



Prototype Of Wheel Suggestion Control Using Android Based On Arduino Uno R3

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Abstract

Development of a wheeled suitcase prototype with arduino-based technology, so that the suitcase can run using its own Android to move the wheeled suitcase. The suitcase control method can use Gesture mode, namely the buttons that have been provided on Android to move the wheel. There is also a Gyroscope, which is a sensor used to track rotation or rotation of the movement device. In other words Gyroscope is referred to as a device that is used to maintain the orientation of an angle to remain stable. The experimental method of this research aims to make observations that are interconnected between cause and effect. After testing the wheeled suitcase using Gesture Mode in this study using the buttons provided by android to move as it should, and for Gyroscope Mode by maintaining the orientation of the android so that the suitcase moves according to the movement of the android. In testing the author has tested the distance of the android connection to the wheeled suitcase, the results obtained are a distance of 7 meters and it is still connected.

Keyword : Arduino, Gesture, Gyroscope, Prototype

Introduction

Airport or airport is an area on land and/or waters with certain boundaries that is used as a place for aircraft to land and take off, boarding and dropping passengers, loading and unloading goods, and places for intra and intermodal transportation, which are equipped with safety and security facilities. aviation security, as well as basic facilities and other supporting facilities [1]. Some people at the airport who go for vacation trips definitely need a suitcase, one of which is a wheeled suitcase, wheeled luggage is a solution for some people who are traveling. Problems arise when the user always pulls or pushes the wheeled suitcase in every activity so that the user feels uncomfortable with that condition and easily gets tired. The existence of technology in this life we can feel the benefits, because with the existence of technology it is very easy for us to carry out daily activities. On the other hand, technology is now leading to Internet Of Thing-based smarthomes. Internet Of Thing has a concept that aims to expand the benefits of being connected to an internet connection continuously [2]. With this, it is necessary to develop a prototype of a wheeled suitcase that combines technology. so that the wheeled suitcase can move using Android users.

The purpose of this wheel suitcase prototype control feature using Android is to change the manual work system of the wheel suitcase from being pulled or pushed to automatic using Android. And the benefits of a wheeled suitcase prototype to facilitate user activities. And the method of controlling the wheel suitcase prototype can use two ways, namely using Gesture, namely the buttons that have been provided on Android to be able to move the wheel suitcase prototype. Can also use Gyroscope Mode, Gyroscope is a sensor device that is used to track the rotation or rotation of a device based on movement. In other words Gyroscope is referred to as a device that is used to maintain the orientation of an angle to remain stable. In activities such as tilting or rotating the phone, the Gyroscope works with the help of the Accelerometer[3]. The hope of this wheeled suitcase prototype can be used by anyone, whether it's families or students, workers, traditional dancers to musicians because they always carry a lot of things when traveling.



Methodology

Research methods

The research method used is the experimental method. This experimental method aims to make observations that are interconnected between cause and effect. The method in this research is as follows:

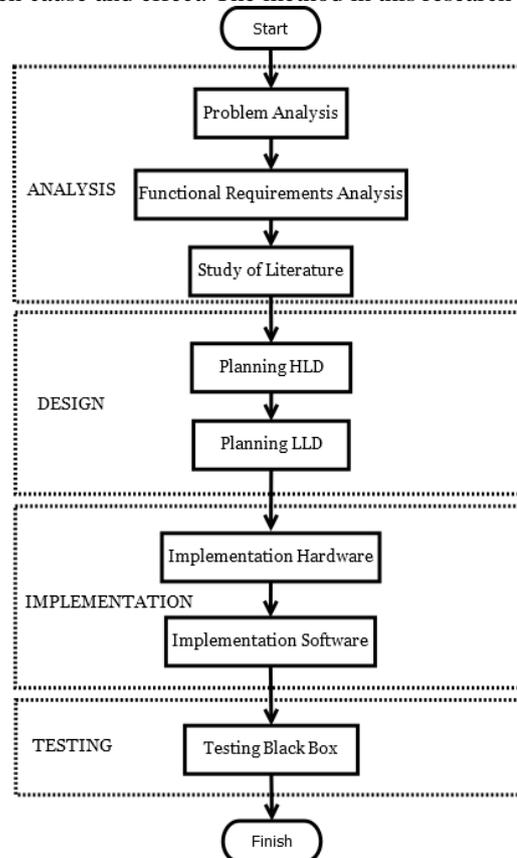


Figure 1 Implementation Method

This research method consists of four stages, namely Analysis, Design, Implementation and Testing.

Analysis

At the analysis stage, it consists of three parts, namely problem analysis, functional requirements analysis, and literature study. The analysis of the problems described in the first chapter and then in the analysis of functional requirements has three types of needs, namely user needs, system requirements and developer needs. While the last one at this analysis stage is a literature study that is needed to study the extent to which research on wheel luggage controllers has been carried out by previous researchers. Literature study is a description of a theory or findings obtained from reference materials to serve as the basis for research activities. It aims to develop a clear frame of mind from the formulation of the problem under study [4].

Design

At the Design stage consists of designing HLD and LLD. The HLD is a high-level design made at the outset, it provides a high-level view of the entire system setup depicting the relationships of various systems and functions that combine to provide the desired solution. While the LLD was created to follow in the footsteps of HLD and provide detailed and in-depth information about HLD.

Implementation

Implementation is the stage of application and testing for products based on the results of the analysis and design that have been carried out previously. The implementation stage is the process of implementing all that has been designed and in this implementation describes the application of software and hardware.

Testing

Testing this research using the Black Box is a test that can be done by making observations, on the results of execution through some test data and checking the functionalities contained in the software [5].

functional requirements analysis

at this stage are functional requirements, are:

user requirements: a. Request Pin and MAC Address HC-06. b. Move Forward, Backward, Turn Left, Turn Right. c. Gesture Mode and Gyroscope Mode.

developer requirements: a. Device Controller. b. Communication between Gadget and Device. c. Gesture Mode and Gyroscope Mode. d. Move Forward, Backward, Turn Left, Turn Right. system requirements: a. Arduino. b. Bluetooth. c. Sending Pin and MAC Address HC-06. d. Motion Forward, Backward, Turn left, Turn Right notifications. e. Gesture Mode and Gyroscope Mode.

Design

Planning HLD

Context Diagram Level 0

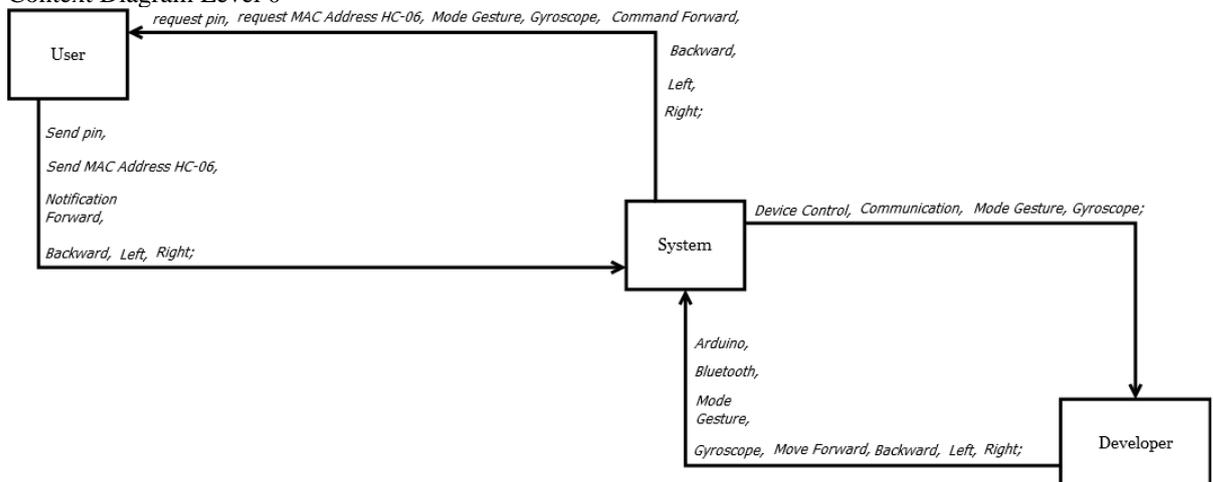


Figure 2. Context Diagram

The diagram above describes the needs of users, systems and developers. User needs are commands for moving forward, backward, left, right. System requirements from users are notification of forward, backward, left, right motion. While the system requirements from the developer are device control, communication, Gesture Mode and Gyroscope. And the developer needs are Arduino, Bluetooth, forward, backward, left, right motion programs.

Planning LLD

Flowchart Level 1

The flowchart explains the stages of communication between Android and the device and the use of modes that are applied by the user.

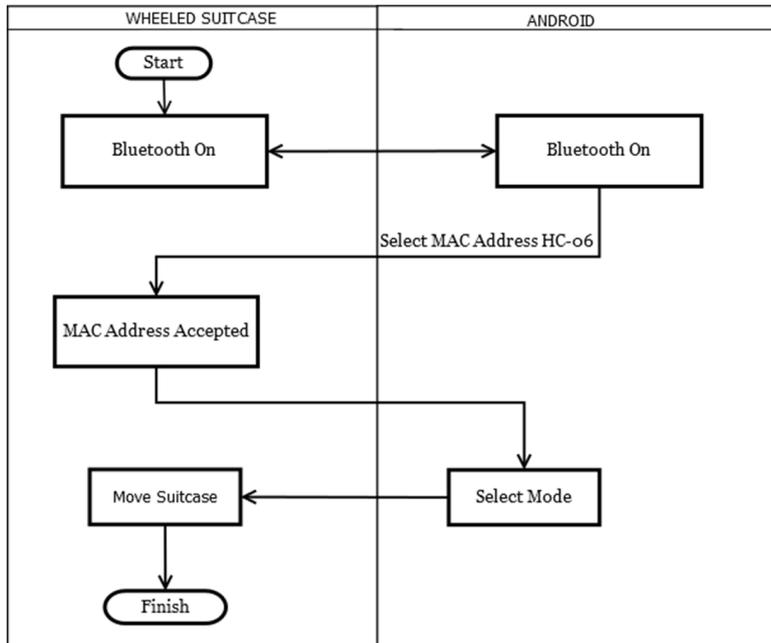


Figure 3 Flowchart Level 1

Block Diagram Level 1

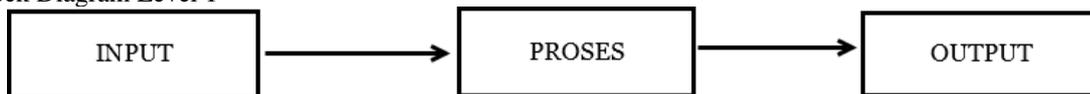


Figure 4 Block Diagram Level 1

Block Diagram is a model whose main function is to model input, process, output or a transaction using predetermined symbols.

Block Diagram Level 2

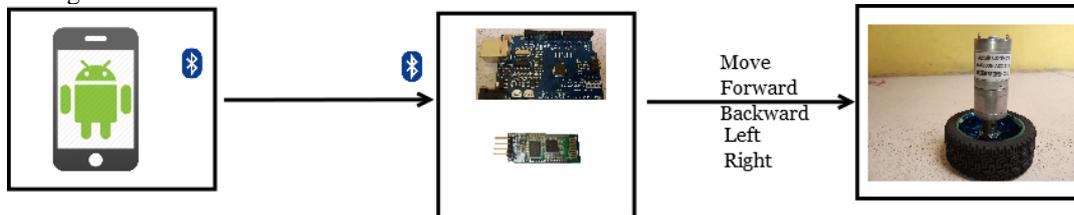


Figure 5 Block Diagram Level 2

The picture above explains that the input is Android, the data on android is sent via Bluetooth and captured by the Bluetooth HC-06 then submitted to Arduino for inspection so that the output wheel of the suitcase can move.

Sequence Diagram Level 2

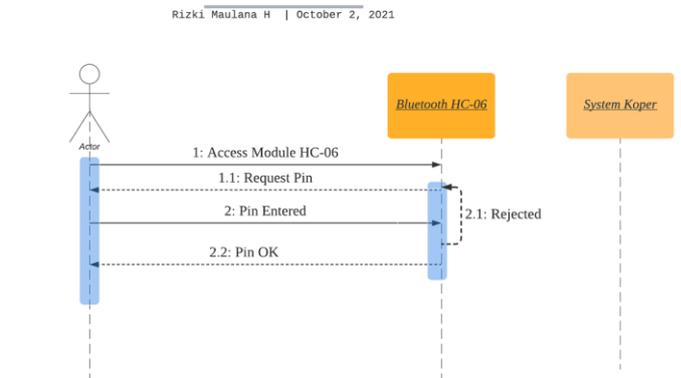
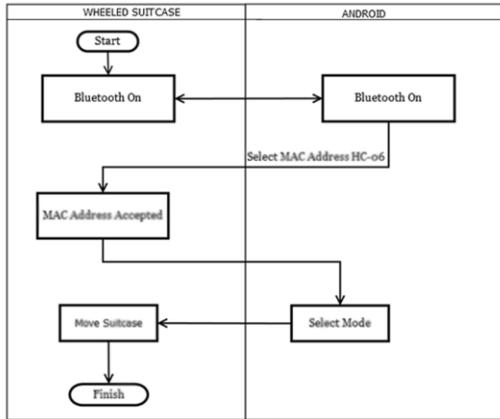


Figure 6 build connection

A sequence diagram is created based on the explanation of each action in the FlowChart to establish an Android connection with Bluetooth HC-06 on the Wheeled Suitcase Prototype.

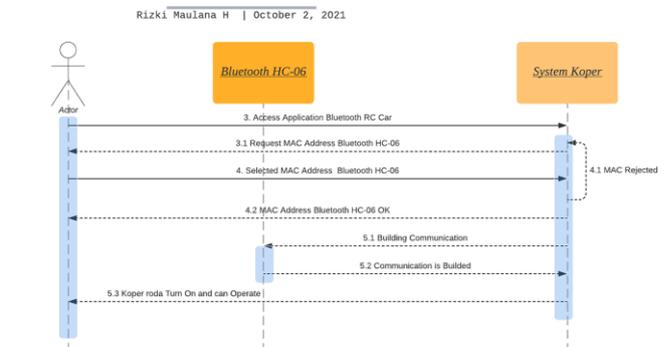
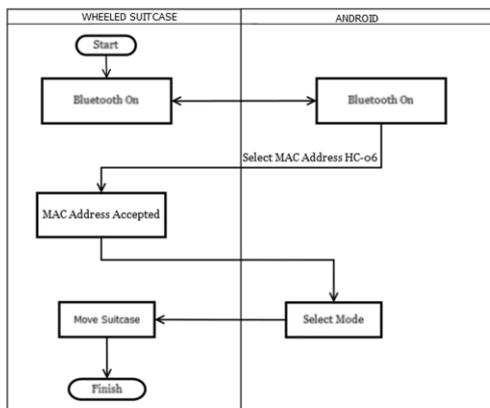


Figure 7 Bluetooth MAC Address Selection

In the Sequence diagram that refers to the FlowChart there is also an explanation of how to select the HC-06 Bluetooth MAC Address.

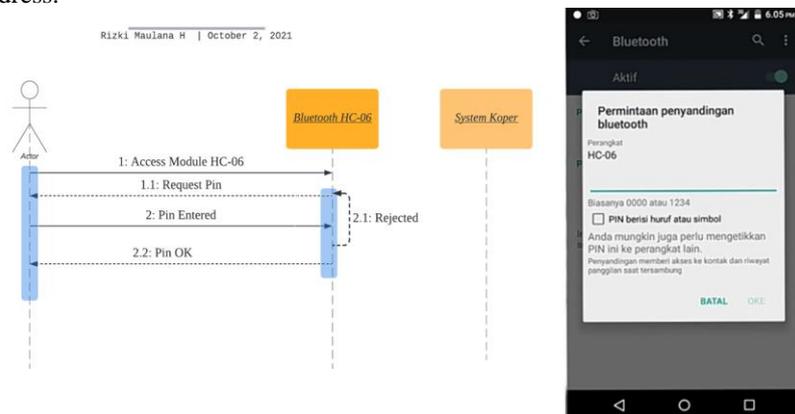


Figure 8 Bluetooth connection user interface

The picture above is the Bluetooth communication User Interface which is translated in the form of a Sequence Diagram.

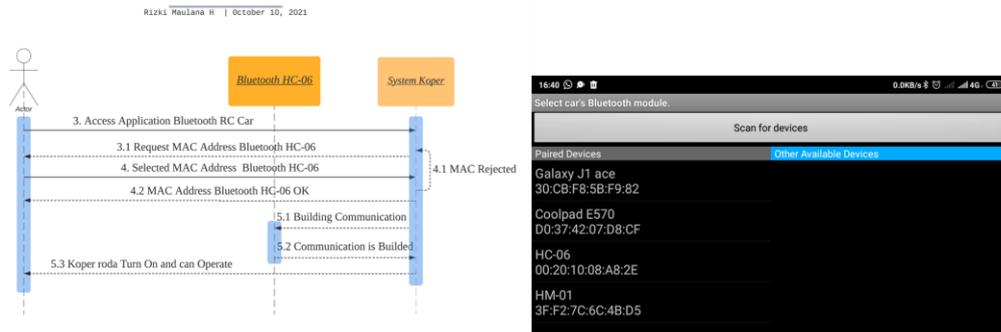


Figure 9 Bluetooth MAC Address selection user interface

The picture above is the User Interface for selecting the MAC Address Bluetooth HC-06 which is translated in the form of a Sequence Diagram.

State Machine Automata Level 2

The last stage in this LLD implements a State Machine as shown below:

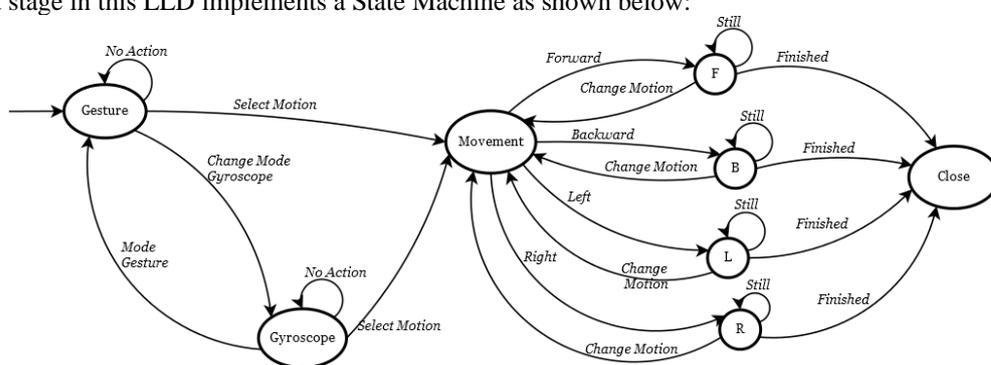


Figure 10 State Machine Automata

The theory of language and automata is the first component of computer science, which is the model and fundamental idea of computing. So it is not an engineering technique for the design of computing systems, which includes hardware and software, especially the application of design theory. But only limited to a model that will later be developed to produce these engineering techniques [6].

Research material

Arduino

Microcontroller is a digital electronic device that has input and output as well as control with programs that can be written and erased in a special way, the way the microcontroller actually works is to read and write data [7]. "Arduino is an electronic kit or open source circuit board in which there is a main component, namely a microcontroller chip with the AVR type (Alf Vegard's Risc Processor) from the Atmel company". Each digital pin on the Arduino Uno board can be used as input or output. By using the pinMode(), digitalWrite() functions. These pins operate at 5V. In addition some pins have special functions: a) Serial: 0 (RX) and 1 (TX) are used to receive (RX) and transmit (TX) TTL serial data. This pin is connected to the corresponding pin of the ATmega8U2 USB-to TTL Serial chip. b) External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. c) PWM: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). This pin supports SPT communication using the SPT library. LED: 13. There is a digital pin 13 LED on the board. When the pin is high value (HIGH), the LED is on (ON), when the pin is low value (LOW), the LED is off (OFF). d) Arduino Uno has 6 analog inputs, labeled A0 through A5, each of which provides 10 bits of resolution (i.e. 1024 bits of different values). By default, 5V from Ground[8].



Figure 11 Arduino Uno R3

Module Bluetooth HC-06

Bluetooth is a form of wireless data communication based on radio frequency. The main use of this Bluetooth module is to replace serial communication using cables. Bluetooth consists of two types of devices, namely Master (data sender) and Slave (receiver). The HC-06 module from the connection manufacturer by default is set at 9,600 bps (can be customized between 1200 bps to 1.35 Mbps). The HC-06 Bluetooth module only acts as a slave device[9]. In this study using Bluetooth HC-06.



Figure 12 Bluetooth HC-06

Module Relay

According to the journal with the title "Design of a Home Light Control System Based on an Arduino Uno Microcontroller using a Smartphone", Adrianto (2015) wrote the definition of a Relay, Relay is an electronic component in the form of an electronic switch that will be controlled by an electric current. In principle, the relay works as a switch lever with a wire wound on an iron rod (solenoid) nearby. When the solenoid is electrified, the lever will get a magnetic field pull generated by the solenoid so that the switch contacts will close. When the current is not received by the solenoid, the force will disappear, and the switch will open again [10]. In this study using a 2 Channel PWM Speed Controller Relay Module 24V 3A.



Figure 12 Relay PWM Speed Controller 24V 3A

Buzzer

Buzzer is a component that has the function of converting electric current into sound. And basically the working principle of the Buzzer is almost the same as the Speaker. The buzzer consists of a diaphragm that has a coil. When the coil is electrified, it depends on the polarity of the magnet. Because the coil is mounted on the diaphragm, every diaphragm vibration is back and forth so that the air vibrates and produces sound [11].



Figure 13 Module Buzzer

Motor DC

DC motor is a type of electric motor that works using a DC voltage source. DC or direct current motors as the name implies, use direct and indirect current / direct-unidirectional. DC motors are used in special applications where high torque ignition or constant acceleration is required for a wide speed range [12].



Figure 14 Motor DC 12V

Smartphone Android

According to the journal entitled "Design of a Home Light Control System Based on an Arduino Uno Microcontroller using a Smartphone", Williams & Sawyer (2011) wrote the definition of an Android Smartphone, Smartphone is a cellular phone with a built-in microprocessor, memory, screen and modem. Smartphone is a multimedia phone that combines the functionality of a PC and a handset to produce a luxurious gadget, where there are text messages, cameras, music players, videos, games, email access, digital tv, search engines, personal information managers, GPS features, internet telephone services and there's even a phone that doubles up as a credit card[13]. Android is an operating system designed by the Google company based on the Linux kernel and also various software such as Open Source and others. Mobile phones that use Android can be used for devices with touch screens such as smartphones and tablet computers [14].

Table BlackBox

Table 1 Table BlackBox

test scenario	test case	Expected results	Test result
Mode Gesture			
move forward	press up arrow key	Prototype Suitcase wheels moving forward	Succeed
Move Back	press down arrow key	Prototype Luggage wheels move backwards	Succeed
Turn left	press left arrow key	Prototype Suitcase wheels turn left	Succeed
Turn right	press right arrow key	Prototype Suitcase wheels turn right	Succeed
Mode Gyroscope			
Move forward	Android position point forward	Prototype Suitcase wheels moving forward	Succeed
Move Back	Android position point back	Prototype Luggage wheels move backwards	Succeed
Turn left	Android position tilt to the left	Prototype Suitcase wheels turn left	Succeed
Turn Right	Android position tilt to the right	Prototype Suitcase wheels turn right	Succeed
Connection distance test		test result	



1,4 m	Succeed
2 m	Succeed
7 m	Succeed

Result

Gesture Mode

To use gesture mode, users simply press the buttons available on Android to be able to operate the wheeled suitcase.



Image 3.1 Move Forward Gesture Mode

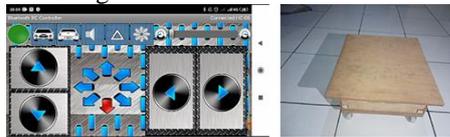


Image 3.2 Move Back Gesture Mode



Image 3.3 Turn Left Gesture Mode



Figure 15 Turn Right Gesture Mode

Gyroscope Mode

to use the gyroscope mode, the user simply measures or maintains the orientation of his android so that he can operate the wheel suitcase.



Image 3.4 Move Forward Gyroscope Mode



Image 3.5 Move Back Gyroscope Mode



Image 3.6 Turn Left Gyroscope Mode



Figure 16 Turn Right Gyroscope Mode

Conclusion

In this study, several conclusions can be drawn: 1. The suitcase Prototype communication with Android via Bluetooth. 2. Users can use Gesture or Gyroscope mode on the Bluetooth RC Car application installed on Android to operate the Wheeled Suitcase Prototype. 4. The programming language embedded in Arduino Uno R3 is C programming.

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