We all live in one world…
We all live in the same environment…
We all know that it's getting worse day by day…
We must all do something about it…

Finally there is a way...

Project Protasis

A Tool for Using Technology Without Harming the Environment

Project Protasis Final Report for the Greek Imagine Cup 2008 Finals

TEAM NAME

Protasis Team

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1 Abstract

1.1 Project Description

Project **Protasis** deals with the problem of environmental pollution. Air and water pollution as well as bad garbage disposal and reduced environmental concern of humans threatens our planet. The main reason for all of these is the bad use of technology. Motivated by recent statistics, showing that drastic measurements towards economical use of energy have to be taken, I developed Project **Protasis**, namely a software and hardware package. There are many tools, both software and hardware that currently exist for solving these problems, but none of them is as effective as **Protasis**. Using advanced hardware equipment, fuzzy logic, artificial intelligence and high-end software development tools this project aims for humans to reduce useless energy consumption and improve our environment. The methodology used is that actually **Protasis** will control almost everything. It is divided in six distinct editions, each one for preventing another environmental issue. In fact **Protasis** will use, by its own, the technology advancements, so that they are used correctly. Experimental tests using **Protasis** showed that energy consumption can be reduced up to 60% in a typical house. Furthermore, carbon dioxide and sulfur dioxide emitted by both industries and vehicles can be reduced up to 100%. Forest fires can be reduced up to these levels also. Project **Protasis** does not only control everything in order to reduce the environmental pollution, but it also offers some other nice features, such as controlling all the devices of your home using your mobile phone from everywhere. The biggest advantage though of Project **Protasis** against other solutions is it's extensibility; it can be used for almost everything that the human mind can think of. Moreover, Project **Protasis** provides many more features, such as controlling your home remotely, from every place in the whole world. More information on **Protasis** can be found on the next sections of this report.

1.1.1 Photo of Air Pollution

2 Introduction

2.1 Main Introduction

Environmental pollution has accompanied industrialization and the advance of technology since the beginning of the 19th century. With the industrial revolution, the environment started suffering because of humans. We were releasing so much carbon dioxide (CO_2) and sulfur dioxide (SO_2) that the skies became gray. Air pollution became a problem during that age. But unfortunately it was not only air pollution that made the environment suffer; there was also water pollution, plus many other factors. That did not only happen with the industrial age; it continues to happen even now, mainly because of factories producing electricity.

When technology started advancing faster, around the 19th century, we started using electrical power more and more. This resulted in more factories producing electricity. These factories are by far those that produce the most air-polluting gases. On the other hand, people who forget to turn the lights off at home, etc., are also responsible for pollution. This is called inefficient energy use and it not only refers to lights and electricity, but also to water and pumps, oil and radiators, etc. So it now becomes clear that this pollution exists mainly due to inefficient use of technology, because lights, water pumps, radiators, etc., are all creations of technology.

Furthermore, bad use of technology has also resulted in forest fires. Many houses have exploded in the woods and ignited large fires, which ultimately burned thousands of trees. Unfortunately, forest fires are sometimes part of someone's craziness as with criminal acts of arson. Sometimes technology is once again responsible, as proposed above, not only for air pollution and forest fires but also for water pollution. We all know that many ships have gone down in the oceans and spilled oil, subsequently polluting the water.

So, what can we say? Is technology a gift or a curse to humanity? Well, I have an answer and I say that it is a gift. Many times people are given gifts, but will they use them correctly? That is up to them. Take for example a sword; someone buys it as a gift for someone else. That does not mean the recipient is going to use it to kill someone else; he will probably use it for decoration. That is the difference between correct use of gifts and incorrect use of gifts. The same happens with technology; it is just that humans use it incorrectly. Most of the technological advancements happened because the military needed them, so we understand that technology is somehow based on the military. That is one kind of incorrect use of technology. The other kind has to do with everyday citizens, who for example forget that the lights are on in their home. This results in very high electrical energy consumption and consequently too much carbon dioxide (CO_2) in the atmosphere. Light was a gift to humanity, without question, but incorrect use of it harms the environment and consequently, mankind.

After all of this, many people said that the advancement of technology was not a good thing and it produced more bad results than good ones. Well, I am not of the same opinion, and I believe that we should think of ways that help us to reduce the bad results that technology produces. Technology is not a bad thing; we just have to use it correctly.

That is where Project Protasis is going to help. It is designed to reduce the environmental pollution due to technology. It uses state-of-the-art technology and it aims to help us use technology achievements in a better and harmless way. Until now, there was no such application; the only similar thing to the Protasis Home Edition that existed was the so-called "smart home," but this is nothing compared to Protasis, which is truly intelligent. Moreover, Protasis protects the environment from forest fires and also from water pollution. However, Protasis does not only care about technological

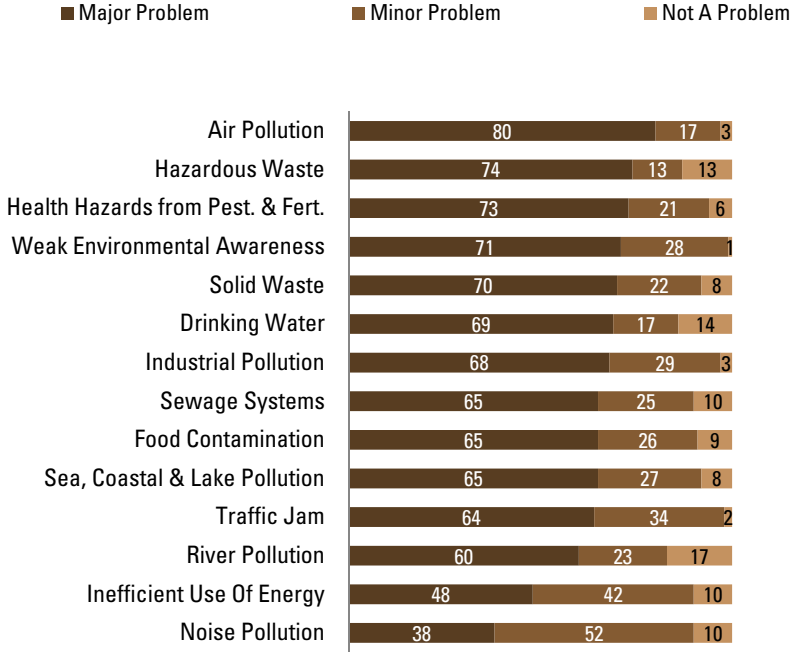
advancements; it also takes care, so that industries do not pollute the environment. As discussed above, air pollution has been a really big issue since the industrial revolution. Well, you may wonder how a reduction in electricity consumption reduces air pollution. I know it seems strange, but if you have read carefully what I said above, you should understand. By reducing electricity consumption we reduce the amount of gases that electricity plants produce. Table 2.1.1 below shows how many grams of carbon dioxide are produced when using some of the most common household devices. Notice how much carbon dioxide (CO_2) is released into the atmosphere while using some of these simple devices. We use these devices every day, so you can understand how much we harm the environment. One motivator for being more careful when leaving the house would be the fourth column of this table, which shows the cost of using each of these devices.

Device	Power (Watt)	CO_2 Emission per Hour (gr)	Cost per Hour (cents)
Electrical Lamp 60W	60	39	0,6
Low Consumption El. Lamp	11	7	0,11
Halogen Light	300	195	3
Television (TV)	80-300	52-195	0,8-3
Stereo	55-500	36-325	0,6-5
Computer (Desktop or Laptop)	80-360	52-234	0,8-3,6
Electrical Cleaner	700-2000	455-1300	7-20
Hair Dryer	800-2000	520-1300	8-20
Hot Water Boiler	300-3200	195-2080	3-32
Microwave Oven	700-2100	455-1365	7-21
Clothes Washer	500-3000	325-1950	5-30
Clothes Dryer	500-5700	325-3705	5-57
Dishwasher	700-3000	455-1950	7-30
Radiator	500-3000	325-1950	5-30
Air Conditioner	800-5000	520-3250	8-50
Small Boiler	1500-6000	975-3900	15-60

2.1.1 Table showing power output, gas emission and cost per hour of use of some home devices.

Furthermore, on Table 2.1.2 below you will find a statistical report that shows the level of importance of certain environmental issues. Notice the most important issues and further down you will understand how important Protasis is and how many of these issues it takes care of. To help you a little bit, Protasis helps to solve eight out of 14 problems, which is a really big number. These eight are also the most important ones described there.

2.1.2 Table: Level Of Importance Of Environmental Problems



2.2 What other tools do exist?

Currently there are many tools, or ways if you prefer, that let us defend against such issues. For example, for homes there exists X10 Smart Homes, which let people control their devices at home more easily. Furthermore, for industries, vehicles and water there exist certain filters. And this is not everything, there are many others also.

2.3 Why is Protasis better?

First of all, X10 Smart Homes is a tool that does not control your home devices by its own. Furthermore, it only controls electrical devices. Protasis is the first application to automatically control all kind of home devices that we (humans) can control by hand. Well, the Protasis application is a little bit expensive but it is worth it for many reasons. Firstly, the X10 devices are more expensive than the Protasis devices, and as for the application you just have to think of one single thing. Think of how much money it will save you from your bills. Moreover, all these filters for industries, vehicles and water are very, and I mean very expensive. Well, Protasis is cheaper if you think of everything, such us the fact that you will not have to change any filters and pay for the new ones, it will do everything by its own and after the first-time

installation you will not have to think of it and pay for it again. Apart from these, Protasis is also much more effective than any other tool that exists for this purpose. You will understand what I mean here on section 4.3 of this report. Furthermore, none of these tools offers you full control of your home from everywhere using your mobile phone.

2.4 Project Goals

Protasis aims to achieve the following:

- **Major Goals:**
  - Reduction in electricity consumption by **up to 60%**. (In homes and industries)
  - Reduction in water consumption by **up to 30%**. (In homes and industries)
  - Reduction in oil consumption by **up to 40%**. (In homes and industries)
  - Reduction in carbon dioxide (CO_2) emissions by **up to 100%**. (In industries and vehicles)
  - Reduction in sulfur dioxide (SO_2) emissions by **up to 100%**. (in industries and vehicles)
  - Reduction in burned forests by **up to 90%**.
  - Reduction in polluted lakes by **up to 100%**.
  - Reduction in biogases by **up to 100%**.
  - Reduction in gases released from burning biogases by **up to 100%**.
- **Minor Goals:**
  - Protection of electrical devices. (In homes and industries)
  - Protection from burglars. (In homes and industries)
  - Remote control over devices, lights, etc. (In homes and industries)

2.5 Summary of Application Components

Protasis can be divided into five components:

- **Project Protasis PC Application**
  - Serves as the system control unit:
    - Includes all of the editions described above.
    - Provides the main processing unit of this application; in a few words it is the core of **Protasis**.
    - Receives all the data the other components send to it.
    - Processes these data.
    - Sends data to the other components to instruct them for several actions.
    - Provides a simple and an advanced interface for both users and technicians.
    - Processes all user preferences.
  - Also operates transparently doing the most important work:
    - Uses fuzzy logic for processing data.
    - Runs many threads simultaneously.
    - All the above make Protasis a truly smart application.

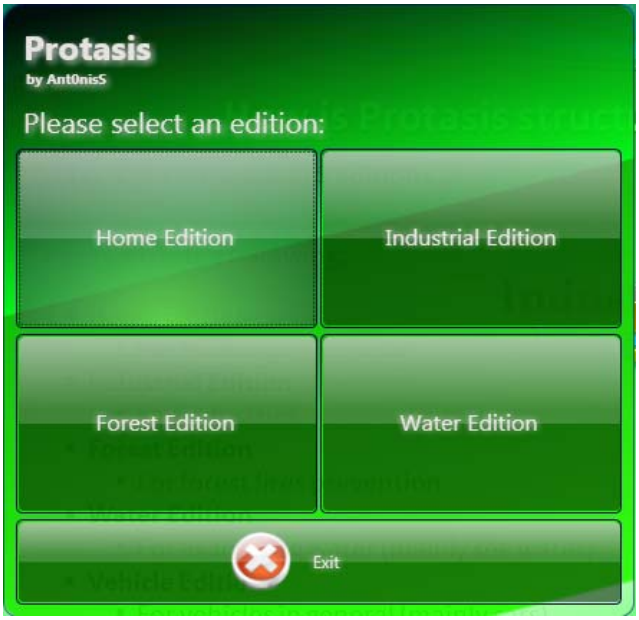
- **Project Protasis PC Client**
  - Receives instruction from the PC application.
  - Translates these instructions so that the computer understands them (e.g. shutdown).
  - Executes these instructions.
- **Project Protasis Remote Devices**
  - Use the ZigBee protocol in order to communicate remotely with the **Protasis** PC application.
  - Collect information about temperature, movement and pressure.
  - Collect GPS information about their position.
  - Send these data to the **Protasis** PC application for processing.
  - Receive data from the PC Application.
  - Turn on/off switches according to the data received.
  - Consume low energy.
- **Project Protasis Mobile Phone Version**
  - Runs on mobile phones.
  - Receives alerts from the PC Application.
  - Allows full control of the devices controlled by the PC Application.
- **Project Protasis PDA Version**
  - Runs on pocket PCs.
  - Accesses all the information sent by the remote devices.
  - Provides total control over devices via PC application.
- **Project Protasis Server Application**
  - Collects all the data the PC application sends to it.
  - Creates statistics, which contain data of energy consumption since the time the user started using the application. They also contain data about other users, with about the same number of devices at home, so that the current user knows if he or she is economical or not.
  - Encrypts these data so they are not accessible by hackers.
  - Can be accessed via Webpage.
- **Project Protasis Webpage**
  - Every user acquires a username and a password when they purchase the application. These are used to access the Webpage.
  - Displays in a user-friendly format all the statistics the server application has created, using graphs and diagrams.
  - Virtual Earth maps with certain highlights for each edition.
- **Project Protasis Chat Application**
  - Called *"AntChat"* and it is built using the Java programming language.
  - Is very simple and it provides instant support for all users.
  - Exists as a standalone application, but is also implemented on **Protasis** Webpage as an applet.

2.6 Summary of PC Application Editions

Protasis PC application is divided into five distinct editions:

- **Home Edition**
  - Automatic control over:
    - Lights
    - Computers
    - Power Plugs
    - Radiators
    - Ovens
    - Microwave Ovens
    - Refrigerators
    - Dishwashers
    - Washing Machines and Dryers
    - Heating Boilers
    - Hot Water Boilers
    - Water Pumps
    - All other devices that can be controlled
  - Remote Control over the same devices
  - Protection of electrical devices
  - Protection from burglars/fire etc.
  - Graphs of:
    - Electrical consumption
    - Voltage
    - Water consumption
    - Oil consumption
  - AntChat (Described below)
  - Statistical reports
  - Web Services
  - PDA version
- **Industrial Edition**
  - All of the Home Edition features
  - Neutralization of CO_2
  - Neutralization of SO_2
  - Protection from burglars/fire etc.
- **Compost Edition**
  - All of the Home Edition features
  - Burning of Biogases
  - Neutralization of gases produced by burning biogases

- **Forest Edition**
  - All of the Home Edition features
  - Forest fire detection
  - Forest fire "elimination"
  - Statistics about forest condition
- **Water Edition**
  - All of the Home Edition features
  - Water pollution detection
  - Water pollution "elimination"
  - Statistics about water condition
- **Vehicle Edition**
  - Neutralization of CO_2
  - Neutralization of SO_2



2.6.1 Screenshot of edition selection form

2.6.2 Screenshot of Protasis Home Edition

3 Architecture

3.1 Architectural Overview

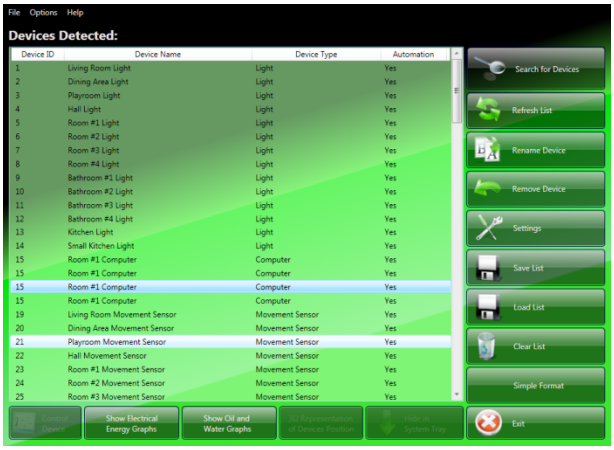
- **3.1.1 Project Protasis PC Application**

Protasis achieves the above in a complex way, but that does not mean it complicates the life of the user. It uses a very simple and user-friendly interface and the only time that the user will need the help of a technician is for the installation of the devices and for the initial setup. So, what makes the interface so user-friendly?

- **Simple and Advanced Formats:** The actual user uses only the simple format and the advanced format is for the technician that sets up the application. The user does, however, have access to the advanced format.
- **Categorized Devices Form:** Categorizes the devices according to device type or according to where the device is located, and facilitates the process of searching for specific devices.
- **Many buttons:** Make application use easier because the user does not have to do complicated tasks—he or she only presses buttons.
- **Help Areas:** In the Settings form, where the user or the technician sets up the program, there are areas on each tab that describe each function. This not only helps the technician, but the user as well.
- **Standalone application:** The user does not have to do anything to control the application. If it has been set up correctly, Protasis is able to run automatically.

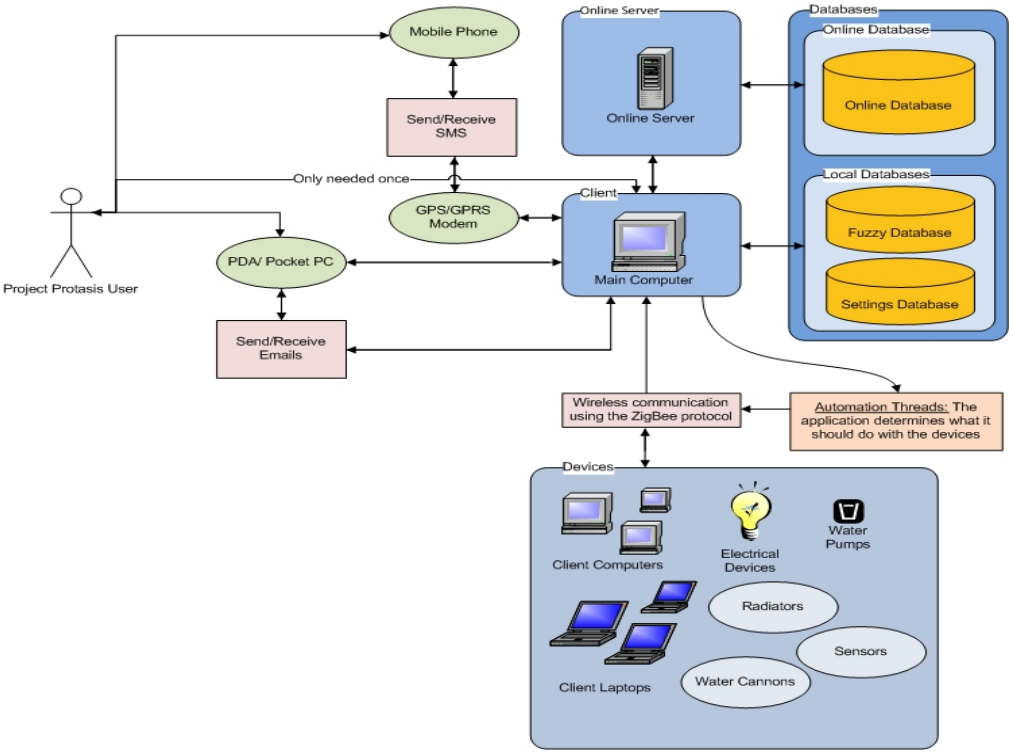
Apart from being a user-friendly application, **Protasis** has many more surprising features. Furthermore, **Protasis** PC application automatically puts itself in the startup programs when installed, in order to be running whenever needed without user control. You may now be wondering how **Protasis** achieves all the things described above and where it implements fuzzy logic. In fact, the whole application is based on fuzzy logic. So, how does each edition achieve its goals?

- **Home Edition:** Home Edition's main purpose is to reduce energy consumption: all kinds of energy (electricity, water, oil). In order to achieve this, the Protasis PC application receives data from the devices. These data include temperature, movement, light, etc. The PC application processes all these and decides whether or not it should, for example, turn off a light. Let us use this example to see how Protasis works. In order to decide whether or not to turn a light on or off, Protasis needs information about movement and light in the room where the specific light is located. First of all, the light information is only needed if the room has a window or a light source. If it does not, light is not taken into consideration. The light sensor should be located right outside the source of light, out of the window



3.1.1.2 Screenshot of Protasis Home Edition

for example, and the movement sensor should be located inside the room in order to check for movement in the room. When **Protasis** runs, it first checks to see if there is light in the source (e.g. window). If there is light it automatically gives an order to the device controlling that light to turn it off. If there is no light it checks for movement. If there is movement it automatically sends an order to the device controlling the light to turn it on. If there is no movement, the application checks to see the setting that the user has given for the time needed without movement in order to turn off lights. While **Protasis** waits for that amount of time to pass, it continues to work. It now checks the electrical energy consumption of that light and the amount of time passed since the time that there was initially no movement. It performs some calculations and if it finds that the light that is on significantly increases electrical energy consumption it automatically sends an order to the device controlling that light to turn it off. This makes **Protasis** a very smart application. The Home Edition works in a similar way to control all the devices in the home. It performs a memory management and runs some threads in a very "performance economical" way. To control the computers in the home, the computers must have the **Protasis** PC Client installed. Furthermore, Home Edition protects your home from burglars, fires, etc., using the same sensors mentioned above. When nobody is home **Protasis** continually checks for movement and if it finds movement it immediately alerts the user and the police department. In order for this to work when the user leaves his home he has to input his leaving to **Protasis**, so that **Protasis** knows that nobody is supposed to be at home from then on. Moreover, **Protasis** continually monitors for fires by checking for smoke, humidity, etc.; combining all the data from the sensors. If a fire is detected, **Protasis** alerts the user and fire department immediately. It can also put out the fire if certain hardware is installed.



3.1.1 Simple Diagram of Project Protasis

- **Industrial Edition:** Industrial Edition achieves its objectives in a different way than the Home Edition. The main feature of Industrial Edition is some chemical reactions; even though it seems strange it is reasonable since its main purpose is neutralization. These reactions are the following:

  - $CaO_{(s)} + H_2O_{(l)} \Rightarrow Ca(OH)_{2(s)}$
  - $Ca(OH)_{2(aq)} + CO_{2(g)} \Rightarrow CaCO_{3(s)} + H_2O_{(l)}$

  } Neutralization of carbon dioxide (CO_2)

  - $(CaCO_{3(s)} \Rightarrow CaO_{(s)} + CO_{2(g)}$ (By heating))
  - $2CaO_{(s)} + 2SO_{2(g)} + O_{2(g)} \Rightarrow 2CaSO_{4(s)}$

  } Neutralization of sulfur dioxide (SO_2)

3.1.1.3 Screenshot of Protasis Industrial Edition

As you can see these are the chemical reactions that result in the neutralization of carbon dioxide (CO_2) and sulfur dioxide (SO_2). **Protasis** achieves these two neutralizations by checking the amount of each chemical in each of the tanks used. The block diagram of this edition is similar to the one for Home Edition. This application uses three tanks for each neutralization, arranged so they can cooperate easily. In the carbon dioxide (CO_2) neutralization we have one tank with calcium oxide (CaO) and water (H_2O), where these two react and produce calcium hydroxide ($Ca(OH)_2$) in a solid state. Water is added and this compound (now aqueous solution) is taken into another tank. This tank is connected to a pipe where the factory expels the carbon dioxide (CO_2) it produces. These two react and produce calcium carbonate ($CaCO_3$) and water (H_2O). **Protasis** has sensors in all of these tanks that maintain the right amount of chemicals in the right place. It also controls the flow of the chemicals through pipes. After this process we have to neutralize sulfur dioxide (SO_2) also, so we simply put into a tank calcium oxide (CaO) and oxygen (O_2) and let the sulfur dioxide (SO_2) coming from the factory pass through this tank. That way, calcium sulfate ($CaSO_4$) is produced, which is completely harmless. As you can see, the second chemical reaction is not completely necessary. It is reported here just for reference. This edition also has all the features of the **Protasis** Home Edition. The core of this edition is the same with the Home Edition's core, so this edition is also almost completed.

- **Compost Edition:** This edition of Project **Protasis** deals with garbage disposal. It contains all of the features of the Home Edition, it burns all the biogases produced by the melting of garbage and takes care so that no dangerous gases are released to the atmosphere. Similar to the other editions, it uses artificial intelligence in order to achieve very efficient results.

- **Forest Edition:** Forest Edition can put out fires; that is its main purpose. So, how does it do that? Well, once again **Protasis** uses fuzzy logic. At first, the application has to detect the fire. In order to detect the fire **Protasis** checks the following parameters:
  - Temperature in one area of the forest
  - Temperature in another area of the forest (far away from the first)
  - Humidity in one area of the forest
  - Humidity in another area of the forest (far away from the first)
  - Smoke
  - Weather conditions
  - Time of the day

3.1.1.4 Screenshot of Protasis Forest Edition

Forest Edition checks all these parameters for many reasons. Let us take them one by one. It takes temperature readings for a certain area of the forest and then it checks the readings at an area far away. If they have about the same temperature it checks a third area. If that one has about the same temperature **Protasis** continues checking more and more areas. If they don't have about the same temperature **Protasis** checks the humidity at the area(s) with the higher temperature and at those with the low temperature. If the humidity is about equal it does nothing. If the ones with the high temperature have low humidity it checks for smoke in those places. If there is no smoke it does nothing, but if smoke is detected it checks the weather conditions, with a light sensor and other sensors. If it is a sunny day **Protasis** starts the process of putting out the fire in the area(s) with the higher temperature. If it is not sunny it performs some calculations to see if there is the need to put out a fire. But, where I said "nothing" above, it is not exactly nothing. **Protasis** actually performs calculations again to see if there is a need to put out a fire. How does **Protasis** put out the fire? This part is really simple; it first alerts the fire department and then if certain hardware is installed it tries to put out the fire on its own. The hardware I refer to are remotely guided water cannons, with water support. **Protasis** is able to control them and throw water in the right place at the right time. Moreover, this edition decides where the fire is more important and there is more danger for it to expand, so if for example there are to fires at one time, **Protasis** decides which one is more dangerous and sends more fire forces there. This "selection" is done using certain factors such as the levels of humidity and the strength of the wind. In the same way it creates statistics of which are the more dangerous forests for fires etc., but this time it uses information collected all over the year. Forest Edition also has all of the features of the Home Edition. The core of this edition is the same with the Home Edition's core, so this edition is also almost completed.

- **Water Edition:** The Water Edition cleans the water in lakes and even in oceans. It only needs the right hardware installed—many many sensors that measure chemical quantities in water, and some tanks. **Protasis** initially tries to detect if the water in that area is polluted. If it is, it determines which chemicals it is polluted with and puts the water into appropriate tanks. Then it neutralizes these chemicals in the tanks and provides clean water. This application does something similar to the Industrial Edition application and controls the amount of chemicals. But, you can understand that the hardware needed is very expensive, because you need many devices around the lake and in the lake to check and take samples of the water. So, it also becomes very difficult to clean seawater, because you need many, many devices. However, you can clean small areas like beaches. The core of this edition is the same with the Home Edition's core, so this edition is also almost completed.

3.1.1.5 Screenshot of Protasis Water Edition

- **Vehicle Edition:** This edition works in a similar way as the Industrial Edition and neutralizes the carbon dioxide (CO_2) and sulfur dioxide (SO_2) that all kinds of vehicles produce. The only limitation is that hardware must be installed in the vehicle during the construction process, which means that companies that construct cars, airplanes, etc., must accept the **Protasis** Vehicle Edition. The hardware that must be preinstalled are all the tanks with the sensors.

- **3.1.2 Project Protasis PC Client**

This serves the part of controlling other computers. Its work is simple; it runs some threads, which continually check for incoming commands from the PC application. If there are any commands available this client translates them in a way that the client computer can execute. It may shutdown a computer, put it into sleep mode, put it into hibernation mode, etc. Afterwards, the user will have to turn the computer on the next time. It can also do this job by itself, but the hardware needed is very difficult to install. Furthermore, as with the PC application, when this client is installed it will automatically place itself in the startup programs, so that it runs whenever the user turns on the computer.

- **3.1.3 Project Protasis Remote Devices**

In order for **Protasis** to work there are certain remote devices needed. These devices consist of four components. These are summed up below:

- ATMega168 Microprocessor
- Arduino Board
- XBee Shield for Arduino Board
- XBee module

The first one is the microprocessor used, which is compatible with the Arduino board. I have programmed it to be able to do everything discussed above. It is connected to the Arduino board, which has a USB port and a port for power support. In order to operate it needs 5 Volts. Then we have the XBee shield, which is attached on the Arduino board and provides support for connection with the XBee module. This module is attached on the XBee shield and provides a low power remote connection. It transfers the data serially. All of these together make up the main device. This device is

also connected to many sensors that acquire data about the surrounding environment. These data are sent via the XBee module to the **Protasis** PC application, which then processes them. The devices connected to the computers do not need to have the microprocessor connected, because all the work is done on the computer's processor. These devices need to have an external power support, so they need to be connected to a power plug that the program does not control, or they can have their power supplied with batteries. These devices, along with the PC application and client are the core of Project **Protasis**.

- **3.1.4 Project Protasis Mobile Phone Version**

This version of Project **Protasis** has many innovative features. First of all, it lets you control all of the devices in your home/industry from any place in the world, using your mobile phone. Furthermore, it receives alerts from the PC Application for whatever strange happens. It has many more features, but these two are the most important ones. It runs on every mobile phone that supports Java ME or .NET Compact Framework 3.5.

- **3.1.5 Project Protasis PDA Version**

This version of **Protasis** aims to let everyone control their homes from anywhere. It does almost everything you can do with the PC application. With the PDA version you can be at your car or at your work and you can simultaneously monitor your home as well as control it. Furthermore, using this version of **Protasis** you will be able to connect to the Web server and see all the statistics about your home/industry/etc., from anywhere. This is especially useful for people who do not spend much time at home, because of work or something else.

- **3.1.6 Project Protasis Server Application**

The **Protasis** Server application functions both as a database and a Web server. The database contains authentication data, data about the user preferences, data about statistics, etc. The Web server does all of the following:

  - Collects all the data the PC application sends to it.
  - Creates statistics, which contain data of energy consumption since the time the user started using the application. They also contain data about other users with about the same number of devices at home, so that the current user knows if he or she is economical or not.
  - Encrypts these data so they are not accessible by hackers.
  - Can be accessed via Webpage.

The **Protasis** Server application can also be accessed by the **Protasis** application itself. When the user has gained access he will be able to see his progress since he bought the application. This server is implemented using Microsoft SQL Server 2005. It runs in an IIS 7.0 server.

- **3.1.7 Project Protasis Webpage**

This is the Webpage used to access the **Protasis** Web server. It has the following features:

  - Every user acquires a username and a password when they purchase the application. These are used to access the Webpage.
  - Displays in a user-friendly format all the statistics the server application has created, using graphs and diagrams.

That way the users have both a secure and easy way to access their statistics. This is especially helpful if they are on a computer where **Protasis** is not installed and they do not have a PDA. That is because they can access it using a simple browser. Furthermore, the webpage uses virtual earth in order to highlight certain areas for each application. For example, in the Forest Edition it highlights areas with more danger for fire with other color than the others etc.

- **3.1.8 Project Protasis Chat Application**

This application is called AntChat. It is used mainly for customer support; that way everyone who has a problem will receive help from a technician. Furthermore, this application is not just a simple chat application. It can also work as a remote administration tool if the user desires, so that the technician does everything for him.

3.2 Artificial Intelligence

- **3.2.1 Fuzzy Logic**

Project **Protasis** uses fuzzy logic in order to achieve many things. For example, when you want to set up the time after which without movement, you want the lights to go off, you tell **Protasis** that you do not want it to be much time, or that you want it to be much time, then it understands what that means in numbers. So, it translates words into numbers. But that is not so simple; it works all the time and these numbers keep changing. You could say that it works as a human mind. When you decide what short and what tall means, you do it in a similar way, by translating the word short into a number (height). It also lets you decide whether you want an economic or a comfort house and it automatically adjusts all the settings needed. It also changes these settings all the time.

- **3.2.2 Smart Algorithm**

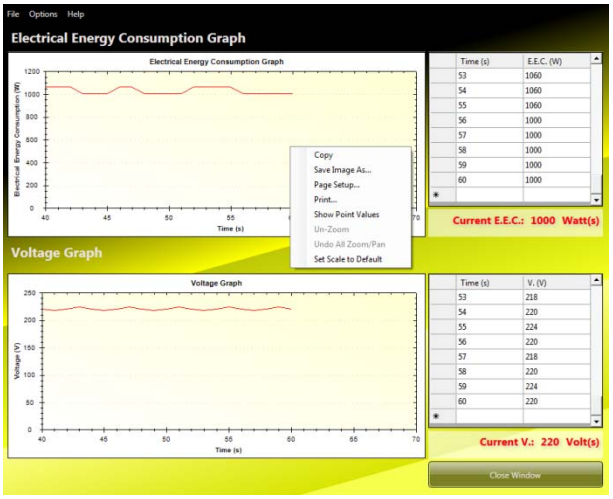
Project **Protasis** uses a very smart algorithm when it decides whether or not to turn off a light for example. This algorithm is not fully developed, but it has been designed. It combines the fuzzy logic discussed above and uses a very complicated case validation algorithm. That way it becomes the most efficient application of its kind.

All these discussed above make Project **Protasis** a very intelligent application. It is like **Protasis** has a human mind, with the difference that it is much faster than the human mind, it never makes mistakes and it processes more factors, than the human mind could imagine, at the same time.

3.3 Technologies

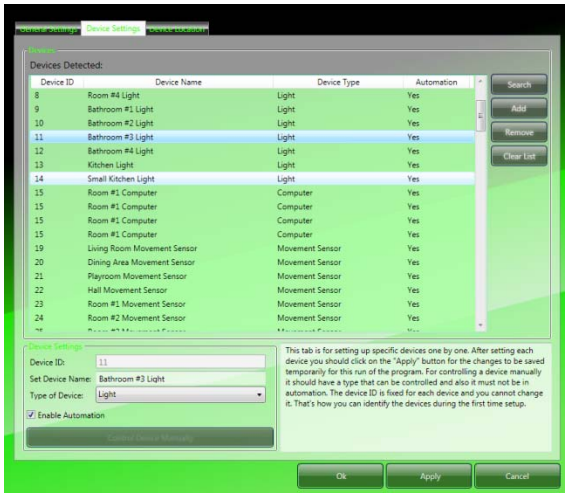
- **3.3.1 Server:**
    - IIS 7.0
    - Microsoft SQL Server 2005 Standard Edition
- **3.3.2 Development Tools:**
    - Microsoft Visual Studio 2005 Professional Edition
    - Microsoft Visual Studio 2008 Professional Edition
    - Microsoft Expression Blend
    - Microsoft Expression Blend 2 December Preview
    - NetBeans IDE Version 6
    - Windows Movie Maker
    - Adobe Flash CS3 Professional
    - Adobe Premiere CS3 Professional

- **3.3.3 Other Technologies:**
    - .NET Framework 3.5
    - .NET Compact Framework 3.5
    - Windows CE Mobile 6.0
    - Windows Automotive
    - Windows Vista Ultimate Edition
    - C# 3 Programming Language
    - C# 2 Programming Language
    - Java Enterprise Edition Version 5
    - Java Standard Edition Version 6
    - Java Micro Edition
    - Java Server Pages
    - C++ Programming Language
    - Arduino Programming Language
    - Machine Code
    - RISC Assembly Language
    - XML Web Services
    - Microsoft DirectX 10.0
- **3.3.4 Hardware:**
    - Arduino Board
    - XBee Shield for Arduino Board
    - XBee Module Simple/Pro Series One/Series Two
    - Compatible with XTend Module
    - GPS Module for Arduino Board
    - GPRS/GPS Module for Arduino Board
    - T.E.D. Electricity Monitor
    - Thermistor
    - Temperature Sensor
    - PIR Sensor
    - Humidity Sensor
    - Light Sensor #1
    - Light Sensor #2
    - 1K Resistor
    - 10K Resistor
    - Relay

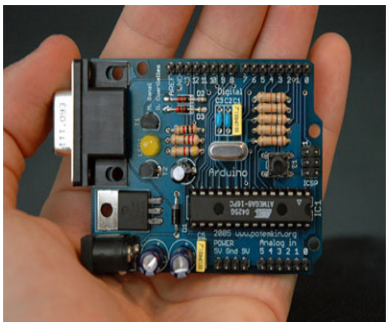


3.3.3.1 Screenshot of Project Protasis Home Edition

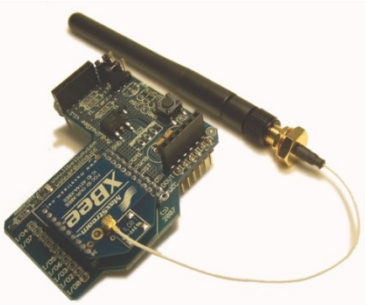
3.3.3.2 Screenshot of Project Protasis Home Edition



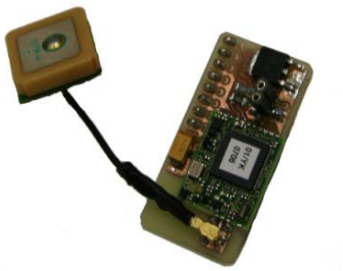
3.3.3.3 Screenshot of Project Protasis Home Edition



3.3.4.1 Photo of the Arduino board

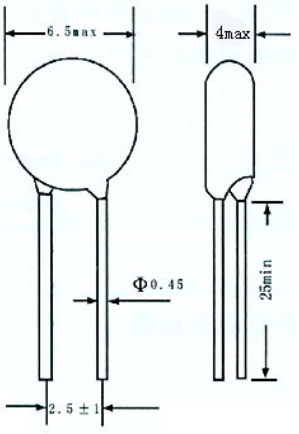


3.3.4.2 Photo of the XBee Shield for the Arduino board attached to the XBee module

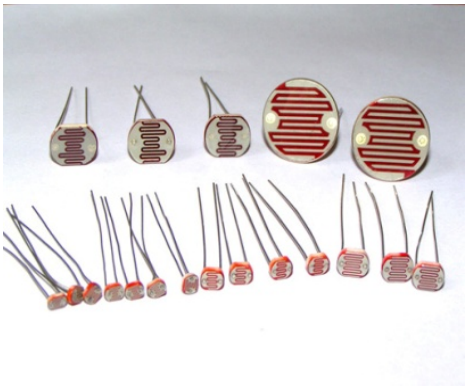


3.3.4.3 Photo of the GPS Module for the Arduino board

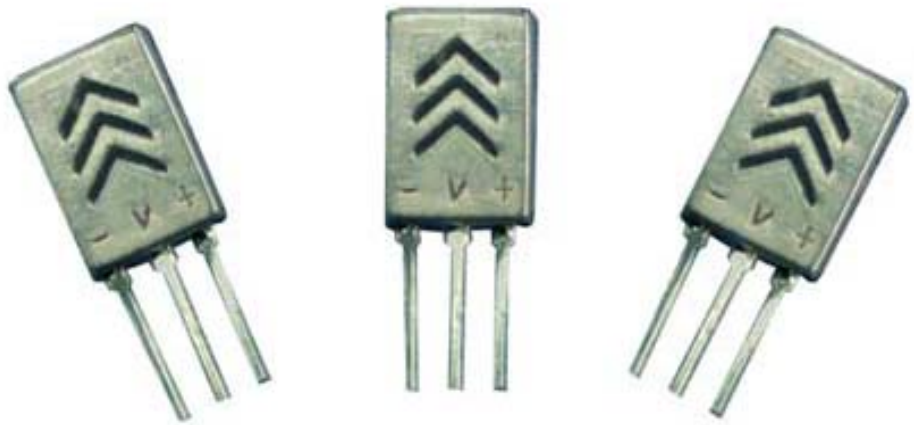
3.3.4.4 Photo of PIR sensor



3.3.4.5 Diagram of thermistor



3.3.4.6 Photo of various light dependent resistors that are compatible



3.3.4.7 Photos of the humidity sensor

4 Conclusion

4.1 Innovation

As you can see, Protasis is a very innovative project that can help all of us. It is innovative because it is the first that:

- Controls all home devices by itself.
- Can neutralize the carbon dioxide (CO_2) that industries produce.
- Can neutralize the sulfur dioxide (SO_2) that industries produce.
- Can put out forest fires by itself.
- Can "eliminate" water pollution.
- Can neutralize the carbon dioxide (CO_2) that vehicles produce.
- Can neutralize the sulfur dioxide (SO_2) that vehicles produce.
- Can burn biogases by itself.
- Can neutralize the gases produced from burning biogases.

4.2 Impact

Right now the whole world is alerted to environmental pollution. The main result of air pollution is global warming, which is continually increasing. Another great problem as discussed above is water pollution. Furthermore, who can argue that forest fires are not a big issue? Take for example in Greece this summer; half of the Peloponnese was burned and the result was not only burned forests, but also even more air pollution because all the smoke produced by these fires went up into the atmosphere. Furthermore, without forests there is less oxygen (O2) produced and less carbon dioxide (CO2) consumed, which makes the ratio O2:CO2 smaller. So, eventually the oxygen (O2) in the atmosphere will not be enough for us to live and the carbon dioxide (CO2) will be enough to kill us. Protasis aims to stop global warming from growing and even "eliminate" it, by fighting against all of the issues discussed in this paper.

4.3 Effectiveness

Protasis aims to achieve the following results:

- Reduction in electrical energy consumption by **up to 60%**.
- Reduction in water consumption by **up to 30%**.
- Reduction in oil consumption by **up to 40%**.
- Reduction in carbon dioxide (CO_2) emissions by **up to 100%**.
- Reduction in sulfur dioxide (SO_2) emissions by **up to 100%**.
- Reduction in burned forests by **up to 90%**.
- Reduction in polluted lakes by **up to 100%**.
- Reduction in biogases by **up to 100%**.
- Reduction in gases released from burning biogases by **up to 100%**.

4.4 Extensibility

Protasis is also extensible, from many points of view. Its extensibility features are summarized below:

- If you buy a new device after you have set up the application, you can easily add it, without having to search again for new devices and set them all up right from the beginning.
- Some future features have already taken into consideration, so the code is structured in a way that they can be implemented very easily.
- There are still many features to be added and they will be added very soon.

Though the biggest of its extensibility features is that the core of this project can be used for everything that the human mind can think of. For example, there could be an edition of Project **Protasis** for automatically injecting insulin to patients, or even detecting vertigo in pilots. This makes Project **Protasis** completely extensible.

4.5 Updates and Improvements

Protasis aims to include the following:

- Multilingual system for international use.
- Automatic light dimmer.
- Review of statistical reports by experts and comments by them on how to reduce consumption or whatever the statistics show.
- Games for small children that will affect their concern about the environment.
- New editions, concerning other environmental issues. For example, an edition that helps in dividing the different types of garbage, for recycling.

4.6 Further Information

Right now Project **Protasis** consists of the following:

- 7 Versions – 1 Edition – Core for Unlimited Number of Editions
- 450.000 Lines of Code
- 43 Technologies (see the 3.3 Technologies section pages 15-16)
- 3 Databases – 40 Tables – 277 Columns
- 1.50 GB – 2.464 Files – 337 Folders

4.7 About the Author

My name is Anthony Platanios (AKA Ant0nisS) and I am 16 years old. Right now I am in the first year of the International Baccalaureate Diploma program. I wrote Protasis in order to eliminate all the environmental issues that exist right now and I hope that it will be successful. I hope that I will win the Imagine Cup 2008 and with Protasis I believe I can. During the time I was creating this project, I met many difficulties, such as exams at school, so I did not have much free time. But I persevered and finally accomplished my goal. Every single thing on this project is created by me, and all the ideas are mine. I did the brainstorming, design and programming of Project Protasis.

Filename:	Project Protasis Final Report
Directory:	I:\Imagine Cup 2008\Project Protasis\Project Protasis Final Report
Template:	C:\Users\Ant0nisS\AppData\Roaming\Microsoft\Templates\Normal.dotm
Title:	Project Protasis
Subject:	A Tool for Using Technology Without Harming the Environment
Author:	Project Protasis Final Report for the Greek Imagine Cup 2008 Finals
Keywords:	
Comments:	
Creation Date:	14/5/2008 11:26:00 πμ
Change Number:	16
Last Saved On:	15/5/2008 3:40:00 πμ
Last Saved By:	Ant0nisS
Total Editing Time:	102 Minutes
Last Printed On:	15/5/2008 3:40:00 πμ
As of Last Complete Printing	
Number of Pages:	21
Number of Words:	7,167 (approx.)
Number of Characters:	35,121 (approx.)