ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΠΑΝΕΠΙΣΤΗΜΙΟ ΜΑΚΕΔΟΝΙΑΣ

Smart Biometric Devices: The technology that will save lives!

Department: Applied Informatics - Science and Computer Technology

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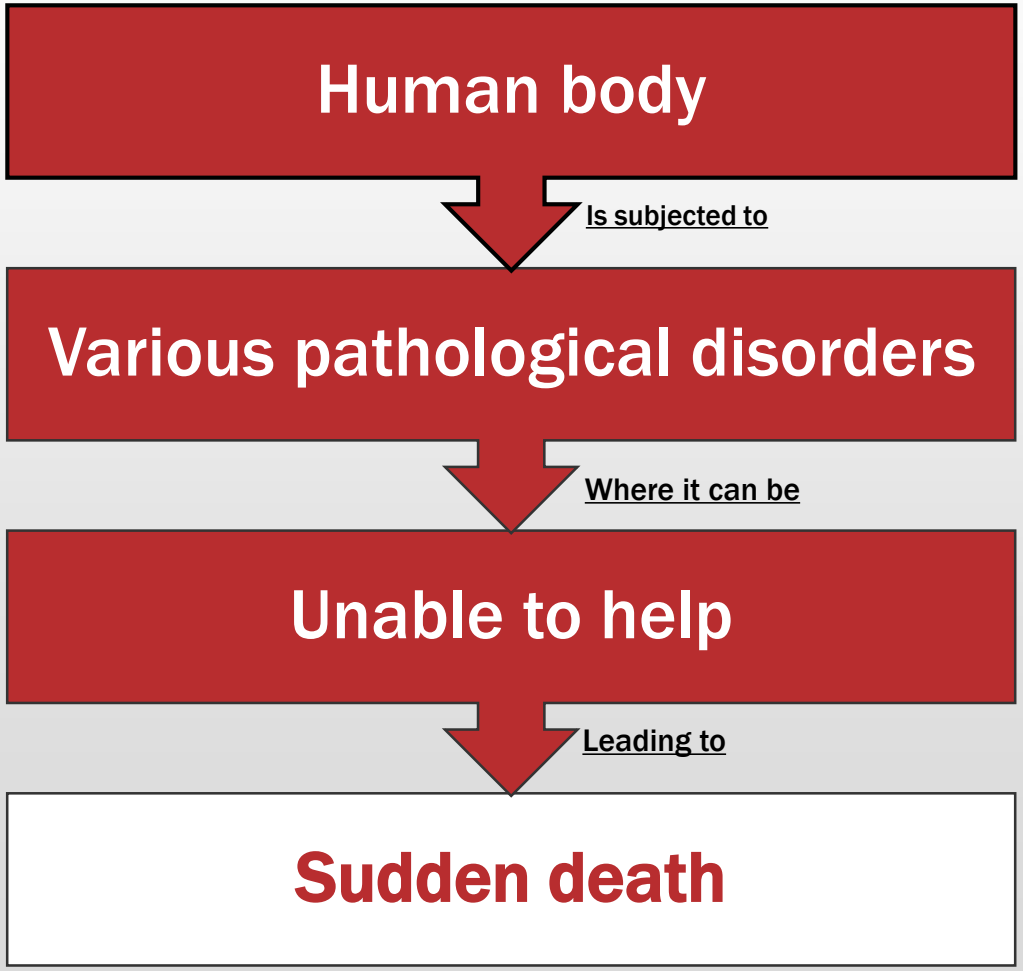
Purpose of the research

- Development of the health sector utilizing the possibilities offered by informatics.
- Meeting more and more human needs.
- Prevention and possible avoidance of sudden deaths.

Introduction to the Problem



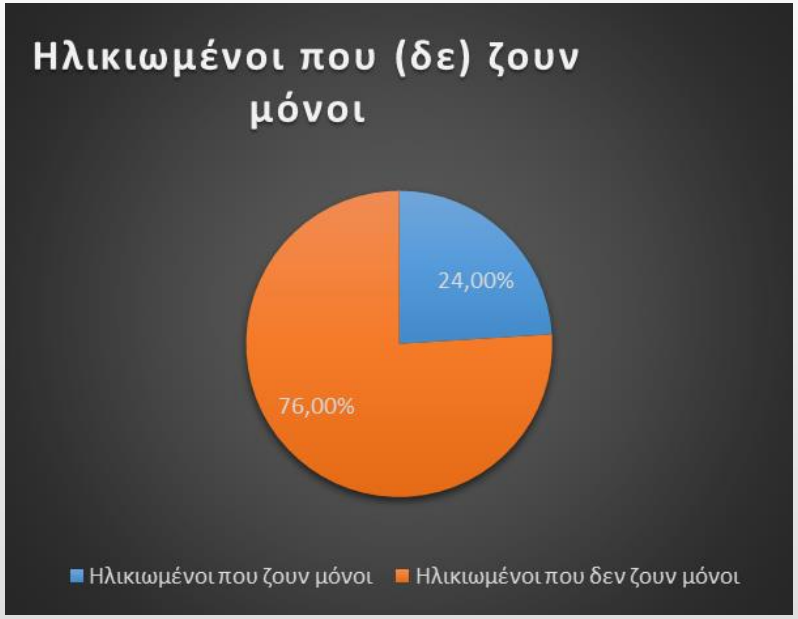
Detailed description of the problem

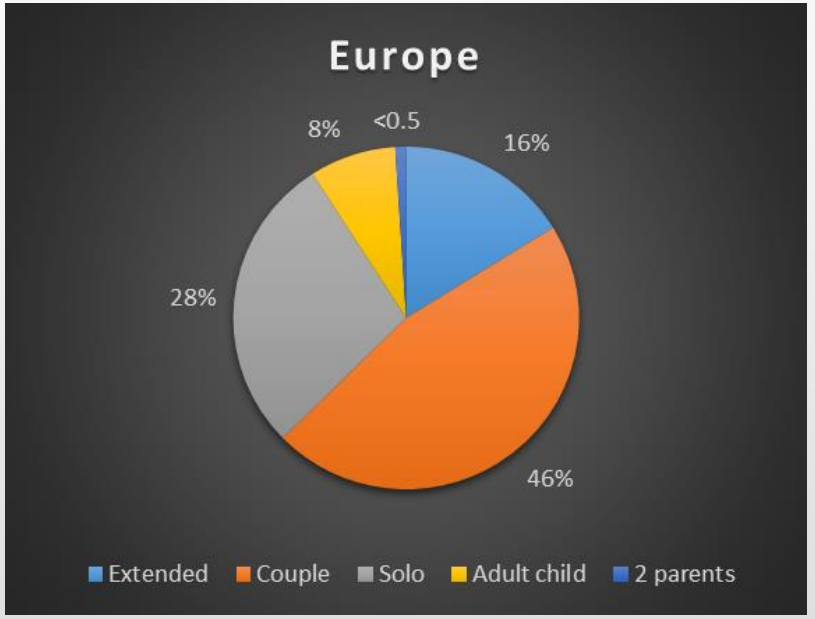
- Many elderly people and people with health problems are left alone, deprived of the necessary medical care when they need it.
- Athletes suffer from diseases they are unaware of and often reach their limits during competitions and training.
- Employees often put too much effort into their work, or engage in a profession through which they can put their lives in danger (eg security guards).

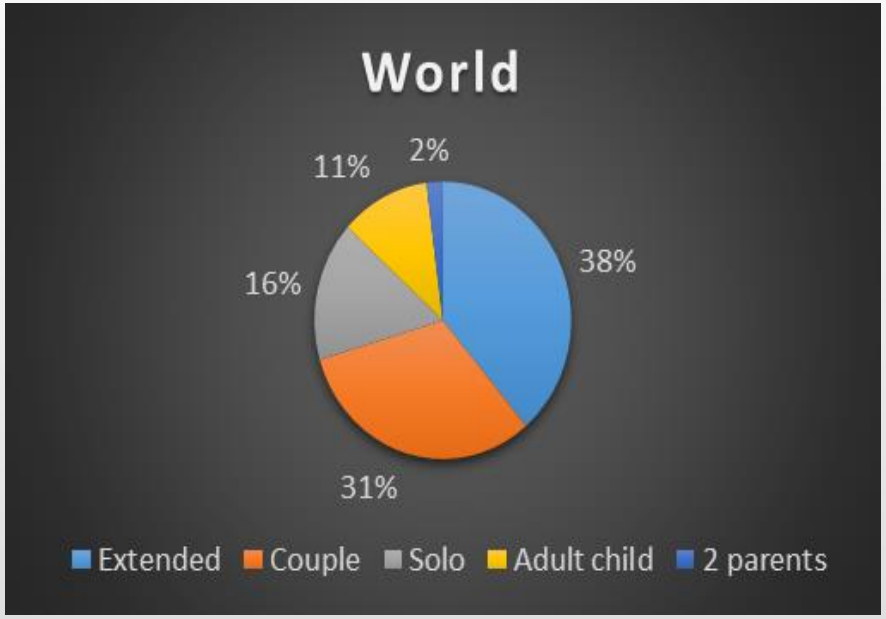
Such conditions can lead to health problems as well as healthy ones to an unexpected death.

- In Europe there are 3-4 sudden deaths per population of 2,000 people every year.
- Every year in the US 400,000-460,000 people die from sudden cardiac death in the Emergency Department or before they reach the Hospital.

Statistics of seniors living alone (1)

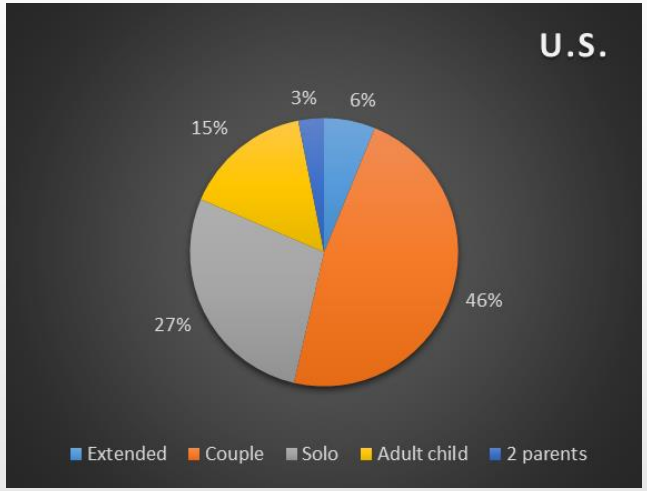


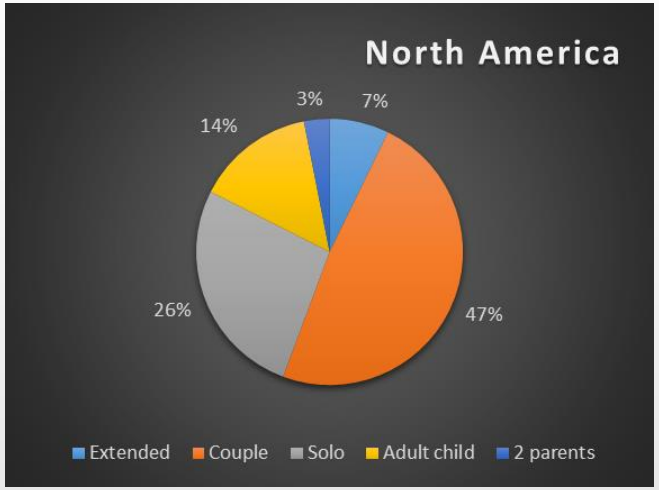


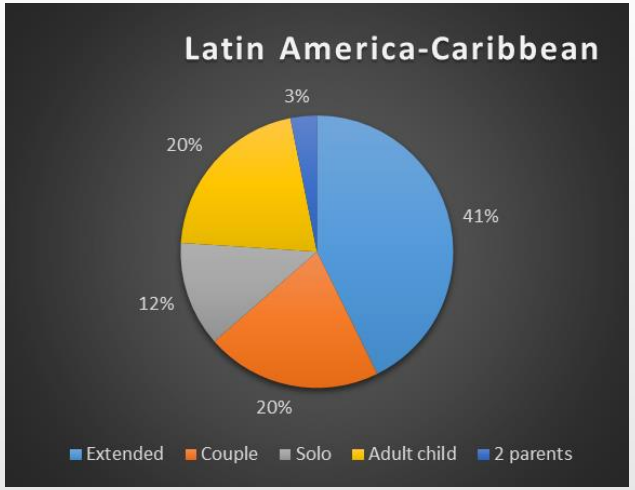


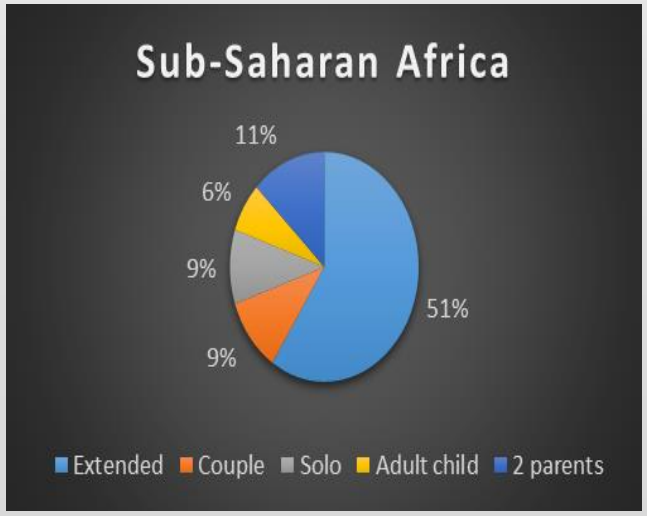
In Greece, 550,000 elderly people live alone, of which 529,000 elderly people are marginalized (80% have a chronic illness, while more than 53% have reduced their activities due to health problems).

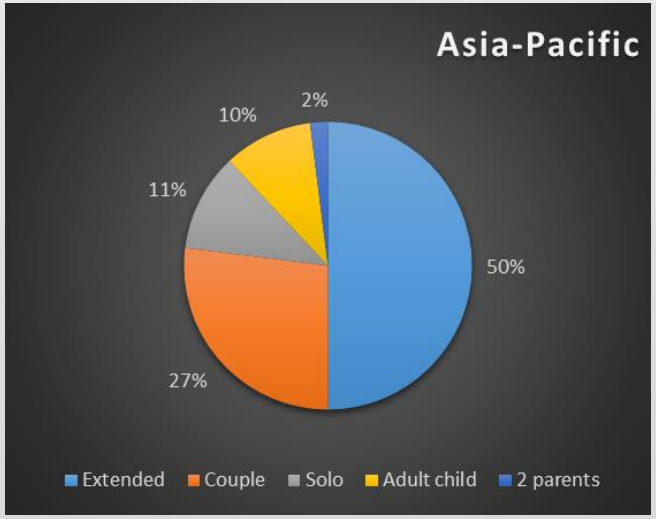
Statistics of seniors living alone (2)

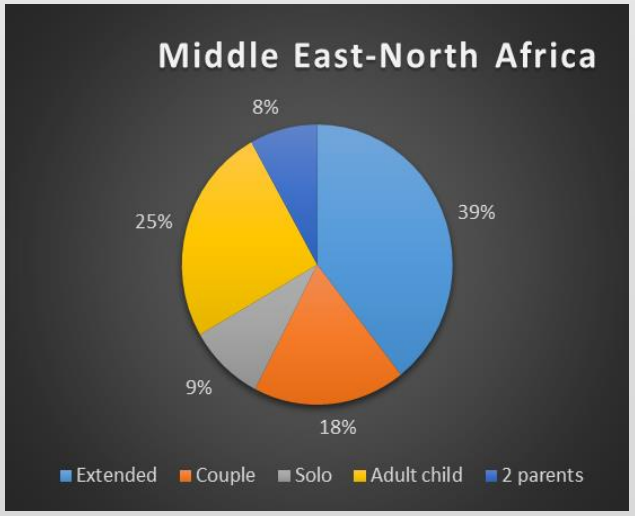












What is the human effort to solve the problem

Biometric devices:

Heart rate monitor

Blood pressure monitor

Thermometer

Oximeter

Biometric smartwatch

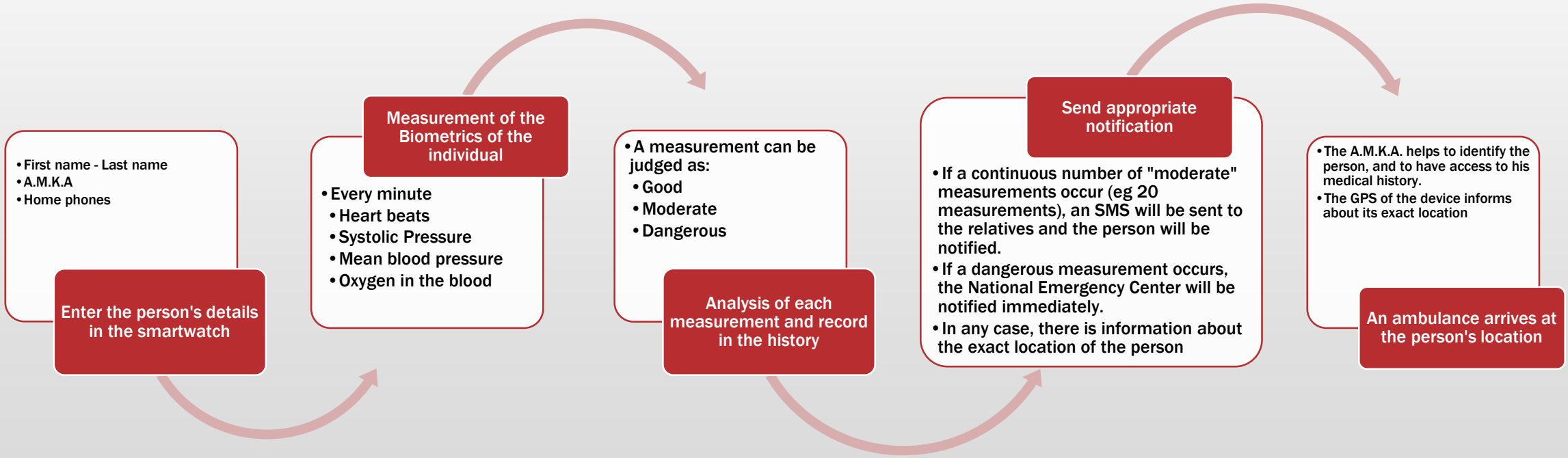
Emergency button
(panic button)

Introduction to our innovation

Detailed analysis of the proposal and methodology to be followed (1)

- The proposed solution is a biometric smartwatch to constantly draw the biometric measurements of the human body, which will be analyzed with appropriate software and based on medical criteria, will recognize if the person needs help. Thus, if the software determines that there is significant instability in human health, it informs itself as well as the National Emergency Center or its relatives, informing about its exact location.

Detailed analysis of the proposal and methodology to be followed (2)



Indicative algorithm for controlling metrics

```java
public String estimateSituationofMetric()
{

    if(oxygenMeasurement<=100 && oxygenMeasurement>=94)
    {
        situationOfTheMetric = "good";
    }
    else if(oxygenMeasurement>=90)
    {
        sumForMedium++;
    }
    else
    {
        situationOfTheMetric = "dangerous";
        return situationOfTheMetric;
    }
    if(systolicPressure<15)
    {
        situationOfTheMetric = "good";
    }
    else if(systolicPressure<20)
    {
        sumForMedium++;
    }
    else
    {
        situationOfTheMetric = "dangerous";
        return situationOfTheMetric;
    }
    if(meanArterialPresure<7)
    {
        situationOfTheMetric = "dangerous";
        return situationOfTheMetric;
    }
    else if(meanArterialPresure<=8)
    {
        sumForMedium++;
    }
    else
    {
        situationOfTheMetric = "good";
    }
    if(heartBeats>=60 && heartBeats<=80)
    {
        situationOfTheMetric = "good";
    }
    else if(heartBeats>80 && heartBeats<120)
    {
        sumForMedium++;
    }
    else
    {
        situationOfTheMetric = "dangerous";
        return situationOfTheMetric;
    }

    if(sumForMedium>=20) {
        sumForMedium = 0;
        return "medium";
    }

    return situationOfTheMetric;
}
```

This piece of code checks and judges whether the metric it receives as input is "good", "moderate" or "dangerous".

This code snippet,
depending on the alphanumeric to be accepted,
"Medium" or "dangerous", sends SMS to
relatives or notifies the state service respectively.

```java
public void informForSituation(String situation, Metric theMetric){

    if(situation.equalsIgnoreCase("medium")) {
        sendNotification.SendingSMSToHisHomes();
    }
    else if(situation.equalsIgnoreCase("dangerous")) {
        String message = "";

        String [] recievers = new String [1];
        recievers[0] = "ics20044@uom.edu.gr"; //email of the government agency that will receive its notifications.

        message = firstName+" "+surname+", with  A.M.K.A: "+amka+"\n"+"Location: ...."+"\n\n"+"Oxygen Measurement: "+theMetric.getOxygenMeasurement()+"\n"+
        "Systolic Pressure: "+theMetric.getSystolicPressure()+"\n"+"Mean Arterial Presure: "+theMetric.getMeanArterialPresure()+"\n"+"Heart Beats: "+theMetric.getHeartBeats();

        sendNotification.sendGmailToTheManagementCenter("[redacted]", recievers, "Άτομο κινδυνεύει", message);
    }
}

}
```

email αποστολέα password email

Indicative SMS notification algorithm

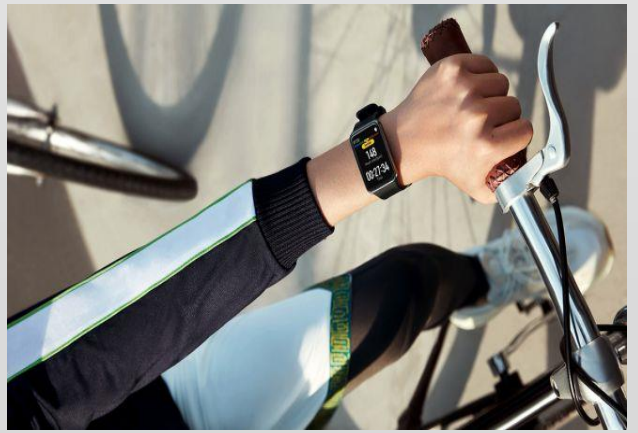
```
62
63      /*This method is responsible for notifying the relatives of the person wearing the device via SMS*/
64      public static void SendingSMSToHisHomes() {
65
66          try {
67              // Construct data
68              String apiKey = "apikey=" + "[redacted]"; //API key
69              String message = "&message=" + "Τα στοιχεία του ατόμου, μαζί με την ακριβή τοποθεσία του";
70              String sender = "&sender=" + "Παροχή Βοηθείας";
71              String numbers = "&numbers=" + "Οι τηλεφωνικοι αριθμοί των οικείων που θα δεχτούν το μήνυμα";
72
73              // Send data
74              HttpURLConnection conn = (HttpURLConnection) new URL("https://api.txtlocal.com/send/?").openConnection();
75              String data = apiKey + numbers + message + sender;
76              conn.setDoOutput(true);
77              conn.setRequestMethod("POST");
78              conn.setRequestProperty("Content-Length", Integer.toString(data.length()));
79              conn.getOutputStream().write(data.getBytes("UTF-8"));
80              final BufferedReader rd = new BufferedReader(new InputStreamReader(conn.getInputStream()));
81              final StringBuffer stringBuffer = new StringBuffer();
82              String line;
83              while ((line = rd.readLine()) != null) {
84                  stringBuffer.append(line);
85              }
86              rd.close();
87
88              //return stringBuffer.toString();
89          } catch (Exception e) {
90              System.out.println("Error SMS "+e);
91              //return "Error "+e;
92          }
93      }
94
95  }
96
```

This code snippet is responsible for informing them relatives via SMS that person is in danger.

https://www.textlocal.com/

Parameters taken into account by the software

- The smartwatch in case it is removed from the person's hand will not receive and therefore will not examine its biometric measurements, so that there is no wrong mobilization of the medical units. This will be achieved with a sensor that will detect if the smartwatch is worn.
- Depending on the weather conditions and the actions of the individual, the limits of biometric measurements can vary. For these special cases it is necessary to modify the limits of the metrics that appear in the algorithm presented taking into account for example, the speed at which the person moves, the ambient temperature, etc.



Software scalability

- In addition to the basic application of the software in the biometric smartwatch, it was possible to expand, and external biometric devices that are permanently placed in the body, to be connected wirelessly either with a simple smartwatch as well as with a smartphone.

- The data of the individual measurements are kept in a database, therefore in a software extension we could use these measurements to use machine learning to make predictions for the health of the individual in the future.

Areas that can be applied

Basic use

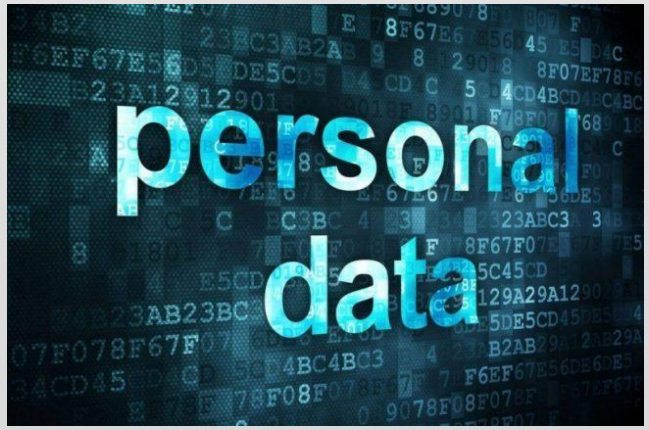
- For daily use, and especially for the elderly and people with health problems.

Expansion to other areas

- **Workplace**
  - Monitoring the health of employees
- **Sports**
  - Monitoring the health of athletes during training and competitions
- **Security Forces / Army**
  - In various missions where the uniformed people put their lives in danger, it will be possible to control and locate them (eg in a state of fire a firefighter may lose consciousness and there is no one near him to offer help) .

Ethics of our research and ethics

- The specific solution of our research fully meets the established rules concerning the protection of the personal data of each person. Every user of the proposed technology has no reason to be afraid to exploit their data for further reasons, as their data will only be used by the National Emergency Center and hospitals to monitor their personal health.



Conclusions

- Undoubtedly, the coverage of human health needs is a primary issue and therefore the continuous development of the health sector is considered necessary. The combination and utilization of existing technologies can contribute to the realization of our idea, in a short time, thus limiting the sudden deaths that affect the global community.

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End of Presentation!

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