

Design Construction and Implementation of a Motion Detection System

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Abstract

This work presents the design, construction and testing of a motion detection system. The principle of operation of this burglar alarm is simple. When an object moves towards the direction of the sensor the alarm is triggered and the siren begins to operate. The sensor can operate in a dark environment as it depends on the temperature of an object, the system also supports lighting of your environment as you can on and off your bulbs through the system. These actions alert the owner of the house and security staff to the presence of an intruder. This project was developed to make a motion detector using the Arduino microcontroller and the PIR sensor. The other items used in this project are the LED and a Piezo buzzer for signaling once motion is detected. The group aimed to show how each component functions and how they work together to perform the task. They also constructed a circuit from which the components were connected. From the results, it is evident that motion, a physical property, can be used to effect changes in a digital device and using the LED and Piezo buzzer, the motion can be announced thereby allowing it to be used as an intruder alarm.

1. Introduction

The burglar alarm is an integrated system designed to detect unauthorized entry or intrusion into a building or space.[1] Such systems also are variously called security alarms, security systems, alarm systems,

intrusion detection systems, perimeter detection systems among other similar terms.

Burglar alarms are used in residential, commercial, industrial, and military properties for protection against burglary (theft) or property damage, as well as personal protection against intruders.[2][3] Some alarm systems protect only against burglary, while combination systems provide both fire and intrusion protection. Intrusion alarm systems may also be combined with closed-circuit television surveillance systems to automatically record the activities of intruders, and may be interface to access control systems for electrically locked doors. [4]. Systems range from, self-contained, noisemakers, to complicated, multi-area systems with computer monitoring and control.

Methodology

The main objective of this project was to design, construct, and implement a motion detection system that is capable of detecting motion and triggering an alarm upon such detection. In this methods chapter, I will discuss how I detailed the process of implementing this mechanism. To start off my research, I confirm the need of potential users for such a system,

construct, and
implement a motion detection system.

The proposed system design is in two parts:

- i. Hardware Design: This is made up of the design of the physical components required to carry out the proposed project.
- ii. Software Design: This is made of the programs that will control the microcontroller at the center of the system.

Hardware Design

The hardware section, which is the physical part of this system is made up of the following

circuit units:

- I. Regulated Power Supply
- II. Microcontroller Unit
- III. Switching Circuit
- IV. PIR sensor unit
- V. PCB unit
- VI. Display Unit
- VII. Remote control
- VIII. LCD panel
- buzzer

AT Mega 328P Description

ATmega328P is a very advance and feature rich microcontroller. It is one of a famous microcontroller because of its use in ArduinoUNOboard

Figure 1: ATmega 328 with Arduino Uno Mapping

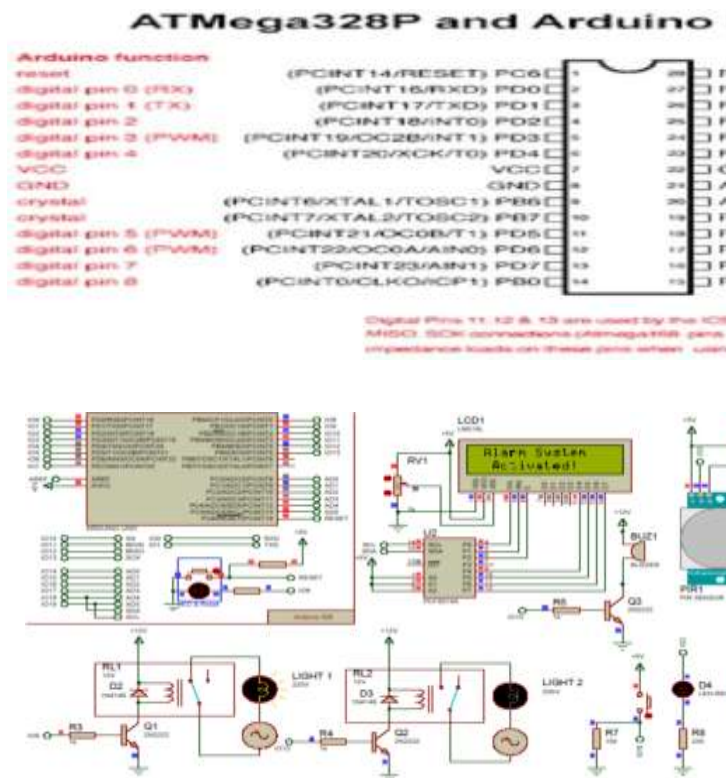


Figure 2: circuit diagram of the system

Liquid Crystal Display (Lcd)

The LCD is a 16x2 LCD based on HD44780 controller is used for displaying the required parameter. The control lines EN, R/W and RS of the LCD module are

connected to pins A1, A2 and A3 of Port A of the microcontroller, reectively



Figure 3: A Liquid Crystal Display Modul

Power Supply

A power supply is generally an electronic circuit that supplies a voltage from alternating current (AC) to direct current (DC). It comprises, in general, the following elements: transformer, rectifier, filter, and regulator circuits. Power supply units are applied in

computers, amateur radio transmitters and receivers, in general, all those electronic devices that have a DC voltage input. An uninterruptible power supply is essential. for computers which holds volatile data from time to time.

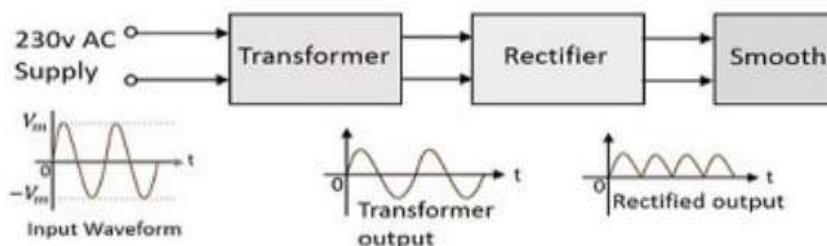
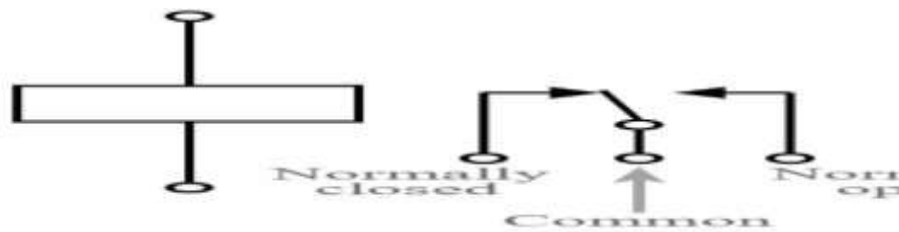


Figure 4: Power Supply Block Diagram.**Relays**

A **relay** is a switch that works using electricity instead of manual operation. It has input terminals that receive one or more control signals and output terminals that carry out the switching action.

Depending on how it's built, a relay can have different kinds of contacts some that connect (make), some that disconnect (break), or a mix of both. There are several types of relays, such as



electrothermal, electromechanical, solid- state, and hybrid relays.

Software Design

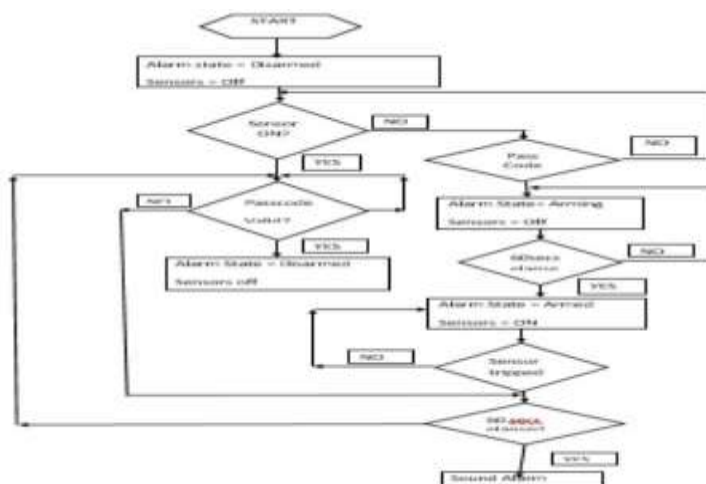
The software running in the system are set codes developed in the Arduino Integrated Development Environment embedded to the micro-controller to control the components and dev We have the alarm control panel: this consists mainly of a small keypad, plus an additional 'buzzer' to indicate that the alarm has sounded. Alarm system is designed in such a way that the user having set the alarm by entering a four-pass code via the keypad

Overall, the system is built to operate like this:

- i. The system starts in 'Disarmed' state when first powered up.
- ii. In Disarmed state, the sensors are ignored. The alarm does not sound.



Figure 5: the hardware part of the system



Flowchart

Figure 6 : simplified program flowchart for the software architecture.

Discussion

To achieve reliable results and optimum performance from any electronic construction project, specific tests (static and dynamic) are carried out to determine if the device is operating under the required

Conclusion

From the circuit schematic, the write up and the tests carried out, it can be concluded that the alarm system is functional and can be

installed where ever it is required be it a commercial or residential asset to act as the first line of defense before the arrival of the police in the event that a burglary incident occurs.

Reference

- [1] S. Member, A. Farouk, S. Member, I. Z. Jin, and S. Member, "UAV- Assisted IoT Applications , Cybersecurity Threats , Directions," *IEEE Trans. Intell. Veh.*, vol. PP, pp. 1–21, 2023, doi: 10.1109/TIV.2023.3309548.

[2]K. A. Nagaty, IoT Commercial and Industrial Applications and AI-Powered IoT IoT Commercial and standard conditions. Also the precautions taken and safety considerations made in achieving both the hardware and software part of our work are considered. Detection range for the motion sensor detector system varies with battery strength and the reflecting object surface. Its range is about 1.5 meters. The system was demonstrated thus: the receiver output was connected to a light emitting diode (LED). When an object enters the zone, the LED starts blinking. Industrial Applications and AI-Powered IoT, no. January. 2023. doi: Faisel, Z. G., Hussein, M. S., & Abood, A. M. (2019). Design and realization of motion detector system for house security.17(6),3211–3217. <https://doi.org/10.12928/TELKOMNI> KA.v1 7i6.13142

10.1007/978-3-031-16344-9.

[3] G. K. Walia, M. Kumar, and S. S. Gill, “AI-Empowered Fog/Edge Resource Management for IoT Applications: A Comprehensive Review, Research Challenges and Future Perspectives,” *IEEE Commun. Surv. Tutorials*, vol. PP, p. 1, 2023, doi: 10.1109/COMST.2023.3338015.

[4].Adriansyah, A. (2014). Design of Small Smart Home System Based on Arduino.123– 127.
Badamasi, Y. A. (2014). The Working Principle Of An Arduino .
[5].Bajpai, M., & Agrawal, A. P. (2013). Integration of 2 D Secure Barcode in Identity Cards : A New Approach. 2(4), 1225–12