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IMPLEMENTATION OF A SECURITY SYSTEM WITH LASER SENSORS AND ARDUINO NANO AS MAIN CONTROL

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ABSTRACT

Implementation of a Security System with Laser Sensors and Arduino Nano as Main Control is an innovation that combines laser sensor technology with Arduino Nano control intelligence to increase the security level of a certain area. This system is designed to detect unwanted intrusion or penetration using strategically installed laser sensors. Laser sensors function as perimeter monitors, measuring and monitoring changes in light caused by the movement of surrounding objects. The information obtained from the laser sensor is then transmitted to the Arduino Nano as the main control. The Arduino Nano acts as the brain of the system, analyzing data received from laser sensors and making decisions based on pre-programmed security algorithms. In an intrusion detection situation, the Arduino Nano will activate a user-defined security response, such as activating an alarm, sending a notification to the user's device, or connecting to a broader security system. This system provides a security solution that is smart, responsive, and can be integrated with other systems. The implementation of this security system with laser sensors and Arduino Nano can be implemented in various environments, including homes, offices,or industrial areas that require additional layers of security. The advantage of this system lies in its ability to detect movement with high accuracy and respond quickly, providing effective protection against potential security threats.

Keywords: Security System, Laser Sensors, Arduino Nano, Intrusion Detection, Environmental Safety.

INTRODUCTION

In the face of the complex dynamics of the modern environment, intelligent and innovative security solutions are becoming increasingly urgent. Implementation of a security system using Arduino Nano with laser technology is considered a progressive step to provide a solution that is efficient, effective,and accessible to various groups[1]. The smart home concept, as described by by[2] , refers to the integration of electronic devices in a network so that all home devices can be monitored and controlled centrally

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through one central device or microcontroller [3] Microcontrollers, as explained by[4] act as controllers that regulate work processes in an electronic circuit. Arduino, one of the commonly used microcontrollers[5] stands out for its own boatloader, making it easier for card manufacturers to control the system directly. In controlling electronic devices, sensors are used to detect parameters such as distance, temperature and light. Because Arduino is able to support various sensors for smart homes, such as light, sound, temperature, pressure and humidity, as well as controlling surrounding technological devices, such as lights, motors and batteries[6]

A laser is an optical source that emits photons in the form of a coherent beam. Laser light is monochromatic, with only one color emitted in the form of photons that move in all directions, depending on the electromagnetic waves it produces[7] The laser doping process involves replacing certain ions in the photonic material by other ions, creating a new energy band gap. Each decrease in this band gap produces photons with a certain color spectrum, according to the wavelength and energy of the photon produced.[8] Laser characteristics include monochromatic (specific wavelength), coherent (at the same frequency), and light spread. concentrated, coordinated, and heading in one direction[9] By considering the laser concept and Smart Home design, a "SECURITY SYSTEM USING ARDUINO NANO AND LASER" was created. The aim of this design is to develop a microcontroller in the context of a home to increase the efficiency, comfort and safety of its occupants. Apart from that, this system allows automatic control of almost all home appliances without human intervention.[10]

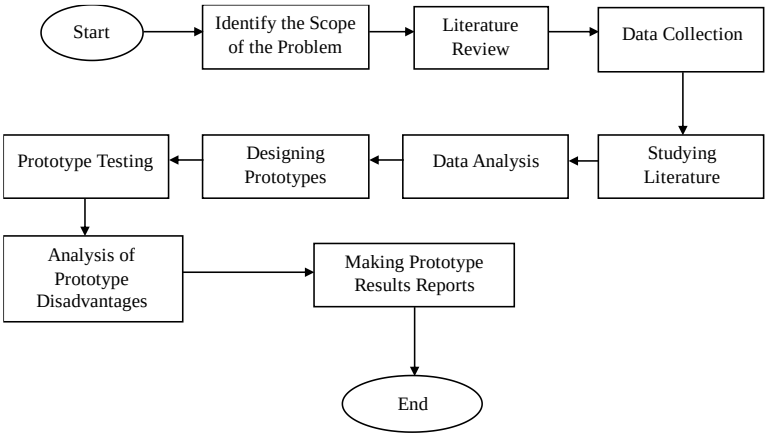
Time and energy efficiency in creating a device can be achieved with a microcontroller. Microcontrollers are the result of reducing electronic systems which initially required many supporting components[11] In the IoT based smart security and home automation system, a pir sensor is installed at the building entrance, so that if there is human movement, the sensor will trigger to provide input to the microcontroller, the owner will receive a notification in the form of a voice call, so the owner can warn the intruder by turning on the light. and alarm as a warning via keypad buttons that have been previously programmed[12]

LDR (Light Dependent Resistor) light sensor is the resistance when the amount of light received changes. The amount of resistance (light dependent resistance) on the LDR light sensor depends on the amount of light received by the LDR itself. LDR is often referred to as a device or sensor in the form of a photosensitive resistor.[13]

METHODS

Research stage

In developing and implementing a light sensor-based security system for security so that it makes implementation easier and can run systematically and refers to the desired goals, steps are made in the research stages which will be carried out as follows:



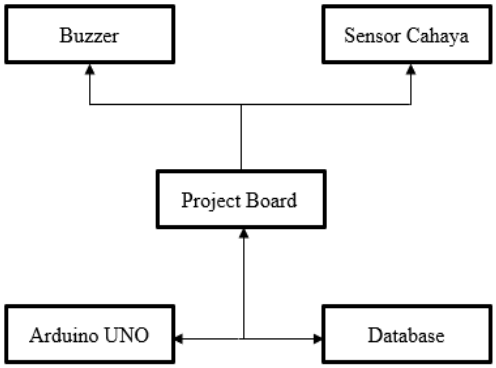
Angka1Diagram alur metode prototipe

In this research, the literature study method was used which was applied in the planning and design stages of the LDR Light sensor which was integrated with software to manage the security system based on LDR Light sensor data. This research methodology includes the following stages:

1. Identification of system components aims to identify the key
2. components needed in system development including the selection of security sensors
3. Prototype design aims at how all components will interact in the system
4. Software development focuses on developing software that will control system operations that will enable data processing from the LDR light sensor in accordance with ambient security requirements.

In this methodology chapter, our research has involved a series of critical steps to develop a relevant and efficient Light sensor-based security system. In-depth literature study provides a solid foundation of knowledge, enabling a deep understanding of existing LDR Light sensor technologies. Next, we identify the key components required, including selecting the right soil moisture sensor, appropriate microcontroller, efficient water pump, and other elements. In the prototype design stage, we consider how all components will interact synergistically in the system. The software development we have completed allows controlling system operations with sensor data processing capabilities.

Block Diagram

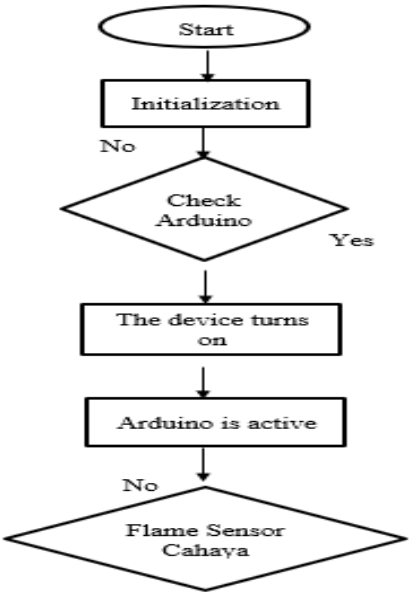


Angka2Diagram Blok Sensor Api

Explanation of Circuit Drawing:

In this research, the author created a series of light sensors. The light sensor is a tool that detects movement by utilizing the presence of a laser that appears. The laser size detected is with a wavelength of 760 nm to 1100 nm. The Arduino Nano microcontroller as the main component of the Light Sensor is assembled using other components. The detector used to detect fire is infrared.

FLOWCHART



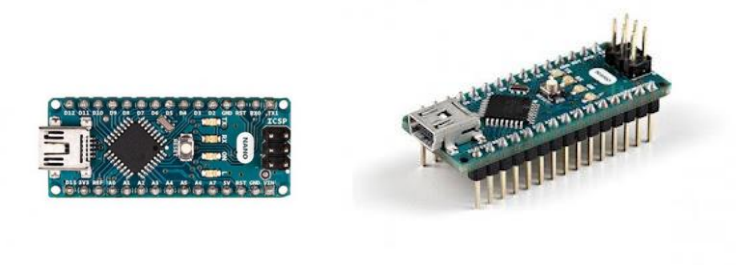
Gambar flowchart

Flowchart explanation:

The image above explains how the light sensor circuit works. When an object is directed parallel at a certain distance in front of the light sensor, if the laser light is directed at the sensor which is a light sensor connected to the buzzer. When an object passes through the laser light detected on the light sensor, the buzzer will sound indicating that there is an object that passes through the laser beam.

Discussion

Arduino nano



Picture 1 arduino nano

Arduino nano is a small, complete, microcontroller board and one of the boards that uses the atmega328p IC (arduino nano v3). It has more or less the same function as

the Arduino Uno, but in different packaging. This Arduino nano works with a USB mini-B cable and not a standard one.

Tables and figures are presented in the middle, as shown in Table 1 and Figure 1. Then, the tables and figures are quoted/referenced in the text. Avoid the words in the image above, in the image below, just state the name of the image and table referred to.

Laser

picture 2 laser

In a security system using a laser with Arduino Nano, the laser acts as a light emitter which is reflected to the light sensor. The use of lasers in this context is to form a "vertical line" which, when interrupted by an object, will cause a change in light intensity that can be detected by a light sensor. . A laser is a device that emits electromagnetic waves through a process called spontaneous emission. The term laser is an abbreviation of light amplification by stimulated emission of radiation[14]

Laser Pin Identification:

- Lasers usually have two cables, namely positive (usually red) and negative or ground (usually black).

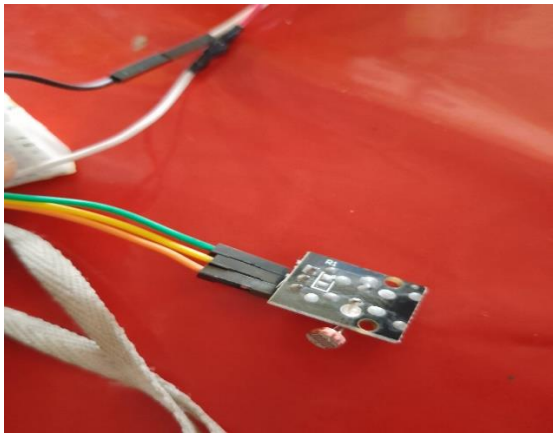
Connect Laser Positive Cable to Arduino Output Pin:

- Determine the output pin on the Arduino Nano that will be used to control the laser.
- Connect the laser's positive cable to the output pin you specified.

Connect the Laser Negative Cable to Ground (GND) of Arduino:

- Connect the negative or laser ground cable to the GND pin on the Arduino Nano.

LDR light sensor



Picture 3 LDR sensor

In a security system using a laser with Arduino Nano, a light sensor (Light-Dependent Resistor or LDR) functions as a detector component that is responsive to changes in light intensity. This sensor plays an iA laser is a device that emits electromagnetic waves through a process called spontaneous emission. The term laser is an abbreviation of light amplification by stimulated emission of radiationmportant role in detecting whether the laser line emitted by the laser has been interrupted by an object or not. [15]

- Select Light Sensor: Use a photodiode or phototransistor as the light sensor. This sensor will detect changes in light intensity that occur when the laser is interrupted by an object.

Light Sensor Pin Identification:

- Light sensors generally have two pins, namely the output pin and the ground pin (GND).
- Connect the light sensor output pin to the analog input pin on the Arduino Nano (for example, pin A0).

Connect Sensor Ground Pin:

- Connect the ground pin (GND) of the light sensor to the ground pin (GND) on the Arduino Nano.
- Use Resistors (If Necessary):
- Some light sensors require a resistor to stabilize the signal or adjust the sensitivity level.
- If necessary, connect a resistor between the light sensor output pin and the ground pin

Buzzers

Gambar 4 buzzer

In a security system using a laser with an Arduino Nano, the buzzer is used as an audio device that provides a signal or indication that the laser monitoring the area has been interrupted by an object. The use of a buzzer in this context is to provide a sound warning or alarm when the light sensor detects a change in light intensity which indicates an interference or object is between the laser and the sensor.

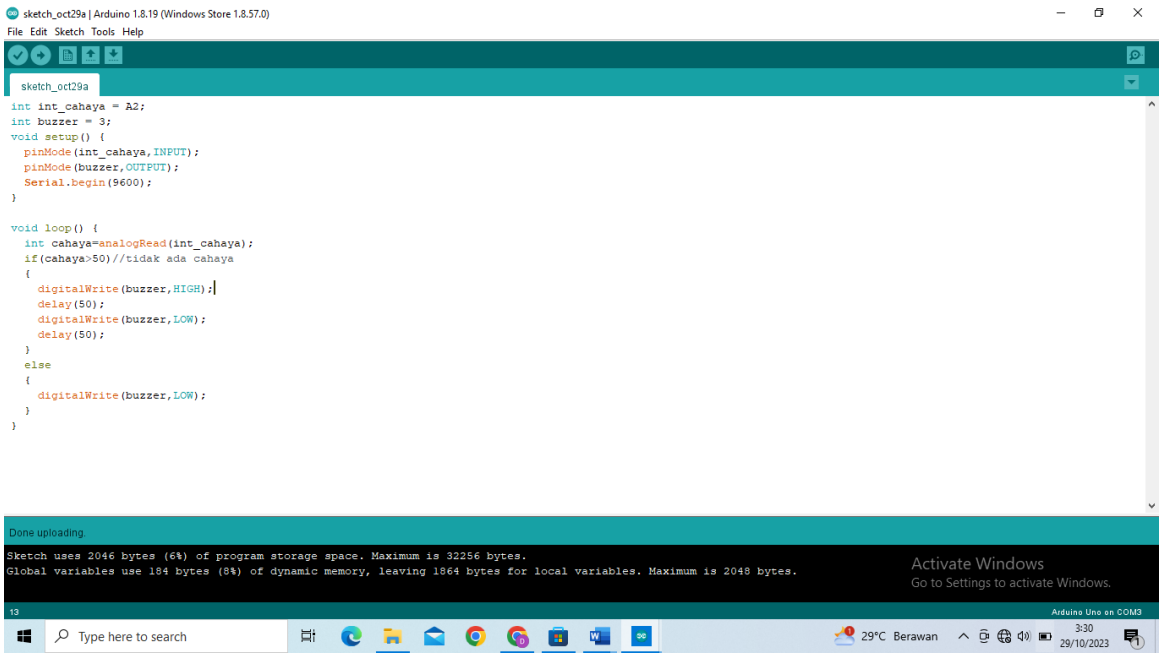
Identify Pins on Buzzer:

- Buzzers usually have two pins, namely positive (+) and negative (-).
- If your buzzer has three pins, one can be used for additional control (for example, to set the sound frequency). However, for most simple projects, you only need two pins: positive and negative.
- Connect the positive pin of the buzzer to the output pin that you have specified on the Arduino (for example, the digital pin). Connect the negative pin of the buzzer to ground (GND) on the Arduino.

Connect Buzzer to Arduino:

- Connect the positive pin of the buzzer to the output pin you have configured on the Arduino (for example, the digital pin). Connect the negative buzzer pin to ground (GND) on the Arduino.

Coding results



Gambar5 coding

sensor in: Analog input pin that reads values from the light sensor. In a security system using a laser with an Arduino Nano, a sensorpin or sensor pin is a variable that determines the pin number on the Arduino that is connected to a light sensor, such as a Light-Dependent Resistor (LDR). The main task of the sensor pin is to provide information to the Arduino about where the physical light sensor it is connected to is located so that the Arduino can read and process the signal it receives from the sensor.

buzzerPin: The output pin that controls the buzzer as an indicator. In a security system using a laser with an Arduino Nano, the buzzer pin is a variable that determines the pin number on the Arduino that is connected to the buzzer. The main function of the buzzer pin is to provide information to the Arduino regarding where the physical buzzer is connected so that the Arduino can control it according to the program logic that has been written.

This code works by turning on the laser, reading the light sensor value after the laser passes the object, and if the sensor value is less than 500, it will activate the buzzer to provide an indication that the object is detected.

Light sensor test results

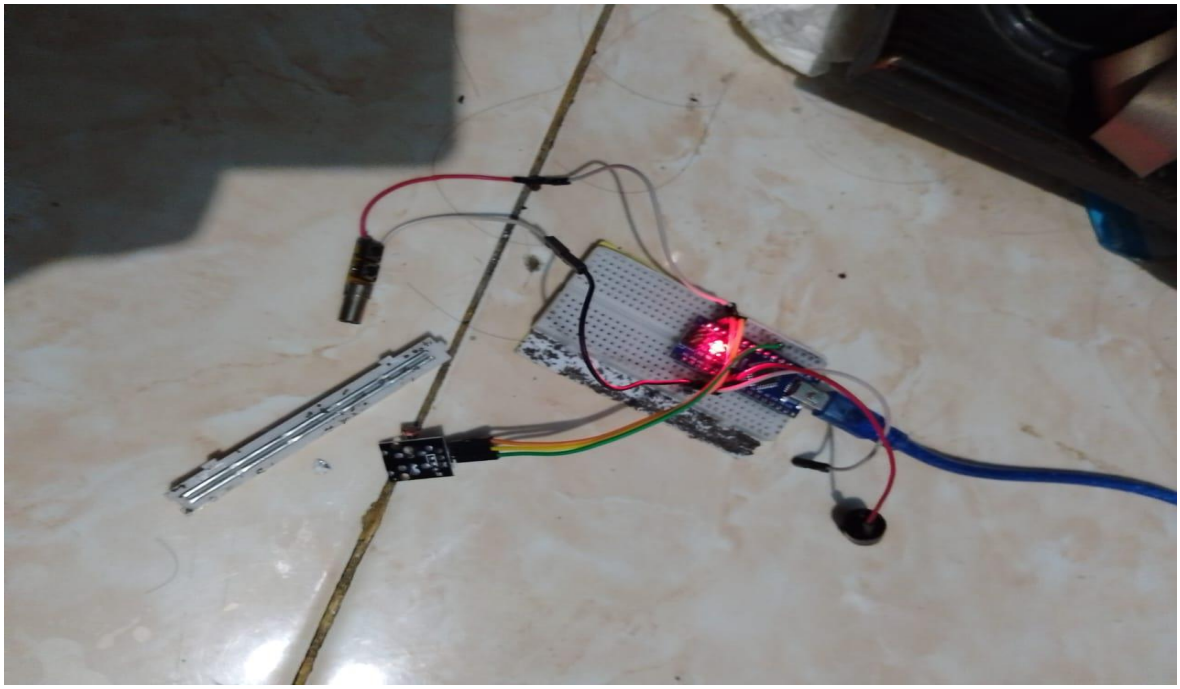


Figure 6 Testing the Arduino UNO nano and sensors

Figure 6 shows the results of testing the fire sensor connected to the Arduino nano. When voltage is applied or when a program is executed, the Arduino indicator light is red. Similar to Arduino, the light sensor can function when a buzzer sounds when the laser light is hit by an object.

Conclusion

Arduino Nano is a small, complete, microcontroller board and one of the boards that uses the ATmega328P IC (Arduino Nano V3). It has more or less the same function as the Arduino UNO but in different packaging. This Arduino Nano works with a USB Mini-B cable and not a standard one.

The term Laser is an acronym. Laser is an abbreviation for Light Amplification by Stimulated Emission of Radiation. A laser is a device that emits a coherent beam of light through an optical amplification process. There are many types of lasers including gas lasers, fiber lasers, solid-state lasers, dye lasers, diode lasers, and excimer lasers.

Suggestion:

Additional Security Sensors

- Add additional security sensors such as motion sensors or temperature sensors to detect unusual changes around the observed area
- Add image processing capabilities with the camera to identify objects or visually monitor the observed area.

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