

## Creación de una aplicación para control de un coche de radiofrecuencia en dispositivos que usen IOS

*Creating a car radio frequency control application for IOS devices*

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### Resumen

El objetivo fue crear una aplicación que controle un coche de radiofrecuencia en dispositivos que usen iOS, utilizando los siguientes materiales: una Mac Book Air 13", una licencia como desarrollador de Apple y software XCode.

El costo de la aplicación es gratuito ya que ayuda a patrocinar algunas empresas que se publicitan al momento de ejecutar la aplicación. Una de las ventajas de este proyecto es que la tecnología utilizada (bluetooth), es más precisa que otras que no pueden manejar el coche de radiocontrol en exteriores.

Puesto que se enlaza para su conexión segura, el ahorro de baterías es mejor y su duración mayor. Aunque el costo es un poco más alto, la potencia aumenta favorablemente. El diseño de la aplicación es simple y fácil de comprender por personas de cualquier edad.

Muestra un margen de error mínimo: del 5 %, pero si se presenta el caso, la aplicación se cierra por sí sola para después reiniciarse normalmente.

En conclusión, se logró el objetivo de crear una aplicación que controle a un coche de radiocontrol. Dicha aplicación maneja una comunicación óptima y fácil de utilizar, y aunque su costo es un poco más elevado, su potencia es mucho mayor en comparación con la del modelo anterior. Asimismo, se evitaron gastos innecesarios en baterías al sustituir tecnología de comunicación (bluetooth), satisfaciendo al usuario.

**Palabras clave:** radiofrecuencia, dispositivo, iOS, coche, control.

### **Abstract**

The objective was creating an application that controls a car's radio frequency devices that use iOS, using the following materials: a Mac Book Air 13", an Apple license and XCode. The cost of the application is free since it helps to sponsor some companies that are advertised at the time of executing the application. One of the advantages of this project is that the technology used (bluetooth), is more accurate than others that cannot handle the radio control car in outdoors. Since it links to for secure connection, battery saving is better and greater durability. Although the cost is a little higher, the power increases favorably. The design of the application is simple and easy to understand by people of any age. Shows an error minimum margin: 5%, but if the case arises, the application closes by itself then rebooted normally. In conclusion, the goal of creating an application that controls a car's radio control was achieved. This application manages a best and easy to use communication, and although their cost is slightly higher, its power is much greater in comparison with the previous model. Also unnecessary in battery costs were avoided by substituting the communication technology (bluetooth), satisfying the user.

**Keywords:** radio frequency, device, iOS, car, vehicle, control.

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## Introduction

James Clerk Maxwell was the first to mention the theoretical basis of the propagation of electromagnetic waves. And Heinrich Rudolf Hertz, between 1886 and 1888, was the first to experimentally validate the theory of Maxwell. On the other hand, the first time that this technology was used is attributed to different people: Alejandro Stepanovich Popov made his first demonstrations in Saint Petersburg, Russia; Nikola Tesla in St. Louis, Missouri, United States and Guillermo Marconi in the United Kingdom

(<http://www.icarito.cl/enciclopedia/articulo/segundo-ciclo-basico/educacion-tecnologica/historiade-la-tecnologia/2009/12/71-6278-9-4-medios-de-comunicacion-electronicos.shtml>).

The origin of Radio Frequency is sadly related to the war, specifically with the second world war, in which the use of radar allowed the detection of aircraft kilometres away, but not his identification (<http://www.it.uc3m.es/jmb/RFID/rfid.pdf>) “1/4”.

Although the word used radio, television broadcasting, radio, radar and mobile phones are included in this class RF emissions. ([http://fido.palermo.edu/servicios\\_dyc/publicacionesdc/vista/detalle\\_articulo.php?id\\_libro=138&id\\_articulo=4638](http://fido.palermo.edu/servicios_dyc/publicacionesdc/vista/detalle_articulo.php?id_libro=138&id_articulo=4638)).

Other uses include audio, video, radio, emergency services and data transmission by digital radio; both civil and military. (<http://prezi.com/jrk1kkhb10jf/untitled-prezi/>) “13/20”.

This application is a mobile operating system company Apple Inc (IOS), originally developed for the iPhone (iPhone OS), after being used in devices like the iPod Touch, iPad and Apple TV. The user interface of iOS is based on the concept of direct manipulation, using multi-touch gestures. Interaction with the OS includes gestures such as slips, touches, pinching, which have different definitions depending on the context of the interface. Internal accelerometers are used to make some applications to respond to shaking the device (for example, the undo command) or rotate in three dimensions (one common result is to change from portrait to landscape or portrait). iOS, or iPhone OS, has few years. But despite those years, Apple is forcing the emergence of a new version every year, approximately cycle. Really, and being faithful to the definition version as software engineering, it can not be called new version as only rewriting the code from 0 entitles you

to add a new number before the point. This detail, however, was lost long ago in the dawn of time (<http://www.meneame.net/story/ios-historia-pasada-futuro-inmediato>).

Undoubtedly, the App Store and the international arrival of the iPhone 3G, brought a major boost for the platform and almost led to a reinvention of the concept. A whole year passed until the appearance of iPhone OS 3. Version 3 represented an interesting integration of new and review of necessary items. An interesting year and an interesting version, which was also the release version of the device that would change the concept of tablet for ever: the iPad. Introduced in January 2010, incorporated as operating system version 3 until November of the same year (several months after the release of version 4 for iPhone / iPod Touch) which finally received the long-awaited version 4 and its star feature (<http://www.tecnocaracas.com/2011/05/ios-historia-pasada-y-futuro-inmediato.html>).

Currently you can add modules to control RF devices from the touch screen of the phone. IOS experience does not end on a touch device, this experience can be transmitted and spread, proof of this are devices that can be controlled with iDevices (iPad, iPhone, iPod Touch). Another physically interact with idevices is AppSpeed Monster Truck, which is controlled by a small accessory and its official implementation, the compatibility of this monster truck remote control is achieved with an RF transmitter (RF) in the 30-pin connector This just highlights over the iPhone, control modes are 2: using capacitive screen or via motion sensors, the optimum range is about 15 meters, powered by 3 AAA batteries that can be recharged by via USB, we can see as increasingly appear radio frequency devices with the use of our intelligent devices (<http://www.informacioniphone.com/2011/09/appspeed-monster-truck-el-carro-a-control-remoto-para-los-idevices.html>).

Therefore, mobile devices have had a significant evolution, which have applications that facilitate the use of new technologies, which allow us to have access to our accounts in social networks, access to information, power control devices like TV through the wireless network. When creating the application for mobile devices with IOS operating system it will help us to be easily accessible, driving with a compatible car radio with this technology which has a 2.4GHz frequency also will be more comfortable for the user and speeds driving the car.

The iDevice (iPhone, iPad, iPod Touch) is our remote control, which replaces the conventional remote control uses a 9V battery, expensive for its duration of 15 days. This is to improve the interface of the application in a friendly and comfortable for easy handling and access to the environment. Application development with object oriented languages procedural development process involves obtaining knowledge of programming to develop the application, which will allow us to control the radio control device (drive).

For the operation of the Bluetooth application including any iDevice it is used today. The application is used in the iOS operating system is the platform used by mobile devices such as iPhone, iPod and iPad only, which gives us a uniqueness with only one user group.

We now have an attractive and innovative application that encourages the use of single movements of the mobile without pressing any button, which makes the car more fun remote control compatible with our mobile devices.

In Mexico it has not implemented the creation of an application to register it in AppStore of Mexico, which is capable of controlling a one car radio so that the user can acquire and save on buying batteries, with the passage of time they become costly.

Research questions:

Does the creation of an application in iOS allows control of a radiofrequency device at low cost?

What is the feasibility of creating an application for controlling an RF device with a mobile device that uses iOS, using the model of prototyping?

Current applications control device radio are still not developed by a developer in Mexico, so that application to control a car radio, which built on our iDevice (Bluetooth) technology used was developed, and link to the car radio for easy setup and operation.

Create the application for mobile devices with iOS operating system will help us to have easy access and management of a car radio compatible with this technology, which has a frequency of 2.4GHz also be more comfortable for the user and speed up the driving the

car. This improves the application interface in a friendly and comfortable for easy handling and access to the environment.

New models and programming languages are used, for example, Object-C, AppArchitect, XCode. A new approach to apply in any iDevice is required. Creating applications for devices like the iPhone, is a very important aspect to the exponential growth of this type of applications, and has demonstrated the success of many companies engaged in the creation of mobile applications for iOS devices ie iPhone iPad and iPod Touch.

Aprendimos a programar para iOS por medio del software gratuito de Apple (XCode), que es una programación orientada a objetos, para poder subir la aplicación a AppStore México. Esta aplicación de iOS pretende estandarizar un radiocontrol de 2.4 GHz que sea compatible con cualquier coche de dicha frecuencia, haciéndolo una opción bastante atractiva para divertirse sin la necesidad de utilizar botones. Esto mismo nos hace aprender y conocer la programación mediante Objet-c que es programación orientada a objetos, y así poder diseñar la aplicación. Ahí podremos programar las acciones básicas para controlar el coche de radiocontrol.

We learned to program for IOS through the free software from Apple (XCode), which is an object-oriented programming, to upload the application to AppStore Mexico. This iOS app aims to standardize a 2.4 GHz radio that is compatible with any car that frequency, making it quite attractive to have fun without the need to use option buttons. This also makes us learn and know by Objet-c programming that is object-oriented programming, so you can design your application. There we can program basic actions to control the car radio.

### **General purpose**

Create an application control car radio to devices using iOS.

### **Materials and methods**

The research methodologies were used for the development of this document are:

- **First phase:** Using documentary techniques for obtaining information about developing applications for iOS and use of transmission to mobile communication with the car radio.

- **Second phase:** Using exploratory methodology for information on using Bluetooth technology communication with the device.

o Software Review: Build a guide for the design-based learning software operating procedures.

o Review of Internal Documents: Refers to the manuals or guides as to develop and design applications.

o Review of External Document: They are focused on the design of the car radio.

- **Third phase:** Analytical methodology using Unified Modeling Language (UML) modeling program classes to define the levels of inheritance relationships between classes and objects of the program. UML is used, since the diagrams developed are independent of the programming language in which they are implemented. They are used in object-oriented design specific components. Model View Controller (MVC) for generating the interface and graphic objects linkage with the source code is used. Source code generation using the Objective-C using OOP.

- **Fourth phase:** Application of methods and techniques for prototyping methodology for application development. Using as Interface Development Environment (IDE) Software Development Tools (SDK) 5. Methodology Rapid Application Design (RAD) for final application development.

Since we have the computer, now it's time to download the software development (XCode) coming free for your computer, and also have to check in at: <https://developer.apple.com/>

We mentioned earlier that we have to make the development of an application for iOS that is our raw material, which is the computer. Since we know what we need now it is a matter of how much we have to invest, if we are to take any funding and support to carry out the project, if we are to have sponsorship and so on.

Use low-cost computer that is mentioned Mac Book Air 13-inch, the license as a developer for Apple and XCode Development Software that is free. It is taken for granted that we

know programming or have taken a course of Objective-C programming to program in XCode.

The cost of the application is free, as it will be sold to a specialized company car radio. Also, when downloading the application to another company shortly we will advertise for more income and return on investments.

The goal is a 2.4 GHz radio that is compatible with any car with that frequency, making it a very attractive option for fun without the need to use buttons, using Object-C is an object-oriented programming, where we can program basic actions about controlling the car radio and satisfy user needs. It is that this find it easy to use and economical to replace the conventional control by the mobile device.

Or computer system used for processing the application, was obtained with the following characteristics:

### **MAC BOOK AIR 13 PULGADAS: 128 GB**

#### **Specifications:**

- Dual Core Intel Core i5 1.3 GHz
- Turbo Boost up to 2.6 GHz
- Intel HD Graphics 5000
- Memory 4GB
- Flash Storage 128 GB1

Purchased from the Apple store near you.

The computer equipment used within the University Center Temascaltepec or, failing that, in the home of the programmer. No territorial restrictions whatsoever face.

Interfaces:



The interface is designed for the user to use the application easily and comfortably, with a single click (touch). When your operation running opens, which is operated radio control device.

If your iOS device stops working or have any problem will be manufacturing defect. The application is available to download as many times as desired by the user, who uses an account for that which is linked to a database that can be useful for other iOS devices (idevices).

### **Users and human factors:**

This application is designed for people of all ages, children, adolescents and adults. Overall, it is for users who are willing to make the most of your iOS device (idevices), to have fun and save the batteries of the remote, which will be replaced by the iDevice.

Its use is simple for anyone and brings a manual on the operation and functions; also it offers a video explaining how to use the application and how to connect each of the device.

Instructions to be easy to understand use, the user can not improperly use the system.

### **Functionality:**

Its main function is to control radio control device (accelerate, brake, reverse, turn (left and right). As the user operates or use the application and hold on radio control device, you can control. There are several modes of operation radio control device, such as speed and turn right or left, the back (reverse) by turning to right or right, and simply accelerate and advance or reverse (back).

It can be improved according to the views of the user or company to which it has under the application, or when devices (idevices) require an upgrade or the application is not compatible with the device (iDevice). For this, the developer can maintain it in future failures or incompatibilities. The speed of application execution is fast, since it is only operation and does not store data, and their response time is minimal for control of radio control device, with a favorable performance.

**Documentation:**

Basic knowledge on radio, operation, features, and building iOS applications (programming via XCode) are required to operate the radio control, user manual operation, minimum requirements of the device (iDevice), binding characteristics (bluetooth ), and application. It should be provided online (Online) and / or paper.

The developer must have the minimum necessary knowledge about radio control, its features and operation, iOS, programming languages, object-oriented (using XCode). For its part, the user is provided with a manual operation, installation (link connection via Bluetooth to the car radio control), and technical information (minimum requirements, and features bluetooth application), with clear instructions.

**Facts:**

Data entry begins with instruction for compiling the application, and this through the transmitter sends to the receiver (radio control device), the recipient to carry out the actions that the user desires. The sending of these instructions will be according to frequency of use (number of times used) that the user wants. It has a margin of error of 5%, and minimum response time.

**Resources:**

Material resources are (1 Mac Book Air 13 "), the (XCode) software and developer license from Apple to build the system (application); Also, you must have knowledge of object-oriented [Objective-C, (XCode)], knowledge of radio control device, bluetooth (features, functionality) programming; and maintain compatibility updates especially for idevices.

The skills needed for developers are: knowledge in object-oriented programming, basic knowledge of operation of a transmitter to a radio control device. Furthermore, the physical space occupied by the application is about 21.75 MB. Operating precautions are not operate the radio control device on walls or obstacles that prevent a direct view of the iDevice with the radio device and the user.

Its use is for indoor and outdoor. It is recommended to avoid moisture and do not handle multiple cars in the same band. It is also recommended allocating adequate space to play. If a child uses the product, should always be supervised. On the other hand, being an electronic game, if used in excess it can cause pain and irritation in the eyes. Be sure to take a 10 minute break every hour, even if you feel you do not need.

There is a prescribed schedule that part of the application development through bluetooth to the radio control device. The spending limit for this project amounts to \$ 20 000.00 (\$ 16 499.00 for the Mac Book Air 13 ", \$ 2 303.79 for the developer license from Apple and books come to occupy).

### **Quality assurance:**

The characteristics of the communication technology (bluetooth), radio control car and implementation is reflected in the user manual and a tutorial video of operation. If the application detects failures, this comes at the beginning on the screen iDevice, showing an error message and saves a line of code error in a log file on the system.

The correct application maintenance (fix) errors thereof and includes improvement. It is difficult to move the application from one location to another or from one iDevice to another, since the application is uploaded to the server from the AppStore and in any part of Mexico that has an Internet connection, the iDevice can download the application for same.

Generally, the purchase of a mobile application is clicking the buy button next to the description of the application. Most smartphones have built a bank account to make purchases, so the buying action automatically deducts the value of the account applications built on the Smartphone, which makes the buying process easy. In addition, mobile applications are typically very inexpensive (US \$ 0.99 to US \$ 10), unlike applications desktops, whose value is much higher. Smartphone popular games typically cost \$ 1, while a popular PC game costs about \$ 50.

Developers, using simple and inexpensive applications, pointing to large volumes of low margin sales and that is the appeal that has kept consumers so far by; This strategy is expected to continue to give good results in the future.

To start developing applications for mobile devices with iOS are a number of minimum requirements, which are:

- **A Mac:** used to develop applications for iOS. The tools needed for the development of these applications are only available in the MacOSX operating system.
- **Register as Apple Developer:** In our case, we are required to give a registered iOS developers, this can do it in the iOS Dev Center. Thanks to this we can access various resources available to developers, as the iPhone SDK.
- **iPhone SDK:** development environment X-Code, which developed the application using the Objective-C language programming, as well as an iPhone Simulator to run and test our applications without need for It includes a Apple device, as well as several libraries and a graphical tool that allows us to design user interfaces.

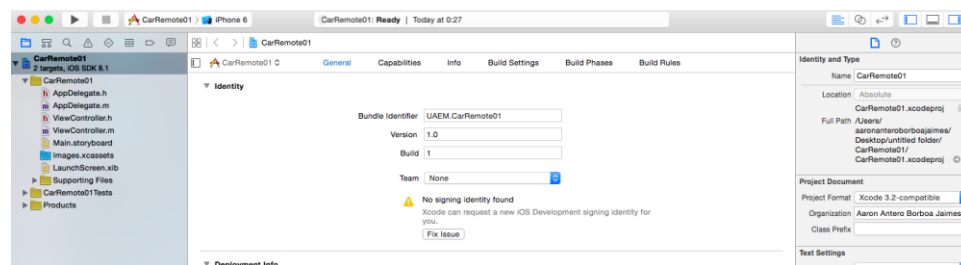
Since the minimum requirements are known to create an application, you must select the components or devices.

## Results

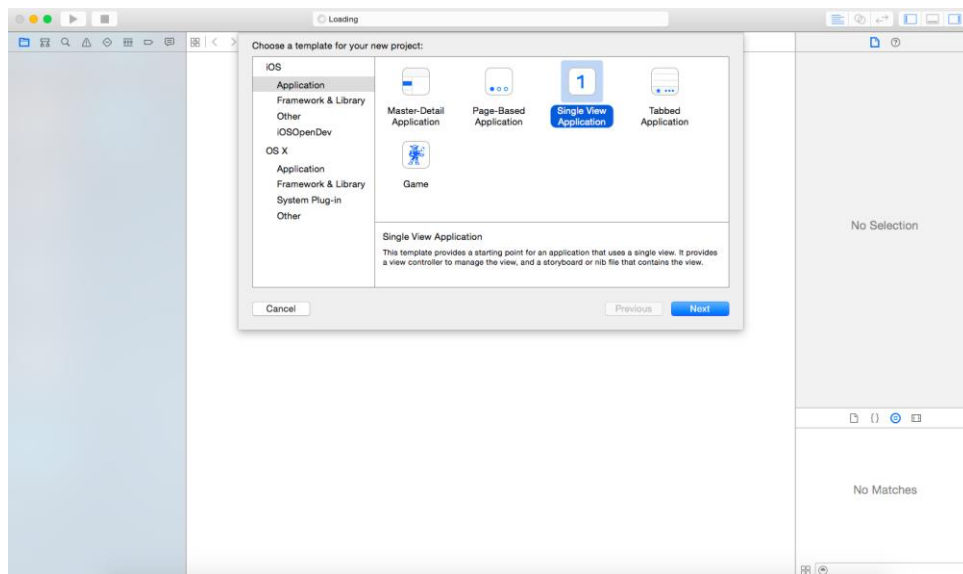
First, we must have Xcode software, which is free in the store of Apple Store installed. Right here we will start to click Create a new project.



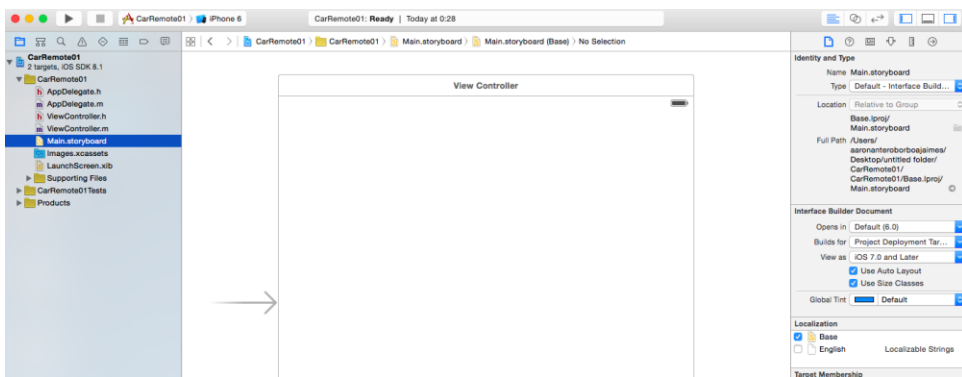
After creating the project configuration commands us to our application where we can select iOS devices with which it is compatible, among other features.



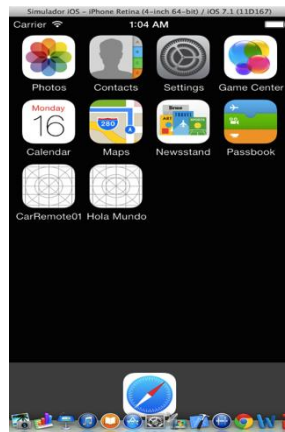
It gives click Next, since our application is Single view application (single application view).



This screen is our entire user interface, but we can still schedule. It is the design of our application (display).



This is the first view which shows the iOS simulator using XCode free software provided by Apple. That began to create our application, still has no image on the icon called "CarRemote01" where clicking the application opens.



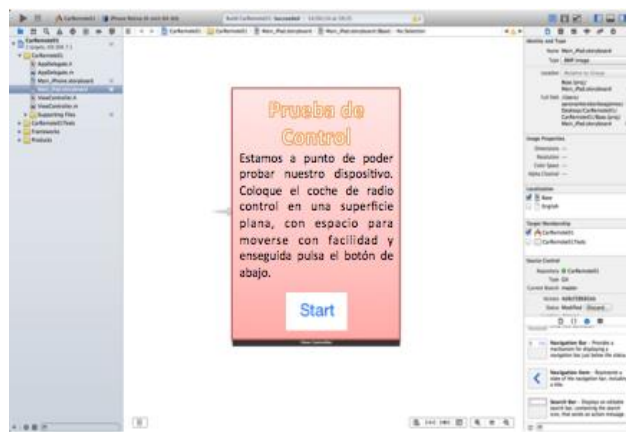
This is the first screen of your application, which shows a series of instructions to consider to link the iDevice with the car radio.



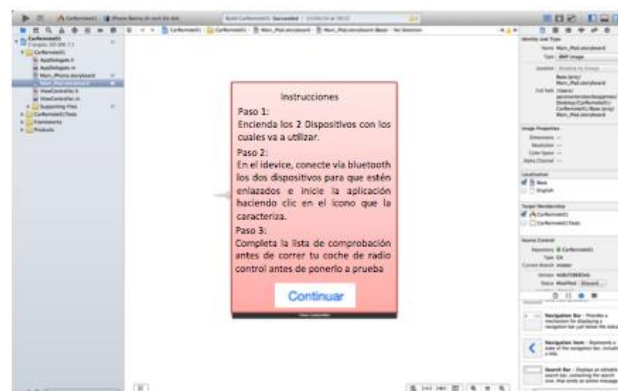
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After clicking on the Continue button in the previous screen, this screen that recommends specific area for easy handling of the car radio is listed.



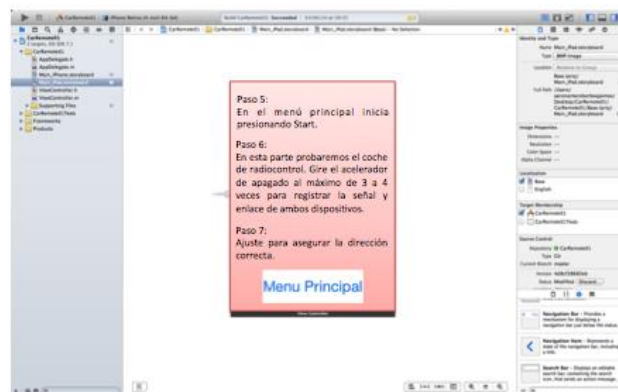
This screen is displayed when clicking on the icon ( ) statements, where the signs to follow to configure your iDevice with the car radio to function properly displayed.



After clicking the Start button from the previous screen, this screen where you can see the main menu. Hence the support options, instructions, video tutorial, settings and Start (where we on the screen radio control device) appear.

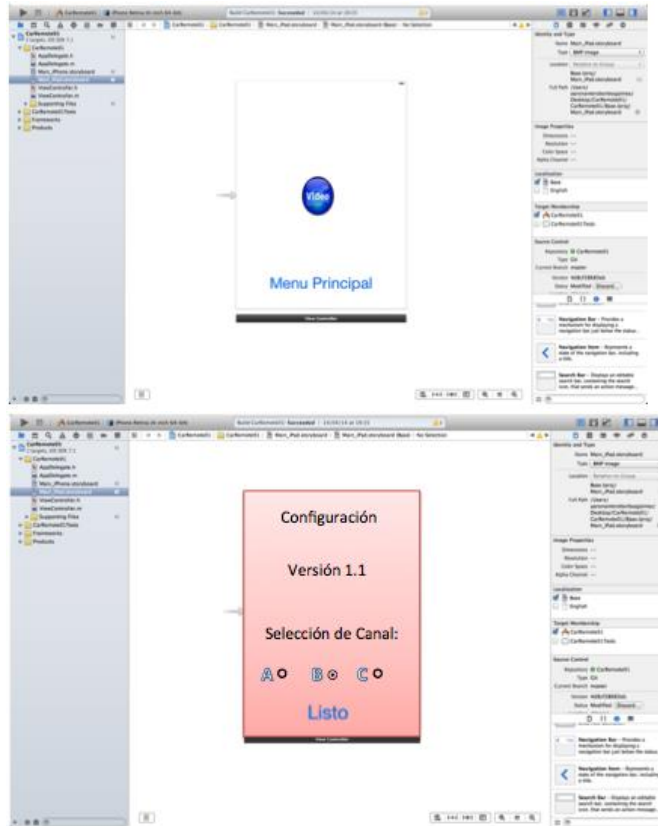


This is the second instruction screen, which appears when you click the Continue button on the first screen. It shows the main menu button after following all indications.

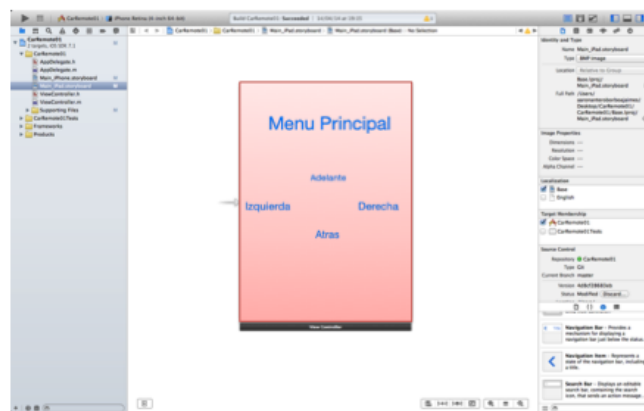


This screen appears when you click on the icon of the video tutorial, which shows the presentation of the operation of the car radio, from initial configuration to use.





This is the setup screen where you can configure the communication channel radio control device with the iDevice, because if they are not in the same channel can not communicate. It also shows the version of the application, and button ready to return to the main menu.



This is the Start screen main menu, which helps control radio device, which send instructions to follow our car (which is directed forward, backward, turn left or right).

The code we use for communication iDevice with the car radio control through technology embedded in our iDevice, bluetooth, is:

```
Int unChar;                                digitalWrite(led, LOW);                    digitalWrite(motorB,
void adelante();                            Serial.write("retroceder                    HIGH);
void reversa();                              ");                                        }
void derecha();                             Break;                                    void reversa(){
void izquierda();                           case '<';                                digitalWrite(motorA,
                                                izquierda();                             HIGH);
void setup(){                               digitalWrite(led, HIGH);                 digitalWrite(motorB,
Serial.begin(9600);                          Serial.write("izquierda"                LOW);
}                                             );                                        }
                                                break;                                    void izquierda(){
void loop(){                                case '>';                                digitalWrite(dirA,
char unChar =                                derecha();                                LOW);
Serial.read();                               digitalWrite(led, LOW);                 digitalWrite(dirB,
switch(unChar){                              Serial.write("derecha");                HIGH);
case W;                                       break;                                    }
adelante();                                case 'c';                                void derecha(){
digitalWrite(led, HIGH);                    }                                        digitalWrite(dirA,
                                                }                                        HIGH);
Serial.write("Avanzar");                    void adelante(){                         digitalWrite(dirB,
break;                                       digitalWrite(motorA,                     LOW);
case 's';                                   LOW);                                    }
reversa();
```

While the code that is preloaded on the car radio is:

```
int lucespin = 7;
int motor1Pin1 = 11;
int motor1Pin2 = 12;
int enable1Pin = 13;
int motor2Pin1 = 8;
int motor2Pin2 = 9;
int enable2Pin = 10;
int state; int
stateStop=0;
void setup() {
pinMode(lucespin,
OUTPUT);
pinMode(motor1Pin1,
OUTPUT);
pinMode(motor1Pin2,
OUTPUT);
pinMode(enable1Pin,
OUTPUT);
pinMode(motor2Pin1,
OUTPUT);
pinMode(motor2Pin2,
OUTPUT);
pinMode(enable2Pin,
OUTPUT);
digitalWrite(enable1Pin
, HIGH);
digitalWrite(enable2Pin
, HIGH);
Serial.begin(9600); }
void loop() {
if(Serial.available() >
0){
state = Serial.read();
}
if (state == 'A'){
digitalWrite(lucespin,
HIGH);
}
else if (state == 'B'){
digitalWrite(lucespin,
LOW);
}
if (state == '1') {
digitalWrite(motor1Pin
1, HIGH);
digitalWrite(motor1Pin
2, LOW);
digitalWrite(motor2Pin
1, LOW);
digitalWrite(motor2Pin
2, HIGH);
}
else if (state == '2') {
digitalWrite(motor1Pin
1, HIGH);
digitalWrite(motor1Pin
2, LOW);
digitalWrite(motor2Pin
1, LOW);
digitalWrite(motor2Pin
2, LOW);
}
else if (state == '3' ||
stateStop == 1) {
digitalWrite(motor1Pin
1, LOW);
digitalWrite(motor1Pin
2, LOW);
digitalWrite(motor2Pin
1, LOW);
digitalWrite(motor2Pin
2, HIGH);
stateStop=0;
}
else if (state == '4') {
digitalWrite(motor1Pin
1, LOW);
digitalWrite(motor1Pin
2, LOW);
digitalWrite(motor2Pin
1, LOW);
digitalWrite(motor2Pin
2, HIGH);
}
else if (state == '5') {
digitalWrite(motor1Pin
1, LOW);
digitalWrite(motor1Pin
2, HIGH);
digitalWrite(motor2Pin
1, HIGH);
digitalWrite(motor2Pin
2, LOW);
}
}
}
```

## Discussion

A previous application to the created, which has the correct functionality and precise same using a connection different communication: an infrared transmitter, making it less precise for transmitting communication idevice the car radio, either upon contact with sunlight, or when the infrared mistakenly blocked with any object or with the user's hand.

The technology mentioned, which in this case is bluetooth, prevents loss of communication with the car radio, unless there are obstacles, walls, or non visible to control the car through

idevice. Although the cost is slightly higher than the infrared, this handles a more power efficient than the previous. The user will feel more satisfied with the quality of communication and battery life.

Communication is done via Bluetooth, it does not occupy a robust transmitter to send the order. In contrast, the infrared has a transmitter that sends instructions to car radio, using rechargeable batteries. Ours saves transmitter batteries. Currently all the iOS mobile devices have this technology, facilitating communication and the link between them, and making it faster to set up.

## **Conclusions**

The goal of creating the application management of a car radio could be reached with optimal communication and easy to use. Although the cost is slightly higher, power greatly increased compared to the previous model, avoiding unnecessary costs when replacing batteries communication technology (bluetooth). Thus, the user is more satisfied.

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