Remotely Controlled Spy Robot Using Communication Protocols – A Survey

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Abstract—Numbers of terrorist attacks, crimes or natural calamities are occurring in our country. In such unpredictable conditions many people lose their lives, wealth and property. We cannot forget 9/11 terrorist attack in which 101 people including nine foreigners and 14 policemen lost their lives while about 300 people got injured. In such situations human beings are endangered of lives hence the idea is to make a robot to tackle these worst conditions. The aim is to make a spy robot which can go around in such conditions and provide information to the rescue team. This entire work will be done on ARM processor with Linux operating system ported on it.

Index Terms—Spy Robot, Web-Camera, Embedded Web Server, Embedded Linux, Video4Linux, MJPG Streamer Algorithm, CGI Script

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1 INTRODUCTION

A Robot is a virtual artificial agent, which is usually an electro-mechanical machine controlled by PC, mobile or remote. An autonomous robot is able to do tasks on its own with artificial intelligence embedded in it.

Spying is getting one's confidential or secret information without his or her permission. An intelligent spy robot is designed to get the confidential details of anybody from remote area without making our life in danger. A spy robot has the ability to spy and to survey its environment or different situations using a camera. The visual gathering from such a robot can be recorded and viewed by human directly [5].

During terrorist's attacks, hostage situations or crimes like bank robbery, etc. where humans cannot enter the crime scenes, a robotic machine can move around such places and provide information to the rescue team. The videos can provide ample information to the rescue team how to handle the situation and plan to help the people in danger.

The limitation of CCTV cameras in discussed in [6] while the real time systems provide an immediate response for crime detection and the prevention.

In literature [1] a PC controlled wireless robot was made under a wireless local loop created by a Wi-Fi Modem. To overcome the distance constraints, literature [5] discussed about using DTMF technology for military and security purposes.

The main principle of network remote video surveillance system based on embedded system as discussed in literature [7] is to set an embedded web server at the video surveillance terminal. The video signal should be digitalized first, then compressed by the high compression chip and finally is sent to the built-in web server.

The continuous monitoring of the videos is not required as discussed in [9] where the video frames were compared with a template image. While comparing if any intrusion is detected then the authorized person is notified via GSM. Similar work is done in literature [12] where the videos were captured and transmitted over internet. And users were notified via SMS.

Data-acquisition systems with remote accessibility are in great demand in industry and consumer applications. In some requirements, human beings have been replaced by unmanned devices that will acquire data and relay the data back to the base [4]. An acquisition unit designed to collect data in their simplest form which is based on Linux [3], which is a popular choice for embedded PC systems.

The performance bottlenecks of the intelligent robot are focused on the following aspects. The first trade off is between the development cost and the hardware performance. Low cost hardware may lead to performance issues. However as the complexity increases the accuracy of the hardware decreases with less precise results, hence the performance of the hardware would be inadequate. The trade off is between complexity of controls and the real-time performance. If the hardware performance is insufficient to control of the complex

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tasks, the system performs slowly. So it generates a serious problem in real time applications [1].

2 PROPOSED WORK

The aim is to make a spy robot which can go around in unpredictable conditions and provide information to the rescue team. So humans can be moved out from direct exposure to potentially dangerous situations while robotic system will be able to perform the security and surveillance functions more effectively. It is required to develop and implement an affordable low cost web-camera based surveillance system for remote security monitoring. Authorized user can access to their monitoring system remotely via internet with the use of PC or a mobile phone. This entire work is done on ARM processor with Linux operating system ported on it.

This research work discusses to make a Spy robot which can go around the endangered areas where humans cannot. A webcam will be attached to the robot to capture videos. The controlling of this robot will be done from console. There are different communication technologies which can be used for the controlling purpose. Technologies such as RF communication, DTMF, Zigbee, WIFI, Internet etc. can be used. The main goal is to have a world wide access to this spy robot for which Internet can be used.
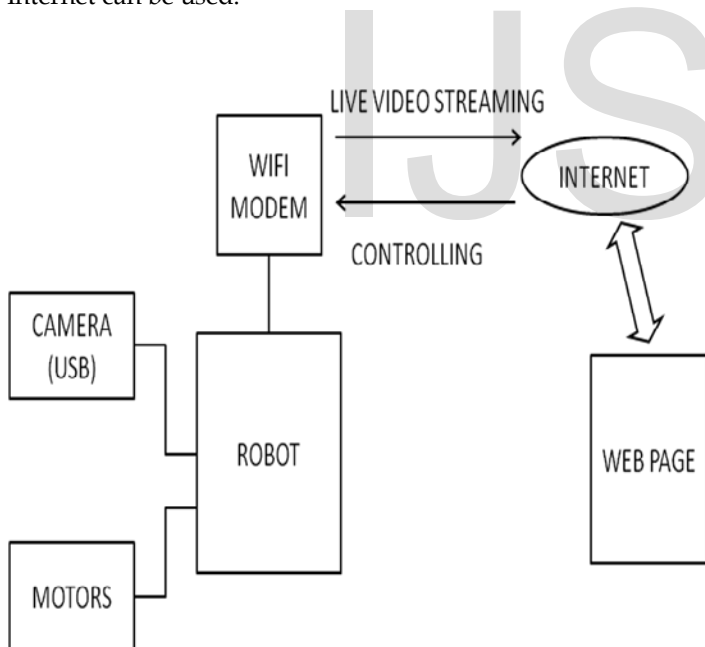

Fig 1: Block Diagram

The block diagram shows that the project is divided into two sections. The robot will be somewhere at a remote place, the crime site, spying the activities. And the controlling of it will be done from any part of the world through a webpage. The robot consists of an USB camera to capture the videos from the crime scene, and transmit the same to the web browser. The rescue team can view the live videos over web browser with secured login and password. Only registered

user can view the confidential videos. We are using internet to control the robot as well, hence it is an Internet Controlled Spy Robot.

This spy robot will capture the videos and transmit it on a webpage which can be accessed by an authorized person with secured login and password. The live video streaming can be viewed on the webpage. Also the controlling of spy robot will be done through the same web page. CGI scripting is used for interfacing the robot from webpage. The CGI script accepts data, processes them, and returns an answer [4].

The spy robot works on ARM architecture with Linux operating system embedded in it. Using Linux platform, the video is captured using video4linux algorithm. The video captured are then compressed and are transmitted over web browser using MJPG streamer algorithm. The controlling of spy robot is directly done through the web browser by using CGI scripting.

3 SECTIONS

The entire system is designed on LINUX platform and the interfacing is done using the CGI scripting. The ARM GCC compiler is used to compile the source code. Linux is a free operating system and an open source development platform, for interfacing different embedded devices. The video capturing is done using Video4Linux algorithm. The video captured are compressed and sent to the webpage using MJPG streamer algorithm. The live video streaming will be done on the web page using MJPG streamer. The advantages of Embedded Linux and the different software usage are discussed below.

2.1 Advantages of Using Embedded Linux

1) **Various development options –** Every development tool does not work for all applications. As per the application, requirements change. Using Linux, wide range of development tools is available. For example, writing programs using different platforms such as C, C++, Java, Perl, Php, Python, and FORTRAN.

2) **Huge collection of applications –** One of the most important advantages of Linux operating system is the huge collection of open source applications, the web servers, ftp, telnet, ntp, ssl, sql, email, and many more.

3) **Best networking provided –** Linux provides the best networking of all of the possible operating systems. As our systems move into new inventions, IPV6, IP masquerading, network address translation (NAT), and security are going to play an ever more significant role.

4) **Source codes –** To be frank, the codes are already written for different applications. The source code is available and we can use them free of cost. Hence, it is

not compulsory to read everything, but instead use the source codes for the required applications. Linux is the best example for providing complete openness.

2.2 ARM GCC compiler

The ARM GCC compiler which in turn contains editor, linker, and compiler generates three files. The combined source code is edited and all the files are linked by the linker. After the linker the file which is .obj file sent to the compiler to generate .bin file. Here the compiler will generate three files .elf file, .bin file, .obj file. In these three files .bin file is used. The .bin file is dump on to the ARM kit.

2.3 Qt creator (Cross compiler)

Qt is a cross-platform application framework used for application software development with a graphical user interface (GUI), and non-GUI applications such as command-line tools and consoles for servers. Cross-compiling is the process of compiling an application on one platform and producing executable code for a different platform or device.

2.4 MJPG streamer algorithm

MJPG-streamer algorithm is a command line application that copies JPG-frame from a single input plug-in to multiple outputs plug-in. It is used to stream live JPEG files over any web browser using a webcam. It is basically used for embedded devices with very limited resources in terms of RAM and CPU [10].

2.5 Video Capture on Video4Linux

Video4Linux (V4L) is the Linux kernel on a video device driver that allows control of a video capture card on Linux machines. Video4Linux provides the same programming interface to various TV card, parallel, USB audio and video capture device. Normal use of video capturing device relies on the support of the Video4Linux standard. For USB camera, its drivers need to provide implementations of basic I/O interface functions such as open, read, write, close, of interrupt processing, of memory-mapped I/O channel features and of control the IOCtl interface function. A lot of commands exist for the IOCtl system call; hence API is complex to understand. The correct set of IOCtl functions to call in a V4L program depends on the type of the application.

2.6 CGI (Common Gateway Interface)

Common Gateway Interface is a specification for transferring information over the World Wide Web server. CGI is used to pass a user's request to an application program and obtain required data. Many HTML pages that contain forms, for example, use CGI scripts to process and verify the form's data. Any programming language such as C, Perl, Java or Visual Basic can be used in the CGI scripting. For dynamic interaction of web servers and users CGI scripts are used. CGI is a platform independent interface, defines standard communication interface between the web server and the executable program which the user can access [8].

4 CONCLUSION

The Internet controlled Spy Robot has been aimed to design in such a way that it can fulfil the needs of the military, the police and armed forces. It has countless applications and can be used in different environments and scenarios. For instance, at one scenario it can be used by the armed forces, military purposes, while at another instance it can be used for spy purposes. Also the same spy robot will provide the secret information to the rescue team so they can plan accordingly and help people from hostage situation and terrorist attacks.

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