A System for 360 Video Surveillance with Multiple Remote Control Access

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Abstract: The idea of this project is to provide enhanced security measures to a specific perimeter to prevent any kind of unauthorized intrusion or tampering. The module consists of a computer terminal and an IP (Internet Protocol) based camera that communicates with the user's system to transmit/receive live data to/from the User. The system makes use of a third party app called the Skype for live video streaming purpose. The camera can be manually controlled by the user at anytime from anywhere in the world as long as he has internet facility available. The proposed system can detect motion and provide a warning in case of suspicious movements in restricted zones. Once an intrusion is detected, it sends an alert through the GSM module to the User and also to the nearby Police Headquarters as a security measure. These systems have applications in different sections like monitoring of bank vaults, safes or any kind of restricted perimeter.
Keywords: Surveillance; security; real time monitoring; remote access; skype.

1 INTRODUCTION

The increase in crime rate have necessitated the installation of Surveillance cameras in homes, banks, traffic signals and any corporate establishment. Surveillance is the process of monitoring events or two or more persons in a place. [1]Surveillance cameras are easy to install and offer a detailed monitoring of the secured perimeter. With advancements in technology, closed circuit television monitoring has been replaced by IP based surveillance systems. With the flexibility of acquiring systems that can work wirelessly, this work focuses on the design and implementation of a surveillance system that can be accessed through multiple devices on authentication for monitoring purposes. Also, the system can trigger an alarm response in case of any security breach. The surveillance camera can be static or can be rotated in any desired direction to get a better view of the area. [2] Nowadays,

researches experience a steep growth in surveillance systems. Therefore, a system that transmits real time data and can be accessed from multiple authorized device in case of security breach is needed. This system ensures higher levels of security and helps simplify a complex challenge. The system has a wide range of application like monitoring of bank vaults, valuables, human activity and traffic. It can be used in both homes and corporate establishments.

2 BENEFITS OF THE VIDEO SURVEILLANCE SYSTEM

2.1 Remote Access

Previously, surveillance cameras were wired and anyone could tamper with the wirings and disable them but with the advent of wireless technology and remote access, the system can be made accessible from anywhere in the world. [3].

2.2 Multiple Access

The traditional surveillance system consists of one computer terminal that is manned by security officials. But the proposed system enables any person in the world to access the capture, with proper authentication.

2.3 Real Time Monitoring

In the past times, the surveillance systems used to record videos the captured videos were used for investigation and forensic purpose after the event happened. But in modern days, systems can alert the neighborhood and response to alarms immediately.

Video Surveillance cameras require constant human supervision. These kind of systems are error prone and have limited ability to respond in real time. However, the proposed system can detect human intrusion by using sensors and can alert the neighborhood as well multiple users who have access to the system. The users having access to the system can manually control the direction of the camera from anywhere in the world.

3 SYSTEM ARCHITECTURE

The system consists of a computer terminal that is connected to the internet and is used to view the activities as captured by the surveillance camera. The computer makes use of data packets and therefore can be used to remotely view and record the activities captured by the IP (Internet Protocol) camera throughout the day. The streaming of digital video feeds take place across IP (Internet Protocol) wirelessly.

The system is wired a microcontroller that is connected to heat sensor and a passive infrared sensor [4]. Passive sensors can function without generating any infrared radiation. In case of detection of any suspicious activity, a buzzer will be triggered. The IP camera is mounted on a holder that is connected to a DC motor. When the alarm goes on, simultaneously a call is forwarded to all the numbers registered on the system. The users can make use of the third party application called Skype and access the live video feed as streamed by the system. Also, the users can control the direction of the camera by controlling the direction of the motor. This is obtained by the use of DTMF (Dual Tone Multi Frequency) decoder that is programmed by the microcontroller. The system alerts the users by using GSM module that is again, programmed by the microcontroller. The microcontroller has the database of all the numbers of the Users who will be alerted in case of a security breach. [4] The settings of the Skype application can be customized to auto

accept video calls from numbers already registered on the application. The numbers when connected through Skype video calls can monitor the live video feed from any part of the world.
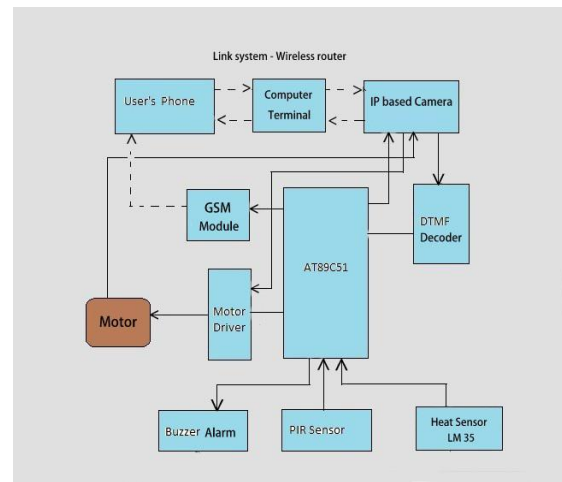

Fig. 1. General architecture of the proposed surveillance system.

4 DESIGN OF THE PROPOSED SYSTEM
4.1 Moving Object Detection and Tracking

The sensor is the core part of the system. Passive Infrared Sensors (PIR) sensors detect the infrared radiation coming out of the human body and is widely used in security systems. [5][6]Human body radiates IR at a range of 10-12 micrometer [4] [7] and PIR sensors detect motion by the difference in the radiation wavelength and send a high signal to the signal pin. [8].The output of the PIR sensor is connected to the input of the microcontroller Atmel 89C51.
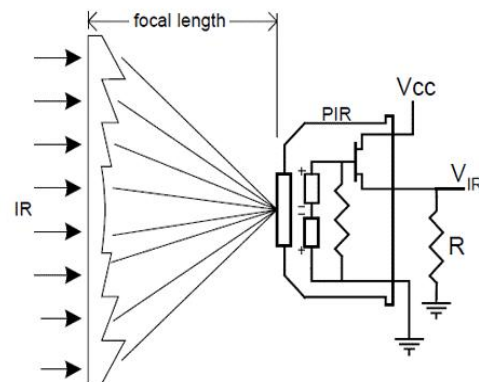

Fig. 2. Output waveform of PIR sensor.

4.2 Monitoring of Room Temperature

LM 35 Temperature Sensor is used to monitor the temperature of the secured perimeter to ensure proper functioning of the IP (Internet Protocol) based camera and the associated electronic components. For the highest functionality of the system, the room temperature must not cross its threshold value. In case of excessive temperature

rise due to any situation, the alarm system will be triggered. [9]

4.3 Motor Control Using DTMF Tones

The simple rotating clamp holding the IP (Internet Protocol) is camera is driven by a DC motor that is remote-controlled over 3G/2G Internet via the application called Skype using DTMF tones. Wireless connection is done by mobile phone network that can be done over large distance.

Dual frequency DTMF method is quite reliable and there exists a specialized decoder chip. DTMF chip is read out by the decoder module board that controls the DC Motor with the help of motor driver IC LM 2930.

When an authorized user makes a Skype call to the computer terminal which is connected wirelessly to the IP camera, the system auto accepts the call and receives live video feed over the internet. Now, if the user presses any key on the key pad, while being connected on Skype, a DTMF tone is generated by the user's keypad which corresponds to the desired angular position of the DC motor.

This DTMF signal, received by the system is then decoded by the DTMF decoder MT8870 [10] and is sent to the microcontroller Atmel 89C51. The microcontroller is programmed beforehand for all possible inputs and gives corresponding output signal to DC motor driver which enables the motor to rotate in either clockwise or anticlockwise direction around 360 degrees. The motor can be stopped and reset accordingly. [11]

Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

Fig. 3.Output Logic of DTMF Decoder.

4.4 Microcontroller Unit

The Microcontroller ATMEL AT89C51 is used to control the entire system and is responsible for the following -

1) Receives the signal from the PIR Sensor and the Temperature Sensor

2) Triggering the Alarm System based on the outputs of the sensors

3) The direction of the motor is controlled by the DTMF Signals which is decoded and sent to the controller. AT89C51 enables rotation of the motor in the desired direction.[10]

4) The GSM Module SIM900A connected to the microcontroller forwards a call to one or multiple authorized users as customized by the user when the alarm is triggered on any immediate occasion.
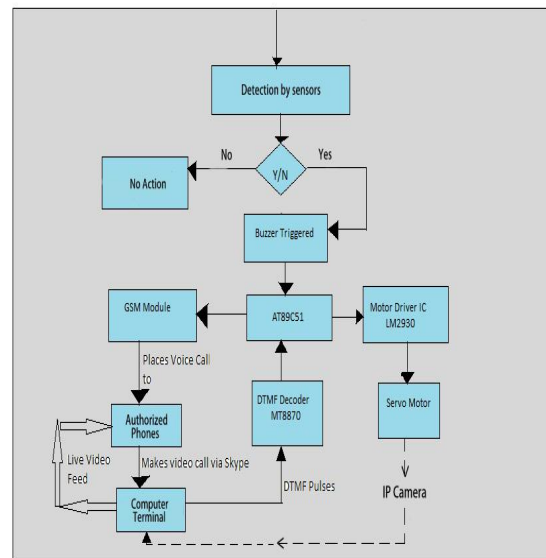
5 FLOWCHART OF THE PROPOSED SYSTEM

Fig. 4. Flowchart of the system.

6 IMPLEMENTATION OF THE SYSTEM

The core component of the system is the microcontroller Atmel 89C51.All the other components are programmed through the controller to function accordingly. When the PIR sensor detects any kind of motion or the temperature goes above the threshold level, the microcontroller triggers the alarm and the buzzer goes off. At the same time, an alert voice call or message is forwarded to a set of pre-set numbers through the GSM module SIM900A.On receiving the alert, the authorized users can choose to view the secured
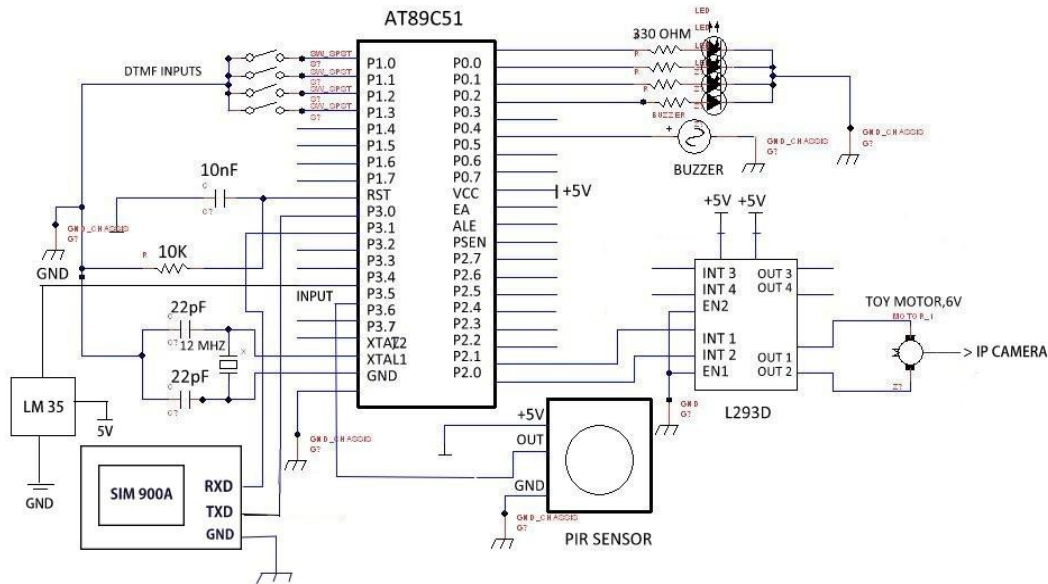
Fig. 5. Circuit Diagram of the Surveillance Module.

area and can do so by making a video call through a very popular third party application called the Skype.

The Skype allows live video streaming of the area under violation through the computer terminal of the IP based camera. The user can also manually control the security camera through Skype that has DTMF enabled dial pad tones. The DTMF decoder is programmed by the microcontroller and is connected to the camera. The camera is set on a simple rotating clamp driven by a servo motor that is remote-controlled over 3G Internet via Skype using DTMF tones. The camera can be made to move 360 degrees clockwise or anti-clockwise as desired by the user. In figure 5, the circuit connection of the system has been shown. A cell phone has been used instead of the computer terminal for cost effectivity.

The camera can also be set on record mode to view the capture for inspection any time later. Also, the camera can transmit live video footage of the area under surveillance to the computer terminal whenever required.

7 RESULTS AND DISCUSSIONS

The system offers an enhanced level of security that traditional Closed Circuit Television monitoring and it is cheaper since the application Skype can be downloaded and used through any smart phone. Moreover, this system works on both 2G and 3G connectivity which is an added advantage.

While designing the system, different kinds of sequences containing four major type of camera movements have been considered.

1. Clockwise movement

2. Anti-clockwise Movement

3. Stop

4. Reset

The complexity of the situations and the detection of more than one Human figures has also being considered. The system works better in confined areas. Also, multiple users can access the live video feed at the same time in an interconnected system. They can even communicate with each other through the computer terminal.

8 CONCLUSION

The development of this project brought to light obstacles as well as opportunities in the process of attaining a system capable of maintaining security and preventive vigilance. The applications in which this system can be utilized optimally are quite a few in number. The basic objective is of security purpose and providing one or multiple users with a notification in case of a potential security threat, comes hand in hand with allowing him the option to get an actual live footage with 360 degree coverage from anywhere in the world as long as he has internet facility available. The system is cost effective and helps in conservation of energy since the system works only when there is security contravention. This system can further be enhanced for future prospect.

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