

Eye2see: A Mobile Surveillance System for Pocket PCs

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Abstract:

As technology progresses and evolves, the trend is targeting mobile environment and cloning all current aspects of technology into mobile platforms. The need to control and access information from anywhere and through wireless fashion is rising. Eye2see is an excellent example on utilizing mobile technology.

Keywords: Mobile Technology, imate, Pocket PC, and Surveillance System.

1. Introduction

Mobile technology is the most important and impressive offspring of technology. Below is a list of some new aspects of mobile technology:

• Bluetooth

Bluetooth is a standard developed by a group of electronics manufacturers that allows any sort of electronic equipment from computers and cell phones to keyboards and headphones to make its own connections, without wires, cables or any direct action from a user. Bluetooth is intended to be a standard that works at two levels:

- It provides agreement at the physical level Bluetooth is a radio-frequency standard.
- It also provides agreement at the next level up, where products have to agree on when bits are sent, how many will be sent at a time and how the parties in a conversation can be sure that the message received is the same as the message sent.



• LANs and WANs

LAN (Local Area Network) is a network that links computers, printers and other devices located in an office, a building or even a campus. A WAN (Wide Area Network) is a system that extends for greater distances and is used to connect LANs together.

• Smart phones



A Smart Phone is a mobile phone that can send and receive voice, data and video. This phone generation has various features like connecting to the Internet for web access and receiving emails. The Smart Phone consolidates the typical mobile phone with the Personal Digital Assistant (PDA) and digital camera, and thus creating a powerful communicating Mobile Intelligent Device (MID).

- **PDA**

Personal Digital Assistant, or PDA, a remarkable, tiny, fully functional that you can hold in one hand. A PDA can do more than hold calendar events. PDAs are the one of the fastest selling consumer devices in history. These devices receive information, process information, and communicate with other computers and PDAs.



functional computer address books and devices in history. communicate with

One of the most important things involved with successful mobile work and telecommunicating is good communication. There are a wide variety of tools and technology available today to keep us connected no matter where we are. The good news is that these tools and services seem to keep getting less expensive every day. With the technology available today, the issue of mobile computing being difficult to accomplish is a thing of the past.

2.0 Proposed Idea

After examining all the information mentioned before, one could foresee that a project tackling mobile technology is a precious and interesting task to do. The initial proposed idea was to develop an application for a smart phone running the Symbian operating system. An application could be a system utility, game or a graphical one. After some consultations, a more interesting proposal has emerged. The issue of controlling a remote object using a PDA was more appealing and genuine. The object to be controlled is a cam and not a simple web cam. It should have a tilt, pan and zoom features. To summarize in few words, the application to be developed is a mobile surveillance system that allows a mobile user to access a cam installed at a specific target place and to manipulate its movement and monitor.

The Scope

The scope of the project and the features that are included in the application are listed below:

- Capability to retrieve frames from the cam at an acceptable time delay.
- Capability to control the tilt / pan / zoom features of the cam (4 basic directions, home repositioning, 4x zoom).
- Capturing frames at will and store the captured images into the PDA memory.
- Ability to browse captured images.
- Schedule future tasks to run invisibly in the background and save image frames into storage card memory.

3.0 Surveillance Systems

Surveillance systems are widely spread applications one can find a large variety of similar systems. Some online websites offer such services but the most famous ones are the ones that are packaged with specific cameras. Once the cam is installed and the specified application allows the user to access the cam from any PC connected to the internet.

What is unique in this project is that it offers a solution that was never provided before at least in normal surveillance systems. As mentioned before, surveillance systems are meant to be used with PCs or notebooks but not with handhelds or PDAs.

This proposed application will be a breakthrough in the surveillance systems world. Monitoring our home while we are driving, watching a special place to assure its security from a mobile location are examples of the offered services. Figure 1 illustrates this claim by showing an example of a similar application that is going to be launched on July 1st, 2004.

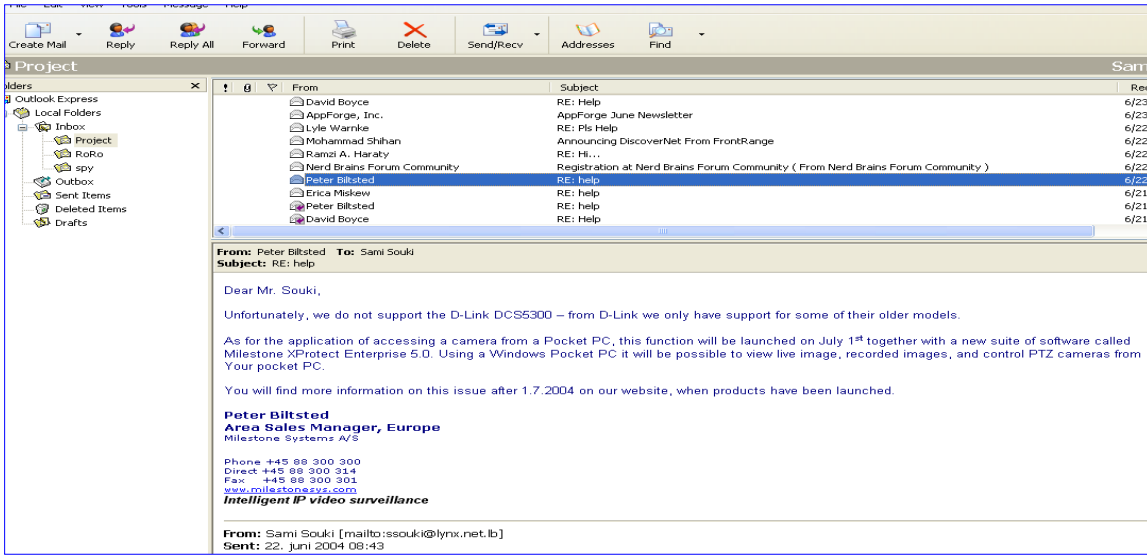


Figure 1 – Milestone systems application

Figure 2 shows that the manufacturer has no plans for similar applications.

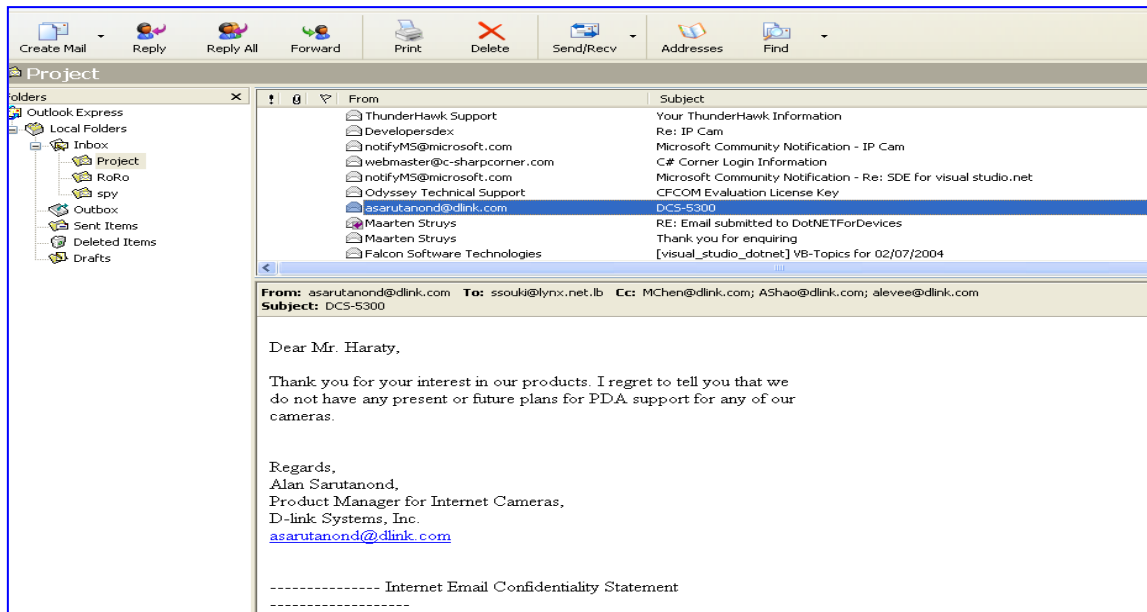


Figure 2 – D-Link Support

Resources

A. DCS 5300

The cam that will be used is a DCS 5300 manufactured by D-Link.

The D-Link *SecuriCam DCS-5300* Internet Camera is a full featured system that connects to an Ethernet, Fast Ethernet or broadband Internet provide remote high-quality video and audio. The **DCS-5300** is the latest to the D-Link internet camera line. The camera features a motorized pan and tilt on more expensive cameras. This function allows the viewing area of the camera to extend 270 degrees side-to-side and 90 degrees up and down.



surveillance connection to product added function found

B. I-mate PPC

I-Mate pocket PC, the I-Mate PPC is a fully integrated voice enabled GSM/GPRS personal computing device that runs the phone edition of windows Mobile 2003 an SDIO slot to be used for memory cards.



portable and features

C. Visual studio .NET 2003 Architect Edition

First Approach

The DCS 5300 cam is a stand alone camera that has its own operating system and ROM built in. It has an Ethernet interface, once plugged into a network it configures itself as an independent component that can be accessed through a web interface. In other words, the cam can be accessed through its IP address which will invoke an active-X control built in the cam memory (ROM). The only piece of code provided by the camera documentation is the following:

```
document.write("<OBJECT ID=\"VaCtrl\" WIDTH=362 HEIGHT=306\";
document.write(" CLASSID=CLSID:A93B47FD-9BF6-4DA8-97FC-9270B9D64A6C\";
document.write(" CODEBASE=\"http://xxx.xxx.xxx.xxx:5004/plugin/h263ctrl.cab#version=1,7,0,5\">");
document.write("<PARAM NAME=\"Url\" VALUE=\"http://xxx.xxx.xxx.xxx:5004/cgi-bin/video.vam\">");
document.write("<PARAM NAME=\"VSize\" VALUE=\"SIF\">");
document.write("<PARAM NAME=\"RemoteIP\" VALUE=\"xxx.xxx.xxx.xxx:5004\">");
document.write("<PARAM NAME=\"RemotePort\" VALUE=\"5001\">");
document.write("</OBJECT>");
```

This characteristic implies that the cam acts as a COM (component object module) object. Therefore, the first approach to tackle this application was to use the cam as a COM object.

COM Object

Components developed using Microsoft's COM provide a way by which two objects in different object spaces or networks, could talk together by calling each other's methods. This excellent technology forces the operating system to see applications as objects.

COM forces the OS to act as a central registry for objects. The OS takes the responsibility of creating objects when they are required, deleting them when they are not, and handling communications between them, be it in the same or different processes or machines. One major advantage of this mechanism is versioning. If the COM object ever changes to a new version, the applications that use that object need not be recompiled.

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The wonderful thing about COM components is that they are never linked to any application. The only thing that an application may know about a COM object is what functions it may or may not support. In fact, the object model is so flexible that applications can query the COM object at run-time as to what functionality it provides.

Some Problems

Now looking at the features provided by the pocket PC, one discovers that Javascript and active-X are not supported neither by the operating system nor by the internet browser installed.

As for the DCS 5300 cam support, nothing was available to aid in solving this problem. A Software Development Kit (SDK) was an essential requirement which was not provided by the manufacturer as shown below in figure 3.

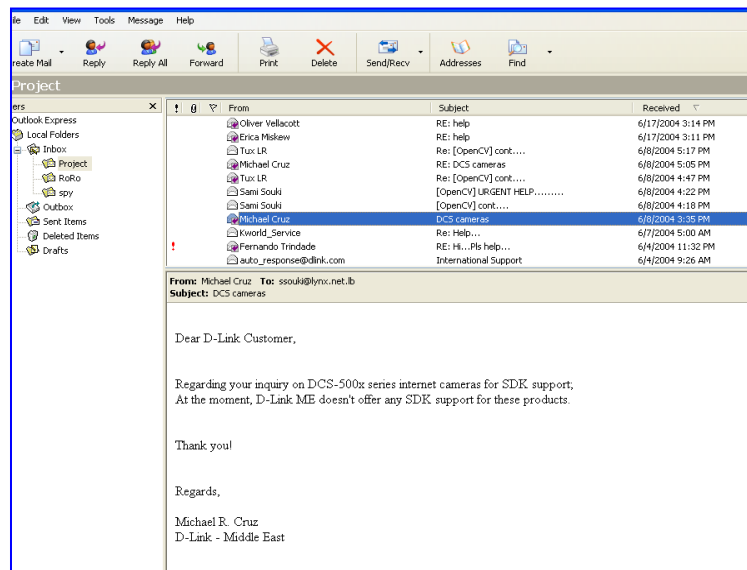


Figure 3 – D-Link SDK for DCS-5300 cam

Second Approach

A second approach was considered to solve the problems mentioned above. In this approach, it was decided to use the Visual Studio .NET 2003 (Architect Edition) to develop an application that is capable to establish a connection between the cam and the Pocket PC.

Visual Studio .NET 2003 includes integrated support for the Microsoft .NET Compact Framework. Using the Microsoft Windows Forms designer, Microsoft Visual Basic and Microsoft Visual C# developers, one can easily build, debug, and deploy powerful applications for the Pocket PC, Pocket PC Phone Edition, and other smart devices powered by the .NET Compact Framework. Integrated emulation enables developers to program and debug applications.

Main Algorithm

The features previously listed in the scope section are described below:

- ***Capability to retrieve frames from the cam at an acceptable time delay.***

The main idea was to establish a tunnel (connection) between the eye2see program and the cam by addressing its IP address and then using timers to regulate the frame rate. A ***webrequest*** was used and the data retrieved from the cam was encapsulated into a stream variable. This variable (stream) was later on converted into a bitmap image to be displayed in the main form.

- ***Capability to control the tilt / pan / zoom features of the cam (4 basic directions, home repositioning, 4x zoom).***

The same approach as in the first feature was used. A ***webrequest*** was adopted to send a request to the cam. Five parameters were used to summarize the Five directions listed. The zoom feature was programmed and implemented on one side mainly on the Pocket PC. In other words, the zoom action was simulated by manipulating the image frame retrieved from the cam.

- ***Capturing frames at will and store the captured images into the PDA memory.***

This procedure was developed using Visual C# .NET. Converting a bitmap variable into a bitmap image file to reside on storage memory was not a straight forward task. The C# module, the variable bitmap had to be read bit by bit and stored in a two dimensional matrix and then be written to a file which constitutes the bitmap image.

- ***Ability to browse captured images.***

A form was created to enable the user to browse the captured frames. This procedure scans the target directory and loads the names of the captured images into a combo list and displays the chosen picture upon selection.

- ***Schedule future tasks to run invisibly in the background and save image frames into storage card memory.***

The scheduling issue was somehow a challenging task because the schedule task must reside in memory (in the background) until it is triggered when the target time is met. Therefore, this module was developed separately. It is installed automatically with the main package and is called from within the eye2see main program but it remains running in an invisible mode until it finishes the capture. The captured frames will be stored on the storage card if found if not they will be stored in a specific folder.

Setup

After the application is compiled successfully and the build process accomplished in Visual Studio .NET 2003, a CAB file is created and can be transferred to the PDA to be installed.

Basic requirements to run the application:

- 1- The DCS-5300 cam should be connected to the Internet either through a direct real IP or through a PC, notebook or a router. If the cam is connected to a PC (without router) Network Address Translation (NAT) should be used to forward and tunnel the requests of the PDA to access the cam.
- 2- The PDA should be connected to the Internet either through dial-up or GPRS. The latter is preferable for its speed and flexibility.
- 3- After a successful installation of the application, the IP of the cam should be provided to the eye2see software to establish connection.

4.0 Conclusion

To conclude, it is worth mentioning that mobile computing is a very essential and hot area in this century and should be taken into consideration by implementing a wide variety of application that may simulate existing ones supported only for personal computers or invent new applications.

5.0 Future Work

As for future enhancements to the eye2see application the following could be done:

- 1- The capability to transmit audio.
- 2- Transmitting streaming video instead of frames.
- 3- The ability to schedule infinite capturing tasks.
- 4- An interesting feature could be programmed to produce an alert whenever a motion occurs in front of the cam.

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