

The background features a dark grey gradient with a subtle circular motion blur effect. Overlaid on this are several abstract geometric shapes: a large blue triangle pointing down from the top left, a green parallelogram below it, and a smaller blue triangle pointing up from the bottom left. In the top right corner, there's a pattern of light grey 3D rectangular blocks resembling a circuit board or architectural model.

MATT Prototype

By Kumar Laxmikant



Project objective

- Accurate Sound Representation
- Realistic User Interface
- Remote connectivity
- System independent Software
- Compatibility and Portability
- Interactive Learning
- Educational Content - Personalised Learning
- Customization Options

Dataset - Sound

Heart

(40 Sounds)

Location:

- Mitral Valve
- Aortic Valve
- Pulmonary Valve
- Tricuspid Valve
- Erb's Point

Acute myocardial infarction
Acute pericarditis
Aortic stenosis & regurgitation
Aortic valve regurgitation
Aortic valve stenosis
Atrial septal defect
Austin flint murmur
Coarctation of the aorta
Congestive heart failure
Continuous murmur
Diastolic murmur
Dilated cardiomyopathy
Early systolic murmur
Fourth heart sound gallop
Functional murmur
Holosystolic murmur
Hypertrophic cardiomyopathy
Mid-systolic murmur
Mitral stenosis & regurgitation

Mitral stenosis & tricuspid regurgitation
Mitral valve prelapse
Mitral valve regurgitation
Mitral valve stenosis
Normal heart
Opening snap
Patent ductus arteriosus
Pericardial rub
Pulmonary hypertension
Pulmonary valve regurgitation
Pulmonary valve stenosis
Split first heart sound
Split second heart sound
Stills murmur
Systemic hypertension
Tetralogy of fallot
Third heart sound gallop
Tricuspid valve regurgitation
Ventricular aneurysm
Ventricular septal defect

Lungs

(18 Sounds)

Location:

- Left Upper Lobe
- Left Middle Lobe
- Left Lower Lobe
- Right Upper Lobe
- Right Middle Lobe
- Right Lower Lobe

Amphoric respiration
Bronchial respiration
Bronchovesicular respiration
Coarse crackles
Diminished vesicular respiration
Fine crackles
Gurgling rhonchi
Harsh respiration
Pleural friction rub
rhonchi
stridor
Vesicular respiration
wheezes
asthma
covid-19

Bowel

(14 Sounds)

Location:

- Left Upper Quadrant
- Left Lower Quadrant
- Right Upper Quadrant
- Right Lower Quadrant

borborygmus
Bruits due to renal arteries stenosis
capotement
constipation
Crohns disease
diarrhea
Hyperactive sounds
Hypoactive sounds
Irritable bowel syndrome
Normal bowel
Normal bowel sound with bruits
Paralytic ileus
Peritoneal friction rub
Ulcerative colitis

Korotkoff

(5 Sounds)

Location:

No Locations specified

Tapping
Swishing
Knocking
Muffling
Silent



Technology Used - Software

Framework



Database



Front-End



Back-End



Technology Used - Operating System

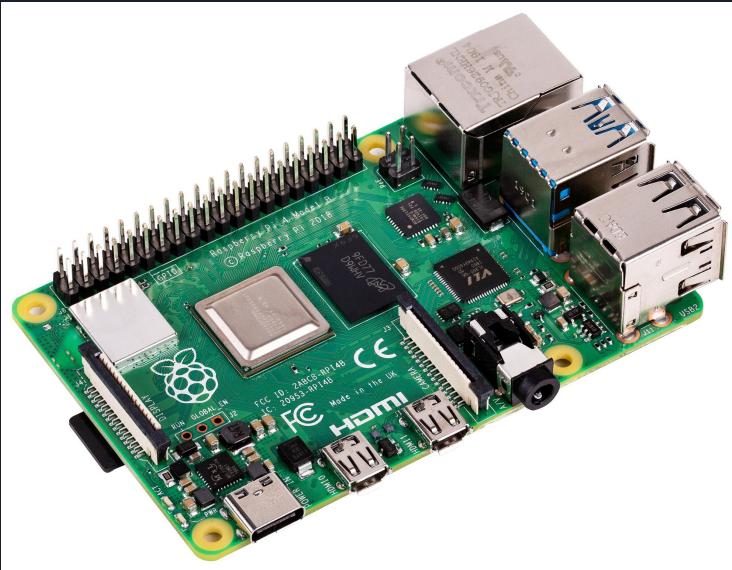
Raspberry Pi OS (Legacy, 32 bits)

A port of Debian Bullseye with security updates and desktop environment



Technology Used - Hardware

Raspberry Pi 4 Model B



16x2 LCD Display



Bootable USB SSD



Buzzer

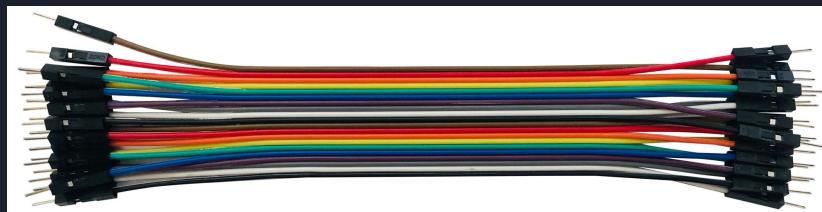


Technology Used - Hardware

USB 3.0 7-Port Hub

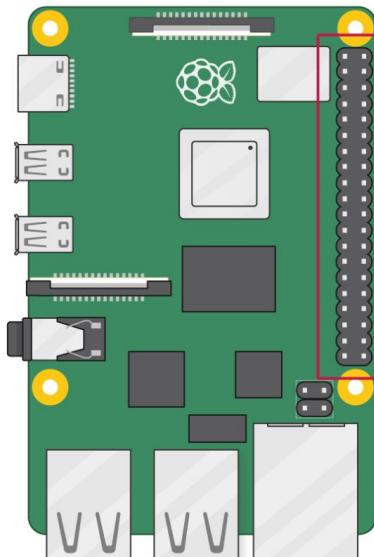


5.1 channel USB Sound Card



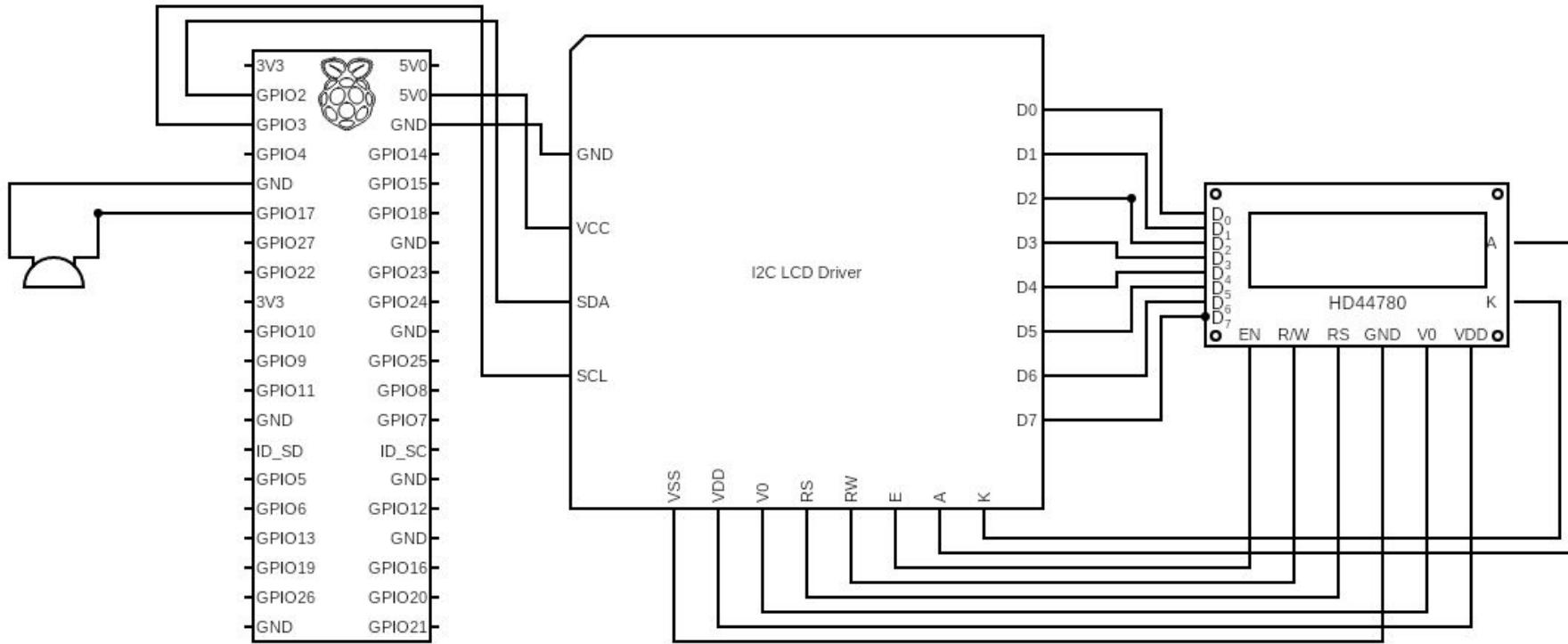
Jumper Wire

Pinout Diagram - Raspberry Pi 4 Model B



3V3 power	1 2	5V power
GPIO 2 (SDA)	3 4	5V power
GPIO 3 (SCL)	5 6	Ground
GPIO 4 (GPCLK0)	7 8	GPIO 14 (TXD)
Ground	9 10	GPIO 15 (RXD)
GPIO 17	11 12	GPIO 18 (PCM_CLK)
GPIO 27	13 14	Ground
GPIO 22	15 16	GPIO 23
3V3 power	17 18	GPIO 24
GPIO 10 (MOSI)	19 20	Ground
GPIO 9 (MISO)	21 22	GPIO 25
GPIO 11 (SCLK)	23 24	GPIO 8 (CE0)
Ground	25 26	GPIO 7 (CE1)
GPIO 0 (ID_SD)	27 28	GPIO 1 (ID_SC)
GPIO 5	29 30	Ground
GPIO 6	31 32	GPIO 12 (PWM0)
GPIO 13 (PWM1)	33 34	Ground
GPIO 19 (PCM_FS)	35 36	GPIO 16
GPIO 26	37 38	GPIO 20 (PCM_DIN)
Ground	39 40	GPIO 21 (PCM_DOUT)

Circuit Diagram



Auscultation Simulator

Welcome
Student

Heart tones

Murmurs

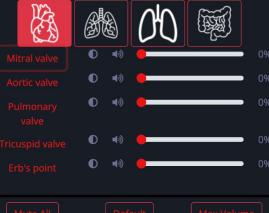
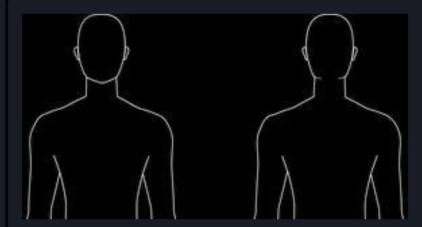
Aortic Value

Mitral Value

Pulmonary Value

Tricuspid Value

Pathologies



Auscultation Simulator

Welcome
Student

Heart tones

Murmurs

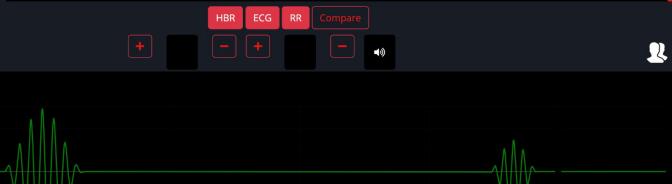
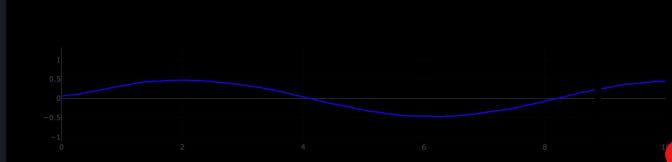
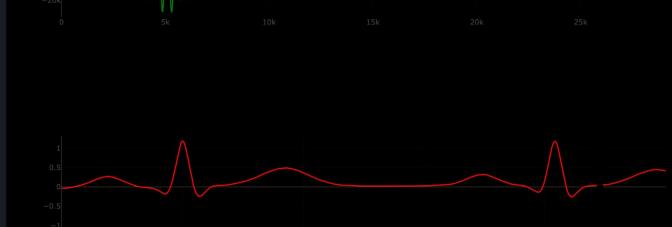
Aortic Value

Mitral Value

Pulmonary Value

Tricuspid Value

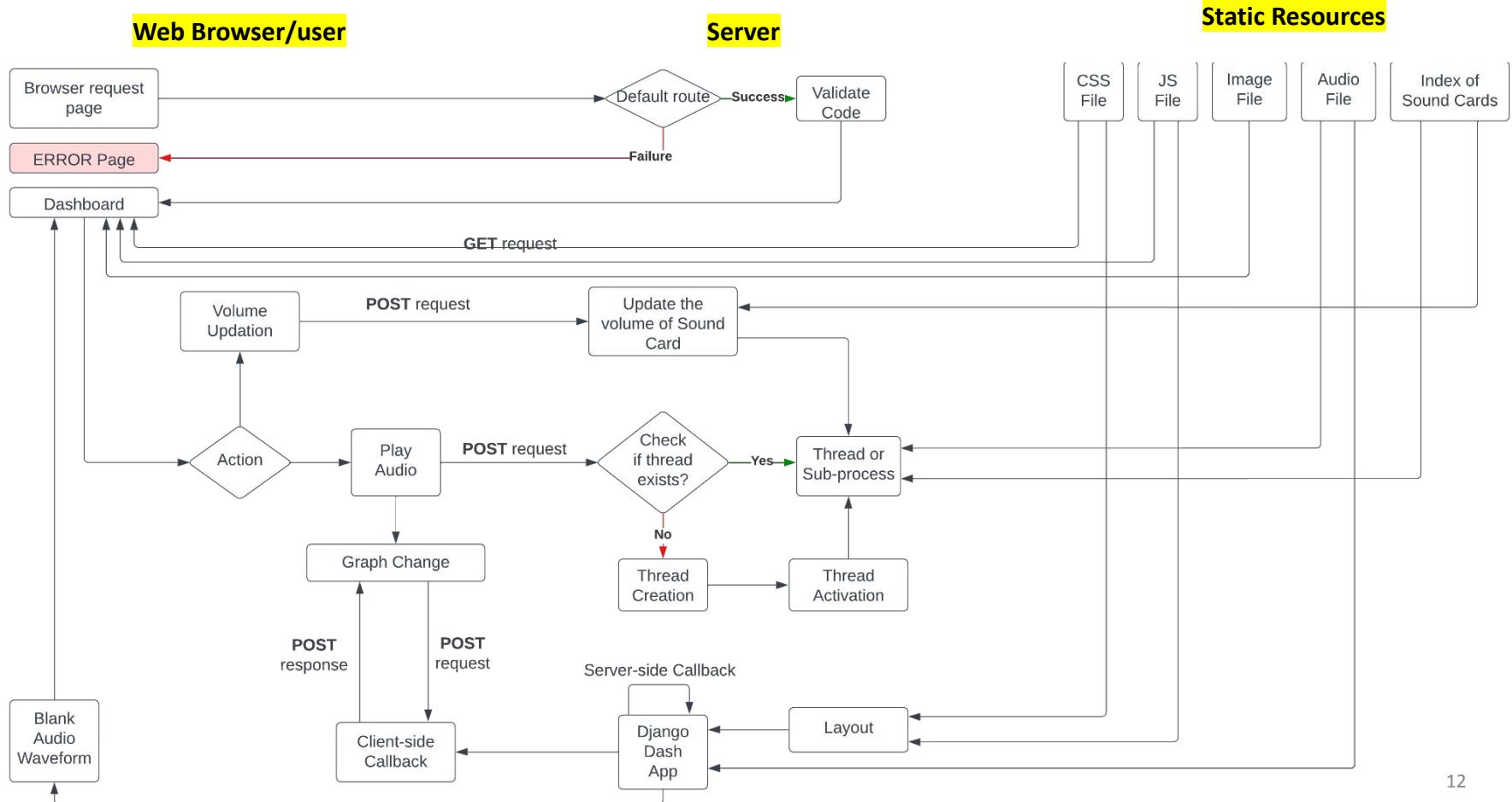
Pathologies



Feature: Adaptive UI



Flow Diagram



Project timeline

Project Initiation

- Collected Audio Dataset
- Tech stack finalization
- Theme finalization



UI Completion

- Front End completed
- Back End initiation
- Raspberry Pi setup initiation
- Audio testing initiation

Backend Configuration

- Backend completed
- Communication channel initiation
- Raspberry Pi's wireless configuration completed
- Audio testing completed

March

Raspberry Pi Configuration and documentation

- Communication routes setup
- Documentation initiated
- Full Stack application configured in Raspberry Pi

UI Components

Auscultation Simulator

Welcome Student

- Heart tones
- Murmurs
- Aortic Value
- Mitral Value
- Pulmonary Value
- Tricuspid Value
- Pathologies

Header

60 15

Mute All Default Max Volume

Mitral valve Aortic valve Pulmonary valve Tricuspid valve Erb's point

Right Vertical Navigation Bar

Graph Panel

HBR ECG RR Compare

Left
Vertical
Navigation
Bar

UI Components

Full Screen

Heart Rate Updation

Breadth Rate Updation

Heart Panel

Lungs Anterior Panel

Lungs Posterior Panel

Bowel Panel

Auscultation Simulator

Welcome Student

Heart tones

Murmurs

Aortic Value

Mitral Value

Pulmonary Value

Tricuspid Value

Pathologies

ECG Waveform Visualizer

Respiratory Rate Waveform Visualizer

Audio Waveform Visualizer

ECG Waveform (Comparison) Visualizer

HBR ECG RR Compare

Mitral valve

Aortic valve

Pulmonary valve

Tricuspid valve

Erb's point

Mute All

Default

Max Volume

To mute all soundcards

Set soundcards to 50% volume

Set soundcards to 100% volume

The interface is a dark-themed application for auscultation simulation. It features a sidebar on the left with user profile and category icons. The main area displays two human silhouettes with auscultation points. Below the silhouettes are four waveform visualizers: ECG, Respiratory Rate, Audio, and Audio Comparison. A central control bar at the bottom contains buttons for Heart Rate (HBR), ECG, Respiratory Rate (RR), and a Compare button.



Future Works

01

Custom Audio Adapter: The proposed custom audio adapter board features multiple aux ports with individual gain control and audio mixing capabilities for a versatile and personalized audio experience.

02

Optimizing Graph Rendering: Future plans could involve implementing a new client-side module to accelerate graph rendering and updates, ensuring a faster and more responsive display.

03

Enhancing Security Measures: In future developments, a key focus will be on fortifying the application's security by incorporating robust cybersecurity features, enhancing protection against potential threats and ensuring user data integrity.

04

Towards Seamless Connectivity: In the upcoming updates, the application could be enhanced to provide live updates across multiple connected devices, preventing resource deadlocks and ensuring a seamless user experience.

Thank you!

