ESP-8266 WiFi Module

The ESP-8266 is a low cost WiFi chip with full TCP/IP stack with microcontroller capabilities. Although many versions exist, the exact module used in this project is the ESP-01. The module was selected due to its low cost and small package size which allows it to be integrated with any of the instruments. The software for the WiFi module was written in C++ using third party libraries. The WiFi module is key to the project’s success since it allows the user to communicate wirelessly with the instruments thereby removing the need for wires. This has two effects: firstly, it gives the orchestra a more refined look making it more appealing to the public and secondly, it adds Internet of Things (IoT) capabilities to the instrument which is something of great interest in the technology sector and is likely to attract more attention. Since the module can be programmed separately and acts as a standalone system it can be used in conjunction with any microcontroller which supports UART. For this reason the WiFi module is used on all instruments including the ones with processors which already support WiFi. This was done deliberately to save time as the code as well as hardware needs to be developed only once. The following paragraph explains how the WiFi module works.

Due to the extremely small package on the module, only 8 pins are available. Out of those 2 are reserved for serial communication (Rx and Tx), 2 are GPIOs and the rest are used for programming. When the module is first powered on it automatically connects to the WiFi of the Raspberry Pi and subscribes to a unique topic. Once a message arrives from the conductor to the WiFi module it then passes that message to the microcontroller of that instrument via UART (Tx and Rx). Once the WiFi module is ready to transmit via serial one of its GPIO pins goes high which triggers a signal to the microcontroller to read the serial buffer. The instrument is also capable of transmitting messages back to the conductor which is useful for debugging purposes as well as transmitting information such as the songs stored in the instrument. If at any point the connection between the WiFi module and the conductor is broken the module will automatically try to reconnect.