The Heeluxe Analysis Last, or HAL, is a durable and accurate model foot with embedded sensors and distance gauges that can reliably determine the fit of shoes in a time efficient manner. There are many problems with the way shoe fit measurements are done, especially as demand scales with company growth. Cost to ship shoes from overseas manufacturing sites to testing facilities increases if the test results indicate a change in design is needed. This can lead to an inefficient process of sending shoes back and forth for minor adjustments. HAL will be able to be used by shoe manufacturing factories so that they themselves will be able to get results from a standardized model foot and modify their shoes based on the data that they acquired.

Once the HAL is inserted into a freshly manufactured shoe, the user can launch the software. When the shoe is tightened, HAL outputs a pass/fail indication for every sensor location based on the sensor pressure output and the distance (in mm) from each LIDAR sensor. Data read from each test can be saved to an SD card or displayed on a webpage using a WiFi module.

The HAL comes with an easy to use software installed on a Nextion 7" LCD Touchscreen. Users can directly interact with the electronic measurement components via options on the touchscreen that command an Arduino Mega.

**Key Measurement Components**
- **SingleTact Force Sensor (x8)**
  - Calibrated for 45N/10lb force
  - 15mm Diameter
  - I²C Communication
- **LIDAR Distance Sensor (x3)**
  - Time of flight distance sensing
  - Range 5 mm – 100 mm
  - 3 locations used to sense distance from shoe to heel, toe, and top of foot
- **Wooden Dowel (Sensor Holder)**
  - Adjustable in position
  - Unscrews to release sensor for easy replacement

**Key Software Features**
- Date and Time Keeping
- Unit selection between kPa, N/mm², and PSI
- 2 Default calibration fits
- Ability to set up to 6 custom calibrations
- Pass/Fail read out on results page
- Numerical pressure read out on measurement page
- Exports pressures to SD card
- Updates I²C address of new sensor if replaced

Acknowledgements: The HAL team would like to thank Geoffrey and Allison from our industry sponsor, Heeluxe, for investing their time to help us achieve the best project outcome possible. We would also like to thank Professor Reza Abdoolie, Professor Ilan Ben-Yaacov, and our TA Evan Blasband for their technical guidance.