# 可樂電子琴

## 目標

- ○製作可樂電子琴
- https://youtu.be/Ttm62RBdOuo

## 材料

Arduino

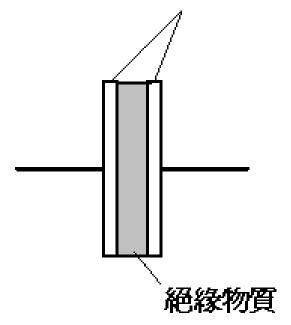
○(大)電阻:1MΩ

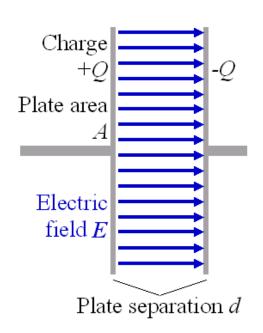
○ 導電物體

## 什麼是電容

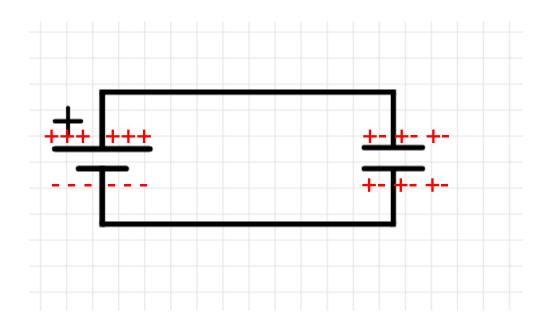
- 電容是可以儲存電荷元件
- 兩平行板隔著介質(如空氣)就可以形成簡單的電容

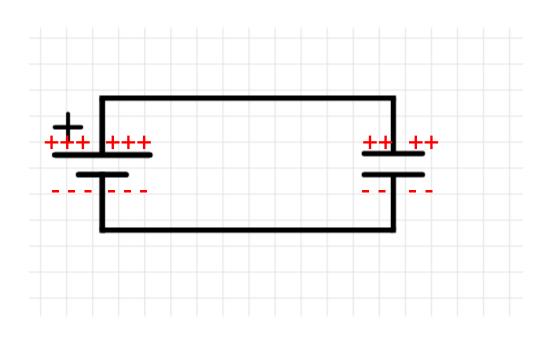
#### 導電平行板





## 電容充電



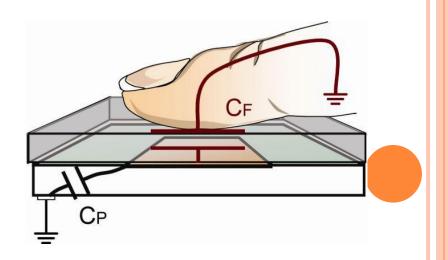


### RC電路

- ○接上電源瞬間:視為短路
- 電容充電
- 當經過足夠時間後: 充飽電, 視為斷路

## 電容式感測原理

- 人體帶有一個電容
- 當手指觸碰導電物體後,如同接上一個電容
- 使得充電時間變長,需要更久才能充飽電



### Capacitive Sensor

電容式感測

o 使用Capacitive Sensing Library

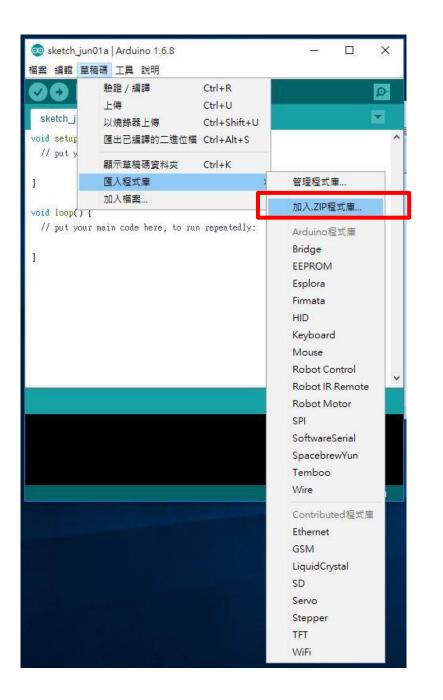
○下載:http://ppt.cc/ojKl2

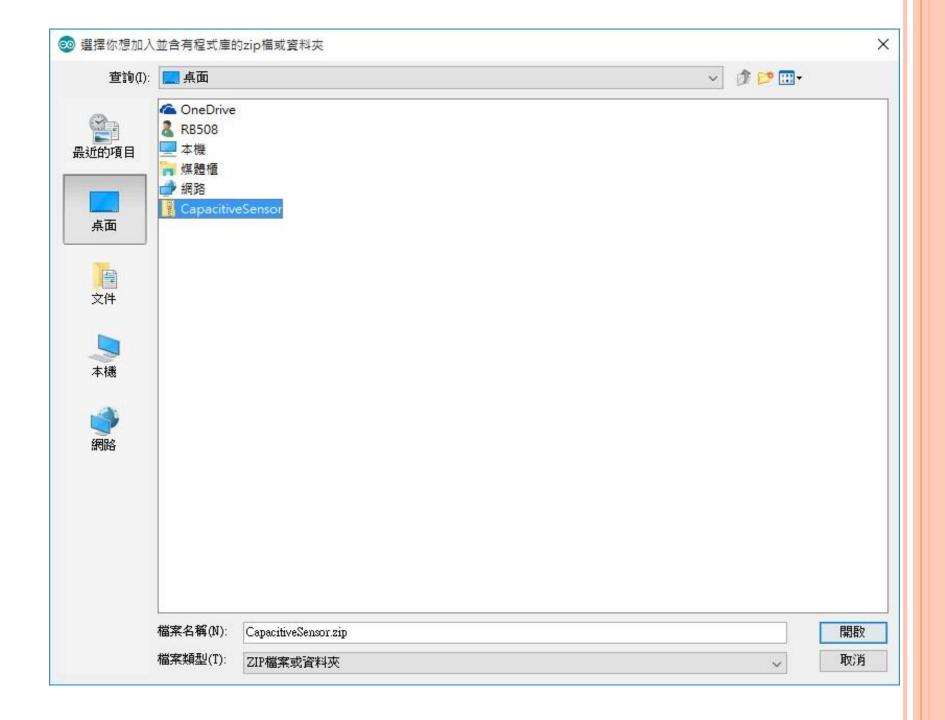
 http://playground.arduino.cc/Main/CapacitiveSensor ?from=Main.CapSense

## **Import Library**

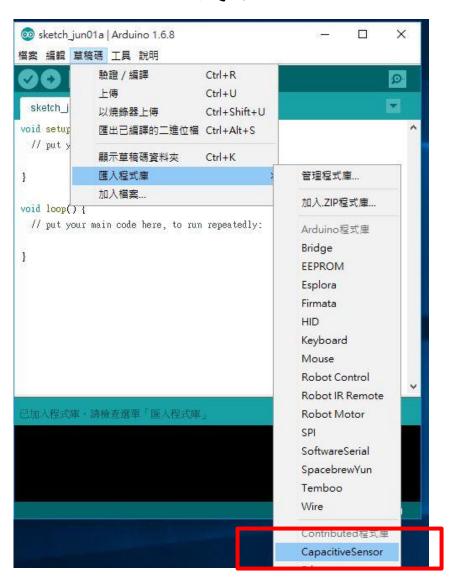
- 1.下載 CapacitiveSensor
- ○2.草稿碼→匯入程式庫
- ○3.選擇該資料夾







### 匯入成功!



### 測試是否匯入成功

o 按下CapacitiveSensor會自動引入該函式庫

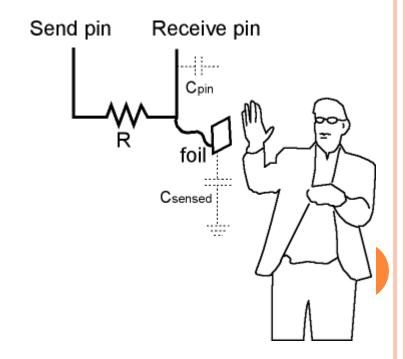
#include < Capacitive Sensor.h>

○ 如圖所示,接著試著編譯看看!



## 感測原理

- 計算發送腳狀態改變後,接收腳產生狀態改變的時間差
- 人體觸碰會影響此時間差
- 電阻值大小也會對時間差產生直接影響



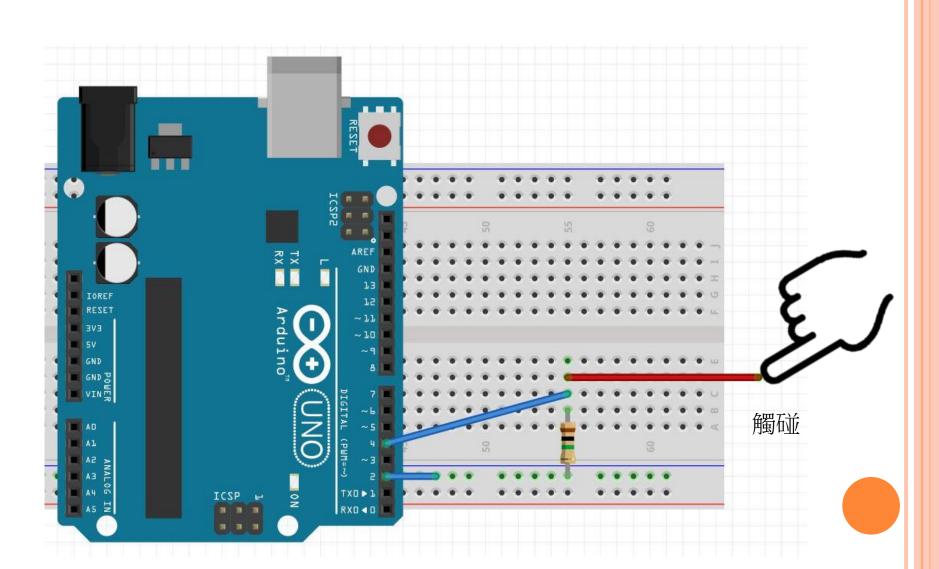
## Capacitive Sensor Library

- CapacitiveSensor CapacitiveSensor(byte sendPin, byte receivePin)
- 用於建立一個CapacitiveSensor
- o sendPin為傳送腳位, receivePin為接收腳位
- e.g.設定2為傳送腳位,4為接收腳位
  - CapacitiveSensor cs=CapacitiveSensor(2, 4);
- o long capacitiveSensor(byte samples)
- 計算接收腳狀態改變所需時間
- o e.g.取得時間
  - long time=cs.capacitiveSensor(30);
- 須注意大小寫不同

## Example 1

- ○利用Arduino、電阻、導線
- 觀察並測試Capacitive Sensor如何使用

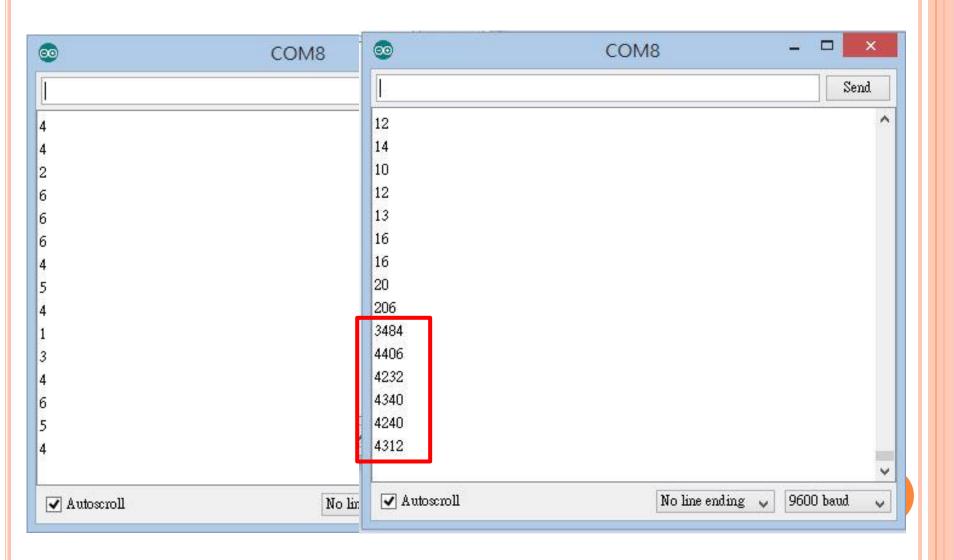
## 電路圖



```
#include <CapacitiveSensor.h>
CapacitiveSensor cs= CapacitiveSensor(2,4);
void setup()
   Serial.begin(9600);
void loop()
    long total1 = cs.capacitiveSensor(30);
    Serial.print(total1);
    Serial.print("\n");
    delay(10);
```

○ 觀察手指未觸碰時、靠近時、觸碰時的數值變化

```
sketch_may26a | Arduino 1.0.5-r2
File Edit Sketch Tools Help
  sketch_may26a §
#include <CapacitiveSensor.h>
//導線的觸碰測試
CapacitiveSensor cs= CapacitiveSensor(4,2);
void setup()
   Serial.begin(9600);
void loop()
   long total1 = cs.capacitiveSensor(30);
   Serial.print(total1);
   Serial.print("\n");
   delay(10);
                                                        Arduino Uno on COM1
```



### 改良

- ○如果觸碰導線,輸出1(true),反之輸出0(false)
- o 利用if判斷式,及capacitiveSensor數值特性達成

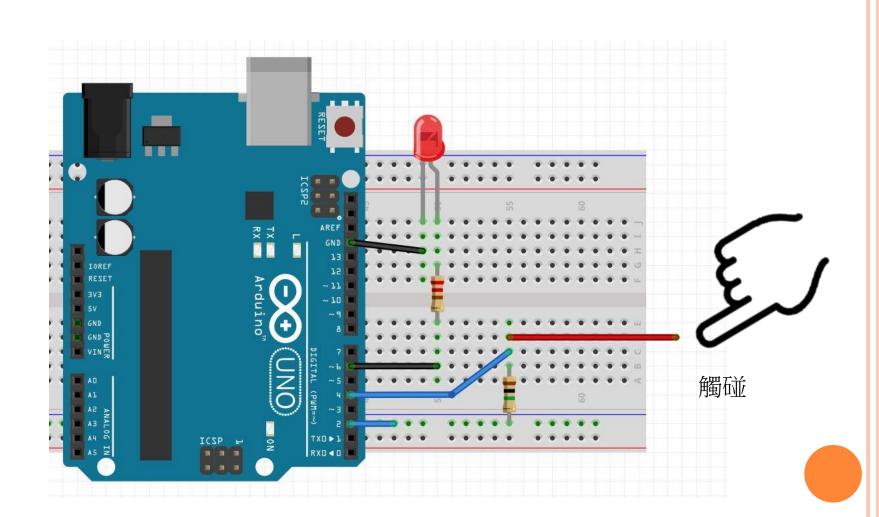
```
sketch_may26a | Arduino 1.0.5-r2
File Edit Sketch Tools Help
  sketch_may26a §
#include <CapacitiveSensor.h>
//導線的觸碰測試
CapacitiveSensor cs= CapacitiveSensor(4,2);
void setup()
  Serial.begin(9600);
void loop()
    long total1 = cs.capacitiveSensor(30);
    int touch=0;
    if(total1>50){
        touch=1;
    else{
        touch=0;
    Serial.print(touch);
    Serial.print("\n");
    delay(10);
```

```
void loop()
{
    long total1 = cs.capacitiveSensor(30);
    int touch=0;
    if(total1>500){
      touch=1;
    else{
      touch=0;
    Serial.print(touch);
    Serial.print("\n");
    delay(10);
```

## Example 2

- ○利用Arduino、電阻、導線、LED燈
- 目標:如果觸碰導線,則讓LED燈發亮

## 電路圖



```
#include <CapacitiveSensor.h>
#define vcc 6
CapacitiveSensor cs=CapacitiveSensor(2,4);
void setup()
{
    pinMode(vcc,OUTPUT);
    Serial.begin(9600);
}
```

### Code cont.

```
void loop()
{
    digitalWrite(vcc,0);
    long total1 = cs.capacitiveSensor(30);
    int touch=0;
    if(total1>500)
        touch=1;
    else
        touch=0;
    if(touch==1){
      digitalWrite(vcc,1);
      delay(300);
    Serial.print(touch);
    Serial.print("\n");
    delay(10);
```



## Example 2改良

- ○利用Arduino、電阻、導線、LED燈
- 目標:模擬觸碰式電燈
- 觸碰後電燈亮,再次觸碰電燈熄滅

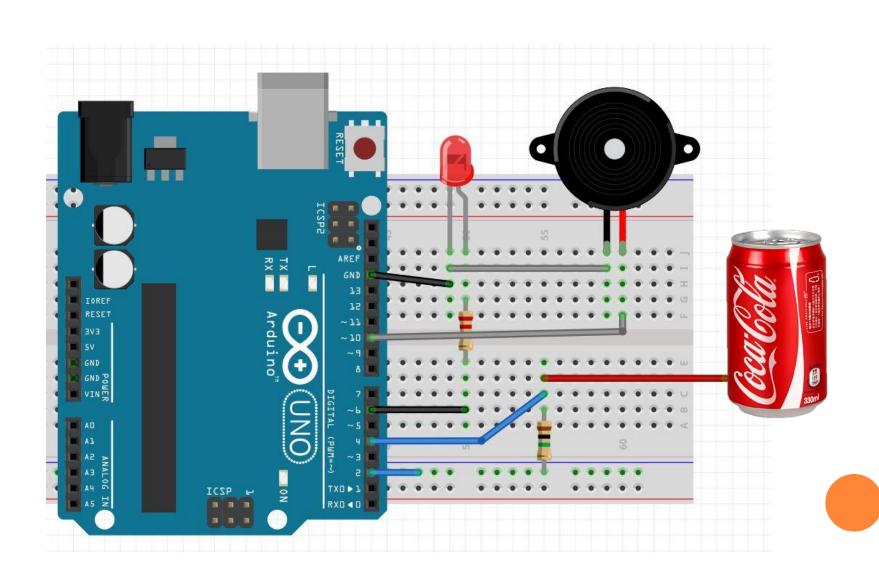
```
#include <CapacitiveSensor.h>
#define vcc 6
CapacitiveSensor cs=CapacitiveSensor(2,4);
int led=0;
void setup()
   pinMode(vcc,OUTPUT);
   Serial.begin(9600);
```

#### Code cont.

```
void loop()
    long total1 = cs.capacitiveSensor(30);
    int touch=0;
                                  if(touch==1){
    if(total1>500)
                                         if(led==0){
        touch=1;
                                           digitalWrite(vcc,1);
    else
                                           led=1;
        touch=0;
                                         else{
                                           digitalWrite(vcc,0);
                                           led=0;
                                         delay(300);
                                       Serial.print(touch);
                                       Serial.print("\n");
                                       delay(10);
```

### 可樂電子琴

- 將蜂鳴器及電容感測功能結合
- 當觸碰到可樂罐時,讓蜂鳴器發出聲音
- #define NOTE\_C5 523
- #define NOTE\_D5 587
- #define NOTE\_E5 659
- #define NOTE\_F5 698
- #define NOTE\_G5 784



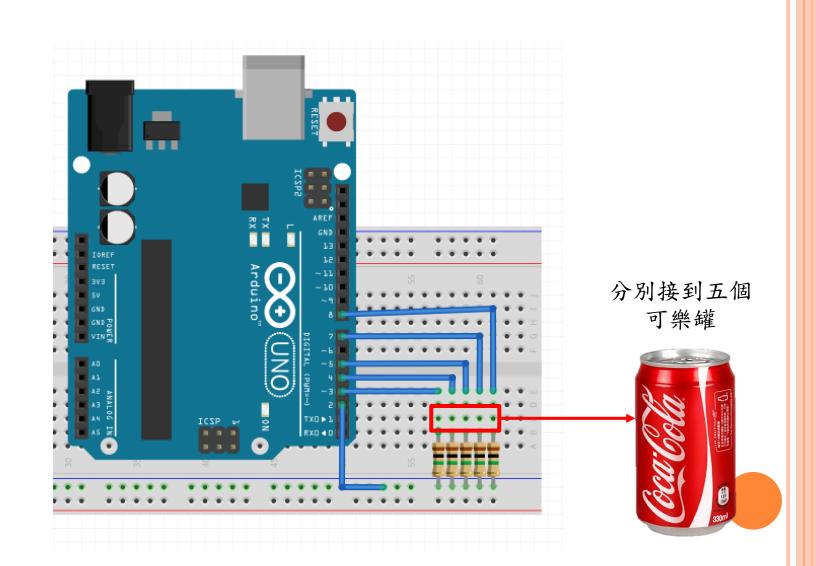
```
#include <CapacitiveSensor.h>
CapacitiveSensor cs=CapacitiveSensor(2,4);
#define vcc 6
#define buzzer 10
#define t NOTE C5 //Do
void setup()
   pinMode(vcc,OUTPUT);
   pinMode(buzzer,OUTPUT);
   Serial.begin(9600);
```

### Code cont.

```
void loop()
{
    long total1 = cs.capacitiveSensor(30);
    int touch=0;
    if(total1>300)
        touch=1;
    else
        touch=0;
    if(touch==1){
      digitalWrite(vcc,1);
      tone(buzzer,t,100);
      digitalWrite(vcc,0);
    Serial.print(touch);
    Serial.print("\n");
    delay(10);
```

### 增加琴鍵

- ○跟你的組員一起合作
- 組合出更多琴鍵的電子琴
- 且每個琴鍵有各自的音調



```
#include <CapacitiveSensor.h>
#define vcc 6
#define buzzer 10
CapacitiveSensor cs1=CapacitiveSensor(2,3);
CapacitiveSensor cs2=CapacitiveSensor(2,4);
CapacitiveSensor cs3=CapacitiveSensor(2,5);
CapacitiveSensor cs4=CapacitiveSensor(2,7);
CapacitiveSensor cs5=CapacitiveSensor(2,8);
int t[]={NOTE C5,NOTE D5,NOTE E5,NOTE F5,NOTE G5};
void setup()
   pinMode(vcc,OUTPUT);
   pinMode(buzzer,OUTPUT);
   Serial.begin(9600);
```

#### Code cont.

```
void loop()
{
    long total[5];
    total[0]=cs1.capacitiveSensor(30);
    total[1]=cs2.capacitiveSensor(30);
                                               for(int i=0;i<5;i++){
    total[2]=cs3.capacitiveSensor(30);
                                                    if(total[i]>300)
    total[3]=cs4.capacitiveSensor(30);
                                                        touch[i]=1;
    total[4]=cs5.capacitiveSensor(30);
                                                    else
                                                        touch[i]=0;
    int touch[5];
                                                    if(touch[i]==1){
                                                        digitalWrite(vcc,1);
                                                        tone(buzzer,t[i],100);
                                                        digitalWrite(vcc,0);
                                                        break;
                                               delay(10);
```