

# The Prototype Electrical Control Devices Based On Smart Relay Arduino

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**ABSTRACT:** *There are many losses caused by the installation and control of the electrical system in a building / home that was not true. This research aims to create a prototype instrument control relay based intelligent arduino (according to application design and design of electrical installations), which can control and secure the electrical devices (KKB, water pump machine, tv, lights and MCB), contained in a building / home, so avoid the danger of a short circuit, a fire, and also it is more efficient in the use of electrical energy.*

*the results showed that the prototype device that made a good job, so it can secure and control all electrical devices contained in a building / home, either from close range or from a distance using a smartphone.*

**Keywords:** *electrical devices, prototype control device, smartphone, short circuit.*

## I. INTRODUCTION

It has been a lot of technology that was created, one of which was made by researchers is the prototype instrument control relay based intelligent arduino to control and secure the electrical devices of a building / house (KKB, water pump machine, TV, electric lights and MCB) which including widely known by the public. one uses the smart relay arduino in this study is able to be used as a safety and control devices, either at close range or from a distance, according the wishes of the controller. There are a lot of accidents and losses caused by the installation and utilization of electricity that is less true. Has already that when the electrical installation in a building or home has been given a voltage of PLN, the installation is no longer included in the private domain, but it has become public domain. carelessness on the installation and use less power can actually be fatal. for example, a building / house fire due to electrical short circuit could potentially propagate the fire to the buildings around it, it is very detrimental crowds. has been a lot of news broadcast on television or newspapers about fires due to electrical, and even lead to death. to prevent that required knowledge of the electrical installation is good and right and should be added with the use of intelligent relay control Arduino whose function is to secure the building / house and its contents. in Indonesia, electrical installation standards already set forth the general rules of electrical installation. This standard contains implementation guidelines and electrical installation and the conditions that must be met.

### A. The equipment in the building/house

electrical devices contained in a building / house are power tools that have got the flow of electricity, which serves for provide comfort and ease in carrying out all the activities in buildings / houses. The attached is the standard voltage in Indonesia set the general rules of electrical installation. Nominal voltage supplies used shall correspond to the nominal voltage of electricity from the battery, generator, transformer or the hand. one implementation is neutral to the standard voltage line or conductivity of the conducting phase to neutral is 220 volts and 380 volts phase to phase with a frequency of 50 Hz. under these conditions conclusion one sense that is referred to ARTL are all tools used in the household working process always requires a power source of standardized, which aims to streamline and streamline the process and the work of domestic work, good timing, cost and energy used<sup>[2]</sup>.

The electrical equipment to be controlled and monitoring in this study consisted of: a miniature circuit breaker and the lights, which were in a house or a multi-storey building.

## **B. Relay**

A relay is an electronic circuit that is simple and composed;

- a. switch,
- b. electromagnetic field (coil wire),
- c. iron shaft

The components of working process are begun when the flow of electric current through the coil, and then create a magnetic field around it change the switch position so as to produce an electric current is greater. A simple component that is with minimal shape could generate larger currents. This simple component in its development by using as a basic component of a variety of electronic devices, light vehicles, electronic networks, television, radio and even in 1930 was used as the basic tools of computer whose existence is now being replaced by microprocessors such as Intel Corp and AMD. All of it because of the use of relay has advantages such as:

1. can control their own current and voltage that is desired
2. maximizes the magnitude of the voltage to reach the maximum limit.
3. can use the switch as well as a coil is more than one, tailored to the needs.



**Figure 1.** Relay

The relay is also widely used to control machines that work sequentially prior to the microprocessor technology available, for example in injection molding machines, blow molding and conveyor belt.

## **C. Arduino**

Arduino is an open source electronic kits designed specifically for enabling everyone to develop electronic devices that interact with a variety of sensors and controllers. Arduino Duemilanove is a microcontroller board based ATmega 328. The board has a 14 pin microcontroller input / digital output (6 of them can be used as PWM outputs), 6 analog inputs, 16MHz crystal oscillator, a USB connection and ICSP header. Arduino Uno is a microcontroller board based ATmega 328. The board has a 14 pin microcontroller input / digital output, six of them can be used as PWM outputs), 6 analog inputs, 16MHz crystal oscillator, a USB connection and ICSP header, jack power, ICSP head and the reset button. Arduino is able to support the microcontroller; can be connected to a computer using a USB cable.



**Figure 2** Arduino

- a. mikronkontrolerAtmega 328
- b. operating at a voltage of 5V
- c. input voltage (recommendation) 7 - 12V
- d. limit input voltage 6 - 20V
- e. digital pin input / output 14 (6 supports PWM output)
- f. analog input pin 6
- g. current per pin input / output 40 mA
- h. flows to pin 3.3 V is 50 mA
- i. 32 KB flash memory (ATmega 328) of which 2 KB used by bootloader
- j. SRAM 2 KB (ATmega 328)
- k. 1 KB EEPROM (ATmega 328)
- l. a clock speed of 16 MHz

The arduino can be supplied power through a USB connection or power supply. the power selected automatically. Power supply can use a DC adapter or battery. the adapter can be connected by a striking jack adapter on supply input port connection. Arduino board can be operated using external supply of 6-20 volts. if the supply is less than 7V, sometimes 5V pin will supply less than five volts and the board may be unstable. if using more than 12 V, the voltage regulator can be very hot and cause damage to the board. No voltage on the 7 to 12 volts.

#### **The Explanation On Power Pins As Follows:**

Arduino board to the input voltage using a voltage from the outside (as mentioned 5 volts from the USB connection or the voltage is regulated). the user can provide a voltage through this pin, or if the supply voltage using a power jack, access using this pin. the regulation of power supply is used to power the microcontroller and other components on the board. 5V regulator can through vin use on board, supply by USB or 5V supply other regulations. 3.3 volt supply obtained by FTDI chips in the board. Maximum current is 50mA. Server as a ground pin on arduino ground lines. ATmega has 32 KB of flash memory for storing code, also 2 KB for the bootloader. ATmega 328 has 2 KB of SRAM. Every 14 digital pins on the arduino can be used as input or output, which uses pin function mode, digital digitally write and read. Input / output operating at 5 volts. Each pin can generate or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) 20-50 KOhms. Some pins have the following functions: serial; 0 (RX) and 1 (TX). Used to receive (RX) and send (TX) TTL serial chip. This pin is connected to the pin correspondent from FTDI USB to TTL serial chip. Eksternal interrupt on pin 2 and 3. These pins can be configured to trigger inter up on a low value, a rising or falling edge, or a change in value. PWM 3, 5, 6, 9, 10, and 11 function supports 8-bit PWM output with analogWrite function. SPI 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK) pin make up support SPI communication, which still supports the hardware, which is not included in the arduino language. LED 13 will connect pin 13 when the pin is worth HIGH, LED life, when the pin is LOW, the LED die.

#### **D. Smartphone**

Smartphone is an advanced technology which is a combination PDA and mobile phone. new technologies that resembles a personal digital assistant (PDA), which has a variety of functions and ease of access to the Internet (Philippi and Wyatt 2011) sophistication of smartphones compared to mobile cellular lies in the operation system is powerful, the speed of the process is high, multimedia device the very latest, connections best internet and touch screen. according to Brusco (2010), a smartphone is a mobile phone that works like a computerized system, messaging (e-mail), internet access and has a wide application as a means to find information such as health, sports, money and various and assorted topics. or when it is concluded smartphone like a computer but is small in size. Smartphones become a primary need for personal and professional who frequently make long-distance communication like send messages (e-mail). The special quality of the smartphone is a sophisticated system that serves to download and install applications with short time.

This application of the program on the desktop computer, but not complicated and can be taken anywhere. Smartphones was created to provide a wide range of applications that can be downloaded from the Internet by using an operating system (OS) specific like apple with iOS, Google Android, Microsoft Windows Mobile and Windows phones, Nokia Symbian, RIM Black Berry OS and others.



Figure 3 Smartphone

#### E. Router

A router is a computer networking hardware that is used to divide the protocol to other network members. The router function generally is a link between two or more networks to carry data from one network to another. But different router with the switch, because the switch is only used to connect multiple computers and form a LAN (local area network). While routers are used to interconnect the LAN with other LAN.



Figure 4 Modem Router

## II. THE RESEARCH METHODS

### A. Types of Research

This types of research is a designer's products are designed and made a prototype smartphone based control tool.

### B. Materials and Equipment of the Research

#### 1. Materials

- |                                        |                          |
|----------------------------------------|--------------------------|
| 1) board all set                       | 9) Relay set             |
| 2) exchange switch 2 sets              | 10) Smartphone           |
| 3) electrical installation cable I set | 11) Digital Multimeter   |
| 4) lighting 2 Pcs                      | 12) Digital Ammeters     |
| 5) Arduino                             | 13) MCB                  |
| 6) Ethernet shield                     | 14) Jack connector 1 set |
| 7) USB cable                           | 15) Adapter              |
| 8) Jumper wire                         | 16) Screw shield         |

#### 2. Equipment

- 1) Access point TP-Link MR-3020

### C. Design of Electrical Installations

Installation Design of the electricity used is based; Regulation PUIL '2000, SPLN, and LMK prevailing in Indonesian. In this design used a safety MCB 2A, which serves to secure the entire device installation of electrical equipment in the building / residence, in case of short-circuit, which can be controlled automatically via Smartphone. Each KKB, KKK, lights and MCB are used within the building must be controlled by a relay

that contained in the Control Panel. To control the water pump engine for the reservoir, use Water Sensor Controls, which is controlled directly from Arduino, via a relay board inside the panel. So if the water in the tank runs out of control (the lowest level), the engine pump will run automatically, and otherwise, if the water in the tub is full, the control of the engine will stop (OFF) automatically. Image that Design electrical installation can be seen in Picture 5..

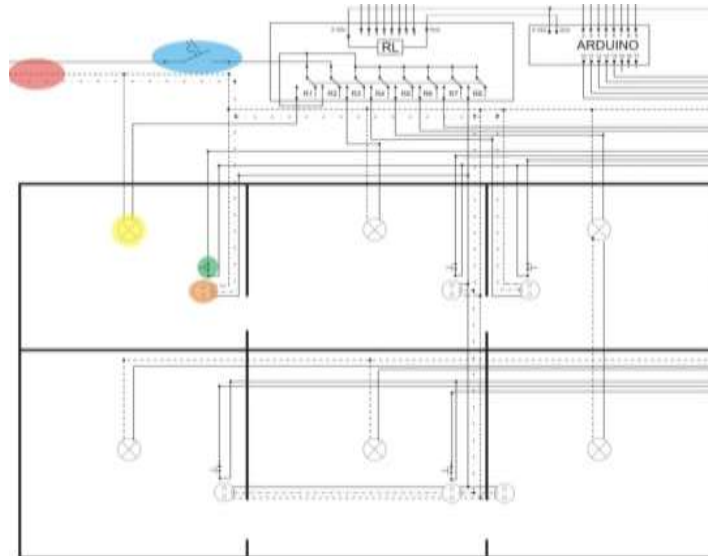


Figure 5 Wiring Diagram

**D. The Collection Various Data**

data collection techniques used were interview techniques by expert electrical installation, library research, direct measurement techniques and documentation

**E. The Pilot Control System**

**1) Local Network**

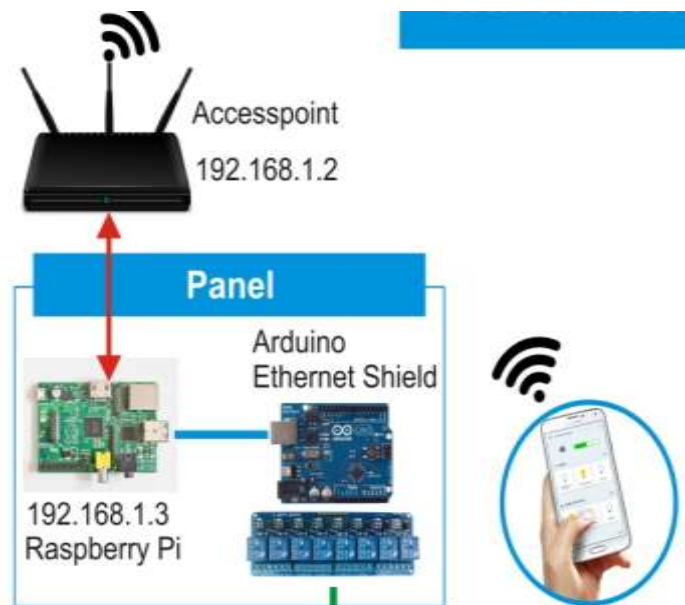


Figure 6 Control Uses Local Network

In the picture above shows a accesspoint used as a media liaison between the smartphone and raspberry that functions as a server and arduino serves as a control device for device electrical appliance (KKB, water pumps, Lamps-electric lights, and MCB), via a relay intelligent arduino , smartphone serves as the controller will send instructions to arduino via the web-based application that is contained in raspberry, with ip address /

local 192 168 100 102 that serves to control / turn on the lights, KKB and MCB. the workings system of these control devices, namely through the instruction of the device arduino forwarded to the relay board, which next to the switch, KKB and MCB, according to customer wishes.

2) Internet Connection



Figure 7 Control Uses The Internet

in the figure above is the development of local connections so that the user can control the electrical appliance (KKB, water pump machine, TV, electric lights and MCB) via an internet connection. in Figure 6 there and a modem / router that functions as a media liaison local and internet connection. so users can monitor and control the electric appliance the user must be able to access the address "http://www.penelitian-kendaligedung.ngrok.com" on a user's smartphone, the next page will appear on the website smartphone used as a remote user to send instructions to arduino whose function is to control the electrical equipment in a building or house.

III. THE RESULT OF THE RESEARCH

A. The Result Of The Reseach

After the design of the application made by the research team, then made the design of electrical installations, such as pad Figure 7 and Figure 8. Software has been enhanced further downloaded to arduino and ready to function. After testing of all devices of household electrical appliances (KKB, water pump machine, TV, electric lights and MCB), the obtained results as shown in Table 1 to Table 5

Table 1. Testing For Electric Lights

Saklar	Manual	Smartphone	Light	Note
1	ON	ON	ON	consistent
	OFF	OFF	OFF	consistent
2	ON	ON	ON	consistent
	OFF	OFF	OFF	consistent
3	ON	ON	ON	consistent
	OFF	OFF	OFF	consistent
4	ON	ON	ON	consistent
	OFF	OFF	OFF	consistent

Table 2. Testing for KKB

KKB	Smartphone status	NOTE
1	ON	KKB worked,tension 220V
	OFF	KKB unworked, 0V
2	ON	KKB worked, tension 220V
	OFF	KKB unworked, 0V
3	ON	KKB worked, tension 220V
	OFF	KKB unworked

Table 3. Testing for KKB 1 with Load Light Sleeper 1

KKB 1	Smartphone status	NOTE
	ON	Turn on
	OFF	Turn off

**Table 4.** Testing for KKB 2 with Load Light Sleeper 2

KKB 2	Smartphone status	Note
	ON	Turn On
	OFF	Turn Off

**Table 5.** Testing for KKB 3 with Load Testing TV

KKB 3	Smartphone status	Note
	ON	ON
	OFF	OFF

#### IV. Discussion

The testing of the control system on the device electrical appliance of a building / house either manually via push-button switch, or automatically by using table 1, at which time the lamp 1 is turned on (ON) manually via a button switch, the smartphone also looks Lighting ( ON position). Otherwise if the button on the smartphone pressed to extinguish the lights automatically switch OFF position. When the light switch position ON for 2, then the position of the switch on the smartphone is also in the ON state. sebaliknya pada when the switch button on the smartphone to the lamp 2 in the OFF, then automatically switch position is also in the OFF state. The same applies to the lamp 3, 4, and 5.

in Table 2, at which time KKB 1 is fed via a smartphone, then after a try by using the voltmeter shows the voltage value of 220 volts. This suggests that KKB 1 The study functioned well. Otherwise if the smartphone is pressed to the off position, then the voltage value indicated by KKB 1 = 0 Volt. the same applies for KKB KKB 2 and 3. When the ON key is pressed, the smartphone looks light sleeper 1 mounted on KKB 1 will light up, this suggests that KKB1 position in a state function (ON). Conversely when the OFF button is pressed, then a light sleeper 1 will be extinguished, which means the position of the KKB 1 in a position not function (OFF). The same applies to Table 3 and Table 4. in table 5 can be seen the test results were as follows. When the ON button is pressed on the smartphone, then look TV mounted on KKB 3 will turn, this suggests that KKB 3 position in a functioning state (ON). Conversely when the OFF button is pressed, the TV goes out, that means the position of KKB 3 in a state of not functioning (OFF). specifically for the control of water pumps that would fill the reservoir, then when the input cable Machine water pump is connected to one of the KKB that is in the market buildings that have been made, then the reservoir can be controlled (ON / OFF) via smartphones such as the control of the collective labor agreements has been applied.

#### V. CONCLUSION

- 1) The software-based control systems arduino smart relay has been functioning Well, this is evidenced by the good functioning of all the systems of control in the security system, as well as for various electrical devices being controlled.
- 2) Prototype smart relay-based control instrument arduino have been made to control the KKB, pumping machine, TV, electric lights and MCB, has been functioning well, this has been proven in research trials.
- 3) Interface and application-based control system made arduino smart relay has been functioning well and controlling device electrical equipment contained within a building or home.

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