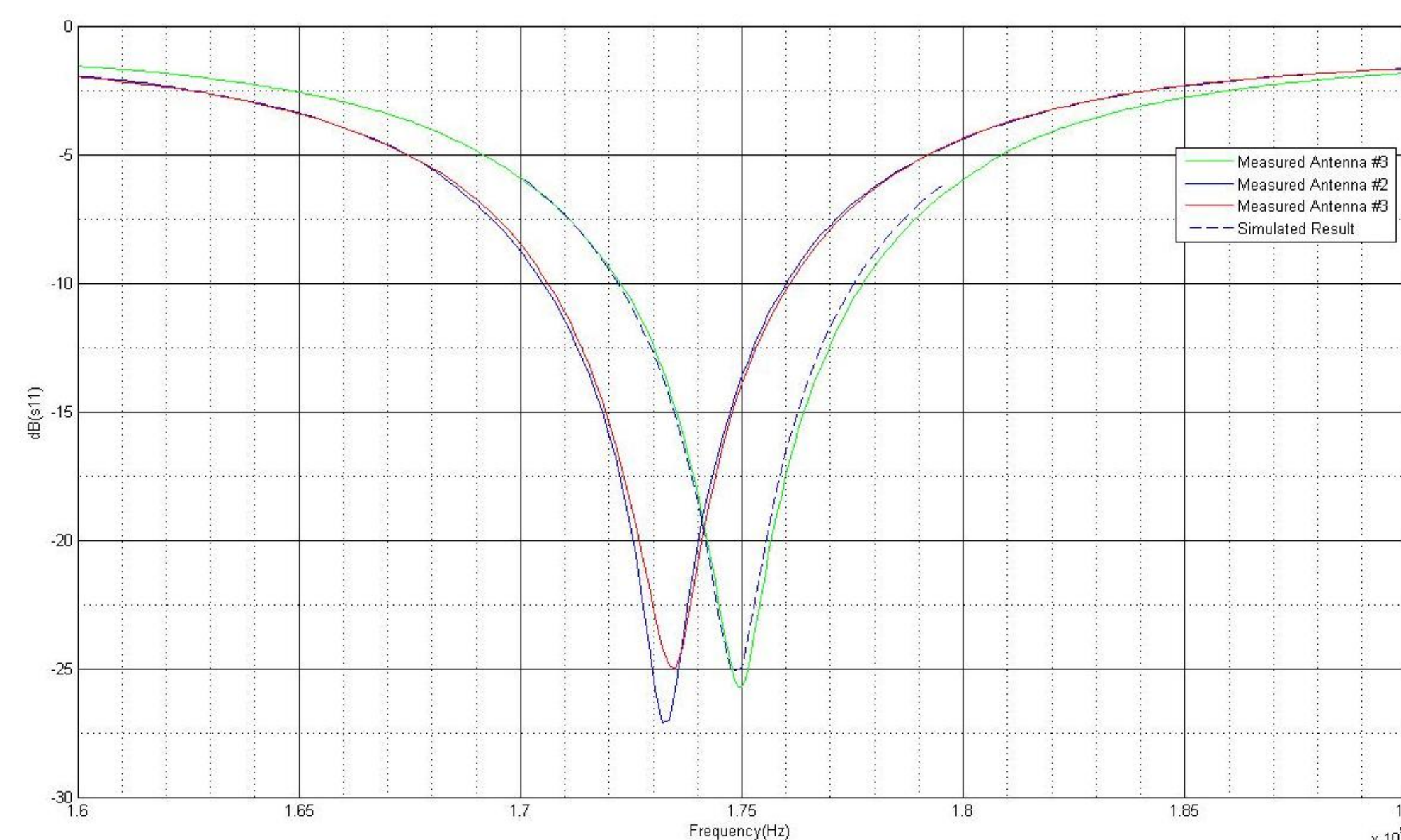
The two antenna system can be used to perform amplitude based direction finding. These two antennas are identical to each other and are squinted at a fixed angle α from y-axis. The incoming from s direction will go through the two antennas' radiation pattern at different place therefore the two antennas will receive different power . Therefore a look-up table which contains the relationship between the power ratio and the arriving angle will be used to find the direction of arrival.

The system will only detect signals which are in a specified frequency range and coming from a limited angle range. Also it will have limitation for the distance between the transmitting signal and receiving antennas.



Antenna Design, Simulation and Test Analysis

Antennas are going to detect signal with frequency of 1710-1785MHz. Patch antennas are designed and built. The three antennas are tested at the chamber with the network analyzer to test its bandwidth and central frequency and the results are compared with simulated one. The century of two antennas are slightly lower than expected but the cover range is still acceptable.



Power Detectors

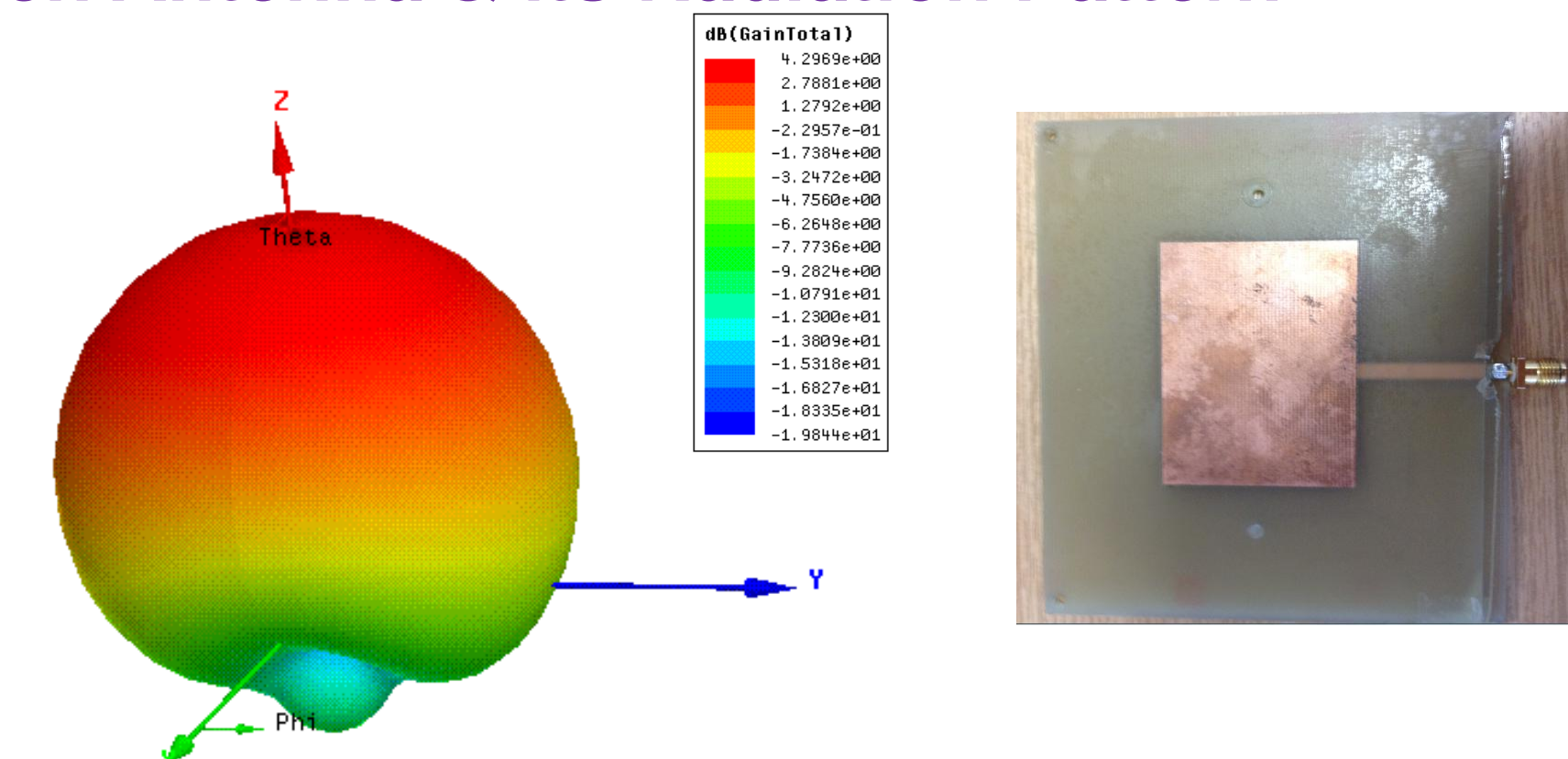
To detect the power received by Antennas and show the result in the form of voltage.

Data Capturing Circuit

To send data from the power detectors to computers for further processing.

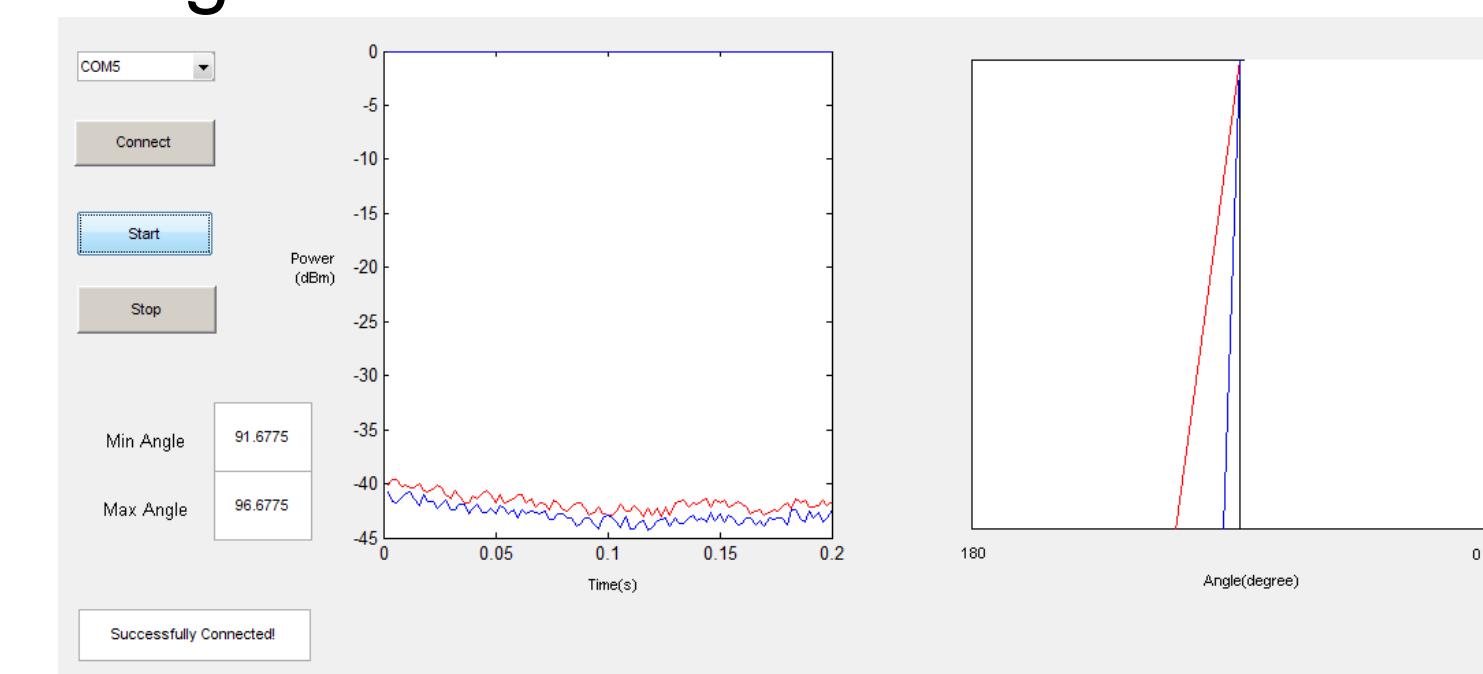


Patch Antenna & its Radiation Pattern



Outcomes and Limitations

The powers received by antennas and the angle of incidence will be shown in MATLAB GUI. The system works on a distance of 45cm and degree range of 45-135 degree.



Future Work

- Dual band and Broadband antenna: add slots on radiating patch.
- By combine the amplitude and phase method to extend the system's effective distance.
- To increase the effective angle range: using eight or more antennas to expand the effective angle to 360 degree.
- To detect multiple signals: using antenna array. The number of signals resolvable depends on the number of elements of the array. With n elements, it can resolve n-1 elements.