FSU researchers work to help mobile devices keep going and going...

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Gary Tyson and David Whalley are researchers at Florida State University. Credit: Michele Edmunds/FSU Photo Lab

So, your smart phone lets you play music, send text messages, check e-mail, surf the Web, access apps and play games, but somehow it's not quite smart enough to keep from running out of juice when you actually need to make a phone call.

Don't blame the phone; blame inefficient processor pipelines that have failed to keep pace with emerging mobile technology, according to Florida State University computer science professors David Whalley and Gary Tyson. But for millions of users struggling to keep their cell phones and other mobile devices charged, help is on the way.

Whalley, Tyson and a colleague at the University of Pittsburgh have

been awarded a $1.2 million, four-year grant from the National Science Foundation to develop a more energy-efficient processor for mobile embedded systems that will perform as well as traditional pipelined processors. Mobile embedded systems involve computer processors that are embedded in cell phones, handheld game consoles, e-book readers and other devices that can be carried and run on batteries.

"Minimizing energy consumption is very important to these systems because it is vital to extend the life of the batteries that power them," Tyson said.

A more energy-efficient processor could potentially reduce the cost of mobile devices because the hardware would be less complex, and the technology could lead to the development of new kinds of even smaller and lower-power mobile devices.

Pipelined processors are similar in concept to assembly lines to build automobiles. Rather than building each car from start to finish and then starting on the next, several cars are in the assembly line at different stages, getting different parts all at the same time. The same goes for computer instructions — they go through a pipeline where various tasks associated with the instruction are performed. There can be several instructions in the pipeline at the same time, but different tasks are performed at each cycle.

"The problem is that current techniques used in pipeline designs can waste power by performing redundant and sometimes unnecessary computations," said Whalley, who is also chair of the Department of Computer Science.

Whalley and Tyson are designing a statically pipelined processor that reduces the inefficiency by eliminating most of the redundant computation.

"Rather than having each instruction go through several cycles, a statically pipelined processor will control all aspects of the processor during a single cycle," Whalley said. "This direct control reduces the need for complex pipeline support hardware and avoids a lot of repetitive and redundant actions."

Whalley and Tyson already have one patent accepted and another one under review for other features that would support low-power design. This new project will complement those ideas and could lead to the development of a whole new class of very low-power devices, such as ant-size environmental monitors that could measure ocean currents and temperatures or the next generation of heart pacemakers that would require less frequent surgeries to change the batteries.

They also are working on a project that involves developing a new secure mobile computing environment to protect laptops and other mobile devices against security threats and malicious computer viruses, called malware. While traditional approaches have sought to prevent malware by patching software vulnerabilities and blocking viruses, the FSU researchers are working on an approach that would limit any outbreaks to only a few systems. This would allow countermeasures to be employed before significant economic damage occurs. This project is supported by a separate $500,000, three-year NSF grant.

Provided by Florida State University