



International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijircce.com

Vol. 6, Issue 5, May 2018

Enhancing Smart Home Security using Image Processing and Sensors

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ABSTRACT: Home automation is the recent trend in the field of embedded systems and plays a major role in designing various smart home hardware and software designs. It is very interesting to see how home automation concepts has made the life easier for humans. With the rapid advancement in technology, smart homes have become prone to some security challenges and so the need arise to solve the security challenges that are accompanied with its operation. This project provides a low-cost intelligent wireless security and monitoring solution using motion detection technology and controlling devices remotely using Android-based smartphone app. Atmega32 microcontroller with other peripheral devices which include Light Emitting Diode (LED), different kinds of Sensors like IR (Infrared) Sensor, Motion Sensor, Gas Detector, Max 232, Analog to Digital Converter are responsible for reliable operation of the proposed Security System. The proposed home security system monitors and control system design intelligent services for users and provides reliable security within reasonable cost.

KEYWORDS: Automation, image processing, security, IoT.

I. INTRODUCTION

The existing systems for security are high cost, non-user friendly and non-scalable. Hence to overcome these problems, an efficient and reliable system needs to be developed. The main objectives of this project (i.e. Smart Home Security) are to design and implement a home automation system using IoT that is capable of monitoring and controlling various sensors and keep a watch with the help of cameras. The proposed system has a great scalability by using microcontroller to interconnect various sensors to the server. This will decrease the cost and will increase efficiency of the system. Today, there exist various threats to our home so there is a need of proper security system. Smart home security system is applied in order to provide comfort, energy efficiency and better security. Smart Home System is still rarely used in India because of the cost and difficulty of getting the device. The objective of this product is to offer a small smart home security system designed and created by utilizing WLAN network based on Atmega32 microcontroller and various sensors. The system is able to detect motion of an intruder by using camera, motion and IR sensors, also detect smoke using a smoke detector. The expected work contributes towards the development of ubiquitous home security.



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II. RELATED WORK

Smart home systems are the technology within a home provide safety, comfort and energy efficiency to the users of the system. Adding technology to the home environment can give a better quality of life for everyone. There has been a significant rise in the home automation recently due to cost reduction and various services provided by the smartphones and tablets which allows enormous connectivity. With the introduction of Internet of Things, the research and implementation of home automation are getting more popular [1]. Diverse and miscellaneous technologies are used for effective data transfer, sense and control such as Bluetooth, Wi-Fi, RFID and cellular networks.

The studies in [5] have presented Bluetooth based home automation systems using android smartphones without the internet controllability. The devices are physically connected to the Bluetooth sub-controller which is then accessed and controlled by the smartphone using built-in Bluetooth connectivity. However, due to limited range of operation (maximum upto 100 m) the system is unable to cope with mobility and can only be controller within the vicinity. The Bluetooth system is directly installed beside the conventional electrical switches on the wall . The Bluetooth wireless connection enabled by the system communicates with interface (GUI) on PC/laptop.

Researchers have also tried to provide network interoperability and remote access to control devices and appliances at home using home gateways [4] introduced a Wi-Fi based home control system using PC based web server which manages the connected home devices. The main part of the system consists of a Microcontroller with an Ethernet module for controlling. This Ethernet module is connected to a Wi-Fi router which gives a static IP address to it so that it can use TCP/ IP based communication with other 3 accessing devices connected to the same router. This module is connected to four appliances through relay devices to automatically turn on and off those devices. As the relay devices are current controlled device, current amplification is needed to support low current output of the microcontroller. Now that was a part which requires human control. To make this design more efficient an automatic system has been designed as well. For this automated system there is a temperature sensor which senses its immediate environment (i.e., a room) and indicates current temperature. A PIR module is used for this purpose which senses any kind of intervention at the front gate to alert the user about an intruder.

III. PROPOSED APPROACH

To develop a system providing Home Security using camera sensor, motion sensors, IR sensor, smoke detector to monitor and control intruder's activities and thereby altering through audible alarms and notify through emails to discourage further progress. The camera attached captures the image followed by image recognition, subtraction, blob detection, blurring, thresholding and detection of motion. Various sensors attached get activated by an intruder's activity and triggers an alarm and send notification via an electronic mail. Live feed of the camera can be accessed through valid and authorized smartphone. The application will register user's details and then the user can see the live video streaming of the intruder's activity inside their home. Input/output block consists of 2 pieces of PIR (Passive Infrared) motion sensor and an MQ5 sensor and buzzer as an output. PIR sensor is used to detect the presence of motion. In addition, this sensor is also used for security systems to detect suspicious movements. If it detects any suspicious movements, an alarm will sound. A MQ5 is functioning as gas leakage monitoring. Output part consists of the relays and the buzzer. Buzzer serves as a warning alarm when there is suspicious movement.

IV. SIMULATION RESULTS

The Fig.1.given below is the picture of the hardware used for simulation of the system. The different components included in the hardware are:

- Microcontroller- Atmega32 (AVR family)
- Max232 IC
- PIR sensor for motion detection
- Gas leakage sensor- MQ 5 series
- IR sensor
- Buzzer to raise an alarm

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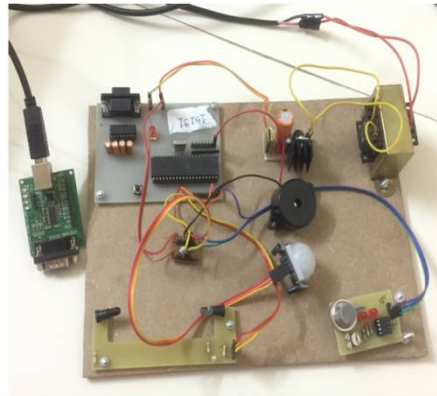


Fig. 1. Hardware used

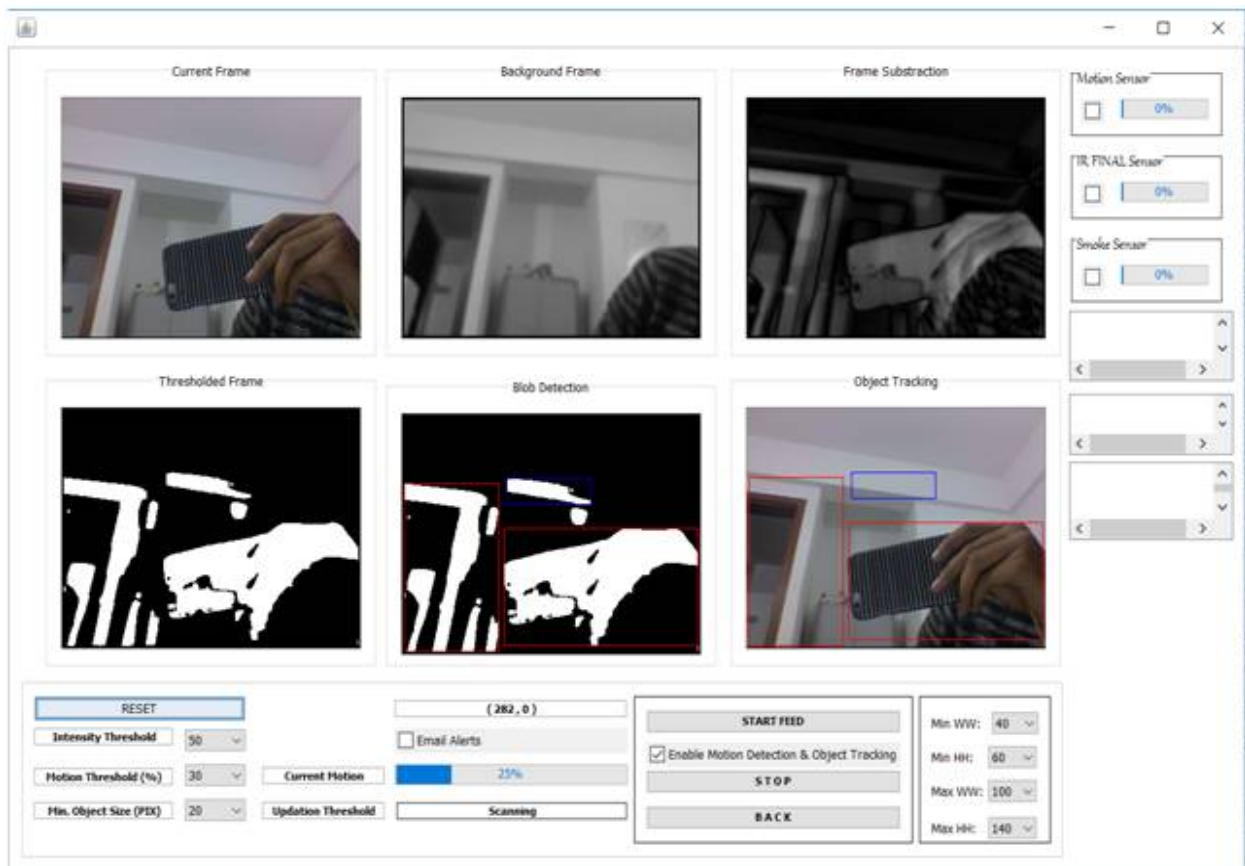


Fig. 2. Blob detection

The fig. 2 shows the blob detection technique where the first frame shows the current frame captured by the camera, the second shows the background image from which the current frame is compared. In the third frame, image subtraction takes place of the current and background image. Thresholding of the image is done in the fourth frame. The intensity



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of thresholding can be changed by the user according the user's requirements(less intensity increases the sensitivity if the detection algorithm). Blob is detected and displayed to the user in the fifth and sixth frames. Upon the detection of blob the alarm is raised.

V. FUTURE SCOPE AND APPLICATIONS

Future work will entail the operation system based design will be more efficient and will require less number of resources. Integrating the GSM devices to control the devices remotely is one of the prominent future applications. It will help the clients to even receive alerts online with the current system with the offline alert option with the GSM system. Design and integration of a home control application. This will improve the system and also provide comfort and energy efficiency. The proposed system can reduce the theft rates and will provide security to elderly people and children at home.

VI. CONCLUSION

To conclude, a home automation system based on motion detection which uses Atmega32 microcontroller. The system is focused to provide at most security to the closed flats while the owner is out of station thereby reducing the rates of house thefts. It also aims at providing safety to elderly people and differently disabled people. The prototype developed can monitor and control the activities at home or office. The security system will also be useful in case of the fire accidents at home.

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