

Demo Abstract: RETOS-based Distributed Acoustic Source Detection

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Abstract—This demonstration shows the distributed acoustic source detection (DASD) system which is implemented with the RETOS multi-threaded operating system. DASD uses an array of inexpensive microphones and the source detection is operated in fully-distributed manner. With this demo, we show the programming convenience of developing WSN applications using RETOS. We also demonstrate that RETOS is a mature and practical system which can be used for the development of real-world WSN applications.

I. DISTRIBUTED ACOUSTIC SOURCE DESCRIPTION

Detecting the locations of acoustic sources automatically in indoor or outdoor environments has many practical applications in WSN. We have previously developed a range-free and fully-distributed acoustic source detection system (DASD) in TinyOS environment [1]. With the development of the RETOS operating system [2,3,4], we have recently re-implemented DASD in the RETOS environment. In our demonstration we show the feasibility, efficiency, and programming convenience of developing DASD by using multi-threaded operating system.

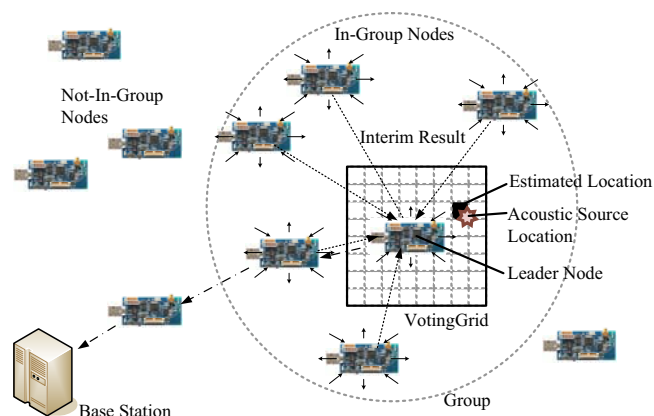


Figure 1. DASD system overview

Figure 1 illustrates the overall structure of DSLD. Upon an acoustic event, a group, which is a unit of acoustic source localization, is constructed on-the-fly with all the listening nodes of the event. By comparing the listening times of all nodes in the group, a leader is selected being the closest to the

acoustic source. A voting grid is then constructed in the leader node. The voting grid is a two-dimensional array of fields which are used to estimate the location of the acoustic source. Every node in the group votes for the possible location of acoustic event separately, and the voting results are collected in the leader node to finalize the location.

II. DEMO DESCRIPTION

The RETOS operating system currently support TI MSP430, ATmega128, Chipcon's CC2430 family of microcontrollers. For DASD implementation, we built MSP430-based nodes, which is similar to Tmote Sky[5], as well as an add-on sensor board. The sensor board has microphone, ultrasound, temperature/humidity, and light sensors. Figure 2 shows the hardware platform used for DASD.



(a) MSP430 mote

(b) Sensor board

Figure 2. Hardware platform

The demo scenario is as follows. Given the indoor environment, we deploy 8 sensor nodes at known positions. The nodes are time-synchronized via the FTSP protocol [6]. Once the nodes are ready for the event diction, a sound is generated by wood sticks or hand clapping. The estimated location of sound source is then drawn in the specifically designed GUI at a base station. Figure 3 shows the snapshot of the planned demo.

With this demo, we also show the usage the RETOS operating system. First, the kernel is built and loaded into the hardware. Upon the RETOS boot, the modularized FTSP code is then loaded into the kernel via the loadable module feature of RETOS [7]. Finally, the DASD application code is loaded into the system and runs as an RETOS application. The FTSP module and the DASD application can also be removed without rebooting the system.

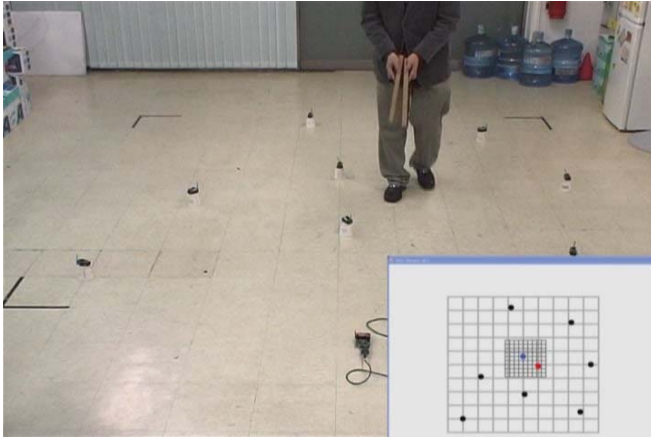


Figure 3. Demo environment

ACKNOWLEDGMENTS

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