Robotic Kit For Children

Interaction Design degree Project stage 2

Guide - Prof. Ravi Poovaiah

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IDC (Industrial Design Center)

Approval sheet

Robotic Kit For Children

Interaction Design Project 2

Guide - Prof. Ravi Poovaiah

Approved for the partial fulfillment of requirement for the degree of

Masters of Design in Interaction Design at Industrial Design Centre,

by – Ujjwal Likhar, Roll No 07633005

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Chairperson : _____

Internal examiner : _____

External examiner : _____

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Finally thanks to my batchmates for their help and feedback.

Ujjwal Likhar, April '09

Abstract

Robotics is a subject through which kids can learn many things. It has electronic, mechanics, software, problem solving, team work, etc. which provides a broad perspective and a huge scope of learning for the kids while they play.

Robotic toys fascinate kids a lot. There are many robotics toys available in market which are getting very popular now a days. These toys mainly come in human or insect form, but now a days company like wow-wee are exploring various animal forms also. The toys can be a pre-assembled or in form of kit which kids can assemble themselves and play. To make a robot from a kit needs more knowledge and learning for the kids. In Indian market the robotic kits that are available are not only very difficult to assemble but also the robot lacks the outer form.

The main objective of this project is to design a robotic kit that can involve kids or make them participate to develop a robot. The kit is designed to be very simple and attractive so that it arouse interest and makes possible for them to assemble easily and to play in an environment created by themselves.

Content

Introduction

Along with necessary design knowledge, prototyping skills forms one of the important skill set for an interaction designer. I wanted to undertake a project that shall enhance my prototyping skills and at the end of project I have something realizable in hands.

Hence this project is started with an intent of creating a interactive product for which prototyping support is available. TRI (The Robotic Institute) an incubator company at SINE , IIT Bombay

TRI [The Robotics Institute],IIT Bombay

TRI [1] Techno solutions Pvt Ltd is an IIT Bombay alumnus venture in the field of educational robotics & embedded systems with current focus in college level education.
TRI was founded in November 2005 and is currently incubated at SINE, IIT Bombay. TRI is a constant facilitator in the scientific and technical education of students by providing them requisite resources through wide variety of kits, parts, software based programming tools, basic & advanced level workshops and web based learning resources.

Research

- What is a Robot ?
- Classification of Robot
    - Aerial robot
    - Underwater robots
    - Land robots
        - -Industrial robots
        - -Domestic robots
- Robotic Toy Kits
- Sensors
- Robotic Competitions
- Movies on Robot

What is a Robot ?

Definition

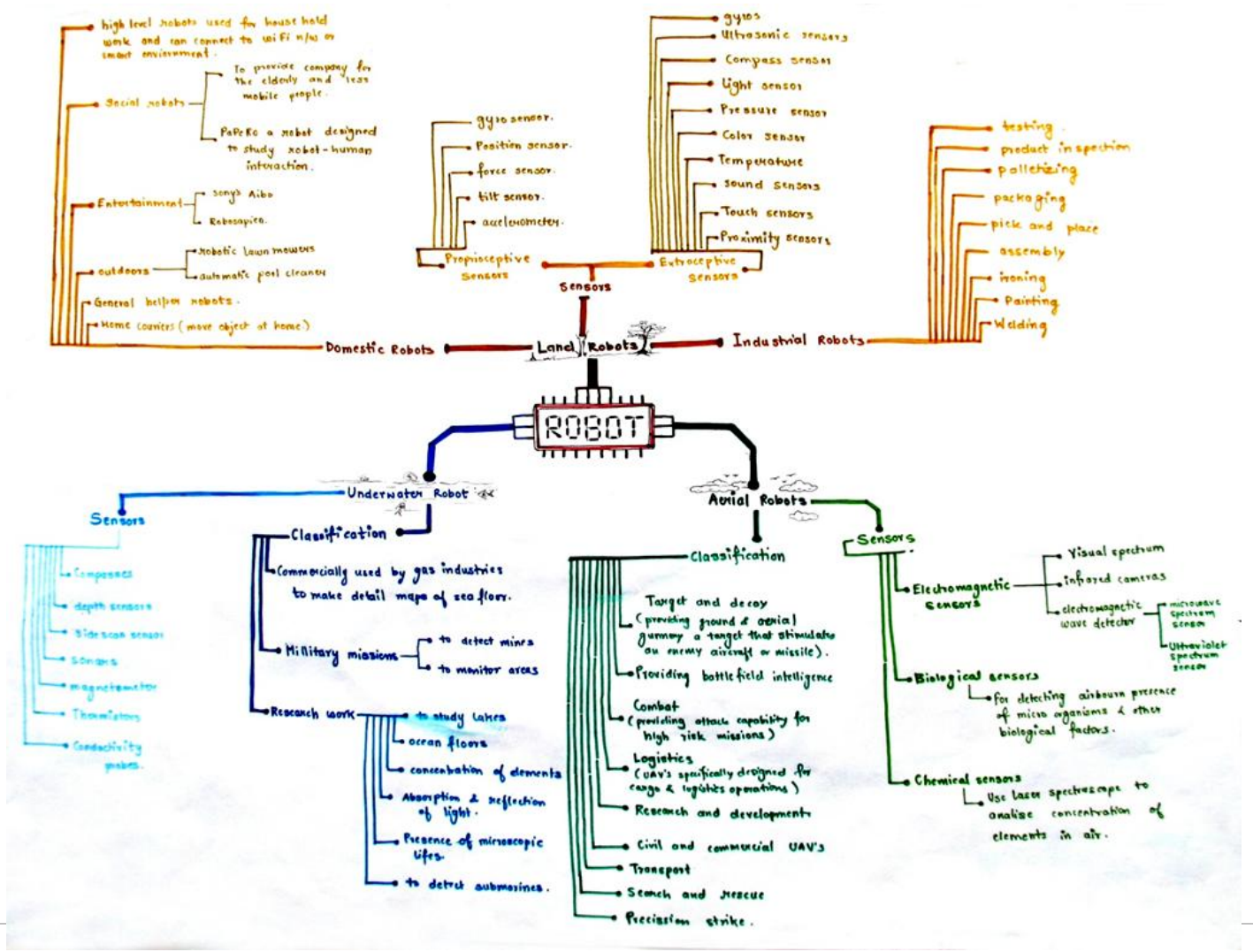
"An automatically controlled, reprogrammable, multipurpose, manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications."- definition is used by the International Federation of Robotics

A typical robot will have several or possibly all of the following properties.

- It is artificially created
- It can sense its environment, and manipulate or interact with things in it.
- It has some ability to make choices based on the environment, often using automatic control or a preprogrammed sequence.
- It is programmable.
- It moves with one or more axes of rotation or translation.
- It makes dexterous coordinated movements.
- It moves without direct human intervention.

Classification of Robot

- Aerial robots
- Underwater Robots
- Land Robots



Aerial robots (unmanned aerial vehicle (UAV))

An **unmanned aerial vehicle (UAV)** is an unpiloted aircraft. UAVs come in two varieties: some are controlled from a remote location, and others fly autonomously based on pre-programmed flight plans using more complex dynamic automation systems. Currently, UAVs perform reconnaissance as well as attack missions. They are also used in a small but growing number of civil applications, such as firefighting. UAVs are often preferred for missions that are too "dull, dirty, or dangerous" for manned aircraft.

UAVs typically fall into one of six functional categories:

•Target and decoy - providing ground and aerial gunnery a target that simulates an enemy aircraft or missile

•Reconnaissance - providing battlefield intelligence

•Combat - providing attack capability for high-risk missions.

•Logistics - UAVs specifically designed for cargo and logistics operation

•Research and development - used to further develop UAV technologies to be integrated into field deployed UAV aircraft

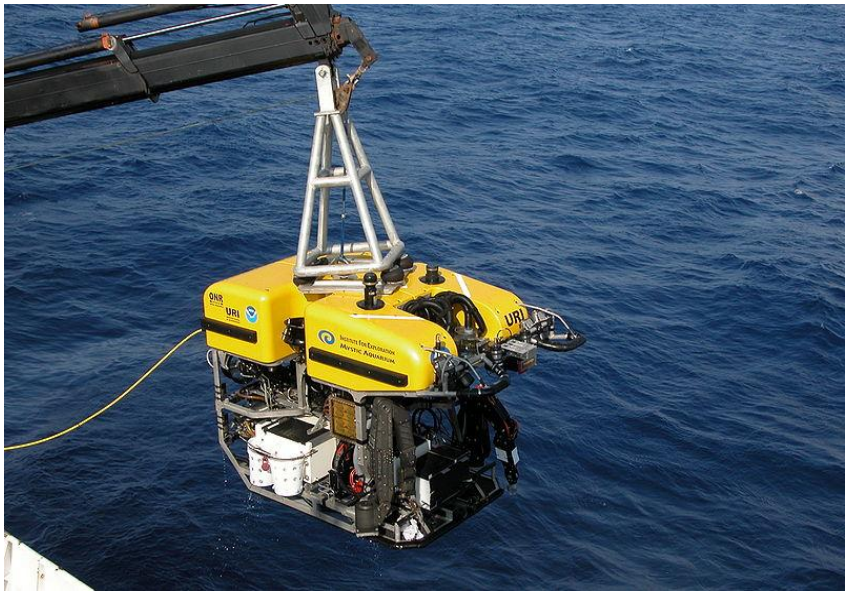
•Civil and Commercial UAVs - UAVs specifically designed for civil and commercial applications

Underwater robots (Unmanned underwater vehicles)

Unmanned underwater vehicles can be divided into two categories:
Remotely operated underwater vehicles (ROVs), controlled by a remote human operator.
Autonomous underwater vehicles (AUVs), which operate independently of direct human input.

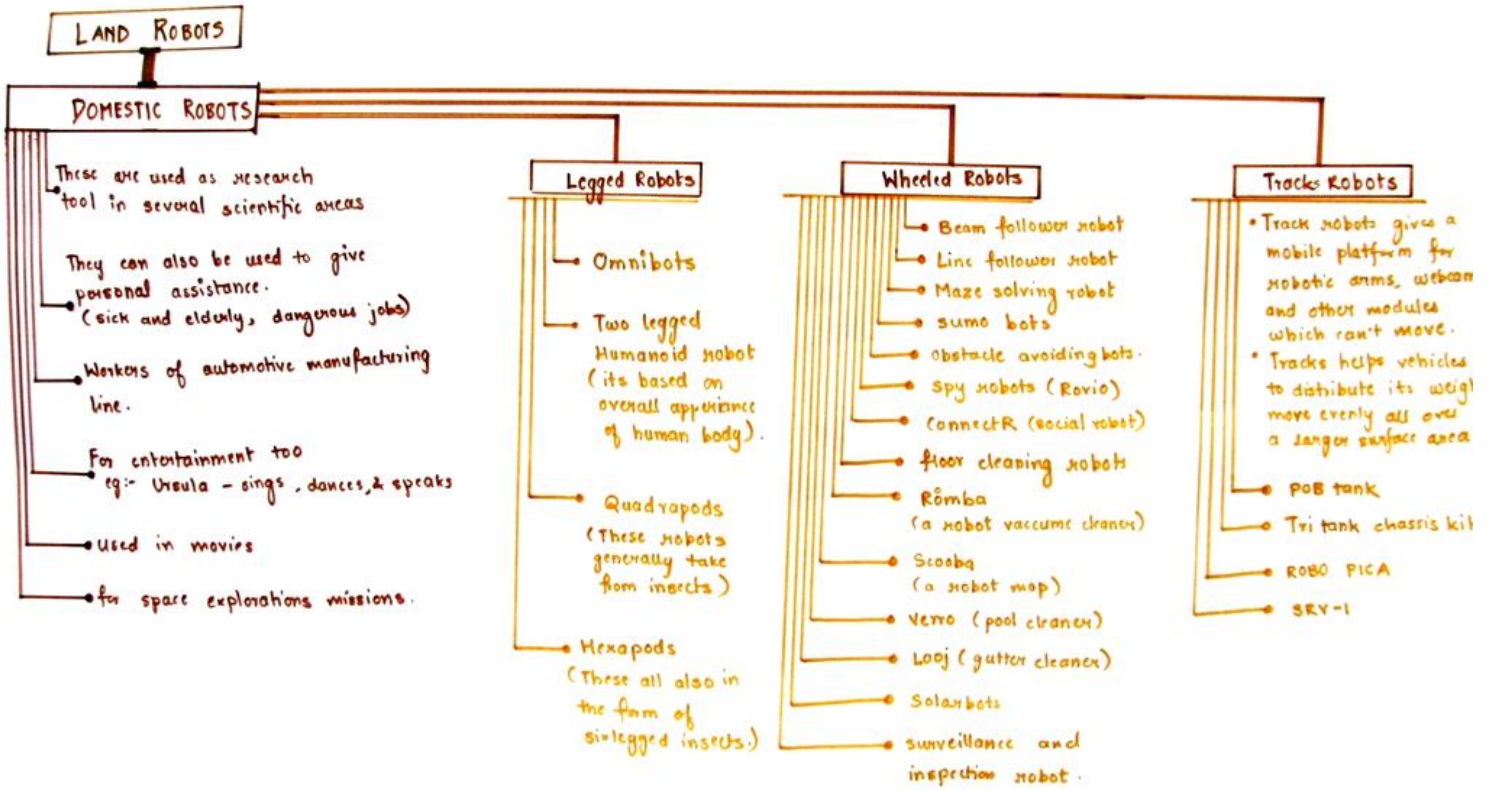
Remotely operated underwater vehicles (ROVs) is the common accepted name for tethered underwater robots in the offshore industry. ROVs are unoccupied, highly maneuverable and operated by a person aboard a vessel. They are linked to the ship by a tether (sometimes referred to as an umbilical cable), a group of cables that carry electrical power, video and data signals back and forth between the operator and the vehicle. High power applications will often use hydraulics in addition to electrical cabling. Most ROVs are equipped with at least a video camera and lights. Additional equipment is commonly added to expand the vehicle's capabilities. These may include sonars, magnetometers, a still camera, a manipulator or cutting arm, water samplers, and instruments that measure water clarity, light penetration and temperature.

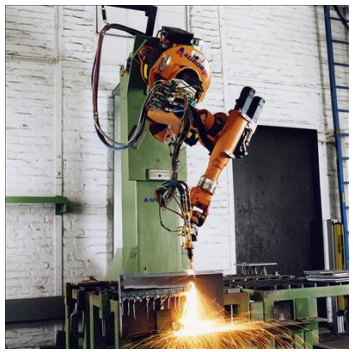
An **autonomous underwater vehicle (AUV)** is a robot which travels underwater. In military applications, AUVs are also known as **unmanned undersea vehicles (UUVs)**. AUVs constitute part of a larger group of undersea systems known as unmanned underwater vehicles, a classification that includes non-autonomous remotely operated underwater vehicles (ROVs) -- controlled and powered from the surface by an operator/pilot via an umbilical.

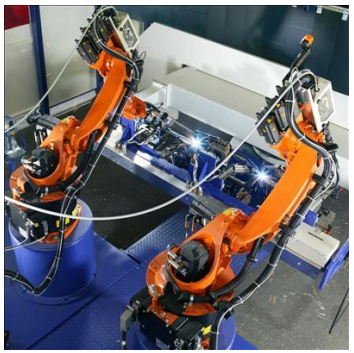


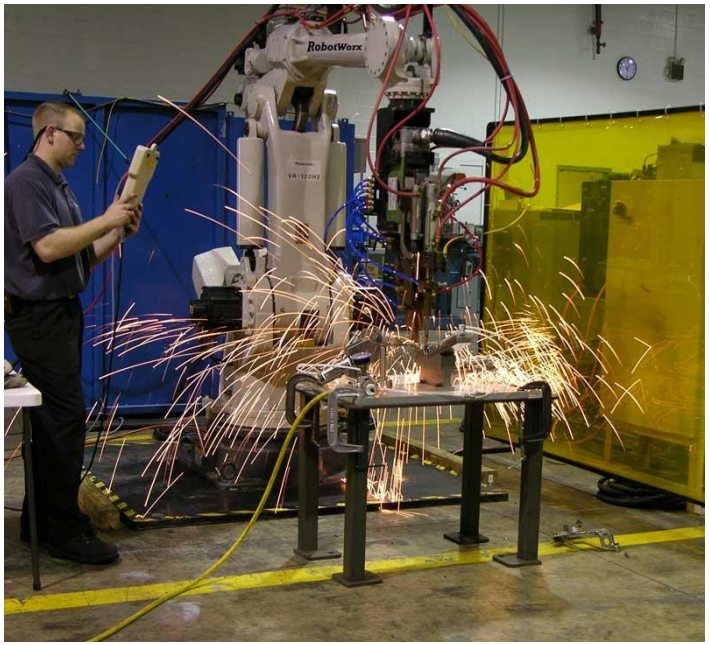
Land robots

- Industrial robots
- Domestic robots
  - Legged robots
  - Tracked robots
  - Wheeled robot









Industrial robots

An **industrial robot** is officially defined by ISO as an *automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes*. The field of robotics may be more practically defined as the study, design and use of robot systems for manufacturing (a top-level definition relying on the prior definition of *robot*).

Typical applications of robots include welding, painting, ironing, assembly, pick and place, packaging and palletizing, product inspection, and testing, all accomplished with high endurance, speed, and precision.

The most commonly used robot configurations are articulated robots, SCARA robots and Cartesian coordinate robots. In the context of general robotics, most types of robots would fall into the category of robotic arms.
Some robots are programmed to faithfully carry out specific actions over and over again (repetitive actions) without variation and with a high degree of accuracy. These actions are determined by programmed routines that specify the direction, acceleration, velocity, deceleration, and distance of a series of coordinated motions.

Domestic robots

A **domestic robot** is a robot used for household chores. Thus far, there are only a few limited models; science fiction authors have suggested that they could become more common in the future. There are different types and classes:

•Low level: a basic home robot is any robot that can be used at home, including the entertainment robots, like Aibo.
•Care and chore robots: used for household chores.
•The highest level robot is the domobot: used for household chores, autonomous and connected to a WiFi home network or smart environment. Some of them can also include a USB port.

Home couriers
Home transport robots are a main element in the domestic robotic system, because they join specialized processes, moving objects at home (i.e. clothes from the bathroom to the washing machine or glasses from the table to the dishwasher)
General helper robots
There are also general domestic helper robots, i.e. HRP-2.
Outdoors
Robotic lawnmowers, Automated pool cleaners are robots for cleaning swimming pools.
Entertainment
Toy robots include Sony's Aibo, a robot pet dog also used by many universities in the RoboCup autonomous soccer competition Robosapien, a small humanoid remote controlled robot
Social robots
Robots whose main object is social interaction (partner robots). Wakamaru, a humanoid robot designed to provide company for the elderly and less mobile people

Domestic robots

Outdoors

An **Automated Pool Cleaner** is an vacuum cleaner intended to collect debris and sediment from swimming pools with minimum human intervention. Pools using such a cleaner on a routine basis are not only visually cleaner but also using less chemicals which means lower operating costs.

Robotic lawn mowers

Robotic lawn mowers represented the second largest category of household autonomous robots. A typical robotic lawn mower requires the user to set up a border wire around the lawn that defines the area to be mowed. The robot uses this wire to locate the boundary of the area to be trimmed and in some cases to locate a recharging dock. Robotic mowers are capable of maintaining up to 5 acres.
Robotic lawn mowers are increasingly sophisticated, are self-docking and some contain rain sensors if necessary, nearly eliminating human interaction.
With no emissions and the demand of environmentally responsible technology on the rise, robotic mowers are increasingly becoming the mower of choice for the affluent, environmentally conscious homeowner or business.

Domestic robots

Entertainment

AIBO (**A**rtificial **I**ntelligence ro**BO**t, homonymous with "pal" in Japanese) was one of several types of robotic pets designed and manufactured by Sony
Being able to walk, "see" its environment via camera, and recognize spoken commands, the AIBO robotic pets are considered to be autonomous robots, since they are able to learn and mature based on external stimuli from their owner or environment, or from other AIBOs. The AIBO has seen use as an inexpensive platform for artificial intelligence research, because it integrates a computer, vision system, and articulators in a package vastly cheaper than conventional research robots. The RoboCup autonomous soccer competition had a "RoboCup Four-Legged Robot Soccer League" in which numerous institutions from around the world would participate. Competitors would program a team of AIBO robots to play games of autonomous robot soccer against other competing teams.

i-Cybie is a robotic pet that resembles a dog. It was manufactured by Silverlit Electronics. The i-Cybie robot responds to sound, touch, voice commands via remote control. Although i-Cybie does possess a limited amount of artificial intelligence, programming is not easily modifiable by the end-user, and it is not capable of autonomous learning. The i-Cybie was one of the first robot pets on the market that could power itself via its Walk-Up-Charger.

AIBO

i-Cybie

Domestic robots

Social robots

The **PaPeRo** is a personal robot being developed by Japanese firm, NEC Corporation. It is noted for its cute appearance and its facial recognition system. The robot's development began in 1997 with the first prototype, the R100, and adopted the name PaPeRo, which stands for "**Pa**rtner-type-**Pe**rsonal-**Ro**bot"
PaPeRo has been researched and developed with the intention of its being a partner with human beings and its being able to live together with them. For this reason, it has various basic functions for the purpose of interacting with people.
PaPeRo is a little helper during the day and can play games with people. In addition, when consulted with questions like "Is today a good day for a date?", or "Is today a good day for a drive?", PaPeRo will connect to the internet, obtain a weather report or information about a person's fortune and then say if today is a "recommended day." Furthermore, if PaPeRo is in a good mood, it will dance to please people.
Basically, PaPeRo has a cheerful character that enjoys speaking with people, but will change depending on the way it interacts with people. Changes in character are expressed by the way it speaks, its vocal quality, its music, and the way it moves. Here are PaPeRo's representative characters.

PaPeRo

Robotic toy kits

Various robotic toy kits are studied in order to understand what sets a robotic kit apart from toys and what are possible things can be made out of these kits. Few of the popular kits are explained here below.

Lego MindStorm NXT:

Lego Mindstorms [15] is a line of Lego sets which consists of Lego blocks with programmable bricks ,servo motors , sensors (ultrasonic, sound, touch, and light), and additional mechanical components such as (such as gears, axles, and beams) to form different robots .These bricks can be programmed through an intuitive drag and drop NXT interface over PC

MA-VIN Robot Kit

Features

-Modular construction for easy reconfiguration
- Valuable educational tool for robotics
- Easy Icon-based visual programming for beginner
- Also programmable in C with WINAVR
- Uses standard I2C Bus for sensor ports
- Expandable by optional modules
- Develop skills in microelectronics, programming, robotics, sensors
- Great teaching assistant for group challenge
- Good for teaching C programming

Applications

-Line Tracer detect and follow line
- Light Tracer interaction with light
- Sound Tracer interaction with sound
- Pathfinder navigate a maze
- Robot Sports Soccer, SUMO

Lego MindStorm NXT

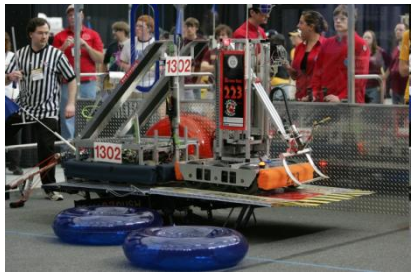
MA-VIN

Sensors


FORCE SENSOR
To measure force contact with the enviornment
TILT SENSOR
To measure inclination
ACCELEROMETER
To measure the acceleration.
ON-OFF SENSORS, no o/p on screen.
DISCRITE SENSORS
Gives a range of values, given o/p on display
ANALOG SENSORS
POSITION SENSOR
To know the exact position of robot
PROPRIOCEPTIVE SENSORS
GYRO SENSOR
It is used for Balancing robot
Sensors
EXTEROCEPTIVE SENSORS
Electromagnetic Sensors
detect electromag. waves
Ultrasonic sensor
works on sound frquency.
SOUND SENSOR
responds to sound or can be triggered
COLOR SENSORS
Sense colours in RGB composition
BIOLOGICAL SENSORS
LIFE
In detecting airborn microorganisms & other biological factor
CHEMICAL SENSORS
senses smell & odour & concentration of elements in air.
LIGHT SENSOR
Respond to change in light intensity & can be triggered
LINE SENSOR
senses the line and follow it (high contrast)
DEPTH SENSOR
depth
senses depth of bore
PROXIMITY SENSOR
sensor
object
measures relative distance betw. sensor and the object.
TOUCH SENSOR
gives feedback when touched or can be trigger by touch
Temperature sensor
senses any change in temperature & give feedback
PRESSURE SENSORS
It sense the pressure on the surface
COMPASS SENSOR
N
locates the direction object facing.
SIDESCAN SENSOR
It senses the side walls and pass through

Robotic Competitions




Basically robotics competition encourages enthusiast to built robots for competition and in the process they about robotics.

Micromouse
Techfest, IIT Bombay.

Trinity fire fighting robot
Trinity College in Hartford, Connecticut, USA.

First Lego league
FIRST : For inspiration & recognition of science and technology.

Botball
program of the KISS Institute for Practical Robotic

VEX robotics
VEX Robotics Design System.

TRICKS
ThinkLab,TRI.

Movies on Robot

Various movies on robots were seen like Wall-E, i-Robot, etc. These robot movies help to analyze the robot behavior, their emotions and personality. The movie characters are basically futuristic and are imaginative but still they give a sense of realistic robots and gives a good inspiration to work in this field.

User studies and analysis

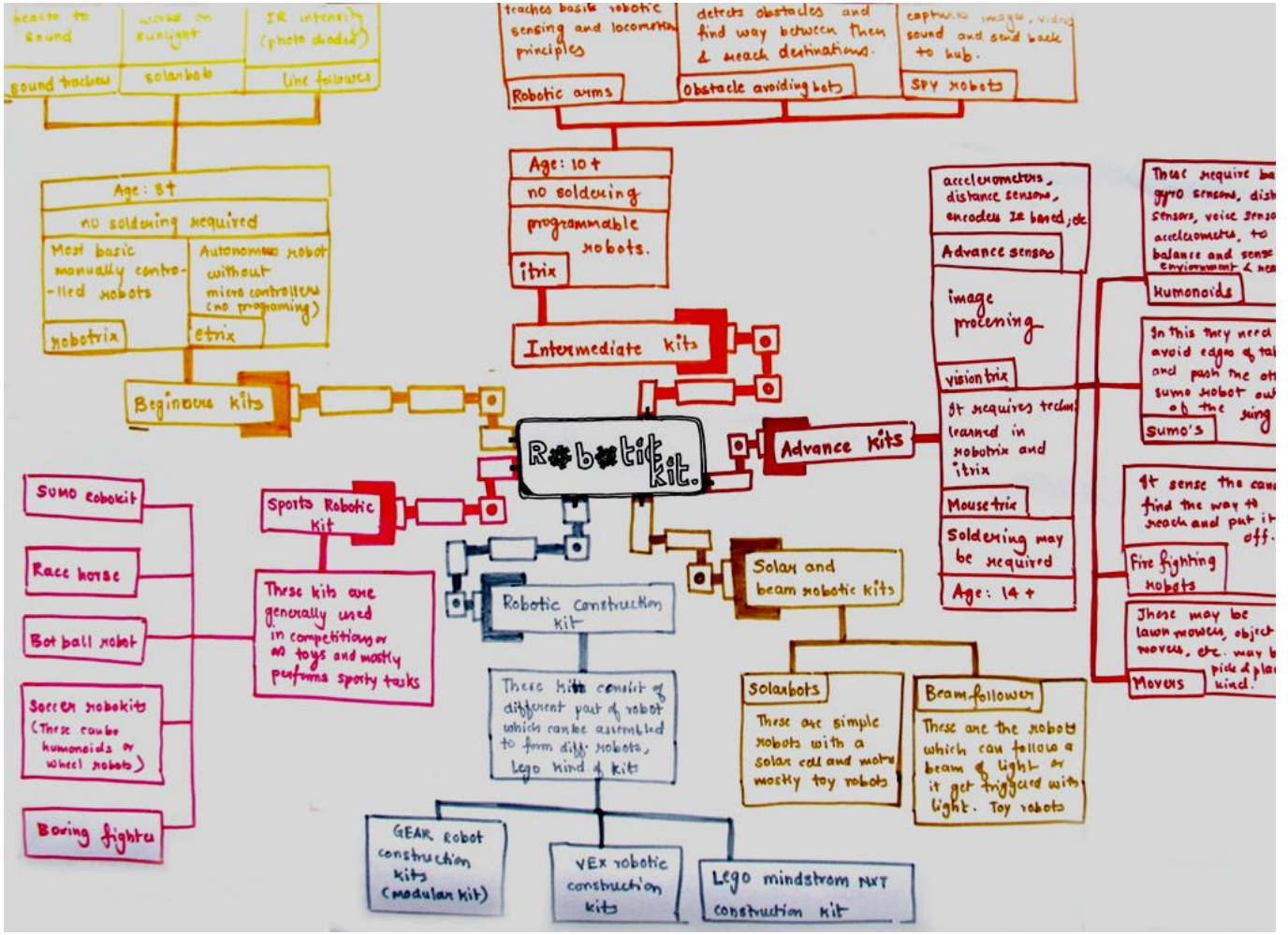
After the research and data collection, experts from the robotics field were contacted to know more about robotics, the current trends, cutting edge technology, their work on robotics, etc. Inputs were taken from them on what all basic components should a robotic kit have. They also gave information about the robotic workshops organized by them. What all is covered in the workshop and difficulty levels in the workshop (beginner, intermediate and advanced level).

Robotic experts:
Name: Mr. Mufaddal
Age: 23 years
Computer Engineer
Currently working with TRI Thinklabs.
Project : Designing of PCB's
Development of new robotic kits.
New Designs (Functions)
Name: Mr. Adwait
Age: 24 years
Instrumentation & control system Engineer
Currently working with TRI Thinklabs.
Project : Two wheel balancing robot

Analysis
Problems faced by students using kits **:**
Fixing screws
Over a period of time Robot shakes.
Problem with gear matching.
Problem matching holes of two parts due to manufacturing defects
Shorting of PCB because of metal chassis
Damaging Sensors due to sorting.
Breaking of Acrylic chassis

Classification of Robotic Kits

- Beginners kit
- Intermediate kit
- Advanced kit



Robotic workshops

Following insights were evolved after discussing with experts.

roboTrix (Beginners level)
most basic manually operated robots.

eTrix (Beginners level)
Autonomous robots without microcontroller, no programming required.

iTrix (intermediate level)
Programmable robots.

visionTrix (Advance level)
Robots with image processing, use accelerometers, distance sensors, encoders IR based.

mouseTrix (Advance level)
For this robot students need to combine knowledge from roboTrix & iTrix.

Market survey

After data collection, research and talking to experts a market survey was done to study the various robotic kits available in the market. I met Mr. Harish owner of the MAC-NET Technology, a robotic shop at lamington road. In the meeting Harish told about the various kinds of kits available in their shop. They have some basic kits for beginners as well as advanced kits for experienced. They also supply various components required to build a robot.

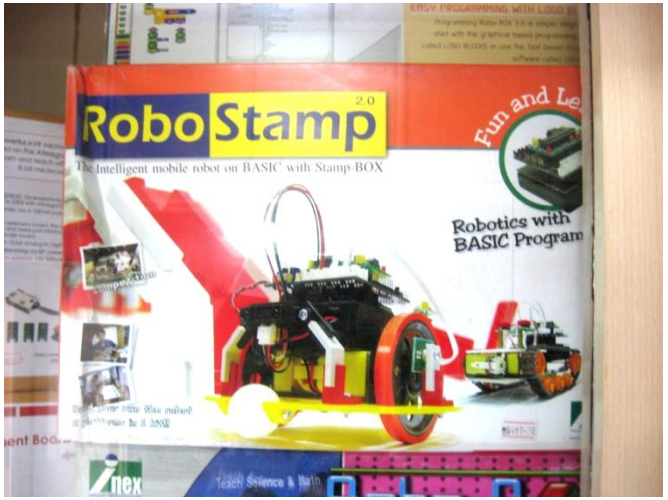
Beginner level kits are the most basic one to build manually controlled robot. Beginner's kit can have autonomous robots with pre programmed microcontrollers, which does not need any programming or soldering. Examples for beginner level kits are sound trackers, solarbots, line follower, etc.

Intermediate kits where in soldering is not required but some kind of programming is required. These kits are for age group of 10+ kid's. Some examples are Robotic arms which teaches basic robotic sensing and locomotion principle. Obstacle avoiding robot which detects obstacle in the way and finds a way between them and reach the destination. Spying robots captures images, videos, sound and send back to the hub.

Beginner level kits

Intermediate kits

Robotic Kits

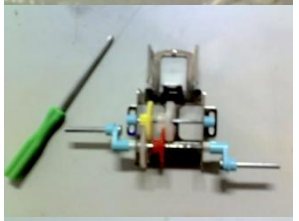


Advanced kits sometime requires soldering and some knowledge of programming. It includes stuffs like image processing, uses advanced sensors like accelerometer, distance sensor, encoders, etc. Some examples of these kind of robots are
Sumo's. These robots have to avoid edges of table and push the other sumo robot out of the ring.
Fire fighting robots these robots basically sense fire finds the way to reach it and put it off.
Humanoids basically requires balancing gyro sensor because it stands on two feet, distance sensors ,voice sensors, accelerometers to balance and sense the environment and react.

There were other shops Visha electronics, Gala electronics and Vega electronics. These shops provide components only and not robotic kits.
Some robotic toys available in the market which are remote operated and mainly in humanoid form. "Robosapien" is a humanoid robotic toy. The toy is capable of a walking motion without recourse to wheels within its feet. It is also able to grasp objects with either of its hands, and is also able to throw grasped objects with a mild force. It has a small loudspeaker unit, which can broadcast several different vocalizations.

Study of Robotic Kits

A beginner level robotic kit “solabug” was studied. The kit consists of a body and leg parts, lots of washers, nuts and screws, gears, and motor. It takes approximately four hours to assemble the complete robot. The manual provided with the kit is not clear and its difficult to understand which part to match with which one and where to fit. Too many components confuses and difficult to handle.



User Study

User study was done with some children. Question were asked to them like what is their idea about robot, have they seen any robot, what all purpose robot can be use, etc. Then they were asked to draw picture of robot to get their perception of robot. Kids were invited to IDC to see a movie on robot, to show them some toy robot and play with it. Their behavior with the robot was observed and monitored to get an idea of what all the things they do with the robot, what comments they make, etc. After this session some questions were asked to the children like what they liked in the movie, which character they like the most and why and which features of toy robot they like the most.

User statements

- क्या स्पीड है
- सबको बचाता है
- कुछ भी कर सकता है
- रोबोट से हम कुछ भी करवा सकते है
- रोबोट स्टील का होता है
- रिमोट कण्ट्रोल से चलता है
- लाइट भी निकालता है
- उसकी आँख मैं लाइट होता है
- रोबोट उड़ भी सकता है
- आग भी बुजाता है

User Study

Observations and insights

- They like robot obeying there order
- Speed matters them a lot
- They think robot are made to help and save others.
- They have this feeling that robots can do anything
- Robot is a tough guy
- They are very excited with the way robots move n do things
- They like playing with remote They like new things to explore like when I showed them six legged machine, they are more curious about how it works.
- They like the sound n light feed backs from robot
- They like multi-tasking robots.

User group

Main objective behind this study was to understand toy design process and most importantly what constitutes Play Value among toys.

Age Groups

Different age groups defined for toy design are as follows.
A.Babies from birth to one year. .
B.Toddlers: One to three years.
C.Pre-schoolers: Three to five years.
D.School age: Six to nine years.
E.Senior schoolers :Nine to twelve years.
F.Teenagers. Thirteen to Eighteen years
G.Adults Eighteen above

So I have decided to design a kit for the age group of 8+ kids and

PLAY and **LEARN** as keywords.

Game and toy design consideration

Play value

Play value is defined as "A characteristic of products with features that

- promote a child's interactive exploration &
- use a child's imagination &
- ability to pretend to create enjoyable play and
- incorporates a child's interest to encourage repeat play"

Some of the aspects that constitute play value are:

Fun

When they are fun and engaging, playthings are said to have play value.

Involvement

In short, objects of play must be compelling and encourage the child's involvement in order to have true play value.

Long lasting uses

Play products should last as long as possible and have many different and long lasting uses

Multiple uses

Toys tend to have high play value when they may be used, engaged and employed in manifold ways

Self-directed play / Control

Children need to be in charge of their own play activity.

Game and toy design consideration

Appeal to more than one age or stage of development

Those games with strong playability appeal to more than one age or stage of development. For example, Monopoly and

Promote respectful interaction

Toys have greater play value that promote respectful, non-violent and non-stereotyped interaction among children. For example,

Useful for further learning

Play value is enhanced by toys and games that help children develop skills useful for further learning and mastery such as Scrabble and The Game of Life

Excitement /Stimulus hunger

Toys should try to satisfy tremendous stimulus hunger that children have. It Their senses are sharply sensitive and constantly in search of excitement. They are too inquisitive to explore the world.

Creative Play

Creative play is expressed when children use familiar materials in a new or unusual way, and when children engage in role-playing and imaginative play.

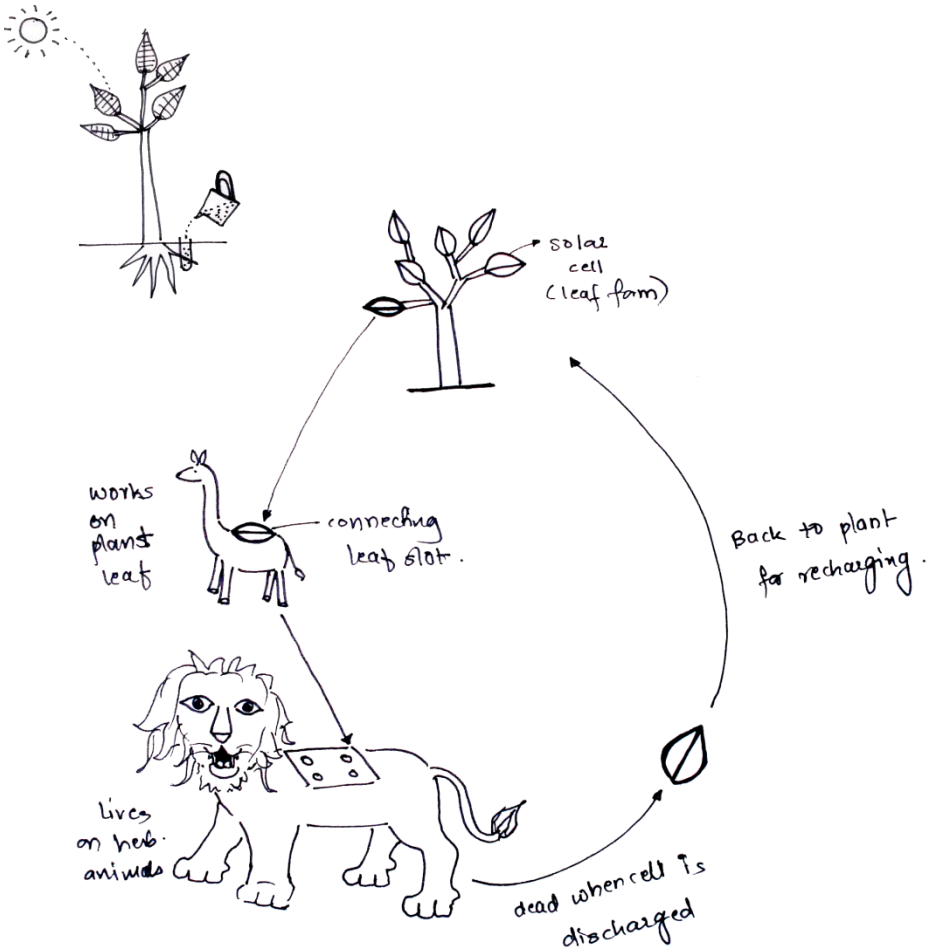
Foster Imagination

Play helps develop each child's unique perspective and individual style of creative expression.

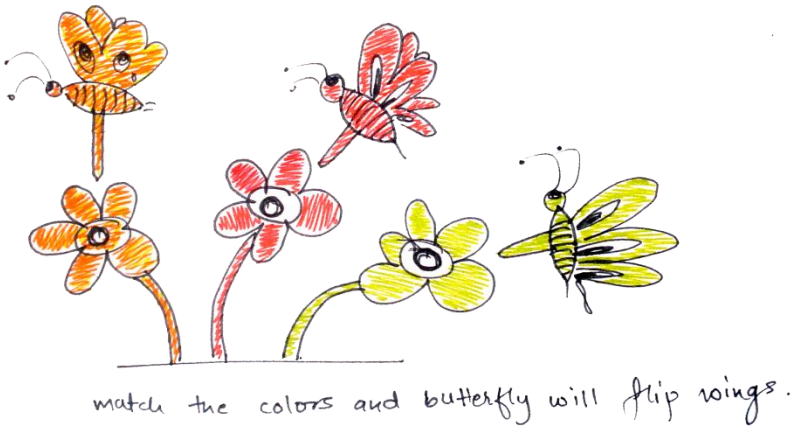
Initial explorations

Idea 1

This idea was to explain the biological life cycle in which the detachable leaves of the plant are solar cell. After connecting all leaves and kept in the sunlight, the plant gets energy from sun and the branches starts moving slowly. The solar cell leaves gets charged. Then the solar cell leaf can be detached from the plant and connected over the herbivorous animal which feeds on plant, so the animal starts movements and looks like as if it came to life after eating those leaves. . The legs of the animal are connectors which can be connected at the back of carnivorous animal. Finally when the cell is discharged and the animal stops working. The leaf then can be removed and connected back to plant to recharge it

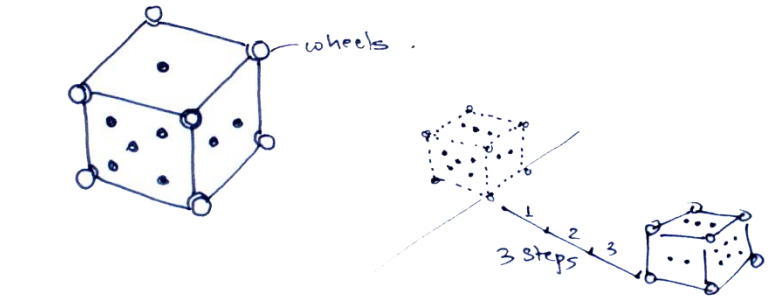


Initial explorations



Idea 2

This idea is to match the color of flower and the butterfly. Kids need to put the butterfly over the flower. If the color of the flower and the butterfly matches then the butterfly flips its wings.



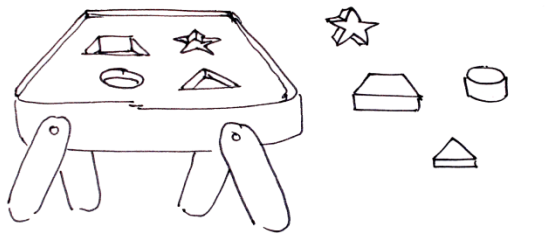
Idea 3

In this idea there is a dice with circular wheels on all Its corners. So when one rolls the dice and which count comes at the top face the dice takes those much steps forward. When the dice is rolled, it takes that many number of steps as that of its count. .

Initial explorations

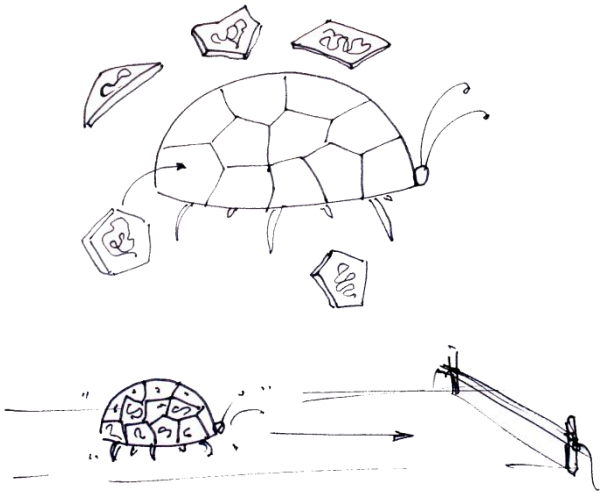
Idea 4

This idea is to match shapes. In this there is a robot with different shape sockets at the back of the robot and there are different shapes which fit over it perfectly. When kid fits all shapes over it correctly the robot circuit completes and it runs .

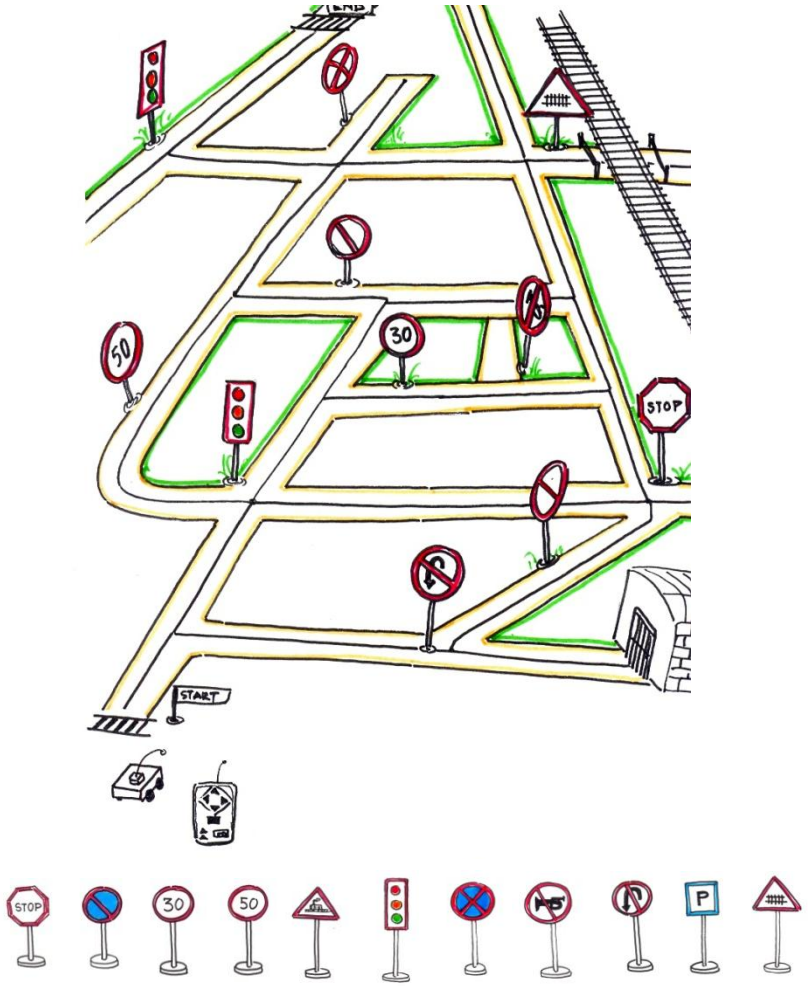


Idea 5

In this idea kids have to solve a puzzle to activate the bug. The shell at the back of the bug is in the form of a jigsaw puzzle. Once kid solve the puzzle correctly and connect it the bug will get activated and starts running. Kids can play race with it by connecting the jigsaw puzzle at the starting point and put the activated bug on the race track.



Initial explorations

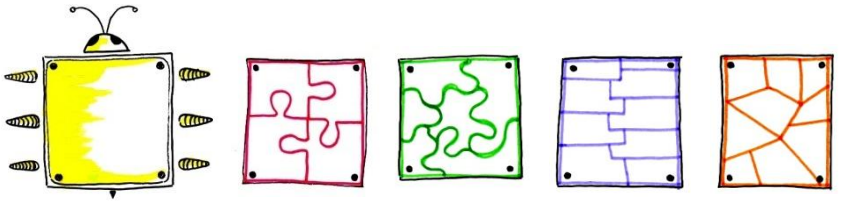


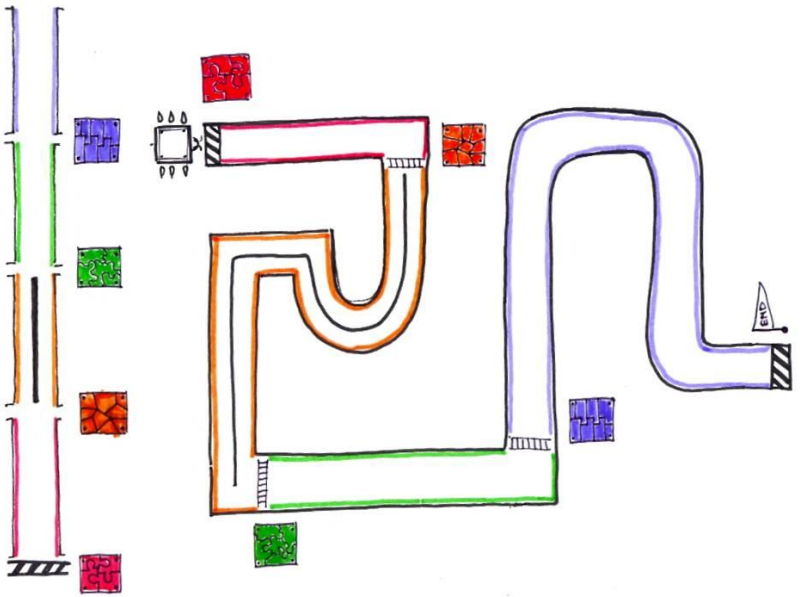
Idea 6

This idea is to teach and make the kids aware about the road side traffic signs. In this there will be a board with a road map on it. There will be small connector socket holes besides the road. In those holes small traffic sign board can be fitted. These traffic sign boards with RFID tags on which will be detected by a base server. Kids will be provided with remote controlled robots and they have to guide the robot from the starting to the end point following the road signs. If any of the sign rule is violated then the kid will lose control over the robot and the base server will take the robot to the jail.

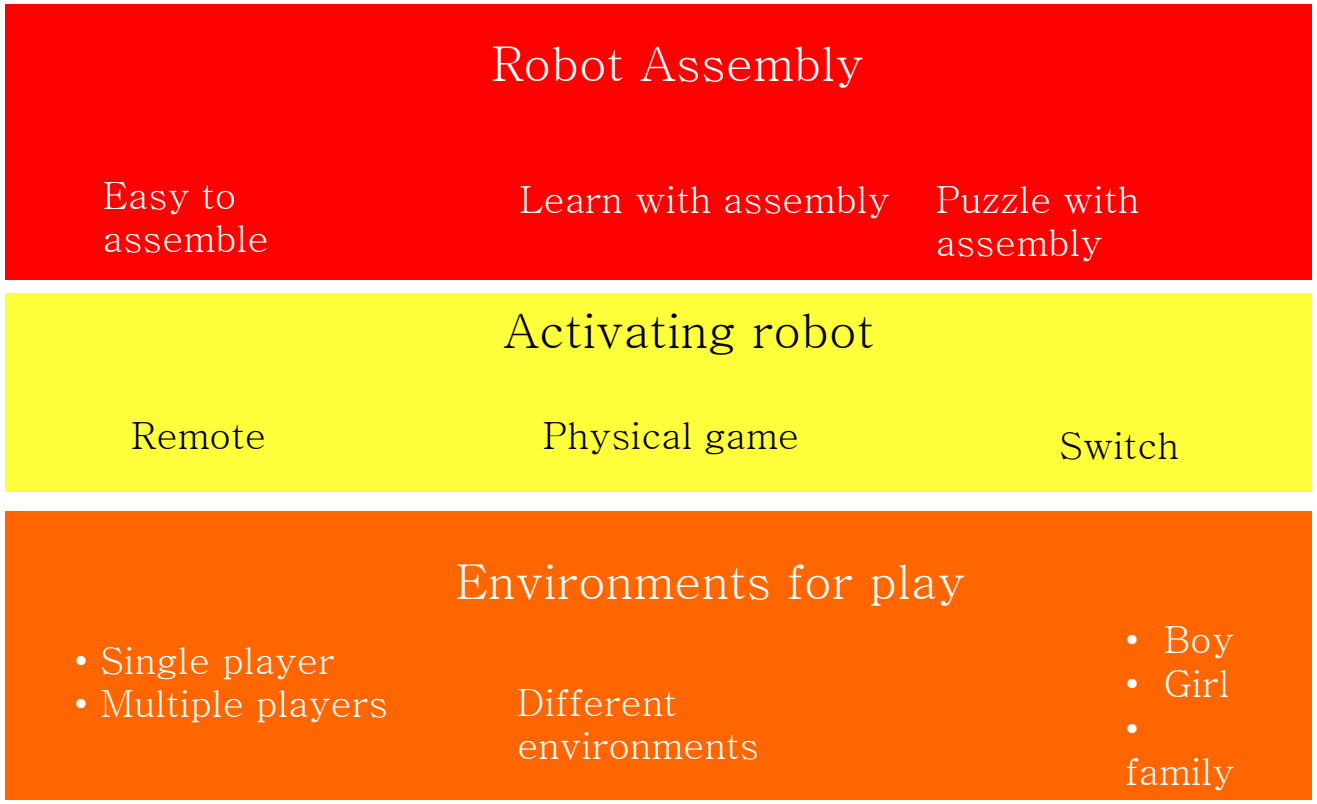
Idea 7

In this idea there is a robot with various types of sensors and the robot can perform activities like to follow a line to Follow light, avoid obstacles, respond to sound.
There are different puzzles which fits at the back of the robot. The idea is to activate each sensor with each puzzle.
Kids can play relay race with itor they can use individual activity of robot and can play any other game.
Kids can build their own race tracks and can keep each puzzle at certain check points where kid have to replace The other puzzle over it and move it forward.
Likewise they need to solve all puzzles to reach the destination point.





Project Domains



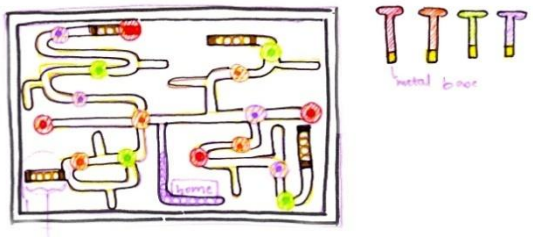
From initial ideations I divided my project into three domains:
Firstly different ways of assembling a robot. Children can learn through assembly, after my user studies I found that available kits are very difficult to assemble so it should be easy to assemble, and it could be solving puzzle to form an assembly.

Secondly the ways of activating it.
It could be by remote, by switch or by any physical game.

Third was the game environment where children can play with the robot.
The game environment could be for single or multiple players. There could be different environment which ever the kid likes. They can buy environment separately.

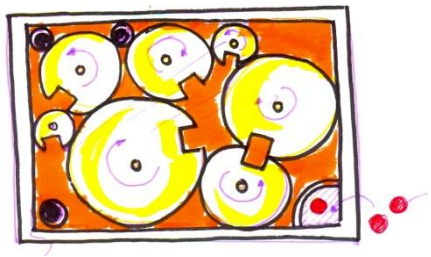
Secondary ideations

Ideation on activating robot through games



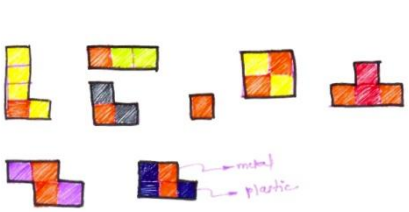
Idea1

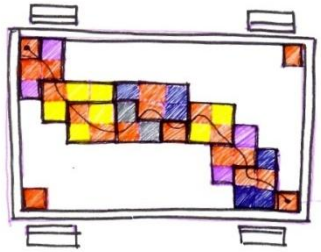
In first idea there are four nails of different colors and with A metal bottom. There is a maze with four end points. The kid have to take four nails of same color at the given end point where the metal bottoms of four nail connects together to activate one sensor. Likewise each end point is for different sensor to activate.



Idea 2

In this idea there are three holes at the end between the rotating discs with a small cut on the surface. So kids need to take a metal ball all over from starting point to the respective holes to activate the sensor.





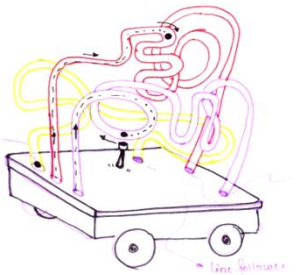
Idea 3

This idea has a rectangular platform with four metal connectors at each corner and there are some brick game forms in which some square are made of metal.
So kids have to arrange these pieces on the platform in such a way that it makes connection between the diagonal connectors to activate a particular sensor.

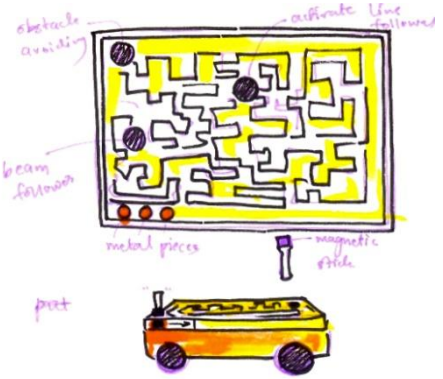
Secondary ideations

Ideation on activating robot through games

Idea 4
In this idea there are coiled hollow tubes which connects two ends in which other end is a hole where a sensor is activated. So there will be a metal ball at one point and kid have to take the metal ball all way round to other end to make the connection and activate a particular sensor.

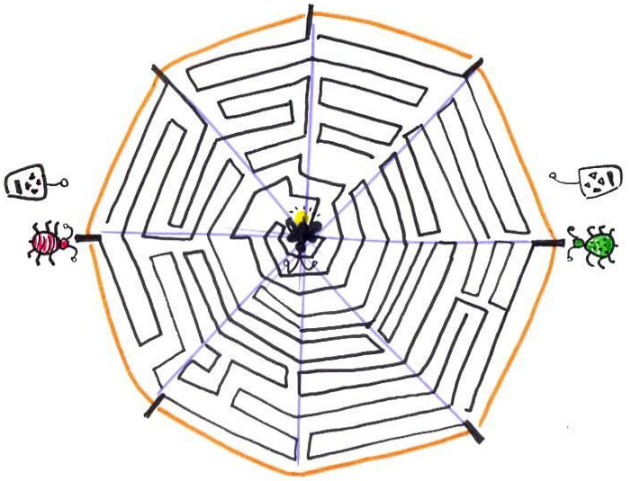


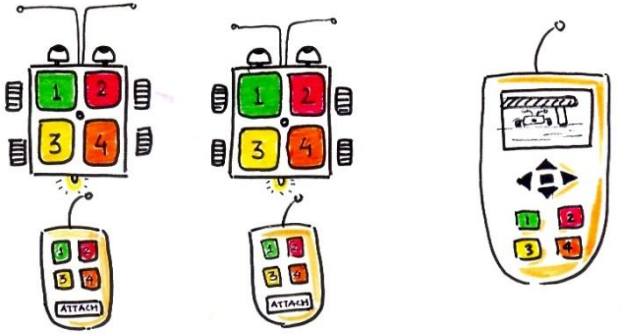
Idea 5
This idea has a maze on the flat surface and paths in the maze ends at certain holes and each hole can activate a sensor. Kids have a metal discs and a magnet which they can use to move metal discs in the maze to reach a end hole where they can activate that particular sensor and make robot run.



Idea 6
In this idea the shell of tortoise will act a number lock which can be activated with a personalized 3 digit number. Other way is to have a touch sensor on the tortoise head to activate it

Secondary ideations (game ideas)





Game ideas 1

This is a two player game. Each player will have remote controlled spider robot which can follow line. There is a line maze in form of spider web. At the centre of the web there is a fly. The task is to reach the center of the maze, grab the fly and return to the starting point. If the losing spider catches the other spider with the fly it can pull it back to its destination point and still wins the game

Game ideas 2

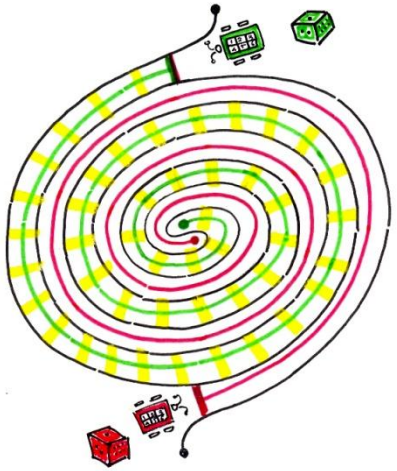
This is chor police kind of game where two kids will have one robot each. The robots have number buttons at the back. When same number or color button is pressed by both the kids the robots can give feedback. So one kid can hide his robot somewhere in the house and other kid have to press the same button which the hidden robot kids had pressed. So by matching and number and getting feedback one can catch other's robot.

Secondary ideations (game ideas)

Game ideas 3

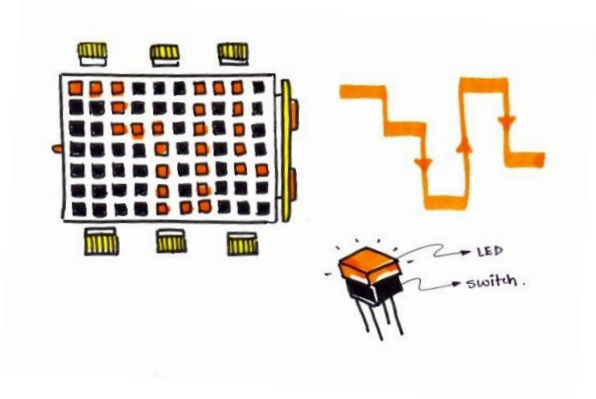
In this game there is a robot bug ,which runs on button cell, and can follow a line, follow light, bump detector and detect other creatures in the game. It is operated by a remote. The remote has manual controls to move the robot in the environment and auto mode buttons to make the robot follow the light or line. t's a two player game, one kid has to hide small creatures and button ell (which is food for the robot) in the environment, below houses and other kid has to search and take creatures to the end in minimum time. Each creature has its own points. Then the other kid have to hide creatures and food in the environment and opponent will have to beat the time taken by the first player.

Secondary ideations (game ideas)



Game ideas 4

In this idea there is a robot with six button at its back. The robot can follow a line. The game consist of a spiral board which ends at the centre. In the game the kid has to roll a dice and press the button at the back of the robot with number same as that of the dice count. The robot will move forward that many number of boxes in the spiral. The one who reaches the destination first wins the game.



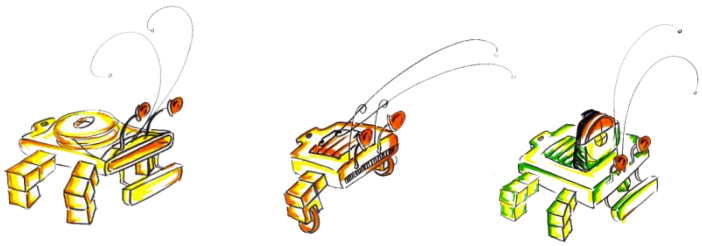
Game ideas 5

This idea consists of a matrix of LED switches at the back of robot. So one has to press LEDs and form a path and the robot will move in the same path formed.

Final idea

After initial and secondary ideation I have decided to freeze on game idea 3 as final idea because it can be made more playful, kids can built there own environment provided with the kit. They need to assemble the robot in the kit and play in the environment. Each environment consists of the game characters which fits over the basic robot from the kit. So kids don't have to buy the robot assembly again and again, but they can buy new environment separately.

Final concept



After finalizing the idea I had started working on the detailing the idea where in there will be a robot which a kid need to assemble, after that he/she needs to built the environment with the stuff provided in the kit where if it is a city environment then the houses, buildings, trees, etc things are provided in the kit which are paper crafted which unfolds and takes a house or a building form.
In the game there will be a Robocop which can sense small robot thieves hidden in the environment.
One of the kid need to hide the thieves in the environment and other kid has to drive the robot cop in the city and find all thieves and reach the end point with thieves in minimum time.
Then first player can hide the thieves in the environment
And second have to search all thieves and reach end point in time less that the time taken by the previous player.

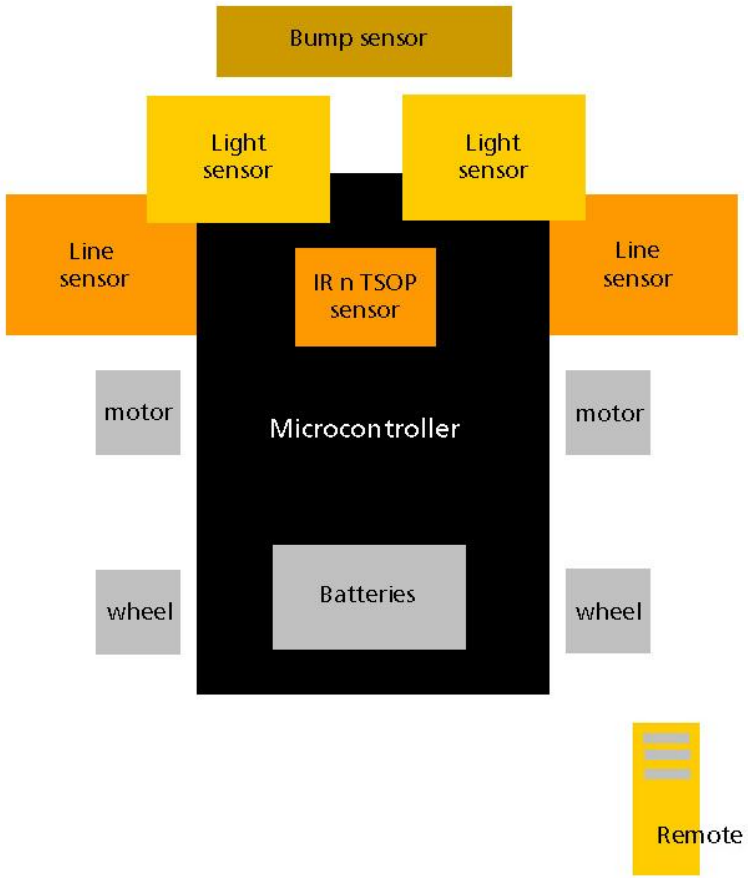
Kit

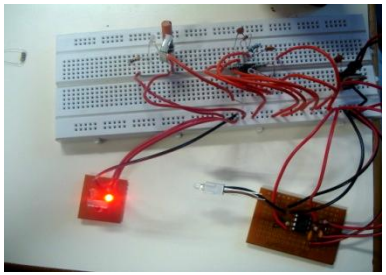
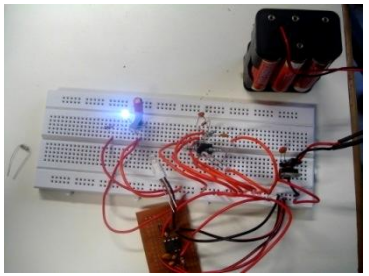
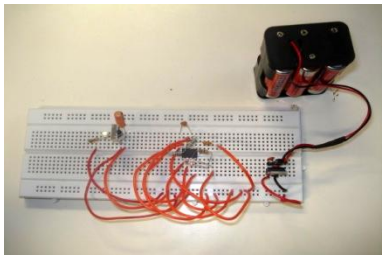
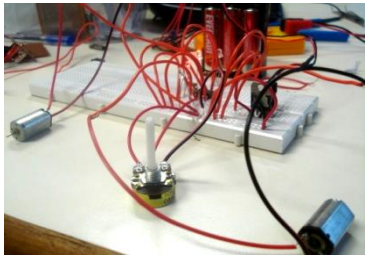
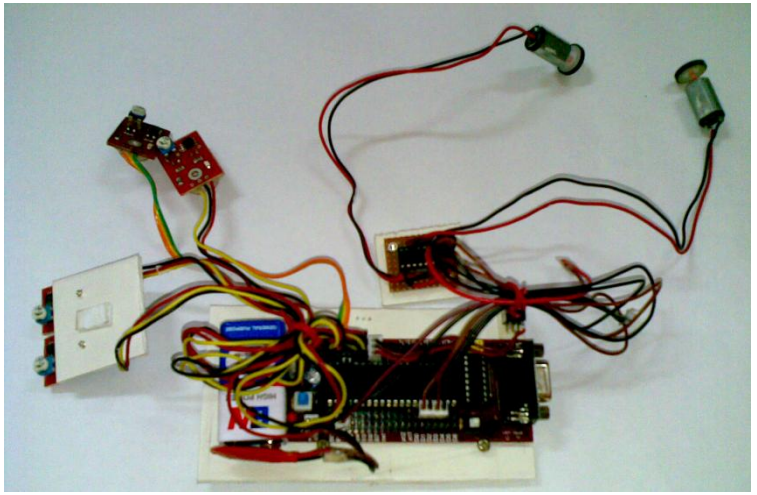
Components of kit

- A Robot (in different parts, which needs to be assemble)
- Remote to operate robot.
- Environment (select as per choice)
- Characters which fits over the robot depending upon the environment selected. (characters changes according the environment)
- Elements which robot can sense in the environment.
- Elements to make the game environment (can be made from paper, which can be folded and unfold to form a structure, which can be placed in the environment).
- Torch and black adhesive tape

Components of Robot

- It can follow the given line on the flat surface.
- It can follow the light.
- It can detect creatures or something as per the selected environment.
- It can sense bumps or collusions.
- Remote operated:
- Move in four direction manually.
- Separate buttons on remote to switch into line
- follower or light follower



Prototyping

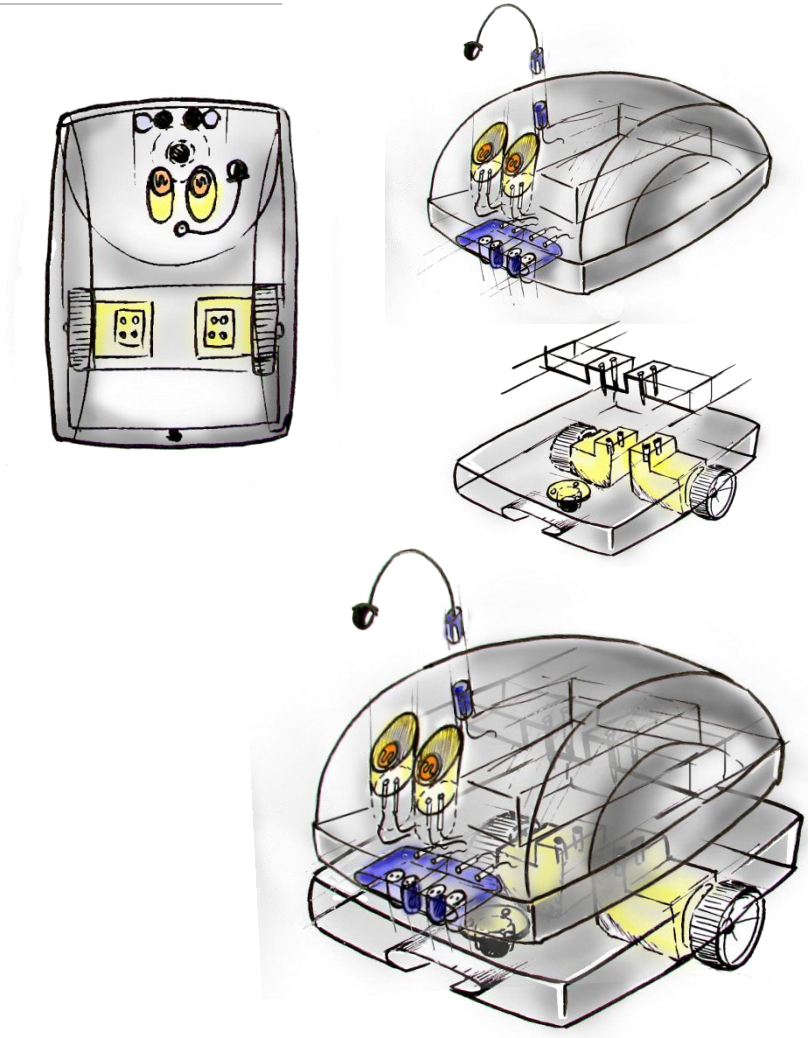
Circuit

For working prototype circuit part is very important. From TRI website got the basic circuit sensors. After discussing with the TRI experts finalized the circuit diagram and the components required. The various features short listed were line follower, light follower, motor driver, bump sensor, TSOP sensor, controller and 8 channel Rf module remote. After finalizing the circuit for each of these features and using the components suggested testing for each circuit was done on breadboard. After successful testing on bread board the printed circuit board was made and components were mounted on it.
Next step was to connect sensors and motors to the controller circuit. WINAVR was used to program the controller. A program was written to merge sensors and motor and loaded to controller. With all these completed setup testing was done.

Prototyping

Robot assembly details

After testing the circuit the outer assembly was done. Now as concept says the kit consists of a robot in parts which a kid has to assemble to form the final module.
From user study it was found that it is very difficult for kids to screw and assemble, so modules which can be fitted without screwing were thought of. So in this there is a chassis which consists of all the circuitry part and connections for sensors are taken out and each sensor becomes a module to be fitted to form a robot. Motor connections are also through connectors so wired connection is not needed.

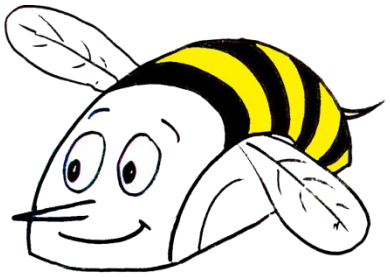


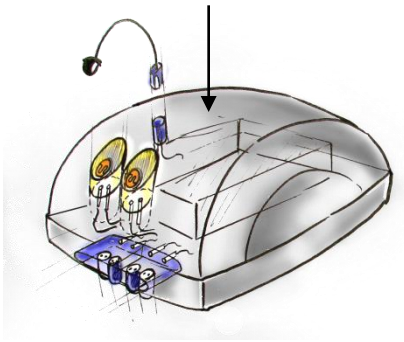
Prototyping

Environment

The kit also consists of _playing environment for the robot. Depending on the environment different game character module can be changed which can fit over the basic robot module.
For example if the environment is of city, then it has buildings, houses, trees, etc. so the kit will have a printed city map and paper crafted houses folded to form a flat module which can be unfolded to form a 3D house. Trees are also made from paper in pieces, which can be connected to form a 3D tree.
The kids can select one or more environment of their choices for a basic robot kit.

Prototyping (Characters)





Cop

thieves

Scenario

Rahul Rai
8years
Likes to play with
Robotic toys

He has many Robotic Toys.
Every month he buys a new robotic toy.

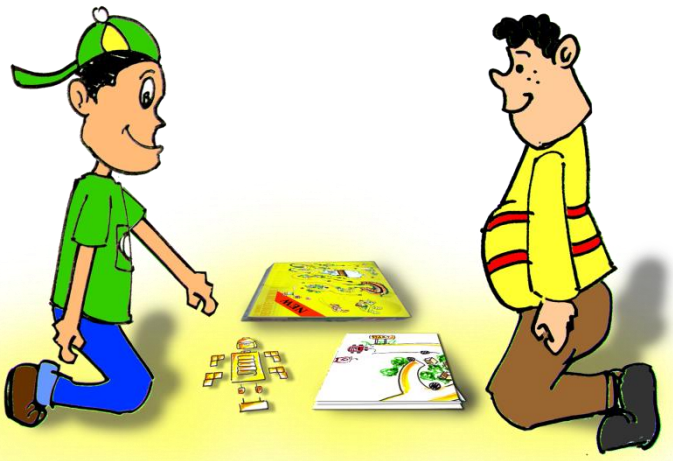
Scenario

Scenario

Next day in school he tells his friend about the new robotic kit he bought from market yesterday and invites him to play with him

Scenario

.....that afternoon after school



Scenario

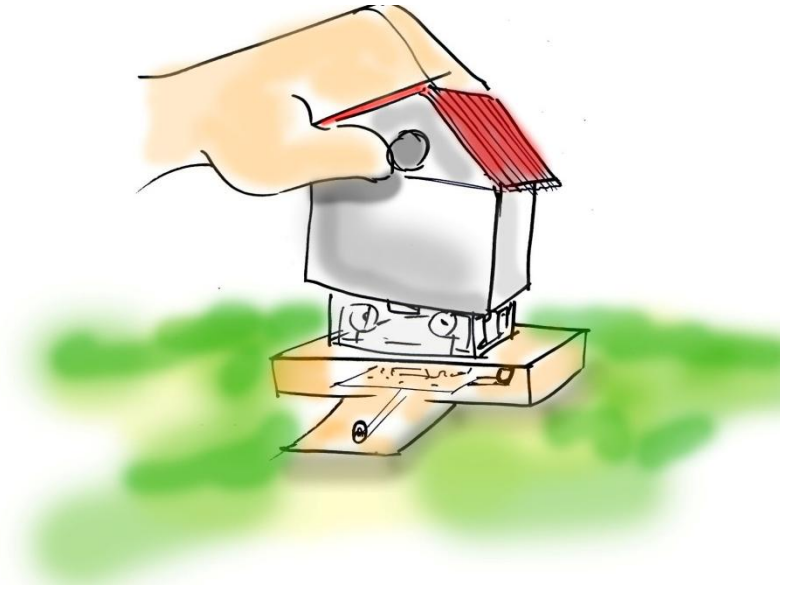
After reading instruction they start playing the game.

Scenario

Before starting they tossed to decide who will play first.

Scenario

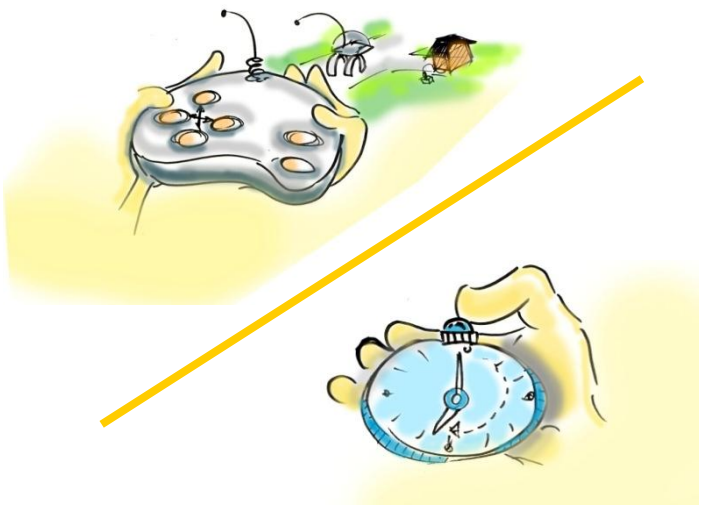
In the game one player hide the element in the environment and other has to search for it.



Scenario

So one player starts the game and other one records the time.

Player 1



Player 2

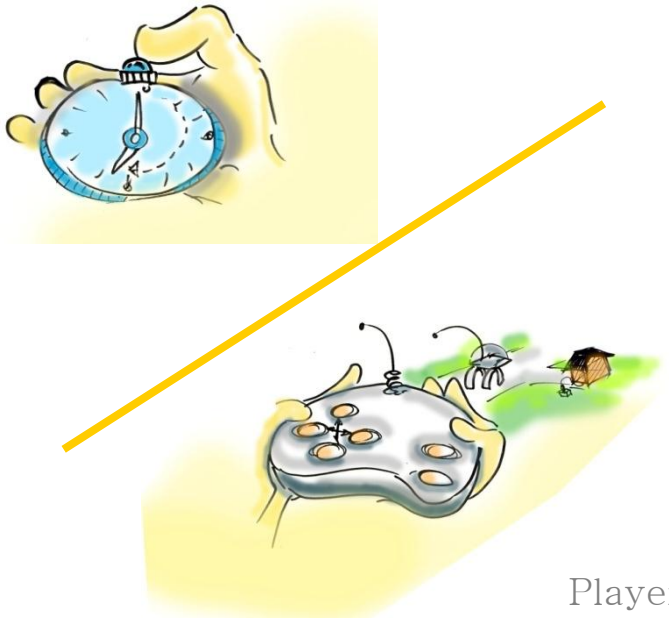
Scenario

First player completes the game in 10 minutes. Now other players chance and first player will now hide the elements in the environment.

Scenario

Now player2 starts the game and player 1 one records the time.

Player 1



Player 2

Player 2 completes the game in 12min 15 sec.

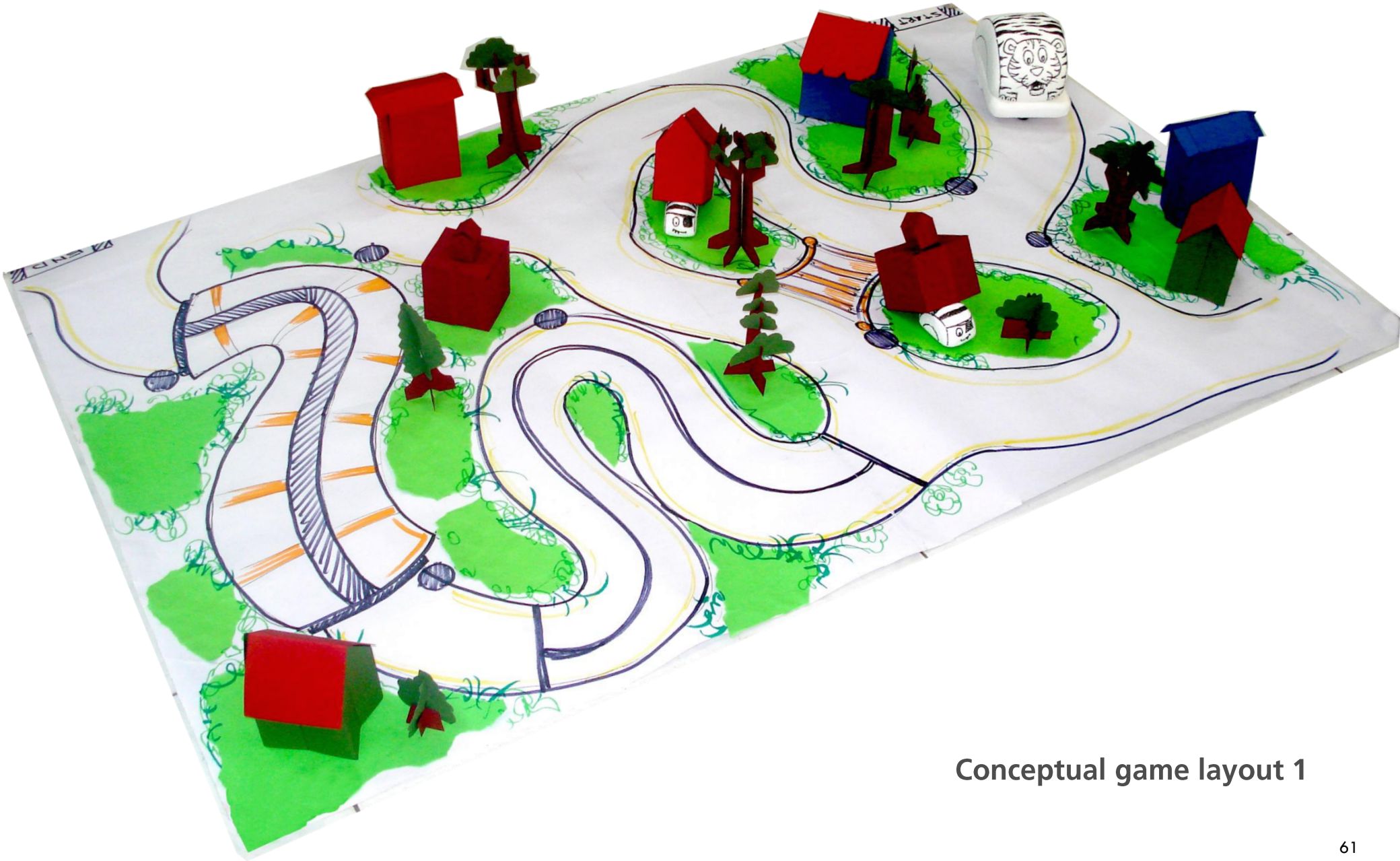
Scenario

So player 1 wins the game.

Mockup models

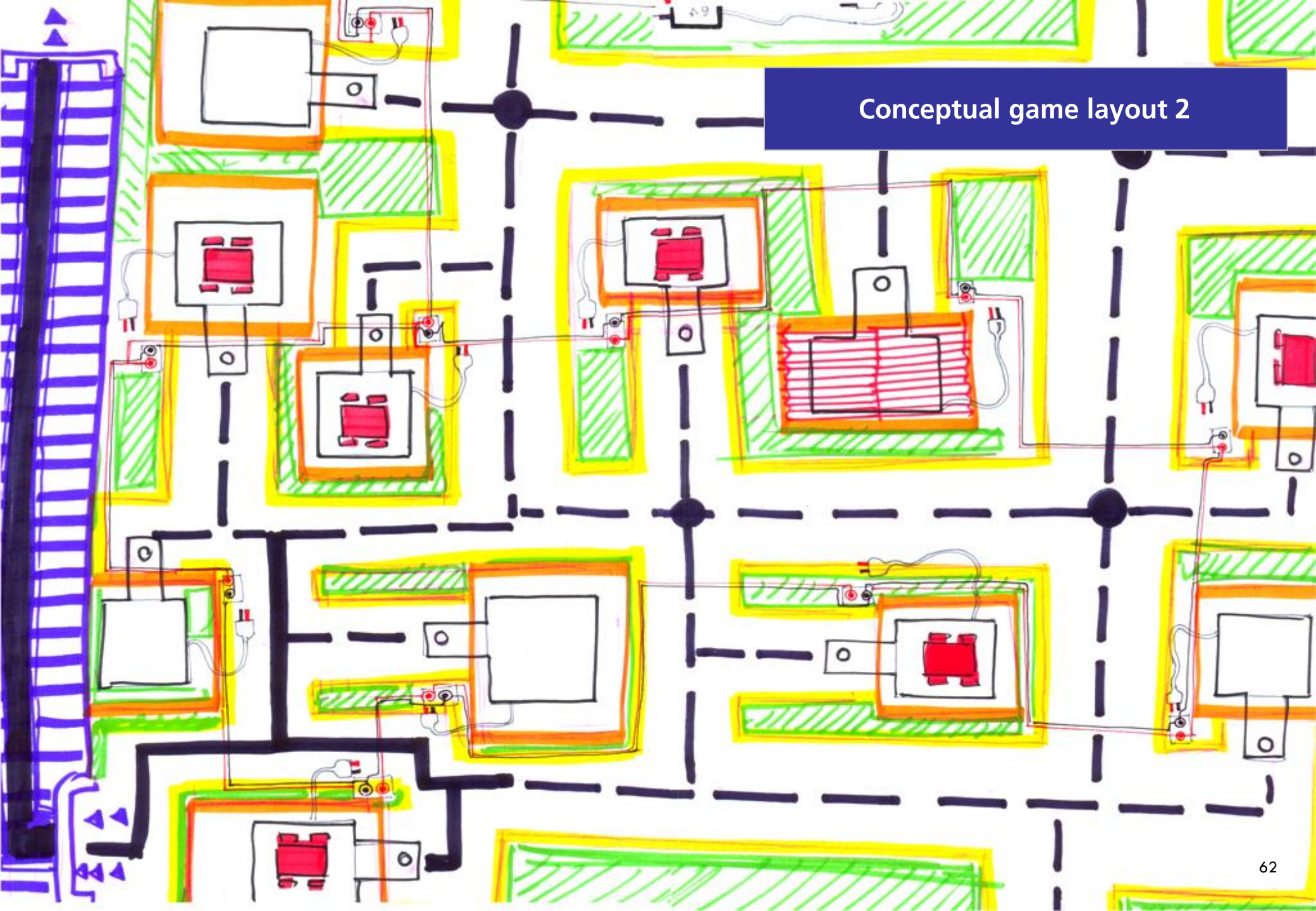
Conceptual layout of game

Conceptual game layout 1

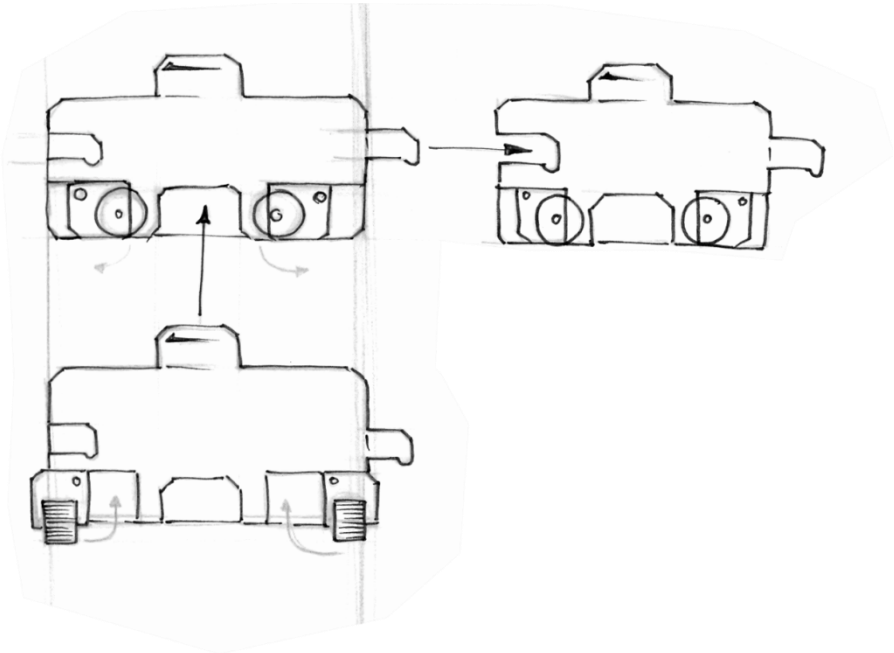


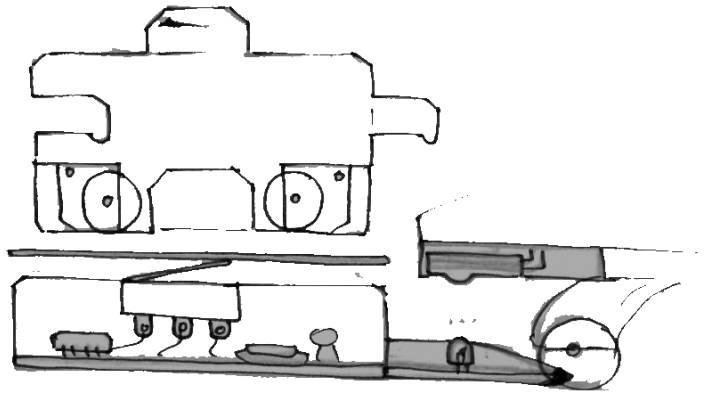
Conceptual game layout 1

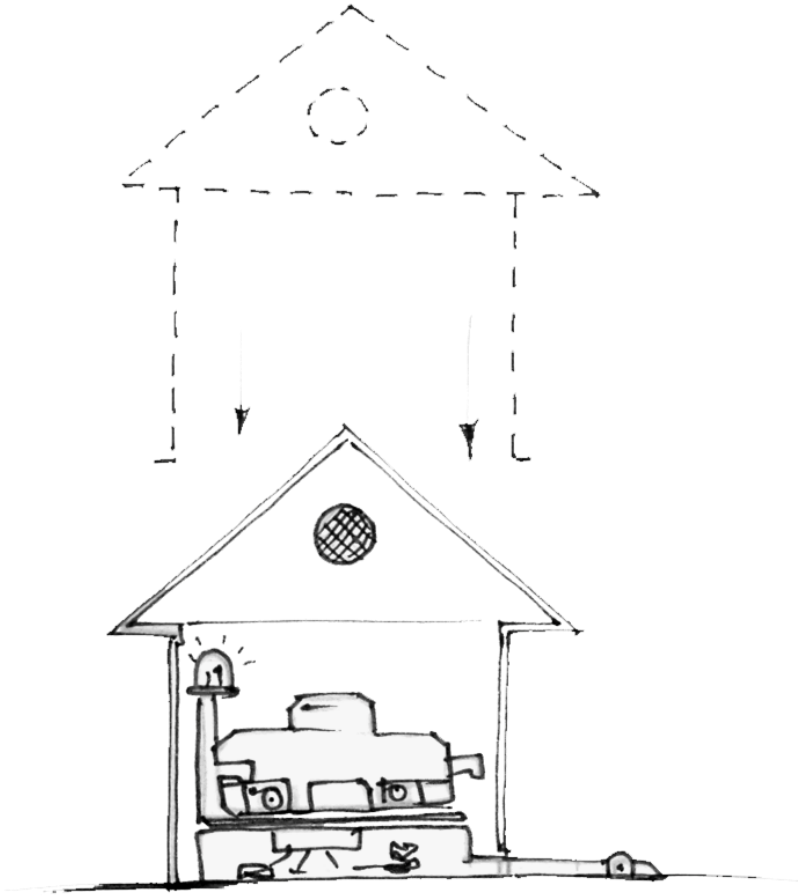
Conceptual game layout 2

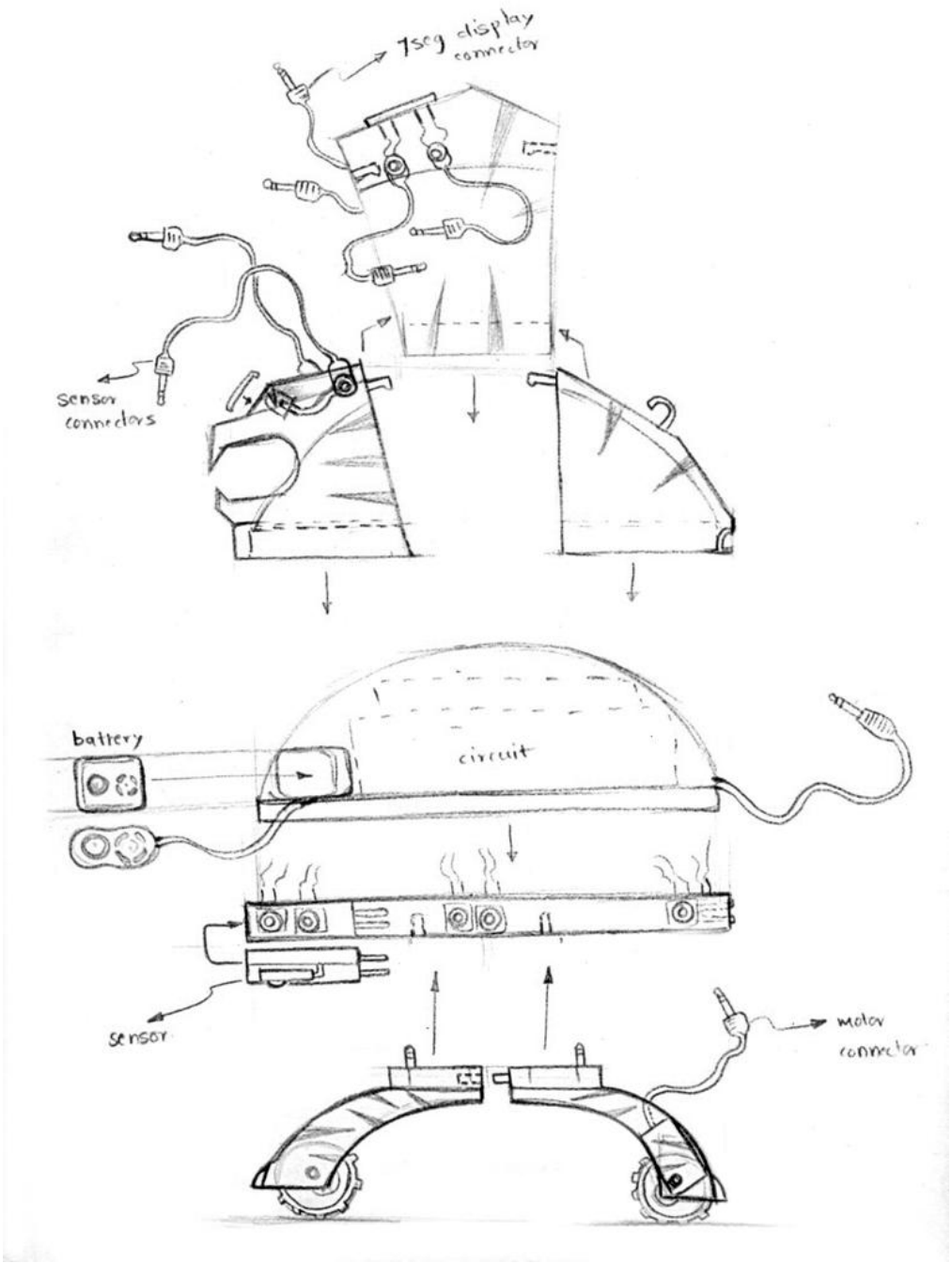


Elements in the game

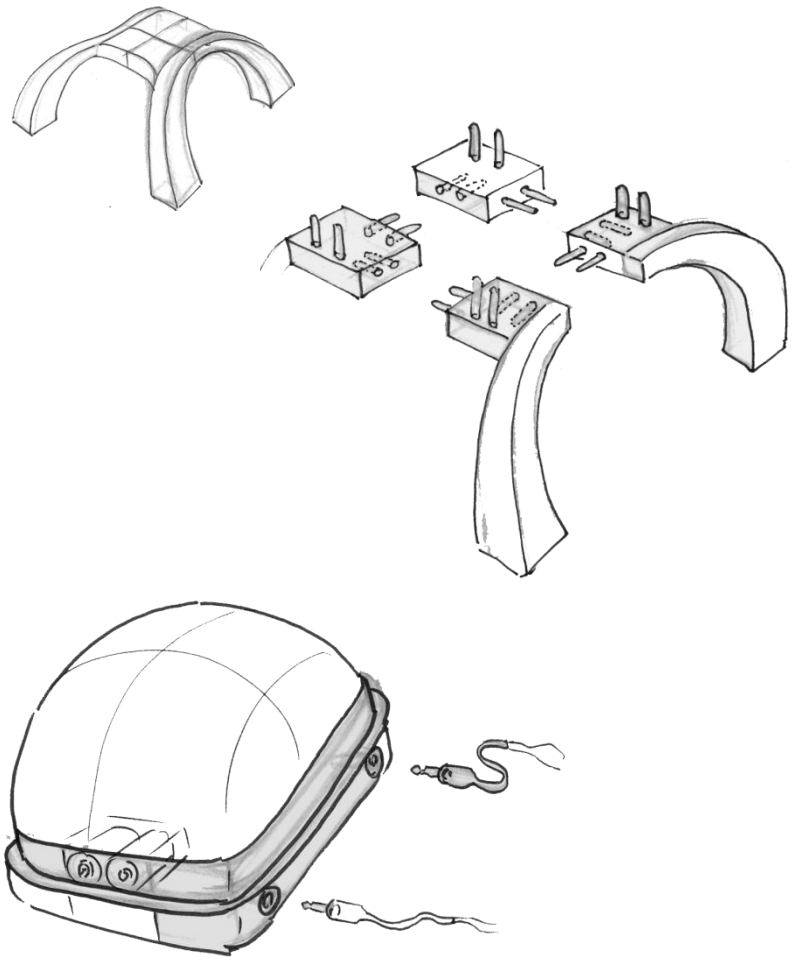




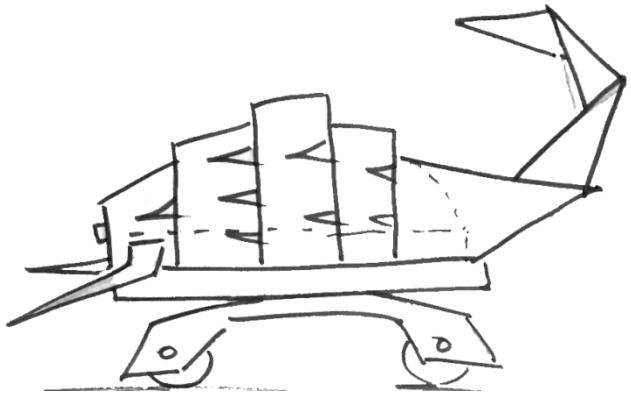


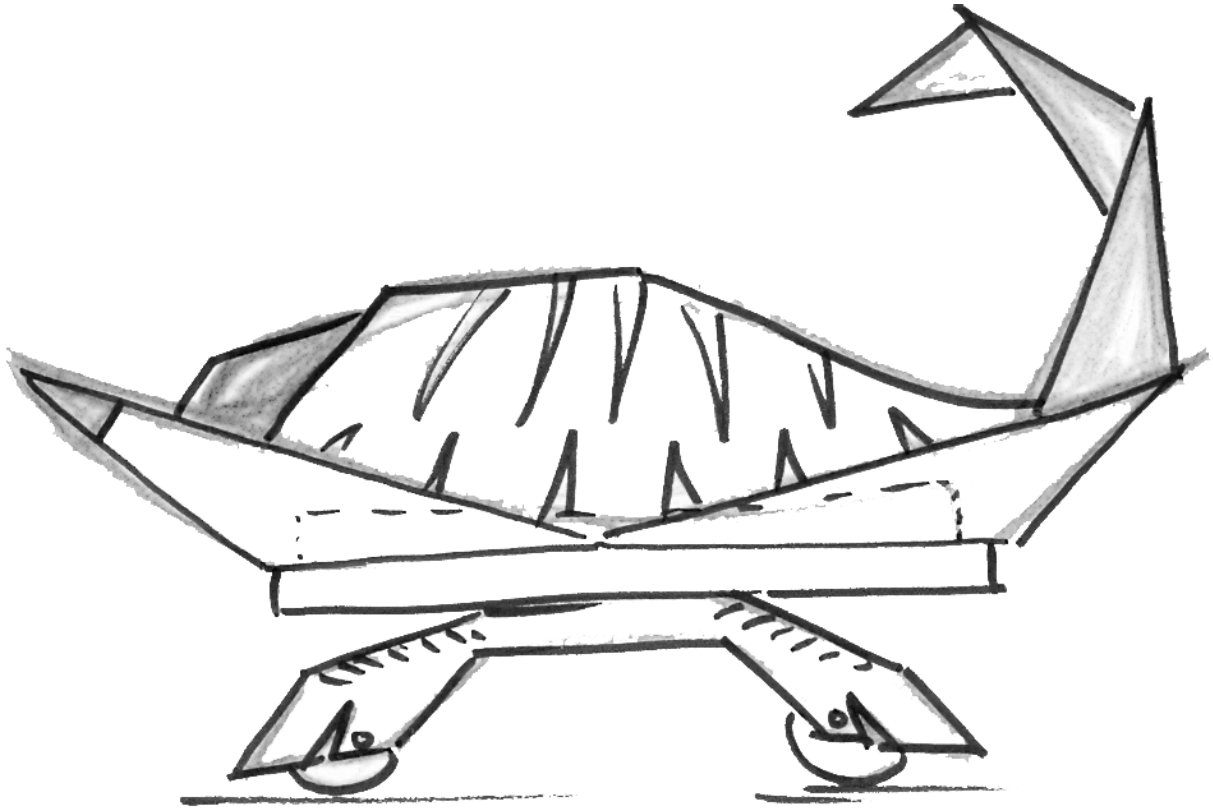


Robot Assembly

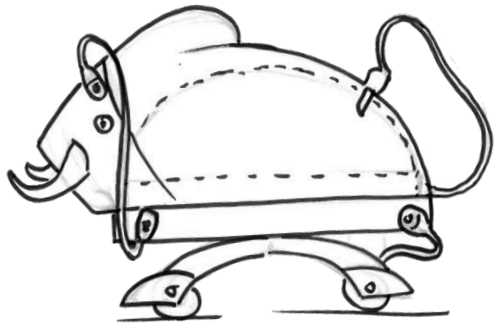


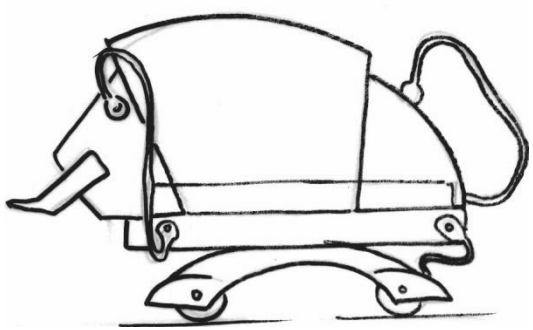
Robot Character (Scorpio)

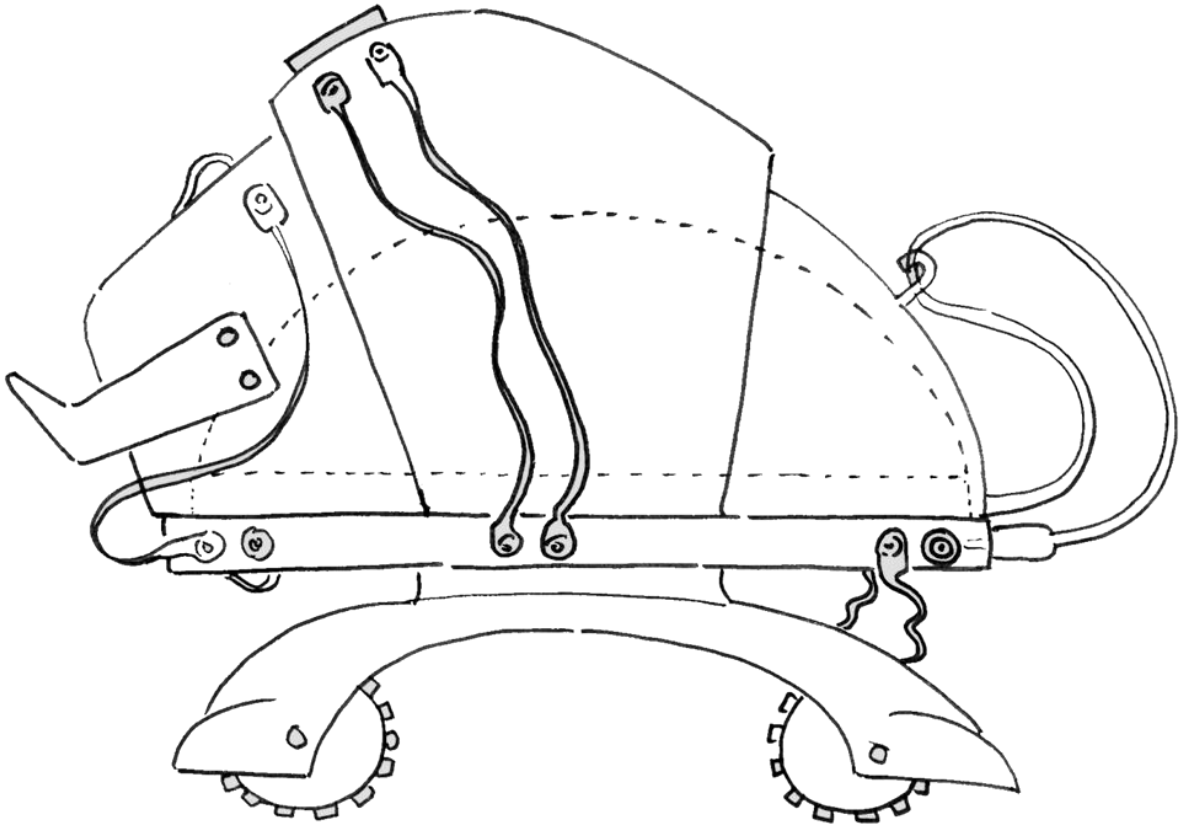




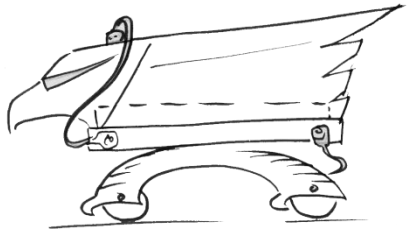
Robot Character (Bull)

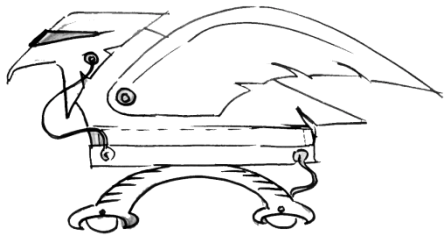


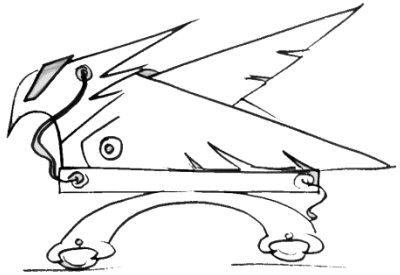


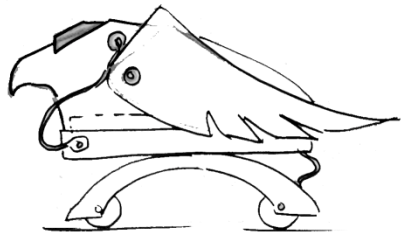


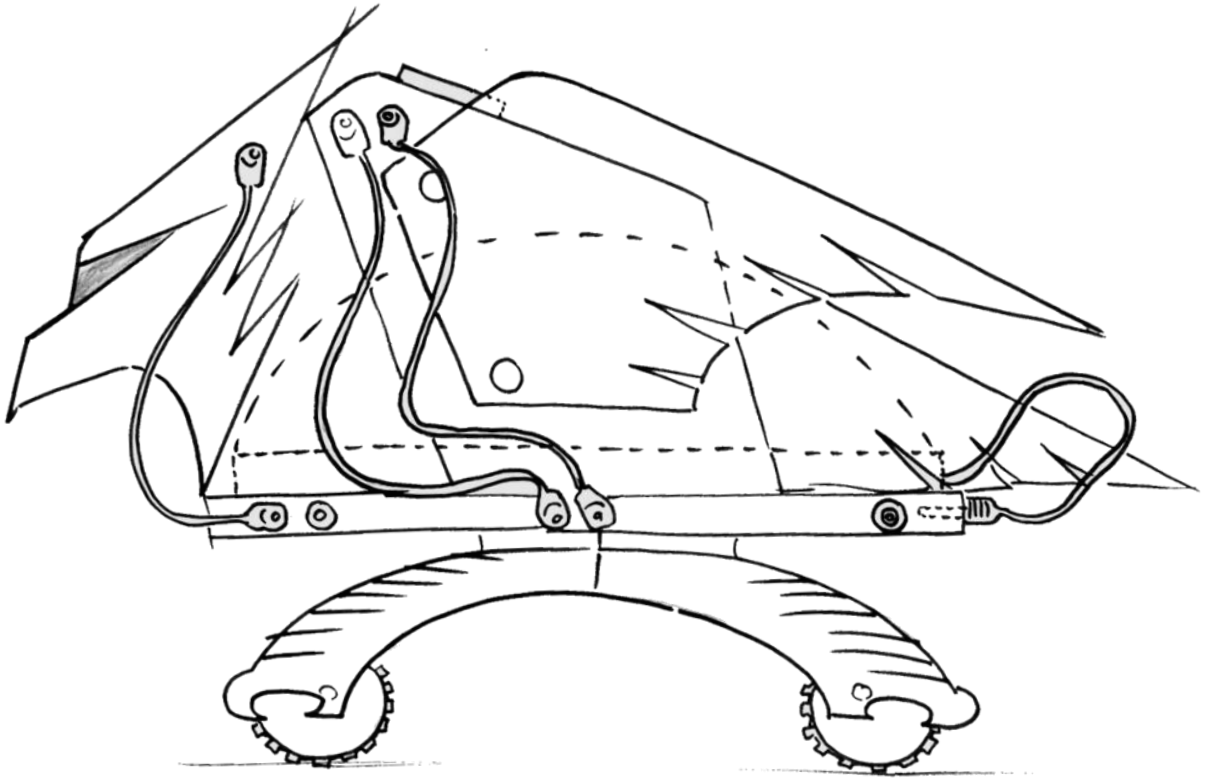
Robot Character (Eagle)



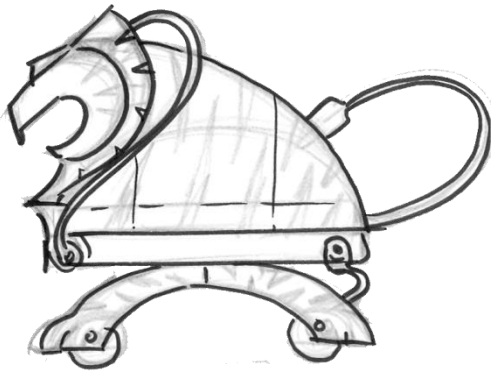


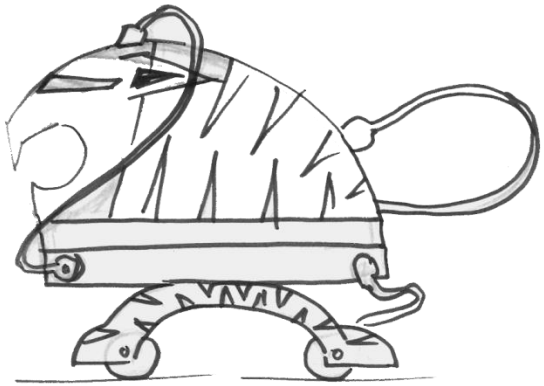


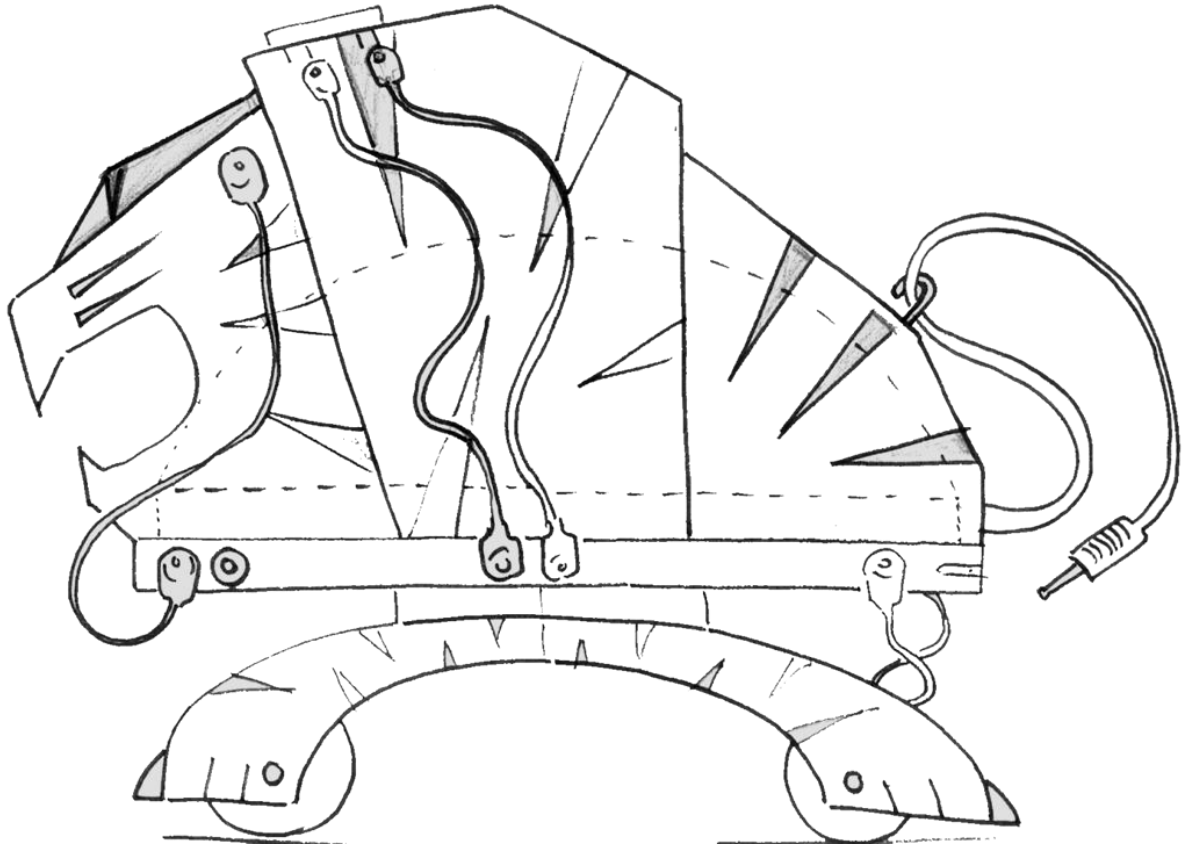




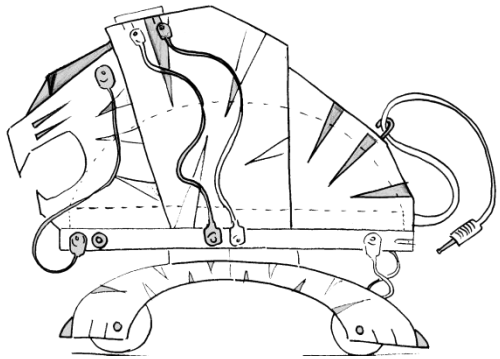
Robot Character (Tiger)

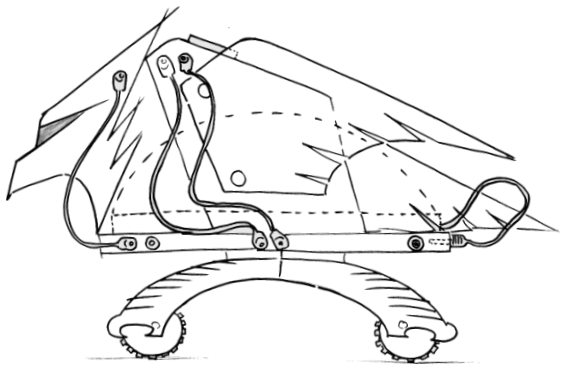


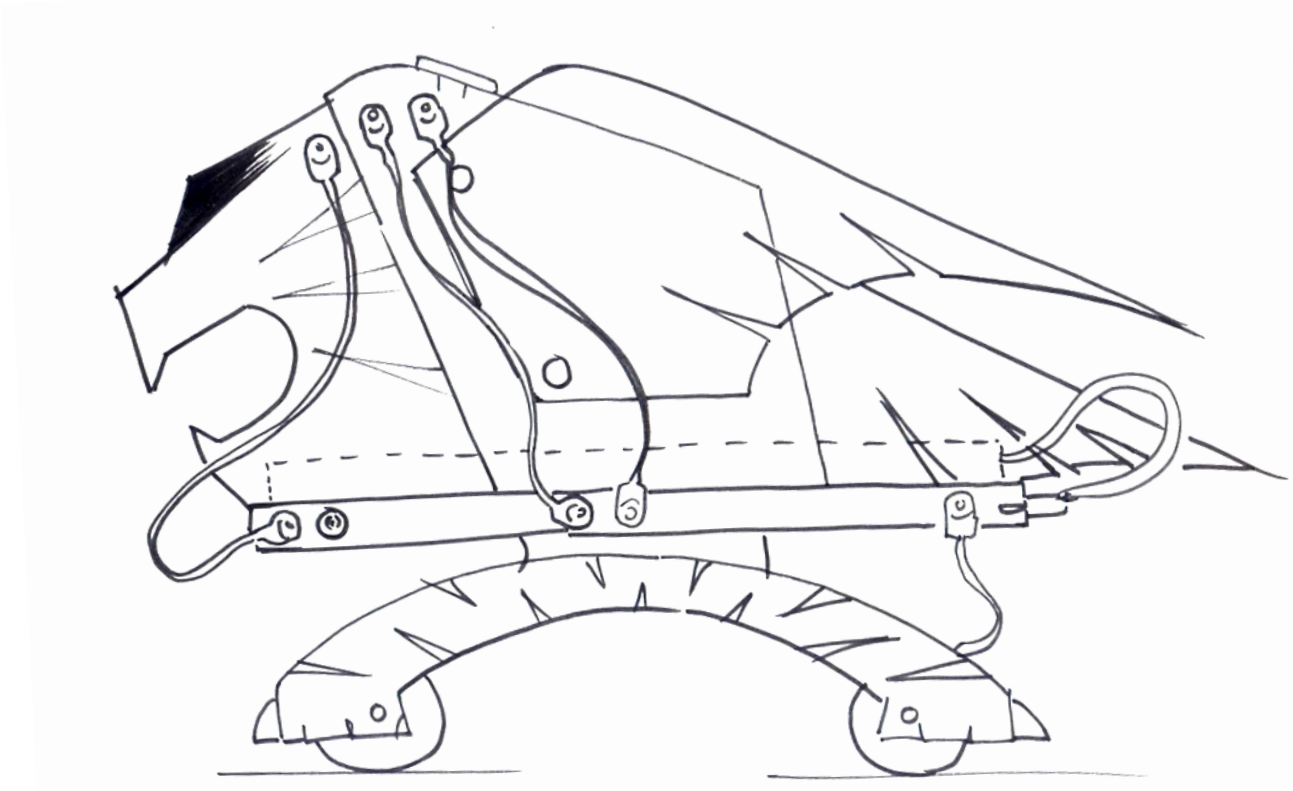




Combination (eagle and tiger)

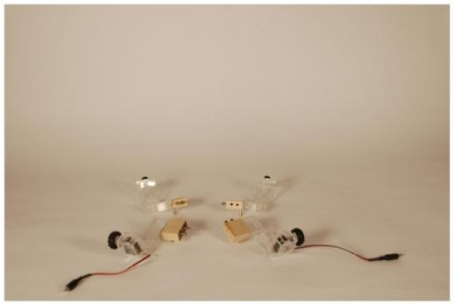
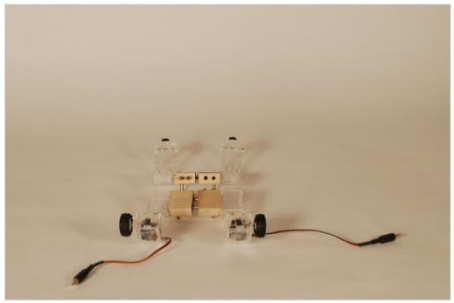
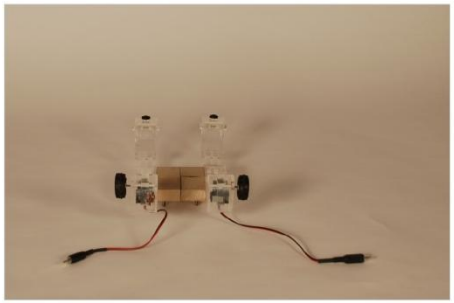
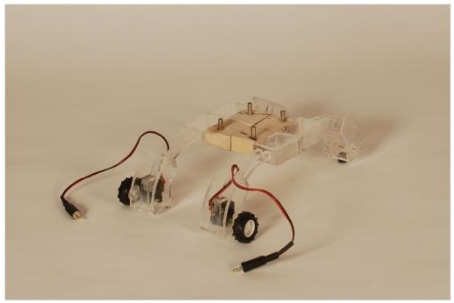
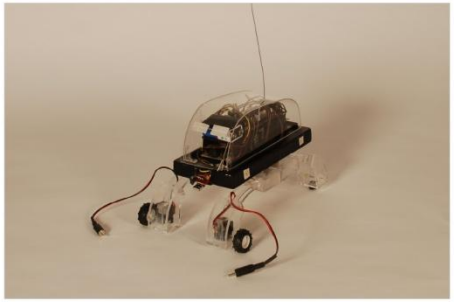
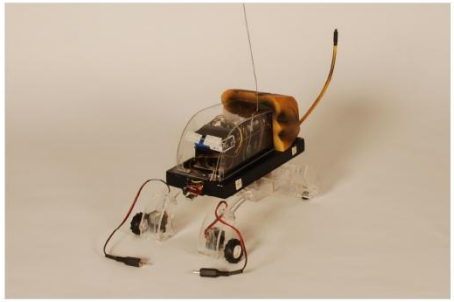
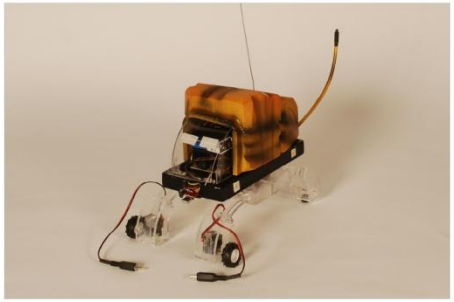
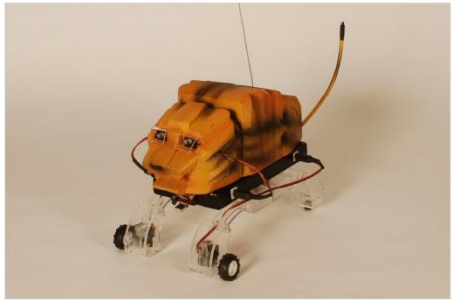




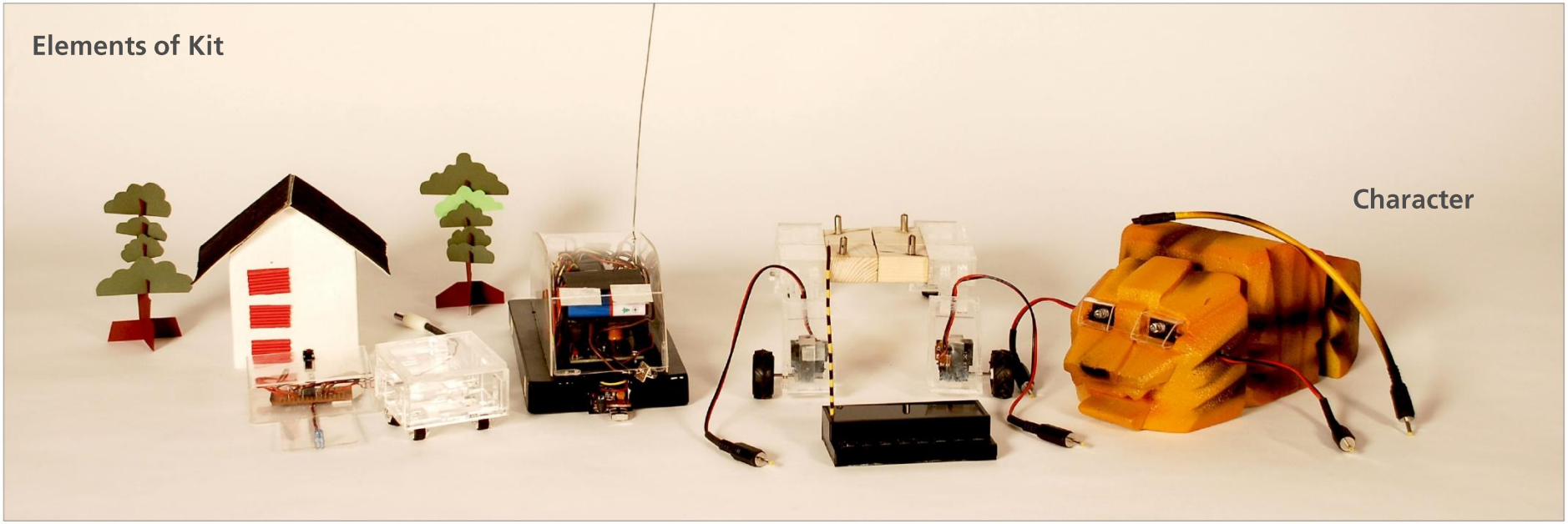


Prototype

Assembly

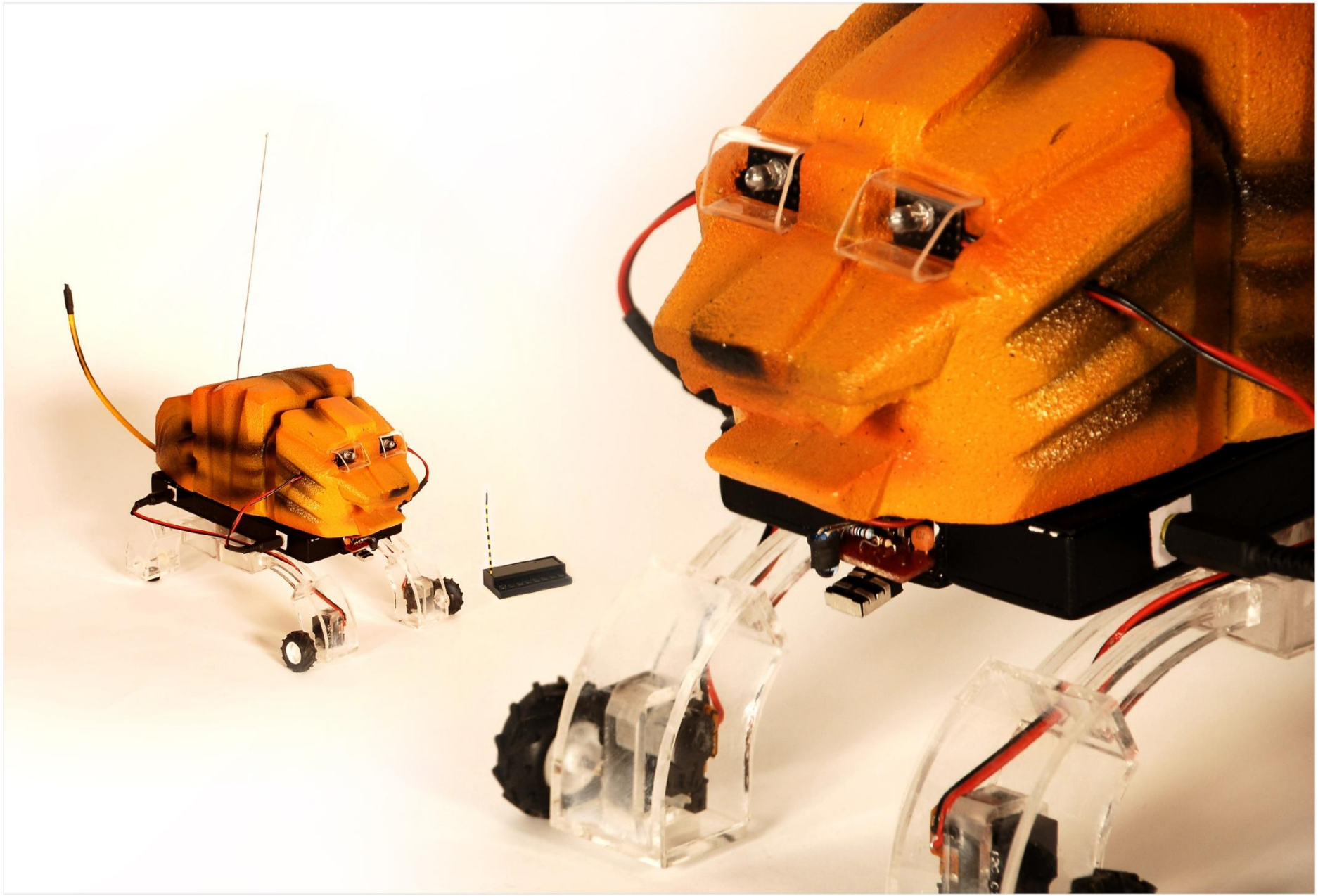









Elements of Kit



Character

Environment



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