

COMPANY

Q-Bot Ltd.
q-bot.co

LOCATION

London, United Kingdom

SOFTWARE

Autodesk® Product Design Suite Ultimate
Autodesk® Inventor®
Autodesk® Simulation CFD

Filling an energy gap in older homes

q-bot uses intelligent tools to transform construction jobs

“We believe innovation happens in a systematic way and in response to customer needs or desires, and that is how we approach the development of our intelligent tools.”

—**Mathew Holloway**
Managing Director, q-bot.



q-bot's specially designed robot

Laying the foundations

The construction industry has long been associated with dirty and dangerous tasks. While modern advancements and safety measures have changed this, there are still a number of difficult jobs that technology hasn't been able to improve. q-bot is a company that was founded to address these issues and turn difficult, disruptive and dirty jobs into clean, efficient and safe processes. While its overall aim is to create tools that can do this across the whole of the built environment, its current focus is using modern tools to transform the complex task of making pre-20th century houses well insulated and energy efficient. In the UK, this is a major task as a quarter of its housing stock is pre-20th century and renovating these houses to make them as safe and energy efficient as modern houses can be a challenge.

Getting inside the problem

q-bot was founded in 2012 by cleantech entrepreneur Thomas Lipinski who identified a gap in the built environment market around the way older buildings are insulated, as he saw that while insulation can be retrofitted in the majority of the structure, heat and energy can still be lost through the suspended timber floorboards.

However, installing underfloor insulation traditionally poses a number of major problems, the most serious being the floorboards have to be removed so the insulation can be put down. This can result in damage to the property, as well as disruption to those people living in the house as they have to remove furniture and carpets to gain access to the floorboards. It also causes additional waste and resource use as insulation panels have to be individually cut to shape. This was one of a number of problems that Thomas wanted to solve with q-bot, and to help them execute their ideas they brought on board Mathew Holloway as Managing Director. Mathew is a graduate of the Royal College of Arts, Imperial College and Bath University, and prior to his involvement with q-bot he had been a tutor at Imperial College London on its Innovation Design Engineering course, as well as a founder of two previous start ups.

Focusing on the problem of insulating suspended timber floorboards the q-bot team realised they needed a solution that could install floorboard installation without moving any aspect of the floorboards themselves. They identified that the best way to fit installation and leave the floorboards and the room itself intact would be to spray insulating foam directly

The Autodesk Cleantech Partner Program supports clean technology innovators with design and engineering software they can use to accelerate their development of epic solutions to the world's most pressing environmental challenges. For more information, visit autodesk.com/cleantech.

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to the underside of the floorboards. However, in order to do this, they needed some way of getting all the necessary equipment into the void, and a method for accurately and consistently applying the foam in a space that a worker couldn't access. To make this even more challenging, the solution would need to adapt to a range of different floor layouts and be able to easily move the weight of the hoses and spray equipment across the floor space. The final challenge was that the entire solution would have to be compact enough that it could access the void below the floorboards through a small gap, such as an access panel or removed airbrick, helping minimise disruption to the rest of the building.

"At q-bot we take a very practical approach to design, identifying problems in the marketplace and developing tools to overcome this. We believe innovation happens in a systematic way and in response to customer needs or desires, and that is how we approach the development of our intelligent tools," says Mathew Holloway, managing director, q-bot.

Building a solution

After their initial research and development, the team at q-bot quickly realised that a small, intelligent wheeled robot would be the best way to solve the problems they were facing. The concept designs for this solution initially took shape as hand-drawn sketches, outlining what it would look like and the components that would be needed. While there are a number of small industrial robots already available to buy, it was clear to Mathew and the team that they weren't good enough for the specific job they would need to do. They lacked the power to pull insulation spray equipment while being too large to fit through small gaps, and their specialised nature also meant they were too expensive to be of practical application for the q-bot project. As a result, it was decided that q-bot would develop its own robotics platform from the ground up. With these specially designed robots, the time taken for a house to be insulated in this way has dropped from around ten days to just one.

The right tools for the job

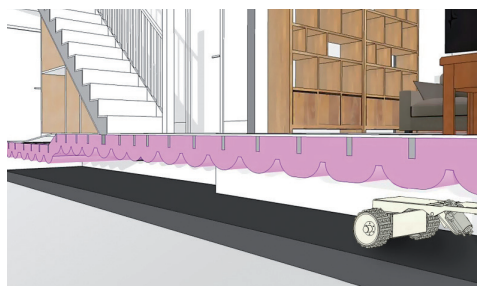
In order to turn the initial sketches into a finished product, the q-bot team used Autodesk® Inventor® from the Autodesk® Product Design Suite, which it had been given access to thanks to its involvement in the Autodesk Cleantech Partner Program. Using the initial concept designs and rough prototypes, Mathew and his team modelled

the robot in Inventor, assembling a fully working, mechanically accurate simulation of the final robot within the software. Using this model, the q-bot team was then able to use the simulation functionality of Inventor to see how the robot would perform in real-world situations.

"The insights we gained from the simulation tests we ran in Inventor were used to further tweak the model before each iteration of the design was built. The simulation process was invaluable as it allowed us to test and tweak the designs without having to first spend time and money creating a physical prototype. Each prototype was tested in the lab and the performance fed back into the simulations to improve the next iteration of the design. Using this rapid iterative development process we were able to improve the performance of the robots threefold over twelve months, which simply would not have been possible without access to the tools provided by Autodesk®" explains Holloway.

As well as using Autodesk solutions to design the body of the robot, another important element was the modelling of the insulation and heat loss through the floors to demonstrate the performance of the insulation process. This was done by using Autodesk® Simulation CFD (Computational Fluid Dynamics) to simulate how the insulation foam would impact heat loss in a real world situation. The team also took this one step further by simulating the environments where the foam would be applied to see the impact that the insulation foam would have on heat loss.

"At q-bot we have developed a process of systematic innovation that focuses on creating solutions to address problems that we see in the market. We're constantly updating and tweaking our designs, and the software that Autodesk has given us means we can try these improvements and adjustments before making the next iteration of the solution," says Holloway.



Insulating suspended timber floors

"The models and simulations that we developed for our designs using Autodesk's tools allowed us to easily test and refine our designs before building the prototype, meaning we could develop our solutions much more quickly."

— **Mathew Holloway**
Managing Director, q-bot.

Planning for the future

Mathew and his team are confident about the future plans they're building for q-bot, and are looking at a number of other additional applications for the tools they have already developed. At the same time, thanks to the company's innovative approach to identifying and solving problems in the built environment, we'll soon see new examples of its q-bot's intelligent tools transforming the construction industry.

For more information

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