6. OPEN ISSUES AND FUTURE WORK

The solution presented in this thesis realises an study on how to use and exploit the audio interface of a wearable device. This study provides a good platform for future work in this field. Future work will involve:

- First of all, all the characteristics in need of *improvement* (see section 4.1.2), the *additional functions* (suggested in section 4.2.1), and the *additional* new *clients* (suggested in section 4.3.1), could be considered as the base for a future thesis, since the work to be done is quite extensive and the result will be highly appreciated, as concluded in the present thesis' evaluation.

- Combining the work done in this thesis (with or without the suggested improvements) with the work done by Giulio Mola[18] would be highly appreciated, since significant *power savings* could arise from it. Having in mind that another logical improvement of the application could be including audio files in the playlist that need to be downloaded to the wearable device, the audio manager would have to pass information to the network interface manager for a correct behaviour of the application. This last manager can use this information to decide whether connection is needed at the moment, or not (the playlist may have enough content to be outputting without needing to download songs), and if needed, the manager can decide when would be needed (that would be earlier enough to have the file completely downloaded when comes the time to output it), and which of the interfaces to use (depending on the bandwidth needed).

- This thesis has not focused on any aspect of *security* that may have to be taken into consideration. This fact opens a future expansion of the application that handles security aspects. In a real implementation of the application, in which the manager would always be receiving UDP datagrams from any sources that may want to send commands, an authentication that the commands received are legitimate would be needed. A good way of doing this is to have a signed message hash (a so called HMAC). There has been work done in this field that could be added to the present application[38].

- A field of great interest when improving the present application is the introduction of *spatial audio*, which allows the application to locate audio sources as if they were at different points in space. This could enable the manager to overlap audio playout from different sources at the same time, while enabling the user to mentally separate these

different sources (via the so-called "cocktail party" effect). It should be possible to provide such spatial audio with the SmartBadge as it has high quality stereo output.

- Another possible area for future work, could be building upon the previously work done in *context-awareness*, since this additional context information could enable the application to make better the decisions about what to play and when. Additionally, generating audio alerts based on the user's location (as already described in Sean Wong's report) provides a very direct service that is often applicable to nomadic user's who want to know where they are, what is located near them, etc.

- As stated before, a possible future improvement could be to include *XML* for an alternate implementation method of the playlist, manipulating the actual XML document, for example using the Extensible Stylesheet Language Transformations (XSLT)[35], the Document Object Model (DOM)[33] or the Simple API for XML (SAX)[34] APIs .