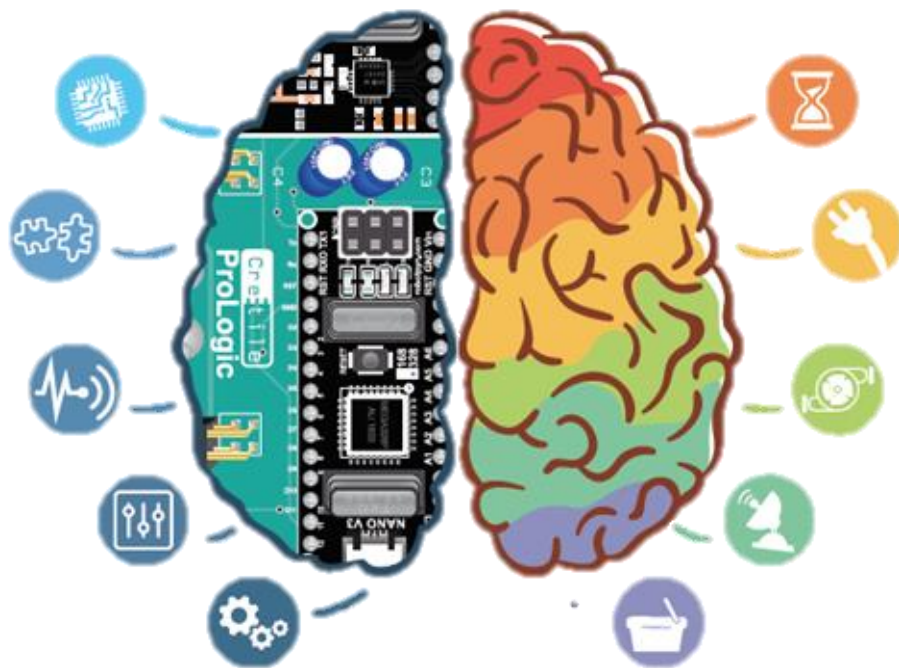


# Maker's Book

For Pioneer Kit



*Imagine and You Shall Create!*

Version 2.1



# Table of Contents

<b>1. Introduction to Cretile</b>	<b>5</b>
<b>2. How to use Cretile</b>	<b>7</b>
<b>3. Making Your First Circuit</b>	<b>9</b>
<b>4. Pioneer Cretile Modules &amp; Their Function</b>	<b>13</b>
<b>5. Project Ideas!</b>	<b>33</b>
<b>Project 1: Open Door Alarm</b>	<b>34</b>
<b>Project 2: Energy Saver Lamp</b>	<b>37</b>
<b>Project 3: Remote Controlled Vehicle</b>	<b>38</b>
<b>Project 4: Intruder Alarm</b>	<b>42</b>
<b>Project 5: Automatic Water Tap</b>	<b>43</b>
<b>Project 6: Blinking Light Program</b>	<b>45</b>
<b>Project 7: Fish Food Machine</b>	<b>49</b>
<b>Project 8: Obstacle Avoiding Robot</b>	<b>52</b>
<b>For More Project Ideas visit <a href="http://edu.cretile.com">edu.cretile.com</a></b>	<b>57</b>
<b>6. Explore More Cretiles (Not in your kit)</b>	<b>59</b>
<b>7. Support Details</b>	<b>65</b>
<b>8. Troubleshooting Guide</b>	<b>67</b>
<b>8.1. General Troubleshooting</b>	<b>67</b>
<b>8.2. ArduBlock Setup Troubleshooting</b>	<b>68</b>
<b>8.3. ProLogic Program Specific</b>	<b>69</b>
<b>8.4. Android Application Development Specific</b>	<b>69</b>



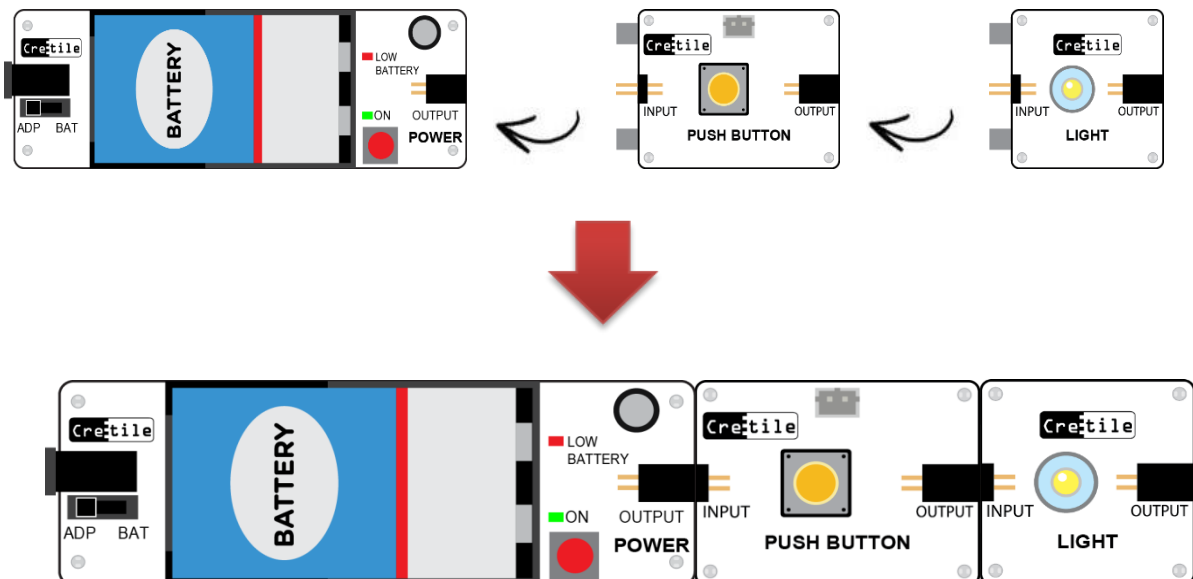
# 1. Introduction to Cretile

---

Cretile is a kit of modular electronics & electro-mechanical blocks which can be connected with each other like puzzle pieces. Electronic circuits can be made just by connecting Cretiles to each other.

Cretile is designed in such a manner that Cretiles can be connected to each other only in the right manner, avoiding possibility of wrong connection. When Cretile are connected they hold each other strongly. This avoids troubles that could arise because of loose connections.

Below image shows how three Cretiles can be easily connected to each other to make a circuit.



Cretile offers a large number of blocks that perform different function. This allows you to mix different functions and build incredibly large number of combinations and projects.



## 2.How to use Cretile

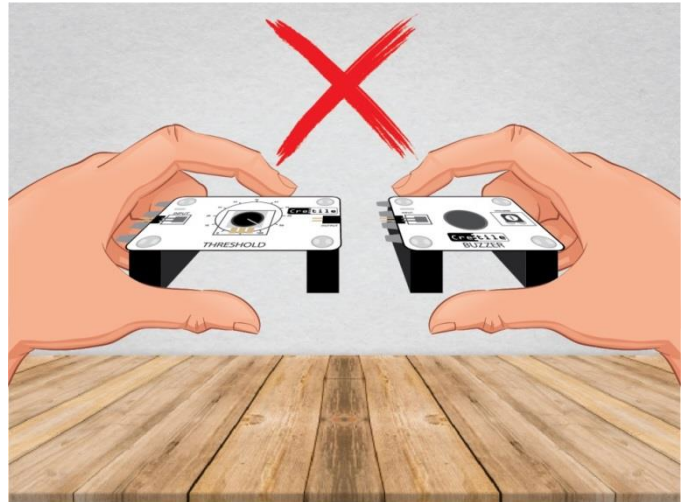
---

- 1) While connecting two Cretiles, place the Cretiles on a flat surface such as table and connect by sliding them against each other as shown here.

Cretiles are very easy to connect to each other. If you are finding it too difficult to connect Cretiles to each other, chances are you are connecting them incorrectly.



- 2) Do not try to connect Cretiles without any support of surface. This may damage the pins connectors of Cretile. Always place on a flat surface while connecting.



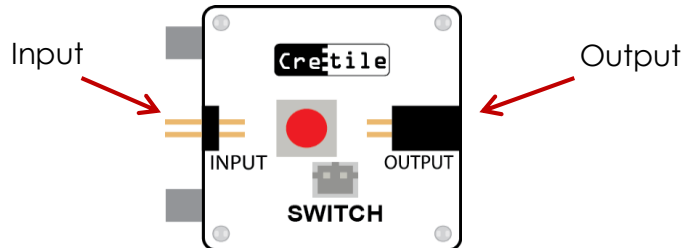
- 3) While disconnecting two Cretiles do not pull Cretiles forcefully from each other. Firmly hold one of the Cretiles and softly pull second Cretile out while moving it little up and down.
- 4) Always switch OFF Battery/Power while making Cretile circuit.
- 5) Do not touch Cretile circuit part when Cretile circuit is switched ON. Make sure that Cretiles do not come in contact with any liquid or metal. There are two exceptions to this: submersible pump must be put in water and connectivity Sensor can touch metal parts or liquids.





### 3. Making Your First Circuit

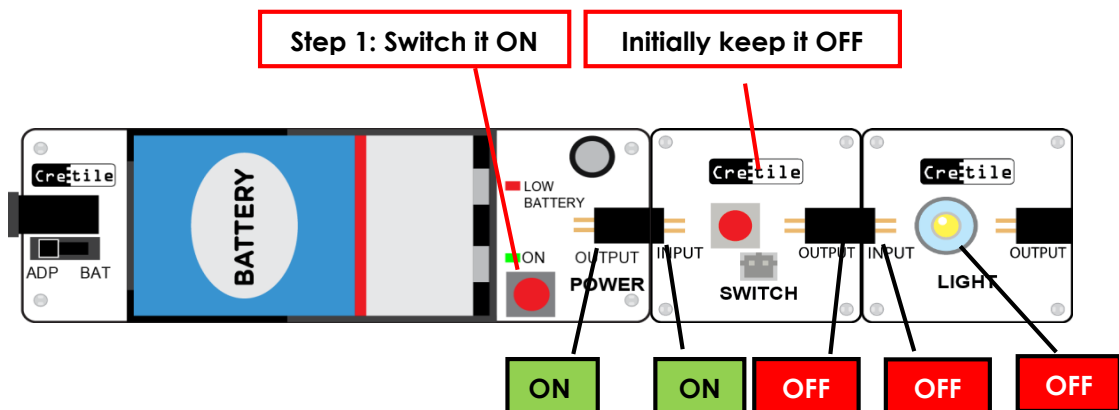
Let's understand how any Cretile block function. Below diagram shows Cretile 'Switch' block. It takes has one input and has one output.



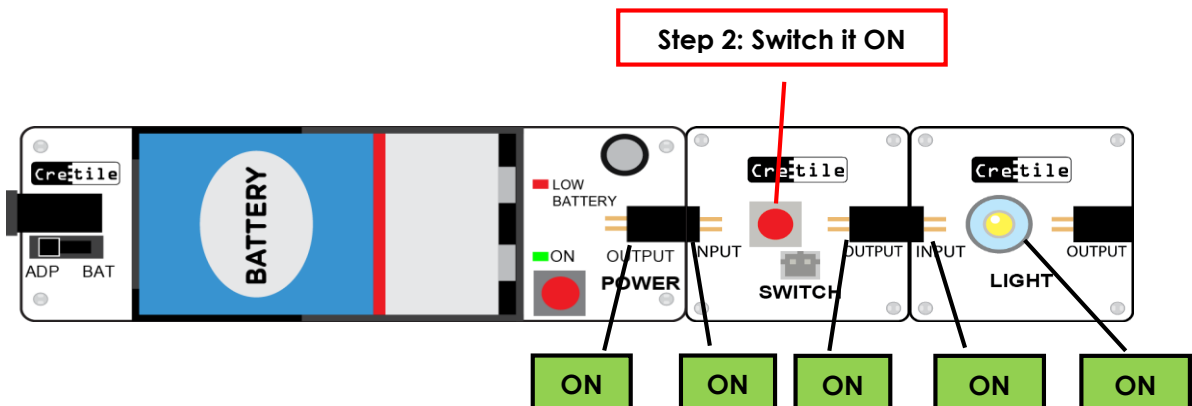
When Cretiles are connected to each other, a Cretile block receives ON or OFF signal at its input. It then uses that input and changes it as required and provides output signal at its Output pins. The next connected Cretile receives this output signal from previous Cretile at input pins.

Let's build our first circuit: Connect Battery/Power, Switch & Light as shown below.

**STEP 1:** Once connected, switch Battery/Power ON. Initially keep the Switch in OFF position. See below diagram to understand ON or OFF signals that are exchanged between Cretiles.



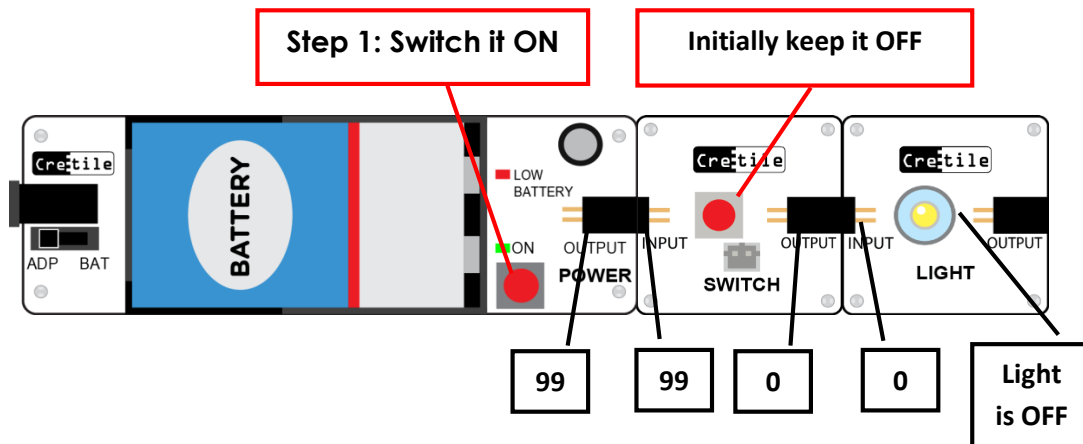
**STEP 2:** In the second step, put the Switch in ON position. Now see below diagram to learn how signals that are exchanged between Cretiles changes.



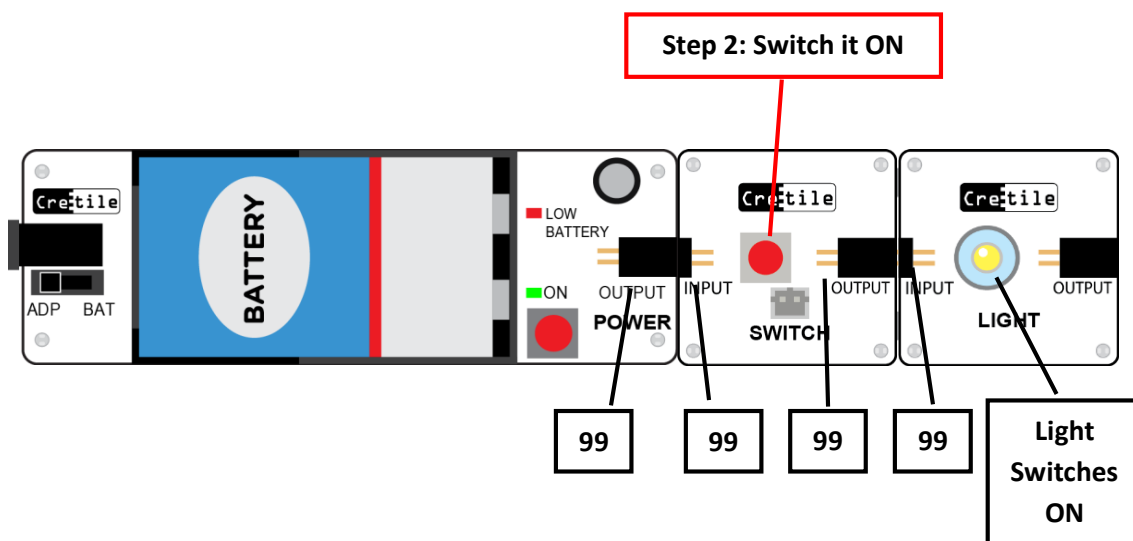
While ON and OFF terms are used for simplicity of understanding, in reality Cretiles gives values from 0 to 99 at its output. It uses different voltage levels to tell 0 to 99 values to next connected Cretile.

Zero is equivalent to OFF while 99 is equivalent to ON. Let's relook at our circuit with this new understanding.

**STEP 1** can be visualized as below:



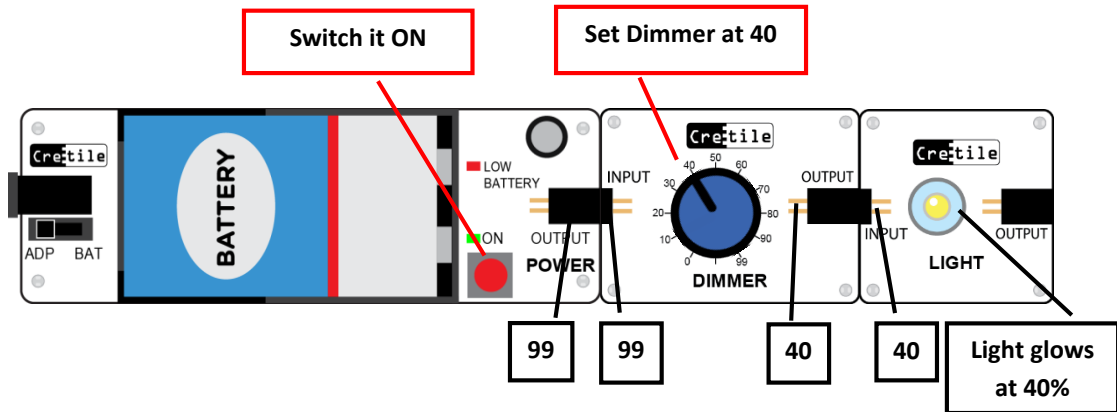
**STEP 2** can be visualized as below:



Now let's do an interesting change to our first circuit. Let's replace Switch with a Dimmer.

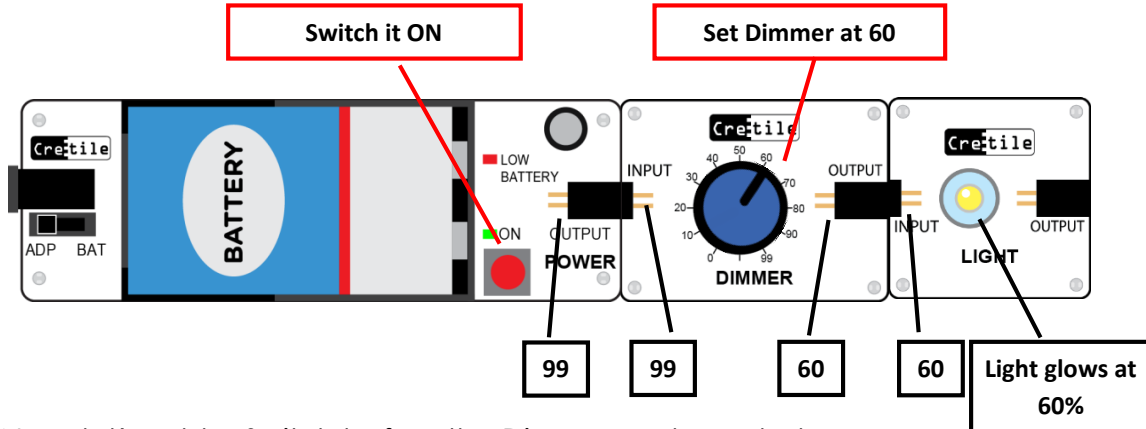
Cretile Dimmer is similar to fan speed regulators. It provides different levels of output to the Cretile connected to it.

As said before, Cretiles exchanges different values from 0 to 99 at its output. Values at inputs and output for different Cretiles can be visualized as below.

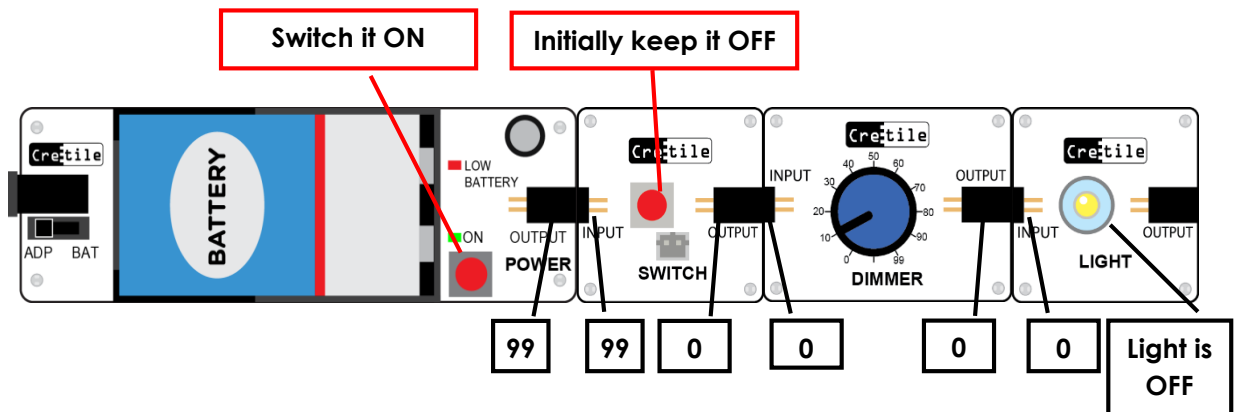


In above setup, as Battery is switched ON, Dimmer receives value '99' at its input. This enables the Dimmer. As the Dimmer knob is set at '40', it provides '40' at its output which is received by Light at its input. As Light receives '40' at its input the Light glows at 40% brightness.

Now set the Dimmer knob to 60 and observe the changes that happen.



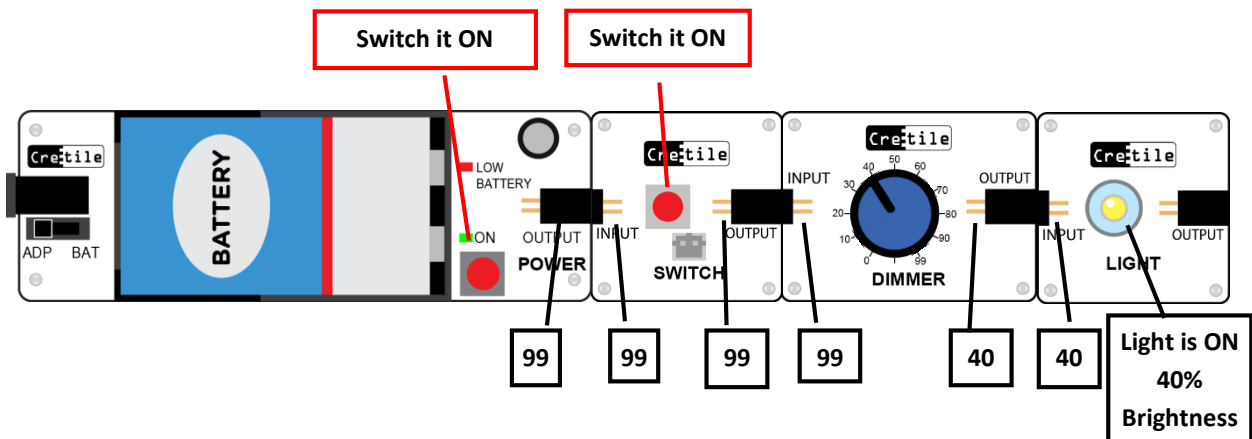
Now, let's add a Switch before the Dimmer as shown below:



Cretile	Input	Cretile Action	Output
Battery	-	Provide power from 9v batteries	99
Switch	99	Depending on Switch position give output	0
Dimmer	0	Dimmer gets enabled with zero input. Depending on knob position it provides output.	0
Light	0	Depending on input received glow the Light.	Light is OFF

As the Switch is in OFF position, Dimmer receives zero at its input and hence Dimmer is disabled. Hence, irrespective of Dimmer knob position Dimmer will give zero at its output.

Now operate the Switch to ON position and observe the change as shown below. As you put Switch in ON position, its output becomes '99'. This enables the Dimmer. As the Dimmer knob is at '40' Dimmer provide '40' at its output. This is given as input to Light and hence Light glows at 40% brightness.

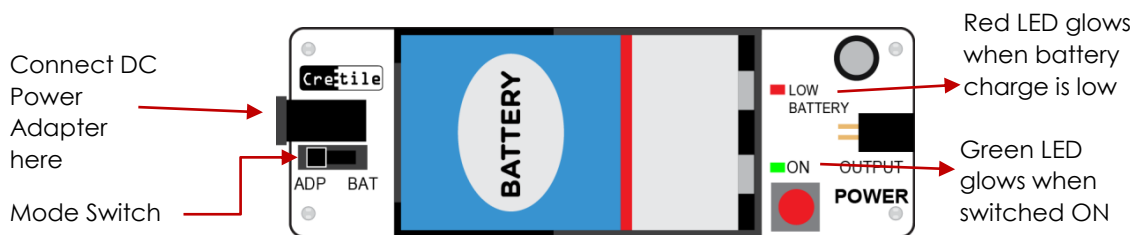


Cretile	Input	Cretile Action	Output
Battery	-	Provide power from 9v batteries	99
Switch	99	Depending on Switch position gives output	99
Dimmer	99	Dimmer gets enabled with 99 input. Depending on knob position it provides output.	40
Light	40	Depending on input received glow the Light.	Light glows at 40% brightness

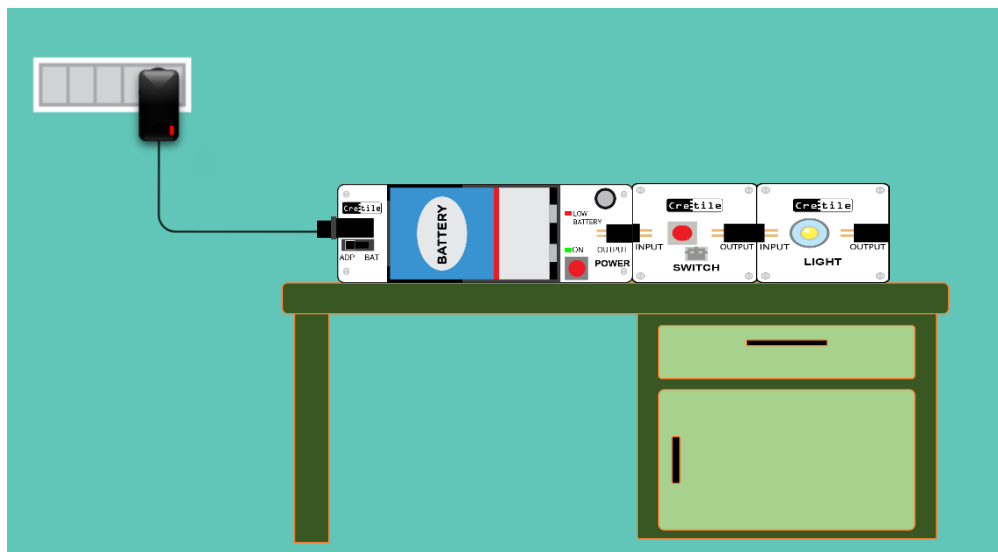
## 4. Pioneer Cretile Modules & Their Function

### BATTERY/POWER

Cretile Battery/Power supplies power to other Cretiles connected to it. It takes power from either a battery or from a DC adapter. You need to connect one 9V battery in the battery socket provided. Alternatively connect the 9V/2A adapter provided at the power jack. Preferably use rechargeable 9V batteries as they would not last long. If you connect a non-rechargeable battery, ensure that you avoid using any motors or water pump in the project as they would drain out the battery very quickly.

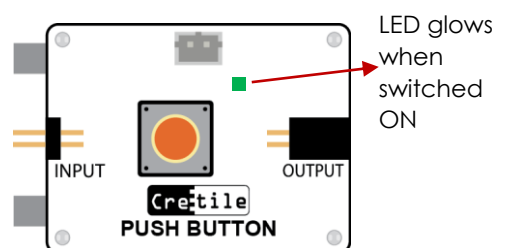


The mode switch decides if power is taken from battery or adapter. A DC adapter can be connected to Battery/Power as shown below.



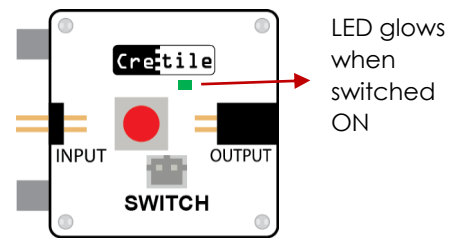
### PUSH BUTTON

Cretile Push-button is similar to switch used in door bell. It has one input and one output. It is by default OFF. Cretile Push Button remains ON for the duration the push button is pressed. Once the push button is released, it switches OFF.



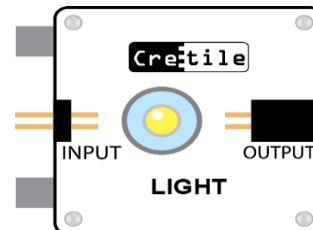
## SWITCH

Cretile Switch allows you to control Cretiles connected to it. It has one input and one output. The Cretiles connected on the output can be switched ON or OFF with the switch provided on this block.



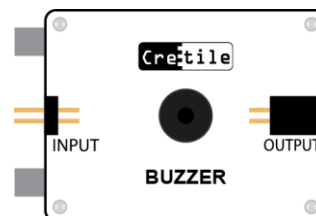
## LIGHT

Cretile Light provides light for your creations. It has one input to switch the light ON or OFF and to control light intensity.



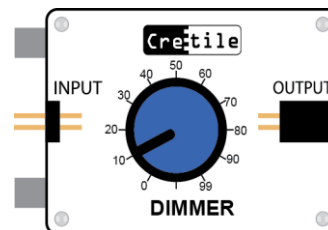
## BUZZER

Cretile Buzzer provides sound for your creations. It has one input to switch the buzzer ON or OFF.

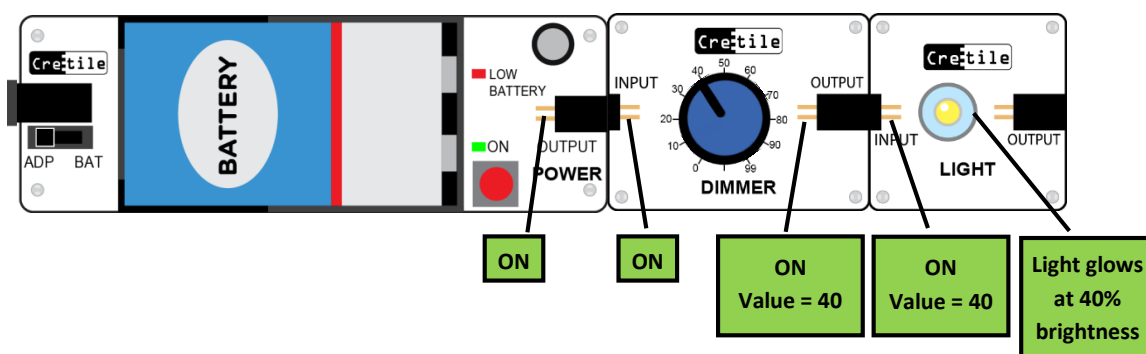


## DIMMER

Cretile Dimmer is similar to a fan speed regulator. If we connect Dimmer to a Motor, it can change the speed of Cretile Motor. Similarly, if connected to Light it can be used to change intensity of Light. Dimmer can be used in multiple other scenarios.



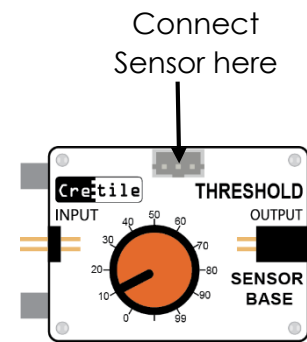
**Make & learn:** Connect Battery + Dimmer + Light in sequence & power-on the assembly. You can vary the intensity of the Light by operating the dimmer knob. Similarly, speed of Cretile Motor, sound of Cretile Buzzer etc. can also be controlled using Dimmer.



## SENSOR BASE WITH THRESHOLD

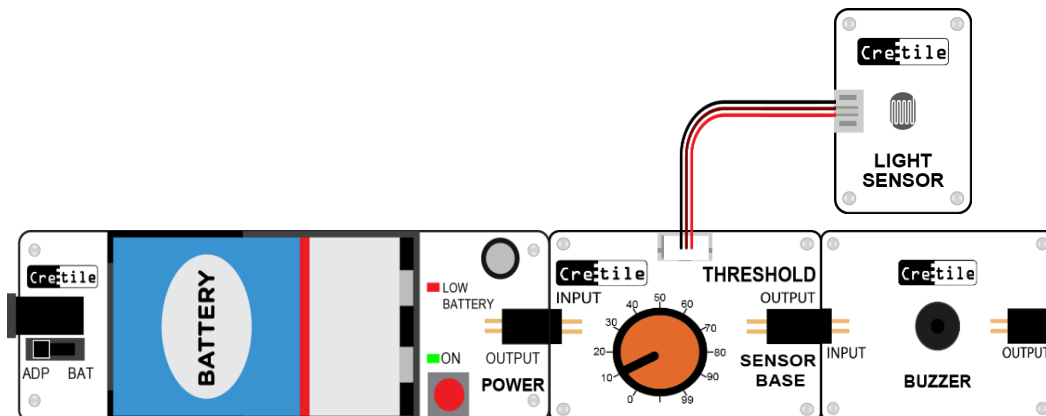
Cretile Threshold with Sensor Base is useful in projects where you want action to happen only if input is more than a certain value. If input is less than dial position value, the output remains OFF. When input is more than dial position value, output becomes ON

Cretile Sensor Base with Threshold allows you to make use of various sensors in your project. You can connect variety of sensors (one at a time) to Cretile Sensor Base. Sensors such as Light Sensor, Obstacle Sensor, Magnetic Sensor, Sound sensor and many others can be connected to Sensor Base. One such example connection is shown below



**Make & learn:** Let's build a morning alarm that will ring only when the room brightness increases beyond a certain level. Here you will use Cretile Threshold to control the level of brightness beyond which the Buzzer should switch ON

Connect Battery + Threshold with Sensor Base+ Mount light sensor on Threshold with Sensor Base+ Buzzer in sequence & power-on the assembly. Keep the Cretile Threshold module at say 20% position. Keep this assembly at a place where morning sunlight can fall on the Cretile Light Sensor. In the morning, when sunlight brightness increases beyond 20%, the buzzer will start ringing. If you increase Threshold to 30% then it will take more light for the alarm to turn ON



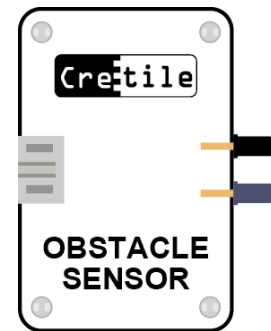
Sensor connected generates ON or OFF signal depending on its functionality e.g. a Sound Sensor generates ON output when sound is detected. Sensor Base with Threshold makes sensor signal available at its output.

## OBSTACLE SENSOR

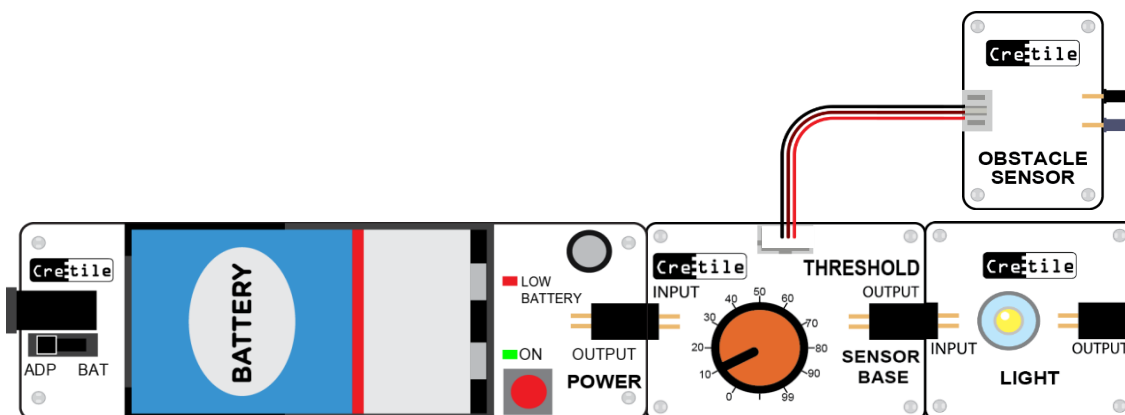
Cretile Obstacle Sensor detects presence of an obstacle in front of it. To use it, you need to connect it to the Cretile Sensor Base with Threshold.

The sensor is ON when obstacle is detected. It switches ON when an object is close enough in front of it. Sensor can detect objects that are within few millimeters to few centimeters away from it.

Obstacle that you want to detect in your project could be near or far. Note that Obstacle sensor does not detect black surfaces/obstacles. It may detect black surfaces only if brought very close to sensor.

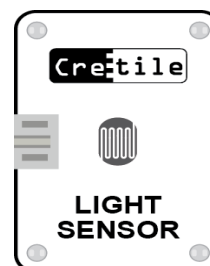


**Make & learn:** Connect Battery + Sensor Base with Threshold (with Obstacle Sensor mounted on it) + Light in sequence & power-on the assembly. Switch ON Battery. You will observe that the light will ON only when there is an obstacle in front of the obstacle sensor.



## LIGHT SENSOR

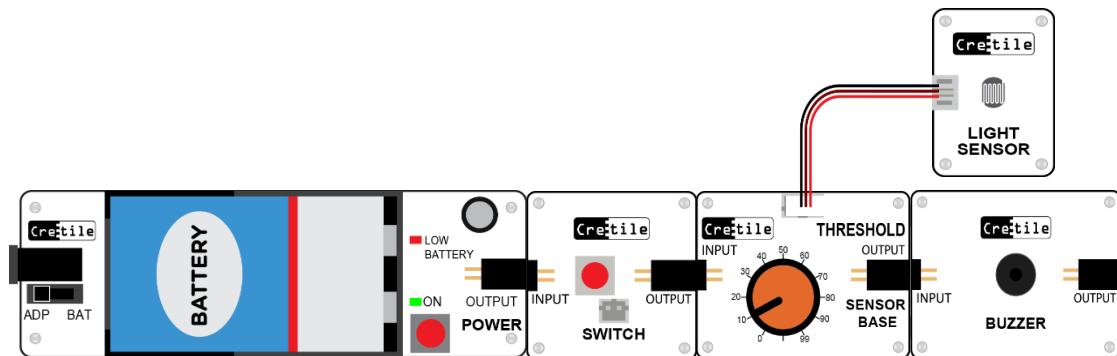
Cretile Light Sensor generates output based on brightness of light shining on it. To use it, you need to connect it to the Cretile Sensor Base with Threshold.



**Make & learn:** Connect Battery + Switch + Sensor Base with Threshold (with Light Sensor mounted on it) + Buzzer in sequence & power-on the assembly. Switch ON Battery and put the Switch in ON position. Use a flash-light/torch and focus light on Light Sensor.

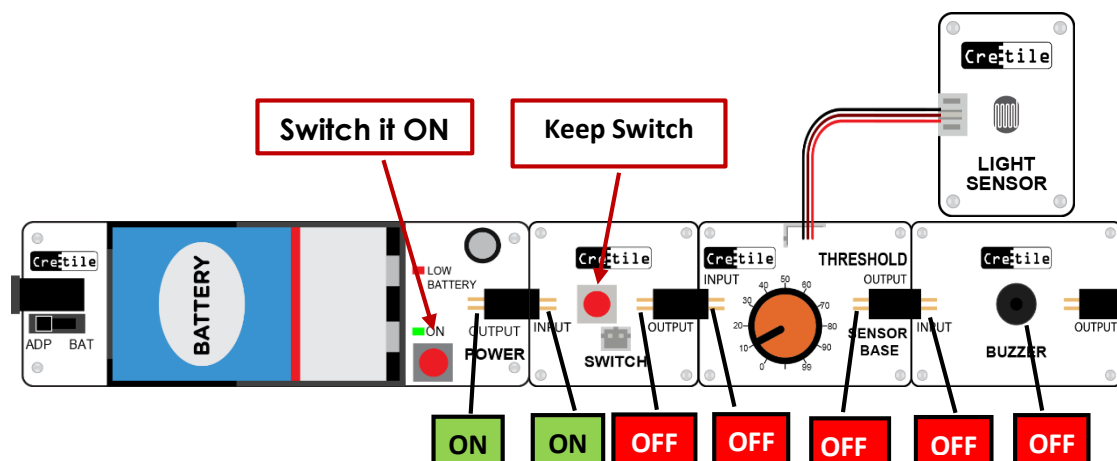


You will observe that the Buzzer will sound loudly with more light and softly with less light shining on the Cretile Light Sensor.



Now put Switch in OFF position. The output of Switch changes to OFF which disables the Sensor Base with Light Sensor. Thus Light Sensor does not respond to any changes in light shining on it. The output of Light Sensor thus remains OFF. Buzzer receives OFF input and hence does not ring.

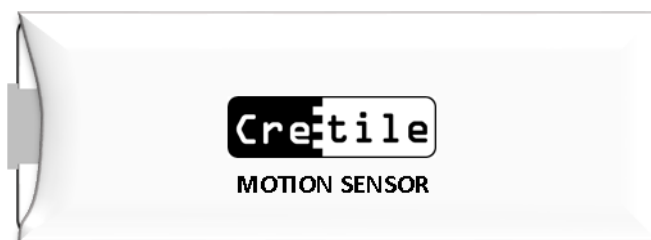
Below diagram shows different input and output states of Cretiles if Switch is in OFF position.



## MOTION SENSOR

Motion Sensor is a sensor that detects the motion around. You must have heard about a Burglar alarm. This alarm detects an intruder and start ringing loudly. This kind of devices use a sensor called Motion Sensor.

Below image shows Motion Sensor. It needs to be used with Sensor Base. It generates ON output when Motion around it is detected. Otherwise it generates OFF output.



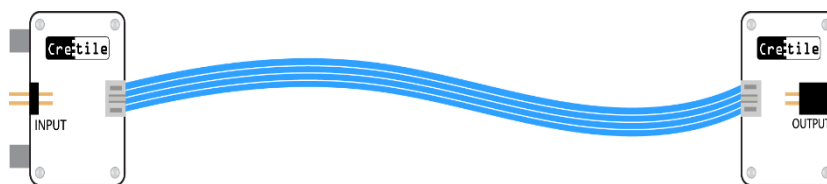
This sensor keeps emitting signals called microwave signal. The sensor can detect when these microwave signals are obstructed by any movement around it. So, we can use this sensor in our projects to detect person, animal or object movement etc. e.g. You can use this sensor if we want to switch ON Buzzer/light when car arrives near parking lot.

Note that in the beginning this sensor needs about 30 seconds to start functioning. After 30 seconds, it will detect motions around it. So, when you start the project that involves Motion Sensor, do not expect correct results for the first 30 seconds.

This sensor can work even if it is covered or kept inside a wooden drawer or inside a metal box. This makes it easy to use in different projects. The sensor however cannot detect motion beyond brick walls. It works both in dark as well as in light. Note that this sensor can only detect motion of objects that are 5 centimeters or more away from the sensor. So, if the object moving is too close to the sensor, it will not detect it.

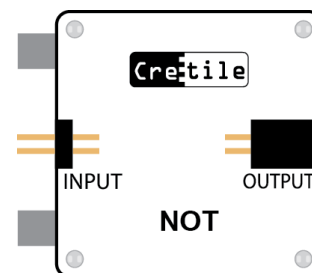
## WIRE

Cretile Wire is used when you need to connect two Cretiles kept at a distance. Wire gives you flexibility to keep the Cretile blocks in different location as per your project requirement.

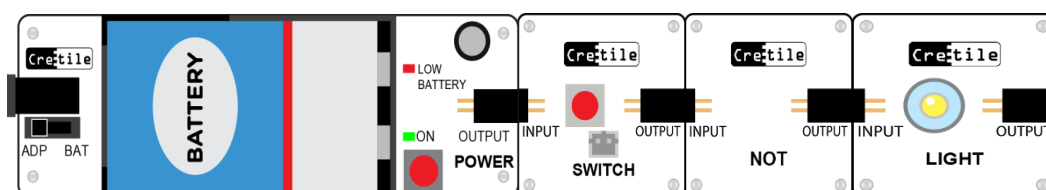


## NOT GATE

Cretile NOT performs inverting operation. It has one input and one output. If input is ON, its output switches OFF. Likewise, when input is OFF, its output switches ON.

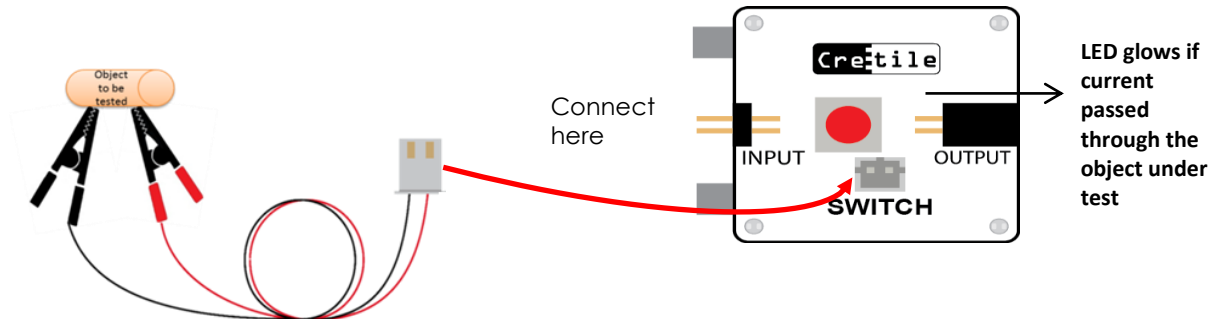


**Make & learn:** Connect Battery + Switch + NOT + Light in sequence & power-on the assembly. When you operate Cretile Switch to ON position the Light switches OFF. Similarly, when you operate Cretile Switch to OFF position the Light switches ON

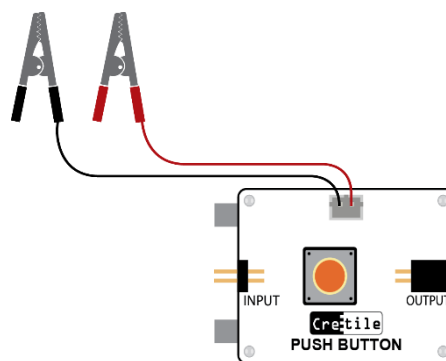


## CONNECTIVITY

You can use Cretile Connectivity to test electrical conductivity of an object. Connect the Cretile Connectivity to Cretile Switch as below. Now connect pins on two sides of the object to be tested. If the object is good conductor of electricity, then Cretile Switch switches ON.

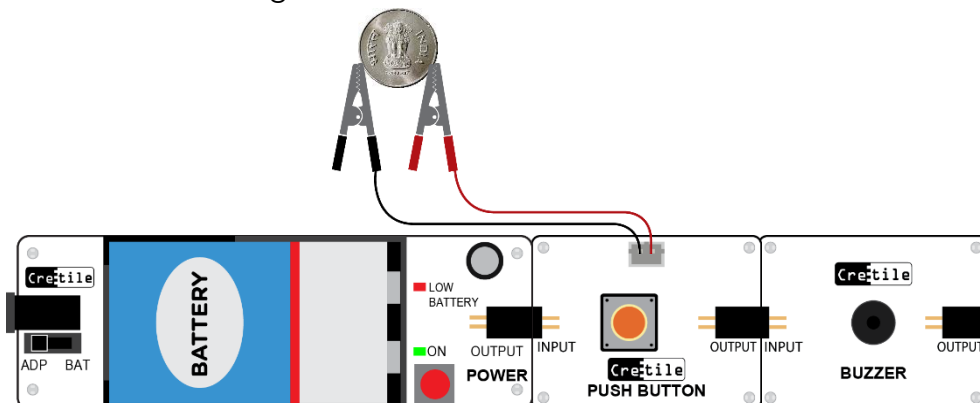


You can connect Limit Switch to Push Button as well instead of Switch.



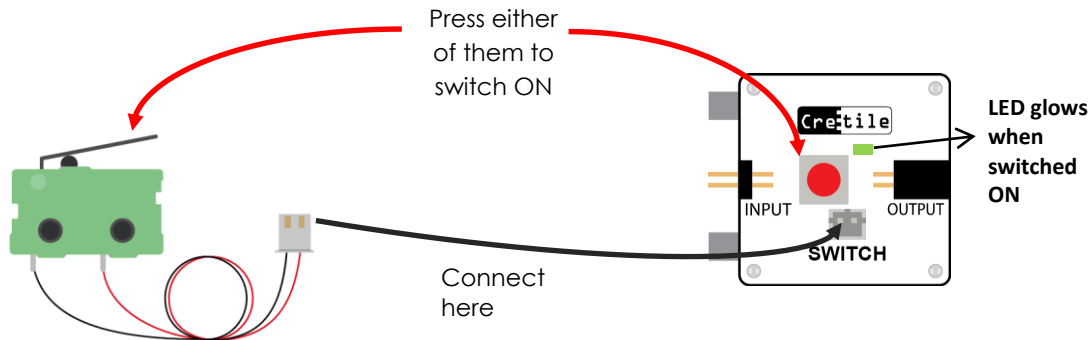
**Make & learn:** Connect Battery + Push Button with Connectivity Sensor + Buzzer in sequence & power-on the assembly. Connect the sensor pins to two sides of an iron metal piece e.g. a coin. As metal is a good conductor of electricity, sensor generates ON at the output of Push Button and hence the Buzzer starts to ring.

Now disconnect the sensor pins from coin and connect those to a plastic piece. As plastic is bad conductor of electricity, sensor generates OFF at the output of Push Button and hence Buzzer starts to ring.

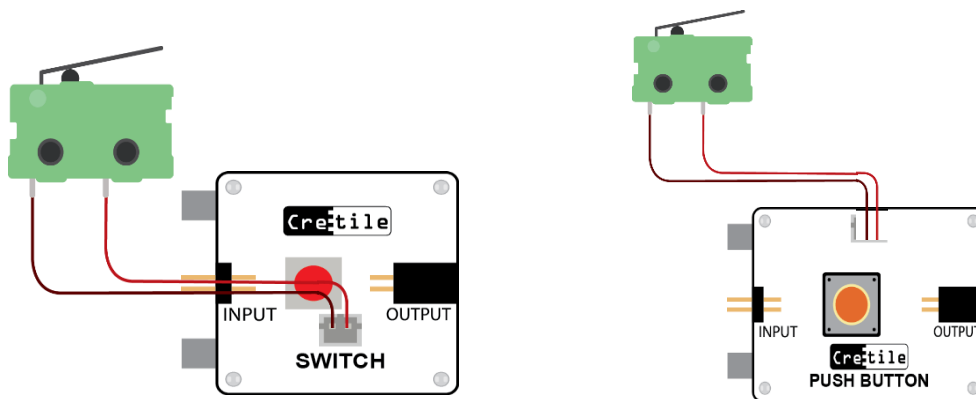


## LIMIT SWITCH

Cretile Switch or Push Button can be extended to operate using a Limit Switch as shown below. This way Cretiles connected to Switch can now be switched ON or OFF either by operating the button on the Switch or by operating the Limit switch.

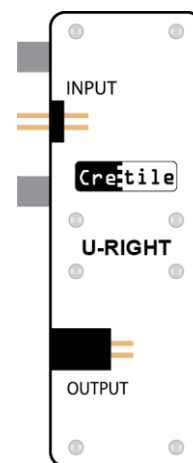


You can connect Limit Switch to Push Button also. Once connected it would look like as below.

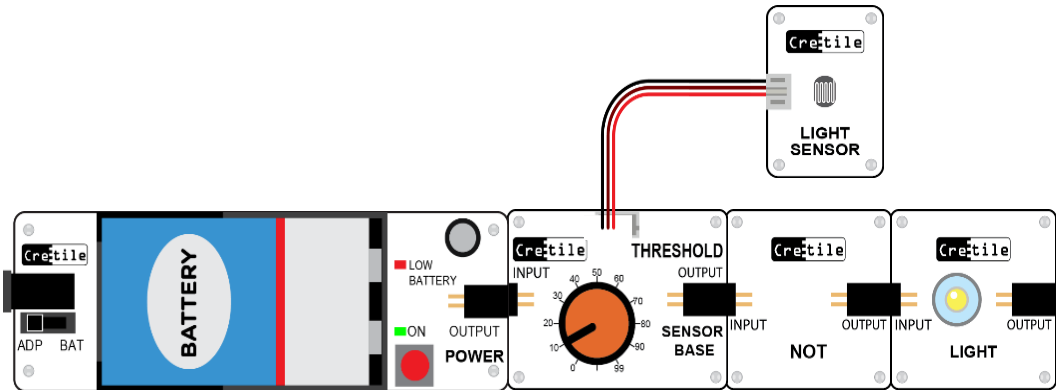


## U-RIGHT

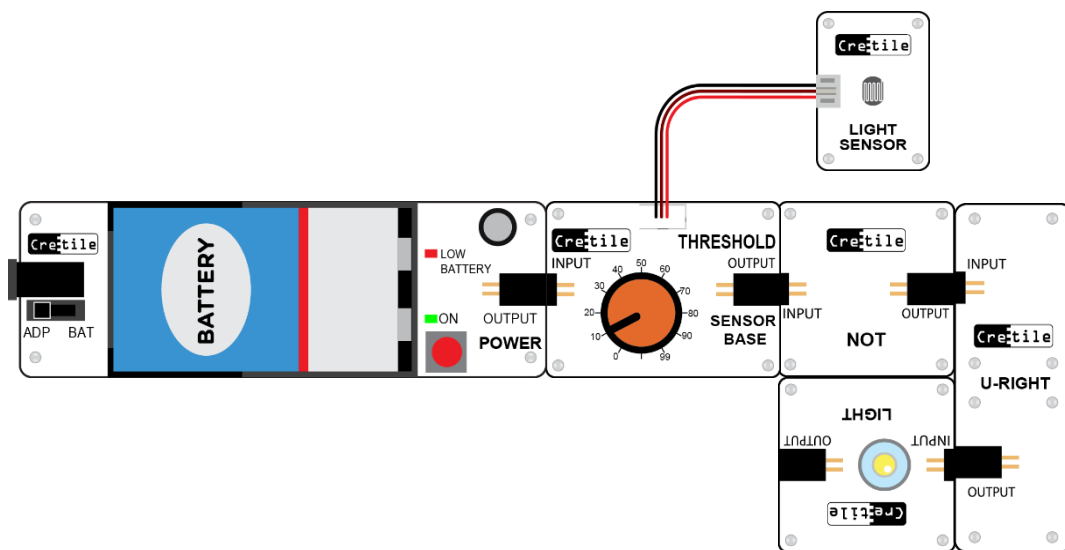
As we keep adding more components to the circuit, the circuit become elongated. This would require more space and difficult to handle. U-Right and U-Left in a circuit helps to reduce the circuit length and add row to the circuit. U-Right and U-Left will have one input and one output port.



**Make & learn:** Let's consider the below circuit, it is elongated and difficult to place in small area. In this case we can use U-Right and U-Left to add rows to the circuit.



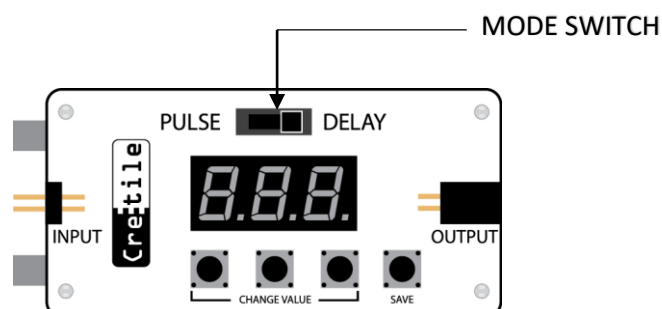
U-Right in the circuit will add a row to the bottom of the circuit and reduce the length of the circuit



## PULSE/DELAY

Cretille Pulse/Delay can perform two functions: A Time Pulse or Time Delay.

The functionality can be decided by using mode switch. It has one input and one output.

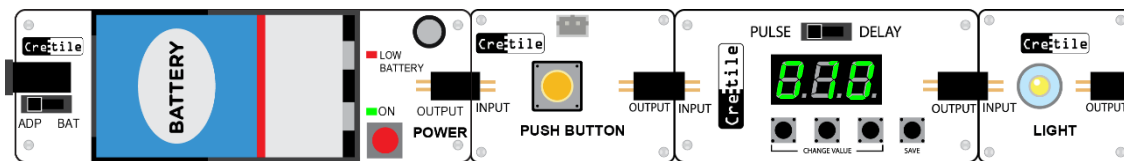


## PULSE

Cretile pulse is used in situations where you want the action to happen only for a certain amount time.

**Make & learn:** Let's make a project that keeps the Cretile Light switched ON for 10 Seconds only. Battery Module + Push Button+ Pulse/Delay + Light in sequence. Put the Cretile Pulse/Delay in Pulse mode. Set the Pulse value to 10 seconds with 'CHANGE VALUE' buttons. Use 'SAVE' switch to store the Pulse value for future use. Now operate Cretile Push Button once. You will observe that the Cretile Pulse starts counting down from 10 to zero. During this period the Cretile Light remains ON. Once the countdown reaches zero, the Cretile Light goes OFF.

Even though the Push Button is switched ON only for a moment, the switching ON action is stretched to the 10 seconds, as if you had pressed the push button for 10 seconds.

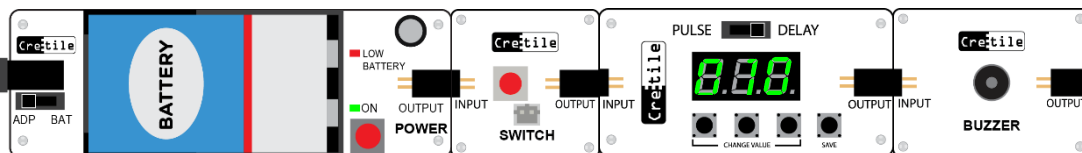


## DELAY

Cretile Delay is used in situations where you want the action to happen after a certain amount of time.

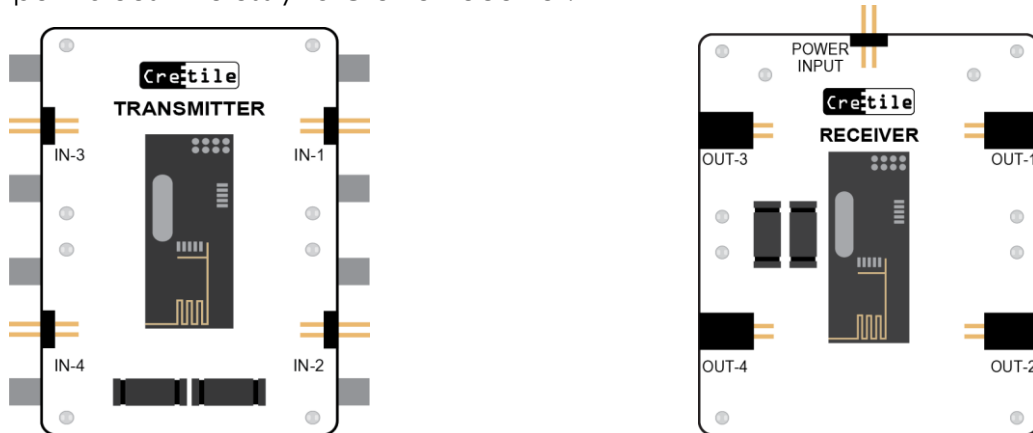
**Make & learn:** Let's make a -down alarm. Use Battery + ON/OFF Switch + Pulse/Delay + Buzzer in sequence. Initially keep the Cretile Switch in OFF position. Set the Cretile Pulse/Delay to delay mode. Set the Delay value to 10 seconds with 'CHANGE VALUE' buttons. Use 'SAVE' switch to store the Delay value for future use. Now operate Switch to ON position. You will observe that the Cretile Delay starts counting down from 10 to zero. During this 10 second period the Cretile Buzzer remains OFF. Once the countdown reaches to zero, the Buzzer starts to ring.

You have delayed the action of switching ON the Buzzer by 10 seconds after operating the switch.



# TRANSMITTER & RECEIVER

Cretile Transmitter and Cretile Receiver talk to each other wirelessly. It gives your projects ability to remotely control and take action. Cretile Transmitter has four inputs. It sends these four input values wirelessly to Cretile Receiver.

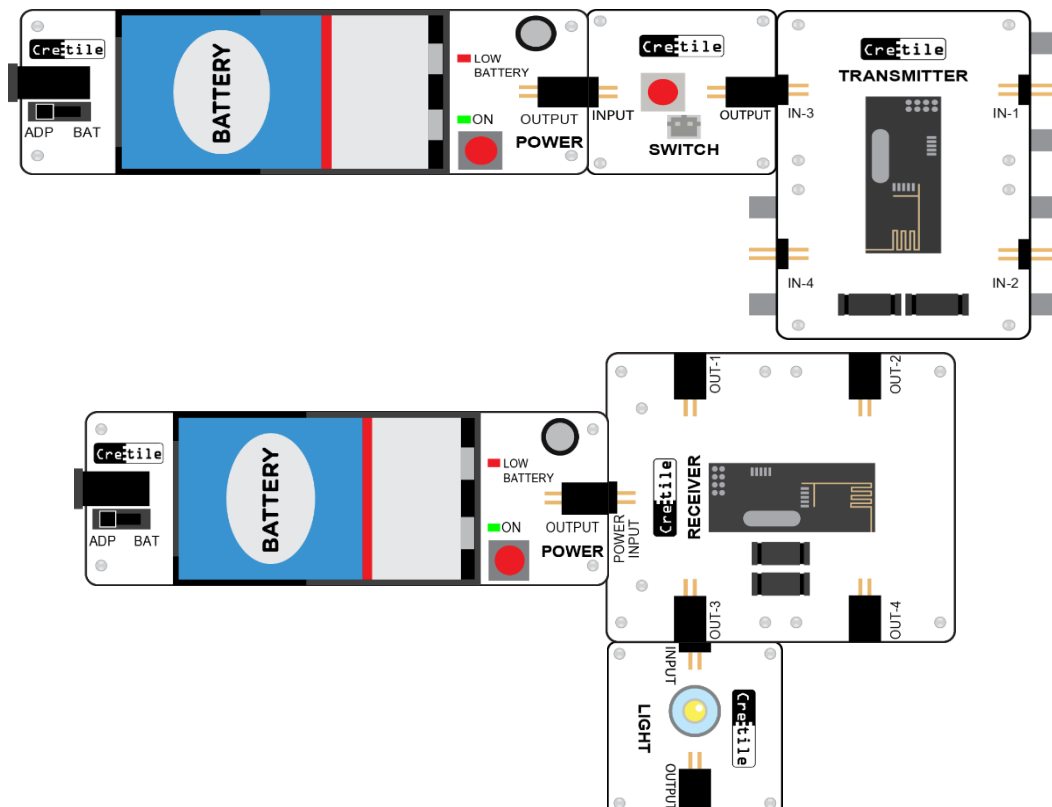


Cretile Receiver is always listening to messages from Cretile Transmitter. Four outputs of Receiver reflect what is received by it.

Cretile Receiver and Transmitter need separate power supply. You can use either Cretile Power or Cretile Battery for supplying power to Cretile projects.

**Make & learn:** Connect Cretile Switch to one of its inputs of Cretile Transmitter, say Input-3 (IN-3). Connect Cretile Light to corresponding output of Receiver, in this case Output-3 (OUT-3). Now operate the switch on the Cretile Switch to ON position. It will switch ON the Cretile Light connected at Receiver.

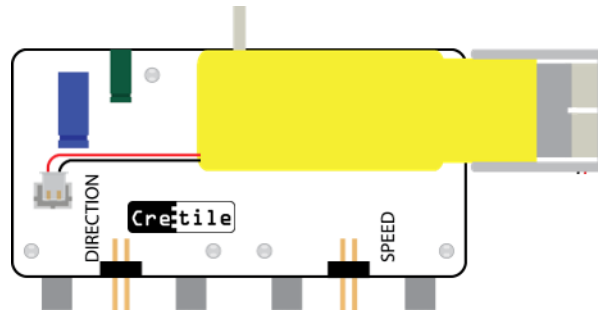
You can connect any or all the four inputs at Transmitter to control corresponding four outputs connected at Receiver.



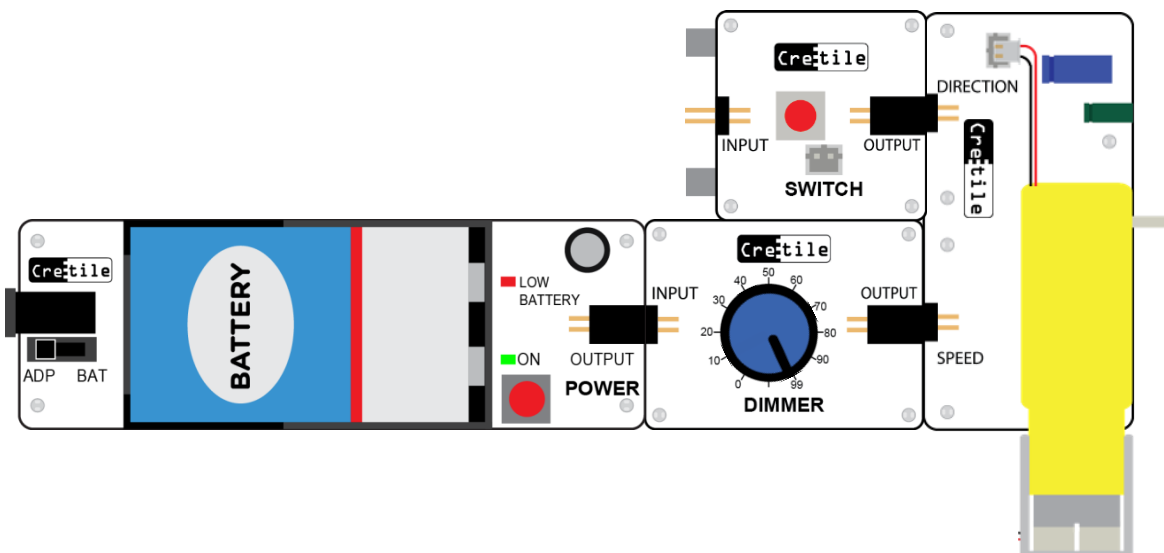
# MOTOR

Cretile Motor provides motion to your creations. The Cretile Motor comes with a wheel and a pulley. Motor has two inputs: one to control speed of motor & other to control direction of motor.

Prefer using Cretile Rechargeable battery or Cretile DC Adapter instead of Cretile Battery while using Motor as it consumes more energy and could drain out batteries quickly.



**Make & learn:** Connect Battery/Power + Dimmer at 'Speed' input. Connect Cretile Switch at 'Direction' input and power-on the assembly. With Dimmer you will be able to change Motor speed & with Switch you will be able to change Motor direction.



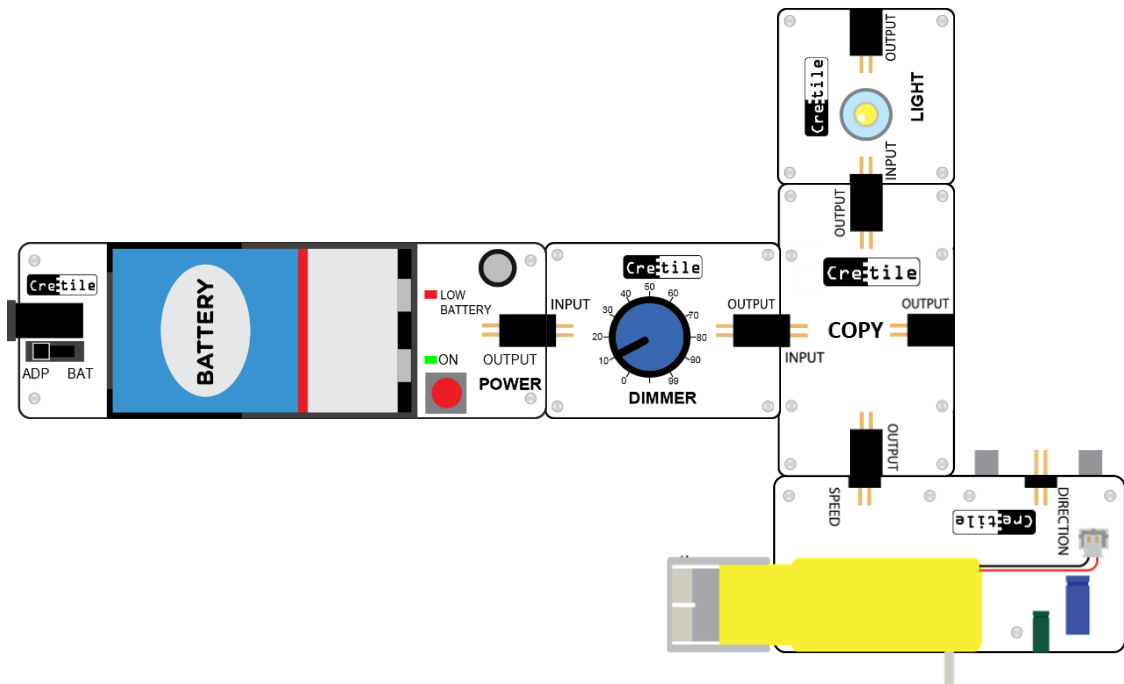
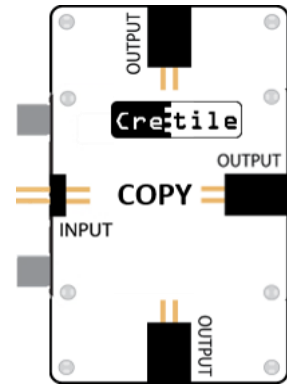
Cretile Motor also allows you to use other types of motors in your project. You can connect motors such as High Speed Motor, Submersible Pump Motor and Vibration Motor can be connected to Motor Module. We shall learn about this in the later sections.



## COPY

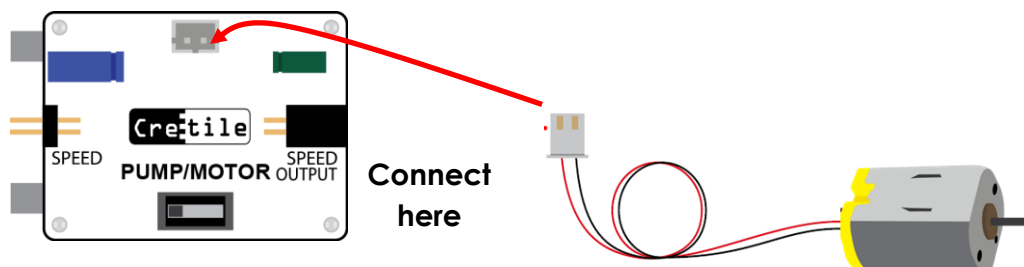
Cretile Copy is useful when you want to control two or more Cretiles with only one input. Input of COPY gets replicated at its three outputs.

**Make & learn:** Let's say you need to change both light intensity and motor speed with one dimmer. Connect Power + Dimmer + Copy in sequence. Connect Motor speed at one of the outputs of Copy. Connect Light at other output of Copy. Now, power on the assembly. As you operate the dimmer, light intensity and motor speed changes simultaneously

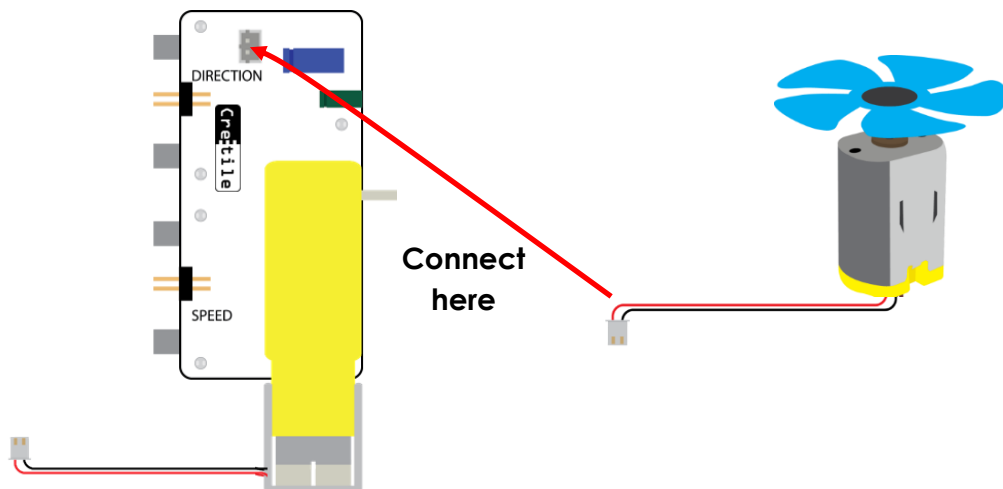


## HIGH-SPEED MOTOR

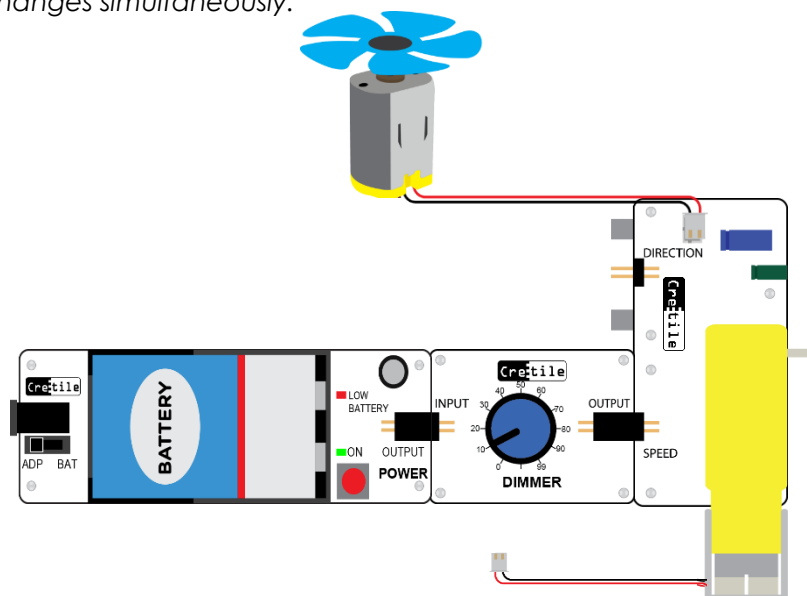
Cretile High-Speed rotates at high-speed as compared to Cretile Motor. You need to connect high-speed motor to Motor module as shown below. The kit comes with accessories such as fan etc. that can be mounted on the motor shaft.



Alternatively, you can drive the Cretile High Speed Motor using Cretile Motor module as well.

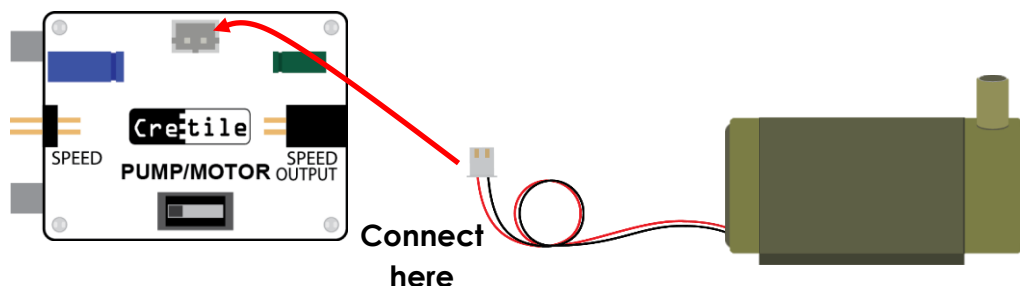


**Make & learn:** Let's say you need to control High Speed motor speed using dimmer. Connect Battery + Dimmer + Motor mounted with High Speed Motor in sequencer. Connect Motor Module speed port at outputs of Dimmer. Now power ON the assembly. As you operate the dimmer, High Speed motor speed changes simultaneously.

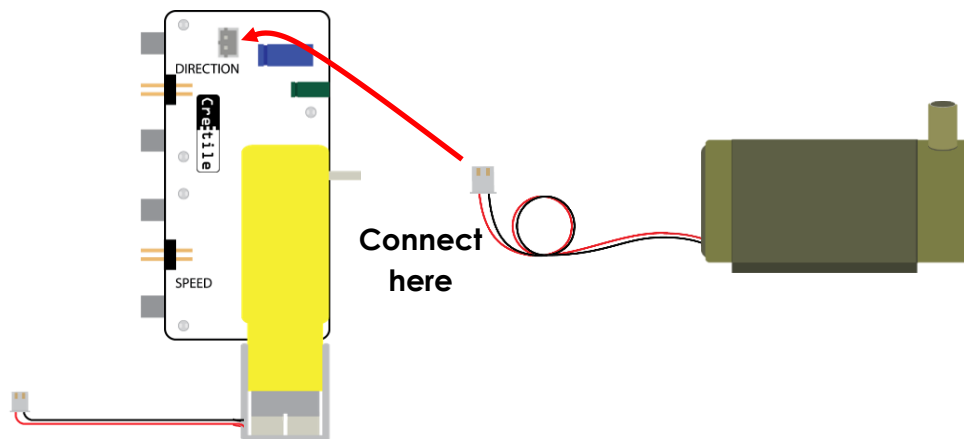


## SUBMERSIBLE WATER PUMP

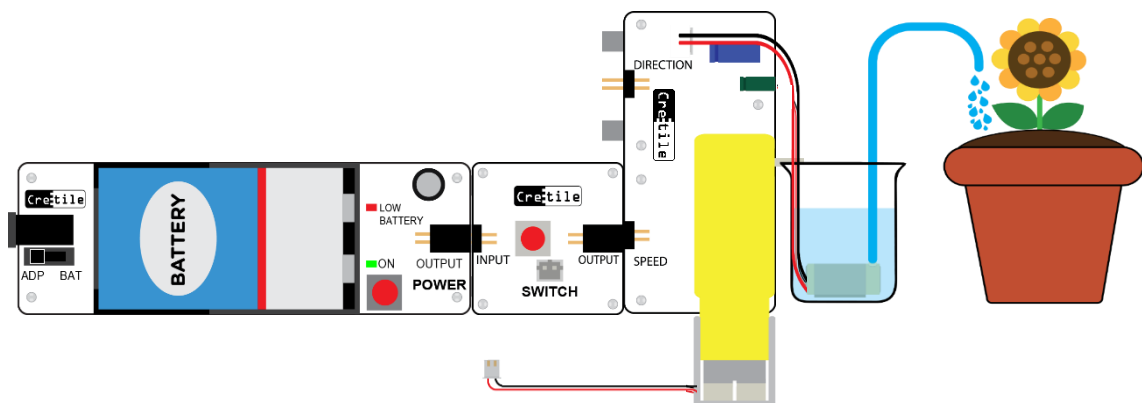
Submersible mini water pump can be used for pumping water. The pump has to be immersed completely inside water. This pump has to be used with Motor module as shown below.



Alternatively, you can drive the Cretile Pump using Cretile Motor module as well

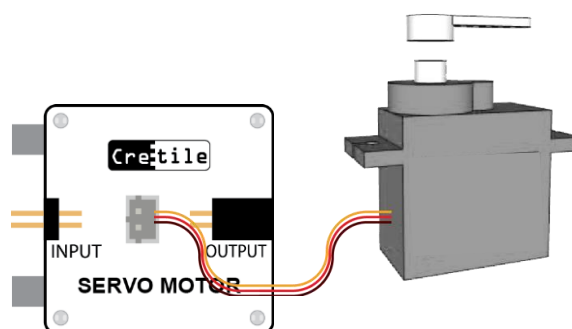


Now immerse the pump completely inside water as shown below to use it.

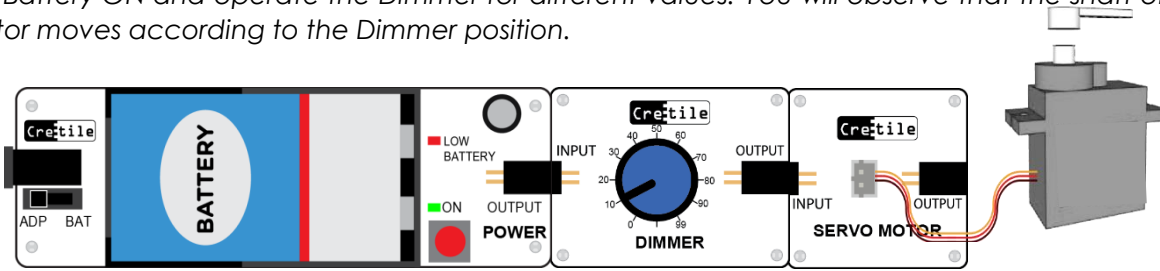


## SERVO MOTOR

Cretille Servo Motor can be used in projects where you need to control position of motor shaft e.g. in project where you need to wave flag or move motor shaft to a specific location and stop. You can mount the object to be moved on shaft of the servo motor and control the motor movement as required.



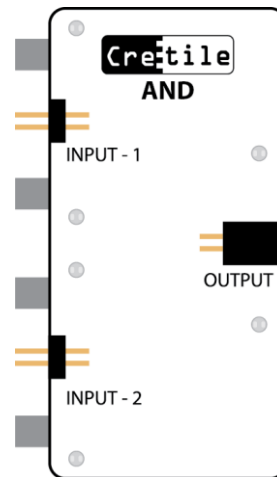
**Make & learn:** Connect Cretile Battery + Dimmer + Servo Motor in sequence as shown below. Switch the Battery ON and operate the Dimmer for different values. You will observe that the shaft of the motor moves according to the Dimmer position.



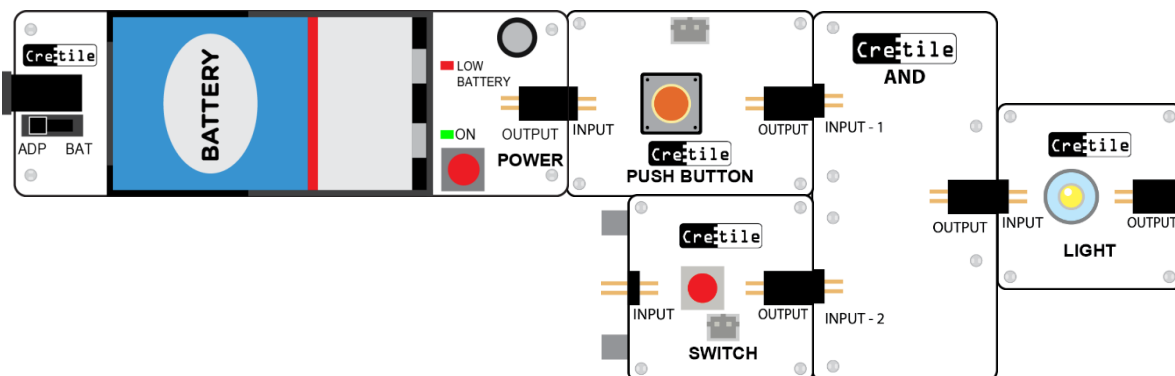
## CRETILE 'AND'

Cretille AND provides functions of AND Logic Gates. Cretille AND has two inputs and one output. Below table explains how AND Logic Gate function depending on inputs provided to it.

AND		
IN1	IN2	OUT
ON	ON	ON
ON	OFF	OFF
OFF	ON	OFF
OFF	OFF	OFF



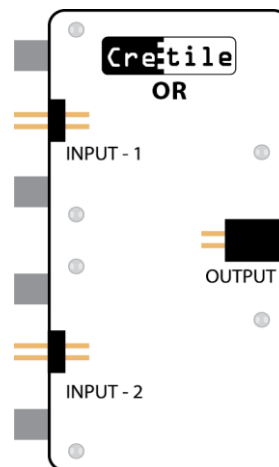
**Make & learn:** Connect Battery + Push Button at Input1 of Cretille AND. Connect Switch at Input2 of Cretille AND. Connect Light at the output of Cretille AND as shown below. You will observe that the Light glows only when both the Push Button and Switch are ON. If any one of them are OFF, the Light will remain OFF.



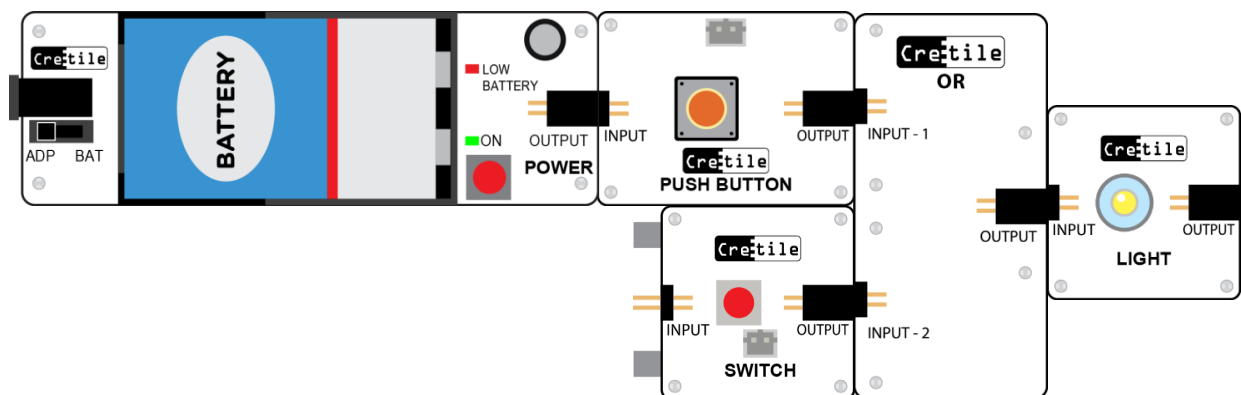
## CRETILE 'OR'

Cretile OR provides functions of OR Logic Gates. Cretile OR has two inputs and one output. Below table explains how OR Logic Gate function depending on inputs provided to it.

OR		
IN1	IN2	OUT
ON	ON	ON
ON	OFF	ON
OFF	ON	ON
OFF	OFF	OFF



**Make & learn:** Connect Battery + Push Button at Input1 of Cretile OR. Connect Switch at Input2 of Cretile OR. Connect Light to output of Cretile OR as shown below. You will observe that the Light will be switched ON if any of the Push Button or Switch is switched ON. The Light will be ON even if both Push Button and Switch are switched ON. The Light will go OFF only when both Push Button and Switch are OFF.



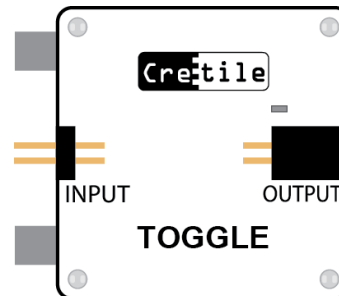
## CRETILE 'TOGGLE'

Toggle is not a Logic gate. Toggle reverses the currently present output. So, upon switching ON input, if the present output is ON, it goes to OFF state. Similarly, upon switching ON input, if the present output is OFF, it goes to ON state.

A real life example is TV power that toggles when remote input is given. On pressing the power button on the remote the TV switches ON if it is currently OFF. Otherwise, it switches OFF if already ON.

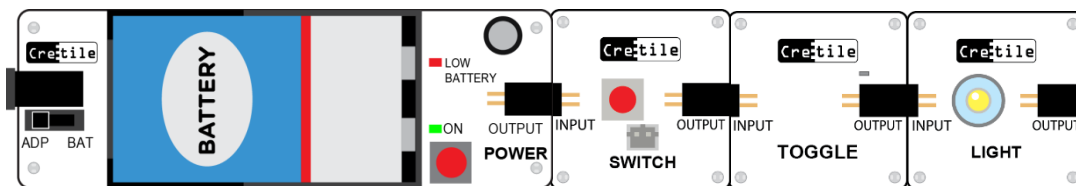
Below table shows how Toggle input will change the output

TOGGLE	
INPUT	OUT
First ON	ON
Second ON	OFF
Third ON	ON
Forth ON	OFF
And so on....	
OFF	Retains previous output



**Make & learn:** Connect Cretile Push Button to Input and Cretile Light to Output of TOGGLE Module.

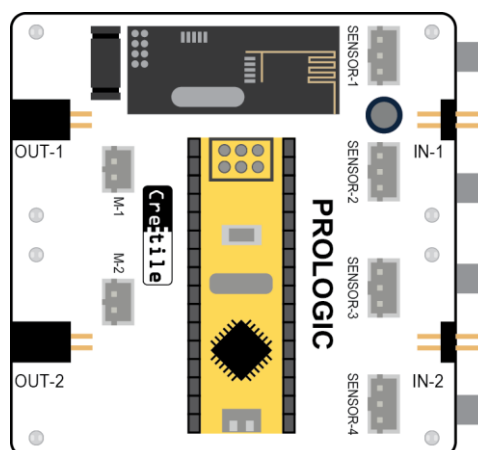
Once you press the Push Button at Input the Light will switch ON. If you press the Push Button again, the output will switch OFF. So, output toggles between ON and OFF every time Push Button is pressed at the input.



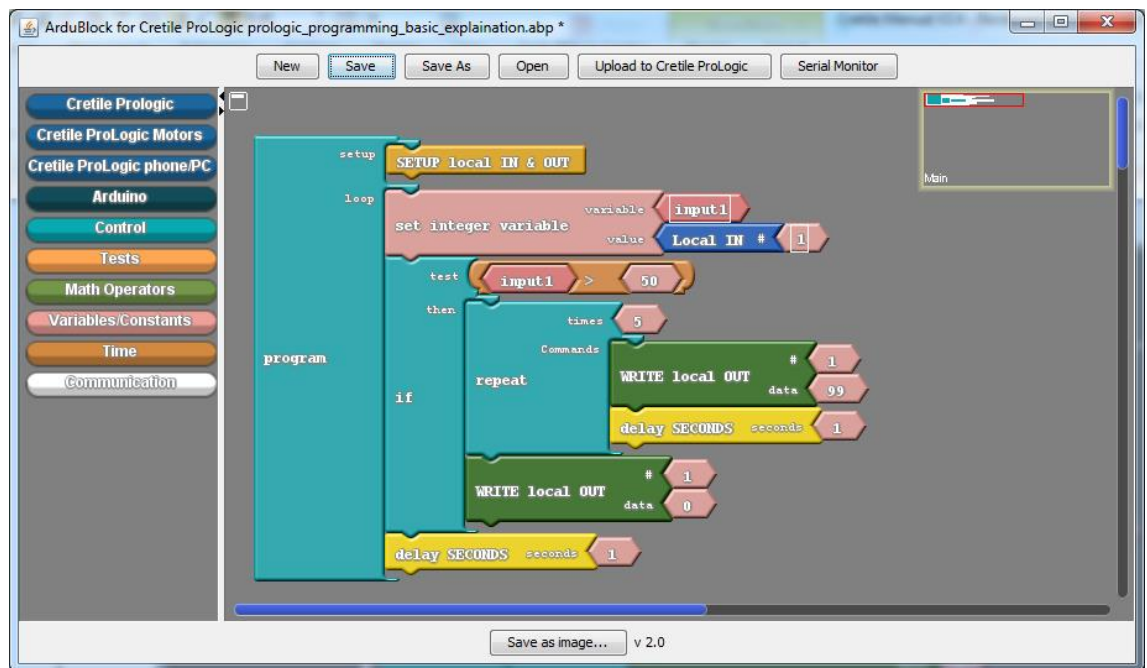
## PROLOGIC

Cretille ProLogic is a programmable module. It can be programmed using ArduBlock\* or by writing C/C++ code.

ArduBlock provides a simple drag and drop Graphical User Interface (GUI) to build a program Logic.



The ArduBlock environment looks like below



To download the Cretile Software use/click below link. Unzip the folder to extract executable file.

<http://bit.ly/cretile-sw-v2>





## 5.Project Ideas!

---

# Project 1: Open Door Alarm

---

## OBJECTIVE:

We will create an alarm which will ring if the door is left open

## LET'S EXPLORE:

Sometimes we forget to close house door and it can result in many unwanted situations like insects/mosquitoes coming inside. It can also be a security problem as burglars can get access to the house easily. The function of the door alarm is to alert us when the door is left open.

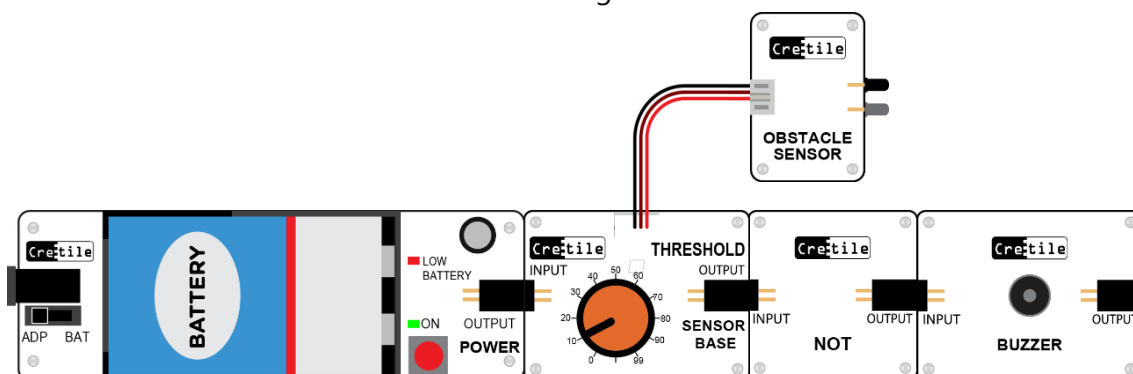
There are multiple ways to detect if the door is open and ring an alarm. In this activity we will make use of an Obstacle Sensor.

Think where else you can use this open door alarm? Think of situations where a door is left open or closed is important to know. And when we say door, just don't restrict to a house door. It can be an appliance or cupboard door too.

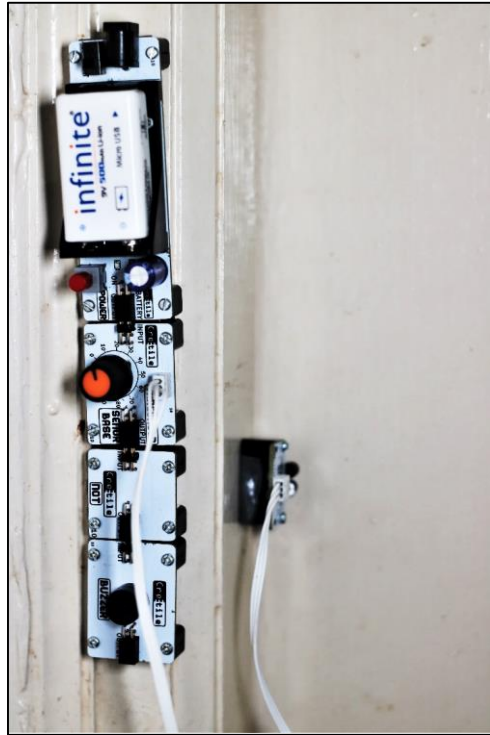
## CRETILES NEEDED:

1. Battery
2. Sensor Base
3. Obstacle Sensor
4. Not Module
5. Buzzer

Connect the Cretile blocks as shown in below diagram.



Assemble Cretile setup on door frame as shown below:

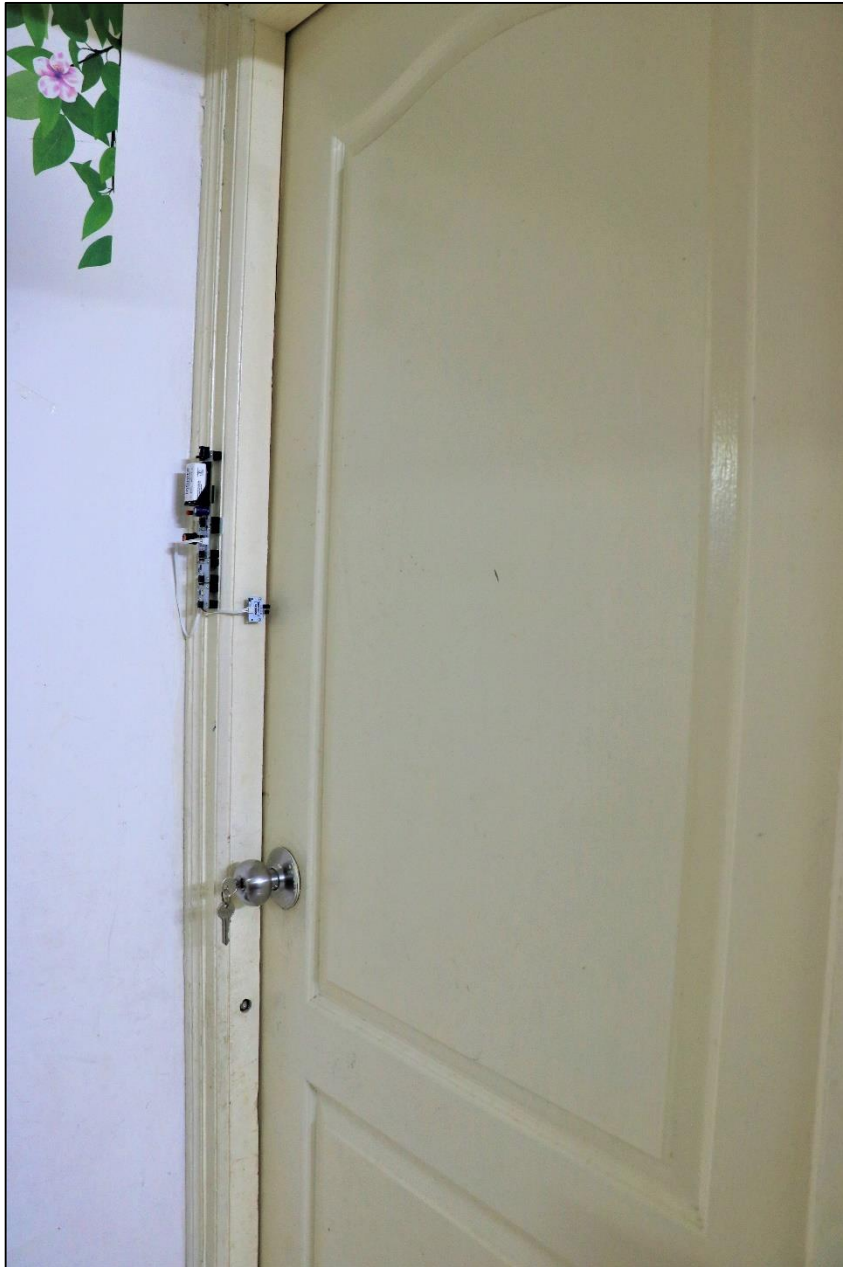


- In this setup, Battery/Power provides power to other Cretiles connected to it
- Mount the Obstacle Sensor on Sensor Base.
- When an obstacle is detected the Sensor Base gives ON output.
- In case of no obstacle is detected, Sensor Base generates OFF output.
- NOT Module is connected to the output of the sensor base. NOT module inverts the input and gives the Output.
- When Input to Not Module is ON, it gives the output as OFF and vice versa.
- Buzzer is connected to the output of the NOT Module.

So, when door is closed, Obstacle Sensor detects it and hence as discussed above sensor Base gives ON output. Then the Not Module inverts ON output to OFF. Hence the Buzzer connected to it does not ring.

When door is opened, the door (obstacle) isn't present in front of Obstacle Sensor. Hence as discussed above, Sensor Base gives OFF output. Then the Not Module inverts OFF output to ON. Hence Buzzer connected to it starts to ring.

Assemble Cretile setup on door frame as shown below:



## EXPLORE MORE:

- Make a close door alarm instead of an open door alarm
- See if you make similar alarm using any of the other sensors e.g. a Magnetic Sensor.
- Change the alarm in such a manner that the alarm will ring if the door is left open for more than 1 minutes and not immediately when opened.
- Can we ring an alarm at a different location inside the home? E.g. ring an alarm in the kitchen if the front door is left open.

# Project 2: Energy Saver Lamp

## OBJECTIVE

To build a light which will automatically switch ON when light level in the room is low and switch OFF when light level in the room is sufficiently bright.

## LET'S EXPLORE

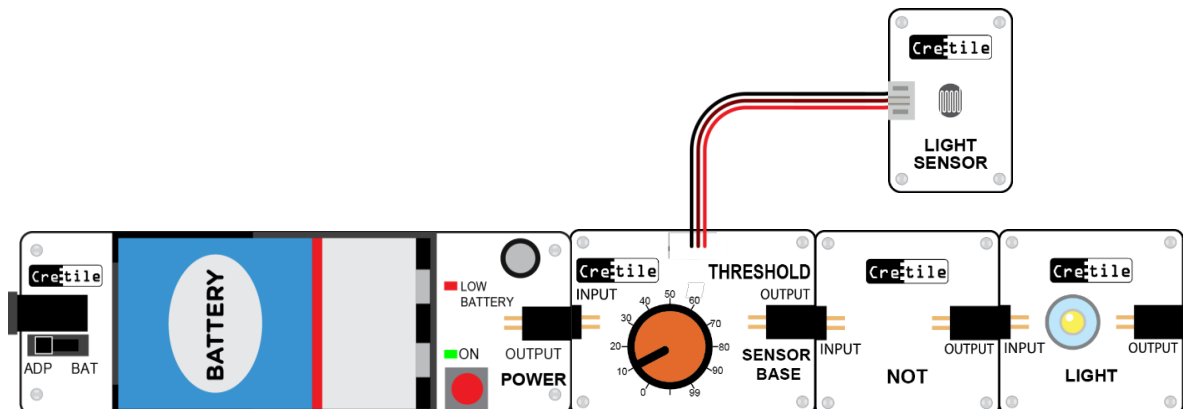
By keeping light switched ON at appropriate light levels, we can save energy that otherwise would have got wasted because of human errors.

## CRETILES NEEDED

- Battery/Power
- Sensor Base with threshold
- Light Sensor
- Light
- Not Module

## ACTIVITY

Connect the Cretiles as shown below:



Keep the Threshold at say 30% position. Whenever it gets dark, output of Light Sensor will be less than the Threshold setting. Hence the output of Threshold will be ON. Not Module converts OFF at its input to ON at its output. This will switch ON the Light.

When the light level in the room is bright enough, the output of Light Sensor becomes more than the Threshold and hence output of Threshold becomes ON. Inverter converts ON at its input to OFF at its output. This will switch OFF the Light.

## EXPLORE MORE:

An interesting variation of this project would be to use Smart Switch in the place of Light. You can connect a table-lamp to Smart Switch. This way you would be able to switch ON the table lamp instead of the Cretile Light

# Project 3: Remote Controlled Vehicle

## OBJECTIVE:

Goal of the project is to make remote controlled vehicle. Vehicle can turn left, right and move forward using a remote control.

## LET'S EXPLORE

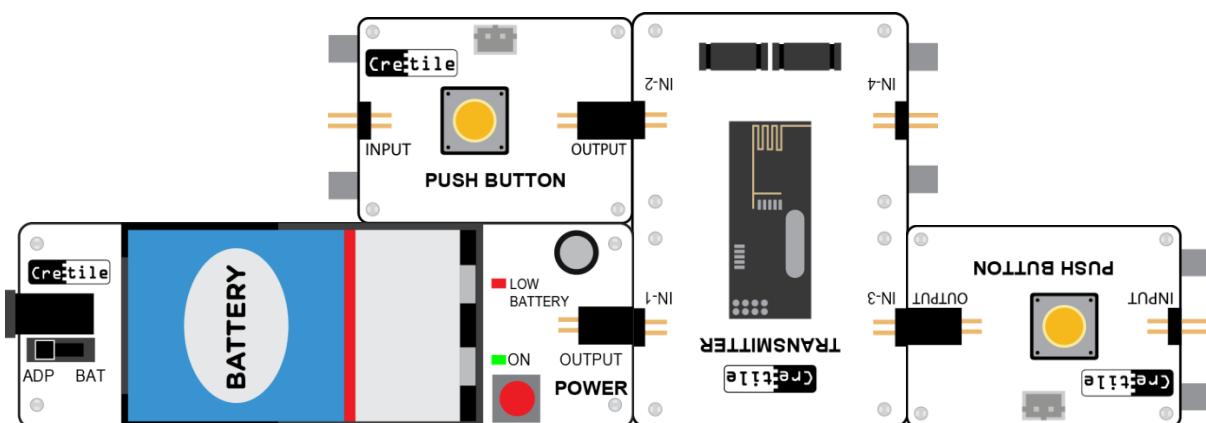
Robotics is an emerging technology area. Robotics has applications in many different areas like defense, manufacturing, agriculture, rescue etc. In some hazardous situations, robotic vehicles are sent instead of human beings. These vehicles are controlled remotely from a safe location using a control device. In this project we will make a remote controlled vehicle.

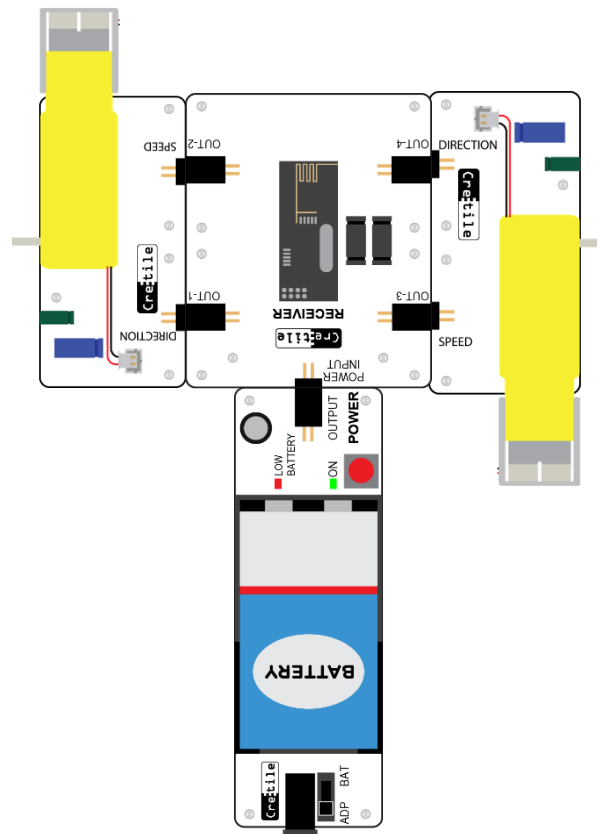
## CRETILES NEEDED

1. Battery - 2
2. Push Buttons – 2
3. Switch
4. Transmitter
5. Receiver
6. Motors – 2
7. Wheels -2

## ACTIVITY

Connect the Cretiles as shown in two diagrams below.





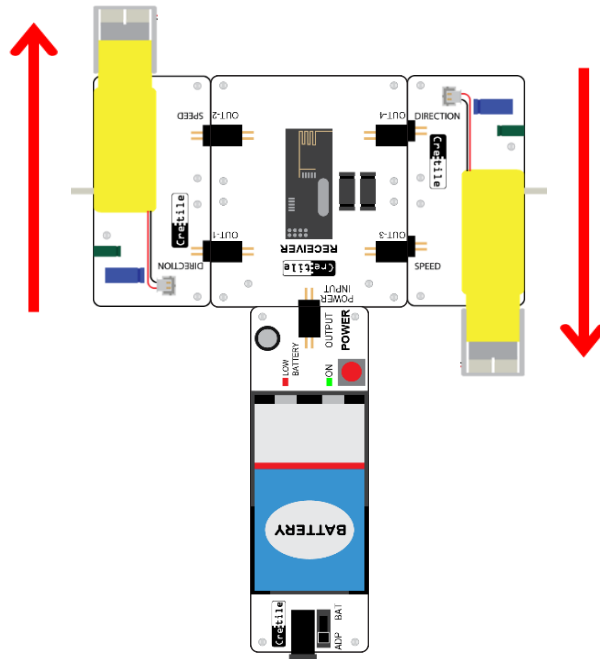
Vehicle Assembly

What controls what in this setup?

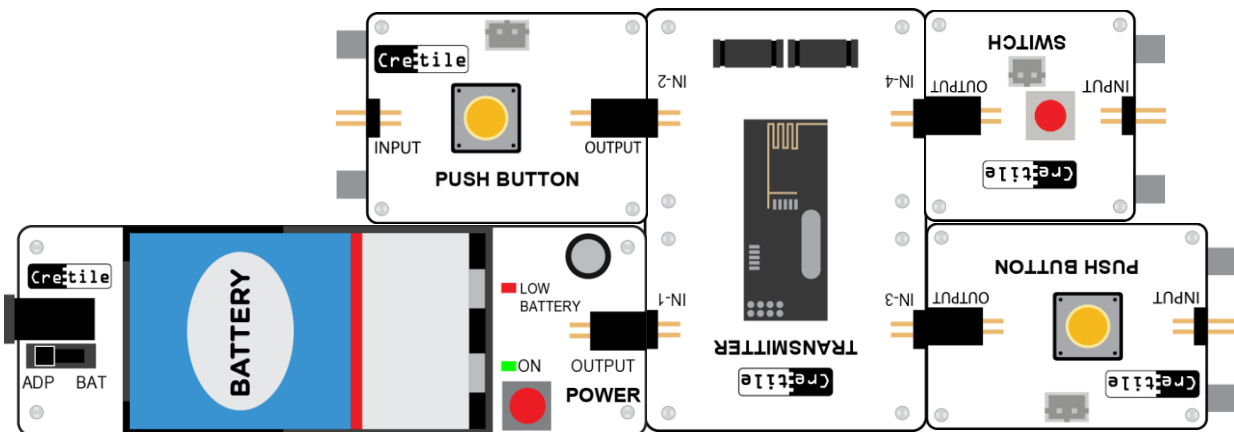
Push Button at IN-2	Controls speed of left Motor at OUT-2
Push Button at IN-3	Controls speed of right Motor at OUT-3

When you operate both the Push Buttons the vehicle will rotate at the same position.

To move the vehicle forward, we need to change the direction of Motor on the right side.

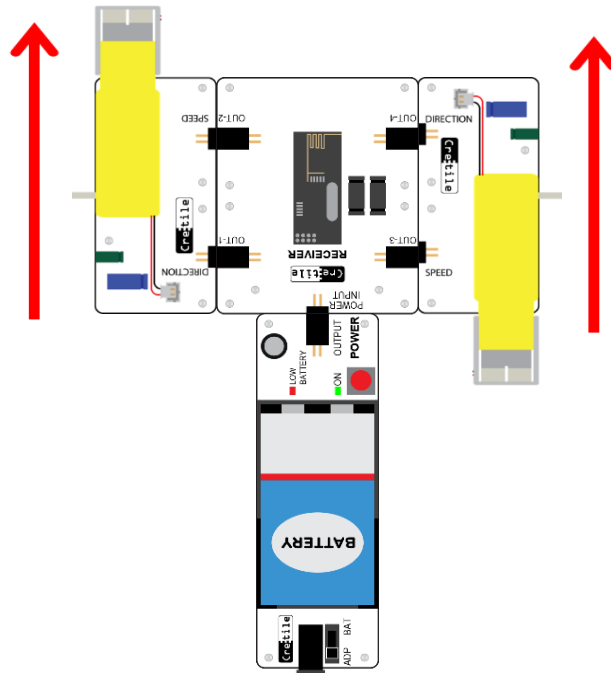


If you observe, the direction of the right side motor is controlled at OUT-4. Hence, we need to connect a control at IN-4 to change the direction of this motor. Let's connect a Switch at IN-4 of Transmitter as below:

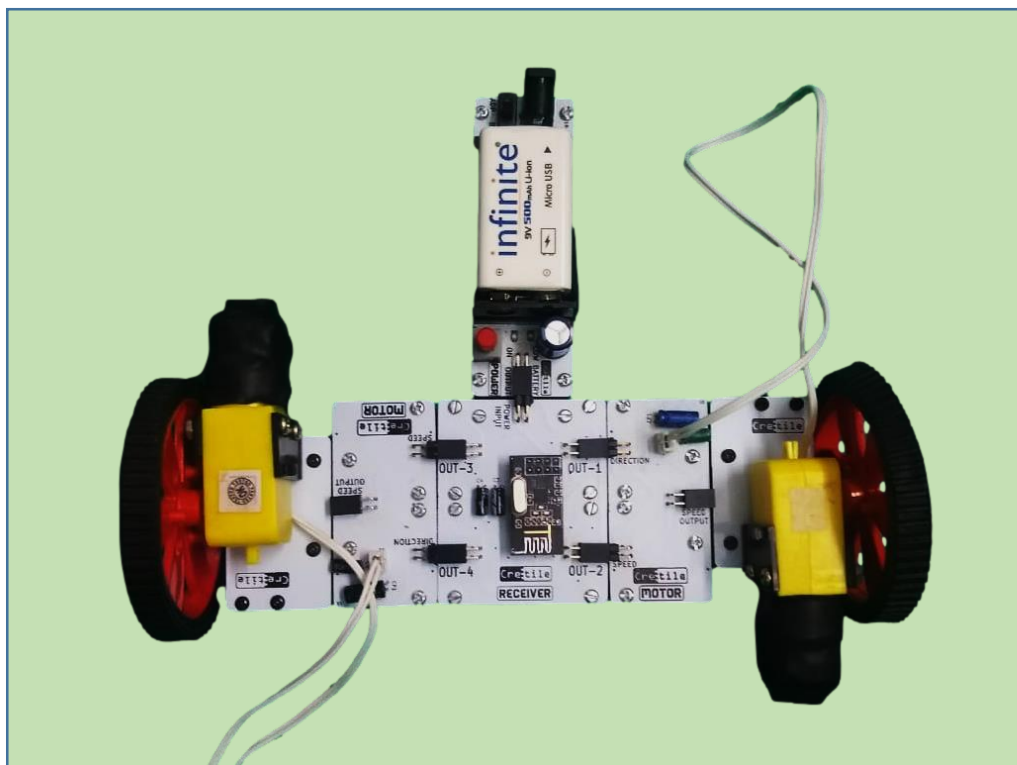


After these changes, if you press both Push Buttons, the vehicle will start to move in one direction.





The vehicle setup looks like below:



# Project 4: Intruder Alarm

## OBJECTIVE

Goal of project is to ring an alarm when any motion in room is detected.

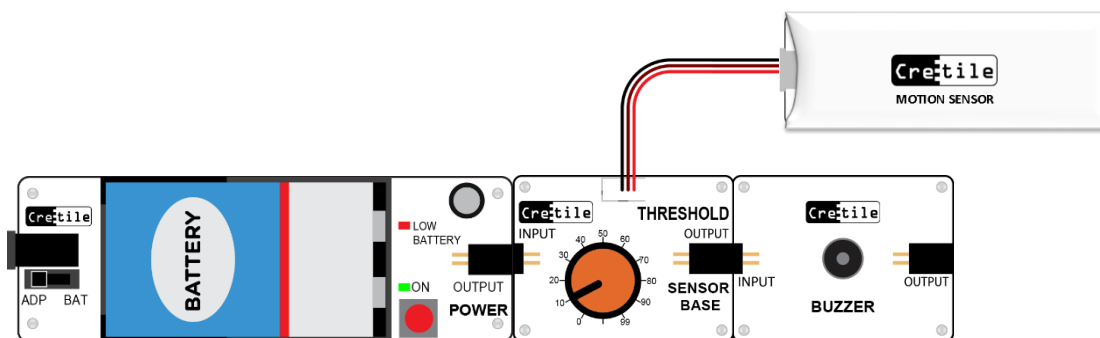
## LET'S EXPLORE

**How can we detect presence of person? What kind of sensor will be needed?**

How can we delay functioning of Intruder alarm so that it doesn't sound alarm immediately and gives us some time to leave the room?

## ACTIVITY

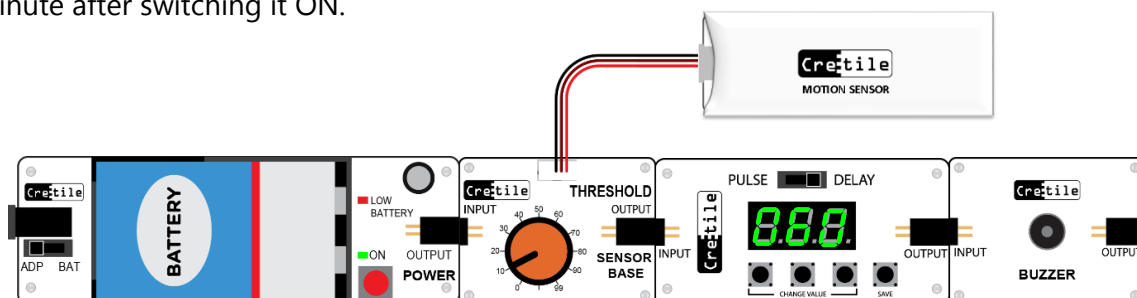
Connect the Cretiles as shown below. Switch the power ON while stepping out of a room. When someone intrudes into your room, the Motion Sensor will detect the motion and Buzzer will start ringing. Note that after powering on, it takes about a minute for the Cretile Motion sensor to work correctly.



However, you would observe that the alarm may ring while you are about to leave the room. We want it to start tracking the motion sometime after we leave. We can use Delay function of Cretile Pulse/Delay to delay the action of Motion Sensor.

Connect the Cretiles as shown below:

- Switch ON the Battery and keep Switch in OFF position.
- Put Pulse/Delay module in "Delay" mode.
- Set the delay value to 60.
- When you put Switch to ON position, the Delay shall start to count down from 60 to zero. The Motion Sensor will get activated only after the countdown finishes i.e. after a minute. This will give you a minute time to leave the room. Thus our intruder alarm will start to function one minute after switching it ON.



# Project 5: Automatic Water Tap

## OBJECTIVE:

Build an automatic control system for tap.

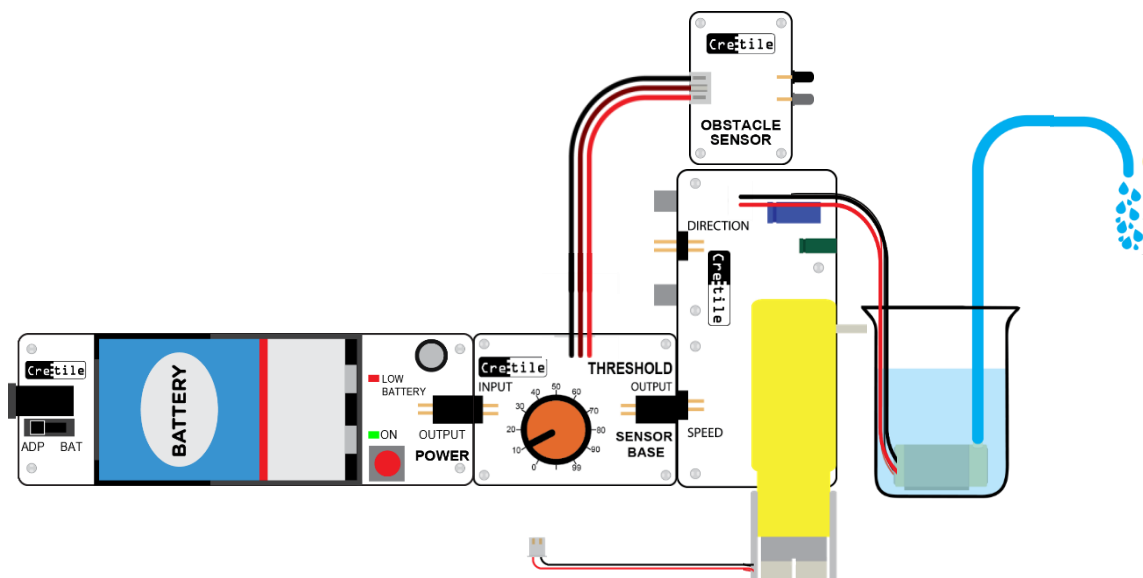
## LET'S EXPLORE:

- Water is an essential resource in the world so it is an important asset.
- Generally, in home, hotels, schools it happens that after tap is opened, we forget to close it. Water will be wasted if we don't close tap.
- The automatic control system for tap water which can save wastage of water without the presence of any operator physically.
- What Components will you need?
- Which Sensor can we use to sense if person needs water
- Think where else can we use this?

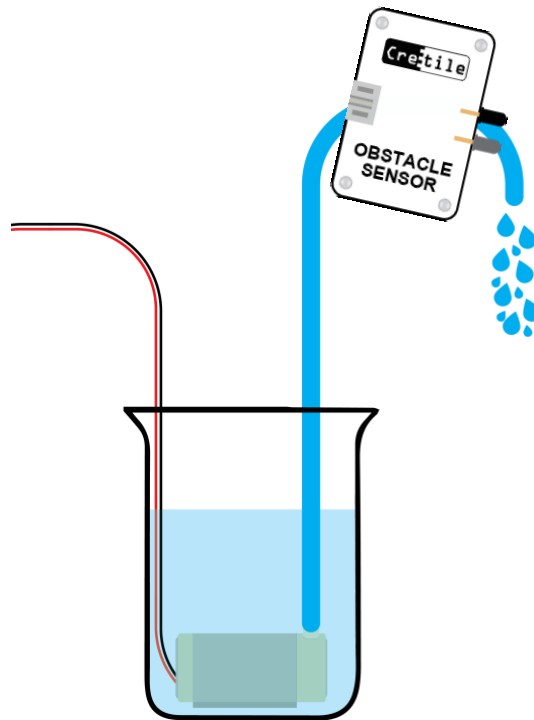
## CRETILES NEEDED:

1. Battery
2. Sensor Base with Threshold
3. Motor Module
4. Obstacle Sensor
5. Submersible Water Pump

Connect the Cretile blocks as shown in below diagram.



Fix obstacle sensor to pipe using tape as shown in below figure. It should be fixed slightly above the end of pipe so that flowing water doesn't touch the sensor.



- Battery gives the power to other Cre:tiles connected to it.
- Sensor base allows you to make use of various sensors. We have used obstacle sensor to detect the presence of hand in this project.
- Obstacle Sensor will switch ON when object is detected. It switches OFF when there is no object.
- Submersible water pump which is connected to pump/motor, used for pumping water and it has to be immersed completely inside water then it initiates the flow of water.
- Thus when Obstacle sensor detects the hand, then the pump will start and water starts flowing from the tap.

## EXPLORE MORE:

- Use pulse/Delay module to release only fixed amount of water.

# Project 6: Blinking Light Program

---

## OBJECTIVE

To write a program that makes the light Blink.

## LET'S EXPLORE

### What is blinking?

Find any LED light in your house. Use button to switch on and then off for some time with same gap of time. LED bulb or light will switch on and off with same interval. This is called blinking.

Now instead of manually pressing the button on and off if we had a program to do this then what steps or commands will be required?

Write down these commands or steps on paper.

## CRETILES NEEDED

- Power or Battery
- Prologic
- Light

## ACTIVITY

The steps required to follow to make a Light blink are:

1. Switch ON the Light
2. Wait for a while (e.g. 1 second)
3. Switch OFF the Light
4. Wait for a while (e.g. 1 second)

Above four steps, if done again and again will blink light.

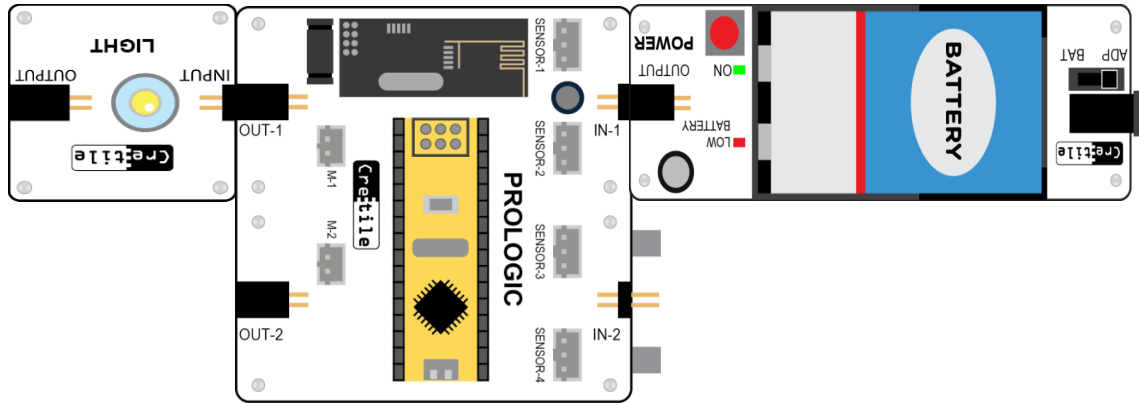
Typically, students miss step number four. Show them what happens when a room light is turned OFF for a fraction of second and immediately turned ON. Human eye cannot detect a very short duration between two light ON actions. It appears that the light was always ON.

Our computer is very fast and if step four is missed the Light will be turned OFF only for a fraction of a second and then turned ON immediately. So, we would observe that the Light is constantly ON instead of blinking.

Also, the four steps mentioned above needs to be done in a repeated manner. If not done repeatedly, then the light will switch ON for a second, then switch OFF and then will remain

switched OFF as there are no further instructions. So, the four steps mentioned above have to be done again and again to get the blink action.

## ASSEMBLY



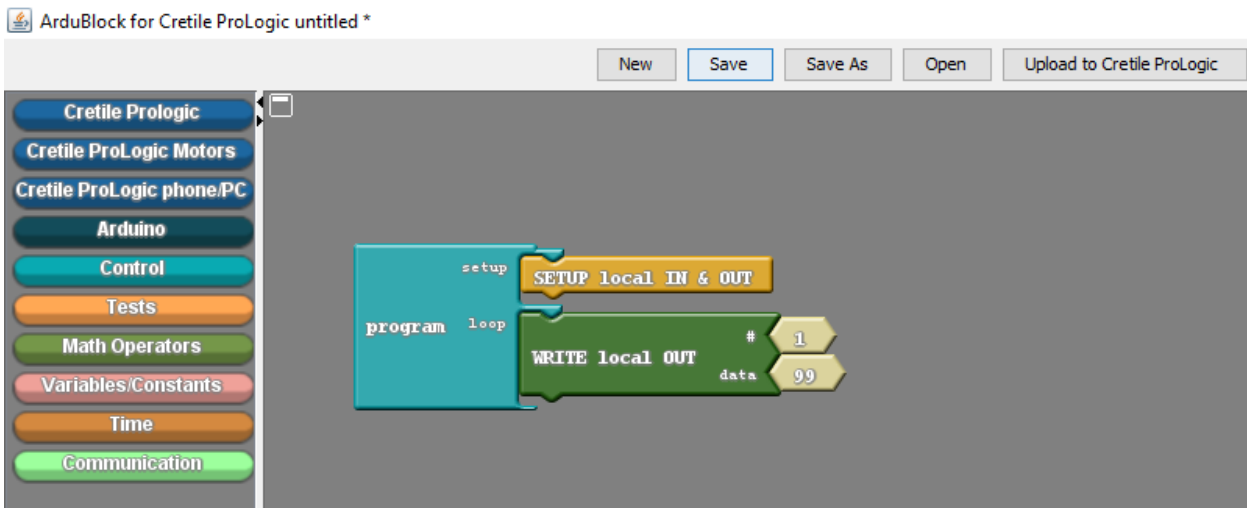
Connect the Cretiles as shown above.

## PROGRAMMING

Open ArduBlock and let's start programming.

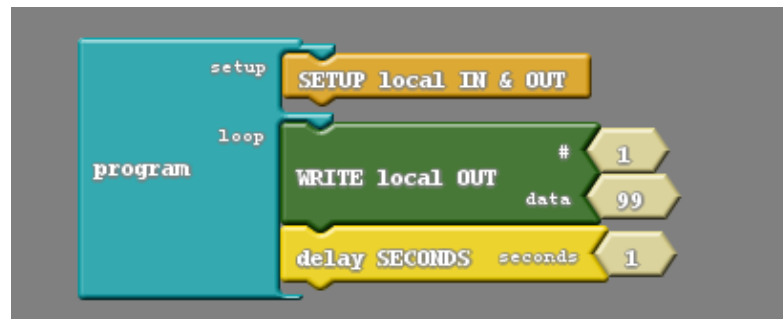
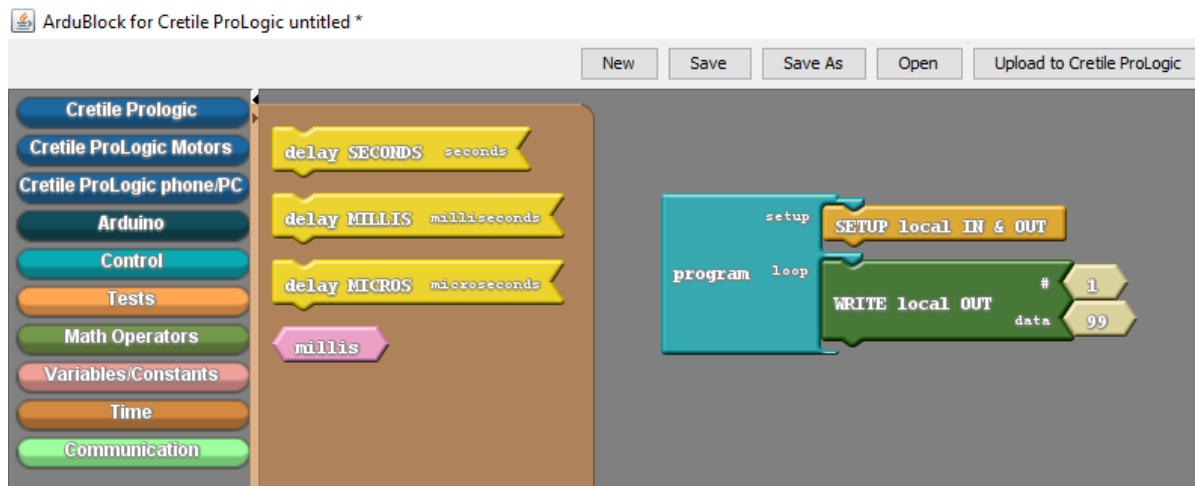
### STEP 1: Switch ON the Light

As the Cretile Light is connected at OUT-1 below step is required to switch the Light ON.



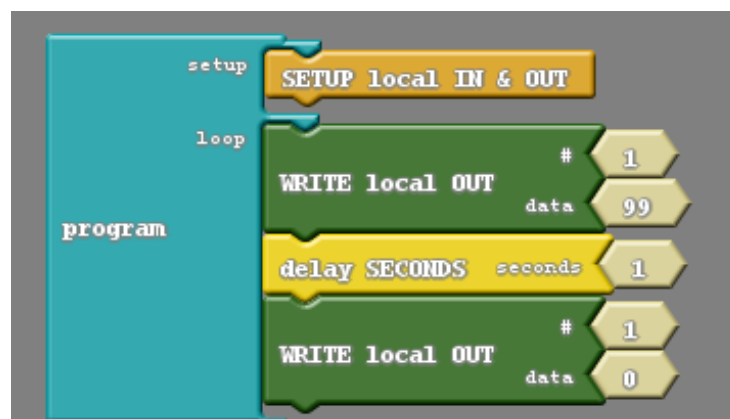
## STEP 2: wait for a second

Open the 'Time' drawer and use 'delay SECONDS' function from it as shown below:



## STEP 3: Switch OFF the Light

To switch OFF the Light connected at OUT-1 use below step



#### STEP 4: wait for a second

After switching OFF the light we need to wait for one second. Do it using 'delay' function as shown below



**Doing it again and again:** as discussed before we want the above four steps to be performed again and again. Note that we have added these four instructions in the loop section of our program. The steps mentioned in the loop section of the program are carried out by our computer again and again until the computer is switched OFF.

Now upload this program to ProLogic and observe the output. You shall find that the Light switches ON for a second and then switches OFF for one second and this keeps happening again and again.



# Project 7: Fish Food Machine

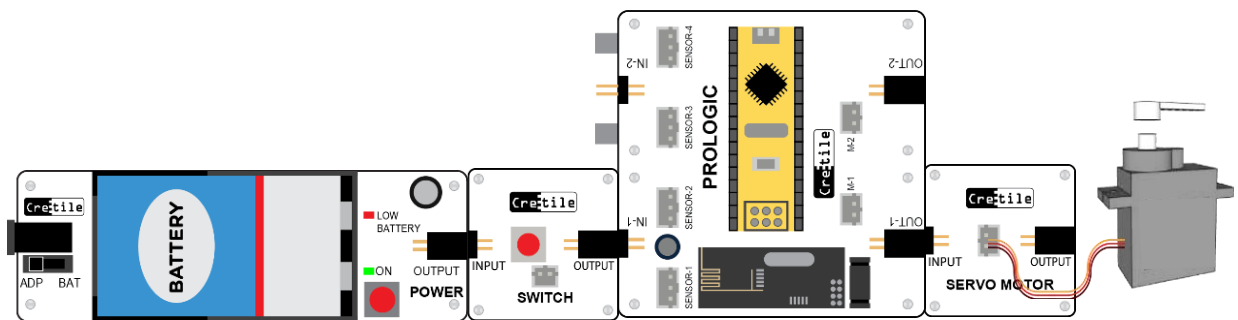
## OBJECTIVE

An automatic fish feeding machine that puts food into the aquarium at regular intervals of time as given in our ProLogic Code

## CRETILES NEEDED

- Battery
- Switch
- ProLogic
- Servo Motor Module
- Servo Motor

## CRETILE ASSEMBLY

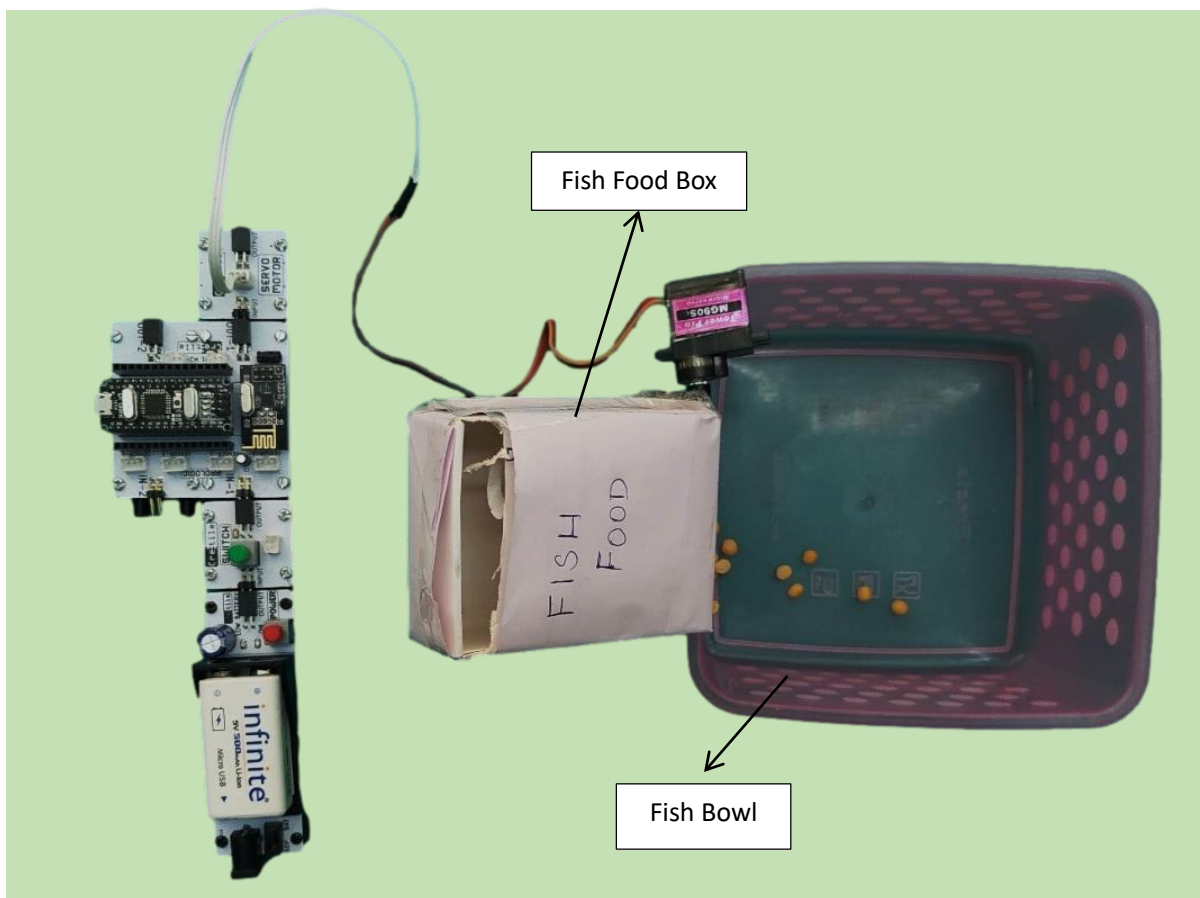
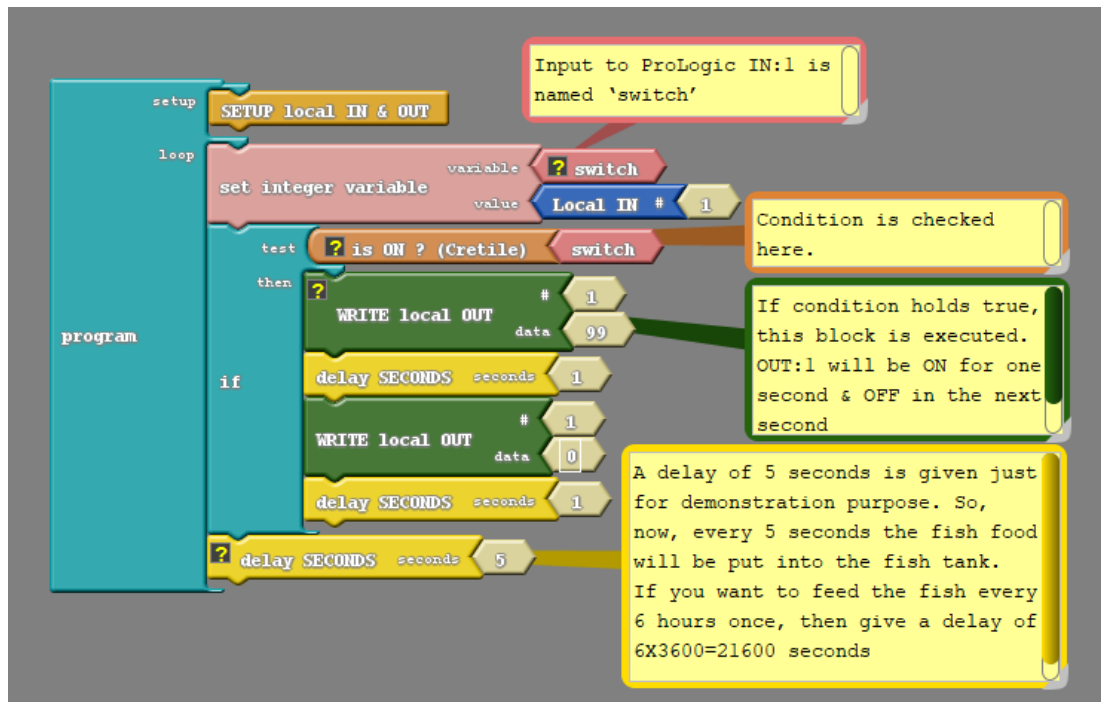


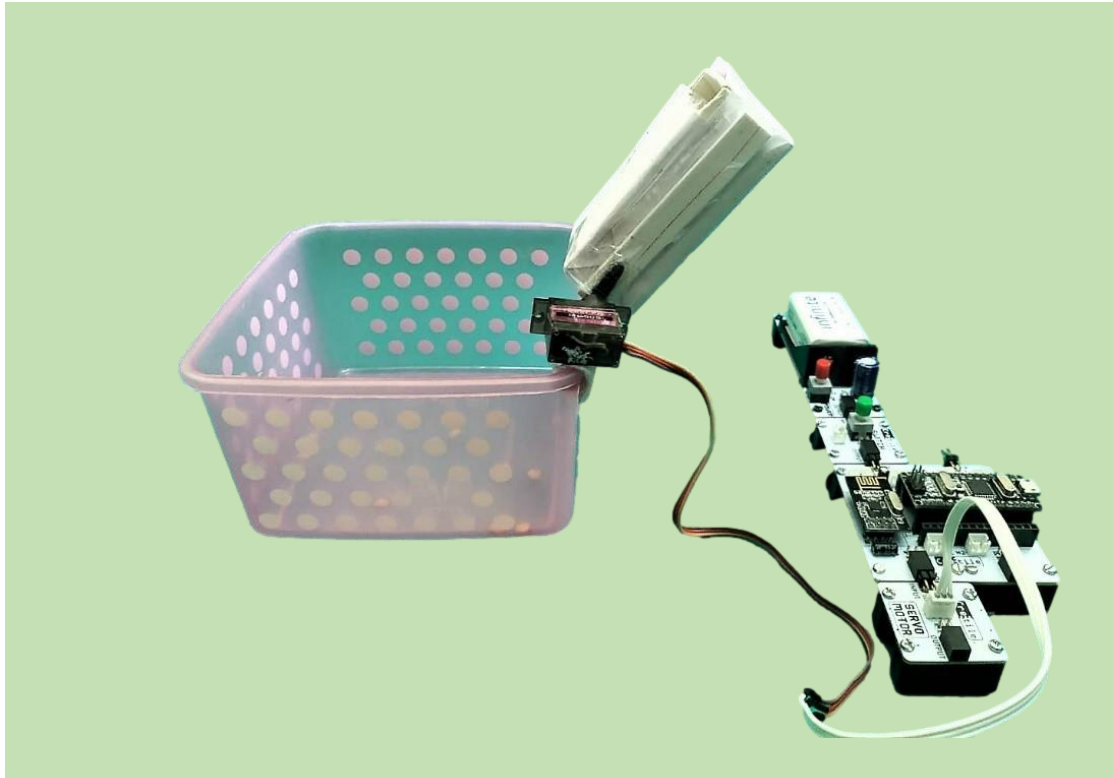
## CONSTRUCTION

- Make the connections as shown in the Cretile Assembly
- Upload the ProLogic Code to the ProLogic Module.
- Now stick the servomotor arm to the fish food box as shown in figure using tape. And make few holes on top of the box.
- Now remove the connection from the system to the ProLogic Kit and place it near the aquarium as shown in figure.
- Switch ON the battery in the battery module and turn the switch module ON. Now the Fish Food Feeding Machine will automatically drop the food into the aquarium once in every 8 hours from the moment the switch was pressed to turn ON.

## WORKING OF PROGRAM

Automated Fish Food Feeding Machine is programmed using the below code in ArduBlock





## EXPLORE MORE

How can we make an automatic plant watering system using same program used in this project?

# Project 8: Obstacle Avoiding Robot

---

## OBJECTIVE

Prepare a robot that changes its path when an obstacle comes in its way

## DISCUSS

### Where can obstacle detection be useful?

Obstacle detection can be very useful in the robotics. Have you seen a floor cleaning robot?



If we develop (floor) cleaning robot then obstacles like table, chair, cupboard etc. will be a problem for the robot and robot has to avoid hitting them and avoid getting stuck at one place while cleaning room.

Hence if we use obstacle detection system, robot can change direction when it encounters an obstacle.

### How can we detect the obstacle?

We can use the obstacle sensor to detect the obstacle.

## CRETILESNEEDED

- ProLogic
- Data cable
- Battery
- Motors
- 2 Robotic wheels
- 2 Obstacle sensors
- 5 mm sun board

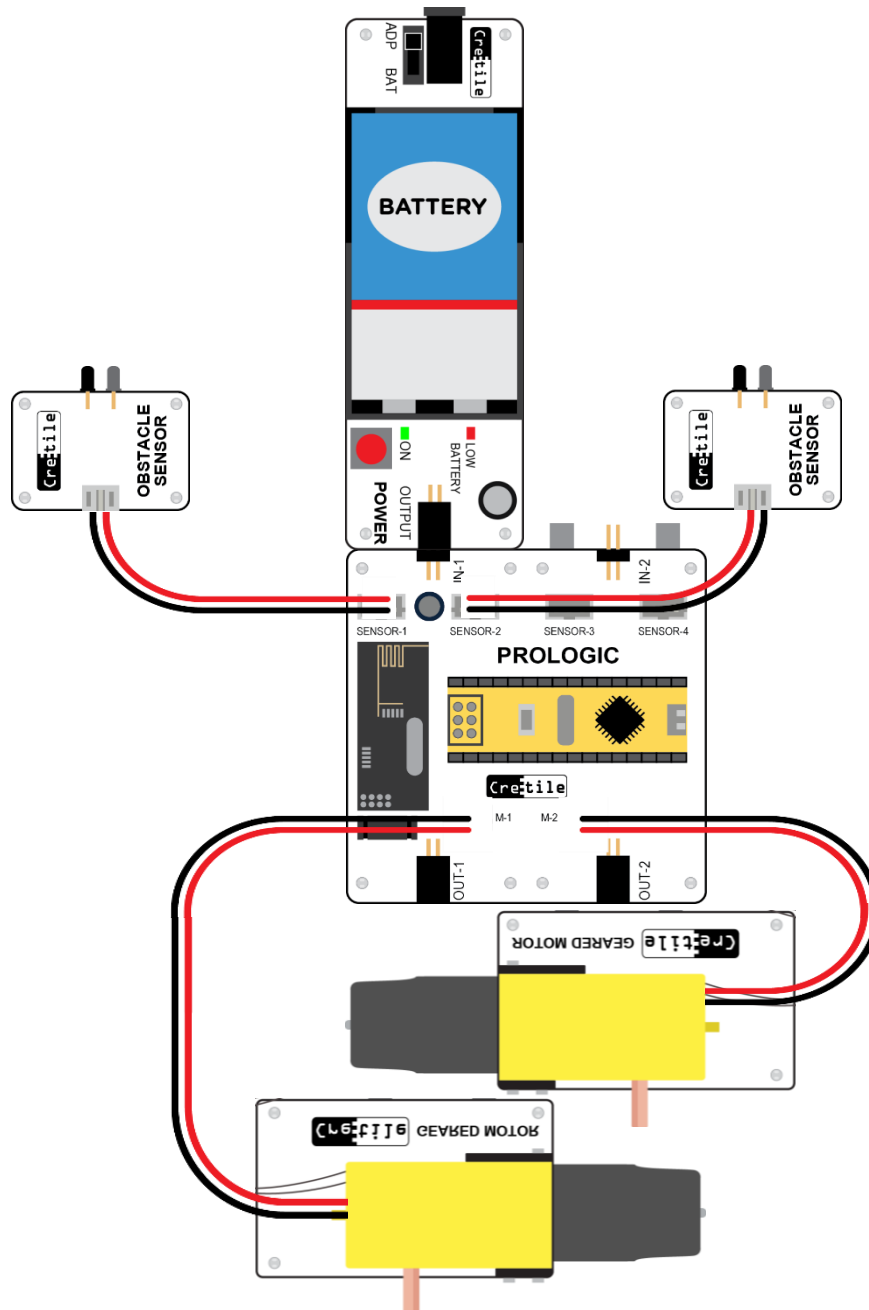
## ASSEMBLY

Connect the modules as shown in the below diagram

Place the assembly on the 5 mm sun board

Attach the caster wheel to the bottom side of the sun board

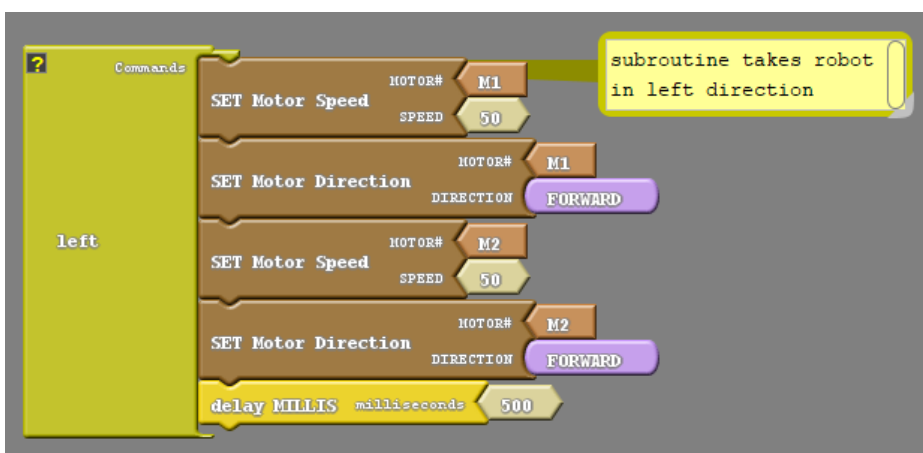
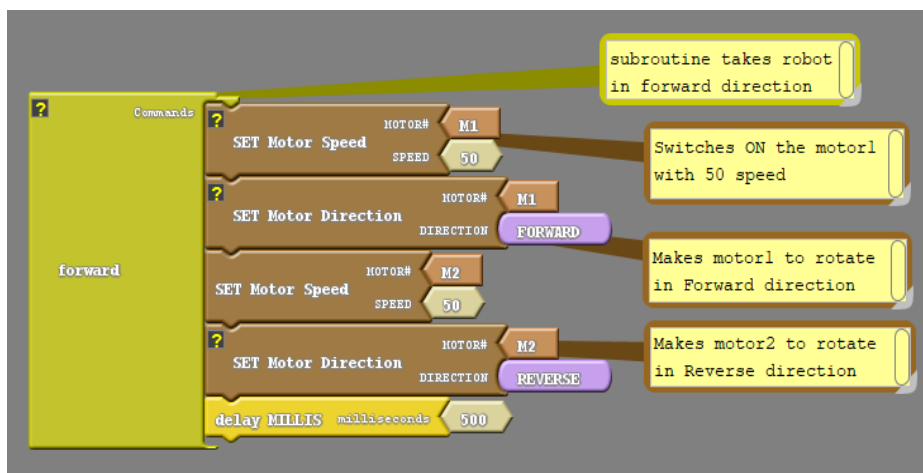
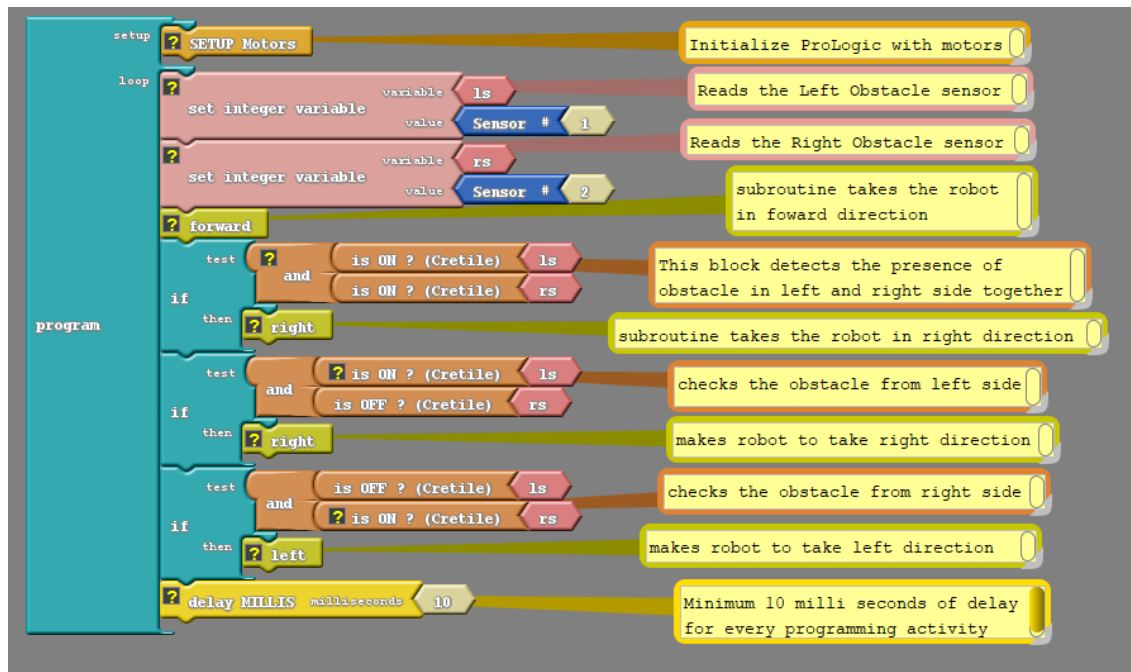
Place the Obstacle sensors at the appropriate place as shown in figure



## PROGRAMMING

Let us learn the programming part of this project

Below ArduBlock program is the complete program of above project



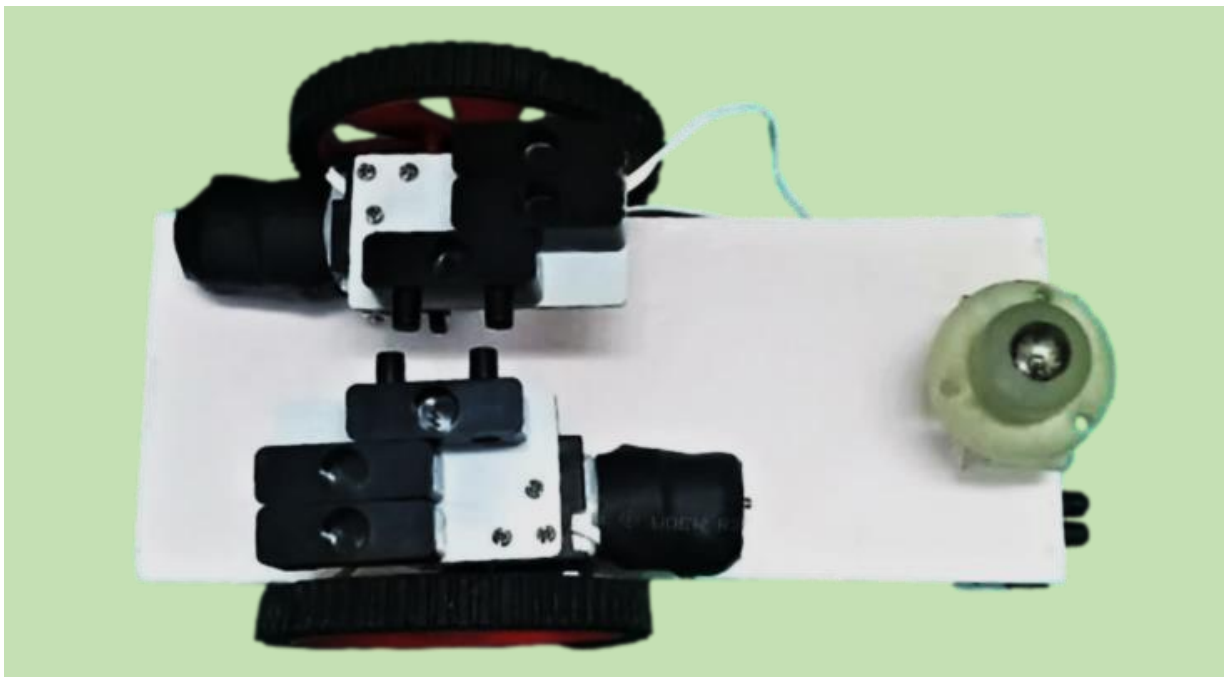
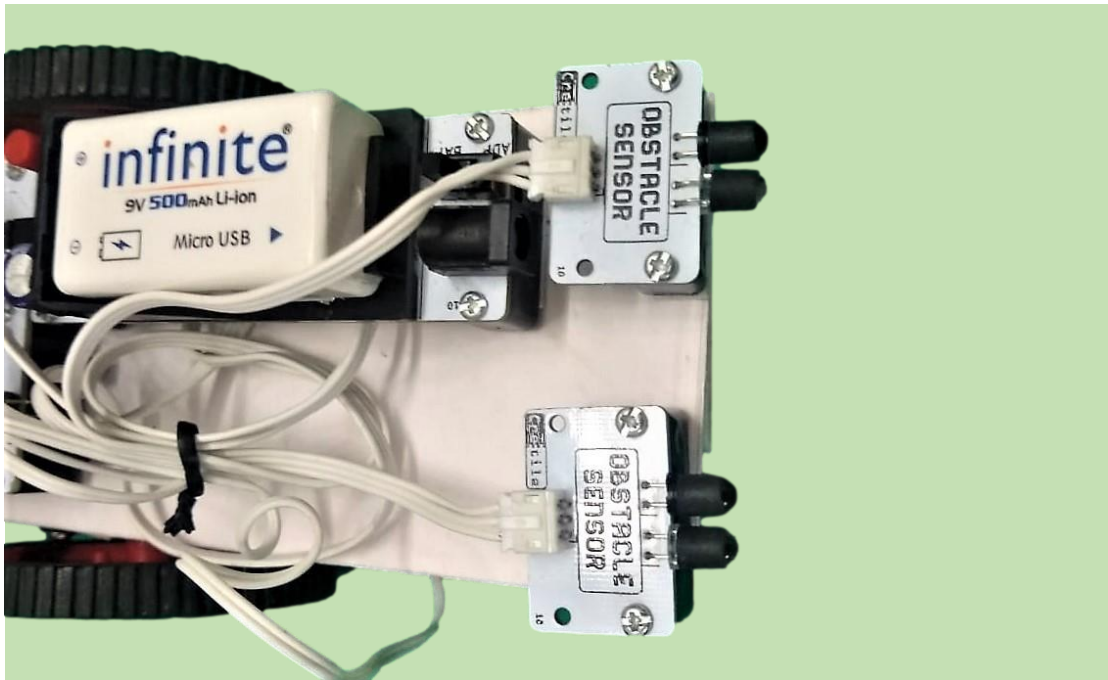


## CONNECTIONS

- Place the entire assembly on the cardboard as shown in figure. Also, connect the wires from the motor modules to the ProLogic as shown in figure.
- Place the Obstacle Sensor on the front side of the robot as shown in figure.









## For More Project Ideas visit [edu.cretile.com](https://edu.cretile.com)

---

**You must have received login credentials for [edu.cretile.com](https://edu.cretile.com). In case you have not, you can always request it by sending an email to [support@cretile.com](mailto:support@cretile.com)**

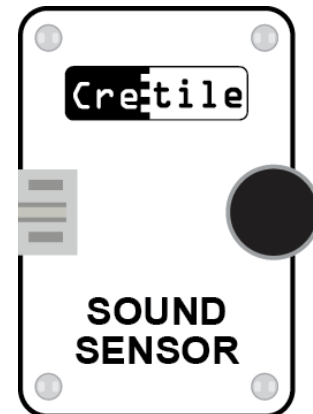


## 6. Explore More Cretiles (Not in your kit)

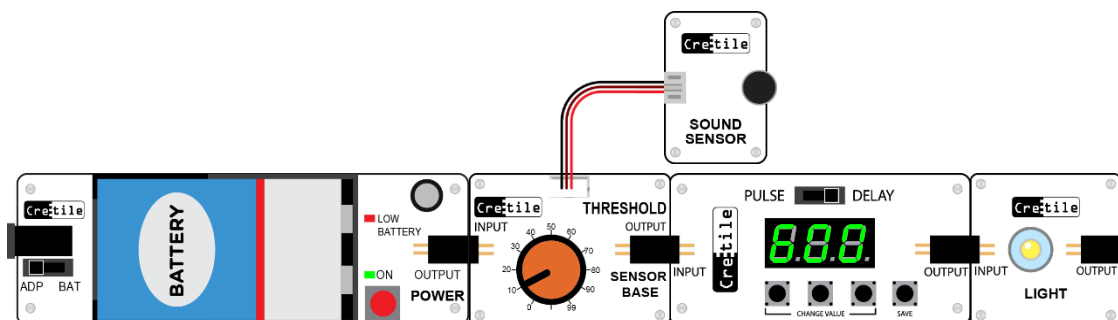
### SOUND SENSOR

Cretile Sound Sensor detects sound. To use it, you need to connect it to the Cretile Sensor Base. The sensor by default remains switched OFF indicating no sound detected by it. It switches ON when sufficiently loud sound is detected by sensor.

The sensor remains ON only momentarily for duration of sound detected. E.g. when you clap around the Sound Sensor it remains ON for a short duration of the clap.



**Make & learn:** Connect Cretile Sound Sensor to Cretile Sensor Base with Threshold. Now, connect Battery + Sensor Base with Threshold (with Sound Sensor mounted on it) + Pulse-Delay + Light in sequence. Put the Cretile Pulse/Delay in Pulse mode. Set the Pulse value to say 600 seconds with 'CHANGE VALUE' buttons. Use 'SAVE' switch to store the Pulse value for future use. Now clap near the Sound Sensor. You will observe Sound Sensor detects the clap sound and gives ON Signal to Cretile Pulse. The Cretile Pulse starts counting down from 600 to zero. During this period the Cretile Light remains ON. Once the countdown reaches zero, the Cretile Light goes OFF.

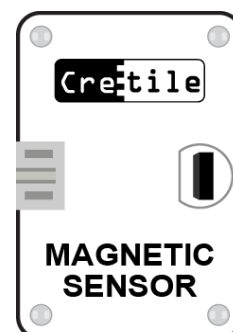


### MAGNETIC SENSOR

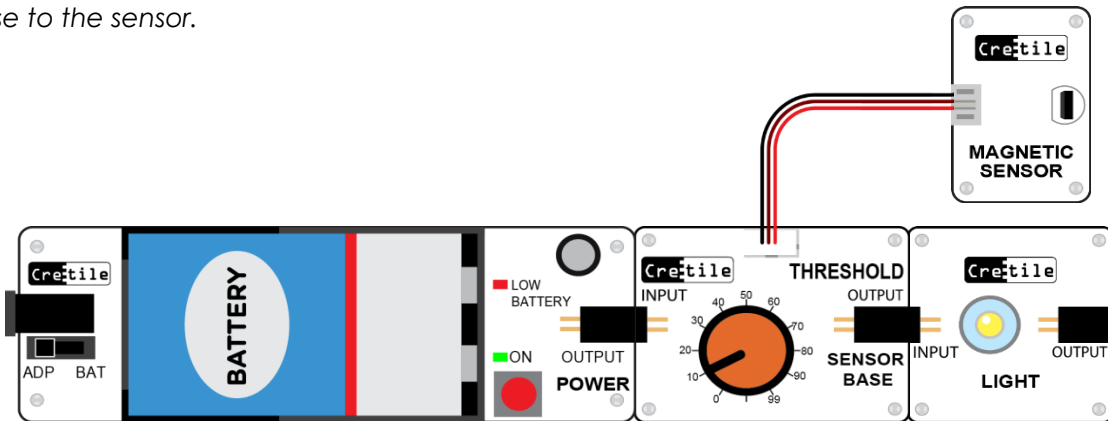
Cretile Magnetic Sensor detects the presence of magnet near it. To use it, you need connect it to the Cretile Sensor Base with Threshold.

The sensor is by default OFF and switches ON when a strong magnet is brought close to it.

It will work only with one of the sides (pole) of a magnet. So, try both sides of the magnet to check which of the sides work.



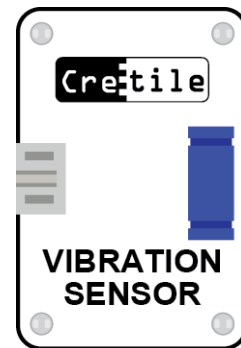
**Make & learn:** Connect Cretile Magnetic Sensor to Cretile Sensor Base with Threshold. Now, connect Battery + Sensor Base with Threshold (with magnetic sensor mounted on it) + Light in sequence. Now bring a strong magnet close to the sensor. You will observe that the Light glows when the magnet is close to the sensor.



## VIBRATION SENSOR

Cretille Vibration Sensor detects vibration of the surface on which it is placed. To use it, you need to connect it to the Cretille Sensor Base with Threshold.

By default, Cretille Vibration Sensor remains OFF. It switches ON when vibration is detected on the surface on which it is placed. E.g. The sensor switches ON when surface on which the sensor is placed is tapped.

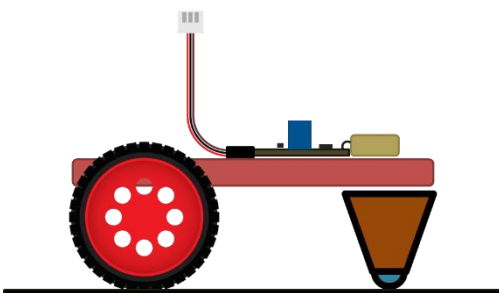


## TILT SENSOR

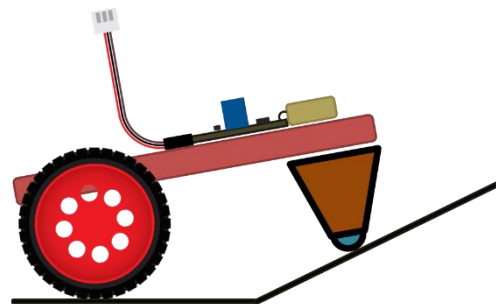
Cretille Tilt Sensor detects the surface is tilted or not, on which it is placed. To use it, you need to connect it to the Cretille Sensor Base.

Cretille Tilt Sensor by default remains OFF when placed on a flat surface that is parallel to ground e.g. on the top surface of a table. It is switched ON when the sensor or surface on which it is mounted is tilted.

Tilt Sensor mounted on a robotic vehicle moving on a flat surface

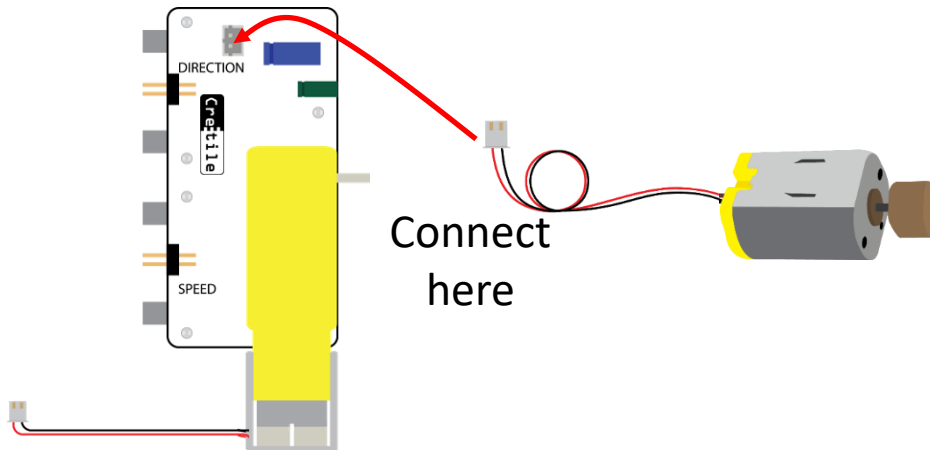


Tilt Sensor mounted on a robotic vehicle climbing a tilted surface



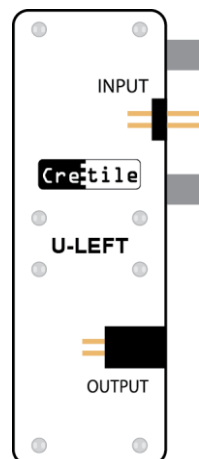
## VIBRATION MOTOR

Cretile Vibration Motor provides vibration functionality similar to that of vibration in smartphone when an incoming call comes. You need to connect Vibration Motor to Motor driver as shown below.

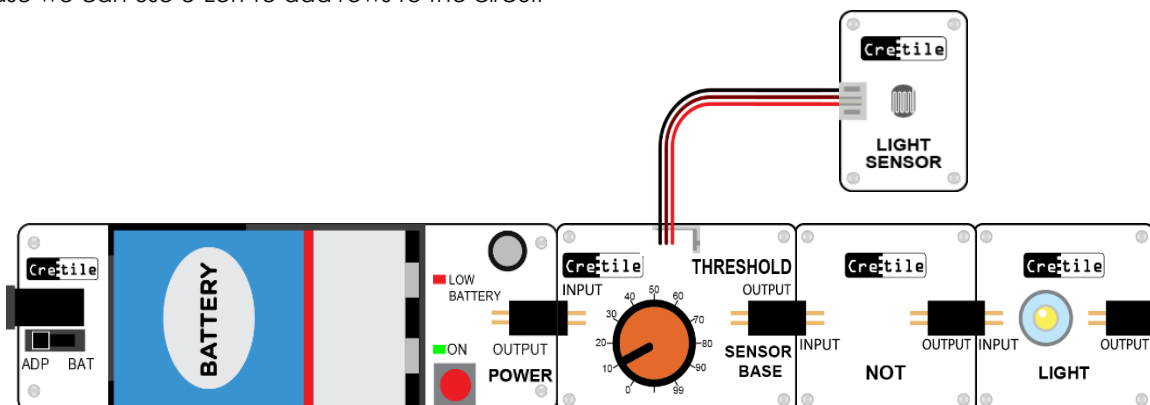


## U-LEFT

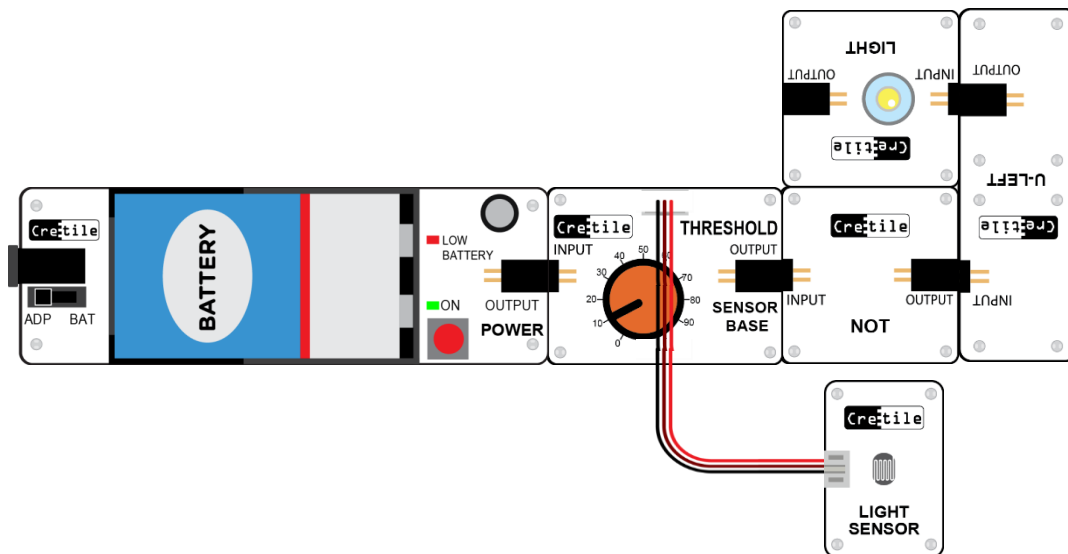
As we keep adding more components to the circuit, the circuit become elongated. This would require more space and difficult to handle. U-Right and U-Left in a circuit helps to reduce the circuit length and add row to the circuit. U-Left will have one input and one output port



**Make & learn:** Let's consider the below circuit, it is elongated and difficult to place in small area. In this case we can use U-Left to add rows to the circuit

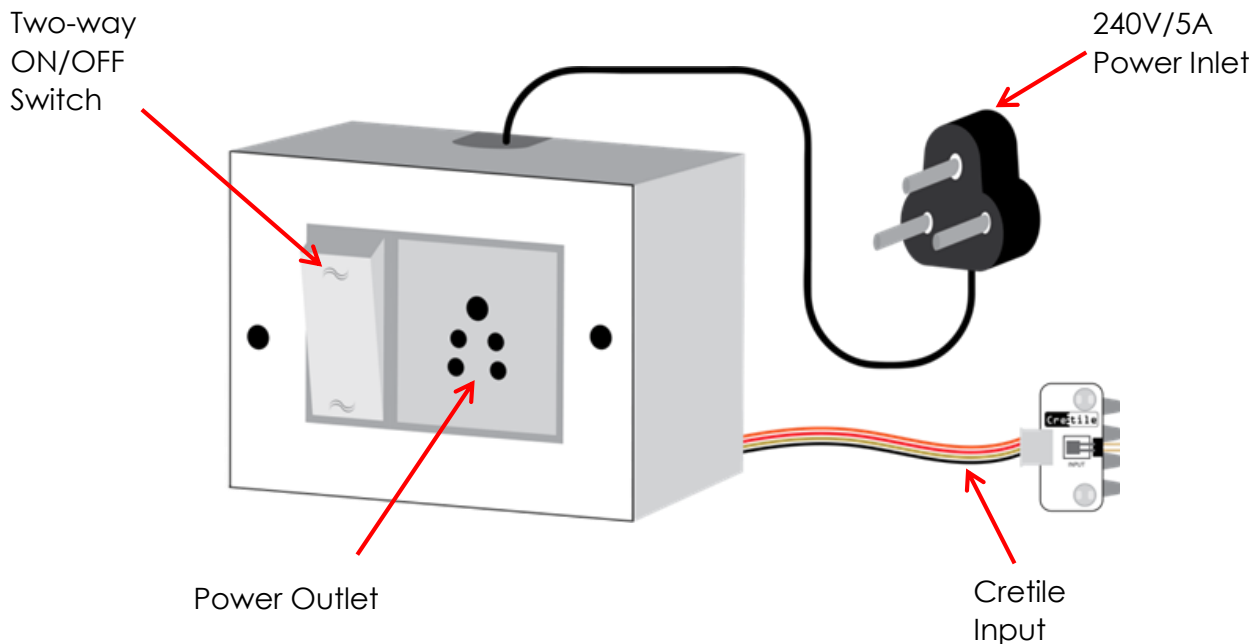


U-Left in the circuit will add a row to the top of the circuit and reduce the length of the circuit



## SMART-SWITCH

Cretille SmartSwitch lets you to control 240V/5A appliance with Cretille. Cretille SmartSwitch looks like a regular wired extension box that we use in home or offices. It has one Cretille input. You can control an appliance connected to SmartSwitch with Cretille logic connected at this Cretille input.



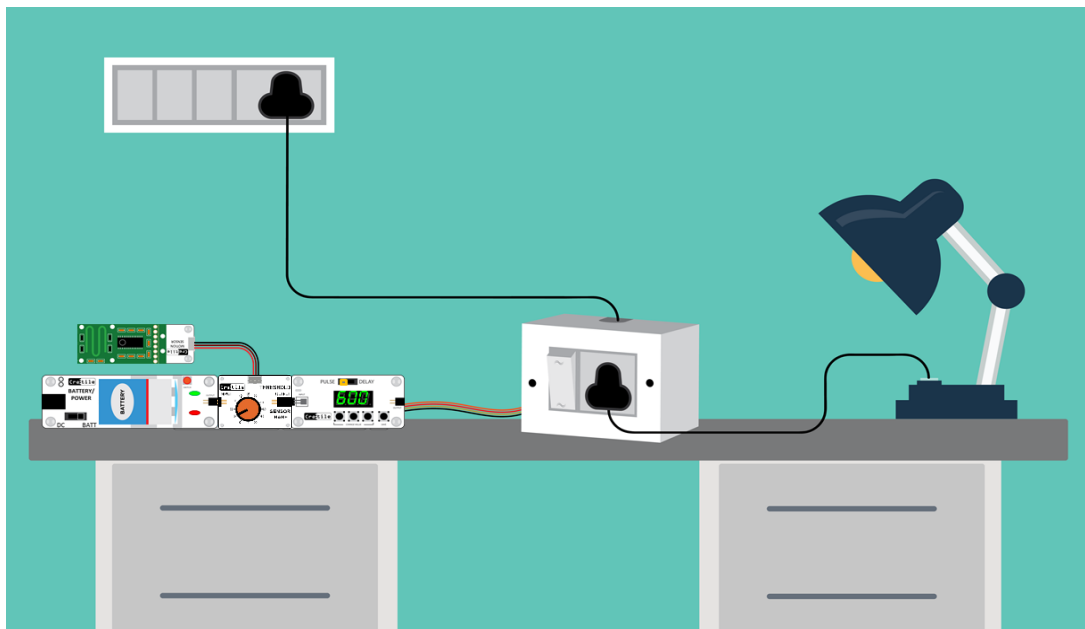
**WARNING:** Do not connect any appliance that has rating above 240V/5A rating. Typically, in India, appliances such as a table lamp, night lamp/ Phone chargers etc. should be of rating equal to or below 240V/5A rating. However, read appliance rating and ensure compatibility before connecting. If you are not sure, do not connect appliance to SmartSwitch. Take help from an expert or call/email to Cretile support for further assistance.

**Make & learn:** Let's control a table lamp with Motion detection. Make the connections as below. Connect the table lamp at SmartSwitch socket.

Connect Battery + Motion Sensor + Pulse Module in sequence at Cretile input. Connect the power input to 240V wall power and switch ON the power supply. You would observe that the table lamp does not switch ON.

Now switch the Cretile Battery ON. Motion Sensor starts to detect the motion around it. When some motion happens around Motion Sensor it switches ON the table lamp. With Pulse the table lamp shall remain ON for at least time set on it. When motion around the Motion Sensor stops, it will switch OFF the table lamp.

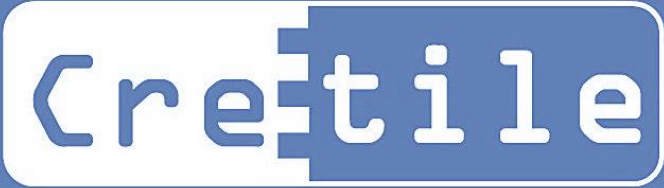
**Note:** Motion Sensor takes about a minute to start functioning correctly. After powering ON, wait for about a minute before you expect your Motion Sensor based projects to function correctly.



You will find that SmartSwitch also an 'Two-way ON/OFF'. This switch along with 'Cretille Input' operates the appliance connected to it. Below table illustrates the same.

Cretille Input	Two-way ON/OFF Switch	Action on Appliance connected
ON	ON	ON
ON	OFF	OFF
OFF	ON	OFF
OFF	OFF	ON

Note that, when Cretile input is OFF and Two-way switch is also in OFF position the appliance connected to SmartSwitch switches ON.



# Support & Troubleshooting Guide



## 7. Support Details

---

When you receive your kit, do the following:

- Quickly check if all the components in the kit are working as expected. Refer to “Functioning of Cretiles” section from the manual for this.
- Check if there is any physical damage to any part of the kit

If you find any issue with your kit, do not worry; report the same by writing an email to [support@cretile.com](mailto:support@cretile.com) and include the below items in the email

- Use suitable subject line such as “Need support for Cretile kit – Your Name”
- In the body of the email mention the below:
  - Your Name:
  - Address:
  - Phone Number:
  - Kit Name:
  - Date of purchase:
  - Where did you purchase the kit:
  - Describe the problem you have identified with the kit
- Attach relevant photos/short videos of the same problem. This could help us resolve the issue faster for you

We will revert to your email at earliest we can. Typically, it could take from a couple of days to a week for us to contact to you.



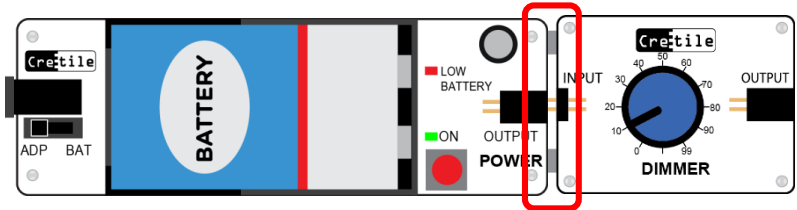
## 8. Troubleshooting Guide

Follow this section when you think that the kit is not functioning as expected. It is very likely that the kit is functioning as expected and you have missed taking a specific step or missed taking a step while making projects using Cretile. This section will help you identify the same.

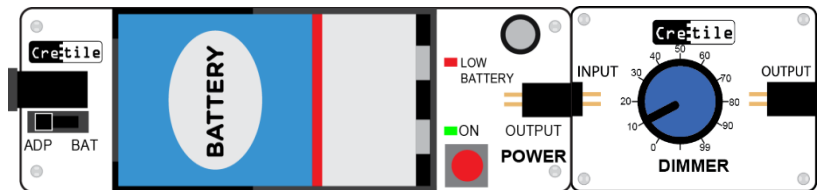
### 8.1. General Troubleshooting

1. Ensure that Cretiles are firmly connected to each other and there is no gap left between two Cretiles

Incorrect connection



Correct connection



2. **Low charge on battery:** one of the primary causes of your Cretile assembly not working as expected could be that the batteries that you are using have ran out of power. Try with new batteries or charge the batteries sufficiently in case you are using rechargeable batteries.

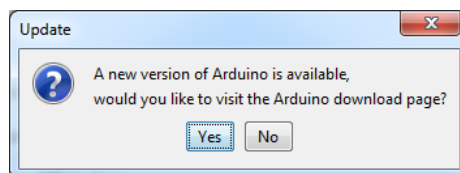
Note that 'Battery & Power' combined Cretile has a low battery indicator as shown below



3. Ensure that Battery/Power '**Mode Switch**' is incorrect position
4. Using **Motor/Pump/High Speed Motor/Vibration Motor**: As compared to other Cretiles these ones consume much higher amount of power. Hence it is recommended not to use these with 'non-rechargeable' batteries. Always use sufficiently charged rechargeable batteries or along with DC adapter.
5. **Receiver and Transmitter not working**: Receiver (RX) and Transmitter (TX) use wireless communication mechanism. Similar mechanisms are used by commonly used electronic devices such as hands-free phone, Wi-Fi, Bluetooth devices such a speaker etc. Depending on situation and time these devices may disturb the functioning of Cretile Transmitter and Receiver and they may not work as expected. In such situations, either figure out a different place to work on your project or try after sometime.
6. If you working in a school/lab with multiple groups using Cretile TX/RX, ensure that you are using them in pair.
7. Keep in mind that the distance within which TX and RX can talk to each other depends on obstacles in between them. E.g. if there is wall in between RX and TX the distance of RX TX communication reduces.
8. While using **Submersible Pump**, ensure that the pump is fully dipped inside the water. Maintain sufficient quantity of water in the container so that water level is above the pump for sufficient number of operations of project

## 8.2. ArduBlock Setup Troubleshooting

1. Only use Arduino/ArduBlock software version provided by Cretile. The latest version can be found at [www.cretile.com](http://www.cretile.com) in the downloads section
2. When you open the development environment, sometimes, it shows you a message stating a new version of the software is available to upgrade. DO NOT upgrade to newer version; click 'No' and continue.



3. Open Arduino IDE, go to 'Tools' menu and click on the 'Board' sub-menu. In this 'Cretile ProLogic' must be selected while working with ProLogic
4. Open Arduino IDE, go to 'Tools' menu and click on the 'Port' sub-menu. A COM port where ProLogic is connected must be selected. Note that if you see more than one COM port in the 'Port' menu then disconnect the ProLogic and check the COM ports visible in the 'Port' menu and make a note of them. Now again connect the ProLogic and check which COM port newly got added to this list. This newly added com port is what you should select.

### 8.3. ProLogic Program Specific

1. When you remove or reconnect the USB cable between your PC and ProLogic, you might have to select the COM port again from the tools menu of Arduino IDE.
2. When you drag a block from drawer and drop it in canvas, it comes with some default parameters e.g. WRITE block will come with OUT-# as 1 and data as '99'. Remember to update it as per connections in your setup.
3. While working with remote inputs and remote outputs, ProLogic must be switched ON first. Only after ProLogic is switched ON, TX and RX should be switched ON. The order of TX and RX switching ON does not matter as long as ProLogic is switched ON first.
4. One of the Setup block is present in ArduBlock Setup section
5. You must connect Battery/Power to ProLogic and keep the Battery/Power switch to ON position

### 8.4. Android Application Development Specific

1. Ensure that you have installed 'CretileServiceApp.apk' in your Android device. Without this app, the application that you have developed will not be able to communicate with ProLogic. Login to [edu.cretile.com](http://edu.cretile.com) for more information on this.
2. Ensure that you are using a USB data cable to connect ProLogic and Android device. Some of the USB cables have only charging capabilities and not data transfer capabilities.

Thank you for purchasing Cretile. Please read the instruction manual carefully before using the product. Please ensure that the product is used under adult supervision.

## BASIC INSTRUCTIONS

- Always assemble or de-assemble Cretiles in power-off mode
- Always ensure that the product is used under adult supervision and not left unattended.
- Always ensure that the circuit does not come in contact with any metal objects or liquids.
- Always ensure that the product is utilized along with a high quality ISI/ISO/BIS certified 9V 2A adapter with a compatible DC PIN for the power jack in Power module.
- Always ensure that the product is utilized with 9V PP3 battery when using Battery module.
- Always ensure that the battery is connected with correct electrical polarity. Caution should be taken not to short-circuit battery terminals to each other which can damage the product and generate heat that may result in burns.
- Always take maximum precaution while plugging in batteries so that they are not connection to any wrong electrical polarity. Wrong electrical polarity can cause fire or burns.
- Always ensure that the product is used within 0 (zero) to 50 (fifty) degree temperature range only. Exposure to direct sunlight should be avoided.
- Never recharge a non-rechargeable battery.
- If using rechargeable batteries follow the charging instructions as prescribed by battery manufacturer. Do not overcharge.

## IMPORTANT: PLEASE READ CAREFULLY

*Please ensure that you have read and complied with all the details provided on the brochure/instruction manual placed. Please ensure safe and supervised usage of the entire product. In the event that any of the components of the product are dropped, the product may not function as desired. We do not make any express or implied warranties of any kind with respect to the product and we expressly disclaim any warranties of merchantability or fitness for a particular purpose. By using this product, you acknowledge and understand that the battery and the adapter provided separately have not been manufactured by us and we shall in no event be held liable for any loss or damage that may arise as a result of the use of such battery and the adapter. Kindly ensure that you have read and complied with all the instructions provided for the use of the battery and the adapter by the manufacturer. We shall not be held responsible for any incidental, indirect, consequential, or special damages that may arise as a result of the use of the product. Your use of the product implies your acceptance of these terms. If there are any defects or defaults in the product, kindly contact [support@cretile.com](mailto:support@cretile.com) within 10 (ten) days from the date of purchase of the product and the same would be replaced.*

*Any dispute which may arise as a result of the use of this product shall be subject to the jurisdiction of the Courts situated in Bangalore, Karnataka. Kindly keep the instruction manual and package for reference as they contain important information.*

A PRODUCT OF



© 2020, MAKERINME TECHNOLOGIES PRIVATE LIMITED, ALL RIGHTS RESERVED

