Title	**Acoustic imaging device – visualize pneumonia in real time**
Technical areas	Software / hardware
Customer's Project Description	Pneumonia is currently diagnosed with X-ray, which uses penetrating radiation and therefore, contraindicated to children and pregnant women. Technology is ripe for an inexpensive device that can visualize pneumonia inside the lungs in real time using abnormal lung sounds triangulation. Additional pulmonary use-cases for this device include titration of medicine in patients with asthma, emphysema, congestive heart failure, IPF, and COPD. It can also be used in differential diagnosis of these disorders. There are likely other use-cases of this device, outside of pulmonology. These include preliminary localization of intestinal obstructions and diagnostics of joint sounds. Additionally, there could be uses outside of medicine where sound triangulation is used: locating gun shots, investigating structural integrity, ground movements, etc. We will focus on pneumonia, as it is probably the easiest application. 1. First, we will assemble a five-channel audio recorder. For analog to digital conversion, we will use off-the-shelf sound recorders, such as 2-in-1 USB C to Aux Jack Dongle (https://www.amazon.com/dp/B0D2R4CD32). Stacking 5 such devices should enable 5 channel recording. 2. For microphones, let us use 35mm Piezo Disc Transducer Contact Microphone https://www.amazon.com/dp/B0B2QS8VK5 These microphones are very cheap and flat so that they can be glued to a small foam pillow. 3. To test the system, we can use Audacity: https://manual.audacityteam.org/man/multi_channel_recording.html Audacity is a free multi-track audio editor and recorder, can record as many channels as 24 channels. 4. Once the audio is inside a computer, sound can be filtered, abnormal sounds (crackles) identified on all five microphones. The delay of each abnormal sound can be measured and used to triangulate the original location of bronchus that generates the abnormal sound associated with pneumonia. 5. If sound triangulation is performed in real time, acoustic imaging of the lungs will be achieved.

Deliverables	**Acoustic imaging device and visualization software**
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Customer's Supplied Item	n/a