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DEVELOPMENT OF AN INTELLIGENT SYSTEM FOR MONITORING THE SHIP ENGINE ROOM USING MOBILE PHONE

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ABSTRACT

In today's world, ensuring security for important places as well as hazardous environment is a burning issue. Different surveillance methodologies such as alarm system, CCTV, PC based video system are developed to ensure this security. But using all these systems, it is not possible for a person to monitor the security of his or her desired location when they are outside. Now-a-days anybody can communicate with anyone at any time around the globe with the help of mobile phone technology. By keeping the technological facility of mobile phone in mind, a mobile phone based intelligent surveillance system has been described in this paper. This paper will give a solution for the security of the ship's engine room by accessing from the mobile phone when the ship is within the range of radio network. In this system there are server and client (captain or engine operator) end. Server will store images being captured by the webcam of the engine room .Then based on client's request sending from their mobile phone to the server, clients will be able to view the images from their mobile phone that is stored in the server. Clients are also able to move the webcam by sending control instruction from their mobile phone to view the images of their desired position. The developed system has been tested first using the GUI (emulator) designed by NetBeans IDE. It has also been tested using different mobile phones to see the images in real time. This surveillance system can also be implemented for other handheld devices like PDA.

Keywords: *Java 2 micro edition (J2ME),Java Media Framework (JMF),NetBeans IDE, Java programming for server and client software, usage of mobile phone as GUI.*

1. INTRODUCTION

Security is a prime concern in our day-today life. Everyone wants to be as much secure as possible. A security guard can be a physical solution but if the specific location like ship's engine room, office or parking area can be seen and monitored from a remote place, it will be more secured. That is why different monitoring systems like alarm system, CCTV, PC based video system etc. have been proposed [1-4]. But it's not always feasible to be physically near to the system. So, to be in touch with this sort of important systems by not being physically close, we need some sort of remote solution. Today's communication world ensures that anybody can communicate to anyone anywhere anytime across the globe with the help of mobile phone technology [5]. Various type of research works have been conducted in different time by different authors such as a video surveillance system based on Multimedia Messaging Service (MMS) [6-7]. This system is desired to monitor an area continuously and to capture the hazardous momentary event and to send this video image to the user as an MMS or as an e-mail immediately. But the problem with this system is that as the mobile operators do not encourage sending multimedia message to mobile phone from e-mail in fear of spam, the concept could not be verified with the mobile phones. Another research work is controlling remote system using mobile telephony [13-14] which introduces the mechanism of the mobile phone so that the ordinary services of the mobile phones can be leveraged to communicate with and control the remote systems. After reviewing the past researches and exploiting the communication facility of the mobile phone, a mobile phone based

surveillance system has been developed in this research for giving a solution about the insecurity of ship's engine room while the captain is far away from the engine room[13]. Using this system captain (client) or engine operator will be able to watch or monitor their engine room from anywhere of the ship. Although different types of camera with built-in hardware for moving it in any direction are available in the market [15], these are very expensive. In the proposed system a hardware circuit using stepper motor and other accessories are developed for the movement of the webcam to provide a low cost solution. The proposed system will provide the true sense of real mobility and security [16] by accessing the desired place from the mobile phone. The aim of this research is to develop a mobile phone based surveillance system through which engine operator or captain can get snaps of their engine room anytime from anywhere. To achieve the above goal, this research has following objectives:

- To develop a Java Program for capturing image sequences of the important location.
- To develop an interface through which a person can communicate with the server and access the captured images to monitor the desired location at any time.
- To develop a hardware circuit for the movement of the webcam.

Next sections of this paper describe the hardware design that is designed to move the webcam based on client's instruction. Then next portion elaborates the system architecture and its working procedure and then the experimental results getting from emulator (GUI) and real mobile phone.

2. HARDWARE DESIGN

The idea of the hardware design is to move the webcam based on clients command sending from their mobile phone. The working involves a parallel port (DB25), a main IC ULN2003 and a unipolar stepper motor. The schematic diagram of the hardware circuit is shown in Figure 1.

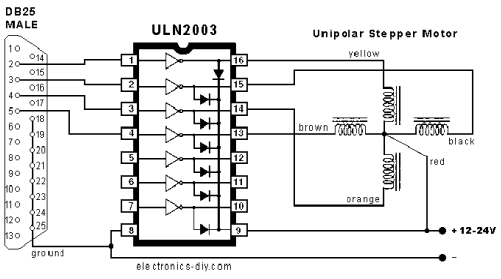

Figure 1. Schematic diagram of the hardware circuit.

Parallel port is a simple and inexpensive medium for building computer controlled system. The simplicity and ease of programming makes parallel port popular in electronic hobbyist world. The parallel port is often used in computer controlled robots, Atmel/PIC programmers; home automations etc. The primary use of parallel port is to connect printers to computers and is specifically designed for this purpose. The pins in DB25 connector are divided into three groups, they are 1) Data pins 2) Control pins) 3) Status pins. In the proposed system parallel port is used for communicating between PC and hardware by sending controlling bits through data pins 2 to 5 as shown in Figure 1and 3.ULN2003 is a 7-bit 50V 500mA TTL-input NPN transistor. In this research it is used to drive the stepper motor. A stepper motor is basically an electromechanical device which converts electrical pulses into discrete mechanical movements. The rotation of the motor has direct relationships to the applied input pulses. In this proposed system the pulses will be applied from the parallel port.

3. SYSTEM ARCHITECTURE

3.1 Operational Procedure of the System

The proposed work consists of three modules 1) image capture module 2) parallel port interface module 3) surveillance software module. Image capture module is responsible for capturing an image of the monitored area and storing it in a specific location of the server. Parallel port interface module is responsible for transferring the control bits to the stepper motor in order to move the webcam on clients command. The software part sends the images to the concerned person.

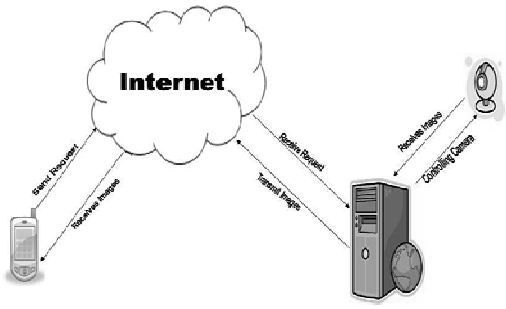

Figure 2. System architecture.

Figure 2 shown above describes how the system works to monitor? In this research, there are client and server end. A webcam will be connected with the server and it will continuously capture images of the desired location and save it to a specific location of the server. On the other hand client will start fetching images from the server by login the URL from their mobile phone. That is why at first client need to

establish a connection with the server. Once the connection is established client will start fetching images from the specific location of the local host where images are being saved that is captured by the webcam using HTTP protocol. Figure 3 shows how control instruction will be transmitted from the parallel port to the ULN2003 on client's demand and then it drives the stepper motor which in turn will move the webcam.

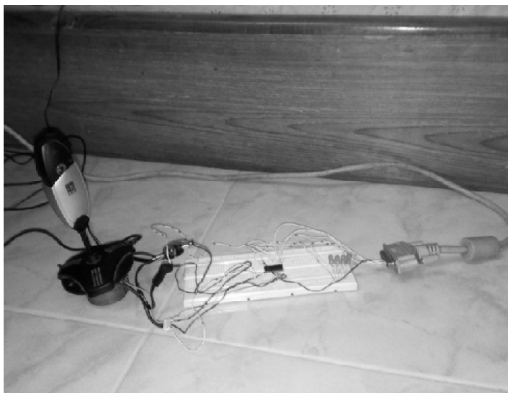

Figure 3. Hardware connection at server side.

3.2 How to Control the Webcam?

Client has also option to send control instruction from the mobile phone for horizontal movement of the webcam. The procedure is as follows:

1) A parallel port will be connected with the stepper motor via ULN2003 IC. The webcam will be placed onto the stepper motor and it will move the webcam based on the instruction getting from the client.

2) After viewing images client can send control instruction from their mobile phone to the server for horizontal movement of the webcam that is left and right movement.

3) After receiving the control instruction for left movement of the webcam, server will send a combination bits that will hit the parallel port first. For right movement the combination bits will be different.

4) Then this combination bit will move the stepper motor as well as the webcam via ULN2003 based on the instruction getting from server.

5) Finally clients are able to view the images based on their control instruction.

For better understanding a flow chart of the overall procedure is given in Figure 4.

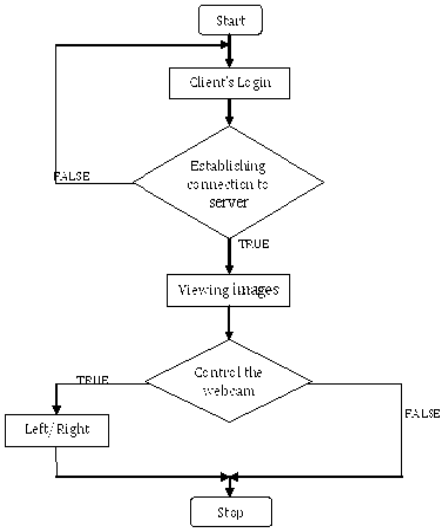

Figure 4. Flow chart of the overall procedure.

4. GRAPHICAL USER INTERFACE (GUI) DESIGN

The Graphical User Interface is a type of user interface item that allows people to interact with programs in more ways than typing such as computers; hand-held devices such as MP3 players, portable media players or gaming devices; household appliances and office equipment with images rather than text commands. A GUI offers graphical icons, and visual indicators, as opposed to text-based interfaces, typed command labels or text navigation to fully represent the information and actions available to a user. In this research GUI is used to help the user to enter the URL by pressing Login from the menu option to view the captured images as well as send control instruction from menu bar just like the real mobile phone for testing purpose before testing with real mobile phone. After login when the user confirms the address, the GUI starts displaying the images it fetched from the server's specific location. From the menu option the user can also select the control instruction to be transmitted to the server for controlling the horizontal movement of the webcam. Figure 5 and 6 shows the snaps taken from the emulator (GUI) while testing the program using local host.

Figure 5. a) Sending request for establishing connection b) sending control instruction to server.

Figure 6. a) Left image b) right image of the desired location.

5. EXPERIMENTAL RESULTS

In order to test the effectiveness of the proposed system, we have conducted using various mobile phones such as NOKIA N-73, Siemens M75, NOKIA 6630, Sony Ericsson W810i, NOKIA 5300 and Philips 960 and the result is successful for the above devices. But time for fetching images varies as GPRS class is not same in all the devices and the data service provider supporting EDGE performs better**.** NOKIA 5300 can fetch 90 images one after another. Fig.7 shows the images fetched by NOKIA 5300 and Sony Ericsson W810i from the server being captured by webcam.

Figure 7. Viewing images by NOKIA 5300 and Sony Ericsson W810i.

Pictures as shown in Figure 6 and 7 are same in both emulator (GUI) and real mobile phones. So it proves that the proposed system functions successfully in real time.

After establishing connection to the server, access time for various mobile phones is also being observed during experiment which is also given in Table 1.

Table 1.Access time for various mobile phones

Model	Time in sec (~)
Nokia N73	10
Nokia 6630	15
Sony Ericsson W810i	25
NOKIA 5300	25-30
Siemens M75	30-35
Philips 960	35

6. CONCLUSION

This research is related to the mobile phone environment as it is becoming a most used technology and it is growing too fast. Exploiting the benefits of the mobile phone technology, a new approach of surveillance system that can monitor any desired places from a remote location has been proposed in this research. A webcam integrated with stepper motor and other hardware accessories are connected to a server placed in the desired location. User can access the server from any remote location anytime and view the images of his/her desired location captured by the webcam. This work has been tested first by using an emulator (GUI) which is designed using the NetBeans IDE and then using different

types of mobile phones. The result is same in both platforms and it proves the proper functionality of the proposed system. But to implement the proposed system for the security of the ship engine room, we need to interface our existing system with two different environments (radio and satellite network) usually used in ship [17]. We have also need to interface our system with the ships built-in controlling system so that we can use the system in both environments as well as can access the internet and these will be done in next version of this research. In order to increase the security, movement of the webcam can be controlled not only horizontally but also vertically too. This feature can also be incorporated in the next version of this research.

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