AN OPEN-SOURCE ROBOTIC STUDY COMPANION FOR UNIVERSITY STUDENTS

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HRI - EDUCATION

Social robots in education gained significant attention in Human-Robot Interaction (HRI) research, resulting in the development of numerous robots specifically designed for diverse educational purposes, such as language learning, personalized instruction, gamification, socialisation, collaboration, and providing learning support for students with special needs or learning difficulties.

However, despite the demonstrated benefits of engagement, enjoyment, and information retention, the high cost and limited evaluations of most existing physical robots presents challenges to understanding how these platforms effectively benefit learners in higher education.

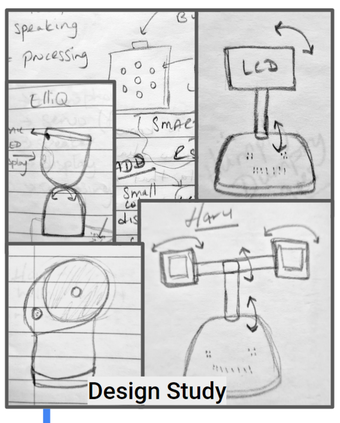
To address this gap, the robotic study companion (RSC) for university students was developed. Based on an evidence-based approach, the RSC follows existing trends in social robot design and provides an affordable open-source platform for future research.

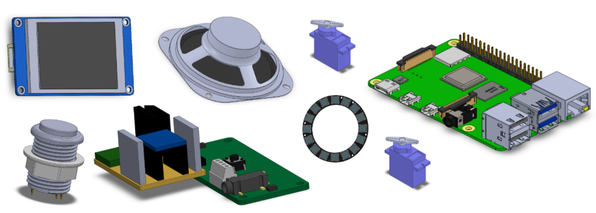
The RSC features a portable, friendly hourglass shape design, standing at 11cm tall and weighing ~374g. It aims to provide academic support to students throughout their learning journey.

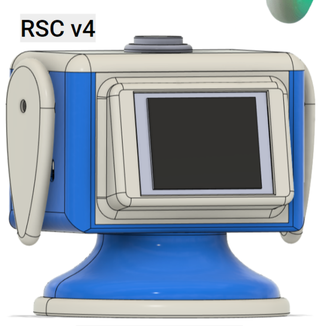
github.com/Farnaz03/RoboticStudyCompanion

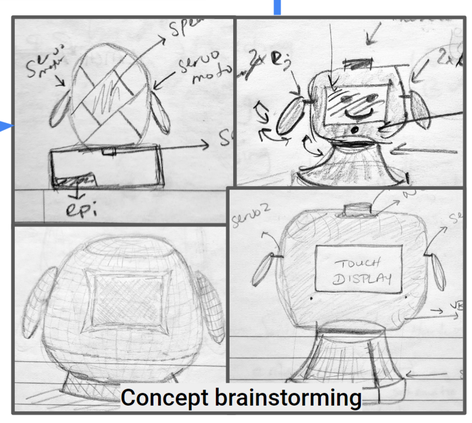
COMPONENTS

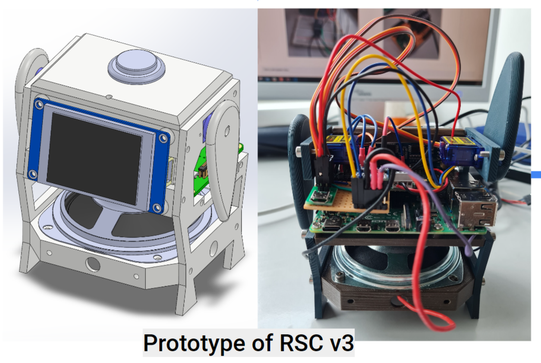
- Raspberry Pi 4B 4GB
- AIY Voice Bonnet v2
- NeoPixel RGB LED Ring
- 2.4'' Nextion Touch Display
- Logic Level Shifter
- 2x Servo SG90
- RGB Arcade Button
- 4ohm Speaker


Design Study


CAD Model of Peripherals


RSC v4
Design iteration


Concept brainstorming


Prototype of RSC v3

The development of the RSC followed a systematic design process, which involved identifying the problem domain, specifying requirements, and designing and prototyping the RSC using design thinking methods. The key drivers for RSC design were determined using the Design Science Research Method, enabling the generation of knowledge during the rapid prototyping phase.

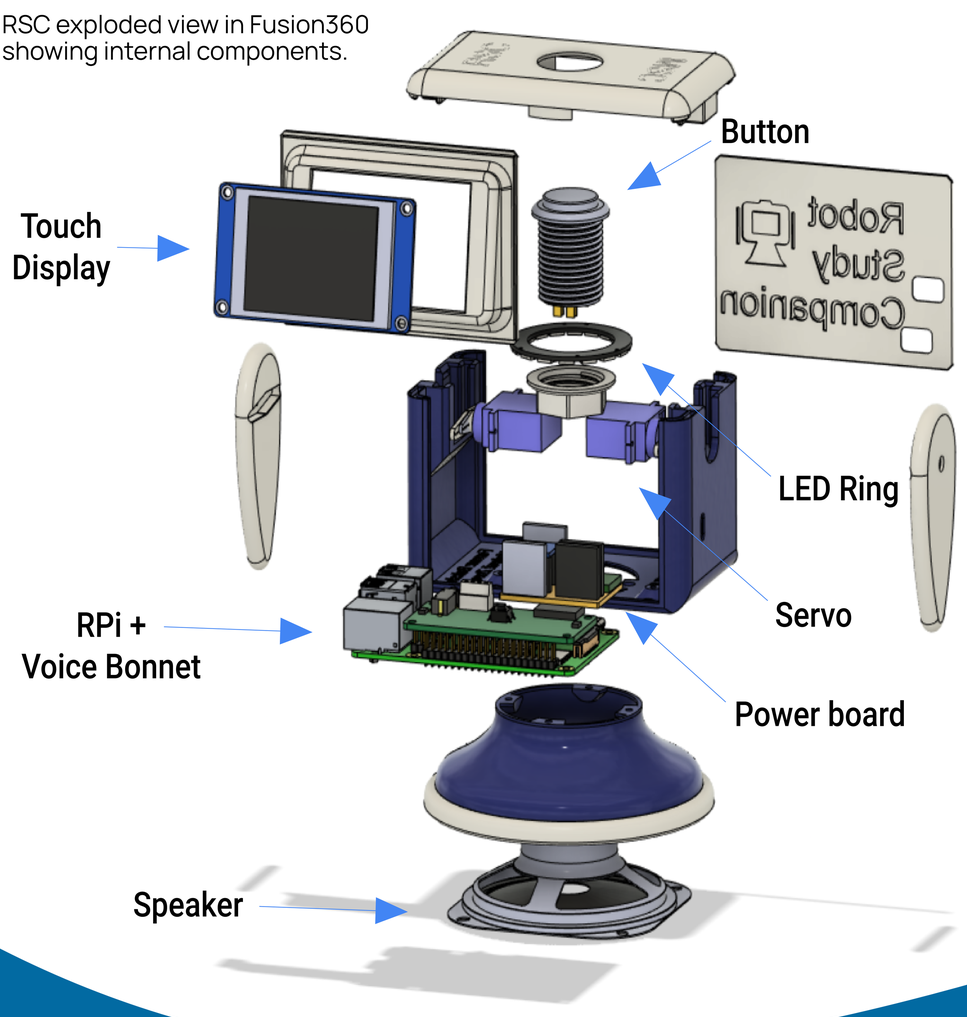
DESIGN & DEVELOPMENT

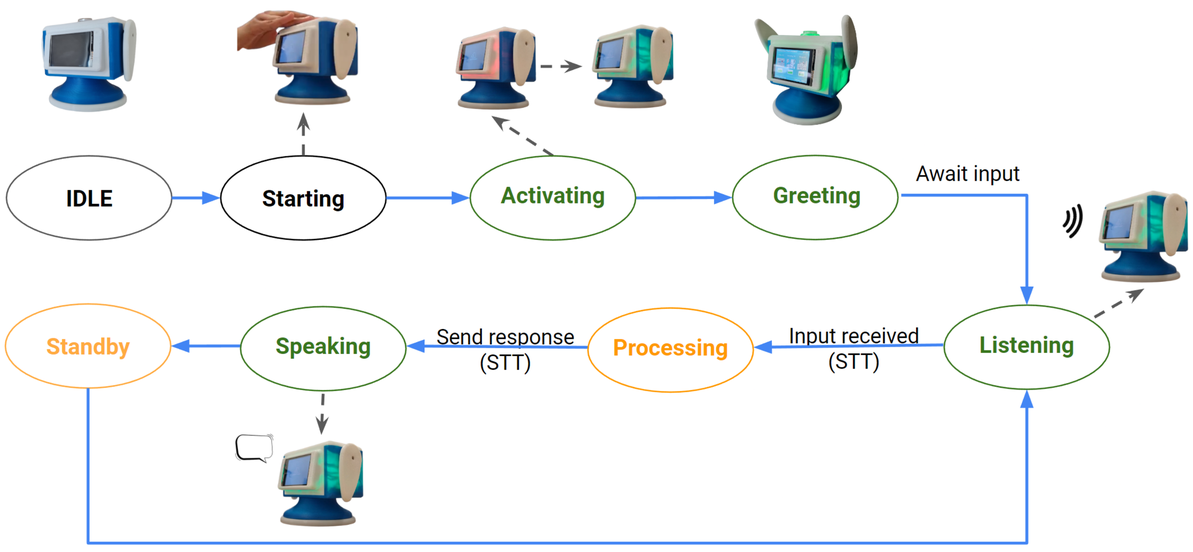
By synthesising the literature review and key findings, this project developed a set of functional and non-functional requirements for the Robotic Study Companion (RSC).

The RSC prototype is constructed using affordable off-the-shelf components and utilises OpenAI's conversational API, which has proven its ability to simplify complex concepts and facilitate interactive conversations, effectively engaging university students in their studies.

To provide a comprehensive user experience, the RSC enables interaction through various modalities such as voice, gesture, and tactile inputs. It incorporates visual, auditory, and motion indicators for enhanced expressiveness. The RSC strikes a balance between cost and technical performance, ensuring affordability for educational institutions and students.

RSC exploded view in Fusion360 showing internal components.





RSC State Diagram. Further development will enhance functionality, enabling a more personalised experience and empowering future research in HRI for university students.

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Tartu, 2023