# The Club of The Future: Participatory Clubbing Experiences

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## Abstract
This article showcases our effort to explore the music club of the future. We present the development and results of an end-to-end system which enhances the club-going experience through the use of wearable technology. Each party guest wearing one of the wristbands actively contributes to the overall experience with their movement and location patterns. The system collects acceleration data from each of the attendees in real-time and feeds it into a pluggable network infrastructure, which processes the data, affecting the environment via data visualization or controlling of the light and sound system of a curated space within the club. Finally, we describe the results of a two night, 450 person per night deployment.

## Author Keywords
Sensors; cultural experiences; Bluetooth LE; design; activity recognition; shared experiences; ubiquitous computing

## ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

## Introduction
Club culture has always been about getting together and enjoying multisensory experiences with other people. These experiences are curated by the event organizers [1] and

**Figure 1:** Real-time data visualization, by CLEVER°FRANKE, in the main room, which illustrates the amount of activity of the crowd as measured by the wristbands. (Author's image)

**Figure 2:** Separate room of the venue in which the sound and light was controlled by the activity level measured in the crowd in the main room. (CC BY Ayman on Flickr)

each individual average club goer typically has little impact on the experience as a whole. But what if the club could actually react to the level of excitement of the crowd? What if the people could actively influence the overall experience simply by their activity? Or more generally: what would the club of the future look like?

This work presents a system which helps to explore these questions by facilitating the creation of a participatory club event by means of wearable technology. It describes a two-day event in which the system was used to enhance the experience of over 900 party-goers, held in the context of the *Amsterdam Dance Event*[1] in October 2016. The central component in our approach are custom-made, Bluetooth-enabled wristbands which collect a variety of data from the wearer. The data is gathered at a central location where tasks such as activity recognition and localization are performed. The resulting data feed can drive a real time data visualization (Figure 1) and affect light and sound of a room within the environment (Figure 2).

The central points explored in this demo are as follows: How can we make a club experience more participatory? Moreover, what if the venue could actually respond to the people within it? To this end, we present a scaled-down version of our infrastructure: Attendees can try the wristbands which feed the data into our system and drive a live visualization that changes according to activity and location.

## Background

This system came into existence as part of a collaboration on wearable technology with *ByBorre*[2], a Dutch fashion designer. For a two-day club-event within the context of the annual *Amsterdam Dance Event* held in October in Amsterdam, we wanted to explore what the club of the future might look like. The core idea of this event was it find ways to learn about the guests' behaviour and try to communicate with the environment with the goal to bring people together and design an experience which would stimulate all the senses at once: Specially created dinner menus, drinks and perfumes, an adaptive sound system and light show with technology playing the role of connecting all the senses into an all-encompassing experience. For this, we evaluated a series of candidate technologies and ways to make a club experience more participatory. Ideally we wanted something compact and unobtrusive, which could be integrated into textiles for people to wear without impacting their experience.

Over the course of two days, a total of 900 people would attend the experience and each one of them would receive one of the sensors. This means that affordability was especially important, since the wristbands can essentially be seen as disposable items. Naturally, as the sensors were to be firmly integrated into textiles, they should also be compact and light and have a long battery, since once fitted into the textiles, they cannot be removed that easily anymore.

In the end, we opted for specially designed wristbands (see Figure 4), which we fitted with off-the-shelf, Bluetooth LE-enabled circuit boards. These boards met the requirements of being small and having long battery life. We decided to create two different types of bands, as the event would have a special programme for a selected few of the guests, which required some of the bands to be able to provide direct feedback to the wearer. However, both of the wristbands would broadcast packets containing sensor data via Bluetooth in a protocol similar to Apple's iBeacon standard.

Much literature is available on crowd sensing with mobile technologies. We used RSSI values in the receivers were

[1] https://www.amsterdam-dance-event.nl/
[2] http://www.byborre.com


**Figure 4:** One of the wristbands that each guest received as part of their invitation, which would measure their activity level throughout the event. (cc) Ayman on Flickr)

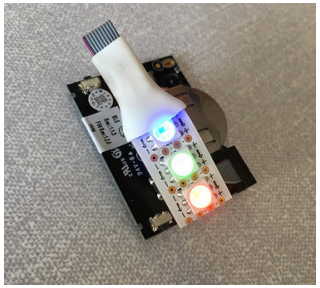

**Figure 5:** One of the Texas Instruments SensorTag boards with a DotStar LED strip affixed to to it, which can be triggered remotely from the central server. (cc) Ayman on Flickr)

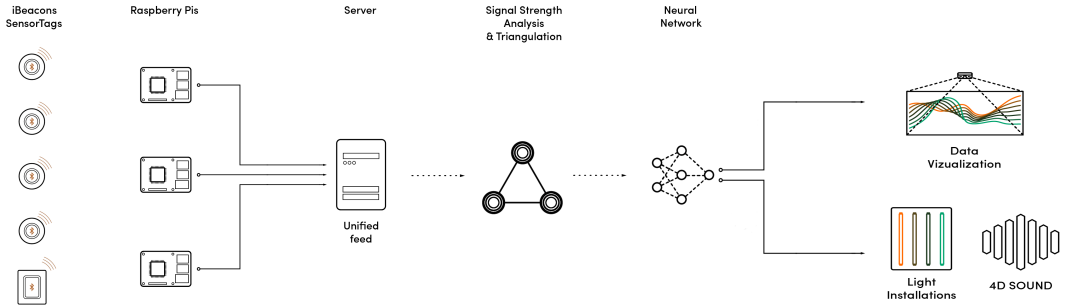


**Figure 3:** The layout of the final system and all its components

used to gain a finer-grained understanding of the user's position. [3] More generally, several different approaches can be employed to perform indoor localization. [4] Next to indoor localization, activity recognition seemed to be a frequently occurring use of such technologies. For instance, sensor networks have used machine learning to learn to recognize different activities. [5] Similarly, this has been done for activity recognition in wearables. [2]

With these intuitions in mind, the system was to make use of wristbands fitted with Bluetooth LE boards, which would broadcast data from various sensors from each party guest to be used in activity recognition and localisation. This way, we were able to feed information back into the venue in different way by means of visualisation and actuation. The specifics of the system and the ways in which the data was used to make the entire clubbing experience more participatory, will be outlined in the upcoming sections.

## Setup

The final system (see Figure 3) which was deployed at the venue was essentially made up of three central components: the wristbands containing the sensors, a series of Raspberry Pis acting as receivers for the wristbands' broadcast messages and a central server at which all the data flows together and is processed.

During the event, we used two different types of wristbands. Out of the total 900 wristbands that we produced, 800 were fitted with *Nearable* boards by *Estimote*. These coin-sized boards broadcast a UUID, 3-axis accelerometer values and temperature readings using a protocol similar to Apple's *iBeacon* over Bluetooth LE. The second type of wristband, of which only 100 were made, uses a *SensorTag* board from *Texas Instruments*. It is slightly larger than the Nearable boards, but it is a more general-purpose board for IoT applications, has more sensors built-in and is fully programmable. We mounted a small strip of RGB LEDs on them (see Figure 5). The idea behind this is that the sensor could be *actuated*, i.e. it could flash LEDs in different colours, should some specified event occur. This was used to signal some of the guests that the next part of their special programme was about to begin.

**Figure 6:** Box with personal invitation and wristband which was sent to the guests. (Author's image)

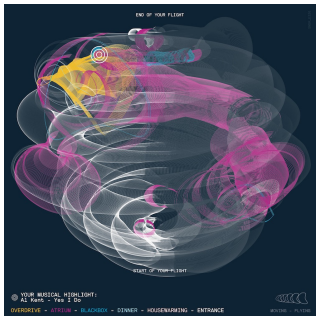

**Figure 7:** Post-event graphic by CLEVER°FRANKE which was sent to each guest, representing a summary of their experience.

The central server connects to all the receivers, reads the incoming data and performs duplicate elimination. This is necessary because a packet from the same wristband might have been received by two different receivers, which are positioned close to each other. The server also runs an activity recognition algorithm, which we trained in our lab using a convolutional neural network by performing different activities such as standing, walking or dancing. Moreover, each of the receivers attaches its own unique ID to each data packet received from the wristbands. This way, we are able to gather a fairly reasonable image of how many people are in each room of the venue at any point in time. This data, combined with the output from the activity recognition algorithm was used to drive a graphic visualisation projected in large format onto a wall of the venue during the event (Figure 1) and additionally was fed into a live audio and light installation (Figure 2) located in a separate room of the venue, where the light and sound would change based on the amount of activity on the dance floor.

## Event

The actual event took place on two days during the week-long *Amsterdam Dance Event* in October 2016 in a multi-room venue with a dance floor, a dinner room and several bars. Each guest was personally invited and received a box as shown in Figure 6 with an invitation to the event and a wristband. During the two days that the event was taking place, we collected a total of about 40 million data points, roughly 13 million of which were packets transmitted by our wristbands. All other traffic stems from other Bluetooth devices, the further analysis of which may be an interesting topic for future research. The data for each guest was gathered and analysed to compile a graphic as in Figure 7 representing this individual's experience during the event, and their favourite song identified by the highest point of their activity level. These graphics were then sent to the special guests as a high-quality print alongside a custom-knit scarf. All other attendees received their individual graphic via e-mail a few days after the event.

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