Adventures of Young Innovators

Volume 2: I innovate solutions

Khalid

Many Tasks!

What did Khalid innovate to do them all on time?

What did he innovate to win the challenge?
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Adventures of Young Innovators

Volume 2: I innovate solutions

First Edition - 2019
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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Sound waves...
why their are different sounds?

Learning Objectives

1. To know sound frequencies and its relation to sound pitch
2. To try making different sounds using household items
3. To know the buzzer and learn to program it
4. To use acquired knowledge to build a two-tone bell

New way of learning

Focus and attention  Inventing  Programming  Analysis  Problem Solving  Creative Thinking
New way of learning

Learning Objectives

In music class

BUUO BUUO TING TI

BOM BOM

What a nuisance!

At Home ..

ANNOYING MUSIC from Sara's room

Does these Audio frequencies bother you?!

Yes, Audio frequencies

Audio frequencies have a wavelength, the closer the waves are the sharper the sound will be, and vise versa.

narrow waves

wide waves:

I will make a device that uses this concept

GREAT idea!
Since human creation, and he was always trying to adapt to nature and discovers its useful characteristics, even if for entertainment, the man began using seashells and snails as tools for the generation of music and beautiful sounds. The man has used tree sticks for flutes, animal skins for drums, and even stones as horns.

The sound principle of musical instruments can be understood by learning the physical properties of the sound that result according to the source and its characteristics.

These sources are different. It may be a string, a tube, a solid object, vocal cords in humans, or otherwise. The difference in the shape and size of the source causes a difference in the degree of sound or its layer and the source must be based on an amplifier to be heard by the ear clearly.
Musical instruments are just machines to produce beautiful sounds and work together regularly to form what we know as music in a stylish, beautiful, and pleasant sound.

A metal flute produces a different sound from a wood-made flute even if it is the same size, because the different materials have different physical properties and the sound travels through each of them differently. Even the vibrations of sound emanating from each of them are transmitted differently in the air, so that man hears it differently.

Musical instruments have developed over time into many types and forms such as:

- **Stringed Instruments**: Strings are the source of the sound, as the string is fixed on two ends and tightened perfectly and is played either by fingers or a custom tool; the most famous types are the harp, violin, and guitar.
- **Pneumatic Machines**: Depend on the work of airflow, whether the air flows through as the result of the blowing of the musician such as with a flute or in a mechanical way such as with an accordion.
- **Percussion Instruments**: Adjust the rhythm and synchronization of the song or piece of music that is played and often consist of a membrane or leather plastic; played by beating with the most well-known being the drum.
- **Electronic Instruments**: With great technical developments, there are many types of modern musical instruments that are very different from older ones. The computer is now used to produce sounds according to pre-prepared programs, which contributed to the development of music in our time to a large extent.
Project Plastic Pieces

1x Medium Gear

1x 15x9 Brick

2x 5x1 Brick

1x 5x3 Brick

Electronics

1x Outputs

1x Inputs
In this project, students will learn how to use variable resistor to generate variable tones and how to connect variable inputs with variable outputs.
Assembly Instructions

1.

2.

3.

4.
**Potentiometer**

A component that allows the user to change its resistance by turning a knob.

**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.

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 oldest and most well-known musical instrument is the guitar, which appeared in Mesopotamia for the first time.

Questions:

1. What are string instruments?
2. Do sounds move in different objects in the same way?
3. How many musical instruments are known today?

Further discussion:

1. Try finding the relation between sound pitch and its source
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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</table>
Smart Trash
for forgotten trash!

Learning Objectives

1. To know pollution and its causes
2. To recognize the ecological balance
3. To be encouraged to find ways to reduce pollution
4. To use acquired knowledge to build a smart trash

New way of learning

- Programming
- Decision Making
- Taking Responsibility
- Inventing
- Problem Solving
- Thinking Skills
Eewk! what a bad smell from Khalid’s room

Look at the Garbage!

KHALID WHAT IS THAT!

.. What!!

How would you stay with this garbage??

OH!!! I will clean it right away

While cleaning ..

I Found it!

Almost Done ..

The trash can will alert me when it’s full

Smart Can from a Smart Boy!

70% full
### Scientific Terms and Concepts

<table>
<thead>
<tr>
<th>Scientific Term</th>
<th>Scientific Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pollution</td>
<td>A serious change that negatively affects the environment.</td>
</tr>
<tr>
<td>2 Ecological balance</td>
<td>Continuous functioning of all elements of nature, without any external forces</td>
</tr>
<tr>
<td>3 Noise Pollution</td>
<td>The noise caused by cars and factories</td>
</tr>
</tbody>
</table>

### What is pollution? and how to protect earth?

From Adam until the 1800s, the Earth’s population was only 1 billion. Environmental problems and pollution were not a concern and were not a source of worry for humans. Life was simple and often dependent on nature.

But from 1800 to 2016 the population of the Earth has increased to more than 7 billion, which means millions of years to reach a population of one billion and only 210 years to reach 7 billion. This sudden increase has resulted in an environmental disaster for Earth, as modern man consumes energy at a rate 70 times more than consumption by humans 200 years ago. Half of the Earth’s population now lives in city centers, which account for only 1% of the earth’s surface area. All of these phenomena are a major cause of pollution which is a condition in which natural components of the environment are damaged or replaced with
hazardous chemicals or energy. This can create a state of imbalance in the Earth’s ecosystem and a number of health risks to both humans and nature.

Pollution is a serious change that negatively affects the environment. The main reasons are:

- **Technical and industrial development** reached by humanity and accompanying activities such as combustion, construction, and wars, as well as the emission of toxic and gaseous substances from cars and factories.

- **Removal of forest trees** for use as fuel or as a material in the textile industry, as it has an effective mechanism for air purification. They play a role in absorbing carbon dioxide and spreading oxygen, which contributes to improving environmental balance, these which has contributed to the imbalance of the environment and raised the rates of pollution. This has caused a dramatic rise in the temperature of the Earth and if this continues our land will become barren desert or flooded with water destroying human life!

There are several types of pollution such as water pollution, soil pollution, and food contamination and scientists have started to consider the noise caused by cars and factories as as another kind of pollution, called noise pollution.

All of these types of pollution cause a lot of harm to humans. They increase the spread of various diseases. They also affect the sources of food consumed by humans and the water they drink through exposure to these pollutants. The pollutants cause great psychological harm to a person, such as depression a significant rise in tension.
Project Plastic Pieces

- Servo Top: 1x
- L Adapter: 2x
- 5x1 Brick: 7x
- 5x3 Brick: 4x
- 5x9 Brick: 4x
- Servo Holder: 1x
- Medium Frame: 4x

Electronics

- Outputs: 1x (SERVO)
- Inputs: 1x (ULTRASONIC)
In this project, students will learn about innovations at home to preserve hygiene by making a smart trash bin.
<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ultrasonic Sensor</strong></td>
<td>Ultrasonic waves that move through matter (Water - Air - Solid Objects), and it caused by movements of bodies, appearing as vibrations.</td>
</tr>
<tr>
<td><strong>Infrared Sensor</strong></td>
<td>Is a sensor that sends waves of electromagnetic energy which are transferred through light. It consists of two components, an emitter and a receiver.</td>
</tr>
<tr>
<td><strong>Buzzer</strong></td>
<td>A mechanical output device that converts electrical energy to sound energy, and uses different frequencies to make different sounds.</td>
</tr>
<tr>
<td><strong>Servo Motor</strong></td>
<td>A motor which has the ability to move to any angle between -90 and +90 degrees, 180 degrees in total.</td>
</tr>
</tbody>
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![Electronics connection diagram](image-url)
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.

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!
Factories around the world produce about 400 million tons of waste every year, most of which is dumped into the seas and on the ground. The most widespread damage is caused by the consumption of plastic products, which are the most dangerous type of pollutant.

Questions:
1. What is the importance of preserving the environment?
2. What are the most dangerous types of pollution?
3. What are the harmful effects of pollution on humans?

Further discussion:
1. Can you find ways to reduce Pollution in your country?
2. Can you make a campaign to introduce your friend to pollution hazards?
Taking Notes will help you develop your projects in the future, and it will prevent you from repeating the same mistakes.

**Programming**

**Construction**

**Connection**

**General Notes**
A Fast solution
to measure long distance!

Learning Objectives

1. To know measuring tools
2. To recognize different measuring units
3. To appreciate scientists in developing measuring tools
4. To use acquired knowledge to build measuring wheel

New way of learning

Programming  Inventing  Focus and attention  Taking Responsibility  Teamwork  Sharing
In today’s challenge, we will find the fastest team to plan a 10 meter soccer field...

You have the freedom to use any measuring tool.

We have to think in a faster way to measure, and I have an idea!

hm!

Introducing my new device, the **measuring wheel**! Each full cycle equals a meter! & it will beep once a cycle completed.

Start NOW..

Fee!!

ONE

rrrr!

TWO!

rrrr!

WE WON!

THREE

rrrr!

TEN!!

rrrr!
What is importance of measuring tools?

A long time ago, then man was interested in measuring lengths, such as a piece of cloth that he used to make clothes, or measuring the area of a piece of land. He also needed to know the water level in wells and the weights of grains or vegetables sold at the market, and even the weights of precious metals.

He was also interested in knowing the amount of milk or food that he needed to buy. At these early times, humans were interested in identifying the day and year, so it was necessary to invent tools to help measure everything imaginable.

At first, people used the arm, they measured length relative to their arms or measured the area of land by their foot or one...
They then used a rope or long wooden board to measure the relative length of things. This wooden board was later developed into a numbered ruler, and eventually,

- **The ruler and meter**: is a stripe with defined distances used to measure flat surfaces. It is approximately 3.28 feet long and is the most widely used longitudinal unit in the world. It was first used in the days of the French Revolution in 1790.
- **Gram / kilogram**: is the unit of measurement of weights in the global system, and offset by (pound) in the English system.
- **Liter**: It is a unit of measurement of sizes and is used in measuring fluid sizes because the weight of each liquid varies according to its density and uses the inserted vessel.
- **Hour**: is the unit of measurement, the time is divided into 60 parts, each part of which is called a minute name, the minute is divided into 60 parts, each part is called a second name.

To determine the seasons and days, people in the past followed the movement of stars and planets. The Egyptians were the first to invent the year system, they estimated that the Sun needed a full year to orbit around the earth. The year was said to consist of twelve months and the month consisted of thirty days. Thus, the number of days of the year is 365 days. During the year, there are generally four seasons in the temperate regions of the earth.

As a result of great technological developments, a lot of things appeared that needed to be measured. These new things did not exist previously in human knowledge, such as the intensity of an electric current, or the speed of water flow, or driving speed, or temperature for medical uses.
Project Plastic Pieces

- **X-Large Gear**: 1x
- **Large Shaft**: 1x
- **L Adapter**: 4x
- **Full Bush**: 4x
- **5x3 Brick**: 1x
- **5x1 Brick**: 3x
- **15x3 Brick**: 4x
- **15x9 Brick**: 1x
- **Large Frame**: 1x

**Electronics**

- **Outputs**: 1x
- **Inputs**: 1x
In this project, students will learn how to use technology in finding intelligent solutions such as measuring large distances. Students will also learn ways to use and program variable.
Assembly Instructions

1. Step 1
2. Step 2
3. Step 3
4. Step 4
5. Step 5
<table>
<thead>
<tr>
<th><strong>Button</strong></th>
<th><strong>Temperature Sensor</strong></th>
<th><strong>Buzzer</strong></th>
<th><strong>LCD</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A mechanical device that closes the circuit when it is clicked.</td>
<td>is a device of type (LM35) used to measure the temperature of the environment surrounding it.</td>
<td>A mechanical output device that converts electrical energy to sound energy, and uses different frequencies to make different sounds.</td>
<td>A single colored screen used to show text messages. Different LCD screens have a different number of characters that can be utilized.</td>
</tr>
</tbody>
</table>
Variables are containers for storing information such as names, symbols and numbers. They are used to store and retrieve large or variable information (e.g., the temperature, or the height of a particular liquid level).

1. Click on \( \text{Create Variable} \) from the right menu.
2. Click on Create Variables.
3. Choose a name and starting value for the variable (e.g., 0).
Did you Know!

The Pharaohs were the first to be interested in measurement and used the various measurement tools mentioned above.

Questions:

1. What are the most important measurement tools that man has known?
2. How did the ancients measure the succession of seasons?
3. Have measurement tools developed over time? How has this happened?

Further discussion:

1. What did you learn from this project?
2. Can you develop the projects?
Taking Notes will help you develop your projects in the future, and it will prevent you from repeating same mistakes.

Take Notes

Programming

Construction

Connection

General Notes
A Timer ..

to accomplish routine work

Learning Objectives

1. To know and appreciate plants kingdom
2. To recognize the basic needs of plants
3. To recognize time units and their parts
4. To use acquired knowledge to build an automatic timer

New way of learning

Planning  Inventing  Innovative Thinking  Analysation  Problem Solving  Time Management
Khalid, don’t forget to water the plants at two o’clock
Okay Dad!

Khalid, don’t forget to feed the fishes at four o’clock
Okay Mom!

Khalid, don’t forget to feed the birds at seven o’clock

I will build robots to help me!

The automated timer robots work, while I enjoy my Popcorn!
What does plants need to survive?

Samer, a ten years old boy, loves plants very much and has a pot of ornamental plants in his room. Samer observed after the wilting period of the plant its glittering and yellowing color. Samer went to his mother with signs of sadness on his face to complain to her about what happened to his plant.

His mother smiled and said, “Do not be afraid, my son. The plant needs some sun and fresh air.”

His mother carried the pot to the balcony and sprinkled it with water. The next day Samer woke up quickly and ran to the balcony to see his plant. It recovered its color and began to look healthy again. Samer was very happy and went to his mother to ask her why this had happened.
His mother replied, “All organisms created by God need food.” Man takes food from different sources to grow his body. A plant relies on itself in the production of food through a process called photosynthesis.

**Photosynthesis** is the process by which a *chloroplasts* uses light, water, and carbon dioxide to produce food for itself. When any of these elements are deficient, the plant is unable to produce its food and withers and wilts, just as what happens when a human is hungry.

A plant has the following basic needs that it cannot live without and it cannot produce its own food when these needs decrease:

- **Water**: The utmost necessity to produce plant food; when water decreases the leaves dry out and the plant dies.
- **Air**: The plant must receive carbon dioxide to conduct photosynthesis and this gas is an air component.
- **Light**: The sun must fall on the leaves of green plants to be able to produce food and growth.
- **Soil**: The plant needs other complementary elements such as salt, nuts, and fertilizers to grow; it gets these elements from the soil.

Therefore, we must take care of the plants and not put the plants in a room for long periods. Plants must be exposed to the sun at all times and watered regularly. Plants must be given fertilizer to provide them with the nutrients to remain healthy.
Project Plastic Pieces

- 3x 5x3 Brick
- 3x 5x1 Brick
- 2x Small Shaft
- 4x L Adapter
- 2x Full Bash
- 2x Half Bash
- 2x Angle Brick
- 2x 15x9 Brick
- 3x 15x3 Brick
- 2x Large Frame
- 2x Medium Frame
- 1x Servo Top
- 1x Servo Holder
- 1x Small Frame
- 3x Medium Frame

Electronics

Outputs
In this project, students will learn to make an automatic plant feeder at specific times without the need for human intervention.
**Servo motor**

A motor which has the ability to move to any angle between -90 and +90 degrees, 180 degrees in total.
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.

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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.
Questions:

1. Can you define photosynthesis?
2. Can you list a number of basic plant needs?

Further discussion:

1. Can you develop the project to feed two plants on different times?
2. Can you use the timer in different projects?

Did you Know!

A plant releases oxygen gas as a result of the process of photosynthesis and thus contributes to the purification of air, so gardens are called city lungs!
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