

Department	School of Computing
Supervisors	Dr Iain McGregor
Project Title	HAAR: Hospital Audio Augmented Reality

PROJECT DESCRIPTION

This project will explore the use of Audio Augmented Reality in hospitals. Out of necessity most devices in a hospital make a sound, whether intentionally or not. The requirement for easily cleaned surfaces, and open plan layouts can make for a highly stressful acoustic environment, that affects staff, patients and visitors alike. The need to have consistent medical alarms, combined with the close proximity of patients with related diagnoses requiring identical medical hardware, can make it very difficult to identify which has been triggered. Much time can be wasted by staff having to reassure both patients and their visitors that an alarm is not indicating a life-threatening situation but is only there to provide confirmation that everything is functioning correctly, or that routine monitoring is required. Auditory alerts could be transferred to a virtual medium, where they only become audible in the physical world if they are not attended to quickly enough. Staff can be equipped with open ear headsets to monitor all of the required technologies, spatially represented in the correct orientation. Reaction times are improved as complex reverberations will not impede accurate interpretation of the spatial location of the source. Expanded auditory content can be represented to guide actions when closer to the sound source, which will help prevent errors in use, as well as ensuring privacy, and reduced noise pollution. Sonic representations of a patient's condition should be just as private as their medical notes. In some Intensive Care Units (ICUs) the average sound pressure level is always at least 5 dB above the World Health Organisation's recommendations, irrespective of the time of day, leading to patient sleep deprivation, which is known to impact recovery.

Within wards privacy curtains are far from private, whilst the visible actions become opaque, the auditory elements remain clear for all to hear. This is not only to preserve dignity, but also minimise stress for patients in the surrounding beds, who also have similar conditions of different severity, who may become distressed when overhearing aspects of a condition that might affect them in the near future. There are many solutions so that when a curtain is closed an acoustic curtain also kicks in. The simplest is that any speakers already built into the physical structure start to play white noise, or the phase inverted sounds already existing within the space in the immediate area surrounding the exterior of the curtain. If speakers are not already available, upward firing directional drivers can be utilised directionally mask the acoustic bleed. If a larger budget is available, and the curtains suitably dense, then highly directional ultrasonic units can be utilised to bounce sound off the screens. Private rooms often have to have their doors kept open so that staff can hear alarms, negating the benefits of medical isolation in transmissible diseases. Some patients report how horrible it is to hear a ticking clock in a hospital as it denotes time passing slowly, reminding them of their forced confinement and their lack of agency. An aspect that becomes an even greater issue the longer they remain.

The proposed research would explore the use of audio AR to dramatically improve patient privacy and noise exposure.

Perspective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should make it clear the project you are applying for and the name of the supervisors.

Academic qualifications

A first degree (at least a 2.1) ideally in Computing, UX or Sound Design with a good fundamental knowledge of interactive audio programming.

English language requirement

IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other,

equivalent qualifications will be accepted. [Full details of the University's policy](#) are available online.

Essential attributes:

- Experience of fundamental Sound Design principles
- Competent in Interactive audio programming C++, C#
- Knowledge of User Experience (UX) research
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Familiarity with mixed reality technologies.

Indicative Bibliography

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