MobiCare Proposal

1 Full details

Eugenio Gaeta
Calle de la Manzana 15, 1A
28015 Madrid
Mobile: +34 647264687
eMail: eugenio.gaeta@gmail.com

2 Project Title: MobiCare

3 Description (1pg)

A healthy lifestyle improves quality life.

The World Health Organization states that physical inactivity is now identified as the fourth leading risk factor for global mortality (WHO).

On the other hand increase the fitness level with the physical activity increases life expectancy. For each increase of 1 MET (Metabolic Equivalent) there is a 12% increase in the life expectancy of men (Myers et al 2002) and a 17% increase in women (Gulati et al 2003). These are just a little set of information that affirms the importance of an active lifestyle.

Adopting a healthy lifestyle is not an easy task. Normally people are not able to change their habits without help and motivation.

MobiCare is the proposed solution to this problem. By means of game elements and game design a mobile game-like application motivates, promotes and helps users to adhere the recommendations of World Health Organization on physical activity. MobiCare is a system whose aim is the enhancement of physical activity. It is based on a set of services, a web platform for professionals and a set of mobile application for users or patients.

The MobiCare mobile applications use: heart rate sensors, text to speech and voice recognition to monitor, evaluate and guide users during their training. The apps also motivate them in order to perform the training sessions as better as they can, in the respect of World Health Organization'recommendations on physical activity. The PBL (Point, Badge, Leadership) framework (used in game design) is applied in MobiCare apps by assigning points and rewards to the user that respects the recommendations. At the end of the training week period the user can convert his points and rewards in virtual goods, if he has complied with the expected objectives.

MobiCare is not an autonomous system that takes care of users or patients; it is rather a system that supports professionals to monitor users' performances by way of training data and

statistics that can be grouped per type of session (single session or group of sessions) and time (day, week, month). Access to monitoring sessions can be done offline and real-time: the platform shows to the professionals which users are training and alert them with color codes if someone needs attention. In this way the professional has the possibility to send real-time messages to the user and help him during his training.

4 Detailed Description (max 11 pg)

4.1 Architecture (3 pg)

MobiCare is not a training application; it is a virtual assistant that helps and enforces users and professionals in the monitoring, guidance, evaluation and promotion of physical activity according to the WHO guidelines. MobiCare does not allow users to register in the system. Professionals in fact need to evaluate users'initial state. Only if they are in a right and safe physical condition, they can be part of the Mobicare program. MobiCare doesn't want to catch users. MobiCare is indeed a helper service for professional and in no way can be used in order to replace their activity.

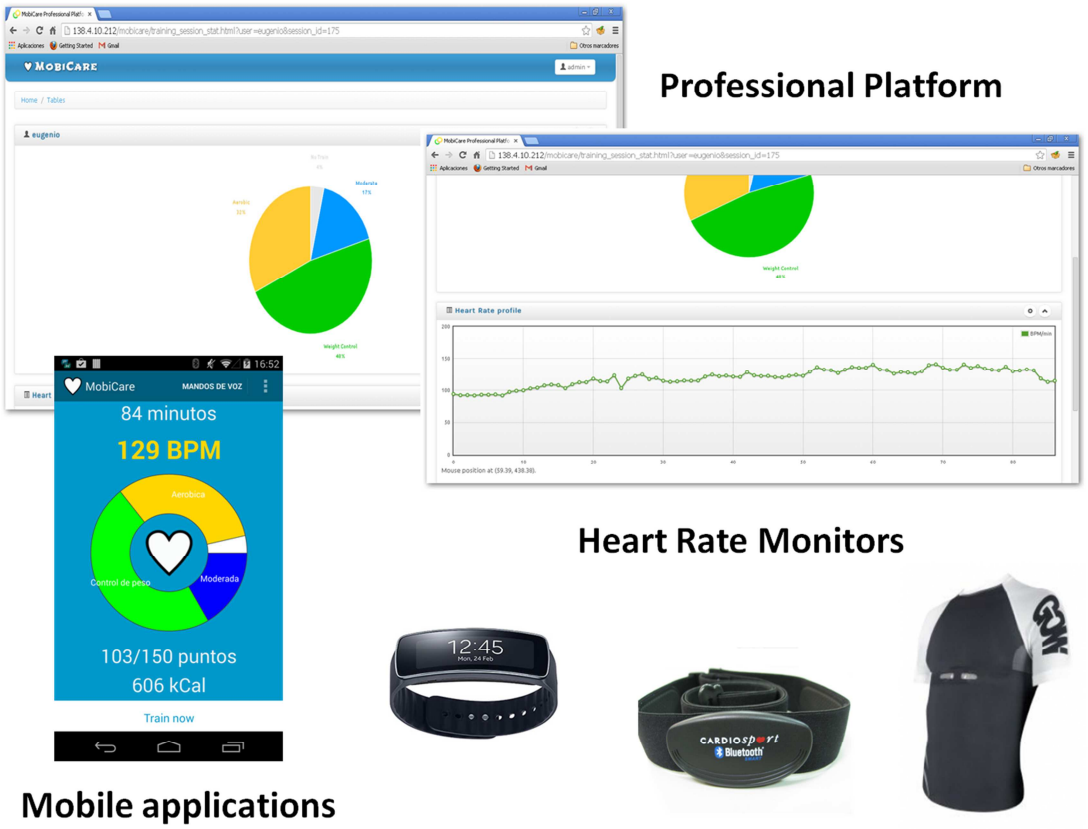

Figure 1: MobiCare overview

MobiCare is based on the AmIRTEM model (Ambient Intelligence Realtime Training Evaluation Model) (Gaeta et al. 2012).

The AmiRTEM model describes the functional blocks needed in order to provide monitoring, guidance and evaluation of aerobic endurance training based on heart rate measures.

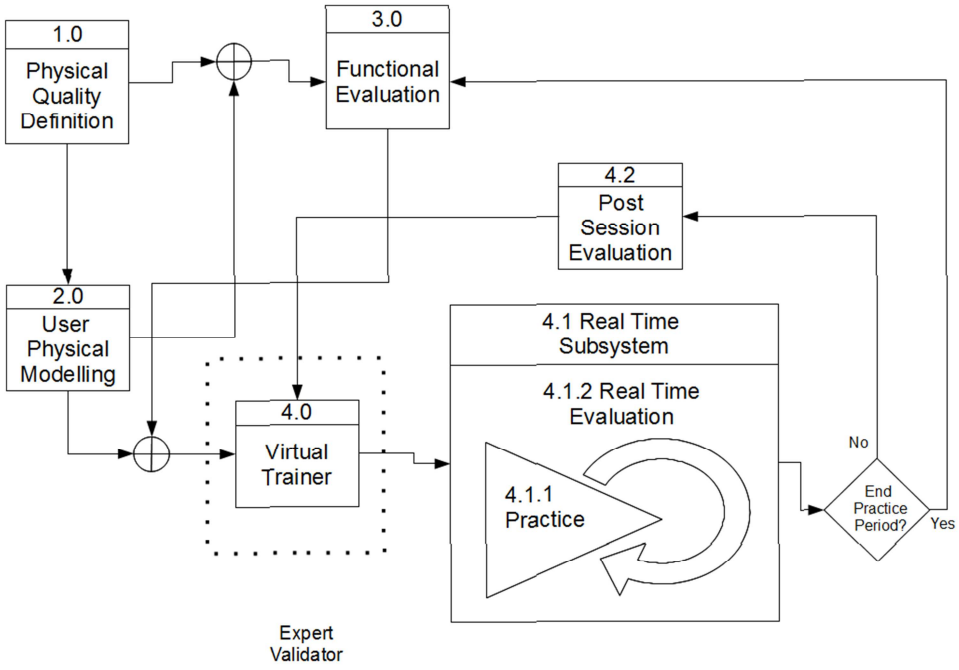

Figure 2: AmiRTEM functional blocks for physical quality training

The functional diagram of the model is described in figure 2. The AmIRTEM model has following four main functionalities.

1. **Physical Quality Definition**: this block provides a theoretical model for physical quality that the user wants to train.
2. **User Physical Modeling**: this block defines a physiological model of the user in those aspects that are related to the physical quality defined in block number 1.0. For instance, HR and VO_{2Max} can be associated with aerobic endurance while a geometric and muscle skeletal model of the shoulder is associated with the flexibility of the arm and so on.
3. **Functional Evaluation Training**: this block defines the special training sessions for the evaluation of the physical quality of block number 1.0.
4. **Virtual Trainer**: this module is the core of the AmIRTEM model, it defines a dynamic training plan that can change during the training period. For example, if a user has difficulties during the training based on a session profile defined in the training plan, the Virtual Trainer changes that profile to another one which has a lower intensity.

   Two blocks can be derived from it:

   i) *Real-time subsystem* performs the monitoring function, assessment, and guidance during the workout of a training session; more in detail this subsystem is divided into:
      a. Practice addresses the continuous monitoring during the workout of the exercise session;
      b. Real-time evaluation plays the role of evaluation and guidance of the exercise session during its execution and compliance with the training profile;

   ii) *Post session evaluation* provides and evaluates each session according to the training profile of the subject and provides a tool to modify the profile of the following sessions to increase the effectiveness of training.

Following the concepts described in AmiRTEM model (figure 2) only some functional blocks of the model will be implemented in MobiCare. MobiCare is based on aerobic endurance; this implies that block 1.0 is not implemented (because MobiCare is not a valid system for other physical quality).

In MobiCare blocks 2.0 and 3.0 are developed as the professional user interface.

All others blocks are intelligent functionalities of MobiCare and will be implemented on client-server architecture based on interoperable services.

The MobiCare architecture will be based in layers in order to provide a high grade of interoperability and scalability with new emerging technologies.

As described in figure 3, the MobiCare layers architecture is a hierarchical architecture where every higher level layer depends on the lower one.

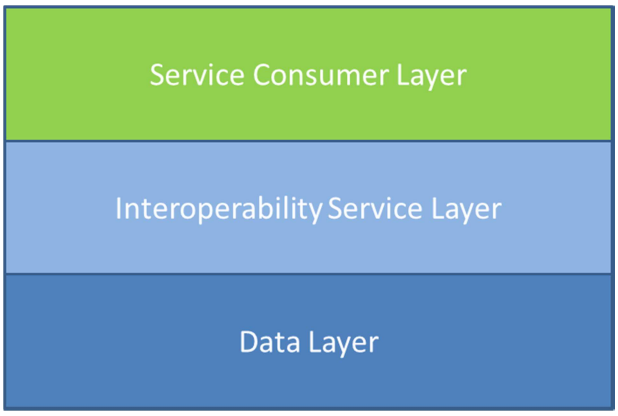

Figure 3: MobiCare architecture layers

The proprietary level of MobiCare is the Data Layer. This layer provides to store and keep access to all data within the platform and also implements all the algorithms that will be exposed and published to the higher levels. Within the beta implementation of MobiCare this layer will have a database and a file storage service.

The Interoperability Service Layer allows publishing MobiCare functionalities for the clients 'application. It will be based on web technologies; the data exchange functionalities will be implemented using standard and platform independent formats, such as XML or JSON.

The Data Layer and the Interoperability Service Layer are the server side in the server-client architecture of MobiCare.

The higher layer, the Service Consumer Layer, is the client side: it will implement the mobile and web based applications for consumer and professional. The first prototype will be developed as an Android application and a responsive web application based on HTML5/CSS3 and Javascript. All client application in MobiCare will be based on MVC architecture (Model View Controller) architecture, as depicted in figure 4.

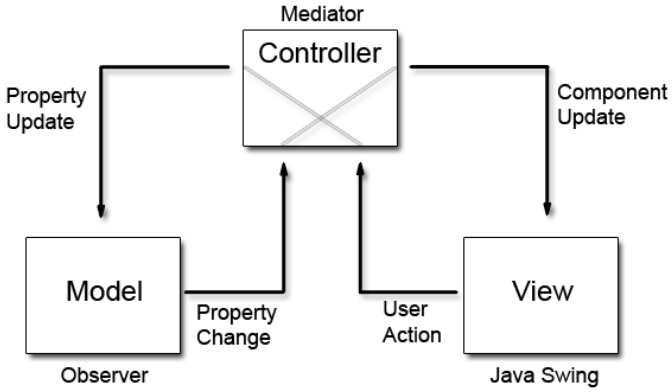

Figure 4: MVC architecture.

In MobiCare the MVC architecture is mapped as follows (shown in figure 5): the Model of MVC is represented by the Data Layer, the Controllers are the Interoperability Layer and the Service Client libraries (part of the Consumer Layer), while the user interfaces (part of the Consumer Layer) are the views of the MVC architecture.

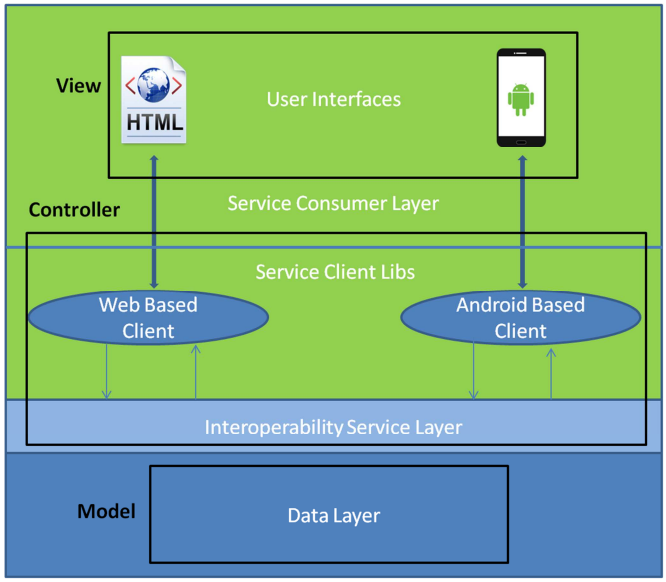

Figure 5: MVC architecture mapping on MobiCare architecture

4.2 Technologies (1 pg)

For the development of MobiCare beta version we will use the most common and spread technologies nowadays available on the market.

For the MobiCare Data Layer we intend to use MySQL database and an FTP Service. We have selected MySQL because it's free, easy to use and a common technology that most of programmers know. The FTP Service is and intuitive technology able to store files and associate them with entry in the database.

For the MobiCare Interoperability Service Layer we want to use for the beta version PHP technology and JSON format. PHP is very low cost and known technology and JSON is easier to

use than other format such as XML. For next releases also XML format, NodeJS, Tomcat or other Java application server technologies will be evaluated.

For the beta version of the MobiCare Service Consumer Layer an Android application, a responsive web for professionals in HTML5/CSS3 and Javascript and if possible an iOS application will be implemented.

In MobiCare will be used only heart rate sensors based on standard heart rate profile of Bluetooth 4.0 technologies. In this way MobiCare will be interoperable with all the different heart rate monitors based on this technology.

4.3 Business model (2 pg)

MobiCare is a no profit app. It will be developed in order to offer a service to the community where all the actors are socially involved. It will be provided for free or just for the cost of hardware maintenance if professionals or healthcare deliveries offer the service for a social scope with no profit intention.

It is worth to underline that the scalability and the modularity of MobiCare allow a high level of customization that professionals could use in order to offer the MobiCare service as part of their business. Indeed, MobiCare is a template platform and applications; the free version is just an example of customization of this template.

MobiCare is not oriented to catch users. MobiCare does not need a critical mass of users in order to start having benefits. MobiCare is a service offered to healthcare professionals or public/private healthcare deliveries. Professionals and deliveries will use MobiCare service in order to potentiate the services they offer to their clients.

The potential clients of MobiCare are: doctors and other healthcare professionals (cardiologists, nutritionists, trianers, etc.), private/public healthcare deliveries, gyms, fitness and wellness centers.

The business model of MobiCare will be based on annual licenses and revenue share. MobiCare wants to offer a low cost price service in order to be accessible to:

1) private professionals that has few patients and want to offer them technological innovation
2) Private/public healthcare delivery with hundreds of patients and special needs.

The annual license will be low cost and will offer a set of basic services and customizations for a limited number of users, this will give the coverage of needs for the basic client that is the private professional. Furthermore, custom licenses with revenue share will be available. In this kind of licenses customer have a high grade of customization and the cost of the service will be based on an annual fee and a progressive cost per user.

As the MobiCare service need Heart Rate Monitor sensors, MobiCare can also provide personalized sensors and sell them in revenue share with its clients.

MobiCare will be sold for business in three profiles:

1. Professional profile
2. Delivery profile
3. Advanced Delivery profile

There will be also the free social profile when MobiCare and the potential customer want to provide the service for a social purpose with no profit intention.

The time to market is estimated in six months after the development of beta version. During this time three pilots are planned:

1. Pilot with professional, in this pilot a private doctor can offer the MobiCare service to his patients for free. The objective of the pilot is to evaluate the best cost effective set of services and customizations needed for the Professional MobiCare profile.
2. Pilot with public delivery, in this pilot MobiCare will be installed in a public delivery center. The objective of the pilot is to evaluate the best cost effective set of services and customizations needed for the Delivery MobiCare profile.

Pilot with private delivery, in this pilot MobiCare will be installed in a private healthcare delivery center. The objective of the pilot is to evaluate the best cost effective set of services and customizations needed for the Advanced Delivery MobiCare profile.

Furthermore the common aim of these pilots is to evaluate the effectiveness of MobiCare's usage. The research question MobiCare wants to respond is: "Is it possible with a mobile Health application to improve quality of life of MobiCare population against a control group population that does not use MobiCare?". If this research question will have a positive response a formal institutional validation protocol for a digital medication will be designed in order to provide a medical certification of MobiCare system.

4.4 Impact analysis (1 pg)

The MobiCare impact analysis will be presented through a use case scenario.

Scenario 1, no MobiCare usage: Mr. Lopez, October 2014.

Mr. Lopez is 45 years old man, he is from Madrid, he has a wife, a 16 years old daughter and a little dog he gave as a present to his daughter some years ago. He is familiar with technologies, he has a smartphone, a tablet and he works 8 hour per day in front of a computer.

He is a sedentary person, he spends a lot of time on sofa watching TV or using his tablet in the weekends. Sometimes he is also a little bit stressed due to the pressing he has at job and home. Furthermore, he would like to have a more active life but he doesn't know how to start with it.

In October 2015 after a year, his lifestyle continues to be the same. Even if, Mr. Lopez has tried to change his habits following some guidelines his general physician gave him in order to have a better lifestyle.

Scenario 2, MobiCare usage: Mr. Lopez, October 2014.

Mr. Lopez decides to use MobiCare in his tablet. He has intention to change his lifestyle and decides to do it with MobiCare. He goes to his general physician who registers him in the system, gives him a heart rate sensor and the credential to use the application.

He usually spends one hour a day using his tablet and starts to invert a little bit of this time using MobiCare.

During the first month Mr. Lopez does not use the application oftenly: his General Practitioner (GP) sends him, through MobiCare, some recommendations and tips about physical activity.

Thanks to this tips and recommendations Mr. Lopez learns that walking 10 minutes per day is a good physical activity that gives him some points in MobiCare application; so he decides to start to go out with the dog of his daughter 10 minutes per day before dinner.

After five months his engagement with MobiCare is close to 20 minutes per day but he hasn't still fulfilled the WHO recommendations. At month six his GP proposes to Mr. Lopez to play paddle though MobiCare app. Paddle is very popular in Spain; his daughter and some of his friends already practice it. So Mr. Lopez starts with paddle classes on weekends instead of watching TV. He likes paddle and uses MobiCare to monitor his activity and to connect with his GP. Now MobiCare monitors his paddle trainings and challenges with his daughter and his friends, reporting Mr. Lopez's activity. MobiCare also motivates and helps Mr. Lopez to follow and improve his new habit.

In October 2015, after a year the lifestyle of Mr. Lopez is significantly changed. Now he knows what is good and what is wrong in his lifestyle. He is more engaged with his pet that also gives him benefits for his health. He satisfies the minimum WHO requirements in order to improve his aerobic resistance for a healthy lifestyle. On the other hand his GP has the data of a year of Mr. Lopez physical activity with just one face to face medical consultation.

4.5 Reason of innovation (1 pg)

Nowadays, monitoring systems based on sensors are expensive, inaccessible and proprietary solutions. The companies that develop sensors invest a lot on money in their hardware and software ecosystem that cannot be modified without their intervention. On top of this, there are a lot of expensive sensors that offer similar functionalities that cannot interoperate with each other.

These facts imply that remote monitoring of patients is not a cost-effective solution for the healthcare deliveries in time of crisis.

MobiCare breaks down these barriers by using standard sensors based on the emerging technology Bluetooth 4.0. The Bluetooth 4.0 adds to the classic Bluetooth standard: Low Energy capabilities and standardization of communication for some common types of sensor (heart rate, blood pressure, pulseoximeter, etc.).

MobiCare does not need investment in the development of sensors and will integrate in every moment many kinds of them if they are based on the new Bluetooth 4.0 standard. Currently there different kinds of heart rate monitors already compliant to Bluetooth 4.0 like smart

shirts, armband, wristband, etc. All these kinds of sensors are automatically integrated in the MobiCare platform.

MobiCare is a flexible, scalable and low cost solution for patient monitoring with standard sensors accessible to all stakeholders involved in healthcare. This is the main innovation compared with current solutions available on the market.

By 2018, ABI Research expects more than 46 million Bluetooth enabled health and medical devices to ship per year. According to TechNavio, the global market for wireless patient monitoring equipment should reach $9.3 billion by 2014 (TELECOM ADVISORY SERVICES).

MobiCare is betting on remote patient monitor and Bluetooth 4.0 technology.

4.6 Development schedule (1 pg)

The MobiCare platform development schedule will be based on tasks and the task resource will be estimated in PM (person/month) that is to say one person's working time for a month, or the equivalent, used as a measure of how much work or labor is required or consumed to perform some task. The time assigned to each task will depend on the resources could be assigned to the project.

The tasks and subtasks of MobiCare platform with the PM needed are:

1. Data Layer specification and development: 1 PM

2. Intheroperability service layer specification and development: 2PM
   - 2.1. Server side development
   - 2.2. Client side development
     - 2.2.1. Android
     - 2.2.2. iOS
     - 2.2.3. Javascript

3. Service Consumer Layer: 9 PM
   - 3.1. Android app
   - 3.2. iOS app
   - 3.3. Web app for professionals

4. Pilots testing: 12 PM
   - 4.1. Bug resolution and UI improvement Android app
   - 4.2. Bug resolution and UI improvement iOS app
   - 4.3. Bug resolution and UI improvement Web app for professionals
   - 4.4. Result analysis

As MobiCare is now in alpha version it is estimated that for the beta version for pilots will need 3 PM of resource.

The pilot testing phase is estimated in six months with 12 PM of resource.

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