

pi-top



MUSIC MAKER



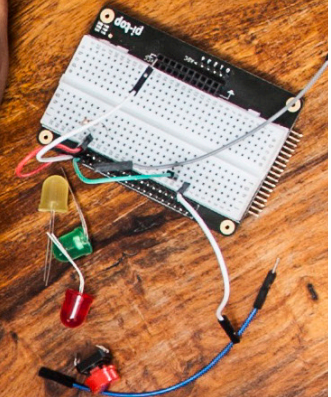
SMART ROBOT



SPACE RACE

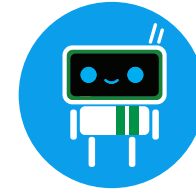
INVENTOR GUIDE

BE INSPIRED





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Innovators have conquered the deepest seas, traversed the highest mountains, harnessed the energy from the Earth and sent humanity to space all in the pursuit of discovery. We are all capable of extraordinary feats, driven by curiosity and adventure into the unknown. At **pi-top** we believe every single person can become a great innovator if given the chance to ignite their own passion in the undiscovered.

There are no dreams too large, no innovation unimaginable and no frontiers beyond our reach, if only we try.

pi-top

How to use this guide

Choose an Inventor Journey

Select one of the pathways to create your own amazing inventions. Use the inventor journey pathways to build up your knowledge to make your final project.

Code & Build

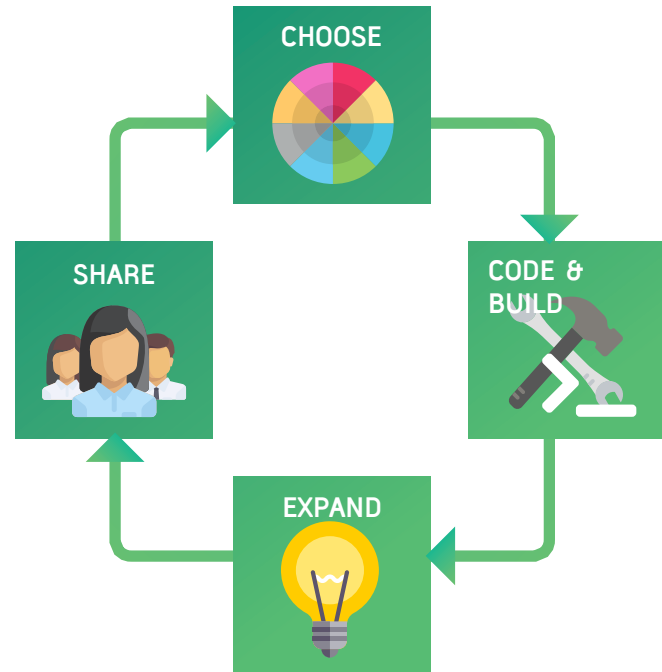
Follow the step-by-step guide in **pi-topCODER** to code and build your invention.

Expand

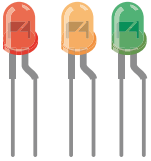
Use your imagination and creativity to build on your creation and invent something new! Add new components and code to expand on functionality in all different ways.

Share

Share your incredible invention with the rest of the **pi-top** community and show what you've invented.



Components



LEDs

LEDs (light-emitting diodes) are little devices that emit light when electric current flows through them.



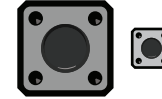
A Jumper Cables

These cables are electrical wires to direct the flow of electricity. You can connect them on your pi-topPROTO+.



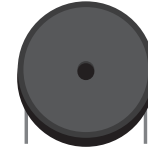
B Jumper Cables

These cables are used to connect the Raspberry Pi GPIO pins to your pi-topPROTO+ ADC pins.



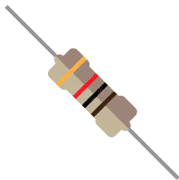
Button

Allow or block electricity flow around a circuit - connect or disconnect things!



Buzzer

Buzzers will make a loud noise when electricity passes through it!



Resistor

Control the amount of electricity that flows through a circuit.



Temperature Sensor

This will change its resistance depending on the temperature around it.



Light Sensor

Detect amount of light - useful for robots to interact with their environment!



Metal Wire

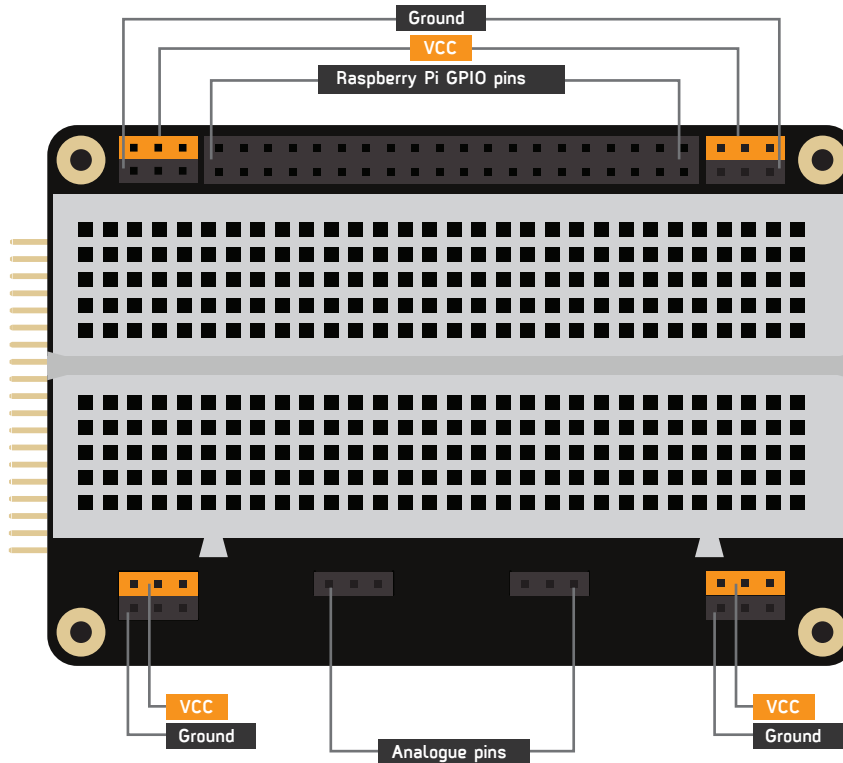
Electricity flows through a metal wire. So, this is a useful tool for lots of your projects!



Variable Resistor

A variable resistor is a special type of resistor which allows you to control the amount of electricity that flows through it.

pi-topPROTO+



pi-topPROTO+ is a prototyping board (the platform) for all your inventions. The breadboard, in the middle, allows you to plug in your LEDs, Buzzers, Buttons and more.

The GPIO pins (general purpose input/output) are used as the physical interface for your Raspberry Pi and the outside world. Follow the **pi-topCODER** app's step-by-step building instructions and bring your inventions to life!

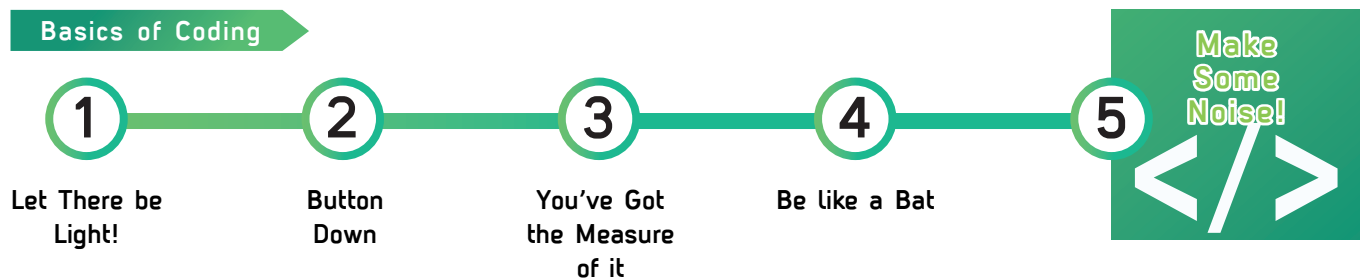
Getting Stuck?

To learn the basics on how the **pi-topPROTO+** works, check out the breadboard lesson plan in the **pi-topCODER** app.

Inventor's Journey

Power on your pi-top - you should be greeted with **pi-topDASHBOARD**. From here, it is easy to launch **pi-topCODER**, where you'll find all the step-by-step guides you need.

First, follow the basic pathway (outlined below) to build your fundamental understanding. Then, follow one of the inventor's journey pathways to design and build new inventions!



Music Maker

1

Don't Push Me

2

Melody Madness

3

Make Some Wubs

4

What's a Theremin?

5

Music Maker



Space Race

1

Rapid Reflexes

2

Tap Tap revolution

3

Double Click King

4

Keep it Steady

5

Space Race



Smart Robot

1

Hello World

2

Clappy Hands

3

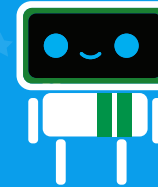
Feed Me

4

Chatter Box

5

It's ALIVE!! //



Let There be Light!



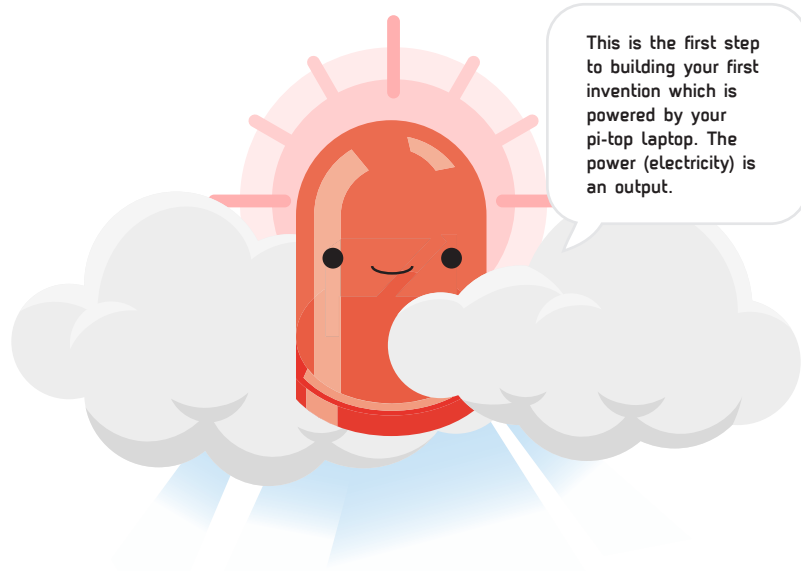
Let's build your first electronic circuit. Add some code to turn on a light. The light is an LED which stands for 'light emitting diode'.

Inventor's Journey



Challenges

Can you make it blink faster?
Can you use other components?



Real-life Applications



Computer Monitor



Traffic Lights

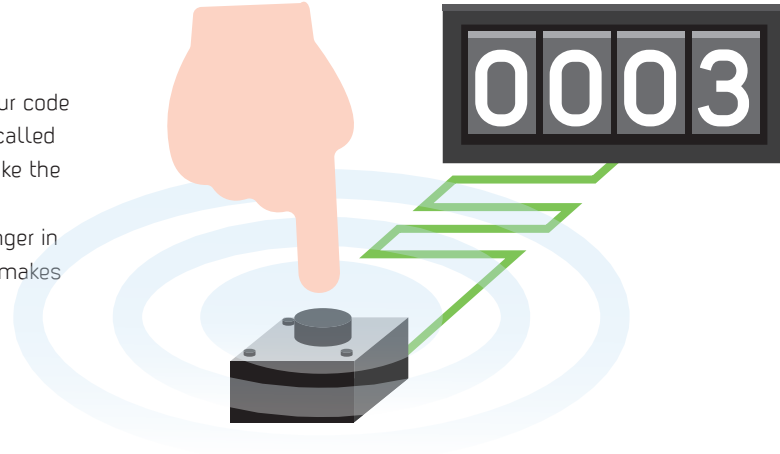


Car Lights

Button Down



This is where you're going to make your code respond by pressing a button, this is called an INPUT. This is one way we can make the digital world, a computer for instance, interact with the physical one, your finger in this case. It could be the switch that makes your doorbell ring.



Inventor's Journey



Challenges

Create a click counter for the button

Real-life Applications



Keyboard



Gaming Controller



Doorbell

You've Got the Measure of it



Sensors which aren't just on or off are called analogue, for example, light. It's not just dark or light, it can be dim. We're going to learn how to measure these values.

Inventor's Journey



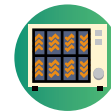
Challenges

Can you measure the temperature? Can you measure how much a variable resistor turned?

Real-life Applications



Science Lab



Oven Temperature



Air Condition

Be like a Bat



Using an ultrasonic sound sensor we can send out a signal and time how long it takes to come back. Using this information we can measure how far away an object is. Here we'll learn how to measure that distance.

Inventor's Journey



Challenges

Can you make an LED light turn on if the distance is too close?

Real-life Applications



Drone
to keep height



Parking Sensor



Robot

Make Some Noise



All music starts with a single sound. Use a **pi-topSPEAKER** or plug in your speaker to create your own orchestra of funny sounds.

Inventor's Journey Completed!



Challenges

How many different sounds can you make as you create your own music?

Real-life Applications



Boombox



Headphones



DJ concert

Don't Push Me



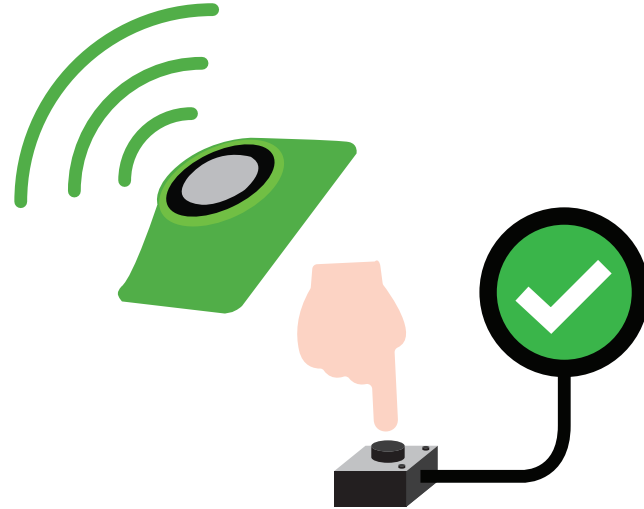
At its most basic form, a musical instrument makes a single sound when you hit a key, or pluck a string. Let's use a button to get your new instrument to make a sound.

Inventor's Journey



Challenges

Can you get it to play different sounds every time you press the button?



Real-life Applications



Boombox



Alarm

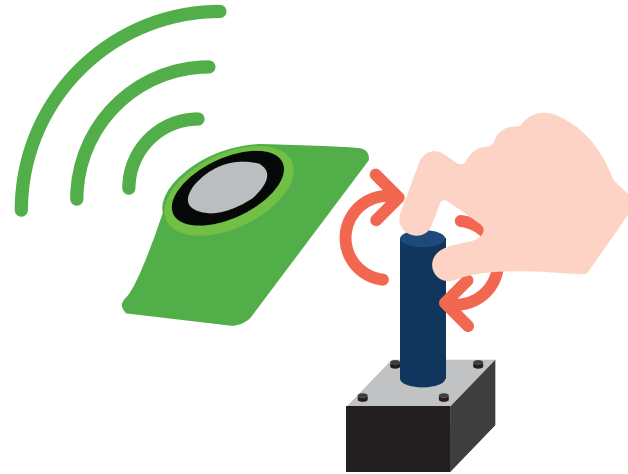


Doorbell

Melody Madness



Music is made out of melodies, and melodies are made out of notes. Using the variable resistor we can change the tone to create different notes, to make a whole tune! The change in tone is called a change in frequency.



Inventor's Journey



Challenges

Can you make your **pi-top** play twinkle twinkle little star?

Real-life Applications



DJ concert



Electric Synth



Alarm System

Make Some Wubs



In earlier lessons we made a light dimmer, let's use that same knowledge to change the frequency of a tone ourselves! This allows us to build the basics of a musical instrument.



Inventor's Journey

3

Challenges

Can you make it so that the speaker only plays 4 different notes? Can you limit your programme so that certain frequencies play a single note rather than a range of notes e.g. 0-100 = c?

Real-life Applications



Theremin



Electric Synth



Doorbell

What's a Theremin?



A Theremin is a musical instrument which makes sounds without even touching it, pretty cool eh! You control it by moving your hand closer to, further away from or along a sensor. Use your hands to make your own hands-free instrument! You can turn our distance sensor into a Theremin to make your own beats.

Inventor's Journey



Challenges

Can you make it only play defined musical notes.



Real-life Applications



Motion Sensing



Microsoft Kinect™



Radar

Sonic Synth



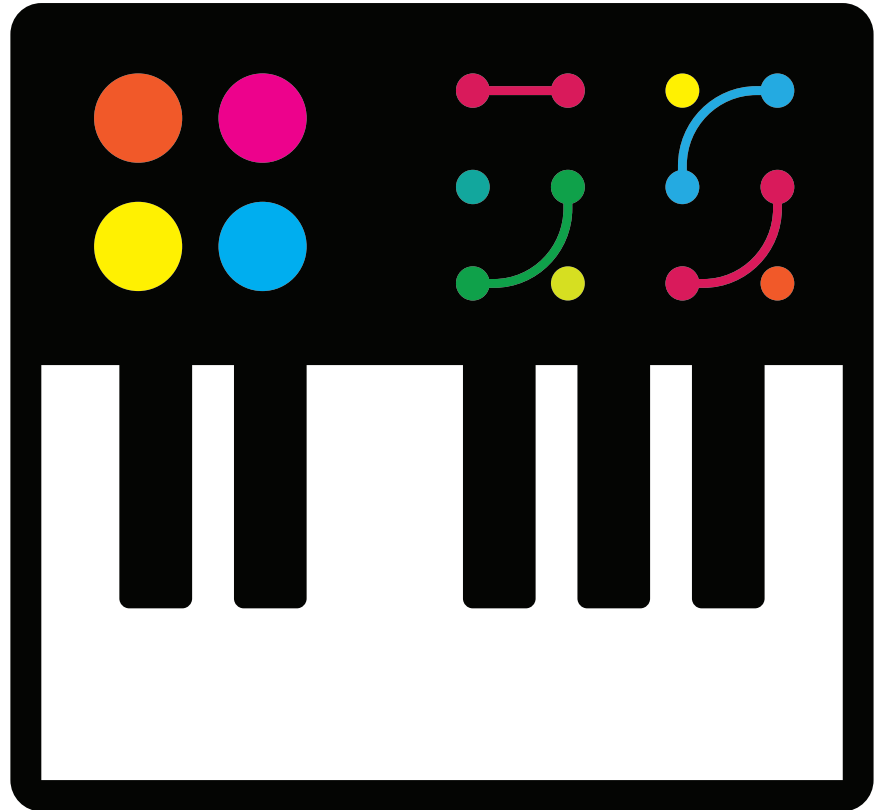
Combine all the previous inventions into one, and make an instrument which is truly unique.

Inventor's Journey Completed!



Challenges

Can you put a beat to your song? Get your friend over and make an orchestra!

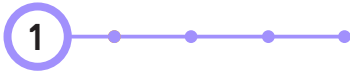


Rapid Reflexes



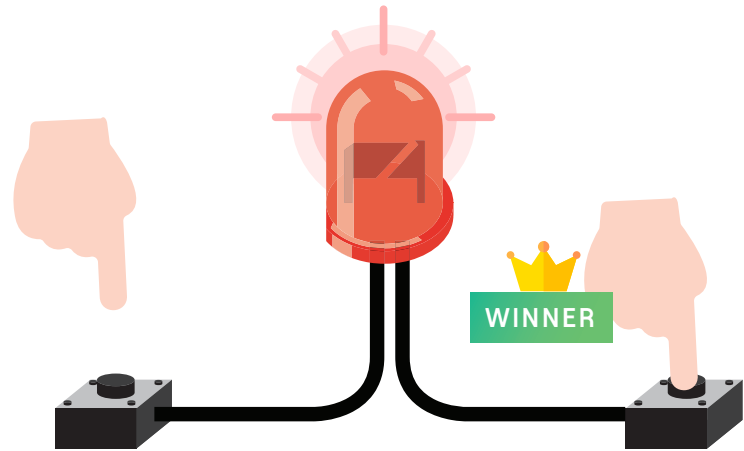
Test your reactions against your friends. With just a few components you can code a game to determine who is the fastest!

Inventor's Journey



Challenges

Make a game for 3 people?
Make a game best of 3.



Real-life Applications



Arcade Games



Sport Competitions

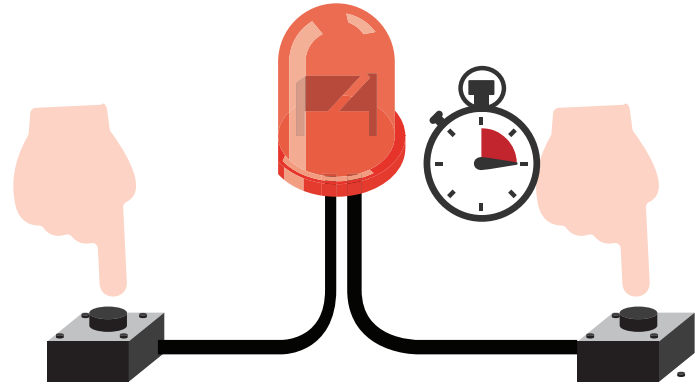


Board Games

Fingers of Fury



How accurately can you time 10 seconds without using a watch? Now that you can detect a button press and the time that is taken to press it, let's write a program which can identify which of two players pushes their button closest to 10 seconds after the game starts.



Inventor's Journey



Challenges

Can you print a timed scorecard for this game?

Real-life Applications



Stopwatch



Video Games



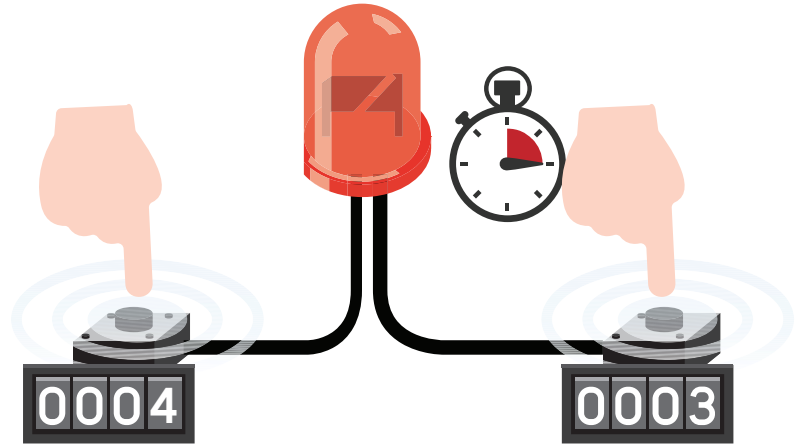
Finger Drumming

Tap Tap Revolution



Challenge yourself to press the button as many times as possible in 5 seconds.

Inventor's Journey



Challenges

Can you make the game end if you can't complete it in under 10s?
Can you make it so your player incurs time penalties every time they touch the wire?

Real-life Applications



Finger
Drumming



Electric
Synth

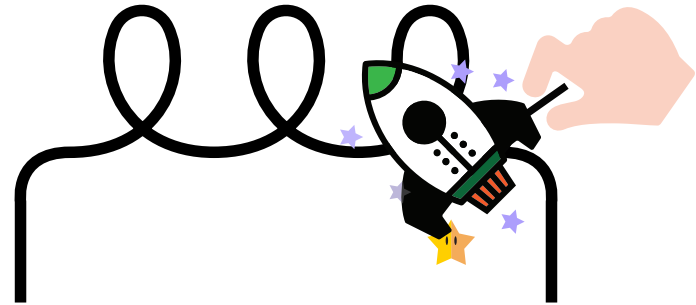


Typing
Speed

Keep it Steady



Add a feature to give players a helping hand. When you press the invisibility button you can touch the wire as many times as you like for two seconds.



Inventor's Journey



Challenges

Can you write your code, so that it randomly chooses the time that invisibility mode will last for? Can you add a sound effect to the invisibility effect?

Real-life Applications



Soldering Circuits



Video Games



Tablet Calligraphy

Space Race



Upgrade the steady hand game to count how many times you have touched the wire, and add a shield to your spaceship.

Inventor's Journey Completed



Challenges

Each touch adds 5s to the total time.

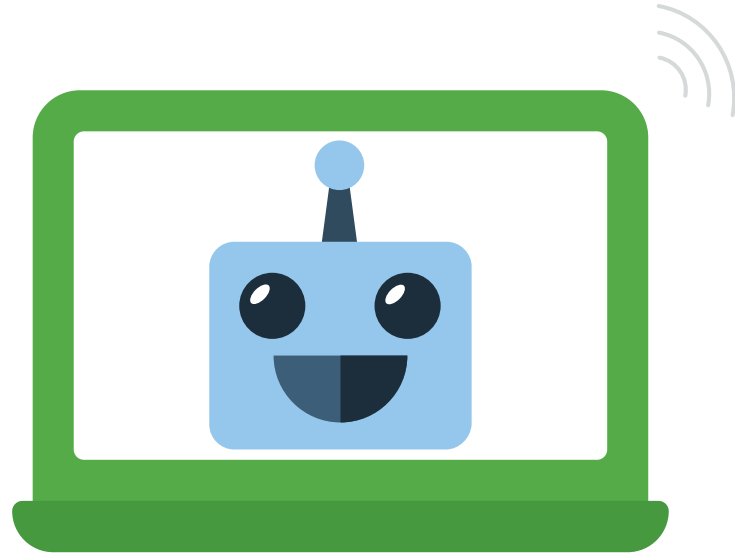


Hello World



Bring your smart robot to life with a voice and glowing ears. It will be able to talk to you and show emotions!

Inventor's Journey



Challenges

Can you make the eyes flash when there is a particularly loud noise?

Real-life Applications



Voice Assistant



Automated Support

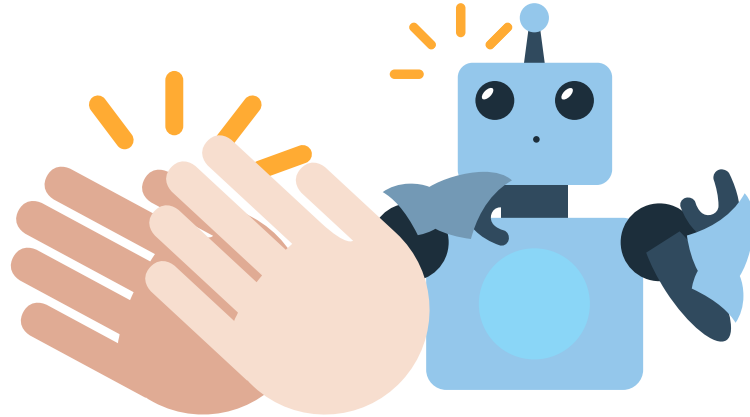


Virtual Pet

Clappy Hands



Make your robot react to noise in its environment. Clap to make it react with a funny noise or phrase!



Inventor's Journey



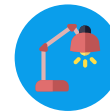
Challenges

Can you make the LEDs light up when you clap? Can you make the greeting appear only to people who clap three times?

Real-life Applications



Noise Detector



Smart Lamp



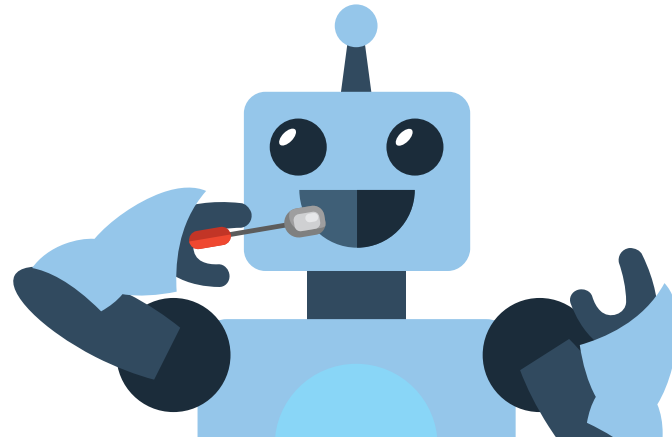
Home Security

Feed Me



Use the light sensor to detect when you put food over the robot's mouth feeding it with more power!

Inventor's Journey



Challenges

Can you make your thermometer play a sound after the temperature has been at a certain level for a period of time?

Real-life Applications



Autonomous Vehicle



Astrophysics



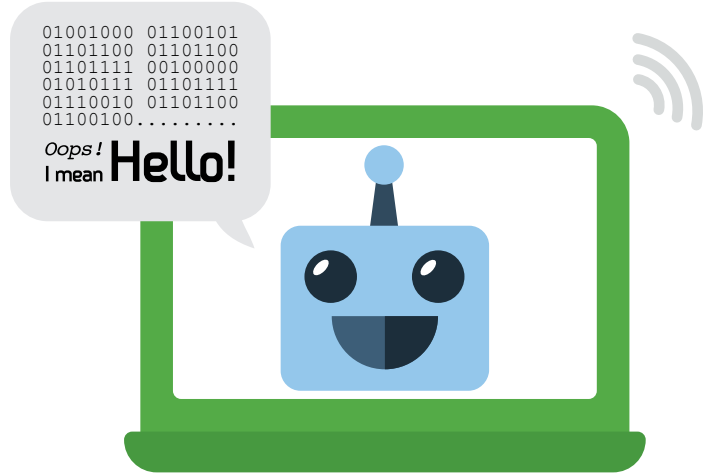
Smart Clocks

Chatter Box



Using the ultrasonic range sensor, your smart robot can sense when people approach your smart robot. Make your robot greet them with a funny greeting!

Inventor's Journey



Challenges

Can you make the greeting appear only to people who clap three times?

Real-life Applications



Parking Sensor



Roller Coasters



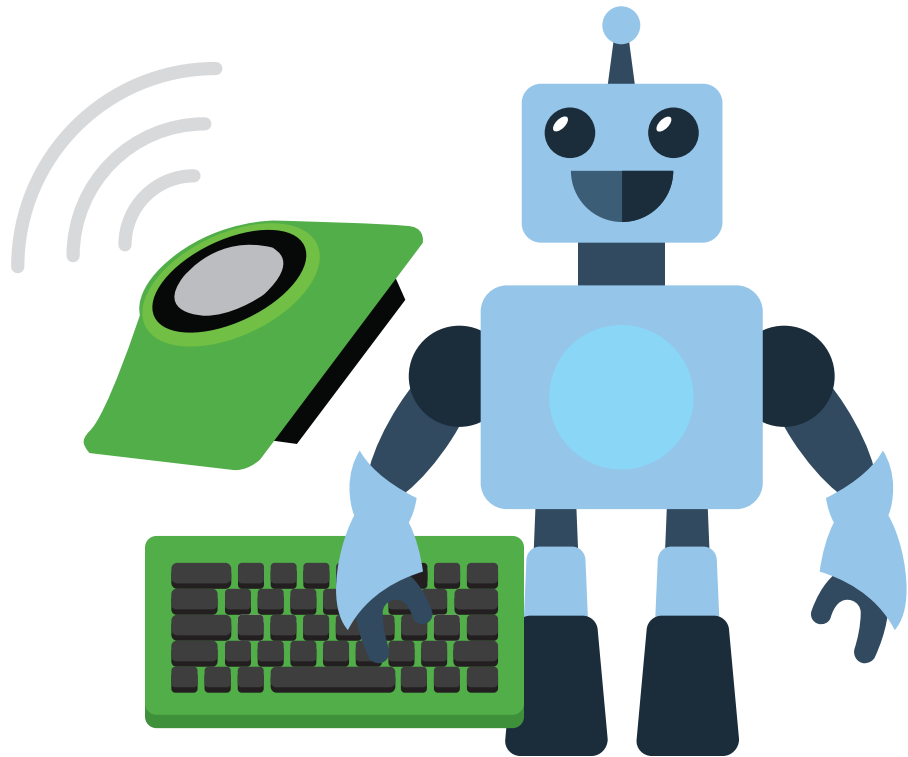
Aviation Safety

It's ALIVE!



Bring the whole smart robot together by combining all the functionality and adding additional input for interaction!

Inventor's Journey Completed!



Troubleshooting

**GPIO pins are not working.
Is there power running
through the pi-topPROTO+?**

Is your **pi-top**PROTO+ aligned with the correct pins? Check that the 34 pin connector is properly aligned with the 34 pin connected in the **pi-top**.

**There is no power running
through my components.**

- i. Ensure jumper cable connects from the 3v3 GPIO to the breadboard on the row with the first component.
- ii. Ensure the final component on the inventor's kit has a jumper cable that connects to the Ground GPIO on the breadboard.

**My keyboard and trackpad
are not working.**

Make sure the USB dongle in the **pi-top** is properly inserted into the Raspberry Pi as this is what communicates with the Keyboard and Trackpad.

**My LED is not lighting
up.**

- i. The 3v3 power connects to the positive side (longer leg) and the Ground should be connected to the negative side (shorter leg).
- ii. Other components with directional problems:
- iii. Diodes, Buttons

Button not working?

Try using a jumper cable to bypass the button (connect it to the start of the next component). If the circuit works, then there is a problem with the Button which can be solved by disconnecting it and rotating it 90 degrees.

Need more help?

Still stuck? Please don't hesitate to email us at support@pi-top.com or send us a tweet to [@GetPitop](https://twitter.com/GetPitop).

www.pi-top.com

Community + Share your Invention

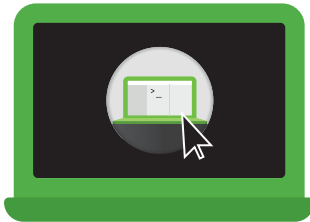
Tag us and use the hashtag
#daretoinvent to share your
inventions with our community.

www.pi-top.com



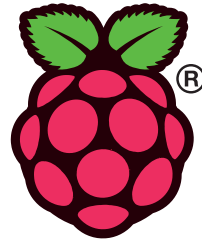
Continue Your Inventor's Journey

Now that you have finished all of the inventor journeys there are a wealth of resources online which you can use to continue building, inventing and discovering new projects.



pi-topCODER

pi-topCODER has a wealth of resources in addition to the inventors pathways.



Raspberry Pi website

The Raspberry Pi website has a wealth of resources which you can explore.

<https://www.raspberrypi.org>



MagPi

This is the official Raspberry Pi Magazine and is full of great projects! You can find it online or in a store.

Glossary

Raspberry Pi

A small credit card sized computer, it is the brain of the **pi-top** and runs the entire computer.

GPIO Pins

The General Purpose Input Output Pins directly interact with the Raspberry Pi. You can code them to do almost anything!

ADC

The Analogue to Digital Converter enables the Raspberry Pi to receive signals from the analogue world. It is part of **pi-top**PROTO+.

pi-topPROTO+

pi-topPROTO+ is a prototyping board (the platform) for all your inventions which connect to the magnetic modular rail. It's made with a breadboard and has a lot of useful pins such as the GPIO pins or ADC pins.

LED

Light Emitting Diode, this is a little light commonly used in electronics. You have to be careful to plug it in the correctly!

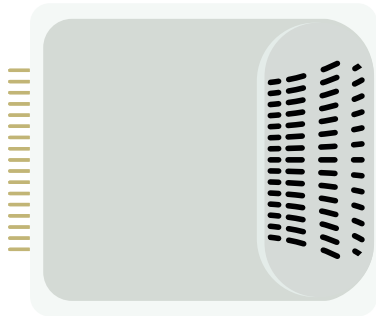
pi-topCODER

A platform on **pi-top**OS which you can use to learn how to build and program awesome projects.

CEEDuniverse

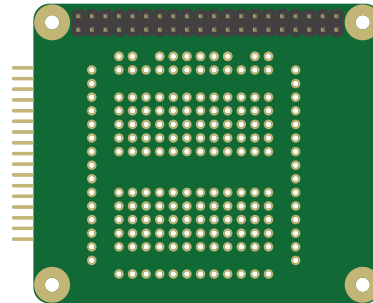
pi-top's very own space exploration game, while discovering new planets and strange creatures you will learn about science, technology and learn how to code.

Visit www.pi-top.com to see our full range of amazing accessories!



pi-topPULSE

pi-topPULSE brings the arts into STEAM. Code your own games, create music and lightshows and build your own pi-top powered Amazon Alexa!



pi-topPROTO

Use pi-topPROTO to make circuits for pi-topCODER and CEEDuniverse & even solder your own projects.



pi-topSPEAKER

Use pi-topSPEAKER to give your pi-top a voice. Enjoy immersive gameplay in CEEDuniverse or making your own music in Sonic Pi.



Notes

BE INSPIRED



pi-top
Model: **2.0**
Brand: **pi-top**
Manufacturer Name: **CEED LTD**
Manufacturer Address:
19 - 23 Featherstone Street
London, EC1Y 8SL

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.



Made in China