



ELECTRICITY AND MAGNETISM

Lesson Plans

ECAM-EPMI, France



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1. Lesson Plan: ELECTRICITY And MAGNETISM

1.1 General information

PhysicsKIT4STEM was created in order to address the gender inequality in STEM education which was the result of female students systematically dropping out of STEM-related tracks at various levels of their education. Furthermore, there has been noticeable decrease in the number of students who pursue science and other STEM-related subjects in general. At an era where education in sciences is more accessible than ever, and where there is an increasing need for more skilled scientists in our society, it is important to understand why so many young students have lost an interest in STEM-related subjects. The issue was identified in our current teaching methods and it was suggested that actions must be taken to increase stimulation, engagement and gender-balance in this area. It was pointed out that the issue must be addressed in secondary education, where young students are more likely to become fond of STEM related subjects and may wish to pursue it in further education or even as a career choice.

In order for these goals to be attained, PhysicsKIT4STEM aims to improve the teaching skills of STEM educators through an alternative hands-on approach to physics. This will be done by capturing the interest of both educators and students through the use of DIY kits to learn electronics and programming by using a Raspberry Pi computer. In addition, the project aims to indirectly pique the interest of young girls to pursue science and engineering to increase the gender-balance in STEM classrooms and the STEM industry in general.

The curriculum modules of this project will cover aspects of physics such as:

1. Forces and motion
2. Conservation of energy and momentum

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3. Electricity and magnetism
4. Waves
5. Gravity

The main objective of this project will be achieved by putting together the developed curriculum, glossary, as well as instructions to assemble the PhysicsKIT consisting of sensors and a Raspberry Pi. In addition, lesson plans for each module developed will support and guide educators through the process of delivering the material. The curriculum will be delivered through a Learning Motivation Environment for skill retention purposes. Finally, the PhysicsKIT Club virtual space will provide access to all project results and infrastructure for supporting the growth of a community of adopters/practitioners/enthusiasts.

1.2 Short description

Electricity has existed since the beginning of the universe, which is composed, according to the physical principles of "matter". Its human-created history dates back to the beginnings of mankind. It is very discreet most of the time, but sometimes manifests itself in a very spectacular and brutal way: for example, in the form of lightning associated with thunder and the attraction of some substances by others (amber and magnet stones).

Discovered in the 18th century, electricity can be made from different sources of energy. The most common is thermal energy, that is, heat produced by burning coal, oil or gas. This heat can also come from groundwater hot water, this is called geothermal. It also comes from radioactive metals such as uranium or plutonium used in nuclear power plants. On the other hand, this heat can simply be that of the sun, it is the solar energy, or that from the wind, it and the wind.

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The electricity we receive in homes, factories, schools, ... is produced in power plants. This electricity can be produced in a variety of ways, including:

- **By friction:** rubbing one object on another (Static electricity) . A plastic latte rubbed on fabric attracts small pieces of paper.
The rubbing of a sweater on the skin...
The movement of clouds in the atmosphere
- **By light:** (continuous current)
Transforming solar energy into electricity.
Photovolataic panel, Calculator, watch, ...
- **Chemical action:** by dipping two different materials into a Mixture Acid (continuous current) and batteries.
- **In heat:** by heating two welded materials together (continuous current)
Thermocouple.
- **Wind:** Wind energy is the energy of the wind, whose driving force (kinetic energy) is used in the movement of sailboats.

Between 1831 and 1839 Michael FARADAY, British physicist and chemist, known for his fundamental work in the field of electromagnetism, multiplied the founding discoveries of modern electricity, including *electromagnetic induction*, whose applications serve as the basis for the entire electrical industry.

1.3 Learning objectives

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At the end of this module, the student will be able to correctly use the vocabulary and terms used in electricity and understand the basic laws and properly apply the formulas to study an electrical system.

The learning tool will cover the production of electricity, the Constitution of matter, Electrical circuit, voltage, electrical current, resistance, Ohm's Law and magnetism.

In this chapter also some experiments that you can perform using the Raspberry Pi and various other sensors. In addition, resources, references and other useful materials were included at the end to improve your learning and understanding of the subject.

1.4 Links to curriculum

The domains/topics to which this lesson plan can be linked are:

- Informatics / Informatics: processing units and peripherals, interfaces, programming language and main coding structures
- Technology: electronics, open-source hardware and software
- Mathematics: the calculation procedure (equations)
- Physics: Electricity & Magnetism (types, analysis)

1.5 Materials required

The following materials will be required for the different experiments

EXPERIMENT 1

- Raspberry Pi 3 (RPI)
- 1 GPIO Extension Board

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- 1 Full+ Breadboard
- 1 Vibration Sensor SW-420
- 4 Jumper Wires (Male to Female)

EXPERIMENT 2

- Raspberry Pi 3 (RPi)
 - 1 GPIO Extension Board
 - 1 Full+ Breadboard
 - 1 Linear Magnetic Hall Sensor KY-024
 - 4 Jumper Wires (Male to Female)

1.6 Duration

The duration of this lesson plan in total is estimated to 180 minutes, as the following:

- 60 minutes – Introduction to Electricity & Magnetism
- 60 minutes – Explanation of the components used
- 60 minutes – Experiments and results. Lesson Plan

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2 Lesson Plan

The lesson plan is divided into three phases, introduction, preparation and conclusion.

2.1 Introduction

The electricity

Let's examine the smallest element that constitutes matter. indeed the **atom**. This latter made up of:

- of a **nucleus** which is positive (+).
- one or more **electrons** which are negative (-).

The electron rotates, in an orbit (layer), around the core.

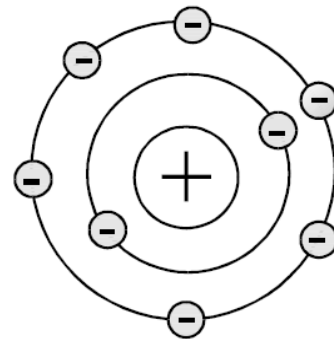
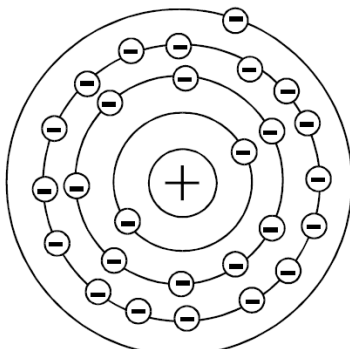
The electrons (-) are attracted to the nucleus (+), but don't stick to it because there is a force centrifugal which moves it away from the nucleus.

The atom has a precise number of electrons (-) distributed over successive layers.

The carbon atom

Let us take two examples:

▪ The copper atom

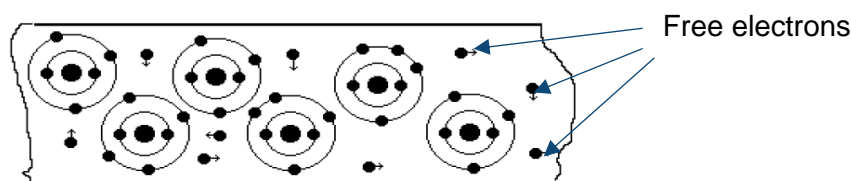


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Atoms which have less than four electrons in their last shell easily lose one (this is the case with copper). We call this: electron-free.

The atom which has lost an electron is no longer complete. It will then try to attract another free electron in its vicinity or on another nearby atom. This happens in all subjects.

So here is what happens in a copper wire for example.

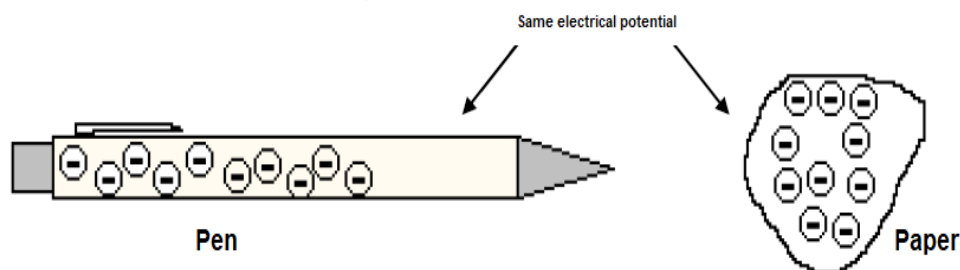


There is an exchange of free electrons between atoms, in different directions. Their displacement is amplified if we rub the material, heat it and press him.

- **Experience to illustrate this phenomenon**

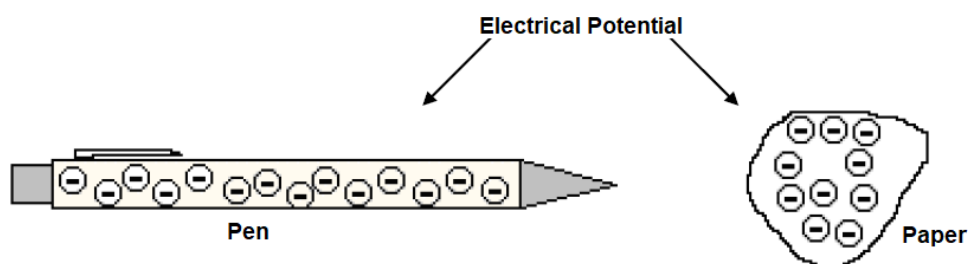
For this experience, a ballpoint pen and a small piece of paper are required. We remark, nothing happens if we just approach the pen of the paper pieces on the table. Because the two elements (paper and pen) have their atoms balanced. We say both objects have the same electrical potential.

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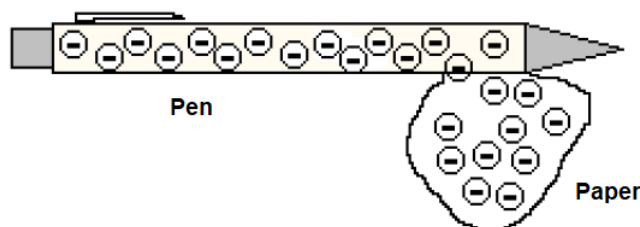


Now we rub the pen energetically on the pants for a few seconds, and we approach the pen slowly from the paper.

We remark that the paper sticks to the pen, because the exchange of free electrons has been amplified. Free electrons from the pen went into the pants. So there are now more free electrons in the paper than in the pen. It is said that the two objects are not at the same electrical potential.



When the paper, pen was approached, a balance was created between the free electrons of the pen and paper.



Then, a few moments the paper falls, the balance is achieved and the two objects are to the same electrical potential.

In summary, there was an exchange of free electrons between the two objects, after rubbing the pen on the pants and after approaching the pen to the paper. This exchange occurred from the pen to the paper. Therefore, we can say that the pen has more electrons in the pen than the paper. Knowing that, the electron has a negative charge, therefore, the paper has a positive charge. The electrons moved from the pen which had a negative electrical charge to the paper which had a positive electrical charge, which is ***the principle of electricity***.

All the forces involved in the interactions between atoms can be explained by ***electromagnetic forces*** acting between electrically charged atomic nuclei and the electrons of atoms.

Electricity and magnetism

In 1820, the Danish physicist Hans Christian Ørsted was the first to demonstrate the existence of a link between electricity and magnetism. This man contented himself with publishing the results of his experiments which made the rounds of scientists of his time and led to a host of discoveries in the field of electromagnetism.

In his experiment, he approached a compass to a simple electrical circuit in which an electric current was flowing and found that the needle of the magnet was spinning (see photo).

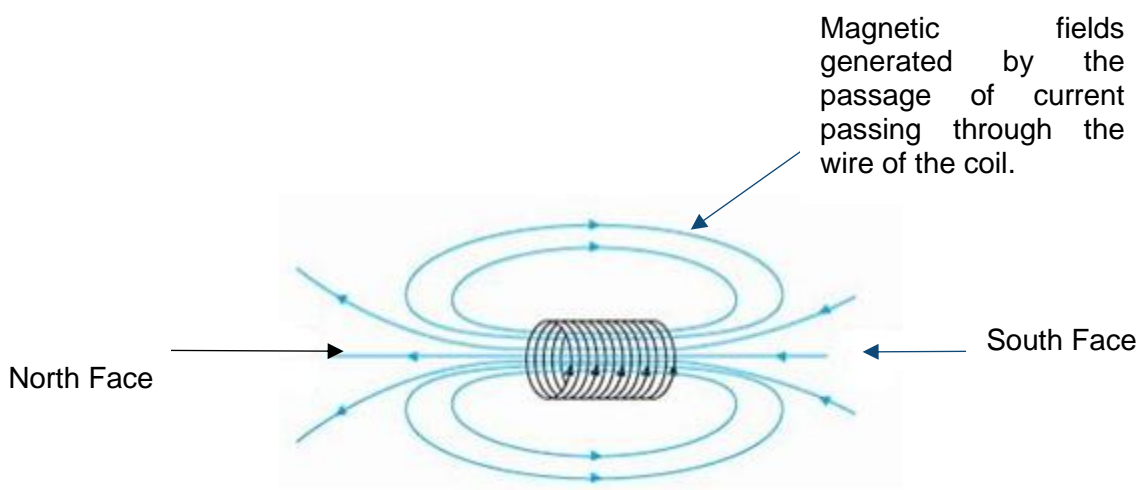


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When the circuit is open, therefore no current flowing through the wire, the compass indicates the earth's magnetic north. If we close the circuit, so we let the current flow, then the compass needle points in another direction for north.

This simple experiment showed the connection between the movement of electric charges (i.e. electric current) and the generation of a magnetic field. So moving electric charges generate a magnetic field.



With this experiment, Hans Christian Ørsted had just shown that the movement of electrical charges (later referred to as an electric current) produces a magnetic field.

▪ Solenoid and magnetic field

A solenoid is a coiled helical thread, forming a long cylinder. When a solenoid is traversed by an electric current, it creates a magnetic field in its vicinity and especially within itself. This magnetic field is oriented according to the axis of the cylinder (Figure a).

The magnetic field, thus created by a solenoid is then similar to that created by a right magnet with a north pole and a south pole (Figure b).

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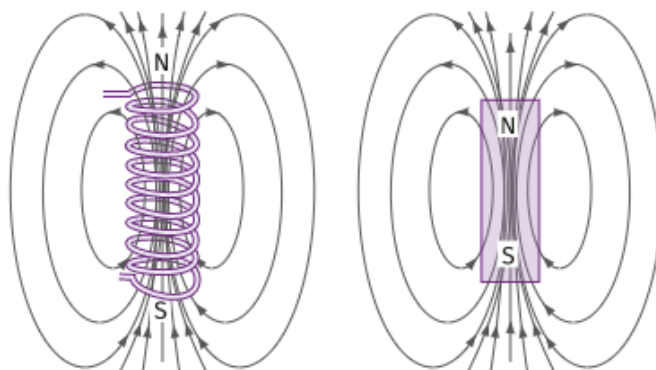


Figure a

Figure b

Electromagnetic induction: The phenomenon of the appearance of an electrical voltage in a conductor subject to a variable magnetic field.

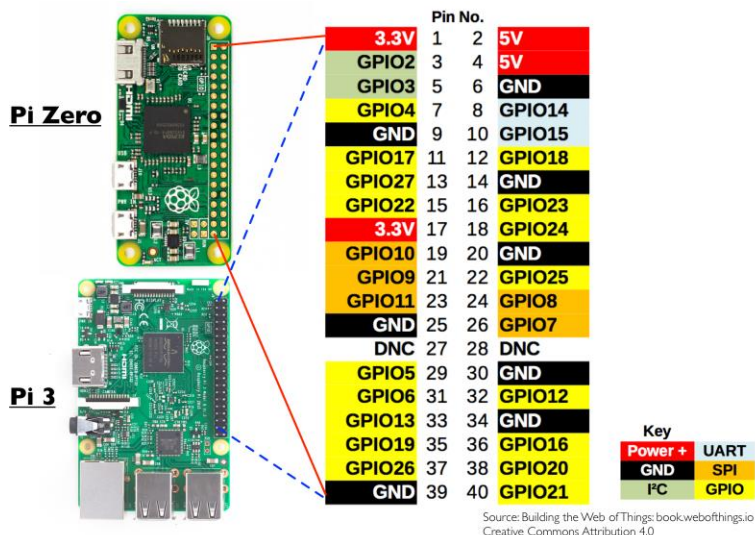
2.2 Preparation

One powerful feature of the Raspberry Pi is the row of GPIO pins along the top edge of the board. GPIO stands for General-Purpose Input/Output. These pins are a physical interface between the Raspberry Pi and the outside world. At the simplest level, you can think of them as switches that you can turn on or off (input) or that the Pi can turn on or off (output).

The GPIO pins allow the Raspberry Pi to control and monitor the outside world by being connected to electronic circuits. The Pi is able to control LEDs, turning them on or off, run motors, and many other things. It's also able to detect whether a switch has been pressed, the temperature, and light. We refer to this as physical computing.

There are 40 pins on the Raspberry Pi (26 pins on early models), and they provide various different functions.

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You'll see pins labelled as 3V3, 5V, GND and GPIO2, GPIO3, etc:

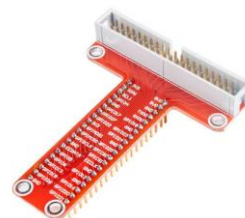
Anything connected to these pins will always get 3.3V of power	3.3 volts	3.3 V
Anything connected to these pins will always get 5V of power	5 volts	5V
Zero volts, used to complete a circuit	Ground	GND
These pins are for general-purpose use and can be configured as input or output pins	GPIO pin 2	GPIO2
Special purpose pins	OTHER	OTHER

To make our activities with this Kit more easy, We can use a 40P T-Cobbler Plus GPIO Breakout Board.

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The T-Cobbler Plus is an add on prototyping board from Adafruit specifically designed for the 2x20 connector-type Raspberry Pi, and can break out all those tasty power, GPIO, I2C and SPI pins from the 40-pin header onto a solderless breadboard. This set will make "cobbling together" prototypes with the Pi super easy.



WARNING: If you follow the instructions, then playing about with the GPIO pins is safe and fun. Randomly plugging wires and power sources into your Pi, however, may destroy it, especially if using the 5V pins. Bad things can also happen if you try to connect things to your Pi that use a lot of power; LEDs are ne, motors are not.

Experiment 1

1- Vibration Sensor SW-420

First off all, we have to enable the Remote GPIO

First is to enable Remote GPIO from either the graphical interface or a terminal.

Using the Graphical Interface, go to:

Preferences > Raspberry Pi Configuration > Interfaces > Remote GPIO (Choose enable) and click on OK.

Using the Remote Terminal:

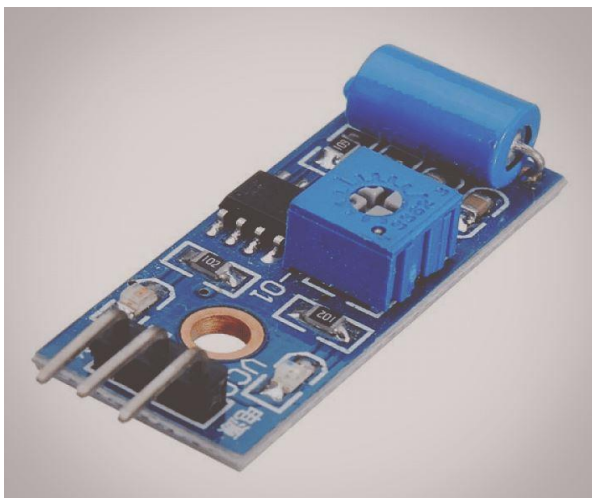
Execute the command : "sudo raspi-config"

Go to "Interfacing Options"

Go to "Remote GPIO"

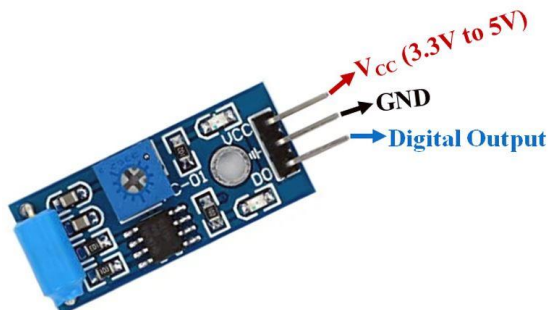
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Choose "Yes"



The Vibration Sensor (SW-420) is a high sensitivity non-directional vibration sensor. When the module is stable, the circuit is turned on and the output is high. When the movement or vibration occurs, the circuit will be briefly disconnected and output low. At the same time, you can also adjust the sensitivity according to your own needs.

is used to detect vibrations. The threshold can adjust using an on-board potentiometer. During no vibration, the sensor provides Logic Low and when the vibration is detected, the sensor provides Logic High.



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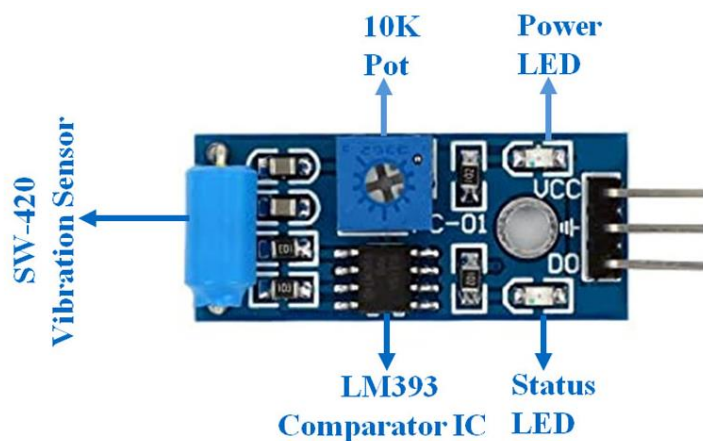
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Pin Configuration of Vibration Sensor Module

Description	Pin Name
The Vcc pin powers the module, typically with +5V	VCC
Power Supply Ground	GND
Digital Out Pin for Digital Output.	DO

Brief about SW-420 Vibration Sensor/Motion Sensor Module

This Vibration Sensor Module consists of an SW-420 Vibration Sensor, resistors, capacitor, potentiometer, comparator LM393 IC, Power, and status LED in an integrated circuit. It is useful for a variety of shocks triggering, theft alarm, smart car, an earthquake alarm, motorcycle alarm, etc.



LM393 IC

LM393 Comparator IC is used as a voltage comparator in this vibration sensor module. Pin 2 of LM393 is connected to Preset (10KΩ Pot) while pin 3 is connected to vibration sensor. The comparator IC will compare the threshold voltage set using the preset (pin2) and the Vibration Sensor pin (pin3).

Preset (Trimmer pot)

Using the onboard preset, you can adjust the threshold (sensitivity) of the digital output.

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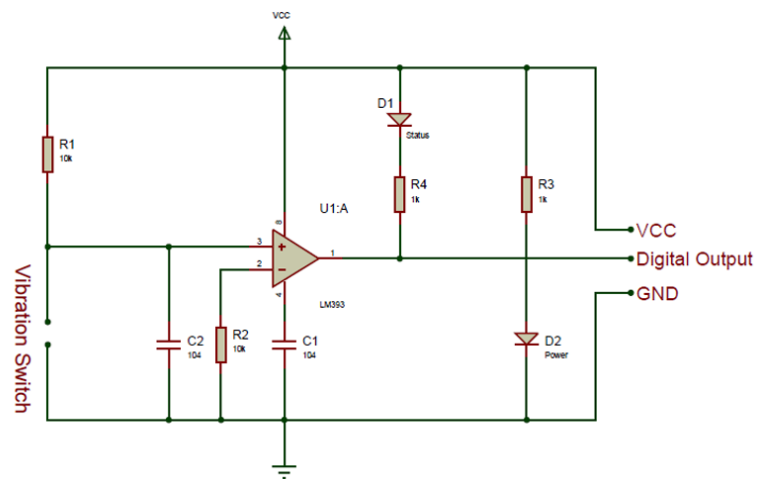
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SW-420 Vibration Switch

Vibration switch recognizes the amplitude of the vibration to which it is exposed. The switch response can be electrical contact closure or contact opening. The electrical contact may be either an electromechanical relay or a solid-state device.

How to Use SW-420 Vibration Sensor Module

Vibration sensor module consists of three pins i.e. VCC, GND, and DO. The Digital out pin is connected to the output pin of the LM393 comparator IC. The Internal Circuit diagram of the Temperature sensor module is given below.

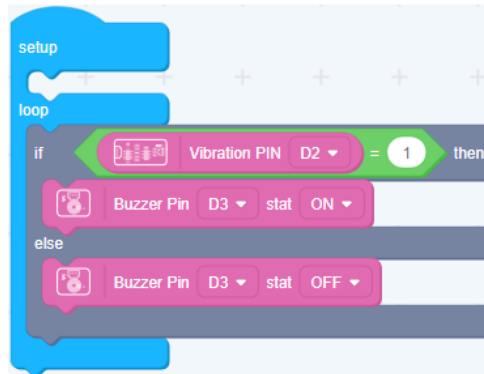


Using the Vibration sensor module with the microcontroller is very easy. Connect the Digital Output pin of the module to the Digital pin of Microcontroller. Connect VCC and GND pins to 5V and GND pins of Microcontroller.

Applications of Vibration Sensor Module

- Shocks triggering
- Theft alarm
- Smart car
- Earthquake alarm
- Motorcycle alarm

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```
#!/usr/bin/python
import RPi.GPIO as GPIO
import time

#GPIO SETUP
channel = 17
GPIO.setmode(GPIO.BCM)
GPIO.setup(channel, GPIO.IN)

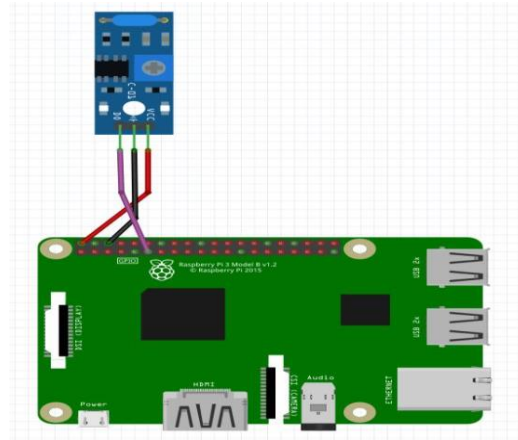
def callback(channel):
    if GPIO.input(channel):
        print "Movement Detected!"
    else:
        print "Movement Detected!"

GPIO.add_event_detect(channel, GPIO.BOTH, bouncetime=300) # let us know when the pin goes HIGH or LOW
GPIO.add_event_callback(channel, callback) # assign function to GPIO PIN, Run function on change

# infinite loop
while True:
    time.sleep(1)
```

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```

1.  #!/usr/bin/python
2.  import RPi.GPIO as GPIO
3.  import time
4.
5.  #GPIO SETUP
6.  channel = 17
7.  GPIO.setmode(GPIO.BCM)
8.  GPIO.setup(channel, GPIO.IN)
9.
10. def callback(channel):
11.     if GPIO.input(channel):
12.         print "Movement Detected!"
13.     else:
14.         print "Movement Detected!"
15.
16. GPIO.add_event_detect(channel, GPIO.BOTH, bouncetime=300) # let us know when the
    pin goes HIGH or LOW
17. GPIO.add_event_callback(channel, callback) # assign function to GPIO PIN, Run
    function on change
18.
19. # infinite loop
20. while True:
21.     time.sleep(1)
  
```

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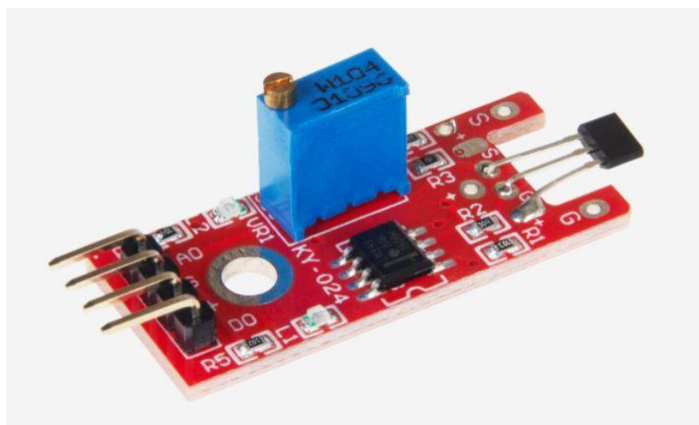
Experiment 2

2.2.2-Linear Magnetic Hall Sensor

Description

The KY-024 Linear magnetic Hall sensor reacts in the presence of a magnetic field. It has a potentiometer to adjust the sensitivity of the sensor and it provides both analog and digital outputs.

The digital output acts as a switch that will turn on/off when a magnet is near, similar to the KY-003. On the other hand, the analog output can measure the polarity and relative strength of the magnetic field.



Specifications

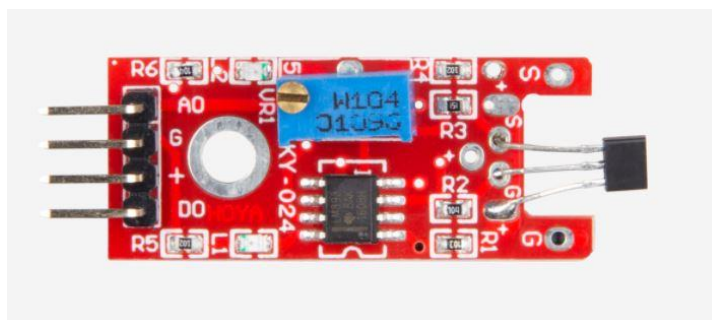
The KY-024 module consists of a 49E Linear Hall-Effect Sensor, a LM393 Dual Differential Comparator, a potentiometer, two leds and six resistors. It's compatible with popular electronics platforms like Arduino, Raspberry Pi, Esp8266 and Teensy.

Operating Voltage 2.7V to 6.5V

Sensitivity 1.0 mV/G min., 1.4 mV/G typ., 1.75 mV/G max.

Board Dimensions 1.5cm x 3.6cm [0.6in x 1.4in]

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Chipset A3141

OP-Amplifier LM393

Digital Output If a magnetic field is detected, a signal is given out here.

Analog Output Direct measured value of the sensor unit

LED1 Indicates that the sensor is powered.

LED2 Indicates that a magnetic field has been detected.

PIN-ASSIGNMENT



So, In this experiment, we will learn how to use the linear hall sensor module.

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Component Required:

- (1) x Uno R3
- (1) x Linear hall sensor module
- (1) x USB cable
- (x) x F-M wires

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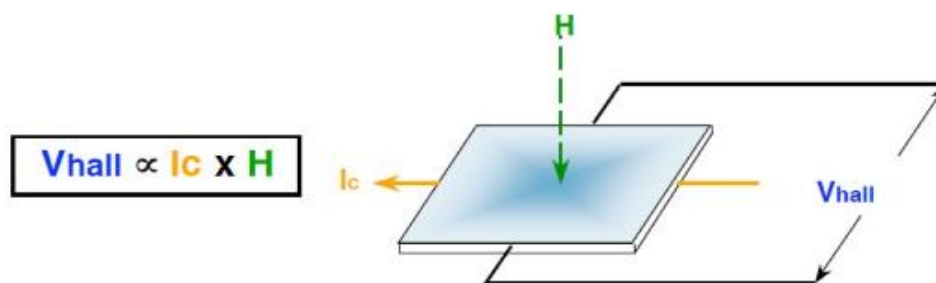
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Dwg. PH-003A

Pinning is shown viewed from branded side.

ABSOLUTE MAXIMUM RATINGS at $T_A = +25^\circ\text{C}$

Supply Voltage, V_{CC}	28 V
Reverse Battery Voltage, V_{RCC}	-35 V
Magnetic Flux Density, B	Unlimited
Output OFF Voltage, V_{OUT}	28 V
Reverse Output Voltage, V_{OUT}	-0.5 V
Continuous Output Current, I_{OUT}	25 mA
Operating Temperature Range, T_A	
Suffix 'E-'	-40°C to $+85^\circ\text{C}$
Suffix 'L-'	-40°C to $+150^\circ\text{C}$
Storage Temperature Range,	
T_S	-65°C to $+170^\circ\text{C}$



V_{hall} = Output Hall-effect voltage

H = Magnetic Flux created by magnet or current-carrying conductor

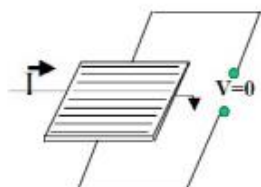
I_c = Constant supply current

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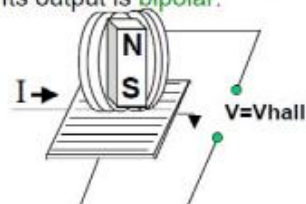
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Hall-effect Sensing Mechanism

- The current source is applied through a thin sheet of semiconductor material.

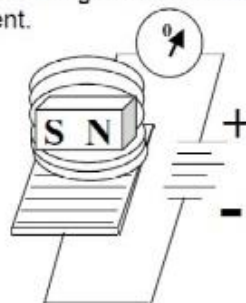


- A magnetic field applied **perpendicular** to the element creates a voltage change = V_{hall} . Its output is **bipolar**.

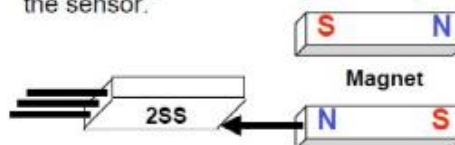


Magnetoresistive Sensing Mechanism

- A magnetic field applied **parallel** to the element changes its resistance and creates a current.



- MR is **omnipolar**—either pole will operate the sensor.



Design Factors – Magnetic Types

Unipolar: Only a south pole will operate the sensor. The sensor turns on with the south pole(+) and off when the south pole is removed.

- Bipolar: Sensor output is pole-dependent. A south pole (+) is designed to activate the sensor; a north pole(-) is designed to deactivate. It's possible that the sensor could turn off and still be within a positive Gauss level.

- Latching: Specifications are tighter on latching. Sometimes it is designed to make certain that when the south pole(+) is removed from the sensor, it will stay on until it sees the opposite pole(-).

- Omnipolar: The sensor is designed to operate with either magnetic pole(+ or -).

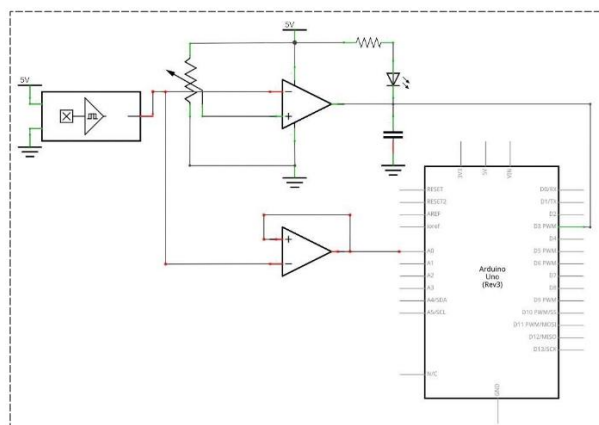
- Ratiometric linear: Output is proportional to magnetic field strength. Output sensitivity range is 2.5 – 3.75 mV per unit of Gauss.

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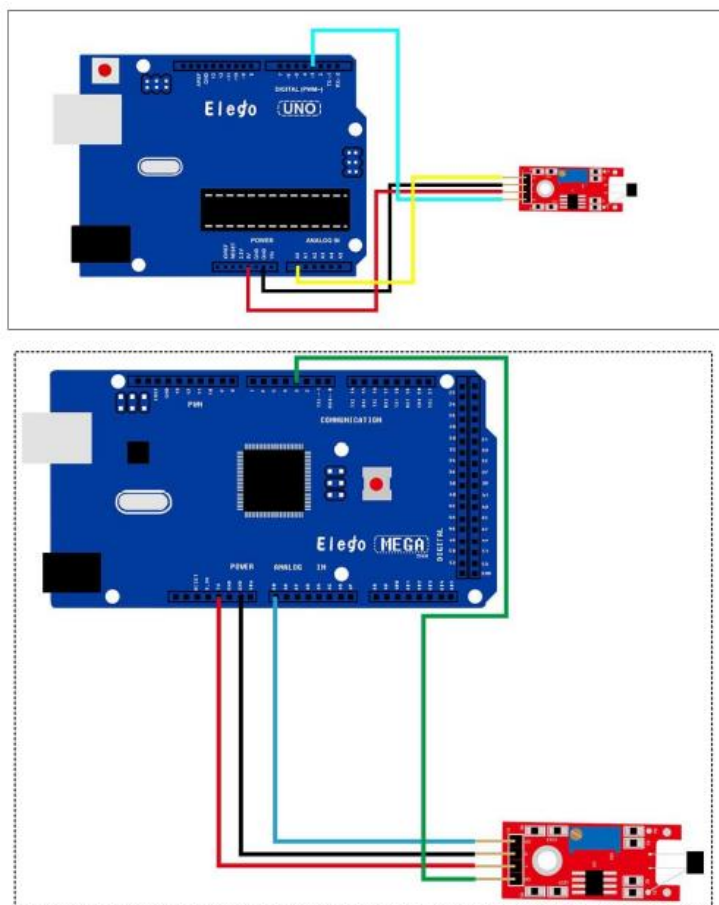
Connection

Schematic



wiring diagram

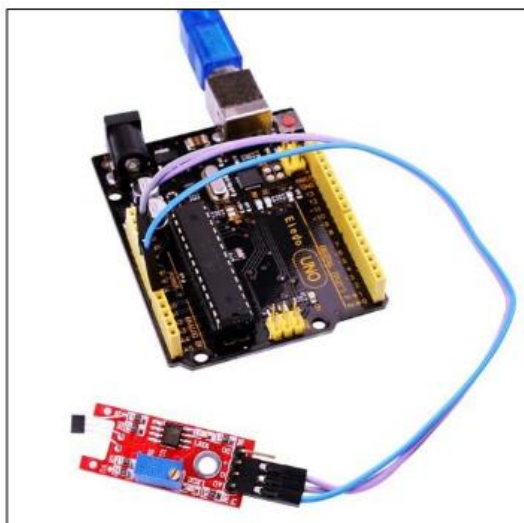
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Result

For the hall sensor module, we can choose the output: digital output or analog output. In the following picture, we use the DO port to output. so we can see that if the hall sensor sensing the magnetic force, the light will turn on.

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Program:

Linear Hall Module:

linear_hall_module | Arduino 1.8.19 (Windows Store 1.8.57.0)

Fichier Édition Croquis Outils Aide

```
linear_hall_module $
1 int Led=13;//define LED port
2 int buttonpin=3; //define switch port
3 ;int val;//define digital variable val
4 void setup()
5 {
6 pinMode(Led,OUTPUT);//define LED as a output port
7 pinMode(buttonpin,INPUT);//define switch as a output port
8 }
9 void loop()
10 {
11 { val=digitalRead(buttonpin);//read the value of the digital interface 3 assigned to val
12 if(val==HIGH)//when the switch sensor have signal, LED blink
13 {
14 digitalWrite(Led,HIGH);
15 }
16 else
17 {
18 digitalWrite(Led,LOW);
19 }
20 }
21 |
```

Analog Hall Module:

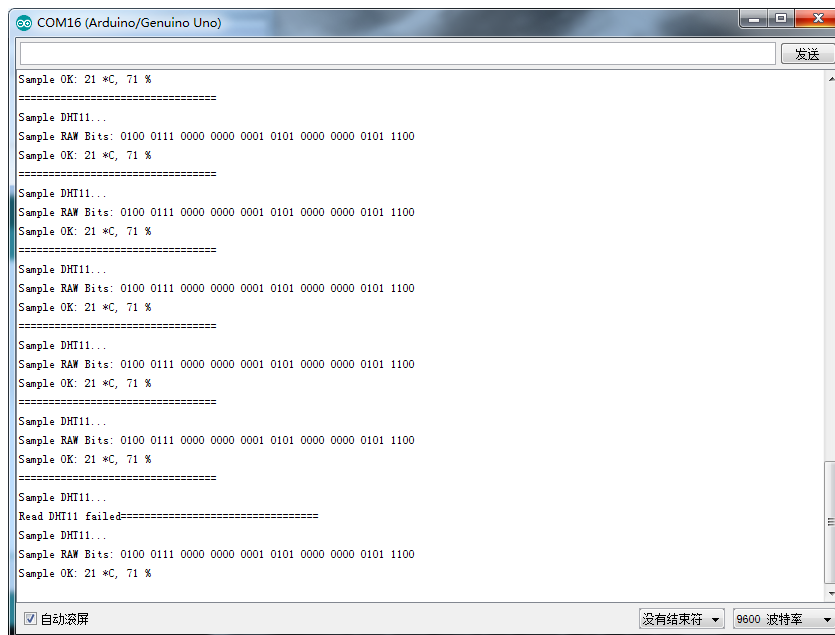
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analog_hall_module | Arduino 1.8.19 (Windows Store 1.8.57.0)

Fichier Édition Croquis Outils Aide

```
analog_hall_module$
1 int sensorPin = A0;    // select the input pin for the potentiometer
2 int ledPin = 13;      // select the pin for the LED
3 int sensorValue = 0;  // variable to store the value coming from the sensor
4
5 void setup()
6 {
7   pinMode(ledPin, OUTPUT);
8   Serial.begin(9600);
9 }
10 void loop() {
11   sensorValue = analogRead(sensorPin);
12   digitalWrite(ledPin, HIGH);
13   delay(sensorValue);
14   digitalWrite(ledPin, LOW);
15   delay(sensorValue);
16   Serial.println(sensorValue, DEC);
17 }
18
```

Upload the program then open the monitor, we can see the data as below:

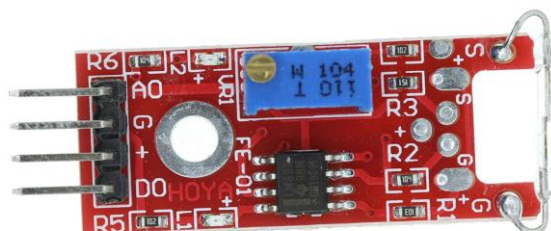


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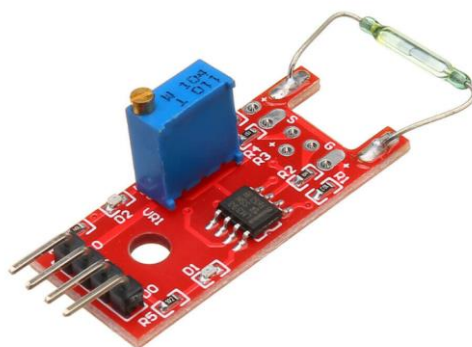
Experiment 3

2.2.3- 4pin Magnetic Reed Switch Module



Applications:

This module can be apply in Program-controlled switches, copiers, washing machines, refrigerators, cameras, Disinfection cabinet, door, window magnetic, electromagnetic relays, electronic weighing, level meter, gas meter, water meter and so on.



Specifcatons:

working voltage 3.3V-5V

output format: digital switching output (0 and 1)

PCB size: 3.2cm x 1.4c

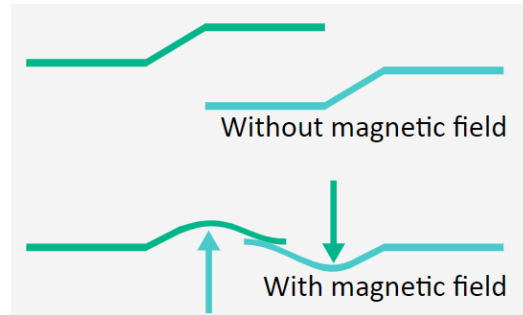
using a wide voltage LM393 comparator

clean, good waveform driving ability ,more than 15mA.

a fixed bolt holes for easy installation

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If a magnetic field is detected, this is output at the digital output. Reed contacts have the property that their two thin contact springs, located inside the glass tube, move towards each other if a magnetic field is nearby.



This closes an electrical contact, which then switches the signal through.

Digital output: If a magnetic field is detected, a signal is output here.

Analog output: Direct measured value of the sensor unit

LED1: Indicates that the sensor is supplied with voltage

LED2: Indicates that a magnetic field has been detected

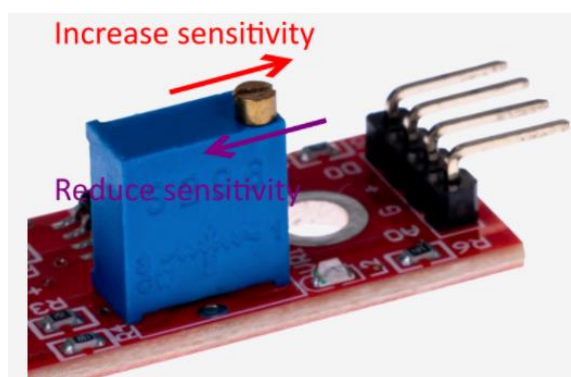
HOW THE SENSOR WORKS

This sensor has three functional components on its circuit board. One is the sensor unit at the front of the module, which physically measures the current environment and outputs it as an analog signal to the second unit, the amplifier. This amplifies the signal depending on the resistance set on the rotary potentiometer and sends it to the analog output of the module.

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It should be noted here: The signal is inverted; if a high value is measured, this results in a lower voltage value at the analog output.

The third unit is a comparator, which switches the digital output and the LED when the signal falls below a certain value. By means of the rotary potentiometer the sensitivity can be adjusted as shown in the following figure:



This sensor does not give absolute values (e.g. exactly measured temperature in °C or magnetic field strength in mT), but it is a relative measurement: One defines a limit value relative to the given normal environmental situation and a signal is given, which can be further processed, if this limit value is exceeded or another state than the normal case has occurred.

This behavior is excellent for temperature monitoring (KY-028), proximity switches (KY-024, KY-025, KY-036), alarm monitors (KY-037, KY-038), or encoders (KY-026).

So, In this experiment, we will learn how to use reed switch and mini reed switch module.



1.DO: digital output
2.VCC: 3.3V-5V DC
3.GND: ground
4.AO: analog output

Component Required:

(1) xUno R3

(1) x USB cable

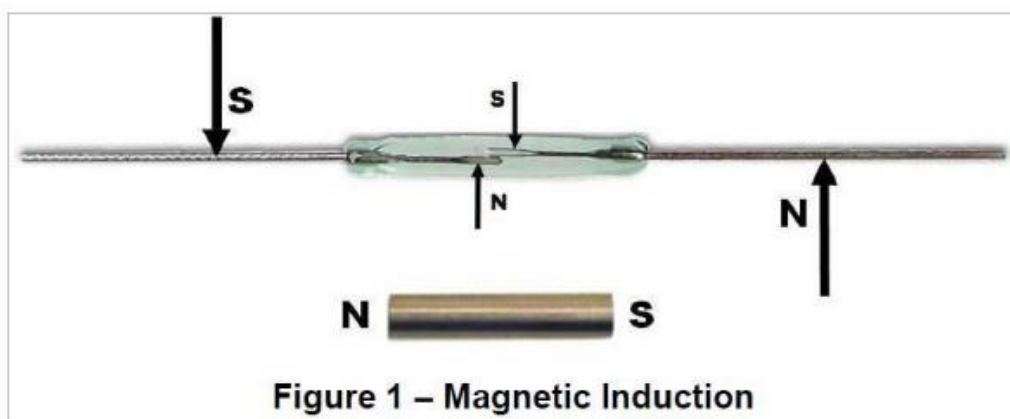
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(1) x Reed switch module

(x) x F-M wires

Although a reed switch can be activated by placing it inside an electrical coil, many reed switches and reed sensors are used for proximity sensing and are activated by a magnet. As the magnet is brought into the proximity of the reed sensor/switch, the device activates. As the magnet is removed from the proximity of the reed sensor/switch, the device deactivates. However, the magnetic interaction involved in activating the reed switch contacts is not necessarily obvious. One way of thinking about the interaction is that the magnet induces magnetic poles into the metal parts of the reed switch and the resulting attraction between the electrical contacts causes the reed switch to activate.



Another equally valid way of thinking about the interaction between a magnet and a reed switch is that the magnet induces magnetic flux through the electrical contacts. When the magnetic flux is high enough, the magnetic attraction between the contacts causes the reed switch to close.



Figure 2 – Magnetic Flux

The following are examples of typical reed switch and reed sensor activate distances.

Difference between the reed switch module and mini reed switch module

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As we can see, the reed switch module is bigger than the mini reed switch module. So the bigger one may have more function than the mini one. The reed switch can output in two ways: digital and analog. The mini reed can only output in digital.

There have 7 red pcb modules. The difference between the red and small pcb is same as above.

Principle

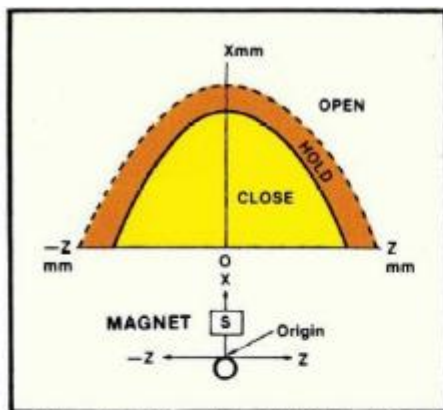


Figure 3 – Magnet Parallel to Reed Sw.

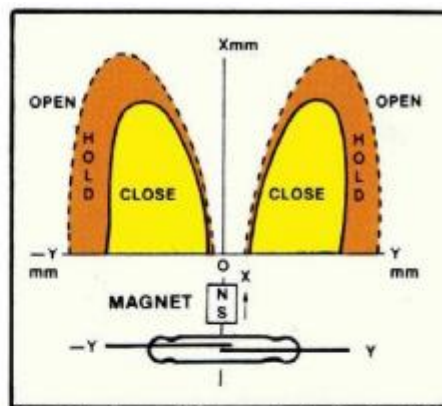


Figure 4 – Magnet Perpendicular to Reed Sw.

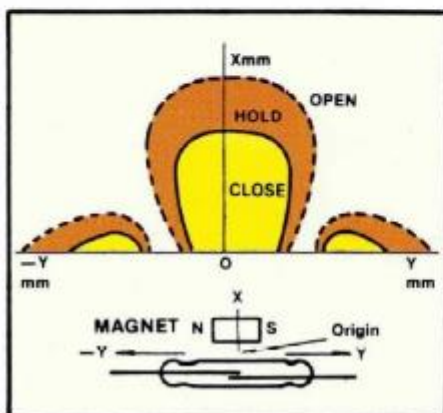


Figure 5 – Magnet Parallel to Reed Sw.

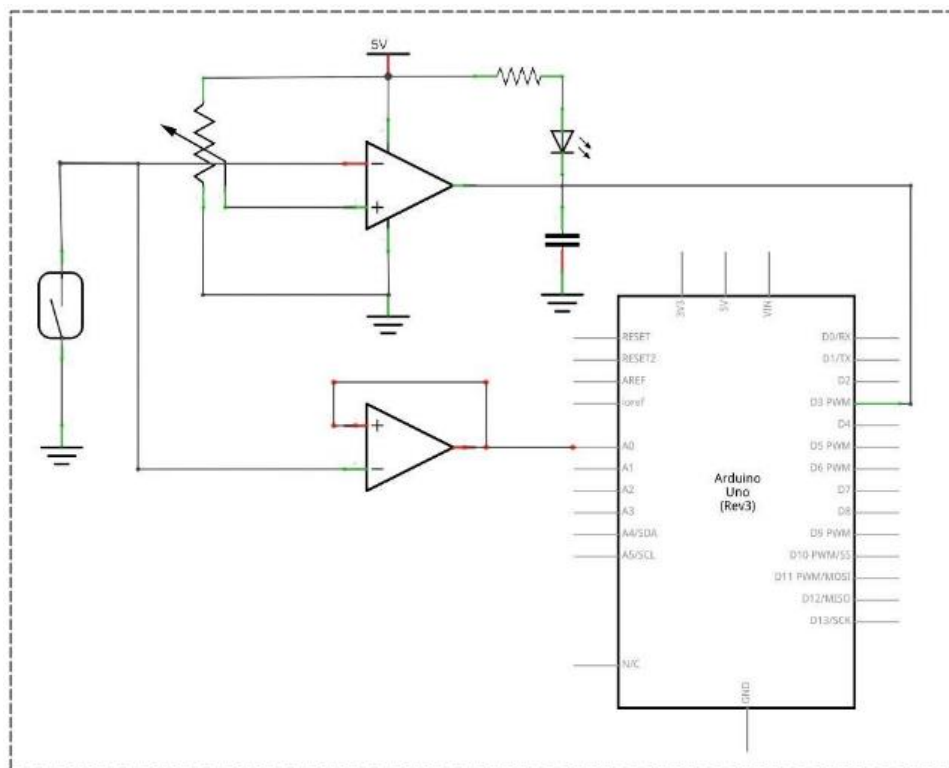
As can be seen, the magnetic orientation and location relative to the reed switch play important roles in the activation distances. In addition, the size of the activate regions(lobes) will vary depending on the strength of the magnet and the sensitivity of the reed switch. Proper orientation of the magnet with respect to the reed sensor/switch is an important consideration in meeting the application's requirements across the tolerance range for mechanical systems, magnetic strength and reed sensor or reed switch sensitivity.

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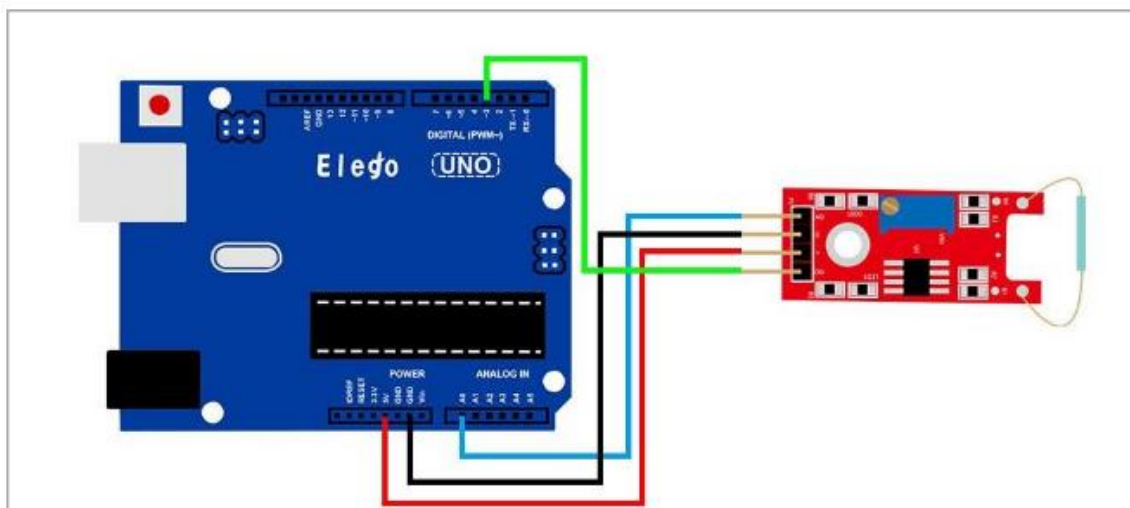
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Connection of reed switch module

Schematic

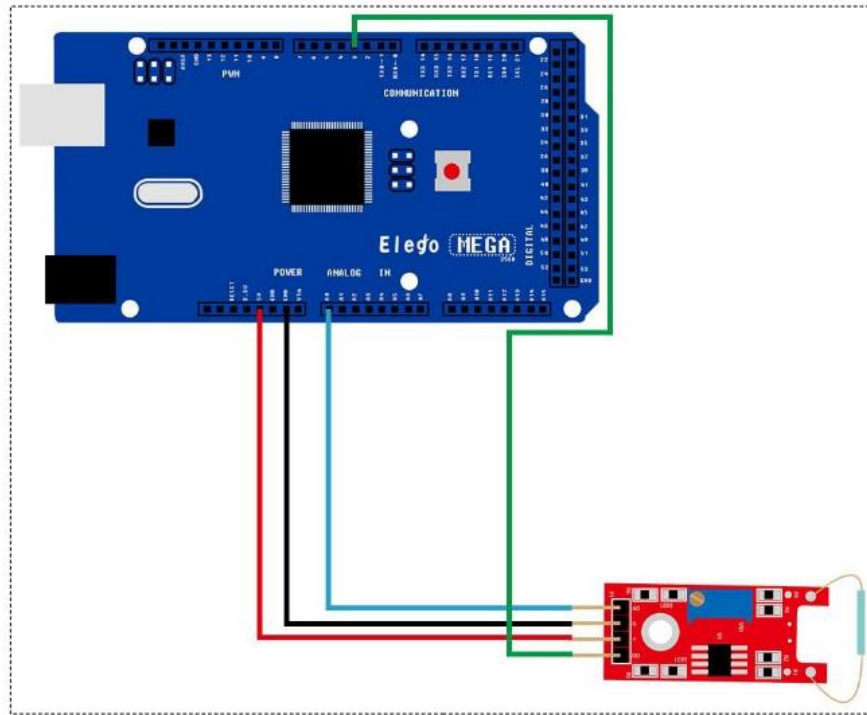


Wiring diagram



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Program:

Mini Reed

MINI_REED | Arduino 1.8.19 (Windows Store 1.8.57.0)

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```

MINI_REED $
1 int Led=13; //define LED port
2 int buttonpin=3; //define switch port
3 int val; //define digital variable val
4 void setup()
5 {
6   pinMode(Led,OUTPUT); //define LED as a output port
7   pinMode(buttonpin,INPUT); //define switch as a output port
8 }
9 void loop()
10 {
11   val=digitalRead(buttonpin); //read the value of the digital interface 3 assigned to val
12   if(val==HIGH) //when the switch sensor have signal, LED blink
13   {
14     digitalWrite(Led,HIGH);
15   }
16   else
17   {
18     digitalWrite(Led,LOW);
19   }
20 }
21
22

```

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REED_SWITCH

REED_SWITCH | Arduino 1.8.19 (Windows Store 1.8.57.0)

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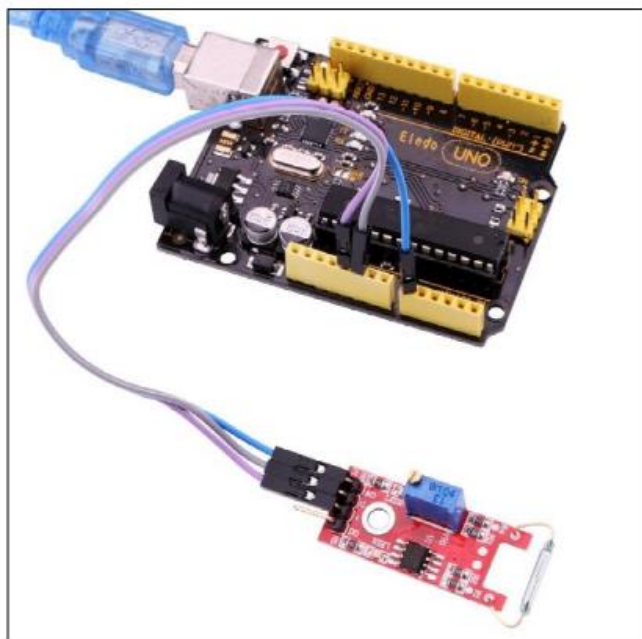
```

1 int sensorPin = A0;    // select the input pin for the potentiometer
2 int ledPin = 13;    // select the pin for the LED
3 int sensorValue = 0; // variable to store the value coming from the sensor
4
5 void setup()
6 {
7   pinMode(ledPin, OUTPUT);
8   Serial.begin(9600);
9 }
10 void loop() {
11   sensorValue = analogRead(sensorPin);
12   digitalWrite(ledPin, HIGH);
13   delay(sensorValue);
14   digitalWrite(ledPin, LOW);
15   delay(sensorValue);
16   Serial.println(sensorValue, DEC);
17 }
18

```

Result:

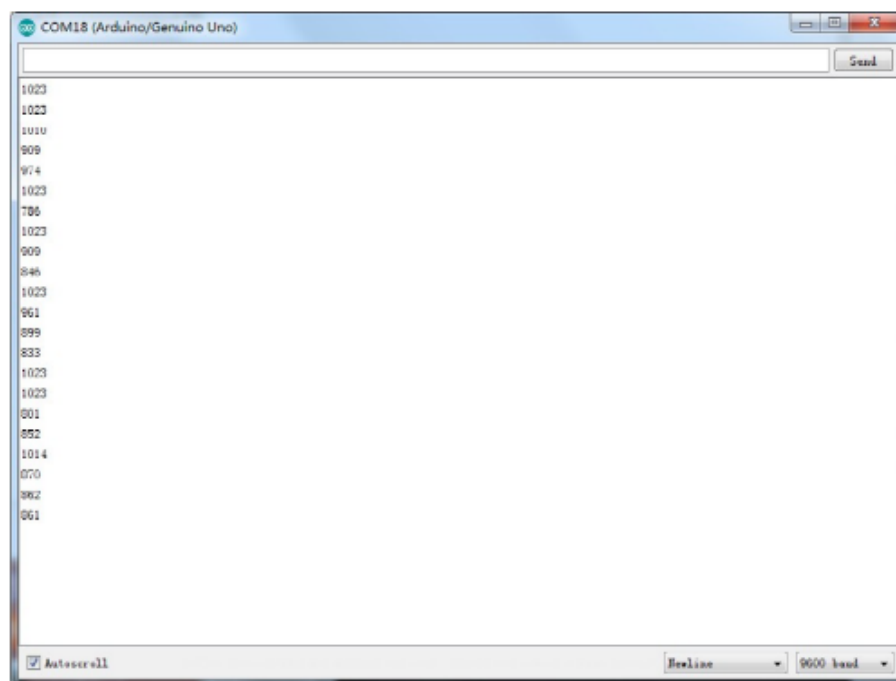
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In this experiment, we use the AO pin of reed switch module. When the sensor sensing magnetism, the module will output a data which reflect the strength of the magnetism. The number is from 0 to 1023.

Upload the program then open the monitor, we can see the data as below:

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2.4 Conclusion

This Module 3 is devoted to the fundamental concepts of Electricity and Magnetism. After a general introduction on this theme, where certain methods of electricity production have been introduced, the concepts on the constituents of matter are discussed. In this part, we have shown that Electricity is a displacement of free electrons from a negatively charged area (-) to a positively charged area. Then the link between electricity and magnetism was highlighted where the emphasis was placed on the fact that a moving electrical charge generates a magnetic field, and a magnetic field induces an electrical charge movement, producing an electric current. The rest of this module was devoted to the presentation of voltage, current and resistance in an electrical circuit. Before concluding, two examples to discover how to use PhysicsKIT and Raspberry Pi to carry out experiments and understand all the concepts discussed in this module through simple electronic montages.

References or Resources

<https://gpiozero.readthedocs.io/en/stable/recipes.html>

<https://learn.sunfounder.com/lesson-1-hall-sensor/>

<https://notenoughtech.com/rpi-sensors/hall-sensor-module/>

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https://www.linkerkit.de/index.php?title=KY-025_Reed_Modul

<https://docs.sunfounder.com/projects/sensorkit-v2-pi/en/latest/>

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