Predicting the future to decrease the temperature of mobile devices

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The number of sensors all around us is rapidly increasing. From smartwatches and heart-rate monitors to smart refrigerators and thermostats, everything is measured and tracked. All these sensors for

the Internet of Things (IoT) devices need batteries and they consume a lot of power. The project ZERO (Towards Energy Autonomous Systems for IoT) aims to create efficient devices that exploit the energy already around them, such as light, vibration and heat.

One of the solutions University of Twente Ph.D. student Baver Ozceylan is working on involves decreasing the [temperature](#) of mobile devices. When the temperature of a circuit increase, the amount of energy needed also increases, even though the processing activities stay the same. Small mobile devices, like sensors, often can't have active cooling hardware. It's not possible to give a smartphone a huge watercooler for example.

Optimizing software

Instead of adding cooling hardware, Ozceylan wants to develop software or a thermal policy for mobile devices to optimize heat dissipation. "We only want to optimize software and not the hardware, because many [mobile devices](#) have limitations like the available space," says Ozceylan. The current policy decreases the performance of the CPU of a [device](#) only if the temperature gets above a certain threshold. "Right now, devices run on full performance constantly and they will consume more power than necessary," according to Ozceylan.

Predicting the future

The solution he developed: a model that predicts the future. The device knows that it has a certain number of tasks and already knows its current temperature. Ozceylan explains: "The model will constantly ask itself, "What will the temperature be in ten seconds if we run all these tasks at a certain percentage of power?" and then changes the performance accordingly."

Currently, Ozceylan is working on a method that schedules all the tasks to keep an optimal temperature. This might mean that some tasks get delayed. "This is the most challenging part, because this delay shouldn't affect the user experience," says Ozceylan. With his work, the device's temperature stays low and the overall energy consumption will decrease.

Baver Ozceylan conducts his research in the Design and Analysis of Communication Systems group under the supervision of prof. Boudewijn Haverkort. He got his bachelor and master degrees in Electrical Engineering at the Middle East Technical University in Ankara. He and his team recently received the 2019 Harvey Rosten Award for Excellence, an annual award celebrating a piece of work representing an advance in thermal analysis of electronics equipment or components.

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