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Implementation of the Smart Car Controller System in Cars Based on the Internet of Things

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ABSTRACT
This research aimed to create innovations in the development of the Internet of Things in car accessories to add system accessories to cars. The type of research used was experimental research. The subjects studied in this research were car users whose hobbies were various types of cars. The use of Internet of Things media in car accessories is very unique and has not been widely used to create innovations in the development of Internet of Things technology. This research aimed to help car users control their cars through the voice control feature, as well as to make car users a second choice to upgrade their car systems compared to buying a sophisticated car at an expensive price. The research results showed that there were still very few car users equipped with control systems compared to luxury car users who had sophisticated systems. Thus, it can be concluded that the idea of a voice control system using the Internet of Things for car accessories could help car users increase the sophistication of the car system and is a good choice.

INTRODUCTION

Internet of Things is a method or concept for connecting a device that has been designed to a device circuit board so that it can be controlled using other devices when connected to the Internet, the main function of the Internet of Things is that tools or items are connected to a network so that they can be controlled easily by other devices, which allows these tools or items to be able to activate and disable it so that other devices can access data information (Ihza et al., 2022). Nowadays, technological needs are increasingly developing so rapidly. Apart from that, technological needs have begun to collaborate with any field. Therefore, the author is trying to create an IoT (Internet of Things) technology that is applied to four-wheeled vehicles to help users operate the car through an application (Juwariyah et al., n.d.).

A smart Car or what can be called a smart car is an Internet of Things system that is applied to cars so that the car has features that seem sophisticated and keeps up with current developments in the digital era so that the system applied to the car helps make it easier for users to operate (Juwariyah et al., n.d.). The Internet of Things (IoT) in the current era is developing in the world of technology and offers various features and options for controlling other devices, where these features can be used to control a car using voice protocol commands that have been created in the protocol program, and many more. IoT has a variety of features that are more than those mentioned above and will continue to develop to make life easier for people who use it (Mulyadi et al., 2019).

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This application will be developed using MIT App Inventor and Arduino IDE as software for developing Arduino systems and applications for mobile devices. Apart from these two applications, this application also uses relay technology as the main feature which is developed using software. Mobile Internet of Things was chosen because its development is relatively easier (Vernanda et al., 2018). The Internet of Things has been widely used in various fields, such as in the smart car sector which has been widely used to make it easier for users to operate cars. In developing this application, client-side programming languages such as Javascript, C++, and Kotlin were chosen so that later this application could be implemented on various mobile operating system platforms. For now, applications will be developed on the Android platform because according to a survey I conducted, Android use in Indonesia dominates (Soedjarwanto, 2021). This research was carried out to create new ideas that utilize the Internet of Things technology and make it easier for car users or car enthusiasts to add advanced system features to the cars they use.

METHOD

Literature Review

Development of Smart Door Lock for additional system technology with servo motors using MCU node. In the system being built, the door can lock and unlock after controlling the remote that has been programmed. The difference between this research and smart car research lies in the target object being the car interior such as power windows, lights, air conditioning and so on which can be controlled on a smartphone (Soedjarwanto, 2021). Development of a Multi-Language Voice Control IoT Home Automation System Using Google Assistant and Raspberry Pi. This research discusses the connection between smartphones and Google Assistant through IFTTT, which in smart car research will also use the workings of the Multi-Language Voice Control IoT Home Automation system. Using Google Assistant and Raspberry Pi to create voice command protocols from smartphones (Munasinghe et al., 2019). IoT-Based Electronic Device Control System Using Voice Control. In the system built, the voice remote functions to control electronic devices which are equipped with relays as electrical circuit breakers. The difference between this research and smart car research lies in the application used in this research, Bylink, while in Smart Car research the Mit app inventor will be used (Artono & Susanto, 2019). Wireless sensor network systems and the Internet of Things are the introduction of wireless or cableless sensor network systems that utilize technology and WSN which can be applied in various sectors ranging from agriculture, education, industry and others, including applying Smart car system research (Artono & Susanto, 2019). Voice Recognition to Control and Monitor Robot Arms in IoT using a Smartphone is an Internet of Things system that utilizes IFTTT as an intermediary between Internet of Things devices and smartphones, then a voice protocol is used to control robot movement, which in Smart Car research will also utilize technology This is a voice protocol to control car injuries and other car features (Soedjarwanto, 2021).

Data Collection Procedures

The data collection procedures used by the author in this research are:

1. Power Window Schematic

A scheme is a picture or form of visualization of the interpretation of a concept (Arizal et al., 2023). In Fig. 1, there is a picture that contains the power window control on a car (Subani Muita, n.d.) which is very necessary in this research to find out the cable schematic that will jump to the relay module.

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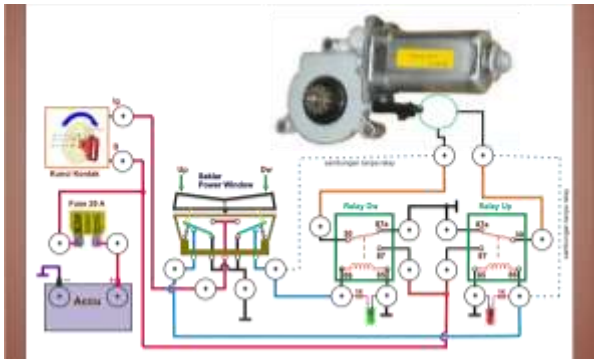

Fig. 1 *Power Window Schematic*
Source: https://sakhsondotcom.wordpress.com/2014/11/24/504/

2. Car AC Schematic

A schema is a picture or form of visualization of the interpretation of a concept (Arizal et al., 2023). In Fig. 2, there is a picture containing schematic data for the flow of AC electrical cables in cars (Mukhlis Akhmad, 2022) which is very necessary in this research to find out the part of the cable that will jump to the relay module (Mansfield, 2006).

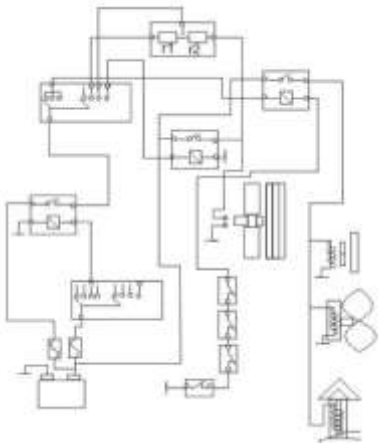

Fig. 2 *Car AC Schematic*
Source: http://reygareysa.blogspot.com/2014/01/rangkain-kelistrikan-ac-mobil.html

3. Head Lamp Schematic

A schema is a picture or form of visualization of the interpretation of a concept (Arizal et al., 2023). In Fig. 3, there is a picture containing schematic data on the electrical flow of the headlamp on a car (Arizal et al., 2023) which is very necessary in this research to find out the part of the cable that will jump to the relay module.

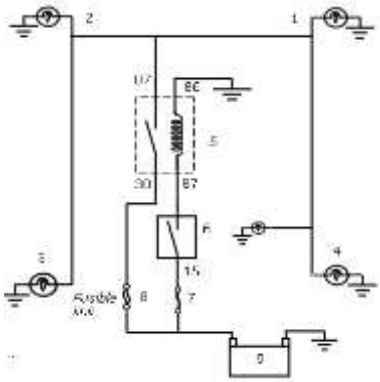

Fig. 3 *Head Lamp Schematic*
Source: https://moservice.id/news/rangkaian-komponen-lampu-kepala

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Business Rules

In general, control operations in the car interior are still done by pressing or turning switches, such as using power windows which require pressing the switch on the car door, using car air conditioning by pressing or turning the switch and using headlamps by turning the switch.

RESULTS AND DISCUSSION

Results obtained from interface design and UI program creation from prototype designs that have been created using the MIT App inventor tools. Contains a description of the Implementation Section which includes a description of the tools for the implementation stages, operating system, implementation tools, program algorithm, application input-output interaction display and initial stage implementation testing. For the network field, implementation contains the results of the network design being built, network supporting infrastructure and initial network testing (Putra & Nugroho, 2016). Software requirements: (a) MIT App Inventor, (b) Google Firebase, (c) Arduino Uno IDE, and (d) Windows 10. Hardware requirements: (a) Smartphone, (b) Laptops, (c) RAM, (d) Hard disk, (e) VGA, (f) Relay, and (g) Step Down.

The results of trials using the black box method on the application of the Smart Car System Implementation in Internet of Things Cars can be seen in Table 1.

Table 1
BlackBox

No	Data Input	Expectations	Observation	Conclusion
1	Navigation Voice controller	to be able to move pages	Successfully moved pages	Accepted
2	Button Speak	Hope you can access speech according to voice protocol.	Successfully access speech	Accepted
3	Navigation More	Can switch pages	Successfully switch pages	Accepted

Implementation

From the interface design and program creation, the results obtained can be seen in Fig. 4.

Fig. 4 *Dashboard Interface*

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The results of creating a UI from a prototype design that has been created using the MIT Appinventor tool. Then on the main menu, you will be presented with the voice controller page which can be seen in Fig. 5.

Fig. 5 *Voice Control*

Fig. 5 is the result of creating a program that has been run.

Dashboard Page Implementation

Implementation of the Dashboard page interface is an implementation of the application page used by application users which contains a menu about the Smart Car System.

Block dashboard page script

The dashboard page script block is a script to create the first page on the dashboard (Fig. 6).

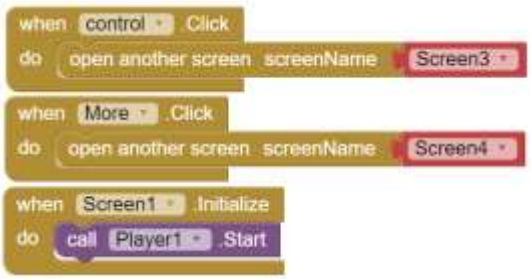

Fig. 6 *Script Block Dashboard*

Dashboard Page View

The Home page is the main page of the Smart Car System application. This page functions as a place to display menus about this application. The Dashboard Display can be seen in Fig. 7.

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Fig. 7 *Dashboard View*

Results

From the research I conducted, a prototype result of the Smart Car application can be drawn in Fig. 8.

Fig. 8 *Dashboard*

Fig. 5 is the start page or dashboard page when opening the Smart Car application, the dashboard page contains two menus, namely the Voice Controller and More menus. When you click the Voice Controller button, a loading page will appear in Fig. 9.

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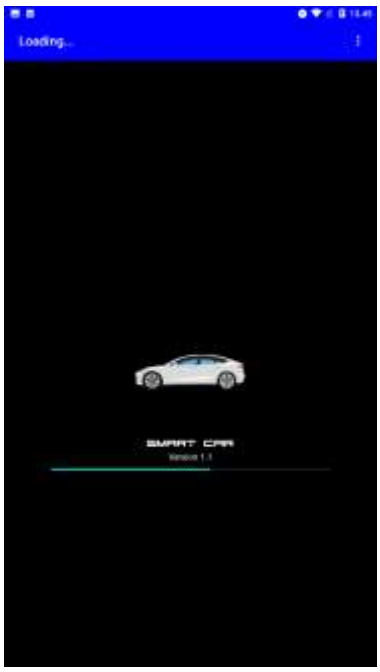

Fig. 9 *Loading*

Fig. 6 is the Loading page which appears when the Voice Controller button is clicked and will display the Voice Controller page after the loading process is complete, then the Voice Controller page will appear in Fig. 10.

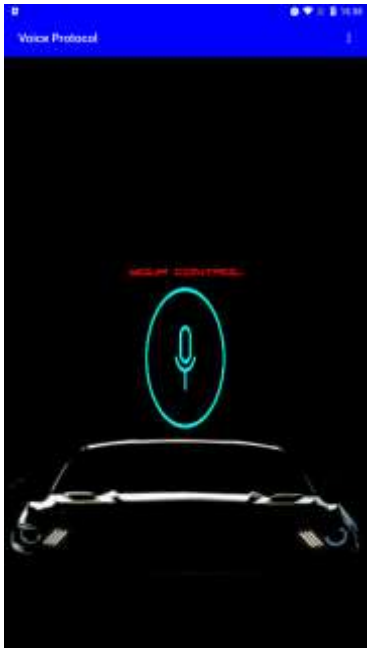

Fig. 10 *Voice Control*

Fig. 7 is the third page or control page when pressing the Voice controller menu in the Dashboard section of the Smart Car application, the voice control page contains control functions in the car to control the car interior such as headlamps, power windows and car air conditioning by pressing the Speak button on This control menu then says the control commands then the execution process in the car interior begins (Nonthaputha et al., 2021).

Next, the source code embedded in the ESP8266 is as follows:

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```
// Library
#include <FirebaseESP8266.h>
#include <ESP8266WiFi.h>
#include <WiFiClient.h>

#define RHeadlamp D1
#define RAC D2
#define UPPWR D3
#define UPPWL D4
#define DWNPWR D5
#define DWNPWL D6
String t = "0";
WiFiClient client;

// Firebase
#define FIREBASE_HOST "https://esp8266new-14394-default-rtdb.firebaseio.com/"
#define FIREBASE_AUTH "rMib4Ppssrlc2Xk2GXyhYoFza7KMcQ4Pw3UxWK6u"

//Nama Wifi
#define WIFI_SSID "RedmiNote12Pro"
#define WIFI_PASSWORD "orataksandi"

// FirebaseESP8266
FirebaseData firebaseData;

void setup () {
  Serial.begin(19200);
  // Wifi
  WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
  Serial.print("connecting");
  while (WiFi.status()!= WL_CONNECTED) {
    Serial.print(".");
    delay (500);
  }
  Serial.println();
  Serial.print("Connected with IP: ");
  Serial.println(WiFi.localIP());
  Serial.println();
  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Pmode();
}

void loop () {
  core ();
}

void Pmode(){
  pinMode (RHeadlamp, OUTPUT);
  pinMode (RAC, OUTPUT);
  pinMode(UPPWL, OUTPUT);
  pinMode(UPPWR, OUTPUT);
  pinMode(DWNPWL, OUTPUT);
  pinMode(DWNPWR, OUTPUT);
```

```
}
void core () {
  if (Firebase.getString(firebaseData, "/Path_read/headlamp")) {
    if (firebaseData.dataType() == "string")
    {
      String RLY = firebaseData.stringData();
      if (RLY == "1") {
        Serial.println("headlamp ON");
        digitalWrite(RHeadlamp, HIGH); }
      else if (RLY == "0") {
        Serial.println("headlamp OFF");
        digitalWrite(RHeadlamp, LOW);
          }
      else {Serial.println("Salah kode! isi dengan data 0/1");}
    }
  }
  if (Firebase.getString(firebaseData, "/Path_read/ac")) {
    if  (firebaseData.dataType() == "string")
    {
      String RLY = firebaseData.stringData();
      if (RLY == "1") {
        Serial.println("AC ON");
        digitalWrite(RAC, HIGH); }
      else if (RLY == "0") {
        Serial.println("AC OFF");
        digitalWrite(RAC, LOW);
          }
      else {Serial.println("Salah kode! isi dengan data 0/1");}
    }
  }
  if (Firebase.getString(firebaseData, "/Path_read/uppwR")) {
    if  (firebaseData.dataType() == "string")
    {
      String RLY = firebaseData.stringData();
      if (RLY == "1") {
        Serial.println("UPPWR ON");
        digitalWrite(UPPWR, HIGH);
        delay(3000);
        Firebase.setString(firebaseData, "/Path_read/uppwR", t); }
      else if (RLY == "0") {
        Serial.println("UPPWR OFF");
        digitalWrite(UPPWR, LOW);
          }
      else {Serial.println("Salah kode! isi dengan data 0/1");}
    }
  }
  if (Firebase.getString(firebaseData, "/Path_read/uppwL")) {
    if  (firebaseData.dataType() == "string")
    {
      String RLY = firebaseData.stringData();
      if (RLY == "1") {
        Serial.println("UPPWL ON");
        digitalWrite(UPPWL, HIGH);
```

```
      delay(3000);
      Firebase.setString(firebaseData, "/Path_read/uppwL", t); }
    else if (RLY == "0") {
      Serial.println("UPPWL OFF");
      digitalWrite(UPPWL, LOW);
        }
    else {Serial.println("Salah kode! isi dengan data 0/1");}
  }
 }
 if (Firebase.getString(firebaseData, "/Path_read/dwnpwR")) {
  if  (firebaseData.dataType() == "string")
  {
    String RLY = firebaseData.stringData();
    if (RLY == "1") {
      Serial.println("DWNPWR ON");
      digitalWrite(DWNPWR, HIGH);
      delay(3000);
      Firebase.setString(firebaseData, "/Path_read/dwnpwR", t); }
    else if (RLY == "0") {
      Serial.println("DWNPWR OFF");
      digitalWrite(DWNPWR, LOW);
        }
    else {Serial.println("Salah kode! isi dengan data 0/1");}
  }
 }
 if (Firebase.getString(firebaseData, "/Path_read/dwnpwL")) {
  if  (firebaseData.dataType() == "string")
  {
    String RLY = firebaseData.stringData();
    if (RLY == "1") {
      Serial.println("DWNPWL ON");
      digitalWrite(DWNPWL, HIGH);
      delay(3000);
      Firebase.setString(firebaseData, "/Path_read/dwnpwL", t); }
    else if (RLY == "0") {
      Serial.println("DWNPWL OFF");
      digitalWrite(DWNPWL, LOW);
        }
    else {Serial.println("Salah kode! isi dengan data 0/1");}
  }
 }
 delay(500);
}
```

Next, the database section uses Google Firebase (Fig. 11) as a data operation and connection bridge between the ESP8266 and the Smart Car Application on the smartphone.

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Fig. 11 *Google Firebase*

Fig. 11 is Google Firebase in the real-time database menu which displays posts and gets data from the ESP8266. Next is the sourcode of the Smart Car Controller application which was created using MIT App Inventor.

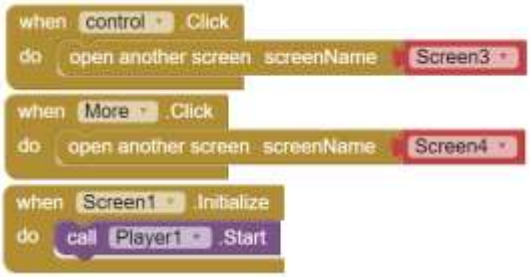

Fig. 12 *Sourcode Dashboard*

Fig. 12 is a source code image on the dashboard page of the Smart Car application.

Fig. 13 *Sourcode Loading*

Fig. 13 is a source code image on the Smart Car application loading page.

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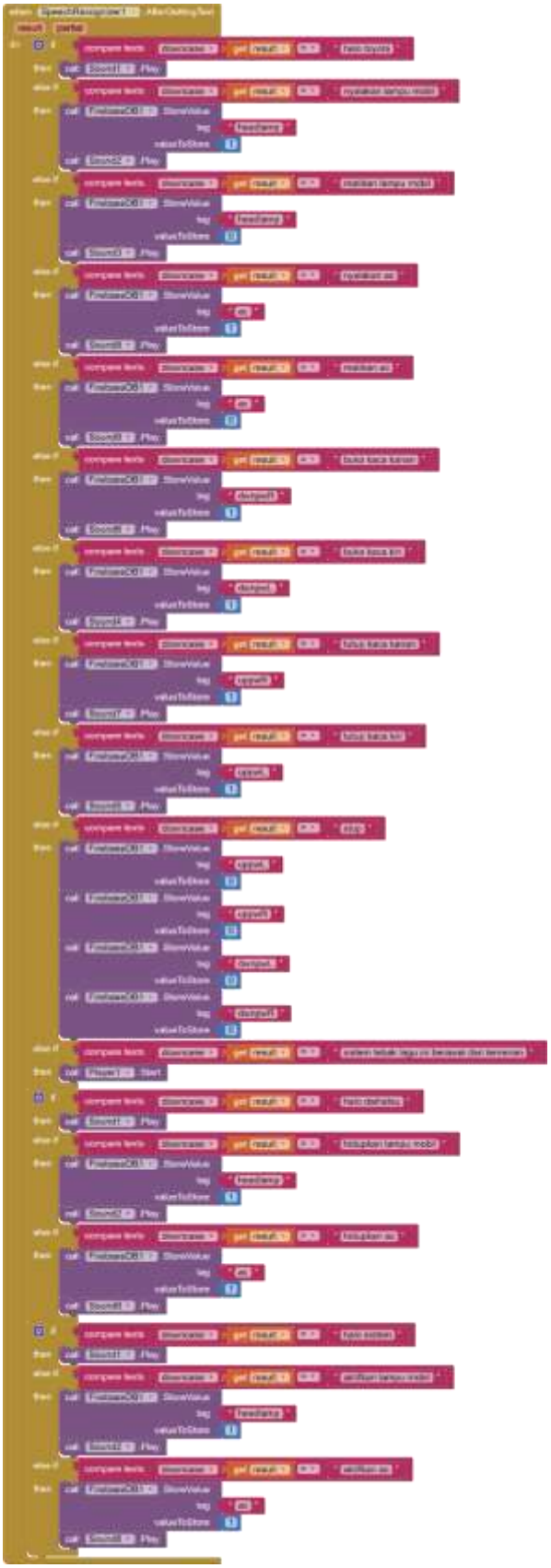

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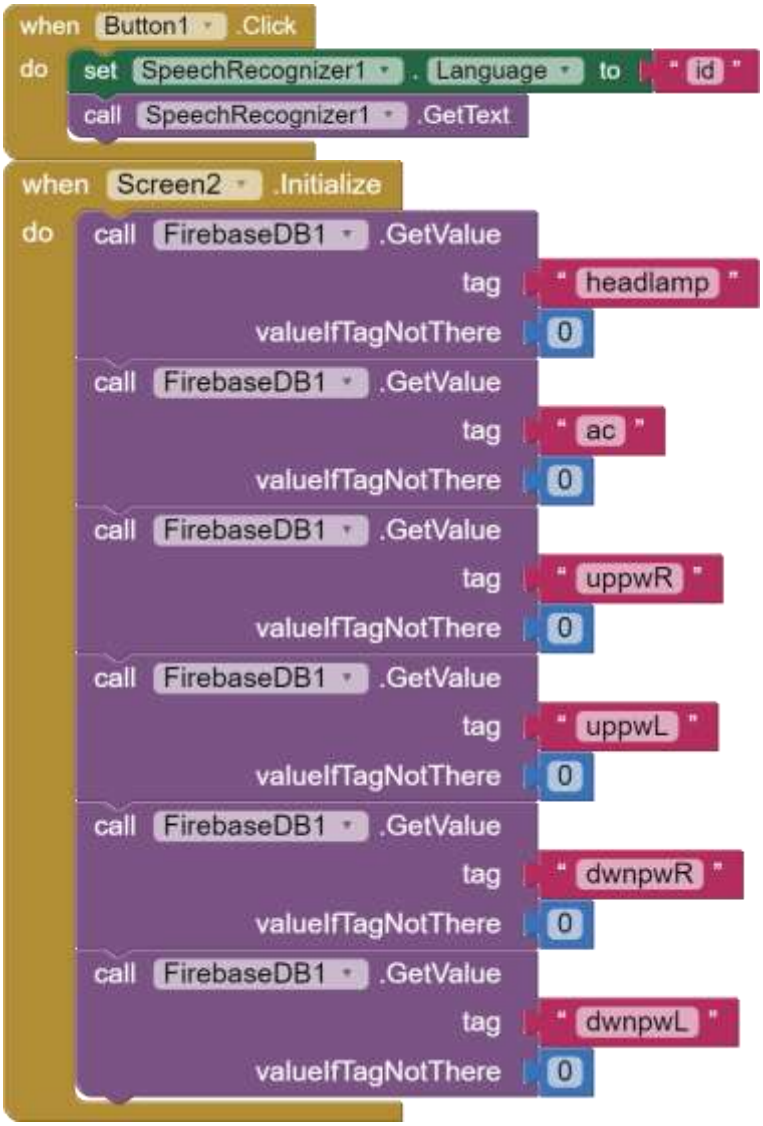

***Fig. 14** Sourcode Control*

Fig. 14 is a source code image on the Smart Car application control page.

Discussion

Through discussions, car enthusiasts suggested that the voice control system be packaged in the smallest possible form because according to them, small packaging would make it easier to place in the car. Fans of car variations also say that this system is very unique and needs to be developed in the world of the Internet of Things and automotive technology. From discussions held with car enthusiasts, it was concluded that you do not need to buy an expensive car to get advanced features on your car, but with this system, older cars can use it.

CONCLUSIONS

Based on the results of the analysis carried out on the Smart Car System as an additional tool or accessory for the interior and electricity of four-wheeled vehicles that utilize the Internet of Things as a tool or medium to help make driving a car easier. To be more effective and sophisticated, it can be concluded that control could be done using a smartphone or Android-based head unit in a car and this application could be used as a practical medium when driving a car. The author will always update the system and circuit to provide maximum performance for the Smart Car System.

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