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Smart Vehicle Ignition Control System

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Abstract—*A system and method for turning on and off a vehicle's engine and air conditioning system from Android smartphone is disclosed. The system comprises IOT Smart Vehicle Ignition Control Kit and an android application. The kit installed in vehicle is configured to turn on or off engine and air conditioning system of vehicle. A vehicle start and stop code is programmed in IOT Smart Vehicle Ignition Control Kit and configured to communicate with user's smartphone and can receive commands from a particular smartphone of the user. An android application is installed on the smartphone which lets the smartphone to connect wirelessly with the IOT Smart Vehicle Ignition Control Kit by means of Bluetooth or Wi-Fi. Kit is configured to send and receive commands and signals to turn on or off the engine and AC. If vehicle is started with smartphone and gear handle or handbrake handle is moved, engine will turn off. Selected device features of the vehicle engine's and AC's to turn on or off are controlled when the vehicle having IOT Smart Vehicle Ignition Control Kit installed in it and is connected to smartphone to receive on or off commands sent by user from smartphone to on or off engine and AC of the vehicle. The system lets the user to control the engine and air conditioning system remotely with smartphone.*

1. INTRODUCTION

Nowadays, to start a vehicle and its AC, we have to go to vehicle and put keys in the keyhole and start the engine. Then to start the AC we have to turn on the AC switch. Starting of the engine can be done from vehicle's wireless key remote but turning on the AC cannot be done wirelessly.

In cold weather conditions, we have put keys in the key hole of the vehicle, start the engine and keep it running for 10 to 15 minutes until it warms up. Only after that vehicle is recommended to run. So if user is in hurry, going to vehicle then starting it on and then waiting till it warms up will consume time and running the vehicle until it not warmed up is not recommended. If done so, engine's performance and life will be affected.

In summers, a bright sunny day can raise ambient temperature to several degrees and if vehicle is parked in sunlight for several hours then the interior of the vehicle becomes very hot and user have to first turn on the engine and then AC to bring down the temperature this thing also consumes.

In winters, the ambient temperature is several degrees' low, so the interior vehicle has to warmed up by turning on AC blower and this will also take time to get desired results.

2. PROPOSED SYSTEM

The idea is to make an IOT Smart Vehicle Ignition Control System to start and stop the engine and turn on or off Air Conditioning System of vehicle wirelessly by touching the contact switches displayed on the smartphone. It consists of IOT Smart Vehicle Ignition Control kit 100 and a smartphone software application 301. The kit is needed to be installed in the vehicle and electrical connections are to be made on the lockset ignition wiring to start and stop engine and on the AC switching wires to on or off AC with relays. Sensors are installed on Gear handle, Handbrake Handle to sense the movement, on engine to sense temperature, on output of rectifier/regulator to sense ignition.

A smartphone software application is to be installed on the smartphone which provides user interface to connect and communicate the smartphone with IOT Smart Vehicle Ignition Control kit wirelessly. User have to first launch smartphone application then need to connect with vehicle by entering the passcode programmed in the kit. When connected user have to tap on the buttons displayed on the screen of the smartphone which will send command signals to IOT Smart Vehicle Ignition Control kit which will turn on or off engine and Air conditioning system wirelessly from several meters without putting vehicle key in the key hole. The ignition status and Air Conditioning System status will be displayed on the screen of smartphone. If connection is interrupted or lost between IOT Smart Vehicle Ignition Control kit and smartphone, vehicle will be turned off. Vehicle will be turned off after a predefined time programmed in the kit.

2.1 Components of IOT Smart Vehicle Ignition Control System

A. An IOT Smart Vehicle Ignition Control Kit installed in the vehicle comprising:

a) Wi-Fi/Bluetooth Receiver (communication module) 101 configured to:

1. Communicate with user's smartphone to send and receive data and command signals.
2. Connected to controller board & requires power for operation.
3. Needs to be paired with user's smartphone by means of Wi-Fi or Bluetooth communication to receive command signals from User's smartphone.
4. If Wi-Fi is present and communication module is able to pair with user's smartphone's Wi-Fi by matching the alphanumeric password entered by user with the preprogrammed password in the Wi-Fi module. If matched, a connection will be established between user's smartphone and communication module by means of Wi-Fi communication else connection will be terminated.
5. If Wi-Fi connection cannot be established by any means, Bluetooth module can be used to pair the user's smartphone with Bluetooth module by matching the alphanumeric password entered by user with preprogrammed password in the Bluetooth Module. If matched, a connection will be established between user's smartphone and communication module by means of Bluetooth communication else connection will be terminated.

b) Controller Board 102 configured to: It is processing board consists of a microcontroller.

1. All peripherals such as Wi-Fi/Bluetooth Receiver, Engine Temperature Sensor, Gear handle Sensor, Handbrake Position Sensor, Ignition Sensing Relay, Air Conditioner Switch Relay, Ignition Relay Board are connected to it.
2. It takes input from Wi-Fi/Bluetooth Receiver, Engine Temperature Sensor, and Gear handle sensor, Ignition Sensing relay and processes this data according to the program written in the controller and generates output signals for relays to open and close contacts of relays on Ignition Relay Board to start/stop engine and Air Conditioner Switch Relay to turn on /off AC.
3. The power required for operation is supplied by Battery or Charge Controller.

c) Ignition Relay Board 106 configured to: It is Relay Board having electromechanical relays that are triggered by the type of output signals received by controller board which will start/stop the engine by opening and closing relay contacts connected on the ignition triggering circuit. It is connected to controller board. It requires power for operation.

d) Ignition Sensing relay 109 configured to: It is sensing relay used to check the status of that vehicle is on/off by sensing the power output from the alternator.

1. The coil terminals of the relay are connected at the output of regulator / rectifier circuit of the vehicle and the contact terminals of the relay are used as switch which is further connected to controller board.
2. When the engine is off, there will be no power output from the alternator so the relay contacts will remain open.
3. As the engine will be turned on, relay will be energized thus closes the contacts of relay, this gives a signal to controller boards that the engine is turned on.
4. It is connected to controller board. It requires power for operation.

e) Air Conditioner Switch Relay 107 configured to: It is an electromechanical relay board.

1. It is triggered by the type of output signal received by controller board which will start/stop the AC by opening and closing relay contacts connected on the AC switch circuit.
2. It is connected to controller board. It requires power for operation.

f) Engine Temperature Sensor 105 configured to: It can be a thermistor or thermocouple or electronic thermometer which will sense the temperature of engine and will give its data to controller. When the temperature on the engine temperature sensor is raised to predefined value or after 15 minutes completion the engine will be automatically turned off and will give the notification to the user on smartphone application that the engine is warmed up and ready for operation. It is connected to controller board. It requires power for operation.

g) Gear handle sensor 104 configured to: This will sense the position of the gear handle. It is connected to controller board. It requires power for operation.

1. If the position of gear handle is at neutral position then it will give signal to controller only then engine can be started by app.
2. If Gear handle is not at neutral or its position is changed engine will not start from app.
3. If engine is started from the smartphone app and gear handle is moved i.e. its position is changed it will turn off engine immediately.

h) Handbrake Position Sensor 103 configured to: This is optional sensor which will sense the position of the Handbrake handle. It is connected to controller board. It requires power for operation.

1. If Hand brake is applied i.e. at pulled up state, sensor will sense this change and only then engine can be started else it will not start.
2. If engine is started and Hand brake is released down or its position changes from up to down, sensor will sense this change thus it will give signal to controller to turn the engine off.

i) Battery 110 configured to: This system is standalone unit having its own battery which will supply power to all the peripherals and Controller Board.

1. It gets charged by Charge Controller while engine will be in running mode with 12v dc supply from the output of rectifier/regulator.
2. Battery will give 24/7 power supplied to whole system.
3. If discharged it will shut down the system and can be recharged again.

j) Charge controller 108 configured to: provide power to charge battery It takes power from the vehicle's rectifier/regulator to charge the battery as well as powering all peripherals and Controller Board.

1. When vehicle is at off state the battery will power the Controller Board and all Peripherals.
2. As the engine is turned on, the charge controller will start recharging the battery as well as powering the Controller Board and Peripherals.

IOT Smart Vehicle Ignition Control kit will be powered by a separate battery present in kit. Battery will be charged and IOT Smart Vehicle Ignition Control kit will be powered by charge controller and when the engine of vehicle will be in running. IOT Smart Vehicle Ignition Control kit will be continuously powered on 24/7 consuming very less power and will be waiting for user's command signal from smartphone application.

3. WORKING OF SYSTEM

Engine will start only if these conditions satisfies:

A) IOT Smart Vehicle Ignition Control kit should be powered on.

B) IOT Smart Vehicle Ignition Control kit should be connected to smartphone wirelessly.

C) Vehicle should be on Neutral gear.

D) Hand brake of vehicle should be applied.

If these conditions satisfied, then controller board inside IOT Smart Vehicle Ignition Control kit will energies relays which will start the engine of the vehicle.

Air conditioning system will start only if these conditions satisfies:

1. Engine should be turned on.
2. AC will start only after 30 sec delay of start of engine.

Some Situations Explained:

1. Engine will not start if vehicle is not on the Neutral gear.
2. Engine will be automatically off if gear handle position is changed.
3. Engine will not start if hand brake of vehicle is not applied.
4. Engine will be automatically off if handbrake position is changed.
5. Vehicle can be started without inserting key in the keyhole and if someone puts the key inside the keyhole when vehicle is started via app, then it will turn off the engine immediately.
6. If battery of this kit is low it will be shutdown kit.
7. Kit will be powered by battery when engine is off, if engine is turned on, then battery will be charged by charge controller and kit will be powered by charge controller.

4. BRIEF DESCRIPTION OF DRAWINGS

An IOT Smart Vehicle Ignition Control Kit installed in the vehicle comprising.

a. Wi-Fi/Bluetooth Receiver (communication module) 101
b. Controller Board 102
c. Ignition Relay Board 106
d. Ignition Sensing relay 109
e. Air Conditioner Switch Relay 107
f. Engine Temperature Sensor 105
g. Gear handle sensor 104
h. Handbrake Position Sensor 103
i. Battery 110
j. Charge controller 108

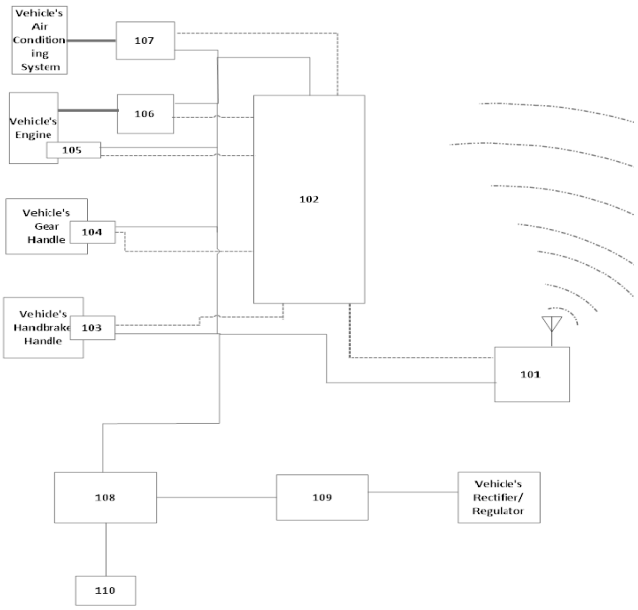

FIG. 1: a block diagram of kit for starting vehicle's engine and air conditioning system from smartphone.

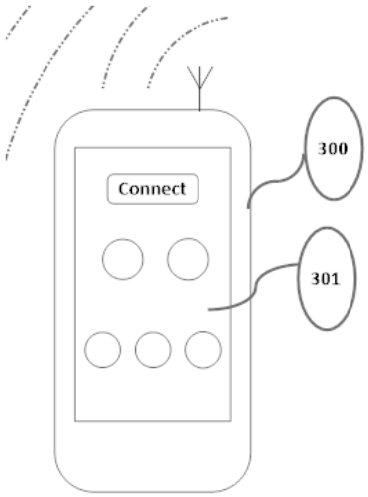

FIG. 2. An interface of the smartphone app.

a) Smartphone 300

b) Software Application 301

5. CONCLUSION

The system was developed and tested in real life situations. The system was able to start the engine of vehicle as well as its AC from a smartphone application. The system is reliable for starting engine and ac, is applicable for everyday use.

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