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SURVEILLANCE SYSTEM USING HAND MOTION ROBOT CONTROL

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ABSTRACT— **over the span of last few years, the evolving technology, for interacting with the robotic devices has diversified drastically. The proposed prototype model emphasizes on making use of hand motions for navigating a robot and camera in a specified direction along with computer controlled surveillance. There are three basic components involved in the system that are Analog Accelerometer, IP Camera and RF Transceiver. The Analog accelerometer recognizes the hand movements in X, Y and Z axes which are then transmitted wirelessly from users' end via transmitter and robot receives the signal through receiver. A camera is mounted on robot so that the robot can perform live streaming and allows the images and videos to be stored onto a computer system. The proposed system can be helpful to explore remote locations where humans cannot reach. Thus, the prototype can be used for various applications such as Line of Control, exploring unmanned areas that demonstrate the usefulness, viability and flexibility of the system.**

I. INTRODUCTION

The main challenge in developing the Current system was of eliminating the extensive use of Image Processing. It was a manual system with lot of development complexities and also had difficulties in controlling the same. The image was captured with the help of a web camera. After conversion of the captured Image into the digital data, it was transferred to the serial port and further to the robot for navigation, which was a very tedious and cumbersome procedure. All this process made extensive use of the wired communication via serial port. The Surveillance system using Hand Motion Robot Control reduces the complexities encountered in previous system and eventually eliminating the use of Image Processing. The proposed system makes use of hand motions to control the robot; thus omitting the need of web camera for capturing images. The robot is further used to monitor and to provide a surveillance of its surrounding environment. Thus it reduces the use of human risk on critical locations such as Line of Control, mines. The advantages of the proposed system are multitasking, which uses wireless connections to transfer real time data; compulsory brightness is not needed for hand motions, it is motion controlled robot along with computer controlled camera navigation; also this robot can be helpful for handicapped person, as he or she can navigate the robot.

II. FLOW OF THE SYSTEM

A) Software Application

On entering the application, the system operator will have three options to choose from, which are – User Login, Administrator Login, and Exit. If the system operator clicks on User Login or Administrator Login, the operator will be prompted to enter his correct username and password. On verifying the entered credentials a new window will come up allowing the operator to choose from a variety of facilities which are Open Photos, Open Videos, Start Camera, Reset Password, and Logout along with another unique feature of having a Dual In-Line Package Switch (DIPS) bit sequence. The operator will be able to view this bit sequence on the current window itself. The operator needs to set this bit sequence onto the transmitter and then only he will be able to control the system hardware. Thus, even if a person knows the DIPS, he will not be able to access the software; since he is not a registered operator and thus won't be able to see any kind of surveillance. After this, if the operator clicks on Start Camera, the externally attached IP camera will start automatically. Clicking on Open Photos or Videos will guide the operator to previously saved photographs or videos onto his storage

disk. Further, clicking on Reset Password will prompt another window which requires Admin Login, thus this feature provides a high level security. If the operator clicks on Logout, he will be navigated to the Window having options- User Login, Administrator Login, and Exit.

B] Hardware System

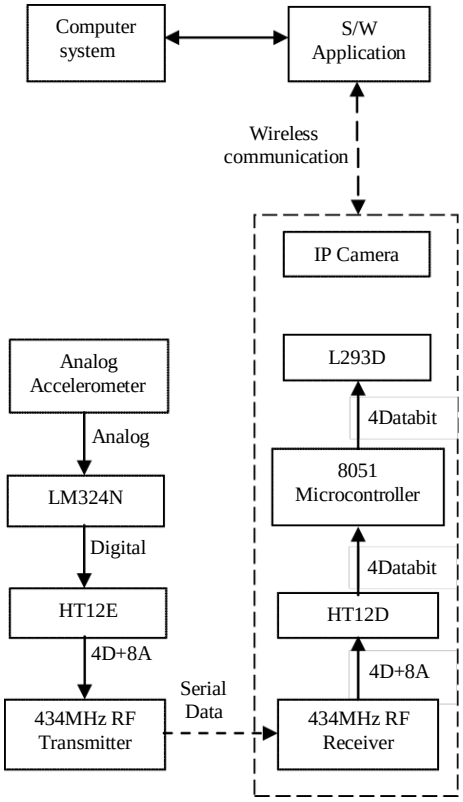

Figure I: General block diagram of navigation system

Part A] Navigation

The Analog Accelerometer senses the hand motions in the X-Y-Z axes and accordingly sets the sequence for the location co-ordinates in terms of the direction to navigate. This sequence of voltages is converted into the digital format using the IC LM324N. The four bit digital data along with the eight address bit forms the set of 12 parallel signals. The IC HT12E encodes these 12 parallel signals into 12 serial bits. This 12 bit serial data is then transmitted over the 434MHz Radio Frequency Transmitter which transmits this serial data wirelessly. On the receiver side the same frequency receiver receives this 12 bit serial data. The IC HT12D decodes the serial data into 4 bit data and 8 bit address. To transmit a specific signal the address bits of the encodes and decoder IC's must be same.[4] The four data bits are then given as input to the port 0 of the 8051 micro-controller. The 8051 micro-controller processes the 4 bit data and gives the corresponding output on port 1. The output from micro-controller is an input to the IC L293D. The IC L293D is a motor driving IC which takes four bit input from the 8051 micro-controller and sets the four bits according to the direction of the motor. Out of the four bits two bits are used for driving one motor while the other is used for another motor. This combination of four bit sequence can be incorporated to drive the motors in forward, backward, left or right directions.

Part B] Surveillance

The surveillance of the surrounding environment is implemented using an IP Camera. The IP Camera is an integrated wireless camera which combines high quality digital video camera with network connectivity and a powerful web server which is connected to the desktop or a laptop from anywhere on the local network or over the Internet. The basic function of IP Camera is transmitting v i d e o on the IP network remotely. The high quality image is transmitted with speed of 30 fps on LAN or WAN. The IP camera is based on TCP/IP standard and has a web server inside which supports Internet Explorer. The IP Camera can be used to monitor some remote places such as Office surveillance or home surveillance. The Wi-Fi protocol 802.11 IEEE standards consist of series of half- duplex over-air modulation techniques that use the same basic protocol. The most popular are those defined by the 802.11b and 802.11g protocols. The 802.11b, 802.11g and 802.11n are new multi- streaming modulation techniques. The advantages of using the IP Camera are - it supports multiple protocols and provides transportation (TCP/IP, HTTP, SMTP), Night Vision, Alarm sensor, Dynamic Domain Name System (DDNS), and it also allows authorized users view the live streaming and stores images and videos in a specified folder onto the computer.[5]

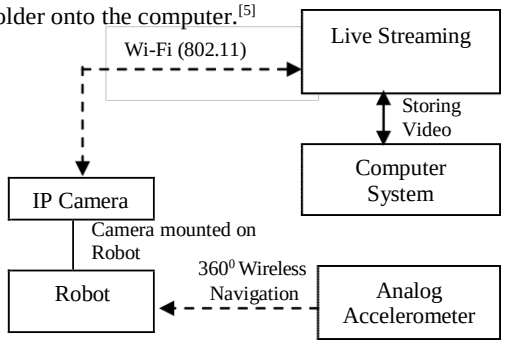

Figure II : Block schematic of Surveillance system.

The IP Camera is mounted on the robot chassis. A DC motor is attached vertically to the base of the camera. The camera can be rotated in 360° in clockwise or anticlockwise direction. Along with this, the camera supports vertical movement which provides a complete surveillance of the surrounding environment in all directions. The DC motor can be navigated using another accelerometer in both the directions. The IP Camera transmits the data through wireless network onto the desktop. The camera also provides security by asking the user to enter his or her credentials at the time of initial log in. It also has a dedicated IP address which can be accessed over LAN or Internet.

I. Flow of Application:

Part A]

The whole system works as a dynamic application.
Its' working can be illustrated by the following mathematical model:

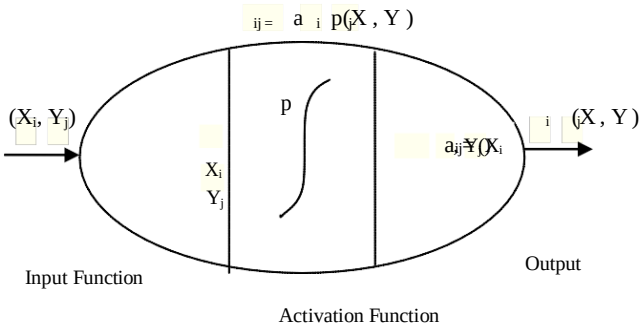

Figure III: A simple Mathematical Model for Surveillance System

The input set consists of:

1) X = "X" co-ordinate from 0 to n.
2) Y = "Y" co-ordinate from 0 to n.
3) M= Distance moved in meters.

Processing Function:

1) P (Xi, Yj) = Transition Function.

Initial Conditions:

1) X_i = NULL
2) Y_j = NULL
3) m = NULL
4) a_i = NULL

This indicates that prior to the very first operation of the robot the "$\mathbf{X_i}$" and "$\mathbf{Y_j}$" co-ordinates, "**m**" and "$\mathbf{a_i}$" be zero or will be having null values.

When the robot moves in the forward or backward direction the "X" co-ordinate will remain constant. Similarly, when the robot moves in the left or right direction the "Y" co-ordinate will remain constant.

Part B]

The data from the transmitter is transmitted to the receiver; while transmitting the data it is ensured that the data is encrypted citing security concerns. The following mathematical model explains how encryption and decryption of the data takes place.

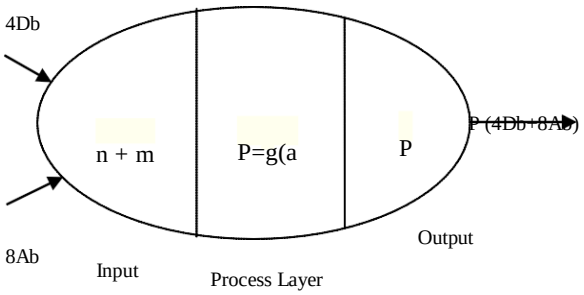

Figure IV: A simple Mathematical Model for Data Transmission

The input set consists of:

1) n = Four (4) Data bits.
2) m = Eight (8) Address bits.

Output:

1) P

Initial Conditions:

1) Data Bit Sequence= 0000

2) Address Bit Sequence= 00000000

Where,
Db= Data Bits
Ab= Address Bits

This indicates that prior to the very first operation of transmission of data, the Data Bit sequence as well as the Address Bit Sequence will initialized to zero.

I. Future Work

The future enhancements include under water monitoring which can be achieved by making the robot and the IP Camera waterproof.

Another enhancement that can be carried out to the existing system is making an unmanned aerial vehicle. This can be achieved by making use rotor blades.

II. Conclusion

Making use of the existing software and hardware components, the Surveillance System can be implemented in any circumstances.

III. Acknowledgment

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IV. References

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