A Study of Various Electronic Security Sensors Devices and Technology at Various Application Field Accompanied With Real Time Project Implementation of Sensor

Vijay Laxmi Kalyani, Parmeet Kour, Peram Navya

Vijay Laxmi Kalyani, Electronics and Communication Engineering, Government Women Engineering College, Ajmer, India.
vijaylaxmikalyani@yahoo.com
Parmeet Kour, Electronics and Communication Engineering, Government Women Engineering College, Ajmer, India.
parmeetbarkha@gmail.com
Peram Navya, Electronics and Communication Engineering, Government Women Engineering College, Ajmer, India.
cutenavya21@gmail.com

Abstract: Nowadays electronics is everywhere and we are surrounded with electronic gazettes many of them are helping us in maintaining security at various places, there are many security problems faced by banks, homes etc. Without proper and strong security a vault can be penetrated. A security system is used in residential, commercial, industrial, Medical and Militaries as well as personal protection. In this paper we are discussing about the various electronic security sensor devices and technology that are used in security system and their applications.

Keywords: security sensors, electronics devices, real time implementation of sensing device, applications

I. INTRODUCTION

Sensor devices are in great demand, recently, the concept of Internet-of-things (IoT) gathers attention, especially when integrating IPv4 and IPv6 networks, many types of sensor devices are available such as movement sensors to measure the acceleration, rotation, speed, inclination, torque, vibrations, resonance. Atmosphere sensors measure the gas, oxygen, temperature, moisture, vacuum, pressure, wind. Position sensors measure the displacement, position, proximity, level gap. Liquid sensors measure the flow, moisture, humidity, pH, pressure. Sound sensors measure the acoustic, ultrasonic, resonance. Technology-oriented sensors such as the nanosensors, optical, chemical, magnetic, biosensors.

Now in present days security is needed everywhere in the places like banks, homes, small scale industries, in business etc. There are more cases of burglary so securing the places like banks, homes etc. become very important. By considering this, in this paper we are describing the various electronic security sensor devices and technology that are used in the security system and their applications. We use LDR (Light Dependent Resistor) as a sensor which detects the darkness. The PIR (Passive Infrared) sensors are sensitive to the person's skin temperature. The micro wave detector detects the motion through the principle of Doppler radar. A Glass break detector is a sensor that detects if a plane of a glass is shattered or broken. The ultra-sonic detectors detect movement and relay the information back to the receiver with the help of ultra - sonic waves.

II. TYPES OF SENSOR IN ELECTRONIC WORLD

Security system: The security system is a method by which something is secured through a system of interworking components. The main part of any security is the sensor or detector. A sensor is a device whose purpose is to detect the change in its environment or it detect the light, heat, motion, moisture, pressure. The output is generally a signal that is converted to the human readable display or transmitted electronically over a network for further processing. There are different types of sensors used in security system.

1. MOTION SENSOR

A motion sensor is a sensor that responds to a moving object particularly people. It performs the tasks to alert the user for a motion in a particular area. It is an electronic device that detects the physical movement in a given area and transforms motion into an electric signal. Motion sensors are commonly used in security systems for example as triggers for automatic lights or trips for remote alarms and similar applications. Some of the motion sensors are used in security system.

1.1 PIR Motion Sensor

The PIR sensor is the most common sensor used in households and small business environments. The term passive refers to the fact that the detector does not generate or radiate its own energy; it works entirely by detecting the heat energy given off by other objects. [1]. the sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves

are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

Fig.-1 shows the diagram of PIR Sensor

Source:http://www.circuitstoday.com/pir-sensor-based-security-system

1.1.1. Applications of PIR Sensor

- Save energy with appropriate usage of electricity by introducing PIR sensor that will turn off light when not needed.
  - o Staircase
  - o Office Cabins
  - o Conference Rooms
  - o Car Parking
  - o Street Lights
  - o Cafeteria
  - o Laboratory
  - o Security & Surveillance

1.1.2. PIR Sensor Based Security System

This electronic security system can be used in banks and other high security areas. A normal electronic security system will have a transmitter and a receiver. The transmitter sends out an IR laser and this will be received by the receiver. When an intruder walks past the device, the IR beam is cut and thus the alarm is activated [2].
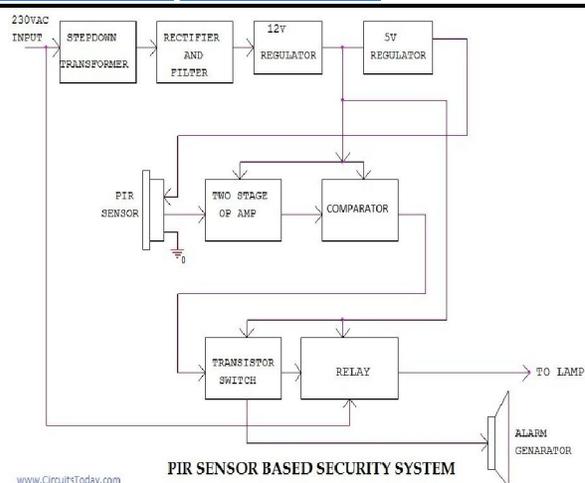

Fig.-2: The block diagram of the PIR based security system

Source: http://www.circuitstoday.com/wp-content/uploads/2011/07/PIR-Block-Diagram.jpg

1.2. Ultrasonic Sensor

Using frequencies between 15 kHz and 75 kHz, these active detectors transmit ultrasonic sound waves. The Doppler shift principle is the underlying method of operation, in which a change in frequency is detected due to object motion. This is caused when the object must cause a change in the ultrasonic frequency to the receiver relative to the transmitting frequency [3].

In this detector ultrasonic signal is transmitted by the transmitter in the area which has to be protected, now these waves are reflected by the solid objects like walls, floor etc. and then detected by the receiver. When the surfaces are stationary, the frequency of the waves detected by the receiver will be equal to the transmitted frequency. However, Change in frequency will occur as a result of the Doppler principle, when a person or object is moving towards or away from the detector. Such an event initiates an alarm signal. This technology is considered obsolete by many alarm professionals, and is not actively installed.

Fig.3: Ultrasonic Sensor

Source: https://electrosome.com/wp-content/uploads/2014/08/HC-SR04-Ultrasonic-Sensor.jpg

1.2.1. Application of Ultrasonic Sensor

- Door Alarm using Arduino and Ultrasonic Sensor

Working on this **Arduino Door Alarm** is very easy. Whenever anyone comes in the path/range of Ultrasonic Sensor, microcontroller detects the distance of object from the sensor and if the object is in the defined range, it sends the High signal to the buzzer and buzzer starts beeping [4].

Fig.4: Door Alarm using Arduino and Ultrasonic Sensor

Sour**c**e**:** https://electrosome.com/wp-content/uploads/2014/08/HC-SR04-Ultrasonic-Sensor.jpg

1.3. Microwave Sensor

In this detector a microwave radiation is emitted by the transmitter, because of the moving object phase shifts occurs in a reflected wave by the same object. The receiver result in a heterodyne signal at low audio frequencies.
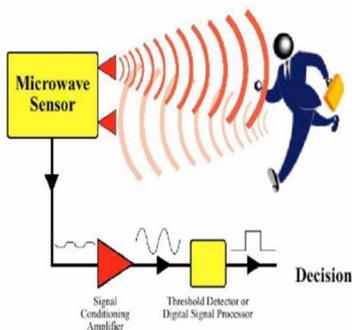

Fig.5: Microwave Sensor

1.3.1. Applications of Microwave Sensor

- These detectors, apart from addressing security problems, are also used in door openings.

- These detectors are used to detect the heartbeat and breathing rate of a human.
- These detectors are used in the elevator shaft way where they are used to display the information regarding the parking of a car in an elevated parking system.
- These sensors are used in security issues and traffic law enforcement.
- They are used in monitoring the light system of a house or a building.

1.4. Tomographic motion detector

Tomographic motion detection systems sense disturbances to radio waves as they pass from node to node of a mesh network. They have the ability to detect over complete areas because they can sense through walls and other obstructions [5]. It has the advantage over existing motion sensor that it detects the low false alarm rate. It can be completely hidden from view.

1.4.1. Applications of Tomographic motion detector

- Used for automation and security in homes and places.
- Used for security to protect businesses and civilians that needs unbeatable security to protect their assets. For example :Jewelry stores and pawn shop.
- Used for security in dirty and dynamic environments like warehouses and machine shops where traditional sensors get blocked either by equipment or dirt.

1.5. Dual-technology motion detectors

Most modern motion detectors use combinations of different technologies. While combining multiple sensing technologies into one detector can help reduce false triggering. For example, many dual-tech sensors combine both a PIR sensor and a microwave sensor into one unit. In order for motion to be detected, both sensors must trip together. This lowers the probability of a false alarm since heat and light changes may trip the PIR but not the microwave, or trees may trigger the microwave but not the PIR. If an intruder is able to fool either the PIR or microwave, however, the sensor will not detect [6].

2. Glass Break Sensors

Glass break sensors are used in electronic alarm near the glass doors that detects if a thief broke the glass. Glass break detectors usually use a microphone, which monitors any noise or vibrations coming from the glass. If the vibrations exceed a certain threshold (that is sometimes user selectable) they are analyzed by detector circuitry [7].

Fig.6: Glass Break Sensors

3.   Window Sensors and Door Sensors

Window and Door Sensors are the center of any security system. Door and window sensors come in two pieces. One fits onto the door or window itself, while its counterpart attaches to the frame. The two pieces are positioned to be right next to each other. When the two pieces are separated, such as when the door or window is opened, they send a signal to the alarm panel [8].

4.   LDR (LIGHT DEPENDENT RESISTOR)

A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity a function of the incident electromagnetic radiation. Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance [9].
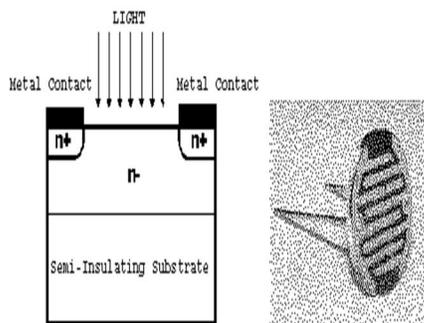

Fig.7: Diagram of LDR

4.1. Working of LDR

Working of LDR is based on principal of Photo Conductivity. When photons of energy greater than the band gap of semiconductor is incident on the LDR, light is absorbed by the semiconductor material when the electron goes from valence band to conduction band and hence conductivity increases and resistivity decreases.

4.2. Applications of LDR

LDR have low cost and simple structure. They are often used as light sensors. They are used when there is a need to detect absences or presences of light like in a camera light meter. Used in street lamps, alarm clock, burglar alarm circuits, light intensity meters, for counting the packages moving on a conveyor belt, etc.

4.3.   REALISTIC IMPLEMENTATION OF LDR SENSOR

Here we discussed many types of sensors and now we are discussing a security system based on the use of LDR sensor. For realistic implementation we use a LDR (Light Depended Resistor) to detect security problems. Using this we can be control the theft attempt and other security threats. This work can be implemented in hostels, banks, home etc. where security is needed. In this system we are using LDR which detects darkness. It uses the transistors to switch ON and OFF the lights and generating the noise automatically. It automatically generates the noise whenever an LDR detects the shadow of thief. In this system the transistors work in saturation region and cut off region. We are using a buzzer which provides a noise when LDR detect the shadow. When a continuous light incident on the LDR the resistance is low then both the transistors are in cut off mode and there is no noise and LED does not glow. Whenever a thief comes in front of LDR, because of the shadow of thief the resistance of the LDR increases. Because of the voltage drop across the LDR is greater than 0.7 V, makes the transistors works in saturation mode. By this the noise is generated and the LED glows.
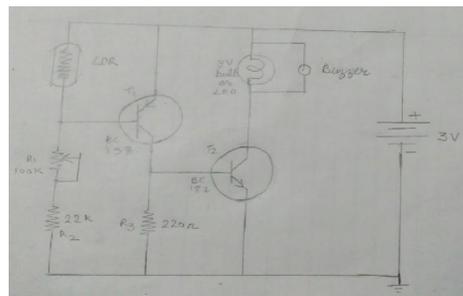

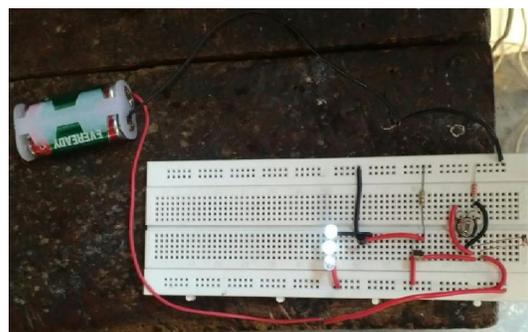Fig.8: circuit diagram of security system using LDR

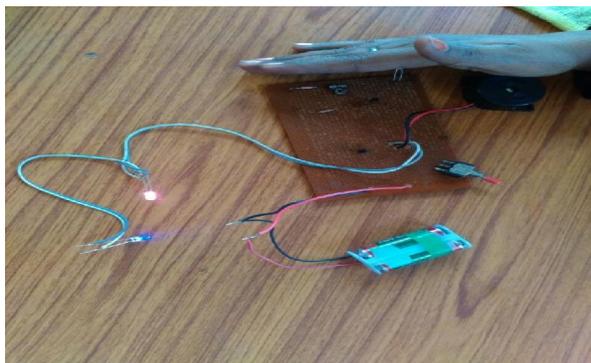Fig.9: security system using LDR implemented on breadboard

Fig.10: security system using LDR implemented on PCB

III. FUTURE OF SENSOR TECHNOLOGY

With the help of Sensors we can improve the world through energy sources like fuel cells and batteries and solar power, health, safety and security for people, environmental monitoring, through diagnostics in medical field. In future sensor-enabled devices communicate with each other with the help of "internet of things (IoT)".

III. CONCLUSION

Hence we concluded from this paper by using the different types of security sensors such as motion sensors, glass break sensors, Window and door sensors, LDR etc. that these sensors are used in the security system. These sensors provide the security protection in the places like malls, banks, homes, conference rooms, offices, hostels etc. The world is full with sensors and assume it without the sensors like older days, the amount of money and energy now could be saved by using sensors and the security improvements in various areas like banks and hospitals etc. is a great help to the mankind.

We have taken a small step in this direction to make and implement the sensor based device to be implemented in the real sense in the test area of the college and later with the improvement in the design and requirement it will be replicated in other areas also.

REFERENCES

[1] https://en.wikipedia.org/wiki/Security_alarm
[2] http://www.circuitstoday.com/pir-sensor-based-security-system
[3] https://en.wikipedia.org/wiki/Security_alarm
[4] http://circuitdigest.com/microcontroller-projects/door-alarm-using-arduino-ultrasonic-sensor
[5] https://en.wikipedia.org/wiki/Motion_detector
[6] https://en.wikipedia.org/wiki/Motion_detector
[7] https://en.wikipedia.org/wiki/Glass_break_detector
[8]http://securityalarm.com/what-are-the-different-types-of-security-sensors/
[9]http://www.electrical4u.com/light-dependent-resistor-ldr-working-principle-of-ldr/

Author's Details

V.L. Kalyani assistant professor in ECE department Govt. Women Engineering College, Ajmer. She is a member of IAENG. Attended various seminars and conferences, STC and FDP'S etc. and published many papers in Conferences and Journals.

Parmeet Kaur presently perusing B.TECH from ECE branch from Govt. Women Engineering College, Ajmer

Peram Navya presently perusing B.TECH from ECE branch from Govt. Women Engineering College, Ajmer