

Demo Abstract: eSense - Open Earable Platform for Human Sensing

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ABSTRACT

We present eSense - an open and multi-sensory in-ear wearable platform for personal-scale behaviour analytics. eSense is a true wireless stereo (TWS) earbud and supports dual-mode Bluetooth and Bluetooth Low Energy. It is also augmented with a 6-axis inertial measurement unit and a microphone. We demonstrate the eSense platform, the data exploration tool with the open APIs for the real-time visualisation of multi-modal sensory data, and its manifestation in a 360° workplace well-being application.

CCS CONCEPTS

• **Human-centered computing** → **Ubiquitous and mobile computing systems and tools**;

KEYWORDS

Earable, human sensing, behaviour analysis

ACM Reference Format:

Fahim Kawsar, Chulhong Min, Akhil Mathur, Alessandro Montanari, Utku Günay Acer, and Marc Van den Broeck. 2018. Demo Abstract: eSense - Open Earable Platform for Human Sensing. In *The 16th ACM Conference on Embedded Networked Sensor Systems (SenSys '18)*, November 4–7, 2018, Shenzhen, China. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3274783.3275188>

1 INTRODUCTION

Wearables are finally here. Established forms, e.g., a timepiece, a ring, and a pendant are getting a digital makeover and are reshaping our everyday experiences with new, useful, exciting and sometimes entertaining services. However, for a broader impact on our lives, the next generation wearables must expand their sensing capabilities beyond the narrow set of exercise-related physical activities.

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SenSys '18, November 4–7, 2018, Shenzhen, China

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ACM ISBN 978-1-4503-5952-8/18/11...\$15.00
<https://doi.org/10.1145/3274783.3275188>

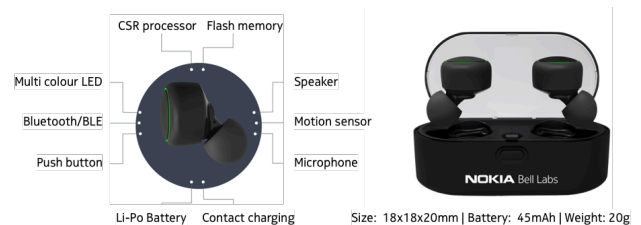


Figure 1: eSense open wearable platform.

To this end, we present eSense - an aesthetically pleasing, and ergonomically comfortable in-ear high definition wireless stereo wearable [1]. As illustrated in Figure 1, eSense is equipped with a microphone, a 6-axis inertial measurement unit, and a dual-mode Bluetooth and Bluetooth Low Energy (BLE). Leveraging the combination of microphone, accelerometer, gyroscope, and BLE, eSense offers three sensing modalities - audio, motion, and proximity. It is powered by a CSR processor and a 45 mAh battery. Most importantly, eSense is an entirely open data platform that allows developers to gather real-time data streams of these multi-sensory modalities as well as offering them with several configurations and reprogramming capabilities.

Earables provide unique opportunities and advantages for human sensing. First, placement in the ear enables earables to monitor head and mouth movements besides whole-body movements in a non-invasive way. This unique capability uncovers opportunity for many novel applications in the areas of personal health, dietary monitoring, and attention management. Second, earables are intimate and discreet enabling users to have immediate and hands-free access to information in a privacy-preserving and socially acceptable way. Third, earables provide the freedom of movement and hands-free interaction minimising situational disability and fragmentation of attention. Besides, earables can be worn for long hours without any impact on primary motor and cognitive activities.

2 EARABLE SENSING

We have extensively explored the characteristics of audio, inertial, and BLE signals captured by eSense in a variety of experimental settings. We compared eSense against a smartphone and a smartwatch considering several key factors that impact activity recognition

