**Amplified FM Tuner Evaluation Board**

From: Aldo Ndreu, Ryan Antolin, & Erick Cantos  
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# Declaration of Joint Authorship

We, Aldo Ndreu, Ryan Antolin, and Erick Cantos confirm that this work submitted for assessment is the joint work of ourselves, and is expressed in our own words. Any uses made within of other works of any other author, in any form (ideas, equations, figures, previous technologies, tables, programs, texts) are properly acknowledged at the point of use. A list of the references used is included. Aldo Ndreu has handled the software and mobile application, while Ryan Antolin has handled the Database, and Erick Cantos has handled the hardware aspects of this project.

# Approved Proposal

## Executive Summary

As students in the Computer Engineering Technology program, we will be integrating the knowledge and skills we have learned from our program into this Internet of Things themed capstone project. This proposal requests the approval to build the hardware portion that will connect to a database as well as to a mobile device application. The internet connected hardware will include a custom PCB with the following sensors and actuators such as the Speaker Bonnet & FM Tuner Evaluation Board - Si4703. The database used in this project will be Firebase and will store FM radio stations, and possibly favorited stations.

The mobile device functionality will include setting or selecting different FM radio stations, favoriting different FM radio stations, displaying song or station currently playing, and will be further detailed in the mobile application proposal. We will be collaborating with the following department which is the Prototype Lab (For Extra Help). In the winter semester we planned to form the group of Aldo Ndreu and following students, who are also building similar hardware this term Ryan Antolin and Erick Cantos. The hardware will be completed in CENG 317 Hardware Production Techniques independently and the application will be completed in CENG 319 Software Project but will need some changes and adjustments in order to meet specific requirements. These will be integrated together in the subsequent term in CENG 355 Computer Systems Project as a member of a 3-student group.

## Background

The problem solved by this project which we will be creating will be the capability of being able to connect to an amplified Speaker Bonnet via FM Radio. How this will work is by taking a mobile device and connecting to the database in order for the FM Radio stations to play through the Speaker Bonnet. A bit of background about these topics will include both devices being used. One of the device being used will be the FM evaluation board tuner chip. This device does more then tuning into FM stations, it can also detect both data service and radio broadcast data service. It can also be used to display station id and song to the user as well as have great filtering and carrying detection. This board will be able to pick up multiple radio stations and makes a great tool in order for it to be implemented with a Raspberry Pi. The other device used is the amplified speaker bonnet. By using the speaker bonnet, this will act as the output for FM Tuner sensor and will be the primary source in which the sound will be coming from. It will amplify the audio by boosting the signal in certain areas that you usually cannot hear with your current mobile speakers.

We have searched for prior art via Humber’s IEEE subscription selecting “My Subscribed Content” and have found and read which provides insight into similar efforts.

## Concluding remarks

This proposal presents a plan for providing a solution for FM Tuner sensor to be connected with the amplified speaker bonnet for high quality sound. This is an opportunity to integrate the knowledge and skills developed in our program to create a collaborative capstone project demonstrating my ability to learn how to support projects. We request approval of this project.

# Abstract

Amplified sound is important when wanting to hear certain audio at a greater and increased state. By connecting an FM tuner sensor to a speaker bonnet, the outputted sound should be at a level where it is enjoyable and meets user satisfaction when tuning to different frequencies. This system will allow users to tune into certain frequencies while also producing amplified sound. The FM tuner sensor will obtain data through the mobile application from the database and allow different frequencies to be sent to the Raspberry Pi in order to allow users to listen to certain stations. The database will grab most of the sensors data, and make it available to an Android application. The application will display different user selections as well as a favourites tab to satisfy user preference. This system has the potential to be unique given all the necessary implementation and should provide users great satisfaction when used assuming they have internet connectivity.

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# Illustration List

# 1. Introduction

The task of being able to deliver amplified quality sound while being able to connect a device or sensor to this type of device requires specific hardware setup. To this end, we have developed an integrated solution by creating a speaker bonnet which acts as the output to the FM tuner sensor by picking up the local frequencies and producing them in an amplified state.

Our system will have a database that will have local radio station frequencies which will be accessible via an android application and Raspberry Pi.

Despite possible redundancy of our system due to other products capable of playing FM radio stations, and other amplified speaker created and used, we nonetheless feel that our system will be unique in the sense that we are combining both sensors in a way that has never been done before.

Due to both sensors needing to be connected to specific pins, our system needed both sensors to be able to interact together without any conflicting issues, which we solved by creating a custom PCB board as well as acquiring a header in order to have the appropriate connection.

We will make all source code for our Android Application using Android Studio and in addition we will be using Python in order to communicate to the Raspberry Pi available.

# 2. Project Description

## 2.1 Problem

## 2.2 Rationale Behind Project

## 2.3 Project Scope

## 2.4 Requirement Specifications

### 2.4.1 Database

There will be a Firebase Database located on a co-located development platform. This database will be connected to a front-end administrated by Firebase’s API. This database will hold a variety of user inputs in relation to the FM radio stations, as well as favorited radio stations. The database will contain a single table, and the fields in the table will be: user inputs when choosing different FM radio stations, favorite FM radio stations, and a description or logo of each FM radio station. (Developed by Ryan Antolin)

### 2.4.2 Mobile Application

There will be a mobile application (currently only available on Android platforms) which will take the data from the database, and display the FM radio stations as well as their appropriate logo. This will trigger the FM tuner to find the station that is needed and the image will be taken from an online source (with copyrights). Users will be able to scan for available stations in range and the output will be released through the speakers. The view of the application will have a have a unique display with station information such as: what song is currently playing, the frequency of the station, and a volume control seek bar. (Developed by Aldo Ndreu)

### 2.4.3 Web Interface

There will be a web interface that will take the data from the database including the favourites and stations that users can easily see. Each station will have a different page depending on which station is currently playing. Web interface will show the contents of the database for user to review. Should update on page load. (Developed by Ryan Antolin)

### 2.4.4 Software

There will also be a software aspect to this project which will combine the codes used on both projects into one single code. This part of the project will require the python code to be taken from the FM tuner sensor and be combined with the speaker bonnet. The speaker bonnet uses a specific script in order to run and play sound which will then be integrated with the python code used for the FM tuner sensor. Once the hardware has been correctly setup and the correct code has been applied, they should perform the appropriate task which is getting the frequencies from the FM tuner and audio being outputted through the speaker bonnet. (Developed by Aldo Ndreu)

### 2.4.5 Hardware

There will also be hardware specifically designed for this project which will connect both sensors being used onto a single platform. This is a challenging task to be performed considering both sensors require specific pin connection on the Raspberry Pi. A fritzing diagram and other layouts have to be created in order to brainstorm the connection procedure. A custom PCB board is also needed in order for the connections to align according to requirements and two header pins in order to connect the cables onto the appropriate slots. Once all the appropriate procedures have been followed, there should be a successful connection by both sensors. (Developed by Erick Cantos)

# 2.5 Project Overview

### 2.5.1 Bill of Materials

### 2.5.2 Time Commitment

### 2.5.3 Mechanical Assembly

### 2.5.4 PCB and Soldering

### 2.5.5 Power Up

### 2.5.6 Unit Testing

### 2.5.7 Production Testing

# 2.6 Problems Encountered

# 2.7 Approaches

# 2.8 Walkthrough of System

### 2.8.1 Server

### 2.8.2 Phone Application

### 2.8.3 Website

# 3. Progress Reports

# 4. Conclusions

# 5. Recommendations

# 6. Technical References