Adventures of Young Innovators

Volume 4: Finding solutions through scientific innovation

Elevator

Have you ever dreamed to make an elevator? Come-N-Build one!

Leg...

Khalid has an idea for science project, will he be able make it?

First Edition - 2019
Adventures of Young Innovators

Volume 4: Finding solutions through scientific innovation

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EBot Microcontroller & Software

EBot is an ecosystem developed by Creative Bits Solutions-Kuwait, it focuses on teaching programming and prototyping through a very easy process. It consists of two main parts a Microcontroller unit which is a small compact digital computer, and an educational software that uses drag and drop method to make programs without writing long codes.
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Color Blind ..
was the cause of the problem!

Learning Objectives

1. To understand how does the rainbow happen
2. To know the visible spectrum and its wavelength
3. To use the color sensor and learn to program it
4. To use acquired knowledge to build color detector

New way of learning

Decision Making  Communication skills  Programming  Innovative Thinking  Social Skills  Inventing
New way of learning

Learning Objectives

Come & buy tasty yellow apples!

Ha Ha...

but it is RED!

How does my blue shirt look like?

haha,, So funny!

What's wrong Sir! Can't you distinguish between colors?!

No, son.. I am blind!

I want people to think that I can see, so no one would steal my apples!

Don't worry sir, I am going to make you a device to help you see the colors!

At Home..

Could you explain what is color?

Colors are light waves, that has specific length. Each color has a different wavelength. Red has the longest wavelength 678. Violet has the shortest wavelength 735. When all the waves are seen together, they make white light.

Can we make a device that can see colors?

Sure, by using Color Sensor!
What is Rainbow?

Ahmad was in the school in the science class, when he looked from the window of the classroom to see a beautiful array of colors in the sky, regular arc-shaped between the clouds! Ahmad asked the science teacher: Many games and pictures contain colors, but I have never seen colors in the sky! The teacher replied: These are not random colors that appear in the sky, it is a rainbow, and I will explain you what this beautiful color arc is and how it is formed, and how it relates to the frequencies of light that the human eye can see.

In the beginning, you should know that a rainbow is a natural physical phenomenon that occurs when the rain...
falls on a sunny day, as a result of the refraction and dissolving of sunlight inside the rain drop, and its appearance is in the form of a semi-circular or arc, so that it called by this name. Because the white light is the result of mixing all colors, it will dissolve to the colors of its composition when refracted inside the drop of water, we see only seven colors are red then orange, yellow, green, blue, indigo, violet, which is located inside what is called the visible spectrum.

The visible spectrum is the part that the human eye can distinguish from the electromagnetic spectrum. The wavelengths in the air range from 380 to 750 nm, starting in red and ending in violet, with all other colors gradient in between.

The human eye can distinguish between different colors by its wavelength, and the sensitivity of the eye is larger at the wavelength between green and yellow, when the white light falls on an object, the body absorbs all frequencies of white light and reflects the rays that reflect the color. The body so that vision occurs. When the wavelength exceeds the red color “infrared rays” or violet color “ultraviolet”, the human eye cannot see those rays.
Project Plastic Pieces

1x 15x9 Brick

3x 5x3 Brick

4x 15x3 Brick

Electronics

Inputs 1x
In this project, students will learn about color sensor and how to use it, then make a device that produces specific tones for certain colors.
**Color Sensor**

A component used to measure the intensity of colors. Color Sensors depend on the frequency of light reflected by different bodies when exposed to a white light.

**Buzzer**

A mechanical output device that converts electrical energy to sound energy, and uses different frequencies to make different sounds.
Input Reading is a feature used to read the values of a sensor based on its surrounding environment. It is used to identify the values of the sensors in the current environment to ensure the best functionality.

1. In the Ebot Blockly software, click on Input Reading from the right menu.
2. Select the type of sensor and the pin that is used to connect to it, and then click Debug. Make a note of the values.
Did you Know!

Do you know that the Greeks were the first to try to study the light and how a rainbow formed, but the Muslim scientist, “Ibn al-Haytham” was the first to establish theories about light, such as the state of the moon and rainbow, and later contributed to the invention of the photograph machine “Camera”

Questions:

1. What are the color wavelengths that the human eye cannot distinguish?
2. How many colors in the spectrum?
3. How do human eyes distinguish colors?

Further discussion:

1. Think about new ways to make use of color decomposition
2. What improvements can you add to this project?
Taking Notes will help you develop your projects in the future, and it will prevent you from repeating same mistakes.

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A Fan ..
to be controlled by a remote

Learning Objectives

1. To be introduced to remote controlled systems
2. To encourage experimentation to make new innovations
3. To integrate previous experiences to create new projects
4. To use acquired knowledge to build fan project

New way of learning

Focus and attention  Analysation  Problem Solving  Innovative Thinking  Programming  Inventing
Khalid feels very hot, I think an electric fan will be a great solution for him

its TOO hot, I am super sweaty!

GREEAT! I can control the direction of the fan with this remote!

What’s this E?

Here you are the fan’s RC

The fan is ready to use

Exactly! then the servo is connected to the fan, which is connected to RC, so you can control it

DC motor to rotate the fan

Servo motor to control direction

Remote Control (RC)

You’ve used a Servo motor which only rotates 180 degree!

RC Sensor
Remote controlled devices

Human groups have developed special means of communication through ages. Each human group has its own language and means of communication where they can distinguish vocabulary of their own language and understand its meaning. However, the great technological developments at the beginning of the last century have forced man to invent new ways of communicating with each other world closer together, he has also developed ways to communicate with machines.

Man has always imagined that he would find a way to communicate with family or friends in other part of the world directly and instantly. This dream came to life in 1972 when the mobile phone was invented for the first time. The discovery of this revolutionary invention was based on the principle of convert-

<table>
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<th>Scientific Term</th>
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<tr>
<td>Remote control</td>
<td>A component of an electronic device used to operate the device from a distance</td>
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<td>Mobile phone</td>
<td>A portable telephone that can make and receive calls over a radio frequency</td>
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<tr>
<td>Infrared</td>
<td>Are waves of electromagnetic energy that are transferred through light</td>
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<tr>
<td>Ultrasonic waves</td>
<td>Sound waves with a frequency above the upper limit of human hearing.</td>
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ing audio signals into a symbolic code, that is then translated by a central transmission station and sent back to a receiver phone, and finally translated to the receivers ear as a distinctive human voice. In the early days, mobile phones were initially large in size, with relatively large antennas.

At the turn of the millennium, major developments were taking place with mobile phones. They became smaller and equipped with screens, and then their functionality began to develop as games and messages are added, and finally added were the amazing cameras and features that we know today.

The remote control is a simple electronic device that enables control of various electronic devices remotely by transferring wirelessly encrypted data, which is interpreted by a receiver to execute the desired command (such as increasing the volume on the TV or turning off the air conditioner, among others).

There are different types of remote controls, depending on how they operate. Some work with radio waves, in which signals can travel through walls and objects, including ultrasound. This type of device appeared in the 1980s.

The most common types of devices are infrared controls, or invisible rays that cannot be distinguished with the human eye. Infrared controls are produced with a controller through an electronic component called a diode. This type is most common in speakers, TV controllers and others.
**Project Plastic Pieces**

- **Outputs**
  - 1x RGB

**Electronics**

- 1x Medium Gear
- 1x Large Gear
- 1x L Adapter
- 5x1 Brick
- Large Frame
- 15x3 Brick
- 15x9 Brick
- 6x 15x9 Brick
- 6x L Adapter
- 2x 5x1 Brick
- 2x Large Frame
- 6x Large Frame
In this project, students will learn to make a fan that can be controlled wirelessly via Bluetooth and has RGB LED lighting.
**DC Motor**

A device that converts electrical energy into mechanical energy in a rotational manner.

**RGB LED**

Is an LED that have 3 primary colors inside: Red, Green, & Blue. It combines them to produce any color.
Input Reading is a feature used to read the values of a sensor based on its surrounding environment. It is used to identify the values of the sensors in the current environment to ensure the best functionality.

1. In the Ebot Blockly software, click on Input Reading from the right menu.
2. Select the type of sensor and the pin that is used to connect to it, and then click Debug. Make a note of the values.
Did you Know!

The first idea for a remote control appeared in 1898 by the scientist “Nicolas Tesla,” but the first radio remote control only appeared in 1939.

Questions:

1. What is the importance of mobile phones?
2. How does the remote control work?
3. What are the most important features of mobile phones that we know today?

Further discussion:

1. Try innovating new projects using RC technology.
2. How would the information gained from this project help you in your future projects?
Taking Notes will help you develop your projects in the future, and it will prevent you from repeating same mistakes.

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Elevator on the tree!

Learning Objectives

1. To understand the benefits of pulleys
2. To understand the types of pulleys
3. To Know the Pivot Point
4. To use acquired knowledge to build elevator project

New way of learning

Decision Making  Innovative Thinking  Analysation  Sharing  Teamwork  Problem Solving
Wow, we finally finished building a Tree house
Great! Let's move our stuff there!

HUFF,, That's exhausting!!
HUP,, YES!

I got an idea!

I will build a secret automatic spider-shaped elevator to move our stuff up!

WE DID IT!
What are the benefits of pulleys?

Every day, Amjad liked to watch the construction of a hospital on his school road. He saw how the sandbags and heavy equipment were lifted from the bottom of the building to the top by a large machine called a crane. He wondered how this machine works and who invented it?

The **pulley** has been known since ancient times, especially by the Babylonians, who used it to lift large stones during the construction process, and is also known by the pharaohs, who used it to build the pyramids. The pulley has become an essential tool in many professions, especially in construction work. It is a simple machine consisting of a hollow wheel surrounded by...
a rope that allows for the lifting of weights to a higher height than is possible for the man with his bare hands. The pulley reduces force, and allows for the carrying of heavyweights by reducing the effort to lift them. Pulleys are used with several different types of systems:

- **Movable Pulley**: the wheel has a free axis that can move in all directions.
- **Fixed Pulley**: the wheel has a fixed center, so the axis does not move.
- **Compound Pulley**: both fixed and mobile systems are used.

To build on a simple system of pulleys, man invented machinery to lift and lower heavy objects, and to move these objects horizontally to other places. The **crane** has a solid arm that moves around a fixed point called the **Fulcrum**, which is a meeting point for force and resistance. It has at least one fixed wheel and one mobile wheel attached to the rope.

The work of the crane is linked to three elements: **force**, **resistance** and **fulcrum**. Therefore, cranes are classified into three different types according to the position of these three elements:

- Type one: the **fulcrum is between force and resistance**, this is the most common application of the crane, such as swings, scissors, and scales.
- Type two: the point of **resistance is between force and fulcrum**, such as the cap of a soda water bottle and a nutcracker.
- Type Three: the **force is between resistance and fulcrum**, such as a fish hook and hockey stick.
Project Plastic Pieces

1x Full Bush
1x Half Bash
2x Medium Gear
2x Small Gear
6x 5x3 Brick
1x Medium Frame
2x 15x9 Brick

Electronics

1x Outputs
2x Inputs
In this project, students will learn how elevators work and the role of pulleys, then make a simple elevator lift things.
A mechanical device that closes the circuit when it is clicked

A device that converts electrical energy into mechanical energy in a rotational manner.
Live control is a feature that allows the user to connect directly to the outputs and control them, without the need to download the code to the Ebot.

1. Click on 🔄 from the right menu.
2. Select the type of output to be measured by marking (✓) in front of the pin, then choose the sensor type from the drop-down menu and select its properties below.
3. Press the Start button at the bottom of the screen to see the changes, now you can change the values and see changes directly in your project.
Did you Know!

The first person to mention cranes for the first time, was the Greek scientist Archimedes in 260 BC.

Questions:

1. What are the elements associated with the work of the crane?
2. Why did the ancients use pulleys?
3. What is the working method of pulleys?

Further discussion:

1. Can you invent new projects using Pulleys?
2. What improvements can you add to this project?
Taking Notes will help you develop your projects in the future, and it will prevent you from repeating same mistakes.

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Bones
a science project!

Learning Objectives

1. To distinguish between different bones and muscles
2. To recognize the importance of bones
3. To know servo motor and how to program it
4. To use acquired knowledge to build soccer leg project

New way of learning

- Innovative Thinking
- Inventing
- Problem Solving
- Programming
- Planning
- Focus and attention
The muscles cover the skeleton which consists of the 206 bones...

Now, I want each one to prepare a project on this concept for next class.

Hmm... I must find a good idea for the project!

I FOUND IT. These soccer playing kids inspire me with an idea!

last step and I will finish from Zico’s model leg, he is my Favorite!

The Final touch, Team’s Logo

Excellent idea and execution Khalid!

Great! Marvelous!
### What's the importance of bones?

Fahd is a talented child, who practices sports regularly, but did not follow the teacher’s instructions in the physical education class. He fell while playing with the ball and broke his leg! Fahd stayed in his bed for two full months, during which he could not exercise, but he managed to walk again after his leg was able to repair itself! So how does that happen!?

**Bones** made the structural system in the human body, which is responsible for the overall shape of the body, and from God’s grace to the human that the bones can repair itself by itself, as the bones help the body to move and give shape, and contains cells to repair what affects the bones of fractures of life, Bone-

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<td>Bones</td>
<td>Any of the pieces of hard whitish tissue making up the skeleton in humans and other vertebrates.</td>
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<tr>
<td>Muscles</td>
<td>A band or bundle of fibrous tissue in a human or animal body that has the ability to contract, producing movement in or maintaining the position of parts of the body.</td>
</tr>
<tr>
<td>Joint</td>
<td>A structure in the human or animal body at which two parts of the skeleton are fitted together.</td>
</tr>
<tr>
<td>Servo Motor</td>
<td>Is a rotary motor that allows for a precise control in terms of angular position, acceleration and velocity.</td>
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forming cells produce new bone, while osteoporotic cells disassemble old bones, and this process takes place continuously in our bodies!

The human body contains 206 bones, each fitted together bones are called **Joint**, and the joints are sensitive parts containing fluids that facilitate the movement of human, they work together with cartilages to connect between bones and muscles together. Wrong movements during the exercise may cause twisting joints and muscle pain.

The **muscles** are composed of flexible muscle fibers and form most of the body weight, and the number of skeletal muscles in the human body are about 600 muscles which have the major role in movement, speech, eating, and exercise.

To maintain healthy bones, muscles and joints, you should exercise regularly, and eat a healthy diet that contains protein and milk.
Project Plastic Pieces

Outputs
- 2x Servo Top
- 1x Large Gear
- 2x Medium SHAFT
- 2x Full Bush
- 2x Servo Top

Inputs
- 1x IR
- 1x 5x3 Brick
- 3x 5x1 Brick
- 4x 2x Servo Bracket

Electronics
- 4x L Adapter
- 2x 5x1 Brick
- 3x Medium Frame
- 1x Full Bush
- 4x Large Frame
- 1x 15x9 Brick
- 2x Medium Shaft

5x3 Brick
3x 5x1 Brick
4x 5x1 Brick
2x Servo Bracket
4x L Adapter
2x 15x9 Brick
In this project, students will learn how the leg works, the role of bones and muscles in them, then make a mechanical leg model.
Infrared Sensor

is a sensor that sends waves of electromagnetic energy which are transferred through light. It consists of two components, an emitter and a receiver.

Servo motor

A motor which has the ability to move to any angle between -90 and +90 degrees, 180 degrees in total.
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3. Press the Start button at the bottom of the screen to see the changes, now you can change the values and see changes directly in your project.
Did you Know!

That **X-rays** are rays that help us to detect the bone fractures that may occur in the human body!

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**Questions:**

1. How many bones do you have in the human body?
2. How many muscles in the human body?
3. What is the importance of muscles?

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**Further discussion:**

1. What happens if there are no bones in the human body?
2. Does fish have bones?
Taking Notes will help you develop your projects in the future, and it will prevent you from repeating same mistakes.

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Scientific innovation stories ..

A series of stories about young adventurers facing problems in life and inventing solutions using Ebot. Each book contains four different scientific technology projects for children that develop programming, electronics connections, and mechanical skills.

The series include the following books:

Skills gained:
- Problem Solving
- Projects Programming
- Electrical Projects
- Mechanical Projects