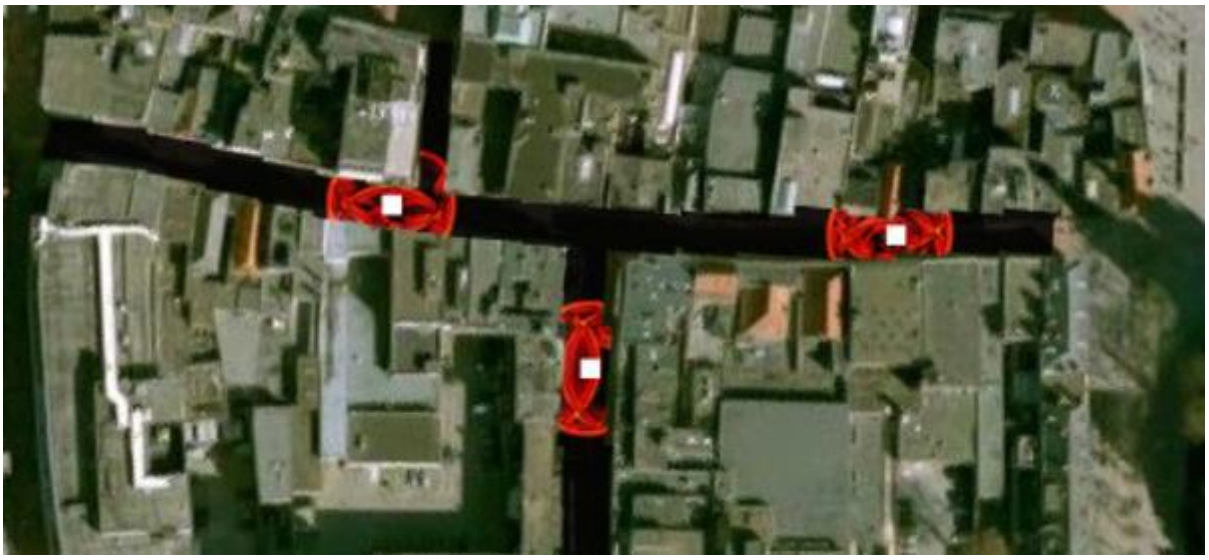

3D sound maps to help neighbourhoods ‘absorb’ noise

Loud neighbours, traffic, and even trains - these are the noises of the modern urban neighbourhood. To help nullify this racket, urban planners may soon use 3D audio maps to design streets that absorb noise.

16 March 2016 - By STEVE GILLMAN

Urban areas are often filled by apartment buildings or enclosed spaces known as ‘city canyons’ by sound planners.

Sound travels in between these areas, reflecting and scattering against building facades, while atmospheric conditions like wind can further increase noise levels. All of this can make your neighbourhood a very loud place to live.

However, by mapping and identifying different types of sounds in urban environments, researchers hope to help city planners come up with ideas to reduce this noise.

‘What is important is sound absorption because noise can then be taken away,’ explained Maarten Hornikx, who received a Marie Skłodowska-Curie grant for the openPSTD project, which is developing a 3D sound simulation method that assesses noise distribution within the urban environment.

‘There are already noise mapping software tools that work for a lot of areas in cities, but for cases (such) as narrow city canyons, side streets and inner yards where traffic noise sources are not visible, they don’t give the correct results,’ he said.

Sound is a sequence of waves which propagates, or vibrates, through a medium such as air or water. The openPSTD system computes sound propagation from sources of noise in the ‘urban soundscape’ as well as

how wind affects this propagation.

It then presents the information in 3D to provide precise readings that planners can use to implement targeted solutions to deal with noise pollution.

‘We have a method that is far more accurate than most standardised prediction methods,’ said Hornikx, of the Eindhoven University of Technology, the Netherlands. ‘Since it is so detailed you can think of small-scale effects on a street level and how that can improve the noise situation.’

Article continues below

The openPSTD software produces a 3D model of how soundwaves travel through the air in a particular environment
The openPSTD software produces a 3D model of how soundwaves travel through the air in a particular environment. Image courtesy of openPSTD

This could include things such as using sound-absorbing materials for road surfaces and buildings, or introducing acoustic panels or green walls at specific noisy places.

Green walls are vertical gardens made of plants or trees. For many years they have been used along busy roads as barriers against noise, and if introduced at a street’s weak spots or on the facades of buildings they can improve the soundscape of a neighbourhood.

‘Installing a green wall can be worthwhile for noise reduction and for other effects it might bring,’ added Hornikx.

Hornikx hopes that openPSTD will provide the information necessary for urban solutions to be introduced to neighbourhoods to achieve what he calls a ‘positive sound environment’.

Multiple layers

Whether it’s a busy street, office or house, each environment has its own soundscape which is made up of multiple layers of sound. These sounds can reveal valuable information about the setting.

‘In the future we are going to have systems that map out noise and characterise why the environment is pleasant or disturbing,’ said Tuomas Virtanen, Associate Professor at the Department of Signal Processing, Tampere University of Technology, Finland.

For this, however, you need sophisticated technology that can differentiate between the types of sounds, such as birdsong, traffic noise or voices.

‘Humans are amazingly good at detecting multiple sources of sound, but it is challenging for computers,’ added Virtanen. He is principal investigator of EVERYSOUND, which is funded by the EU's European Research Council to develop software that can automatically classify sounds in everyday environments.

‘We have audio recordings and then have experts listen to them, annotating what sounds are present. We feed both the audio recordings and the annotations into our algorithms and the system learns the sounds,’ he said.

These algorithms will allow the EVERYSOUND system to analyse recordings taken in everyday situations such as a street, park, home or building and provide high-level descriptions of the sounds contained within.

‘We could monitor audio in an office environment and get statistics about the noises there,’ said Virtanen. ‘We could see if there are noise disturbances and if this affects people's work.’

Eventually, the system could be automated further to monitor noise and detect the source of problematic sounds.

‘You can develop phones, cars or robots that can recognise sounds in their environment,’ said Virtanen. ‘They could monitor areas to see what people are doing or what kind of machines are there or other types of vehicles.’

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