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Title: Applications of Dedicated Sensor Platform LSIs to MEMS-Based Tactile Sensor Networks for Robotics and to Human Finger Motion Sensing

Abstract: This presentation introduces the development and applications of our original sensor platform LSI designed for both robotic and human finger motion sensing. The LSI integrates two types of sensor interfaces: eight channels for capacitive sensor input and eight channels for analog voltage amplification and A/D conversion. In addition, it incorporates multiple functions such as digital signal processing of sensor data and event-driven serial communication using an original protocol with a patented clock data recovery mechanism. These features enable compact and high-speed sensing architectures with minimal wiring, even in network systems consisting of a large number and variety of sensors.

As the first application, I present a robotic tactile sensor network combining this LSI with MEMS-based capacitive tactile sensors. The tactile sensor devices, which include 3-axis force sensing elements, are the same size as the LSI itself (2.5 mm square) and are fabricated and packaged at the wafer level. By utilizing the event-driven communication protocol, the system enables high-resolution, real-time distributed tactile sensing suitable for precise object manipulation and interaction by robotic hands. I also introduce PCB-based tactile sensor devices as an exploratory approach for broader applications.

As the second application, I describe a system that combines the LSI with multiple wearable sensors—such as bending and force sensors—for the analysis of human finger motion. This allows for detailed sensing of hand movements and offers potential applications in rehabilitation support, skill assessment, and human-robot collaboration.

Through these two distinct applications, the talk highlights the versatility and scalability of the sensor platform LSI.

Biography: He received his Ph.D. in Engineering from Kyushu University. After working at Kyushu University and Tohoku University, he is currently a Professor at Tohoku Institute of Technology, a Visiting Professor at Tohoku University, and the Co-founder, Director, and Chief Technology Officer (CTO) of Reisense Inc., a startup originating from Tohoku University.

His expertise lies in semiconductor technologies, particularly LSI and MEMS. He is engaged in the development, implementation, and application of sensor and AI systems that analyze, assess, and utilize the movements and actions of next-generation robots and humans.