

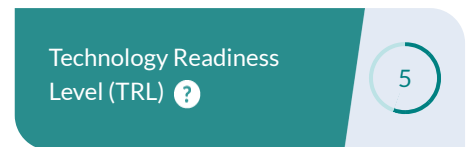
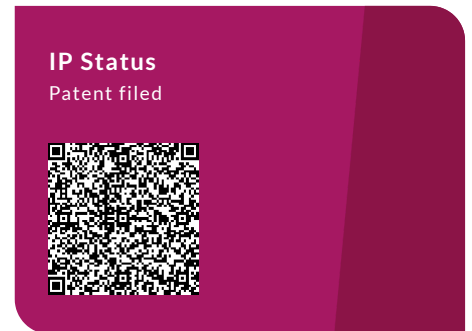
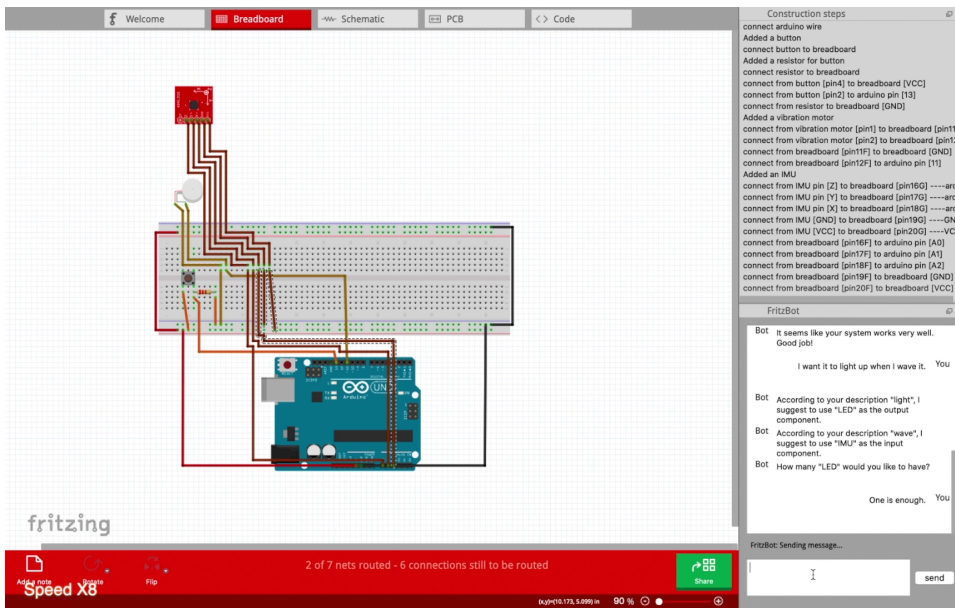
FritzBot: A Data-driven Conversational Agent for Physical-computing System Design

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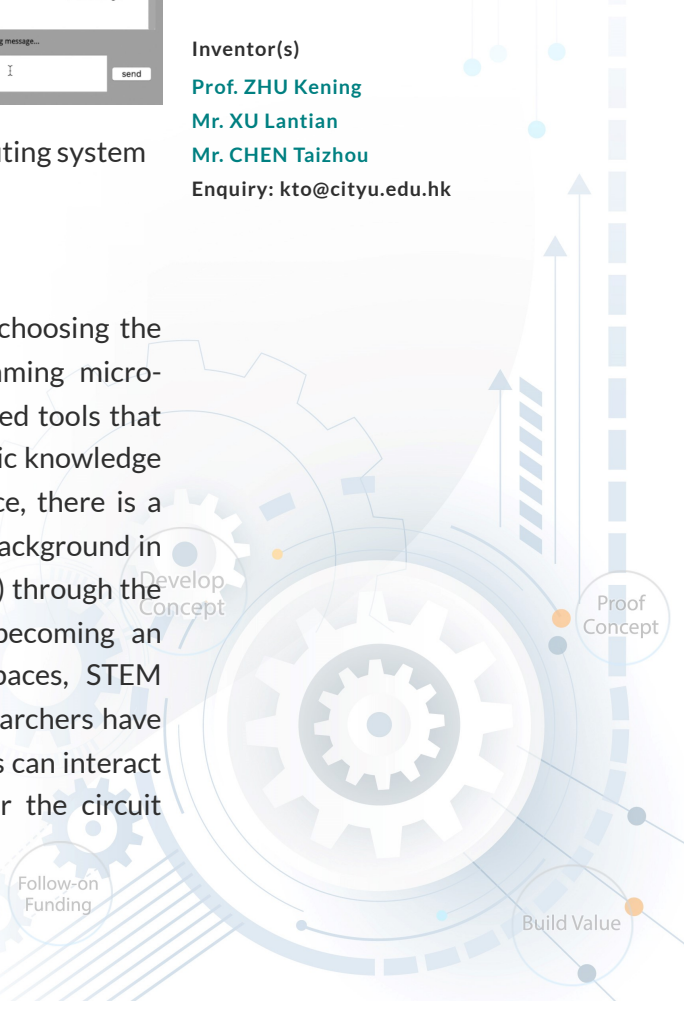


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Opportunity

Building physical computing systems from scratch, especially choosing the right electrical components, designing circuits, and programming micro-controllers, can be challenging for beginners. Existing automated tools that guide users through these tasks still require them to have a basic knowledge of coding, computing theory, and electrical components. Hence, there is a need for a software tool that can guide novice users (with no background in engineering or computer science and little technical knowledge) through the various steps of assembling computing systems, which is becoming an increasingly popular practical learning activity in maker spaces, STEM education, product design and other areas. To fill this gap, researchers have designed FritzBot, a novel data-driven chatbot with which users can interact in conversational language, to help beginner learners master the circuit design and coding tasks involved in physical computing.



Technology

FritzBot is a data-driven conversational agent or “chatbot” that supports novice users in creating physical-computing systems through natural language interaction. It is built on the structure of a bi-directional Long Short-term Memory Network and Conditional Random Field neural network, trained using data from 152 students’ reports on their physical computing course projects. By processing users’ textual descriptions of their physical computing ideas, FritzBot extracts the causal relationships between input and output, identifies the required electronic components, and generates the corresponding Arduino-based circuit and code, along with construction guidelines. FritzBot can also provide users with instructions for improving their designs and adding specific functions to their prototypes.

Advantages

- Unlike existing circuit-autocompletion software, FritzBot enables novice users with no background in engineering or computer science and little technical knowledge to assemble physical computing systems.
- Compared with existing automated tools, FritzBot significantly reduces the time taken and effort required for users to complete various tasks related to circuit design and coding.
- The chatbot’s well-integrated interface and visual output make it easier for users to handle than existing software tools such as Circuito and Arduino IDE.
- Unlike its competitors, FritzBot enables users to ask questions in simple conversational language, making their interaction with the software simple and effective.

Applications

- FritzBot enables users with no background in engineering or computer science and little technical knowledge to easily, simply and enjoyably design and build computing systems from scratch. This will benefit learners and assist teachers in various educational settings and at various levels, such as STEM education in schools and universities.
- Beyond education, the invention has application potential in commercial settings such as new media art and product design, in which physical computing tasks are becoming increasingly common.

