Eureka Project Title & ID: Using AI To Turn A Smartphone Into A Stethoscope (2425MED1009)			
Student Name:	TSE Man Shun Daniel	Project Mentor:	Prof. HO Joshua
Major:	Biomedical Engineering	Department:	LKS Faculty of Medicine

USING AI TO TURN A SMARTPHONE INTO A STETHOSCOPE

INTRODUCTION

STETHOSCOPE
Device to listen to heart sounds

ARTIFICIAL INTELLIGENCE (AI)
Computers being able to recognise patterns and "think"

Combining the two can enhance and democratise healthcare diagnostics. Some recent projects in this area are:

- Zhang et al. (2023): 99.94% accuracy in detecting 11 diseases
- Lee et al. (2024): 73% accuracy in capturing lung sounds with smartphones

The need for such a technology increases, yet there is no widely-used application enabling real-time, reliable heart sounds classification outside.

18.5% (2019) → projected: **33.3%** (2039)

of Hong Kong's population aged more than 65
(Census and Statistics Department HKSAR, 2020)

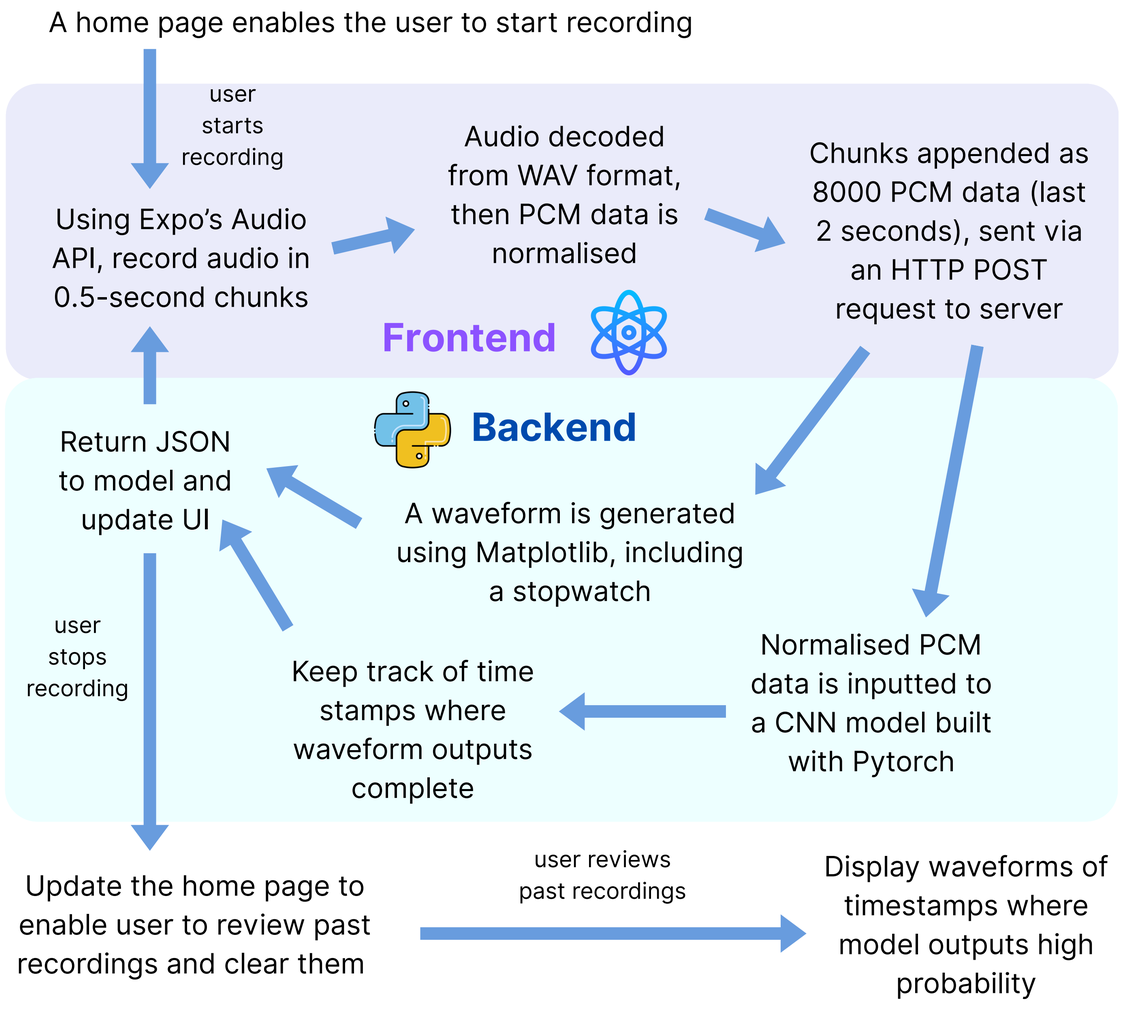
This project aims to bridge this gap by leveraging artificial intelligence (AI) to transform consumer-grade smartphones into medical-grade stethoscopes.

OBJECTIVES

Design a user-friendly interface, enabling medically untrained laymen to turn their stethoscope for reliable diagnosis of heart sounds.

In real-time, achieve classification, and display of audio input, enabling the user to truly turn their smartphone into a stethoscope anywhere and anytime.

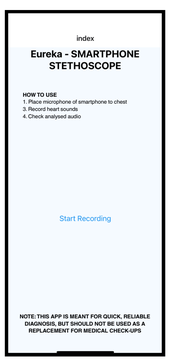
METHOD



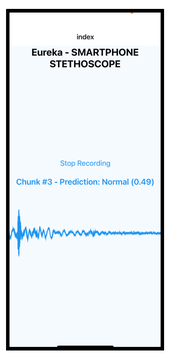
ETHICAL CONCERNS

Although heart sounds cannot identify an individual, they are still sensitive information. Therefore, all heart sounds will be strictly stored locally on the user's Mobile Phone. This approach also avoids legal complications about storing data across different regions in the world.

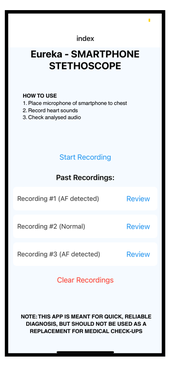
RESULTS



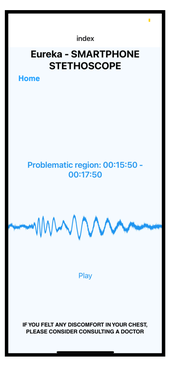
- Minimalistic home screen
- Clear instructions
- Disclaimer to not replace medical check-ups



- Waveform is visualised
- Updates every 0.5s
- User can stop recording



- Past recordings are saved
- Model classification appended
- Review or clear audio



- Replay audio
- Display waveforms of regions of interest
- Advice refer to doctor

LIMITATIONS

Only tested with iPhone 12, yet to try on other Mobile Phones

Requires Internet connection to access the App

Yet to be tested with functional CNN model

CONCLUSION

✓ Real-time classification and waveform
(can use some improvement)

✓ Playback and review of past recordings

FURTHER DEVELOPMENTS

- Test with functional model
- Denoising
- Launch outside of local environment
- Test with other devices

REFERENCES