



**MIDDLE EAST  
TECHNICAL UNIVERSITY**

**DEPARTMENT OF COMPUTER ENGINEERING**



***COSS***

*Computer Oriented System Solutions*

**SENIOR DESIGN PROJECT  
REQUIREMENT ANALYSIS REPORT**

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# **1. INTRODUCTION**

## ***1.1ABOUT THE REPORT***

In first part of report there will be background information about wireless connections and AP-400. Next titles give brief information about project goal and scope. In second section we describe our team structure and hierarchy. Next section will inform about the researches, interviews and questionnaires done. However in the market there are not so many samples related to our project.

Then, there will be the core of this report, project requirements. In this part, we will consider what we will need for accomplishing the project with best features. Next modeling part takes place. Data, process and behavioral modeling planned in project explained with details. In next section we will have our planned works, Gantt chart.

## ***1.2BACKGROUND INFORMATION***

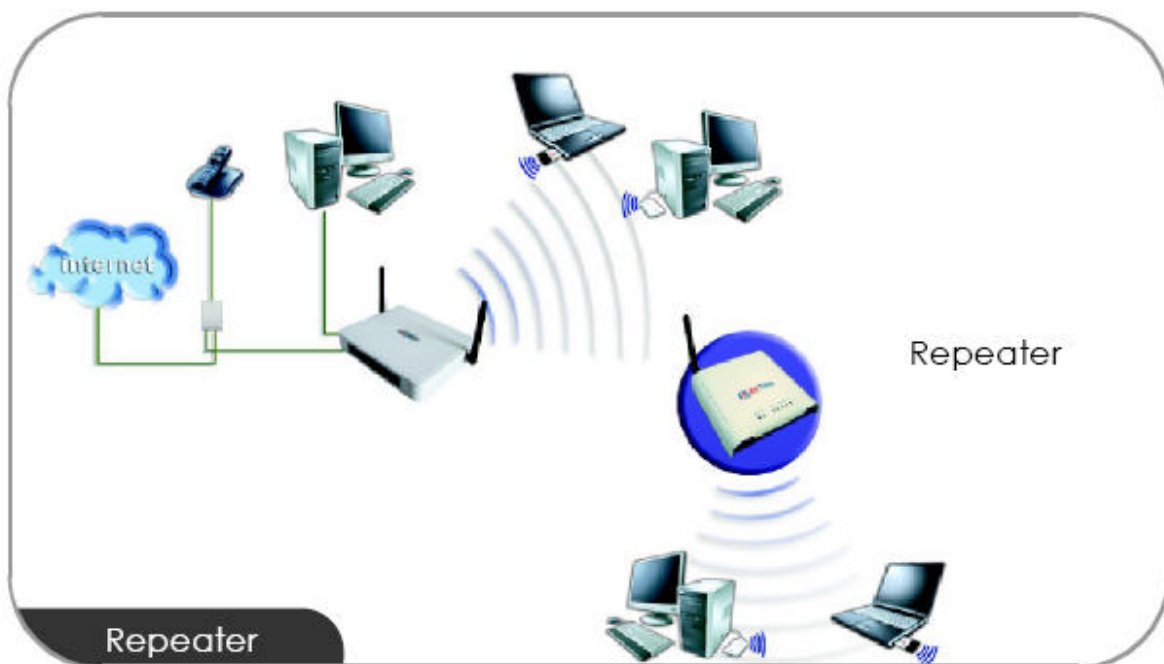
Millions of people around the world use the Internet every day -- to communicate with others, follow the stock market, keep up with the news, check the weather, make travel plans, conduct business, shop, entertain yourself and learn. Staying connected has become so important that it's hard to get away from computer and Internet connection because one might miss an e-mail message, an update on his/her stock or some news that needed to know. With the business or personal life growing more dependent on electronic communication over the Internet, people might be ready to take the next step and get a device that allows accessing the Internet on the go. That is where wireless Internet comes in.

Countless number of companies and their products are already in the market and many others are in the development state, waiting for the time to appear in the market to have their own share of it. That is where AirTies and AP-400 comes in.

## ***1.3ABOUT AP-400***

- IEEE 802.11b/g compliant, 54Mbps Wireless Access Point, Repeater, Bridge
- Fully compatible with 802.11b/g wireless devices
- AirTies Mesh Technology support
- Used as a "Wireless Bridge", ability to include wired devices with an Ethernet interface in the wireless network
- Wireless operating ranges of up to 400 meters outdoors and 100 meters indoors

- Advanced wireless security with support for WPA2, WPA, WEP and 802.1x standards
- High performance through the use of the latest chip technologies
- With "Auto MDI/MDIX", it automatically detects straight and cross Ethernet cables
- Easy to use Web-based user interface
- Automatic local IP address assignment by the DHCP server
- Firmware updates through the web interface
- 24x7 technical support by the highly trained AirTies Technical Support backed up by the AirTies R&D team



## ***1.4PROJECT DEFINITION AND GOAL***

AP-400 has the capabilities of wireless access point, bridge and switch. It has an embedded Linux operating system. One can see the connection information only when it is plugged in to a PC. To indicate which features are in operation we will add an LCD to AP-400. This feature eliminates the need for advanced software and status-monitoring procedures typically needed through the use of a computer. We will use a button based control system to circulate information shown on the display.

## ***1.5PROJECT SCOPE***

Primarily, we will have an AP-400 with LCD functionality. The basic functions shown on LCD will be:

- How many connections there are
- IP's of connections
- Current connection speed

Secondarily objectives are:

- Using high resolution LCD to have better user interface.
- Ability to warn by sound effects
- Displaying the amount of data flow for specific periods of time.

## **2. TEAM ORGANIZATION**

### ***2.1TEAM STRUCTURE***

We prefer Democratic De-Centralized type of team structure. In this structure there is no leader; decisions are given by group consensus. So communications between team members are of the same level.

This structure provides us to be more productive and to learn faster. The disadvantage of our structure is that it takes more time than the centralized structures. Because of this problem we plan all tasks carefully so that time schedule will not be exceeded.

Our team philosophy is ***"Together Everyone Achieves More"***.

## **2.2 TEAM ROLES**

We've given roles to the group members according to what their personalities best fit.

Gözde KIRDAR: Is the optimist of the group. She is the key to overcome hard times, when the individuals fall into despair about the project and need a refresh. She is also a summarizer.

Kürsat ÖZER: Is the communicator of the group. Communication between the group members and the course assistant is his responsibility. He is like a bridge between the group members.

Emre KOSTUR: Is the pessimist of the group. He is responsible for waking up the group from their sweet dreams about the project. He also controls the members' responsibilities whether they are finished on time or not.

Ümit SIVRI: Is the creator of the group. He finds new ideas to the project and comes with alternative ways to solve the problems. He is also a summarizer.

## **3. MARKET RESEARCH**

### **3.1 LITERATURE SURVEY**

#### **3.1.1 Belkin N1 Vision**

##### Overview

The N1 Vision wireless router offers an easy way to view network's broadband speed, computer bandwidth usage, and the status of connected devices - all from an easy-to-read display.

Packaged in a new sleek and sophisticated design, N1 Vision offers a good in networking performance with its wireless 802.11n 3x3 radio design and wired gigabit ports. The N1 Vision wireless router continues Belkin's commitment in providing the best user experience in the home market through its Plug-and-Play "CD-less" installation and simple network security setup.

##### Features

- Interactive Status Display shows network's broadband speed, computer bandwidth usage, the status of connected network devices, and more.
- Plug-and-Play CD-less setup
- Easy Security Setup with support for Wi-Fi Protected Setup™ and Multiple SSID

- 802.11n draft 2.0 compatible - 3x3 radio design provides excellent speeds and complete wireless coverage
- 4 Gigabit Ports

### General Information

**Interactive Display:** The interactive display is on the front of the N1 Vision, which indicates which features are in operation.

**4-Way Keypad:** The keypad enables the movement of the up, down, left, and right function that may apply to the screen shown in the interactive display.

**OK Button:** For most screens in the interactive display, the “OK” button will activate the desired feature.

**Menu Button:** Pushing this button will take back to the Menu Screen within the interactive display.

### Interactive Display

The N1 Vision’s interactive display is a powerful instrument for viewing network information. The display can provide essential router-status information such as the state of the Internet connection to details such as each device usage and speed of the Internet connection. Within the numerous features of the display, there are also built-in help guides and tips for troubleshooting.

### **Startup Screen**



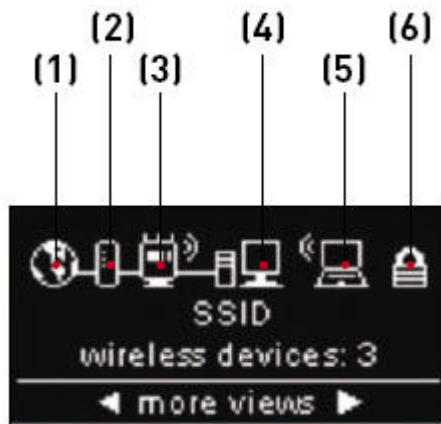
Once the N1 Vision has been plugged in, the “Startup” screen will appear to indicate that the N1 Vision is currently in the boot-up state.

### **Information Screens**

After the N1 Vision has finished starting up and the Plug-and-Play Router Setup process has been completed, the first in a series of informational screens will appear. These screens show the network status. Push the right key (>) or the left key (<) to cycle through them. The following outlines the details on each.



## A. Network Status



Once the N1 Vision has been plugged in, the “Startup” screen will appear to indicate that the N1 Vision is currently in the boot-up state.

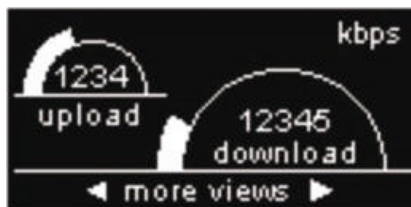
1. Internet Connection
2. Modem Connection
3. N1 Vision (Router) Wireless State
4. Wired Computers
5. Wireless Computers
6. Security

## B. Broadband Download Speedometer



This screen will display the current download speed being transferred through the Internet connection. The speed will be measured on the speedometer against the fastest speed that has been measured by the N1 Vision since being activated.

## C. Broadband Upload/Download Speedometer



This screen will display the current upload and download speed being transferred through the Internet connection. The speed will be measured on the speedometer against the fastest speed that has been measured by the N1 Vision since being activated.

## D. Connections/Speed

Connections / Speed	
Jan's_Laptop	2316 k
DELL_LTXP	245 k
HP_2600	0 k

At the bottom, there is a 'more views' button with left and right arrows.

This screen displays all devices currently connected to the N1 Vision and the speed of the broadband data that is being downloaded or uploaded per each device.

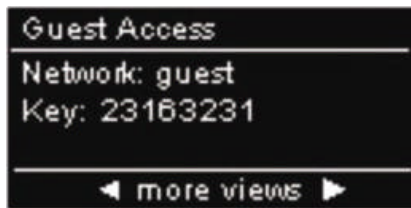
## E. Usage Past 24 Hours

Usage past 24 hours	
DELL_LTXP	6.5 M
Jan's_Laptop	4.2 M
Kids_Mac	.8 M

At the bottom, there is a 'more views' button with left and right arrows.

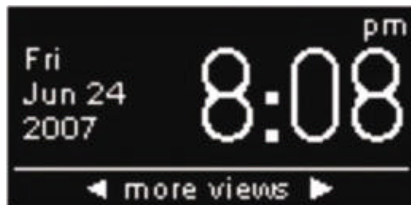
This screen displays all devices currently connected to the N1 Vision and their broadband usage over a period of 24 hours.

## F. Guest Access Status



This screen indicates whether guest access is enabled or disabled.

## G. Date & Time



This screen displays the date and time. To toggle between standard and military time, push the up or down key.

## Menu Screen



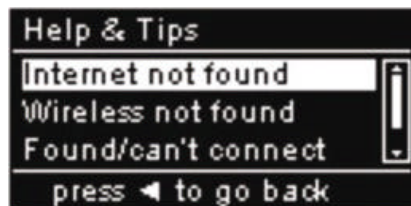
Push the “Menu” button to open the display’s Menu options. The Menu option allows the user to enable features within the N1 Vision. The following outlines the details of each feature within the Menu section.

### A. Wireless Security



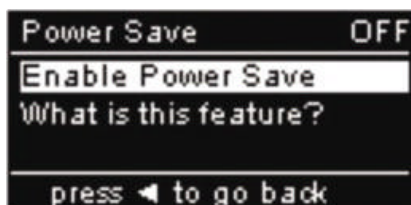
Select Wireless Security by pressing the “OK” button to view these options. From the Wireless Security options, the choices available are listed on the figure left.

### B. Help and Tips



Select this option for additional information.

### C. Power Save



Select this option to conserve the display’s power or if you prefer to turn off graphics. When power save is ON, the display will turn off within two minutes after any user interaction.

### **3.1.2 D-Link DIR-660 Limited Edition Xtreme N Gbit Router**

#### Overview

Introducing new cutting edge technology, D-Link raises the bar once again by incorporating the industry's first OLED display on the router that monitors the network activity. Created around the idea of "You can never have too much information" the Network Activity Display provides time-saving benefits for network specialists and the casual network administrator alike. With a luminous and vivid display, pertinent information will be relayed to the user on-demand. Whether user wants to monitor network's health or is unsure of network settings, user can quickly check all of the router security types, network connectivity, wireless network names, and other settings.

Features that have made D-Link excel above its competitors are included with the DIR-660. Gigabit WAN and LAN ports combined with the D-Link award-winning QoS Engine and Intelligent QoS technology continue to bring rich Internet content to the PC—lag-free and jitter-free. The wireless technology embedded in the DIR-660 is no slouch either. Incorporating D-Link Xtreme N technology, speeds are up to 14x faster and provide 6x the range when compared to 802.11g. Legacy 802.11g and 802.11b devices need not worry. Not only is it backward compatible, the DIR-660 actually improves wireless efficiency in legacy devices. Intelligent QoS helps to enrich user's wireless experience wherever user is in home - regardless of the equipment. The DIR-660 knows that the movie or music streaming gets priority over traditional file downloads—with no compromise to speed. It provides clear and enhanced audio when making VoIP calls and scorching fast page loads while surfing the web.

Since security is a large concern for networks, the DIR-660 provides the strongest level of wireless protection available today: WPA2™. The defense does not stop there. The Internet can be a cesspool of viruses ready to invade your home and hackers looking to steal your identity. To help combat these potential threats, the DIR-660 provides with Dual Active Firewalls and a host of harm negating features to keep the information where it belongs. Whether accessing e-mail, surfing the web, chatting online, streaming multimedia content; the D-Link Limited Edition Xtreme N Gigabit Router is the perfect cornerstone for network.

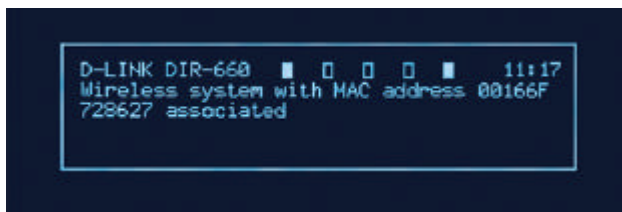
#### Xtreme N™ Router Benefits

- Intelligent Wireless Prioritization Technology.
- Xtreme N technology allows for farther home coverage.
- Network Activity Display for on-demand network information.

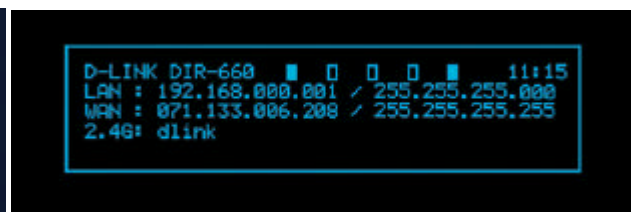
- Secure your wireless network using advanced WEP™, WPA™, or WPA2™ encryption.
- Easy to get started with D-Link's new Quick Router Setup Wizard.
- Supports Good Neighbor Policy – will not interfere with other wireless networks.
- Backward compatible with 802.11g and 802.11b devices including game consoles and digital media players.

### Some figures from DIR-660

LCD Screen Displays MAC Address



LCD Screen Displays LAN & WAN



### 3.1.3 D-Link DGL-4500 Xtreme N Gaming Router

#### Overview

The D-Link® Xtreme N™ Gaming Router (DGL-4500) is a device built especially for gamers. Experience the power of our Xtreme N Duo™ wireless technology for data transfer rates of up to 300Mbps and Gigabit LAN and WAN Ports to get the game on faster than ever before. In addition there exists an updated version of GameFuel™ technology to get the game going smoother. It also provides in a high-performance CPU and a Network Activity Display to give a serious gaming router.

Nothing ruins a frag-fest faster than lag. GameFuel allows user to customize the network settings to prioritize game traffic so other users do not hog all the bandwidth.

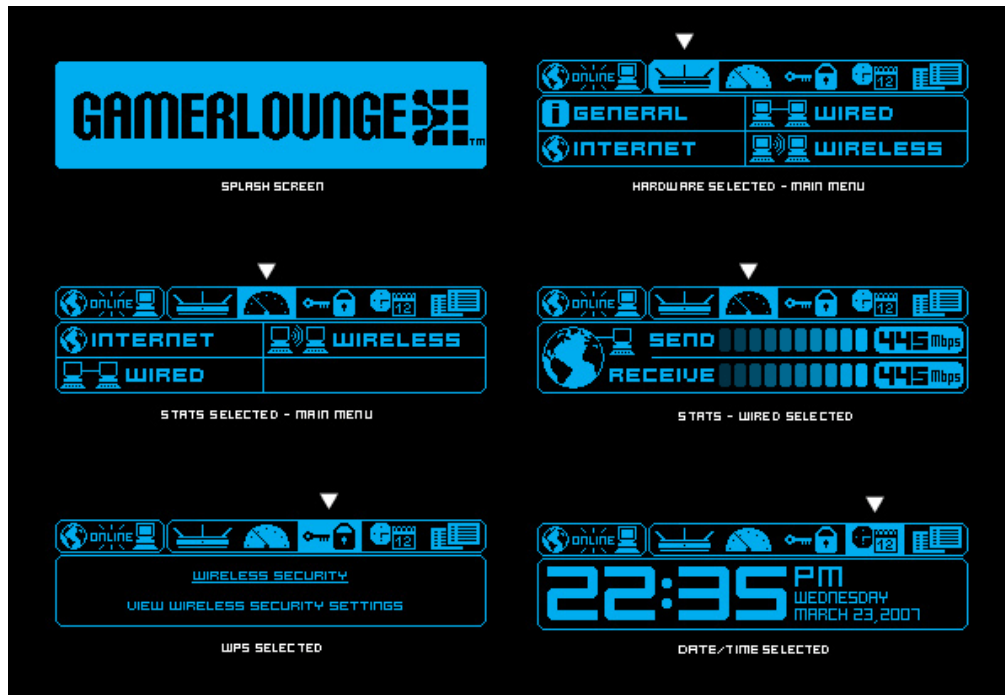
A Network Activity Display is included to show what is going on with the router. Checking the Internet, LAN, WAN and other various settings all from one screen is possible. Also a clock is included in the product so that spent time while playing the game can be seen.

With Xtreme N Duo technology the router also has the power of dualband (2.4 or 5GHz) wireless signals to get the game on in the wireless band of choice.

Push the limits of networking technology and experience the evolution of gigabit speed. Share broadband Internet, boost network performance and stay competitive in online games.

Built with the gamer in mind, the Xtreme N Gaming Router (DGL-4500) combines GameFuel technology, Gigabit ports, high-performance CPU, and the new Network Activity Display to give user a user-friendly gaming router.

## Some figures from DGL-4500



## 3.2 INTERVIEW AND QUESTIONNAIRE

### 3.2.1 Interview with Alper KILIÇ

Since we do not have much experience about such an embedded project, we decided to talk someone who is experienced in this field. Therefore we arrange a formal meeting with Alper KILIÇ who is an assistant at METU Computer Engineering Department. One person from the team, Emre, is assigned to make this interview. Before going to the meeting, some questions were prepared and the meeting proceeded according to our questions. The meeting with Alper KILIÇ was performed on 02.11.2007 at METU Computer Engineering Department in his office. This useful meeting took approximately fifteen minutes. First, purpose and description of the project was explained to him. Since he does not have any experience about AP-400, some features of AP-400 were explained.

First subject we discussed was how to obtain statistics from AP-400. Since chip on AP-400 is mostly used for other purposes, he advised us to use another chip like PIC16F877 to monitor gathered statistics. The purpose of using PIC16F877 is that we are familiar to this chip from CENG 336 and it has needed features like RS232. He reminded us that we could use CENG 336 PIC Development Tool (PICDEV) at first phases of the project. Chip of AP-400 and PIC16F877 will communicate over RS232. Some information will be wanted by

PIC16F877 via RS232, and then gathered information will be sent again via RS232. This information must be decoded such that both chips can understand which information is wanted or sent.

Second subject was how to monitor gathered information on LCD. He explained that we would write a protocol between PIC16F877 and LCD to show collected statistics. This protocol will be like last year's LCD protocol for PICDEV.

Last subject is about hardware design. We must design a new small board that contains PIC16F877, four buttons on control panel for user commands, an LCD to monitor information and ICSP (In Circuit Serial Programming) capability. This board can be designed with the help of some programs like Altium Design.

To sum up, interview with Alper KILIÇ is very useful for us because after the interview, we have found valuable answers to most of our questions and our design decisions became clearer. He shared his experiences about hardware design which is an ambiguous topic for us.

### **3.2.2 Questionnaire**

Questionnaire can be seen under the Appendix A This questionnaire is applied to forty people. Results of questionnaire are mentioned below.

First question asked to the potential user is that whether user is currently using wireless network or not. Questionnaire continues if answer of this question is "yes". Only two of the potential users answered this question "no". Other thirty eight people answered "yes" and continued the questionnaire.

Second question is for finding the device used for wireless network. Access point, router and wireless modem are the options that can be selected. Eight people chose "router" option; ten people chose "wireless modem" option; remaining twenty people chose "access point" option.

Third question is asking if there exists any screen on the wireless network device to monitor the statistics gathered from device. As we expect, all thirty eight participants selected "no" choice because in the market there are a few devices.

In forth question, we asked the participants what type of statistics or information should be monitored on the LCD of wireless network device. They have a chance to select more than one choice and add additional statistics or information they want. Thirty five of the participants want to see information about connected computers like name, IP, connection speed etc. Thirty of them expect to see total download and upload statistics. Twenty five of them want to see status of all wired and wireless networking devices. Fifteen of the

participants want to see bandwidth usage of each user for last day. Only five of them expect to see general information like date and time on the LCD. Some of participants want to see additional information except these. One of these is uplink status determined by pings or TCP connections to a server outside the network. Another one is the number of actively connected computers to the wireless network device wired or wireless.

Fifth question is about marketing. We try to determine at which price our wireless network device with LCD can be sold to the customer. Therefore, we asked participants the price difference they can pay for our device instead of theirs. Twenty five of participants selected the choice “15\$ - 30\$”. Eight of them chose “0\$ - 14\$” option. Remaining five people accepted to pay more than 30\$ for such a device with LCD display instead of theirs.

## **4. PROJECT REQUIREMENTS**

In this part we will explain what is required for the project and in which aspects the project needs these requirements. There are mainly two parts of requirements, hardware and software requirements for developing phases. In this part, we will also touch the requirements of cooperative company of this project, AirTies, and last user requirements.

### ***4.1 SOFTWARE REQUIREMENTS***

There is lots of software that will be used. We will explain the environments and then give information about tools that are planned to be used.

#### **4.1.1 Environments**

**Linux:** Since AP-400 uses embedded Linux kernel, Linux platform will be used for development and testing phases. All team members have enough experience on Linux due to our Computer Engineering Department Courses. We will also use many tools from a web browser to electronic circuit designing software. We have to search for these software tools for Linux. There are more explanations on next topics.

**Windows:** We said main development will be done on Linux; however the last user usually uses Microsoft Windows and its versions on Turkey market, so we will have to check and test the product on Windows. Unfortunately, some software that is curial for project don't have Linux version, therefore we will use these on Windows if needed.

### 4.1.2 Software Tools and Programs

We have received a packed which contains the embedded Linux and its configurations running on AP-400 from AirTies. We will do developments on that packed. We cannot give the packed details due to the privacy policy of both companies.

Notepad: Simplest text editor. It is running on Microsoft Windows. We will use this tool in order to make urgent and minor text editing.

Tera Term (Pro): Tera Term (Pro) is a free software terminal emulator (communication program) for MS-Windows. It supports VT100 emulation, telnet connection, serial port connection, and so on. Its version is 2.3. We will use this software in order to communicate with AP-400 by serial communication protocol, RS232. Configuration and user interface is very simple.

Minicom: Minicom is one of the easier serial port applications to use line Tera Term. It is curses based, so it's a full screen application with a status bar, menus, and an easy-to-use interface. The advantage of minicom is, being a Linux application. In implementation phases, we use that software mostly. Configuration is also very easy.

CCS C Compiler: The compiler has a generous library of built-in functions, preprocessor commands and ready-to-run example programs to quickly jump-start any project. Drivers for real-time clocks, LCDs, A/D converters, and many more are innate features to the CCS C Compiler. There are versions running on both Microsoft Windows and Linux machines.

Altium Designer: Altium Designer is the unified electronic product development system that allows developers to take a design from concept to completion within a single application. It brings together hardware, software and programmable hardware development within a unified environment that allows all aspects of an electronic product to be designed and managed within a single system. We will use this tool for board design, mostly. It can also simulate the board designed on it.

Driver of RS232 – USB Converter: Many notebooks do not have serial port. We have to convert it any other communication protocol. These converters do not work without algorithms, so we need drivers for these converters.



## ***4.2 HARDWARE REQUIREMENTS***

Since the project based on a machine, we have to consider more about hardware parts. We will give information about project hardware tools that will be used and developed.

### *AP-400:*

AP-400 is the most important hardware of this project, provided by AirTies. There are a main processor and three more chips with different functionalities. Main processor does the network and internet related jobs. Others have the jobs about memory, circuit electricity and wireless communication.

*Socket and Voltage Converter Cable:* This cable has a mini rs232 socket to plug in AP-400 and a serial port on the other end. This cable provided by AirTies in order to link AP-400 to a computer. The inner voltage of AP-400 is 3.3V and computer serial ports have 5V connections. So this cable is a curial part of project even if it is nothing in project scope.

*USB to RS232 Converter:* This cable converts the serial port to USB interface. Today many notebooks do not have a serial port by the reason that general users do not need them. Only developers needs them, besides only few of developers requires it. We will use this converter to plug in AP-400 to computer's USB connection.

*PIC16F877:* This processor is the core of our implementation. The button based control unit, LCD and AP-400 communicate via this processor.

*CEng336 Lecture Embedded Board:* We do not have much experience on such a large scaled and complex project, for the time being, we will use CEng336 Embedded Board for first prototypes. The features that board has are:

- A well-formed documentation is available for this board.
- It has 16x4 characters LCD. So we will not spend time to display characters and lines. It connected to D-PORT of pic16f877.
- There is no need for additional configuration of buttons on board. They are connected to B-PORT of pic16f877.
- We do not need additional devices for programming pic16f877. Board has a parallel port and programmer kid for processors.
- It has a speaker that might be used for extra features.

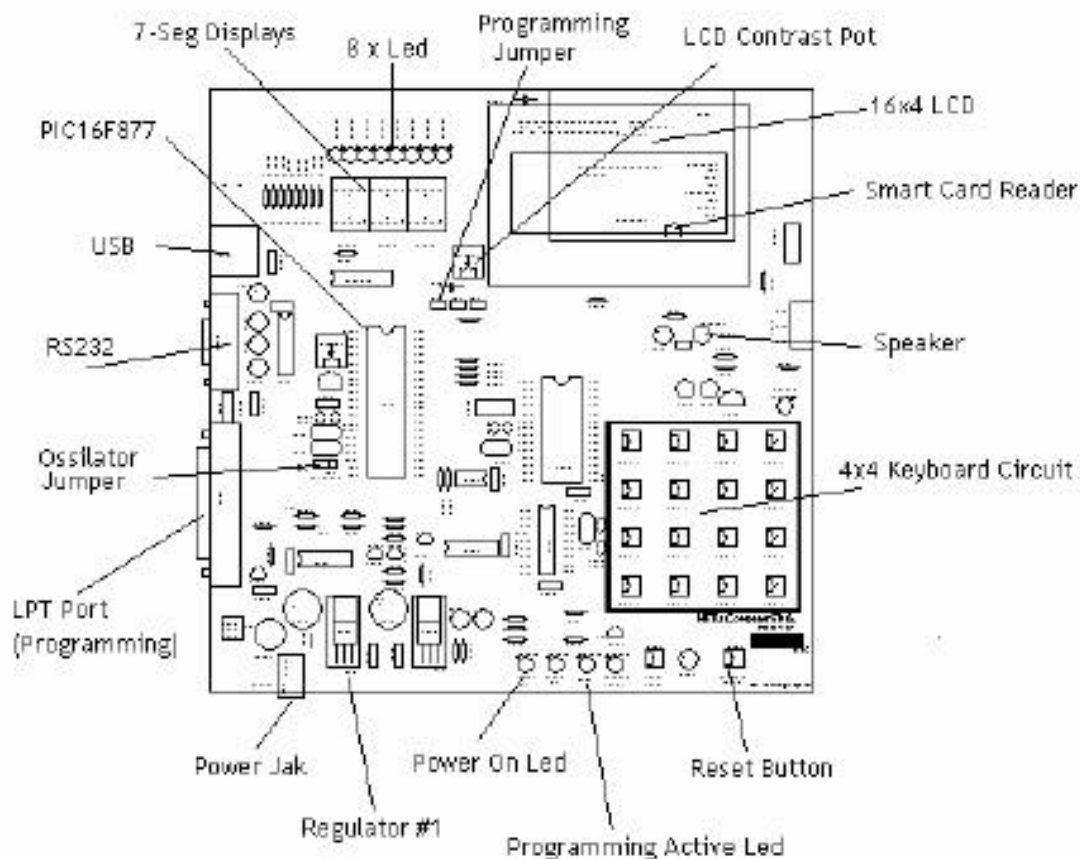


Figure: CEng336 Embedded Board

Graphic LCD: The visual part of the project. We will firstly use CEng336 Embedded Board's LCD to test our basic functionalities. For the last product, we decided to use graphic LCD and came up with three different LCD resolutions.

- First one has 128x64 resolution,
- Second one has 240x64 resolution,
- Last one has 320x240 resolution



Figure: Above LCD has 128x64 resolution.

Resolution of LCD affects LCD's size and the price. So these factors and user demands will affect the selection LCD. LCD colors will be decided based on upcoming surveys.

### ***4.3FUNCTIONAL REQUIREMENTS***

Primary required functionality is the ability to display user needs, which are acquired from Market Researches, on LCD.

Demands of the people using AP-400 are based on how much people use internet connections, their upload-download amounts, connection speeds and primarily who the connected users are.

### ***4.4NON-FUNCTIONAL REQUIREMENTS***

User Friendliness: Since end-user usually will not have the technical knowledge, design of user interface should be easy to understand. To provide this, we will use menu and submenu systems. That menu system will be controlled by simple and functional control mechanism, buttons.

Performance: For existing AP-400 system performance not to be affected from the addition of new LCD functionality we will add a new processor to the system. This new processor will handle communications with LCD, buttons, core processor.

Reliability: The addition of new elements to the existing circuit should not other systems in AP-400. New addition should not cause system to crash. We should consider every possibility beforehand and test the system thoroughly.

Cost: Since the system will be mass-produced and put in to the market, cost of new system and its addition to existing system should be affordable for end-users.

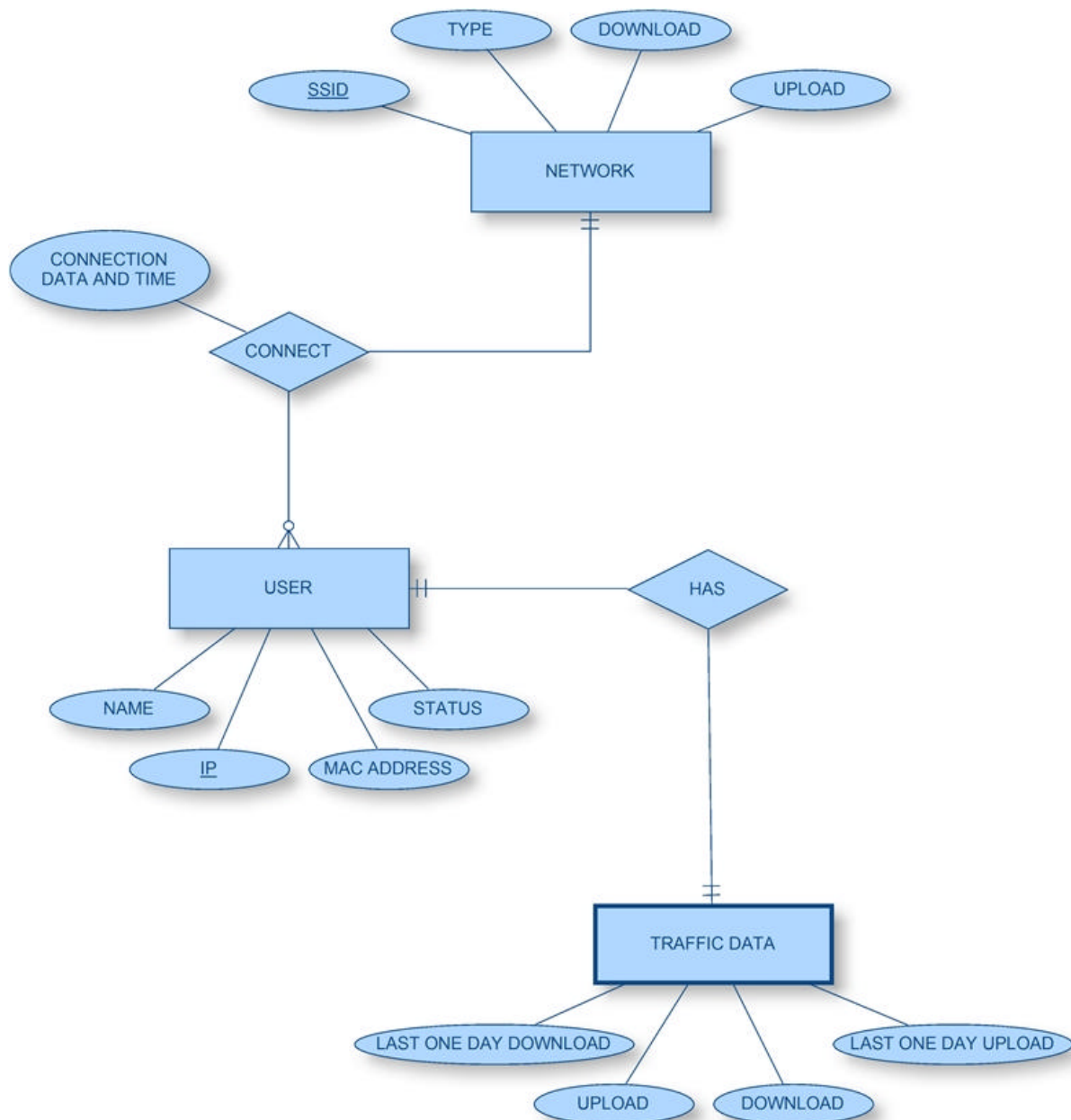
## 5. MODELING

### 5.1 DATA MODELING

In our system data will be stored by the embedded Linux running on AP-400. We will only retrieve data from the operating system, so there will be minor changes in data storing.

As the stored data on the operating system do not obtain all information we need, we will derive from necessary information by processing pure data.

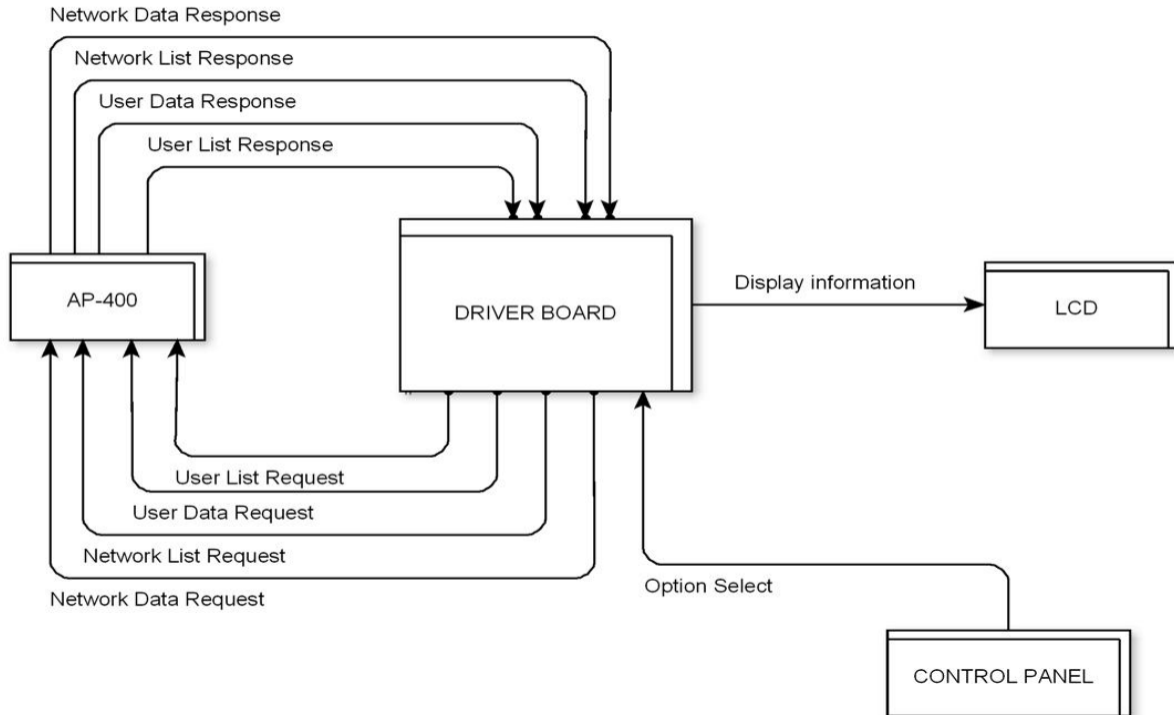
Data will be stored as in the figure below.



## 5.2 FUNCTIONAL MODELING

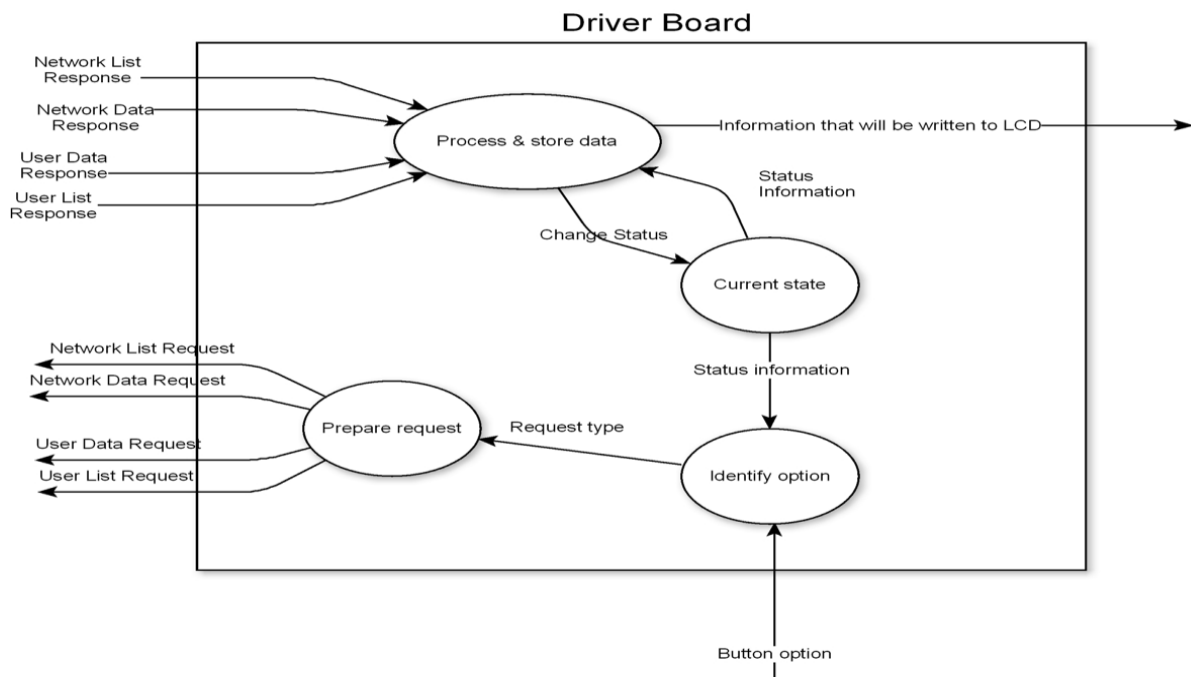
### 5.2.1 Data Flow Diagram – Level 0

DFD LEVEL 0



### 5.2.2 Data Flow Diagram – Level 1

DFD LEVEL 1



### 5.2.3 Data Dictionary

<b>NAME</b>	<b>REQUEST NETWORK DATA</b>
<b>FROM</b>	DRIVER PROCESSOR
<b>TO</b>	AP-400 MODULE
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	Include requester information of the selected network data (SSID, traffic, type...) from AP-400 embedded Linux.
<b>NAME</b>	<b>REQUEST NETWORK LIST</b>
<b>FROM</b>	DRIVER PROCESSOR
<b>TO</b>	AP-400 MODULE
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	Include requester information of the current network list (by SSID) from AP-400 embedded Linux.
<b>NAME</b>	<b>REQUEST USER DATA</b>
<b>FROM</b>	DRIVER PROCESSOR
<b>TO</b>	AP-400 MODULE
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	Include requester information of the selected user data (IP, name, MAC address, traffic) from AP-400 embedded Linux.
<b>NAME</b>	<b>REQUEST USER LIST</b>
<b>FROM</b>	DRIVER PROCESSOR
<b>TO</b>	AP-400 MODULE
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	Include requester information of the current user list in the network by name.
<b>NAME</b>	<b>RESPOND NETWORK DATA</b>
<b>FROM</b>	AP-400 MODULE
<b>TO</b>	DRIVER PROCESSOR
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	The requested network data (SSID, traffic, type...).
<b>NAME</b>	<b>RESPOND NETWORK LIST</b>
<b>FROM</b>	AP-400 MODULE
<b>TO</b>	DRIVER PROCESSOR
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	The current network list (by SSID).

<b>NAME</b>	<b>RESPOND USER DATA</b>
<b>FROM</b>	AP-400 MODULE
<b>TO</b>	DRIVER PROCESSOR
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	The selected user data (IP, name, MAC address, traffic).

<b>NAME</b>	<b>RESPOND USER LIST</b>
<b>FROM</b>	AP-400 MODULE
<b>TO</b>	DRIVER PROCESSOR
<b>FORMAT</b>	RS232 SERIAL PORT COMMUNICATION
<b>DESCRIPTION</b>	The current user list in the network.

<b>NAME</b>	<b>OPTION SELECT</b>
<b>FROM</b>	CONTROL PANEL(BUTTONS)
<b>TO</b>	DRIVER PROCESSOR
<b>FORMAT</b>	ELECTRICAL SIGNALS
<b>DESCRIPTION</b>	The signals that show which button pressed.

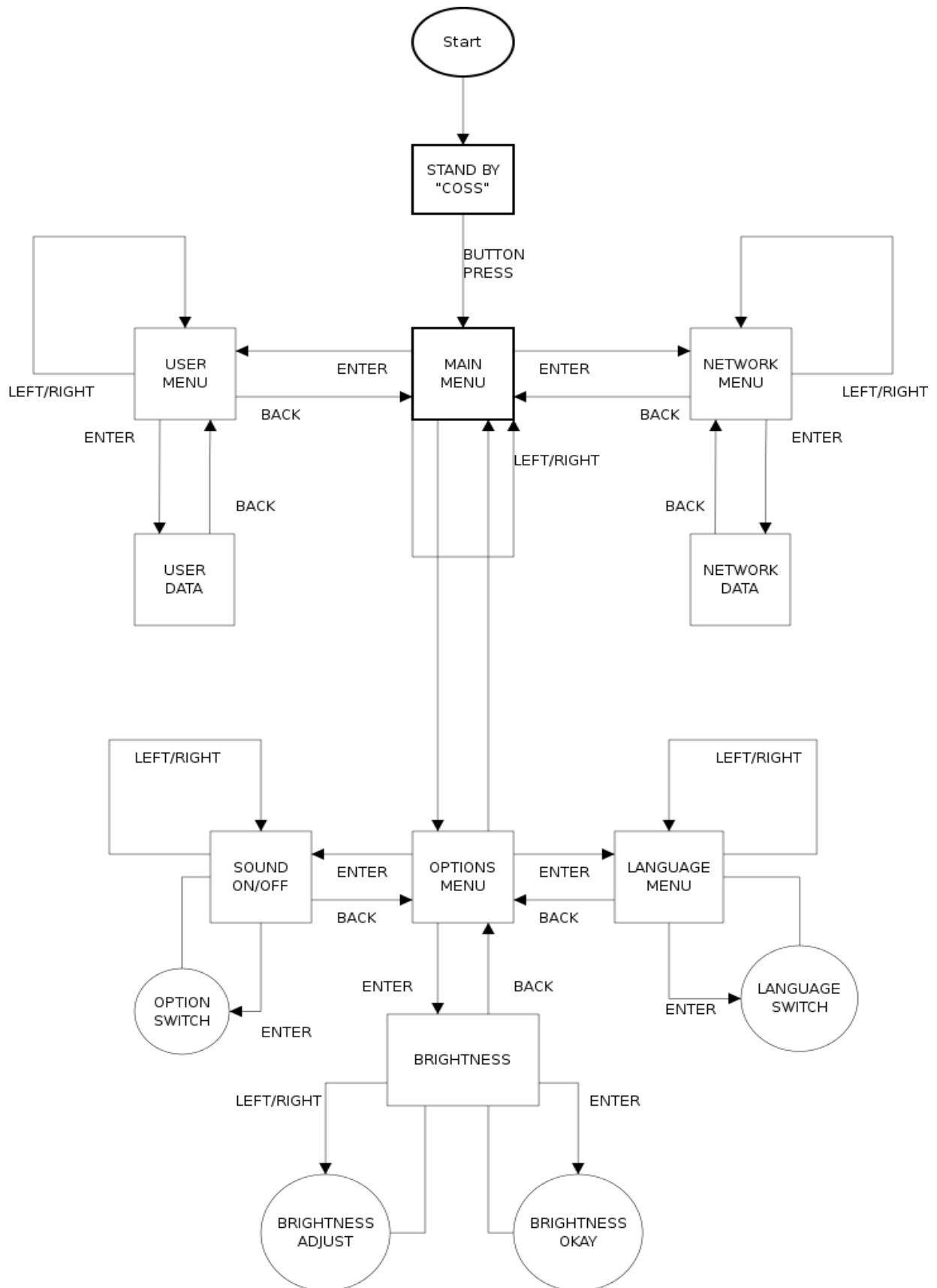
<b>NAME</b>	<b>DISPLAY INFORMATION</b>
<b>FROM</b>	DRIVER PROCESSOR
<b>TO</b>	LCD PANEL
<b>FORMAT</b>	ELECTRICAL SIGNALS
<b>DESCRIPTION</b>	The processed data that includes the display information of display screen.

<b>NAME</b>	<b>STATUS INFORMATION</b>
<b>FROM</b>	N/A
<b>TO</b>	N/A
<b>FORMAT</b>	ELECTRICAL SIGNALS
<b>DESCRIPTION</b>	This data represents LCD's current status. It flows through the units which need this LCD's status to prepare request queries and generating LCD display data.

<b>NAME</b>	<b>REQUEST TYPE</b>
<b>FROM</b>	N/A
<b>TO</b>	N/A
<b>FORMAT</b>	ELECTRICAL SIGNALS
<b>DESCRIPTION</b>	The data that will help to generate queries.

### 5.3 BEHAVIORAL MODELING

Behavioral model is based on menu selection by four buttons- left, right, enter, back.





## 6. RISK MANAGEMENT STRATEGY

### 6.1 RISK MANAGEMENT

Risk management is essential for the project because of the possibility of the future problems that may occur. Unforeseen risks can be catastrophic for the development process due to the deadline, which is also one of the most important risks, and proper risk management is necessary in order to prevent that from happening. Project team has established a detailed and standardized RMMM plan as shown below. Risk management plans due to every non-negligible risk can be found below, too.

RMMM consists of four parts: description, mitigation, monitoring, and management, of all which are explained below.

Description: A short information about the risk situation considered.

Mitigation: A forehand resolution for the problem. The process to prevent the risk from becoming reality.

Monitoring: The procedure for following the risk situation. By monitoring, team will be able to identify the problem and take the necessary way out.

Management: The procedure to follow during the risk situation. The solution to the problem considered.

### 6.2 RISKS

#	<u>Risk Situation</u>	<u>Probability</u>	<u>Importance Level*</u>
1	Temporarily Unavailability of a Member	30%	2
2	Lack of Knowledge and Experience on Subject	70%	2
3	Miscommunication among Team Members	10%	1
4	Problems with the Development Tool	30%	3
5	Poor Time Management	40%	3
6	Low Attendance to Group Work	20%	2
7	Overloaded Course Schedule	50%	3
8	Difficulties in Finding Hardware Devices	15%	1

\*Importance has three levels, first (1) has the highest importance level.

### 1 – Temporarily Unavailability of a Member

Description: Due to various reasons, one or some members of the group may not be reachable or available for a (short) period of time.

Mitigation: NA

Monitoring: Attendance sheets for projects meetings.

Management: Other members will take over the work of the unavailable one.

### 2 – Lack of Knowledge and Experience on Subject

Description: Project members may not have proper knowledge and the experience for the project

Mitigation: Group members should spend considerable amount of time for research at the beginning of the project.

Monitoring: NA

Management: We will make research during the development process and ask experienced people about the proper knowledge needed.

### 3 – Miscommunication among Team Members

Description: Members of the group may argue with each other and the communication among the group may get disrupted.

Mitigation: At the beginning of the project, members should spend some time together to understand the personalities of each other and know better.

Monitoring: Peer discussions.

Management: Some meetings for the whole purpose of criticizing members should be done so that members will have the opportunity to criticize each other in a well formed way.

### 4 – Problems with the Development Tool

Description: Problems may occur with the development tools those of which will be used during the development process.

Mitigation: All of the group members will have a good knowledge of the tools. They will use the tools beforehand and have enough experience on them.

Monitoring: NA

Management: Experienced development tools users will be asked for help. Newsgroup of the department will be used for that kind of a problem.

## 5 – Poor Time Management

Description: Time management may not be done properly. Time periods for specific processes may be too short or too long.

Mitigation: Schedule should be done accordingly. Exams, quizzes, homework should be taken into account during the scheduling process.

Monitoring: Schedule will be checked during the beginning of every group meeting.

Management: Schedule will be renewed.

## 6 – Low Attendance to Group Work

Description: Due to personal reasons, a group member may miss the meetings frequently.

Mitigation: Works will be divided into parts at the beginning of the project.

Monitoring: There will be an attendance sheet.

Management: Unattended member will be punished (fee). The assistant, responsible for the team, will be informed of the situation.

## 7 – Overloaded Course Schedule

Description: Course schedule may be too overloaded and may prevent group members to pay attention to group works.

Mitigation: Lecture hours are known beforehand, schedule will be done accordingly.

Monitoring: Course discussions among the members will be done.

Management: Members will help each other during the overloaded course and exam periods.

## 8 –Difficulties in Finding Hardware Devices

Description: There may be some difficulties in the process of obtaining hardware required for the project.

Mitigation: Proper hardware obtaining ways will be decided.

Monitoring: NA

Management: AirTies and the department will be informed of the problem and will be asked for help.

The risks foreseen and the plans are not final and will be updated in case of existence of new identified risks so that our risk management will always be up-to-date.

## **7. PROJECT PROCESS**

### ***7.1 PROCESS MODEL***

We will progress the project by analyzing the situation and the problem, designing virtual system, implementing and testing it. These phases are distinct and they do not have common tasks. The process model should have well distributed jobs. Besides, we, as a group, do not have much experience for such a project. We will need to go over the process steps over and over. Moreover, from time to time, we will go back to the previous steps to revise them. In other words, a feedback mechanism is a must.

*“Waterfall with feedback”* is the ideal process model because of the reasons we explained above.

### ***7.2 GANTT CHART***

According to group members' personalities, we have made a strict schedule for the project. It is attached to Appendix B.

## **8. CONCLUSION**

During the preparation of this report, we gained a lot of valuable information about our senior design project. By the help of market research, we can find the statistics and information that can be monitored on the LCD. Products at the market improve our creativity on our product. Interview and questionnaire help us to specify the requests of the end-user. While writing report, all requirements are again revised and listed. In modeling section, we decided on how our product will operates with respect to data, function and behavior. These models will act as a guide during the whole project. Risk management section is one of the most important issues in the requirement and analysis report. Since our hardware is easily breakable and our project has a strict due date, risks must be handled in reasonable time. Gantt chart will be our main guide to follow in this project since all tasks and subtasks are included according to time and team members.

To sum up, this report made most of the unknown points clearer for us. The things that will be done in the following weeks, how the project will make progress and risk managements has been well understood.

## 9. APPENDICES

## 9.1 APPENDIX A

## Questionnaire

1. Do you use wireless network in your working area or in your house?

? Yes

? No

2. Which one of the following devices is used for the wireless network?

? Access Point

? Router

## ? Wireless Modem

3. Is there any status display like LCD on your wireless network device?

? Yes

? No

4. Which one(s) of the following statistics do you want to see on the wireless network device? (You can choose more than one)

? Information about the computers that are connected to the network (name, IP, connection speed etc.)

? Total download and upload in kbps

? Status of networking devices

? Each user's bandwidth usage for last 24 hours

? General information like date and time

? Another:.....

5. How much extra money would you pay for a network device with an LCD that displaying some statistics instead of yours?

? 0\$ - 14\$

? 15\$ - 30\$

? 30\$+

## 9.2 APPENDIX B

#	Name	Duration	Start	Finish	16 Sep 2007	17	18	19	20	21	22	23 Sep 2007	24	25	26	27	28	29	30 Sep 2007	01	02	03	04	05	06	07 Oct 2007	08	09	10	11	12	13
1	Formation of Team	5.0 d	17.09.2007	21.09.2007																												
2	Project Selection	8.0 d	21.09.2007	28.09.2007																												
3	Selection of Project	5.0 d	21.09.2007	25.09.2007																												
4	Project Topic	4.0 d	25.09.2007	28.09.2007																												
5	Reports	57.0 d	05.10.2007	30.11.2007																												
6	Proposal Report	2.0 d	05.10.2007	06.10.2007																												
7	Requirement Analysis Report	12.0 d	05.10.2007	05.11.2007																												
8	Initial Design Report	13.0 d	18.11.2007	30.11.2007																												
9	Preparing Development	45.0 d	28.09.2007	12.11.2007																												
10	Operating System	16.0 d	28.09.2007	12.10.2007																												
11	Installing	8.0 d	28.09.2007	05.10.2007																												
12	Testing	4.0 d	09.10.2007	12.10.2007																												
13	Installing and Testing Software	7.0 d	12.10.2007	18.10.2007																												
14	Setting Up Hardware	22.0 d	22.10.2007	12.11.2007																												
15	Research	16.0 d	18.10.2007	02.11.2007																												
16	Market Research	18.0 d	18.10.2007	05.11.2007																												
17	Literature Survey	8.0 d	26.10.2007	01.11.2007																												
18	Questionnaire	8.0 d	25.10.2007	29.10.2007																												
19	Interview	1.0 d	01.11.2007	01.11.2007																												
20	Shopping	29.0 d	15.10.2007	12.11.2007																												
21	Outgoing AP 400	3.0 d	20.10.2007	22.10.2007																												
22	Outgoing LCD	8.0 d	05.11.2007	12.11.2007																												
23	Outgoing Other Hardware Tools	22.0 d	22.10.2007	12.11.2007																												
24	Outgoing Software	4.0 d	15.10.2007	18.10.2007																												
25	Development	48.0 d	05.11.2007	22.12.2007																												
26	Planning LCD Related Applications	18.0 d	06.11.2007	20.11.2007																												
27	Planning LCD Functions	7.0 d	05.11.2007	11.11.2007																												
28	Designing LCD Interface	10.0 d	11.11.2007	20.11.2007																												
29	AP 400 Linux Applications	31.0 d	06.11.2007	06.12.2007																												
30	Compiling Emulators/Linux	14.0 d	22.11.2007	05.12.2007																												
31	Deployment of Compiled	4.0 d	05.11.2007	08.11.2007																												
32	"Hello World" Application	4.0 d	08.11.2007	11.11.2007																												
33	Copying Linux Applications	21.0 d	11.11.2007	01.12.2007																												
34	Implementation of Driver	14.0 d	01.12.2007	14.12.2007																												
35	Driver Card Design	18.0 d	14.11.2007	28.11.2007																												
36	Designing Board	10.0 d	14.11.2007	23.11.2007																												
37	Making Board	7.0 d	23.11.2007	29.11.2007																												
38	Testing	8.0 d	14.12.2007	22.12.2007																												
39	Software Testing	8.0 d	14.12.2007	18.12.2007																												
40	Hardware Testing	5.0 d	18.12.2007	22.12.2007																												
41	Prototype Producing	25.0 d	22.12.2007	15.01.2008																												
42	Producing	21.0 d	22.12.2007	11.01.2008																												
43	Testing	5.0 d	11.01.2008	15.01.2008																												
44	Presenting Final Presentation	7.0 d	08.01.2008	14.01.2008																												





Explanation of the colors used in the Gantt chart is below:

All Members: Blue

Ümit: Aqua

Gözde: Yellow

Emre: Light Orange

Kürsat: Green

Kürsat-Gözde: Violet

Kürsat-Ümit: Sea Green

Emre-Ümit: Red

Emre-Kürsat: Pink

Ümit-Gözde: Tan

Gözde-Emre: Lavender



## 10.GLOSSARY

Bandwidth: The amount of data that can be carried from one point to another in a given time period.

IEEE 802.11: set of standards for wireless local area network (WLAN) computer communication in the 5 GHz and 2.4 GHz public spectrum bands.

kbps: Thousands of bits per second.

LCD: Liquid Crystal Display

MAC: Media Access Control.

Repeater: to receive the signal from the main transmitter from one direction, and then to amplify it and "repeat" the same signal much stronger in another or continued direction.

SSID: Service Set Identifier.

Static IP address: A fixed address assigned to a computer or device that is connected to a network.

TCP/IP (Transmission Control Protocol/Internet Protocol): A network protocol for transmitting data packets within a network.

WEP (Wired Equivalent Privacy): A type of wireless security provided by Wi-Fi, based on number-sequence encryption.

Wi-Fi (Wireless fidelity): The name for 802.11 wireless network technology that indicates interoperability among 802.11 products.

Wireless LAN (WLAN): A system of connecting computers and other devices within the same physical proximity for sharing resources such as an Internet connection, printers, files, and drives. The network uses high-frequency radio waves rather than wires to communicate among wireless devices.

Wireless router: An all in one wireless communication device that includes a wireless access point and may include an Ethernet hub and other features.

WPA (Wi-Fi Protected Access): A specification based, interoperable wireless security feature for which a pass phrase (password) is required.

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