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AB Smart Fonkey

In partial fulfilment of the requirements for the degree of

Bachelor of Science in Computer Science

Supervisor: Asghar Ali Shah

Department of Computer Sciences

Bahria University, Lahore Campus

January 2019

Certificate

We accept the work contained in the report titled

"AB SMART FONKEY",
written by

BILAL HASSAN KHOKHAR
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as a confirmation to the required standard for the partial fulfilment of the degree of
Bachelor of Science in Computer Science.

Approved by:

Supervisor: ASGHAR ALI SHAH

_____ (Signature)

January 25$_{th}$, 2019

DECLARATION

We hereby declare that this project report is based on our original work except for citations and quotations which have been duly acknowledged. We also declare that it has not been previously and concurrently submitted for any other degree or award at Bahria University or other institutions.

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Date   :   _____

Specially dedicated to

my beloved father (Shahid Hassan Khokhar)

(Bilal Hassan Khokhar)

my beloved father (Syed Manzar Sibtain)

(Syed Mujtaba Sibtain)

ACKNOWLEDGEMENTS

AB SMART FONKEY

ABSTRACT

The objective of this device is used to control user car functionalities. User can control his/her car by his/her smartphone. Everything is getting smarter now days, so user car keys should be smarter. Our project will turn user's ordinary car key into smart keys with the help of smartphone. Fonkey device will be installed on user's car, this device will communicate through smartphone with the help of "Bluetooth". User's has just need to connect this device by Bluetooth with pairing of each other to putting right password and able to control car some functionalities i.e., ignition, AC/FAN, LOCK/UNLOCK, TRUNK.

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NOW YOU CAN CONTROL YOUR CAR FEATURES BY YOUR SMARTPHONE.

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AC/FAN

Handbrake

Multiple User

CHAPTER 1

INTRODUCTION

1.1 Background:

Everything is getting smarter now a day's, even TV's and A/C's are smarter, so why not User car keys get smart. Our project will turn user's ordinary car keys into a smarter key. Now a days mobile phones become a basic need for everyone. People can't think to live a day without their smartphones. FonKey will allow user to control his/her car function using his/her mobile phone like user can unlock or lock and start the engine, control car A/C and many more functions.

Humans are not machines, so mistakes can happen. There are many problems in the existing systems which are as follow:

- User has lost his car keys.
- User has forgotten his keys inside the car and car is locked.
- User has mistakenly taken the keys with him/her outsight and there is an emergency at home and they can't access the car without the keys.
- User parked his car under the sun, when he returns the car is too hot and it's uncomfortable to sit inside the car.
- Don't have enough spare keys for everybody at home.

1.2   Smart FonKey

Our purpose is to make a digital key for any car so the user doesn't have to face any problems like keys missing or lost, in the future. FonKey eliminates these problems and provides many functions i.e. Ignition, Lock/Unlock, Protection, AC/Fan, Trunk.

1.3   Need for FonKey:

This System is designed to overcome some problem related to car keys like sometimes, you can't find your keys, or your keys are inside the car and the car is locked and there is no spare key around. You parked your car under the sun and when you came back its too hot and uncomfortable to sit inside the car. FonKey can overcome these problems very easily. Now a day everybody owns a phone, so this system converts your phone into your car keys, so you don't need to worry about your car key anymore.

1.4   Smart FonKey and its applications:

FonKey will allow user to control car function using user smartphone. FonKey eliminates these problems and provides many functions.

- To provide Protection
- To Lock/Unlock
- To Start the Engine
- To Open the vehicle Trunk
- To control AC/Fan
- To check Hand Brake Safety (when starting the engine)

1.5   Problem in Existing System:

Humans are not machines, so mistakes can happen. There are many problems in the existing systems which are as follow:

- sometimes user can't find the keys.
- while starting the car, sudden user goes out for the car for done some work when user's come back to sit his/her car, the car is locked and user's forget his/her keys inside the car, there is no spare key around.
- User parked car under the sun and when user came back its too hot and uncomfortable to sit inside the car.

FonKey can overcome these problems very easily. Now a day everybody owns a smartphone, so this system converts your smartphone into your car keys, so User has no need to worry about car key anymore.

1.6   Components of Fonkey:

FonKey proposes a system which consists of two parts, Hardware and Software. The hardware is installed in the vehicle which can be controlled by smartphone using an app. The hardware installed in the vehicle can control some function of the vehicle. In the hardware a microcontroller is used which is controlled by the app using the Bluetooth of the smartphone.

There is a Bluetooth module in the device which connects with smartphone to send and receive data between controller and the smartphone. It's easy to use and no need to worry about car keys anymore.

1.6.1   Main Modules:

FonKey have two main modules which are as follow:

- Software (includes android app)
- Hardware (design a microcontroller circuit)

1.6.2   Software:

App uses the smartphone Bluetooth to communicate with the microcontroller. App Inventor for Android is an open-source web application originally provided by Google, and now maintained by the **Massachusetts Institute of Technology (MIT).[1]**

It allows newcomers to programming to create software applications for the Android operating system (OS). It uses a graphical interface, very similar to Scratch and the StarLogo TNG user interface, basically Scratch and StarLogo allow users to drag-and-drop visual objects to create an application that can run on Android devices. In creating App Inventor, Google drew upon significant prior research in educational computing, as well as work done within Google on online development environments**.**

1.6.3   Hardware:

It includes a microcontroller with is controlled by the app. The controller controls the vehicle functions. Bluetooth module for the communication between the smartphone and the controller.

CHAPTER 2

Introduction to System

2.1 Introduction to System

FonKey is electronic device which can be installed in any vehicle which is then can be controlled using any smartphone using the app. The installed device has the capabilities to control car some function in other words the car function is controlled by the App. FonKey has anti-theft function when turn on the car will not start with the key. It has a safety feature which will not start the car until the hand break is pulled, it also includes some other features like you can lock or unlock the car, open the car trunk, turn on the car A/C by starting the car from the app. The communication between the microcontroller and the app is by using the Bluetooth of the smartphone. First user has to paired with the device by using a given 6-digit alpha numeric code which will be the key of your car.

2.2 System Setup and Structure

FonKey is an electronic device which is used to control vehicle function and the device is controlled by smartphone through Bluetooth. FonKey consist of two parts which are as follow:

- Software
- Hardware

2.2.1 Software:

It includes an android app for the smartphone. App uses the phone Bluetooth to communicate with the device to send or receive data. App has some features which are as follow:

- User manually connects for the first time; next time it will automatically connect with the device.
- When the security function is on and the user disconnect with the device, next time when the user open and connects the app will automatically turn on the security button of the app.
- App will tell the user if the hand break is pulled or not when the user tries to start the engine. App will not allow to start the engine until the hand break is pulled.
- To program the microcontroller, we use Arduino IDE. It uses C/C++ language to write the code and then convert the code into assembly language and then upload the code into the controller. The controller receives data form Bluetooth module and the Bluetooth module receives data from the smartphone and the controller also send data to smartphone through Bluetooth module.
- The Arduino IDE also used to program the Bluetooth module and the code is upload in Bluetooth module with the help of another microcontroller.

2.3 Android Application:

We use online tool called MIT APP Inventor in which code blocks are used to make an android application. It easy to use and understand. Following are the steps to make the FonKey application.

2.3.1 Enter User License Agreement:

Following code block will show a user agreement when the application run for the first time. If the user accepts the agreement, then the **EULA function** will save the user choice in **TinyDB1** so when the application open next time this function check the user choice if the choice is **Accept** then it will open **Screen2** else it will show the agreement. The **Notifier1**show the agreement and get user choice through variable named **choice.** If the user choice is Cancel, then Notifier1 will close the application.

Connect Screen:

The first block "**BeforePicking"** will show a list of paired Bluetooth devices, user have to choose FonKey from the list.

The second block "**AfterPicking"** will first clear the saved address of the previous Bluetooth device and then save the address of the Bluetooth device picked by the user and if the device is in range and connected to FonKey device then the connect button image will change to Connected.

Database System:

First a global array name **bt_add_arry** is initialized which is used to store the address and name of the Bluetooth device. Function **save_bt_add** will save only address which will be at index of 1 of the array and store a check vale in check variable so when next time the application open then it will automatically connect to the previous device address. Function **clear_bt_add** will simply clear the address and check variable values.

Initialization:

This block simply checks if the data base has address of the device then it will call the **connect** function else it will do nothing whenever the screen2 is open.

Connect Function Screen:

When **connect** function is called it will connect to the stored address of the Bluetooth device in the data base and if the application is connected with the device it will change the connect button to Connected, else display short error message Unable to Connect.

Error Screen:

If the application is not connected with device and the user press some button and error will occur and it will show a short message FonKey Disconnected.

Protection Function Screen:

When the user tab protection button it first check that the application is connected or not, if connected then it will change the button image and send a variable **pro-on** to device and if engine is running or A/C, Fan is on then it will have turned them off and show a short message Car Security Turned ON. If the protection is ON and the user press it again then it will change the image to OFF and send a variable **pro-off** to device which will turn off the protection of the car.

Auto Protection Checker:

Whenever the application is connected this block will call a function **pro_check** which check the current state of the protection of the car by sending a check variable and receiving a check variable through which the application knows the state of the protection of the car. If the protection of the car was "ON" then it will change the protection image to Turned ON so user know that the protection was turned on.

Protection Check Function:

When this function is called it will send a check variable named **check_protection_status** to device and receive a variable in return from the device if the received variable is **1** then the application know that the car protection was turned on else it will do nothing.

Lock Function:

User just tap the lock icon button and the block below send a variable **lock** to device and the device lock the car doors. Then the application shows a short message Car Locked.

Unlock Function:

User just tap the unlock icon button and the block below send a variable to device and the device unlock the car doors. Then the application shows a short message Car Unlock.

Trunk Function:

User just tap the trunk icon button and the block below send a variable to device and the device open the car's trunk. Then the application shows a short message Trunk Open.

Fan Function:

When the user presses the fan icon button then code block below checks if protection is off and then send a variable **blower-on** which turn on the car fan and ignition if the user presses it again it will check if engine is running it will only turn off the fan by send a different variable **only-blower-off** else it only turns off the car fan by sending **blower-off**.

A/C Function:

When the user presses the A/C button then this block first check if the car engine is running by comparing the image of the start engine button if not then it will display a short message Please Start Engine First. If the engine is running and then the user presses the button then it will send a variable **ac-on** to device and the device turn on the fan and A/C both because A/C won't work without the fan the application then displays a short message Fan & A/C Turned ON, if the user presses the button again then it will turn off the fan and A/C by send a variable **ac-off** to device and the device turn off the car A/C and fan and display a short message Fan & A/C Turned OFF.

Closing the Application:

When user presses the smart phone back button it will display a message and if the user chooses "**Yes"** then this block will close the application else do nothing.

Engine Start Function:

When user presses the start button first it checks the protection is off by comparing the image of the protection button if not then it will display a short message Turn OFF Protection, if its off then it will send a check variable to device which will check the current status of the handbrake if the car handbrake is not pulled then the application will not receive the check variable from the device and then the application show a short message Please Pull Handbrake, if the car handbrake is pulled then the device send **2** to application and then it will know that the car handbrake is pulled so it will send the a variable **engine-on** to device which will turn on the car engine and display a short message Engine Started. When the user presses it again then it will send a variable **engine-off** to device which will turned off the car engine and display a short message Engine Stopped.

2.4 Hardware:

The hardware of the device consists of the following parts:

- **Microcontroller (ATMega328P-AU)**

    The controller is the brain of the device which control the vehicle functions when a command is received through Bluetooth module, when a command is received the controller process the command and check the conditions that apply on that command and when the conditions are satisfied the requested function of the vehicle is turned on.

- **Bluetooth Module (HC-05)**

This module has a range of 10 meters. It is used to send or receive serial data between the smartphone and the controller, it just works like a gate through which the data can go and come when the Bluetooth is connected. To connect with the Bluetooth module first the user has to paired with a 6-digit alpha numeric code.

- **Step-Down Buck Converter**

It is used to convert the DC 12volt into 5volt. It is used because the controller and the Bluetooth module operate on 5volts.

- **Relays**

Relays are like switches when a relay is energized through its coil it turn on and connect the two pins. In the FonKey device relays are used to operate heavy load functions of the vehicle.

- **IC (UNL2003)**

It is a NPN transistor IC which has 7 inputs pins and 7 output pins and 1 vcc pin, 1 ground pin. It takes positive signal on input pins and gives negative polarity on the respected output pin. In FonKey device it is used to turn on the relay and also trigger the lock/unlock and parking indicator function of the vehicle. Its input pins are controlled by microcontroller.

2.2 Main Aim and Work Environment:

The whole purpose of the project is to minimize the problems related to the car key and also to modify the old fashion key into smart and better by using the technology

we have today. Its work environment is very simple it can be installed in any vehicle by any good electrician, it also has a manual in which every instruction is descripted in detail about how to use and install it. Conclusion is to provide the effective solution of basic problems that a user faces related to the car keys. In future we hope to provide more function and facilities by using the modern technology.

2.5   Conclusion and Future Prospectus:

Conclusion is to provide the effective solution of basic problems that a user faces related to the car keys. In future we hope to provide more function and facilities by using the modern technology. It helps user to interact with their car in easy, smart and efficient way.

CHAPTER 3

System Analysis

3.1   Feasibility Study:

The project was subjected to a feasibility study to check the viability economically, technically and to complete in a timely manner.

3.2   Economic Feasibility:

With the rapidly decreasing cost of micro controllers, sensors and IOT devices, developing a basic Controller which is controlled by a smartphone is economically cheap and feasible. Small micro controllers and computers like raspberry pi and Arduino has made it easy, accessible and cheap to develop new digital products. With the growing resources in the open source world like Open CV and MIT App Inventor 2, you can develop products without investing capital in software.

3.3   Technical Feasibility:

Using an Arduino microcontroller to control the functions of the vehicle and controlling the Arduino with the smartphone by using the Bluetooth module, we can then control the functions of the car.

3.4   Tools & Technology:

There are some other tools which are used to build the electronic device like soldering iron, solder, multi-meter, wire cutter, wire strippers, PCB board on which the all components are connected. The following are the main components (includes hardware & software) used for the build of the FonKey device.

- Arduino Pro Mini (At Mega 328 micro-controller)
- Bluetooth Module (HC-05)
- Step-Down Buck Converter
- IC (UNl2003)
- Relays
- PnP Transistors
- Resistors
- Diodes
- Wires
- Smartphone
- MIT APP Inventor 2
- Arduino IDE
- Dip Trace (PCB Layout)

3.4　Operational Feasibility:

The proposed system is operationally feasible because of the following reasons:

- If the user left the key inside the and car has locked, he did not have to worry about it because FonKey is a digital key you just have to remember the password
- When the car is parked under the sun, its uncomfortable to sit in the car but with the FonKey you can turn on the car A/C and cool down the car.
- FonKey has an antitheft function when turned on, the car won't start even with the keys.

CHAPTER 4

System Study

4.1   Present System:

People use keys to open the vehicle door it's pretty old. If user parked the car under the sun then it became so hot and uncomfortable to sit in the car, or user parked the car in a suspicious area and user is worried about the car safety. Sometimes accidently left he/she keys inside the car and the doors of the car locked automatically then he/she has to call an expert to open the car. Now a day's everyone is in hurry. People don't want to waste their time and sometime its annoying when we can't find the keys and we are in a hurry. Now it's time to change the old fashion key style into smart and better style by using the technology today we have.

4.2   Proposed System:

FonKey is an electronic device which can be installed in any vehicle except for those vehicles which have key immobilizer, which is then can be controlled using any smartphone through the FonKey application. The installed device has the capabilities to control some function of the vehicle such as it can lock/unlock vehicle doors, start the vehicle engine, it can open the vehicle trunk if the vehicle doesn't have a motor then the user has to install the motor, fan of the vehicle can be turned on and Air Conditioner too, in other words the vehicle functions are controlled by the FonKey Application. FonKey device has a reset button which will turn off the engine of the vehicle and A/C & Fan. The reset button is necessary because when the user starts the

engine or A/C they can't be turned off by the key of the vehicle. The signal wire of the reset button can be attach with the key detection wire of the key ignition lock. FonKey has a safety feature which checks whether the hand break is pulled or not when the user tries to start the engine of the vehicle. If the hand break of the vehicle is not pulled and user press the engine start button to start the vehicle engine the controller will check the current status of the hand break and send the status to smartphone through Bluetooth module of the device, Application then show a notification that the hand break is not pulled up. User has to connect for the first time, next time the FonKey Application will automatically connect with the device when comes in the range of the Bluetooth. When the antitheft function is turned on and the user disconnect with the device, next time when the user connects with the device it will automatically tell the user that the antitheft function is turned on.

4.3   Key Features:

- Antitheft Function
- Lock/Unlock Function
- A/C Control Function
- Fan Control Function
- Start the Vehicle Engine
- Opening Trunk
- Hand break Safety (when starting the engine)

4.4   Context Level - DFD:

Fig.4.4

4.4.1 Level 1 DFD: For Device:
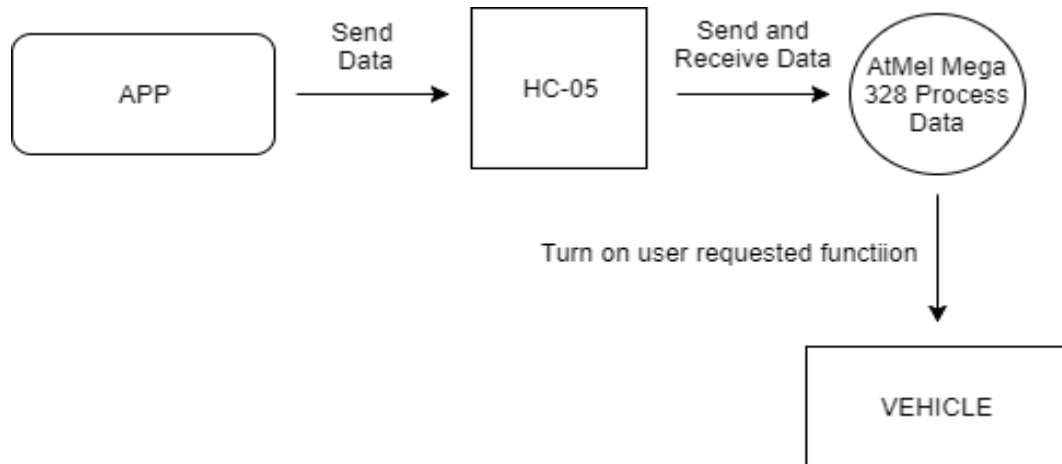
Fig.4.4.1

4.4.2 Level 1 DFD: For User:
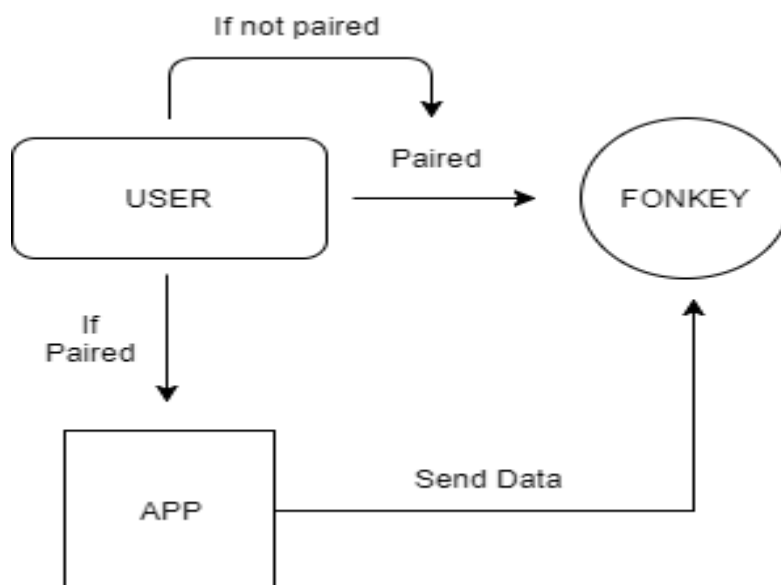
Fig.4.4.2

4.4.3 Level 2 DFD for device:
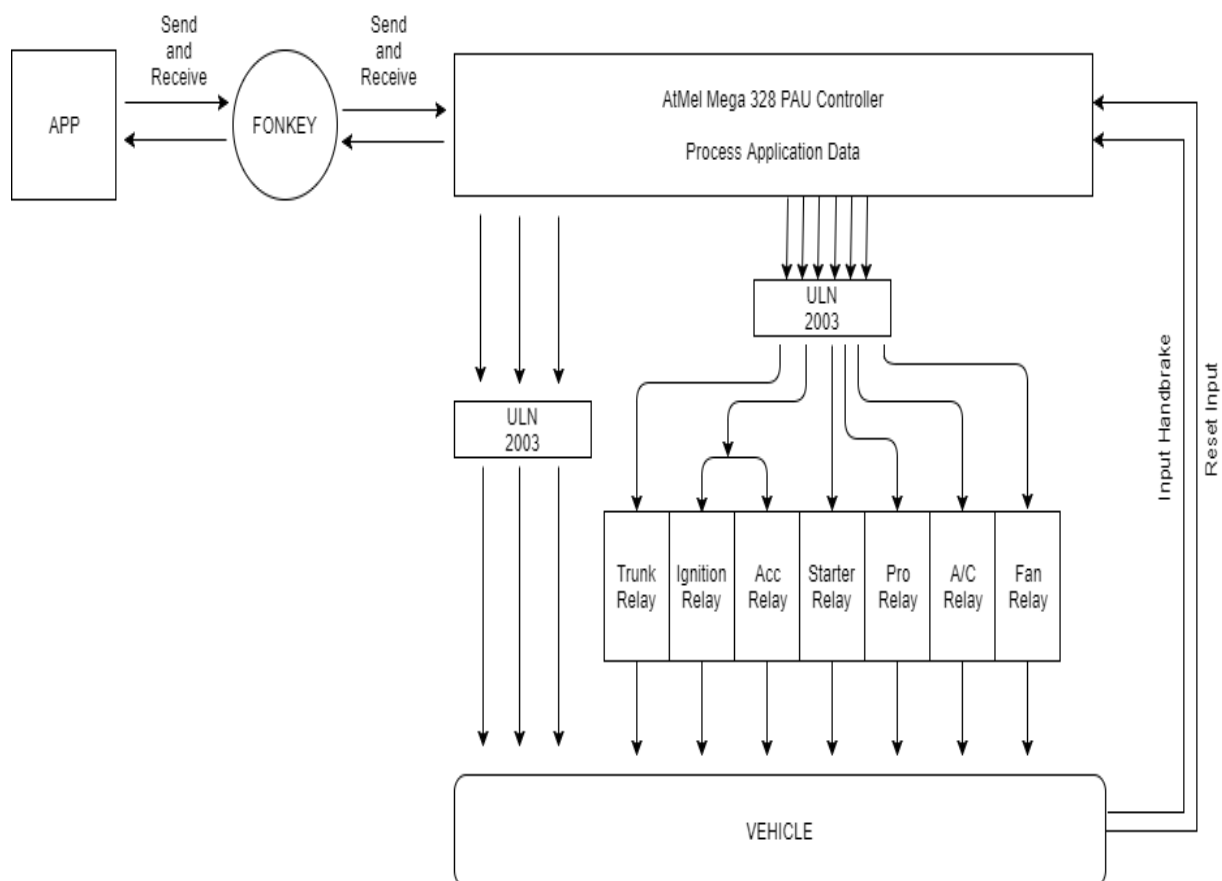
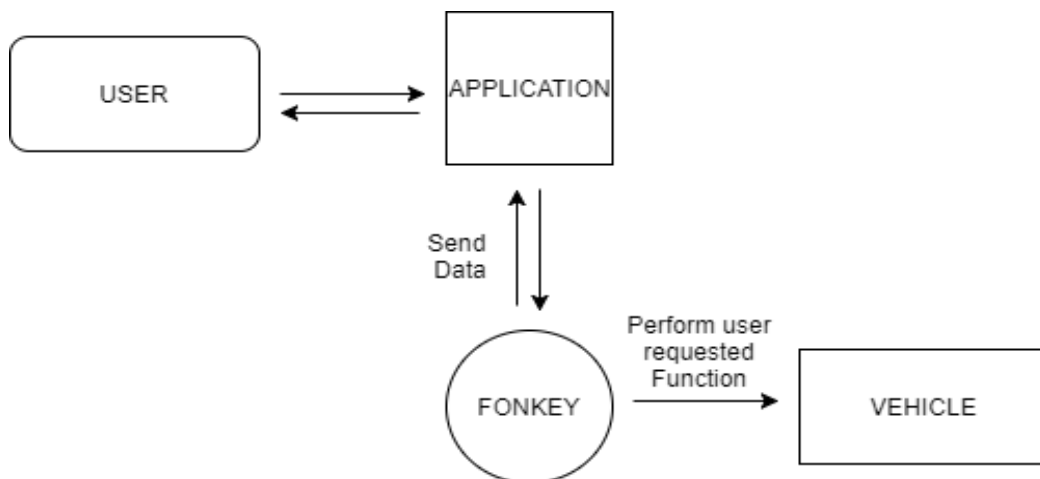**Fig.4.4.3**

4.4.4 Level 2 DFD for user:

Fig.4.4.4

4.5   Features Explained:

FonKey features are explained with diagrams how they work and what function they performed, following are the features:

4.5.1   Anti-theft Function:

When antitheft function is turned on ten the vehicle won't start with the key it cut the power in the ignition coil. If the user disconnects from the device and exist he application, next time when the user connects with device then the application turns the antitheft button green to notify the user that the antitheft function is turned on.
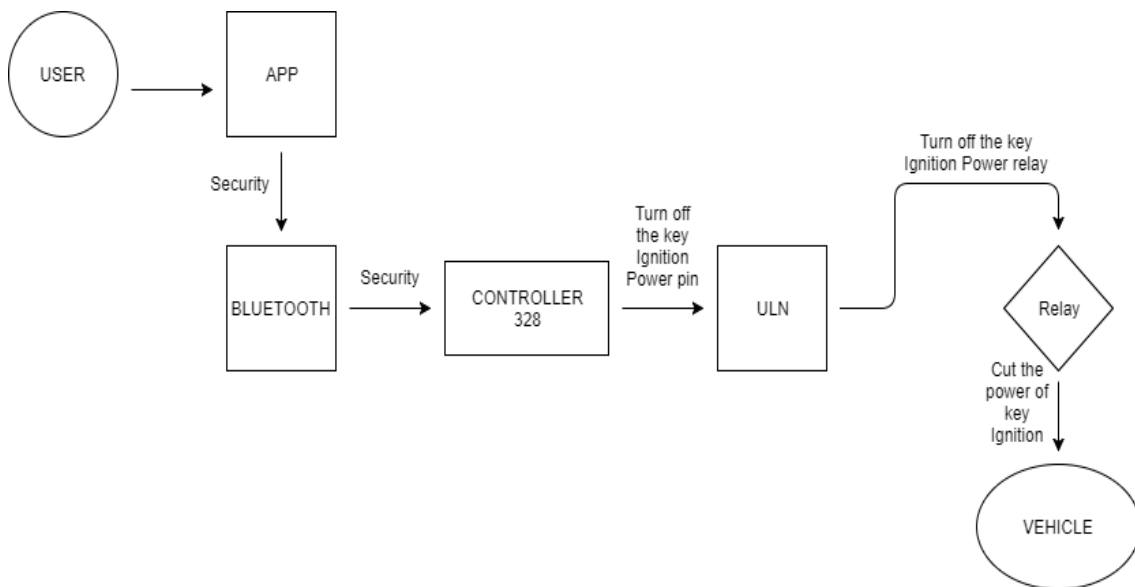
Fig.4.5.1

4.5.2 Lock Function:

User just have to tab the lock button from FonKey application and within seconds the doors of the vehicle will be locked. The device triggers a short pulse which will lock the doors of the vehicle.
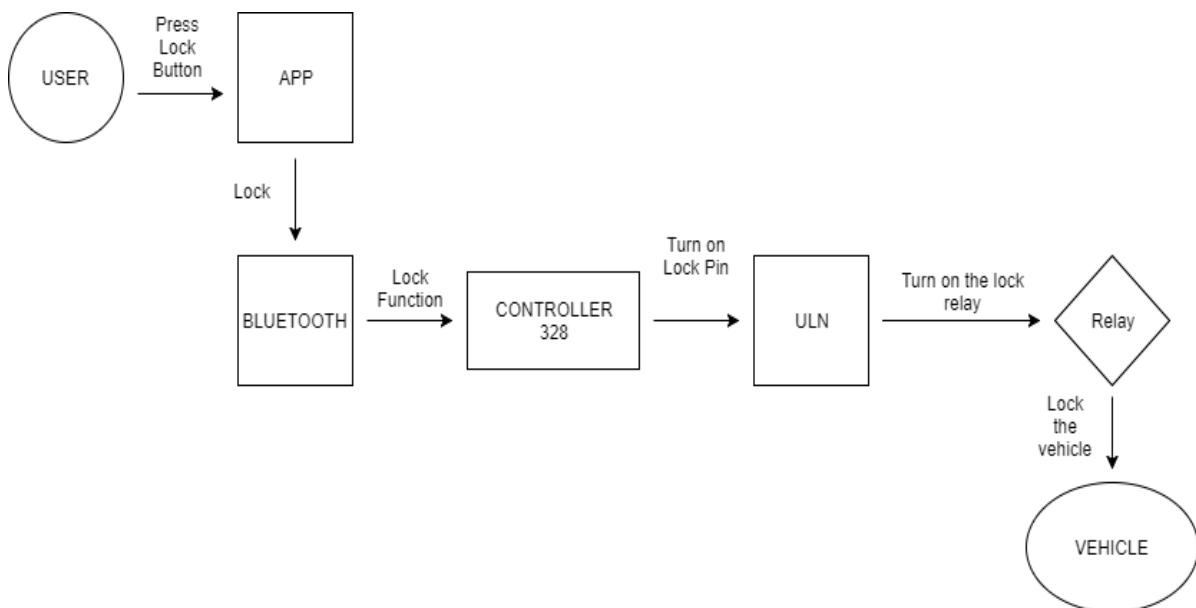
Fig.4.5.2

4.5.3   Unlock Function:

User just have to tab the unlock button from FonKey application and within seconds the doors of the vehicle will be locked. The device triggers a short pulse which will unlock the doors of the vehicle.
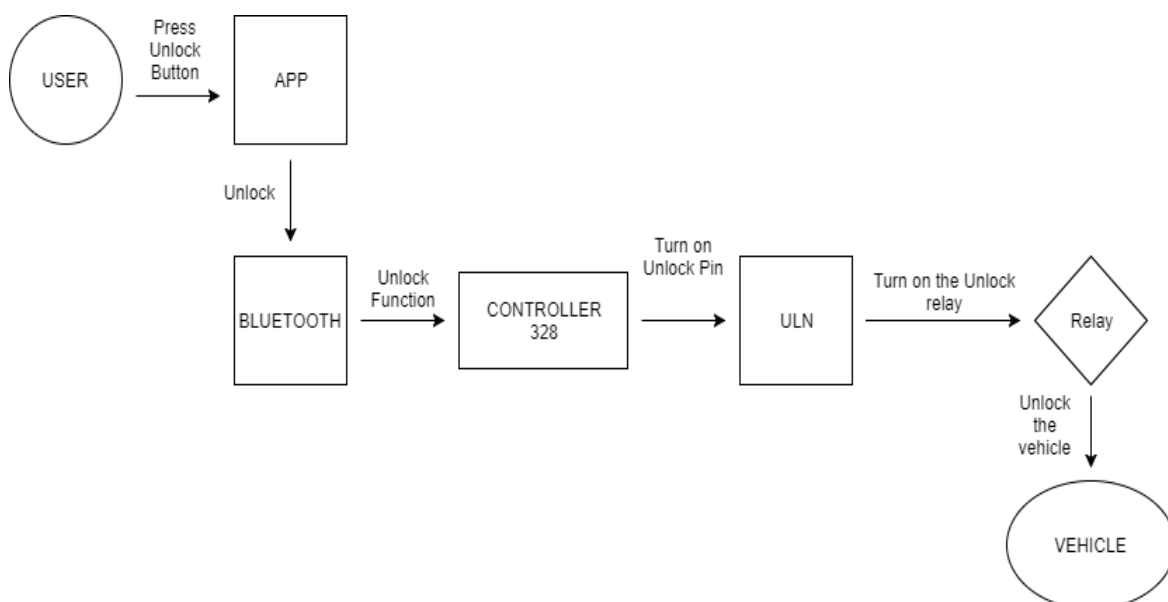
Fig.4.5.3

4.5.4   A/C Control Function:

To turn on the vehicle A/C user first have to start the vehicle engine. If the user presses the A/C button in application and the engine was not running then the application will show a short notification "Please Start the Engine" otherwise it will turn the fan and A/C.
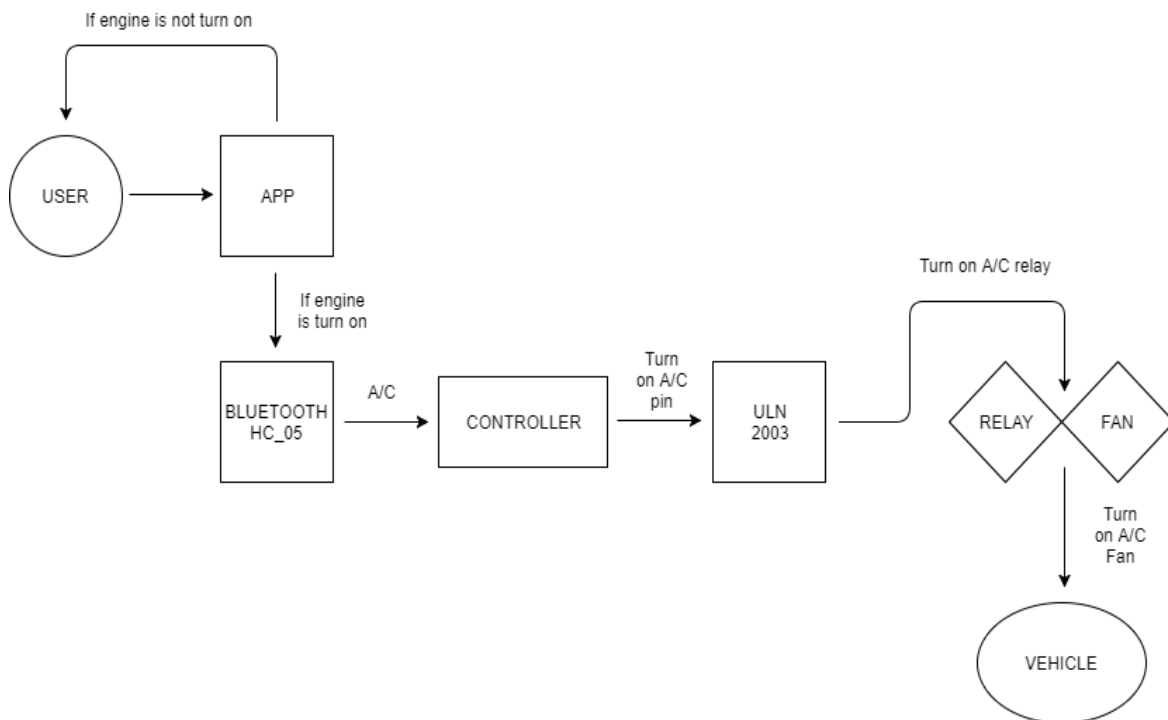
Fig.4.5.4

4.5.5   Fan Control Function:

When the user presses the fan button then the device turns on the ignition first and then the fan of the vehicle. Device can only control one speed of the fan and the speed of the fan cannot be changed by the application.

Text

If engine is not turn on

USER

APP

Turn on Ignition and
Fan relay

BLUETOOTH
HC_05

Fan

CONTROLLER
328

Turn on
Ignition
and
Fan pin

ULN
2003

RELAY

FAN

Turn on
Ignition and
then Fan
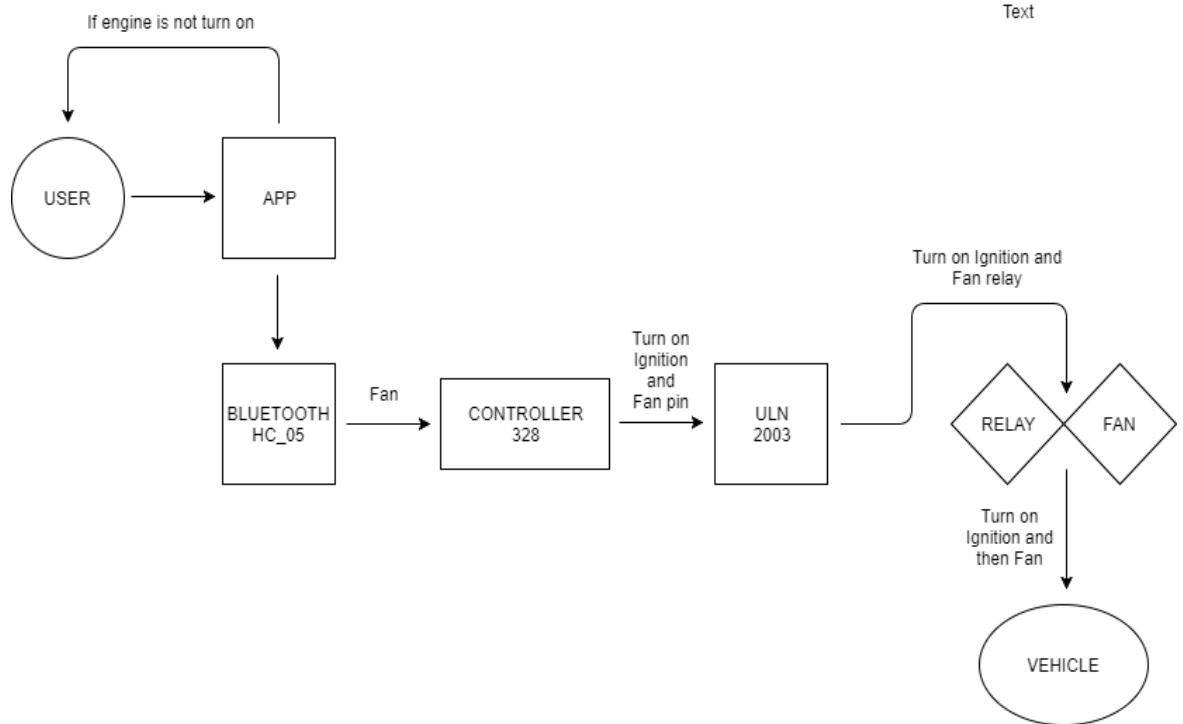
VEHICLE

Fig.4.5.5

4.5.6 Opening Trunk Function:

Just press the trunk button in the application and within seconds the trunk of the vehicle will be open. Device will trigger a pulse to the motor of the trunk if the vehicle does not have a motor then the user has to install the motor to use this function.
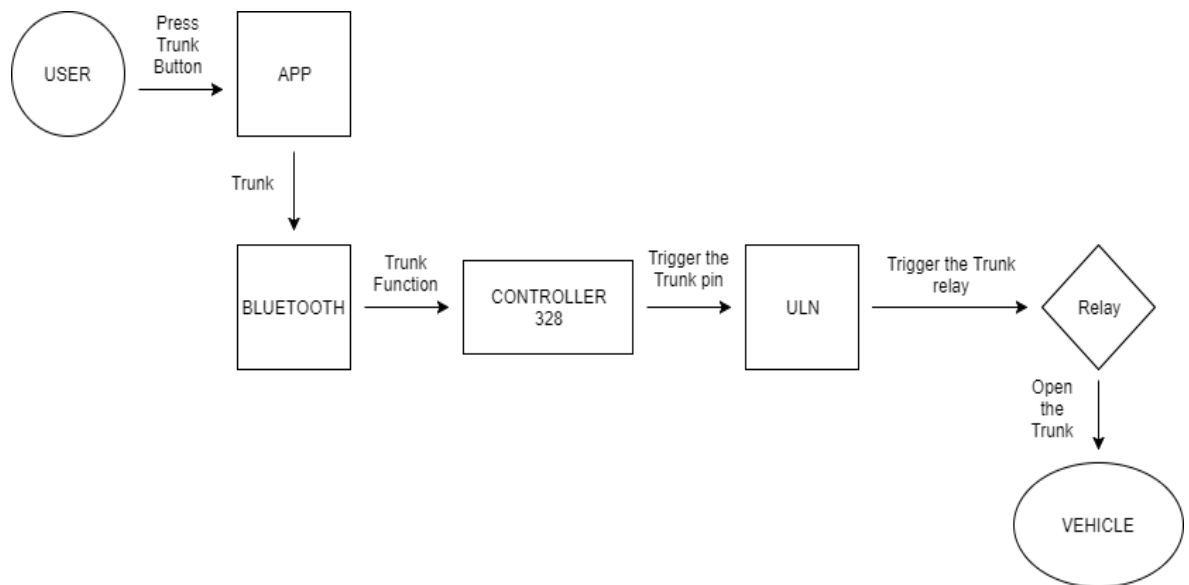
Fig.4.5.6

4.5.7   Start the Engine Vehicle Function:

When the user presses the engine, start button the device first checks the hand break status of the vehicle if the hand break is pulled then the device will start the engine and if the hand break is pulled then the device sends the status to application and application show a short notification "Please Pull HB!" to tell the user that the hand break of the vehicle is not pulled up so the engine cannot be start.
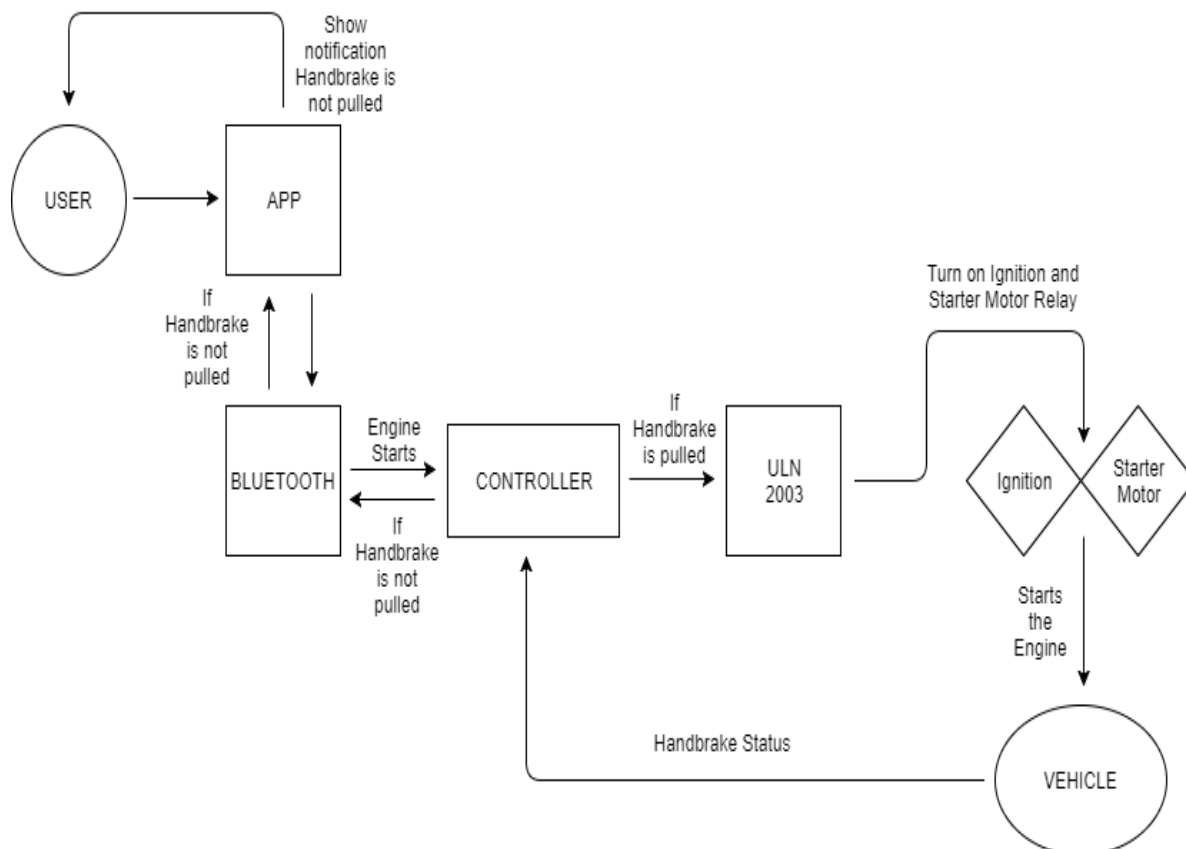
Fig.4.5.7

4.5.8   Handbrake Safety Function:

If the vehicle type is automatic transmission, then this function not necessary. If the vehicle type is manual transmission, then is must be wired properly. Read installation manual to see how to install. This feature is important because some people park their car in gear so when the user start the engine accident might happen.

4.6   Limitations:

- It only works when application relates to the device.
- The range of the Bluetooth module is only10 meters.

4.7 Use Case Description:

A use-case description is a text that captures the detailed functionality of a use-case.

Description of all use-cases are written down in this section:

4.7.1 <Use-case #1>

Use-case description typically contains the following parts:

Table 1 (User Login)

Name and ID	User Login and User-01
Brief description	It is used to describe the how user is going to be connected with App through smartphone through Bluetooth module and control this feature.
Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app.
Trigger	It is the event that causes to initiate the app with vehicle to control their features .
Alternate flows	User must have to enter password, only first time, to connect with app.
Post Conditions	User can be able to control the vehicle functions

4.7.2 <Use-case #2>

Use-case description typically contains the following parts:

Table 2 (Anti-Theft Function)

Name and ID	Anti-Theft and AT-01
Brief description	It is used to describe the how user is going to be connected with anti- theft function through blutetooth module and control this feature.
Preconditions	User has not been connected with app yet.

Basic flow or Happy path	User has to connected with vehicle through this app.
Trigger	It is the event that causes to initiate the app with vehicle to control the anti-theft function.

Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions

4.7.3   <Use-case #3>

Use-case description typically contains the following parts:

Table 3 (Lock Vehicle)

Name and ID	Lock Car and LC-01
Brief description	It is used to describe the how user is going to be connected with lock function through blutetooth module and control this feature.
Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app.
Trigger	It is the event that causes to initiate the app with vehicle to control the lock function.
Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions

4.7.4   <Use-case #4>

Use-case description typically contains the following parts:

Table 4 (Unlock Vehicle)

Name and ID	Unlock Car and UC-01
Brief description	It is used to describe the how user is going to be connected with unlock function through Bluetooth module and control this feature.

Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app to use following feature of app through smartphone.
Trigger	It is the event that causes to initiate the app with vehicle to control the unlock function.
Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions

4.7.5 <Use-case #5>

Use-case description typically contains the following parts:

Table 5 (A/C Control)

Name and ID	A/C Control and A/C-01
Brief description	It is used to describe the how user is going to be connected with A/C function through blutetooth module and control this feature.
Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app to use following feature of app through smartphone.

| Trigger	It is the event that causes to initiate the app with vehicle to control the trigger function.
Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions

4.7.6 <Use-case #6>

Use-case description typically contains the following parts:

Table 6 (Fan Control)

| Name and ID	Fan Control and FC-01
Brief description	It is used to describe the how user is going to be connected with Fan function through blutetooth module and control this feature.
Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app to use following feature of app through smartphone.
Trigger	It is the event that causes to initiate the app with vehicle to control the fan control function.
Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions

**4.7.7 <Use-case #7>**

Use-case description typically contains the following parts:

Table 7 (Opening Trunk)

Name and ID	Opening Trunk and OP-01
Brief description	It is used to describe the how user is going to be connected with Opening Trunk function through Bluetooth module and control this feature.
Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app to use following feature of app through smartphone.
Trigger	It is the event that causes to initiate the app with vehicle to control theopening trunk function.
Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions.

4.7.8   <Use-case #8>

Use-case description typically contains the following parts:

Table 8 (Start Engine)

Name and ID	Start Engine and SE-01
Brief description	It is used to describe the how user is going to be connected with Start Engine function through Bluetooth module and control this feature.
Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app to use following feature of app through smartphone.

Trigger	It is the event that causes to initiate the app with vehicle to control the start engine function.
Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions

4.7.9 <Use-case #9>

Use-case description typically contains the following parts:

Table 9 (Handbrake Safety)

Name and ID	Handbrake Safety and HS-01
Brief description	It is used to describe the how user is going to be connected with Handbrake Safety function through Bluetooth module and control this feature.
Preconditions	User has not been connected with app yet.
Basic flow or Happy path	User has to connected with vehicle through this app to use following feature of app through smartphone.
Trigger	It is the event that causes to initiate the app with vehicle to control the handbrake safety function.
Alternate flows	Alt 1 user must have to enter password, only first time, to connect with app. Alt 2 user will able to control this feature.
Post conditions	User can be able to control the vehicle functions

Use Case Diagram:

Fonkey App Functions
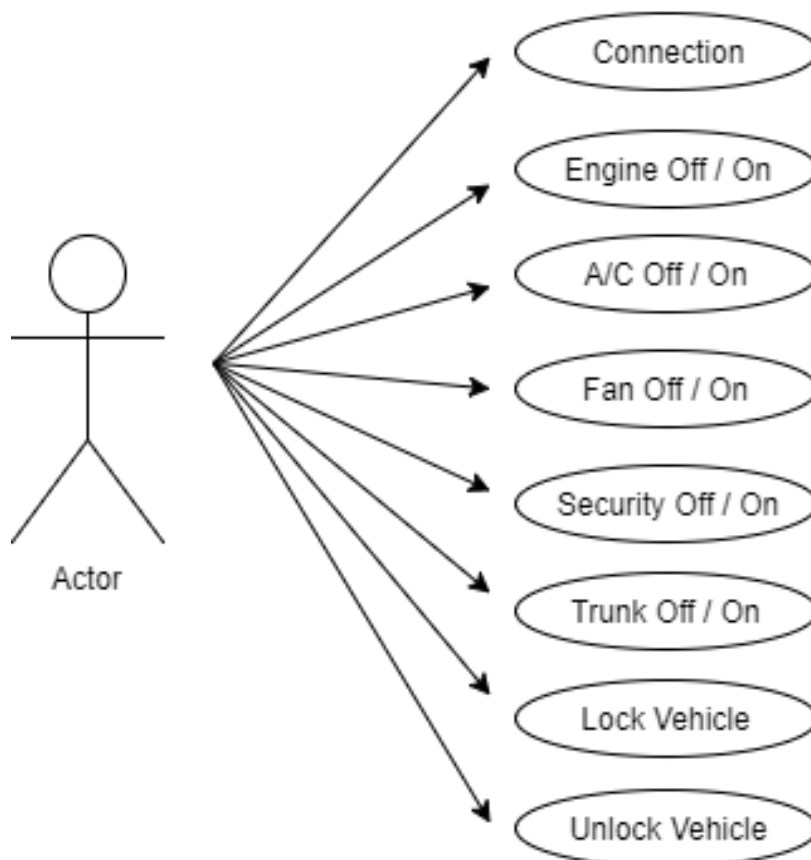
4.8   Sequence Diagram:

A Sequence diagram depicts the sequence of actions that occur in a system. The invocation of methods in each object, and the order in which the invocation occurs is captured in a Sequence diagram. This makes the Sequence diagram a very useful tool to easily represent the dynamic behavior of a system.
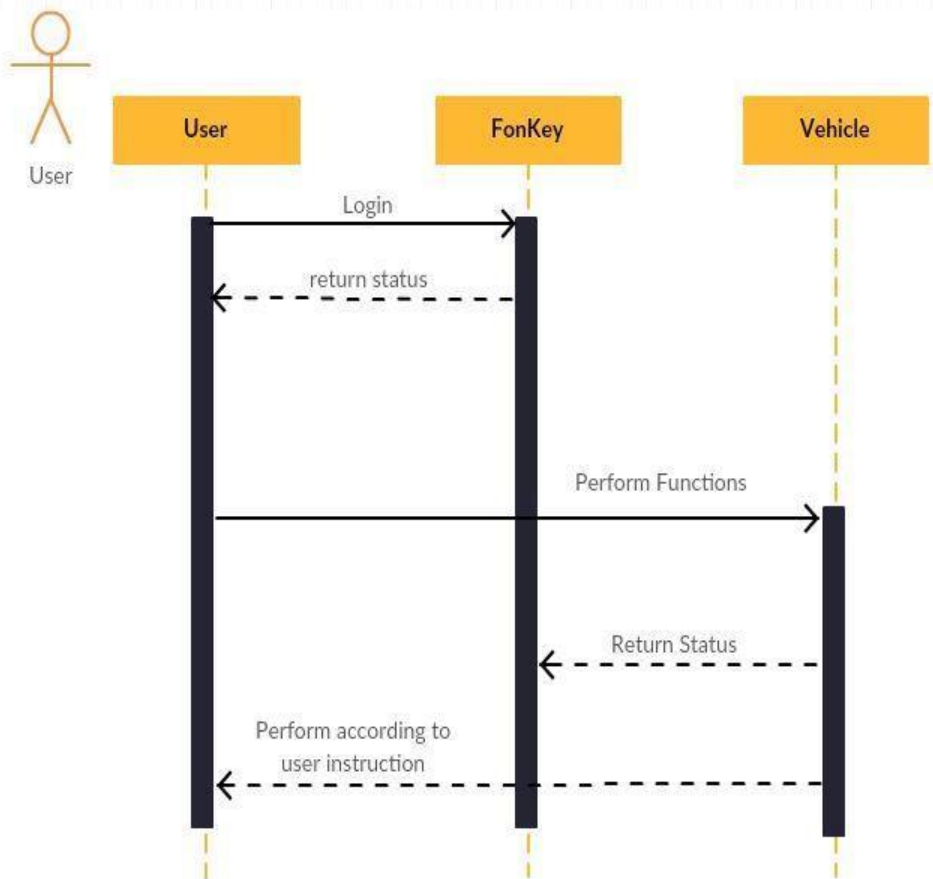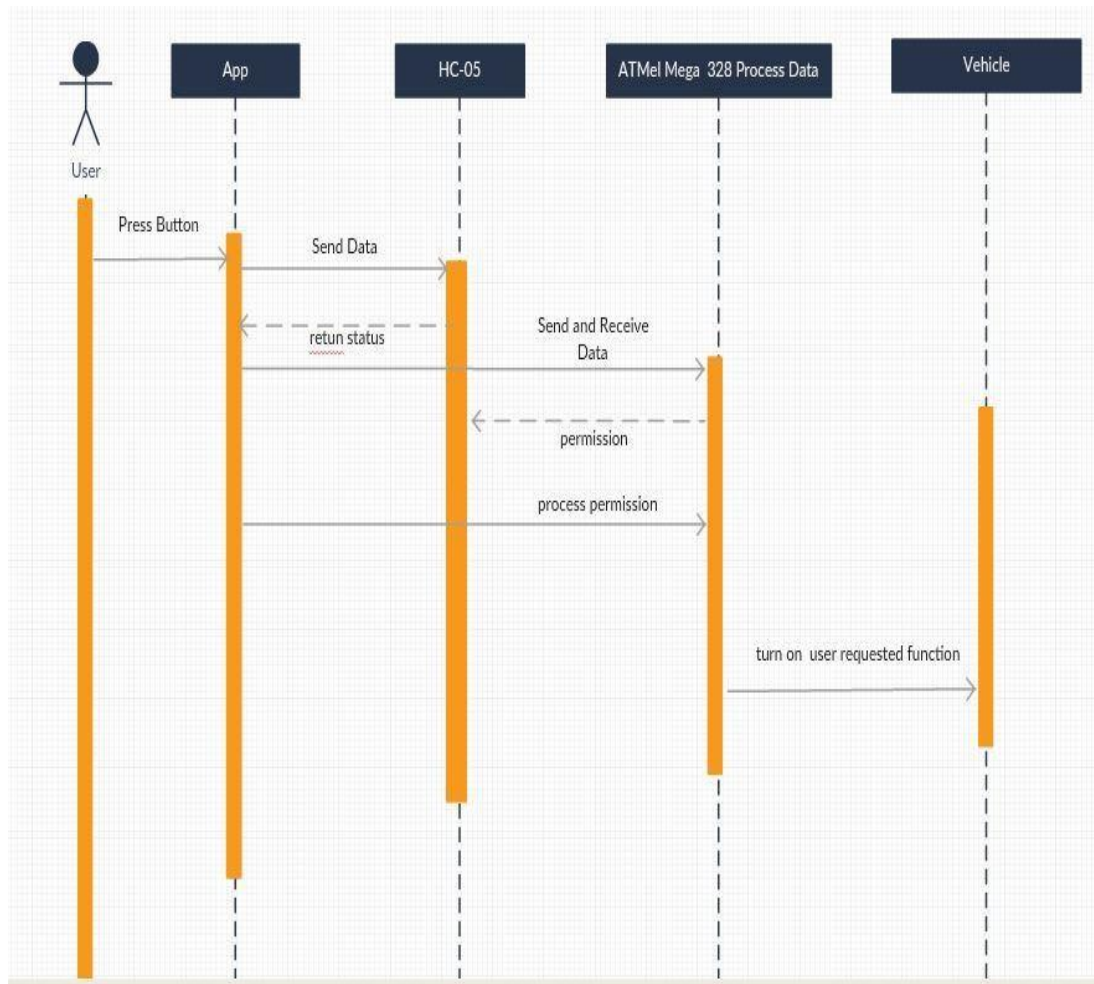
Connect with Vehicle through Smartphone Sequence Diagram
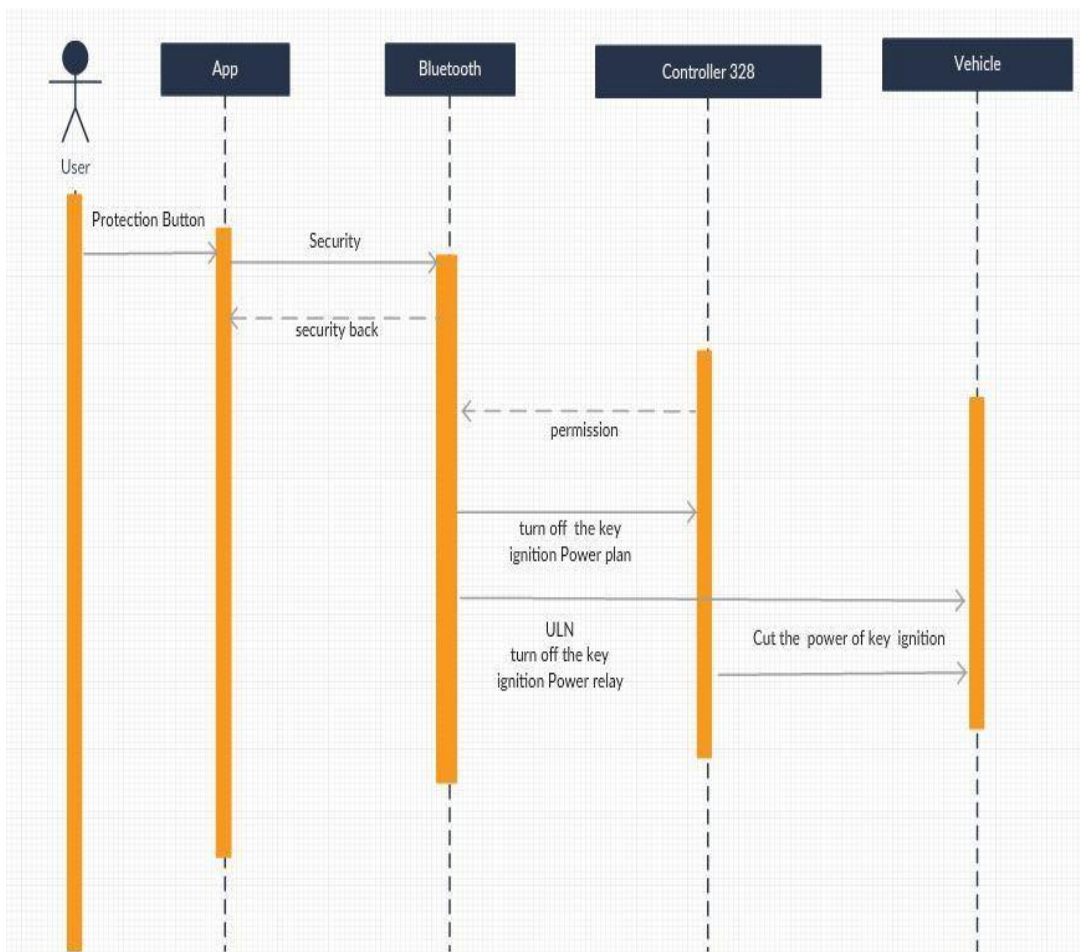
Protection Button Sequence Diagram
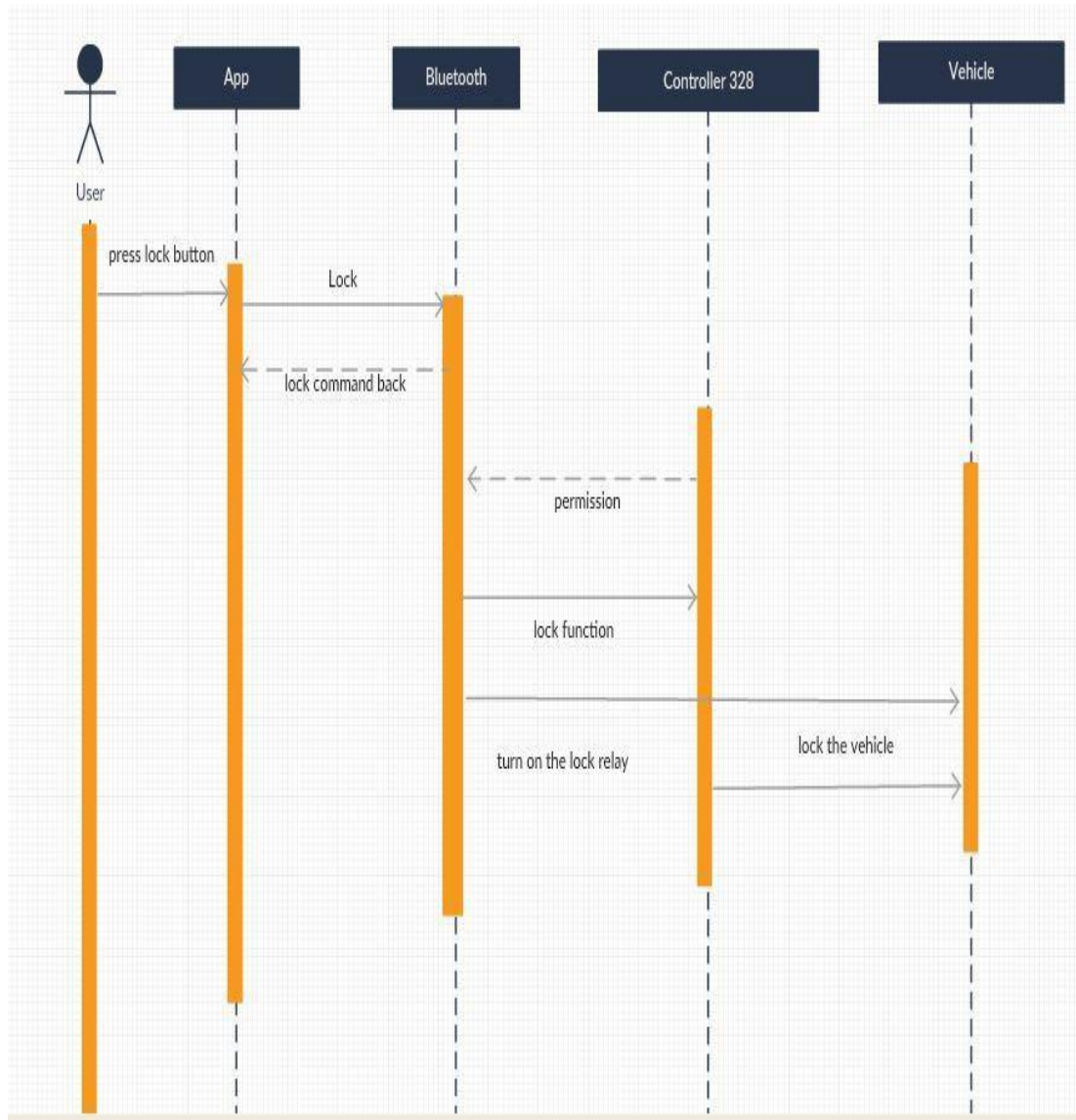
Lock Button Sequence Diagram
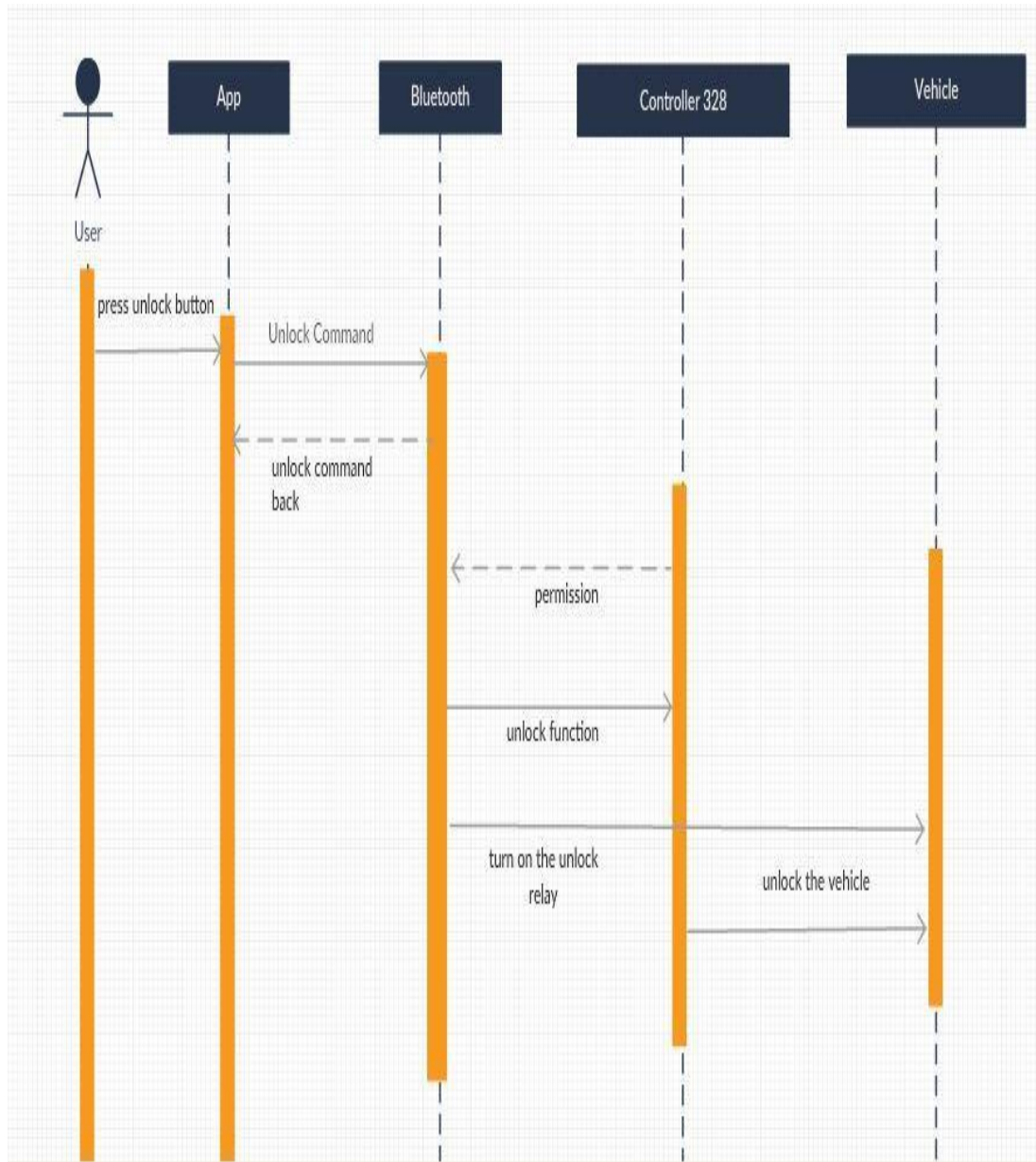
Unlock Button Sequence Diagram
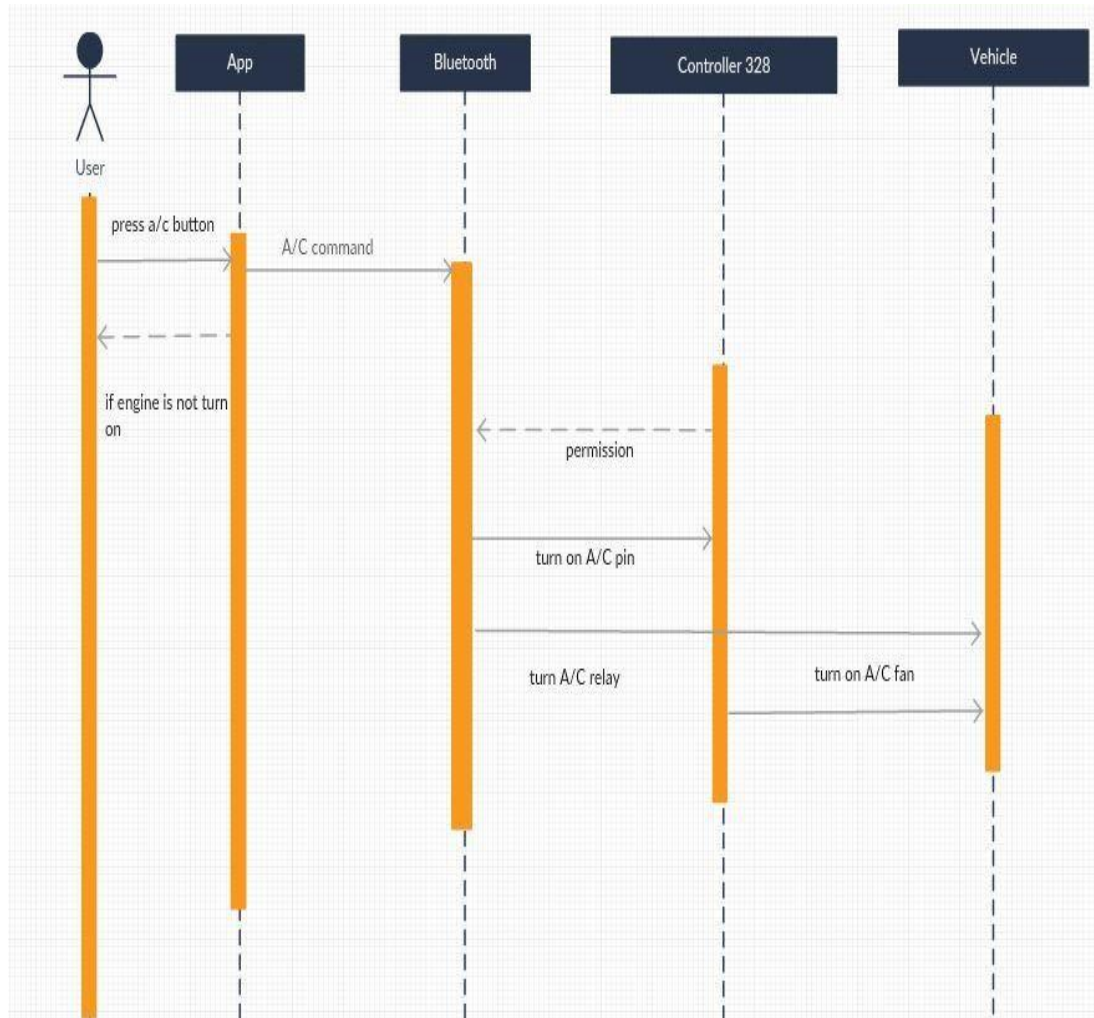
A/C Button Sequence Diagram
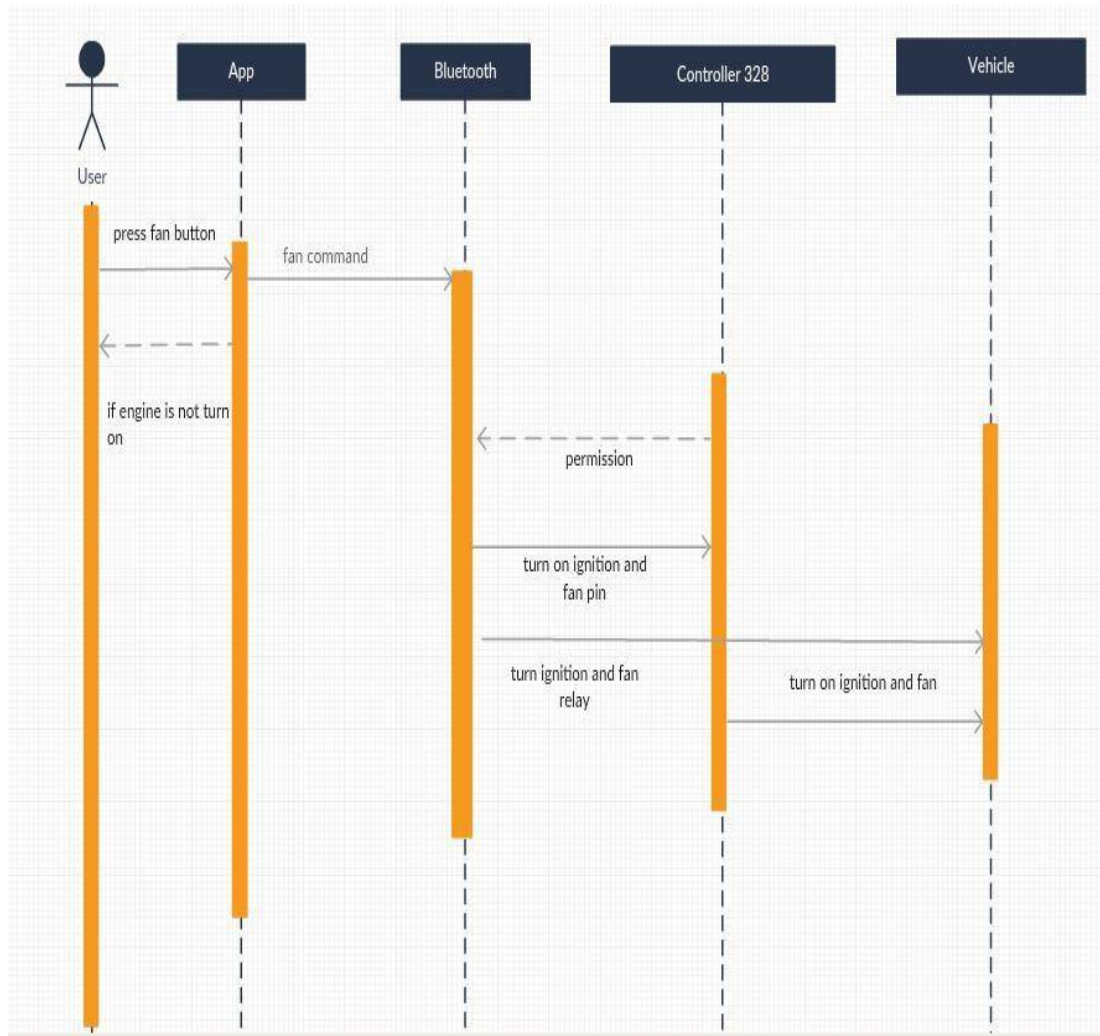
Fan Button Sequence Diagram
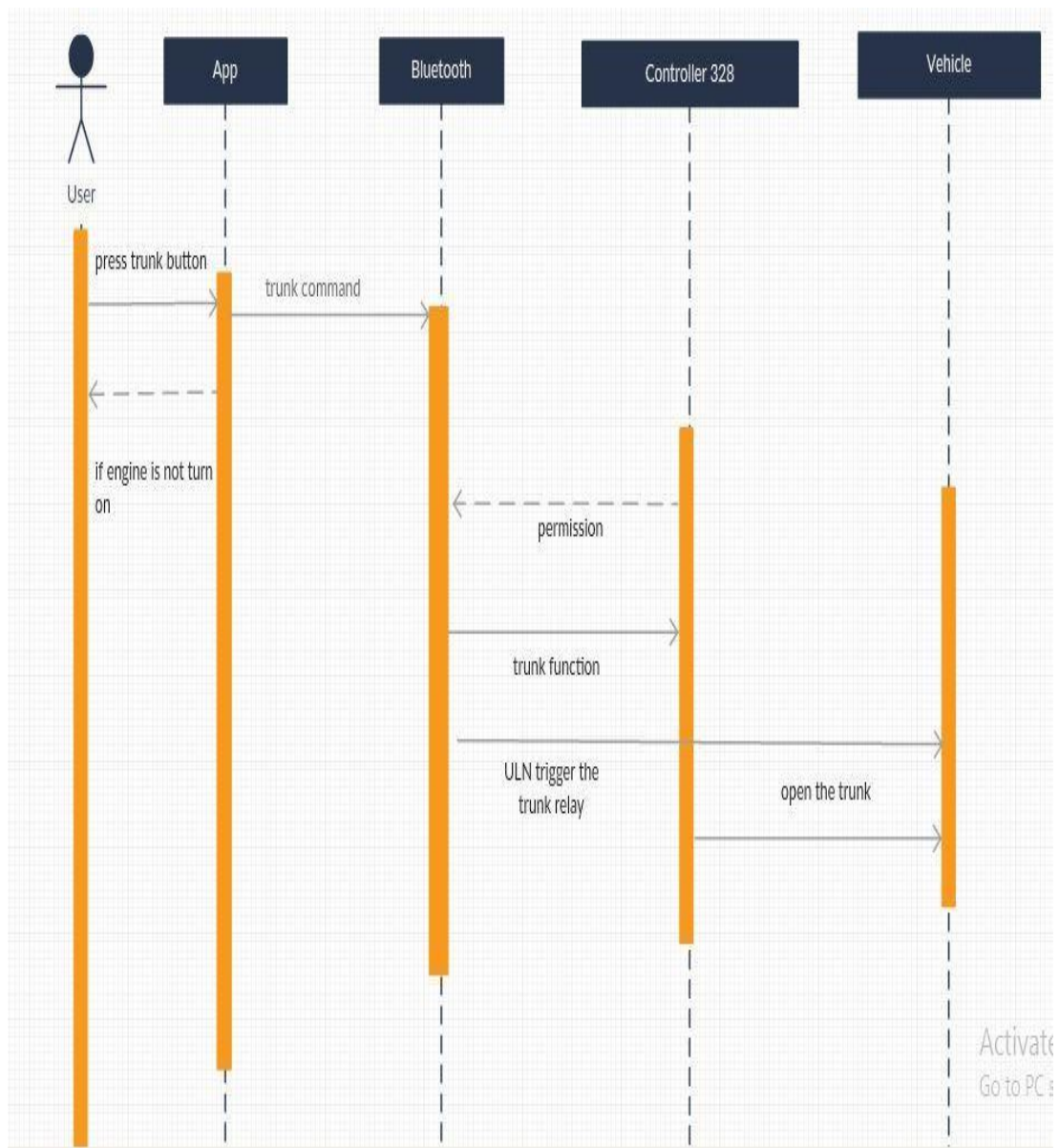
Trunk Button Sequence Diagram
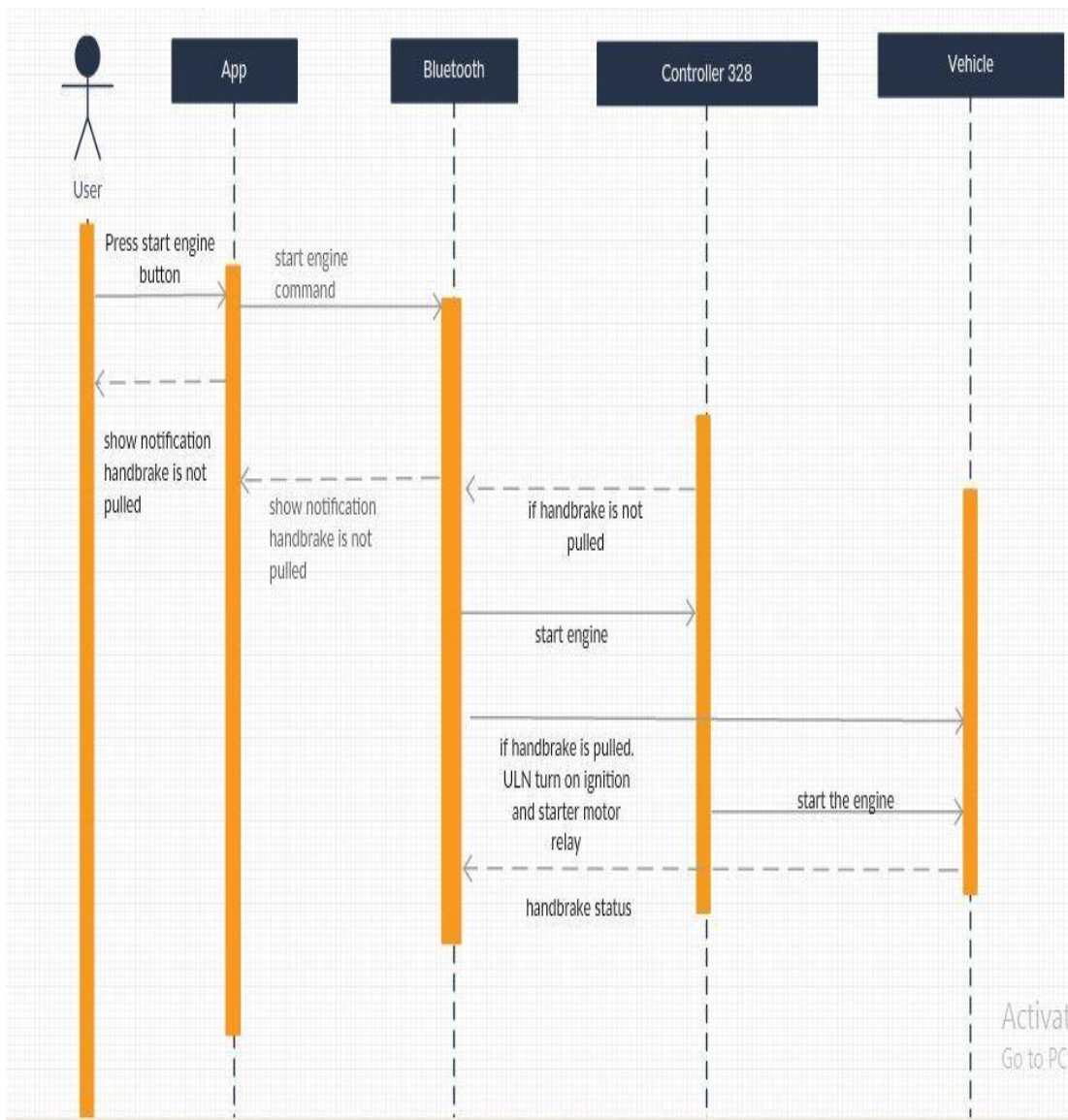
Start Engine Button Sequence Diagram

4.9   System Flowchart Diagram:
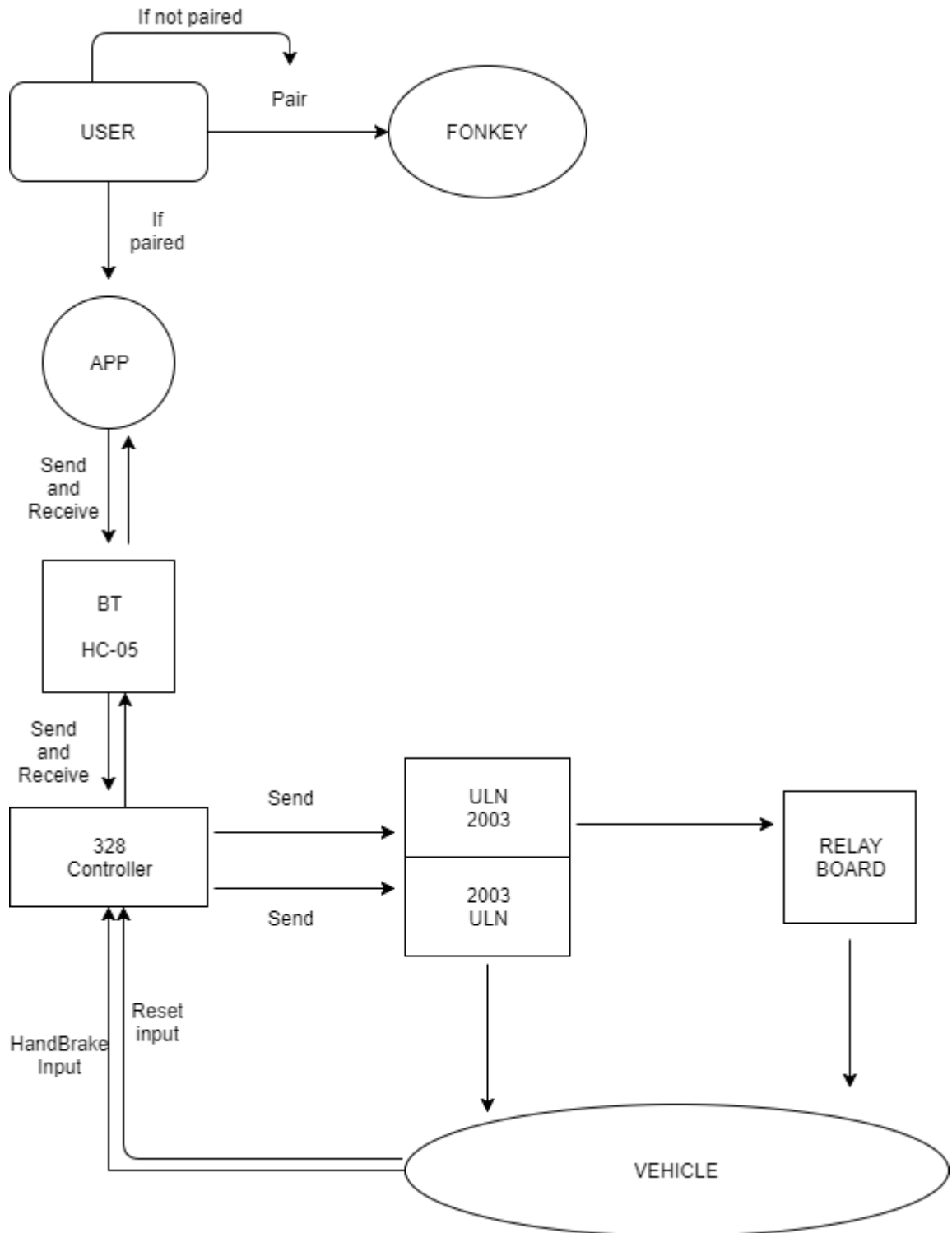
Relational Model for Application – FonKey System

CHAPTER 5

USER MANUAL

5.1   Steps for Installing the Application

- Download the Application and install on your smartphone.

- After installation following screen will appear.

Guide for using the FonKey Application

First **Turned On** your smart phone Bluetooth.
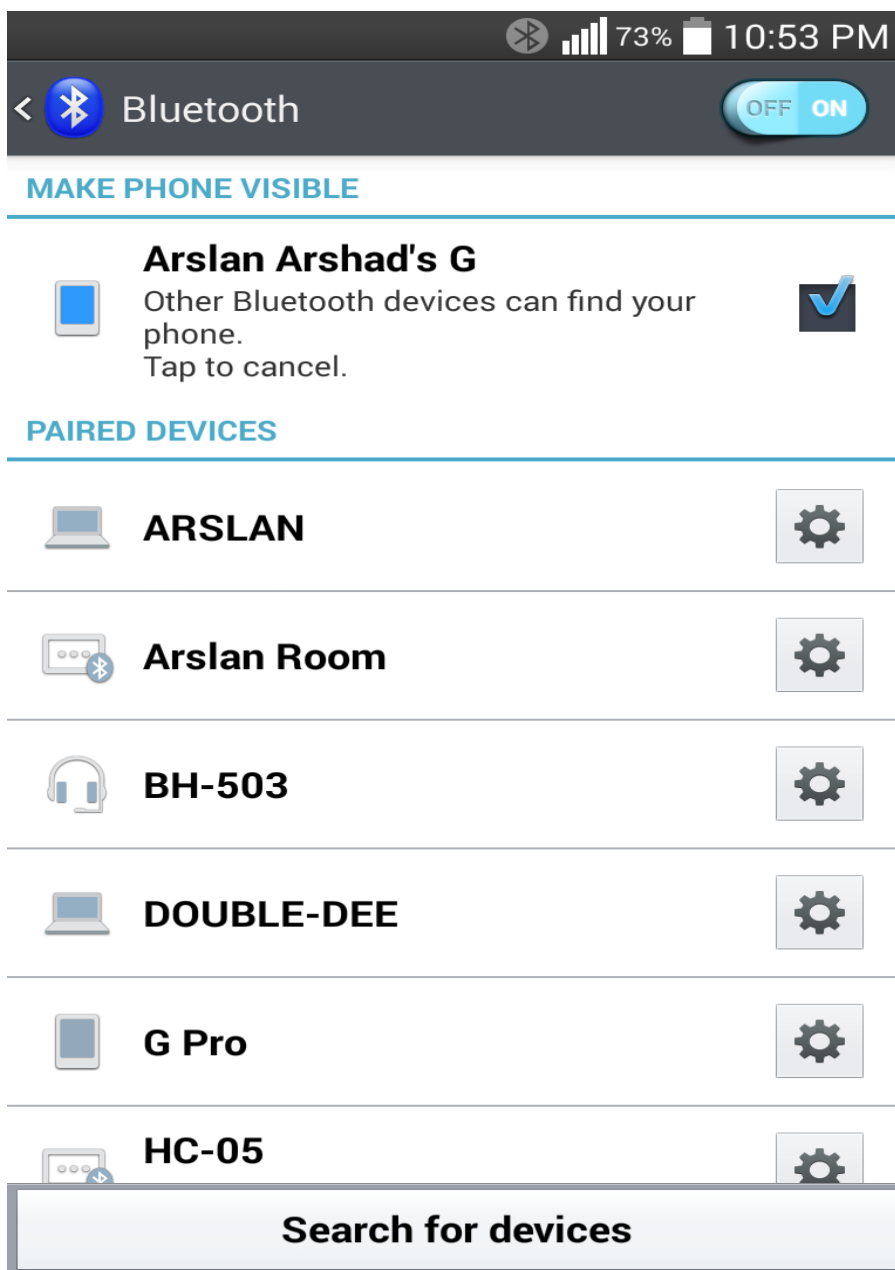
Click '**Search for devices**' it will show you available device.
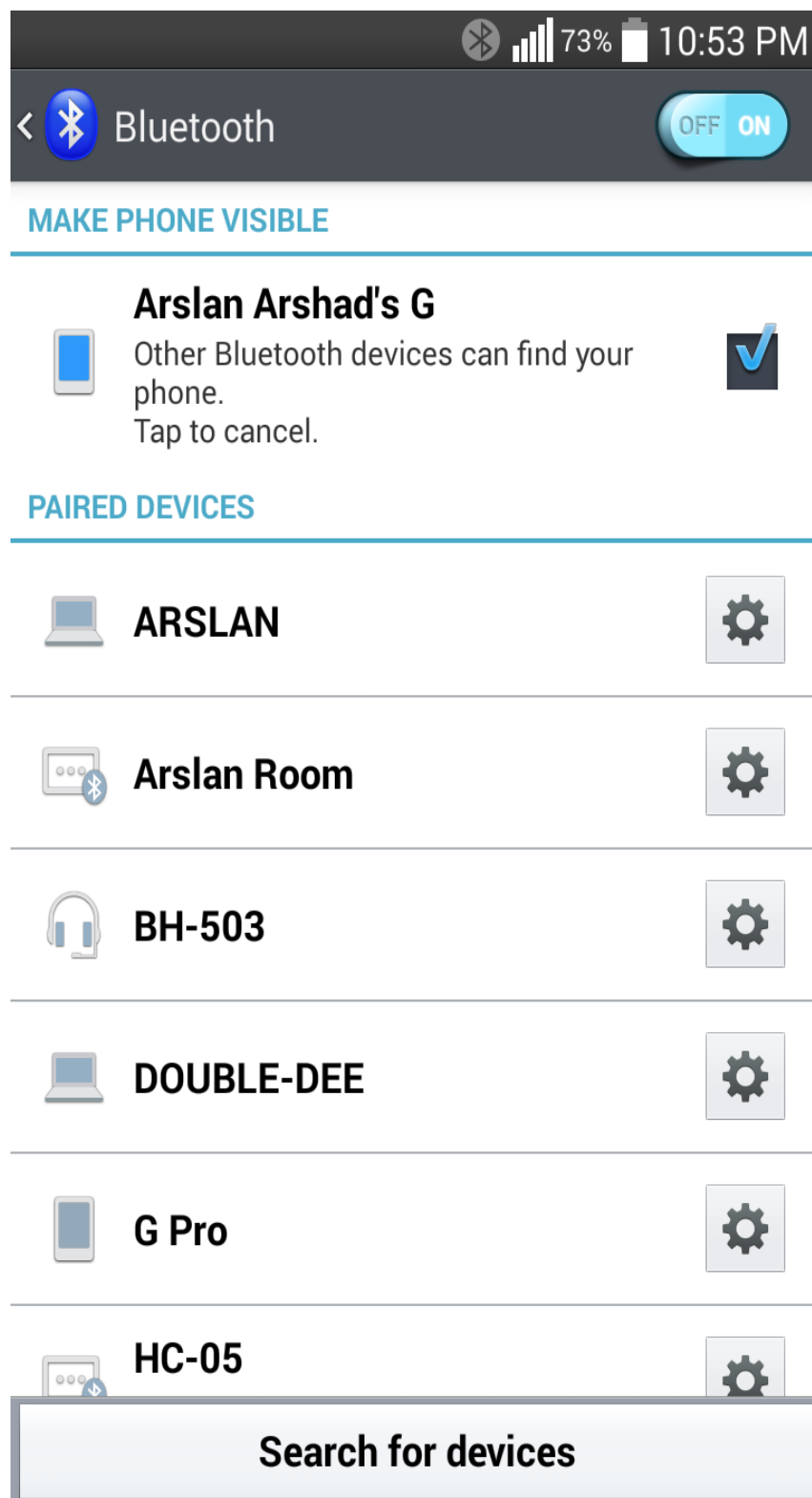
Device named **FonKey** will appear in the list, then click on **FonKey**.
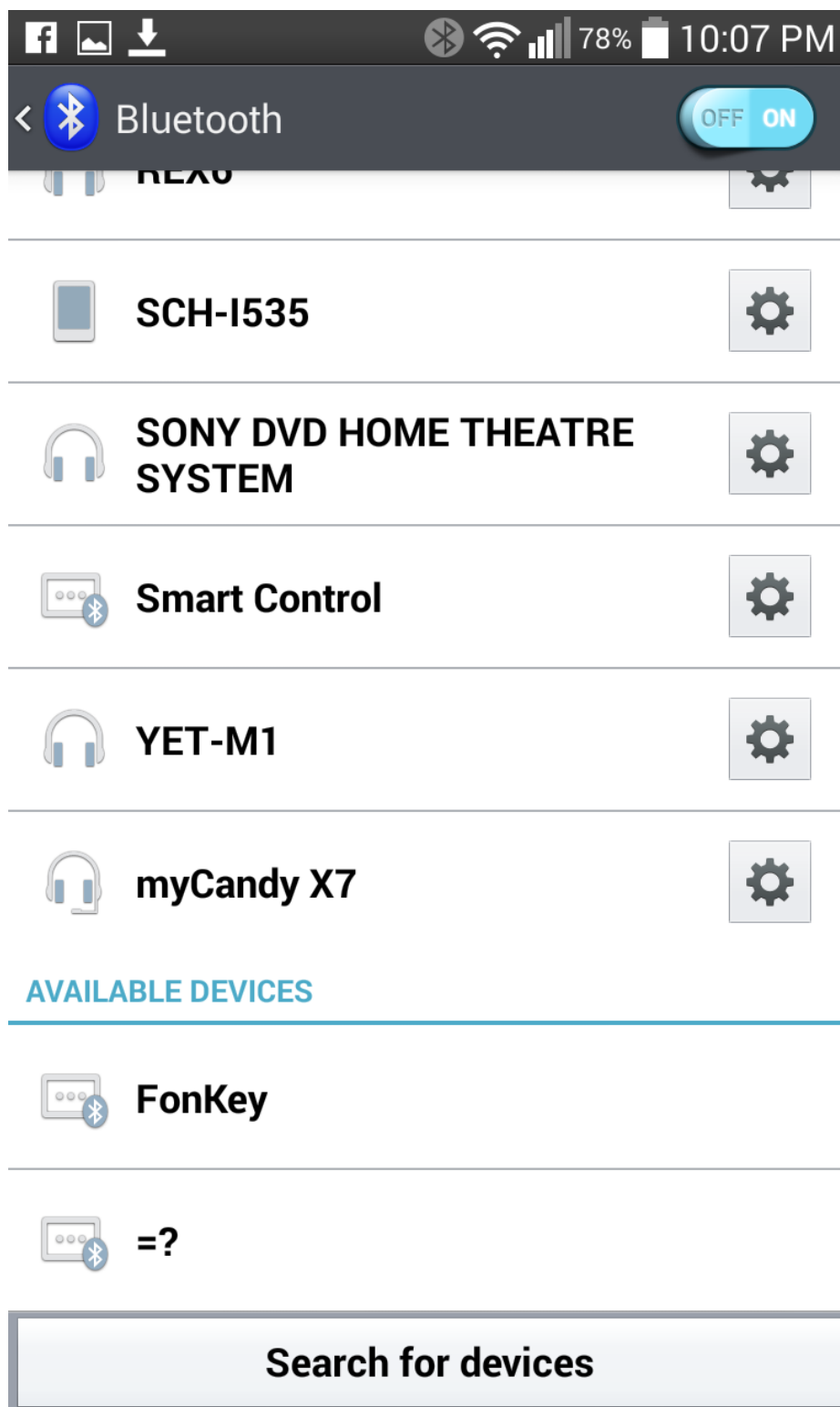
After clicking on **FonKey** a dialog box will appear for PIN to pair.
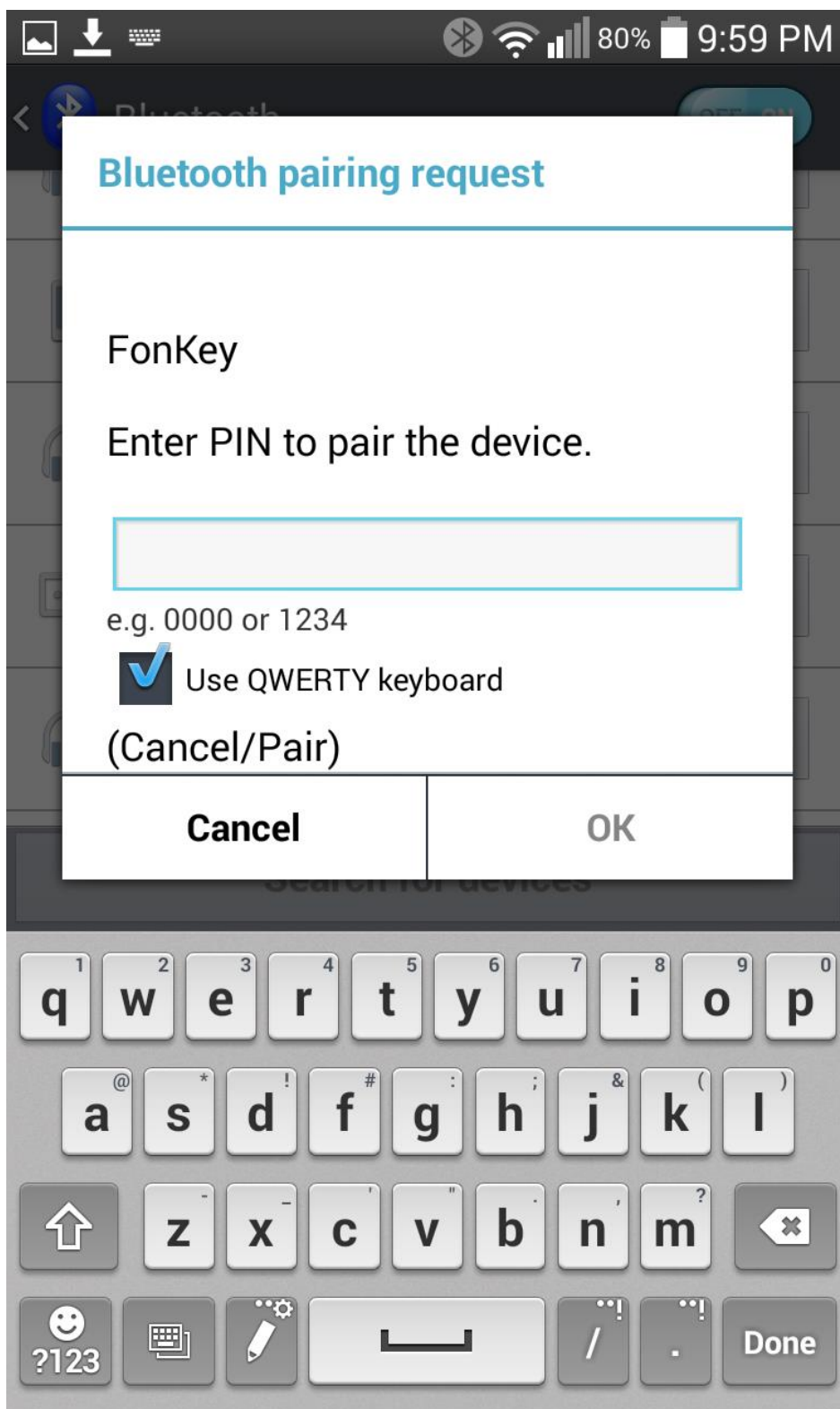
Enter 6-digit Alpha Numeric **PIN**, PIN is in the device box.
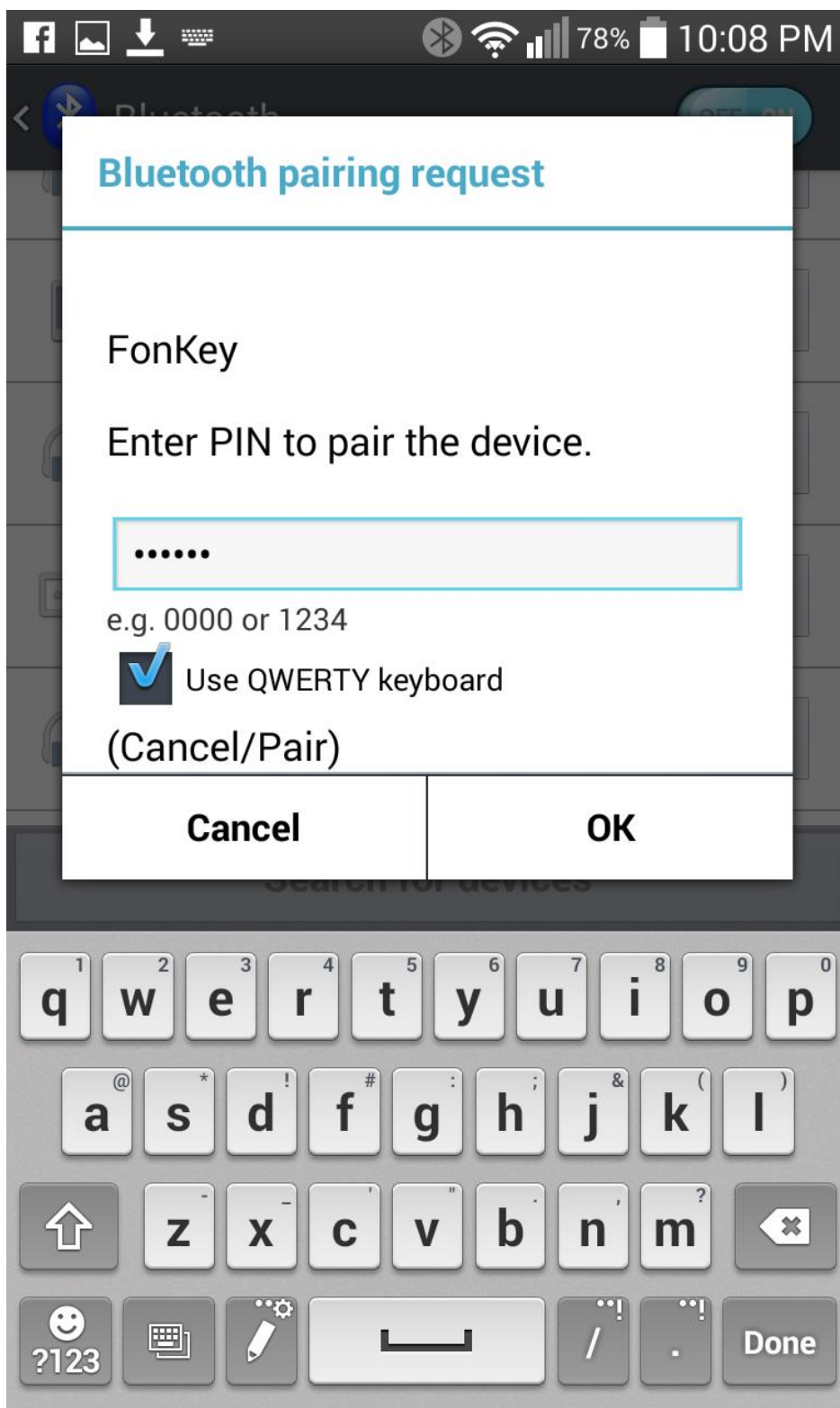
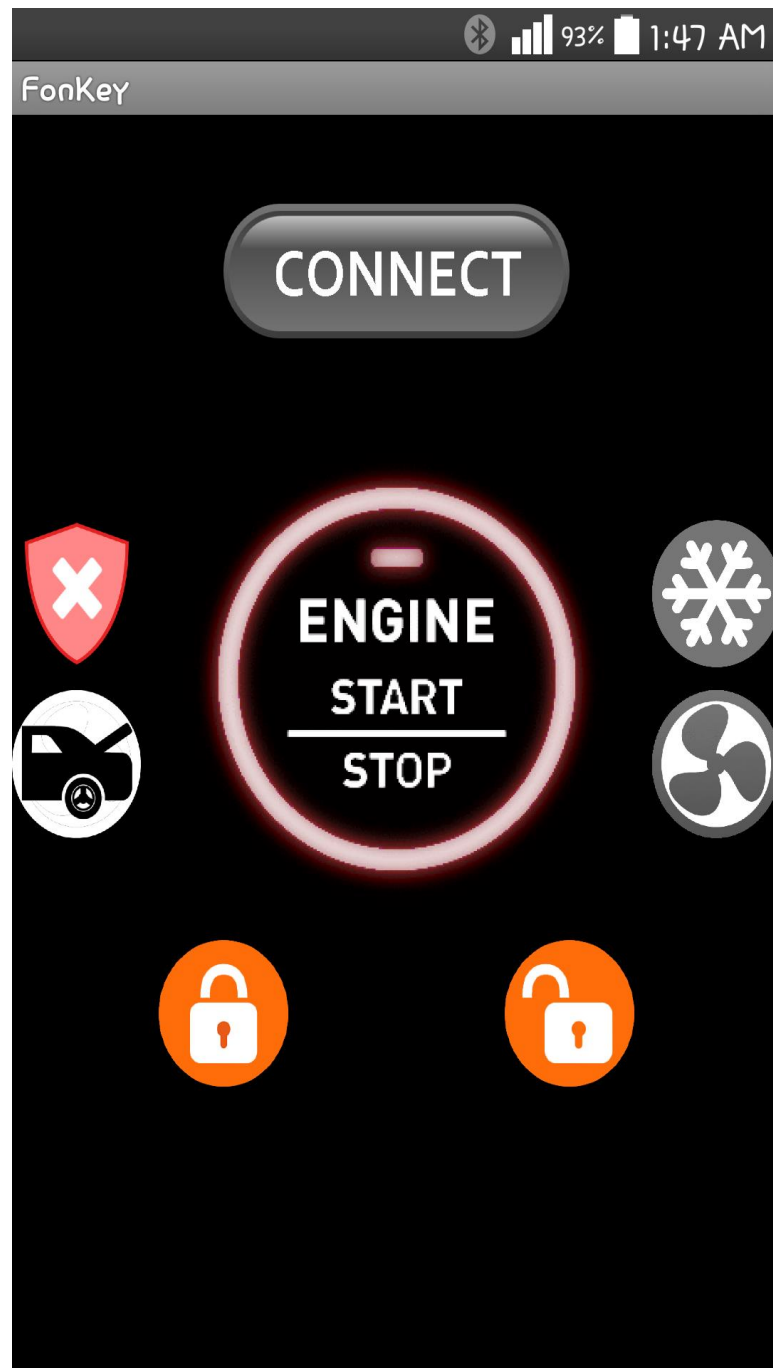After entering the correct pin FonKey will show in paired list.
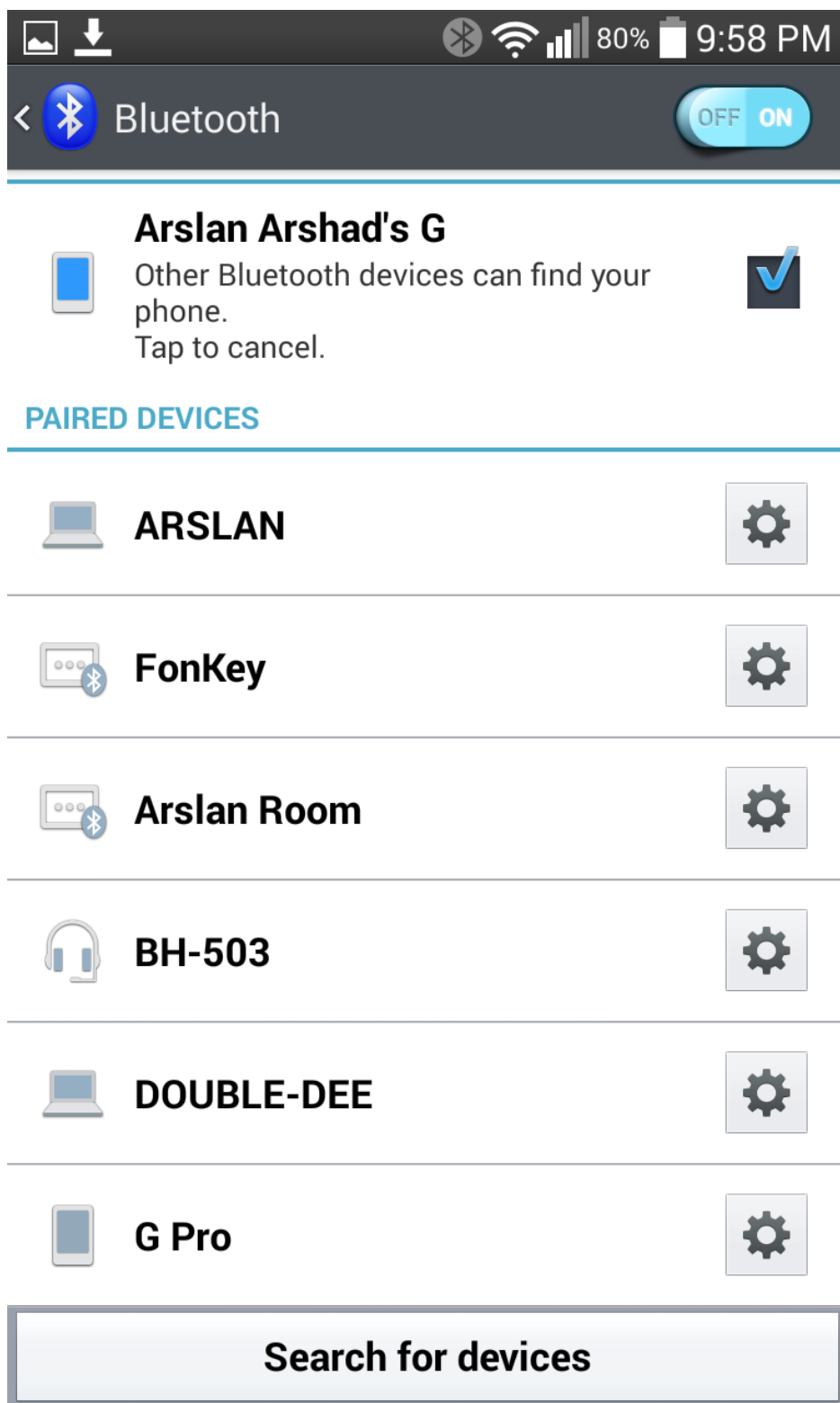
After pairing open the FonKey Application by clicking the icon.
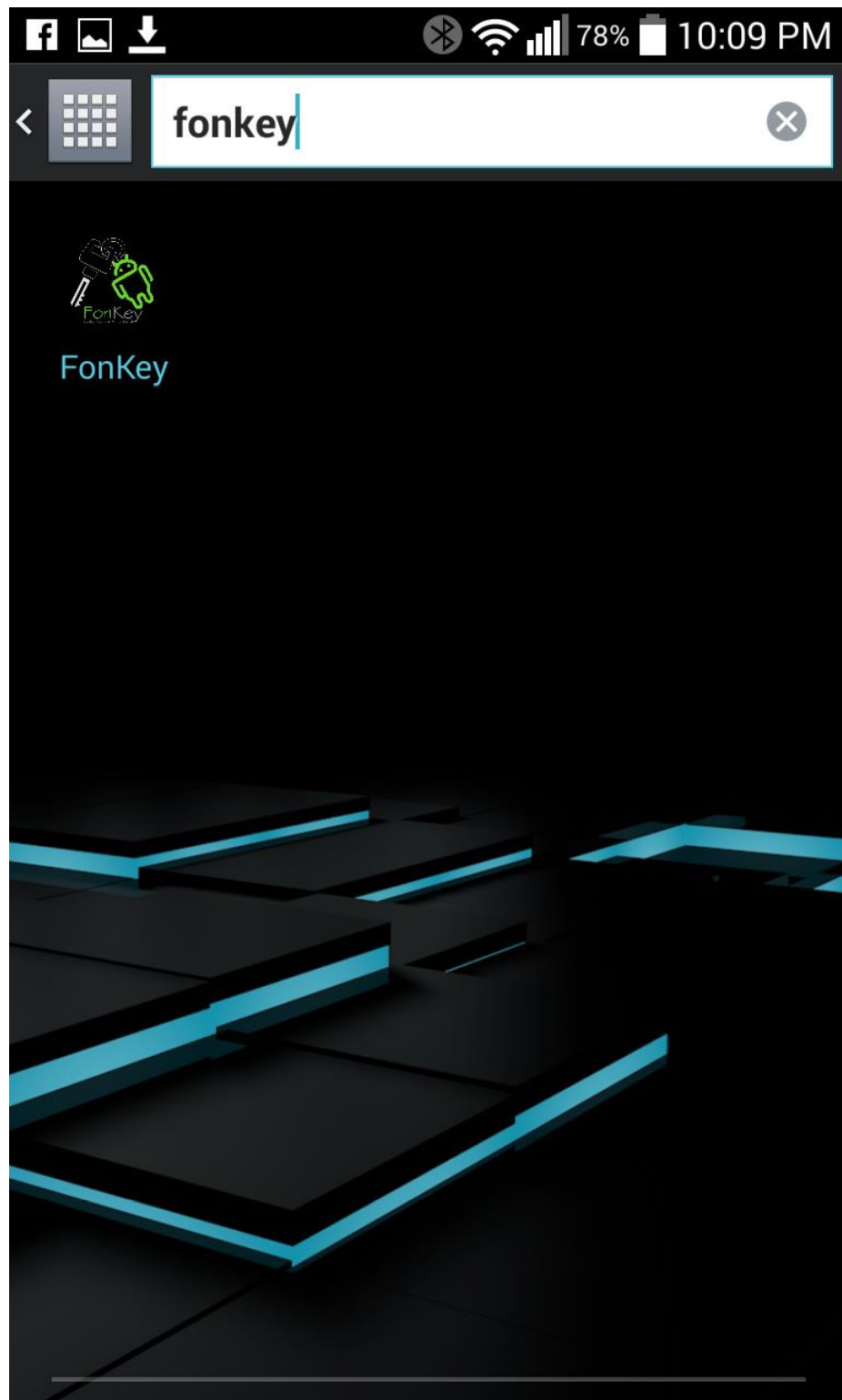
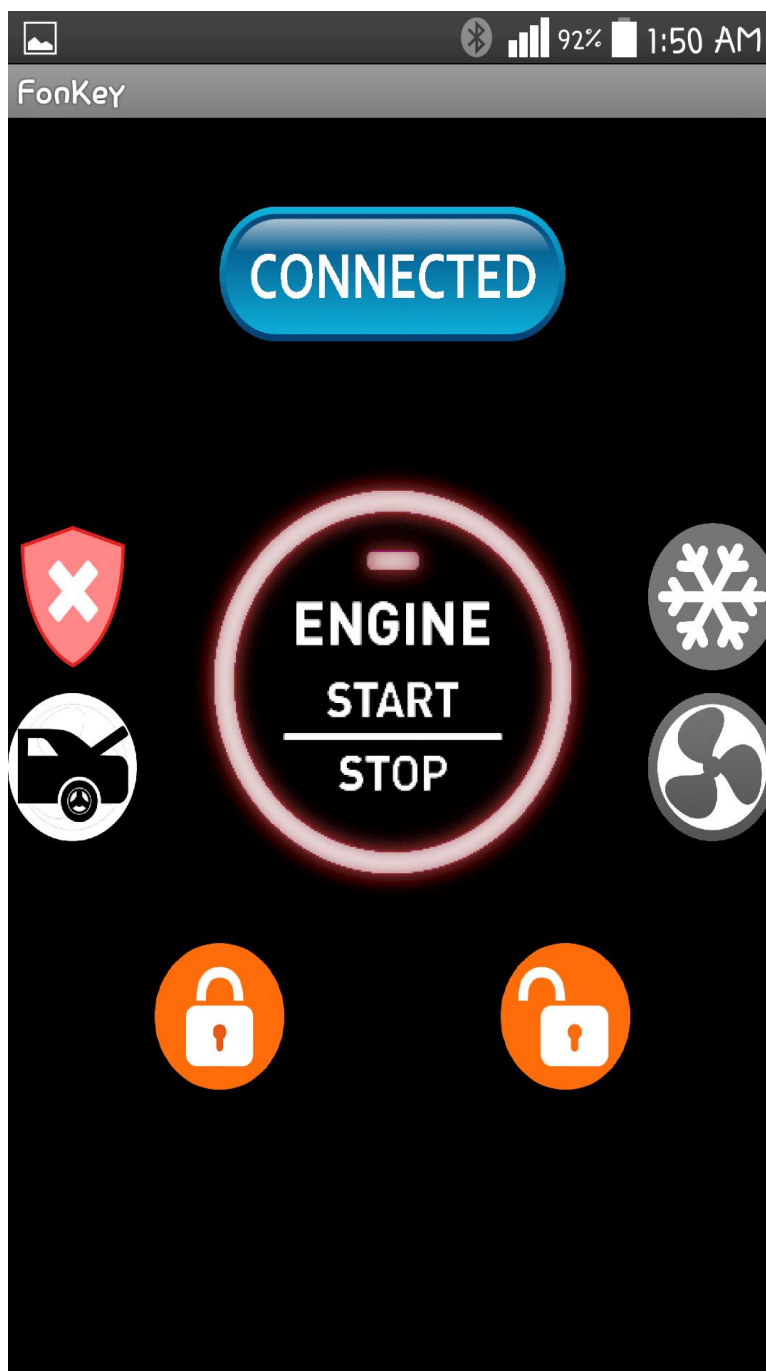After opening the application Accept the Agreement of FonKey.
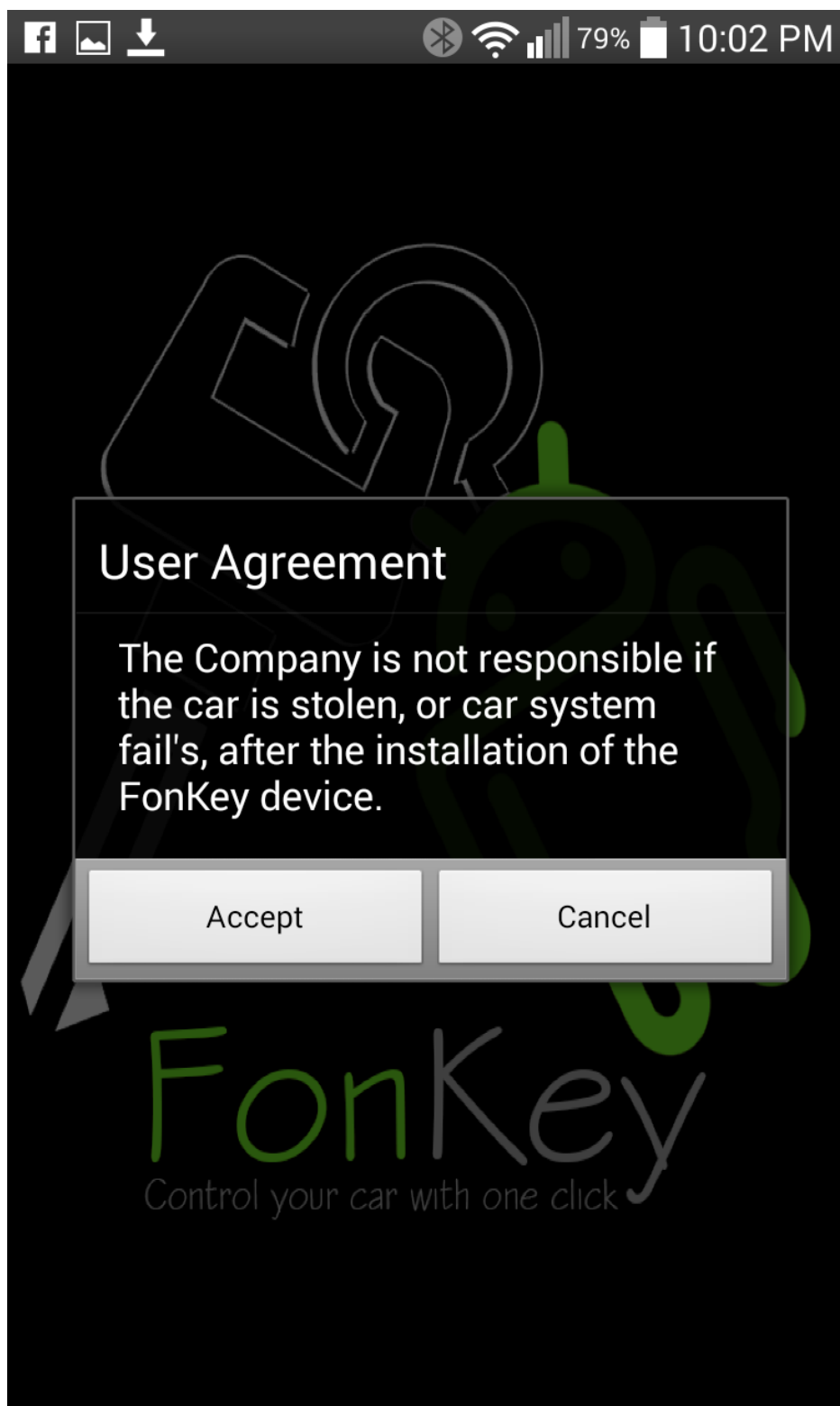
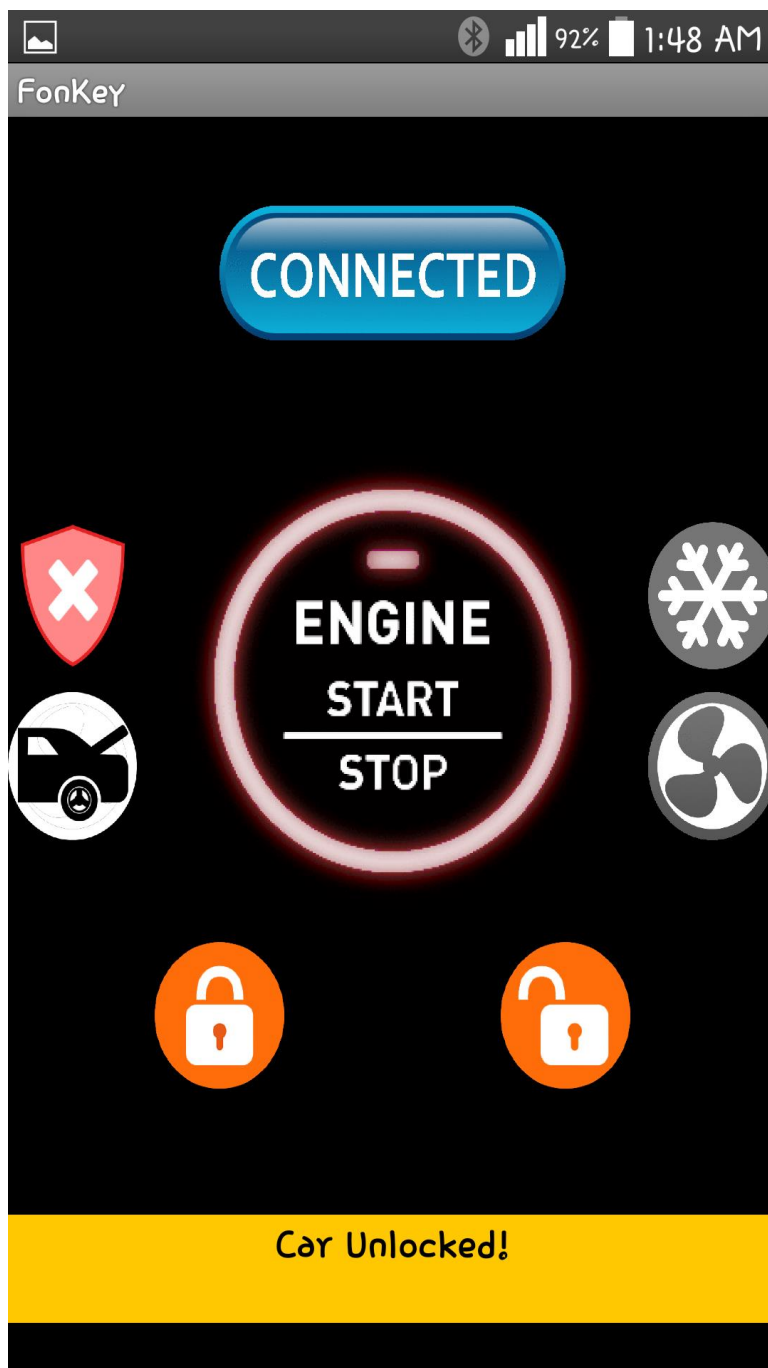After accepting the agreement, a new screen will open.

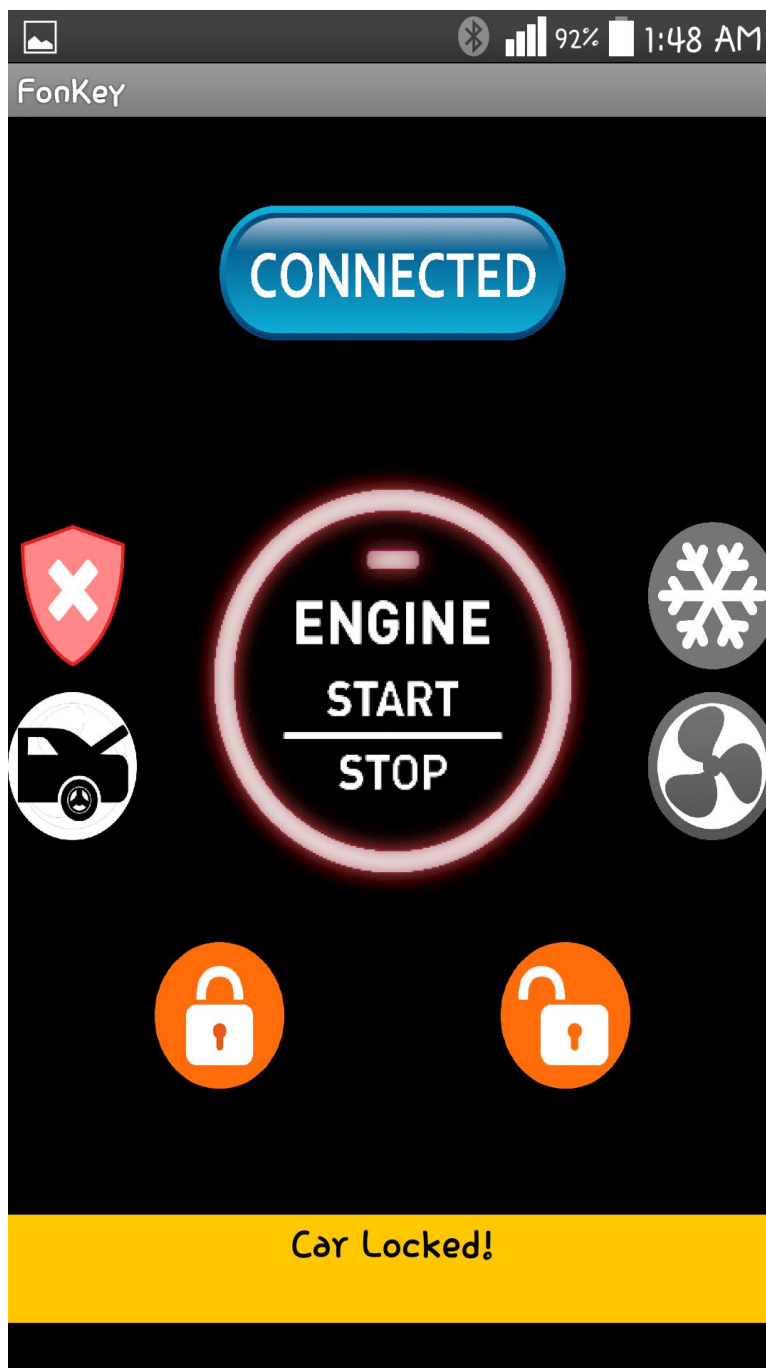Click the **Connect** button and select **FonKey** from the list.

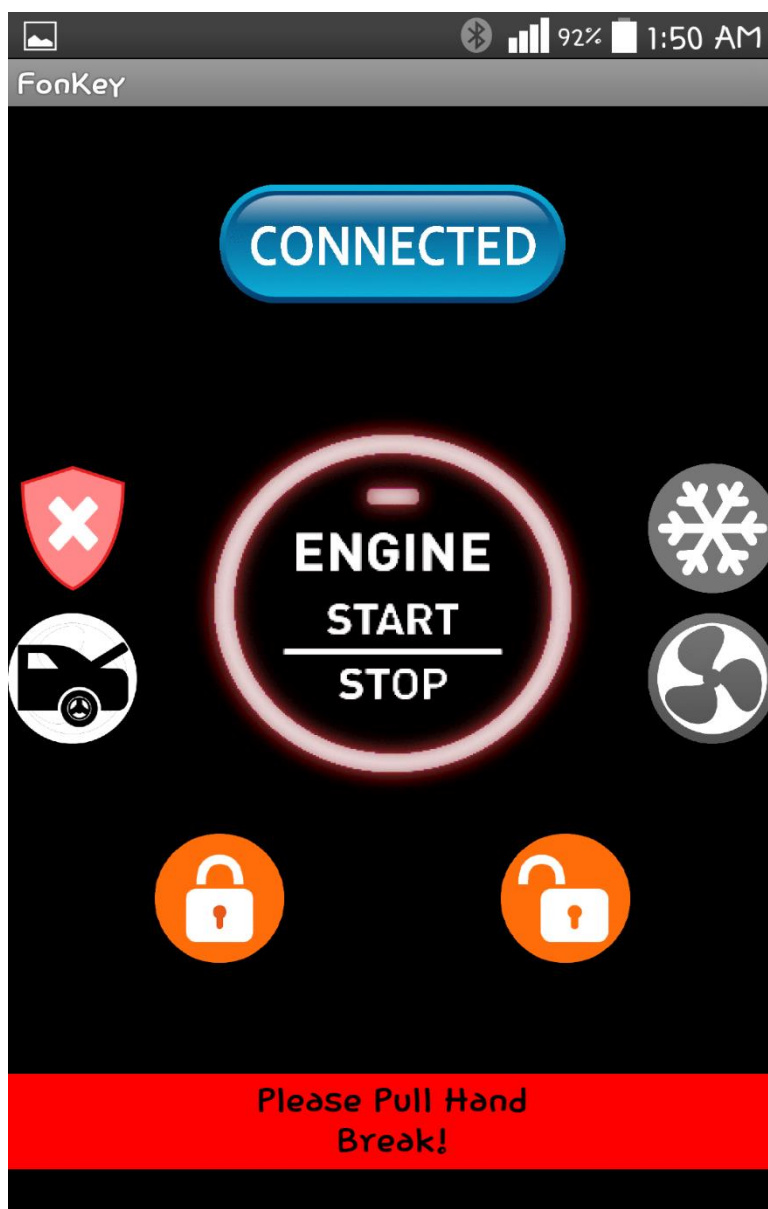After selecting the FonKey, **Connected** button will appear.

Click the **Unlock** button to unlock the car doors.

Click the **Lock** button to lock the car doors.

Click the **Engine Start/Stop** button to start the engine, if the hand break is not pulled, device will show a notification and will not start the car engine.

Click the **Engine Start/Stop** button to start the engine, if the hand break is pulled, then the device will start the car engine and the button will turn green.
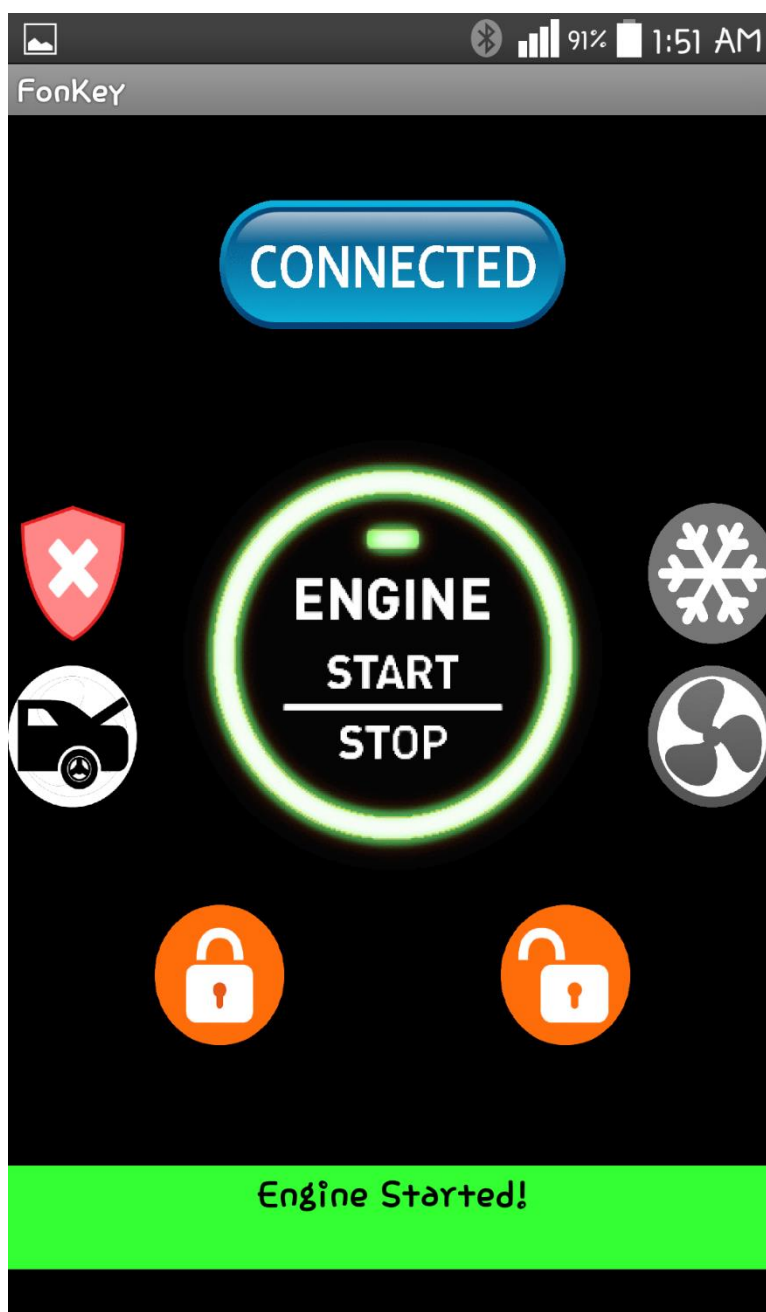
Click the green **Engine Start/Stop** button to turn off the car engine.
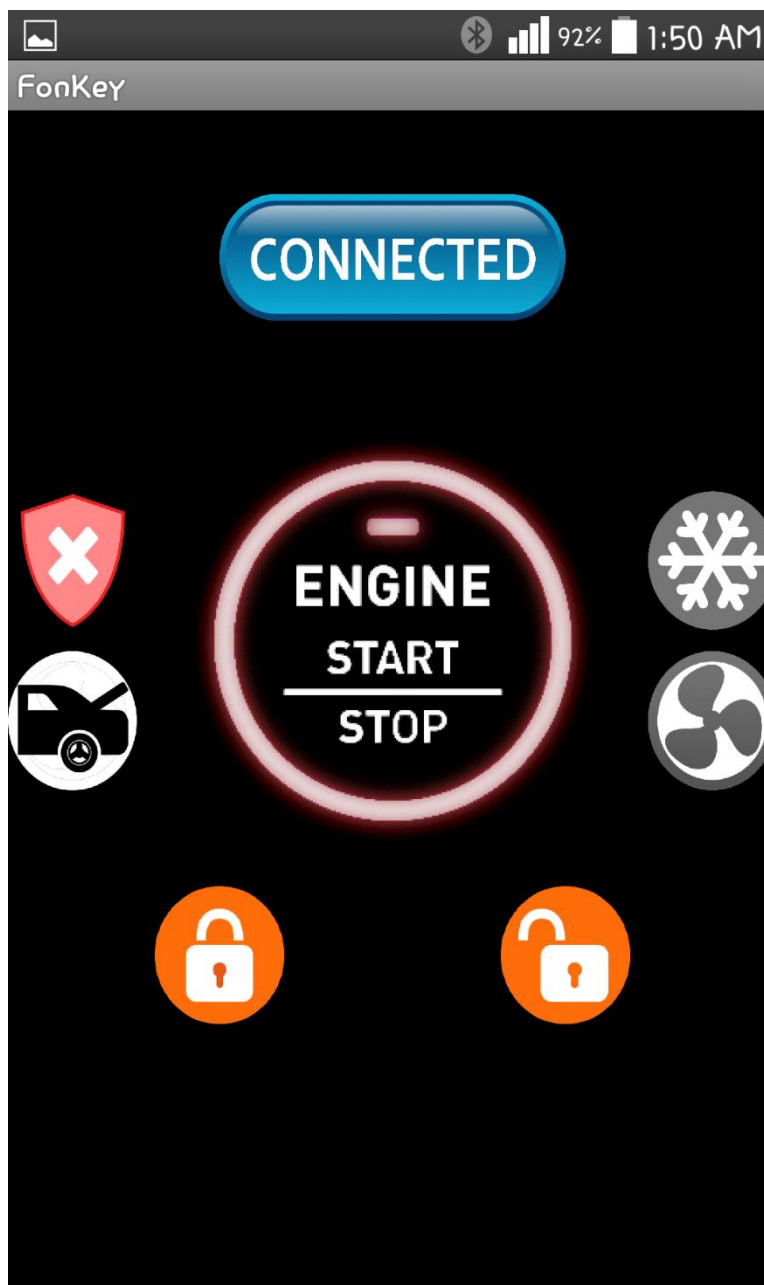
Click the **Shield button** to turn on the antitheft function. When this turn on the car won't start with key and the button turn green.
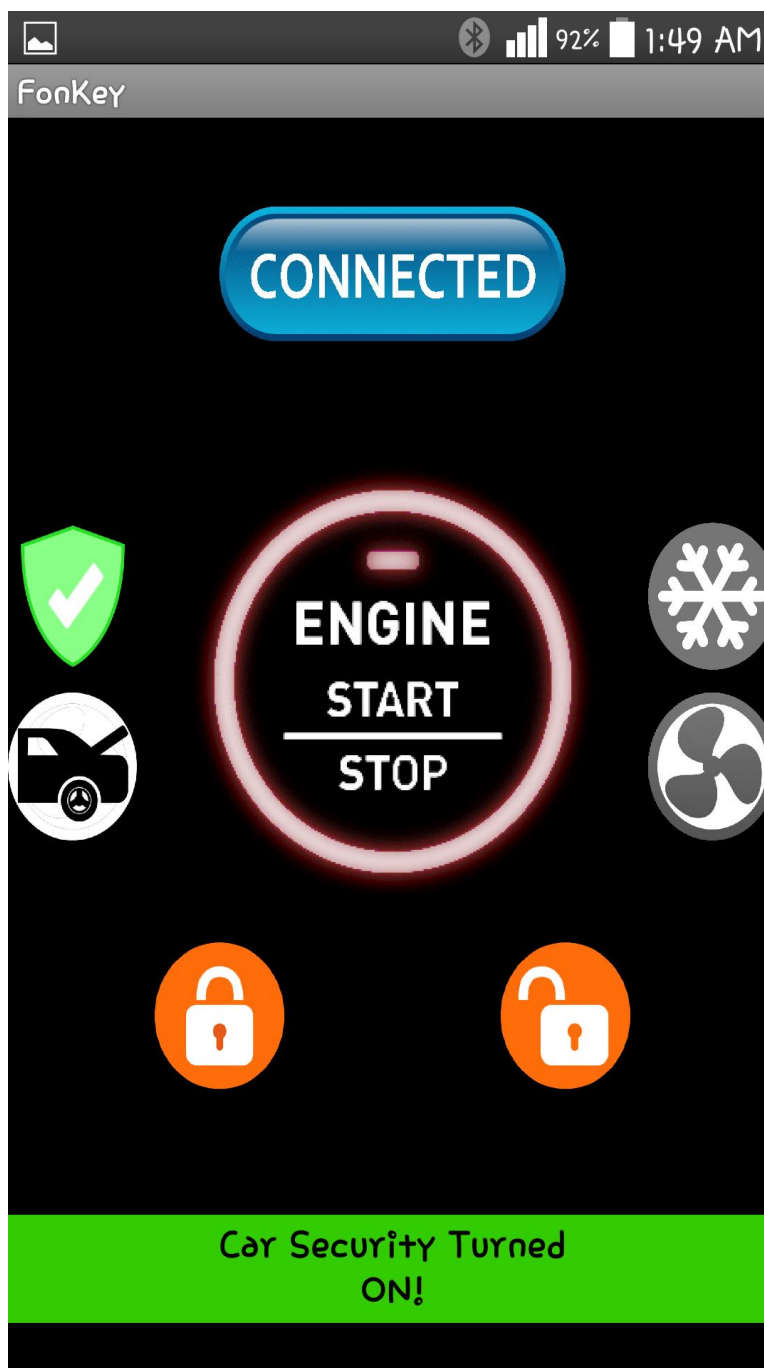
Click the **Green Shield button** to turn off the antitheft function.

\
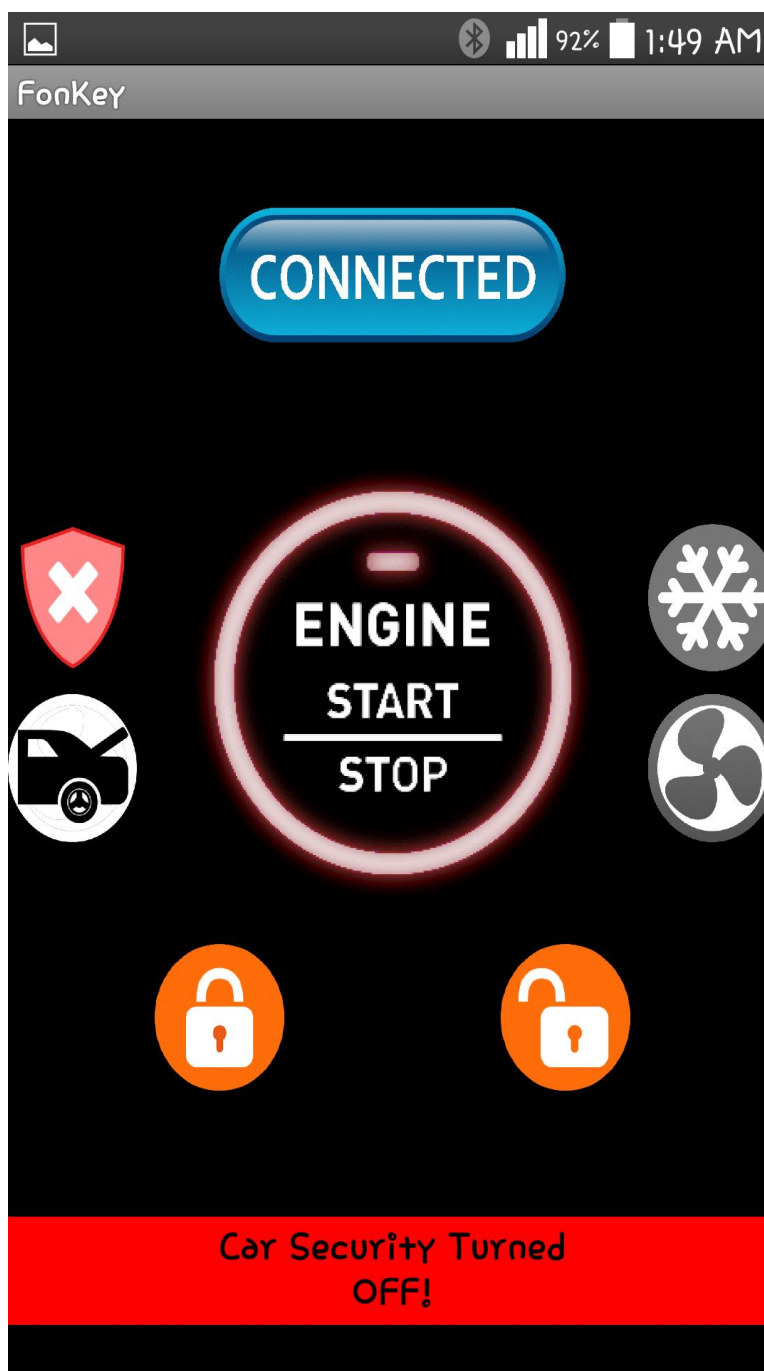
Click the Car **Trunk button** to open the car trunk, a notification will appear.
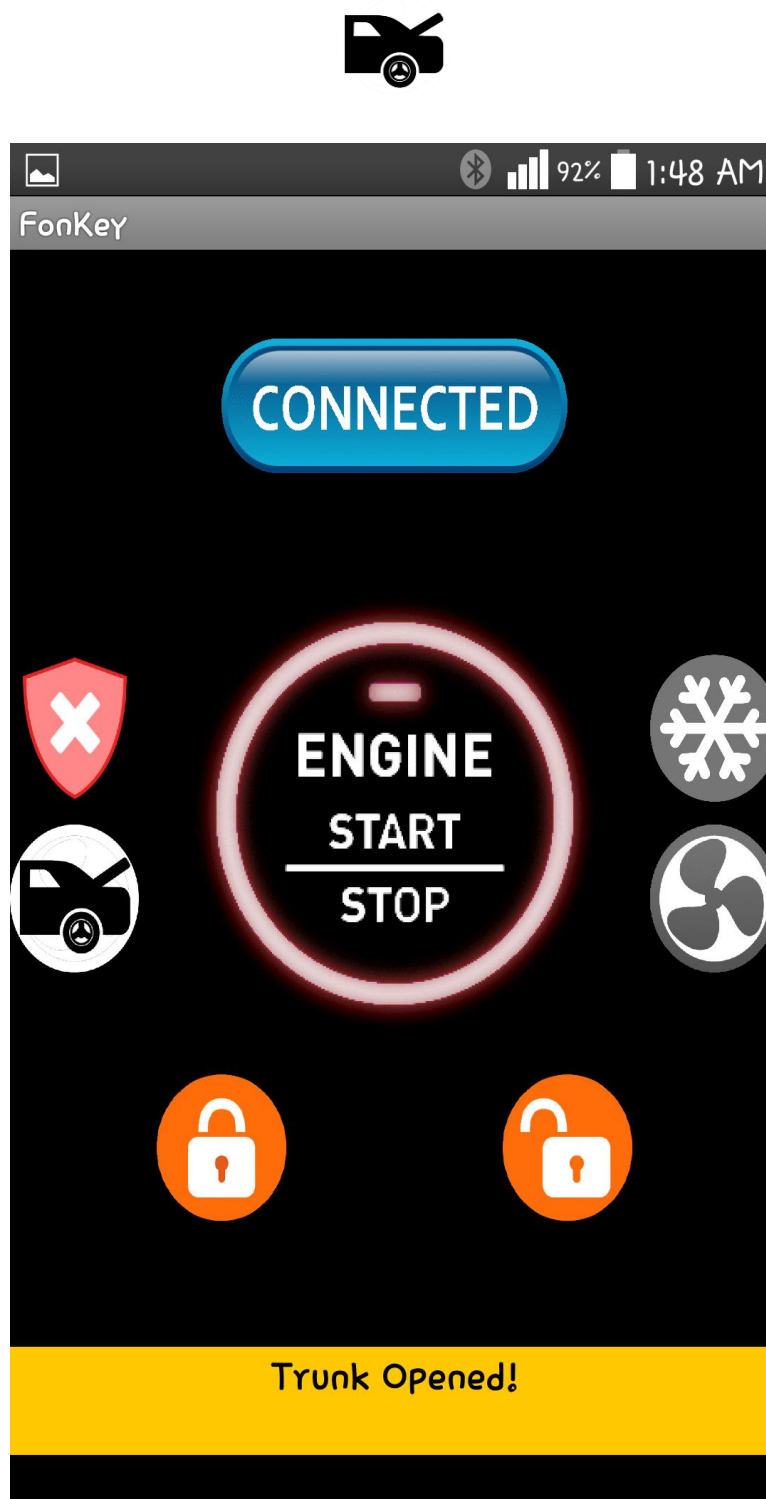
Click the **Snow Flake button** to turn on the car A/C, if the engine is not running application will show a notification and will not turn on the car A/C.
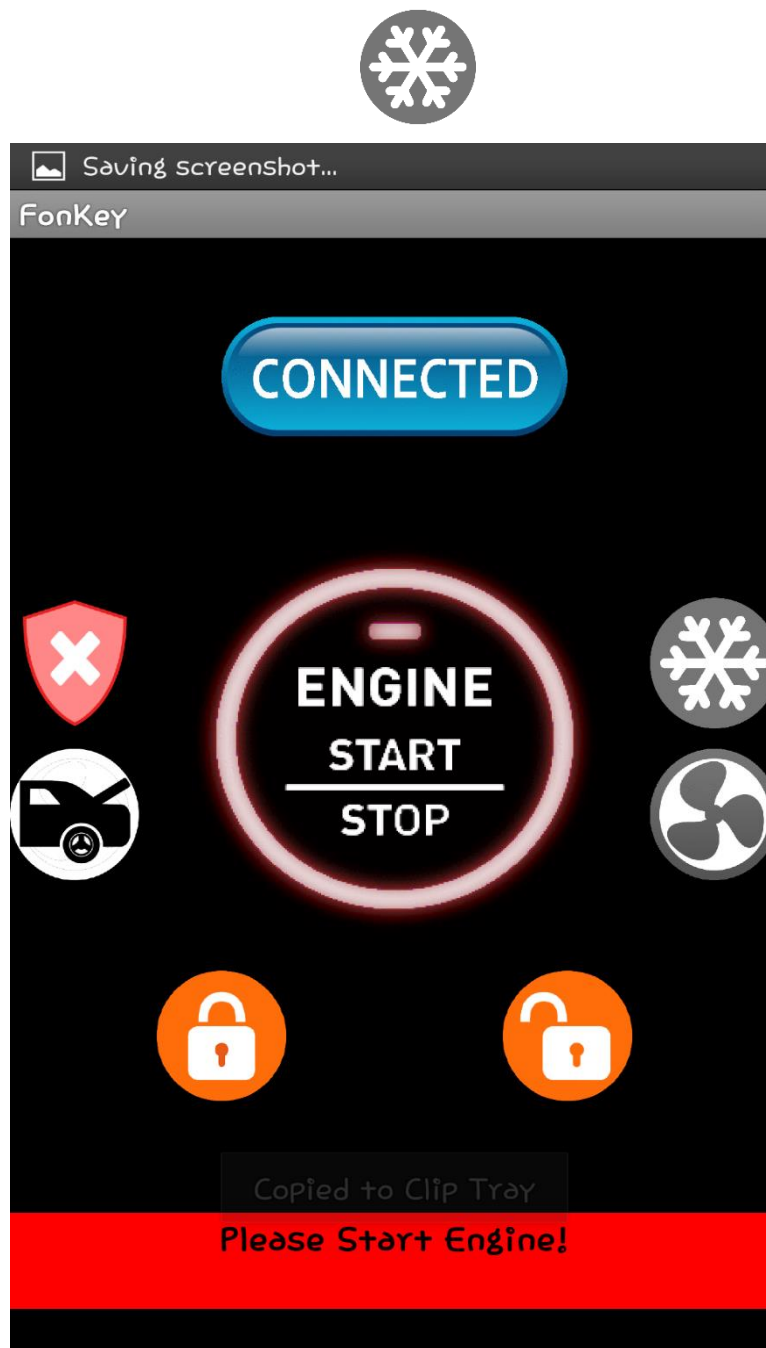
To turn on the **A/C button** to start the engine and then click the **Snow Flake button** to turn on the A/C and when turned on the button will turn to blue and the fan also turned on.
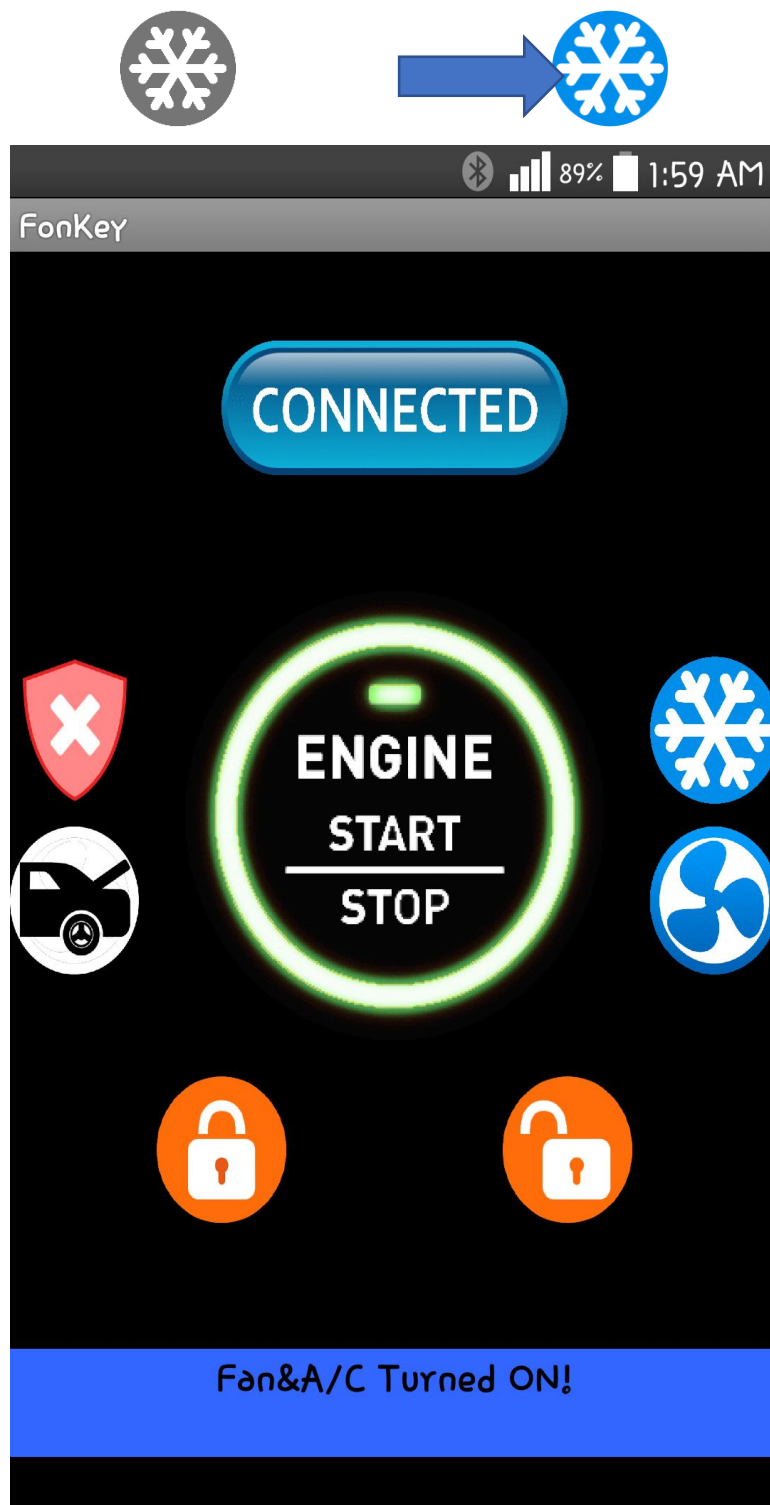
To turn off the A/C click the blue **Snow Flake button** to turn off the A/C, it will also turn off the fan.
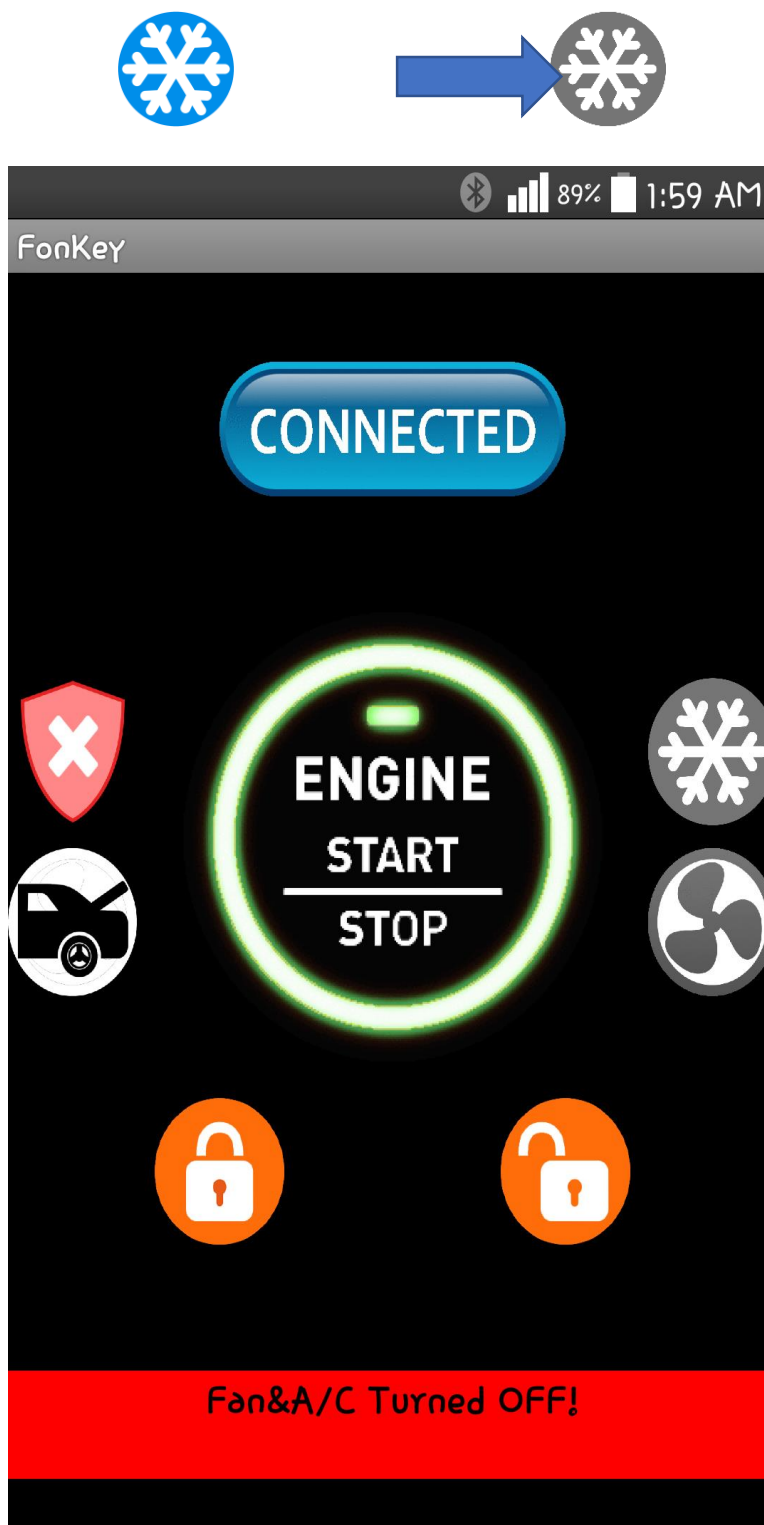
Click the **fan button** to turn on the car fan, it will turn to blue when turned on.
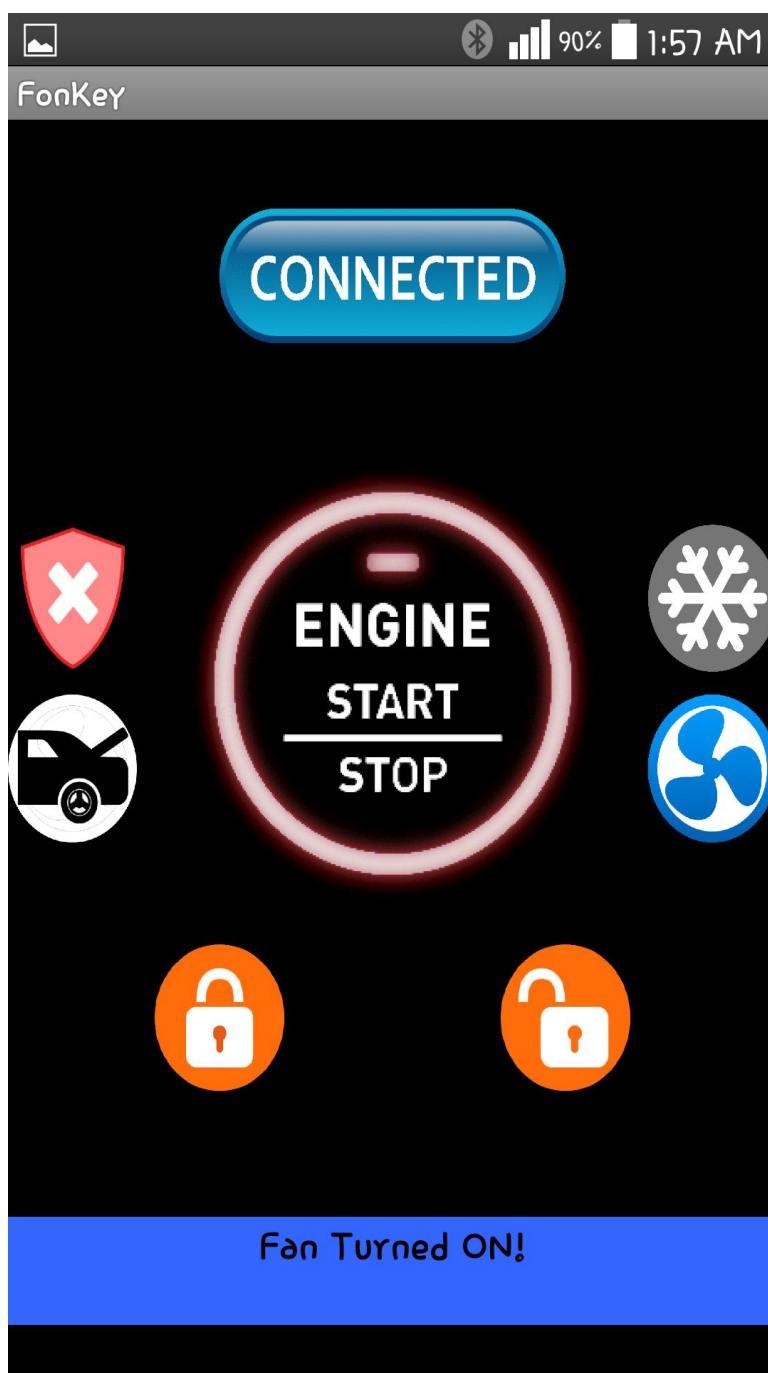
Click the blue **fan button** to turn off the fan, it will turn to gray when turned off.
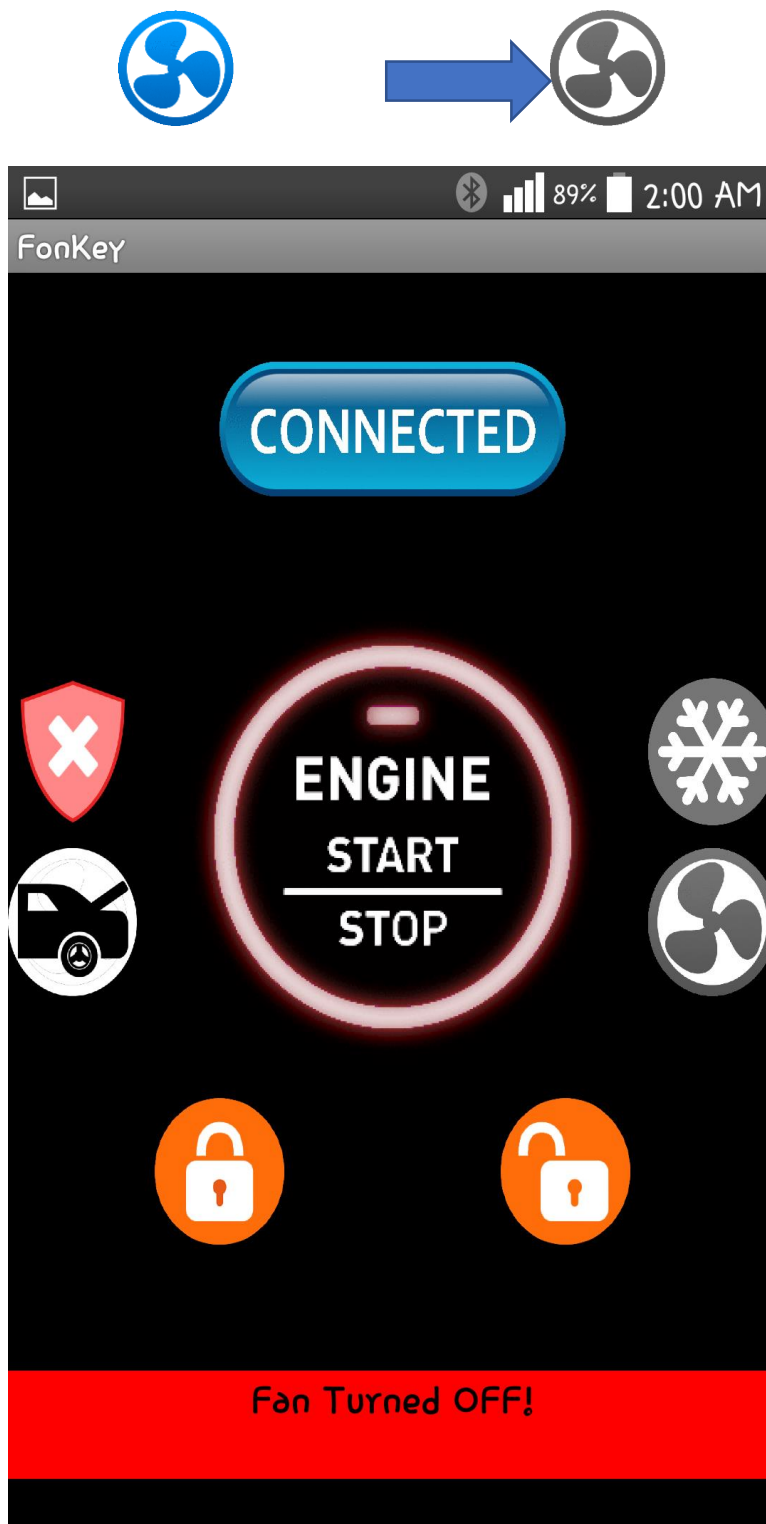
Press the Back button on your smart phone to close the application. Press **Yes** to exist.
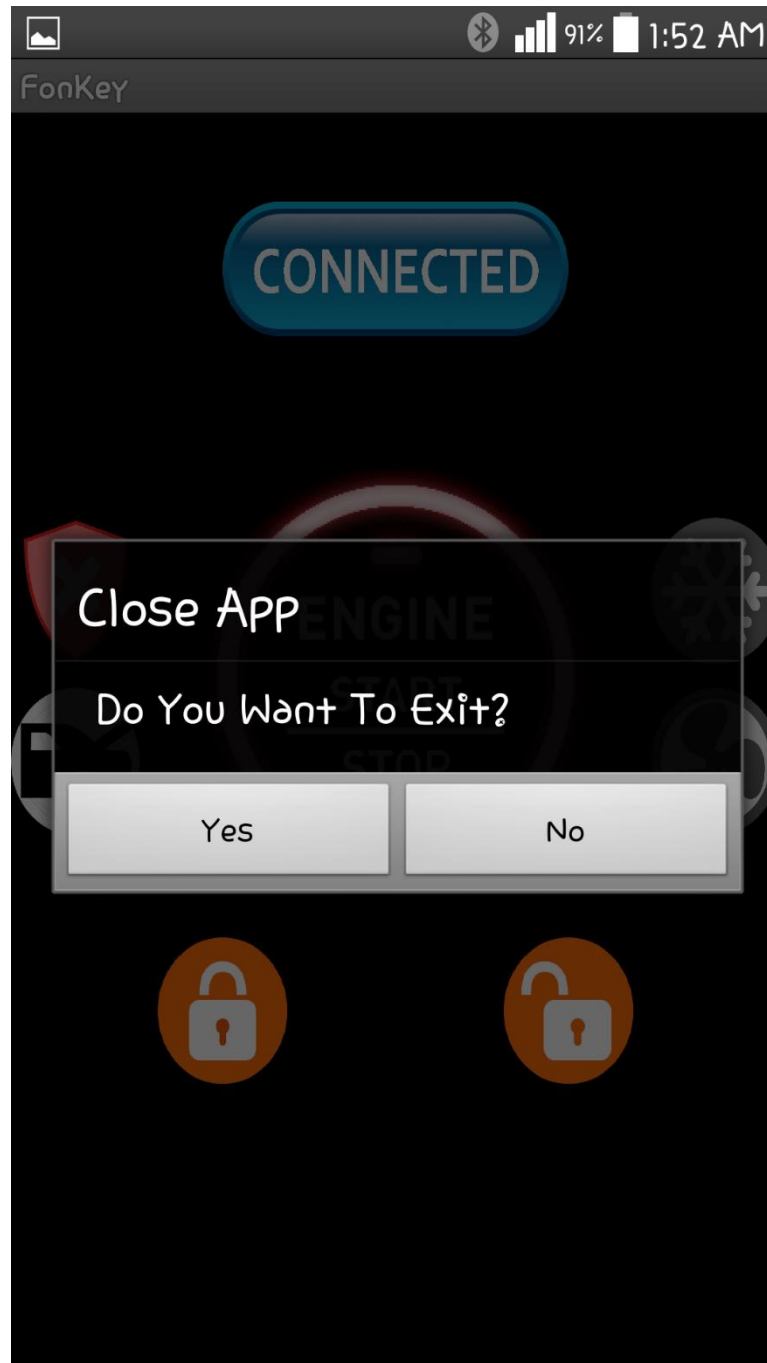
CHAPTER 6

Installation Manual

6.1   Before You Begin

6.1.1   Over view of device

6.1.2   Device wires information

6.1.3   Required Tools for installation

6.2   Installation of Device Function

6.2.1   Wiring the Engine Start function

6.2.2   Wiring the antitheft function

6.2.3   Wiring the Parking Light Indicator

6.2.4   Wiring the Lock function

6.2.5   Wiring the Unlock function

6.2.6   Wiring the vehicle Trunk function

6.2.7   Wiring the hand break safety

6.2.8   Wiring the A/C function

6.2.9   Wiring the Fan blower

6.2.10   Powering the device

6.3   Before You Begin

Read the installation manual carefully before installing the device in the vehicle. This Smart key device has been designed to be installed BY PROFESSIONAL

- Can be installed on an automatic as well as manual vehicle.
- Once you install this device, you must verify that the vehicle will not start in any forward or reverse gear, regardless of the type of vehicle.
- Do not install any component near the brake, gas pedal or steering linkage.
- Some vehicles have a factory installed transponder immobilizer system that can severely complicate the installation. There is a possibility that this system cannot be installed on some immobilizer-equipped vehicles.
- Most vehicles have an SRS air bag system. Use extreme care and do not probe any wires of the SRS system.
- Disconnect the car battery before beginning work on the vehicle.
- Check behind panels before drilling any holes. Ensure that no wiring harness or other components are located behind the panels that would otherwise be damaged.
- Do not use conventional crimp lock, bullet on any wiring. Poor wiring, i.e. taped joints will possibly introduce unreliability into the device and some functions may not work. We suggest soldering all connection points.
- Install the wiring neatly under carpets or behind trim to prevent possible damage to wires.

6.4   Over View of the Device

Smart key device offers the following functions which are controlled by the smartphone through Bluetooth.

- **Engine Start** (Start the vehicle engine)
- **Lock/Unlock** (Can lock & unlock vehicle doors)

- **Trunk** (Device can open the vehicle trunk)
- **Hand Break Safety** (if hand break is not pulled, device will not start the engine and notify the user about the hand break)
- **A/C** (device can turn on the vehicle A/C)
- **Blower** (device can turn on the vehicle fan/blower)
- **Antitheft Function** (when this function is turned on then the device will not start the vehicle engine through the vehicle key)

6.5 Required Tools for the installation

- Soldering iron and solder
- Voltmeter
- Wire Stripper
- Wire Cutters
- Needle nose pliers
- Straight head & Phillips-head screw-drivers
- Electrical Tape
- Pliers

6.6 Device Wiring Information

Label	Polarity of wire	Specification
ACC	Positive (+)	Gives output +12volts
IGN	Positive (+)	Gives output +12volts
STR	Positive (+)	Gives output +12volts
PRO	Constant Positive (+)	Gives Constant output +12volts
Lock	Negative (-)	Tigger door lock (For polarity read 2.4 article)

Unlock	Negative (-)	Trigger door unlock (For polarity read 2.4 article)
Trunk	Positive (+)	Trigger the trunk motor (For polarity read 2.5 article)
Park	Negative (-)	Parking Light Input
HB	Negative (-)	Hand Break Signal Input
A/C	-	Read 6.14 article.
Blower	-	Read 6.15 article.
VCC	Positive (+)	+12volts Input
GND	Negative (-)	-12volts Input

6.7 Wiring the Engine Start function

For this function we need three wires from the ignition harness

Accessory wire (polarity (+))

Ignition wire (polarity (+))

Stater Motor Wire (polarity (+))

Note: To identify the wire use multi-meter or read car owner's manual.

When you identify the wires then,

- Join the Accessory wire to device wire label as **ACC**.
- Join the Ignition wire to device wire label as **IGN**.
- Join the Stater Motor wire to device wire label as **STR**.

Note: Solder the wires before taping them or use proper connectors.

6.8 Wiring the Anti-theft function

For the antitheft function you need to identify the constant +**12volts** wire with the help of a multi-meter and then cut the Constant positive +**12volts** wire from the key ignition connector, then join the device wire label as **PRO** in the Key Ignition Connector in the place of Constant positive +**12volts**.

Note: To identify the wires use multi-meter or read cars owner's manual

Solder the wires before tapping then or use proper connectors.

6.9 Wiring the Parking Light Indicator

Join the device wire label as **Park** with parking light input wire, the polarity of the parking light input wire should be Negative **(-)**.

OR

Connect the **Park** wire of the device on the Negative terminal **(-)** of the flasher relay of Parking Light.

6.10 Wiring the Lock Function

First identify the car lock a trigger pulse wires from the cars owner's manual or use multi-meter. When you identify the trigger pulse wire then connect the **Lock** wire of the device with the vehicle lock trigger pulse wire.

6.11 Wiring the Unlock Function

First identify the car unlock trigger pulse wires from the cars owner's manual or use multi-meter. When you identify the trigger pulse wire then connect the **Unlock** wire of the device with the vehicle lock trigger pulse wire.

6.12   Wiring the Vehicle Trunk Function

First identify the car trunk motor trigger pulse wires from the cars owner's manual or use multi-meter. When you identify the trigger pulse wire then connect the **Trunk** wire of the device with the vehicle trunk motor trigger pulse wire. If the vehicle trunk does not have any motor, then the user has to install the motor first. Then connect one wire to battery one terminal and other wire to the device if the motor work in opposite direction just reverse the wires of the motor

.

6.13   Wiring the Hand Break Safety

Join the wire label as **HB** of the device with vehicle hand break signal wire (The hand break signal wire displays a symbol (**!**) on the dashboard if the hand break is pulled). The input polarity of the **HB** is negative **(-)**. If you have an automatic transmission vehicle then connect the device wire label as **HB** to negative (-).

Note: This function will not start the vehicle's engine until the hand break of the vehicle is pulled.

6.14   Wiring the A/C Function

Open the A/C switch check for two wires that turn on the vehicle air conditioner, then attach these two wires to the device wires label ad **A/C**.

6.15   Wiring the Fan Blower Function

Open the Fan switch and check for two wires that turn on the vehicle fan blower, then attach these two wires to the device wires label as **Blower**.

6.16   Powering the device

Connect the wire label as **VCC** to constant +**12volts**.

Connect the wire label as **GND** to constant **-12volts**.

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M. Banzi, M. Shiloh, *Getting Started with Arduino*, 3nd Edition, The Open Source Electronics Prototyping Platform, 2008.

S. Monk, Programming Arduino, 4th Edition, Getting Started with sketches, 2011