

# A wearable augmented reality system to improve the quality of life of sedentary people

Aarón Munguía, Pedro C. Santana, Paulina Calderón, Francisco González  
School of Telematics, University of Colima, Colima, México  
{aamun, psantana, karla\_calderon, fgvega}@ucol.mx

## ABSTRACT

The sedentary lifestyle is a common problem in most countries, such as Mexico. For that reason, it's necessary to promote a lifestyle change that includes physical activities and a healthy nutrition. The objective of this paper is to provide a technological solution to motivate people to walk, receive health benefits, and additionally, receive points, which can be exchanged for prizes. With this we pretend to motivate people to walk and improve their health. Thus, if a person doesn't walk to improve their health, we will encourage it with a prize.

## Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces, input devices and strategies, user-centered design.

## General Terms

Human Factors.

## Keywords

Walk, wearable device, augmented reality, health care, walking routes, community exercise.

## 1. INTRODUCTION

The sedentary lifestyle is a common problem in most countries, such as Mexico. For that reason, it's necessary to promote a lifestyle change that includes physical activities and a healthy nutrition. This is a very alarming problem that has to be treated immediately. Has been found that walking 20 minutes daily helps to reduce the problem, besides is an exercise that does not require a lot of effort and most of people are able to walk [1]. This work on progress is being done in the city of Colima, México, where there are a lot of different places where people can go to walk, run or jog. Some places are public or private sports centers and also there are public parks. At private sports centers the user should paid in order to exercise there. For all the services that sports centers offer, it is acceptable to pay this quantity, but for the ones that can't or doesn't want to pay it, there are parks and open places available to do exercise. Based on an analysis, we propose a wearable augmented reality system which includes a pair of glasses capable to project a sequence of marks which indicate the places where users need

to pass though a walking route. This will be possible using the augmented reality that consist of defining a direct or indirect vision of a physical environment in the real world, which elements are combined with virtual elements for the creation of a mixed reality in real time [2][3]; besides, we will use a web service that will manage all the user's information, routes and prizes that they will receive. The users will be able to win prizes, walking the routes earning points completing the activities indicated by the system. There will be individual and group routes, this means the users will be able to walk alone or in groups, having the advantage that in this last modality they will get more points (if more people walk, you earn more points) and will have social interaction with the walking's community on his neighborhood.

## 2. UNDERSTANDING SEDENTARY PEOPLE

Our field work was designed to understand both people who are not used to walk as people who already walk. We focused on four main aspects: health care, stay in shape, expected rewards and accompanying to exercise.

### 2.1 Method

In order to get information about the main reasons why people exercise and all the activities they do while exercising, we used the direct observation (10 persons) and apply seven interviews. An analysis of characteristics of the people experiencing our target scenario (lack of exercise) feed a discussion to determine typical profiles. From there, we identified a number of individuals with those profiles and who were likely to share with us their experiences. We included people of different gender, age and living in the same city where we will be proposing the solution. Another fact that we considered was if the people walk individually or in groups and which extern devices (i.e. gadgets) were using while walking. Our interviews were semi-structured, both interviews and observation were conducted within the Morelos sport center in the city of Colima on Mexico. We consider that the points previously mentioned cover a considerable variety of scenarios to obtain a preliminary understanding of the conditions experienced by our potential users in general. We also want to get knowledge in order to bring a better experience to the users and make them feel comfortable while walking using our solution.

### 2.2 Results

Based on the analysis of both interviews and direct observation, we identified major themes for each topic of inquiry. In this section we explained some of the most relevant results. With direct observation we found that most people exercise alone (activities like walking, jogging or running), they were using

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sport clothes and also carrying with them a mobile music player. The people that were walking in a group were doing it slowly and generally talking to each other, looking at the view or the rest of people. Most people that walk in groups are middle-aged adults that do exercise not only to improve their health but also to eliminate stress. Those facts point to the relevance of providing appropriate mechanisms to help them to improve the experience. The questionnaires brought us different kind of information. We found that most of middle-aged adults go walking mainly to keep a good health. By the other hand, the 90% of young people walks as a recreational activity. And the rest of people do it for health, to look good or have good shape. Based on these findings, we engaged in designing a system that overcomes some of these aspects and intends to encourage sedentary people to walk and improve the experience of those who already walk in order to reduce the negative effects of having a sedentary life.

### 3. RELATED WORK

Some design concepts and products have intended to make people walk and gradually change a sedentary life to an active one in order to improve their quality of life. *Runkeeper* is an iPhone application that enables you to use the built-in GPS in your iPhone 3G to track all of your outdoor fitness activities, including duration, distance, pace, speed, elevation, calories burned, and path traveled on a map. It can store all of your historical activities on the RunKeeper website and share with your friends [4]. *WalkJogRun* is a web system to plan running routes with a calculator of distance and speed. They use a map to set starting and visiting spots, then the system draws the route where you can see the distance between the points and what are the estimated time for a given speed. [5]. *Chick Clique* is a Persuasive Technology to Motivate Teenage Girls to Exercise. It's a preventative health cell phone application that helps motivate teenage girls to exercise by exploiting their social desire to stay connected with their peers. The intent of Chick Clique is to provide information at opportune times in order to modify the behaviors of girls and ultimately lead to improved health habits. Chick Clique offers a way to reach out to young women who enjoy technology and need motivation to continue being physically active throughout adolescence [6]. *Nike+* is a sensor based system that must be placed inside your tennis and has the capacity to be connected to iPod nano, Sportband, iPod touch or iPhone 3GS to monitoring distance, calories, pace and race time or synchronize with the gym equipment. All trainings performed by users are registered in the nike+ web site where you can connect with friends too [7].

The above presented systems and our own findings have motivated us to propose a system to help sedentary people to walk through a wearable augmented reality device. Through this device, the users improve their walking experience with relevant information on their routes.

### 4. SYSTEM FEATURES

As we discuss previously, we found that the main problem is to motivate people to walk and exercise. So, to give this motivation and make them rise up and walk, we propose enhanced walking routes that will be randomly generated and located around the user's community. The system will generate routes that are marks on the road indicating the direction to

follow for getting points, circuits can be generated for any location in the world thanks to GPS technology but will be especially generating routes close to the place where the user lives. The user must go to the place indicated by the glasses and once in position, with the help of the augmented reality the users will be able to see the marks through the route which indicates where they needs to walk by. By walking through the routes the users will earn points that can be exchanged for products that can be selected from the catalog included in the system. There will also be an option for walking through community routes, this means, several users can agree in order to walk through the same routes at the same time, having the advantage of getting more points, we will bonus this action in order to encourage people to walk in groups to motivate sedentary people who do not like to exercise alone. Each walk will be different and unique, because people will be watching images that can't see without the wearable device; these images will convert the walk experience more enjoyable.

#### 4.1 Device

The interaction device (see Figure 1) are special glasses which allow the user to watch the graphics information generated by the system, based on the user's environment, this is known as augmented reality, evolving the user in a richer reality (see Figure 2). It will have a headset to make a more enjoyable walk for the user with music or sounds, as well as a camera to take photos or video to keep the memory of the walk and share it with friends.

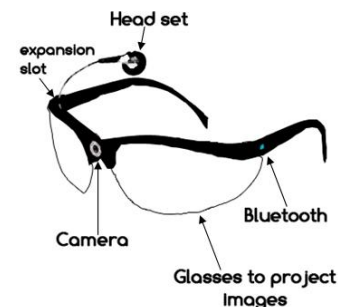


Figure 1. The interaction device.

Below are the device features which can be seen more detailed inside the architecture of the system:

- A GPS, which will help to know the global position glasses and the user.
- A rechargeable battery.
- Glasses that will let you watch virtual objects.
- Micro-camera for pictures of your walks.
- Headset for listening to music or sounds.
- An accelerometer, which will help to know the inclination of the glasses.
- Pedometer to count the user steps.
- Bluetooth for connectivity and shared files and data.
- Flash memory where data from sensors will be stored and also the state of the circuits.
- Micro-SD slot for memory expansion.

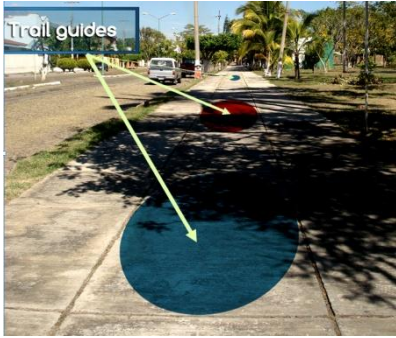


Figure 2. Example as how the user will interact with the marks.

## 4.2 Web Server

The web server will be responsible for generating the routes based on the user's personal data. The users will have the possibility to receive routes generated by them or using any of the community routes (sports centers, parks or re-creative areas). The routes will be walked on 30 minutes approximately but the time and the distance will be increasing gradually depending on the continuous use and the user's physical condition. The server will receive data of the routes from the device to record of the achieved distance thanks to the information provided by the GPS and the way that the user did it with the help of the pedometer. The user will have a personal page (profile) in the system (see Figure 3), where the prizes that she wants to obtain will be shown, their friends, and the quantity of earned points. The routes are categorized in 3 types: walked ones, pending ones and community ones, all of them will be shown in different colors in order to be in one single map that the user will be able to see. Giving the users the opportunity to choose their prizes, will give us important information about their likes, this will also help to the system to suggest routes that the user doesn't know but may be interested in. To clarify how these features are addressed by our system, we elaborated several scenarios of use to illustrate the system's functionality. The creation of scenarios enabled us to generate and communicate design ideas for our system and to understand better the implications of particular design solutions [8]. Next, we present some of the use scenarios in which we envision how the sedentary people may be encouraging to walk through our augmented reality device.

## 4.3 Scenario 1

*Alejandra López, a girl of 20 years old, goes to do exercise on a Wednesday afternoon after having finished her homework, she decides to go and take a walk using the youWalk system to keep earning points. Alejandra logs into the system and sees the available circuits for taking a walk. After choosing one, she decides to invite her friend Rodrigo to walk the circuit together. Immediately Rodrigo receives a text message on his mobile letting him know about Alejandra's invitation. He sees the message and logs into the system to confirm the invitation sent by Alejandra. Alejandra also receives a text message that notifies that her invitation has been accepted by Rodrigo. Rodrigo pick her up and they go together where the start of the circuit takes place, they turn on their glasses in order to look the circuit in an enhanced way and pass by all the marks required to get the virtual objects placed in there, while they*

*spend some time talking, admiring the view, taking pictures and exercising together.*

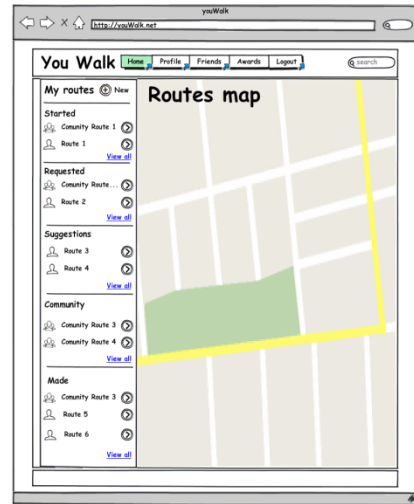


Figure 3. Mockup of the user's profile.

## 4.4 Scenario 2

*Maria has 6 months using her youWalk glasses and walking through all her neighborhood and surrounding areas, for that reason she has earned a lot of points. One day before going to walk, Maria was watching the prizes in the youWalk catalog and saw she had enough points to get a shirt that she liked. Then she decides to exchange her points for the shirt, so her points were discounted and she received the shirt. Now she wears it every time she goes to walk.*

## 5. SYSTEM DESIGN

In order to achieve the system's functionality we are proposing a wearable augmented reality system. Next, we describe the system's architecture and show some images from a mockup of the system that we made for this paper.

### 5.1 System's Architecture

The components of the architecture (see Figure 4) are described next:

- SMS: will help us to let know users when they have a new invitation or they've accepted one they made.
- GPS: will help us to know the global position of the user and help the user to find routes depending on the place and distance the user wants.
- Image Projection: The glasses show the marks on the road that guide the user and the direction they have to take.
- Camera and video: The user can take photos or videos of landscapes that will see during their journey. This is done with the augmented reality glasses and only will have to press a button, hold for video and press for photo.
- Headset: The user will spice up their walks with sounds or music and for this will use the headset.
- Bluetooth: The user will use Bluetooth as a communication medium between the glasses and their computer.
- Pedometer: The pedometer will count to know how many steps were walked on the route
- Accelerometer: It will help the system to know the inclination of the glasses on the head, with the help of this

device the virtual objects will be shown like if they were set in just a place, looking similar to real objects, we mean, head tracking.

- Slot expansion: The expansion slot allows the user to use a micro-SD memory to provide more space and store more routes and multimedia elements.

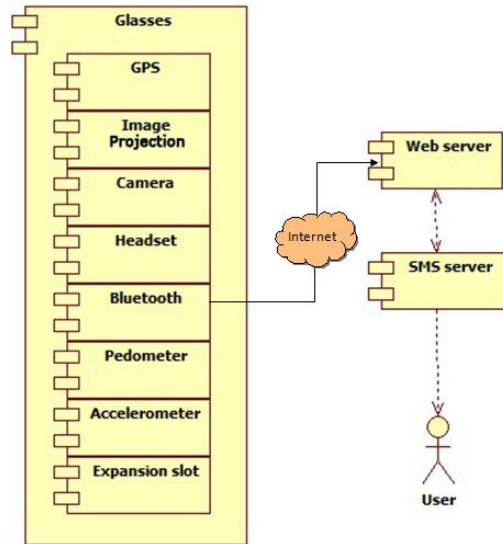


Figure 4. The wearable augmented reality system's architecture.

## 6. CONCLUSIONS AND FUTURE WORK

We have presented a wearable augmented reality system to motivate people to walk by providing rewards as long as they're constant with their physical activities. With the implementation of this system we pretend to make an impact on people who use it and eventually they invite more people to walk through community routes and get bigger benefits. Just a few minutes a day will help to stay in shape and also avoid diseases. In case some people have sight problems and require getting magnifying glasses, they'll have the option to set their glasses

with their own prescription and features. As a part of our future work we plan to develop a system's prototype and conduct an evaluation with users (people who already walk and sedentary people). This will enable us to know the system's ease of use and how the system will fit within their current practices. We also plan to implement an advertisement system in order to make the reward catalog self-sustaining.

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