

UbiClub – A Context-Aware Environment for Nightclub Entertainment and Management

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Abstract—This paper presents an application of an ubiquitous networking environment in the context of a nightclub. Using the ambient intelligence space surrounding the customers, a variety of services can be provided, which significantly enhance customer experience and simplify the management of a nightclub. After surveying related work, we motivate the application of ubiquitous technology in a nightclub environment by proposing a set of promising applications. Based on these applications, required contextual information and technologies are identified. A suitable system architecture of an ubiquitous service platform for a nightclub is then presented and technological challenges arising in such an environment are further discussed.

Index Terms— Wireless sensor networks, Context awareness, Application, Multi-modality, Ambient intelligence, Nightclub

I. INTRODUCTION

FOR decades discotheques and nightclubs have drawn the attention of millions of people in all countries around the world. Upcoming terms such as *club culture* indicate the social importance that clubbing has taken in our society. The mixture of music, dancing and the presence of other enjoying people have made clubbing to become one of the most important recreational activities for people, preferably on weekends. Especially for younger people in the twenties and early thirties (occasional) clubbing has become an integral part of their life. Clubbing helps them to release the pressure of business and other duties in their daily lives, gives them the opportunity of distraction and entertainment, while enjoying themselves among peers.

Advances in consumer electronics and electronic music predominantly in the nineties have shaped a new generation of technophile consumers. Consumer expectation are constantly increasing, motivated by TV broadcasters, artists and the music industry. When going to a discotheque customers expect famous DJs, high quality sound systems and superb visual entertainment. While providing such high tech in their facilities,

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nightclub operators often deteriorate the quality of customer experience by inappropriate use of technology. Examples are the use of overly loud music or lighting, ignoring the customer needs to establish social contacts.

One essential requirement to create an enjoyable atmosphere is to be aware of customers' needs and expectations and their current mood. By knowing what the customer likes, and how they feel at different moments, appropriate atmospheric adjustments can be made, in order to increase a positive customer experience and to maximize the own revenue as a nightclub operator.

This paper presents an application of a ubiquitous network environment in the context of a discotheque or nightclub. Using contextual information of customers obtained by sensors and other information databases, the nightclub provider is aware of customer needs and current emotions and is thus able to apply appropriate measure to enhance their experience. Furthermore by taking advantage of ubiquitous technology, management of a nightclub can be notably simplified.

Several aspects make the research of context-aware application and ubiquitous networking technology challenging in a nightclub environment: a) the mix of traditionally separated application environments, b) high density deployment of wireless sensor nodes in a size limited indoor environment, c) the possibly complex interaction between different wireless sensor networks, d) multi-modal sensing, that is the simultaneous collection of data from different types of sensing devices and their interpretation, e) indoor location in highly populated environment.

We believe that the mixture of technophile generation of customers as well as the experimental trendsetting nature of the nightclub entertainment industry provides a fruitful application ground for ubiquitous networking. Connected with the right business opportunities, a nightclub environment can be a significant driver for novel context aware applications and ubiquitous networking technologies.

The remainder of the paper is structured as follows. Section II surveys relevant work in ubiquitous networking and related context-aware application environments. Section III explores the application space by studying concepts of enhancing user experience in a nightclub environment with the help of ubiquitous computing technology. Useful technologies and required context information and interactions are identified in section IV and a system architecture of an ubiquitous service platform for the nightclub is presented. Technological

challenges for the envisioned platform are identified in section V. Final conclusions are presented in section VI.

II. BACKGROUND AND RELATED WORK

Our discussion in this paper combines various fields in computer science and social science. As a result there are many related works from different areas. Among them we mainly focus on works on a) Interactive dance performances b) technical developments in club scene and c) Mobile Social Networking (MSN) Services in this section.

A. Interactive Dance Performances

Interactive dance performances are an active area of research and have recently included sensor network technology. Sensors are used to capture specific movement or physiological data of the dancer, in order to control and synchronize visual effects and audio content as enhancement of the dance performance.

One of the earlier contribution in literatures for example is the work "Heartbeat Duet"[2] by R. Wechsler. In this system two dancers wear chest electrodes and transmitters data while they dance. Each dancer's heart beat is used to enhance the music by feeding back the heartbeat as a separate musical note. Also controlling stage light using the heart beat has been considered. The proposed system targets mainly special dance performance enhancement, however, is not really suitable for a night club environment.

Project CodeBLUE [3] by D. Hromin et al. has examined the use of Bluetooth for a collaborative music creation system in club setting. In their work they have enable dancers to provide useful feedback to the DJ by special movements by wearing sensor equipped clothing. The overall process is presented at the DJ as a control panel. DJ is provided with a control panel which could be used as another channel for creativity. This idea is similar to our UbiClub vision; however according to there scenario's given CodeBLUE project focuses only on the dance floor music manipulation and light control by dancer's direct involvement. The manipulation is done by triggering the sensors by special dance movements. However special movements might restrict dancer's freedom and it might be effect enjoyment level of the customers. A more recent work is published by C. Park [4] has proposed a promising sensor network technology. Park et al. use cubic centimeter sized sensor nodes to collect the location of the dancer and proximity to installed stage artifacts. Based on the relative location of the dancers with respect to themselves and to the stage artifacts different sounds and lighting effects are triggered.

B. Technical Development in Club Scene

The DJ equipment, sound system and lighting have been always the center of technical advancements in a nightclub. In many nightclubs also visual jockeys (VJs) are starting to play a more prominent role. Currently, the VJ plays video clips and controls the light settings in harmony with the DJ's music selection. Most of the VJs use computer based software for video manipulation. Novel technological developments such as the Pioneer DVJ [5] allows combination of VJ and DJ's job

together, and has gained significant attention of the night club operators and customers alike. On the customer service management side technologies have also evolved to more sophisticated systems. As an example many clubs give VIP status for loyal customers and provided special and priority services. Currently most of the clubs uses ID card system and deploy a lot of ground stuff to provide these services. However Baja club [1] in Barcelona has gone a step ahead of providing injected RFID technology solution for their VIP customers. We can imagine more and more clubs turn towards hi-tech solutions for providing more memorable club experience to their customers.

C. Social Networking Services

Several ubicomp projects directly or indirectly discuss MSN applications for meeting new peers. As an example Digital Aura project [6] could be given. However, these applications hasn't gained wide acceptance in real world situation. Nokia Sensor [7] provides commercial proximity based profile showing/receiving services using Bluetooth technology. However this service is limited to proximity based social networking. Also when the area is highly populated profile matching is needed for satisfactory recommendation, it is not clear whether Sensor [7] provide such services. In our understanding none of these projects has tested or designed MSN in a night club environment and our preliminary survey showed us it could be a promising application.

III. EXPLORATION OF THE APPLICATION SPACE

In order to identify applications in a future club environment a study has been conducted in Tokyo and London with DJs and various people at the age of 18-30, which regularly attend nightclubs. We listed the applications that have caused major interested amongst the interviewed audience and form the basis of our UbiClub vision.

A. Ambient DJ

Major night clubs tend to have very spacious dance floors with capacities of several hundreds or even thousands of people. In such a scenario, it is very difficult for the DJ to get an accurate impression of the mood and activity development of the audience on the dance floor. However the ability to sense the user's mood is a defining factor of success of the DJ and enjoyment of the customers.

When the DJ and VJ know the customer mood it is easier to manipulate the music, light and video projections correctly to make the party going. Furthermore the convergence of DJ and VJ into a joint interface would allow harmonised interplay of audio and visual effects, thus maximizing the influence on the audience. Current technological developments have recognized the potential and first products appear, which offer such converged interfaces [5]. UbiClub takes this step further by sensing the user mood and activity levels using wearable and environmental sensors. This mood data is provided to the DJ via special displays, e.g. mood distribution maps of the environment and is fed into system algorithms. The DJ is thus

exactly aware of the ambient atmosphere and its changes. Intelligent algorithms harmonise lights and video and reduce the DJs technical burden. This gives the DJ more freedom to focus on its artistic performance in order to maximize customer enjoyment.

B. Social networking

Even though there are many online social networking systems and dating services, especially younger people are more dependent on meeting each other in real world situations. Night clubs are one of the situations people meet suitable partners and friends. A mobile social networking service could greatly simplify the identification of compatible partners and friends. At UbiClub a user is free to specify its own personal and preference profile and activate the social networking service. In case two compatible people are physically closer to each other their wrist watches provided by UbiClub will glow in a special colour. This will enable the first trigger of conversation with two individuals. When they really get to know each other by talking, they can command to exchange their profiles via background servers (e-mailing each others profiles) or into there hand held devices through P2P connectivity.

C. Friend locator

Locating friends in a night club is a problem every clubber is exposed to several times during a night. Packed crowd and loud music makes it a difficult task even in a small night club. Thus, at UbiClub all the users are tracked and for allowed friends can locate his/her position using a info-terminal or personal mobile device. Keen searchers for partners can also use the service to find club-areas with compatible people.

D. Ambient adaptation

The control an adaptation of the nightclub environment can go further than the adjustment of music and light effects as discussed in the Ambient DJ application. UbiClub allows the adaptation of other environmental features, in order to increase the feeling comfort for customers. This includes adaptation of background music in lounges according to audience preference, sound level of music according to the number of users or environment, temperature and background light level. The ambient adoption will also consider the mood of the audience within a room. Adaptation can go as far as controlling the injection artificial fog and aromatic scents to create an enjoyable atmosphere, stimulation all senses of the clubbers.

E. Customer Care

Like any other business, nightclubs are dependent on customers and their loyalty. Common practice to encourage people to revisit the nightclub is to give away discount vouchers applicable for another nightclub visit. Some nightclubs also provide VIP status to very loyal customers or costumers paying a membership fee to e.g. gain access to special lounges. Pieces of paper, however, are often lost or the membership card may be forgotten at home, bringing the clubber in uncomfortable situations.

UbiClub offers possibilities to provide more advanced

customer care services. Discount vouchers can be given away electronically, e.g. RFID, after a visit or via an advertisement in a magazine and may be part of the clubbers service profile and are recognized at every visit automatically. Additional profile information of the customer can be used such as personal profiles or service history to provide more personalized services. Examples of a services based on personal profile information is free entry on the customer's birthday or promotions on the customers favorite drink. The clubber could also accumulate loyalty points for each visit, and receive some reward or higher status based on his service history.

F. Security

Personal security is often a concern within a nightclub. Over consumption of alcohol in conjunction with aggressive personalities can often spoil a nightclub experience or even bring people into life threatening situations. It is not unlikely that the same persons repeatedly cause troubles in nightclubs and gain access since the staff at the doors is unaware of their history. Therefore security management based on user history profiles could prevent those people to re-enter the nightclub. Databases with black listed persons could even be exchanged between night clubs to minimize the security risk for clubbers. Furthermore location systems and cameras can lead to quicker detection of trouble makes if such a security problem occurs.

It has often been reported that extreme behavior of clubbers such as excessive dancing or influence of alcohol and drugs on human bodies, as well as environmental conditions, e.g. heat due to overcrowding may lead to medical conditions. Examples of these are loss of consciousness, overtiredness or dehydration. Physiological sensors at the clubber can warn the clubber that such a condition may occur or trigger an alarm system, so appropriate action can be promptly taken. Thus by the means of ubiquitous technologies a saver nightclub environment can be created.

G. e-Payment

Today most transactions within a nightclub are handled via cash or credit cards. Often wallets need to be carried around either in the pockets or hand bags. As result the mobility and level of comfort of the clubber may be limited. Connected with the fear of loosing them or their disappearance if left unattended, the clubber may not freely enjoy the atmosphere or participate in the environment with the desired degree of freedom. While some nightclubs already deploy smart card based payment system, wallets or credit cards still need to be used at the exit. UbiClub offers an e-Payment system in its premises that allows a clubber to use an electronic wallet instead, e.g. in the form in an active RFID tag. Transactions can range from prepaying the club visit from home or paying at the entrance to buying drinks, food or multimedia items. e-Payment could also pave the way for new business models, e.g. entrance fee based on the actual duration of the stay in the nightclub. Furthermore the waiting time in queues at the entrance of the nightclub or at the bars could be reduced, which is a major annoyance for many clubbers. e-Payments can be also easily

combined with e-vouchers and electronic discounts, providing attractive and easy to use opportunities for customer care as discussed in a previous subsection.

H. Remote ordering and notification

Queuing at the bar to buy a drink is often a time consuming matter in a nightclub. While most likely not being presented with an adequate choice of drinks under time pressure, the waiting time in a queue is often proportional to one's own physical size or appearance or left to the arbitration of the bar man. UbiClub offers a system for remote ordering of drinks to increase the comfort and enhance the service to the customer. The customer is presented with a choice of drinks and food, via a personal device, e.g. mobile phone, or at a stationary terminal within the nightclub. The customer has time to browse the menu and can be made aware of current special offers. Once a customer has made its choice, the request is inserted into an electronic ordering system. Based on different fairness criteria e.g. first come first serve or prioritization e.g., VIP, the bar staff is made aware of the orders. After completion, the customer may be informed via a message where to pick up his order, or the order could be dispatched to the customer's current location.

I. Targeted advertisements

A nightclub environment presents a good platform for targeted advertisements. UbiClub offers intelligent displays distributed at the wall of the nightclub, or in the toilets, which are able to sense the presence of a person. Based on person's user profile or contextual information, e.g. customer's mood, the customer is presented with personalized advertisements. Examples of such advertisements are the favorite drink for a thirsty customer or title and CD cover of a song, the customer is currently enjoying.

J. Air-tunes

How many times have you heard a song in a nightclub, which you really liked and you were dying to know the title of the song or album or the artist's name? UbiClub offers the air-tunes application that allows users to query the current play list of the DJ on air, so information of the current, or a previous song can be easily downloaded to a personal device with visual IO capabilities. The user can store the whole playlist or the songs selectively and later at home obtain his new favorite song and recall the club experience. The creation of the playlist in the background could be created dynamically on the fly via RFID tags attached to records or obtained from the CD players, thus not limiting the creativity and adaptability of a DJ.

The service could even be extended by a commercial purchase system based on e-Payment. Similar to i-Tunes[8], a song that the user enjoys can be obtained by a single button click, e.g. by downloading the digital rights to a personal device of the user and a successive free download from a website later, or by e-Mailing the digital rights or mp3 to an e-Mail account of the users.

K. Personalized video

A night out in the club is often a special memorable

experience, which a clubber would like to recall at a later moment of time or share with some of his friends that are not present. In order to make this experience really unforgettable, UbiClub offers a personalized video service that allows a clubber in a moment where she feels special to trigger the recording of a personal video sequence. Close by cameras within the UbiClub start tracking clubber's movements and recording its activity, e.g. while she is dancing and enjoying herself with her friends. After the club visit the video clip can be downloaded from the UbiClubs website with a personal access code obtained after automatic payment transaction in the background.

L. Asset tracking

Large nightclubs often employ multiple bars and are required to cater for several hundreds or even thousands of users. Often it is difficult to guarantee the constant supply of all possible drinks at all bars during a night and it takes quite some effort to determine the required stock up for the next day. UbiClub allows effective management of drink supplies in a nightclub by automatic tracking of consumed items. Shortage of specific drinks can be easily determined at each bar during the night, and pre-emptive measures can be taken. Linked with supply-chain mechanisms, suppliers can be automatically informed of the required stock up for the next day, without intervention of the nightclub operator.

IV. SYSTEM ARCHITECTURE

This section analyzes the previously presented context-aware applications according to their technical requirements and presents a system design for a nightclub service platform, capable to support the envisioned applications. The overall system architecture can be decomposed into a sensor network platform, which is responsible for the augmentation of the ambient intelligence within the nightclub, and a service platform, which makes use of the gathered contextual information to provide the envisioned applications to clubbers, DJs and nightclub operators.

A. Sensor platform

1) Identification of required context

The majority of the envisioned applications are user centric (all except L) and require the access to customer information. For most of these applications it is essential to determine the identity of a customer. An identifier may be of interest also for assets, which are to be monitored within a nightclub. The user identity serves as key to access various user related databases in the background, which we refer to as user profiles. User profile can include personal information of the user such as characteristics and preferences, information required for payment transactions, the status of a user or other service related information specific to a user, e.g. collected discount vouchers etc. Besides the profile of a user, the service history (E,F, H,I) of a user is required. Some of the services rely on physiological parameters of the user. Parameters can be simple ones such as heart rate (A, F) or more complex such as mood (A, B, D, I).

Some of these applications consider those parameters individually (B, I,F) or jointly for a group of users (A, D). Also the activity of users (A,D), the location of the user (B,C,D,H,K) with the nightclub as well as proximity to objects (I) is considered. Besides location, applications (D) may require other environmental information such as temperature, light or noise level. Finally the state of an asset (e.g. full, empty) has significance in some applications (L). Table 1 provides a summary of required context information for the respective applications.

2) Required technologies

While some of the desired contextual information can be obtained by user and service related databases, other requires the sampling of ambient space in the nightclub by a variety of sensors. Such contextual information can be roughly classified into environmental context information and user related context information.

Possible sensors to sense the required environmental context information include light sensors, temperature sensors, humidity sensors, proximity sensors, location sensors microphones (noise) or video cameras. These sensors are installed in the premises of the nightclub and form an environmental sensor network via wireless and or wired infrastructure. Another part of the environmental network are RFID readers, which may assist location services or provide user identity for services.

User related context information is obtained from a body sensor network (BSN), which is worn at the body of a clubber, and with some assistance of the environmental sensors. Both user activity and mood are complex high level contextual information, which cannot be easily inferred to by single sensor readings.

Table 1: Required contextual information in applications.

Application	Context information
A	Mood, heart rate, activity, location
B	User identity, location, user profile, mood
C	User identity, location, user profile
D	User identity, temperature, light, noise level, mood, user preference, activity
E	User identity, user profile, user history
F	User identity, user profile, service history, location, mood, heart rate, activity
G	User identity, user profile
H	User identity, user profile, location, history
I	User identity, user profile, proximity, mood, service history
J	Current song, user identity ,user profile
K	User identity, location
L	Asset identity, state

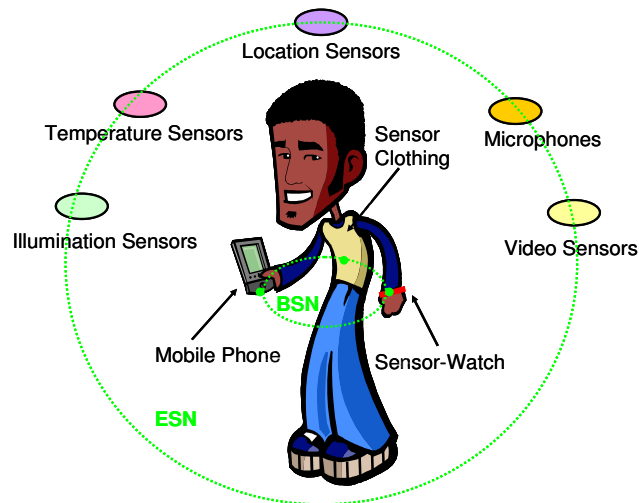


Figure 1: Body sensors and environmental sensors surrounding the clubber.

In order to determine such context, intelligent classification algorithms and fusion of physiological as well as environmental sensor data may be required. A part of the sensors in the BSN is consequently responsible for the collection of physiological parameters of the user. Examples of these are pulse oximeters (heart rate), skin conductance or body temperature sensors. Detailed user motion can be captured with 3D accelerometers and gyroscopic sensors. As part of the BSN an RFID tag can provide user identification. The BSN includes also environmental sensors to assist the collection of user related environmental context, e.g. for location or proximity.

The BSN has to be deployed as little intrusive as possible on the clubbers body in order to not cause discomfort and restrict their mobility. Figure 1 shows an example deployment, where the required sensors are part of a sensorised textile and a wrist watch device, obtained at the entrance of the club. Communication between the different sensor nodes of a BSN can be wired, e.g. within a textile, or wireless. The BSNs then connect via dedicated gateways, e.g. wristwatch device or personal mobile phone to access points located the networking infrastructure of the nightclub.

Collected sensor data is partially preprocessed across the sensor networks in a distributed fashion, and collected at several sensor network servers (SNS) in the network infrastructure. The SNS acts as consumer of the information provided by the sensor networks and performs further processing, multi sensor fusion and context classification in order to recover the high level context information required by the application.

B. Service Platform

The service platform can be decomposed into three subsystems, namely an application subsystem (AS), profile management subsystem (PMS) and facility management subsystem (FMS), which implement different functionalities in the UbiClub system. A possible implementation of UbiClub system is depicted in figure 1. The details of the subsystems as well as their interactions are described in following.

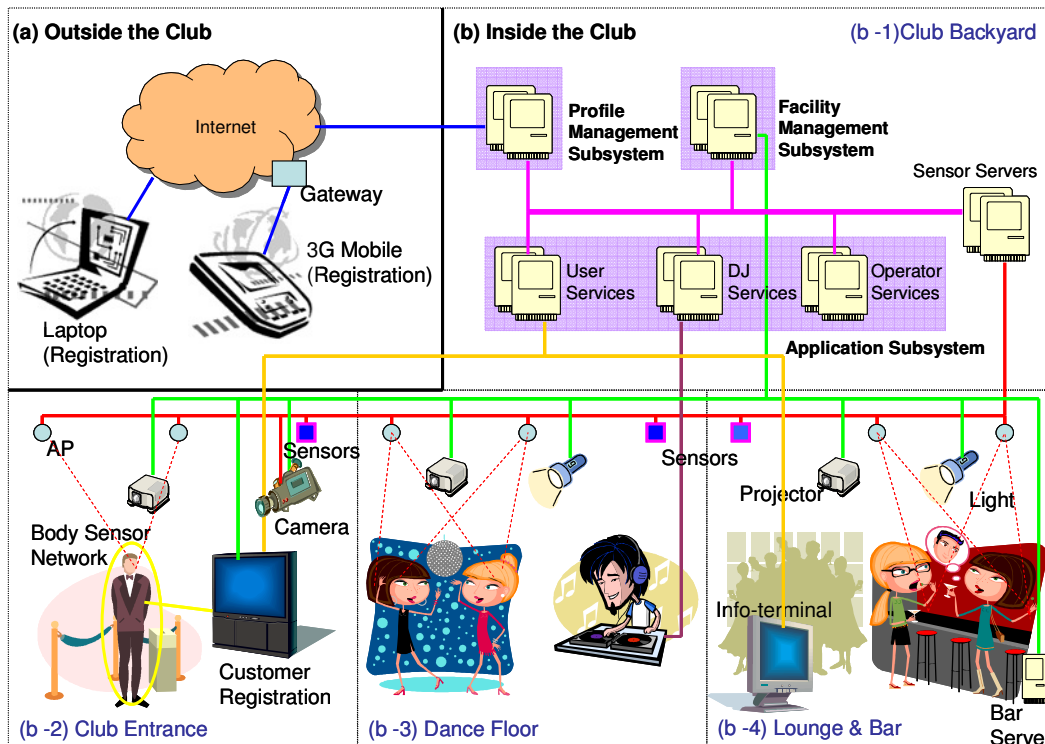


Figure 2: Overview of a possible implementation of the UbiClub system architecture.

1) Application subsystem

The AS provides a platform for execution of different applications that are envisioned in the UbiClub environment. Applications within the execution environment gain access to contextual information of users and the nightclub environment via well defined service API. The AS obtains the relevant information from PFM and the sensor platform. The service API allows also the interaction with facilities in the nightclub environment through the use of the FMS.

The AS offers all user services to the customer within the nightclub via standardized service interface, e.g. web services, which can then be accessed via a personal device or installed terminal within the nightclub through the network infrastructure. The operator of the night club is provided an enhanced set services, which allow configuration of applications, monitoring of assets, insights into all payment transactions as well as access to all environmental information and controls. Also a special service interface is exported to the DJ.

2) Profile management subsystem

The PMS maintains user profile information for each customer in the nightclub. User profiles include disclosed personal details, payment information, service history and accumulated tokens, user status, user preference and authentication and security data. A subset of the data can be accessed and manipulated by the users via an external web service interface, or can be automatically synchronized with his personal mobile device, when entering the nightclub. The profile data can also be accessed by application server to update the state, e.g. after a payment transaction, or to obtain

desired contextual user information, e.g. preferences of a user.

3) Facility management subsystem

The FMS allows the control and management of a variety of facility system in the environment of the night club. This include the control of the sound level and light effects, video projectors, air conditioners, cameras, as well as various other actuators to influence the nightclub environment. The facility management system also keeps track of the assts within a nightclub. The AS usually requests the activation of the actuators controlled by the FMS.

V. TECHNOLOGICAL CHALLENGES

We believe that a nightclub represents an interesting playground for ubiquitous networking and context aware applications and exposes various challenges that are not very apparent in currently studied ubiquitous application spaces.

a) *Suitable localization method in crowded indoor environments:* UbiClub requires high precision localization of hundreds of users within a single room simultaneously. Thus, a cost effective, high precision and scalable location sensing system is needed. However, current RF based localization methods, e.g. RADAR [9] are not able to provide such a because of the high interference levels. Experiments with an earlier prototype based on ultrasonic [10] have provided higher accuracy, however have shown that the complex deployment and the required density of a sensor grid results in high deployment costs. Furthermore scalability might be problematic and the sensor tags worn by the clubber might be too bulky. Current research efforts concentrate on

designing an ultrasonic system with appropriate form factor utilizing wide band ultrasound to increase scalability and auto-calibration of nodes in the reference sensor grid, to ease their deployment. As an alternative mechanism for location, a combination of RFID readers installed in the floor of the nightclub and RFID tags in shoes of the clubber can be envisioned.

b) *Wearability of sensor nodes:* Clubbers are particularly very conscious about the way they dress. Current sensor nodes are too bulky to be worn and unsuitable in such dynamic environment and the positioning of sensors may be very restrictive. Thus an integrated and fashionable wireless sensor nodes that could be worn as accessories e.g. in fabric or as a watch are needed. Current research on wearable sensors and sensor textiles are already providing prototype solutions; however durability, e.g. number of wash cycles, and comfort of wear requires further improvement. Once the production process are refined to cater for larger markets at affordable prices, we expect fashion designer to pickup this trend to provide fashionable non-intrusive sensorised accessories and cloth that are acceptable by most customers.

c) *Mix of traditionally separated application environments:* In most of the ubicomp research focus on specific application scenario and develop sophisticated solution for it. UbiClub combines environmental, human and object centric sensors networks into a common application space. The coexistence of the different domains in a single environment requires trading-off features of existing solutions to achieve an optimized system design for the overall environment. Such a problem can only be studied in a real-life deployment. Therefore efficient solutions will be studied on a testbed UbiClub environment that implements key applications.

d) *High density deployment of wireless sensor nodes in a size limited indoor environment:* Nightclub usually represent densely populated places in limited indoor environments, resulting in high density deployment of wireless sensor nodes. Existing communication technologies may fail or be unable to deal with the resulting hostile radio channel and provide insufficient capacity due to bandwidth limitations. This is further complicated by the limited transmission power of the sensor nodes. A more robust transceiver design may be required and novel access technologies suitable for such an environment have to be investigated. A good starting point for further investigation is an air interface based on UWB, as currently studied by the 802.15.4a working group.

e) *Complex interaction between different heterogeneous wireless sensor networks:* The dense deployment of various BSNs, ESNs and wireless access points nightclub infrastructure opens up a various possibilities of communication and interactions. BSNs can directly interact with each other or the ESN, or communicate via access point of the nightclub infrastructure. Access point could be reached

directly or via multiple hops depending on capacity and coverage. Furthermore terminal capabilities of users, user mobility as well as communication preferences have to be considered. Designing necessary mechanisms to coordinate the possible interaction and provide flexible and seamless communication between these networks is a challenging task.

f) *Multi-modal sensing and context inference:* The generation of complex high level context information such as mood or activity of a user requires the simultaneous sensing and processing of context information from multiple sources and modalities. In short term adaptation of existing measurement techniques to parameters captured by less intrusive physiological sensors, together with the intelligent interpretation of physiological parameters in association with the ambient environment will generate the desired context information with higher accuracy and consistence. In long term novel sensors based on nano-technology will allow non-intrusive measurement of physical a biochemical signals that allow the interpretation of physiological state with much higher accuracy.

VI. CONCLUSIONS

This paper presents UbiClub, an application of a context-aware environment for nightclub entertainment. Using the ambient intelligence space surrounding the customers within a nightclub, UbiClub is able provide a variety of new services, which significantly enhance customer experience and simplify the management of the nightclub. We believe that the mixture of technophile generation of customers as well as the experimental trendsetting nature of the nightclub entertainment industry provides a fruitful application ground for ubiquitous networking. Connected with the right business opportunities, a nightclub environment can be a significant driver for novel context aware applications and ubiquitous technologies.

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