CITY BUILDER

Creating Remote Communication Products for Children with Physical Isolation

Masters Project
Design Process Journal

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https://app.mural.co/t/mscpdestudio/r/1590149672368

Background

Communication problems when children have physical isolation

Because of the spread of **Coronavirus**, the whole world has been trapped in a situation of **lockdown**. Therefore, as children, they are also restricted by policies at home. The government has closed schools and all places of entertainment, requiring families to isolate themselves. Different countries have different policies. Children are **forbidden to go out and contact others**.

▶ Current Situation

Approximately **1.4 billion** children worldwide facing this problem

Ongoing research shows that **63%** of British parents already perceived their children to be feeling lonely in the first few weeks of lockdown.

Children's loneliness probability increase of around **40-50%** compared to normal levels. Lockdown is putting children's **mental health** at risk.

https://www.bbc.co.uk/news/in-pictures-52550702

https://theconversation.com/why-children-need-to-play-with-their-friends-as-soon-as-they-can-138066

▶ Primary Research — Find problems

Day in the life

Through desk research, understand and summarize two scenario of children's daily life in the presence of physical isolation.

1. Like playing with their parents.

Parents have their jobs.

Play with toys by yourself. Because of the lack of interactivity in toys, quickly loses their interest

2. Open the photo album and miss the time with friends.

Want to go back to school.

Want to play with friends.

Problems

Dissatisfaction with existing products and toys

Children's needs or companionship from friends

Market research

					interactivity
					sense of company
					creativity
					imagination
					Long term attraction emotional needs

Through the investigation and comparison of user feedback of several different forms of products on the market, the reasons for disappointment and loss of interest in the products are obtained.

▶ Secondary Research
User research, observation and interview

Because the actual lockdown situation does not allow the real observation of children's life. Therefore, the in-depth research is carried out through the observation of documentary and user video interviews.

Documentary observation

Understand the target users through the most **subconscious needs** of children in real life

- Attracted by new technology game
- Needs for groups or friends
- Communicating through games
- Emotional expression and empathy
- Entity and sense of participation

https://www.channel4.com/programmes/the-secret-life-of-4-and-5-year-olds/on-demand/63592-005

User/Stakeholder interview

NAME: QI XING
AGE: 5
Primary school

- Hard to get in touch with friends during lockdown
- Want to play outdoors with friends
- Play alone / watch tv
- Prefer to be accompanied, ball games
- Toys with interaction
- More focused when playing with friends

Three kindergareners

- Strong desire to communicate with peers or friends during the lockdown
- Prefer responsive toys
- Toys/Products with independent creativity and more imagination are more likely to attract them
- The younger they are, the more eager they are for friends to accompany and play
- Creative games children like to play alone or up to two people

Determine the specific age of target users

don't understand the meaning of friendship and friends

Like outdoor group activities
Start thinking logically
More flexibility

0 1 2 3 4 5 6 7 8 9 10 11 12

be able to notice some information flicker or prompt of the product

Like to play with friends
Start to understand competition and cooperation
Can understand the game
imagination creativity development

friends has changed from playmate to deeper emotional communication

Children who have a need for the company of their friends and have their own knowledge of products or toys are older than 5 years old. However, when they are 9 or 10 years old, their sense of companionship to their friends is not only reflected in games.
The age range of children was **5-9** years old

https://www.naturalchild.org/articles/research/ages_stages.html
https://www.apa.org/act/resources/fact-sheets/development-5-years
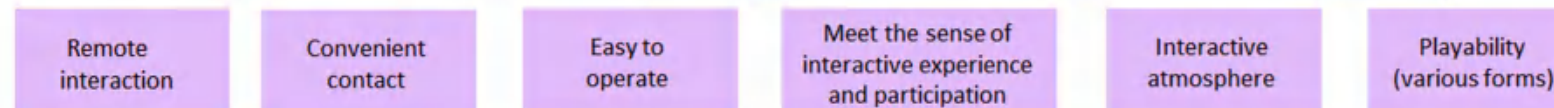https://www.goodtoknow.co.uk/family/child-development-stages-ages-1-5-4829#age4

The problem is that it can't satisfy children's long-distance contact and can't attract children. The need for products/toys can help children establish communication and enhance the sense of remote companionship

Insight

Products or toys can help children and peers establish remote connections in an attractive way. Help achieve emotional care or companionship. It is easy to operate, easy to contact with peers, and has a real sense of participation.

User Requirements

Product requirements

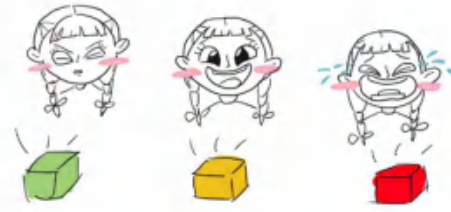| Remote interaction | Convenient contact | Easy to operate | Meet the sense of interactive experience and participation | Interactive atmosphere | Playability (various forms) |

1. Real feeling sensory contact
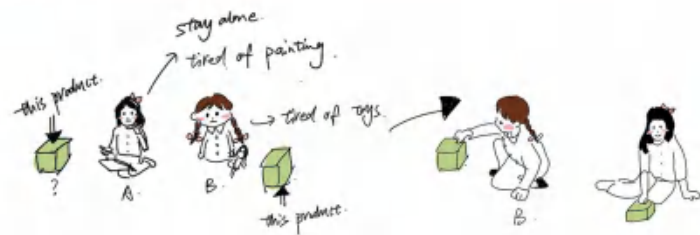
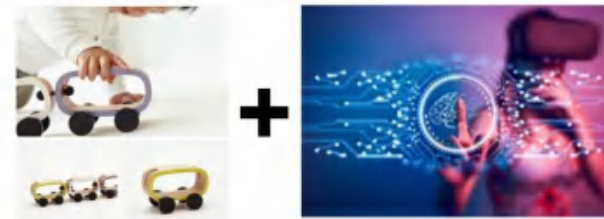## 2. Product can meet outdoor experience

3. Emotion change monitoring

4. Flexible appearance

5. Combination of physical toys and virtual experience

## 6. identify emotions and express ideas empathy

7. Shared and co created accessible surface

Finally decided to develop the idea of the **combination of physical products and virtual experience**, and combined with several other ideas marked by a blue label for further design. Through user research and observation, it is found that activities or games with real sense of participation have long-term attraction to children, and they are easily attracted by new technology products with physical feedback. Remote interaction uses digital technology experience to enhance the sense of interaction and companionship. The most easy way for children to form communication and contact, as well as produce interactive activities is the way of **game playing**, so decided to develop this idea.

Explore the form of the game

Children's favorite form of multiplayer play

FUN

78%   63%
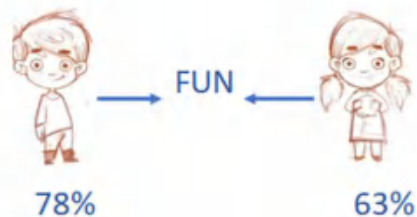
Most people, regardless of gender, play is for FUN

Competitive < Cooperative

Cooperative exergaming has been found to increase motivation, promote continued play.

Arwen M. Marker and Amanda E. Staiano.Games for Health Journal.Feb 2015.25-30.http://doi.org/10.1089/g4h.2014.0066

Individual children listed up to five favorite toys

Computer games 19%

Manipulative (building and design) toys **18%**

Sports 15%

Dolls   23%

Stuffed animal 13%

Summary

Through the exploration of game forms, the game of positioning cooperative relationship in multiplayer game is more likely to be loved by children and the motivation of long-term play than that of competitive relationship. In addition to computer games and dolls which full of emotional companionship, the most attractive toys for children are construction games, which meet the potential needs of the target children for the development of creative imagination. Therefore, the development of the concept will focus on the long-distance communication toys and the cooperation mode.

► Persona

Description:

Can only contact friends through their parents, and only use the screen to communicate in isolation, which make her quickly lose interest.
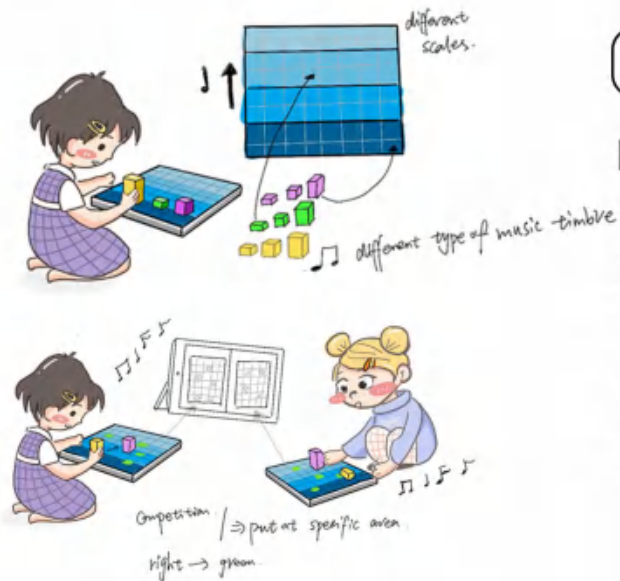
Goal:

A game product can be convenient to contact friends at the same time, can play games and communicate with each other.

Needs:

Long term attraction, simple operation, sense of company and participation

NAME: Anita
AGE: 6
Primary school

Concept 1

Music cube

This is a remote interactive music module game. The bottom board is divided into different ranges, and each module is divided into different high and low tones according to the height. When the user places the music module on the bottom board, different music can be created.
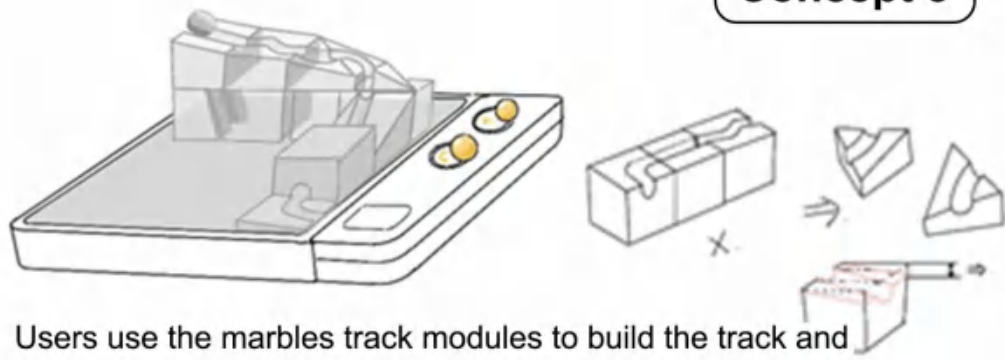
Concept 2

Cubes of different colors   board
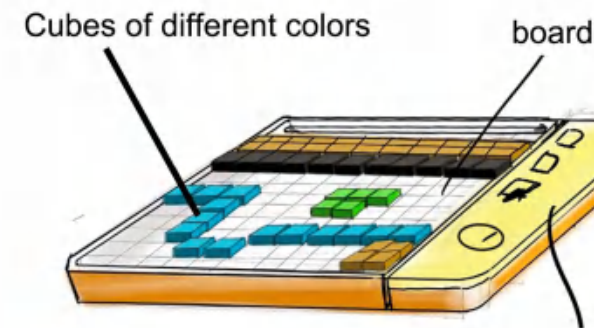
Knowing the world with color

This design is based on children's understanding of color at a young age, and uses different color f oundation blocks to build the environment. Connected with smart devices, the interactive mode requires users to ensure the connectivity of roads and rivers
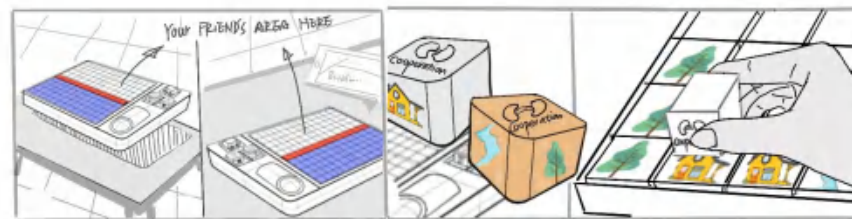
Concept 3

Users use the marbles track modules to build the track and ensure that the marbles can move smoothly. The remote interaction mode is that the starting point and the ending point of two users are connected. The display screen of the smart device can be used to show that the marbles travel in the track built by multiple users.
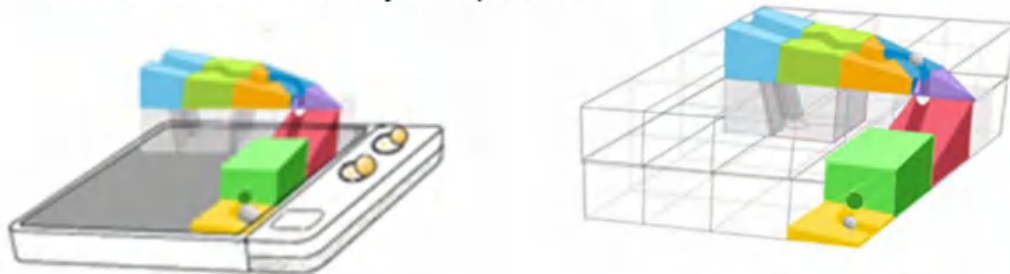
Module size test

Concept 4

The bottom plate is a module that can be pressed like a keyboard, and the road is constructed by pressing. There are three basic modules, one is the trolley module, which constructs roads to make the trolley open to traffic. The other two are modules with basic patterns. The patterns on each surface are different. The patterns are presented on the base module by contact rubbing. Product development is interactive in two modes.
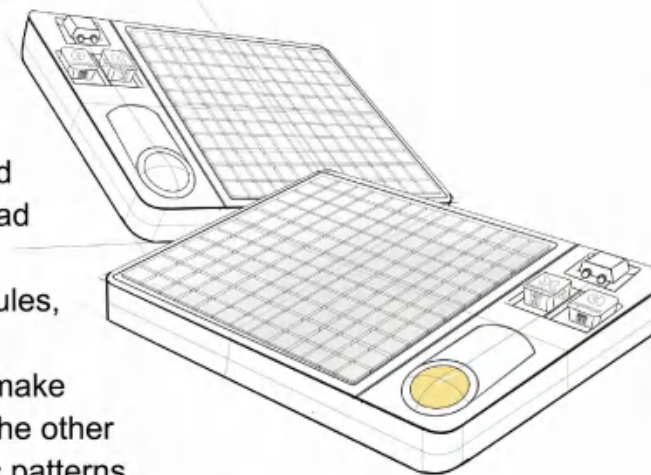
Concept 5
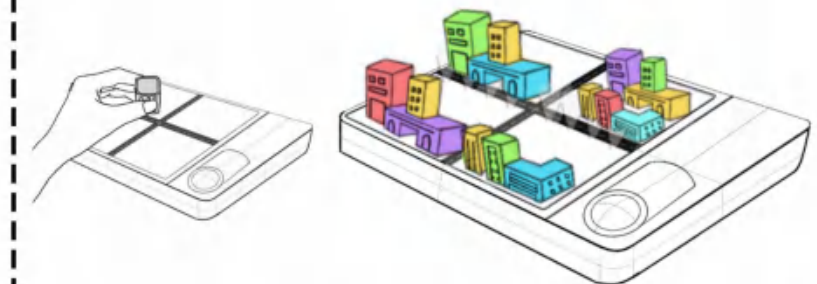
Toys for urban construction. Users set up the city by placing modules on the bottom plate. Each module is conductive through contact. The bottom plate is divided into four areas. When the number of modules in the same area of two users accumulates to a certain value, the module will turn on the power supply and give the user light feedback. Combined with the use of intelligent devices, when users build a city, they can scan their existing toys through the intelligent devices, and put them into the images presented by the smart devices.

Selections： It was decided to select concept 4 and concept 5 for further development, and finally screened through user feedback. The reason for choosing is that the operation of concepts 4 and 5 is simple and easy for users to master. Through a simple interactive way to combine objects and entities, and give users a certain amount of physical feedback, it has a high fit for the initial user needs.
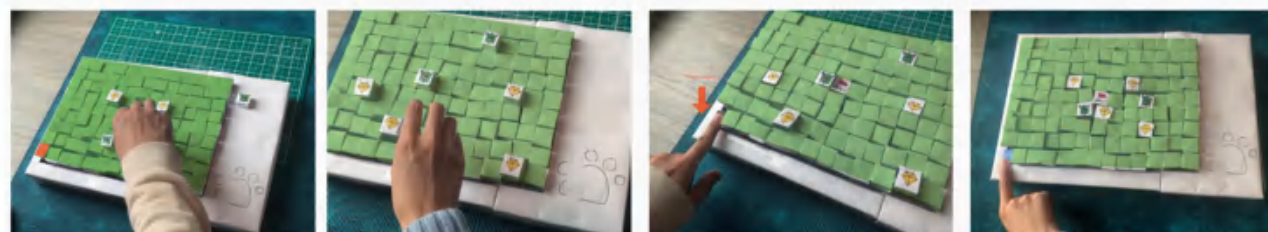
Concept 4 Initial Prototype
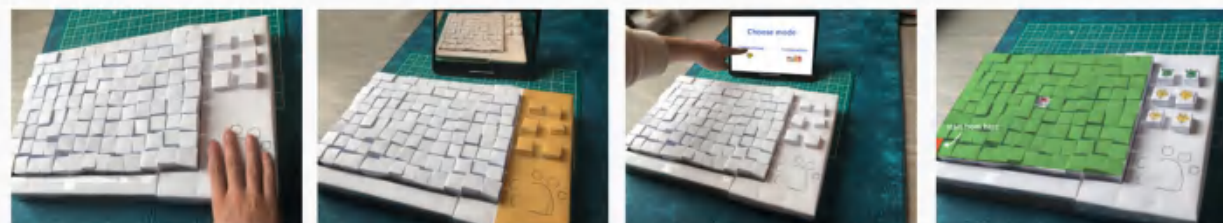
Touch or press a specific area to send a signal to a partner: want to play together

Operation panel lights up to remind / User B touches or presses the same position to connect the call
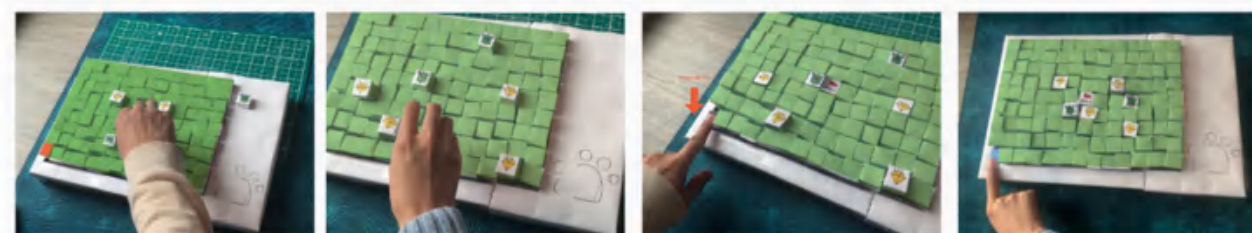
Choose the game mode through the guidance of app

The system selects the same starting point and end point and displays

Set the game for each other through the contact between the movable module, presented pattern on the basic module of another user

Start by pressing in the same position

Set the game for each other through the contact between the movable module, presented pattern on the basic module of another user

Start by pressing in the same position

The pressing road of both sides is presented in different colors at the same time, and the user can see the progress of the others

The one who uses less blocks wins

Concept 4 is primarily a test of the game mode, and the figure above shows what happens when two users connect remotely. After selecting the mode, the system selects the starting point and starting point arbitrarily, and the user sets obstacles and rewards for each other by means of contact with the movable module. The winner is the one who reaches the finish line by pressing the least modules and gets the prize.

User feedback: The game mode of concept 4 is complex, and it takes time for children to understand. Besides, the operation is like keyboard-like pressing, and the physical feedback is not strong. The interaction mode of the product is too simple and the sense of entity is weak.

Concept 5 is more extensible and creative, the operation mode is simple and easy to understand, the entity has a strong sense of operation, and the interaction brought by physical feedback is better than concept 4
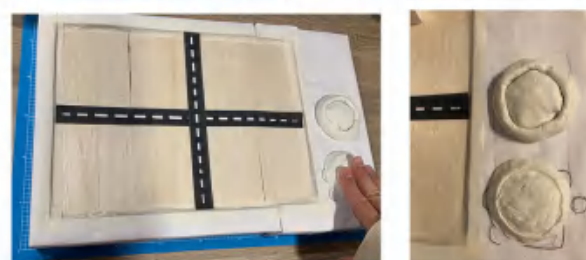
Concept 5 Initial Prototype

User testing

Button size test

According to the size of children's palms, the model was made with equal scale. The operation mode of the two buttons is different, which is selected by user test. When a child is 5 to 9 years old, the palm size is about 5 to 10cm, and after testing, the final size of the button is 6 cm.

Module electrical conduction test

Power supply module with battery

Charged module without battery
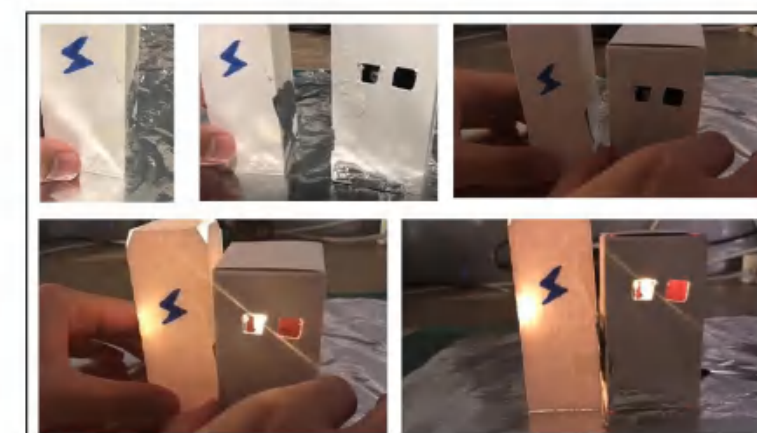
Principle and operation: Connect the battery to the LED as a charging module, and the other one only installs the LED as the charged module. A layer of conductive material (tin foil for experiment) is attached to the surface of the module. Connect the negative pole of the power supply of the charging module to the bottom plate, and the bottom plate is also attached with a layer of conductive material. When the tin foil between the two modules contacts, the circuit is connected.

Module size and shape tests

Summary: According to user feedback and technical research, Concept 4 is relatively weaker than Concept 5 in terms of feasibility and product response to preliminary research needs. So choose Concept 5 as the final design

User's remote connection
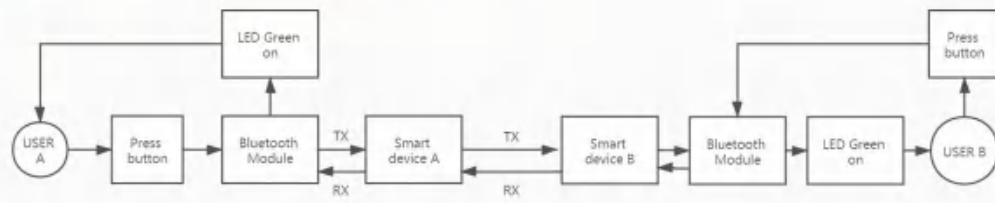
The process of connecting users through product buttons and smart devices is the function to be realized in this part. The indicator light for successful connection turns green, and the indicator light for connection failure turns red. Bluetooth module is a data transmission module based on Bluetooth specification V4.0 BLE Bluetooth protocol. The wireless working frequency band of this module is 2.4GHz, which can realize the communication with the farthest distance of 50 meters. The size of the module is 18.5mm x 13mm x 2.2mm, which is easy to be embedded in the system, and contains a built-in PCB antenna.

HC-09 Bluetooth Module

Electrical conduction between modules

All operable modules are divided into two types: charging modules with built-in rechargeable lithium ion batteries, and ordinary modules with built-in LED lights to conduct electricity by means of contact. The physical experiment of contact charging process is carried out. The charging module uses two button batteries with each voltage of 3V to supply power. The LED lamp of power supply module is connected with iron sheet. The LED lamp of common charging module is connected with iron sheet and silver paper at the bottom. The two modules are placed on the silver paper plane at the same time to realize the power transmission.
In order to avoid the limitation of connection caused by positive and negative polarity, two groups of symmetrical interfaces will be set on each side. The interface from right to left are Power supply, GND, Data input, Data output and four symmetrical interfaces.
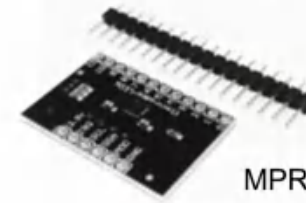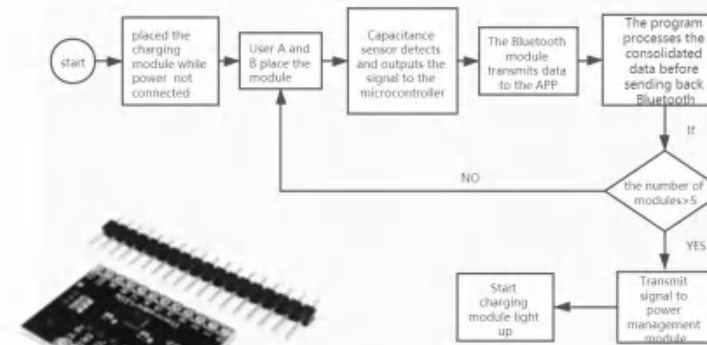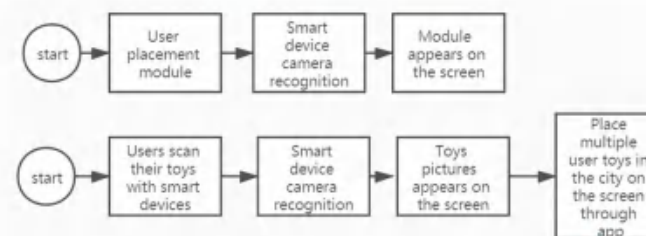

WS2812B
LED Patch

Conductive sheet

Number of detection modules

MPR121 Capacitive Touch Sensor Module

The function of this process is to detect the number of modules through the board, process the data of two users, calculate the total number of modules, and then trigger the charging module to charge to provide power for the LED lights of other modules.

The capacitance sensor is used to detect the quantity by changing the capacitance after placing the module. Bluetooth module is still used for data transmission and reception

Camera recognition function

The first function is: after the user places the module, the camera of the intelligent device recognizes it and projects the 3D model on the screen. The implementation method is as follows: firstly, all modules are modeled and numbered, and the models of several different modules are entered into the APP through programming, and embedded. When a certain module is recognized by the camera, it is compared with the model data in app through image processing technology and fed back to the screen.

The second function is: users scan any existing toys, input their two-dimensional images into the intelligent device through the way that the camera has taken pictures, and then they can operate these two-dimensional images to move in the city of app. Multiple users can simultaneously display the scanned toys and present them in the screen city for interaction. This process also uses the image processing technology of smart devices. The implementation method is: when the user uses the camera to shoot an object, the light sensor on the camera converts the light signal to digital signal, which is processed by the image processor inside the mobile phone or iPad and presented on the screen. The following figure briefly describes its technical implementation

Battery

The batteries here are divided into lithium-ion batteries used in the overall product and lithium-ion batteries used in the charging module to provide power to other modules. They are all rechargeable batteries. The battery of charging module is lithium polymer battery with rated voltage of 3.7V and battery capacity of 200mAh. The battery powering the entire product is a rechargeable lithium-ion polymer battery with a rated voltage of 3.7v and a battery capacity of 5000mAh.

Deliver

▶ Final Design

Conductive plate surface

Upper part of bottom plate

Lower part of the baseplate

Bottom gasket

Arduino microcontroller board

PCB

Electrical contact

Decorative shell

LED

Press-Button shell

Warning lamp shell

Button

Screw

Conductive sheet

(conducting) wire

magnet

Module translucent windows

battery
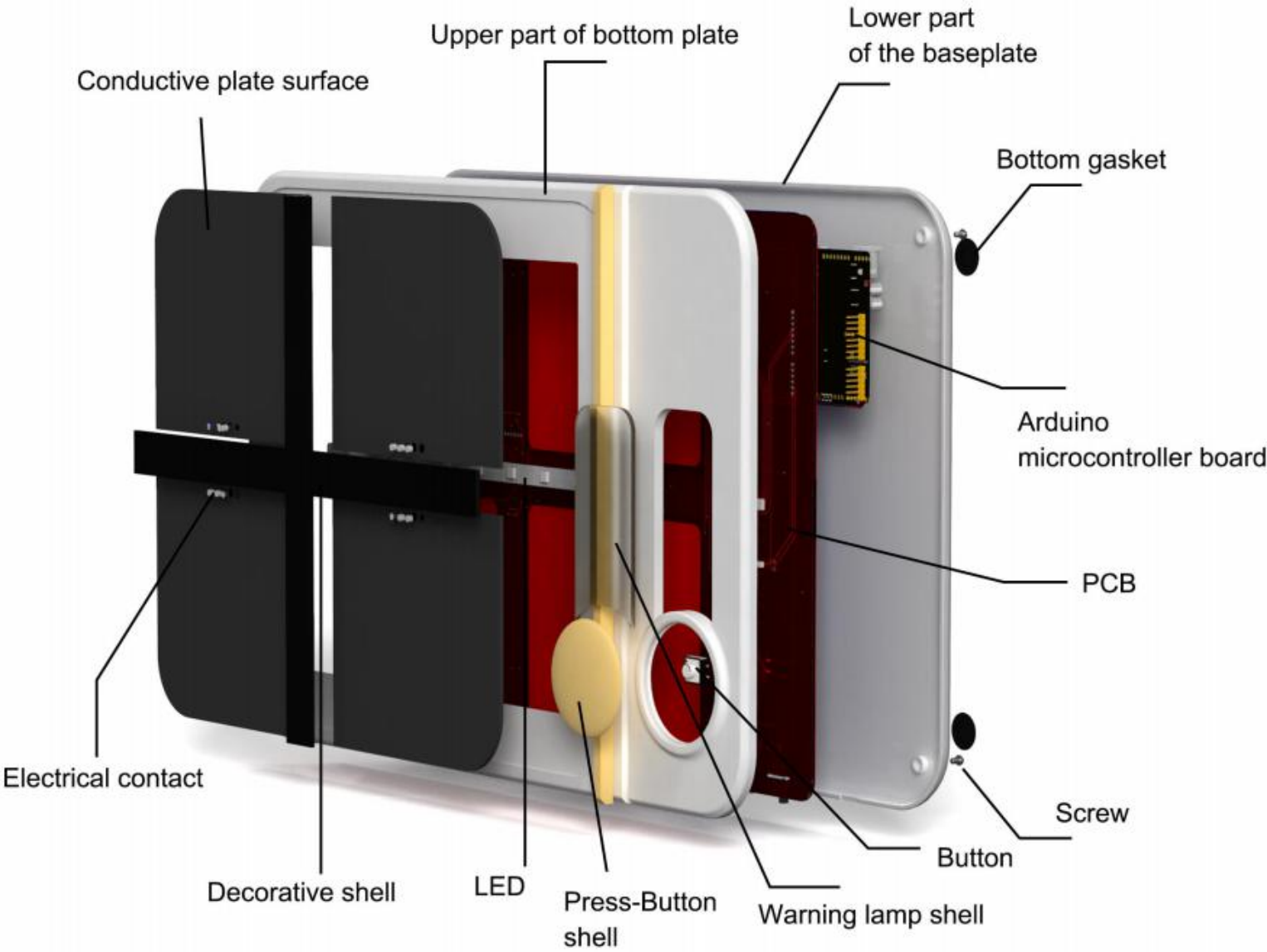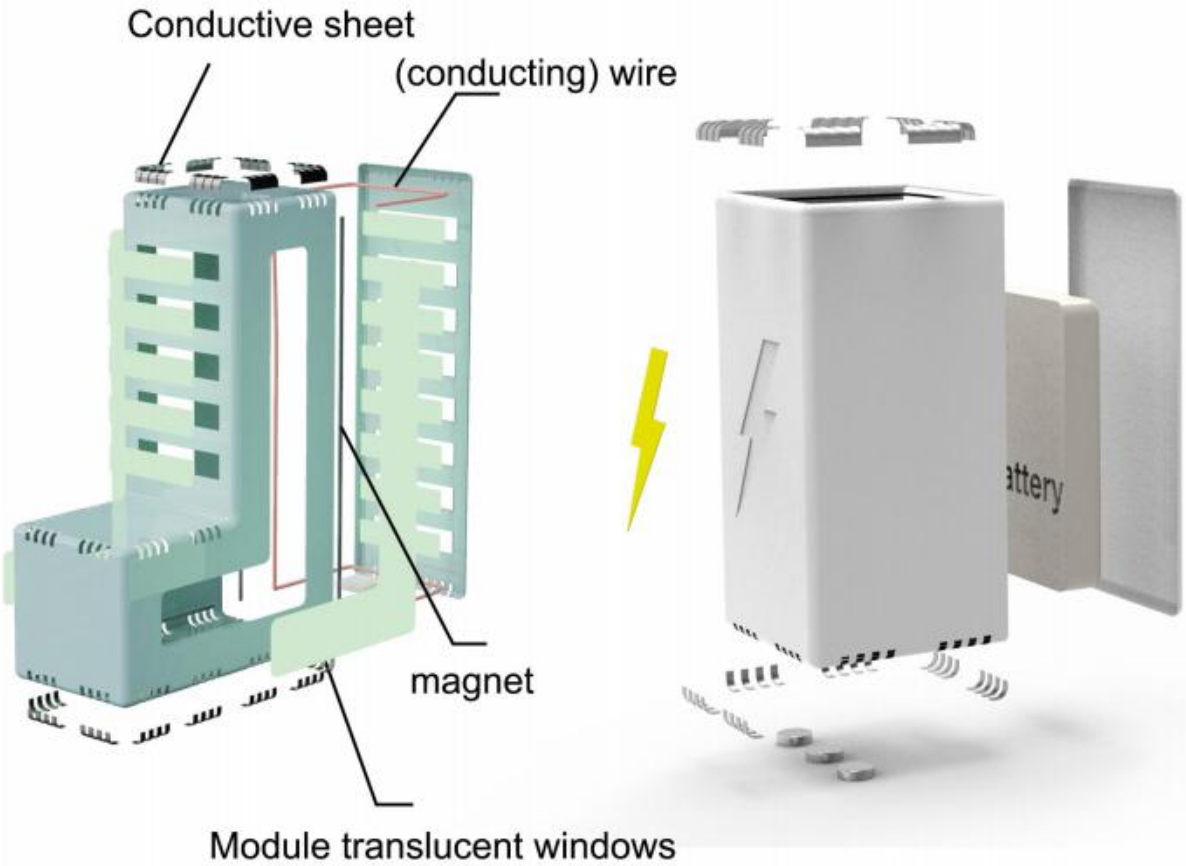
NAME		NAME		NAME	
Lower part of the baseplate		Module shell		Bottom gasket	
Upper part of bottom plate		Module translucent windows		Conductive sheet on the module	
Press-Button		Decorative shell		Electrical contact	
Warning lamp shell		Conductive plate surface			

► Storyboard

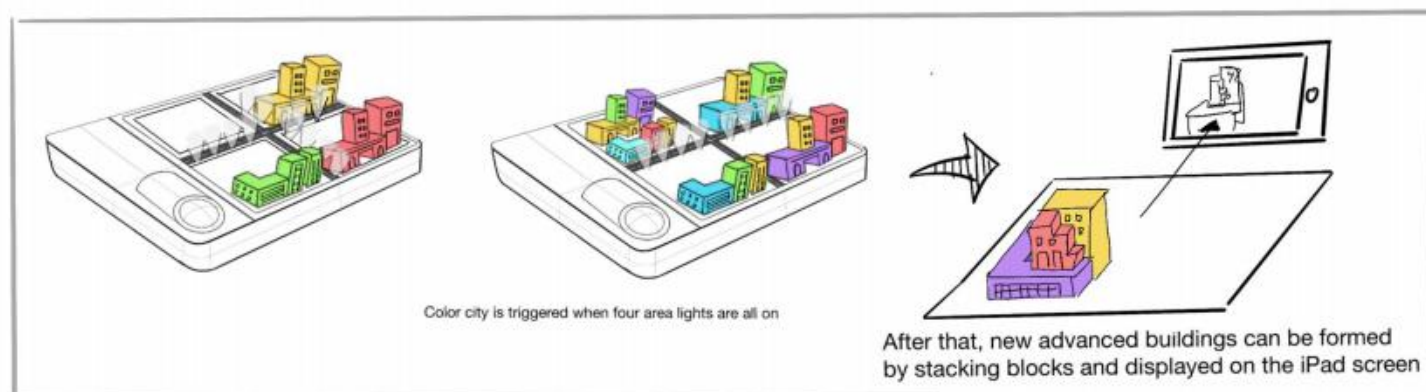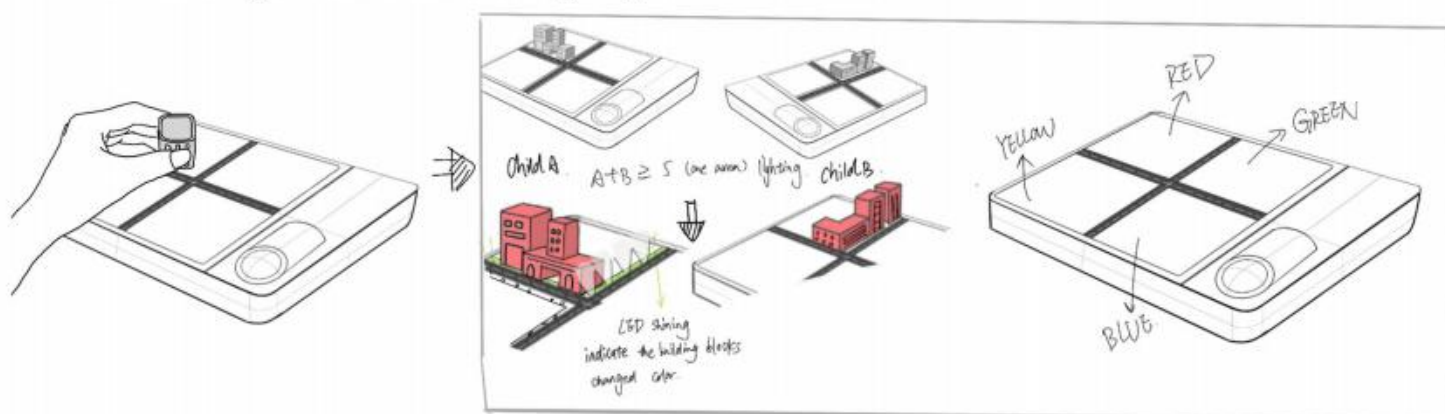Start building different feedback of lighting

RED

GREEN

YELLOW

BLUE

Child A   A+B ≥ 5 (one area) lighting child B

LED shining indicate the building blocks changed color.

Color city is triggered when four area lights are all on

After that, new advanced buildings can be formed by stacking blocks and displayed on the iPad screen

Scan the toys in your home which means that they can live in the city or can be driven between cities.

SCAN THEIR TOYS.

Our toys can be real in the city

► User journey

User 1 presses the button to make a remote connection. The green light is on successfully

User A   User B   User A   User B

User A   User B   User A   User B

When all four areas are lit up, become colorful cities

User A   User B
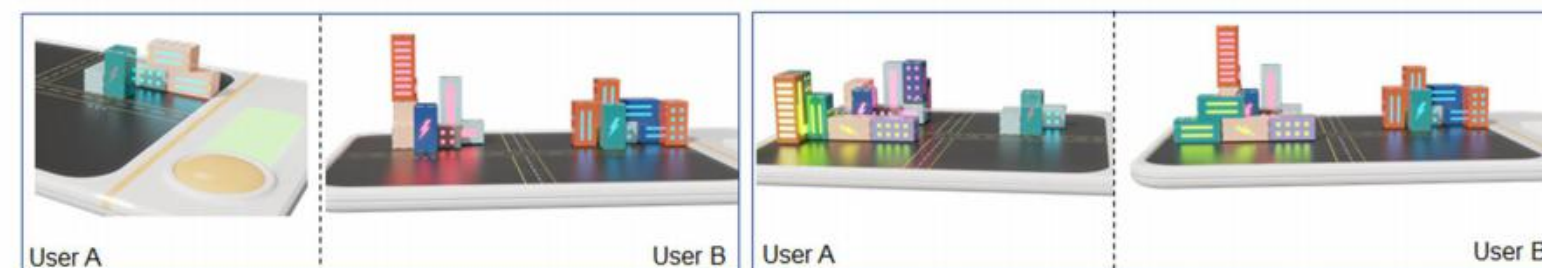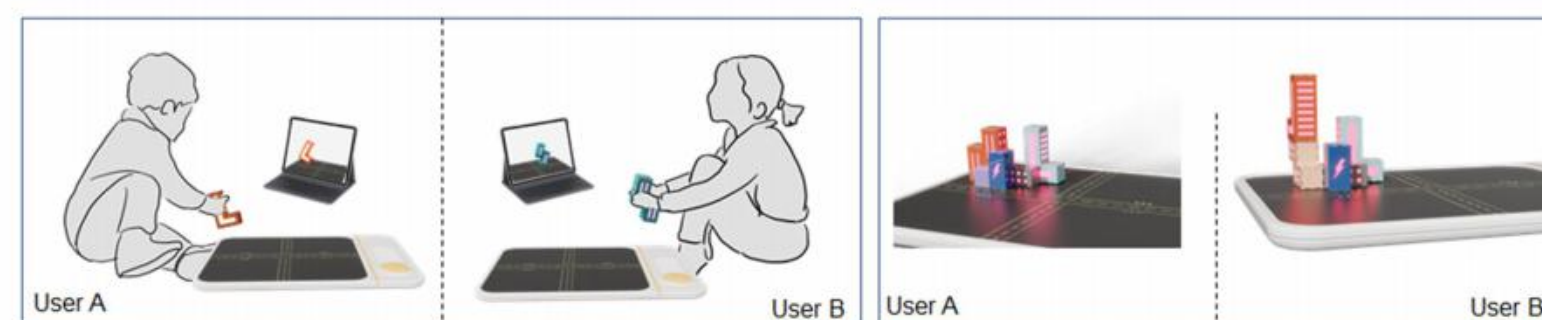
When two remote users are placed to a certain number, the lights will be on according to the area. When the four areas are lit, it becomes a colorful city with neon effect.

Scan your toys and put them in the city

Share toys in the city

▶ Summarize

After repeated feedback and consideration of the concept, the remote toy product is finally created, which provides the possibility of children's long-distance entertainment and company under the condition of physical isolation. The product meets the requirements of target users and stakeholders proposed in the preliminary research. All technical objectives of the project have been demonstrated and materials, manufacturing process and assembly have been considered. Due to the time of the project, no real program was developed to test the product and calculate the actual cost. However, in the design process, including material selection, technology and every step of the process, the cost has been consciously controlled to ensure the realization of the product.

▶ Further work

To bring design into the market, more detailed iterative design will be carried out. Further refine and reduce cost, and explore the possibility of material, technology and process improvement in current design. At the same time, because of the connection of intelligent devices, it is necessary to write the program, and test the program and function iteratively with high-quality product prototype. It may include the test of HALT (highly accelerated life test). Testing will help to consider product defects more quickly and deliver the detailed design to the Engineer for final review. This may find problems that were not found in this short project and make improvements.

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