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A case study for the design and development of a robotic device for spray applied insulation in underfloor voids

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This paper focuses on the application of robotic technologies for the retrofit of thermal insulation under suspended timber floors. Across Northern Europe, there is a large proportion of older, hard to treat homes which remain cold and uncomfortable in winter due to the lack of adequate thermal insulation. In the UK alone, there are as many as 10 million homes with an uninsulated floor that can contribute as much as 40% of the draughts and 25% of the heat loss for a typical dwelling. Traditional methods require the floor to be lifted and insulation panels to be cut and fit by hand. This provides an excellent opportunity for a robotic device to remotely apply insulation in situ, without the hassle and expense of traditional methods. However, the application is particularly demanding as the physical attributes of underfloor voids are highly variable and access has to be achieved through small openings formed in the wall or floor. Once access has been achieved, the void space needs to mapped, navigated and the thermal insulation material applied in an appropriate manner. A review of mobile robotic platforms for this application was conducted before an innovative reconfigurable robotic solution was developed. The design of the resulting solution used a new approach for robotics that combines stage gate and agile product development methodologies, in order to increase the speed of development. The resulting robot is capable of spraying a typical underfloor void in approximately four hours, with reliable operation. To date over one hundred commercial installations have been completed indicating the robustness of the solution developed. The impact on the resident, building and energy usage has been assessed with data logging and calculation of heat transfer using ISO-13370 for selected sites to quantify the benefit for using robotics in this application.

Recent Publications

1.Valiente D, Gil A, Reinoso O, Julia M and Holloway M (2017) Improved Omnidirectional Odometry for a View-Based Mapping Approach. Sensors; 17(2): 325.

Biography

Mathew Holloway has completed his education in Engineering and Design at Bath University (MEng), The Royal College of Art and Imperial College London (Joint Masters, MA and MSc). He has also been the founder of three high tech start-ups where he has taken his ideas into the market place, securing accreditation, sales and the trade sale of his last venture.

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