Artificial Intelligence Enabled Pocket Doppler Ultrasound

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Mission Statement

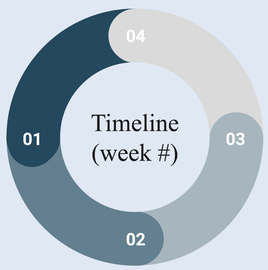
ImageAiD is a company that was created to address the growing gap between available AI technology and medical diagnostic solutions. **We strive to advance the way we use information to empower patients with accessible and accurate healthcare solutions.**

Background

Peripheral artery disease (PAD) is defined as the narrowing or blockage of arteries, both of which are often caused by athersoschlerosis. Over **100m americans are at risk of developing PAD** due largely to an increase in obesity prevalence, and there are no outstanding treatment methods for treating PAD. Because it's symptoms are often masked by other comorbidities, many patients are not diagnosed until the disease is highly progressed. Thus, the **early detection and prevention of PAD is critical** to avoiding adverse outcomes such as major adverse cardiac events (MACE), major adverse limb events (MALE), or death. Furthermore, the process of diagnosing and managing PAD is lengthy and expensive. The time between symptom onset and treatment plan is oftentimes upwards of four weeks.

Patient Symptoms
Patient complains about symptoms or physician notices risk. A vascular lab test is then requested

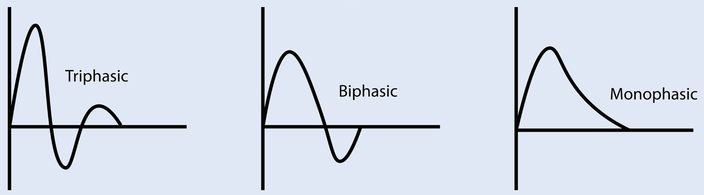
Vascular Lab Test
Ankle-brachial pressure index (ABPI) is measured by Doppler probe in non-standardised fashion



Treatment Plan
Severity and location of the disease can be measured by follow up tests and deeper waveform analysis

Vascular Consult
Patient is diagnosed by a vascular specialist who can interpret both the ABPI and waveform morphology

PAD can be diagnosed by classifying doppler waveforms as monophasic, biphasic, or triphasic (see below). Triphasic waveforms indicate healthy arteries with elasticity, whereas monophasic waveforms indicate heavily calcified arteries. Monophasic waveforms are usually indicative of severe PAD onset and can sometimes point towards MACE, MALE, or death.



Novelty and Market Opportunity

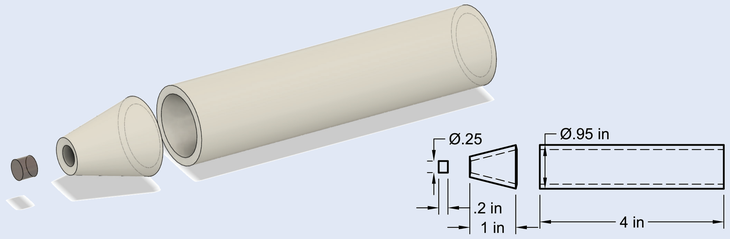
Mayo Clinic's State-of-the-Art Doppler Waveform Algorithm **+** Pocket Sized (for bedside availability) **+** Companion App (for user guidance and real-time AI implementation) **+** Novel Solid Ultrasound Gel Replacement (for never-before-seen portability and replicability) **=** **World's First Prognostic Capability in a Handheld Doppler Device**

1.7B Global Market Size

$600M Estimated Market Share

4.2% CAGR

Product Design



Initial Technical Modeling

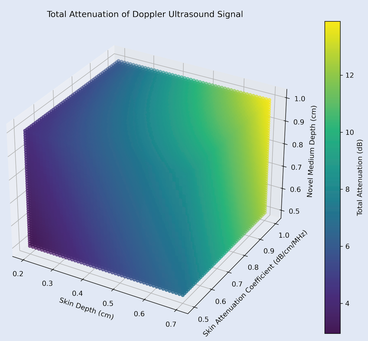


Fig. 1: Attenuation is directly proportional to both skin depth and attenuation coeffiecient, both of which typically increase with obesity factors.

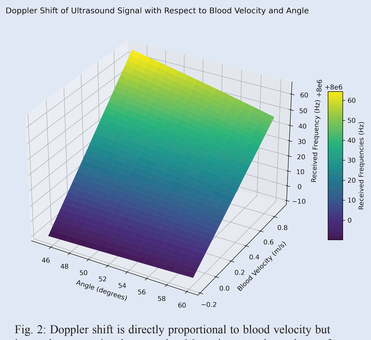


Fig. 2: Doppler shift is directly proportional to blood velocity but inversely proportional to angle. More importantly, values of doppler shift tend to be very small compared to those of the emitted signal, requiring precise measurement techniques to produce accurate insights.

Product Needs and Specifications

Current Issues → **User Needs**

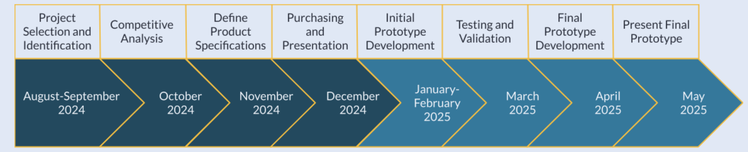
- Diagnostic process is weeks long & requires multiple appointments. Inconvenient. Time Consuming. Expensive → **Cannot be administered routinely** for monitoring / preventative use → Able to be used by bedside whenever available; Prognostic & Diagnostic
- Ultrasound gel requires lot of prep & cleanup, adds discomfort to patients → Minimal cleanup & discomfort
- Requires trained vascular technicians → Can be used with minimal training

Emitted Frequency	8MHz Doppler frequency
Battery Capacity	450 mAh battery capacity
Attenuation	Less than 10 dB in total attenuation
Algorithm Accuracy	Greater than 0.95 area under curve

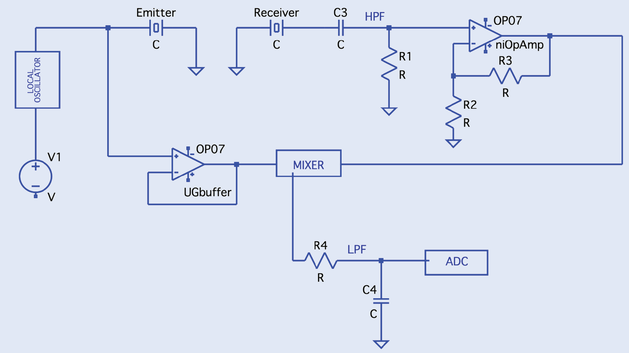
Governing Equations

Doppler Shift	$f_D = \frac{2 f_0 v \cos(\theta)}{c}$
Battery Capacity and Power Consumption	$\text{Capacity} = \frac{BL \cdot P_{\text{avg}}}{V_{dd}}$
Data Transmission Rate	$DTR = \frac{D}{T}$
Signal Emission and Attenuation	$A_{\text{round-trip}} = \alpha \cdot f \cdot (2 \cdot d)$

Project Timeline



Circuit Model



Acknowledgements

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Scan here for more info

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