MIDDLE EAST TECHNICAL UNIVERSITY

DEPARTMENT OF COMPUTER ENGINEERING

CENG491

REQUIREMENT ANALYSIS REPORT

Sirius Software

CONTENTS

1. INTRODUCTION

1.1. Background

Mountain climbing is one of the most popular activities. Although the idea of reaching a peak of a mountain attracts many people, climbing is one of the riskiest activities. It includes many potential dangers like weather, falling rocks and equipment failure. To minimize the risks and potential dangers and provide a safe environment to the mountaineers, the necessary precautions should be taken and an activity plan should be prepared.

Since climbing is a very risky activity, the activity plan should be prepared very carefully; many things like equipment list, weather and terrain conditions, experience and endurance of the team members should be considered simultaneously.

1.2. Project Goals and Scope

Our aim in this project is to develop a software which will provide the best activity plan that meets the given constraints for the selected mountain peak.

In the scope of this project;

- The user will give raster and vector maps in Digital Terrain Elevation Data, Digital Elevation Model or geotiff formats to the system. (*)

- The user will give the group member information such as endurance and experience of the member to the system.

- The user will give the weather information such as temperature, pressure, rainfall, season to the system.

- The user will give the available equipment list in document format so that the software will decide accordingly.

- The user will choose the constraints such as time, safety and distance and specify checkpoints if exists.

- Climb Planner Software will produce a report including an activity plan.

- The software will give an option to visualize the mountain in 3D and simulate the climbing.

(*) We will use the following web sites to find examples of those formatted maps:

- NGA Raster Roam , http://geoengine.nga.mil
- Digital Elevation Data , http://www.viewfinderpanoramas.org/dem3.html

1.3. Detailed Description of the Project

During the process of preparing an activity plan for climbing, various parameters should be considered simultenously.

According to our field research,

For deciding route:

- Weather information
- Elevation of the terrain
- Equipment list
- Member information

For camping plan:

- Nearness to the water source
- Not disturbing the natural life
- Time constraints are taken into account.

Considering the above parameters; the followings will be used as inputs:

- Group member information:
  - Endurance
    - Walking speed (km/h)
    - Climbing speed (m/h)
    - Need for rest
  - Experience

    The experience of a member will be represented as levels. For example a level 1 member has the least experience on climbing while a level 5 member has the most experience.

- Start and end points

- Terrain information

Terrain information will be obtained from digital maps given in raster and vector formats.

- Weather information

  Weather information will be entered manually.

- Constraints
  - Minimizing time
  - Safest route
  - Longest distance walked / day
  - Longest distance climbed / day
  - Passing through checkpoints

The followings will be the output of our software:

- Climb plan
  - Route
  - Estimated duration of plan
  - Equipment list

- Camping plan
    - Camp ground
    - Camping time & duration

- 3D visualization of the map

- Simulation of the climb

2. REQUIREMENTS

2.1. System Requirements

2.1.1. Hardware Requirements

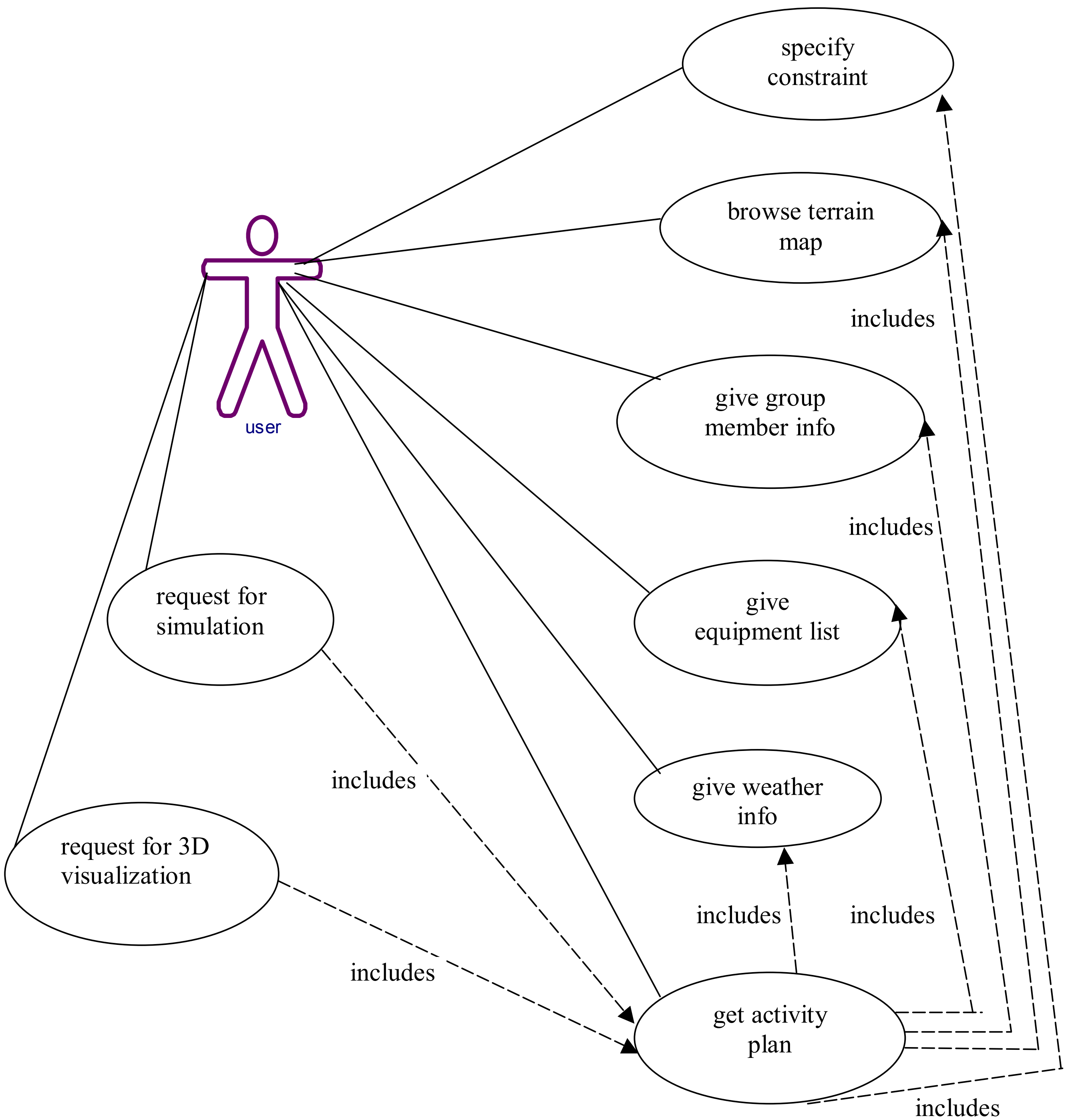
- 3D Graphics Card
- Minimum 512 MB RAM
- Hard Disk
- Internet Connection

2.1.2. Software Requirements

- Eclipse IDE
- GeoTools
- GDAL
- Nasa World Wind
- GRASS
- Windows and Linux Environment

2.2. User Requirements

2.2.1. Use-Case Diagram : Climb Planner



2.2.2 Functional Requirements

- *Browse Terrain Map*: A browser that shows map files in only specified formats appears, user chooses one of them.

- *Give Group Member Information*: From the 'Group Member Information Panel' user fills the necessary information (name, walking speed, climbing speed, need for rest, etc.) and presses 'ADD Button'. Then, the member is added to the system.

- *Give Equipment List*: In the 'Equipment List Panel' all possible equipments are listed. User can select/deselect equipments from the list. When 'Save Button' is pressed, the list is finalized.

- *Give Weather Information*: From the 'Weather Information Panel', user enters temperature, pressure, season and rainfall information to the system.

- *Specify Constraints*: In 'Specify Constraints Panel', there exists options like shortest route, safest route, longest distance walked/day, etc. Entering checkpoint coordinates and clicking 'ADD Button' adds those checkpoints to the system as constraints. User can choose more than one constraints.

- *Get Activity Plan*: By using all the specified information, the software prepares an activity plan that meets the constraints and consists of a climbing route and camping plan. By clicking 'Get Activity Plan Button' the prepared plan is saved.

- *Request for 3D Visualization*: After getting the activity plan, user can optionally request for 3D visualization and save the image.

- *Request for Simulation*: After getting the activity plan, user can optionally display the simulation of the plan and save it.

2.2.3 Non-Functional Requirements

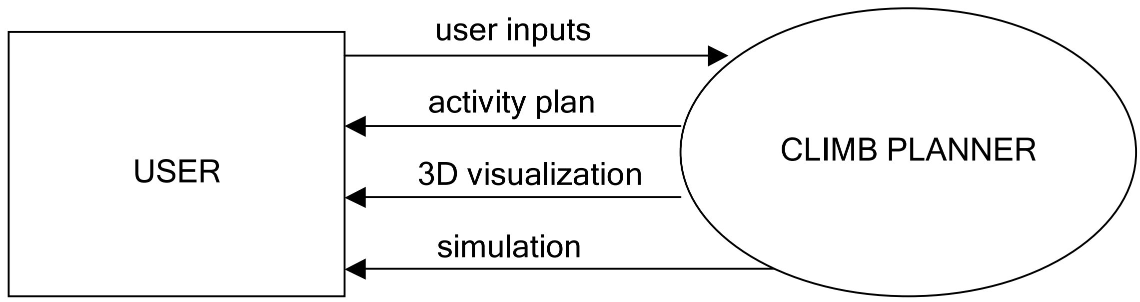
- *Usability*: Climb Planner will be an easy to use application for mountaineers.

- *Reliability*: Taking various factors into account, our program will provide the most optimized plan to the user.

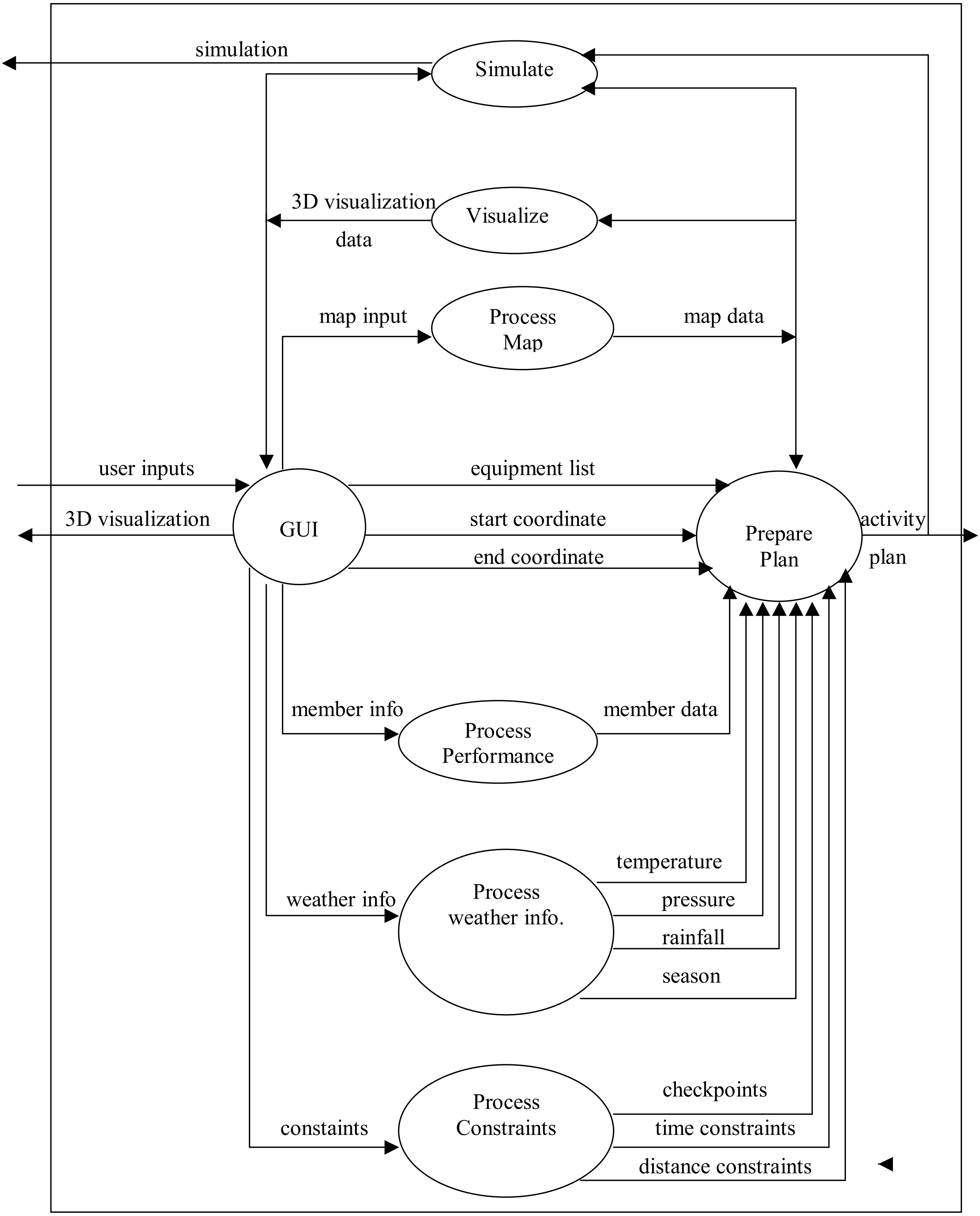
- *Performance*: Since the target application is not time critic, our priority is to provide the best plan to the user. Of course, we will do our best for an acceptable performance.

3. FUNCTIONAL MODELING : Data Flow Diagrams

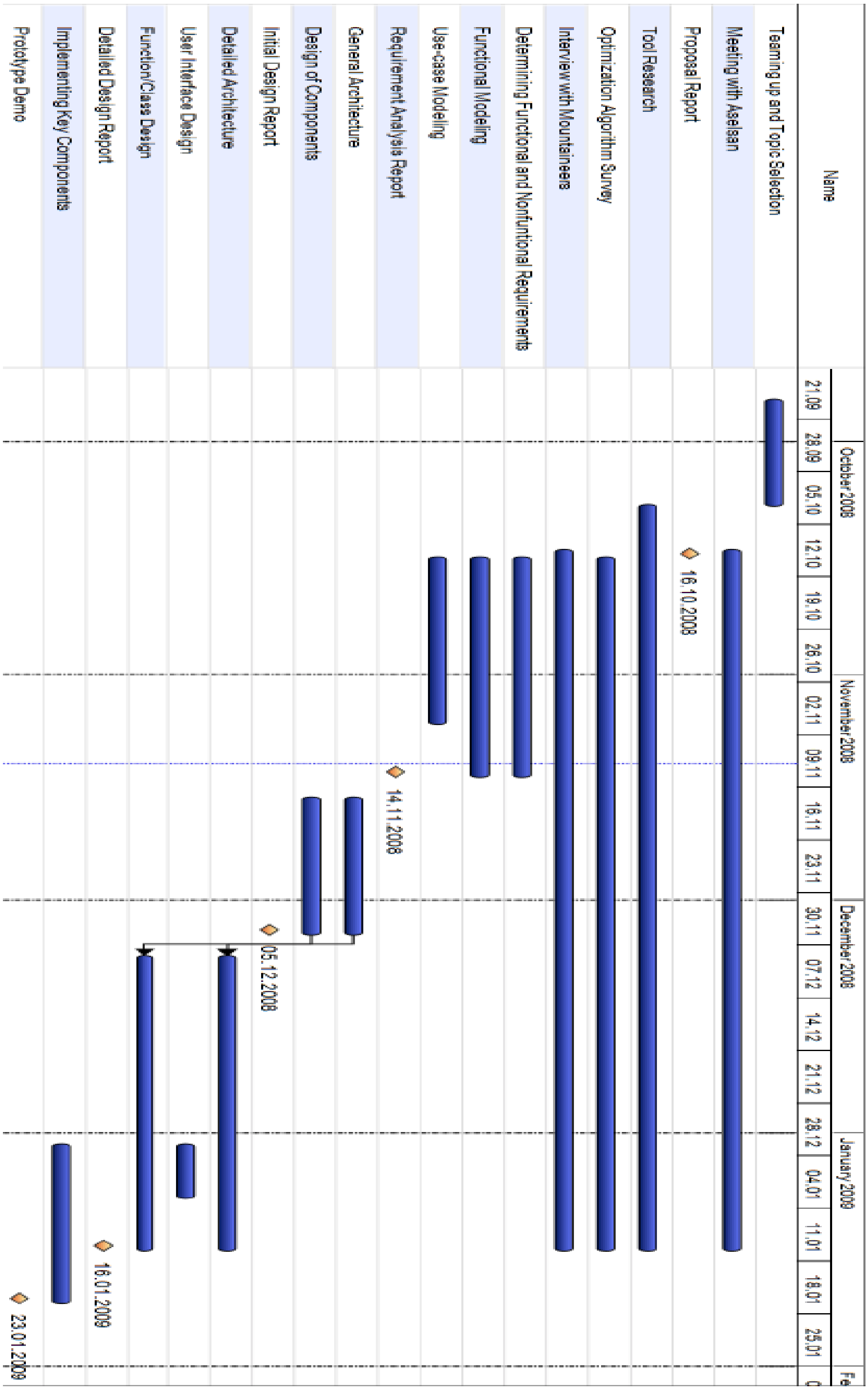
3.1. Data Flow Diagram : Level 0



3.2. Data Flow Diagram : Level 1



4. GANTT CHART



5. PROCESS MODEL

We will follow step by step program. We will do analysis, initial design, detailed design, prototype, implementation, testing and debugging. So, during the development of Climb Planner Software, we will adopt the Waterfall Model.

6. LITERATURE SURVEY

6.1. Interview with Mountaineers

We need information about climbing issue for this project. So, we have made some interviews. First, we have talked with ODTU DKSK. They mentioned about some general concepts about mountain climbing. They described how they make their plan and how they determine the equipment lists.After these general informations, we need to learn detailed information. Hence, we contacted with Zirve Mountain Climbing and Winter Sports Club. They welcomed us. The club's instructor whose name Hasan Hüseyin Boğaz shared his experiences with us. They mentioned about how they climb. We learned important issues about climbing. Some of these are below;

- The best climbing team has two or three people.
- There should be different special shoes for soft/hard earth, snow and climbing.
- The equipment list should be short as possible because carrying equipment is hard in mountain.
- If mountaineers will camp, they should take camping equipment with them.
- Risk depends on the slope,mountaining knowledge, weather conditions and if there is, the state of snow.
- Rocky places hold the snow, so the avalanche risk insreases.
- The shoulders are safest places for climbing, etc.

We will also interview with Tunç Fındık who is the one of best mountaineers in Turkey. He said, now he was at Himalayas. After November 18, he will be in Turkey and we hope to interview him and learned more about mountain climbing.

6.2. Tools and Libraries

6.2.1. GeoTools

Available at : http://geotools.codehaus.org

GeoTools is an open source (LGPL) Java code library which provides standards compliant methods for the manipulation of geospatial data, for example to implement Geographic Information Systems (GIS). The GeoTools library implements Open Geospatial Consortium (OGC) specifications as they are developed, in close collaboration with the GeoAPI project.

6.2.2. GDAL

Available at : http://en.wikipedia.org/wiki/GDAL

GDAL is a translator library for raster geospatial data formats that is released under an X/MIT style Open Source license by the Open Source Geospatial Foundation. As a library, it presents a single abstract data model to the calling application for all supported formats. It also comes with a variety of useful command line for data translation and processing. The related OGR library (which lives within the GDAL source tree) provides a similar capability for simple features vector data.

GDAL/OGR is considered a major project in the Open Source and also in the commerical GIS community due to its widespread use and comprehensive set of functionalities.

6.2.3. NASA World Wind

Available at: http://worldwind.arc.nasa.gov/

World Wind is an open source program which is developed by the National Aeronautics and Space Administration (Nasa). It allows user to zoom from satellite altitude into any place on Earth, leveraging high resolution LandSat 7 imagery and Shuttle Radar Topograph Mission (SRTM) elevation data to experience Earth in visually rich 3D. LandSat 7 is a collection of images at an impressive 15 m per pixel resolution. Combining LandSat 7 imagery with SRTM data, World Wind can display a view of the Earth at eye level. Users can literally fly across the world in any direction. With World Wind, user can view rainfall, barometric pressure, cloud cover, etc. It has a variety of visual guides that help user such as longitude and latitude lines, as well as precise coordinate data.

World Wind is a Java technology component that can be integrated into GIS applications to incorporate 3D earth modeling. World Wind does all the hard work, such as dynamic image selection and retrieval for images of the earth's topography. Since it is an open source software, user can incorporate the component into his/her application to bring together his/her own data with data from other companies, or to use NASA data in new and innovative ways. For instance, World Wind can be use to create flight simulators, using earth or other planets, or it can be used to view data on specific diseases worldwide. The documentation is quite good. We are planning to use Nasa World Wind, in the development of 3D visualization and simulation parts of our project.

6.2.4. GRASS

Available at: http://grass.itc.it/

GRASS (Geographic Resources Analysis Support System) is a Geographic Information System (GIS) used for geospatial data management and analysis, image processing, graphics/maps production, spatial modeling, and visualization.

GRASS contains over 350 programs and tools to render maps and images on monitor and paper; manipulate raster, vector, and sites data; process multi spectral image data; and create, manage, and store spatial data. GRASS uses both an intuitive windows interface as well as command line syntax for ease of operations.

GRASS is an open source project and has GNU General Public License (GPL). It can't be directly hosted on Windows but still a Cygwin version exists. It is written in ANSI-C, and has a prilaminary C++ interface. Hovewer, the weak point abount GRASS is that it is developed by voluntary people and the documentation is quite poor.

6.2.5. DSOL

Available at: http://www.simulation.tudelft.nl/

DSOL is an open source, java based, suite for continuous and discrete event simulation, developed at TU Delft, in the Netherlands. Among its general features: distributed 2D and 3D animation supported, various random number generators, GIS/CAD files supported, statistics, charts included. Continuous simulation is facilitated thanks to: numerical integration of n-th order ordinary differential equations with various numerical integrators supported; realtime clock simulator for Emulation. In discrete event simulation event scheduling is specified through scheduled method invokation and the Single threaded Process Interaction formalism is specified. It implements a flow "formalism" (Arena-like).

6.3. GIS File Formats

Available at : http://data.geocomm.com/helpdesk/formats.html

A GIS file format is a standard of encoding geographical information into a file. They are created mainly by government mapping agencies (such as the USGS) or by GIS software developers.

Popular GIS file formats are raster formats, vector formats and grid formats.

- Vector Formats

Many GIS applications are based on vector technology, so vector formats are the most common. They are also the most complex because there are many ways to store coordinates, attributes, attribute linkages, database structures, and display information.

- Raster Formats

Raster files generally used to store image information, such as scanned paper maps or aerial photographs. They are also used for data captured by satellite and other airborne imaging systems. Images from these are often referred to as remote-sensing data. Unlike other raster files, which express resolution in terms of cell size and dots per inch (dpi), resolution in remotely sensed images is expressed in meters, which indicates the size of the ground area covered by each cell. DEM and GeoTIFF are common raster file formats.

6.4. Optimization Algorithms

Here we list the optimization algorithms we may need to use:

- Cutting-plane method
- Graph Algorithms such as Traversals , Search and Maximum Algorithms
- Hill Climbing Algorithms
- Genetic Algorithms
- Local Search Algorithm
- Quasi-Newton Method