FUNKENGINEERING

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Building a better everything

Discussing the latest technologies with Funk Engineering's Nathan Funk

As the Director of Engineering and Technology for Funk Engineering, Nathan Funk is constantly thinking about improvement. He is forever taking a step back from any product, project or concept he's working on to see if he can build a better mousetrap.

With technology improving constantly – both in ability and availability – Nathan has helped Funk Engineering become one of the best firms in the industry when it comes to new solutions.

Nathan took the time to talk through some of the technologies Funk Engineering is currently using to help manage projects on a budget and a timeline. One such tool he discussed was the Arduino, which is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software.

Q: How has the availability and lowered cost of microprocessors like the Arduino changed or affected how you work as an engineer?

For the first time we are able to dedicate a data acquisition system to a single project. We don't have to try and use one piece of hardware for multiple things. The really neat thing about an Arduino is it has a microprocessor on board, so you can go straight from computer-attached system to a standalone system, meaning you take the program you have on the computer and download it on to the single board computer for a standalone system.

Q: Can you give an example of how this would work?

The microprocessor can be used as a data acquisition system, but it's basically a computer. It has an internal memory, it has an internal processor, and it has its own open-source code library. To put it in very simple terms, it's basically the equivalent of a computer you bought in 1990, but you can buy it now for $20 to $30. To further improve that, they sell all of these plugins that are direct connection, but they also have the ability to add Bluetooth, Wi-Fi, local area network (LAN), Xbee and so on. All this means that for less than $100 of hardware you can make a complete wireless sensor system that operates independently or talks with your computer.

Q: Beyond these added technologies, what does the Arduino do for your project scope?

One of the real cool things about Arduino is it is a completely open source system, so everybody's examples are there. The benefit of this is just unparalleled; Just about anything you can imagine

doing, someone has something like it already and you can save so much development time and cost getting help from others.

Q: How does this affect some of your current projects?

Currently, early in the breadboard stage you can use them as data acquisition system to monitor how everything works together, but once you learn about your hardware you can then pare it down, load it onto the Arduino memory and it runs by itself.

That fits into a project that we are doing with a prosthetic knee. We're working as a contractor on the Ohio Third Frontier Program's Rapid Rehabilitation and Return to Function for Amputee Soldiers (RRRFAS) grant, and the starting point was studying a normal human gait and comparing it to someone with a prosthetic. For most prosthetics, the user has essentially a passive knee, so they have to, for lack of a better term, throw their knee forward to create a walking motion.

This is a situation where what was required was a better understanding of the difference between the two phases of active gaits and understanding how much energy would be required to create a natural swing of the leg. This was where new technology can really improve a project.

Q: What does this added technology mean to the project?

So our customer had a concept, but they had no way to bring it to actual testing; they had no way to evaluate it. That's why they brought us in, because we knew about this hardware and we were able to take their requirements and move forward with it. They were stuck at concept phase and we know a lot about hardware/software data acquisition, so we were able to get them past that point.

To start with, we needed to know how a valve reacts to a control signal when we used it as data acquisition system, but once we learned how it reacted, we could write the actual control code, and then load it onto that Arduino that we had been using. So now instead of just being a data acquisition system, it's a standalone feedback system, so it's basically watching how you walk and actively monitoring the gait cycle of your step. It looks at your hip and knee angles to control those valves and accelerations. This is the part that excites us and really brings a concept to life.

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