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Smart Home Prototype with HC–05 Bluetooth and RFID Modules, Based on Microcontroller

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Abstract

How is the performance of the Arduino Uno in processing smart home creation, as well as the implementation of the results of its classification into Android. This design uses various sensors, RFID for smart door locks and Bluetooth HC-05 for lights and fans. The benefit of making this prototype is to make it easier to turn on the lights and fans so you don't have to bother looking for light sockets or fans. Smart door lock using RFID is a technology used to identify opening doors. This design uses the Arduino Uno R3 device. This device can be remote with Android. The android application uses the MIT App Inventor software. This smart home design can make it easier for users to carry out activities at home where previously they could turn on and off the lights and fans in the living room, still manually by pressing the socket, now they can turn it on with a smart phone connected to the Bluetooth module via an application. Utilize Google's help on Android smartphones to control lights and fans using voice commands. In addition, the author also designed a smart door lock using RFID and matrix keypad, which previously opened and closed the door with a key, now only by attaching an RFID card or pressing a pin to open the door.

I. Introduction

In the development of analog technology at this time, electrical equipment is usually controlled manually by the user. What is directly connected to the device must be turned on and off directly. Sometimes there are still some electrical devices that are still on when they are not in use, this can be caused by the negligence of the user to turn off the electrical device[1]. If the number of electrical devices in a house is quite large, it will be very inconvenient to turn off and turn on electrical devices manually, the use of electrical energy from these devices is also inefficient (wasteful of electrical energy). The house is a place to live that is occupied by a family, basically the house is filled with standard equipment in general[2], for example, such as lights and fans in the living room, also doors and much more, generally controlling current home appliances. still work manually so it is less effective, besides that there are still residents of the house who are still lazy to do easy work such as turning off the lights and fans in the room and turning on manually.

Microcontroller is a controller whose components are very common in modern electronic systems at this time of course, its use is very wide in our lives today such as in offices, homes, schools and others, microcontrollers are widely used in a large number of electronic systems such as the following car system management systems, computer keyboards, electronic measuring instruments, televisions, radios, refrigerators, microwave ovens, printers, scanners and many more of course we can use microcontrollers for various applications, for example for controllers,

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industrial automation, data acquisition, telecommunications and many more. others, the benefits of using this microcontroller at an affordable price can be programmed repeatedly and can be programmed according to what we want[3].

How is the performance of arduino uno in processing the manufacture of smarthomes for someone to use to make things easier, as well as the implementation of the classification results into android. Generally, the scope of information about smart home is very broad, therefore it is necessary to make boundaries so that the author can carry out clearly in accordance with the author's goals: (1) This design uses various sensors, rfid (radio frequency identification) for smart door locks. and the hc-05 Bluetooth module for living room lights and fans. The lights and fans use Bluetooth hc-05, HC-05 is a Bluetooth wireless module with serial port protocol (SPP) communication operating at a frequency of 2.4GHz, this module can be used as a slave (receiver) and can also be a master (sender), benefits Making this prototype is to make it easier to turn on the lights and fans so you don't have to bother looking for the light socket or the fan itself. This smart doorlock using rfid is a technology that is used to collect data or identify using a barcode or magnetic card. (2) This design uses the Arduino Uno R3 device. (3) This application can be remoted with android. (4) The android application uses the MIT App Inventor software.

The framework is a flow that is used as a thought scheme to strengthen the indicators behind the making of this application. Within this framework, explanations will be formed in diagrams.
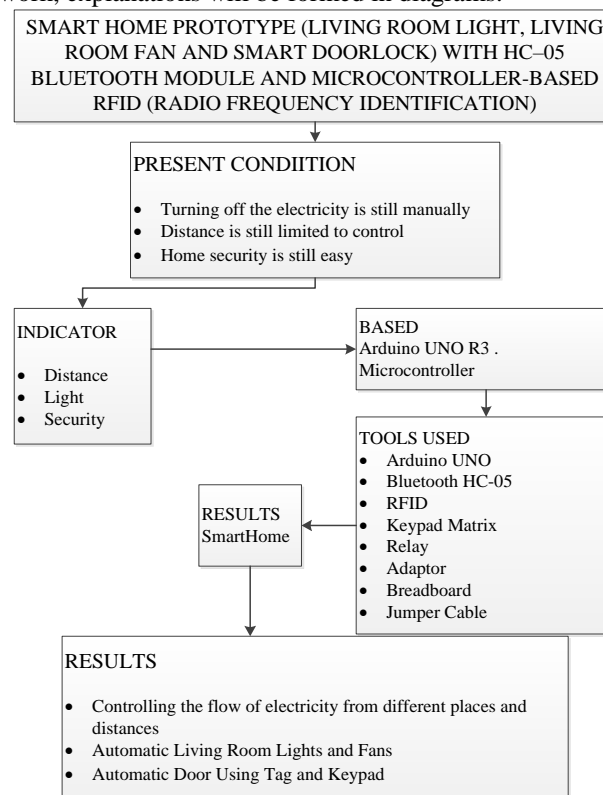

Fig. 1 Thought Diagrams

II. RELATED WORKS/LITERATURE REVIEW

The following table reviews literature from 3 journals used in related research. The components used in the literature review are the name of the researcher, the name of the journal along with the ISSN, the year of publication of the journal, the institution, the title and method used and the conclusion.

TABLE 1
Literatur Review

Researcher	1. Barep adi jaya[4] 2. Amalia Herlina 3. Sherly Ferdiant	1. Pensi Asmaleni[5] 2. Dedy Hamdani 3. Indra Sakti	1. Rio Gaveri Pratama[6]

Journal Name	JEECOM 2019 ISSN 2715-0410	Jurnal Kumparan Fisika e-ISSN: 2655-1403 p-ISSN: 2685-1806	Computers and its Applications Journal e-ISSN 2622-7983
Year	2019	2020	2019
Institution	Universitas Nurul Jadid	Universitas Bengkulu	Universitas Maarif Hasyim Latif
Title and Method	Smarthome With Smart Control, Berbasis Bluetooth Mikokontroler	Development of an Automatic Fan and Light Control System Based on Sound Switch Using Arduino Uno	Arduino Uno R3 Based Home Locking System Design With Radio Frequency Identification (Rfid) And Selenoid Door Lock
Conclusion	1. The microcontroller can be communicated with android devices via Bluetooth serial communication Hc-06 2. Can be developed by adding input in the form of a PIR sensor and a DHT11 temperature sensor, issued in the form of an output to run electrical devices from relays. 3. The disadvantage of this tool is the limited range of the bluetooth signal and the temperature set value cannot be changed from the outside	1. In designing and making an automatic fan and light control system based on a sound switch, several tools and materials are used, namely: Arduino Uno R3 as a Bluetooth Microcontroller HC-05 as a communication tool between smartphones and the control system and relays as light switches and fans, smartphones android, jumper cables, power cables, flashing lights, sockets, laptops. And adapter and PCB board 2. An automatic fan and light control system is made by assembling all components and tools with jumper cables as a link between components	1. Automatic door control system using rfid can be used or installed on almost all types of doors as long as the distance limit is 60 mm. 2. The maximum distance in attaching the Tag/Transponder and PICC card to the RFID reader is around 13.56 MHz. 3. In this automatic door lock system, placing an RFID reader, if the way of attaching or bringing the PICC Tag/Card is not right, the rfid reader will not be able to read. 4. Development can be done by adding sensors installed on doors and windows.

III. METHODS

The HC-05 Bluetooth Module is a TTL level (UART) serial communication converter into a form of wireless communication, namely Bluetooth[7]. RFID is a radio wave-based identification technology[8].

By using various sensors, rfid (radio frequency identification) for smart door locks and HC-05 Bluetooth module for living room lights and fans.

The lights and fans use Bluetooth HC-05, HC-05 is a Bluetooth wireless module with serial port protocol (SPP) communication operating at a frequency of 2.4GHz, this module can be used as a slave (receiver) and can also be a master (sender), benefits Making this prototype is to make it easier to turn on the lights and fans so you don't have to bother looking for light sockets or the fan itself.

Selenoid Door lock is an electronic device whose working principle is using electromagnetic. Selenoid door locks generally use a 12-volt working voltage. Under normal conditions this device is closed or locks the door, when a 12-volt voltage is applied, the lock will open[9].

This smart doorlock using rfid is a technology that is used to collect data or identify using a barcode or magnetic card. The author does the design of the house before making a model that will be used to connect all the systems that will be implemented.
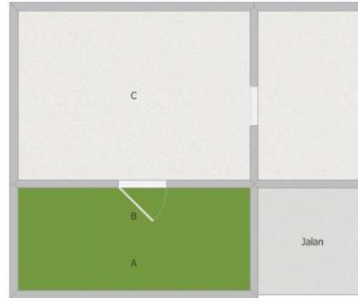
Fig. 2 House Plans

Information:
a. Home page
b. Door
c. Sitting room
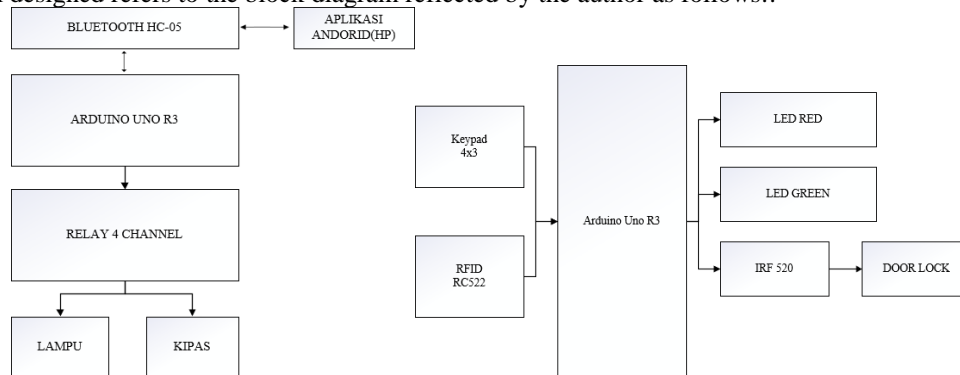The system designed refers to the block diagram reflected by the author as follows::

Fig. 3 Light Block Diagram, Living Room Fan and Smart Door Lock Block Diagram

In this study, the application used by the author is MIT App Inventor as a means of controlling smartphones. Applications can run on Android OS, Blynk is a platform for Mobile OS applications (iOS and Android) which aims to control Arduino, Raspberrp Pi and ESP8266 modules, WEMOS D1, and the like via the internet. The following is a screen design to operate the device using a smartphone using MIT App Inventor:
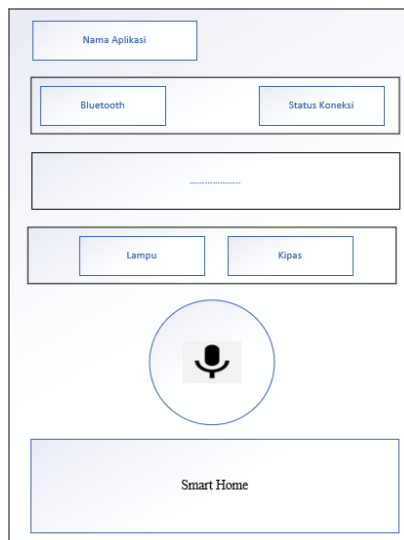

Fig. 4 Application Screen Design for Living Room Fan Light

IV. RESULTS

At this stage the researcher designs a prototype in order to facilitate the understanding process for users and also make it easier for developers if in the future this research wants to be developed to be better.

Wiring diagram is a schematic that describes the relationship between one component and another in detail. Here's the wiring diagram for the living room lights and fans.
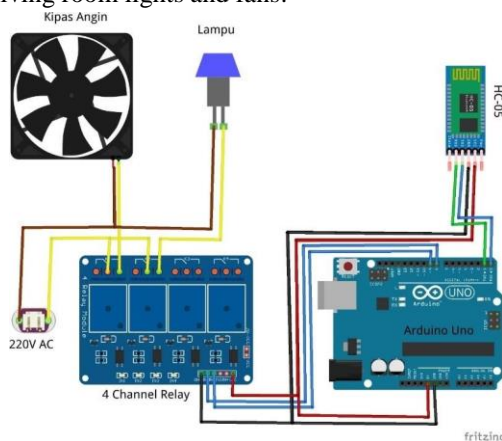
Fig. 5 Living Room Light and Fan Wiring

The following is the wiring diagram for the smart door lock. The smart door lock uses two main components to be able to open the door, the first by using RFID and using the keypad number.
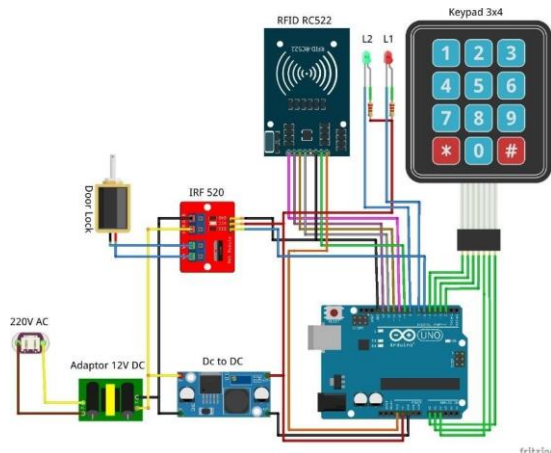
Fig. 6 Wiring Smart Doorlock

The following is an explanation of the picture of the Living Room Light and Fan Wiring for the circuit connection.

TABLE II
LIVING ROOM LIGHT AND FAN WIRING TABLE

Pin on components	Connect to
Relay	Arduino Uno R3
Relay PIN IN 1	Arduino PIN 10
Relay PIN IN 2	Arduino PIN 11
Relay	Breadboard
Relay VCC	Breadboard PIN 5V
Relay GND	Breadboard GND
Bluetooth HC-05	Arduino Uno R3
HC-05 PIN TX	Arduino PIN 0
HC-05 PIN RX	Arduino PIN 1
Bluetooth HC-05	Breadboard
HC-05 PIN VCC	Breadboard PIN 5V
HC-05 PIN GND	Breadboard PIN GND

The following is an explanation of the Wiring Smart Doorlock image for circuit connections.

TABLE III
TABEL WIRING SMART DOOR LOCK

Pin on components	Connect to
RFID RC522	Arduino Uno R2
SDA RFID	Arduino D10
SCK RFID	Arduino D13
MOSI RFID	Arduino D11
MISO RFID	Arduino D12
IRQ RFID	-
GND RFID	Arduino GND
RST RFID	Arduino D9
3,3 V RFID	Arduino 3,3V
Keypad 4x3	Arduino Uno R3
Row 1 Keypad	Arduino D5
Row 2 Keypad	Arduino D4
Row 3 Keypad	Arduino D3
Row 4 Keypad	Arduino D2
Column 1 Keypad	Arduino A0
Column 2 Keypad	Arduino A1
Column 3 Keypad	Arduino A2
MOSFET IRF 520	Arduino Uno R3
VCC IRF520	Arduino +5V
GND IRF 520	Arduino GND
SIG IRF 520	Arduino 6
Door Lock	MOSFET IRF 520
Door Lock -	IRF 520 V-
Door Lock +	IRF 520 V+

V. Discussion

Arduino is a hardware and software platform that can be used by electronics enthusiasts and startups to make prototypes of microcontroller-based controls[10].

In this research, the smart home prototype (living room lamp, living room fan and smart door lock) with a bluetooth hc-05 module and rfid (radio frequency identification) based on a microcontroller is connected to a smartphone application (android), along with the program display on android.
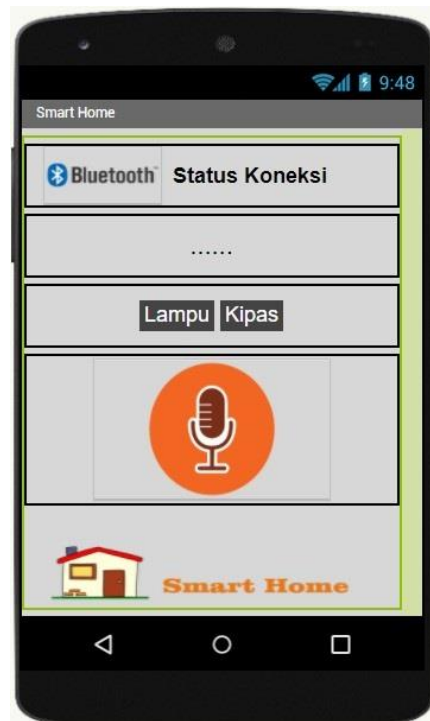
Fig. 7 Tampilan Aplikasi MIT App Inventor

In this study using Blackbox Testing for the testing process. Blackbox Testing is a test that observes the execution results through test data and checks the functionality of the software. The Blackbox test method can be applied to all levels of software testing: unit, integration, functional, and system. Here are the test results using Blackbox Testing:

TABLE IV
Test Results With Blackbox Testing

NO	Pengujian	Hasil yang diharapkan	Keterangan
1.	Bluetooth HC – 05	When the distance condition is 0-10 meters and the bluetooth module is still connected, it can still work used	Valid
	Bluetooth HC – 05	When the distance condition is 11 meters and so on the bluetooth module has been released or has reached its limit then can't be used anymore	Invalid
	Bluetooth HC – 05	When conditions are blocked by glass bluetooth module can still be used	Valid
	Bluetooth HC - 05	When conditions are blocked bluetooth module wall can still be used	Valid
2.	Keypad Matrix	When entering PIN/word password is correct then the door will open	Valid
	Keypad Matrix	When entering the wrong PIN/password, the door will remain closed	Valid
3.	RFID CARD / Tag	When the condition of the rfid card that is owned is exposed to water and the conditions are not too wet, the card still usable	Valid
	RFID CARD / Tag	When the condition of the rfid card that is owned is exposed to water and the condition is very wet, the card will not can be used	Invalid

VI. CONCLUSIONS

Based on the results obtained from the design of this smart home, the following conclusions are obtained: (1). The design of this smart home can make it easier for users to carry out home activities that were previously possible to turn on and off the lights and fans in the living room, still manually by pressing the power outlet, now they can turn it on with a smart phone that is connected to the bluetooth module via the application and utilizes google assistance. exists on android smart phones to control lights and fans using voice commands. In addition, the author also designed a smart door lock using rfid and a matrix keypad which previously opened and closed the door with a key, now only by attaching an rfid card or pressing the door pin can open by itself. (2). The tools that have been designed have succeeded in carrying out their functions properly and can help users to save time in terms of turning on the lights and fans in the living room and can also maintain better home security. (3). The tools and applications have been successfully simulated in the smart home design.

After designing this smart home tool, there are also some suggestions in developing this tool to make it better and more effective in the future. (1). It is hoped that in further research these tools can be developed to be even better by using better tools and in the next design it is hoped that the tools will be added with other sensors. (2). In the next design the tools can be made more concise and easier to use. (3). Apps and tools can help users to save time.

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