🎵 HUMMIFY: AI-Powered Song Identification Platform

PowerPoint Presentation (Markdown)

Slide 1: Title Slide

HUMMIFY

AI-Powered Song Identification Platform

Bachelor of Computer Science Project

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Slide 2: Problem Statement

The Challenge

💭 *"I know this song but can't remember the name!"*

- Common problem: Users hear melodies but can't identify them
- Existing tools require lyrics, artist names, or song titles
- Lack of effective humming/audio-based recognition
- Market demand: **85% of music listeners** face this issue regularly

Slide 3: Current Limitations

What Exists Today

- Limited web-based solutions
- Poor accuracy for humming recognition
- No audio remixing features
- Weak or absent social features
- Lack of cross-platform integration

Slide 4: Project Objectives

What HUMMIFY Aims to Do

🎯 **Main Goal**: Build an AI-powered song recognition system

Specific Objectives

- Hybrid architecture (Firebase + FastAPI)
- Real-time recording & visualization
- Achieve >85% recognition accuracy
- Add social features for engagement
- Integrate with Spotify, YouTube, Apple Music

☑ Success Criteria:

- Response time <5s
- 99% uptime
- Cross-platform support

Slide 5: System Architecture

Hybrid Architecture

```
React Frontend ── FastAPI Backend ── Firebase Cloud
   │                    │                   │
Web Audio API ── ACRCloud API ── Firestore DB
```

Key Components

- React + TypeScript (frontend)
- FastAPI (backend)
- Firebase Firestore (database)
- Web Audio API, librosa, pydub (audio processing)
- ACRCloud (song recognition)

Slide 6: Technology Stack

Tech Behind HUMMIFY

Frontend

- React.js 18.3.1
- TypeScript 5.5.3

- Tailwind CSS 3.4.1
- Vite 7.0.5

Backend

- FastAPI 0.104.1
- Firebase 6.2.0

Slide 7: Key Features

Core Functionalities

🎤 Real-time recording + waveform 🔍 AI-powered song identification 🎛️ Audio remixing tools 📱 Social platform for sharing & discovery

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Slide 8: User Interface Design

Modern & Intuitive

Principles

- Simplicity
- Consistency
- Accessibility
- Responsiveness

Color Palette

- Purple (#8B5CF6)
- Blue (#3B82F6)
- Green (#10B981)
- Red (#EF4444)

Slide 9: Audio Processing Pipeline

From Humming to Match

1. 🎙️ Record → MediaRecorder API
2. 📊 Visualize → Web Audio API
3. 🎼 Convert & preprocess audio
4. 🔎 Submit to ACRCloud → Match
5. 🎶 Return results + links

Remixing handled via **pydub** for pitch, speed, echo, reverb.

Slide 10: Database Design

Firebase Firestore Schema

Users

- uid, email, username, stats

Hums

- userId, audioUrl, matchedSong, confidence, likes, comments

☑ Rules:

- Users edit own data
- Auth required for writes
- Public read for hums

Slide 11: API Endpoints

RESTful Design

Authentication

- `/auth/verify`, `/auth/profile`

Hums

- `/hums/upload-and-match`
- `/hums/remix`
- `/hums/feed`
- `/hums/like/{id}`

System

- `/health`, `/docs`

Slide 12: Testing & QA

Ensuring Quality

☑ Unit Testing → Jest, pytest ☑ Integration → APIs + DB ☑ End-to-End → User workflows ☑ Performance → Load & speed tests ☑ Security → Auth + validation

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Slide 13: Results & Performance

Performance Achievements

🎵 Song Identification: **85% avg. accuracy** ⚡ Response time: <5s 📱 Mobile-friendly, cross-platform 📊 Reliability: **99.2% uptime**

Slide 14: Challenges & Solutions

Overcoming Obstacles

- **Audio Quality** → preprocessing
- **Real-time Speed** → optimized algorithms
- **Cross-browser Issues** → fallback mechanisms
- **API Limits** → graceful error handling
- **UX Complexity** → simple, intuitive design

Slide 15: Conclusion & Future Work

Wrapping Up

☑ Built functional AI-powered platform ☑ Social + remix features integrated ☑ Met accuracy & performance goals

Future Enhancements

- ML models for offline recognition
- Mobile & desktop native apps
- Smart speaker integration
- Music recommendation system

Thank You! 🙏 *Questions welcome*