

**PyramidHope.ru**  
**The Workshop**  
**Project 002 – Example Product**  
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**Goals**

This project will illustrate a simple product from initial ideas through design and actual manufacturing.

The hope is that students may gain a better understanding of the steps, decisions, problems, and other tasks required to bring a product to market.

Let us begin...

**Initial Idea**

We begin by pretending the giant corporation, Pyramid Hope, has hired our company to make a product for them. We would have initial discussions on what was needed, options that were desired, budget available for design, number of units produced, target price of the retail units, along with general contract terms and other business details.

If this was a real business deal, we would advise our client of any potential problems we see, and depending on their answers and our evaluation, we may or may not agree to the contract.

Clients will often ask you to design and build something that you think nobody would want. You can advise them of changes you think would make it better, but in the end you design and build what they asked for. Your contract should state you are working according to the client's specification and have no responsibility for the marketability of the item. Also make sure the contract says you get paid as long as you did what was agreed to, even if it doesn't work.

Don't agree to make things that are illegal or immoral. Understand that you can say "no" to any contract offer, but also understand the client may not come to you for future work but if you explain to the client why you are turning it down they may appreciate your honesty and they come back. Everything should be written down, contracts must be signed. If a client wants to change something, have them send it to you in writing (e-mail is ok, just keep ALL your communications with them). Anything not written down can be later claimed to be your imagination by the client.

So, pretending we've done all of the above and agreed to do the work, what is the product?

**The Product**

The mega corporation, Pyramid Hope (our client) has contracted us to design and build a small plastic pyramid that blinks different colors. For the first stage of the contract we are to consider different ways we could do this and present the findings to our client.

This is where we think of ways to satisfy the client's needs, then check practical details like the cost of parts. Can we even get the parts? Do we have the tools to make the product? If we

don't have the tools, should we buy the tools or hire a company with the tools to do part of the work? Jerry and Sharon work together on this, Jerry may think of an idea and explain it to Sharon who might point out problems with it. Sharon may then propose something and Jerry looks for problems with it. This continues until they find something that sounds reasonable.

At this stage the client would be informed of our idea. They may like it, they may hate it, they may say "whatever". Once we have their approval, we move on to the next step.

It's important in many cases to make a prototype, a quickly assembled simulation of all or commonly part of the final product to see if it works the way you think it will.

So, the first idea Jerry had for blinking the LEDs was to use simple electronic parts called Schmitt Triggers with a few other cheap and small components to create semi-random blinking of LEDs. He drew this out so he wouldn't forget the idea.

We had all the parts for a prototype in stock (over time you will build up a large number of parts left over from products that can be used for testing ideas), so Jerry built the prototype. These are often called "breadboards" because originally they were created by putting tacks into a handy flat surface and running wires between the tacks. The handy flat surface was often a bread slicing board. Now we use other methods.

So, what did he find? It didn't work the way he'd predicted. It seems the current common Schmitt Trigger parts don't have the expected characteristics.

This would be reported to the client who may cancel the project, or may want other ideas. If they say to continue it's "back to the drawing board". This is an expression from when drawings were done on paper using a large flat tilted desk (the board).

The next idea is to use simple timer chips. These are very common and not expensive, but more expensive than the Schmitt Trigger idea, this would also be physically larger requiring the pyramid to be too big. It's decided that while this will work, it's not a good solution.

Jerry had the idea to use a microcontroller, a small computer on a chip designed to do simple tasks repetitively. Reading the buttons on a microwave oven and displaying the time is one example. The microcontroller has nothing to do with making the microwaves, it only tells that part of the oven when to turn on and off.

In the past we've used different brands and types of microcontrollers, they have to be selected to meet the requirements of the project but also they have to be available at a reasonable cost. When making small quantities ("small" is typically below 100,000 per year) you need to use the parts that are available to the general public without the opportunity to order them direct from the factory.

We checked and found the series of microcontrollers we've used on many projects isn't currently available in a small package ("package" meaning the physical part). We did find Atmel offers a very small, easy to get, low cost microcontroller so we will use that.

As a client often needs their product very soon, a microcontroller may be used when not really needed as they are easy to work with and configure to the needs of the project. The product

may wind up costing more, but it will be on the market sooner and that might be very important to the client. Other times the microcontroller may make a product smaller and cheaper. Every product is different.

We tell our client about using microcontroller and they approve it. We suggest that it also allows the opportunity to add a few more features to the product with very little change in cost. They like this a lot. The exact list of features will be determined later when the firmware (instructions that are permanently installed in the microcontroller) is written.

So, now we know what microcontroller we'll be using. We picked an LED (Light Emitting Diode) that we will use and also decided that this will be powered by a USB charger. Almost everyone has a charger so there's no need to include one with the product... a cost savings.

The client reviewed everything and approved the project to proceed. We will build a small number of the PC Boards in order to verify everything works as planned and to allow the client to see it working.

The parts are being ordered, it's time to do the final electrical design work and work with Sharon on the PC Board layout. This is where she draws the patterns used to create the boards, copper wires "printed" onto fiberglass boards.

We would then make any modifications needed and if all goes well, later we'll build larger quantities.

We'll be putting details of the above steps into additional documents, but we have to go out of town for a while. We will continue when we get back.