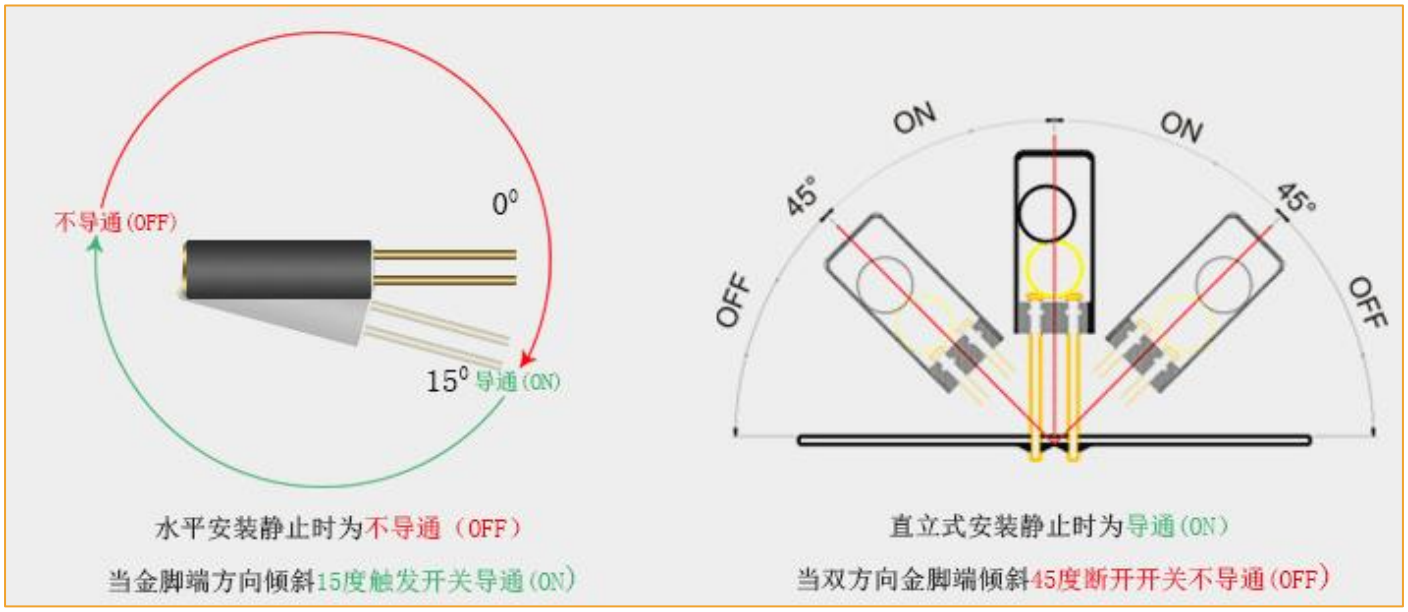
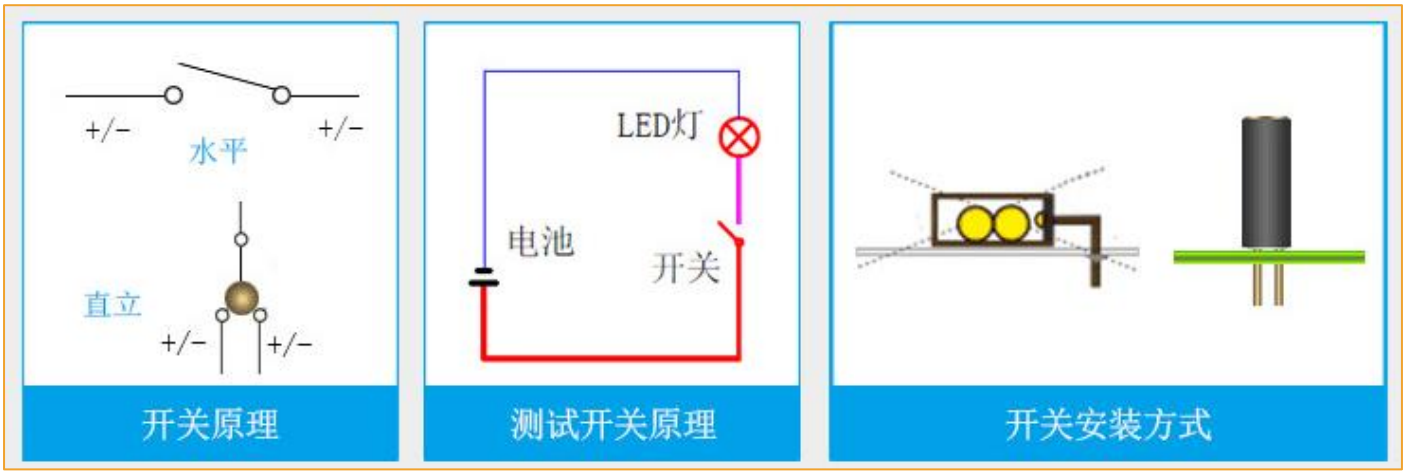
Tilt Switch Experiment

Introduction

The tile switch is also called a steel ball switch which is actually a vibration switch. The ball control the connection or disconnection of the circuit by touching or not touching the pin. Simply explaining this principle is like turning a light on or off. If the switch touches the inner metal plate, the light will turn on and if the switch does not touch the inner metal plate, the light will go out. Changing the path of light by touching a metal terminal or using a small bead in this switch will produce a conduction effect.

The tile switches are extensively used, such as: tire pressure monitoring system (TPMS), pedal lights, digital photo frame rotation, flip cameras, anti-theft systems and so on. The common tile switches in the market are SW-200D, SW-300DA and SW-520D models, etc. The switch used in this experiment is SW-520D which is OFF in a static state. While the external touch force meets the proper vibration conditions or the moving speed produces proper centrifugal force, the conductive needle will instantly be in the ON state and change its electrical characteristics. While the external force disappears and the electrical characteristics will return to the OFF state.





Tilt Switch Parameters

1. Non-directional and it can be triggered at any angle.

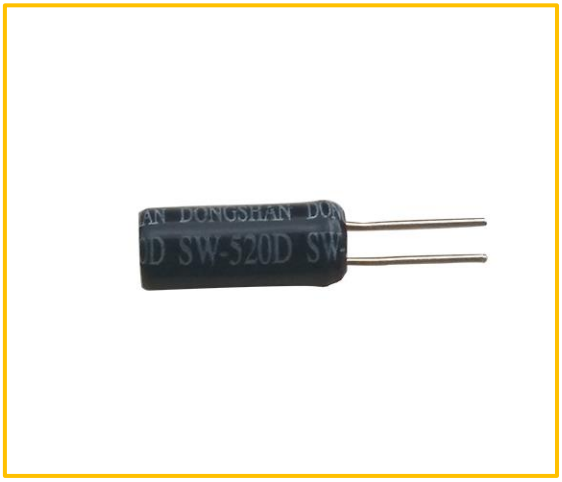
2. Fully sealed package&waterproof and dustproof.

3. It is suitable for triggering in small current circuits.。

4. Double the pin and the touch point is more stable.

5. Sensitive, sealed, 12V 0.1mA, conduction time 0.1ms, open circuit impedance 10M, temperature tolerance 105. (Vibration switches are divided into high sensitivity, sensitivity, standard type and slow type. This switch is a sensitivity type.).

6. Its diameter is 4.5mm and its length is 11mm.



Experimental Purpose

This experiment requires us to understand the working principle of the SW-520D shock sensor and how to use Raspberry Pi to control the SW-520D shock sensor to realize the anti-theft alarm function.

Component List

- Raspberry Pi main board
- T-Cobbler Plus expansion board
- Breadboard
- Cable
- SW-520D Vibration sensor * 1
- LED *1
- Active Buzzer *1
- 10kΩ Resistor *1
- Several jumper wires

Experimental Principle

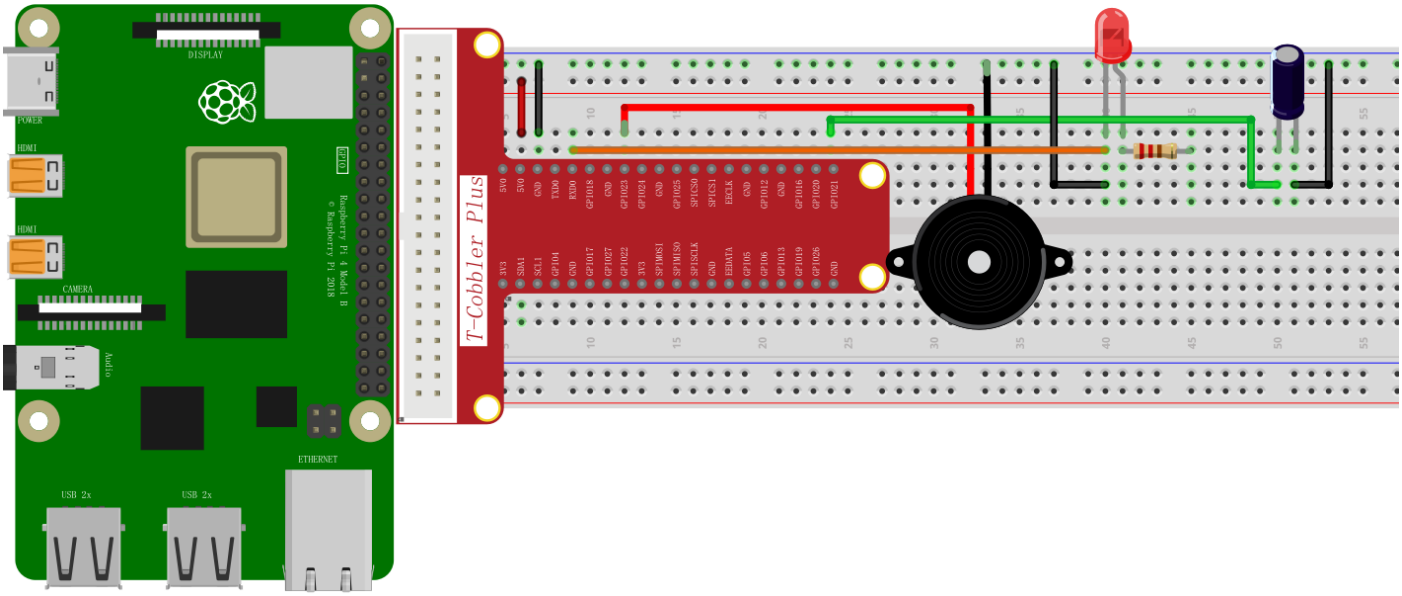
Using the working characteristics of the tile switch, when the circuit board is in a static state, the tile switch is in a conducting state. While an external force touches the circuit board and causes it to vibrate and cause the ball switch to disconnect, an alarm is triggered at this time, the LED is on and the buzzer sounds. While the ball switch returns to the on state, the LED goes out and the buzzer does not sound.

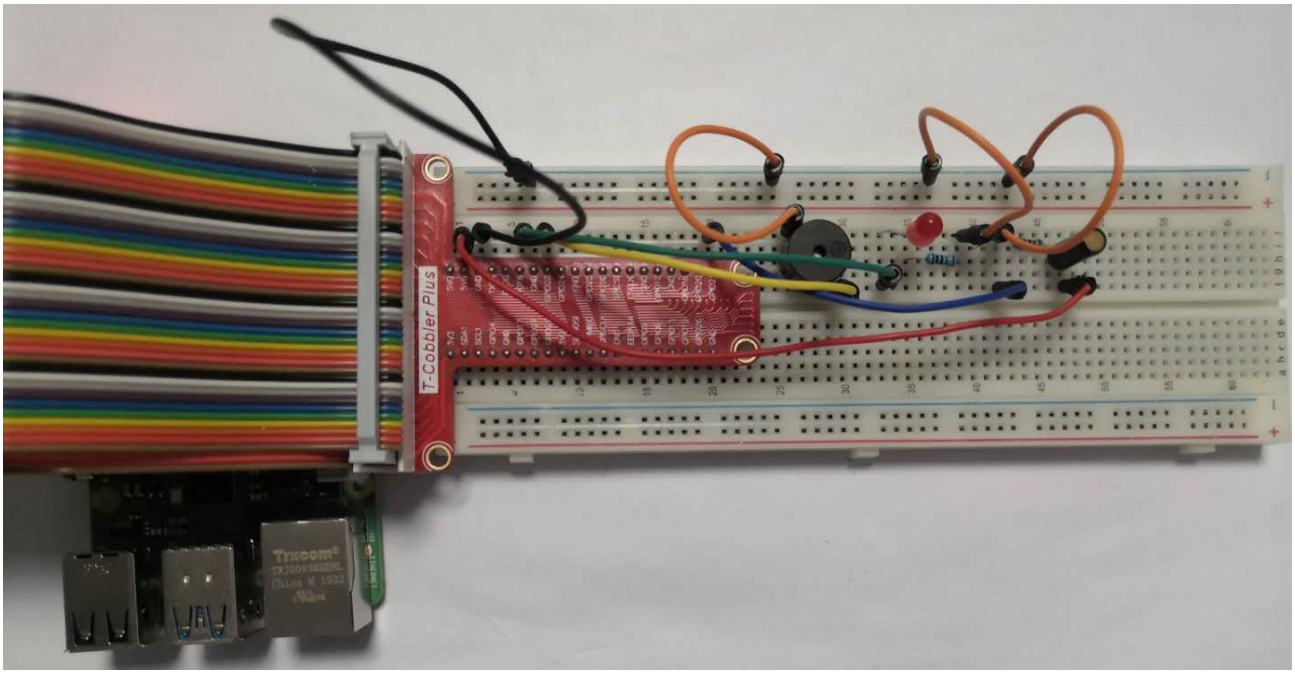
Wiring

Raspberry Pi	Active Buzzer
IO4(wiringPi)/23(BCM)	+
GND	-

Raspberry Pi	SW520D
IO29(wiringPi)/21(BCM)	1
GND	2

Raspberry Pi	LED
IO18(wiringPi)/1(BCM)	+
GND	—





C++ program

```
#include <stdio.h>
#include <wiringPi.h>

int main ()
{
    int buzzer = 4;
    int ledpin = 1;
    int sw = 29;
    wiringPiSetup();
    pinMode(buzzer, OUTPUT);
```

```
    pinMode(ledpin, OUTPUT);
    pinMode(sw, INPUT);
    while(1)
    {printf("digitalRead(sw): %d\n",digitalRead(sw));
        if(digitalRead(sw))
        {
            digitalWrite(buzzer, HIGH);
            digitalWrite(ledpin, HIGH);
            delay(1000);
            digitalWrite(buzzer, LOW);
            digitalWrite(ledpin, LOW);
            delay(10);
        }

    }
}
```

Python program

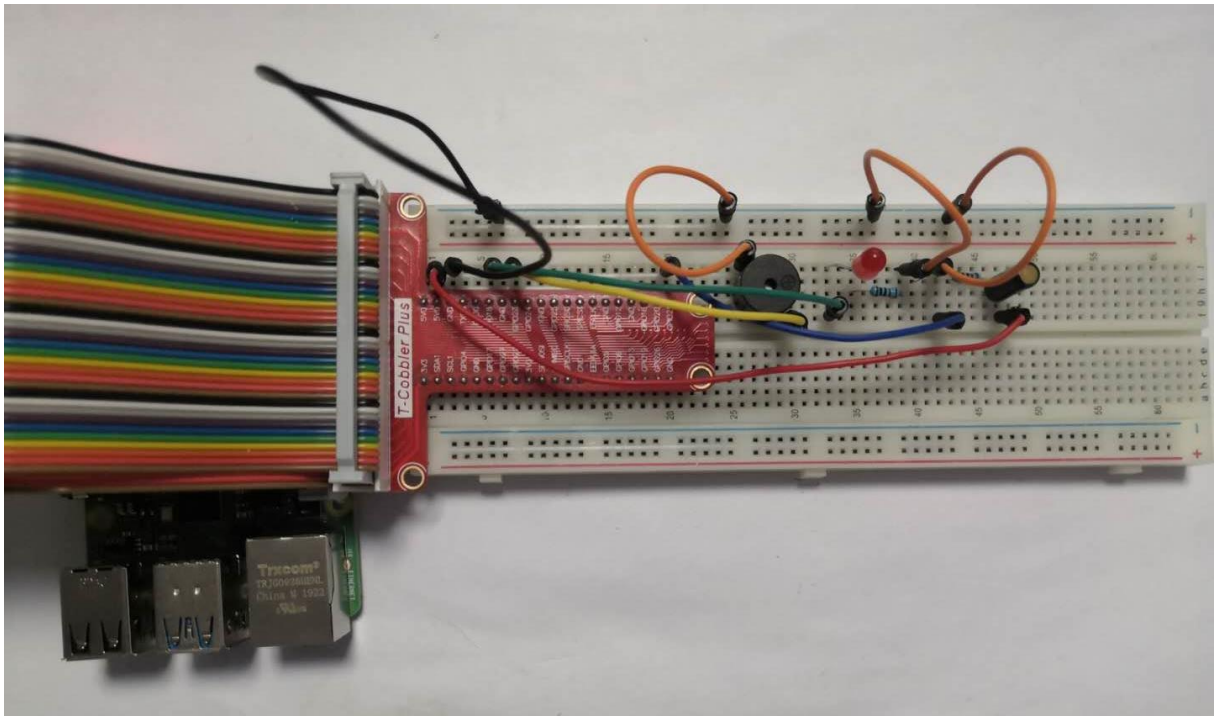
```
import RPi.GPIO as GPIO
import time

buzzer = 23
ledpin = 18
sw = 21

GPIO.setmode(GPIO.BCM)
GPIO.setup(ledpin, GPIO.OUT)
GPIO.setup(buzzer, GPIO.OUT)
GPIO.setup(sw, GPIO.IN)

while True:

    if GPIO.input(sw):
        GPIO.output(ledpin, GPIO.HIGH)
        GPIO.output(buzzer, GPIO.HIGH)
        time.sleep(1)
        GPIO.output(ledpin, GPIO.LOW)
        GPIO.output(buzzer, GPIO.LOW)
        time.sleep(0.02)
GPIO.cleanup()
```

Java program

```
import java.util.concurrent.Callable;
import com.pi4j.io.gpio.GpioController;
import com.pi4j.io.gpio.GpioFactory;
import com.pi4j.io.gpio.GpioPinDigitalInput;
import com.pi4j.io.gpio.GpioPinDigitalOutput;
import com.pi4j.io.gpio.PinPullResistance;
import com.pi4j.io.gpio.PinState;
import com.pi4j.io.gpio.RaspiPin;
import com.pi4j.io.gpio.trigger.GpioCallbackTrigger;
import com.pi4j.io.gpio.trigger.GpioPulseStateTrigger;
import com.pi4j.io.gpio.trigger.GpioSetStateTrigger;
import com.pi4j.io.gpio.trigger.GpioSyncStateTrigger;

public class Tilt {

    public static void main(String[] args) throws InterruptedException {

        // create gpio controller
        final GpioController gpio = GpioFactory.getInstance();

        // provision gpio pin as an input pin with its internal pull down resistor enabled
        final GpioPinDigitalInput sw   = gpio.provisionDigitalInputPin(RaspiPin.GPIO_03,
                                         PinPullResistance.PULL_DOWN);

        // setup gpio pins #04, #05, #06 as an output pins and make sure they are all LOW
at startup
        GpioPinDigitalOutput TAB[] = {
            gpio.provisionDigitalOutputPin(RaspiPin.GPIO_04, "Buzzer", PinState.LOW),
            gpio.provisionDigitalOutputPin(RaspiPin.GPIO_01, "led", PinState.LOW),
        };

        // create a gpio control trigger on the input pin ; when the input goes HIGH, also
set gpio pin to HIGH
        sw.addTrigger(new GpioSetStateTrigger(PinState.HIGH, TAB[0], PinState.HIGH));
        sw.addTrigger(new GpioSetStateTrigger(PinState.HIGH, TAB[1], PinState.HIGH));

        // create a gpio control trigger on the input pin ; when the input goes LOW, also
set gpio pin to LOW
        sw.addTrigger(new GpioSetStateTrigger(PinState.LOW, TAB[0], PinState.LOW));
        sw.addTrigger(new GpioSetStateTrigger(PinState.LOW, TAB[1], PinState.LOW));
```

```
        for (;;) {
            Thread.sleep(500);
        }
    }
}
```

Experimental Effect



Use the Raspberry Pi to control this tilt switch sensor to control a buzzer and a LED. While this switch is tilted, this circuit is connected, the buzzer sounds once and the LED flashes once.。