Finding survivors, protecting drivers

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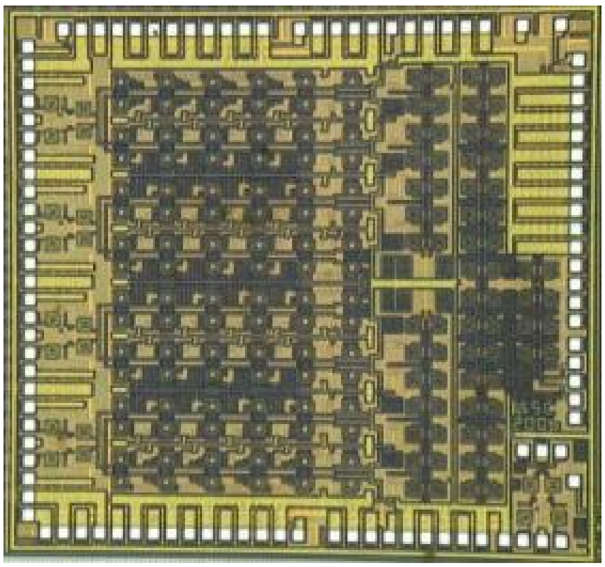

This radar chip, operating in the Ultrawideband range and made from pure CMOS, may help rescuers find lving victims trapped in rubble by detecting heartbeat and respiration. Credit: USC Viterbi School of Engineering

At the IEEE International Solid-State Circuits Symposium, Assistant Professor Hossein Hashemi of the USC Ming Hsieh department of electrical engineering will discuss two radar chips created in his laboratory, both of which detect and generate radio signals, parallel to chips used in cell phones and other wireless devices.

But the new devices also accurately scan, accurately focusing precise beams in specific directions, and also do the reverse, detect, accurately determining the direction of incoming signals.

And unlike other high performance chips with these functions, the USC researchers' designs use ordinary CMOS silicon bases, allowing extremely economical fabrication in standard chip foundries.

According to Hashemi, one chip operating in the 24 GHz range uses an ingenious architecture that combines the functionality of multiple coherent transmitters-receivers ('transceivers'), making it much more compact than previous arrays.

This chip has already attracted the attention of General Motors for possible use in car radar, because ten such devices could be installed in a car for a little more than $100 - less than a tenth of what single devices now in use for car self-parking and blind spot detection systems cost.

These chips can guide parking, and not only detect other vehicles but also pedestrians.

Hashemi believes the same chips can be used to create Local Area Networks with far greater capacity than existing units.

The other radar device also uses a low-cost CMOS chip to detect 'ultrawideband,' probes, low-intensity signals spread across a wide spectrum, emitted in a timed array system. According to Hashemi, a compact beam-forming chip architecture allows processing of the echo picked up by the chip's receiver function to analyze spatial (or directional) data; temporal data, and frequency data to generate detailed information through solid barriers.

The application being most intensively pursued for the chip is “biometric radar,” in which rescuers going through rubble will not only be able to detect living (but not dead) victims trapped in the rubble by picking up the minute movements of their chest caused by breathing and heartbeat.

In clinical settings devices could monitor - without touching - patients who have, for example, severe burns and who cannot endure any contact at all. This chip has attracted intense interest both from industry and government, with funding from Boeing Phantom Works, the National Science Foundation, and the office of Naval Research.

Hashemi's group is collaborating with USC Professor of Electrical Engineering Anthony Levi, SAIC, and Lifewave Inc, who are working to integrate the chips into systems.

Hashemi said that most of the work on both chips was done by graduate students. In both cases, the students came from disciplines outside of chip design and, he said, approached the problem with new eyes, from entirely new points of attack.

The automobile radar chip, he said, is mainly the creation of Harish Krishnaswamy. The wideband biometric radar chip was the inspiration of Ta-Shun Chu - who started his studies as a civil engineer. Jonathan Roderick designed one of the building blocks for the biometric radar chip.

Source: University of Southern California