CHAPTER 8

APPLICATION DEVELOPMENT USING PROTOTYPING

8.1 Overview

The term prototype refers to a working model of an information system application. The prototype does not contain all the features or perform all the actual functions of the final system. Rather, it includes sufficient elements to enable individuals to use the proposed system and determine the features that need to be added or changed.

Application prototyping, the process of developing and using the prototype, has these five characteristics:

- The prototype is a live and working application.
- The purpose of a prototype is to test out assumptions made by developers and users about required system features.
- Prototypes are created quickly.
- Prototypes evolve through an iterative process.
- Prototypes are relatively inexpensive to build.

Chapter 6 explained the reasons behind choosing prototyping as the methodology in this project.

8.2 Benefits of using prototyping

Stated below are the advantages of using a prototype model:

- Provides users with a model of the final product.
- Provides a better view of the product for user.
- Minimises time lost to correct the incorrect development as it arises.
- Minimised the design errors or bugs.
- The efforts of developers will yield a high payoff.
- Reducing the chances of repeating of work (Christopher Martin & Philip Powell, 1992).

8.3 Disadvantage of using prototyping

Below are the disadvantages of using the prototype model:

- Users face difficulty in pre-specifying their information needs, especially in new or rapidly changing situations.
- The complete requirement specifications are dependent on the way in which the technology will be used.
- Static descriptions of systems (e.g. written narratives or graphic charts) often do not sufficiently communicate the detailed dynamics of situations.

- Miscommunication, always a possibility, seems to occur at the most inopportune times (James A Senn, 1989).

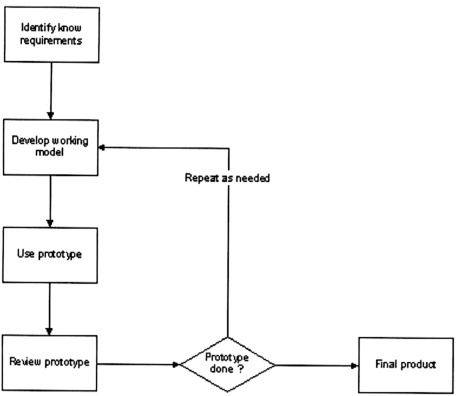


Figure 8.1 Step in prototyping development method

8.4 Steps in prototyping development

Figure 8.1 above show the steps required in prototyping development

- Identify known requirements

  Before prototype is created, both the user and the system developer need to work together to identify the necessary requirements. They need to determine the purpose and the scope they want to cover in the system.

- Develop working model

  In this step, the system developer quickly develops a working model, explaining what activities it will cover, the sequence, and the responsibilities of each participant.

- User prototype

  Both the system developer and the user work together with the prototype and evaluate its features and operation. The experience with the system in an actual application setting should familiarise the user and developer with the system so that they are able to determine the necessary changes or enhancements which is needed to eliminate all inadequate or undesirable features.

- Review prototype

  During the evaluation, the system developer will want to capture information on what users like or dislike, through noticing the way they react and finding out why. Changes to the prototype are planned with the users before they are made.

- Repeat as needed

The process described may have to be repeated several times to evolve the application. Four to six iterations are typical. However, the main aim is that the process continues until users are satisfied with the final product.

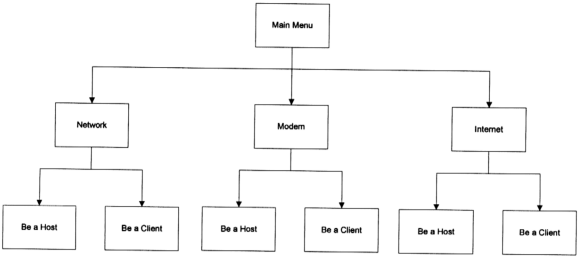
8.5 Develop prototyping model for Remote monitoring system

This is the phase whereby the developer starts developing the project. The aim of this project was to develop a working model of Remote Monitoring System that contain these three major function:

1. Using network (LAN/WAN) for remote monitoring.
2. Using Telephone dial up (Modem) for remote monitoring.
3. Using Internet (Browser) for remote monitoring.

8.5.1 Initial prototype

Hierarchy charts are important tools in assisting the developer to determine the number of modules that would be required for the project. As there are many sub components, the developer may tend to overlook certain modules. Therefore, the interactivity between modules and the hierarchical structure of the various modules can only be appreciated with the aid of the hierarchy chart. Figure 8.2 showing the modules that would be included in the Remote Monitoring project.



Structure design of the Remote Monitoring System

Figure 8.2

In order to fulfil the requirement of the final project, it is not necessary for the developer to develop all the modules in the prototype. Only the main modules (those that form the core of the application) need to be developed.

In the Remote Monitoring System, the mainline activities designed in the prototype may include modules that are able to handle the following:

- Accept remote connection by network.
- Accept remote connection by dial up telephone.
- Capture image from CCTV camera.
- Compress and transmit data to remote user.
- Publish the image to the web.

Secondary requirement, which would normally be included in the real project, but is omitted during creating of the prototype, is as described below:

- User login.
- Validation of remote user.
- Reporting current remote user order data by amount, date.

8.5.2 First iteration (High Level Prototype)

The developer decided to use top down design method to develop the prototype. Based on the figure 8.2 on the page before this, the developer uses Ms Visual Basic to rapidly construct several form that is integrated together as shown below.

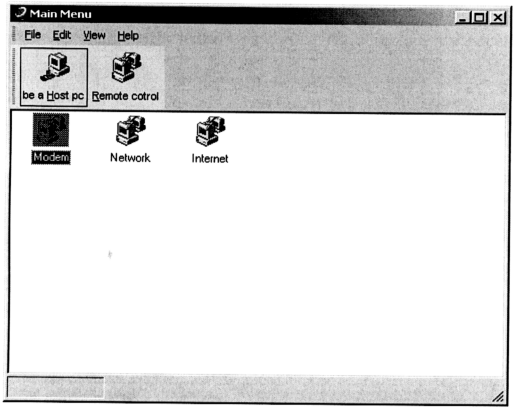


Figure 8.3 Main Menu

The first iteration, is only a high-level interaction. In the next iteration, the function and the procedures would be codes.

8.5.3 Second iteration (Prototype the network module)

The network module can be separated into two sub modules. *(Host and client)* Host computer is designed for listening and waiting for the remote client. When the connection has been established, the host computer will request images from CCTV camera, compress it and send it back to the remote user. This process continues until the connection is released.

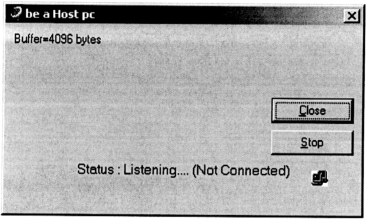


Figure 8.4 Screen design for the host computer via computer network

Before establishing the connection, the remote user has to connect to the host computer, by entering the IP address. Once the connection has been established, the remote client would be able to view the images from the remote site.

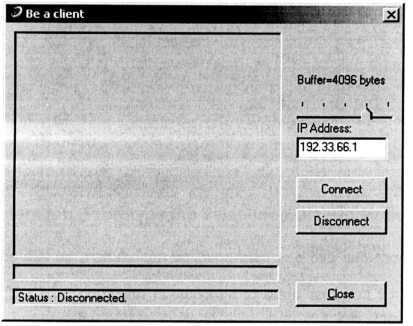


Figure 8.5 Screen design for client computer via computer network

8.5.3.1 Network Module Development Review and Evaluation

Once the network module has been successfully developed, the developer now has to review the prototype.

Stated below are some of the strengths and constraints of using this module:

- A 100 M bps of hub is recommended. The system will still be able to operate on a 10 M bps, hub, depending on the size of the image being transferred. The smaller the size of the image, the better the transfer rate.

- Only one computer is allowed to connect at one particular time, therefore, the other computers will have to wait until the first computer releases the connection before it can connect. The developer is currently trying to

expand the next version of the project so that, it will be able to support multiple users.

- A lower image size is suitable for data transmission.

8.5.4 Third iteration (Prototype the Telephone Dial Up Module)

The telephone dial up module can be separated into two sub modules. *(Host and client).* The Host computer is designed to listen and wait for the requests from the remote client. Once the connection is established, the host computer then requests images from CCTV camera, compress it and send it back to the remote user. This process is iterated until the connection is released. This process is almost the same as the network module yet, the coding of this module is totally different. Figure 8.6 below shows that host computer waiting for remote dial up.

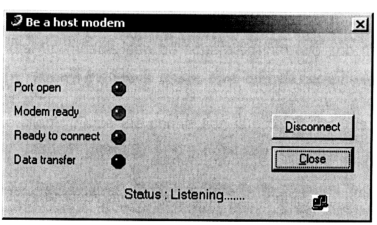


Figure 8.6 Screen design for the host computer via dial up telephone modem

The process of monitoring is same as previous; the remote user has to dial up the connection. Once the connection has been established, the remote client would be able to view the image from the remote site.

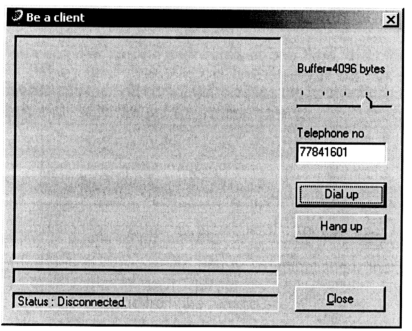


Figure 8.7 Screen design for the client computer via dial up telephone modem

8.5.4.1 Telephone Dial Up Module Review and Evaluation

Developing of the modem module is much more difficult compared to the network module. When using the modem module, the developer, first of all needs to understand the modem command (i.e. dial up telephone and answering telephone). Data transmission over the telephone requires more control and verification as error may occur during data transmission. A procedure of filtering carriage return must be created to ensure the data arrives in a proper manner.

Listed below are some of the strengths and weaknesses of using this module:

- Normal telephone lines support 19.2k per second. Hence, data transmission will be slower than network transmission.

- Only one computer can be connected at one time, the other computers have to wait until the first computer releases the connection.

- It can be monitored anyway in the world.

- A lower image size is recommended

8.5.5 Fourth iteration (Prototype the Internet module)

The Internet module can be separated into two sub modules. *(Host and client).* Host computer is designed for capturing the image and publishing it on to the Internet. However, the client computer does not need to establish the connection. All images and data will be saved in the server, user just needs to logon to the particular web page so that the remote user can see the image at the remote site. Developing this module is easier compared to the previous module. However, developing this module would require in-depth Internet knowledge and skill.

The interval time showed in Figure 8.8 is the number of seconds the CCTV camera will take to capture the image. The File name is the folder in which the image would be stored. Basically this folder is a public or shared folder for Internet use.

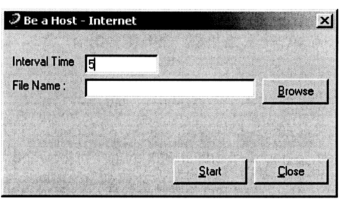
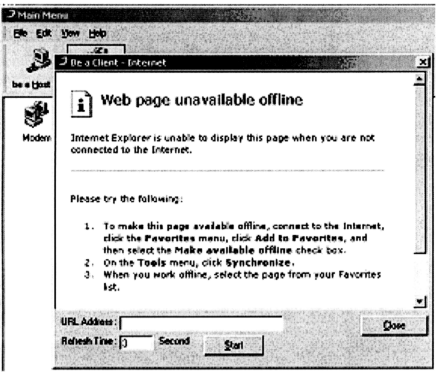


Figure 8.8 Screen design for the host computer via Internet

Figure 8.9 below showing the client use the Internet Browser to open the particular image that is store in the particular web site.



8.9 Screen design for the client computer via Internet

8.5.5.1 Internet Module Development Review and Evaluation

As compared to the network module, the Internet module does not require any dial up connection and does not need any complex algorithms to verify and control the data transmission error. In the Internet module's case, the computer browser handles all the event's error.

Stated below are some of the strengths and constraints of using this module:

- Computer server is a must.
- Web servers will be too busy for publishing the images from the CCTV camera on to the Internet, even though there is no one requesting for the image.
- Only supports time lapse imaging.
- Require additional web server tools such as Internet Information Service (IIS).
- Allows multiple accesses.