

# Integrating Machine Learning Models in a Digital Stethoscope



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## TEAM 1

### INDUSTRY REPRESENTATIVE

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### PROJECT SUMMARY:

As cardiovascular disease (CVD) is a leading cause of death in the United States, medical technology can help physicians more efficiently and accurately diagnose and treat patients. Our design aims to continue the work of previous senior design teams in creating a digital stethoscope that provides precise heartbeat data to effectively and inexpensively detect heartbeat irregularities. Our team engineered a machine learning pipeline by implementing machine learning models onto an AI accelerator chip to perform inference and detection.

### DESIGN GOAL:

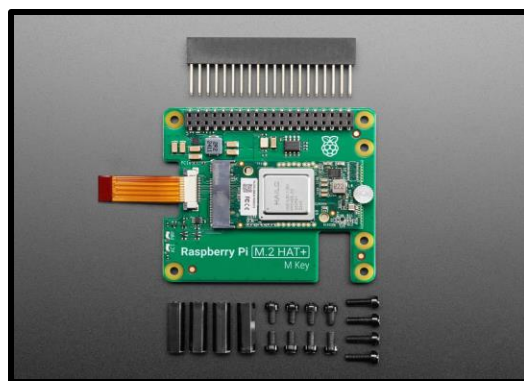
Our team has researched and chosen an AI chip capable of inferencing electrocardiogram (EKG) and phonocardiogram (PCG) signals in real time and developed the process to easily load, manage, and test machine learning models onto the chip. Our design uses a Raspberry Pi 5 with a Hailo 8L AI accelerator chip to import and run inferencing on the data from a digital stethoscope on the machine learning models. The system will indicate whether a heartbeat is normal or abnormal, along with the confidence of that indication.

### DESIGN CONSTRAINTS:

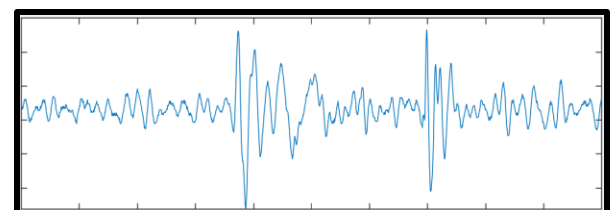
- **Minimum of 2 TOPS (Tera-operations per second) per Watt.**
- **Process capacity of at least 40 frames per second on 224 x 224 frame size.**
- **Process EKG/PCG signals on the embedded device (ML accelerator) and be displayed on the UI within one heartbeat (1 Hz).**
- **Support the PyTorch AI framework**
- **Consume at peak 5 Watts of power or less.**



*Raspberry Pi 5 & Digital Stethoscope*



*Hailo 8-L Chip on M.2 Hat Key*



*PCG Waveform Visualized*