Designing the LoCoMoGo programming application for young children

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The demand for STEM (Science, Technology, Engineering and Mathematics) in the labour market is rising (Graf, Fry, & Funk, 2018) and so might the number of parents that want to prepare their children for it. The startup LoCoMoGo is developing a toy train that teaches children programming to satisfy this demand. However, the primary objective, according to LoCoMoGo, should always be for the child to play and have fun. Part of their product will be an app used to program the train wirelessly. The purpose of this assignment is to design this app and to create a prototype. To start off the analysis the following main research question was written:

What is the best user interface of a mobile application of a toy train which teaches children in the age group of four to six how to program in a playful manner?

From the literature review it can be concluded that children learn by playing. It is argued that learning is the most effective when play is guided. The purpose in this play is set by the adult supervisor, while the child can choose direction within those boundaries. To create a foundation for this guiding, the 5E instructional model (Engage, Explore, Explain, Elaborate, Evaluate) was used to shape the learning process.

Having fun is the inherent motivator for the child to use the product. So, to find out what a child values in playing and having fun, the Integral Play Framework (Wilber, 2004) and Value Sensitive Design (van de Poel, 2014) were used. From this some of the requirements were derived.

In the reviewed studies it was found that the programming concepts that can be taught to a child at the age of four to six are sequencing, conditional programming and loops. They have some difficulties because of their limited cognitive capacity and their underdeveloped coordination of spatial perspectives. So, it was important to have a step-by-step approach and a direct link between the physical and digital part of the product. The importance of the direct link and interchangeability of these parts is also emphasised in one of the studies using the term Hybrid User Interface (Horn, Crouser, & Bers, 2012).

The analysis also consisted of a competitor analysis, PACT-analysis, personas and scenarios. From this analysis the list of requirements was put together, creating a checklist to evaluate the design on. The final design of the app consists the following elements:

- Start board
- Train calibration instructions
- Track selection
- TUI/GUI drawing instructions
- Level selection

- Level 1/2/3
- Free play game mode
- Gameplay instructions
- Pause board

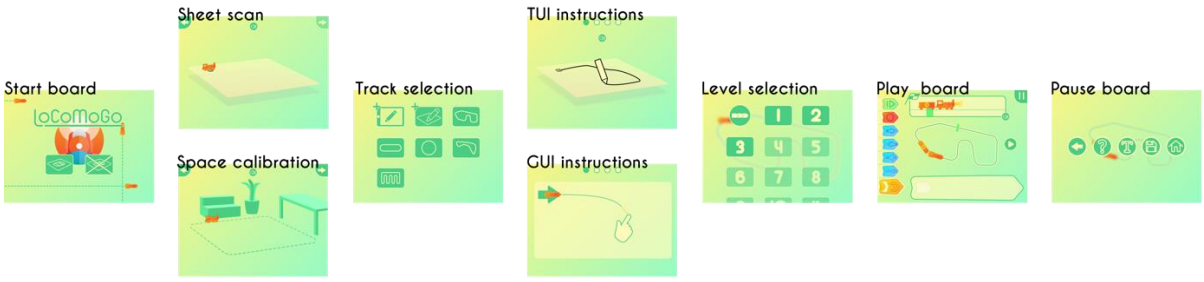

Figure 1: Storyboard

In the levels or free play game mode users can use programming blocks to build sequences that are activated when a trigger is set off. Within the app they can decide to either draw their track physically or digitally. It also shows them how to calibrate the train, so it works with the app.

While designing, a low fidelity prototype was built for a small test with children. This test resulted in a few changes in the design and some recommendations that are not within the scope of this assignment.

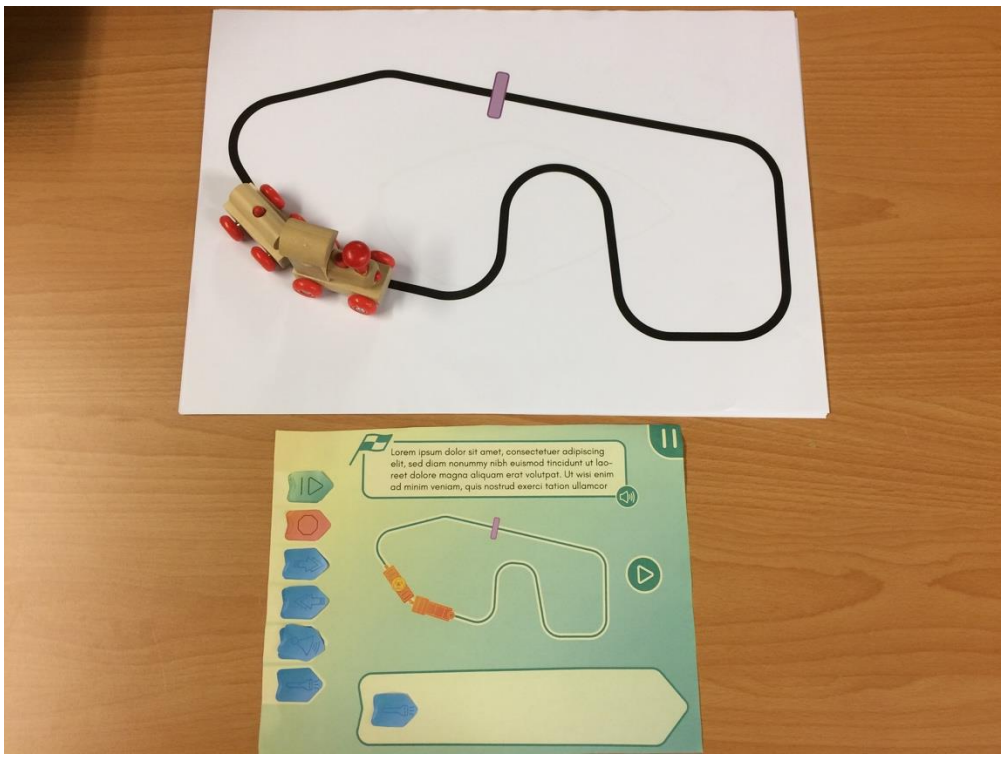

Figure 2: Low fidelity prototype

The final design was built into an interactive prototype that can be accessed by web browser. However, due to limitations of the prototype building tool, some animations were animated separately.

From the evaluation of the list of requirements, it could be concluded that most requirements were fully met. Other requirements either require more testing or have been partly met. To make this design a finished product, more elaborate testing needs to be done. After changes that resulted from the test have been processed, the design needs to be perfected. More animations and sounds could be added to create an interface that is more fluid and responsive. During this process, the changes in the physical part of the product should be taken into account.

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