Interactive shops: how the customer can deal with them both from inside and outside

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ABSTRACT
We present here a proof-of-concept of an integrated system for enhancing the shopping experience in a shoes’ shop. The system uses two modules: (i) one internal to the shop using an interactive totem; (ii) one external to the shop based on the customer’s mobile device and the interactive external shop surface. We describe the technical architecture of the two modules and two different scenarios of the user experience.

CCS Concepts
• Human-centered computing → User interface programming; Touch screens;

Keywords
Multi-touch, Mobile devices, RFID, Arduino.

1. INTRODUCTION
The increasing spread of smart mobile device generated a great deal of interest over the possible usage of mobile devices as remote controllers. There are a lot of studies in the home automation field, for instance, on the possibility to allow users to remotely control house appliances like doors, lights, TVs, music boxes and more [1]. Of course, the mobile devices have much more features than this, but their availability and versatility (they can use dedicated apps or connect to the appliance using a browser) make them really a good choice as controllers. At the beginning of this millennium, infrared ports for wireless data transfer were commonplace on many mobile devices and they have been used as remote controllers to manage TVs and similar home appliances [7].

Wi-Fi and Bluetooth (BT) connections are now used, instead, to achieve this kind of interaction, thanks to the fact that they are more versatile and radio-based, thus not influenced by obstructions. More recently, some controlling functionalities make use of new protocols like NFC (Near Field Communication) or RFID (Radio-Frequency IDentification). It is common to use programmable boards in order to connect mobile devices and appliances since, except for the most recent ones, they do not have any native wireless communication capabilities.

Our main idea was to apply the knowledge built in this field to enhance the shopping experience of the customer having a smart mobile device with the goal of making the shopping easier and funnier. At the same time we develop the proof-of-concept for sellers that give them more options and tools. This system allows sellers to attract new customers by offering them new ways to discover the shop’s products, improving their shopping experience.

We present a prototype for a footwear store based on this approach. In this setting we envision two main interaction areas: inside the shop using a dedicated area (see Fig. 1) and outside the shop through the showcase using a smartphone (see Fig. 2). The former allows users to get all the information about a chosen pair of shoes by placing it on a dedicated platform (that we named iTotem, see Fig. 1). The latter takes place outside the shop, allowing users to make simple and fast searches in the shop’s catalogue using their mobile device (or a touchable surface) by interacting with the products placed in the showcase (see Fig. 2).

2. RELATED WORK
Several studies in sociology and related fields give sellers useful guidelines for creating attractive showcases for their stores. Of course, the purpose of them is to increase the...
number of customers attracted by the shop and, thus, keen to enter and browse the goods. Moreover, these studies also analyse the buying behaviours of customers in correlation with different shop elements.

Bearden and colleagues [3] highlight that atmosphere, location, parking and salespeople’s attitude are critical aspects affecting the store image while Petruzzellis and colleagues [8] explain that the music is the major element of retail atmosphere.

Even the shop’s entrance plays an important role influencing shoppers’ perception as explained by Bansal and colleagues [2]. Probably, the main aspect influencing the customers is the shop window rather than the entrance [10]. In fact this is the mean through which sellers can take their first step towards customers. In [6], the authors examine the consumers’ attention towards sale signs placed outside the shops, and how these factors affect their intention to actually visit it.

All these aspects are useful to attract buyers into the shop, but it is clear therefore that to be successful a business has to satisfy the expectations of their customers. Taking this into consideration, the shop’s interior has to be attractive and pleasant for them as well. Nowadays, technologies such as multi-touch displays are being installed in different kind of stores like footwear and clothing stores since they are the brands more linked to new technologies, but it is not strange to find them also in jewellery or accessories ones, in order to make the shop more attractive for customers.

Sometimes, these displays can be combined with other devices to offer new interaction experiences. For example we can take the Connected Store Demo [4] by eBay and Rebecca Minkoff where we see an interactive experience in both the store showcase and the fitting room. This room is equipped with a mirror surface overlaid by a user interface. In the showcase setting, the user explores the different items in the store. Once she finds something interesting, she requests to try them in the fitting room and the clerk prepares it with all the favourite items.

This approach seems to be really attractive for customers, especially in clothing stores. For this reason we use a similar shop, like a footwear shop, as case study, working on both the shop’s interior and exterior.

As noticed in the introduction, a lot of works regarding the use of mobile devices as remote controllers for house appliances [11] or even vehicles [5] have been presented to the community. These works are not only related to industrial applications but for domestic use too.

Even if most of the works are focused on controlling home appliances, other works present innovative ways control public smart objects.

Usually, in this scenario a single user controls the system and the actions are visible to other people. An example of this interaction approach is still visible in Cagliari at the Thotel where visitors can change the hotel tower’s colour by tweeting a message writing the desired colour [9].

In the last years, many commercial brands are creating dynamic showcases that show videos, change the lights’ colours or even move the exposed products. In some shops, users can interact with the environment by exploring the catalogue through multi-touch projected surfaces or displays, but they can not change the shop’s appearance.

This is our main contribution: we want to give users/customers a new way of interaction, even when the shop is closed, by allowing them to explore the shop’s catalogue and change the store’s appearance.

3. CONCEPT

We describe here the guidelines of the system development. The graphical user interface is divided in five areas (see Fig. 5 for color coding):

A block In this section we display all the images and videos of the chosen shoe. We used some photos taken from different point of views and a 360 degree footage when available.

B block This section contains the user selected (from the list of the previous point) item.

C block Here we show all the shoe’s details, like brand, colours, category, and whether the shoe is for males or females.

D block Here the user can scroll other shoes that are related to the selected one through this list view.

E block In this area there is a pop-up tab that allows users to search other products by looking in the shop’s catalogue choosing by category, brand, size, colour, gender and a price interval. Once the user sets one or more filters the results are listed in the same tab and, by clicking over one of them, the page’s content will refer to the new selected pair of shoes.

When nobody interacts with the system it remains in idle mode and awaits for an RFID reading or a touch event. In fact, the iTotem (see Fig. 1, Fig. 3) is equipped with an...
RFID reader that allows the users to get more information about the shoe by placing it on the platform. Every shoe is tagged with an RFID tag and each tag ID links to the shoes’ details saved in the database.

In stand-by mode it shows a sort of screen-saver explaining how to start the system (i.e., place a shoe over the iTotem). As soon as this happens, the system shows the main view with the five areas as explained earlier.

We made two hypothetical scenarios that are explained at the following video (https://goo.gl/20vQf9) and in the next subsections.

3.1 First scenario: inside the box

Alice is looking for a new pair of shoes and she is walking in a shopping street when she sees a footwear shop. She enters the store and looks for the exposed models and immediately sees a display that informs her to take a shoe and place it on the platform (the iTotem) in front of the screen. Alice takes a sneaker and places it on the iTotem. The shoe is now recognised by the RFID reader and the display starts to show the shoe’s information as explained in Fig. 4(a). Alice can now watch the shoe’s images and she is able to horizontally scroll among them as showed in Fig. 4(b). She can also watch information such as the price, available sizes, materials and even take a look to other similar shoes (see D-Block in Fig. 5). In the same moment Alice sees that the shoes’ shelves change their appearance. The lighting system reflects the user’s interaction, and, due to Alice’s selection, only the shoes interesting for her are lightened by the spotlights. In this way Alice immediately sees which shoes are the ones listed in the “related shoes” section on the display (D-Block in Fig. 5). She now wants to look for cheaper shoes; to do this she uses the filters’ tab by tapping over it as explained in Fig. 4(c), then she selects a price range between 30 and 60 euros and her number. After pressing the filter button both the screen and the shelves change their appearance. The display shows the result of her search as showed in Fig. 4(d) while the shelves spotlights are illuminating only the shoes that correspond to the applied filter (a mockup example of this result is in Fig. 1). Alice finds the right pair of shoes, and she can finally try them up.

3.2 Second scenario: outside the box

Bob is looking for a new cheap pair of shoes but unfortunately his favourite store is still closed. He is looking at the showcase where all the shoes are exposed when he sees a QR-Code (Quick Response Code) placed on the shop’s window. This code allows customers to connect their smartphones to the interactive showcase. He sees all the exposed shoes in the smartphone’s screen, in this way he can retrieve information such as the price, available sizes, available colours and more. He can also use a simple filter in the same way as discussed in the first scenario. Once he chooses a set of filters, the shelves’ lighting system changes the spotlights’ states, by illuminating only the shoes that correspond to the selected filter (a mockup example of this result is in Fig. 2). Now Bob knows that some interesting shoes costs his budget price and are available in the store. When he will be able to visit the store he will ask directly for those shoes, thus saving some time. On the contrary, if no shoes are illuminated he will look in another store, always saving his time. In case the user does not have a smartphone he can uses the touchable window where the same interface discussed in the first scenario is available.

4. IMPLEMENTATION

The system is divided in four main components: (i) the RFID manager; (ii) the Arduino controller; (iii) the Database agent; (iv) the GUI controller.

All these components are controlled by the core component that can communicate with each single part that is hidden to the others (see Fig. 6). We made the whole system using different frameworks and programming languages. The main application has been developed using QT, a cross-platform application framework supporting different programming languages such as Java, Python, C and PHP. It includes a useful API that allows developers to build GUI and manage external tools such as SQL databases, XML parsers, thread managers and more. We also used QtQuick, a collection of technologies designed to help developers for the creation of intuitive, modern, and fluid user interfaces working well especially on mobile devices. In order to make the system working we set up a server equipped with Apache, MySQL and the PHP engine.

The iTotem allows the users to get more information about the shoe by placing it on the platform by using an RFID.

Figure 4: A few screenshots of the running application.

Figure 5: The layout of the UI of the interactive screen.
Figure 6: The architecture of the whole system.

reader that requires every shoe to be tagged with an RFID tag. Each ID links to the shoes’ details saved in the database. These details are displayed over a touchable surface (in our prototype we used a 24-inch multi-touch display) and, through it, users can perform the tasks described before.

To identify the shoes equipped with an RFID tag, we used an ID Innovations branded reader (ID-12LA) connected through a USB module (SEN-09963) of the Sparkfun Electronics that is able to detect a tag from a distance lower than 12 cm (4.7 inch); the tags used are 125 kHz passive cards.

The USB module is directly connected to the PC where the main application runs (in our prototype this PC corresponds to the main server), and it works as an input device, while through another USB connection the application sends commands to the micro-controller board that manages the shelf’s lighting system. For our projects we used the Arduino board that is an open-source physical computing platform based on a simple micro-controller board, that came with a development environment for writing software for it. In detail, the light system is made up of 32 LEDs that are disposed as a 4x8 matrix and through the Arduino it is possible to turn on/off each single LED. This prototype represents a shelf of shoes and each LED simulates a spotlight. As previously said, in our prototype we used a 24-inch multi-touch display (DELL P2714T) that supports up to ten touch points. Even though in a real scenario this should be replaced with a multi-touch wall, thanks to the application responsive design, it runs well in both scenarios.

5. CONCLUSIONS

In this paper, we described a proof-of-concept of an integrated system for enhancing the shopping experience in a shoes’ store offering to customers two different interaction inside and outside the shop. We are currently studying an approach that allows a multi-user usage of the system since, at the moment, it can be controlled by a single user decreasing the customers’ engagement. We are also planning a real test with an Italian brand in order to understand the customers’ feelings and to evaluate the user’s experience when interacting with our proposed system.

Nowadays, as more shopping moves online, clothing and footwear shop are trying to catch customers’ attention improving their buying experience with new technologies that are more interactive like smart mirrors or touchable displays. We think that these smart devices could change the way customers shop, and our contribution make a step forward in this direction.

6. REFERENCES


