Study & Implementation of an Integrated System for Recording the Actions of Individuals Outdoors

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Introduction

• Technology is present throughout the range of daily life's activities

• Improved quality of living
  ▫ Faster and superior fulfillment of needs
  ▫ Increased sense of security and protection

• Focus on vulnerable population groups
  ▫ Elderly and young children
Goals

- Implementation of an inexpensive, easily accessible and easy to use system
  - Web based application, GPS

- Identify the current location of people outdoors
  - Verify presence within prescribed limits
  - Trajectory recognition
Technology & Software

- .NET Framework 3.5
- .NET Compact Framework 3.5
- Windows Mobile 6 Professional SDK
- Virtual Earth Map Control SDK
- Virtual Earth Silverlight Map Control SDK
System Architecture

- Database for proper and efficient support of various functions
  - Archangel

- Application that runs on a windows mobile device
  - SmartDeviceArchangel

- Web based application to manage and monitor the actions of individuals
  - ControlArchangel & ControlArchangelSL
The database of the system

- **Users**: users’ personal data
- **Routes**: users’ routes
- **LatestPositions**: the three (3) last positions that each user was found
- **UserAvgStep**: the average step length of each user
Mobile device application

- **Training mode**
  - User walks around his regular places
  - Every point is transmitted to the server and we construct trajectories

- **Functional mode**
  - Current position is transmitted to the server every 30 seconds

- **Data collected**
  - Username
  - Latitude
  - Longitude
Management Application

- We built two (2) separate applications:
  
  - ControlArchangel, which is based on Microsoft Bing Maps and uses AJAX to execute the asynchronous communication with the server to fetch the geographical data
  
  - ControlArchangelSL, which is based on a new CTP of Microsoft and uses Silverlight with all the advantages that come with it
User's monitoring procedure (1)

• User’s possible states:
  - **Active**: User transmits his current location
    - **OnLimits**: User is within the limits of a known and fixed trajectory
    - **OffLimits**: User is outside of the limits
  - **Inactive**: User does not transmit his current location
User's monitoring procedure (2)

- States definition: OnLimits & OffLimits
  - For each user we define an average step based on his recorded trajectories in the system
  - Based on this value we create a "cloud" around each recorded trajectory
  - The system is personalized for each user
User's monitoring procedure (3)
User's monitoring procedure (4)

- User is Active.OnLimits:
  - We present the, up to 3, nearest points of the user's registered trajectories from his current location
  - Every point on one trajectory, trajectory match
  - Otherwise we record the occurrences and wait for the next sample
    - If in the next sample we have more than one trajectory’s points but only one trajectory that was present in the previous sample we conclude user’s current trajectory
ControlArchangel Application Presentation (1)
ControlArchangel Application Presentation (2)
ControlArchangel Application Presentation (3)

User Selection:
- Dasoulas Konstantinos

User Data:
- Surname: Dasoulas
- Name: Konstantinos
- Username: Gess

User Status:
- Active

User Trajectories: 2
- Show Last Position

Trajectory Data:
- User Average Step is: 57.32 meters.

Position near Current Position
- Distance: 20.78 meters from current position

User is on limits but we can not conclude the trajectory yet
ControlArchangel Application Presentation (4)
ControlArchangel Application Presentation (5)
ControlArchangelSL Application Presentation