

# INTEGRATED INTELLIGENT SECURITY AND SURVEILLANCE USING END TO END BIOMETRICS

M.Srinivasan<sup>1</sup> | Deepa.M<sup>2</sup> | Indhumathi.N.S<sup>3</sup> | Keerthika.P<sup>4</sup> | Mathan.N<sup>5</sup>

<sup>1</sup>(Dept of ECE, Assistant Professor, Anna University, Chennai, India, kmsrinivasan@gmail.com)

<sup>2</sup>(Dept of ECE, Anna University, Chennai, India, deepamukunthan95@gmail.com)

<sup>3</sup>(Dept of ECE, Anna University, Chennai, India, indhumathishunmugam@gmail.com)

<sup>4</sup>(Dept of ECE, Anna University, Chennai, India, keerthika2196@gmail.com)

<sup>5</sup>(Dept of ECE, Anna University, Chennai, India, mathan.natarajann@gmail.com)

**Abstract**—Home security has been a major issue where crime is increasing and everybody wants to take proper measures to prevent intrusion. Security systems are the high tech and convenient systems which ensures real time detection and signaling of the threat to the home. It is mainly required for the people who live alone and who are in out of station. Besides traditional magnetic switch equipped on doors and windows, this system also incorporated with different types of sensors and buzzers, hence the security system will sound an alert when there is an attempt of break-in. It is the system with cameras for face recognition using GSM technology in addition with sensors and buzzer, which provides an Integrated Intelligent Security System. The proposed system is a smart doorbell which allows the people to see, hear and speak to their visitors at the front door via their mobiles to avoid a face to face communication. To announce an intrusion to the user various means like alarms and message over a cell phone is used. Thus the system provides an emergency broadcast via message to notify the family members and also to the nearby Police station to receive the timely help.

**Keywords**— Traditional Magnetic Switch; GSM Technology; Intelligent Security System; Smart Door Bell

## 1. INTRODUCTION

Home security and surveillance plays a crucial role in day to day life. A typical surveillance system continuously monitors its vicinity and stores the surveillance data locally [4]. This may end up in lots of memory and energy wastage. Moreover the surveillance records are under security threat, when the surveillance system is seized or damaged by the intruders. In this paper a new design for surveillance using webcam along with the PIR (Passive Infrared) sensor, MEMS, buzzer and the MCU (Micro Controller Unit) is proposed [1]. The PIR sensor is attached to the webcam through the MCU to detect motion [2].The camera gets enable only when the motion is detected and the SMS (Short Message Services) alert is sent to the user straight away. To ensure the safe storage of surveillance records, it is uploaded to the user through email [3]. The proposed Intelligent Surveillance system offers cost effective, storage effective, energy efficient and secured solution as it uses the computation and communication capabilities of digitalized components.

**Index Terms**— PIR sensor, SMS, MCU, Intelligent surveillance

## 2. SYSTEM MODULES

### A. Detection unit

The detection unit involves with the devices such as PIR sensor, MEMS vibration sensor, Biometric system and LCD. It is the primary module of integrated intelligent system to identify the intrusion [2]. It will provide information about valid and invalid entry using LCD



Fig. 2.1 Intrusion detection using Biometrics

### B. Security unit

The security unit is the secondary module of the system. It consists of buzzer in addition with the detection unit devices. Buzzer will provide a buzzing noise when the door is accessed by an unauthorized person or intruder.

### C. Surveillance unit

The surveillance system is mainly deals with camera and GSM technology. Webcam is used for capturing the image of intruder. GSM technology is used to send the timely notification to the user and also to the nearby police station to get timely help. This avoids the further damage of home.

## 3. SYSTEM ARCHITECTURE

The Fig 3.1 shows the architecture of the proposed system. The PIR sensor senses the movement in its vicinity and activates the MCU. The Hardware module consists of a webcam. The MCU activates the webcam application module on getting trigger from the PIR sensor.

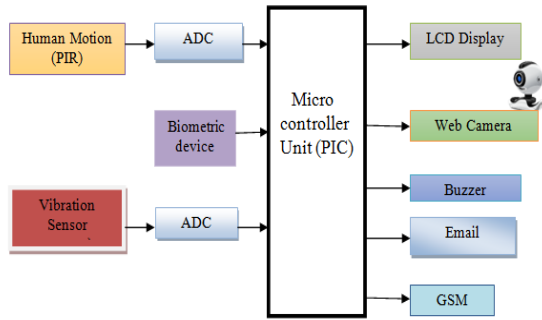


Fig. 3.1 system architecture

Valid and invalid entry of a person can be shown by LCD using one of the Biometric techniques such as fingerprint, facial recognition etc [4]. If it is an unauthorized person's entry buzzer will provide buzzing noise. MEMS sensor is a vibration sensor which identifies the door vibration during the break-in of door occurrences. The webcam starts capturing and simultaneously sends SMS alert using GSM to the user on receiving motion detection signal from MCU. Storing surveillance image in cloud improves security of the surveillance records. The uploaded images are safe in remote location which can be later retrieved and verified though the surveillance system is damaged or seized [6]. The notification module is responsible for notifying the user about the intrusion. It sends email to user with the uploaded image.



Fig. 3.2 SMS via GSM

A. Hardware and software flow diagram

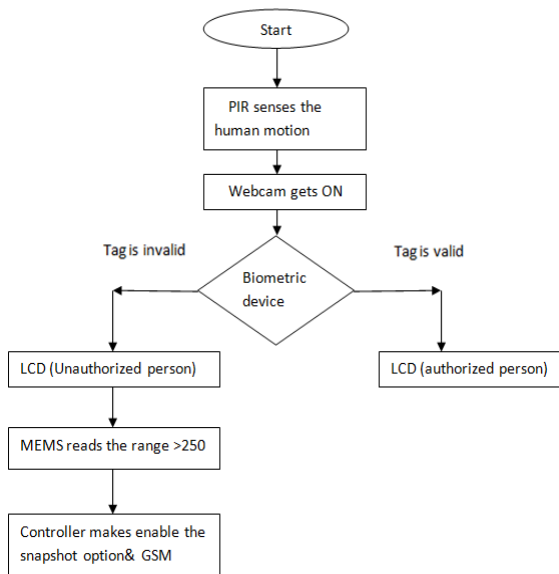


Fig. 3.3 flow chart of process

B. Working process

The process is started with a person's entry. When PIR detects the human motion it will enable the camera to monitor the surrounding and LCD will display "Human detected". Then the person's valid or invalid entry is identified by using one of the biometric techniques. If it is an invalid person entry biometric device enable the buzzer to make buzzing noise. In further if the intruder tries to break the door the break in vibration and angle variation in the door can be read by the MEMS sensor. It will enable the GSM to send notification to the user and also to the police station as SMS "Door broken". The system can also sent mail to the stored user ID with the captured intruder image using outlook option.

4. IMPLEMENTATION AND RESULT

The PIR sensor and the webcam are placed in line so that it can capture the exact visuals when triggered by PIR sensor. For wide range of vicinity the surveillance system is fixed on ceiling of the room or at the door [5]. The PIR sensor needs some time to calibrate itself to the environment. In this design it takes 30 seconds to finish the calibration. Once the sensor finished its calibration it is in active mode checking for the movements. If the output of the PIR sensor is 3.3v it is read as a HIGH by the MCU's digital pin. The HIGH value is triggered when the movement is observed by the PIR.



Fig. 4.1 placement of proposed system

The proposed system can be placed anywhere near the door or roof as shown in Fig 4.1. Single surveillance module is sufficient for a medium sized room. Multiple sensors can be incorporated for the wide surveillance. If the surveillance area is separated by walls, multiple surveillance modules can be placed in each separation and the surveillance records are collected by a single controller.

The advantage of using webcam is that, we don't need any extra camera module as a good quality camera is available by default. The whole design is compact and easily mountable. On comparing with typical surveillance system that uses a laptop/desktop computer, almost similar performance is expected from with lower cost with some compromises in storage and graphical performance [3]. High graphical processing is not needed in this prototype. A mid-range Smartphone is sufficient for this prototype and hence our "Smartphone Enabled Intelligent Surveillance System" is a low cost Intelligent Surveillance solution [4].

A. Notification process

The camera got activated and starts recording once "MOTIONDETECTED" signal is received. An SMS notification is sent to the registered phone number once motion is detected by the PIR sensor. (Fig 4.2).The webcam starts recording its vicinity on receiving motion detection signal. It sends threat notification to the user and also to the police station to get timely help. In addition to this, the system also sends a mail to the user with the captured image of intruder.



Fig. 4.2 captured image of intruder

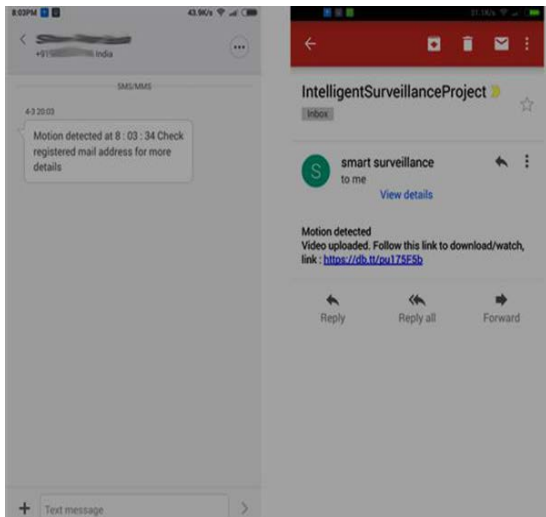


Fig. 4.3 reception of notification

B. Applications

**Emergency Broadcast:** This function broadcasts the emergency message with people's location to their family members who are in their cycle by the Application and their neighbor to get some help Timely

**Visitor Notifying to Elderly People:** When the door bell is pushed the system will send notification to elderly people through mobile application and blink the light bulb for 30 second.

**Real-time Communicating between people and their visitors:** This helps the people to identify

Visitor, the system provides a two-way real-time voice communication between people and visitor with real-time monitoring from the MCU.

5. CONCLUSION

This paper presents a new method for intelligent surveillance utilizing the capabilities of a webcam along with sensors. The network and computational powers of the webcam is utilized for surveillance. The energy usage is reduced by activating the camera only when the movement detected by the PIR sensor. The captured footage is uploaded in cloud to enhance the security. A real time notification feature notifies the user about the intrusion through SMS and email. This design offers cost effective and energy efficient intelligent surveillance.

As a future work, the efficiency of our design can be further improved by adding more sensors to it. To increase the quality of the images during nights, the lights may be turned on automatically when the intrusion is detected. The digital image processing algorithm may be implemented in the application module of webcam to differentiate radiation changes between human and animal species.

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