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Design and Construction of a Three Way Burglar Alarm System

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ABSTRACT

This work present the design, construction and testing of a three way burglar alarm activated by light, break beam and pressure sensor. The principle of operation of this burglar alarm is simple. When the ray of light falls on the light sensor (light dependent resistor) the alarm is triggered and the flasher (light) flashes. The same also happens in the event that an intruders walks through the break beam sensor thereby blocking a projected infrared beam (in an opto-isolator) or exerts pressure by stepping on the pressure sensor. Since it is not possible for an intruder to gain entrance without a compromise in any or all the above conditions, these actions thus alert the owner of the residence and/or security personnel of the presence of an intruder.

Keywords*:* Design, Construction, Gurglar, Alarm, Security, Opto-Isolator & Infrared-Beam.

1. INTRODUCTION

As civilizations evolved, human beings got organized in tribes, groups, and kingdoms. This led to the emergence of ideas such as power, battles, supremacy, and politics. These ideas further fueled the natural need of people to communicate secretly with selective recipient. Presently Computer as an electronic device is used to process data as input and produce result in the form of information as output. In the 1990s, Investigations of past home burglar alarm security system devices and well modernized systems on the market to be attained. Every home owner and tenant are at risk of losing their hard earned possessions to burglars. This has prompted them into looking for more effective systems which provide higher security to their homes. In that way it will bar burglars from their premises, they will not gain access to their property easily without alarm and flasher alerts immediately.

In most domestic alarm systems the intruder detection facility is needed only when the building is unoccupied. From the alarm company's point of view, multiple switching or zoning is justified on the grounds of ease of maintenance and locating and isolating faults should they occur. For some alarm companies to supply rather more comprehensive control panels than are strictly necessary, it is unknown and perhaps just to increase the sale value of the installation and probably to impress the customer. According to research, the common parameters or characteristics of home security system are: 24 hours monitoring of the intruder, Ease of use, Reliability, Efficiency, Fast and precise notification system. Today a number of home security systems are available everywhere. The paper presents the design, construction and testing of a simple activated burglar alarm. The principle of operation of this burglar alarm is simple. When there is reflection of light, pressure on the pressure sensor or break beam through the door, the alarm is triggered and the siren begins to operate. The speaker beeps and the flasher (light) flashes. These actions thus alert the owner of the residence and/or security personnel of the presence of an intruder.

2. LITERATURE REVIEW

Ahmed *et al*, (2006) developed a simple sound activated burglar alarm system which used sound intensity to detect intruders, this is prone to either false trigger of the alarm or non triggering of the alarm if the intruder gets in silently. Oladunmoye *et al*, (2014) constructed a burglar alarm system using metal detectors, the alarm in this case will not be triggered if the intruder does not carry anything metallic in nature. Amewornu, (2015) designed a wireless alarm system using infra-red detector to sense any intruder's temperature, this design will not only detect humans but animals also as well any object that generates heat. Kour and Dhiman (2013) examined the Importance of Home Alarm System Based on LABVIEW Software programmed to scare away intruders by sounding an alarm. The software component of this system makes it more complex to work with.

Nwalozie *et al*, (2015) enhanced the design of home security with an SMS-based intruder detection. The SMS notification may not be loud enough to get the attention of the house owner. Ivy and Modi (2011) presented a domestic intruder system which incorporated the activation of an alarm, capturing an image of intruder, along with sms and email notification but the design was quite complex. Zungeru *et al*, (2012) designed a touch sensitive security system, if however the door is left opened such that the intruder does not touch any part of the door, the alarm does not get activated.

XiaoFeng and ChunGuang (2011) designed a remote laser intrusion detection and alarm system while (Effendi *et al*, 2016) designed an alarm reminder locking (ARL) Security System which made use of a microcontroller in its operation. These required training for effective security. Ullah *et al*, (2015) developed a security alarm using optoelectric device. This is not an all sufficient means of security. This paper presents the design and construction of a three way burglar alarm system. It is activated by light, break beam and pressure sensor. When the ray of light falls on the light sensor the alarm is triggered and the flasher (light) flashes. The same happens when the beam is broken or the pressure sensor is depressed. All the three conditions can happen simultaneously making it impossible for an intruder to gain entry without compromising any or all of the conditions.

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3.0 HARDWARE DESIGN

3.1 The Power Supply Unit

The power supply stage provides the appropriate DC voltage requirements to ensure the circuit components (especially the Active components) are powered properly. The circuit uses +5VDC supply. The power supply stage involves a step down transformer, rectifier, filter capacitor, and a voltage regulator, to give the regulated DC voltage. The circuit for the power supply stage is shown in Fig 1

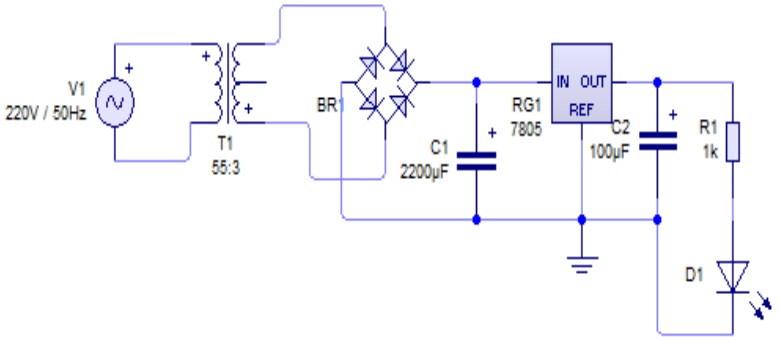

Fig 1: Power Supply Circuit

3.2 Sensing Stage

The opto-isolator is made up of an infrared transmitter and a photo-diode receiver. When the beam is broken, the output of the LM393 op-amp in the detector stage goes low, to allow for the appropriate trigger condition of the monostable stage. Fig 2 below shows the break-beam sensor stage.

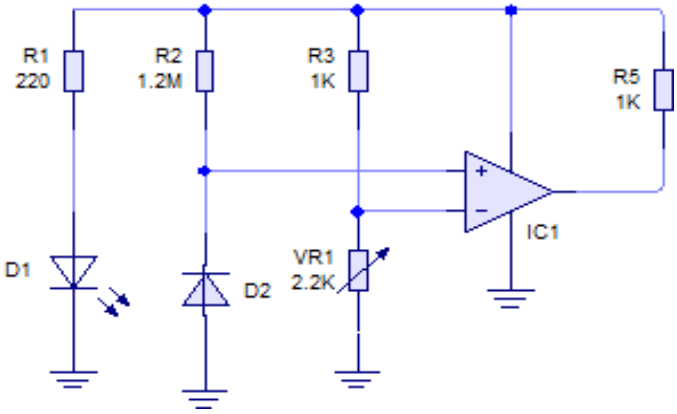

Fig 2: Sensing Stage

The photo diode was used as the main opto-sensor due to its ability to resist day light interference better than the other optical devices. The photodiode is operated in reverse biased condition. In darkness (i.e. without infrared transmission) or during break-beam the photodiode has a high resistance, and a low resistance upon reception of infrared light. The change in resistance causes a change in the drop across the diode, which is fed to the input of the comparator.

The Light Sensor uses Light Dependent Resistor (LDR) which is a semiconductor device that changes its electrical resistance depending on the presence of light. A Light Dependent Resistor changes its electrical resistance from a high value of several thousand Ohms in the dark to only a few hundreds of Ohms when light is incident on it by creating electron – hole pairs in the material. In the absence of light, the resistance of a light dependent resistor is as high as 10 M Ω. In the presence of sunlight, the resistance of a light dependent resistor will fall to 100 Ω. A Light Dependent Resistor is generally connected in series with a resistor with a single DC voltage supply across it.

The output voltage is given by the formular below:

$$V_{out} = \frac{R_{LDR}}{R + R_{LDR}} \times V_{in}$$

$V_{out} = Output\ Voltage$

$V_{in} = Input\ Voltage$

$R_{LDR} = LDR\ Resistance$

$R = Series\ Resistance$

The Output voltage is approximately zero volts in the presence of light while it is approximately V_{in} in the absence of light

The two voltage levels are still influenced by the presence of daylight interference and the separation distance between the transmitter and the receiver. To ensure two distinct levels a voltage comparator is used. The comparator stage allows a precise point to be set where the output voltage will change. This is achieved by adjusting the variable resistor in Fig 2.

The variable resistor is adjusted such that any voltage above the threshold in the inverting input (as the beam is broken) will make the comparator LOW. This LOW output is used to trigger a 555 timer.
$Vout = A_0 \times Vin$

Where
A_0 = open loop voltage gain.
And $Vin = V^+ - V^-$
Vout will drop to V+ for the slightest positive difference in voltage since A0 is often very large (in order of 20000).

The comparator is meant to give a HIGH when the beam is broken and a LOW when the infrared is transmitting to the photo diode.

A comparator circuit compares two voltage signals and determines which one is greater. The result of comparison is indicated by the output voltage: if the op-amp's output is saturated in the positive direction, the non- inverting input (+) is greater or more positive than the inverting input (-), all voltages are measured with respect to ground. If the op-amp's voltage is near the negative supply voltage (i.e 0 or ground potential), it implies the inverting input (-) has a greater voltage applied to it than the non-inverting input (+).

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The Block diagram and Circuit diagram are shown if Fig. 3 and Fig. 4 respectively

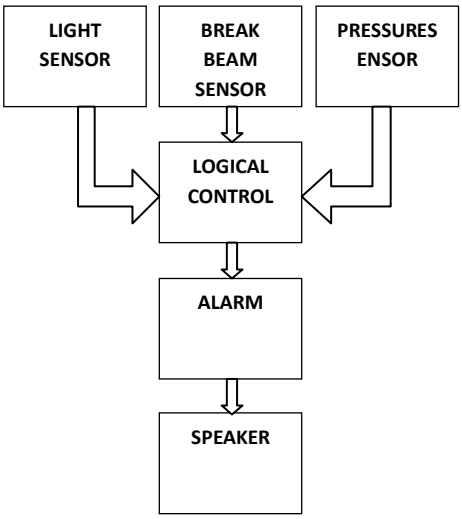

Fig 3: Block Diagram

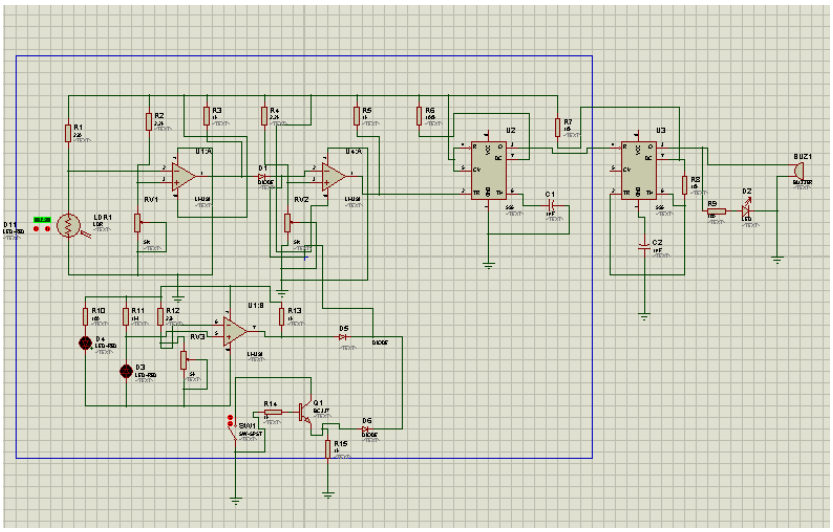

Fig 4: Complete Circuit Diagram

4. MONITORING AND TESTING

The testing of the design was first done on a breadboard, all the components used for the design were fixed on a breadboard as it is in the circuit diagram. The circuit was tested and it worked well. Another testing was done when the components have all been soldered on the Vero board and it worked perfectly well too. The various stages; light sensor stage, break beam stage and the pressure sensor stage were tested separately and the respective observations noted.

5. RESULTS AND DISCUSSIONS

It was observed as soon as the ray of light fell on the light sensor (light dependent resistor) the alarm was triggered and the flasher (light) flashed, hence the light sensor stage worked well.
The output of the comparator was also observed to be HIGH when the beam was broken and LOW when the infrared was transmitting. The HIGH ouput of the comparator triggered the alarm and the flasher indicator flashed This implies proper working of the break beam sensor stage.
In a similar way when pressure was exerted on the pressure sensor the alarm was triggered and the flasher (light) flashed as a sign of correct functioning.

6. CONCLUSION

The design and construction of a three way burglar alarm system was done considering some factors such as application, design economy, availability of components and research materials, efficiency, compatibility, portability and durability. The performance of the system after test met design specifications.
A three way burglar alarm system has been designed, constructed and tested. It is suitable for indoor and out door security. The construction was done in such a way that maintenance and repairs are easy as well as affordable for the user to carry out.

REFERENCES

Ahmed, M. S., Mohammed, A. S. and Agbo G.A. (2006) "Development of a Simple Sound Activated Burglar Alarm System" Leonardo Journal of Sciences, Issue 9, p. 97-102, July-December 2006.

Oladunmoye, M., Oyekunle, V. B. and Oluwatomi, A. A. (2014). "Development and Construction of A Burglar Alarm" African Journal of Computing & ICT, Vol 7. No. 4 - October, 2014, Pp 35-45.

Amewornu, E. M. (2015) "Design Of Wireless Home Security Alarm System" African Journal of Applied Research (AJAR), Vol 1, No 1, 2015.

Kour, G. and Dhiman, J. (2013) "Importance of Home Alarm System Based on LABVIEW Software" Journal of Instrumentation Technology, Vol 1, Issue 1, pp 1-5, 2013.

Nwalozie, G. C., Aniedu, A. N., Nwokoye, C. S. and Abazuonu, I.E. (2015). "Enhancing Home Security Using SMS-based Intruder Detection System" International Journal of Computer Science and Mobile Computing, IJCSMC, Vol. 4, Issue. 6, June 2015, pg.1177–1184.

Ivy, B. P. U. and Modi, G. G. (2011) "Domestic Intruder System" Indian Journal of Computer Science and Engineering (IJCSE), Vol. 2 No. Pages 506-515, 4 Aug -Sep 2011.

Zungeru, A. M., Kolo, J. G. and Olumide, I. (2012) "A Simple and Reliable Touch Sensitive Security System" International Journal of Network Security & Its Applications (IJNSA), vol. 4, issue 5, pp. 149-169, 2012.

XiaoFeng, Y. and ChunGuang, Z. (2011) "Design of airport enclosures remote laser intrusion detection and alarm system" International Journal of the Physical Sciences Vol. 6(17), pp. 4282-4286, 2 September, 2011.

Effendi, M. S. M., Shayfull, Z., Saad, M. S., Nasir, S. M., and Azmi, A. H. B. (2016). "A New Invention Of Alarm Reminder Locking (ARL) Security System" International Journal of Engineering and Technology (IJET), Vol 8, No 1 Pages 465-472, Feb-Mar 2016.

Ullah, M. B., Kabir, H., Roy, T. S., Mehbub, A., Martuza, K. G., Ali, M. R. and Chowdhury, M. A. M (2015) "Design and Development of Low Cost Security Alarm Using Optoelectronic Device" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), Volume 10, Issue 4, Ver. I (Jul-Aug 2015), PP 19-23.