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RESEARCH ARTICLE

CREATION OF AN INTELLIGENT SYSTEM FOR OPTIMIZING ELECTRICAL ENERGY CONSUMPTION FOR LIGHTING IN A BUILDING FOR DOMESTIC OR ADMINISTRATIVE USE

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Abstract

This article consists of the implementation of an intelligent system for the management and optimization of electrical energy consumption in a building for domestic or administrative use. Waste of energy is usually due to laziness, forgetfulness and ignorance. The systems that we have proposed in this part are solutions for optimizing the consumption of electrical energy for lighting. In the creation of these systems we used two kinds of microcontroller cards such as the Arduino card and the ESP8266 Wifi card to control our different sensors and system components. The solutions that we will put in place must manage the factors that lead to the waste of electrical energy in order to be able to manage and optimize the consumption of electrical energy. Our system is called intelligent because the entire lighting system can be done remotely by sending SMS.

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Introduction:-

In recent years, humanity is facing several problems, excessive consumption of energy resources, air pollution, global warming and the collapse of the global economic system [1]. Considering the importance of consumption in the building sector, we see that it is necessary to promote the reduction and control of electricity consumption in the residential and also tertiary sectors [2]. Since the 2000s, with the development of wireless technologies such as wifi or bluetooth, the miniaturization of electronic components, the advent of mobile devices, the invasion of touch screens and connected televisions, engineers can now offer the public products or connected objects or home automation systems that are much more powerful and easy to use [3], intelligent systems can be considered today as a response to the challenges of limiting energy consumption and hunting down waste. It is possible to reduce the consumption of certain secondary devices during peak hours in order to save money and improve the stability of the urban electricity network, domestic cookers.

Electric energy consumption in Burkina Faso is increasing by more than 13% per year. The electrical energy distribution network is already struggling to meet the needs of the customer base. This sometimes leads to voltage drops, load shedding and power outages. Furthermore, 14.5% of the energy produced in Burkina Faso is devoted to lighting [3].

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The objective of this article is to propose an intelligent light source management system which will make it possible to make the building intelligent by automating light sources; to prevent the unnecessary use of light sources and to trigger the relays in the absence of movement and ambient light. With the aim of solving the problems related to the management and optimization of electrical energy consumption resulting from improper use of electrical energy, intelligent systems can be an essential solution for managing and optimizing electricity consumption. electric energy. It is in this sense that we carried out an experimental study with a view to creating a computer program using the Arduino software.

Materials and Methods:-

Materials used:-

Programming instead of traditional wiring has opened a new dimension to the management of electrical installations in homes and buildings, making it possible to add, adjust, modify, change, or repair any function by just mouse clicks. Programming with Arduino software required the following tools :

1. Use of Fritzing software for the design of the real view assembly;
2. Use of Lucidchart software to create the system operating flowchart;
3. Using an Arduino kit,
4. A relay module,
5. A GSM/GPRS module,
6. An ESP8266 card,
7. An HC SR 501 PIR module,
8. One (1) lamp,
9. A switch,
10. A 220V power source,

Methods used:-

One branch lamp with one (1) relay module

Three lamps connected in bypass with one (1) relay module

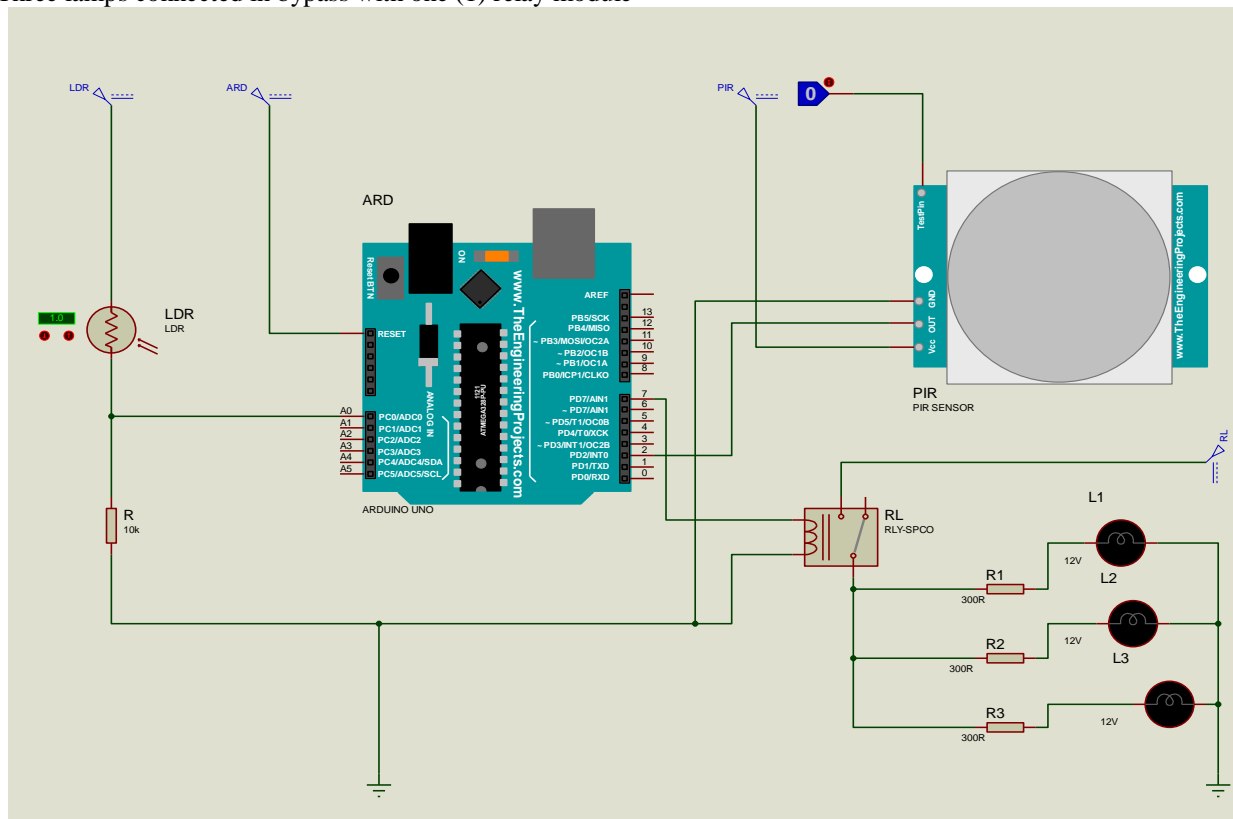


Figure1:- Connection mode.

Painting1:- Details on the connection of the PIR with the ESP8266 card.

the ESP8266 card	GPIO5	Vcc	GND
PIR	out	Wine	GND

Painting2:- Details on connecting the relay with the ESP8266 board.

the ESP8266 card	GPIO0	+Power	GND
RELAY	S Pin	Wine	GND

Painting3:- Details on the making of the GSM/GPRS module.

Microcontroller	ATmega328
Operating voltage	5v
Input Voltage (recommended)	7-12v
Input Voltage (limits)	6-20v
Digital I/O pins	14 (6 of which provide PWM output)
PWM digital I/O clamps	6
Analog Input Pins	6 (A0-A5)
DC current per I/O pin	20mA
DC current for pin 3.3V	50mA
Flash memory	32 KB (ATmega328P); 0.5 KB used by bootloader
SRAM memory	2KB(ATmega328)
EEPROM memory	1 KB (ATmega328P)
Clock speed	16 MHz
LED_BUILTIN	13
Length	68.6mm
Width	53.4mm
Weight	25

Painting4:- Details on button connection with ESP8266 board and relay.

the ESP8266 card	TX	RX	Wine	GND
GSM	RX	TX	Vbat	GND
the ESP8266 card	GPIO2		Vcc	GND
button	Pin button		Wine	GND

Painting5:- Characteristic of the Arduino board.

Arduinoboard	A0	5V	GND
LDR&R	LDR&R	LDR	R

Realization of an automatic lighting triggering system

The twilight switch controls a light circuit depending on the ambient light outside. By combining this light detection system with a presence detector, which operates by thermal signal detection, we obtain an efficient automatic system. This system will be created with the

Arduino which we will program using the Arduino programming language, this programming will take into account the brightness threshold taken as a function of the resistance used and the thermal signal emitted by the body. We will explain the creation of the system, the operating principle and finally present the result obtained.

Principle of operation of the project

The automatic and manual lighting triggering system consists of the use of an automatic ignition system by sending an SMS and by motion detection with the use of a switch which will give the possibility to the user to receive notifications when the motion detection system will send an update which will alert the user about the status of their lamp when there is no detection, and thus, the user will decide to send an instruction by SMS asking him to turn the lamps on or off by controlling the switches.

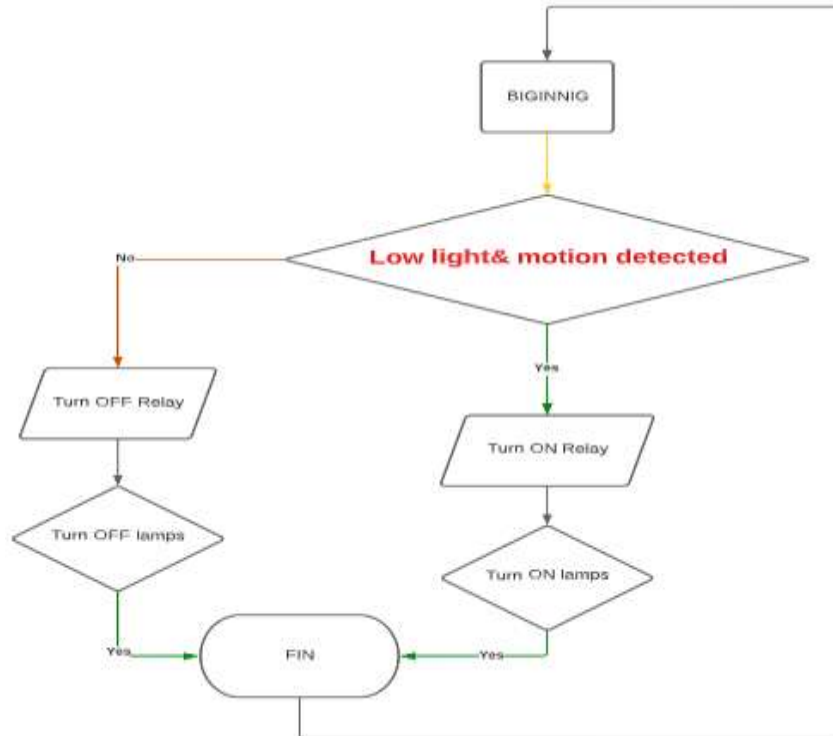


Figure 2:- System flowchart.

Presentation of the connection system

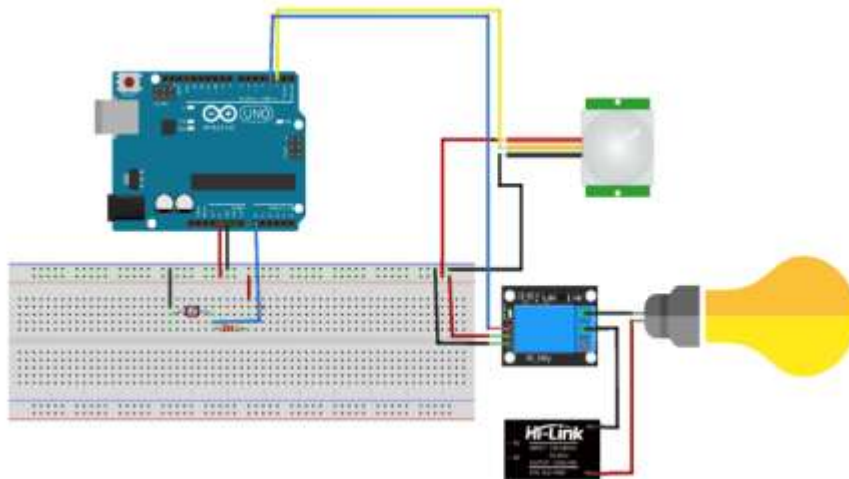


Figure3:- Connection diagram produced by FRITZING.

System Features

The materials used

1. Use of Fritzing software for the design of the real view assembly;
2. Use of Proteus software to design the assembly drawing;
3. Use of Lucidchart software to create the system operating flowchart;
4. Using an Arduino kit,
5. A relay module,
6. An Arduino Uno R3 board,
7. An HC SR 501 PIR module,
8. A light sensor,

- 9. Lamp,
- 10. A 220V power source,
- 11. Voltage divider bridge: here the voltage divider bridge assembly is
- 12. used to provide a smaller voltage at the output of the LDR assembly to

$$V_s = (R \times V_{cc}) / (R + LDR) \quad (2)$$

Painting6:- detail of connecting the pir module to earth.

Arduino	5V	2	GND
PIR module	Vcc	OUT	GND

Creation of an automatic and manual lighting triggering system

The automatic and manual lighting triggering system consists of the use of an automatic ignition system by sending an SMS and by motion detection with the use of a switch which will give the possibility to the user to receive notifications when the motion detection system will send an update which will alert the user about the status of their lamp when there is no detection, and thus, the user will decide to send an instruction by SMS asking him to turn the lamps on or off by controlling the switches. In the remainder of this part of our work, we will explain the creation of the system, its operating principle. The sensors can be coupled with remote monitoring equipment, remote control, building a smart system based on Arduino improves the use of smartphones in smart homes so that they do not affect the occupants of the house. During an intrusion, an alert message can be sent by e-mail or to a mobile phone [6;7].

• **Principle of theoperation**

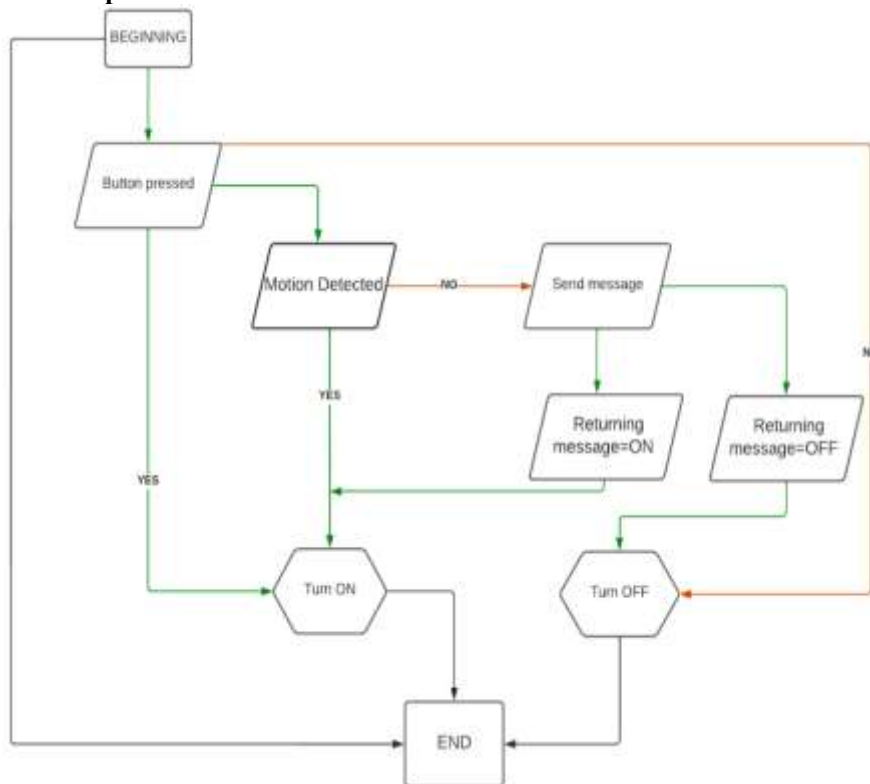


Figure4:- FLOW CHART of automatic and manual control system.

Obtained Results:-

The primary objective of our project which is the optimization of electrical energy consumption, the intelligent system that we have put in place has some advantages.

The program saves energy which can reach 35% to 45%, which results in a reduction in electricity bills [8]. Extending the life of lamps. It ensures the safety of people and property in the building. It also ensures the comfort of the building's occupants. It helps minimize stress linked to peaks in electricity consumption. It ensures and improves the quality of supply, network security, and power supplied, with the reduction of outages, and to improve peak management and avoid major blackouts [9]. Our intelligent system has drawbacks that impact the life of the system components as well as the operation of the system. The slowness of the system in meeting the intended objective and reducing the efficiency of the system was also noted. The systems that we have proposed in this part are solutions for optimizing the consumption of electrical energy for lighting. In the creation of these systems we used two kinds of microcontroller cards such as the Arduino card and the ESP8266 Wifi card to control our different sensors and system components.

Conclusion:-

This article consists of the design of an intelligent system for the management and optimization of electrical energy consumption for lighting in a building for domestic or administrative use. We first carried out the study of the generalities on the management and optimization of the consumption of electrical energy and on the lighting system, we carried out the study of the materials used for the creation of our intelligent systems and finally we proceeded with the realization of the project. The program makes it possible to save energy which can reach 35% to 45% which causes a reduction in electricity bills which seems very important for saving energy in the building.

In this context we propose that the recommendations proposed for the maintenance of the system be taken into account, and also for the optimization of a domestic building, we propose to use the Arduino card instead of the ESP8266 card, because the ESP8266 board works with Wifi but in case there is no Wifi in the building it is better to use Arduino board.

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