1 Project idea & description

My project idea is to create a multimedia station that can play Spotify songs or radio over frequency modulation (FM). The project would be implemented using my own materials so that I can use the station myself afterwards. The backbone of the idea consists of a Raspberry Pi 3 Model B V1.2 and an ESP32-S3-WROOM-1-N16R8 (ESP32-S3) microcontroller.

The Raspberry Pi 3 will run Ubuntu with Robot Operating System (ROS). Furthermore, it will contain the ROS nodes for reading the sensor inputs and displaying information on a small Liquid-Crystal Display (LCD).

The ESP32-S3 will run micro-ROS or FreeRTOS. If micro-ROS can run on the ESP32-S3, then the ESP32-S3 will host the ROS nodes for displaying the frequency and volume on a 7-segment Light Emitting Diode (LED) display and a LED strip, respectively. Otherwise, the two nodes run on the Raspberry Pi 3 and forward the signals to the ESP32-S3 via a serial connection, while the ESP32-S3 runs FreeRTOS with a custom C script controlling the two interfaces based on the received serial signals.

2 Materials

2.1 Computers & microcontrollers

- **Raspberry Pi 3 Model B V**1.2: Single Board Computer (SBC) used as the main component of the multimedia station.
- **ESP32-S3**: Additional microcontroller used for displaying the current radio frequency and the volume.

2.2 Sensors

- **Infrared (IR)-based remote control**: Allows user interactions such as skipping songs or other commands.
- **IR receiver (CHQ1838)**: Receives the IR signals from the IR-based remote control.
- **3-pin linear potentiometer (B10k** (10000Ω)): Used for changing the volume.
- **3-pin linear potentiometer (B100k** (100000Ω)): Used for adjusting radio frequency.
- **FM receiver (Si470x)**: Used in combination with an antenna to receive FM signals at a selected frequency.

2.3 Interfaces

- **7-segment LED display (3461BS-1 440)**: Used for displaying the frequency as a number.

- **LED strip (2510SR-1 440)**: Used for visualizing the current volume level.
- **LCD with Inter-Integrated Circuit (IIC) (1602)**: Used for displaying general information.

2.4 Others

- **Two Shift registers (SN74HC595N)**: Used for easier control of the digits board and LED strip.

3 ROS diagram

This section contains the figure 1 showing the diagram with the used ROS nodes and ROS topics. The project will only use one overall ROS package.

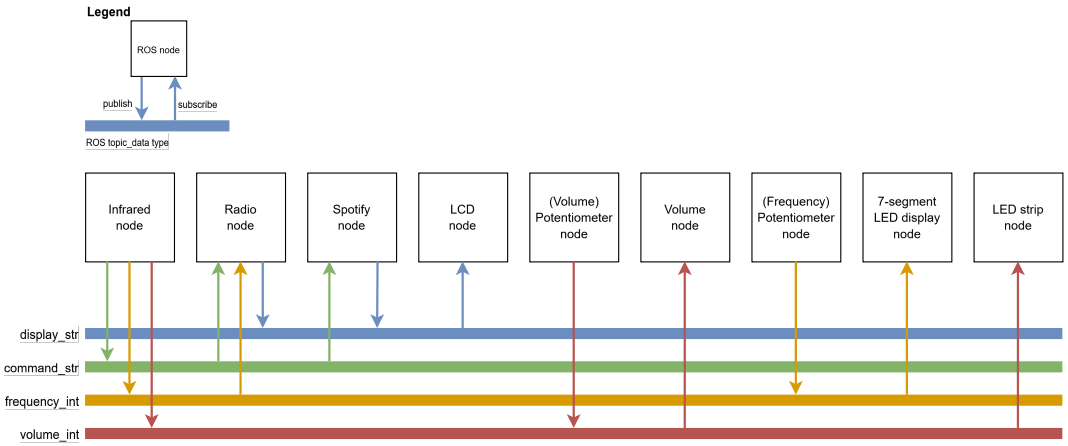

Figure 1: Diagram showing the used ROS nodes and ROS topics.

4 Optional requirements

The following requirements are optional and would be added if there is enough time and/or the above described requirements are not enough for the full amount of points.

- **Control over web**: Implement a website that can control the multimedia station. This would add an additional control node.
- **Control with gestures**: Implement a camera that recognizes gestures to control the multimedia station. This would add a camera node, a gesture recognition node and a control node.