Computer Science Tripos Part II Project Progress Report

Location-based messaging on phones

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Accomplished so far

From the timetable[1] given in the project proposal, weeks 1 to 18 are functionally complete but the existing encoding and packet structure are currently only designed only to facilitate demonstration of the acoustic modem. The project is therefore roughly running on schedule. Informal testing indicates that the performance levels specified in the success criteria[2] are not unrealistic to expect when the phones are attached to speakers similar to those used in the research[3] that inspired the success criteria. Many features not explicitly discussed in the proposal have been implemented to support those that are, including a notification that lets the user immediately end communication and code for storing in and retrieving from a database the location and contact details of all other phones that have discovered the user's phone or have been discovered by the user's phone. A number of technical challenges have been overcome:

- Getting the acoustic modem to work in real-time on all test devices, even when CPU-intensive tasks are being executed. This has lead to low CPU usage: currently from under 30% to under 10% usage across the test phones which are a good representation of the range of Android phones available.
- Android gives no timing guarantee with its audio APIs (and they are also poorly documented). This results in high and unpredictable latency, making anything involving precise timing impossible.
- The audio hardware itself varies considerably between phones leading to a range of responses and the need to avoid any absolute thresholds for signal detection wherever possible.
- The acoustic modem works in non-ideal conditions, able to overcome brief spikes of noise and phenomena such as echoes that might foil other modulation techniques.

As well as these practical issues, plenty of theoretical progress for discussion in the dissertation has been made: extended DTMF tones have been selected based on mathematical properties, an efficient way of using of the Goertzel algorithm in this and similar contexts has been developed and a method of recognising and ignoring bursts of noise efficiently has also been developed.

Still to do

During weeks 15 and 16 media access and admission control will be implemented and I am going to attempt to implement an addressing scheme that exploits the large bandwidth

[1] `http://www.g400.co.uk/cam/partii/project/timetable.pdf`
[2] `http://www.g400.co.uk/cam/partii/project/success_criteria.pdf`
[3] `http://anil.recoil.org/papers/2005-ieee-audio.pdf`

available to improve on the discovery times of Bluetooth by discovering all devices in range simultaneously. In weeks 17 and 18 the details of the packet structure and encoding will be decided upon and written and the database security will be improved, with finishing touches and bug fixes being added to various components of the project. Finally, I am writing unit tests in parallel with the code so that formal experiments and writing of the dissertation should happen on schedule, taking up the majority of the remaining time.