

# Home Security System Based on Sensors and IoT

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**ABSTRACT:** Security is the main concern of the world now days. Sensor based home security system are the high technology and methodical systems which connect wirelessly and ensure real time operation and indication of the threat to the house. The idea of comfortable living in home has changed since the past decade as digital, vision and wireless technologies are integrated into it. Now-a-days internet plays a major role in every area, so integrating sensors technology with an IOT environment could resolve the security issues of society to a great extent. The various drawbacks of existing technologies are cost and range. In this paper a design and implementation of sensor based security system with an IOT environment has been presented, which will resolve various security issues like unauthorized intruder entry, fire detection etc. Therefore continuous monitoring of the home/apartment is possible. The system is cost effective, reliable and has low power consumption.

**KEYWORDS:** ArduinoUno board, sensors, IOT

## I. INTRODUCTION

Smart home security has become absolutely pre-eminent in daily life of household and industrial works. Home security is something that is applicable to all of us and involves the hardware and a personal security practice. The hardware would be the doors, alarms, lock systems and different type of sensors like IR sensor, LDR sensor, acoustic sensor etc. to detect unfavorable condition. In case of personal security practice involving doors locking, activating alarms, closing the windows and many other daily life tasks are performed to prevent a burglary. In the present time a lot of unsolicited activities like theft are increasing continuously so there is need to modify the functionality of existing security systems. Apart from unauthorized entry, fire and LPG leakage in the house etc. are the problems faced by the society which needs equal attention. A data report in America from Federal Bureau of Investigation showed that 1.7 million homes were burglarized in 2014. It was found in the report that an estimated loss of \$3.9 billion was suffered by the victims in the same year. For all the burglaries, on an average the dollar loss per burglary offense was found to be \$2,251[12]. In 2014, there were 1,298,000 fires reported in the United States. These fires caused 3,275 civilian deaths, 15,775 civilian injuries, and \$11.6 billion in property damage [13]. So with the adoption of proficient security system, we can gain control over the things that require constant attention. There are many security issues in the surrounding that should need proper and perpetual attention. Many of these security issues can be resolved by deploying various sensors like IR sensor, fire sensor, LPG gas sensor and water sensor. The application of this system is quite useful when people get to know about the remote intrusions in their house or if there is some undesired event when they are not at their place. In this paper, a low cost security device is presented. The system has two parts: wireless sensor nodes and IOT. It has following features:

- (1) The device consumption power is low: The microcontroller used is ArduinoUno which consumes less power.
- (2) Low cost system: The controller and all other sensors are inexpensive.
- (3) Friendly user interface: LCD display which shows the status of all the sensors.
- (4) Quick response: Whenever an undesired event occurs a message will be displayed with in a second on the website.
- (5) The system is reliable and flexible.

# International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 5, Issue 6, June 2016

(6) Notify the Security firm or the owner with the emergency and its type and notification is done through generation of the message on the website.

(7) 24×7 hours functionality of the system.

(8) System is highly accurate: Correct status of the sensors is updated immediately.

This paper is organized as follows:

Section II describes literature review of existing technologies. Section III gives overview of the system with block diagram. Section IV presents implemented system with interfacing diagram of ArduinoUno board with different sensors. Section V presents implemented system results. Finally, Section VI presents conclusion.

## II. RELATED WORK

So far lot of work has been done in the field of security system. various security systems based on different technologies like Bluetooth, Infrared (IR), Zigbee and Radio Frequency Identification System (RFID) have already been deployed to wirelessly monitor the home security. There have been several commercial and research versions of home security system inaugurated and developed in the past. Hwang and Jin-WookBaek [6] built a smart door lock home security system by using Zigbee technology. The objective of the system was low power consumption and lesser cost. However this system has a limitation of range. Since Zigbee technology is used due to which the range is 50 meters only and data transmission rate is also low even less than Bluetooth and wifi technology.

The proposed system by Huang et al. [7] is Home security alarm system developed by applying Wireless sensor network and GSM technology. The wireless sensor network in home of this system is composed of a single center node module and many data collecting node modules, operating in point-to-multipoint communication mode. GSM based system overcomes the geographical limitation. However it increases the operational cost.

The system proposed by Choudhury et al. [3] provide its users with a simple, fast and reliable way to get help during emergency situations. The system can be placed at any location which can be easily accessed by the user. Two android applications were developed. The limitation of this system is that we need to manually press the button during emergency. Sensors are not present to detect the emergency situation automatically.

The system proposed by Satya et al. [9] consists of an LDR (Light Dependent Resistor) based sensor. If the light intensity goes above threshold the message will be sent to owner through GSM module. The advantage of this system is that the maintenance and operational costs are also mitigated to a minimum low value, and it overcomes the geographical limitation. The limitation of this system is that it is not efficient enough because it will detect undesired object and message will be sent without any need.

Another paper based on android application based security system was proposed by Rajadurai et al. [10] in which password operated keypad was used, which will be activated when the motion of the person is detected. If wrong password is entered, the message will be updated on the android application. The limitation of the system was range, because android application range is only 10 meter.

Xiang Yang et al [11] presented the security system based on internet, which acts as real time monitoring and controlling system. The system used AT91SAM9260 as the host controller, which has several advantages such as credible, flexible, easy maintenance, low cost and so on.

Major weakness of the existing system:

1. Most of systems established on Internet monitoring based systems require higher bandwidth, high data speed rates and high operational cost and hence more suitable for only in industry.
2. Zigbee, Bluetooth based system has a geographical limitation. Data rate transfer rate is also low in Zigbee communication. Range is the biggest challenge in Zigbee and Bluetooth based systems.
3. It is challenging to upgrade existing conventional control systems with remote control system capabilities.
4. In cellular monitoring systems like GSM the long term operational cost is relatively high due to usage charges incurred in each message transaction.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

## III. SYSTEM OVERVIEW

The whole system is categorized in two parts: hardware part which deal with various sensors and software part which deal with IOT (internet of things). There are four kinds of sensor nodes in the system. The sensor subsystem consists of four different types of sensor used for home security like fire sensor, LPG gas sensor, water level sensor and IR sensor. The wireless sensor network data collecting node module is connected with ArduinoUno board. This system monitors the house/apartment through detectors; fire detector, LPG gas detector, water level detector and motion detector. It detects accident/abnormal behavior or event when the monitored physical phenomena exceed a certain threshold. When the IR sensor finds that someone intrudes into the house or when the unauthorized entry through window is detected by motion sensor the data collecting node will send encoded alarm signal to the wireless sensor network center node, through the wireless sensor network established in home. Once the Wireless sensor network center node receives alarm signal, it will send alarm short message to the website which is created as a part of an IOT application in visual studio. The IR sensor is adjusted, such that it will measure the distance ranging from 1cm to 5cm, so that undesired motion is not detected. Fire sensor is there to detect any fire mishaps in the home. Whenever the fire is detected the fire sensor is activated and message is updated on the website. LPG gas leakage is also a big issue that should be considered for security purpose, for that LPG sensor is there. If the gas value increased above threshold value the message will be updated in the website. Another problem related to security purpose is accumulation of water in the basement during rainy season. For this water sensor has been used; if water level is above threshold the message update occur on the website.

### A. System Design

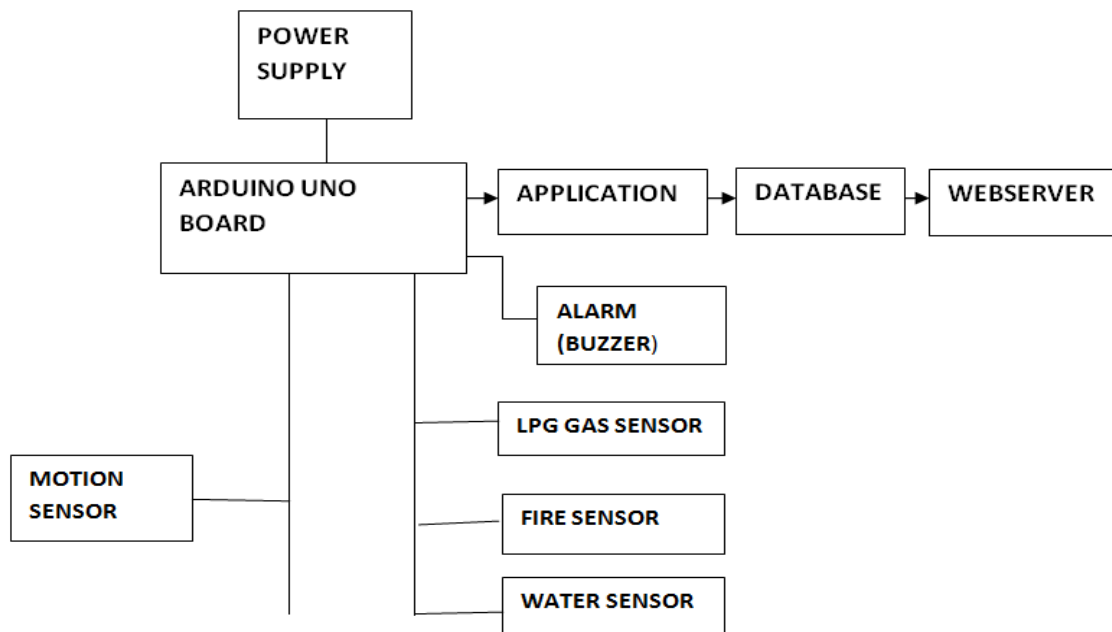


Fig. 1 Block Diagram of System

The general block diagram of the system is shown in Fig 1. In this block diagram the system contains two subsystems:

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

1. Sensor subsystem: It contains IR sensor, LPG gas sensor, fire sensor, and water sensor. When the one of the sensor is interrupted then it provides the input to the processing unit. In turn controller processes the signal and required instructions.
2. Software subsystem: An application in visual studio is created which take the output of hardware through serial port. Then the sensor output is updated in the database server and the sensor data is displayed on the website.

## IV. IMPLEMENTED SYSTEM

Different sensors are interfaced with ArduinoUno board. ArduinoUno board has 14 digital and 6 analog pins. Fire and IR sensors are digital sensors. Water and LPG (MQ6) sensors are analog sensors.

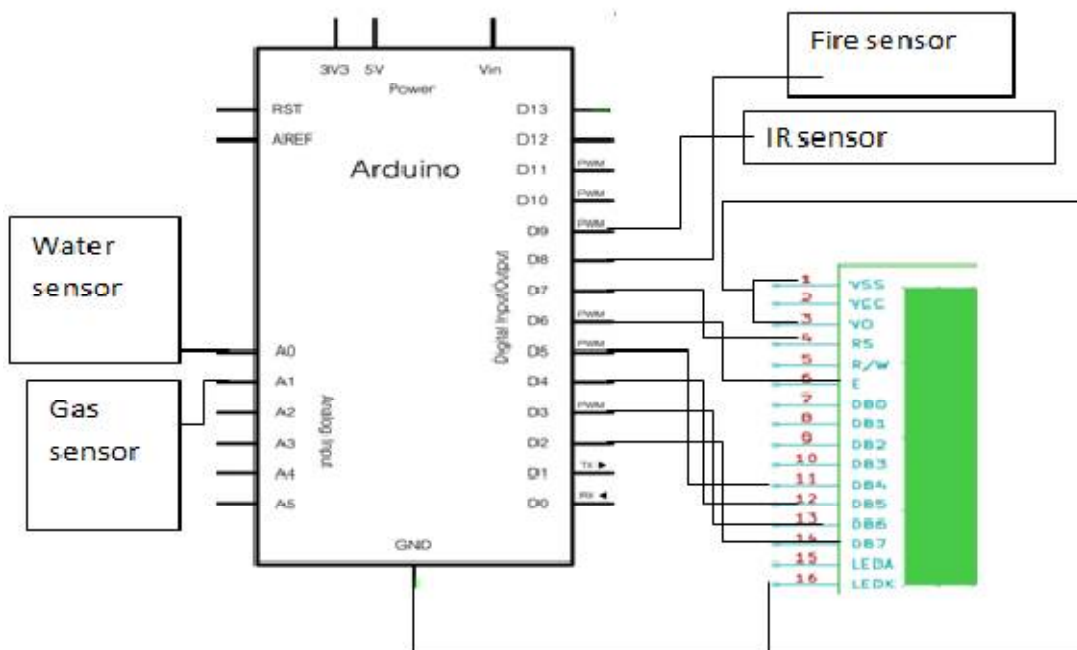


Fig. 2 Interfacing Diagram of the System

Fig.2 shows the interfacing diagram of the system. IR sensor's output pin is connected with ArduinoUno's D9 pin. Ground pin is connected to ground and VCC pin is connected to ArduinoUno's 5v pin. Connect fire sensor output pin with ArduinoUno's D8 pin. Ground pin is connected to ground and VCC pin is connected to ArduinoUno's 5v pin. Connect LPG gas sensor output pin with ArduinoUno A1 pin. Ground pin is connected to ground and VCC pin is connected to ArduinoUno's 5v pin. Connect water level sensor output pin with ArduinoUno A0 pin. Ground pin is connected to ground and VCC pin is connected to ArduinoUno's 5v pin. Interface LCD with ArduinoUno board. An application in visual studio is created to set an IOT environment. Domain and hosting are purchased from the site godaddy.com. After that domain is added to the hosting and index.aspx file which is created in the visual studio, is uploaded. Also database file is uploaded, which is created in the SQL server management studio. The created website can be opened with the domain name by using internet.

**V. RESULT**

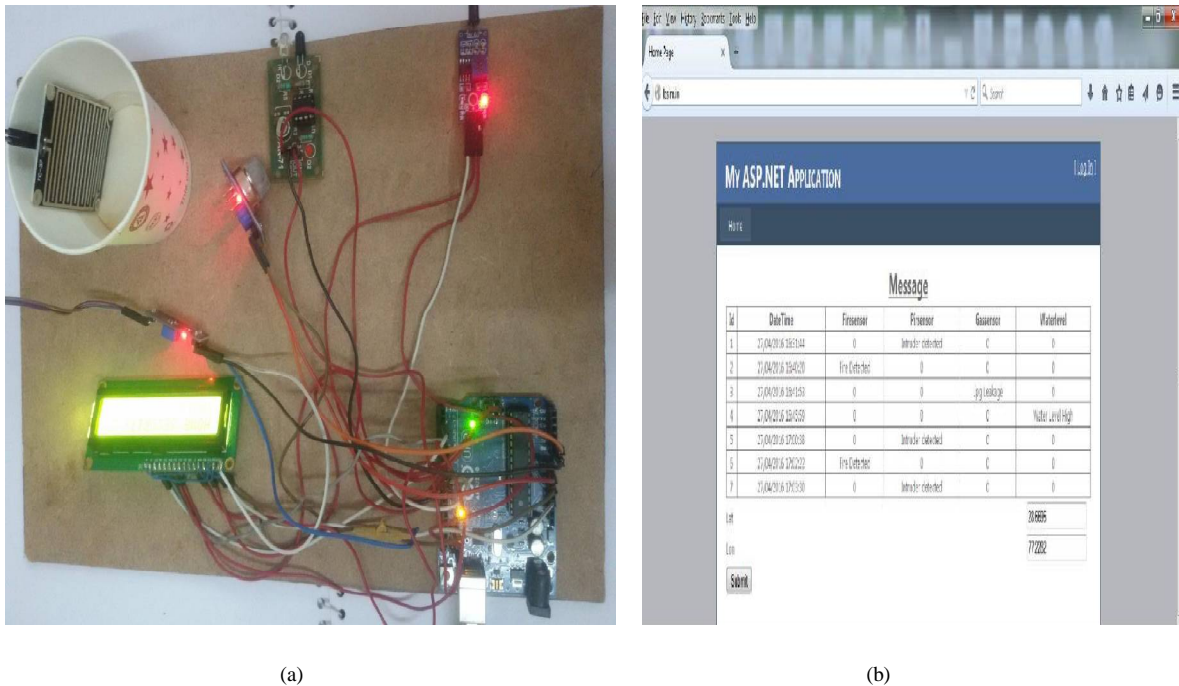


Fig. 3(a) Showing system hardware implementation (b) Display of message on the website.

Fig.3(a) shows the interfacing of ArduinoUno board with different sensors; ArduinoUno board having a 8 bit ATmega328P processor. Code is written in Arduino IDE and uploaded on the board by connecting the board with laptop through USB cable. The code must be verified before uploading. At the same time the visual studio application is running on the computer whose code is written in C# language. If any interruption in the hardware occurs; for example if fire is detected, the database is updated and the message along with date and time will be displayed on the website as shown in fig. 3(b). The time taken for updating the message on the website is less than one second. Latitude and longitude values of the home location are also displayed on the website, so that emergency firm can easily track the location of the accident.

**VI. CONCLUSION**

The system implemented provides a best cost effective solution of the home security system. This system is concerned about overall security of the house and includes circuitry which in worse case (accidents) automatically sense the situation and sends the emergency message on the website, which is easily accessed by security guard/security firm/owner or individual. The extensive capabilities of this system are those, which makes it so interesting. The system is user friendly and reliable. The end product will have a simplistic design making it easy for users to interact with.

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