# Drunk Driving Prevention Key Housing

A car key accessory that can detect the alcohol level in the breath of the driver and help reduce and prevent incidents of drunk driving.

6/9/2018

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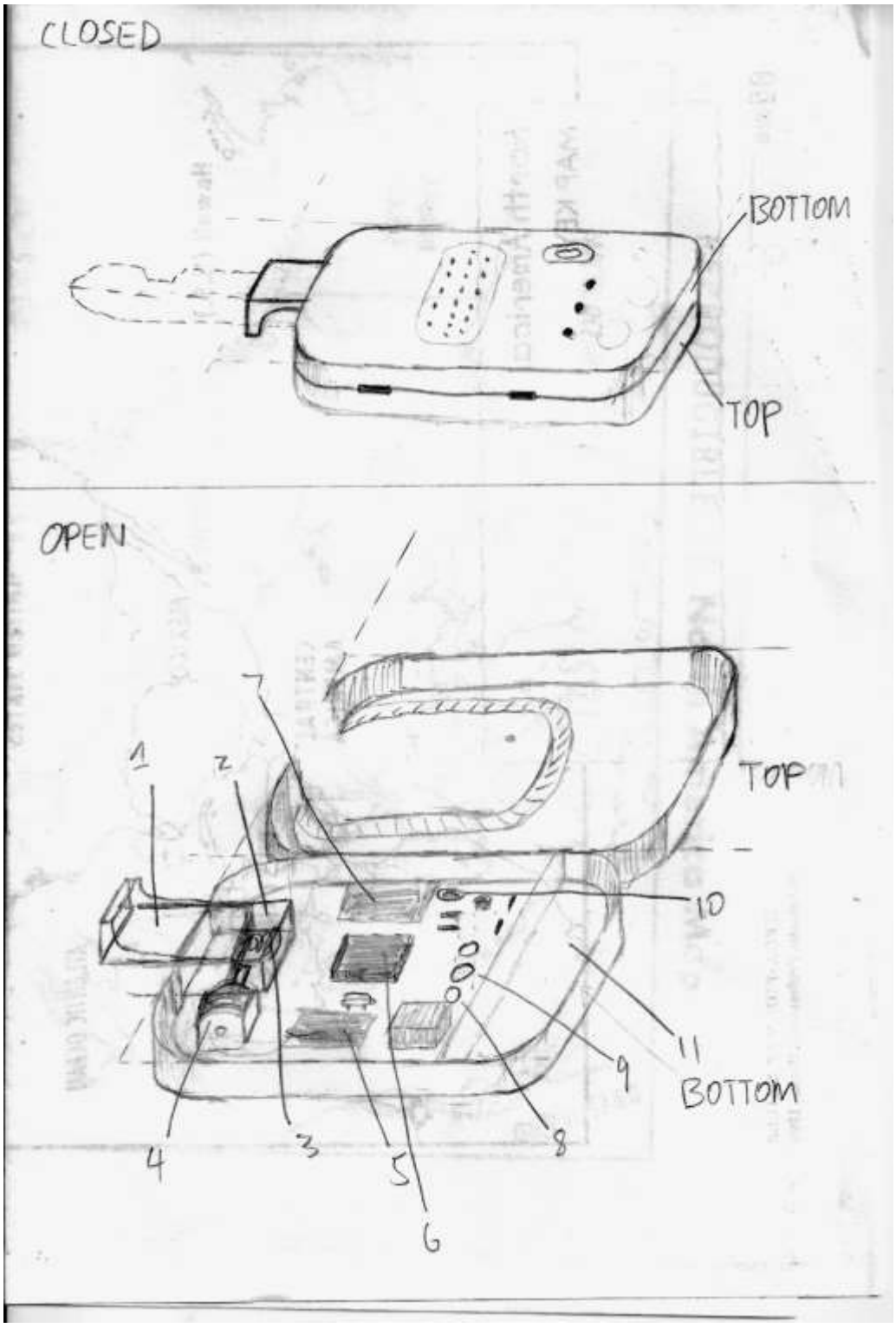
# Introduction

According to statistics, in 2014 in California alone, about 23,993 injuries are due to alcohol-impaired driving. Looking at these data, I wanted to create something that will hopefully reduce or maybe prevent drunk driving. Although many drunk driving prevention mechanisms exist, most are kind of hard to install and use. Searching around for ideas, I got inspired by looking at how a switchblade works. Since to start a car, you need to insert a key fully into the ignition, if the key is prevented from doing that, the car won't start. Using the same principle of how the blade in the switchblade is ejected, I thought of a design that has a retractable plastic sleeve, instead of a blade, that will cover the teeth of a car key and will only retract if a certain condition is met. With the sleeve covering the car key, the key cannot be inserted into the ignition and therefore preventing a car from starting without the need of those complicated mechanisms such as an ignition interlock. The idea of this project is to create a simple and easy to use key accessory that uses this principle with the sleeve to help reduce the number of drunk drivers.

# Drawings and Concepts

## Drawings



1) Sleeve
2) Sleeve Retraction Chamber
3) Spring
4) Solenoid
5) Alcohol Detection Module
6) Microcontroller
7) Voice Control Module
8) Power Indicator
9) Status Indicator
10) Power Button
11) Battery Cabin

# Concept

Fig. 1

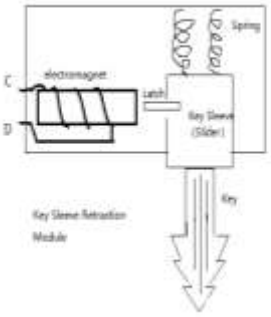
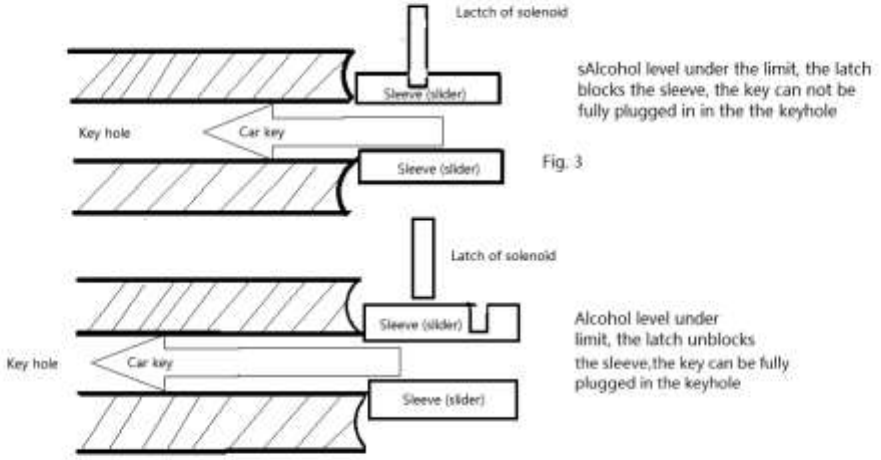


Fig. 2

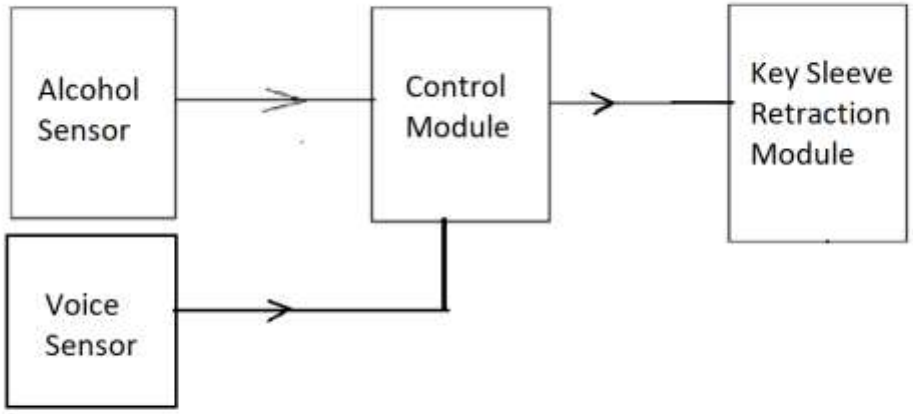



This device consists of an alcohol gas sensor, a microcontroller, a solenoid, and a retractable plastic sleeve on a rail that covers the blade of a key. All of these are placed in two halves of the housing, which is hinged together. The electrical components and the chamber where the key will sit is located in one half, the retractable sleeve will be in the other.

The main concept behind this is when the alcohol sensor detects a high level of alcohol, it tells the microcontroller to stop the solenoid, which is situated on the rail of the plastic sleeve, from moving so that the sleeve cannot be retracted, and therefore the key cannot be plugged into the car's ignition keyhole due to the sleeve as in *fig.3* . If the alcohol level is at a normal level, then the solenoid is allowed to be retracted so the plastic sleeve covering the key blade

can also retract, letting the key be able to be inserted in a car's ignition keyhole in a normal fashion as shown in *fig.4*. When the key is pulled out from the ignition keyhole, the sleeve will again be extended to cover the blade of the key because of the springs attached to the sleeve will push the sleeve back up as shown in the diagram of *fig.2*

# Block Diagram and Components




**Block Diagram**

# Components

This device contains 4 major parts: a Voice Sensor, an Alcohol Sensor, a Control Module and a Key Sleeve Retraction Module (a solenoid, and a retractable plastic sleeve on a rail that covers the blade of a key). The voice sensor, and the alcohol sensor provides data to the control Module to check whether the driver is drunk or not, then the control module uses the data from the sensors and decides whether the key sleeve retraction module is activated or not.

**Voice Sensor:**

Used to check if user is actually using this device by checking the surrounding sound level which indicates if the user is talking to the device or not. If the user is talking, or sound level is high enough, it means the user is breathing out at the device, so signal Control Module to start collecting data on Alcohol Sensor. If the sound level, is not high enough, nothing happens.

**Alcohol Sensor:**

Used to check the alcohol concentration of the surrounding air, which is the user's breath if the user is talking to it. If the alcohol concentration is over a certain threshold, sends a signal to the Control Module to disable the Sleeve Retraction Module. Otherwise, enables the Sleeve Retraction Module.

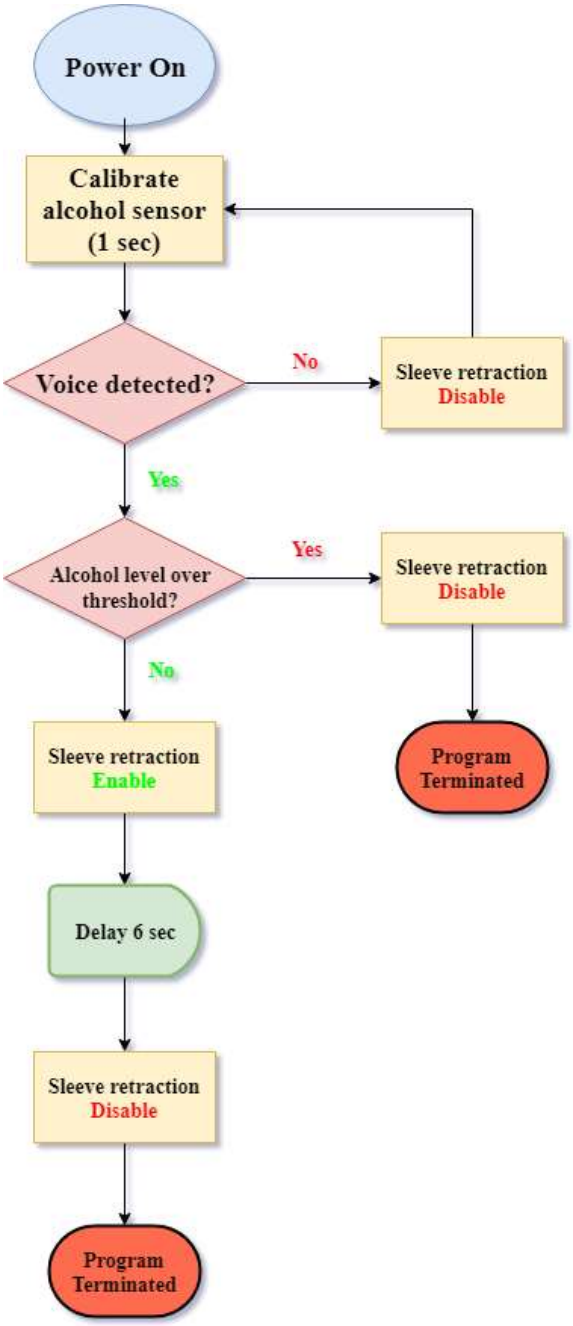
**Control Module:**

The "brain" of the device, takes in the signals and data provided by the Alcohol Sensor and the Voice Sensor, makes decisions based on those data, then controls the Sleeve Retraction Module accordingly.

**Sleeve Retraction Module:**

The module that controls a sleeve over the blade of the key to retract (enable) or preventing it from retracting (disable). The sleeve covers part of the blade of the key to preventing the key being fully inserted into the ignition when the module is disabled

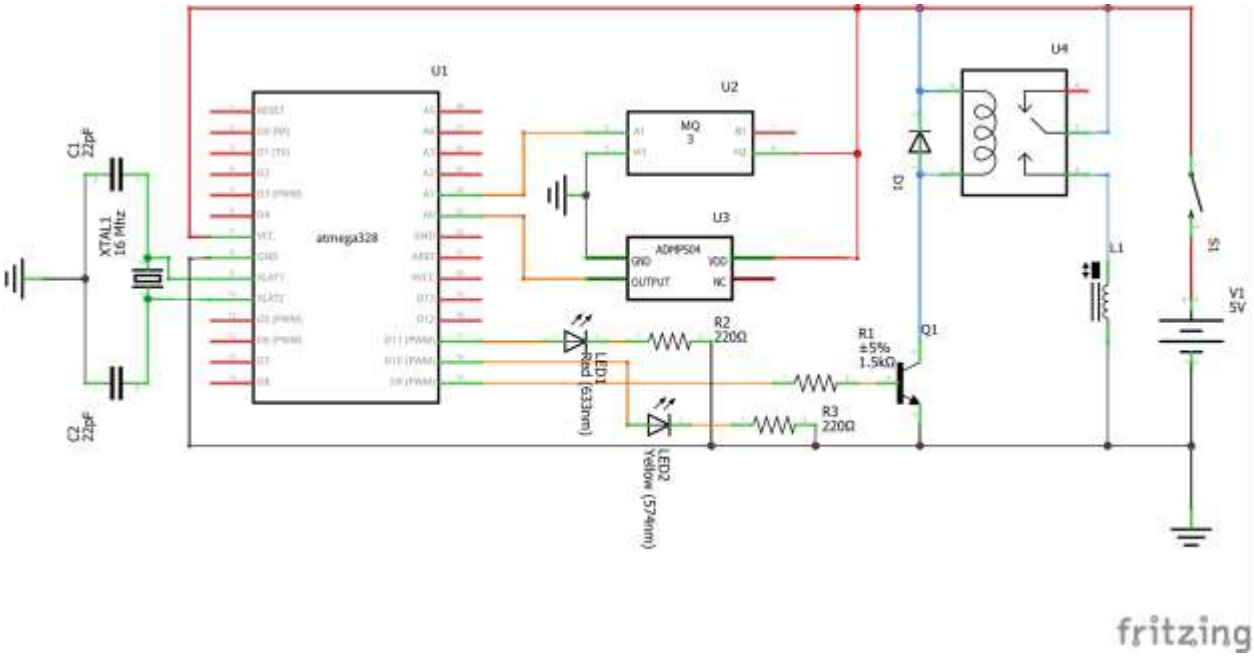
# Flow Chart




***Sleeve retraction disable = Key cannot be inserted fully into ignition**

**Sleeve retraction enable = Key can be inserted fully into ignition**

# Circuit Diagram




- 2x Capacitors (C1, C2) 22pF
- 2x Resistor (R2, R3) 220Ω
- 2x LED (LED1, LED2)
- Resistor (R1) 1.5kΩ
- Crystal Oscillator (XTAL1) 16MHz
- Microcontroller (U1)
- Alcohol sensor (U2)
- Microphone (U3)
- Relay (U4)
- NPN Transistor (Q1)
- Diode (D1)
- Solenoid (L1)
- Switch (S1)
- Battery (V1) 5V

# Code

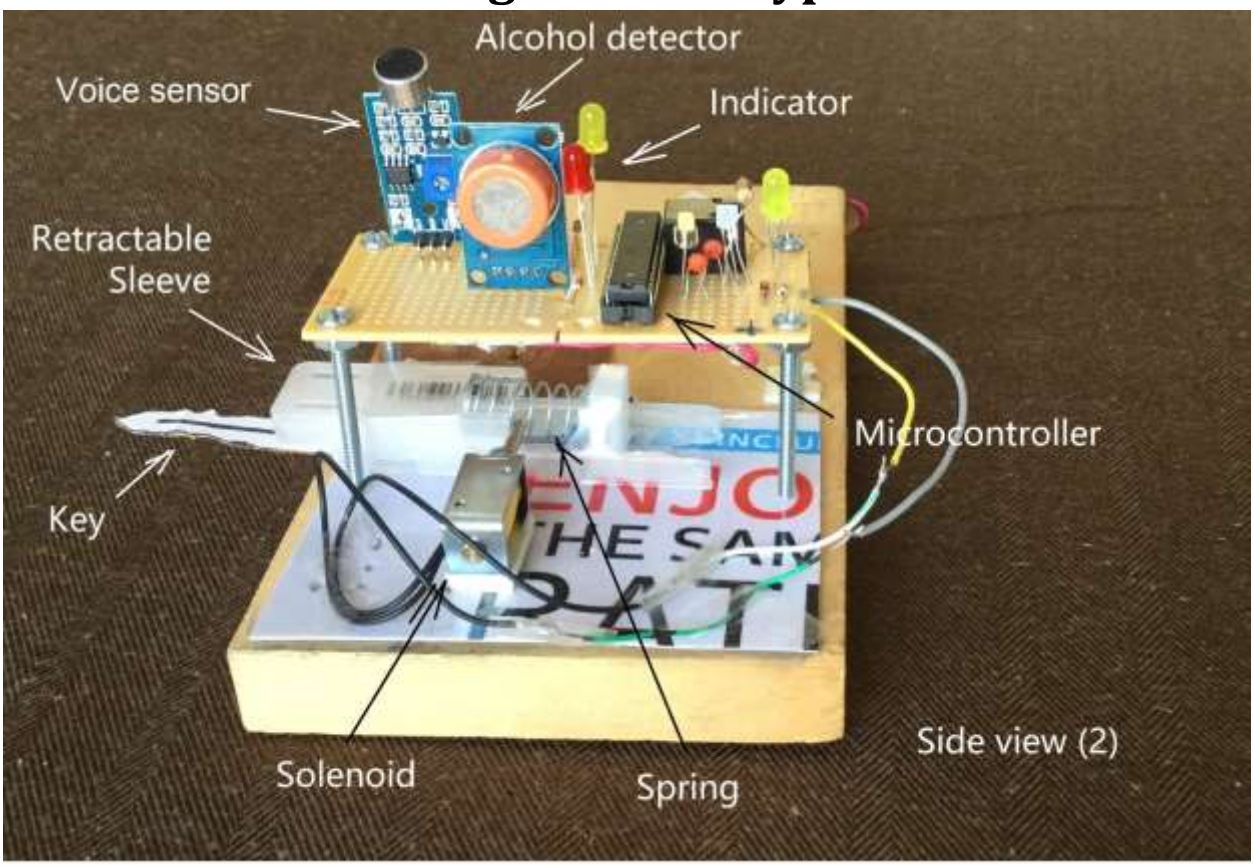
**Programed with Arduino IDE using C/C++ based on Processing

```
//initializing all the necessary constants like pins etc
const int inputGas = 1;
const int inputMic = 0;
const int out = 9;
const int pwLed = 13;
const int signalLed = 10;
const double threGas = 50;
const double threMic = 800;

//initializing thresholds, boolean and counter
double gasVal;
double micVal;
boolean blown;
int count = 0;

void setup() {
  pinMode(out, OUTPUT);
  pinMode(pwLed, OUTPUT);
  pinMode(signalLed, OUTPUT);
  blown = false;
  //gather environmental data reference for gas sensor
  initialization();
}

void loop() {
  //Indicate power is on
  digitalWrite(pwLed, HIGH);
  //Check if human is actually blowing
  start();
```

*** Full code: https://github.com/ansue1234/DDPKey

# Prototype

## Image of Prototype



# Materials of Prototype

- 2x Ceramic Capacitors 22pF
- 2x Resistor 220Ω
- 2x LED
- 1x Resistor 1.5kΩ
- 1x Crystal Oscillator 16MHz
- 1x ATMega328p
- 1x MQ3 Gas Sensor
- 1x Microphone
- 1x Relay
- 1x NPN Transistor
- 1x Diode
- 1x Solenoid
- 1x Switch
- 1x Battery 5V
- 1x  1 in short plastic rail with stoppers
- 1x  ½-1 in plastic sleeve
- 1x  small compression spring

# Usage

1. Press and hold on to the power button to start, do not release unless stated.
2. Wait 1-2 seconds and say a word such as “ah…” toward the Microphone and Alcohol Sensor, remember to breathe out at the same time.
3. If both LEDs are on and the solenoid clicks, insert the key into the ignition.
4. If both LEDs are on and solenoid did not click, repeat from step one.

# Feature and Advantages

## Features

- LED indicator lights to indicate status
  - One for power
  - One for whether the device is working
- Voice detection for decreasing false positive rates
- Key is not allowed to be inserted into the ignition at default condition.
- Able to put on any key

## Advantages

- Low cost
- Simple to use
- Simple to apply it on all keys
- Portable device
- Forced to pass “Alcohol Exam” before driving due to the key not being able for insertion at default and the use of Voice detection.
- Easy to alter and improve

# Reflection

This project is one of the hardest projects I had undertaken because I have to explore unfamiliar territory. Since this is a relatively new idea, there aren't much tutorials or guides I can follow. I have to come up with the plan on my own. However, as the saying goes "Steal the best, invent the rest," I hacked and mobbed various components of other projects. Some of them are my previous projects such as a homemade signal generator. Some are tutorials or guides online, such as parts of a project that said something like "Make your own Arduino Uno" for ideas on how to wire my microcontroller and even a bizarre project called something like "DIY Switchblade" for inspiration on my sleeve mechanism. Inspiration indeed arises everywhere.

Of course, since this project is a mishmash of many projects, there are a lot of obstacles that I faced. One of which is the software that I used. For the electronics portion of the project, I plan on building a software simulation first. Unfortunately, many of the components I need are missing in the software, so I have to use a resistor and a LED to substitute as the components in the simulation, which lead to big problems. This method of substituting the load hid the actual power draw of the real component, making the real component not work with my microcontroller. Another major obstacle that I encountered is a major design failure. Originally, I did not account for the device to be detecting the air before the user blows into the device, so it would allow the key to retract every time. Perhaps this might not be the best way, but the first idea that came to mind after days of puzzling over why this happens was to use a microphone to detect whether a user is actually blowing into the device or not. Unfortunately, this means that I have to rethink my logic process. Therefore, thorough thinking before action is quite important.

Despite these challenges, I still managed to create a device that met my original expectations. However, there are many areas I could improve on. One the most important concern was "What if the user uses this device under noisy conditions?" This question convinced me that the microphone idea is probably not the best way. Perhaps with more time and resources, I could use some fingerprint or voice recognition to actually distinguish the user using the device under any conditions. Overall, despite these shortcomings, I believe this is a pretty successful project created with common household items and resources.

# Official Documents

Below is the United States Patenting and Trademark Office's filing receipt for my patent of the design I created within the project covered in detail above.

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United States Patent and Trademark Office
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|---|---|---|---|---|---|---|
| 62/724,481 | 08/29/2018 | | 70 | TPP43889 | | |

**CONFIRMATION NO. 1082**

**FILING RECEIPT**

62439
SINORICA, LLC
20251 Century Blvd.
Suite 140
Germantown, MD 20874


Date Mailed: 09/06/2018

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The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 62/724,481**

**Projected Publication Date:** None, application is not eligible for pre-grant publication

**Non-Publication Request:** No

**Early Publication Request:** No

**** MICRO ENTITY ****

**Title**

Drunk Driving Prevention Key Housing

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

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