OPTICAL SENSOR BASED ENERGY MANAGEMENT SYSTEM

Abstract:

As per the present situation, the energy consumption is getting increased and it is becoming costlier. People after leaving the office, schools, colleges etc. the lights and ac will have left in on condition which leads to a lot of electricity waste. This problem can be solved by developing an energy management system which can conserve energy in the form of electricity.

This paper focuses on designing an energy management system to reduce energy consumption, improve the utilization of the system, increase reliability, predict electrical system performance and optimize energy usage and reduce the cost.

The operation of this energy management system is as followed:

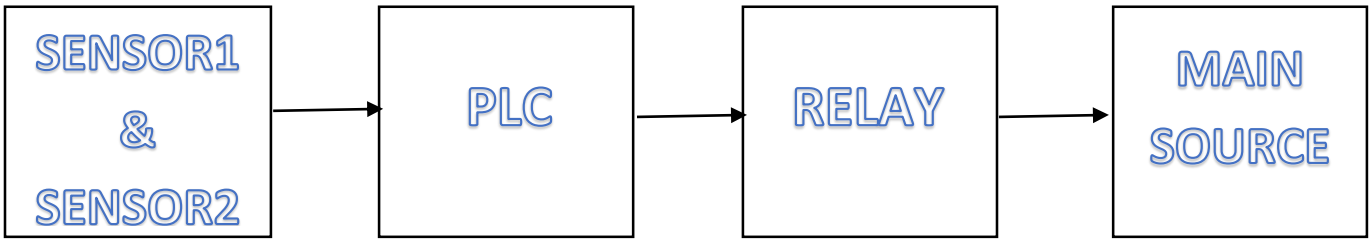
By placing the optical sensors in the entrance of the room as the person enters the room sensor output goes high and it is given to PLC which up counts the value and later it is given to relay. If count value increases the relay is switched on and as a person leaves the room count will decrease relay gets switched off. The relay is connected to the main source. Relay automatically manipulates both lights and air conditioner

The main objective is to design a simple reliable and cost-effective system in which it detects the object through optical sensors and pressure sensors and sensor output goes high. A system was developed based on placing sensors in the entrance if the object is detected the sensor output goes high. The sensor output is connected to PLC. Through PLC it is connected to 24 v relay which controls the automatic switching on/off lights and air conditioner.

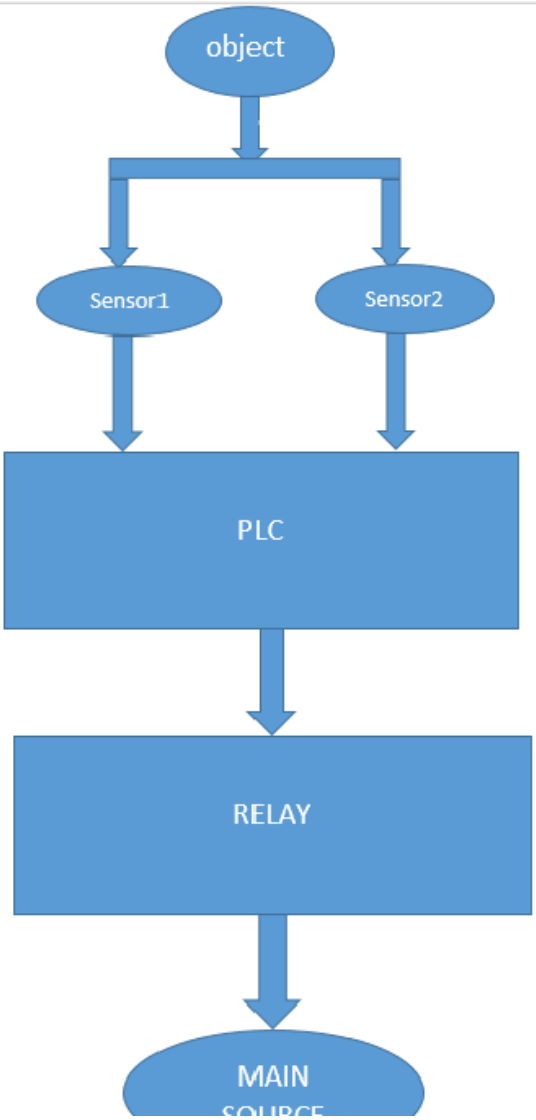
2.KEYWORD

PLC – Programmable Logic Control

3.Block Diagram:



4.Flow Chart:

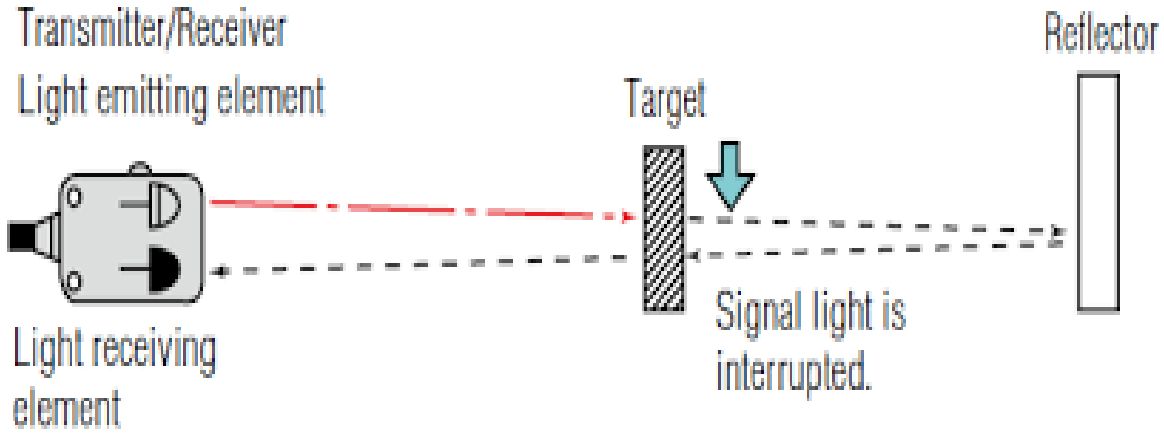


4.1Overview of Optical Sensor:

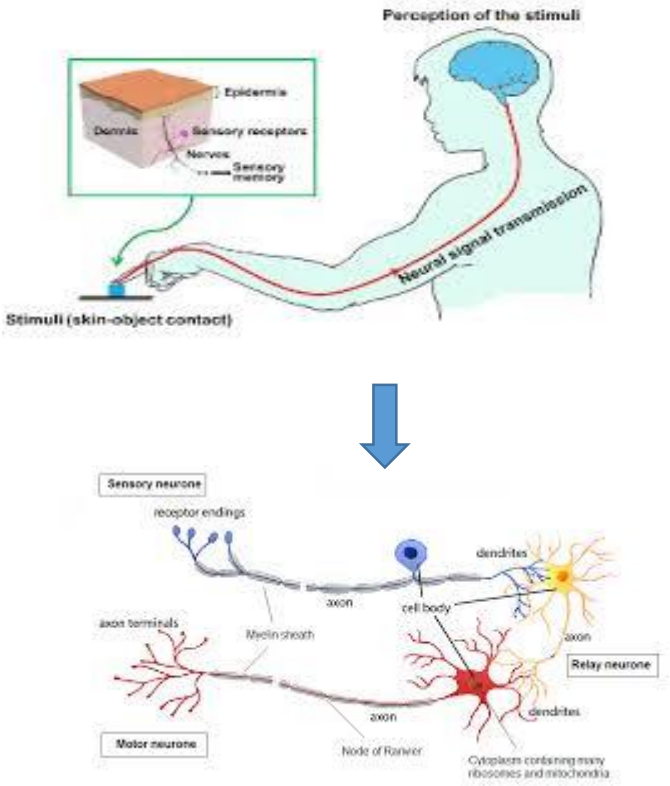
Photoelectric Sensor: A **photoelectric sensor**, or photo eye, is an equipment used to discover the distance, absence, or presence of an object by using a light transmitter, often infrared, and a photoelectric receiver. A through beam arrangement consists of a receiver located within the line-of-sight of the transmitter. In this mode, an object is detected when the light beam is blocked from getting to the receiver from the transmitter.

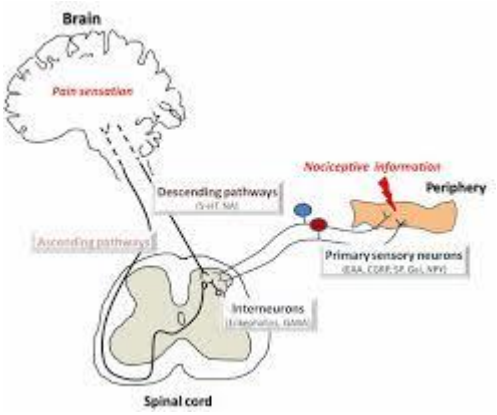
A retroreflective arrangement places the transmitter and receiver at the same location and uses a reflector to bounce the inverted light beam back from the transmitter to the receiver. An object is sensed when the beam is interrupted and fails to reach the receiver.

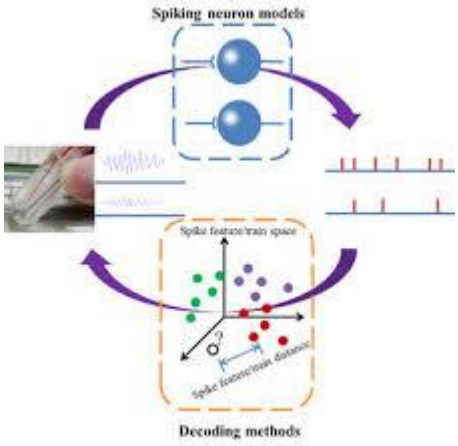
A proximity-sensing (diffused) arrangement is one in which the transmitted radiation must reflect off the object in order to reach the receiver. In this mode, an object is detected when the receiver sees the transmitted source rather than when it fails to see it. As in retro-reflective sensors, diffuse sensor emitters and receivers are located in the same housing. But the target acts as the reflector, so that detection of light is reflected off the disturbance object. The emitter sends out a beam of light (most often a pulsed infrared, visible red, or laser) that diffuses in all directions, filling a detection area. The target then enters the area and deflects part of the beam back to the receiver. Detection occurs and output is turned on or off when sufficient light falls on the receiver.



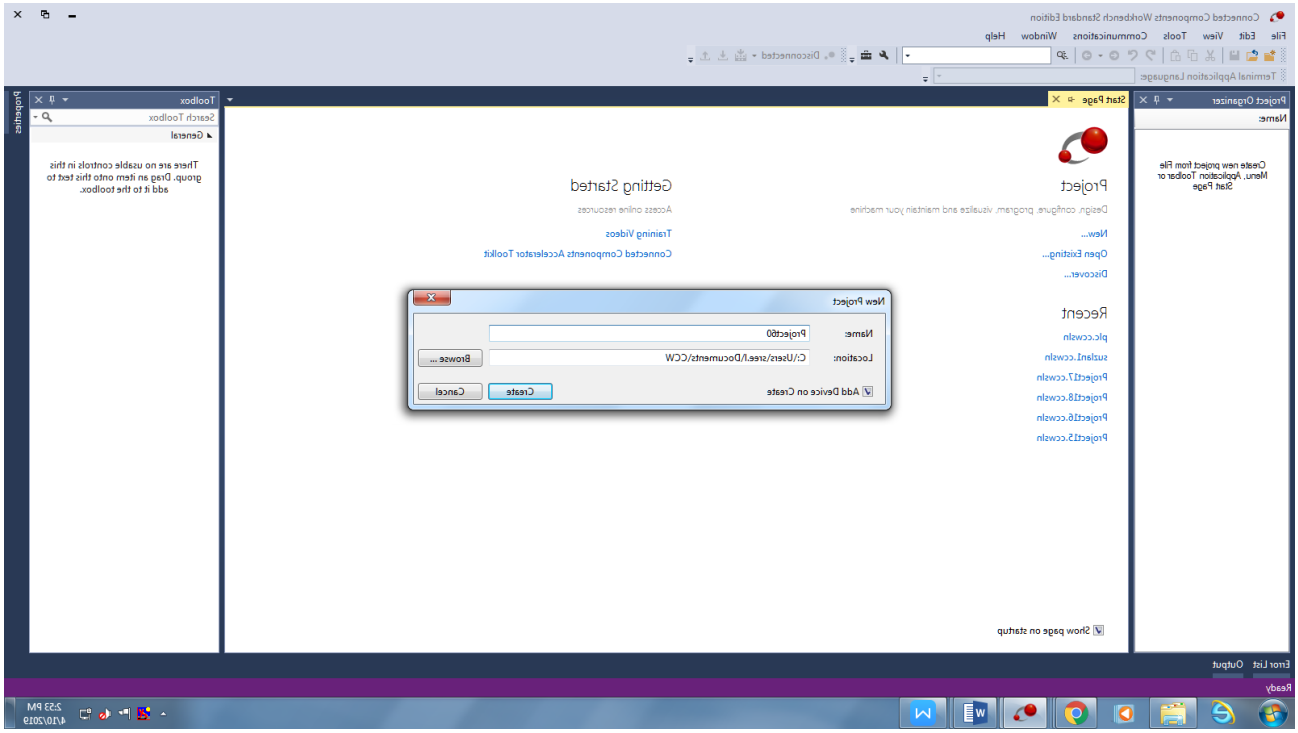
4.2Overview of Pressure Sensors: A pressure sensor is provided which can detect the presence, absence or magnitude of pressure, as well as a pressure profile. The pressure sensor includes a sensor membrane and a sensor device. The sensor membrane is flexible and may be constructed of a conductive material or may include a flexible film attached to a conductive film. The sensor device includes a sensor strip, a voltage source, and an electrical sensor. The sensor strip includes both a conductive strip and a resistive strip. The conductive strip is arranged parallel to the resistive strip. As pressure is applied to the sensor membrane, the sensor membrane distends or deforms towards the sensor strip. As sufficient pressure is applied, the sensor membrane will make both electrical and mechanical contact with both the conductive strip and the resistive strip at a point along the length of the sensor strip. Since the sensor membrane is conductive, the conductive strip and the resistive strip will be in electrical connection with each other. As the point of application of pressure is varied, the point at which the conductive strip and the resistive strip are connected will vary. As a result, the pressure profile exerted on the sensor membrane may be determined. The pressure sensor may be utilized in a variety of environments to sense a wide variety of pressures including either fluid pressure or physical contact pressure.

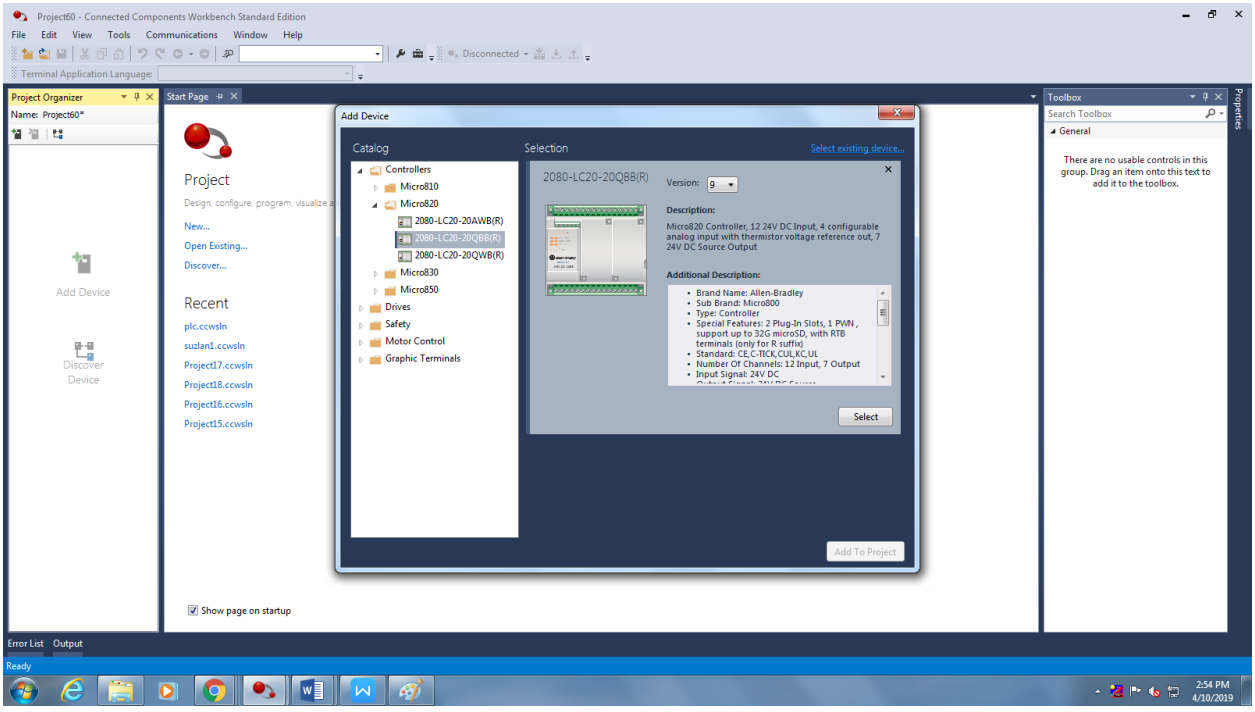






4.3Overview of Programmable Logic Controller (**PLC**): Is a digital computer used for the automation of various electro-mechanical processes in industries. The program is written on a computer and is downloaded to the PLC via cable. These loaded programs are stored in non – volatile memory of the PLC. During the transition of relay control panels to PLC, the hard wired relay logic was exchanged for the program fed by the user. A visual programming language known as the Ladder Logic was created to program the PLC.




Project60 - Connected Components Workbench Standard Edition
File Edit View Tools Communications Window Help
Project Organizer
Start Page
Add Device
Catalog
Selection
Controllers
Micro810
Micro820
2080-LC20-20AWB(R)
2080-LC20-20QBB(R)
2080-LC20-20QWB(R)
Micro830
Micro850
Drives
Safety
Motor Control
Graphic Terminals
2080-LC20-20QBB(R)
Version: 9
Description:
Micro820 Controller, 12 24V DC Input, 4 configurable analog input with thermistor voltage reference out, 7 24V DC Source Output
Additional Description:
Brand Name: Allen-Bradley
Sub Brand: Micro800
Type: Controller
Special Features: 2 Plug-In Slots, 1 PWM, support up to 32G microSD, with RTB terminals (only for R suffix)
Standard: CE,C-TICK,CUL,KC,UL
Number Of Channels: 12 Input, 7 Output
Input Signal: 24V DC
Select
Add To Project
Project
Design, configure, program, visualize
New...
Open Existing...
Discover...
Recent
plc.ccwsln
suzlan1.ccwsln
Project17.ccwsln
Project18.ccwsln
Project16.ccwsln
Project15.ccwsln
Add Device
Discover Device
Show page on startup
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Search Toolbox
General
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Properties
Error List
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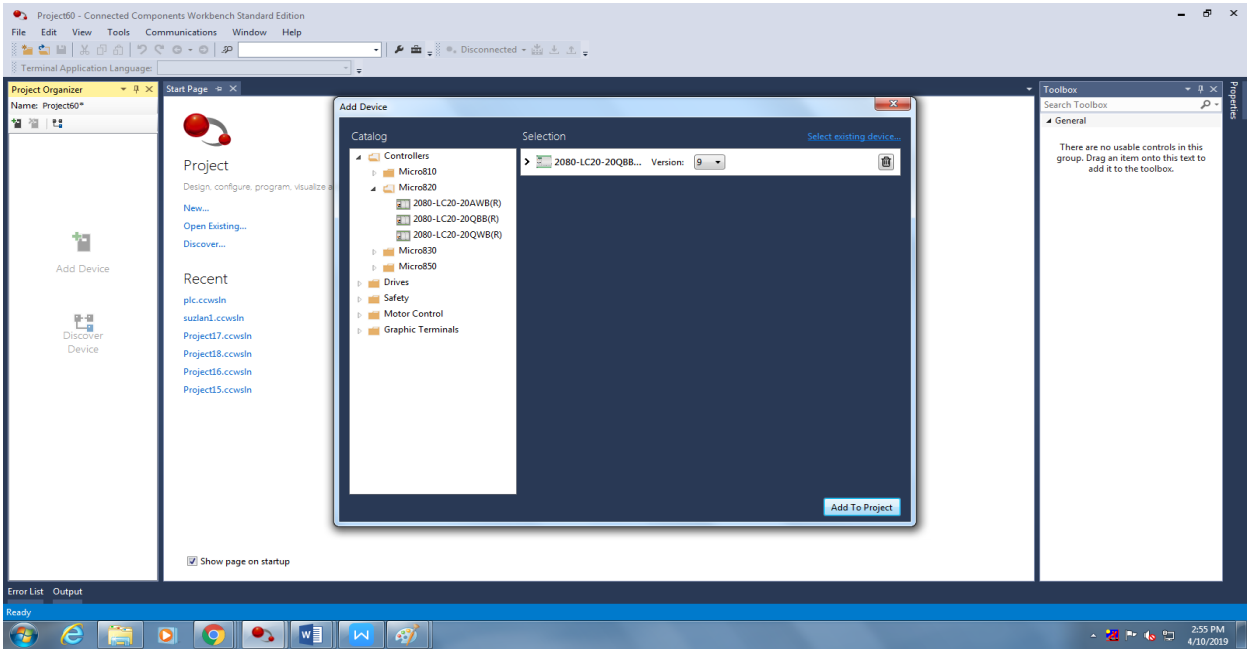
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2080-LC20-20QWB(R)
Micro830
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Graphic Terminals
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plc.ccwsln
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Toolbox
Error List Output
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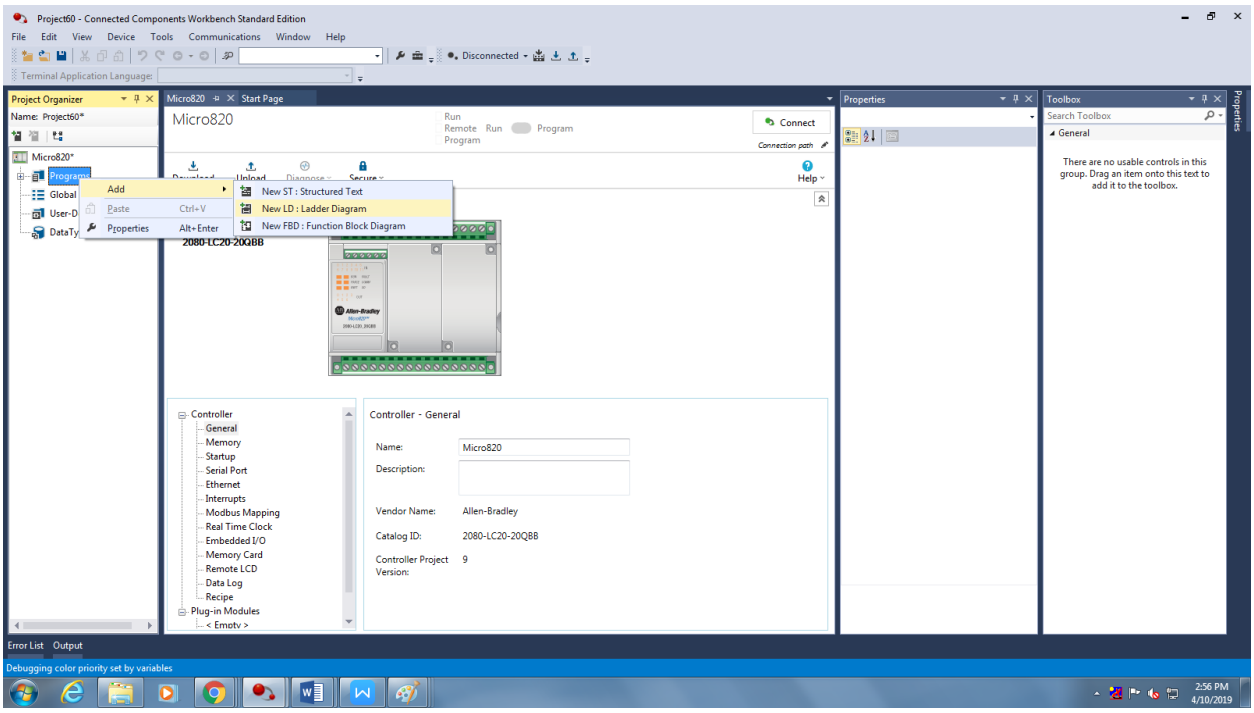
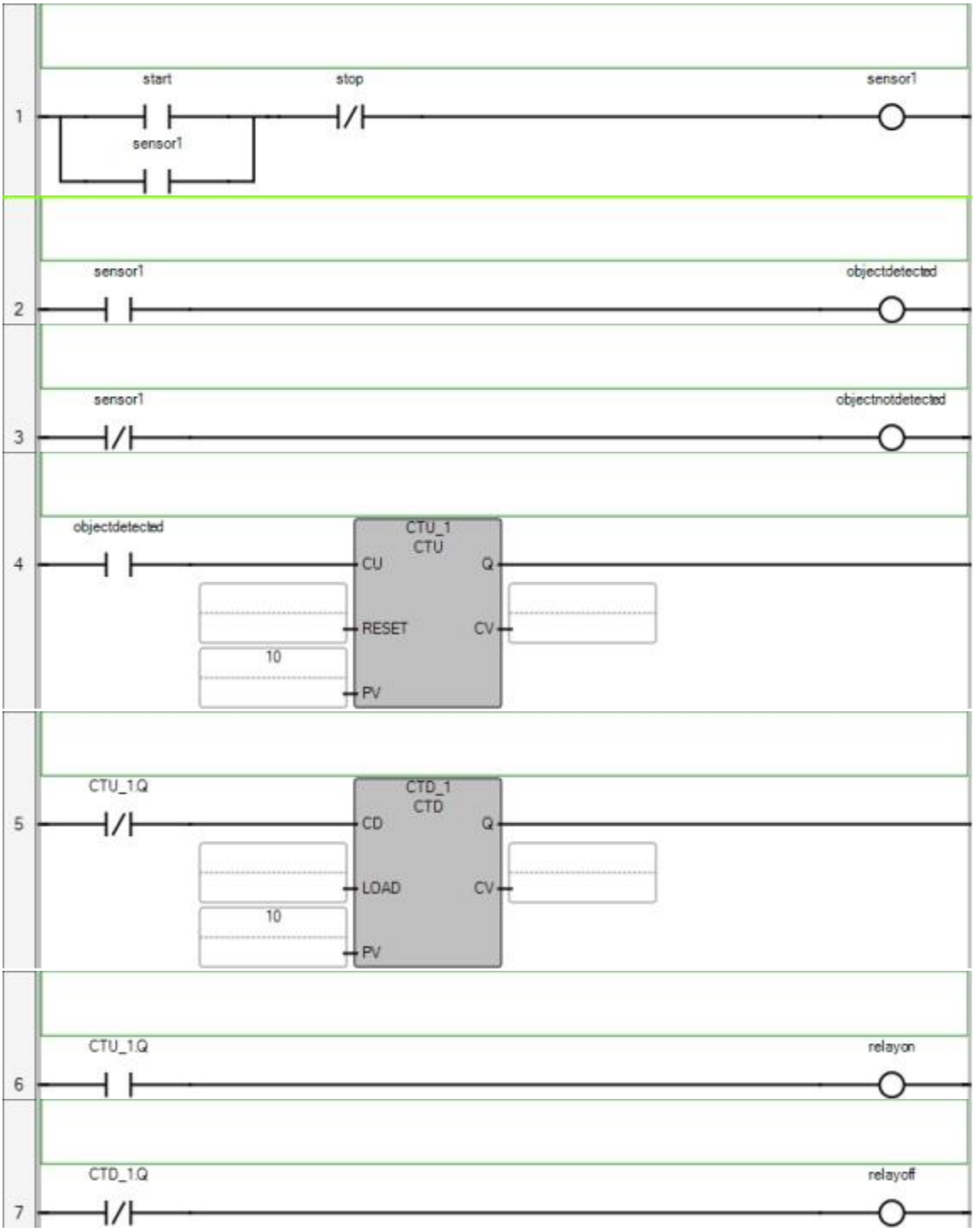

Project60 - Connected Components Workbench Standard Edition
File Edit View Device Tools Communications Window Help
Project Organizer
Micro820
Start Page
Properties
Toolbox
Micro820
Connect
Add
Paste Ctrl+V
Properties Alt+Enter
New ST : Structured Text
New LD : Ladder Diagram
New FBD : Function Block Diagram
2080-LC20-20QBB
Controller
General
Memory
Startup
Serial Port
Ethernet
Interrupts
Modbus Mapping
Real Time Clock
Embedded I/O
Memory Card
Remote LCD
Data Log
Recipe
Plug-in Modules
Controller - General
Name: Micro820
Description:
Vendor Name: Allen-Bradley
Catalog ID: 2080-LC20-20QBB
Controller Project Version: 9
Error List Output
Debugging color priority set by variables

Controller.Micro820.Micro820.Prog1

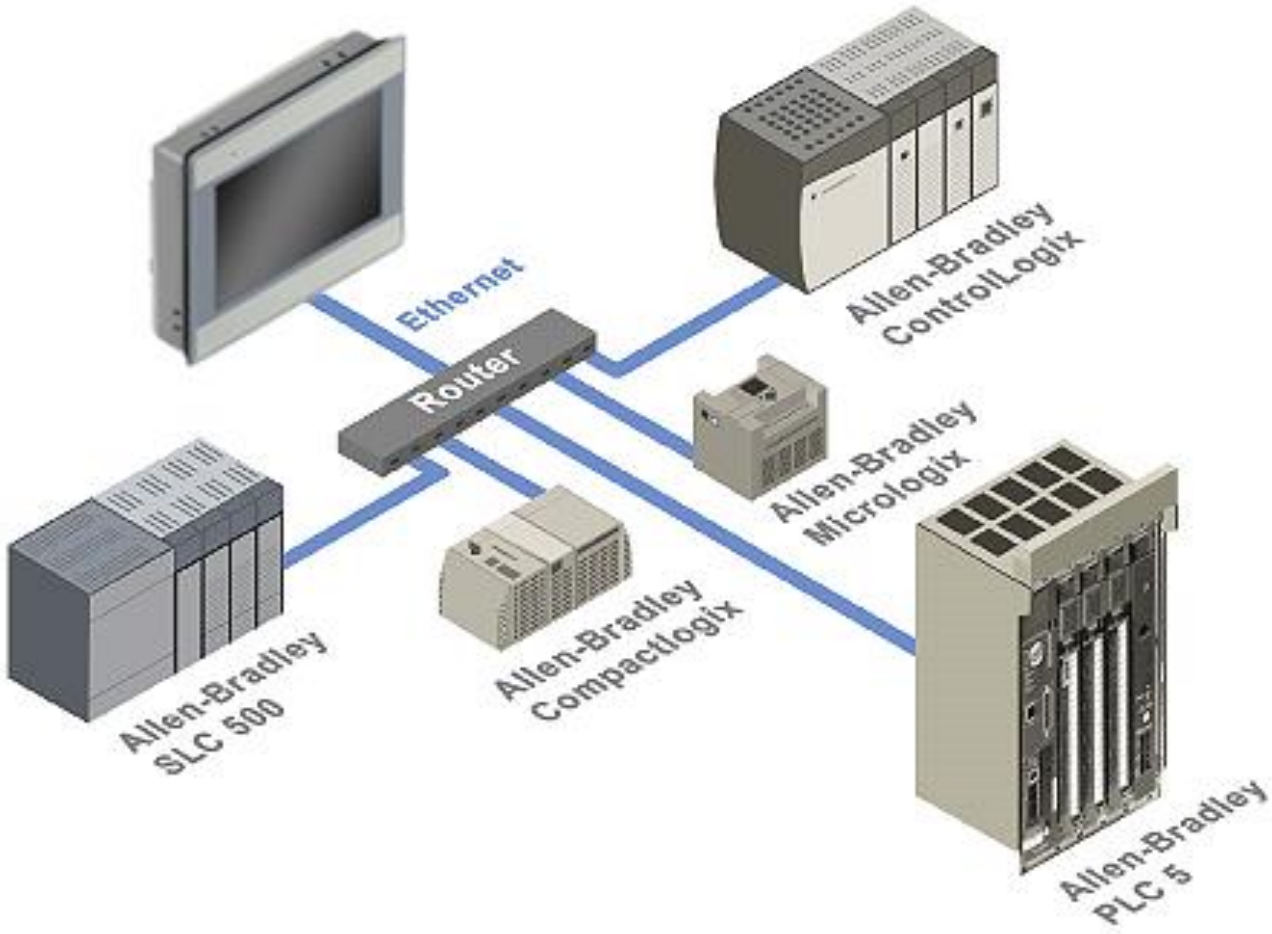


POU Prog1

The POU defines 9 variable(s).

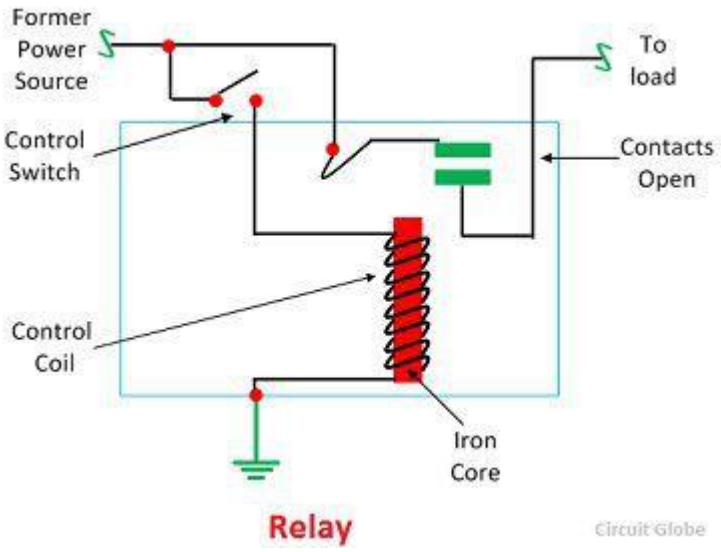
Variable objectdetected

(* *)
Direction: Var
Data type: BOOL
Attribute: Read/Write



4.4Overview of Relay: The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the intolerable or undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area. Thus protects the system from damage.

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field.



This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch.

The inner section of the relay is shown in the figure below. It has an iron core which is wound by a control coil. The power supply is given to the coil through the contacts of the load and the control switch. The current flows through the coil produces the magnetic field around it.

Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence open the contacts.

5.Conclusion: The main objective is to design a simple reliable and cost-effective system in which it detects the object through optical sensors and pressure sensors and sensor output goes high. A system was developed based on placing sensors in the entrance if the object is detected the sensor output goes high. The sensor output is connected to PLC. Through PLC it is connected to 24 v relay which controls the automatic switching on/off lights and air conditioner.

6.Referrences:

1.www.ia.omron.com/support/guide/43/introduction.html

2. https://en.wikipedia.org/wiki/Photoelectric_sensor

3.https://en.wikipedia.org/wiki/Pressure_sensor

4. https://en.wikipedia.org/wiki/Programmable_logic_controller

5.https://circuitglobe.com/relay.html

6.https://en.wikipedia.org/wiki/Energy_management_system