UCL ACCESSIBILITY RESEARCH GROUP

ARGnote

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Pedestrian Accessibility Movement Environment Laboratory (PAMELA)

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Overview

PAMELA is a unique research space allowing for the collection of quantifiable data on human movement and interactions with the immediate environment. PAMELA is able to mimic real world environments in a controlled manner, enabling the collection and analysis of data, allowing researchers to gain a better understanding of how the built environment impacts upon pedestrians ability to move around.

Key Findings

- PAMELA is a large multisensory environment laboratory able to gather quantifiable data on human movement in real world contexts.
- The modular platform has interchangeable surfaces enabling the platform to have steps, slopes, crossfalls and gaps with a variety of different surfaces.
- The platform can be built upon and used to incorporate life-size models of buses, trains and planes, streets, stations to enable study of particular detailed interactions.
- Fixed and moveable cameras ensure visual coverage of the entirety of the platform
- Additional instrumentation allows for tracking of physiology and senses

Aims & Objectives

This ARGnote introduces the PAMELA laboratory, describing its facilities and research uses.

Background

PAMELA is a world leading multisensory pedestrian environment laboratory. The laboratory was built in 2005 to bridge the gap in being able to produce high quality scientifically gathered data on accessibility and pedestrian movement whilst still reflecting real-world conditions. Prior to this, data was either gathered by observing the real world or by recreating movement in artificial conditions. This limited the extent to which phenomena could be studied. PAMELA allows for the real world environment to be replicated and to repeat detailed experiments in a controlled way.

Facilities

The facility consists of a computer-controlled configurable platform, variable lighting and dynamic ambisonic sound systems. The modular platform consists of 60 modules with interchangeable surfaces, each 1.2 m x 1.2 m, giving a surface area of about 86 m^2. They can be used to re-create the various topographies and terrains encountered in the built environment, such as longitudinal and cross slopes (up to a maximum of 20% on each module), steps and gaps. The stability of the platform also allows for various vehicle mock-ups (e.g. train, bus, airplane etc.) and other setups (e.g. living room space, bus stop, street layout, etc.) to be built on top of, or incorporated into, the modules.

The variable lighting system consists of q set of 44 solid state LEDs which have the ability to change intensity and colour saturation individually or in groups to replicate colour and intensity of a wide range of illumination conditions, including varieties of street lighting, from near-darkness to about 1,000 lux at the platform surface. The colour can be blended by mixing pure red, green, blue, amber warm or cool white in any

combination to provide the desired effect. In addition to the solid state LED lighting, there are a number of street lamp fixtures including fluorescents, ceramic discharge, halogen, high and low pressure sodium used for simulating street lighting condition.

The ambisonic sound system consists of programmable speakers (4 fixed active loud speakers with amplifiers, 4 stand-alone special effect speakers and 2 subwoofers) and is used to recreate various environmental ambient sounds / noise for experiment e.g. aircraft flying at different heights, or trains moving within a station.

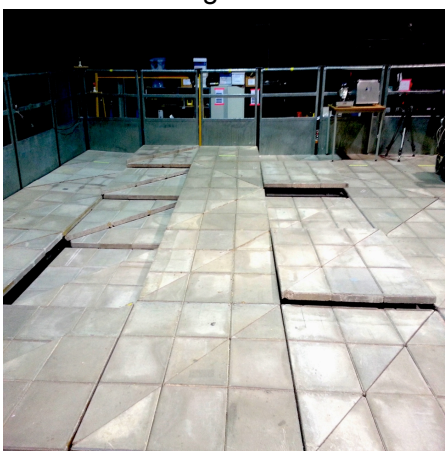

Figure1: Modular platform with different topographies.

Digital cameras can record every movement on the platform, from any angle and can film and track activity in real time. Cameras can be mounted vertically above the platform and around the platform as required to provide the desired views for each experiment. All cameras are fitted with infrared-sensitive lenses so that recording can take place in low light levels. In addition there is eye tracking equipment to record a person's eye movements as they move around the laboratory. These are non-invasive video based glasses with integrated audio recording.

Measurement of gait and human movement in general is measured using four main pieces of equipment. Firstly, the F-scan system, which is an in-shoe pressure and a pair of hand glove pressure sensor analysis system. Secondly, the Xsens MTW development kit consisting of 6 sensors that measure 3-dimensional orientation and acceleration. Thirdly, the Tringo system which can provide non-invasive EMG integrated with inertial sensors able to measure 3-dimensional acceleration. Finally there is a CODAmotion system.

PAMELA has a range of devices that are present on the high street including crutches, walking sticks, wheelchairs, scooters, pushchairs. We also have a London double-decker bus which is fully instrumented to record accelerations and motion, fuel consumption, emissions and energy use, delivering data at 100 millisecond intervals.

Settings

There are a variety of outdoor and indoor settings that the laboratory can replicate from office corridors to high street crossings. The versatility of the laboratory also allows for the creation of full scale mock up vehicles, including train carriages, train platforms, buses and aircraft vestibules.

Research Uses

The capabilities of PAMELA mean that the setting is as close to the real world situation as is possible whilst maintaining control over many of the variables. These capabilities are additionally complemented by an array of data collection devices devised to be usable during movement. One of the unique features of PAMELA is the ability to combine data from different sensors to increase understanding of how a person interacts with the environment. For example, combining eye tracking with F-scan shows how people's responses to seeing an obstacle in the environment translate to changes in gait at a pre-conscious level. Experiments can be carried out with single participants or large groups. Some experiments have involved more than120 people simultaneously participating in a single experiment, others study the movements of a single person under highly controlled experimental conditions.

Research from PAMELA offers scientific evidence for design limits, providing recommendations for engineers, architects, urban designers and planners, and ultimately helps to improve the design of infrastructure and spaces. It also allows clinicians to test theories and therapies in a real-world setting without the complexities of doing so in the actual real environment. Since its establishment the laboratory has been used across a wide range of disciplines including transport, urban design, biomechanics, accessibility, audiology, cognitive neurology and ophthalmology. PAMELA has also been used by a range of industrial groups and practitioners including major city transport operators, railway governing bodies, local and central government transport departments, major airlines and transport, and disability charities and researchers

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