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DESIGN OF A KNOCK TRACKING SYSTEM BASED ON TDOA METHOD FOR RESPONSIVE ENVIRONMENT APPLICATION

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Abstract. *The paper demonstrates a system that is capable of locating the position of knocks on top of a table for context-aware applications. Four sensors, located near the table corners, are employed to record the acoustic waveform coming from the impacts. A microprocessor extracts relevant characteristics from these signals including amplitudes and differential timings, which are then used to estimate the location of the hit. As this system requires only simple hardware, no special adaptation of the touch screen is needed. Further, as all sensors are mounted on the inner surface, the system is easy to deploy as a retrofit to existing tables. The technique can be applied to detect commands in responsive environments.*
Keywords: Interactive system, Knock tracking, Responsive environment, TDOA

1. **Introduction.** A responsive environment is an important topic in the study of modern living technologies. Such an environment can be realized in a context-aware building filled with pervasive devices that help people achieve their tasks at hand in the most natural ways, to the point where such interaction becomes implicit [1-3]. Large scale interactive display walls are a constituting ingredient of such responsive environments. Indeed, a tracking system based on piezo pickups has been presented in [4]. To interact with large-scale displays, it is essential to build a location-aware system that is capable of determining the location on the display that is being pointed at. Although touch-screen panels can facilitate such interactive functions, they are limited to small-scale displays. For large-scale displays at the square meter level or greater, the tasks of detecting the contact event, estimating the impact location and tracking the motion of a trajectory are more demanding. To this end, several approaches including magnetic tracking, inertial tracking, vision tracking, acoustic tracking [5], and so forth have been proposed to track the position of hands in interactive systems for positioning and awareness [6-9]. Among the existing approaches, the vision based tracking technique [10-12] is particularly attractive for users to interact with a large-scale display. Vision-based approaches, however, can be slow and are often sensitive to obstruction, image clutter, target reflectance, and changes in background lighting. Based on the range finding capability, ultrasonic location or acoustic tracking systems are another popular solution for the provision of fine-grained indoor positioning data [13-15]. Unfortunately, due to the attenuation of ultrasound, the