

Multilayered Home Security System with Backup Capability

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Abstract—In present world, Wireless Monitoring and controlling in home security and automation is the emergent area in the research field of embedded system. Security is the degree of shield against any unfavorable condition which is harmful to individual or society and it is something that is the necessity of today. In present day scenario the lives of people have become busier than before. So there is a need of such type of system which will monitor and control the security of the house even if the individual is miles away from home. After doing lot of research in this area a system model is presented which is real time online and offline security based with an automation technology emerged into it. IOT and GSM technologies are used to provide online as well as offline security capabilities in this system. Beside security capabilities system is automated also. The system is flexible and reliable.

1. INTRODUCTION

Smart home is visualized as the comfortable standard of living for many people in near future. Smart home is the grid which provides security and automation ubiquitously. It will make the life more efficient and comfortable. A lot of security issues are there which need individual's keen attention, but it is not possible until there is a device setup in the home which will monitor and control the undesired events continuously when no one is inside the home. In today's time society is facing these security issues like burglary/robbery, fire due to cooking equipment or heating and lightening equipment, LPG gas leakage, water accumulation in the basement due to heavy rain and jamming of pipes due to heavy snow fall in hilly areas. A data report in America from Federal Bureau of Investigation showed the percentage of homes that were burglarized in 2014. Fig. 2 shows that 73.2 percent of burglaries occurred at residences. And 26.8 percent occurred on streets or highways [9]. Other report shows annual average home fire which result in 2,470 civilian fire deaths, 12,890 civilian fire injuries and \$6.9 billion in direct damage. Fig. 1 shows the percentage of these losses caused by fire at residential area [10].

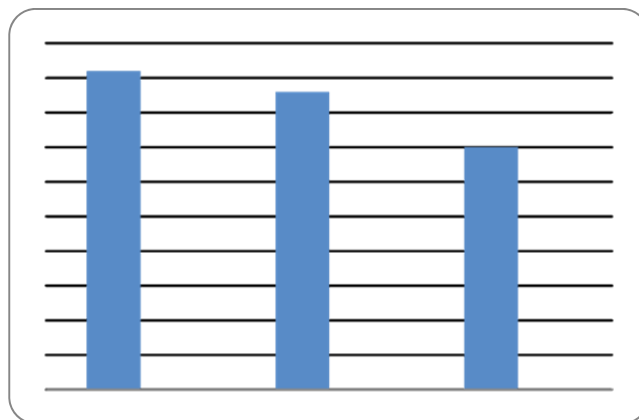


Fig.1. Chart showing injuries/death caused due to fire.

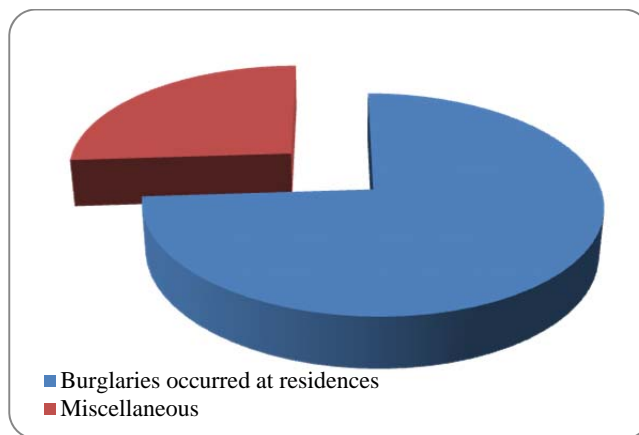


Fig. 2: Chart showing percentage of burglary occurred.

These issues of the security should be resolved efficiently and reliably. In this paper design methodology of multilayered real time based security system is done. The system is efficient enough to react in unfavorable condition. The system has wireless sensor technology along with IOT and GSM technologies with following features:

- (1) User friendly interface is there.

- (2) Reliable and efficient.
- (3) Backup system: Online as well as offline alert message receiving capabilities.
- (4) Easy installation: Wireless communication capabilities of the nodes make the system installation easy such that they can be installed anywhere in the home.
- (5) Fast response time: The message is received or updated within no time since the event occurs.
- (6) The system is expandable. Various sensors or other equipments can be attached depending on the user's need.
- (7) The system works 24x7 hours with lower power consumption.
- (8) Accuracy and reliability is the best feature of the system. The system will provide accurate status of the various sensed parameters.

2. RELATED WORK

Lots of research work has been done in the field of security system. In paper [1] Bluetooth based home automation system was introduced, in this system there is one primary controller and few numbers of Bluetooth sub-controllers. Home devices are connected to a local Bluetooth subcontroller. The communication between device and sub-controller is wired communication. From the sub-controller all communications are sent to the primary controller by wireless communications. Each home device has a dedicated Bluetooth module requirement.

The system proposed in this paper [6] is based on GSM/GPRS gateway and wireless security nodes. Three type of security nodes are there: door security nodes, infrared security nodes and fire alarm nodes. An 8-bit microprocessor, PSoC (Programmable System on Chip) device is used in this system. The data transfer between sensor node and gateway is done through wireless transceiver.

In paper [3] fire alarm system has been presented which uses zigbee technology. The system connects the danger prone zones of the campus or industry to a central control room. Zigbee and multihopping techniques are used to set effective communication over the channel.

In paper [4] PIC microcontroller was used to provide real time surveillance system. Intruder detection and fire detection is done by using Zigbee technology for communication. Real time video capturing feature was also emerged into this system.

In paper [5] ultrasonic sensor was used to detect unwanted intrusion inside the house. A rotating motor is used which allow the sensor to cover wide 360 degree area.

In paper [2] home network security system is based on the IEEE802.11 standard, which provides a good solution for transferring file/data and media date, but this system has high cost and high power consumption.

The system proposed in paper [7] is based on android application. Two android applications are there. The device is placed at any remote location and is manually operated during an emergency situation.

Another paper [8] based on android application which uses IR sensor to detect intruder entry. If an unusual entry is detected the message is updated through android application. Limitations of the existing system are the following:

- 1) Most of the existing systems are based on Bluetooth technology, zigbee technology. So there is range limitation.
- 2) Android application based system has also range limitation and some are manually operated.
- 3) Difficult to install because some expert professionals are needed to install the system.
- 4) Most of the security systems are single system based. In an event of system failure, there is no rescue system to monitor the home continuously.

3. PROPOSED MODEL

There is a need of making multilayered security system with backup capability. Multilayered system is the system which considers the all types of security issues.

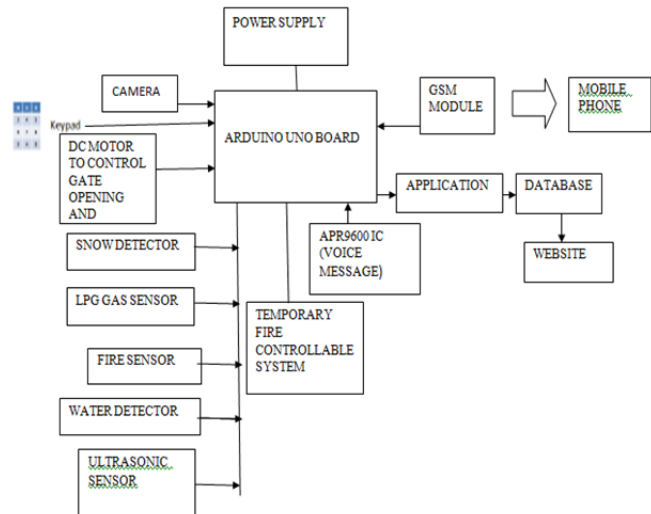


Fig. 3: Block diagram of the system.

The block diagram of system is shown in Figure 3. The system has keypad at the gate if wrong password is entered the message will be received by owner through both online (website) and offline (GSM) mode. The ultrasonic sensor is there to detect unsolicited entry from the backdoor of the house and thus restrict intruder entry inside the house by alerting the owner. Other security factors are taken into consideration by using fire sensor to detect fire, ice detector to detect blockage inside the pipes in hilly areas, water detector to alert the situation when water level goes high due to heavy rainfall.

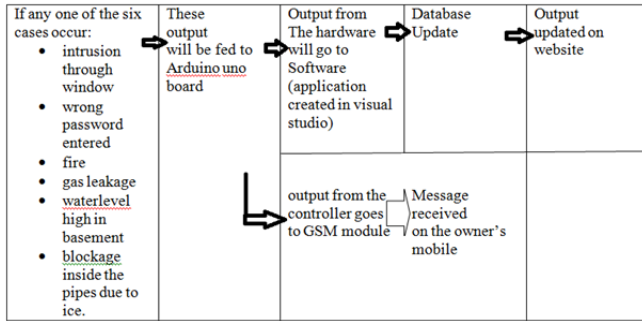


Fig. 4: Working methodology of the system.

The working methodology of the system has been explained in figure 4. There are number of cases that are considered and any unwanted interruption results in alerting the owner as well as security organization. The owner came to know about any disturbance in the home through his mobile phone or by accessing the website. Other family members and security organization came to know about the disturbance in the home by accessing the website. The system has dual monitoring system (online and offline mode) ,if any one of the monitoring system fails due to any reason even in that condition owner came to know about the situation of his home.

4. SYSTEM IMPLEMENTATION

4.1. Arduino Uno board

The Arduino Uno board has an 8 bit ATmega328P processor with 14 digital input/output pins, 6 analog inputs, a USB connection, and a power connection. Arduino Uno board is a controller that will connect various sensor nodes and other communication equipments. It has following features:

- (1) It is 8 bit architecture with better indexing which decreases the processing time.
- (2) Low power requirements.
- (3) Lesser cost approximately available in 500 Rupees.

4.2. Sensor subsystem

Sensor system has analog sensors as well as digital sensors. Analog sensor’s output pin is connected with Aurdino Uno’s analog pins. Digital sensor’s output pin is connected with digital pins of the Aurdino Uno board.

4.3. GSM module (offline mode)

GSM module is used in the system to provide cellular applications. The transmitter pin of the GSM module is connected with receiver pin of the Arduino Uno board. The receiver pin of the GSM module is connected with the transmitter pin of the Arduino Uno board. AT (attention) command are used to set effective GSM communication.

4.4 IoT application (online mode)

To generate an online mode of communication an IOT application in visual studio is developed. By purchasing domain name and hosting the website has been launched which will update the message on the website whenever unfavorable conditions are encountered.

4.5. APR 33A3 IC

APR 33A3 IC is sound recorder IC with 4-8 kHz sampling rate. In this system it is used to alert by generating voice message about the condition which is interrupted. Inside the home individual doesn’t have mobile phone all the time in his/her hand. So in this scenario voice message system is useful. For example if gas leakage or fire is detected the voice message will also broadcasted and hence this system becomes more reliable.

4.6. Temporary fire controllable system

The Temporary fire controllable system act as a protector till the help from the fire brigade station arrived. The system consists of relay unit and exhaust fans. With detection of LPG gas leakage, the controller actuates the fans and window through relay. DC motors are used to run the fan and open the window automatically by controller. Also with the detection of fire, the relay unit will lower down the main power supply switch of the home.

5. EXPERIMENTAL RESULTS

The proposed system is successfully implemented and the results are obtained accurately.

The fig. 5 shows the message updated on the website when any of interruption is detected by the sensors. For example if fire sensor value is high then the database is updated and the message “fire detected” displayed on the website. At the same time owner will receive the message on his GSM mobile as shown in fig 6. The voice alert message is also generated.

Message					
Id	DateTime	FIRE DETECTOR	MOTION DETECTOR	LPG GAS DETECTOR	SNOW DETECTOR
1	27/04/2016 16:31:44	0	Intruder detected	0	0
2	27/04/2016 16:40:20	Fire Detected	0	0	0
3	27/04/2016 16:41:53	0	0	Lpg Leakage	0
4	27/04/2016 16:45:59	0	0	0	Ice blockage inside the pipe
5	27/04/2016 17:00:38	0	Intruder detected	0	0
6	27/04/2016 17:02:22	Fire Detected	0	0	0

Fig. 5: Message display on the website

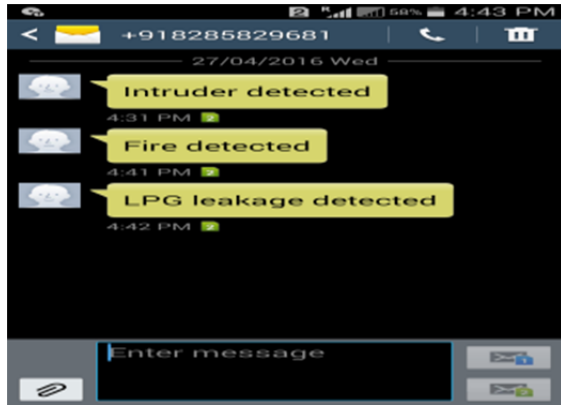


Fig. 6: Message display on owner's mobile

6. CONCLUSIONS

A low power consumption and reliable system has been implemented. The system is IOT as well as GSM based and hence provides backup capability. The monitoring service is accessible through mobile device and laptop. There is no geographical limitation and the website is accessible by multiple users. This system further can be enhanced by using GPS technology in it then it will become easier for the security firm to locate the location of affected area and hence results in more effective system.

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