SpecWare| **NIH Wearable Alcohol Biosensor:** Prior Findings and Next Steps

Team Members

Technical Background and Logic

Prior Prototype

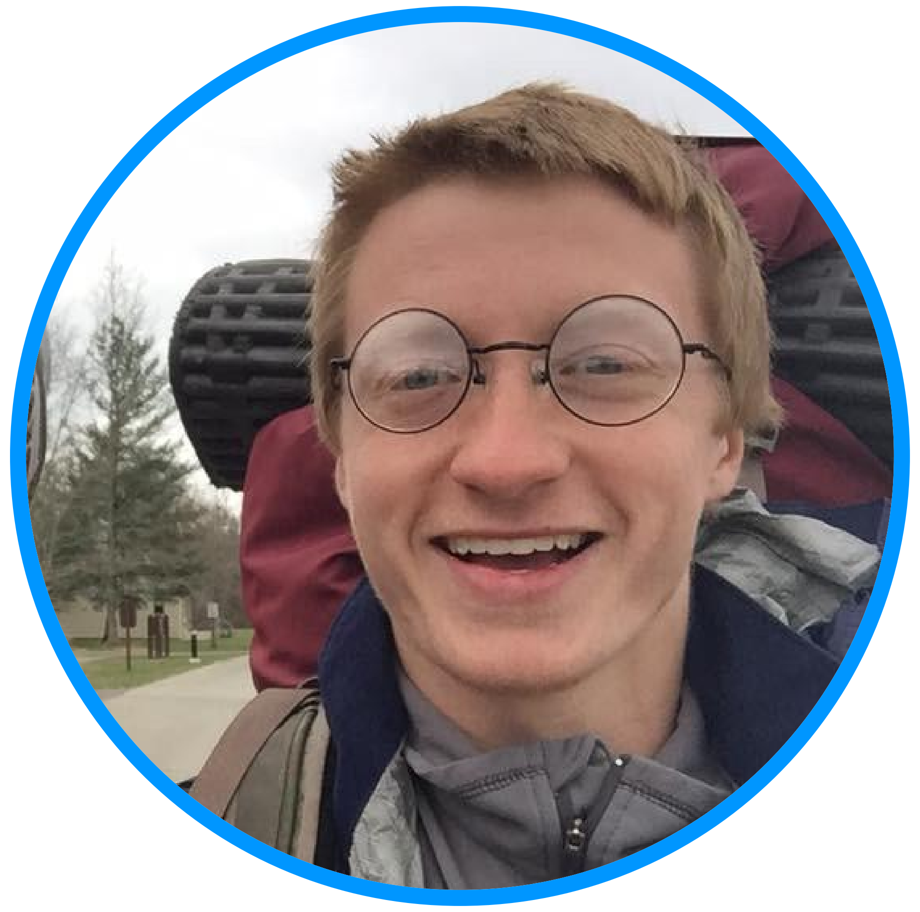
Current Prototype

Technical Results

Next Steps

Current Funding and Support

SpecWare| **NIH Wearable Alcohol Biosensor :** Current Team Members



Shawn Gregory
B.S. Materials Engineering
Ph.D. Materials Engineering- 2021

Materials Properties and Spectroscopy

Ben Rothschild
B.S. Mechanical Engineering- Fall 2017

Manufacturing Design and Circuitry

Alex Saad-Falcon
B.S. Electrical Engineering- Fall 2017

Digital Signal Processing and Circuitry

Maggie Garratt
B.S. Industrial Design- Spring 2019

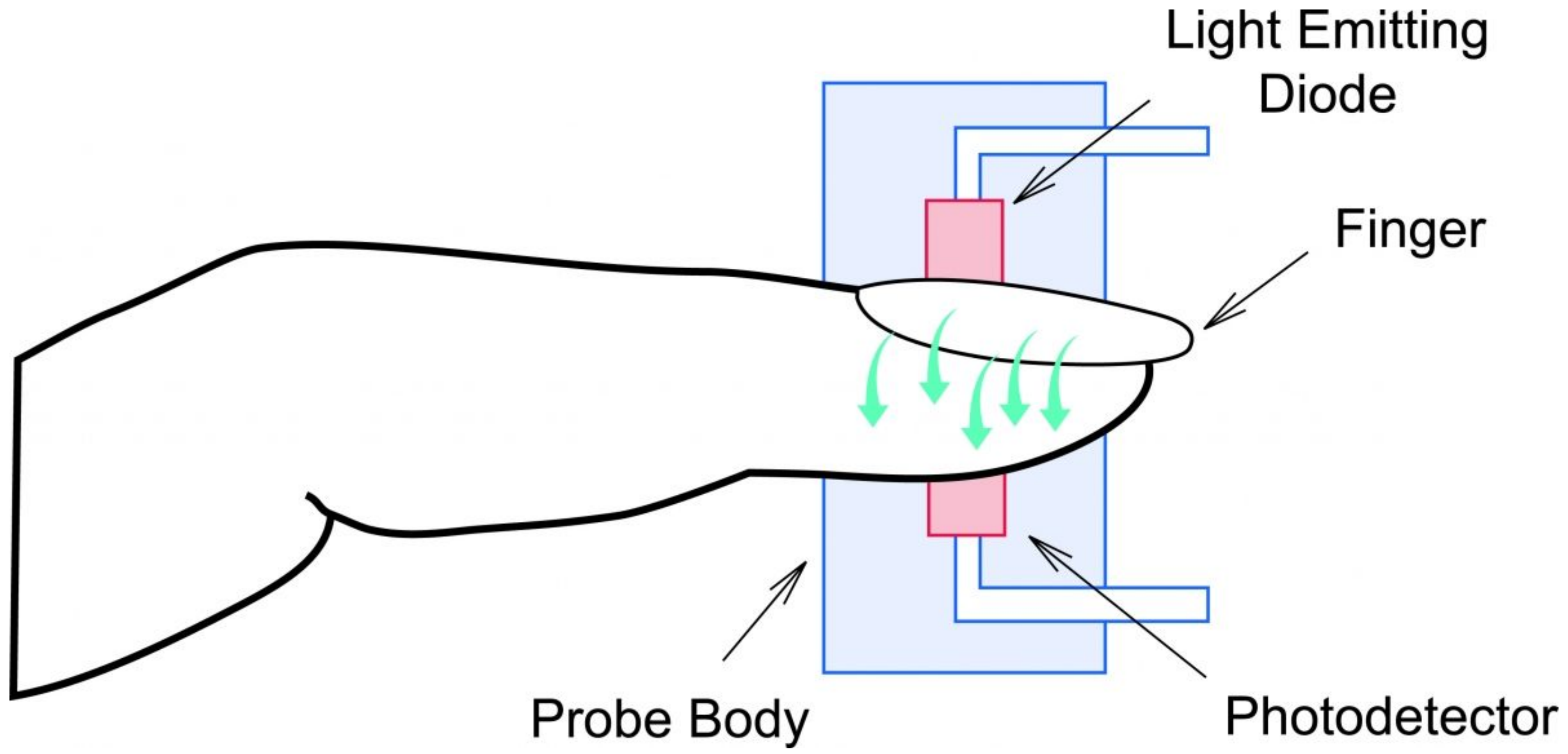
Product Design and Business Relations

Dinesh Ganesan
B.S. Chemical Engineering- Spring 2018

Applied Spectrscopy and Business Relations

Georgia Tech

SpecWare| **NIH Wearable Alcohol Biosensor:** Technical Background



Prior art exists for Near Infrared (NIR) technology to analyze pulse oximetry using discrete photodiodes and emitters.

$$A\vec{x} = \vec{b} \quad \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} a_{11}x_1 & a_{12}x_2 \\ a_{21}x_1 & a_{22}x_2 \\ a_{31}x_1 & a_{32}x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$

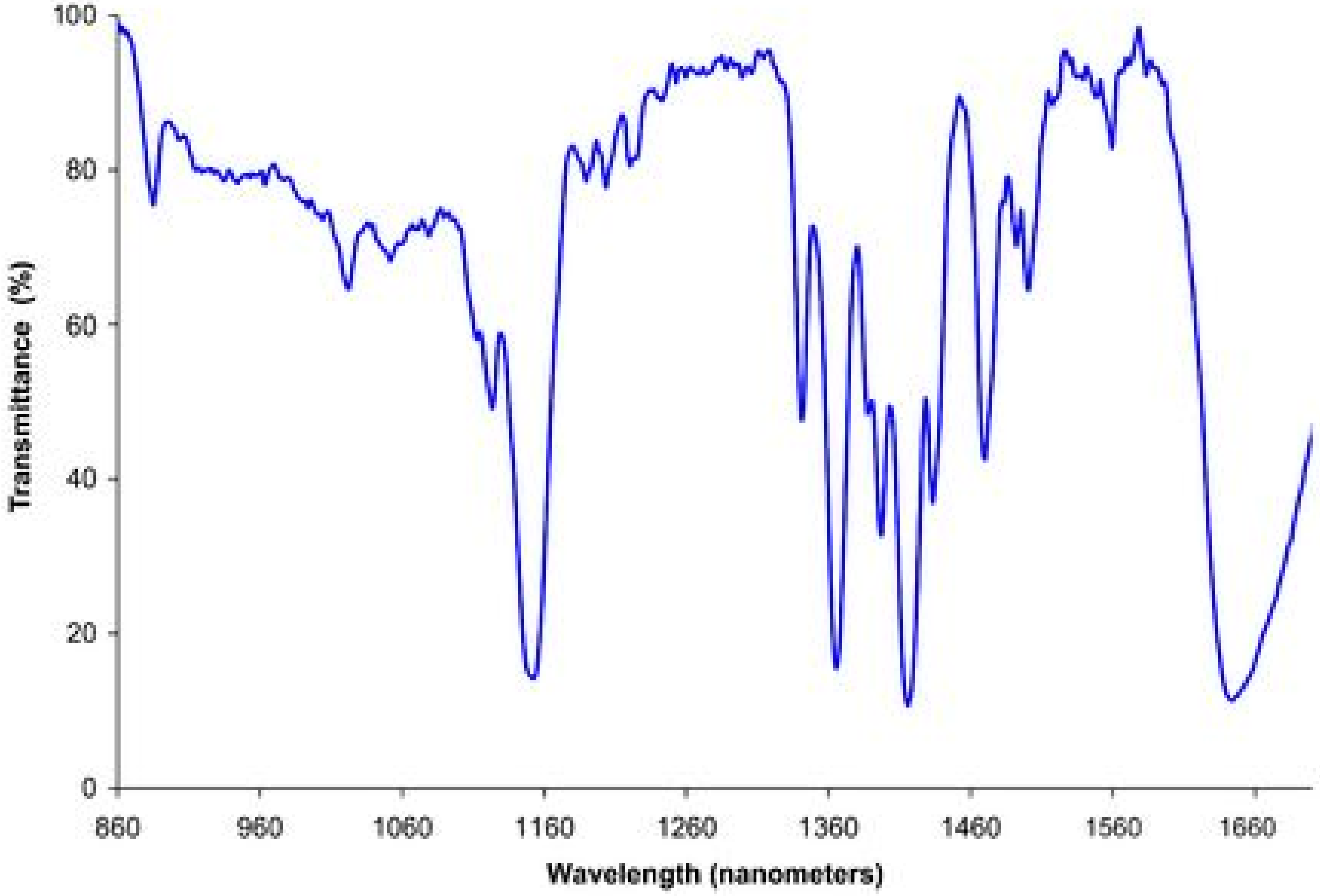
<u>Row Picture</u>
Dot product

$$\begin{bmatrix} (a_{11}, a_{12}) \cdot \vec{x} \\ (a_{21}, a_{22}) \cdot \vec{x} \\ (a_{11}, a_{12}) \cdot \vec{x} \end{bmatrix} = \vec{b}$$

<u>Column Picture</u>
Linear combination

$$x_1 \begin{bmatrix} a_{11} \\ a_{21} \\ a_{31} \end{bmatrix} + x_2 \begin{bmatrix} a_{12} \\ a_{22} \\ a_{32} \end{bmatrix} = \vec{b}$$

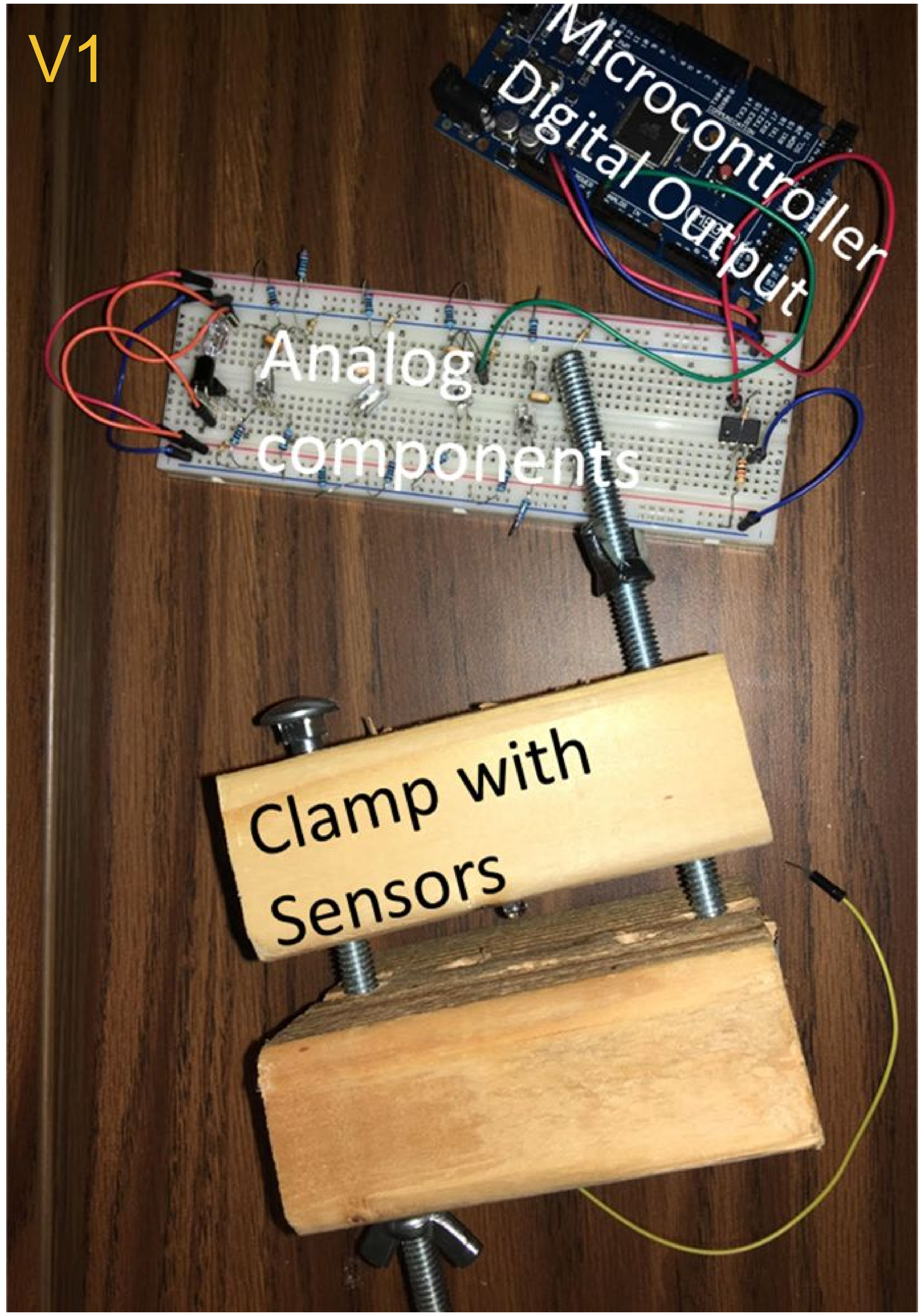
Linear combinations of absorbances can be used to develop an algorithm which correlates discrete absorption spectra with Blood-Alcohol Concentration (BAC)

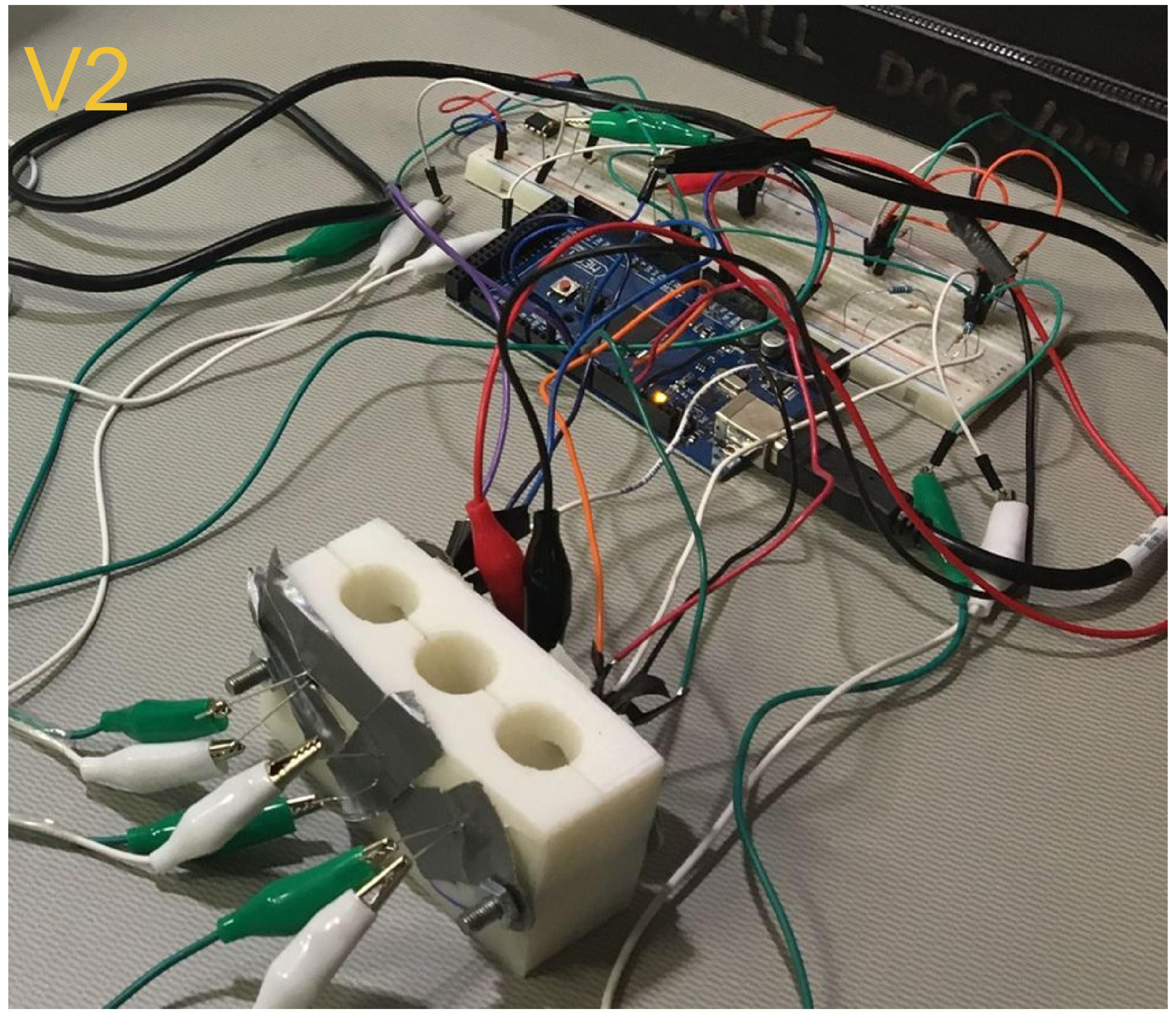


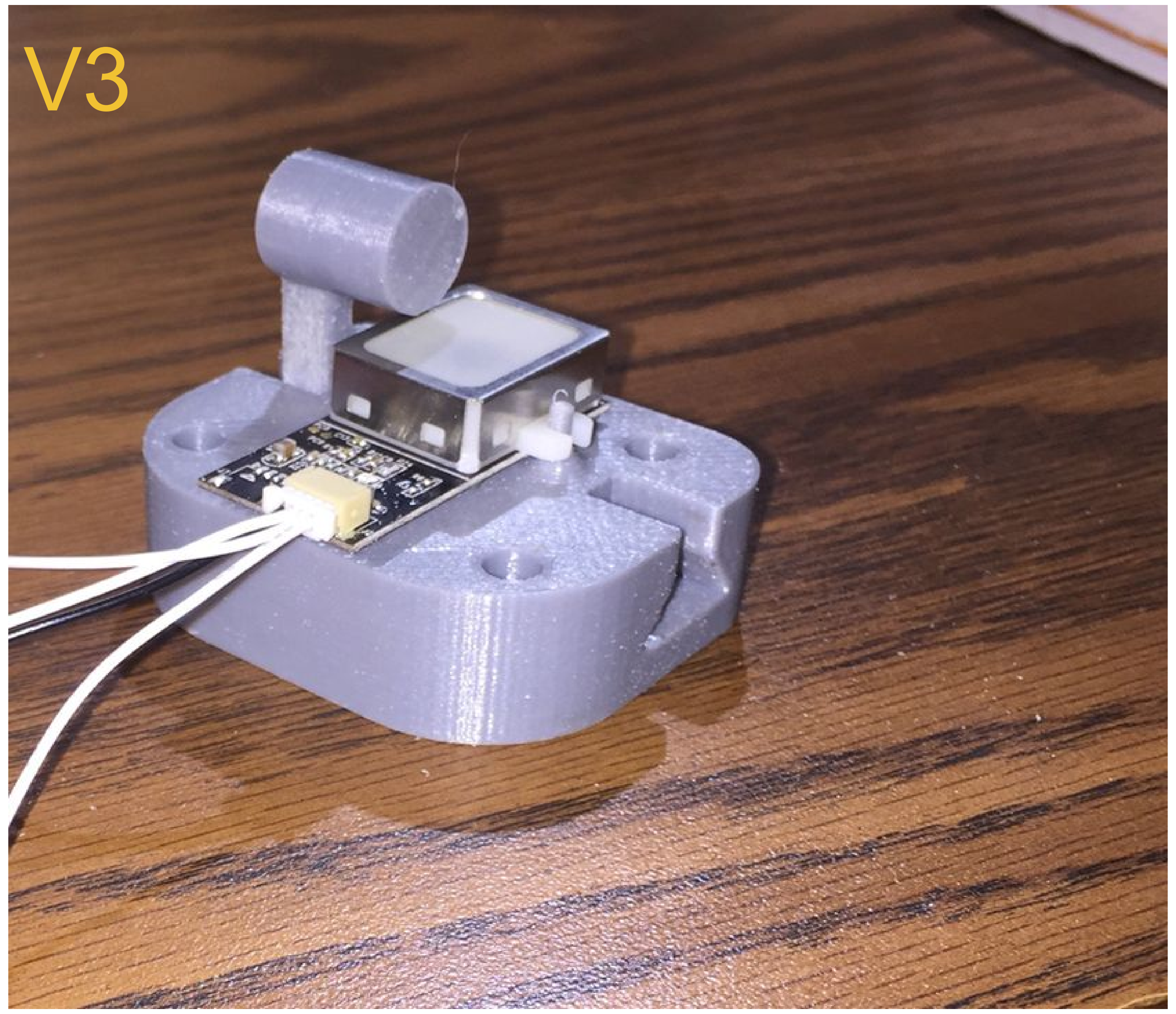
Typical IR spectrums have characteristic wavelengths on the order of 10-50 um. However, characteristics absorptions exist within photon enable devices with wavelengths < 3 um.

Form factors and sensing technology vary. Each can be optimized for the target user and market.

SpecWare| **NIH Wearable Alcohol Biosensor:** Prior Prototypes







All technologies utilize NIR Spectroscopy transmission to find BAC.

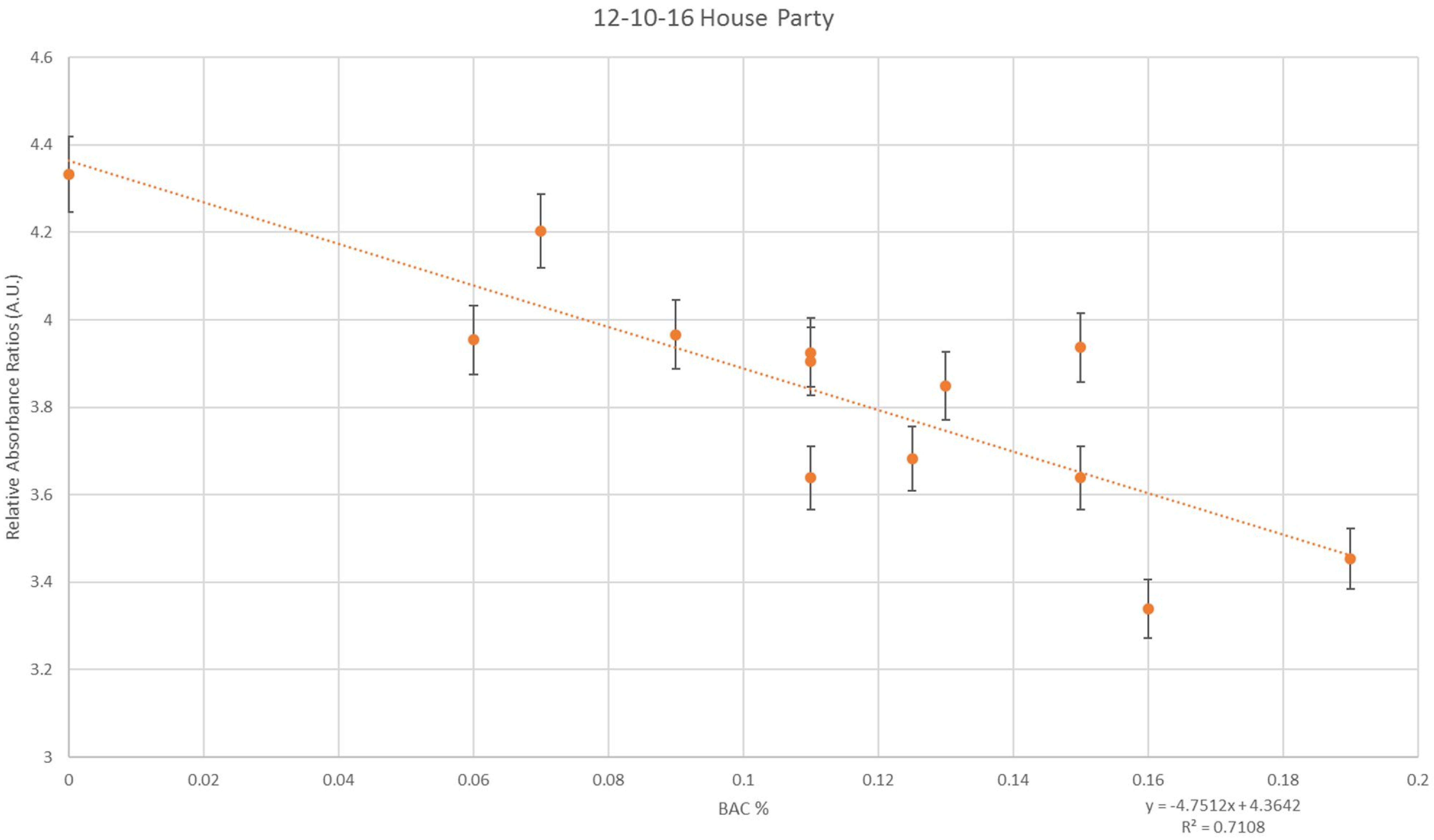
Increasing number of wavelengths were used from V1- V3. Accuracy and repeatability also increased.

V3 features ability to biometrically read fingerprints and concatenate data with individual users.

V3 also enables data storage on device or blue-tooth transmittance of data.

V3 measures transmission through transverse section of finger… mitigating interference of polishes and cosmetics.

SpecWare| **NIH Wearable Alcohol Biosensor:** Prior Prototype

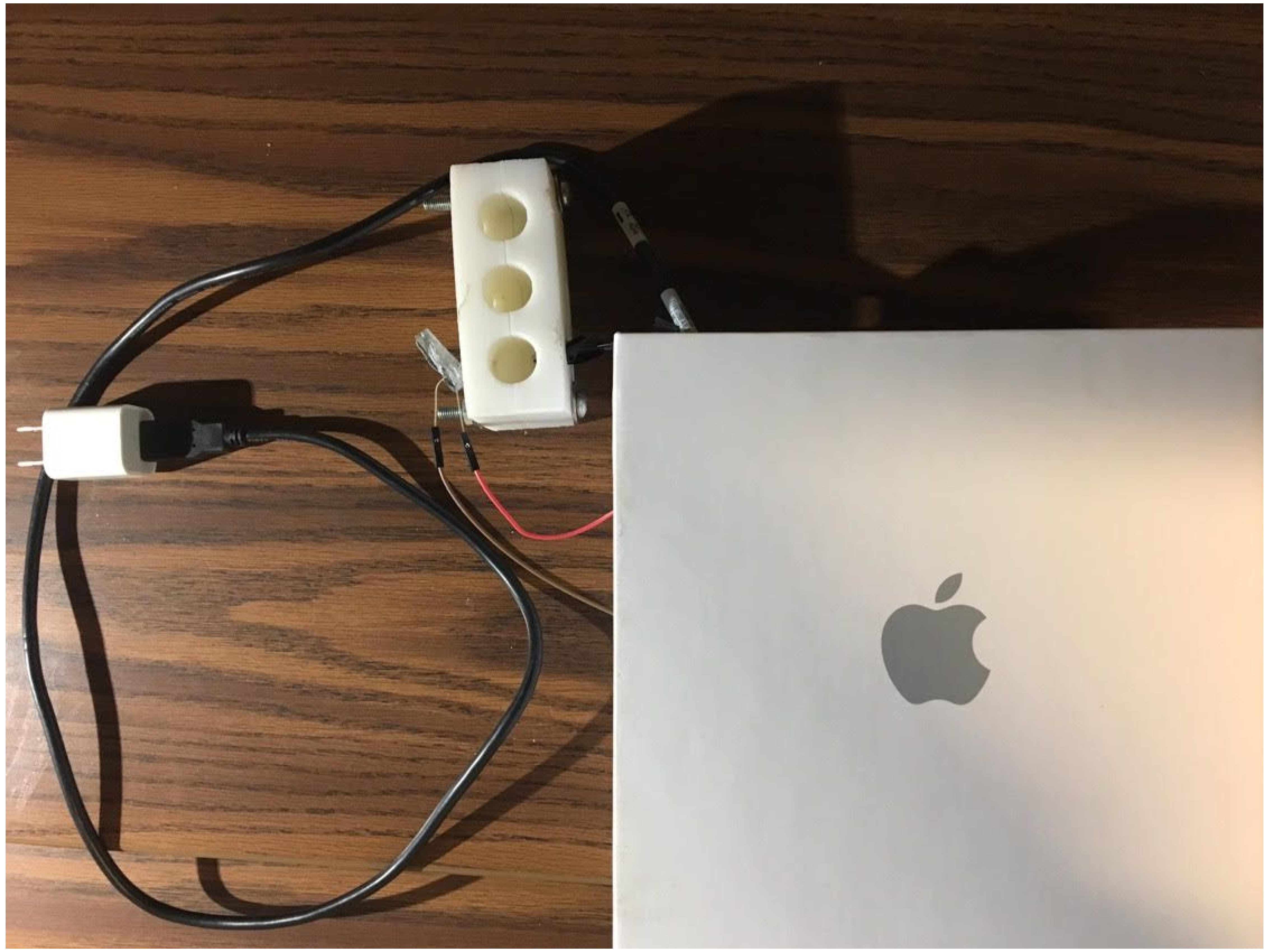


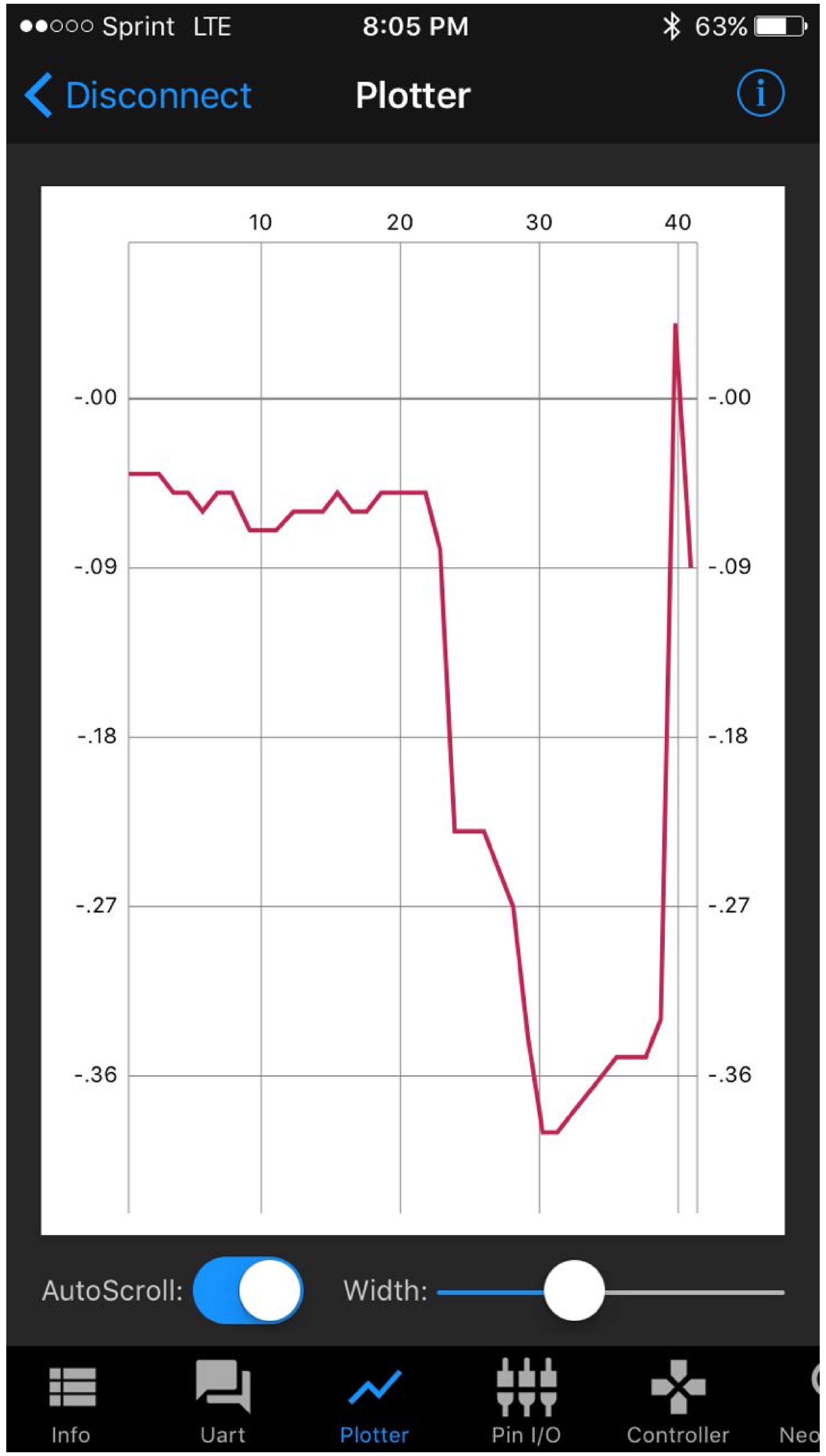
Initial tests were compared against BACTrack keychain breathalyzers in typical college setting.

Linearity between infrared spectroscopy and chemical methodologies proved fruitful

Spectroscopy methods are more difficult for users to “abuse” and likely to provide faulty results with rapidly successive testing.

SpecWare| **NIH Wearable Alcohol Biosensor:** Current Prototype

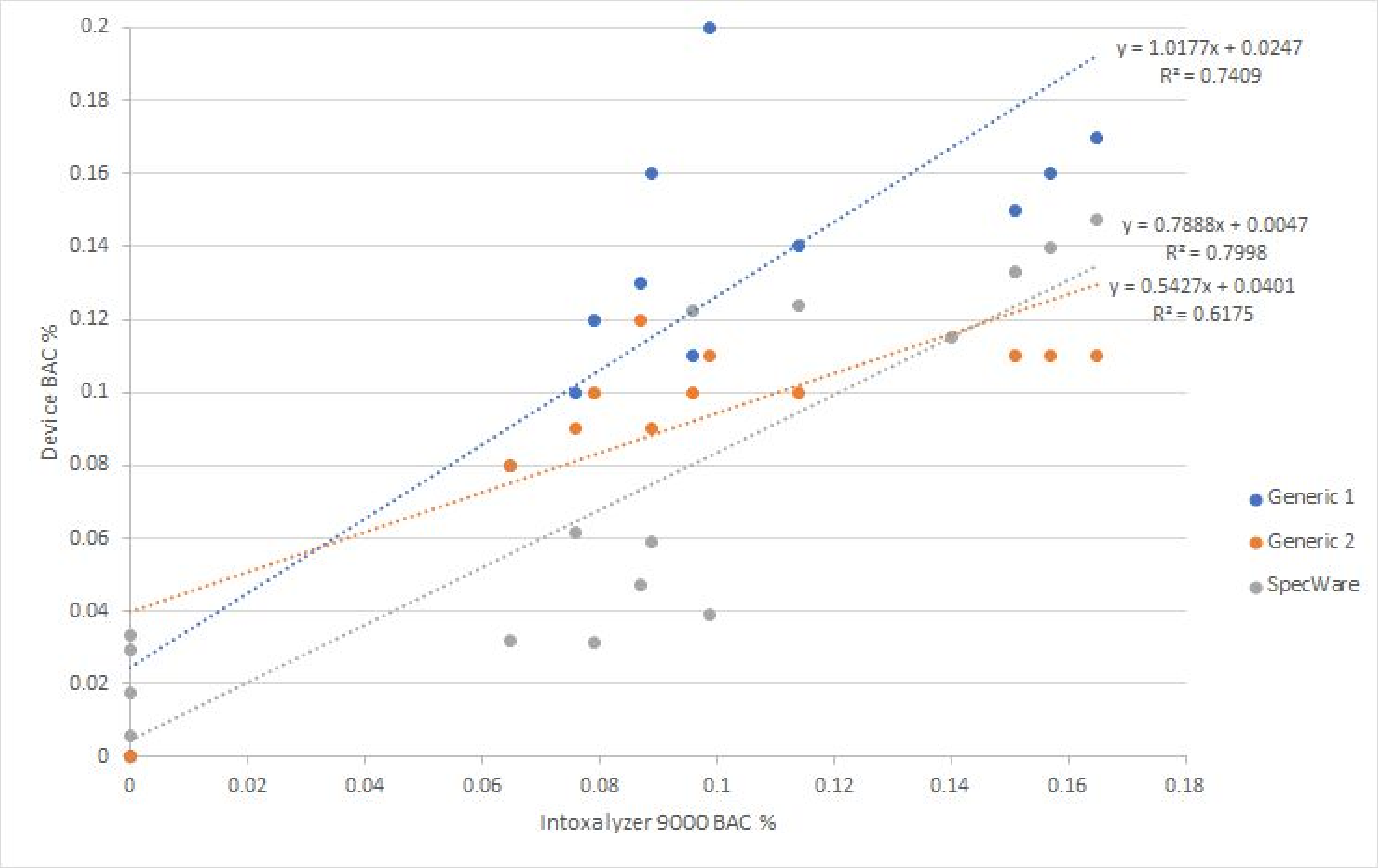




Current model comes in a 8” x 8” x 2” box which houses circuitry and a 6”x2” measurement device.

Data can be exported to a PC or mobile device via 3rd party app. Data transmission can be plotted, parsed, or stored.

SpecWare| **NIH Wearable Alcohol Biosensor:** Current Prototype



Linearity study of SpecWare device, using 6 wavelengths, against an industry standard, Intoxalyzer 9000 was aided by Georgia Tech Police Department (GTPD).

R. sq. correlation was found to be 80%, on par with end-user's practice with common breathalyzers found online, such as BACTrac Keychain.

SpecWare| NIH Wearable Alcohol Biosensor: Longer Term Technical Goals

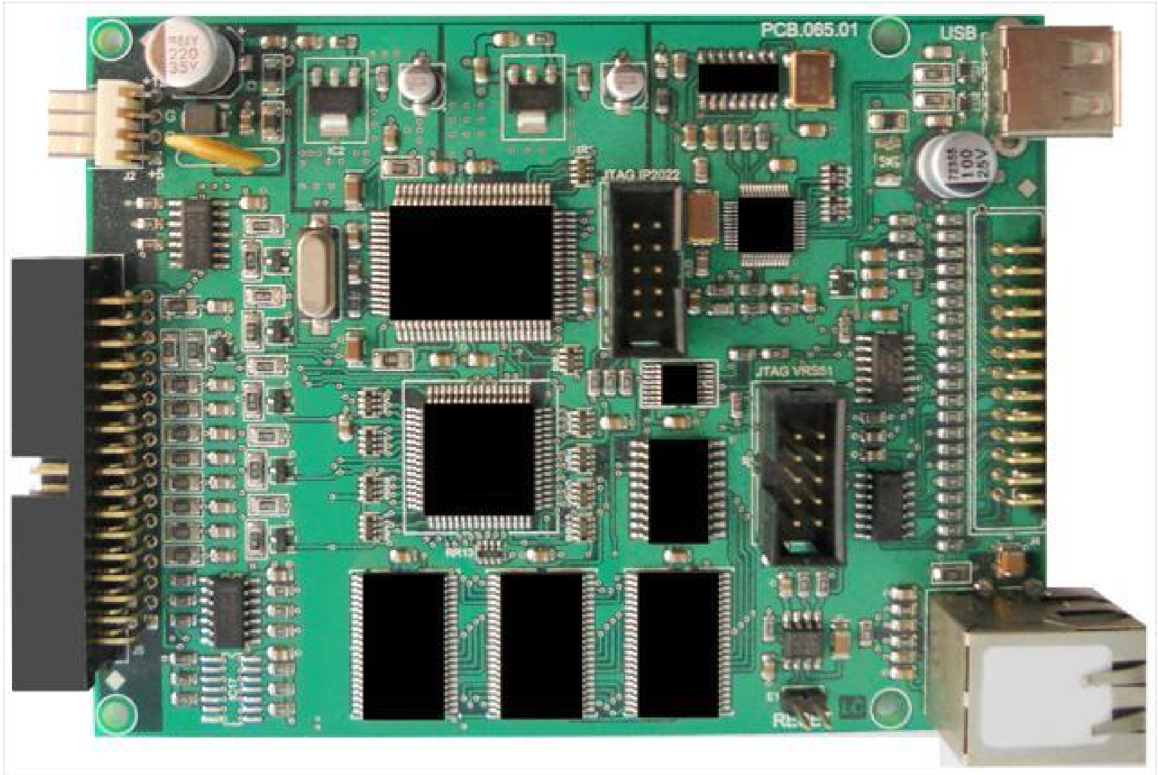
Problem: Multiple devices are needed to measure BAC and other biometrics. Extremely intoxicated individuals make negligent decisions and have deleterious impact on themselves and their communities.

Solution: Create a device which enables consumers to easily and quickly track their BAC so that they and their communities can make better decisions.

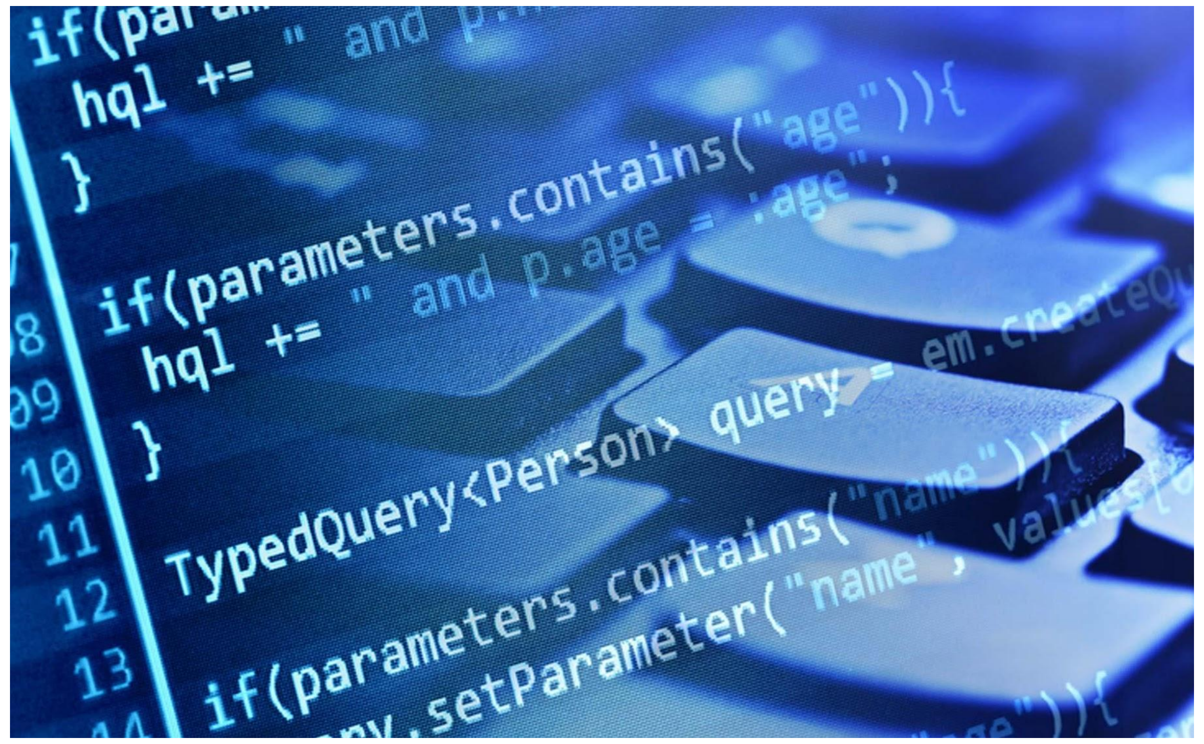
Optimize for end user accessibility and variable environments.

Enclosure: ergonomic, robust, aid in GRR, rapid prototype

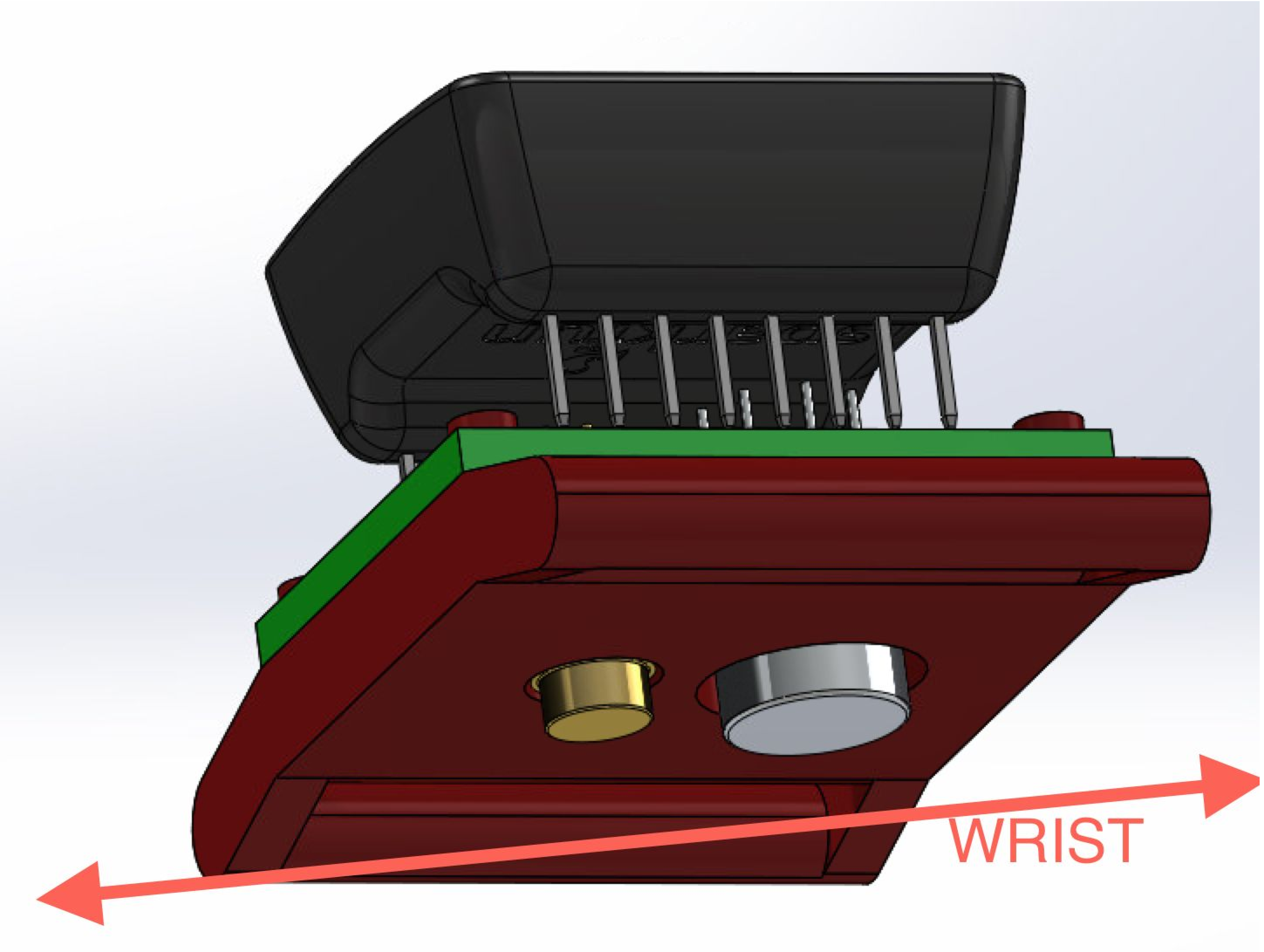
Manufacturing: scalable, facile, not-novel, favorable margins, CoGS < $30



Hardware: utilize proper NIR measuring components, quantize data, and transmit to android phone.



Software: use non-native functions, develop own apps, algorithm derives RR from HR and spO2



A wearable device has been designed and models are being 3D printed.

The manipulation of developed algorithms will be needed to fit transmission curves to reflectance and absorbance spectroscopy.

Although form factor is different than prior tested methods, it is highly likely correlations will still be viable.

Bill of Materials is viable, and modularity of parts and form factor will enable a grand scale of plausible designs and use cases.

BILL & MELINDA GATES foundation

Provided researcher stipend and overhead funding to further develop NIR technology and derive respiration rate from pulse oximetry.

Georgia Tech | CREATE-X Entrepreneurial Confidence

Provided start up capital and incubator to further develop BAC NIR device. Enables plausible entry to analysis of other analytes (opiates, neutrophils, cannabis, etc).

Dr. Shannon Yee- Prof. Mechanical Engr.

Sanjay Parekh- CreateX Founder and Mentor

Dr. Mark Losego- Prof. Materials Science

Georgia Tech provides wealth of resources and mentors to guide technological development.