

makeblock

neuron

Make anything, make everything.



# NeuronCreative Production and Scientific Lab Manual

## -Creative Lab Kit 2.0



[www.makeblock.com](http://www.makeblock.com)

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## Introduction:

The Neuron educational program is designed to use Neuron electronic building blocks (mBlock) as the teaching tools in STEAM education, for students to create fun and interesting works using a variety of materials, and explore simple scientific experiments; in the form of mini-lessons, this educational program inspires teachers to innovatively use the Neuron electronic modules in their teaching, and it can motivate students to be engaged in the activities, learn sensor applications, and improve their programming thinking skills to implement each and every creative idea;

### Contents in this manual:

- Mini-lesson (4 major topics and 21 models)
- Neuron basics Application of teaching ideas and demonstration
- lessons Diagrams for paper
- based models, demo videos, module introduction, software nodes and more

Help teachers and creative lab fans understand the use of Neuron product, provide them with creative inspiration to create more meaningful works or lessons.



**makeblock Curriculum Design Team: Zhang Jilong, Lin Xiasheng, Xiong Qin**

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**JAN, 2018**



## About makeblock :

makeblock Co., Ltd. was founded in 2013. The company's main brand, makeblock, a leading DIY robot-assembly and STEAM educational and learning platform, was created in 2011.

makeblock is a global leader in STEAM education solutions. Makeblock integrates the development and promotion of hardware, software, contents, events and activities, offering STEAM education and entertainment platforms for schools, training institutions and families. The products mainly include easy-to-use programming robot kits, electronic building modules platforms and DIY robot assembly platforms, provide graphical programming APPs and enriched curriculum, which are designed to inspire children's creativity, let children explore their potential, pursue their sense of goodness, beauty and truth, and build a better world. Currently, makeblock products are widely used by schools and families in more than 140 countries and regions.

## Educational Ideas:

“With the development of science and technology, the makeblock education and STEAM education will become more and more important. We hope to build a robot assembly platform to bring together the robot enthusiasts of all ages and make the makeblock education and STEAM education more accessible. Makeblock is aiming to provide the users with the abilities to implement their ideas and we hope more people will turn their ideas into reality. When people are working hard to reach their dreams, they will have endless sense of achievement, which will encourage more people to come up with inventions and creations!” – CEO, Wang Jianjun



## Introduction to Creative Lab:

The exterior design of the Neuron product has won multiple international design awards, such as: Korea's K-Design Award in 2017, Japan's Good Design Award, U.S. IDEA Gold Award, German Red Dot Award, and 2018 CES Design Awards, etc.

The Neuron product also has many wonderful features. The Neuron Creative Lab is a programmable electronic building module created for STEAM education. It has 30 electronic modules with different functions, covering acoustic, optical and dynamic interaction modes; the customized "Neuron APP" can easily create more functions for the electronic building modules to "intelligently" make anything and everything, which also support the drag-and-drop programming (mBlock5) developed by makeblock users to learn programming knowledge.

The Neuron combines electronic technology features and teaching elements. Its exquisite details and playful design can meet the needs of various teaching scenarios and home entertainment and intelligence development. The users of the products are encouraged to integrate things and people around them to creatively make products and implement the creative ideas and make our lives better~

## Table of Contents

## I. How to Use Neuron

1. Nine Features .....	1
1.1 Hardware .....	1
1.2 Software .....	2
1.3 Structures .....	2
2. Three Ways to Play .....	3
1.1 Offline .....	3
1.2 Online .....	3
1.3 Drag-and-drop (mBlock 5) .....	3

## II. Teaching Modes

1. Creation and Exploration (5E) .....	4
2. Problem-Based Learning .....	5
3. Design Thinking .....	5

## III. Mini-Lesson

1. Artist .....	10
2. Engineer .....	34
3. Scientist .....	57
4. Maker's Home .....	74

## IV. Lesson Demonstration

1. 5E Lesson .....	103
2. PBL Lesson .....	105

## V. Attachments

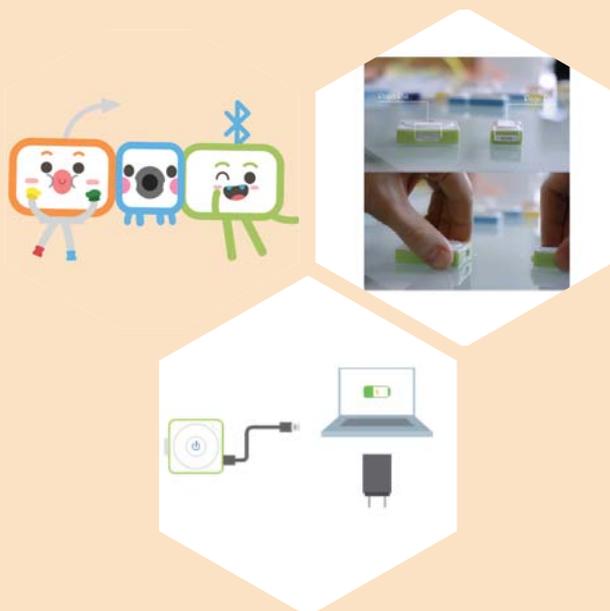
1. Patterns of Paper-Based Models .....	107
2. Module Cards .....	120
2.1 Input Module .....	121
2.2 Output Module .....	134
2.3 Power and Communication Module .....	141
3. Description of Nodes .....	144

## I. How to Use Neuron:

Neuron is a smart module-based electronic product. The product has many electronic modules with different functions to help children easily create works according to their own ideas. The electronic modules are easy to use owing to the compact design and magnetic interface. To create simple electronic works, children just need to connect different modules together. It can also be used to create many fun and interesting smart works by combining with the common craft-making materials; for example, small table lamps, strong light alarms, acoustic control lamps, etc.; the product is magnetic, which is convenient for children to show their own works. In addition, children can also use the Neuron APP to add more features for their works to make it better.

### Nine Features

#### Hardware



1.

**PogoPin:** The modules are magnetically connected, easy to assembly and play, and convenient for children to connect different modules together. It can also prevent children from making mistakes in connecting the modules to the wrong sides. It's easy-to-use and durable for 100,000 plays ;

2.

**Sensor:**The Neuron creative lab has many sensors, and the modules can be divided into 3 categories according to their functions, “energy & communication”, “input”,and “output”, which correspond to green, orange and blue colors respectively, and are convenient for the users to identify the modules with different functions.Every Neuron module is equipped with an independent chip with a unique function. The sensors can collect information/values of the surrounding environment and convert the information into easy-to-read digits and other formats.

3.

**Wireless and wired:** Neuron modules support either wireless firmware update (via Bluetooth,WIFI) with iPads and smart phones, or firmware update and charging by connecting it directly to PCs via micro USB cables.

## Software

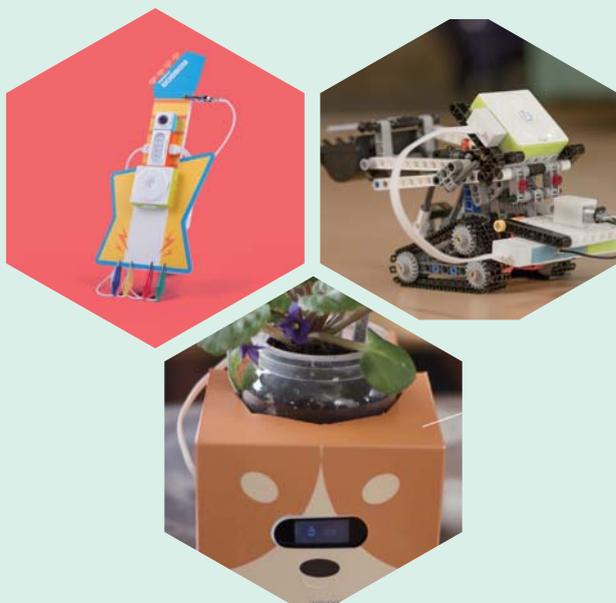
4. **Flow-Based Program:** download the Neuron APP onto your iPad or smart phone, and connect via Bluetooth or WIFI. You can now enjoy the online graphical programming. The APP also has built-in features including 10+ model lessons and guide for novice users. It's very easy to start navigating, even for someone who has absolutely no programming experience. More model lessons will be added in Neuron App.

5. **Visual Program(mBlock5):** Graphical programming software independently developed based on Scratch. It can be downloaded and used by PC users, and more than 2 million users in the world choose mBlock5 as the programming learning tool, which supports windows, macOS, Linux, Chrome OS and other user environments.

6. **IoT cloud platform:** By using the cloud control node in Neuron APP, the users can share their small works by sending the QR codes or links to friends. In addition, it's also possible to use another device to remotely control the creative works so as to show the ideas remotely.



## Structures



7. **Paper-based models** (using craft-making materials) : In the neuron lab kit, there are ready-to-use paper-based models corresponding to some lessons. It is also possible to download paper-based models online, or design your own paper-based models. For kids who love craftworks, the neuron electronic building blocks can add intelligence components to the commonly-used craft-making materials, and make the final works more creative;

8. **Building blocks (LEGO)** : There are several holes on the Neuron magnetic board, adaptive to the LEGO Technical series products, which helps the building block enthusiasts make more creative works; by using the building blocks to make more engineering structures and with the assistance of Neuron's electronic features, your final works will surely have a lot of cool effects.

9. **Everyday materials:** The plants and fruits that you can see in everyday life can also be combined with neuron modules to achieve fun functions; for example, leaves, bananas, lemons, oranges, etc.

## Three ways to play



1

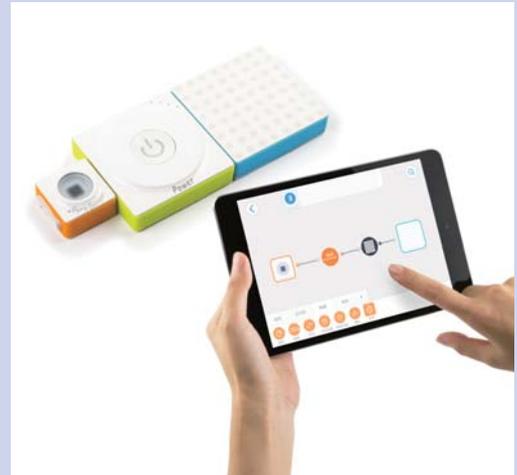
**Offline mode:** Each Neuron module has an independent chip and a unique function. It has some default features via factory settings. Therefore, once user opens the package, the product is readily connected to the module to achieve some simple functions, such as "light sensor + power + display = light value of the current environment"; "gyro + power + LED screen = small ball game, etc.;

**For details, please refer to "Module Cards".**

2

**Online mode(Flow-based):** The online mode graphical programming can be used by anyone as it's very easy to understand. Online programming focuses on developing thinking skills and creativity, other than programming. It lowers the difficulty of programming and reduces the rigid requirements of sequential logic, allowing students to pay more attention to creation of their own works. The online programming has commonly-used nodes, such as "comparison", "digit", "calculation", "otherwise", "and", "or", "switch", etc.; cloud control (IoT) nodes, time nodes, like "delay", "hold", "current time", "sequence", etc.; and advanced nodes, such as "random", "function", "valve" and other advanced programming nodes. It's easy to use, for an example, create a new project --- drag and drop nodes (auxiliary nodes) --- start connection --- enable the function;

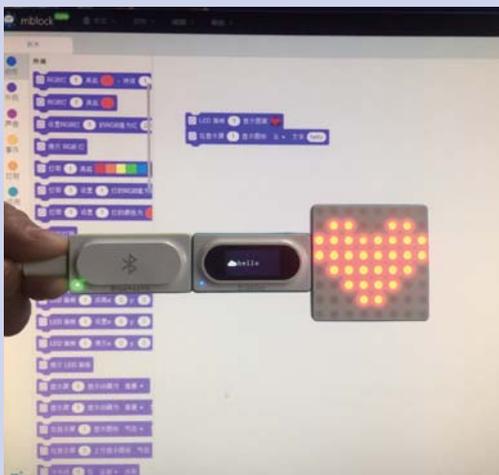
**For details, please refer to the "Description of Nodes".**



3.

**PC mode (mBlock5):** Visual code programming software; mBlock 5, which is developed on the basis of Scratch 3.0, can be used in drag-and-drop programming and code programming. It allows users to create interesting stories, games, animations and other works, and supports makeblock series products, to facilitate the teaching and learning of programming;

Use the Neuron Bluetooth module, USB data connecting cable, and other modules to start programming in mBlock5.



## II. Teaching Modes:

The Neuron product is a smart product designed for STEAM education. It can be used in many teaching areas such as science, technology, art, engineering and other fields. For lessons having different teaching contents, the teaching modes can be slightly adjusted. Teachers can plan their teaching activities and teaching steps according to such teaching modes as problem-based learning, 5E and design thinking teaching modes.

### Creation and Exploration (5E)

In this teaching mode, there are five stages of thinking: engagement, exploration, explanation, elaboration, and evaluation. Students have enough space at each stage to develop their creativity, reasoning ability, and flexibility, etc.



Demonstration lesson for this teaching mode is on page 108.

## Problem-Based Learning

### Problem-Based Learning Process

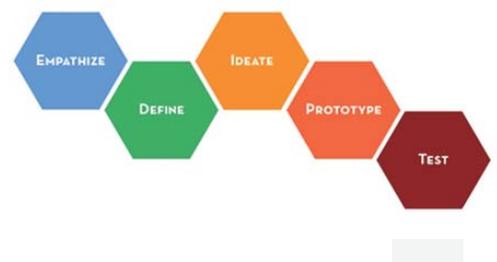


The problem-based learning mode is an active and exploratory learning method that emphasizes the "student-centered" and "problem solving oriented" approach. Under the guidance of the teacher, students start from the question itself, work together through teamwork to explore resources and finally come up with solutions. With this teaching mode, the students can develop the following skills: problem-solving skills; analyzing and summarizing the knowledge points covered in the problems; teamwork ability, including collecting information separately and appreciate diversity; and the ability to obtain and evaluate information.

Demonstration lesson for this teaching mode is on page 110.

## Design Thinking

Design thinking is a methodology to discover problems in life and find solutions from the perspective of socialization. This methodology can cultivate students' sense of social citizenship and abilities to solve social problems from a practical perspective. Design Thinking emphasizes the understanding, focusing, conceiving, and executing processes. In the teaching activities, the process of design thinking is composed of five steps: empathy, requirement defining, ideating, prototype production, and actual testing.



➤ Mini-Lesson

Introduction

The mini-lesson is a lesson plan handbook specifically simplified for teachers and users. Teachers getting the Neutron creative lab kit can start applying it to teaching right away. The Mini-Lesson section includes models of how to create works using Neuron modules (including model introduction, pictures, demo videos, and paper-based model printouts) , teaching steps, programming demonstrations, thinking after class, list of materials, and creative work processes, etc. The materials and models provided in the mini-lesson are for teachers' reference, not supposed to be imitated strictly. Our original purpose is to get the teachers and users inspired by the model making processes and lessons, rather than providing complete teaching materials. In addition, the mini-lesson teaching processes are designed to focus on cultivating students' creativity and Tinker (transformation) skills. We hope the teachers can consider these tips in teaching.

In these short lessons, students can:

- Actively learn and understand new knowledge in the context of previously learned concepts
- Learn to think independently and collaborate with others to complete the project
- Participate in the creative making process and apply the skills learned
- Freely discuss ideas with team members and use appropriate tools to record plans
- Share creative achievements with each other

As directors in the activities, teachers can:

- Join the students' group discussions and help students organize their ideas
- Deeply understand the knowledge requirements for the students and summarize the key points of the lessons
- Provide materials for the activities and answer questions
- Set up the classroom to create the student-centered environment

Method to use the mini-lesson: teachers can watch the video (scan the QR code, or click on the website link) , and determine if the model is suitable according to the requirements of the lesson. If the model is suitable, the teachers can read the teaching contents, list of materials, programming demonstrations, and work production processes, etc. in details.

The screenshot shows the 'Neuron – Mini-Lesson' page for a project named 'Copycat'. The page is divided into several sections:

- Name of Work: Copycat**: Includes a difficulty level of 'Advanced' and a time of '30 Minutes'.
- Lesson Description**: A paragraph describing the project as a cat that follows its owner.
- Teaching Procedure**: A detailed section with objectives, steps (Inspire, Thinking, Programming, Make and Tinker, Share), and an educational website link.

Callouts from the surrounding text point to specific parts of the page:

- A callout labeled 'Pictures, videos and work description' points to the image of the cat and the QR code.
- A callout labeled 'Teaching procedures: teaching objectives and key knowledge points. We recommend the following 5 teaching steps: Inspire: Inspire students to think; Thinking: Guide students to analyze the model; program: Programming design; Make and Tinker: Students have enough time to create and transform; Share: Show the final product to others' points to the 'Teaching Procedure' section.

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Neuron – Mini-Lesson

**Thinking after Class**

➤ **Review on Key Points:**

9. Programming for distance sensing of the ultrasonic sensors;  
10. Use Comparison, Digit and AND nodes.

➤ **Improvement and Optimization:**

6. How about adding a buzzer module?

**List of Materials**

Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth	1	PCS
Ultrasonic sensor	1	PCS
Dual motor driver	1	PCS
Motor kit	1	Kit
Connection cable 20CM	1	PCS
Magnetic board	4	PCS
Wheel kit	2	Kit

Material List

Name	Qty.	Unit
Paper-based cat model	1	Set
Double-sided tape	1	Roll
White paper	1	PCS

Educational Website: <http://education.makeblock.com/> 55

Regarding the list of materials required for making models, the teachers and students can replace any materials in the list with the those chosen according to their own creative ideas.

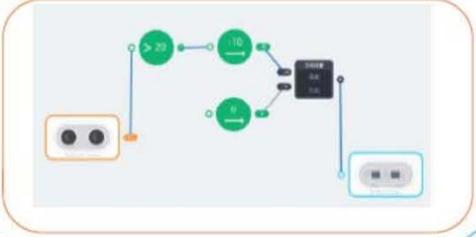
Model-making diagram: If the teachers and students encounter problems during the model-reproduction process, they can refer to this diagram.

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Neuron – Mini-Lesson



➤ Demonstration for online programming



- ✓ Descriptions for hardware modules and software nodes can be found in the appendix at the end of the page;
- ✓ For paper-based models of the same design, please find in the appendix at the end of the page-
- ✓ The works with "☐" are under online modes. Download Neuron APP on iPad or smart phone for programming;
- ✓ Download video of the work from official educational website: <http://makeblock.com>
- ✓ Neuron APP Software version: 1.3.2

Educational Website: <http://education.makeblock.com/> 54

Model programming diagram: If the teachers and students encounter programming problems during the model-reproduction process, they can refer to this diagram. If the teachers and students wish to change any function of the model, they need re-programming.

Table of Contents

**Artist**

Pulling Carrot .....	1
Rotating Face-Changing .....	15
Rotating Colorful Light .....	19
Toy Transformation🌀 .....	24
Shy Penguin🌀 .....	29

**Engineer**

Rocker Toy Car .....	35
Level🌀 .....	39
Smart Watering🌀 .....	44
Copycat🌀 .....	49
Safe Box🌀 .....	54

**Scientist**

Reflectivity of Different Colors .....	60
Exploring the Relationship between Light Energy and Distance .....	63
Now Common Conductors and Insulators .....	66
Thermal Energy Transmission .....	69
Thermometer🌀 .....	72

**Maker's Home**

Energy-Saving Light🌀 .....	78
“Quiet Zone” Reminder🌀 .....	83
Auto-adjustable Clothes Drying Rack🌀 .....	88
Smart Pill Box🌀 .....	93
Plant Guard🌀 .....	98
Visual Door Remote Control System🌀 .....	103

The works with“🌀” are programmed under **online mode**. As such the Neuron programming APP needs to be downloaded using iPad or smart phone;

The lessons are listed in a sequence based on the level of difficulty (basic, intermediate, advanced) in each category.

# Artist



Pull a Carrot



Rotating Face-Changing



Toy Transformation



Shy Penguin

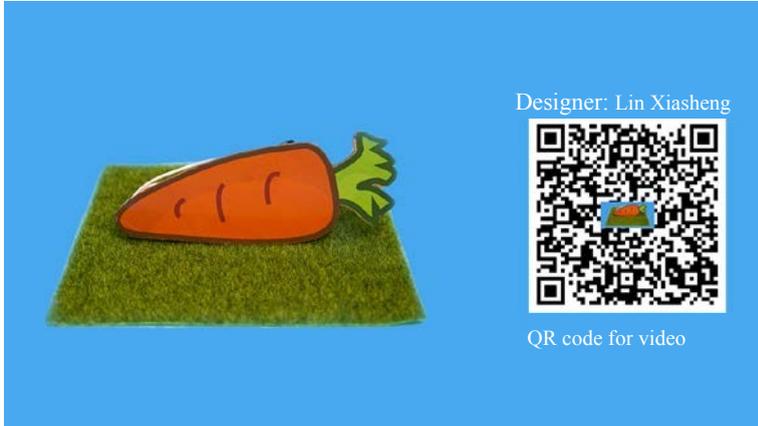


Rotating Colorful Light

## Name of Work: Pulling a Carrot

**Difficulty: Basic**

**Time: 30 Minutes**



Video Link: <http://static.education.makeblock.com/PullupCarrots.mp4>

### Lesson Description:

When the carrot is not pulled out, it remains still, but when it is pulled out, two “NO” signs will appear and shake, as if saying “Don’t pull me out. Don’t pull me out.”



## Teaching Procedure

### Objectives:

This creative work mainly uses gyroscopes and servos.

- 1) When the carrot is in the soil, it is still. At this time, hide the two small hands (“NO” signs) of the carrot by adjusting the angle of the servos.
- 2) When the carrot is pulled out, it will vibrate. When it is vibrating, the servos will rotate quickly.

### Step1: Inspire

By means of anthropomorphic thinking, if the carrot is pulled out of the soil, it may go crazy. If we add small hands (“NO” signs) for the carrot, when it is pulled out of the soil, it will shake its hands.

### Step2: Thinking

What module is used for this work? How can we achieve the functions imagined? What kind of module can feel the vibration, and what kind of module can actually rotate?

### Step3: Make and Tinker

What materials do we need for this work? The functions of the module need continuous debugging to achieve the best results;

### Step4: Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

## Thinking after Class



### ➤ Review on Key Points:

1. Servo angle "return to zero" adjustment;
2. Setup angle of servo

### ➤ Improvement and Optimization:

1. How about adding a buzzer module?

## List of Materials



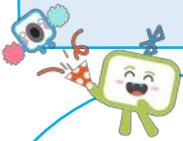
Module List

Name	Qty.	Unit
Power supply	1	PCS
Gyroscope	1	PCS
Dual servo-driver	1	PCS
Servo kit	1	Kit

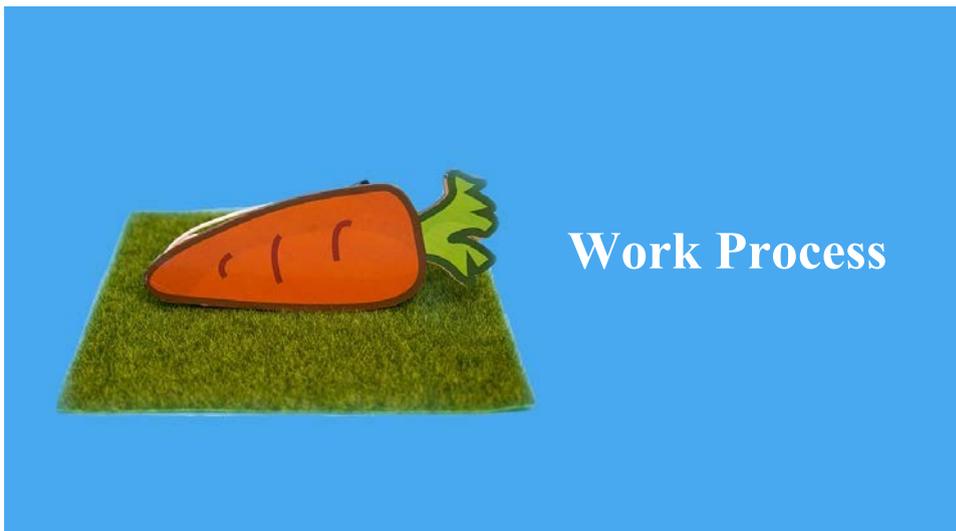
Material List

Name	Qty.	Unit
Cardboard	1	PCS
Paper-based carrot model	1	PCS
Transparent double-sided tape	1	Roll

## Work Production Procedure



➤ Work Production Process:





### Tips

- ✓ Descriptions for hardware modules and software nodes can be found in the appendix at the end of the page;
- ✓ For the paper-based models of the same design, please find in the appendix at the end of the page~
- ✓ The works with “⊗” are made under **online modes**. Download Neuron APP on IPad or smart phone for programming;
- ✓ Download video of the work from official educational website: <http://education.makeblock.com/>
- ✓ Neuron APP Software version: 1.3.2

## Name of Work: Rotating Face-Changing

**Difficulty: Intermediate**

**Time: 30 Minutes**



Designer: Lin Xiasheng

QR code for video

Video Link: <http://static.education.makeblock.com/Face-changing.mp4>

### Lesson Description:

Cold poker king or red heart poker king? Pick whichever you want. Control the poker king's eyes by adjusting the angle of the rocker.

## Teaching Procedure



### Objectives:

Rocker and dual-motor driver modules are used for this work.

- 1) Learn the functions of the rocker and dual motor driver
- 2) Connect the rocker to the motor. Control the motor's forward and reverse rotation speed by adjusting axis Y of the rocker (move the lever of the rocker upwards and downwards). When the rocker is pushed upwards, the motor will rotate clockwise; the more the rocker is pushed upwards, the faster the motor rotates. Similarly, when the rocker is pushed downwards, the motor will rotate counterclockwise

#### **Step1:** Inspire

Sichuan Opera face changing has always been a mysterious trick. How do we use these small modules to achieve the effect of Sichuan Opera Face Changing?

#### **Step2:** Thinking

How do they perform Sichuan Opera face changing? Keep rotating different faces can also achieve the effect of face changing.

#### **Step3:** Make and Tinker

What materials do we need for this work? Which modules can give people a sense of "rotation control", and are also interesting (not boring) ?

#### **Step4:** Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

## Thinking after Class



### ➤ Review on Key Points:

3. When the rocker is in offline mode, can only output Y-axis value can be output, while in online the connected mode, both Y-axis and X-axis values can be output;
4. The motor can only control the rotation speed, not the number and angle of rotations;

### ➤ Improvement and Optimization:

2. What else we can do to achieve Sichuan Opera face changing?

## List of Materials



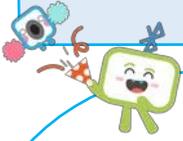
Module List

Name	Qty.	Unit
Power supply	1	PCS
Rocker	1	PCS
Dual motor driver	1	PCS
Motor kit	1	Kit
Magnetic board	4	PCS

Material List

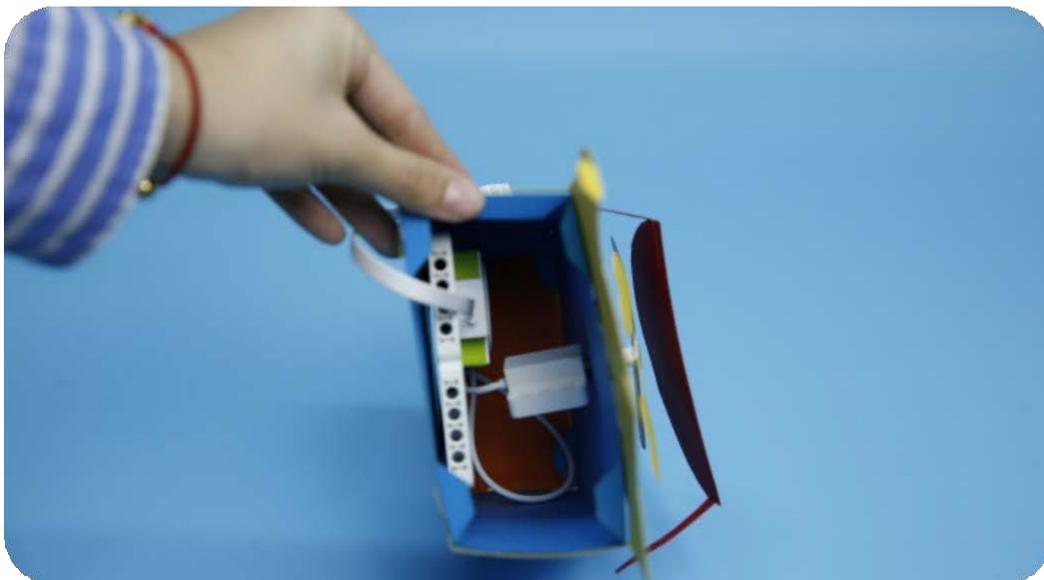
Name	Qty.	Unit
Color cardboard	2	PCS
Glue stick	1	PCS
Double-sided tape	1	Roll
Color marker (black)	1	PCS
Scissors	1	Pair
Art knife	1	PCS

## Work Production Procedure



- Work Production Process:





### Tips

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- ✓ The works with “⚡” are under online modes. Download Neuron APP on iPad or smart phone for programming;
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- ✓ Neuron APP Software version: 1.3.2

## Name of Work: Rotating Colorful Light

**Difficulty: Intermediate**

**Time: 30 Minutes**



Video Link: <http://static.education.makeblock.com/ColorfulLights.mp4>

### Lesson Description:

Press the button, the beautiful colorful light begins to rotate, and you will be surrounded by the splendid lights. By using the Neuron module, you can easily achieve the desired effects. You should try it ~

## Teaching Procedure



### Objectives:

Use the Neuron electronic modules to create works: 1) Use motor- driven module to control the motor rotation;  
2) Use button to start the motor rotation;

#### Step1: Inspire

The teacher can play videos or show the finished works to students; let the students observe and think: how to keep the colorful lights rotating? How to keep the light bar on?

#### Step2: Thinking

What modules does this work use? Which effects have these modules achieved respectively?

#### Step3: Make and Tinker

What materials do we need for this work? The functions of the modules need continuous debugging to achieve the best results;

#### Step4: Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

### Thinking after Class



➤ **Review on Key Points:**

- 5. How to use motor modules and LED light bars under offline mode;

➤ **Improvement and Optimization:**

- 3. Try to add the Bluetooth module and use the Neuron APP to control the color changes, and use the cloud control (IoT) to remotely turn on and off the lights.

### List of Materials



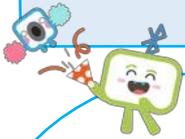
Module List

Name	Qty.	Unit
Power supply	2	PCS
Bluetooth	1	PCS
Button	1	PCS
Dual DC motor driver	1	PCS
DC motor kit	1	Kit
LED light bar driver	1	PCS
Light bar	1	PCS
Magnetic board	6	PCS
Plug	1	Pack

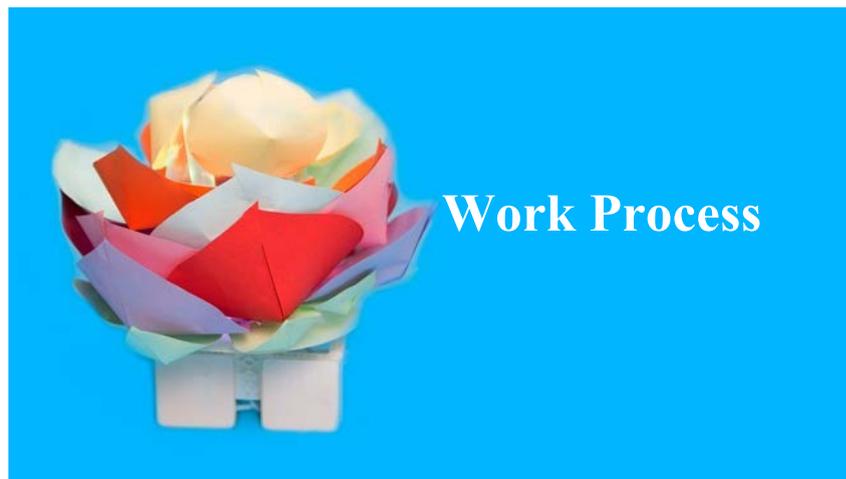
Material List

Name	Qty.	Unit
Petal pattern	7	PCS
Plastic bottle	1	PCS
Cardboard (white)	1	PCS
Transparent double-sided tape	2	Roll
Double-sided tape	1	Roll

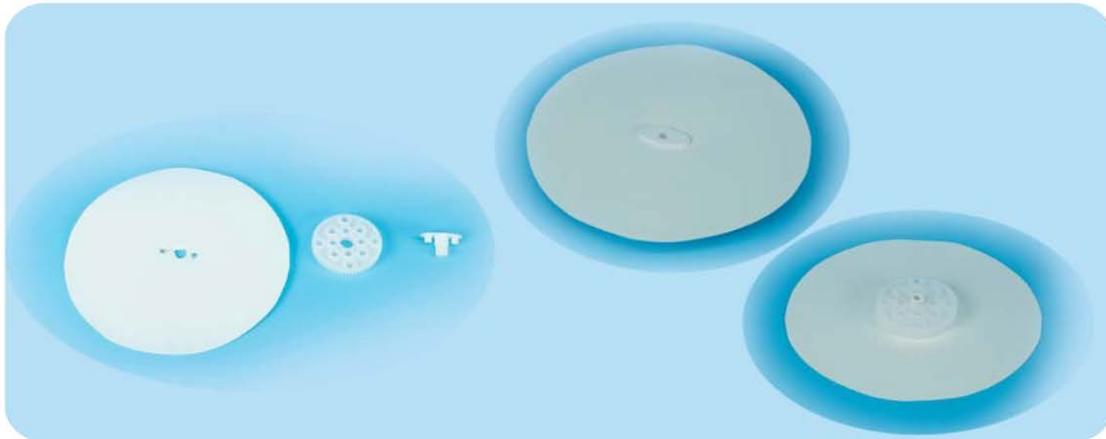
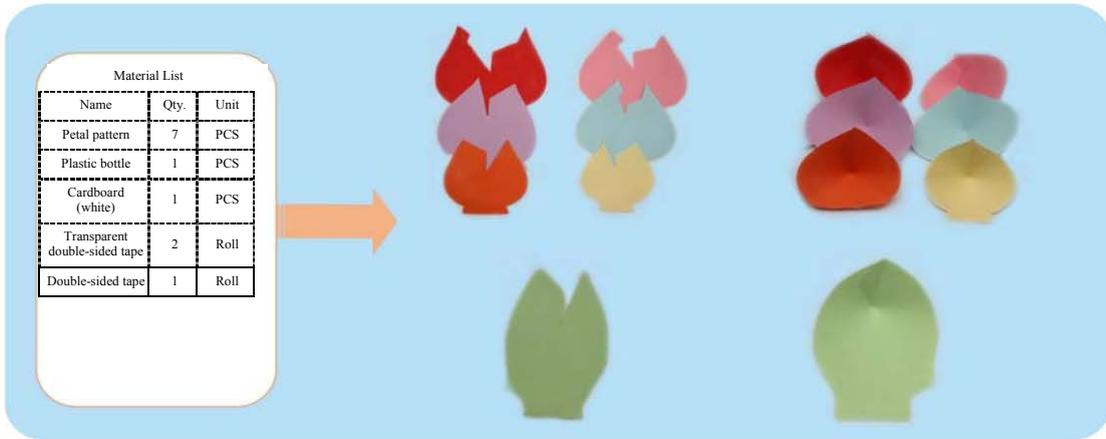
## Work Production Procedure



➤ Work Production Process:



Module List		
Name	Qty.	Unit
Power supply	2	PCS
Bluetooth	1	PCS
Button	1	PCS
Dual DC motor driver	1	PCS
DC motor kit	1	Kit
LED light bar driver	1	PCS
Light bar	1	PCS
Magnetic board	6	PCS
Plug	1	Pack





### Tips

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- ✓ The works with “⚙️” are under online modes. Download Neuron APP on IPad or smart phone for programming;
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- ✓ Neuron APP Software version: 1.3.2

## Name of Work: Toy Transformation

**Difficulty: Intermediate**

**Time: 30 Minutes**



Video Link: <http://static.education.makeblock.com/PuppetsMakeover.mp4>

### Lesson Description:

Use Neuron to make slight modification to your own stuffed toys. You can not only let them know when someone approaches, but also let them start talking.



## Teaching Procedure

### Objectives:

This work mainly uses Wi-Fi, human infrared sensors and speakers.

- 1) Learn how to use Wi-Fi
- 2) Learn the functions of human infrared sensors and speakers
- 3) How to use the speaker's online function

#### **Step1:** Inspire

How to transform your stuffed toys? Let them no longer be "dull" and start interaction with people?

#### **Step2:** Thinking

How to enable them to interact with people? How can they talk?

#### **Step 3:** Programming

Use the Neuron APP for online programming, and try the recording function of the speaker as well as the human infrared sensor.

#### **Step4:** Make and Tinker

How to decorate your toys and Neurons?

#### **Step5:** Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

Thinking after Class:



➤ **Review on Key Points:**

1. How to use Wi-Fi (online and local use)
2. Usage and function of speaker

➤ **Improvement and Optimization:**

4. How about adding a buzzer module?

List of Materials



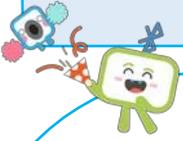
Module List

Name	Qty.	Unit
Power supply	1	PCS
Wi-Fi	1	N/A
Human infrared sensor	1	PCS
Speaker	1	PCS
Wi-Fi cable	1	PCS

Material List

Name	Qty.	Unit
Stuffed toy	1	PCS
Transparent double-sided tape	1	Roll

## Work Production Procedure

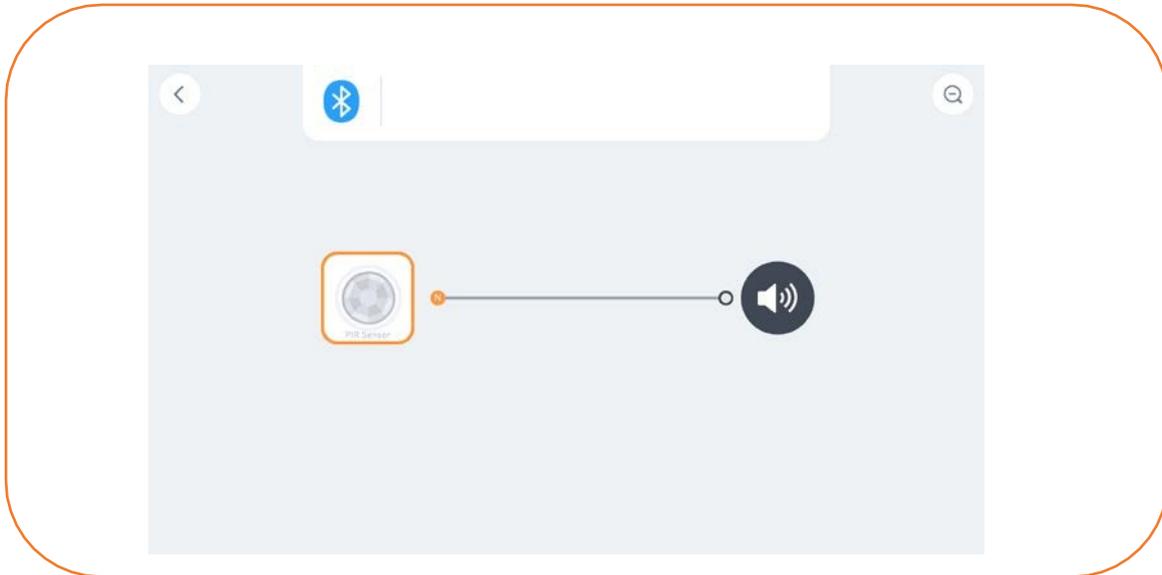


➤ Work Production Process:





➤ Demonstration for online programming



**Tips**

- ✓ Descriptions for hardware modules and software nodes can be found in the appendix at the end of the page;
- ✓ For paper-based models of the same design, please find in the appendix at the end of the page~
- ✓ The works with “🌐” are under online modes. Download Neuron APP on IPad or smart phone for programming;
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- ✓ Neuron APP Software version: 1.3.2

## Name of Work: Shy Penguin

**Difficulty: Intermediate**

**Time: 30 Minutes**

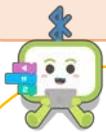


Video Link: <http://static.education.makeblock.com/ShyPenguin.mp4>

Lesson Description:

A penguin lives near an iceberg. Whenever any object (or person) is approaching, it will quietly go hiding. After the object (or person) leaves, it will appear again. By using the Neuron module, you can easily achieve the desired effects. You should try it ~

## Teaching Procedure



### Objectives:

Create works using the Neuron's electronic modules: 1) Use servo module to control the angle of the servo plate; 2) Ultrasonic sensors can sense the distance of any object (or person) ;

Use Neuron APP to achieve the effects of the works: 1) Perform an accurate online adjustment of the angle of the servo to allow the penguin to hide and appear; 2) Compare the digital nodes to adjust the specific distance between the penguin and any object (or person) ;

#### **Step1:** Inspire

The teacher can play videos or show the finished works to students; let the students observe and try telling a story: What is the penguin doing?

#### **Step2:** Thinking

What modules does this work use? Which effects have these modules achieved respectively?

#### **Step3:** Make and Tinker

What materials do we need for this work? The functions of the modules need continuous debugging to achieve the best results;

#### **Step 4:** Programming

Use the Neuron APP for online programming, and try using comparison, numbers, NOTs, and node maintaining;

#### **Step5:** Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

## Thinking after Class



### ➤ Review on Key Points:

6. Servo angle "return to zero" adjustment;
7. Programming for distance sensing of the ultrasonic sensors;
8. Try using comparison, numbers, NOTs, and node maintaining.

### ➤ Improvement and Optimization:

5. How about adding a buzzer module?

## List of Materials



Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth	1	PCS
Ultrasonic sensor	1	PCS
Dual servo-drive	1	PCS
Servo kit	1	Kit
Connection cable 20CM	1	PCS
Magnetic board	4	PCS
Plug	1	Pack
Transparent rubber band	1	Pack

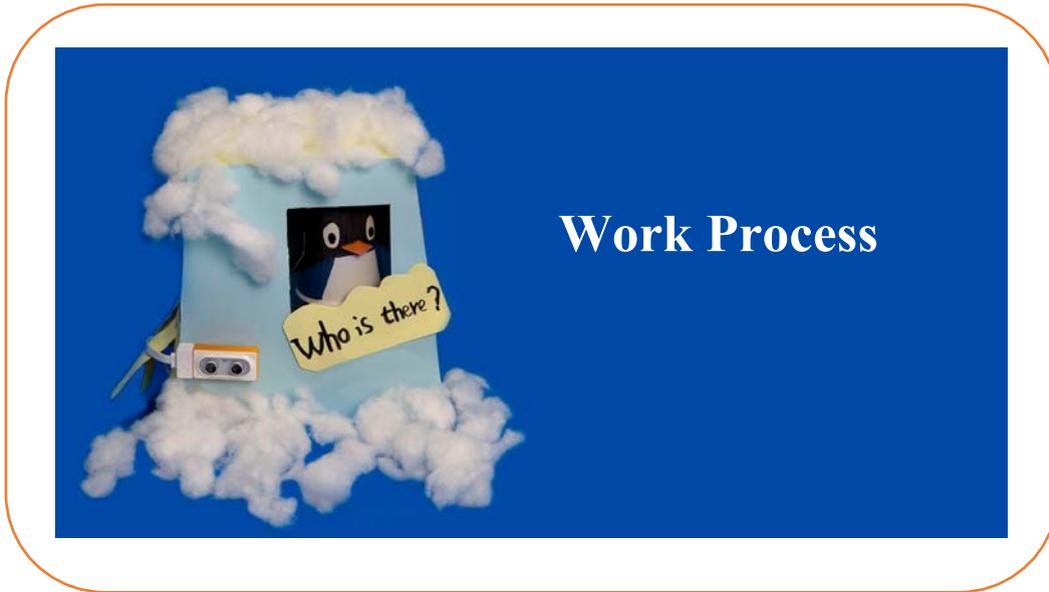
Material List

Name	Qty.	Unit
Paper-based model of iceberg	1	PCS
Ice cream stick	2	PCS
White paper cup	1	PCS
Transparent double-sided tape	2	Roll
Double-sided tape	1	Roll
Colored marker (black)	1	PCS
Color cardboard	2	PCS

## Work Production Procedure



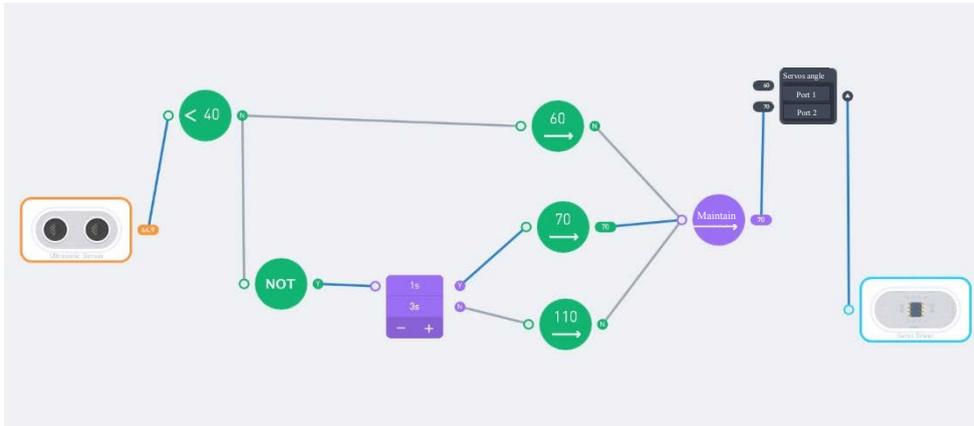
### ➤ Work Production Process:



Module List		
Name	Qty.	Unit
Power supper	1	PCS
Bluetooth	1	PCS
Ultrasonic sensor	1	PCS
Dual servo-drive	1	PCS
Servo kit	1	Kit
Connection cable 20CM	1	PCS
Magnetic board	4	PCS
Plug	1	Pack
Transparent rubber band	1	Pack

Material List		
Name	Qty.	Unit
Paper-based model of iceberg	1	PCS
Ice cream stick	2	PCS
White paper cup	1	PCS
Transparent double-sided tape	2	Roll
Double-sided tape	1	Roll
Colored marker (black)	1	PCS
Color cardboard	2	PCS

➤ Demonstration for online programming



**Tips**

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# Engineer



Rocker Toy Car



Level



Smart Watering

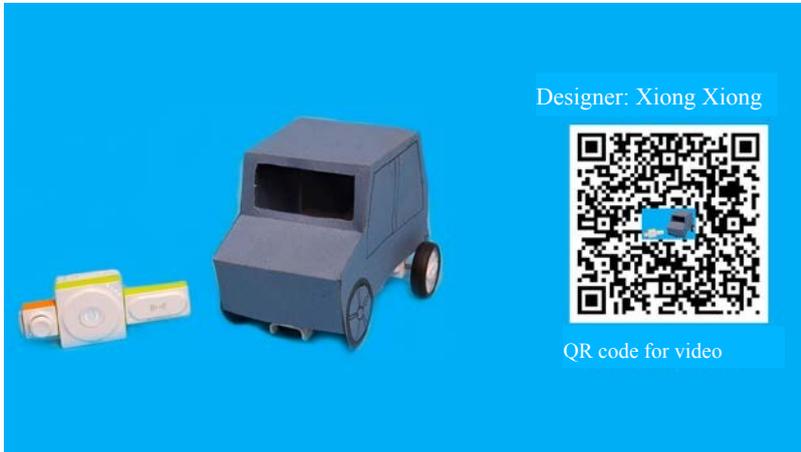


Safe Box



Copycat

## Name of Work: Rocker Toy Car



Video Link: <http://static.education.makeblock.com/LittleCar.mp4>

**Difficulty: Basic**

**Time: 30 Minutes**

### Lesson Description:

Beep-beep, the car is ready, but how can we remotely control it, and let it start running? By using the Neuron module, you can easily achieve the desired effects. You should try it ~

## Teaching Procedure



### Objectives:

Create works using the Neuron's electronic modules: 1) Use motor module to control the movement of car; 2) Use rocker module to trigger the motor module; 3) The wireless receiving module connects the rocker with the car to control the movement of the car.

#### Step1: Inspire

The teacher can play video or show the finished work to students; let the students observe the work and think: can you control this car?

#### Step2: Thinking

What modules does this work use? Which effects have these modules achieved respectively?

#### Step3: Makeand Tinker

What materials do we need for this work? The functions of the modules need continuous debugging to achieve the best results;

#### Step4: Testand Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

## Thinking after Class



➤ **Review on Key Points:**

1. Usage of the wireless receiving module.
2. Usage of the rocker module under offline mode.

➤ **Improvement and Optimization:**

1. Connect the Neuron APP to control the direction of the car.

## List of Materials



Module List

Name	Qty.	Unit
Power supply	2	PCS
Wireless reception unit	1	Pair
Rocker	1	PCS
Dual DC motor driver	1	PCS
DC motor kit	2	Kit
Magnetic board	4	PC
Plug	1	Pack

Material List

Name	Qty.	Unit
Paper-based car model	1	PCS
Double-sided tape	2	Roll
Color marker (black)	1	PCS

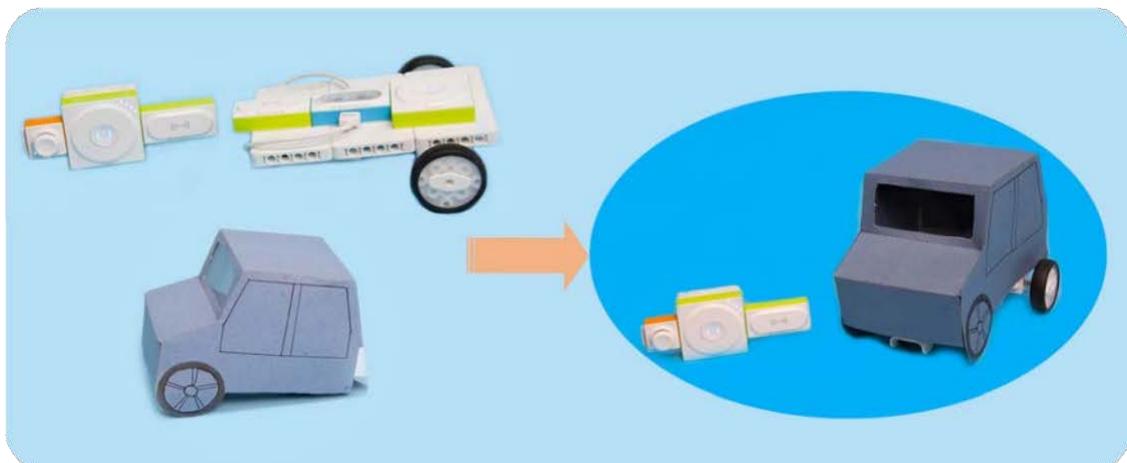
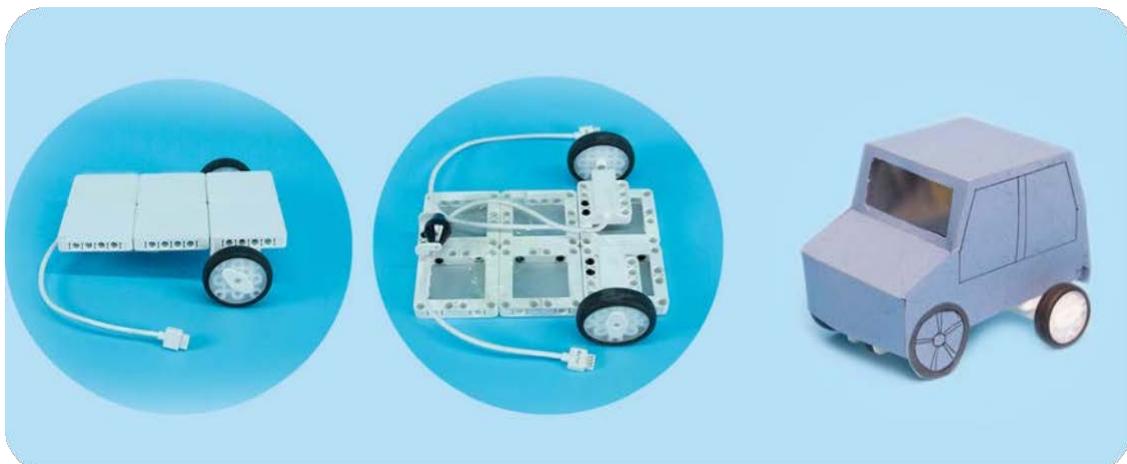
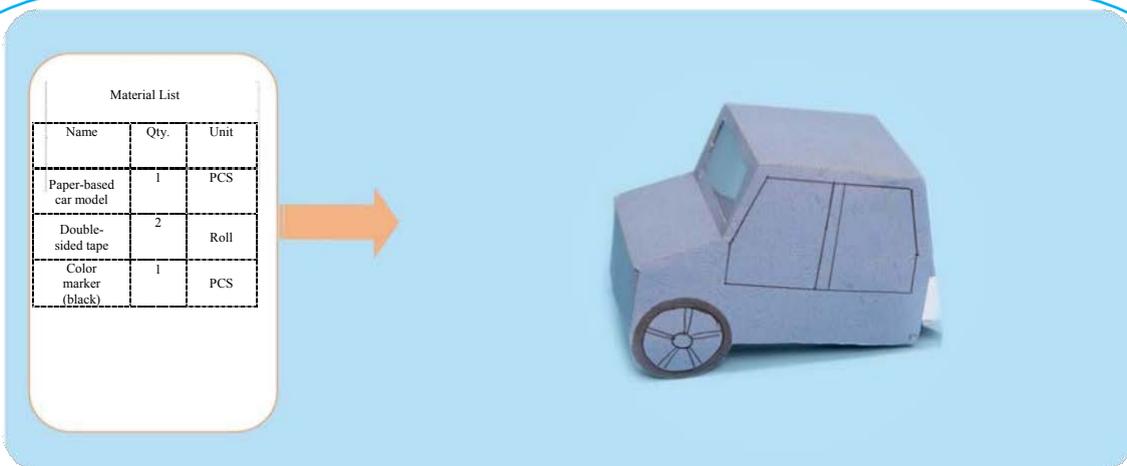
## Work Production Procedure



### ➤ Work Production Process:



Module List		
Name	Qty.	Unit
Power supply	2	PCS
Wireless reception unit	1	Pair
Rocker	1	PCS
Dual DC motor driver	1	PCS
DC motor kit	2	Kit
Magnetic board	4	PC
Plug	1	Pack



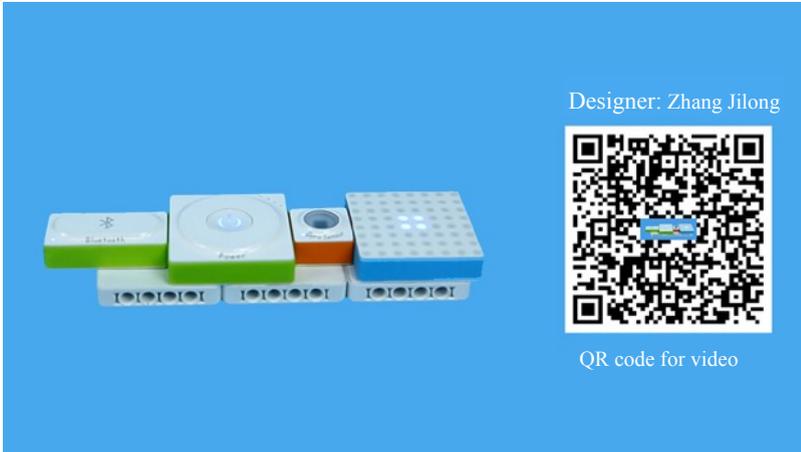
### Tips

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## Name of Work: Level

**Difficulty: Basic**

**Time: 30 Minutes**



### Lesson Description:

Use gyro sensor to detect tilt, and use the Neuron APP for programming to realize horizontal alignment.

Video Link: <http://static.education.makeblock.com/Gradient.mp4>

## Teaching Procedure



### Objectives:

1. Know and learn how to use gyroscopes.
2. Make a level.

### Teaching Procedures:

Step 1: Learn “how to measure if an object is horizontal”.

Step 2: The students shall learn by themselves the knowledge required in this lesson, such as Neuron modules and software nodes.

Step 3: Show the finished work and explain the modules and nodes. Provide necessary materials.

Step 4: After discussions and observation of the finished work, start making a level.

Step 5: Share works with each other.

Thinking after Class



➤ **Review on Key Points:**

1. Usage of comparison programming languages.

➤ **Improvement and Optimization:**

List of Materials



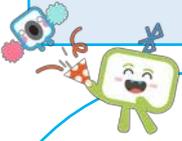
Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth module	1	PCS
LED board	1	PCS
Gyro sensor	1	PCS
Magnetic board	3	PCS

Material List

Name	Qty.	Unit
Cardboard	1	PCS

## Work Production Procedure

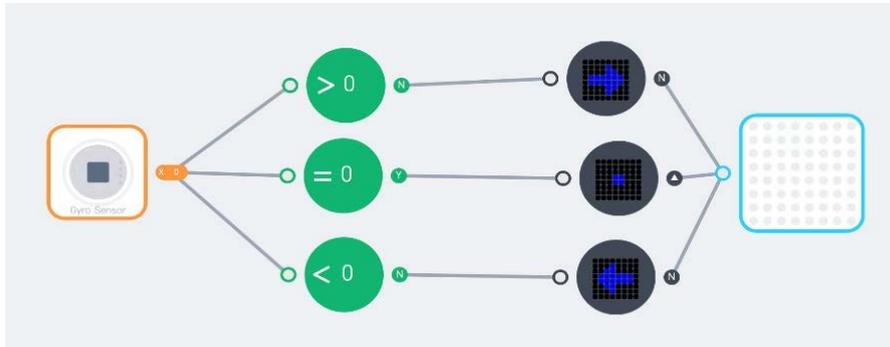


➤ Work Production Process:





➤ Demonstration for online programming



**Tips**

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## Name of Work: Smart Watering



Video Link: <http://static.education.makeblock.com/PlantsGuard.mp4>

**Difficulty: Intermediate**

**Time: 30 Minutes**

### Lesson Description:

Use the soil moisture sensor to monitor plant's humidity, and use the Neuronal APP for programming, so as to start watering when the humidity is too low, and stop watering upon reaching the appropriate humidity.

## Teaching Procedure



### Objectives:

1. Know and learn how to use soil moisture sensor.
2. Making a smart watering system.

### Teaching Process:

Step 1: The project "Transform the manual watering system to auto-watering system used in smart farms".

Step2: The students start group discussion.

Step3: Learn the knowledge of Neuron modules and software nodes to be covered in this lesson.

Step4: Show the finished work.

Step5: After discussing and observing the finished work, start making the watering system.

Step6: Share works with each other.

Thinking after Class



➤ **Review on Key Points:**

1. Usage of comparison programming languages.

➤ **Improvement and Optimization:**

List of Materials



Module List

Name	Qty.	Unit
power supply	1	PCS
Bluetooth	1	PCS
Dual motor driver	1	PCS
Motor driver kit	1	Kit
Soil moisture sensor	1	PCS
Pump	1	PCS
Magnetic board	3	PCS

Material List

Name	Qty.	Unit
Cardboard	1	PCS

## Work Production Procedure

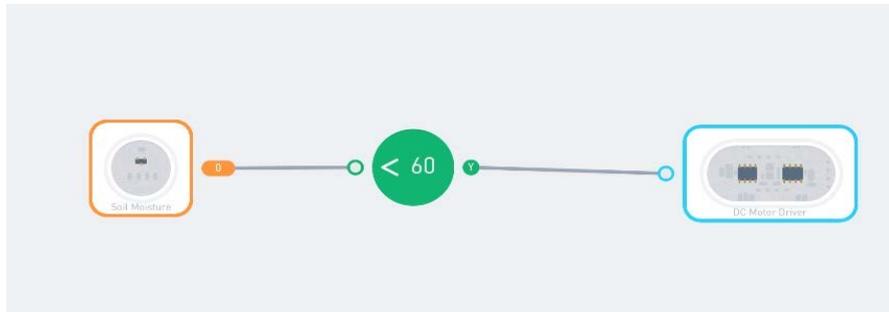


➤ Work Production Process:





➤ Demonstration for online programming



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## Name of Work: Copycat

**Difficulty:** Advanced

**Time:** 30 Minutes



Video Link: <http://static.education.makeblock.com/CopyCat.mp4>

### Lesson Description:

Here is this little cat that is very attached to people. It always follows the person in front of it. The cat would follow you everywhere and will imitate every movement of you. It's just like a copycat following every step of the person in front of it.

## Teaching Procedure



### Objectives:

For this work, we mainly use ultrasonic sensors and motor drivers.

- 1) Learn functions of ultrasonic sensors and motor drivers
- 2) Learn functions of auxiliary nodes of the motor-driven software
- 3) Learn the software nodes: Functions such as Comparison, Digit, and AND

#### Step1: Inspire

The owner loves the cat, but the cat is not attaching to him. How can we make the cat attach to its owner and follow the owner everywhere?

#### Step2: Thinking

How can we make the cat aware of the owner's movement, and then let it follow its owner? Which modules can let the cat know that its owner is leaving? And which modules can let the cat start moving? The ultrasonic sensors can sense the movement of the object in front of them and the motor can drive the wheels.

#### Step 3: Programming

By means of Neuron APP online programming, set that: within a certain distance, when the person leaves the cat, the ultrasonic sensor will sense the change of distance. When the distance is greater than 20cm, the motor will be triggered to rotate. Then the cat will automatically follow the movement of the person.

#### Step4: Make and Tinker

After the cat's function has been achieved, it is time to design the cat's appearance. The ultrasonic sensor has two protruding holes, which can be used as the cat's nose. At the designing stage, two small holes can be drilled.

#### Step5: Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

## Thinking after Class



➤ **Review on Key Points:**

- 9. Programming for distance sensing of the ultrasonic sensors;
- 10. Use Comparison, Digit and AND nodes.

➤ **Improvement and Optimization:**

- 6. How about adding a buzzer module?

## List of Materials



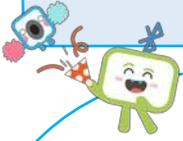
Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth	1	PCS
Ultrasonic sensor	1	PCS
Dual motor driver	1	PCS
Motor kit	1	Kit
Connection cable 20CM	1	PCS
Magnetic board	4	PCS
Wheel kit	2	Kit

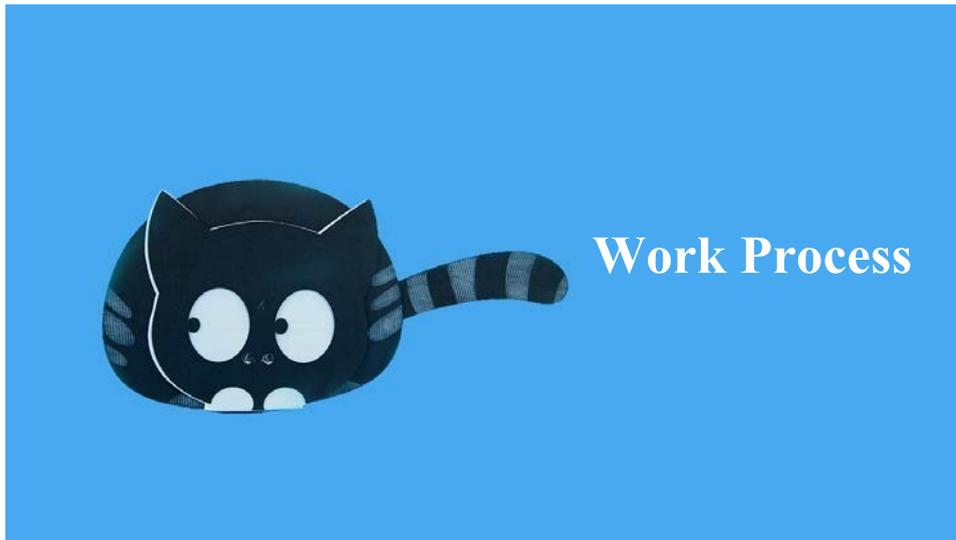
Material List

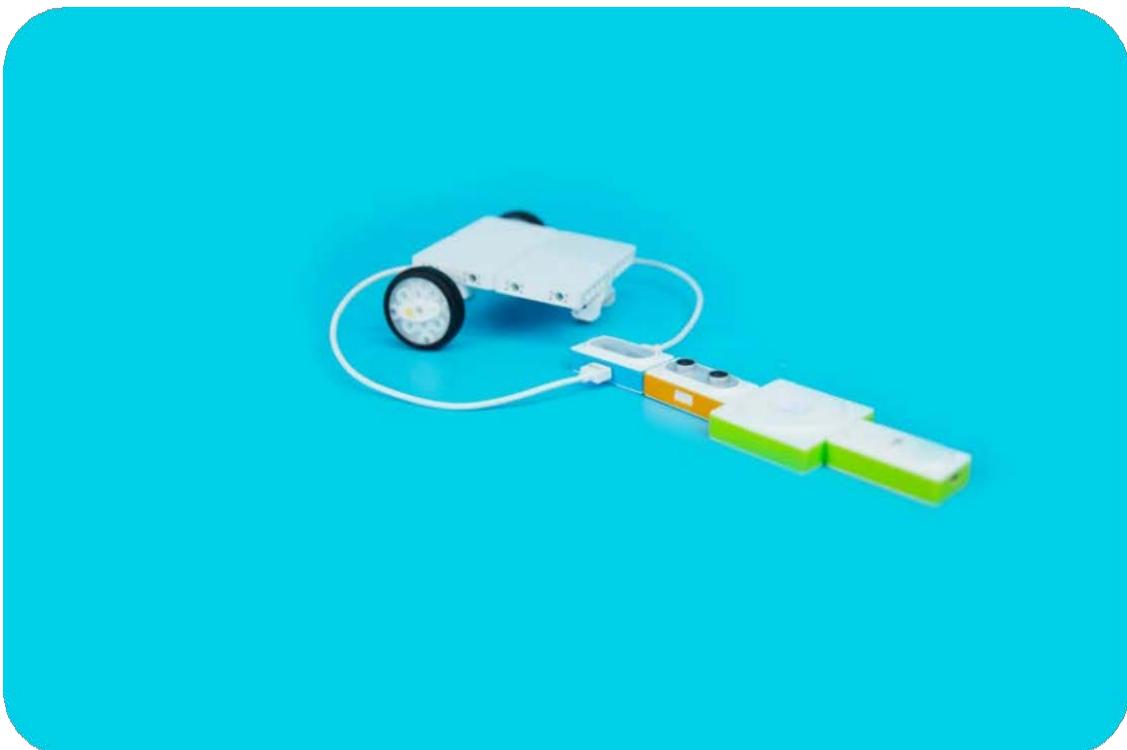
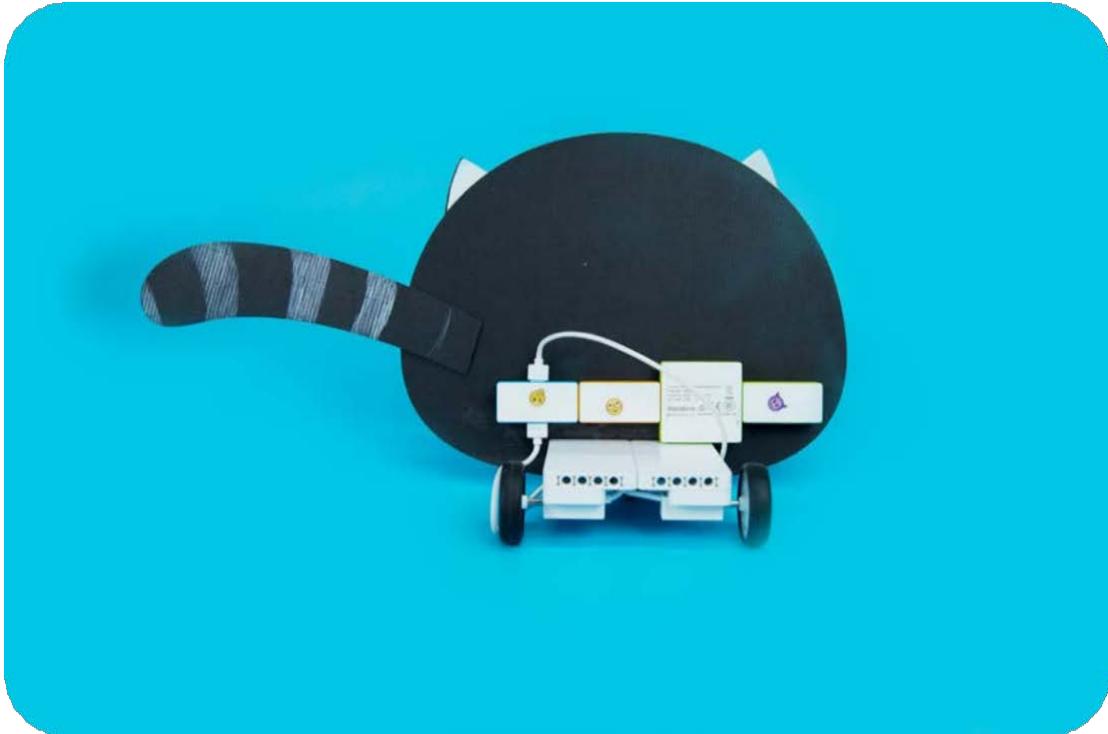
Name	Qty.	Unit
Paper-based cat model	1	Set
Double-sided tape	1	Roll
White paper	1	PCS

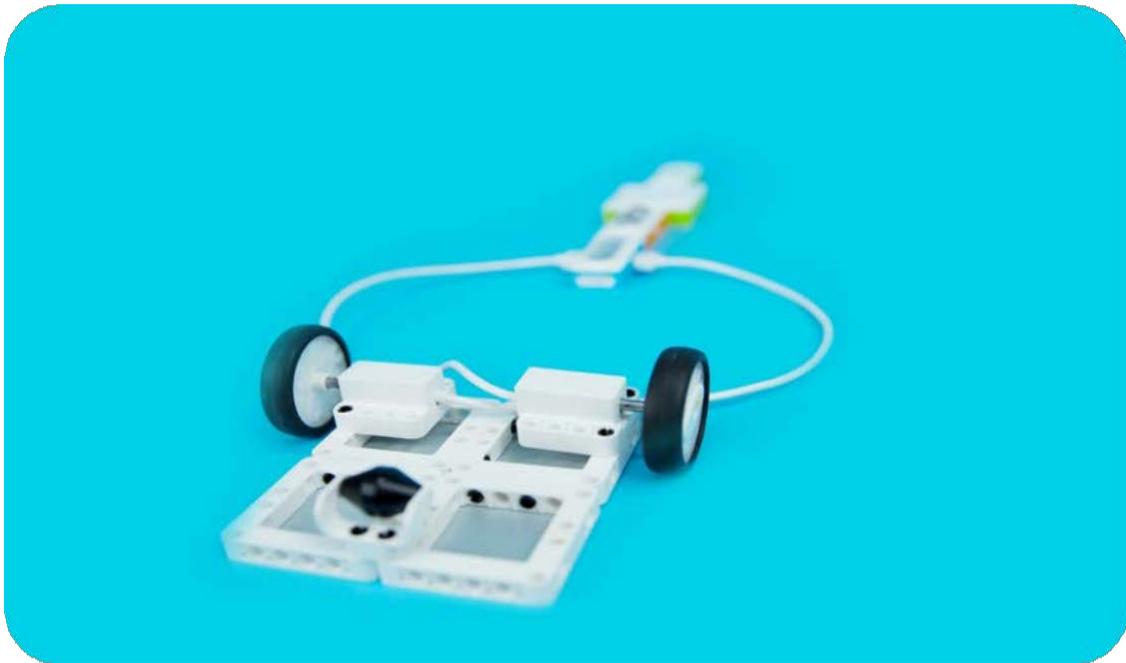
## Work Production Procedure



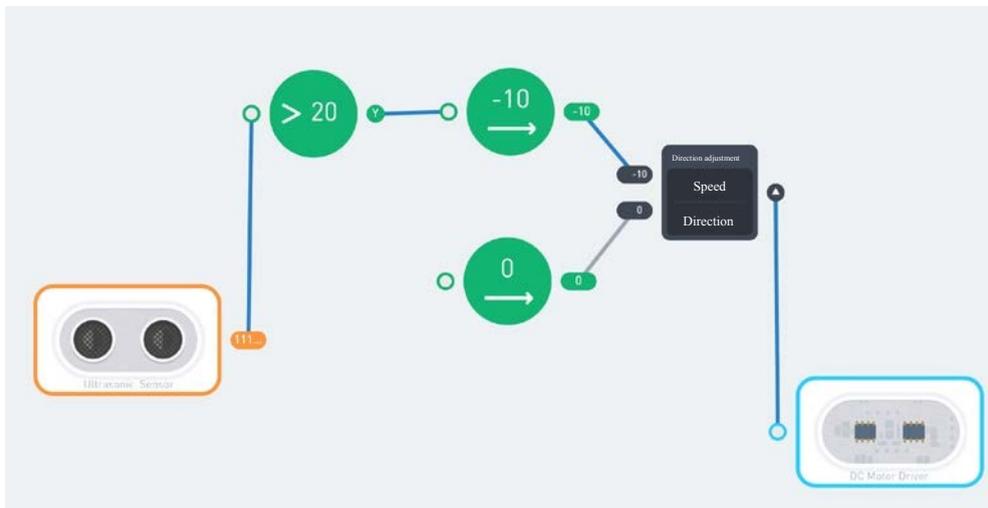
➤ Work Production Process:







➤ Demonstration for online programming

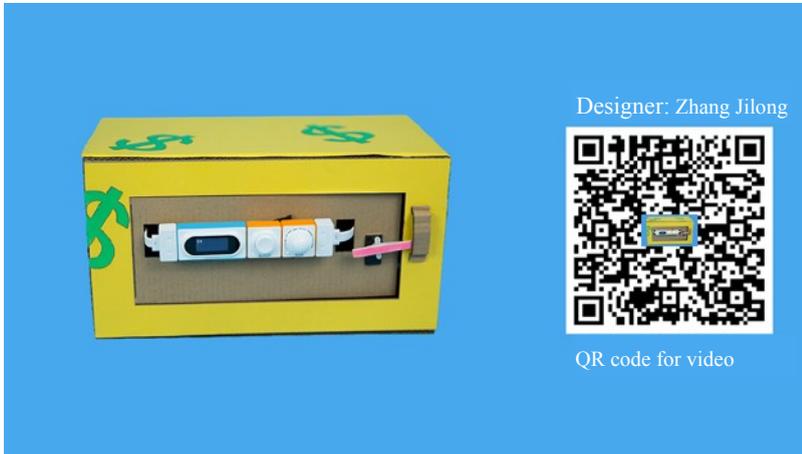


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## Name of Work: Safe Box

**Difficulty: Advanced**

**Time: 30 Minutes**



Video Link: <http://static.education.makeblock.com/SafetyBox.mp4>

### Lesson Description:

Use the knobs to make a cipher lock and the password is displayed on the display. When the password is correctly entered, the indicator will light up. Now press the button the safe box will be opened.

## Teaching Procedure



### Objectives:

1. Know and learn how to use servo.
2. Understand logics “OR” and “AND”.
3. Make a safe box.

### Teaching Process:

Step 1: Learn "How to protect your property"

Step 2: The students shall learn by themselves the knowledge covered in this lesson, such as Neuron modules and software nodes.

Step 3: Show the finished work and explain the modules and nodes. Provide necessary materials.

Step 4: After discussions and observing the finished work, start making a safe box.

Step 5: Share works with each other.

Thinking after Class



➤ **Review on Key Points:**

1. Application of servo.
2. Logics “OR” and “AND”.

➤ **Improvement and Optimization:**

List of Materials



Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth module	1	PCS
Button	1	PCS
Knob	1	PCS
Display	1	PCS
Dual servo-driver	1	PCS
Servo- drive kit	1	Kit
Connection cable 10CM	2	PCS

Material List

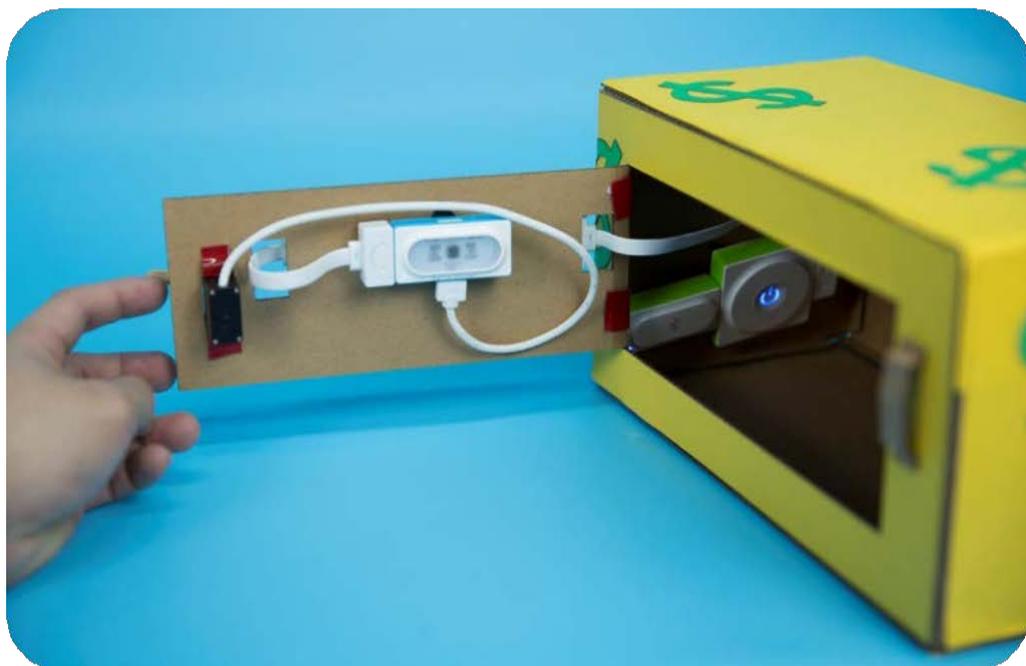
Name	Qty.	Unit
Paper-based model	1	PCS
Transparent double-sided tape	1	Roll

## Work Production Procedure

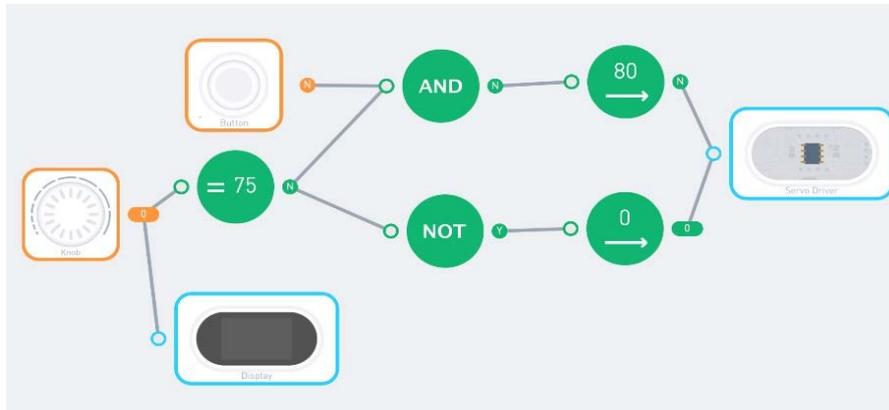


### ➤ Work Production Process:





➤ Demonstration for online programming



**Tips**

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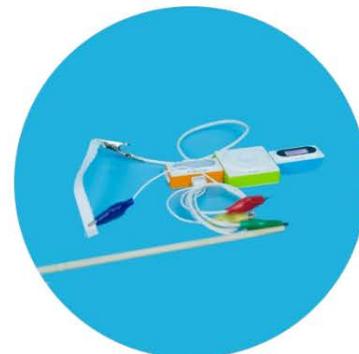
# Scientist



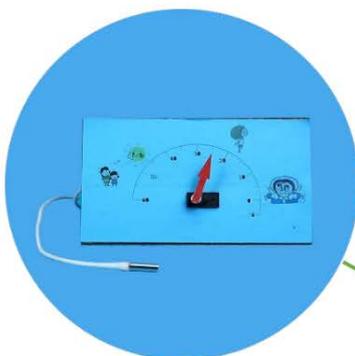
Reflectivity of Different Colors



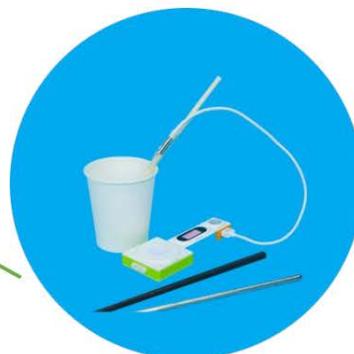
Exploring the Relationship between  
Light Energy and Distance



Know Common Conductors and Insulators



Thermometer



Thermal Energy Transmission

## Scientific Experiment: Reflectivity of Different Colors



**Difficulty: Basic**

**Time: 30 Minutes**

**Lesson Description:**

Use RGB lamps to create direct light that reaches on the paper. Use the light intensity sensor to measure the intensity of light reflected by the paper. Change the color of paper and observe the measured results.

## Teaching Procedure



**Objective of Experiment:**

1. Investigate the effect of color on the light reflection.
2. Learn how to choose colors in architecture and design.

Question: Which color has great reflectivity? What color has strong light absorption ability?

Experiment process:

Step 1: Collect colored paper made of the same material.

Step 2: The distances between RGB lamp, light intensity sensor and paper should remain unchanged.

Step 3: Wait for the data on the light intensity sensor to become stable, then record the result.

Step 4: Change a paper in different color.

Step 5: Record at least 3 measurement results for each color.

Thinking after Class



➤ **Review on Key Points:**

1. Which color can reflect light with the greatest reflectivity?
2. Which fields in our lives does the rule apply to?

➤ **Improvement and Optimization:**

How can we use this principle?

List of Materials



Module List

Name	Qty.	Unit
Power supply	1	PCS
Light sensor	1	PCS
RGB lamp	1	PCS
Display	1	PCS
Knob	1	PCS
Connection cable 10CM	1	PCS
Magnetic board	4	PCS

Material List

Name	Qty.	Unit
Worksheet	1	PCS

## Data



Color	Reflectance				Average
White					
Blue					
Green					
Red					
Yellow					
Black					



### Tips

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## Scientific Experiment: Explore the Relationship between Light Intensity and Distance



**Difficulty: Basic:**

**Time: 30 Minutes**

### Lesson Description:

Use the Neuron's light sensor module along with the display module to make a simple instrument for detecting light intensity. Use this instrument to measure the light intensity at different distances to conclude the relationship between light energy and distance.

## Teaching Procedure



### Objectives:

1. Explore relationship between light intensity and distance.
2. Learn the control variable method in scientific experiments

### Experiment Process:

Step 1: Place the measuring tape on the table for 50 cm.

Step 2: Set up the measuring instrument on the starting point of the tape (0 cm) .

Step 3: Put the flashlight at 10cm on the tape. Ensure that the height of the flashlight is the same as that of the measuring instrument.

Step 4: Record the result when the displayed result of the instrument becomes stable.

Step 5: Move the flashlight backward by 10 cm and record the result.

Step 6: Repeat Step 4 and Step 5.

Step 7: When the flashlight is moved to 30 cm, record the result and return the flashlight to 10 cm on the tape.

Step 8: Repeat this experiment 3 times to get the average value of the results.

### Conclusion:

The intensity of flashlight decreases as the distance from a light source increases.

## Thinking after Class



➤ **Review on Key Points:**

1. Why should we repeat the experiment more than 3 times?
2. Is there a relationship between the energy of light and the distance?

➤ **Improvement and Optimization:**

Try to find the current rule of light decay

## List of Materials



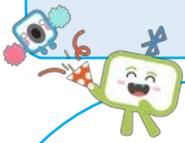
Module List

Name	Qty.	Unit
Power supply	1	PCS
Light sensor module	1	PCS
Display	1	PCS
Magnetic board	4	PCS

Material List

Name	Qty.	Unit
Measuring tape	1	Roll
Worksheet	1	PCS

Data



Distance (CM)	Light Intensity					Average
10						
20						
30						



**Tips**

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## Scientific Experiment: Know Common Conductors and Insulators



**Difficulty: Basic**

**Time: 30 Minutes**

### Lesson Description:

With the feature of a touch switch, make an instrument to determine whether an object is a conductor. Use the instrument to do an exploratory experiment, with the objective to let students learn the conductive properties of household materials.

## Teaching Process



### Objectives:

Identify the conductive household materials

Question: How do I make the touch switch work (forming a loop) ? Give examples of conductors and insulators.

### Experiment Process:

Step 1: Find at least 10 commonly used materials (such as toothpicks, fruits, soda cans, white paper) .

Step 2: Based on the materials found, provide your assumptions as to which ones are conductors and which ones are not.

Step 3: Test the materials one by one, and record the results.

Thinking after Class



➤ **Review on Key Points:**

1. What is a loop?
2. What are conductors and insulators?

➤ **Improvement and Optimization:**

Explore new question: Can the electrical conductivity of objects be changed?

List of Materials



Module List

Name	Qty.	Unit
Power supply	1	PCS
Touch switch	1	PCS
Display	1	PCS

Material List

Name	Qty.	Unit
Worksheet	1	PCS

Data



Material	Conductor	Insulator



**Tips**

- ✓ Descriptions for hardware modules and software nodes can be found in the appendix at the end of the page;
- ✓ For paper-based models of the same design, please find in the appendix at the end of the page~
- ✓ The works with “🔗” are under online modes. Download Neuron APP on IPad or smart phone for programming;
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- ✓ Neuron APP Software version: 1.3.2

## Scientific Experiment: Thermal Energy Transmission



**Difficulty:** Basic

**Time:** 30 Minutes

**Lesson Description:**

Use the temperature sensor to detect temperature changes of objects, and record the results.

### Teaching Procedure



**Objectives:**

Explore the thermal conductivity of different materials.

**Experiment Process:**

Step 1: Collect at least 3 kinds of objects of the same size but of different materials (such as wooden chopsticks, plastic chopsticks, and iron chopsticks) .

Step 2: Attach the temperature sensor on each object. Make sure that the temperature sensor is attached to the same position on each object.

Step 3: Prepare 3 cups of the same size and pour the same amount of hot tap water into each cup.

Step 4: Turn on the timer and record the temperature sensor's results once every 3 minutes.

Step 5: Record 3 sets of results

Thinking after Class



➤ **Review on Key Points:**

1. Which household material has the best thermal conductivity?
2. Which fields in our lives does the rule apply to?

➤ **Improvement and Optimization:**  
How can we use this principle?

List of Materials



Module List

Name	Qty.	Unit
Power supply	1	PCS
Temperature sensor	1	PCS
Display	1	PCS

Material List

Name	Qty.	Unit
Worksheet	1	PCS
Disposable cup	Several	PCS
Iron chopsticks	1	PCS
Plastic chopsticks	1	PCS
Wood chopsticks	1	PCS
Transparent adhesive tape	1	Roll

## Data



Material	Time		
	3min	6min	9min
Iron			
Plastic			
Wood			



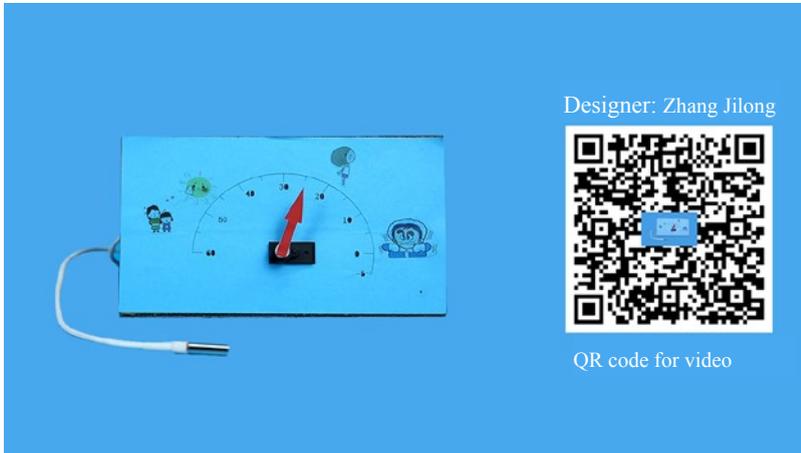
### Tips

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## Name of Work: Thermometer

**Difficulty: Intermediate**

**Time: 30 Minutes**



Video Link: <http://static.education.makeblock.com/Thermometer.mp4>

### Lesson Description:

Use the temperature and humidity sensors to detect the temperature and humidity in the surrounding environment. Use the neuron APP programming feature to “map” the data into degrees which will be displayed on servo.

## Teaching Procedure



### Objectives:

1. Know and learn how to use the temperature and humidity sensor module to explore the surrounding environment.
2. Understand the "Mapping" node.
3. Make a thermometer.

### Teaching Process:

Step 1: Start the lesson by telling a story (or a model) related to temperature.

Step 2: In the exploration stage, the students learn the knowledge covered in this lesson by self-study, such as Neuron modules and software nodes.

Step 3: Changes the external factors to cause temperature and humidity changes, which will let the students experience the natural changes. (For example, hold the sensor tightly and blow into the sensor)

Step 4: Show finished work to the students. Then provide them with necessary materials.

Step 5: After observing the sample finished work, the students start to make their own works.

Step 6: Share works with each other.

## Thinking after Class



➤ **Review on Key Points:**

1. Know and learn how to use the temperature and humidity sensor module to explore the nature environment.
2. Understand the "Mapping" node.

➤ **Improvement and Optimization:**

Try adding other sensors to make the thermometer smarter. For example, add RGB lamp or buzzer to realize reminding function.

## List of Materials



Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth module	1	PCS
Temperature and humidity sensor	1	PCS
Dual servo-driver	1	PCS
Servo kit	1	Kit
Magnetic cable (10cm)	1	PCS

Material List

Name	Qty.	Unit
Cardboard	1	PCS

## Work Production Procedure

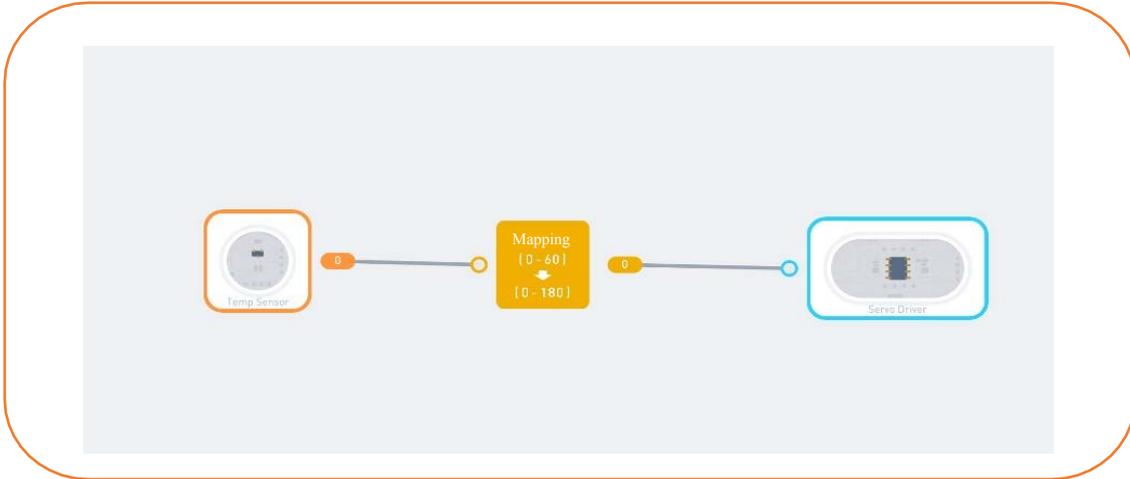


➤ Work Production Process:





➤ Demonstration for online programming



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# Maker's Home



“Quiet Zone” Reminder



Energy-Saving Light



Visual Door Remote Control System



Auto-adjustable Clothes Drying Rack



Plant Guard



Smart Pill Box

## Name of Work: Energy- Saving Light

**Difficulty: Basic**

**Time: 30 Minutes**



Video Link: <http://static.education.makeblock.com/EnergysavingLamp.mp4>

### Lesson Description:

When the night falls, the lights will be lit up in the house, giving family the warmth of home. When the daylight comes, the light will automatically turn off, saving electric energy.

## Teaching Procedure



### Objectives:

The main modules used in this work include the light sensor and the LED driver.

- 1) Know and learn functions of the light sensor and LED driver
- 2) Learn the online functions of the light sensor
- 3) Master the knowledge of software node: comparison

#### Step1: Inspire

We often see these scenarios. When night is falling, a lot of road lamps, signs and household appliances will automatically be turned on; when the daylight comes, the lights will be automatically turned off. How does this happen? We can also install these kinds of lights in our home, which are beautiful and energy saving.

#### Step2: Thinking

What can we do to enable the light to distinguish nighttime and daytime. And how can we let the light off in the night and on at daytime? Which module can realize this kind of effect?

#### Step3: Programming

By means of Neuron APP's online programming, we can let the lights off at daytime and on at nighttime according to the various values obtained from the light sensor;

#### Step 4: Make and Tinker

After the function is achieved, we will begin to make various small works, such as energy-saving desk lamps, signs, and home appliances models!

#### Step5: Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

Thinking after Class



- **Review on Key Points:**
- 11. Functions of the light sensor
- 12. Use of software nodes

List of Materials



Module List

Name	Qty	Unit
Power supply	1	PCS
Bluetooth	1	PCS
Light sensor	1	PCS
LED driver	1	PCS
LED	1	Pack
Connection cable 10CM	1	PCS

Material List

Name	Qty.	Unit
Paper-based house model	1	Set
Double-sided tape	1	Roll

## Work Production Procedure

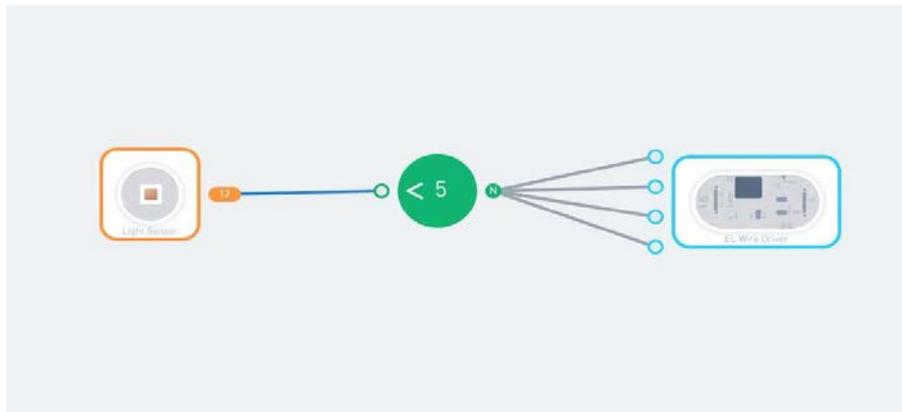


➤ Work Production Process:





➤ Demonstration for online programming



**Tips**

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- ✓ Neuron APP Software version: 1.3.2

## Name of Work: “Quiet Zone” Reminder

**Difficulty: Intermediate**

**Time: 30 Minutes**



Designer: Xiong Xiong



QR code for video

Viedo link:<http://static.education.makeblock.com/SilenceKeeper.mp4>

### Lesson Description:

When you are reading a book in the library, someone is talking very loudly. Sometimes it is not impolite to remind the person directly. Now you can use this “quiet zone” reminder to remind that person~

By using the Neuron module, you can easily achieve the desired effects. You should try it ~

## Teaching Procedure



### Objectives:

Create works using the Neuron's electronic modules: 1) Sound sensor, which can activate the servo when a large volume is sensed; 2) Servo, which can control the opening and closing angles; 3) Display, which can show the volume of voice;

Use Neuron APP to achieve the function of the works: 1) online adjustment of the servo angle accurately, so that the 2 displays can rotate at the same speed; 2) using the comparison and digit nodes to setup, so that if the volume of sound is greater than a certain value, the “quiet zone” reminding sign will be lit up;

#### Step1: Inspire

The teacher can play video or show the sample finished work to the students; let the students observe the work and think: in what everyday life scenarios can we use the “quiet zone” reminder.

#### Step2: Thinking

What modules does this work use? Which effects have these modules achieved respectively? What are the difficulties in using double- servos?

#### Step3: Make and Tinker

What materials do we need for this work? The functions of the modules need continuous debugging to achieve the best results;

#### Step 4: Programming

Use the Neuron APP for online programming, try the nodes such as comparison, digit and others;

#### Step5: Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

Thinking after Class



➤ **Review on Key Points:**

1. Adjust the angle and direction of double-servo;
2. Method to Use comparison and numbers digit nodes.

➤ **Improvement and Optimization:**

1. How about adding an LED module?

List of Materials



Module List

Name	Qty.	Unit
power supply	1	PCS
Bluetooth	1	PCS
Sound sensor	1	PCS
Dual servo driver	1	PCS
Servo kit	2	Kit
Connection cable 20CM	1	PCS
Magnetic board	3	PCS
Plug	1	Pack

Material List

Name	Qty.	Unit
Paper-based box model	1	PCS
Ice cream stick	2	PCS
Color cardboard	3	PCS
Transparent double-sided tape	2	Roll
Double-sided tape	1	Roll

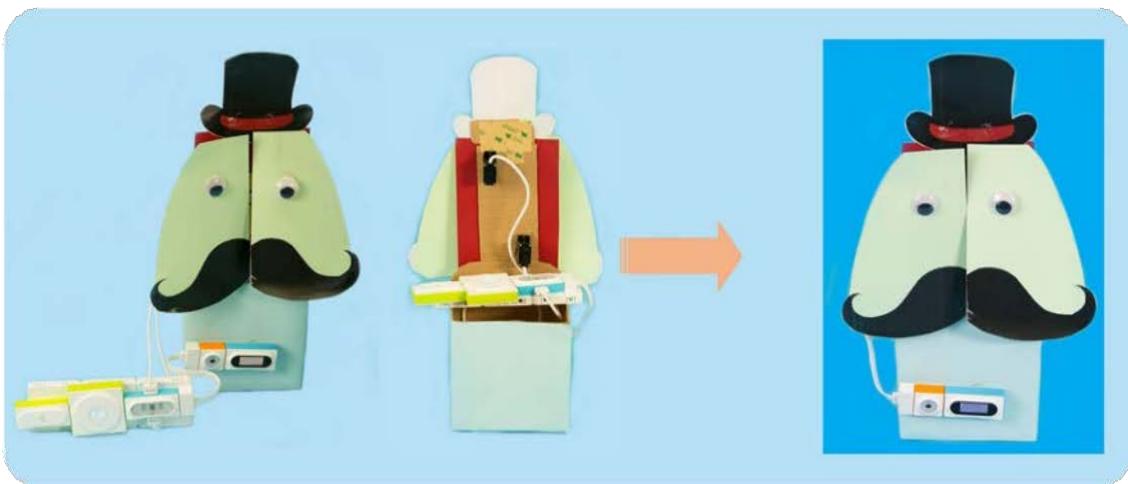
## Work Production Procedure



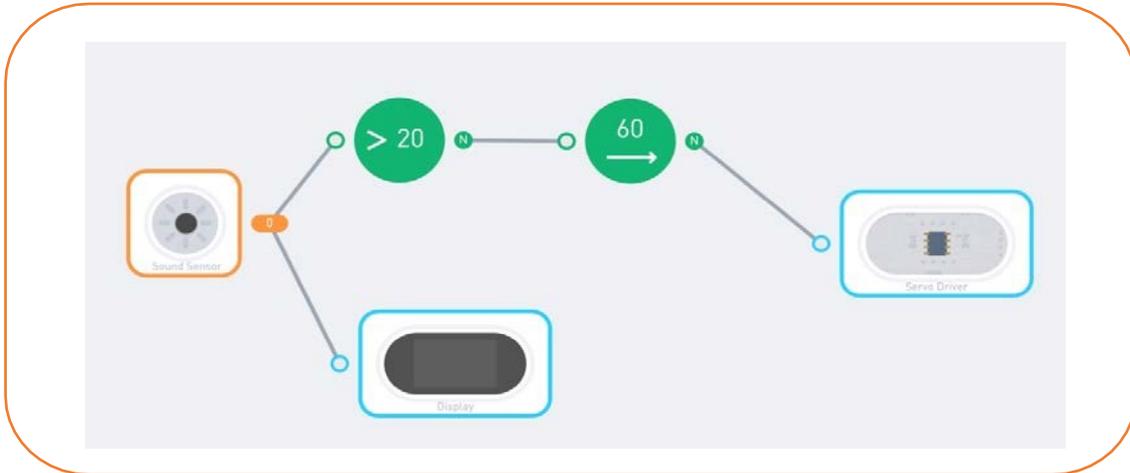
### ➤ Work Production Process:



Module List		
Name	Qty.	Unit
power supply	1	PCS
Bluetooth	1	PCS
Sound sensor	1	PCS
Dual servo driver	1	PCS
Servo kit	2	Kit
Connection cable 20CM	1	PCS
Magnetic board	3	PCS
Plug	1	Pack



➤ Demonstration for online programming



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- ✓ Neuron APP Software version: 1.3.2

## Name of Work: Auto-adjustable Clothes Drying Rack

**Difficulty: Intermediate**

**Time: 30 Minutes**



Video Link: <http://static.education.makeblock.com/ClothesHanger.mp4>

### Lesson Description:

It's raining, but the clothes are still hanging on the drying rack. And there is no one at home to bring the clothes home. You can make an automatic drying rack. By using the Neuron module, you can easily achieve the desired effects. You should try it ~

## Teaching Process



### Contents:

Create works using the Neuron's electronic modules: 1) Use servo module to control the rotating angle of the servo; 2) temperature and humidity sensor can sense the humidity in the environment;

Use Neuron APP to achieve the effects of the works: 1) Perform an accurate online adjustment of the angle of the servo to allow the consistency of the rotating angles for 2 servos; 2) the comparison, digit and NOT nodes can let the automatic drying rack to collect the clothes if the humidity is greater than a certain value, and put the clothes on the rack if the humidity is lower than this value;

#### **Step1:** Inspire

The teacher can play videos or show the sample finished works to the students; the students observe the work and focus on learning the angles and installation directions for the double servos?

#### **Step2:** Thinking

What modules does this work use? Which effects have these modules achieved respectively?

#### **Step3:** Make and Tinker

What materials do we need for this work? The functions of the modules need continuous debugging to achieve the best results;

#### **Step 4:** Programming

Use the Neuron APP for online programming, try the functions such as comparison, digit, NOT and other nodes;

#### **Step5:** Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

## Thinking after Class



➤ **Review on Key Points:**

1. Adjusting the angle and direction of double-servo; programming for distance sensing of the ultrasonic sensors;
2. Use of Comparison, Digit, NOT and other nodes.

➤ **Improvement and Optimization:**

1. Use the cloud control (IoT) to remotely control the rack.

## List of Materials



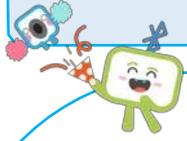
Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth	1	PCS
Temperature and humidity sensor	1	PCS
Dual servo driver	1	PCS
Servo kit	2	Kit
Connection cable 20CM	1	PCS
Magnetic board	8	PCS
Plug	1	Pack
Transparent rubber band	1	Pack

Material List

Name	Qty.	Unit
Paper-based house model	1	PCS
Paper-based balcony model	1	PCS
Ice cream stick	2	PCS
Transparent wire	1	PCS
Transparent double-sided tape	2	Roll
Double-sided tape	1	Roll
Color cardboard	3	PCS

## Work Production Procedure

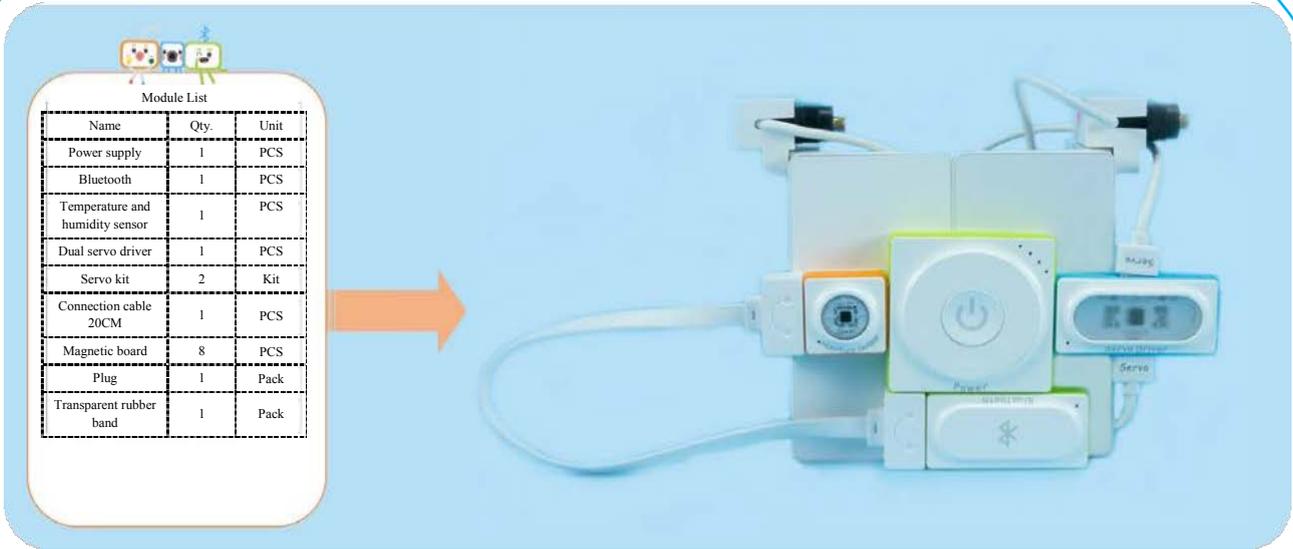


➤ Work Production Process:



Material List		
Name	Qty.	Unit
Paper-based house model	1	PCS
Paper-based balcony model	1	PCS
Ice cream stick	2	PCS
Transparent wire	1	PCS
Transparent double-sided tape	2	Roll
Double-sided tape	1	Roll
Color cardboard	3	PCS





Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth	1	PCS
Temperature and humidity sensor	1	PCS
Dual servo driver	1	PCS
Servo kit	2	Kit
Connection cable 20CM	1	PCS
Magnetic board	8	PCS
Plug	1	Pack
Transparent rubber band	1	Pack

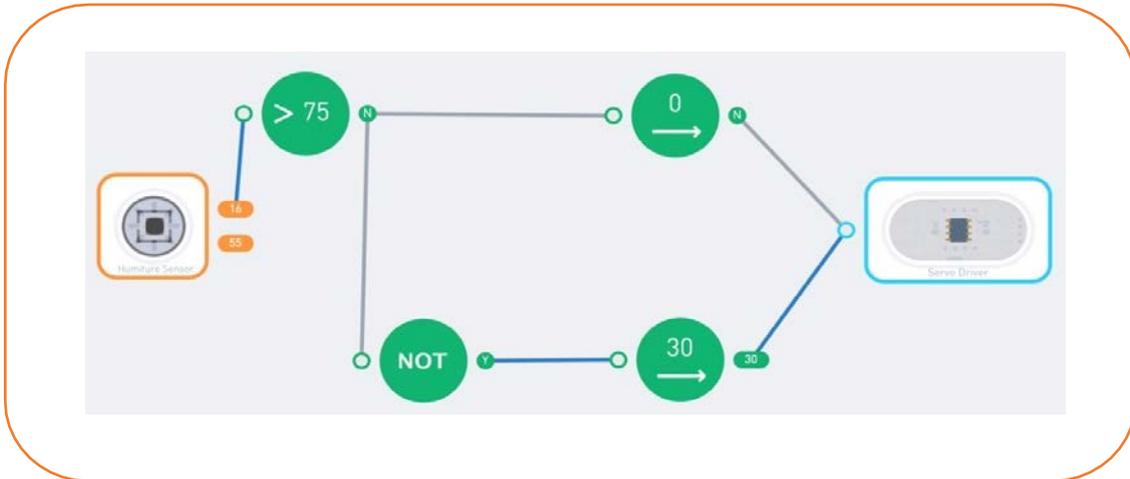


Three images showing the assembly of the robot chassis. The first image shows the chassis with two servos and a motor. The second image shows the electronic components being mounted onto the chassis. The third image shows the completed chassis with a mouse on top.



Two images showing the final assembly. The first image shows the completed chassis being placed inside a yellow and blue house structure. The second image shows the completed house robot with a mouse on top, sitting on a green grass mat.

➤ Demonstration for online programming



**Tips**

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## Name of Work: Smart Pill Box✪



**Difficulty: Intermediate**

**Time: 30 Minutes**

### Lesson Description:

Grandma/Grandpa often forgets to take medicine on time. What should I do? The smart pill box reminds you to take medicine at scheduled time. It can help grandpa and grandma to remember taking medicines on time.



## Teaching Process

### Objectives:

The main modules used in this work include the light sensor and the buzzer.

- 1) Learn the functions of the light sensor and buzzer.
- 2) Learn the functions of software nodes, such as time, digit, comparison and “AND”, etc.

#### **Step1:** Inspire

Grandma/Grandpa often forgets to take medicine on time. How should I remind them to take medicine? If the pill box can automatically remind them to take medicine, that will be terrific.

#### **Step2:** Thinking

First of all, I need a timer and a small alarm that can remind me at scheduled time. Second, when grandma/grandpa opens the pill box and takes the medicine, the alarm would automatically stop. In this way, it won't bother grandma/grandpa too much.

#### **Step3:** Programming

Which modules can help me achieve these functions? The software can help me achieve the timing function. The buzzer can act as a small alarm. But how does the pill box know whether grandma/grandpa has opened the pill box and taken the medicine? The light sensor can sense when the pill box is opened (because the light will reach inside the box) .

#### **Step4:** Make and Tinker

How should I design the pill box? How should I put the modules in the pill box and make it sense the light and make sounds? (Double-layer structure)

#### **Step4:** Test and Share

The work is completed, share your experience and skills, show your work to others, and let more people witness your creativity!

### Thinking after Class



➤ **Review on Key Points:**

- 13. Functions of software nodes
- 14. Functional logic: When it's time to take medicine but the pill box hasn't been opened, grandma/grandpa should be reminded of taking medicine. When the pillbox is opened, stop reminding.

➤ **Improvement and Optimization:**

- 1. Add an LED panel, so as to show some reminders on it.

### List of Materials



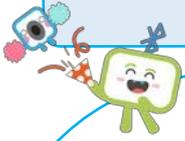
Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth	1	PCS
Light sensor	1	PCS
Buzzer	1	PCS
Connection cable 10cm	1	PCS

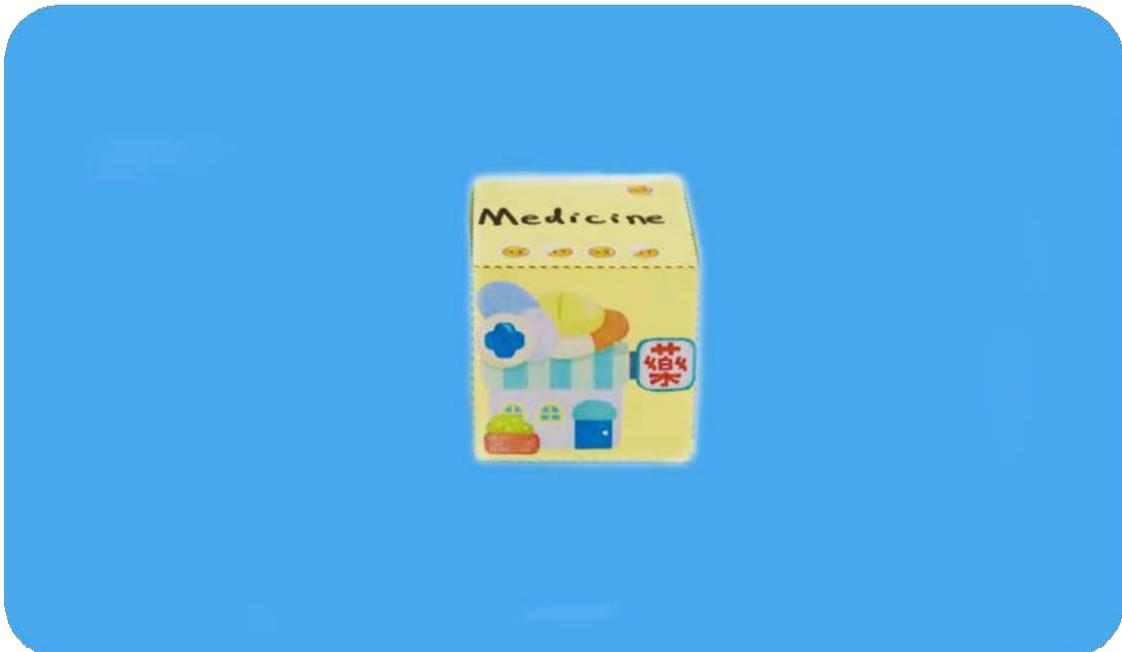
Material List

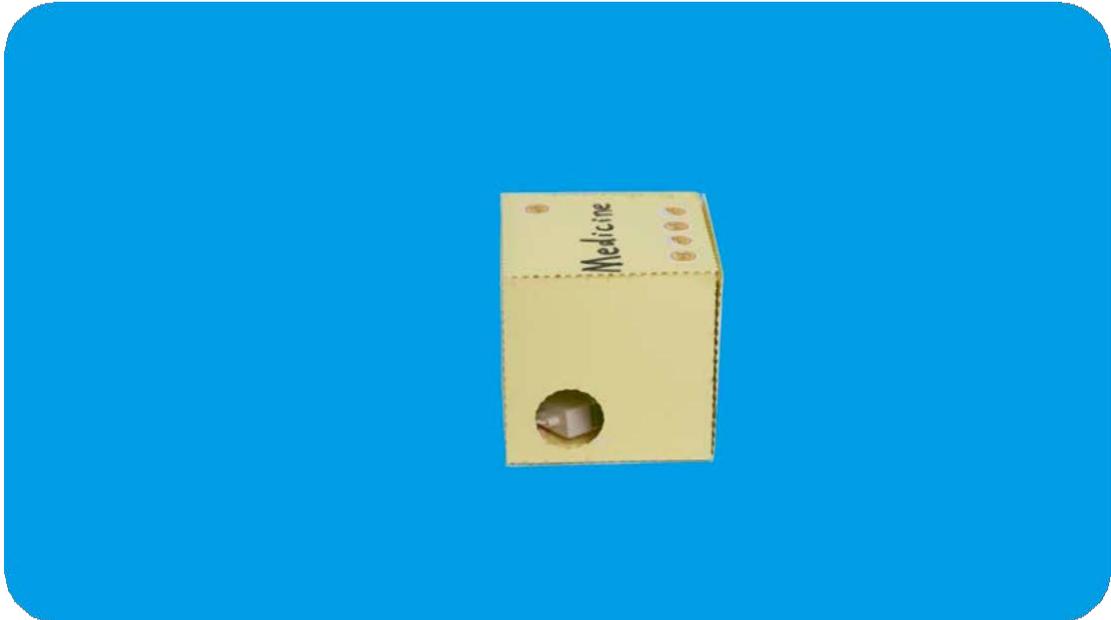
Name	Qty.	Unit
Paper-based pill box model	1	PCS
Scissors	1	Pair
Double-sided tape	1	Roll

## Work Production Procedure



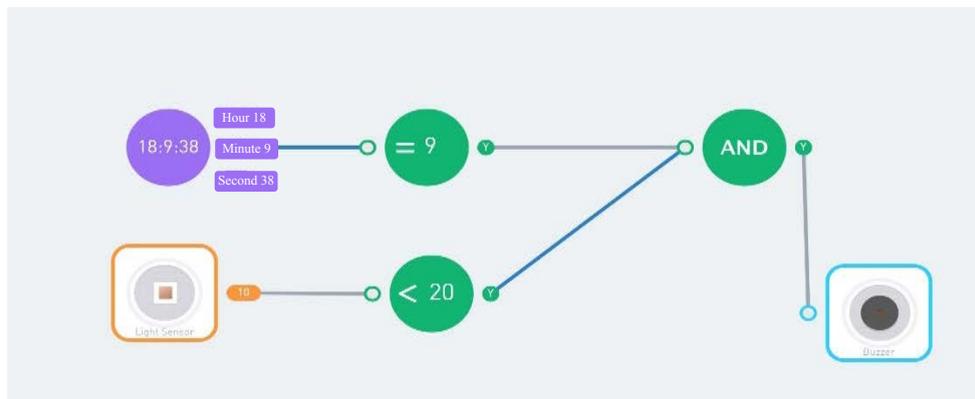
➤ Work Production Process:







➤ Demonstration for online programming



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## Name of Work: Plant Guard



Video Link: <http://static.education.makeblock.com/VisualizedDoorbellSystem.mp4>

**Difficulty: Intermediate**

**Time: 30 Minutes**

### Lesson Description:

Make use of the conductivity of the touch switch and use the Neuron APP programming function to make an alarm system. When the system is triggered, the buzzer makes alarming sounds and the LED flashes.

## Teaching Procedure



### Objectives:

1. Know and learn how to use touch switch.
2. Make an alarm system.

### Teaching Process:

Step 1: Exploring "How to Protect Plants from being Destroyed by Little Animals"

Step 2: Through self-study, the students learn the knowledge covered in this lesson, such as Neuron modules and software nodes.

Step 3: Show the sample finished work and explain the modules and nodes. Provide necessary materials.

Step 5: After discussions and observing the sample finished work, start making an alarm system.

Step 6: Share works with each other.

## Thinking after Class



➤ **Review on Key Points:**

1. The use and principle of touch switch.
2. Alarm system

➤ **Improvement and Optimization:**

Can you make an anti-theft system for your own room?

## List of Materials



Module List

Name	Qty.	Unit
Power supply	1	PCS
Bluetooth module	1	PCS
Touch switch (four control buttons)	1	PCS
RGB light	1	PCS
Buzzer	1	PCS

Material List

Name	Qty.	Unit
Cardboard	1	PCS
Scissors	1	Pair

## Work Production Procedure

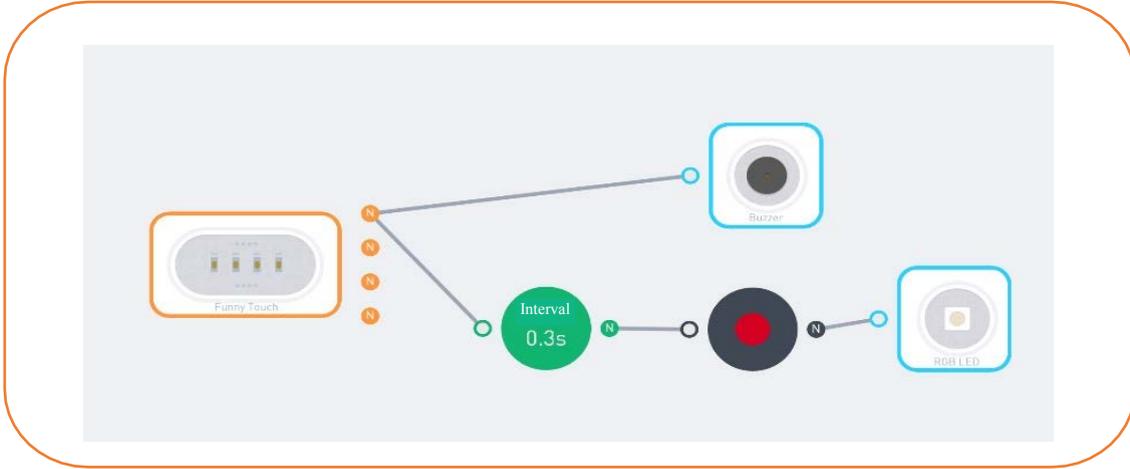


### ➤ Work Production Process:





➤ Demonstration for online programming



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## Glowing and Sounding Cottage

Teacher:	Grade: 4	Time: 1 Hour:
<b>Unit Title:</b> Glowing and sounding cottage	<b>Essential Standards:</b>  <b>4-PS3-2.</b> Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.  <b>4-PS3-4.</b> Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	
<b>Objectives:</b> After this lesson, the students will know how to use Neuron modules; understand the working principle of human infrared sensors, LED drivers and other modules; learn to collaboratively work with others; and be able to use Neuron modules to make their own works.		
<b>Student Group:</b> Group work, pair work		
Materials/Resources		Essential Vocabulary
<b>Teacher:</b> Neuron, materials, PPT, worksheets	<b>Student:</b> Neuron, materials	Electricity, light energy, sound energy, human Infrared sensors, remote control, programming, and cooperative learning
Learning Experience		
Inquiry Based Learning: <input type="checkbox"/> Use of the 5 E Lesson format Learner– centered instruction <input type="checkbox"/> Use of scientific investigation, problem Solving or engineering design <input type="checkbox"/> Hands on– minds on instructional strategies <input type="checkbox"/> Use of Process skills in context– predict, observe, measure, classify, infer, communicate	<b>Engage: Activating Strategy/Hook (Observation)</b> <ul style="list-style-type: none"> <li>The teacher introduces the Christmas stories; wait for the Christmas gifts from Neuron and think how to decorate the Christmas cottage.</li> <li>The teacher show the students the Christmas cottage made by him (a smart cottage that can sense lights and have a doorbell.)</li> <li>The students have 3 minutes to take a close look at the smart cottage, as well as all Neuron modules used, etc.</li> <li>The students observe and explore the function of each neuron module</li> <li>The teacher will explain the function of each neuron module in detail</li> </ul> <b>Explore: Learning Experiences (Thinking)</b> <ul style="list-style-type: none"> <li>The teacher distributes Form 1 and explains what needs to be filled up</li> <li>The students work in pairs to design a structure to achieve all functions of the Neuron. At this time, the teacher needs to guide the students regarding how to learn collaboratively and share work duties. (For example: one person acts as a structure builder and the other a tester)</li> </ul>	

<input type="checkbox"/> Peer Discussion–scientific arguments and explanations	<ul style="list-style-type: none"> <li>• The students have 8 minutes to build the structure according to their design (remind the students to consider time spent and materials to be used during the design process)</li> <li>• The students have 2 minutes to report to the teacher regarding their final design (according to Form 1)</li> </ul>
<input type="checkbox"/> Use appropriate tools accurately  <input type="checkbox"/> Focus on detail-precision & accuracy in observations and measurements	<p><b>Explain: Learning Experiences (Actual practice + immediate direction)</b></p> <ul style="list-style-type: none"> <li>• The students have 30 minutes to build the structure according to their design</li> <li>• The students should report any problem immediately</li> <li>• The teacher will walk around the classroom and provide help and guidance as required</li> </ul>
<input type="checkbox"/> Use of collaboration for learning	<p><b>Elaborate: Extending &amp; Defining (Communication and share)</b></p> <ul style="list-style-type: none"> <li>• The teacher distributes Form 2. The students have 3 minutes to report their works based on the four key points</li> <li>• The students have 5 minutes to show their works</li> </ul> <p><b>Evaluate: Summarizing Strategy (Summary)</b></p> <ul style="list-style-type: none"> <li>• The students conduct self-evaluation (allow the students to evaluate their own works and the entire process, from personal perspective and team perspective.)</li> <li>• The teacher evaluates according to the process and results (there is a corresponding evaluation form)</li> </ul> <ul style="list-style-type: none"> <li>• Review what learned</li> </ul>

**Differentiation Strategies**

<b>Extension</b>	<b>Intervention</b>	<b>Language Development</b>
Adding programming contents	Simplify the structure	The names of the Neuron modules

**Assessment(s) :**

**Teacher Reflection:**

## Explore the impact of different materials on sound emissions

### Lesson Description:

With the knowledge of the topic and under teacher's guidance:  Explore the sounds around you;  Use NEURON sensor to obtain test results;  Learn to record statistic data in tables, and analyze the data and make conclusion;

### Objectives:

Level: Elementary School (10-12 Years Old)

Difficulty: Intermediate

Time: 50 Minutes

### List of Materials:

- ✓ NEURON Modules
  - ◆ Power 2PCS
  - ◆ Knob
  - ◆ Button
  - ◆ Sound Sensor
  - ◆ Buzzer
  - ◆ Display
- ✓ Files
  - ◆ Teacher guide PPT
  - ◆ Test tool model
  - ◆ Student worksheet
- ✓ Attachments and files
  - ◆ Computers
  - ◆ Sound files
  - ◆ Product videos

### Teaching Process:

#### STEP 1: Preparation (3 mins)

1. Teacher's self-introduction, getting to know each other, and be familiar with the environment;  
*The teacher and the students getting to know each other;*
2. Classroom Rules;  
*Such as: raising hands to answer questions, friendly sharing materials, etc;*

#### STEP 2: Lesson Description (10 mins)

1. Have you been listening to the sounds around you?  
*Have we been paying attention to various sounds around us? Listen carefully to the sounds surrounding us;*
2. Guess what you've heard (play audio) ;
  - 1) Distribute worksheets
  - 2) Play audio for various sounds
3. Objectives: Explore the impact of different materials on sound reflection;

#### STEP3: Learning (10 mins)

1. Provide directions via scenarios, introducing the students into the lesson;  
*When we shout in an empty room we can hear the echo, but if the room is filled with furniture we couldn't hear any echo. Why?*
2. Learn the offline mode of NEURON;
  - 1) Distribute Knob, Buzzer, Power (2 PCS) ;
  - 2) Learn to make the Buzzer sound as shown in the PPT;
  - 3) Provide Sound Sensor and display, and learn how to use them*The teachers can refer to the guidance PPT*

**STEP 4:** Exploration (10 mins)

1. Raising Questions;

*Do materials have any effect on the echo? What material has a greater impact on the echo?*

*The teachers can refer to the guidance PPT*

2. Making Assumptions;

*Based on existing materials, make assumptions about the degree of influence of the materials on sound reflection*

*The teachers can refer to the guidance PPT*

3. Making Plans;

*Use the tools provided by the teachers to make plans.*

4. Recording Data;

*Record the actual data measured.*

5. Processing Information and Reach Conclusions

*Perform group discussion and reach conclusion regarding the data measured.*

**STEP 5:** Share (5 mins)

1. What conclusions have you reached from the experiments?

2. What fun features have you found in this lesson?

3. Can you repeat these experiments using the materials of this lesson?

**STEP 6:** Finishing (2 mins)

1. Organize the modules

2. Clean up desks

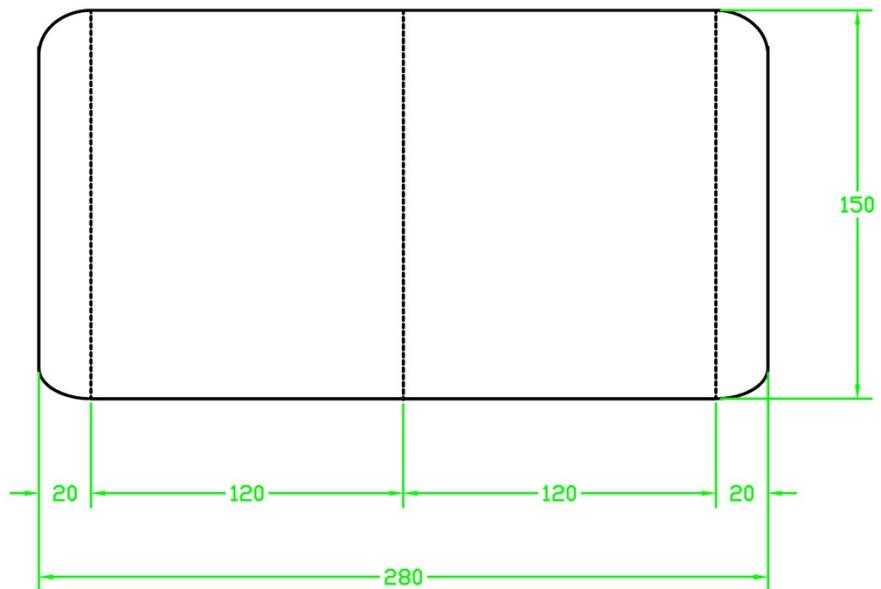
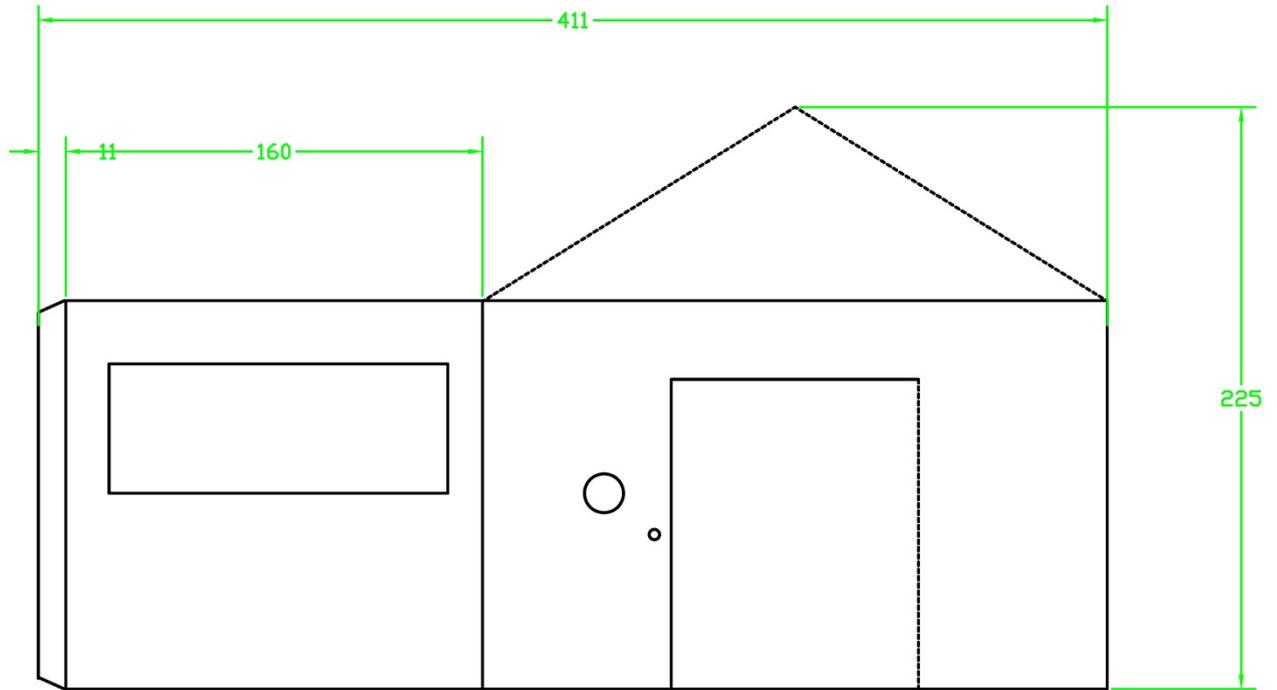
## V. Patterns of Paper-Based Models:

The followings are the paper-based models for your reference: If 1:1 originally sized paper-based models are required, please download from website <http://education.makeblock.com/>

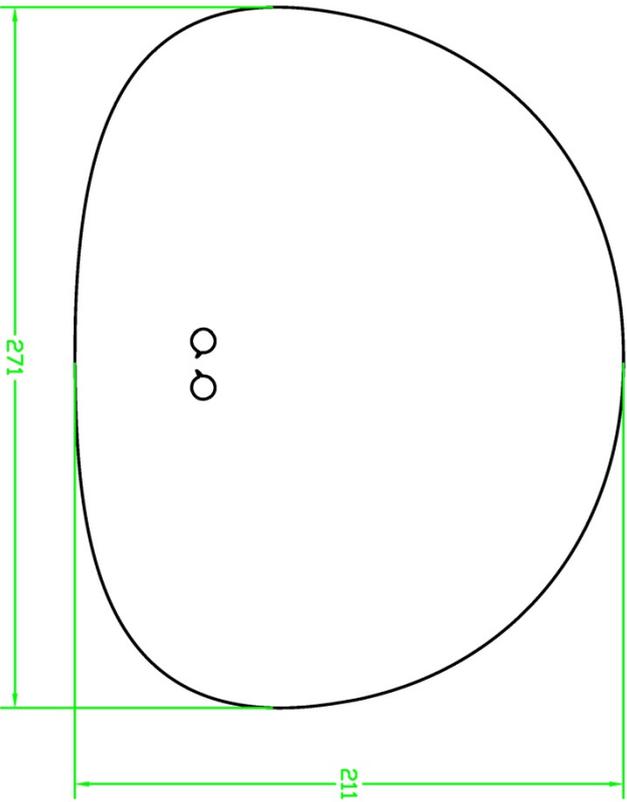
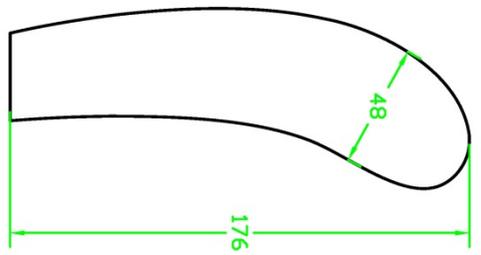
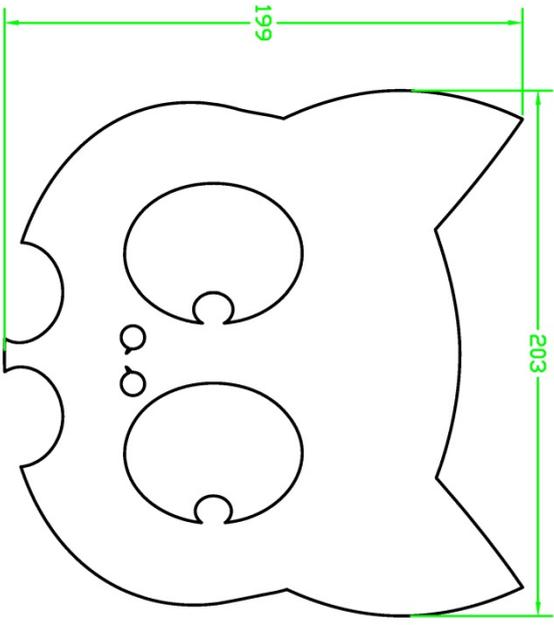
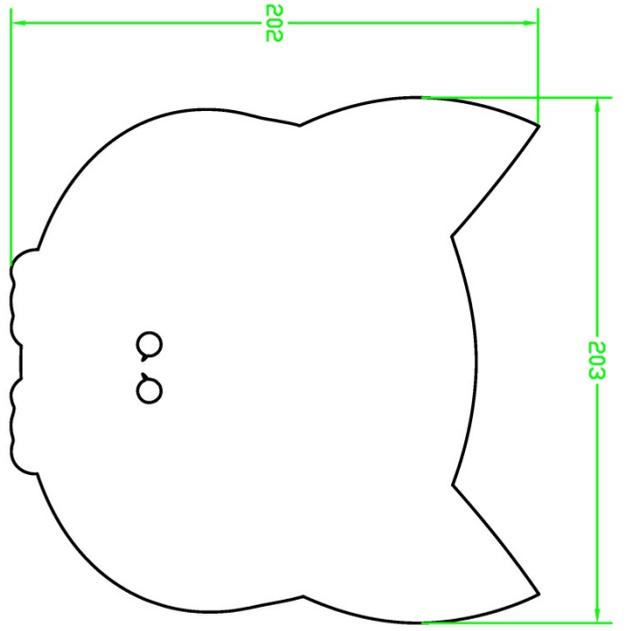
### Existing Paper-Based Models:

- House
- Copycat
- Carrot
- Rotating Face-Changing
- Pill Box
- Safe Box
- Smart Watering
- Plant Guard
- Thermometer
- Quite Zone Reminding Sign
- Penguin & Iceberg
- Toy Car
- Auto-Adjustable Clothes Drying Rack

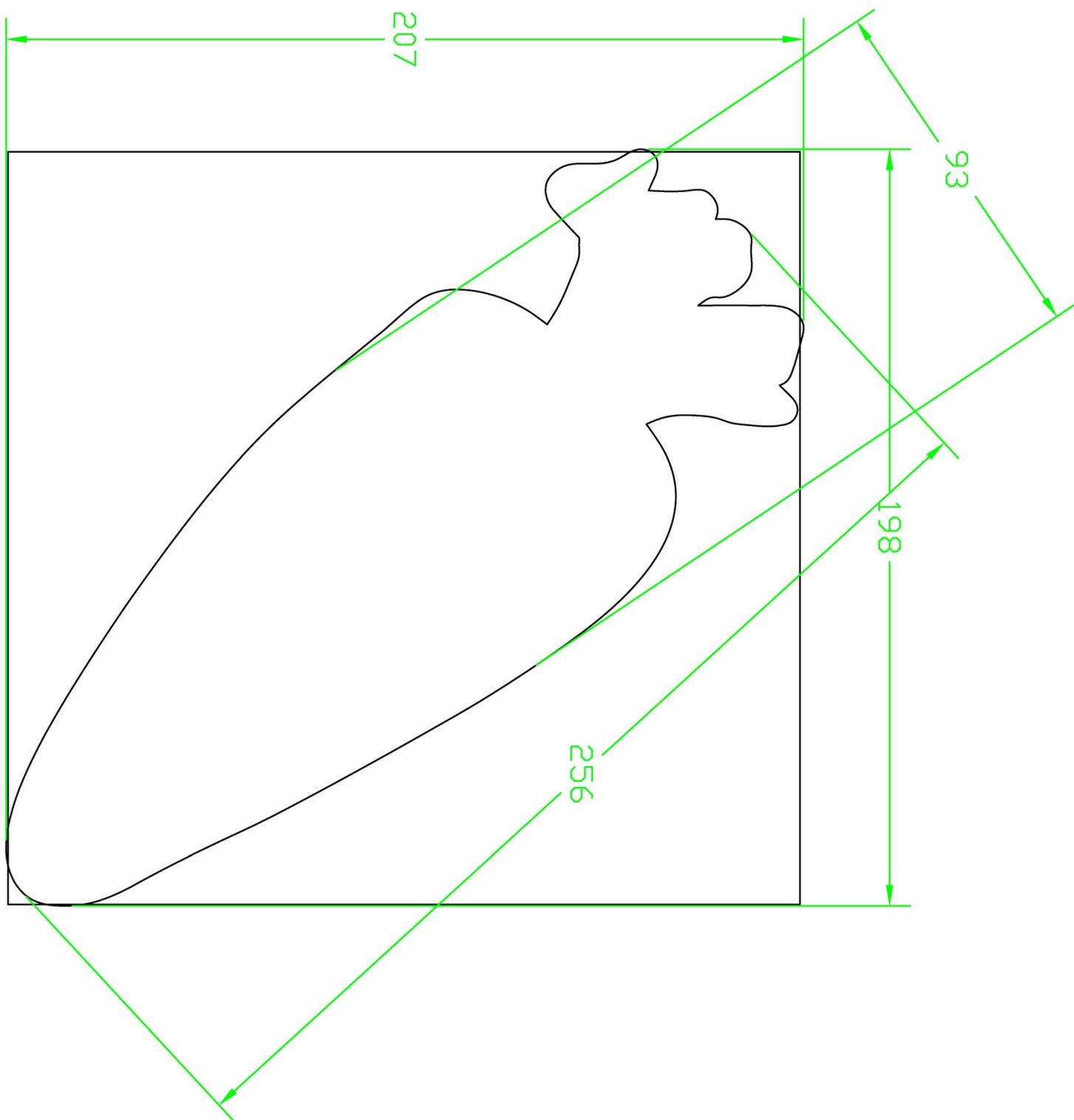
# House



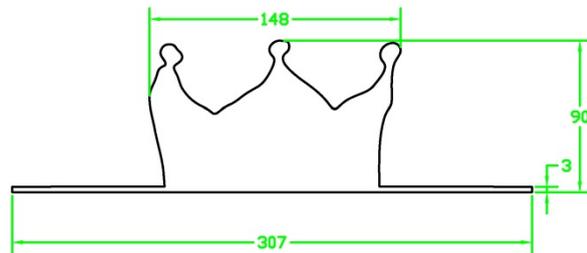
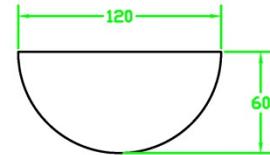
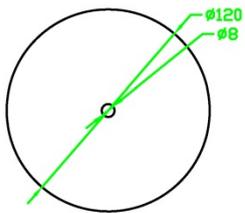
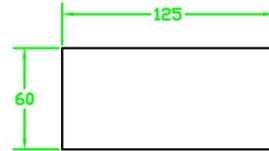
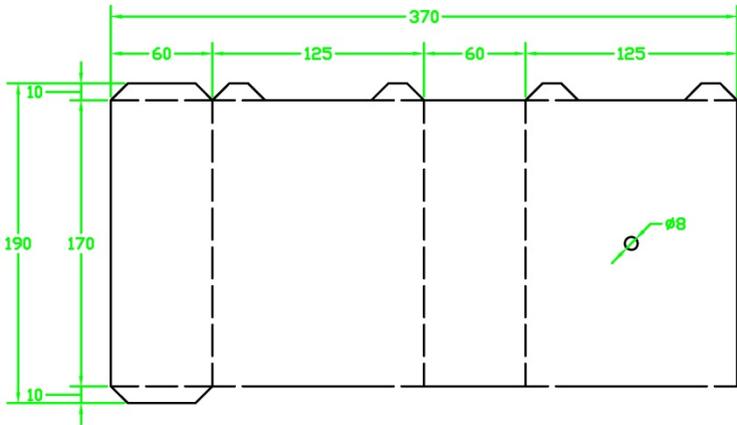
Copycat



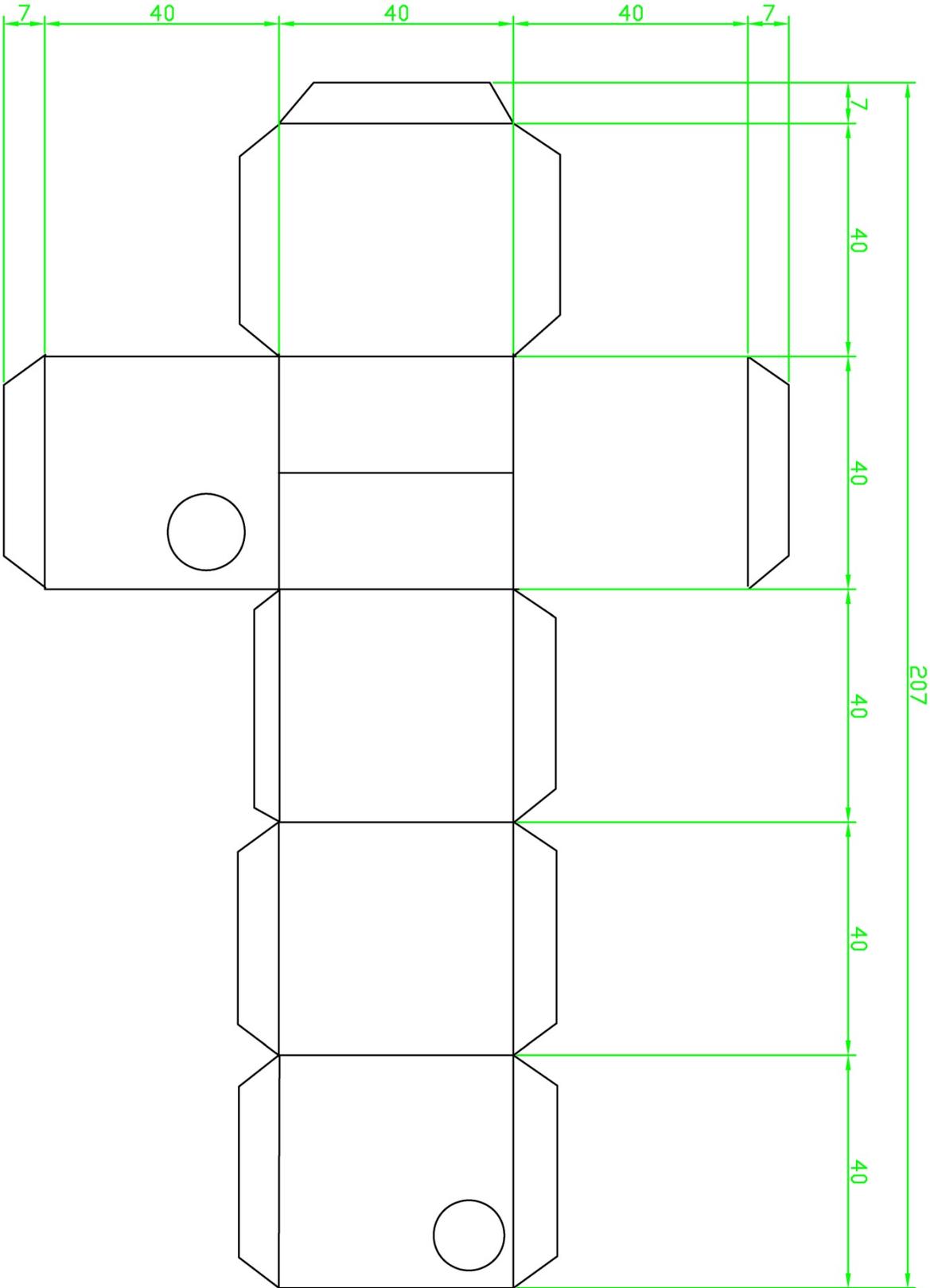
# Carrot



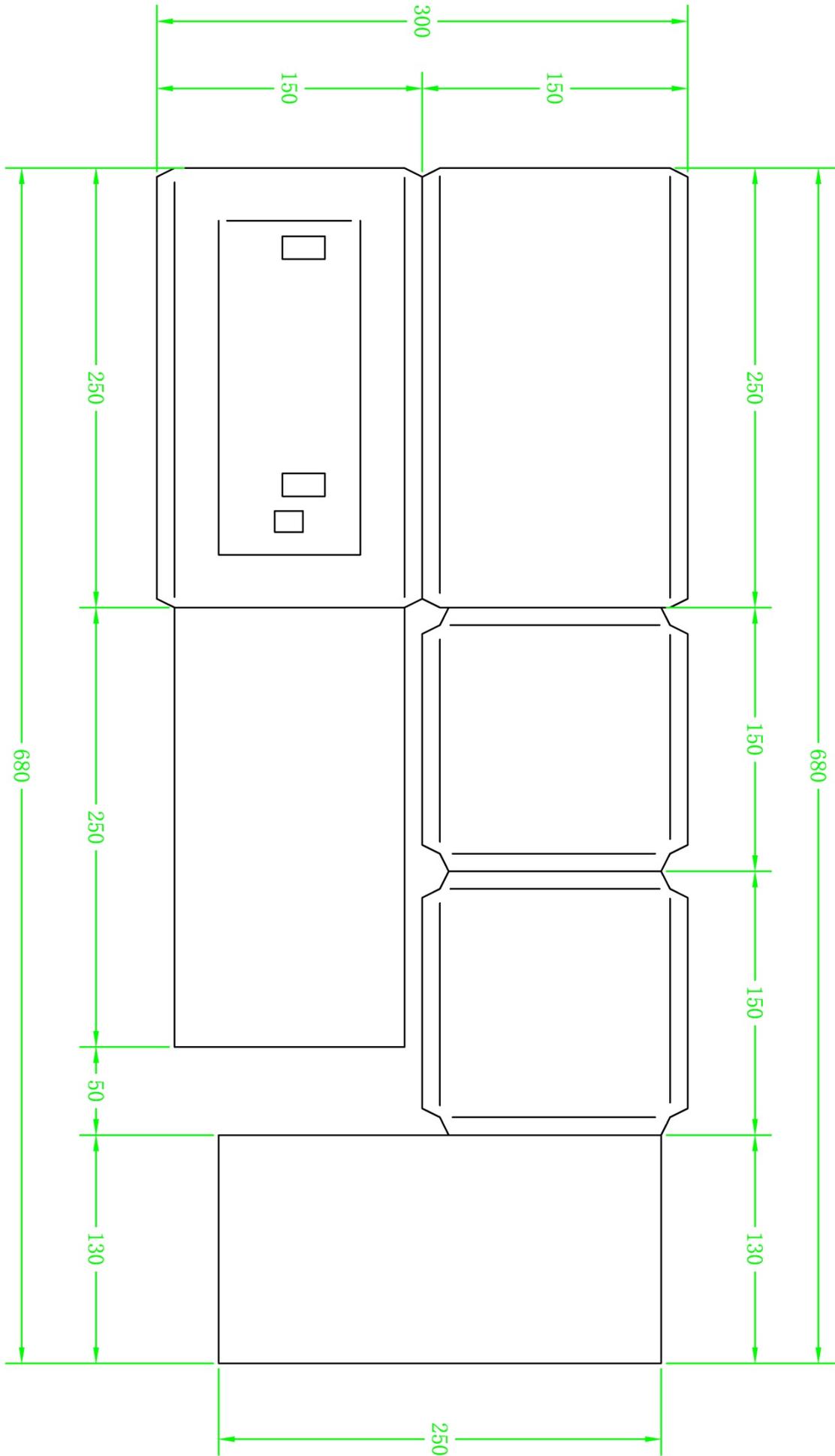
# Rotating Face-Changing



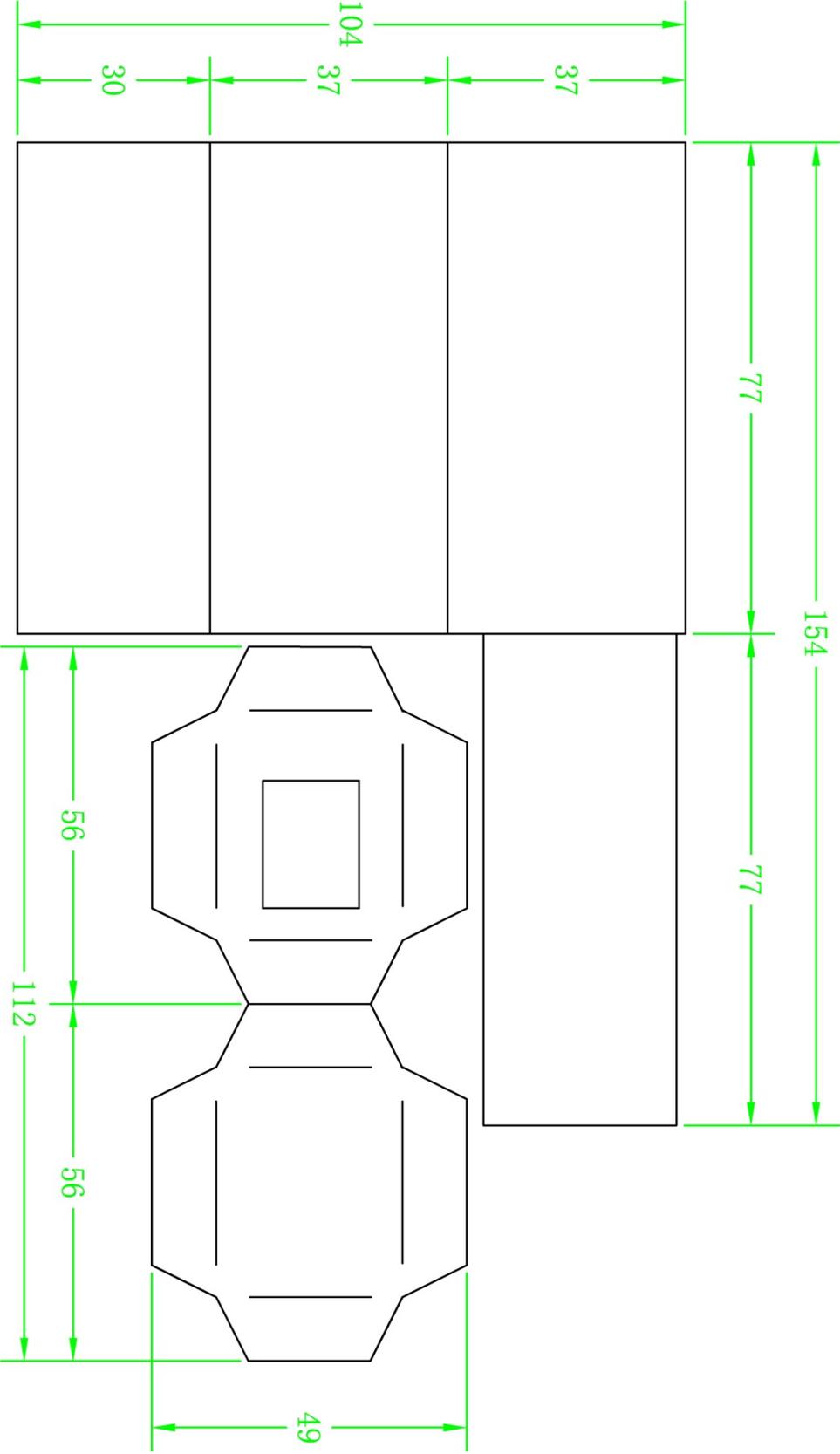
# Pill Box



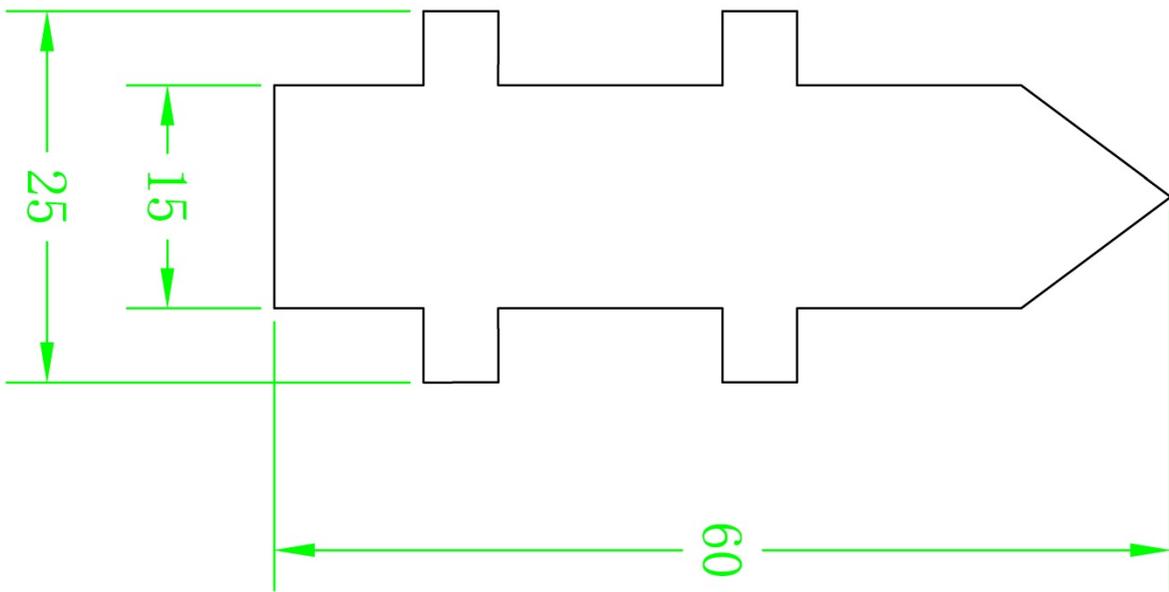
# Safe Box



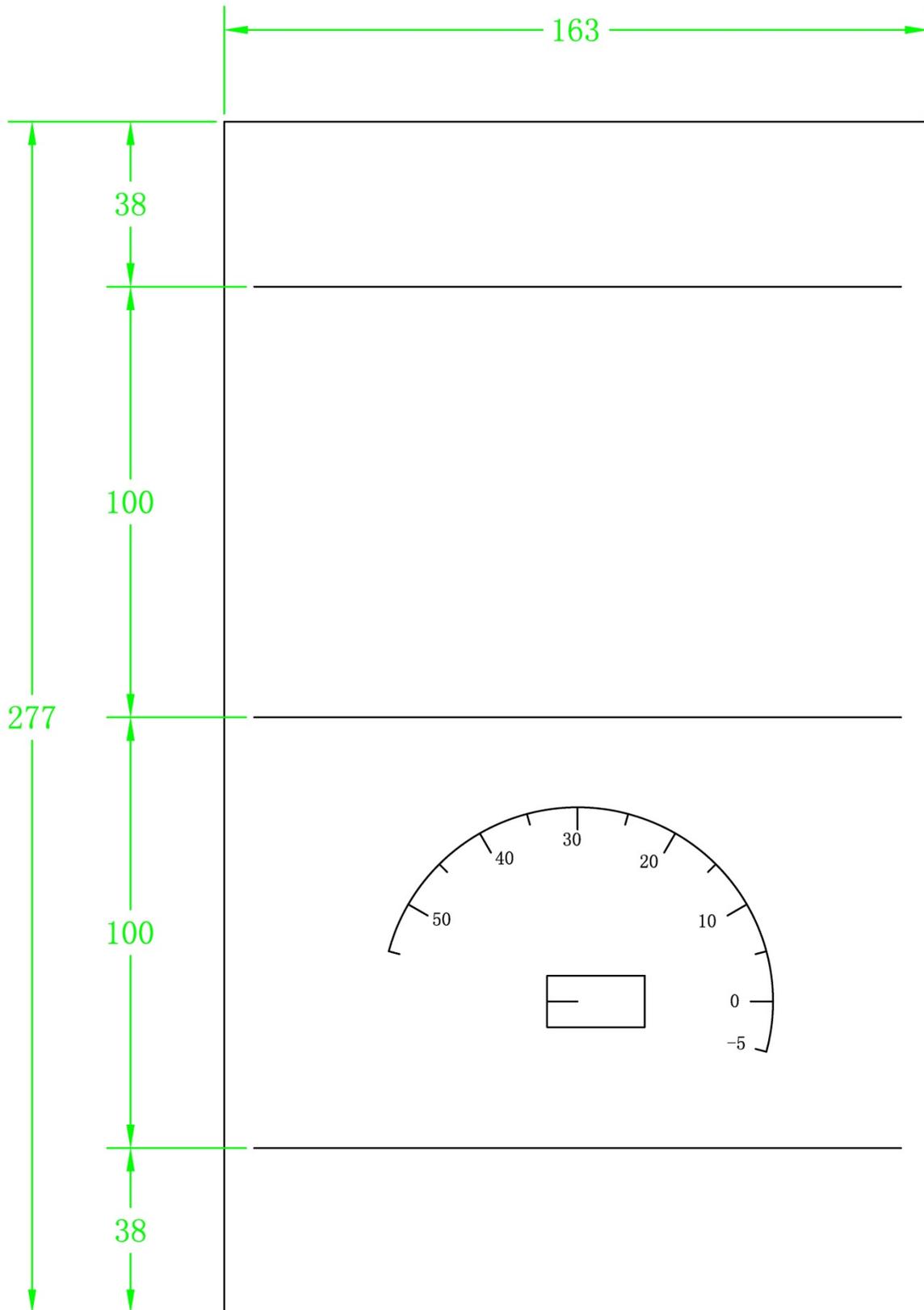
# Smart Watering



# Plant Guard

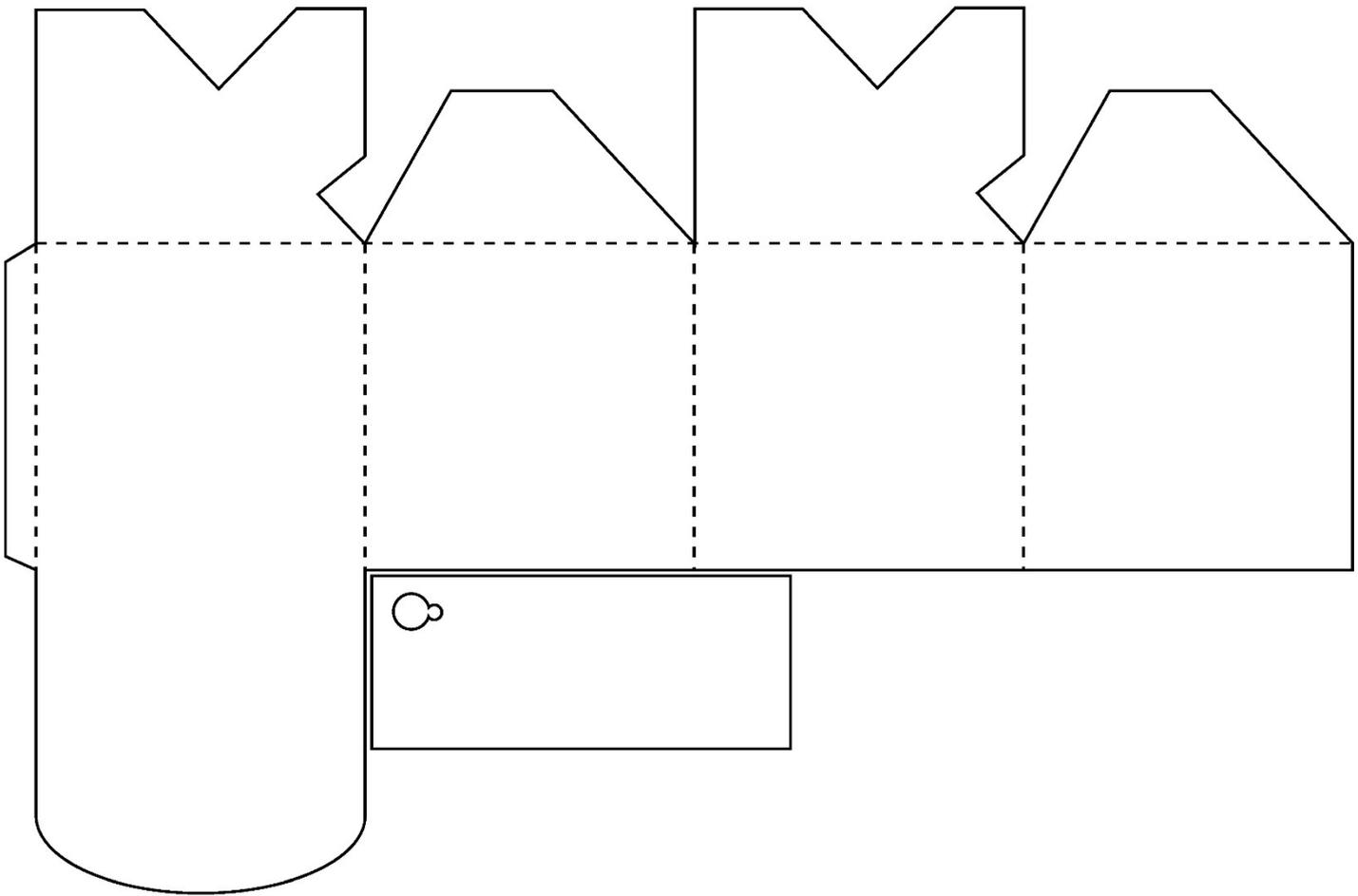


# Thermometer



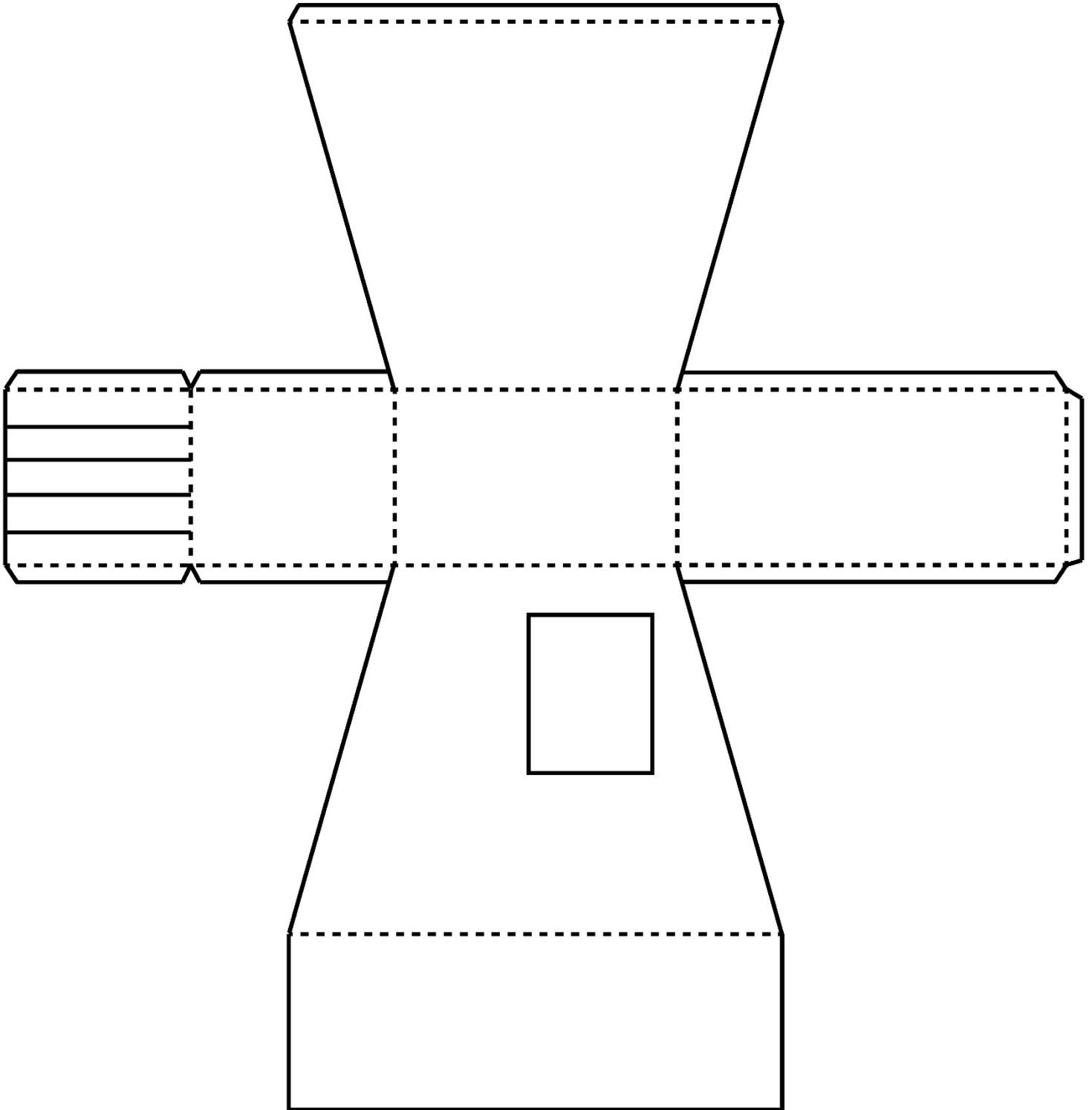
Reminder

Size: 450\*298mm



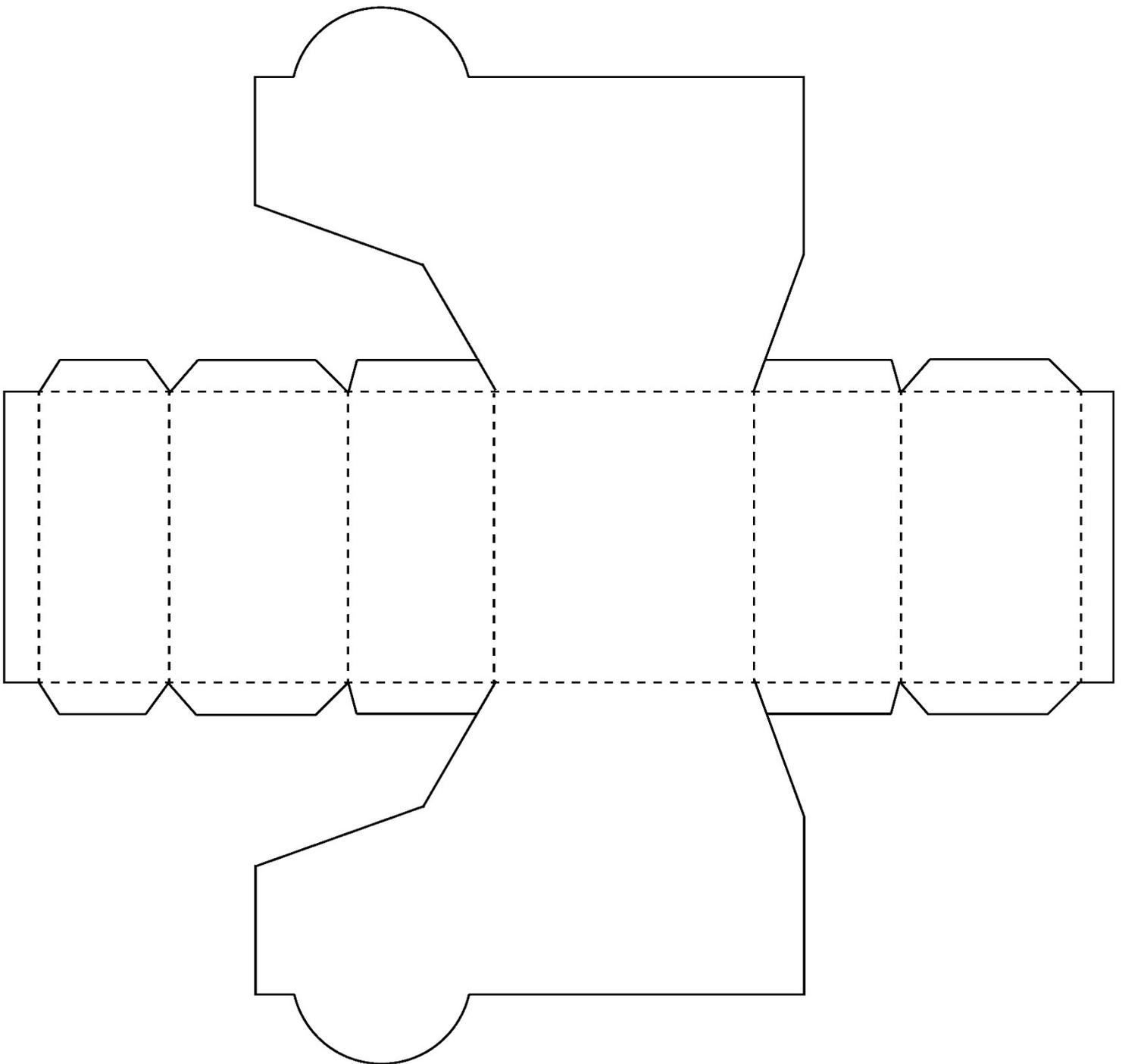
Penguin & Iceberg

Size: 609\*629mm



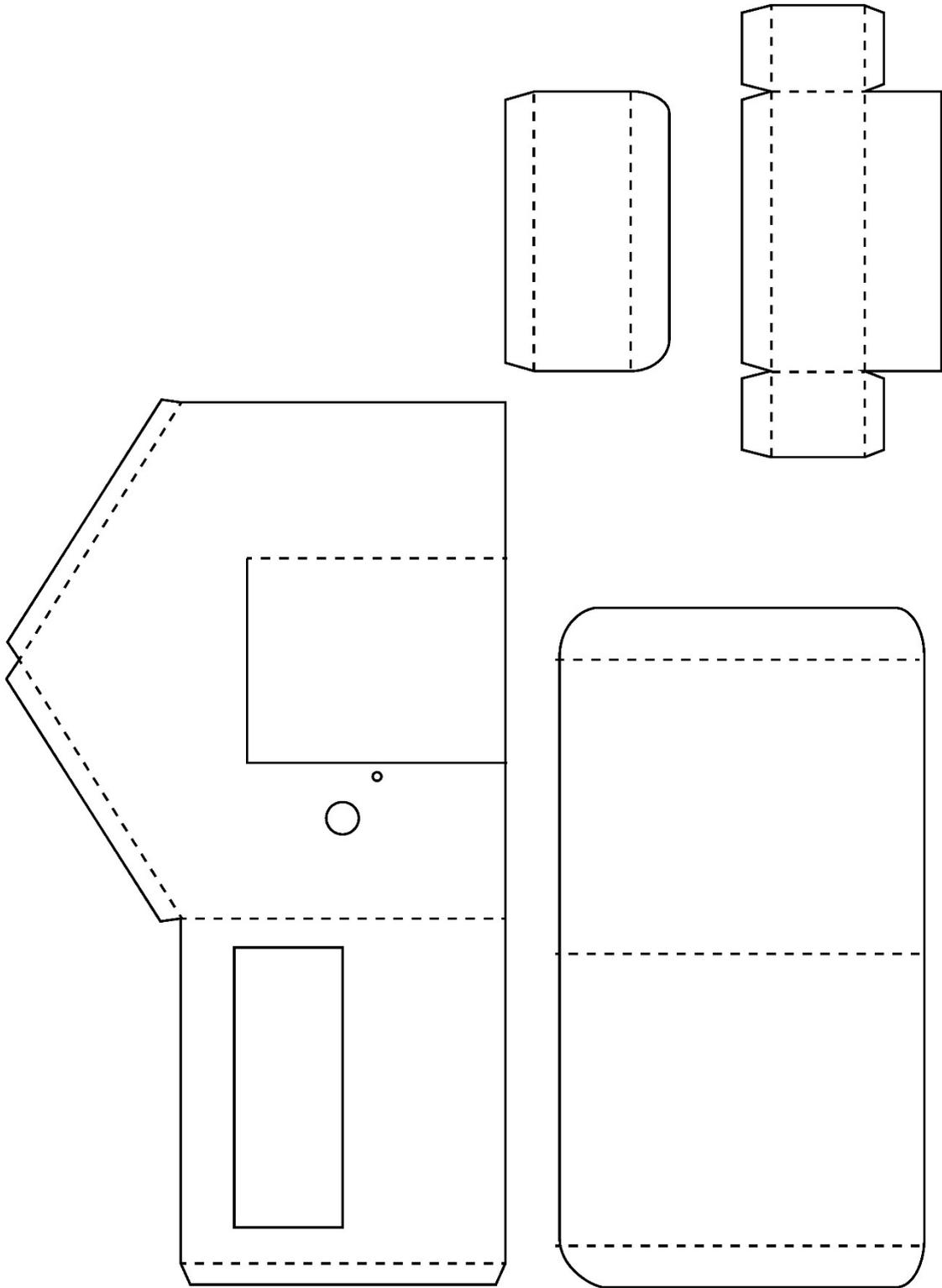
# Toy Car

Size: 341\*327mm



# House and Balcony

Size: 595.5\*431.5mm



## Neuron Block Card



**Block Name:** Light Sensor

**Feature:** The light sensor block detects light intensity of environments. The stronger the light is, the stronger the output signal will be.

**Connecting Example:**



**Building Example:**



Example Details: The light sensor detects the light intensity of environments. The brightness and number of lights on the LED panel vary according to signals from the input block. (When the light intensity is strong, the LED lights will be brighter and the number of lights will be larger; otherwise, the lights will be darker and the number will be smaller. )

## Neuron Block Card



**Block Name:** Dual IR Detector

**Feature:** The dual IR detector block includes two pairs of infrared reflective photoelectric sensors. They can work separately as buttons or used to detect black lines on the ground.

**Connecting Example:**



**Building Example:**



**Example Details:** The example is called Morse Telegraph. Tap the magnetic plate rhythmically and the buzzer will make sounds according to the rhythm. Try sending a group of encoded messages for seeking help?

## Neuron Block Card



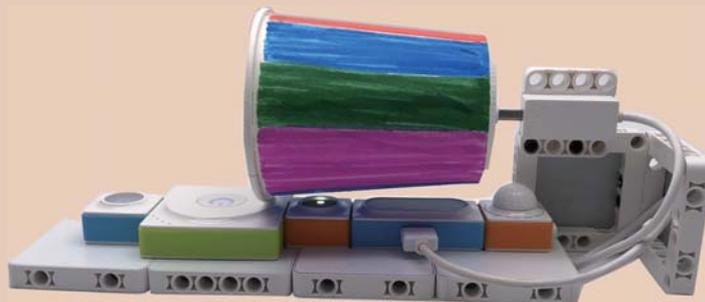
**Block Name:** Color Sensor

**Feature:** The color sensor detects the color of an object.

**Connecting Example:**



**Building Example:**



**Example Details:** The setup detects colors and display lights of the detected color . Try to make yourself a marquee.

## Neuron Block Card



**Block Name:** Gyro Sensor

**Feature:** The gyro sensor provides values of angles and acceleration.

**Connecting Example:**



**Building Example:**



**Example Details:** When you press the plate to the left, the ball on the LED panel will tilt towards the left; press the plate to the right, the ball on the LED panel will tilt towards the right. Have a try.

## Neuron Block Card



**Block Name:** Funny Touch

**Feature:** The Funny Touch detects whether current goes between the four-way pins and the GND pin and facilitates the machine-human interactions.

**Connecting Example:**



**Building Example:**



**Example Details:** Take turns touching alligator clips of different colors and touch the GND wire clip with the right hand. Listen, the buzzer is making different sounds.

## Neuron Block Card



**Block Name:** Humiture Sensor

**Feature:** The humiture sensor detects the temperature and humidity of environments.

**Connecting Example:**



**Building Example:**



**Example Details:** After the sensor finishing detecting the temperature and humidity of an environment, the LED display will show the value.

## Neuron Block Card



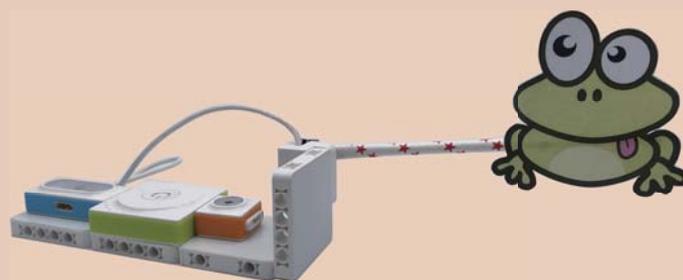
**Block Name:** Sound Sensor

**Feature:** The sound sensor detects the light intensity of environments. When it receives a strong sound signal, it will also output a strong signal.

**Connecting Example:**



**Building Example:**



**Example Details:** The frog sways according to the sound intensity that is detected by the sound sensor; the more greatly the volume changes, the more greatly the frog will shake.

## Neuron Block Card



Block Name: PIR Sensor

Feature: The PIR sensor can detect the movements of a human being within a distance of 3cm.

Connecting Example:



Building Example:



Example Details: When someone is approaching, the dog will wag its tail.

## Neuron Block Card



**Block Name:** Temperature Sensor

**Feature:** The temperature sensor detects the temperature of objects like water and human body. Detection Range: -30-100 C .

**Connecting Example:**



**Building Example:**



**Example Details:** The temperature value of the the water determines the brightness of the LED panel( expansion).

## Neuron Block Card



**Block Name:** Soil Moisture Sensor

**Feature:** The soil moisture sensor detects the moisture of soil.

**Connecting Example:**



**Building Example:**



**Example Details:** The LED display will show the soil moisture value.

## Neuron Block Card



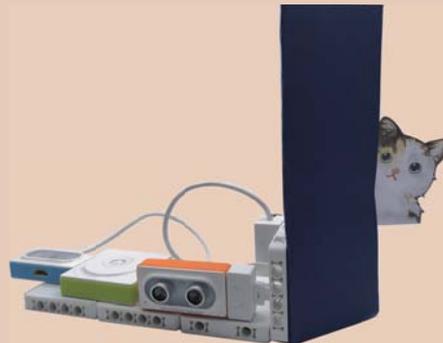
**Block Name:** Ultrasonic Sensor

**Feature:** The ultrasonic sensor detects the distance from itself to an obstacle ahead. Detection Range: 3cm~300cm.

**Connecting Example:**



**Building Example:**



**Example Details:** The ultrasonic sensor detects the distance from itself to an obstacle. The servo keeps rotating according to the value, allowing the cat to show up or hide himself.

## Neuron Block Card



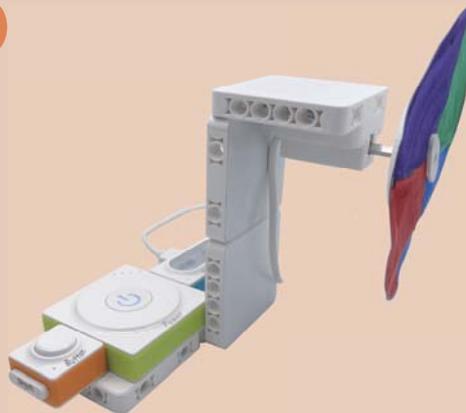
**Block Name:** Button

**Feature:** The button is a common input device. It can serve as a switch.

**Connecting Example:**



**Building Example:**



**Example Details:** Click the button to start the turn plate.

## Neuron Block Card



**Block Name:** Knob

**Feature:** The knob is a common input device. Turning the knob will output a value.

**Connecting Example:**



**Building Example:**



**Example Details:** Make a lighting panel. The larger the knob value is, the brighter the LED panel will be.

## Neuron Block Card



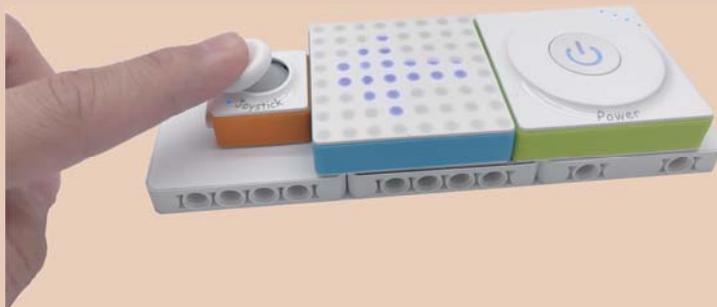
Block Name: Joystick

Feature: Push the joystick to get the X-axis and Y-axis values.

Connecting Example:



Building Example:



Example Details: Move the joystick from side to side and from back to front. The LED panel will show arrows representing different directions.

## Neuron Block Card



**Block Name:** RGB LED

**Feature:** RGB LED means red, blue and green LEDs. RGB LED products combine these three colors to produce different colors of light.

**Connecting Example:**



**Building Example:**



Example Details: Design a lamp. Use the button to control the lamp.

## Neuron Block Card



**Block Name:** Buzzer

**Feature:** The buzzer is used to produce such sounds like alarms, doorbells, phones.

**Connecting Example:**

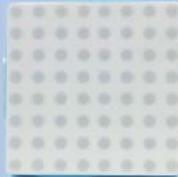


**Building Example:**



**Example Details:** Design a toy that sings. Turn the knob to control the volume.

## Neuron Block Card



Block Name: LED Panel

Feature : The LED panel is made up of an  $8 \times 8$  RGB matrix display. It is used to output images, texts, animations, etc.

Connecting Example :



Building Example:



Example Details: Design a palette. Touch the Funny Touch to change the light color.

## Neuron Block Card



**Block Name:** Dual Servo Driver

**Feature:** The dual servo driver block enables two servos to rotate simultaneously. By working with the dual servo driver block, the servos can rotate by 0~180°.

**Connecting Example:**



**Building Example:**



**Example Details:** Design a catapult. Change the rotation angles by controlling how the gyro sensor vibrates.

## Neuron Block Card



**Block Name:** DC Motor Driver

**Feature:** The DC motor driver enables two motors to rotate simultaneously. By working with the DC motor driver, the motors can control its rotation speed and direction all together.

**Connecting Example**



**Building Example:**



**Example Details:** Design a car. Press the button and the car is moving.

## Neuron Block Card



Block Name: LED Strip

Feature: The LED strip block controls the LED strips.

Connecting Example:



Building Example:



Example Details: Make a glow stick . Press the button to control the glow stick.

## Neuron Block Card



**Block Name:** Display

**Feature:** The display shows the values of the input module.

**Connecting Example:**



**Building Example:**



**Example Details:** Measure the distance from the ultrasonic sensor to an obstacle. Use the display block to show the value.

## Neuron Block Card



Block Name: Power

Feature: provide the power to other modules.

Connecting Example:



Building Example:



Example Details: Each time the power block connects to an output block, the startup program will run (image, sound and rotation).

## Neuron Block Card



**Block Name:** Bluetooth

**Feature:** The Bluetooth block facilitates the wireless connection between devices and blocks .

**Connecting Example:**



**Building Example:**



**Example Details:** Program the blocks with the Neuron app.

## Neuron Block Card



**Block Name:** Wireless Transmitter and Wireless Receiver

**Feature:** The wireless receiver block receives signals from the wireless transmitter block within a distance of 10 meters.

**Connecting Example:**



**Building Example:**



**Example Details:** Pair the wireless transmitter block and the wireless receiver block. Then connect the wireless transmitter block to the input block and the wireless receiver block to the output block; the input block can remotely control the output block.

## Software Nodes Card



**Nodes Name:** Compare

**Explanation:** Compare the inputting number with a pre-configured number.

**How it is used:** when you want something to happen if some value is above, below or equal a certain number. For example:

- 1) If the environment is overheated (temperature above a certain number), sound the alarm;
- 2) If the counter counts to 3, show a smiley face.

**How it works:**



The input is the value to be compared, Pick an operator “<”, “>”, “=”, “≠”, “≤”, “≥”. If the value satisfies the condition, the node will output “yes”; otherwise, it will output “no”.



When the temperature is over 30 (degrees Celsius), sound the buzzer.

**Tips:**

- 1) If the input is a string, the node will try to convert it to a number; if failed, the output will be “no”.
- 2) If the input is an object, the output will always be “no”.
- 3) A hanging input yields “no”.

## Software Nodes Card



**Nodes Name:** Number

**Explanation:** Provide a number as a constant, or under a certain condition.

**How it is used:** when you want something to happen if some value is above, below or equal a certain number. For example:

- 1) Set the parameter of another node. E.g., the rotation speed of a motor;
- 2) Let another node's parameter change to a certain value when something happens. E.g., when the heat is up, the fan motor rotates at a certain (higher) speed.

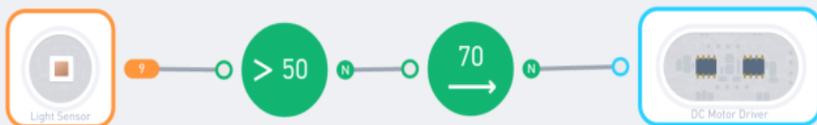
**How it works:**



The number set in the config panel will be sent to the output. If an input is provided, the value is sent only if the input is “yes”; otherwise the output will be “no”.



Example: set the speed of the DC Motor Drive to 50



Example: When the value of the light sensor is above 50, set the motor speed to 70.

## Software Nodes Card



**Nodes Name:** Compute

**Explanation:** Make a certain arithmetic (+, -, \*, /) operation on the input.

**How it is used:** If you want your creation reacts to the slightest change in the room temperature, or you want the car moves, but have more juice when the color is blue, the “Compute” node comes to help. It can: - Amplify the input to a certain factor - Give an initial value of input by adding it to a constant number - Count numbers in a cycle by using the “mod” operator.

**How it works:**



Pick an operator (“+”, “-“, “\*“, “/”) and an operand (the number you want to add or subtract with). The output will be the input compute with the configured operand.



When the temperature is over 30 (degrees Celsius), sound the buzzer.

**Tips:**

- 1) If the input is a string, the node will try to convert it to a number; if failed, the output will be “no”.
- 2) If the input is an object, the output will always be “no”.
- 3) A hanging input yields “no”.

## Software Nodes Card



**Nodes Name:** Interval

**Explanation:** Flips the output repeatedly, at a certain interval.

**How it is used:** The output of the interval node flips between “yes” and “no” by itself. It is useful when:

- 1) You want to make a blinking light or a jiggling robot;
- 2) You want to do something periodically, like taking a photo every 30 seconds.

**How it works:**



In the config panel, choose the how many seconds before the result flips.



Example: making a blinking light



Example: making a “beep-beep” alarm when overheat.

## Software Nodes Card

**NOT**

**Nodes Name:** Not

**Explanation:** YES to NO and NO to YES.

**How it is used:** Logical “NOT” stands for “if not”, “else” or “otherwise”. It flips the input from “yes” to “no” and “no” to “yes”. Useful in cases like:

- 1) Do something when the button is “NOT” pressed;
- 2) If the Interval node is flipped to no, do something else.

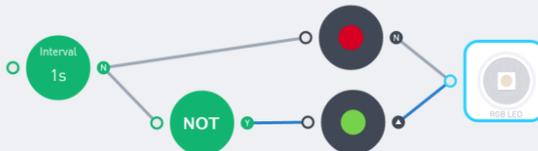
**How it works:**



Just attach the input, and get the opposite result.



Example: if the button is connected, turn red; otherwise, turn green.



Color cycles between red and green.

## Software Nodes Card

**AND**

**Nodes Name:** And

**Explanation:** YES if all inputs are YES.

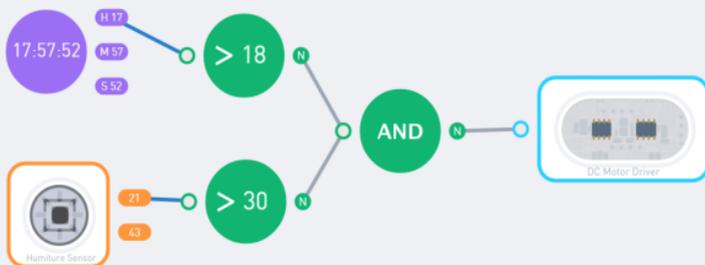
**How it is used:** The logical “AND” node outputs “yes” only when all the input sources say “yes”. It can be used in situations like:

1) If the room temperature is high “AND” it is past 6 o’clock, turn on the fan;

**How it works:**



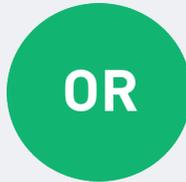
The “AND” node says “yes” when all the sources of input are considered “yes”.



On a hot evening (temperature is over 30 and current hour is over 17, 5pm in the evening), turn on the fan (hooked up to a motor).

Color cycles between red and green.

## Software Nodes Card



**Nodes Name:** Or

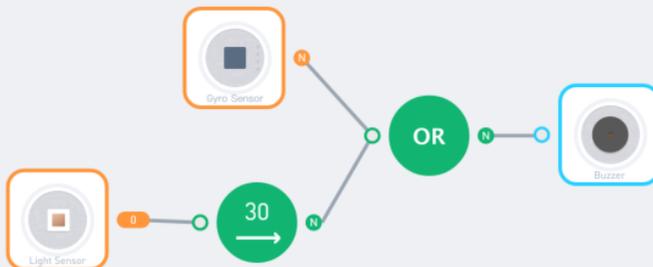
**Explanation:** YES if any of the inputs is YES.

**How it is used:** The logical “OR” node outputs “yes” if any of the input sources say “yes”. It can be used when: - If there is light (the drawer is open), sound the alarm; If the gyro is shaken (the creation is moved by somebody), also sound the alarm.

**How it works:**



The “OR” node says “yes” whenever a source of the input is considered “yes”.



Example: an alarming device that alarms when exposed to light (light sensor value > 30), or if it is moved (the gyro is shaken).

**Tips:**

1) In fact, you do not need an “OR” node very often because an “OR” logic is placed inside the input of most nodes.

## Software Nodes Card



**Nodes Name:** Toggle

**Explanation:** Flip between YES and NO when activated.

**How it is used:** The Toggle node flips between “yes” and “no”. You can use it to: - Convert a button to a switch. Push it, lights on (without the needs of keeping your finger on the button); push again, lights off.

**How it works:**



When the input changes from “no” to “yes”(we call it a “rising edge” in electric engineering), the output will flip between “yes” and “no”.



Example: use a button as a switch

# Software Nodes Card



**Nodes Name:** Counter

**Explanation:** Plus one when activated.

**How it is used:** The “Counter” node keeps a number for counting; it goes up each time the input flips from “no” to “yes”. This is useful when you want to:

- 1) Keep a number of something, like how many times the gyro is shaken;
- 2) Make a stopwatch: count how many seconds did some event last;
- 3) Make a timer: let something happen after a certain time period is passed.

**How it works:**



When the input changes from “no” to “yes”(we call it a “rising edge” in electric engineering), the number displayed in the node will plus one, and goes to the output. If you push the “reset” button, the number will be reset to zero; the same will happen if the “RESET” input changes from “no” to “yes”.



Example: count the length of time when the room filled with people (using the PIR “people sensor”). The result is expressed in seconds.



Example: making a countdown, use the COMPUTE+ node.

# Software Nodes Card



**Nodes Name:** Hold

**Explanation:** Keep the input unchanged for a period of time.

**How it is used:** You can let buzzer sing a song whenever you shake the gyro. But as soon as the gyro is not shaken, the song will instantly stop. To let the song keep playing, you need to “HOLD” the “gyro is shaking” input for a period of time. This is when HOLD comes into the scene. It can:

- 1) Keep the input value, until another not “no” value comes in;
- 2) Keep the input value unchanged for a period of time;
- 3) Let the input change gradually.

**How it works:**



You can choose one of the three modes from the config pane.

Hold

Select

hold until change    hold for time    change slowly

Time

3

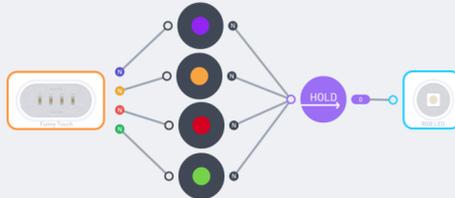
Confirm

NTROLS    TIME    ADVANCED

## Software Nodes Card

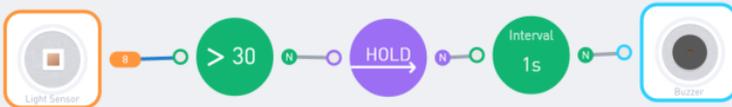


The first, Hold until change: the input will be kept until another input comes in (such as a sad face replaces a smiley face). In other words, the output could be any value other than “no”.



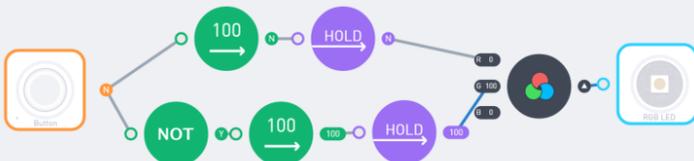
Example: count the length of time when the room filled with people (using the PIR “people sensor”). The result is expressed in seconds.

The second, Hold for time: the input will stay the same for a period of time. In this period, any other input values will be ignored. If the hold period has been passed and the input is still “no”, the output will be set to “no”.



Example: An alarming device that beeps 3 seconds after light detected.

The third kind, Change Slowly: the output will change according to the input, but if the input is a number, every second the change will be no more than the specified number.



Example: When the button is pressed, the light turns from green to red slowly (The number of the HOLD node’s config is set to 3).

## Software Nodes Card



**Nodes Name:** Delay

**Explanation:** Make it happen after some time.

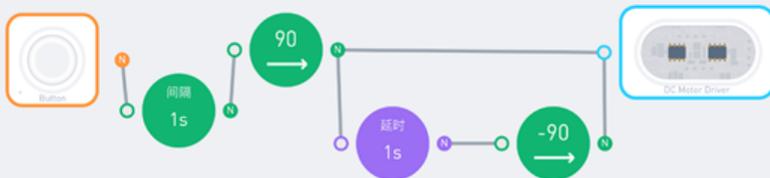
**How it is used:** Delay node will take an input, and send it to the output after a set period of time. It is useful when:

- 1) You want something happens after an event but after a period of time;
- 2) You want something happens after an event, and after a period of time, some other thing happens after an event.

**How it works:**



Every input will be sent to the output after a certain period of time (provided in the config panel).



Example: When the button is pressed, rotate the motor, then rotate it reversely after 1 second.

**Tips:**

- 1) An easy way to understand the “DELAY” node is: the output is always certain seconds behind the input.

## Software Nodes Card



**Nodes Name:** Average

**Explanation:** Average over a period of time.

**How it is used:** Imagine you want to build a device that alarms the mother whenever the baby cry, using the movement value (acceleration) detected by the gyro sensor. But if the alarm sounds every time there is little disturbance of the sensor (e.g. when the baby flips his/her arm), the mother will be crazy. Using the “average” node will let the result reflects the average of the input value over a period of time, filtering out noise data.

**How it works:**



The result will be the average value of the input over a period of time. You can set the period of time (engineers call that sampling window) you want to perform the average in the config panel.



Example: a “baby monitor” that alarms the mother when the baby cries (which makes the gyro shaken for a period of time. The Y Acceleration is used to represent shaking).

**Tips:**

1) A smaller sampling window means the output is more sensitive to the change of the input.

## Software Nodes Card



**Nodes Name:** Today

**Explanation:** Get the date (year, month, day) today.

**How it is used:** Node “TODAY” outputs today’s month, the day of the month, and day of the week. It can be used to: - Do something on a specific day.

**How it works:**



There are 3 outputs in this node, and the meaning is straightforward: the day of the month(D), the month(M), and the day of the week(W) of today.



Example: light up the light strip on May the 4th.

## Software Nodes Card



**Nodes Name:** Now

**Explanation:** Get the hour, minute, and second now.

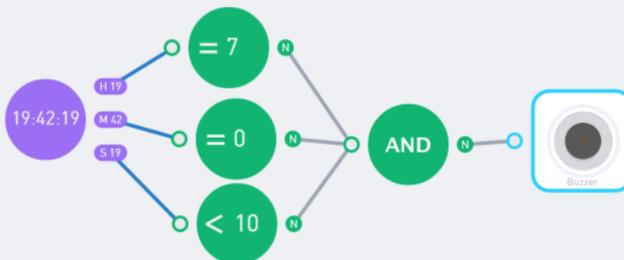
**How it is used:** NNode “NOW” outputs the current time, in the format of hour, minutes, and seconds. It can be used to:

- 1) Do something at a specific time of the day;
- 2) Do something every second, every a few seconds or every minute.

**How it works:**



There are 3 outputs in this node, and the meaning is straightforward: the hour(H), the minute(M), and the second(S) of the current time.



Example: Example: an alarm clock that buzzes for 10 seconds at 7:00.

## Software Nodes Card



**Nodes Name:** Pulse

**Explanation:** Make the output cycles over time.

**How it is used:** The PULSE node's output changes with the time according to the waveform specified in the config panel. It can be used to:

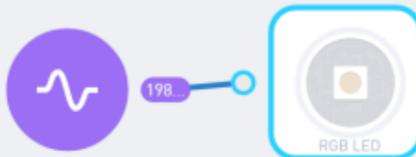
1) Make a “breathing” light/sound/movement effect; make the movement looks smooth;

**How it works:**



In the settings panel, you can set the following parameters of the pulse generated:

- 1) Waveform: it can be “sin”, “square” and “triangle”. “Sin” waveform looks like breathing: it slows down at the top and bottom value. “Square” acts similar to the “INTERVAL” note, it turns on and off at each time period. “Triangle” is steadier (linear) when changing, but drives in the opposite way sharply when it reaches its maximum and minimum value.
- 2) Wavelength: the time in seconds that a pulse reaches its full cycle and starts to repeat itself.
- 3) Amplitude: the maximum value and (the negative) minimum value of the pulse



Example: a breathing light .

**Tips:**

- 1) An easy way to understand the “DELAY” node is: the output is always certain seconds behind the input.

## Software Nodes Card



**Nodes Name:** Sequence

**Explanation:** Perform a series of actions according to their time.

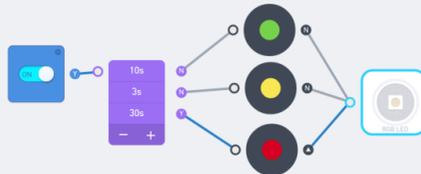
**How it is used:** The “SEQUENCE” node turns on each output one-by-one for a period of time. It can be used for:

- 1) Define an action as a series of moves. Such as shaking heads or waving hands;
- 2) Perform a certain action when a certain condition is met;

**How it works:**



Connect the action to the input of the SEQUENCE node; connect the moves to each of its outputs. Tap on the numbers on the node to set the duration of each output. And use the plus and minus sign to add/remove outputs.



Example: a traffic light that greens for 10 seconds, yellows for 3 seconds, and red for 30 seconds.



Example: when there is a person in front of the device (detected by the PIR sensor), nod head by repeatedly shaking the servo attached to port 1; otherwise, shake head by repeatedly shaking the servo attached to port 2.

## Software Nodes Card



**Nodes Name:** Random

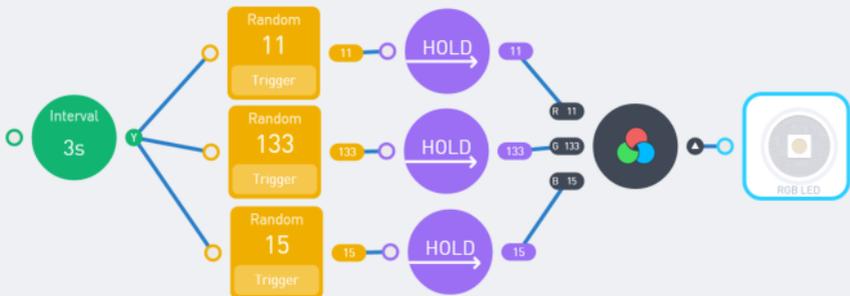
**Explanation:** Make an irregular output every time.

**How it is used:** The RANDOM node can generate a random number. It is used to: - Make a dice, or make an effect that produces a different result every time.

**How it works:**



There are 3 outputs in this node, and the meaning is straightforward: the day of the month(D), the month(M), and the day of the week(W) of today.



Example: a light that changes its color randomly

## Software Nodes Card



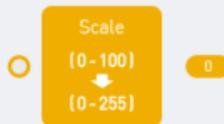
**Nodes Name:** Scale

**Explanation:** Map the input from a range to another.

**How it is used:**

- 1) Cases when the given input ranges from 0-100, but the output needs to be 0-255.
- 2) When the input changes too steadily or drastically, you can scale it to the range you want;

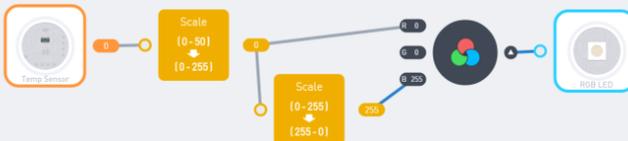
**How it works:**



Set two ranges from the config panel. The input will be scaled according to the set range.



Example: make a thermometer. The temperature (0~50) is scaled to the angle of the servo (0~70) that has a needle stick on it that acts as a pointer.



Example: You can use the Scale node to reverse a value. make a light that changes according to the temperature. When it is hot, it turns red; when it is cold, it turns blue. The first SCALE node scales the range of temperature to 0~255, the range of light color. The second SCALE node makes the “blue” value changes to the opposite direction of the red value.

## Software Nodes Card



**Nodes Name:** Filter

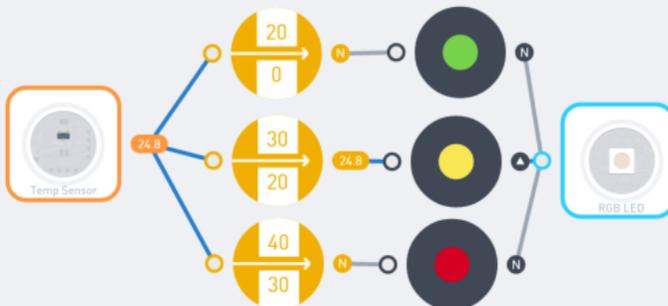
**Explanation:** Only output the input if it falls within the certain range.

**How it is used:** Act differently when the input is in the different range. It makes your program more concise than using a bunch of COMPARE nodes.

**How it works:**



Set a range in the config panel. If the input falls in the range, output the input itself; otherwise, output NO.



Example: when the temperature is 0~20, turn green; when it is 20~30, turn yellow; when it is 30~40, turn red.

## Software Nodes Card



**Nodes Name:** Function

**Explanation:** Pass the input through a mathematical function.

**How it is used:** In case you need to do some mathematical operation, like rounding a number to its nearest integer, FUNCTION comes to help.

**How it works:**



Set the function you want to use in the config panel. The output will always be the input passing through the function you choose.

The settings panel of the function



Example: a knob that can set an integer number from 1 to 10.

## Software Nodes Card



**Nodes Name:** Compute Plus

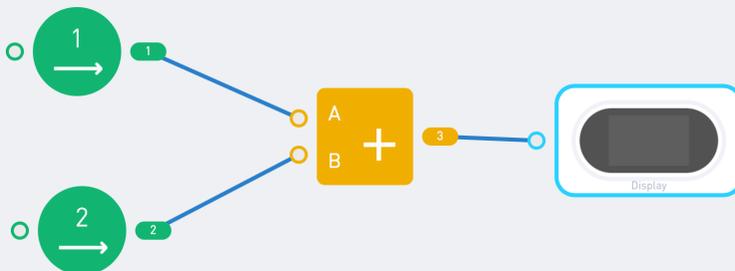
**Explanation:** Make arithmetical operation on two inputs.

**How it is used:** Pick an operator(+, -, \*, /) , make the result variates according to two input sources.

**How it works:**



Set the operator(+, -, \*, /) in the config panel. The result will be .



Example: if you connect A to the upper input, B to the lower input, and the operator is +, then the result will be  $A+B$ .

## Software Nodes Card



**Nodes Name:** Compare Plus

**Explanation:** Compare the value of two input sources.

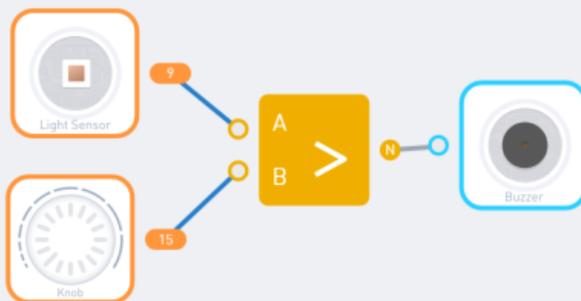
**How it is used:**

- 1) Make a comparison where all operands can change.
- 2) Use the value of a sensor or input device as the threshold of an alarm system.

**How it works:**



Set the operator ( $>$ ,  $<$ ,  $=$ ) in the config panel. Connect two operands to the input. The result will YES if the comparison condition is met. Otherwise it will output NO.



Example: a light-sensor-based alarm device whose sensitivity is controlled by a knob.

## Software Nodes Card



**Nodes Name:** Valve

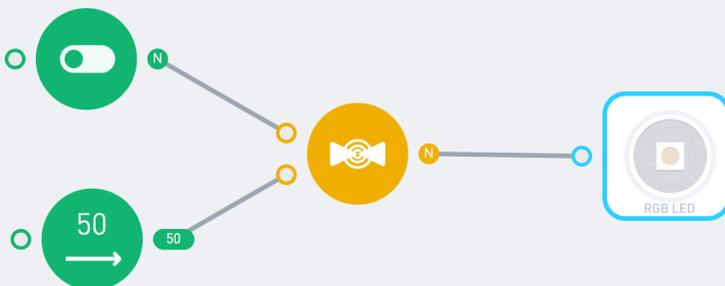
**Explanation:** Output some value if the condition is met.

**How it is used:** “Conditional” nodes like COMPARE only outputs YES or NO; in case you want to output a value other than YES/NO, you will need the VALVE node.

**How it works:**



The upper input takes YES/NO; the lower input takes a value. If the upper input is YES, the lower input is sent to the node's output; otherwise the node will output NO.



Example: While controlling the LED light switch, you can enter the value to control the brightness of the light.



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