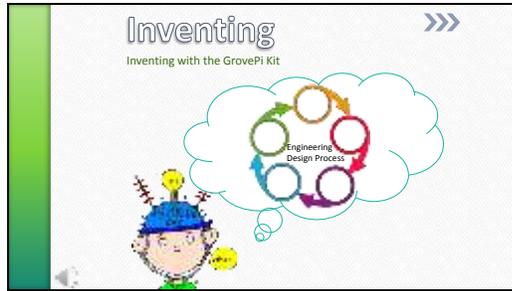


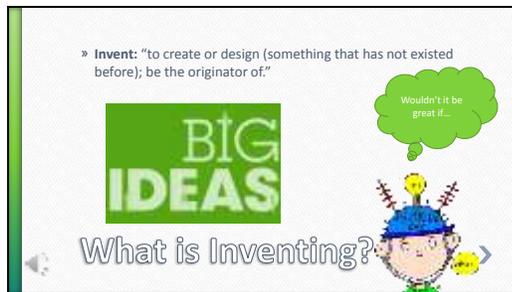
Slide 1



Have you ever wanted to invent something or to take something that already exists and make it even better?

Let's explore how we might do that with the GrovePi kit, and the Engineering Design Process.

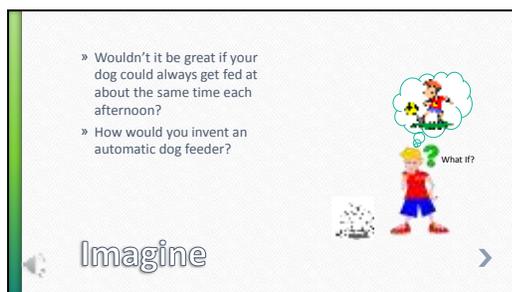
Slide 2



To invent is to create or design something that has not existed before. Most inventions begin with a spark, an idea, thought, or inspiration. Like: wouldn't it be great if... What follows if is a description, (however rough) of what would be great. Then you describe what would make it great and how it might look or work when it is done.

This is your big idea, and it can start from any problem that you encounter.

Slide 3



Imagine that it is your job to feed the dog, after school. On some days you would like to do something else rather than rush home to feed the dog. Sometimes the bus or your ride is late, sometimes you have to stay after school for sports or to rehearse a play, or some other activity.

Wouldn't it be great if your dog could always get fed at about the same time each afternoon?

Let's imagine that you have a dog and would love to make an automatic dog

feeder. What would possibly happen next?

How would you go about inventing an automatic dog feeder?

Slide 4



When most people start an invention, they begin with an idea.

The idea has a purpose, or some goal to accomplish.

They ask a lot of questions that begin with Why? And What? And How?

They start to develop the idea. They look at what already exists and then begin to gather items and design and build components that will work together to accomplish the goal of the invention.

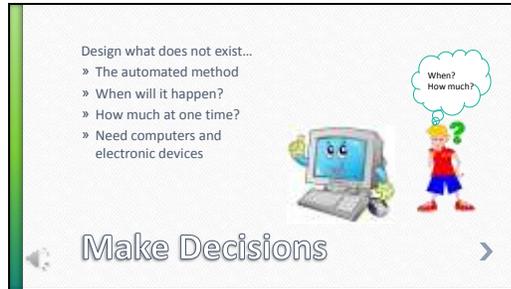
For instance, let's suppose you wanted to build an automated feeding system for your dog.

You might ask how would it work? and What do I need? You might start with something that holds the food, and then something that the pet can eat out of.

You might already have these items or can find used parts or a store where you can buy them.

Later in the process, you may find that you need to alter them, but to begin with you just gather items.

Slide 5

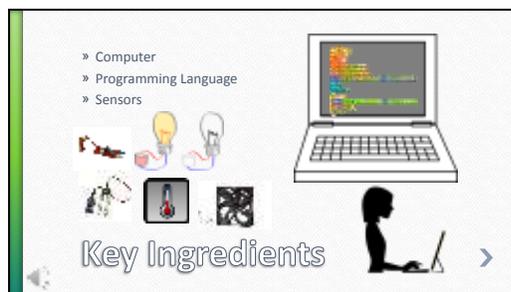


And then you have to design the part that does not exist. In this case it is the automated method of dispensing the food from the holding container to the eating container.

You also have some decisions to make, such as when the food will be dispensed, and how much food is dispensed at one time.

Those are the things that a computer and electronic devices can help with.

Slide 6



When you invent something that has a control mechanism there are some key ingredients that you need.

First, you need a computer which has the ability to compute decisions.

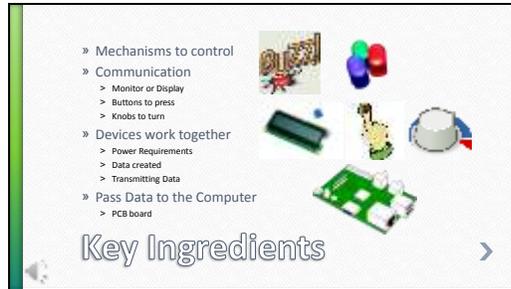
Next, you need a programming language, which is what you use with the computer to tell it the decisions you want to make.

Next you need some sensors which provide data to help you make the decisions.

For instance a light sensor could tell you when it is light or dark and you make the decision to turn a light on or off based on that data.

Or a temperature sensor could tell you when it is cold or hot and you might decide to turn a fan or a heater on or off based on that data.

Slide 7



You also need some mechanisms that you can control with the computer - such as a light, or a buzzer to create a noise, or a motor that can turn to open or close something.

Next, you need to think of who is using your device. They need some communication methods such as a monitor where you can display messages to tell them what is happening and what to do next. You may also want them to press a button to start or stop something or turn a knob to increase or decrease something.

All of these sensors and mechanisms need to work together. Each one has its own requirements for power and its own method of creating and transmitting data. You need a method of connecting them all together and passing the data to and from the computer. That is the job of a circuit board or PCB board.

Slide 8



The GrovePi kit comes with those types of electronic components to help you create an invention. It has a computer, programming language, sensors, communication devices, and a PCB board. As you go through these lessons, you will learn how to connect these devices and how to program the computer to control the sensors and devices and make them do what you want them to do.

Your challenge will be to use what you learn in your invention. You will have to figure out how the controls and

sensors work with the other items in your design to control the devices in your invention.

Slide 9



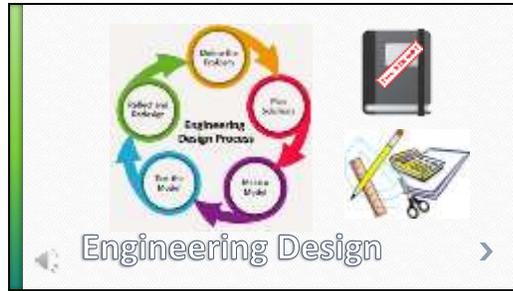
Let's take the automated dog feeder example. You would have to figure out how the electronic control device works with some type of food dispensing mechanism so that it starts and stops the flow of pet food. You would also have to figure out what environmental clues or sensor data will tell you when to do that. Will it be when the pet does something or will it be at particular times of the day or some other method?

It might also be good to let your family enter the time for dispensing the food, or tell them what is happening with the dispenser or maybe when the pet food is low so they can refill the food holder. So you may want to include some kind of display or control panel.

You probably can think of other things that would be nice to have in this invention.

Maybe you want the device to send you a text message to your phone to let you know that it fed the dog, or that it couldn't feed the dog because it was out of food. Each of those decisions become part of the Engineering Design criteria for your invention.

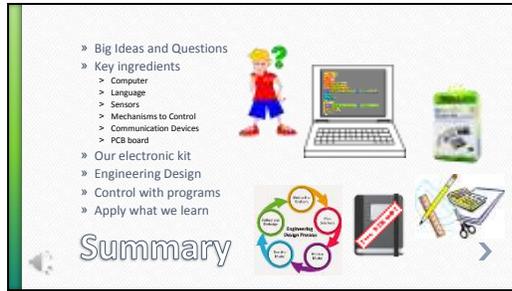
Slide 10



In the Engineering design cycle we begin by defining the problem, then we gather components and plan solutions, then we make a model or a prototype, and then we test the model to see how it works. We typically see things that can be improved upon or things that don't work out as we thought they would, so we reflect on new ways of doing things and a new design. This leads back to the beginning of the cycle and we start over. We continue this process until we have a working product.

Like an engineer, we use an engineering notebook where we make drawings and sketches, write down our ideas as we go through the process, and write down what worked and what didn't work. We usually keep our notebook and our ideas a secret, so that others cannot steal our ideas before we are done. But we do share them with our teacher or mentor, especially if our grade depends on it.

Slide 11



So as a recap, inventions start with big ideas and lots of questions. When we invent something which has a control mechanism we need some key ingredients. These include a computer, a programming language, some sensors, and mechanisms to control, communication devices, and a control board. Fortunately for us, we have those ingredients in our GrovePi electronic kit.

We go through the Engineering Design cycle as we create an invention. And since things hardly ever work out perfect the first time, we keep going through the engineering process and trying different things until it works. We use the tools of engineers to draw our design, and take measurements and collect data. Then we write everything down in a notebook.

We learn as much as we can about the electronic devices we have available, and how we control them with programs. Then we apply what we learned to our invention. So as we learn about a new device, we examine how it might be used in our invention to solve one of our problems or to make the invention easier to use.