Real Time Power and Memory Efficient CCTV Surveillance Recording System

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Abstract

In recent day's conventional CCTV surveillance system recording continuously, so it occupies huge memory space and power consumption even there is no object in monitoring area. In addition the continuous CCTV surveillance recording consumes more time to time review the stored video. Aforesaid parameters limit the effectiveness of traditional CCTV surveillance system. The proposed CCTV system initiate the recording process whenever the object movements in the camera coverage area. This system provides solution for enhancement in recording system. Proposed CCTV surveillance system uses MSP430 controller, microwave motion sensor and camera. When object movements in monitoring area are identified by the microwave motion sensor, MSP430 controller enable the memory storage system. While no movement of object in coverage area, the system avoids the video recording. So that the system utilizes less electric power, reduced memory space and reduces review time of stored video.

Keywords: MSP430 Controller, Microwave sensor, CCTV, Digital video recorder, Light source.

1. Introduction

A surveillance system has become an essential part of any modern automated home and industry. The basic design of a security system begins with analyzing the needs of the inhabitants, surveying existing technology and hardware, reviewing system costs and power consumption, considering monitoring choices, and finally planning the installation. The existing surveillance systems are continuously monitoring and functioning, so that they consume large amount of power. This consumes more power and memory space. Standby electricity leads to the major contribution to the power consumption. According to the statistics, around 3 to 12% of residential electricity usage is due to standby power it varies with countries. Many governments have begun large programs, like "Energy Star Program" and "Watt Plan" to reduce standby power in order to save energy. A solution to overcome these problems could be by using a microwave motion sensor which has the ability to detect the moving object as they come within the sensor's detection range and generates an output. This output can be used for further signal processing or activating other devices like recording system and lighting system.

2. Literature Review

A motion detector is an electronic device that detects the physical movement in a given area and transforms motion into an electric signal. The motion detector may be electrically connected to devices. Motion sensors are used in a wide variety of applications and as a result many different types of motion sensors are available. Motion detectors are mainly used in for security systems. Motion detectors spot the movement in

areas covered by the security sensors. It transmits high frequency radio wave signals and gives a warning that someone is entering into sensor area. Detailed description of a few different types such as Infrared Sensors, Pyro electric Sensors and Ultrasonic Sensors [1].

Infrared (IR) detectors are widely known in the arts of intrusion detection and in Fire/smoke detection. These detectors have basically two forms: active and passive. Active IR detectors include a radiation source and an IR sensor which is sensitive to interruptions in the radiation sensed from the source. A passive infrared motion detection system detects heat energy radiated or emitted by an object, such as a body of a person, moving across a field of view of a heat sensor, such as a pyro electric detector of the motion detection system [2].

Ultrasonic motion detectors project and receive ultrasonic sound energy in a region of interest. Object motion within the region of interest and in the range of the ultrasonic motion sensor is detected and an alarm signal representative thereof is produced. The effective range of ultrasonic motion detectors differs from design range whenever the actual ambient atmospheric sound propagation conditions vary from the design or nominal atmospheric conditions [3].

Surveillance is the monitoring of the behavior, activities, or other changing information, usually of people for the purpose of influencing, managing, directing, or protecting. The word surveillance is the French word for "watching over". The word surveillance may be applied to observation from a distance by means of electronic equipment (such as CCTV cameras). Surveillance is very useful to governments and law enforcement to maintain social control, recognize and monitor threats, and prevent/investigate criminal activity [4].

A highly advanced ultrasonic and an At89c51 microcontroller are used to alert the security personals. Ultrasonic sensor is sensitive to any human movement. It detects infrared radiation coming from any alive body. At89c51 microcontroller is used for main module. In activated condition, when an intruder enters the prohibited area, sensor trigger main module zones, which in turn sends the message to the central camp and a visual and audible alert is produced[5].

3. Proposed Hardware System Design

The proposed design is to detect the moving object in coverage area and it will activate camera module to record video. It avoids the continuous recording and enhances the memory usage, power utilization and review of stored video.

3.1 Descriptions of Proposed System

Microwave sensor detect motion through the principle of Doppler shift in which a transmitter transmits waves at 10.5GHz into a monitoring area after wave receiver receives the reflected waves and then compare to the received frequency with reference frequency to produce a beat frequency that is proportional to range. In order to determine the direction of motion of an object, the oscillator signal is compare with the received signal to generate two output intermediate frequencies, the combination of which determines the direction of movement of an object toward or away from the sensor. For the purpose of intermediate frequencies is given to the amplifier.

Doppler shift output from IF terminal when movement is detected. The magnitude of the Doppler Shift is proportional to reflection of transmitted energy and the range of microvolt's (μV).

A high gain low frequency amplifier is usually connected to the IF terminal in order to amplify the Doppler shift to a processable level. Frequency of Doppler shift is proportional to velocity of motion. Typical human walking generates Doppler shift below 100 Hz. In amplifier section having two stage of operational amplifier the first stage operational amplifier LM324 receives from microwave sensor output of IF frequency and

in order to amplify the IF frequency that amplified signal is given to the second stage for the purpose of interfacing the microwave sensor to MSP430.

3.2 Msp430-16 bit Microcontroller

The MSP430 was introduced in the late 1990s; it is a particularly straightforward 16-bit processor with von Neumann architecture, designed for low-power applications. The amplifier output is given to the MSP430 microcontroller which is programmed to determine the moving object based on the input frequency.

The following block diagram represents the proposed CCTV system.

Figure 1. Block Diagram of CCTV System

Frequency information is provides the motion of the object which helps out to find out the moving object. Based on the frequency information the MSP430 activate the relays. MSP430 have to program the following working mode.

Working mode of MSP430:

Conditions	MSP 430 Mode	Camera Module State	Object Movements
$Ref_{frq} < Rx_{frq}$	Active mode(60 Sec)	ON(60 Sec)	YES
$Ref_{frq} = Rx_{frq}$	Standby mode	OFF	NO
$Ref_{frq} > Rx_{frq}$	Active mode(60 Sec)	ON(60 Sec)	YES

Note: Ref_{frq} – Reference Frequenc, Rx_{frq} – Received Frequency

3.3 Power Management Module

Figure 2. DC to DC Converter

The MSP430 controller based on the condition activates the relay contacts. if MSP430 in standby mode means the relay contacts are open so power supply of the camera is off else MSP430 in active mode the relay contact are close and Relay contacts is connected to the power supply of the camera unit and light source unit.

The camera Vcc terminal is connected to the relay contact, so MSP430 activate relay means camera will capture the moving object otherwise camera in off state. The LDR used to detecting the light intensity. At full light the resistance of the photocell will be few ten ohms and at darkness it will rise to several hundred ohms. The IC₄ 741 is wired as a comparator here. At darkness the resistance of photocell increases and so the voltage at the inverting input of the IC₁ will be less than the reference voltage at the non-inverting input. The output of the IC₄ goes to positive saturation and it switches ON the transistor to activate the relay now night lamp is ON. This unit helpful to capture an object at night time.

3.4 Motion Sensor

In this proposed CCTV system the microwave motion detectors are active motion detector in which a wave transmitter transmits waves into a monitoring area and then a wave receiver receives the reflected waves and then compare the received frequency and reference frequencies to produce a beat frequency that is proportional to range. In order to determine the direction of motion of an object, the oscillator signal is compare with the received signal to generate two output intermediate frequencies, the combination of which determines the direction of movement of an object toward or away from the sensor and output of comparator given to the microcontroller.

The microcontroller, which is programmed to determine the moving object based on the input frequency. Frequency information is provides the motion of the object which helps out to find out the moving object and the controllers activate the relay contact. Relay contact is connected to the power supply of the camera unit and Digital video recorder. Now camera starts to capture the image in monitoring area. If monitoring area there is no moving object, so comparator gives constant frequency to the microcontroller. Now microcontrollers open the relay contact and cut off the power supply of camera unit.

The following flow chart represents the working steps of CCTV system

Figure 3.Flow Chart for CCTV System

4. Result Analysis

Figure 4.Proposed Systems

Memory Management		
	Memory required if object moving	Memory required if no object moving
Proposed system	Need Memory	No need Memory
Existing system	Need Memory	Need Memory

Figure 5. Comparison Table 1

Power Management		
	Power consumption Recording Mode	Power consumption No Recording Mode
Proposed system	12V	0V
Existing system	12V	12V

Figure 6. Comparison Table 2

In comparison with the current application of related features even with the most popular CCTV, this system stands a chance in the market, as it is more flexible, and gives a better management opportunity than the current market applications. Its features, like storage media, time and energy are saved all in one simple package.

5. Conclusion

In this design the MSP 430 operates in two modes; Active mode and Standby mode. A powerful security system is required and Conventional security systems use cameras and process large amounts of data to extract features with high cost and hence require significant infrastructure. So we are trying to develop a surveillance system which is low cost, uses low power, uses less memory and more efficient using MSP430 and microwave motion sensors.

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