Healthy Sport Monitoring System

Parviz ABBASOV[1]

ABSTRACT
Every individual responses differently to physical activity. Working out more than body endures can cause serious health problems. Rapid developments in information and communication technologies affects the whole area of health. Recently developed wearable wireless non-invasive health sensors allow us to create healthcare application. This research aims to give an idea for implementation of healthcare systems in sports area. This system will improve healthy and social life and encourage people to engage more with sport activities.

Keywords: *E-Health, Sport Monitoring System, Biometric Sensors*

1. INTRODUCTION

Everybody does not get equal benefits from exercising. Regular, accurate and careful physical activity is important to protect and improve individual health status [1]. Continuous health control can help sport consultants to increase safety of physical activities and support motivation throughout individuals. It can help consultants to design appropriate training options for each individual. It will help to establish expectations between individuals and sport consultants. Individuals can evaluate their time during the sport and sport consultants can evaluate and improve the workout plans. Long-term and real-time monitoring of medical data informs about the emergency situations. In spite of using conventional methods nowadays technology can help us design the real time monitoring system. Wearable non-invasive sensors will give continuous and real-time vital data about body's work during physical activity. By using these portable sensors with 3G wireless communication technology it creates the real time sport monitoring system [2]. This system will prevent the time loss, reduce the costs and guarantee the safety of the physical activity. Aim of this project is to help sport and health consultants to use more conventional methods and become able to keep individuals health under control more accurately.

2. MISSING ASPECTS (PROPERTIES) WITHIN EXISTING SPORT SYSTEMS

There are various health monitoring systems currently existing. They offer different options to help people engage with sport while monitoring time, distance, steps, burned calories etc, based on target workout advices. Most of them are designed for users and are not suitable for sport and health consultants. These systems do not provide information

[1] *Computer Engineering, Istanbul Aydin University, Istanbul Turkey parvizabbasov@hotmail.com*

that supports remote health control and consultant interventions. They are inadequate to guarantee health safety for individuals. Recently developed wireless biometric sensors can bring a solution to these problems. Vital signs are important part of individual's health. These non-invasive biometric sensors provide continuous control and monitoring of vital data. New designed non-invasive biometric systems are user friendly with being portable, wearable, light and reliable [3]. They can reduce the medical check-up costs, increase the usability of medical application. Using this system will encourage and motivate people to engage sport with health control.

3. ARDUINO PLATFORM

Arduino is a programmable an open-source electronic board. Arduino is using ATMel brand processors [4]. It is helps programmers to develop innovative projects with reduced costs. Arduino IDE editor is compiling our program and installing it to the card. In this project used Arduino Uno rev.3. It is the latest revision of the Arduino platform and e-health sensor platform v2.0 which has been designed by Libelium. Arduino Uno board is an electronic card with 14 digital and 6 analog inputs which are supported by the ATMega328 brand processor [4]. (Fig. 1)

Figure 1. *E-Health v2.0 Platform.*

4. E-HEALTH PLATFORM AND BIOMETRIC SENSORS

E-Health v2.0 platform is providing information which allows to make biometric, medical and sport applications by using Arduino, Rasperry Pi and Intel electronic cards. Biometric data can be send to application by using 6 different wireless technologies: Wi-Fi, 3G, GPRS, Bluetooth, 802.15.4 and ZigBee which allows to do real time monitoring and analyze individual health status [5].

This platform is supporting 9 various biometric sensors: (Fig. 2)

- Pulse
- Airflow (Respiration)
- Body Temperature
- Electrocardiogram
- Glucometer
- Galvanic Skin Response
- Blood Pressure
- Patient Position
- Electromyography

Figure 2. *E-Health v2.0 Platform and Biometric Sensors*

5. DESIGNING OF THE MODEL FOR SPORT MONITORING SYSTEM

Application was developed in the .Net Framework 4.5 with using C# programming language. The database of system was

developed in MS SQL Server. Data transactions between the application and database are operating with sql stored procedures. This system aims to help sport and health consultants. Therefore, only consultants have access to the system. Application consists following forms:

- Login
- Administrator
- User Information
- Vital Signs
- Vital Calculator
- Diagrams
- Report

6. USER INTERFACES

Login window is designed to access the system. (Fig. 3) This window requires the credentials of the users to secure the system. Unauthenticated users cannot access the system. These credentials belong only to health and sport consultants and are created through administrator form. (Fig. 4) User Information form allows consultants to add, delete and update the individual's information. (Fig. 5) Vital Signs form will be designed with continuous monitoring, controlling and analyzing of the vital signs during the physical activity. (Fig. 6)The Vital Calculator window calculates the amount of the daily calorie requirements, body mass index, body fat ratio and exercise heart rate zones. (Fig. 7) It gives feedback to consultants after comparing the results with target zones. In next form consultant can automatically make a report by selecting date ranges of recorded data of the individual. Diagrams form is designed to visually show the changes of vital signs. (Fig. 8)

Figure 3. *Login Form*

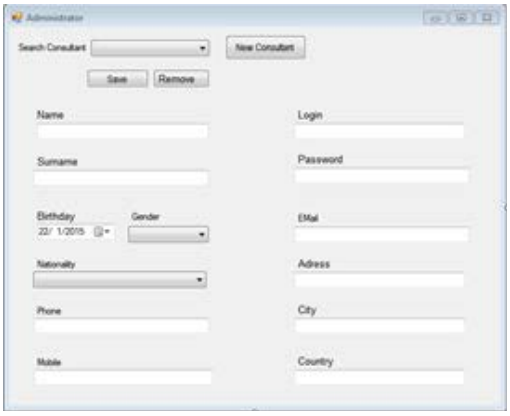

Figure 4. *Administrator Form*

Figure 5. *User Information Form*

Figure 6. *Vital Signs Form*

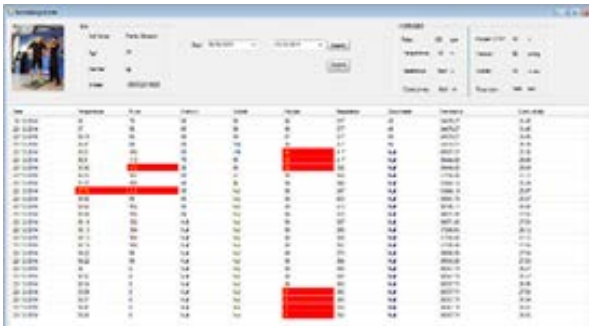

Figure 7. *Report Form*

Figure 8. *Diagrams Form*

7. DATA CONTROL AND PROCESSING UNIT.

Data control and processing are main unit of the health monitoring system. This unit controls the health status changes during sport activity and display all data in Vital Signs form. (Fig.9)

Developed algorithm controls the vital signs according to predetermined health limits by sport doctors. It will automatically warn the consultant if it detects data which is not in predetermined limit ranges. The sample of this procedure is shown in Figure 9.

Figure 9. *System Warning Test.*

After all processes system records information to the database. These processes are performed according to the flowchart in Figure 10.

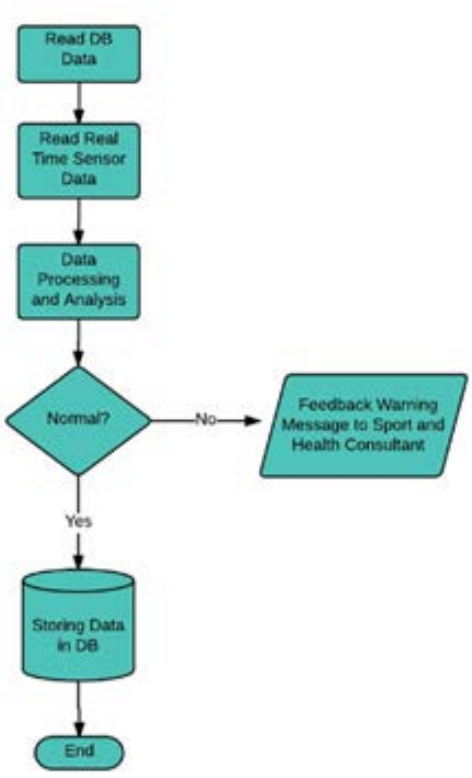

Figure 10. *Data control and Processing Flowchart*

8. WIRELESS COMMUNICATION UNIT.

In this module 3G internet platform is used to provide communication between sensor platform and application requires a high speed internet connection and communication with using WCDMA and HSPA cellular networks. This communication layer is designed according the flowchart in Figure 11.

9. CONCLUSION

This paper presents a technological solution for healthy sport life. It provides an easy way to health and sport consultants to keep control over individuals during sport activity. Sport monitoring system decreases the costs of check-up requirements after every sport day. By integrating this system as a sport consultant module to current sport applications, can make them more useful and safe for people.

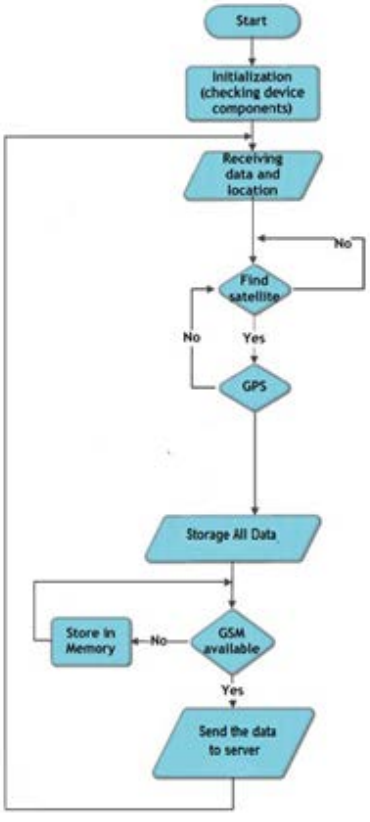

Figure 11. *3G Communication Flowchart*

REFERENCES

[1] Silberner, Joanne (June 7, 2010). "100 Years Ago, Exercise Was Blended Into Daily Life". npr.org. Retrieved 23 November 2010.

[2] Vasileios Exadaktylos, Daniel Berckmans and Jean-Marie Aerts . Non-Invasive Methods for Monitoring Individual Bioresponses in Relation to Health Management

[3] CasaDJ, Armstrong LE, Kenny GP, O'Connor FG, Huggins RA. Exertional Heat Stroke: New concepts regarding cause and care. Curr. Sports Med. Rep. 2012;

[4] Arduino Community Url: http://www.arduino.cc/

[5] Cooking hacks Url: http://www.cooking-hacks.com/documentation/tutorials/ehealth-biometric-sensor-platform-arduino-raspberry-pi-medical

Parviz Abbassov was born in Baku, Azerbaijan. Received his Undergraduate degree from Azerbaijan State Oil Academy and is graduating student from Computer Engineering Master program in Istanbul Aydin University.