LESSON 3 BUZZER PROJECT-MUSIC ROBOT

Lesson Overview

Students will learn how sound produced, note and beat in music, and how to program a music robot with buzzer.

Lesson Target

1. Learn knowledge about sound, and play music with buzzer.
2. Learn about note and beat.
3. Program a robot to play a song.

Lesson Tag

GRAD LEVEL	SUBJECTS	DIFFICULTY	DURATION	GROUP
Elementary, middle	STEAM, computer science physical, music, math	Beginner	2 x 50 mins	1-2 student

Supplies

Robot	Accessories	Other Material	Tools Used
WeeeBot Kit	USB cable	PC with WeeeCode software USB port required;	

Lesson Outline

INTRO: Observe how human and musical instruments make sound, learn how sound produced. (20 mins)

CREATE: Students will learn the Buzzer module and create a song with buzzer. (30 mins)

PLAY: Each group tests, then records learnings from their invention. Students explore how their invention works, plus the coding concepts behind it. (30 mins)

REMIX: Students will customize and enhance their inventions to create their own song, add RGB LED light through opportunities to change the circuit, code, and the game play. (20 mins)

1. INTRODUCE SOUND.

Observe experiment:

E: How to play a musical instrument? Put your hand to a guitar while it's being played, observe and describe what you hand feel.

A: Each musical instrument need to be played in a certain way. For a plucked instrument, we need pizz; for a piano, we need to press the key; for a flute, we need to toot. Instrument will vibrate when making sound, once vibration stoped, sound vanished.
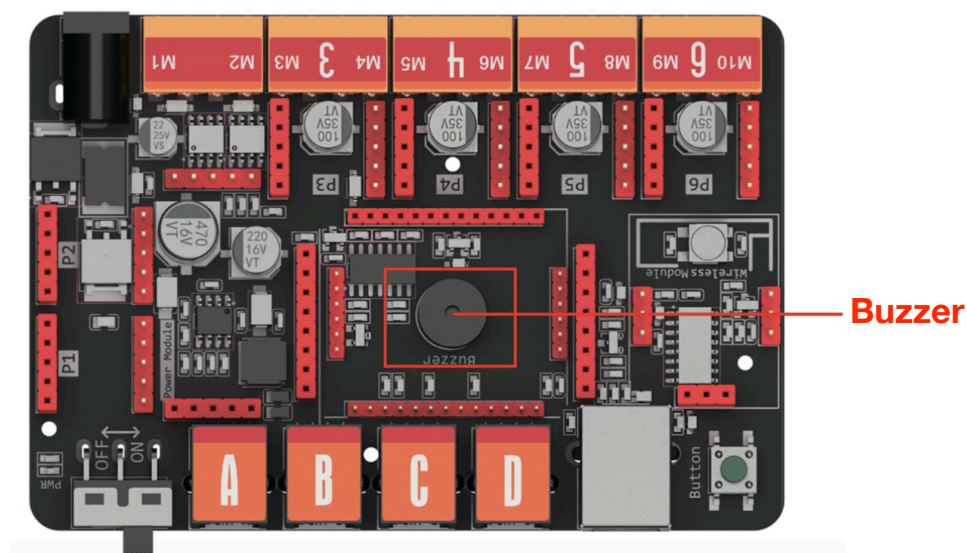
E: Put your hand on your throat, talk in a low voice and then talk in a loud voice, observe and describe what your hand feel.

A: Sound is a vibration that typically propagates as an audible wave of pressure, through a transmission medium such as a gas, liquid or solid. Sound will be changed by the frequency of vibration.

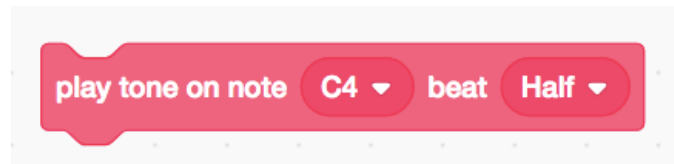## 2. HARDWARE AND SOFTWARE INTRODUCTION

Hardware - Buzzer module
We will use the onboard buzzer of WeeeBot Mainboard. Buzzer make sounds by vibrating as well, and the frequency of vibration decide how it sounds like. Today we will control the buzzer on robot by controlling the vibration frequency to make different tones.

Buzzer

Software - WeeeCode blocks

Open WeeeCode software, find "WeeeCode" category in coding block zone, and check below coding block to control buzzer. Two values can be modified, note and beat.

> **Exercise:**
> 1. Turn on your robot, restore online firmware.
> 2. Run below program, listen to the sound of buzzer.
> 3. Change note "C4" to "D4", listen to the sound of buzzer.
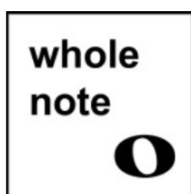> 4. Change beat from "Half" to "Double", listen to the sound of buzzer.

3. LEARN NOTE AND BEAT (MUSIC)

A **beat** is a unit of time in music. In standard 4/4 time, each beat gets a quarter note as below.

Beats are contained inside measures or bars, and these measures are given a **time signature**. A time signature's top number tells us how many beats there are in a measure; the bottom number tells us what kind of note gets that beat.

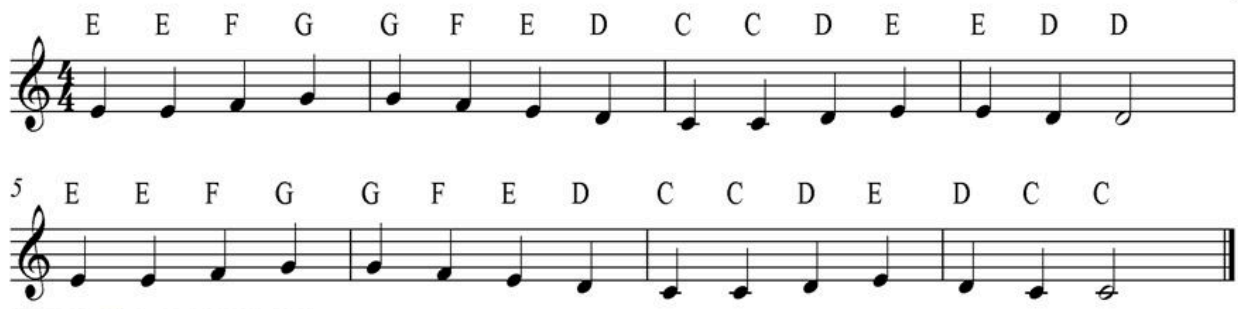Here you go four kinds of **note**.

Play "Ode to Joy"

Now we know note and beat, let's make a music robot play Ode to Joy. Here you go the notification.

Ode to Joy

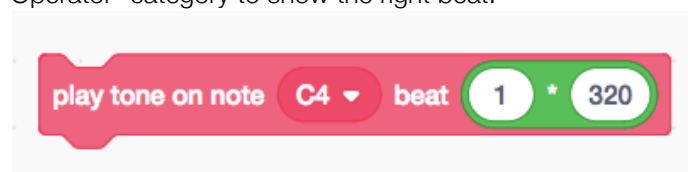The time signature is 4/4, each measure have 4 beat, 1 beat is 1 quarter note.

In music world, we can calculate the time cost for each beat, by BPM showed in music notification.
In robot world, we fixed the time cost by each beat.

Robot Beat	Time
Eighth	125ms
Quarter	250ms
Half	500ms
Whole	1000ms
Double	2000ms

The song's bpm is 190, means one minute contains 190 beats, each beats equals to 60/190=0.32s=320ms. It's quite different with robot beat, we can select **half beat** or **quarter beat** to play this song. Or, we can use number coding block in "Operator" category to show the right beat.

Let's select half beat for this song, so one beat is a half beat.

Now we can analyze this song.

Note Type	Beat Type	Beat in Code
Quarter note	Half beat	Half beat
Half note	Half beat	Whole beat

> **Exercise:**
>
> Code on WeeeCode, make robot play Ode to Joy.
>
> *Sample Program*

4. REMIX

Seven is a magical number. In music world, we use seven letters C, D, E, F, G, A, B to express Do–Re–Mi–Fa–Sol–La–Si. In our last lesson, rainbow is consist of seven colors. Let's do some remix for music and RGB LED light.

Music Note	Color
C (Do)	Red
D (Re)	Orange
E (Mi)	Yellow
F (Fa)	Green
G (Sol)	Cyan
A (La)	Blue
B (Si)	Purple

> **Exercise:**
>
> Code on WeeeCode, make robot play music note from C to B, and show different color on RGB LED when play. Make record and share your project to other classmates.
>
> *Sample Program*