Design and Build a Smart Electrical Socket Using Iot Based Arduino Uno Microcontroller

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***Abstract*—Technological developments make it possible to integrate home electrical devices with control via smartphone. One important device is the socket, which many still use conventional models with weaknesses such as the risk of burning if there is excessive current and short circuits due to being stored in damp places. This research aims to design a smart electrical socket that utilizes Internet of Things technology using the Arduino Uno microcontroller. This socket allows users to control electrical sockets and monitor the temperature and humidity around the electrical socket via a smartphone application remotely while connected to the internet. This research uses a prototyping method, which allows gradual development and testing to achieve the desired results. The research results show that the designed system has stable performance with an average measurement delay of 5-22 ms . With the integration of IoT in this electrical socket, users can more easily manage electrical devices and monitor temperature conditions around the electrical socket, which not only adds comfort but also increases the security aspect.**

Keywords—Smart electrical sockets, Internet of Things, Prototyping, sensors, arduino

I. INTRODUCTION

Currently , developments technology that can regulate device Electricity at home can be controlled through *smartphones* increasingly develop fast. Nowadays humans cannot escape and always connected to use electricity. One of use electricity around we are using socket electricity or frequently called a socket. Socket electricity or socket works as breaker electricity when current Positive and negative currents interact with grounding in the installation electricity [1]. Every House what we can be certain of is have it , socket The electricity usually used at home uses conventional models. Electric socket conventional own shortcomings, that is vulnerable burnt If current excess, esp If cable device electronics are not removed from the socket if it is no longer used. Besides That laying socket Electricity must also be taken into account so that it is not placed in a vulnerable place wet or damp, cause If be in place moisture can increase risk short circuit in socket the electricity .

From these problems, then need made device socket electricity clever. Socket electricity smart who will designed get up own The advantage is where the socket is electricity clever own features that conventional models do not have like it can be controlled from remotely via an application on *a smartphone.* Socket This electricity is connected to the Arduino Uno which is connected to the internet network via intermediary *wifi* .

Application used to control socket electricity that is using the blynk application. blynk is an application on a smartphone that functions to control microcontroller such as Arduino, nodemcu or similar via the internet. [2] blynk classified easy to operate and own complete control .[3]

Arduino is a microcontroller with a programming language its own nature *open source* for the board and program [4]. The Arduino used in this research is Arduino Uno which is Arduino type that uses a microcontroller chip DIL (Dual In-line package) type which makes it easier user to replace the chip if happen damage [5]. Draft *The Internet of Things* (IoT) aims to improve various profit from share mutual internet connection connect and belong ability data sharing , data controllers , and so on . [6]

Feature others from socket This electricity is able to monitor temperature and level humidity around socket electricity by utilizing the DTH11 sensor, the DTH11 sensor is a sensor for detecting temperature and humidity at one module . The DTH11 sensor consists from element capacitive to detect humidity and thermistor to measure temperature . Capacitor gauge humidity own two electrodes separated by material storing dielectric humidity[7]. This sensor has exelent reading quality[8].Data obtained later will displayed on the blynk application which is an application to control device microcontroller like Arduino uno through internet [9].

The data obtained from the DTH11 sensor is then transmitted and displayed on the Blynk application. Blynk is an app that allows users to control and monitor microcontroller devices, such as the Arduino Uno, via an internet connection. With its user-friendly interface, Blynk makes it easy for users to monitor temperature and humidity conditions around the socket in real-time. Users can also adjust various parameters and receive notifications if any conditions require special attention, making this electrical socket not only smart but also safer to use in various situations.

II. METHODS

Methodology used in Design Get up Socket Electricity Clever use Arduino Uno based microcontroller *IoT* is using the *prototyping* method. *Prototyping* is modeling which includes design models starting from planning device software and devices [10]*Prototyping* method used to make an early version of a purposeful system demonstrate concepts, testing designs, as well identify problems and solutions potential use give an overview of the system that will be developed . [6] The following is a *prototyping model* presented in Fig. 1 below . [11]

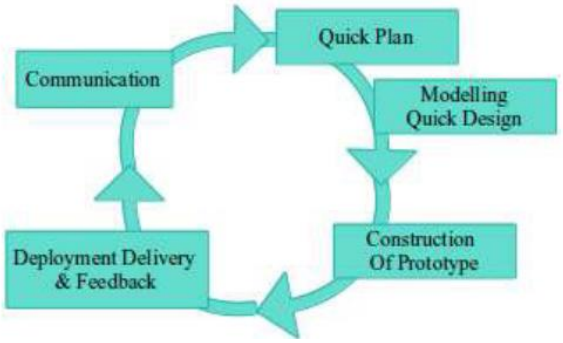

Fig. 1. Flow of the prototyping method

i. Communications

At this stage it is stages involving meetings between developers and stakeholders interest others to understand the research objectives, identify needs and determines room scope system [12].

ii. Quick Plan

The purpose of stages planning This quick is to determine features main a system [13].

iii. Modeling Quick Design

This stage is an involved process fast design creation from planned system will made . [12]

iv. Construction of prototype

This stage is manufacture device *prototype* based on existing designs made including testing and refinement . [14]

v. Deployment, Delivery, and Feedback

This stage is implementation system that has built and tested . At this stage also the system sent to the owning party interest others to get feedback from the user will collected to evaluate and recorded in the written report process Later . [15]

III. RESULTS AND DISCUSSION

The results of this research will explained stages from design research get up socket electricity clever using Arduino uno IoT -based by following channel methodology *prototyping.*

A. Identification of problems

Before starting the prototyping stage, research begins with problem identification. This stage is focused on understanding in depth what are the obstacles or obstacles in the field. From this stage, it was identified that the Sinar Amanah stall had several electronic equipment in its stall. This electronic equipment is connected to a conventional electrical socket, which has the disadvantage of being prone to short circuits, especially if the electrical socket is placed in a damp place. Therefore, it is necessary to create a smart electrical socket that can control devices connected to the electrical socket and can see the temperature and humidity around the electrical socket via an application on a smartphone. Researchers also conduct literature studies on relevant topics regarding the problem being faced and review previous research to address similar problems.

B. Communication

In this stage , the owner roadside stall interviewed to find out condition place and manner collect and adjust device hard . Information collected will used for designing socket electricity this clever .

C. Quick Plan

In the quick plan stage, this is done by creating a flow diagram system in control devices connected to the socket electricity and monitor temperature and humidity around. The Quick Plan that was created presented in the following image :

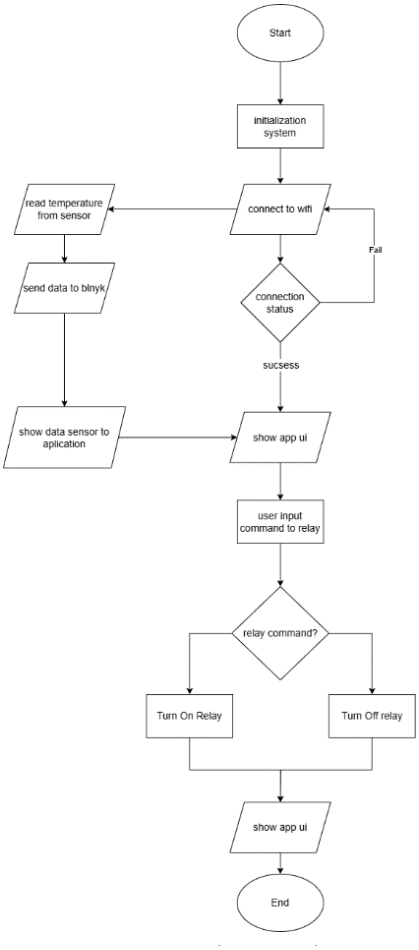

Fig. 2. General diagram System

Fig. 2 explains the flow of the smart electrical socket system. This system begins with system initialization, namely the system process of checking the hardware connected to the microcontroller which is followed by checking the internet network connection. If the microcontroller is not connected

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to the internet network, the system will ask to connect to the internet network first so it can run. If it is connected, the system will display an application menu and there will be information about temperature and humidity obtained from the sensor and relay control button which functions as a control for turning on and off the electrical socket.

D. Modeling Quick Design

At this stage , it is carried out depiction network schematic . The first step is to do creating block diagrams as procedure planning system .

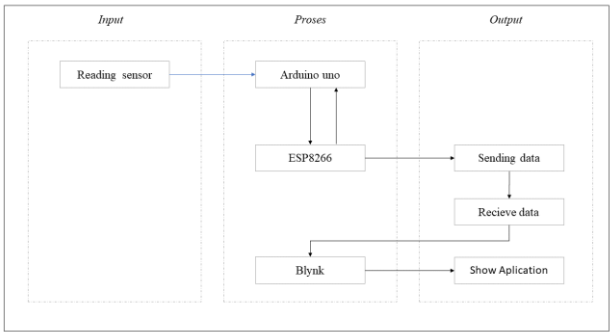

Fig. 3. Block diagram reader temperature and temperature

Fig. 3 explains how to process the tool work consisting from three stages that is *input*, process and *output.* The following is an explanation of the diagram above :

a) inputs

This section is the process of reading the DTH11 sensor as a temperature and humidity sensor.

b) Process

1. Arduino uno

Data from the DTH11 sensor will be processed by Arduino Uno. This data contains temperature and humidity information which is then communicated with the ESP8266 nodemcu.

2. ESP8266

In this section, the ESP8266 nodemcu will be the bridge for sending data and receiving data which will later be sent to the blynk application

3. Blynk

After receiving data from the Arduino Uno via the ESP8266 nodemcu, the blynk application will display temperature and humidity information around the electrical socket.

c) Outputs

1. Data transmission

Data obtained from the Arduino Uno connected to the ESP8266 nodemcu will send data to the blynk application.

2. Data recipient

In this section, data sent from the ESP8266 nodemcu will be received by the blynk application.

3. Application display

The blynk application will display temperature and humidity information which will later be seen by the user.

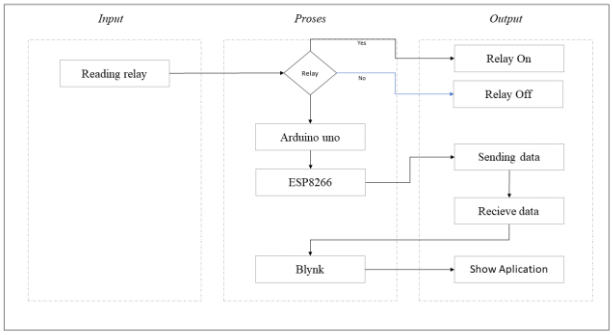

Fig. 4. Relay Reading Block Diagram

Block diagram in Fig. 4 explains the relay reading process. The stages depicted covers *inputs* and *outputs.*

a) Inputs

This section is the process of reading the relay condition

b) Process

- In this section, the relay checks whether it is active or inactive.
- The relay position data will be continued to the Arduino Uno and forward the data to the ESP8266 nodemcu.
- The ESP8266 nodemcu will receive data from the Arduino Uno and send the data to the Blynk application.
- The blynk application will display the relay button and whether the relay is active or inactive

c) Outputs

- In this section, if the input relay is on, then the data sent to the Arduino Uno will be information about the relay being on
- If the relay input result is deactivated, then the data sent to the Arduino Uno will be in the form of inactive relay information
- The blynk application will display a relay button and can be operated by the user

Here is the series schematic from system based on procedures that have been done made

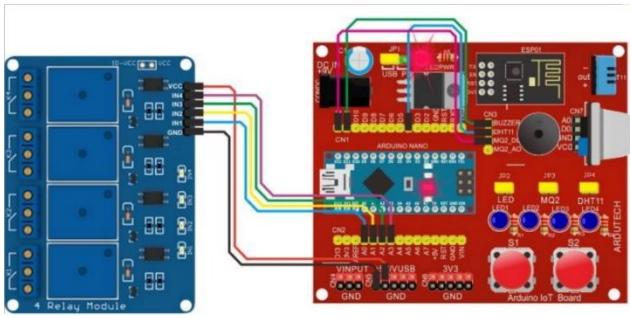

Fig. 5. Schematic network

E. Construction of Prototyping

At the construction of Prototyping stage , namely stages involved assembly device hard work and coding , this stage also includes stages testing to ensure all components works fine.

TABLE I. CODE DHT11 SENSOR PROGRAMMING

```
//==============================
void check_DHT11() {
humi = dht.readHumidity();
temp = dht.readTemperature();
if (isnan(humi) || isnan(temp)) {
Serial.println("DHT11 not read... !");
returns;
```


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```
} else {
Serial.print("Temp=");
Serial.println(temp);
Serial.print("Humi=");
Serial.println(humi);
Blynk.virtualWrite(V0, temp);
Blynk.virtualWrite(V1, humi);
}
}
//==============================
```

In table 1 they are code programming configuration for commands reading data from the DTH11 sensor, the data read is humidity and temperature.

TABLE II. CODE RELAY PROGRAMMING

```
BLYNK_WRITE(V2) { / / RL1
int value1 = param.asInt ();
  digitalWrite ( RL1, value1);
}
void setup( ) {
  Serial.begin (9600);
  EspSerial.begin (9600);
  pinMode ( RL1, OUTPUT);
  digitalWrite ( RL1, HIGH);
  delay( 10);
  Blynk.begin (auth, wifi , ssid , pass);
  delay( 10000);
  dht.begin();
}
```

In table 2 it is configuration to control the relay via the blynk application . the code is used to receive mark from the blynk app and control the relay based on that value. The configuration is designed to allow seamless communication between the Blynk app and the relay hardware, enabling users to remotely control the relay from their mobile devices. This system is highly beneficial for scenarios where remote control of electrical devices is required, offering flexibility, convenience, and enhanced automation capabilities. For instance, users can easily switch their appliances on or off from anywhere, as long as they have access to the Blynk app, making it ideal for smart home applications.

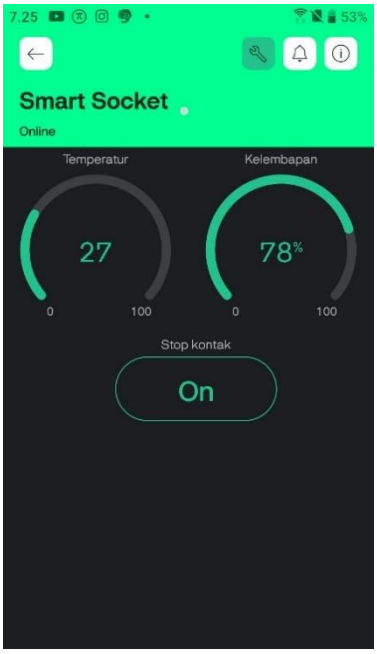

Fig. 6. Results of designing the blynk application

Fig. 6 is appearance from the Blynk app at the moment socket electricity Smart is connected to the internet network . In use socket electricity clever based *Internet of Things*, this Blynk application is used to control device connected in the socket electricity. In this application there are also temperature and humidity monitoring indicators around socket electricity . Then to control socket electricity, at the moment user pressing knob *off* on the application then the Blynk application will send command the relay so that the contact stops will turns on and can be used, then button on the app will changed become *on*, and vice versa If user want to turn off socket electricity user pressing on button for the application and blynk will send commands to turn off relays and buttons in the application will be changed become *off*.

Fig. 7. Results hardware assembly

After stages coding finished, the next step is assembly components and testing process. In the picture above is results from assembly components. The testing process is carried out by connecting the designed smart socket to the smartphone and observing information temperature as well as ambient humidity socket electricity displayed on the application. Following is test results on the DTH11 sensor.

TABLE III. TEMPERATURE SENSOR TESTING

Place	DTH11 sensor	
	Temperature	***Humidity***
Temperature in place 1	24°	76%
Temperature in place 2	22°	63%
Temperature in place 3	26°	18%
Temperature in place 4	29°	10%
Temperature in place 5	29°	10%
Temperature in place 6	22°	70%
Temperature in place 7	19°	78%
Temperature in place 8	26°	59%
Temperature at 9	23°	73%
Temperature at 10	26°	14%

TABLE IV. TESTING BLYNK AND RELAY APPLICATION FUNCTIONS

No	Test	Information
1.	1st try	Succeed
2.	2nd try	Succeed
3.	3rd try	Succeed
4.	4th try	Succeed
5.	5th try	Succeed

6.	6th attempt	Succeed
7.	7th attempt	Succeed

The test in table 4 is carried out by sending commands via the Blynk application to activate or deactivate the relay. Once a command is received by the relay module, the relay status is checked to ensure that the relay has changed according to the given command. This test was repeated seven times to verify system consistency and reliability.

TABLE V. DATA COLLECTION

No	Initial Time	End Time	Delay (ms)
1	20:49:58.327	20:49:58.843	516
2	20:49:58.843	20:49:59.358	515
3	20:49:59.358	20:49:59.874	516
4	20:49:59.874	20:50:00.671	797
5	20:50:00.671	20:50:01.187	516
6	20:50:01.187	20:50:01.703	516
7	20:50:01.703	20:50:02.219	516
8	20:50:02.219	20:50:02.735	516
9	20:50:02.735	20:50:03.251	516
10	20:50:03.251	20:50:03.767	516
	Average *Delay*		522 pp

Table 5 shows the results of the delay calculation between each temperature and humidity data measurement carried out. This measurement was carried out by taking ten data samples collected from the sensor module. Based on the data in table 5 , it can be concluded that the measurement system has a fairly consistent delay time, with an average delay of around 522 ms. However, there is one measurement that has a delay of 797 ms.

This shows that the system has stable and reliable performance in carrying out repeated measurements in a short time. This measurement aims to understand the system response time in carrying out continuous temperature and humidity measurements. By knowing the delay between measurements, it can be determined how quickly the system can update the data and how accurate the data is in a short time. This consistency of delay time is especially important in applications that require *real-time monitoring* , as it ensures that the data obtained is an accurate representation of current conditions.

F. Deployment, Delivery and feedback

In stages *Deployment, Delivery and Feedback* , a successfully designed system wake up demonstrated to owner stall to obtain *feedback* from users [15]

Demonstration process involving systems a representative owner roadside stall named Fachrul Al Farihan. During the demonstration, Fachrul give feedback regarding perceived hardware arrangement needs to be neater to be sure convenience maintenance . By general , designed system has fulfil need user well, good from facet functionality nor convenience use . However, Fachrul also provided additional input for the microcontroller placed in a more sturdy casing. This aims to improve durability and reliability system, esp If used over a long period of time. Besides that is, with a better casing, the internal components will protected from dust, moisture, and potential damage physique others, so the system can operate more stably and sustainably. These suggestions will considered in further development to be sure a system that is more reliable and meets expectations user .

G. Report

Stage end of this research involves preparation document written that presents information , data, and results analysis from overall activities that have been done during the research. Resulting document cover theses, journal articles, and research posters

IV. CONCLUSION

Based on from the results of the research that has been done done then it can be withdrawn a number of conclusion including, among others following Based on from the results of the research that has been done done then it can be withdrawn a number of conclusion including, among others following :

- This research succeeded in designing and building a smart electrical socket using an IoT- based Arduino Uno microcontroller with temperature and humidity monitoring features around the electrical socket.
- This research creates an application to control electrical sockets and monitor temperature and humidity using the bynk application as an intermediary to display control buttons and monitor temperature and humidity.
- The average delay between each temperature and humidity data performed is quite consistent with an average delay of around 539.4 ms. This shows that the system has stable performance in carrying out repeated measurements in a short time.

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