Design Of PC Based Wireless Video Camera Positioning System For Wide Area Monitoring

Banjar Brahma *,[1], Janarsing Narzary[2], Dilip Wary [3]
Instrumentation Engineering Department, Central Institute of Technology Kokrajhar, Assam, India 783370

Abstract

This paper describes a wireless camera positioning system for monitoring of audio/video signal by a PC. The system is developed by using Radio Frequency Identification system, AT89S52 Microcontroller, motor driving circuit, and PC interfacing circuits. The controlling circuit is implemented by integrating hardware and software modules for the movement of the camera along 360 degrees, so to provide maximum security.

Keywords: WVSS; RF Transmitter, Encoder, GUI

1 INTRODUCTION

Wireless video security systems (WVSS) are the most preferred option for surveillance needs over the traditional hardwired system [1]. Unlike the hardwired counterpart WVSS uses a RF transmitter which broadcasts the camera's video and receiver to send the data to the monitor or recorder. Some receivers come with built-in storage, while others need digital video recorder (DVR). Out of the several advantages of WVSS over traditional hardwired system, the main advantage is its flexible placement. The camera can be placed anywhere so long as a line of sight relationship exists between transmitter and receiver. Again with no messy cabling to install, WVSS is more aesthetically pleasing. Other benefits of installing WVSS are its portability, time required for installation.

WVSS also has some unique drawbacks. If there is partial obstruction between transmitter and receiver or if the antenna shifts, the signal bandwidth drops. A second disadvantage is that another third party wireless receiver can pick up the receiver signal, however it can be avoided by using encrypted transmitter and receiver pair. A third disadvantage is WVSS need power for its operation and that has to be provided by either battery backup that has to be recharged on a regular basis or by ac adaptor which implies a wire runs through the camera even though the video connection is wireless.

This paper presents a design of a wireless camera positioning system which offers freedom of movement up to 360^0 panning (rotation in a horizontal plane) and 180^0 tilting (rotation in a vertical plane).

1.1 Project Overview

The system model of the proposed WVSS is shown in fig.1 which says about the connectivity of all the modules.

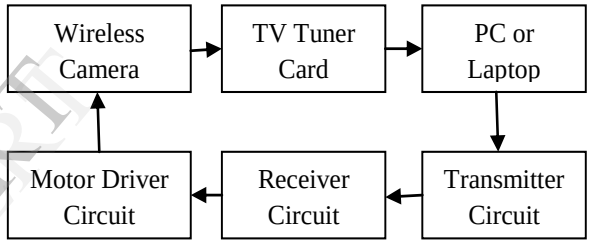


Fig.1 System Model

The system consists of three main parts namely Wireless Controller, Image Acquisition Set up, and Processor.

1. Wireless controller:

The wireless camera controller is designed using the radio frequency (434 MHz) to control the position of the camera with distance 100 meters without obstacle.

2. Image acquisition set up

It consists of an analogue camera (wireless camera) with its associated components set up and suitable interface for connecting it to processor or PC.

3. Processor

It consists of either PC or Laptop.

Image capturing can be done by wireless camera available in various resolutions. Two types of camera are generally available such as digital and analog camera. Digital cameras have direct interface with PC (USB port) but analogue cameras require suitable grabbing card or TV tuner card for interfacing with PC. The frequency used in this project is 434 MHz for

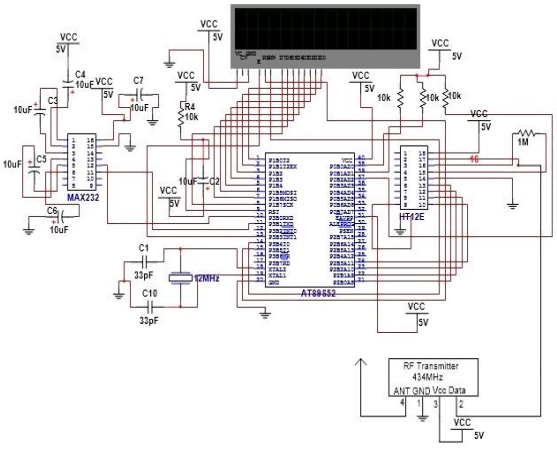
transmitter and receiver. The rotation of the wireless camera is done by the motor driver circuit.

The hardware module of the system consists of transmission and receiving of signal information. The transmission part includes HT12E encoder IC, AT89S52 microcontroller, RF transmitter, and MAX232 for enabling the PC to send controlling signal to microcontroller that is for serial communication between microcontroller and PC. The receiving part has HT-12D decoder IC, RF receiver and motor driving IC LM293D such that camera can be positioned according to the signal information sent from PC. Audio and Video from the wireless camera is received by AV receiver and is processed in PC using USB analog TV tuner card [2]. The Hyper terminal tool is used to debugging and testing the project during development. Finally for controlling the camera from pc/laptop a GUI application is developed using the most popular and powerful windows programming language VB.

2. SYSTEM DESIGN

2.1 Transmitter

The transmitter circuit consists of HT12E encoder IC (2^{12} series of encoders), RF transmitter IC TWS434-A, Atmel AT89S52 microcontroller, MAX 232 IC and 16X2 LCD display unit. For short range wireless control applications, an ASK RF Transmitter-Receiver module of frequency 315 MHz or 433 MHz is most suitable. [7]



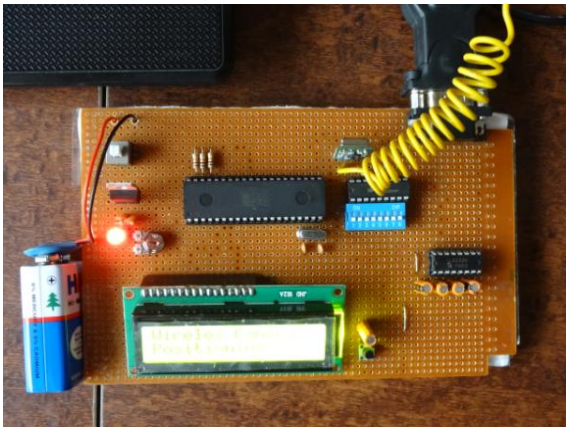
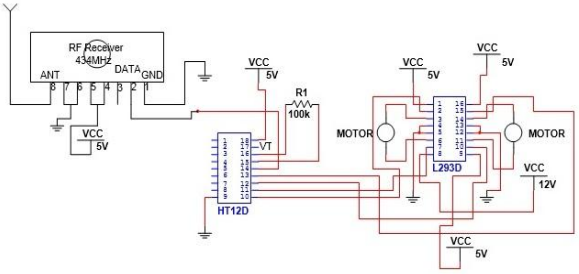


Fig.2 Transmitter Circuit

2.2 Receiver

The receiver part of the system is developed using RF receiver IC RM-433, HT12D decoder IC (2^{12} series of decoders), motor driver IC L293D and two gear motors to offer 180^0 tilt movement and 360^0 panning movement of the camera. The L293D motor driver IC provides bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V, which can drive inductive loads such as relays, dc and bipolar motors.



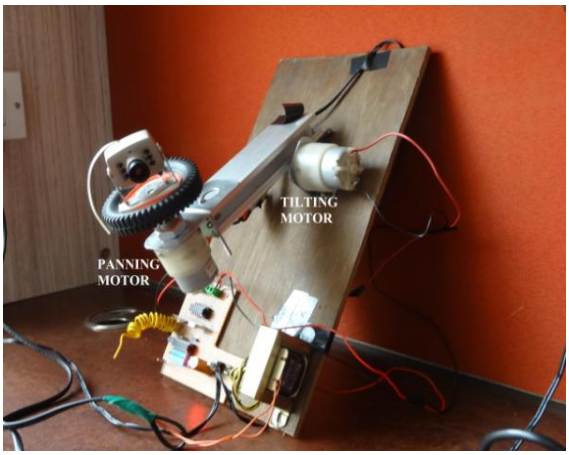


Fig.3 Receiver Circuit

2.3 Wireless Camera

Analog wireless cameras are found in three frequencies: 900 MHz, 2.4 GHz, and 5.8 GHz. Currently, the majority of wireless security cameras operates on the 2.4 GHz frequency. The camera used in this work also operates on the same frequency and has a transmission range of 100 meters in open space; walls, doors, and furniture will reduce this range.

Fig.4 Analog Wireless Camera

2.4 TV Tuner Card

A TV tuner card is a kind of television tuner that allows television signals to be received by a computer. Most TV tuners also function as video capture cards, allowing them to record television programs onto a hard disk much like the digital video recorder (DVR) does.

Fig.5 USB TV Tuner Card

The interfaces for TV tuner cards are most commonly either PCI bus expansion card or the newer PCI Express (PCIe) bus for many modern cards, but PCMCIA, Express Card, or USB devices also exist. In this work i-Ball USB tuner card is used.

2.5 GUI for Controlling Motors

Fig.6 is the main menu of our graphical user interface (GUI). In this GUI, user can control the movement up to 360^0 rotation in the horizontal plane and 180^0 rotation in the vertical plane.

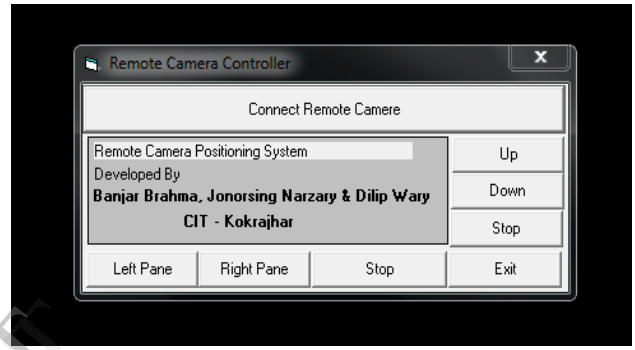


Fig.6 Menu of Camera Control

The following fig. shows the overall GUI of the WVSS.

Fig.7 Overall GUI of Camera Control

3. SIMULATION MODEL

The Hyper-terminal tool which is available with communication port in operating system of windows 7, is used for simulation of the designed system. It support to COMM port of PC. A serial port is used to transfer input signals from a computer onto transmitter circuit through DB9 male interfaced with DB9 female serial port. Pin number 2 and 3 of the female DB9 serial port is connected to the pin number 14 and 13 of the MAX232 IC respectively and the pin number 5 of the DB9 female serial port is grounded. Simulation model of the hyper-terminal is shown in the following figure.

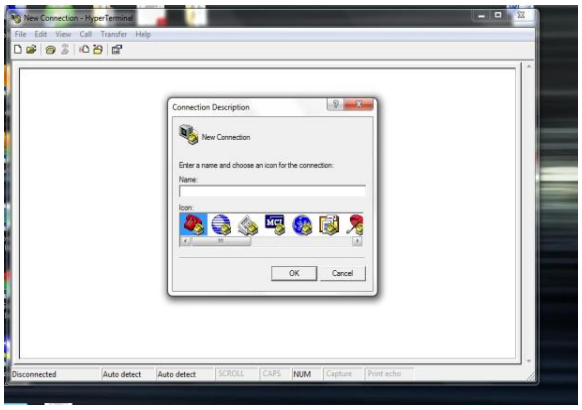


Fig.8 Wireless Camera Control with Hyperterminal

4. CONCLUSION

The project includes the interfacing of RF transmitter, RF receiver module with PC for wireless camera positioning using microcontroller, a pair of encoder and decoder IC and its associated components in conjunction with Visual Basic programming language. The interfacing of microcontroller with PC using RS232 cable and MAX232 IC is such that input signal given from the PC could be transmitted efficiently. When the input is transmitted the motor driving circuit drives the motor. The movement of the camera is designed to rotate 360^0 panning either clockwise or anticlockwise direction and 180^0 tilting up and down direction. The system is designed by integrating the available hardware modules to make it cost effective. The designed WVSS system is relatively cheaper to use compared to similar commercial products already available in market, portable and easy to maintain.

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