

ROBÓTICA EDUCACIONAL

Atividades com o
Kit Criatecno CT100

2ª Edição

FIGURAS



Figura 1.1 - Placa Arduino Uno.

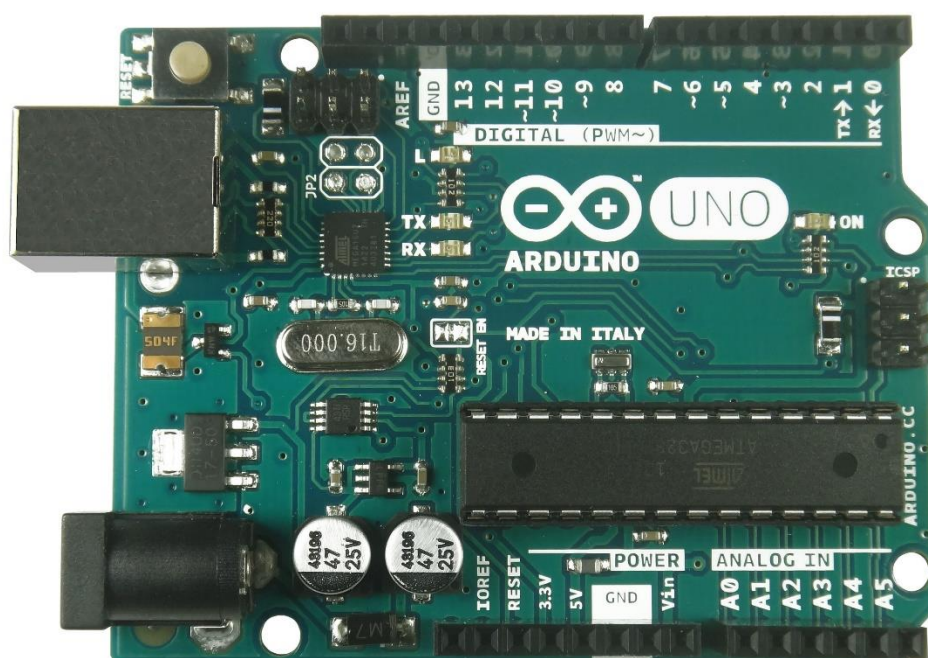


Figura 1.2 - Interface gráfica do Arduino IDE.



Figura 1.3 - Conectando a placa Arduino no computador.

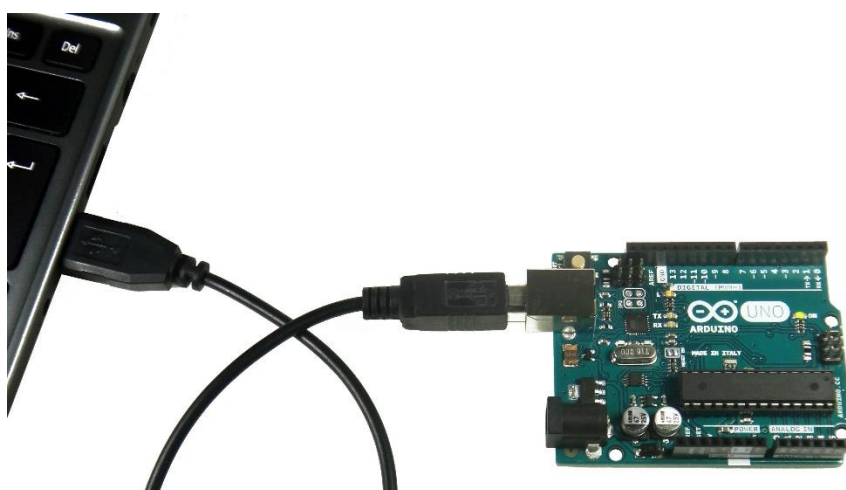


Figura 1.4 - Definindo a placa Arduino a ser utilizada.

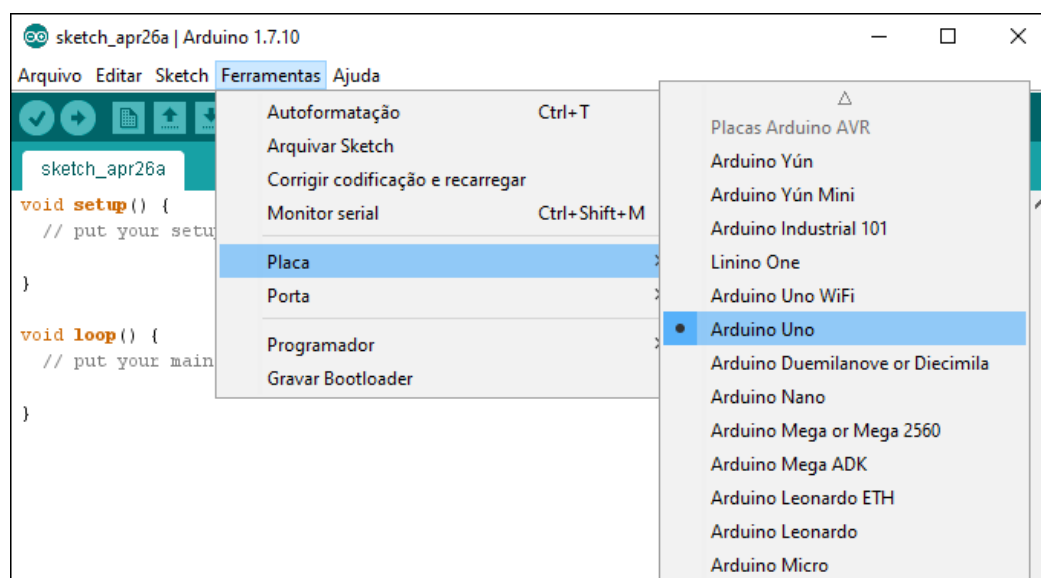


Figura 1.5 - Selecionando a porta serial onde a placa Arduino está conectada.

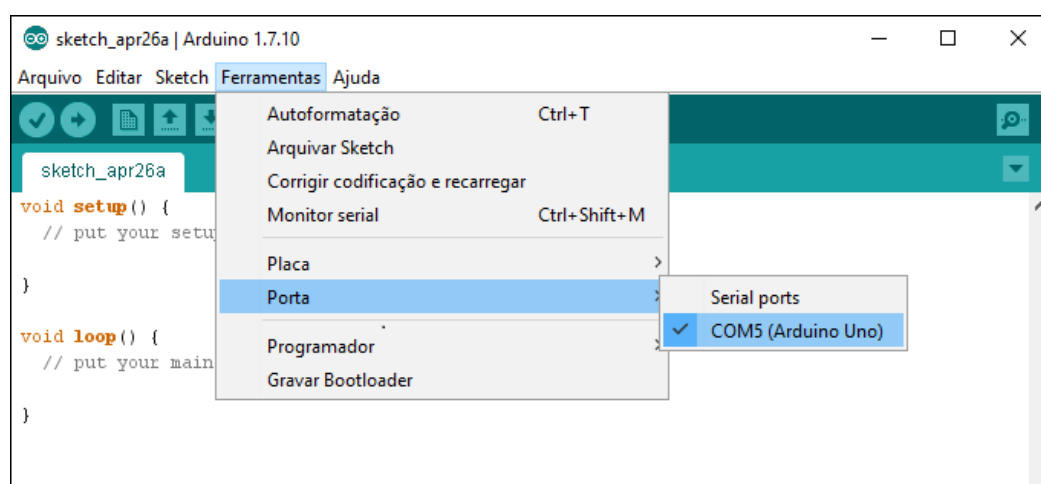


Figura 1.6 - Abrindo o sketch Blink.

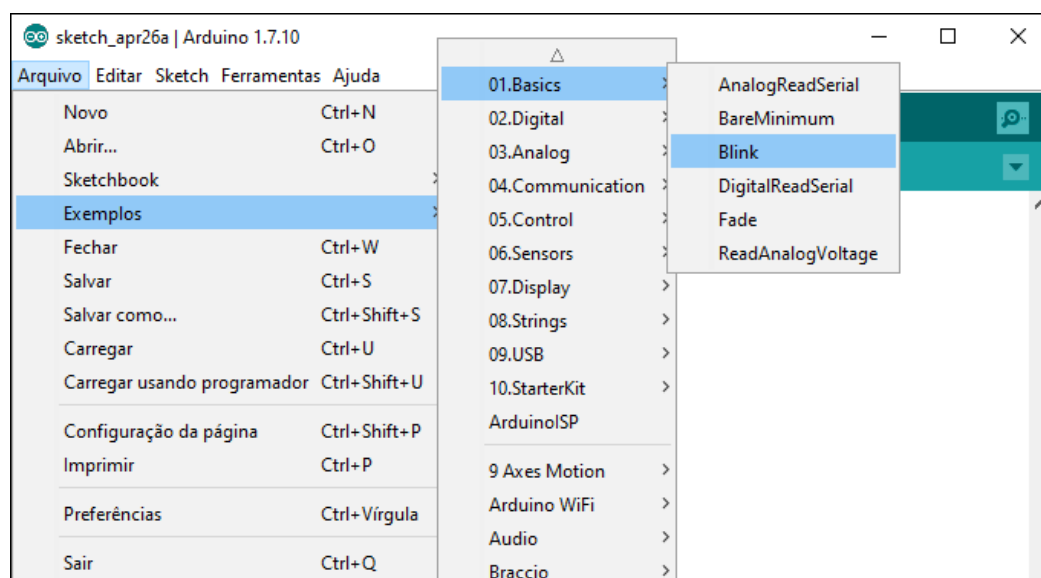


Figura 1.7 - Posicionando a placa controladora Arduino sobre a base de prototipagem.



Figura 1.8 - Posicionando um espaçador entre a placa Arduino e a base de prototipagem.



Figura 1.9 - Inserindo um parafuso através dos furos da placa Arduino, do espaçador e da base de prototipagem.

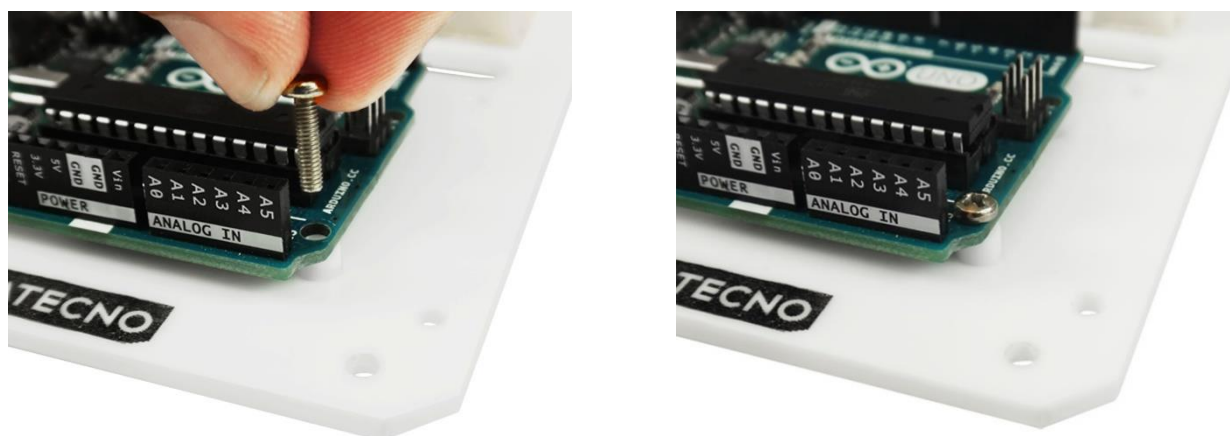


Figura 1.10 - Prendendo uma porca no parafuso.



Figura 1.11 - Concluindo a fixação da placa Arduino na base de prototipagem.

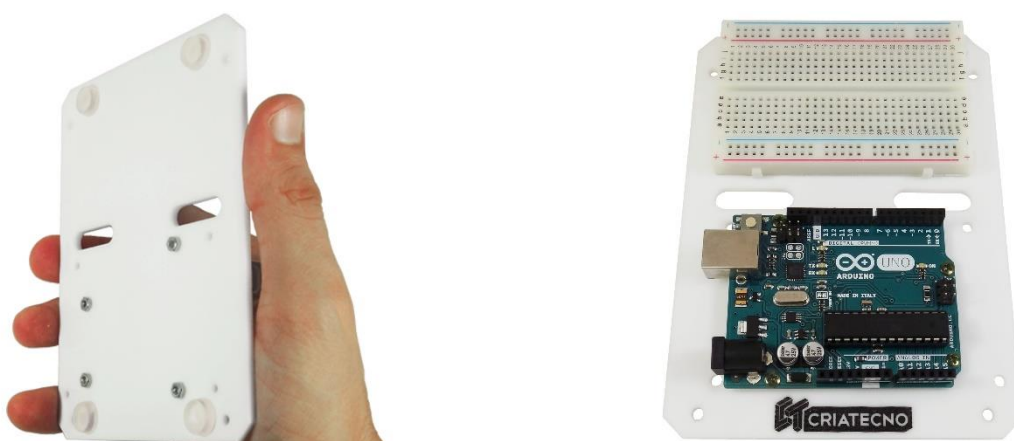


Figura 1.12 - Ligações entre a placa Arduino e a protoboard.

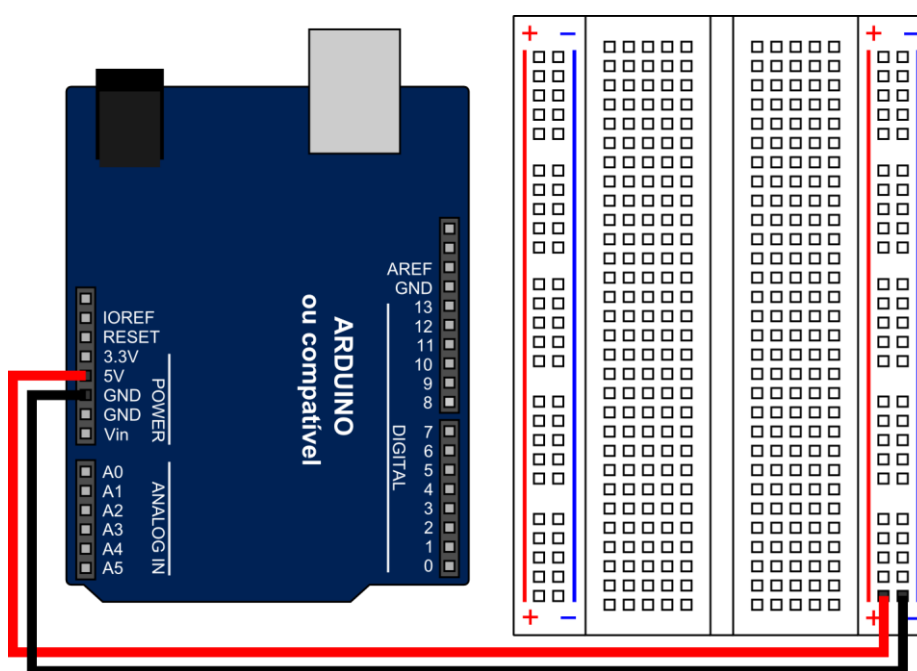


Figura 1.13 - Placa Arduino ligada na protoboard.

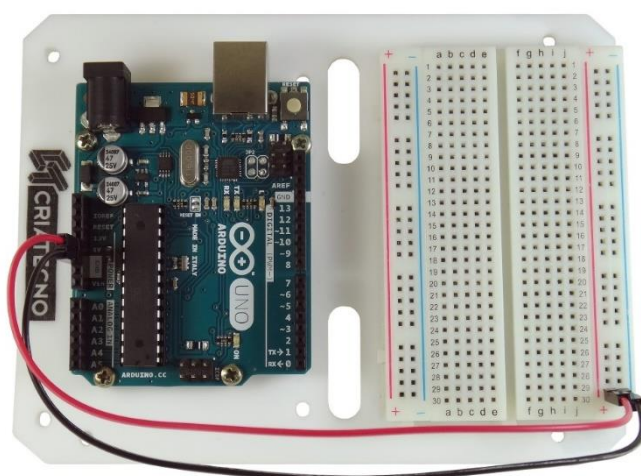


Figura 1.14 - Placa Arduino sendo alimentada por pilhas recarregáveis.

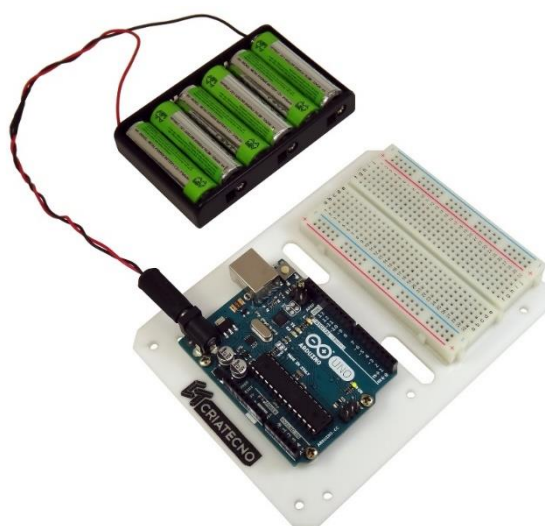
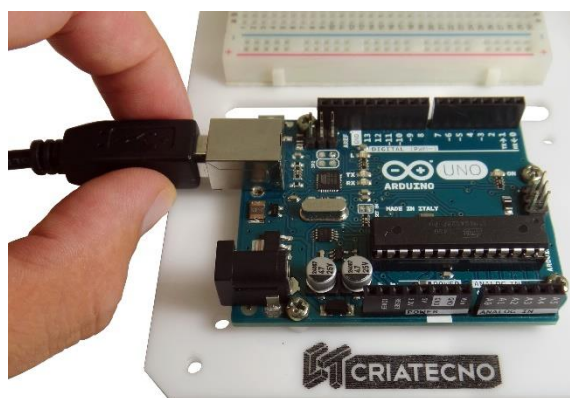
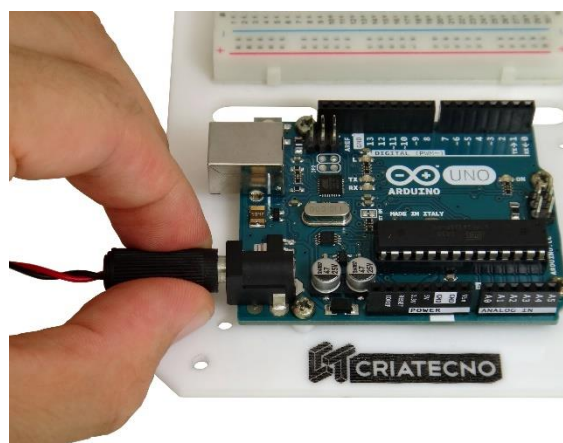


Figura 1.15 - Desconectando (a) o cabo USB e (b) o cabo do suporte de pilhas.

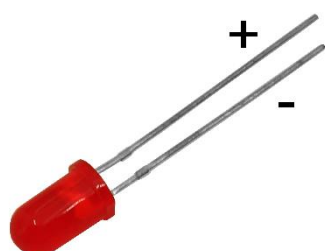


(a)



(b)

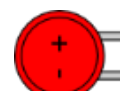
Figura 2.1 - (a) Imagem de um LED, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

Figura 2.2 - (a) Imagem de um resistor, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

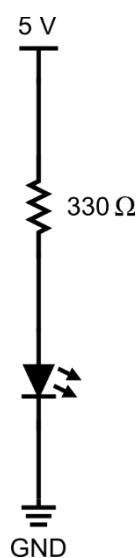


(b)

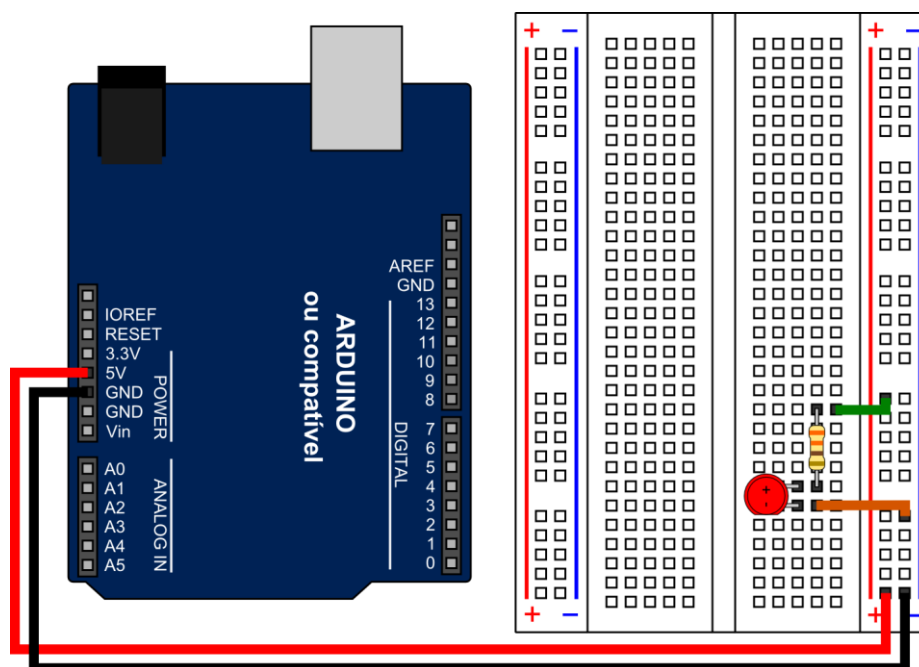


(c)

Figura 2.3 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 1.



(a)



(b)

Figura 2.4 - Circuito eletrônico montado na protoboard.

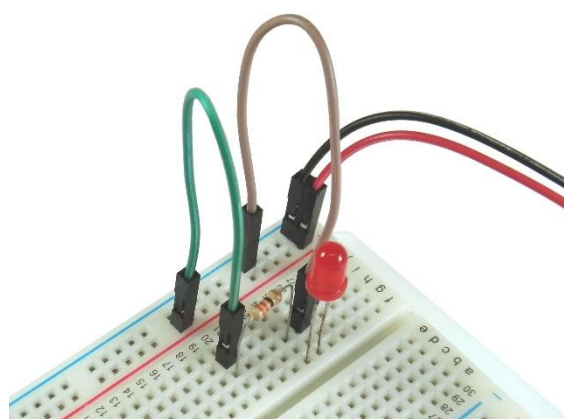
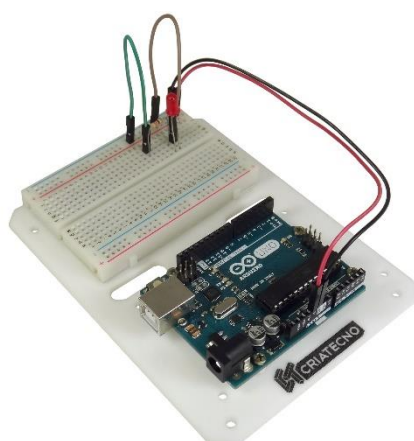


Figura 2.5 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 2.

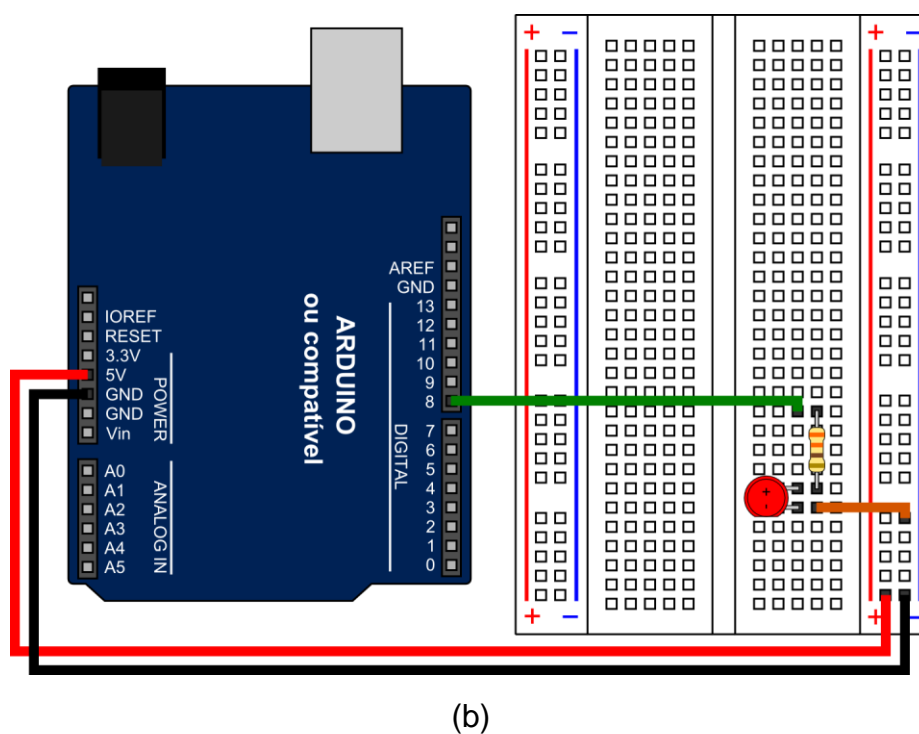
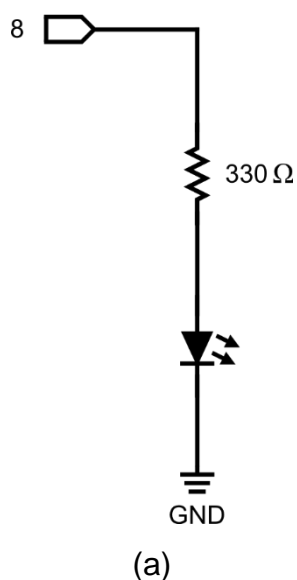
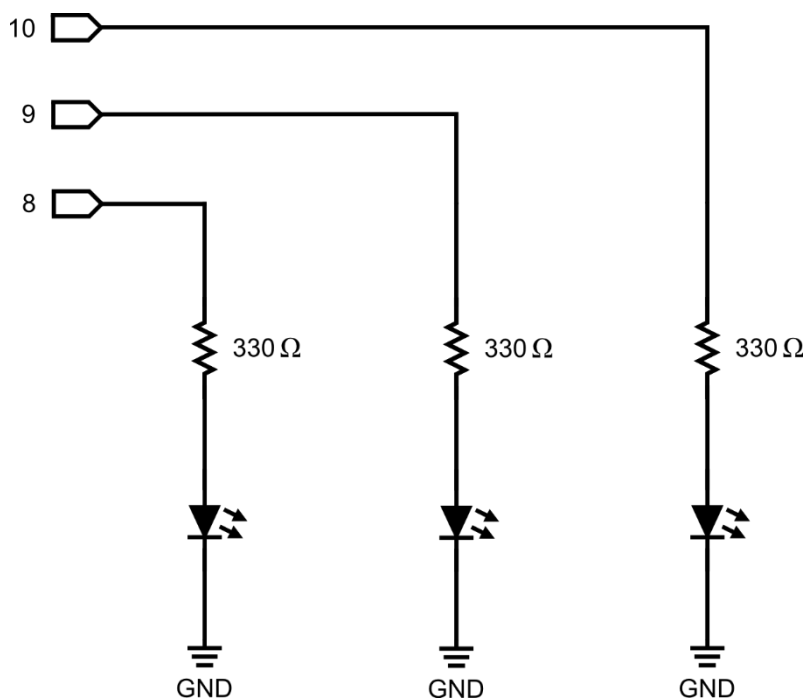
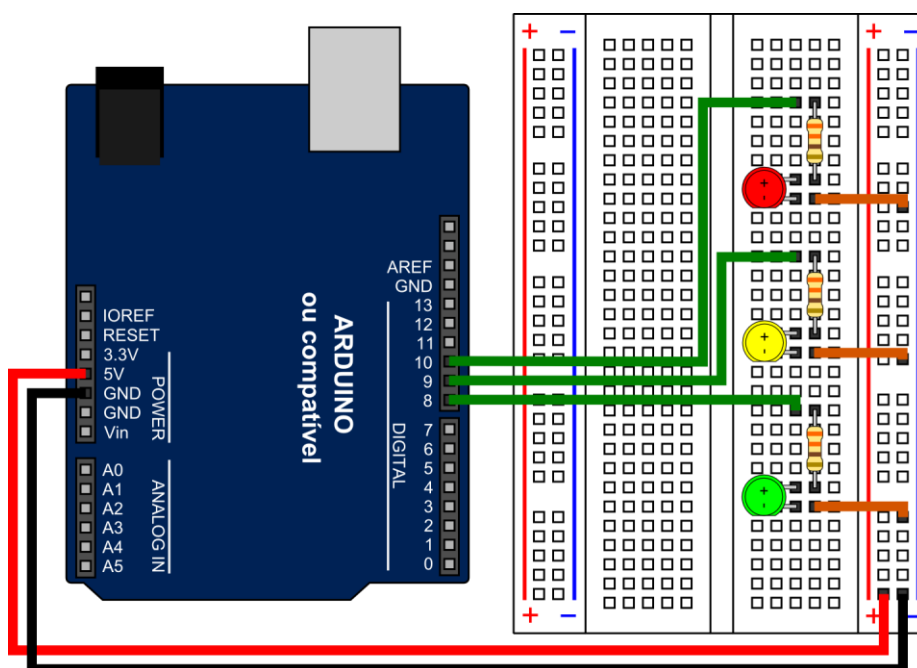


Figura 2.6 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 4.

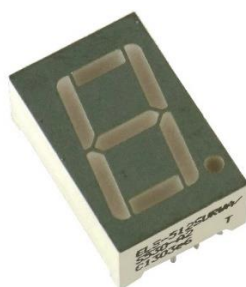


(a)

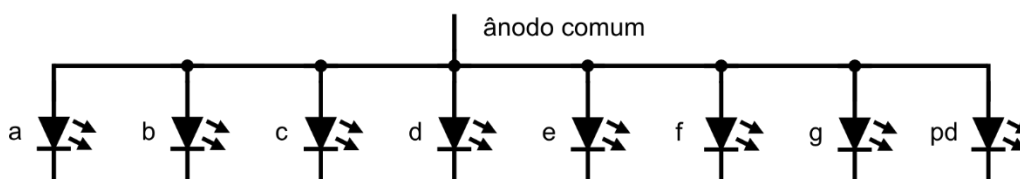


(b)

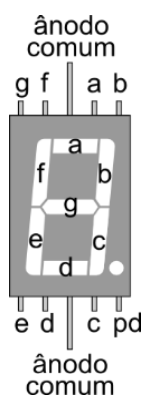
Figura 2.7 - (a) Imagem de um display de sete segmentos, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

Figura 2.8 - Relação dos segmentos do display que devem ser acesos em função do número desejado.

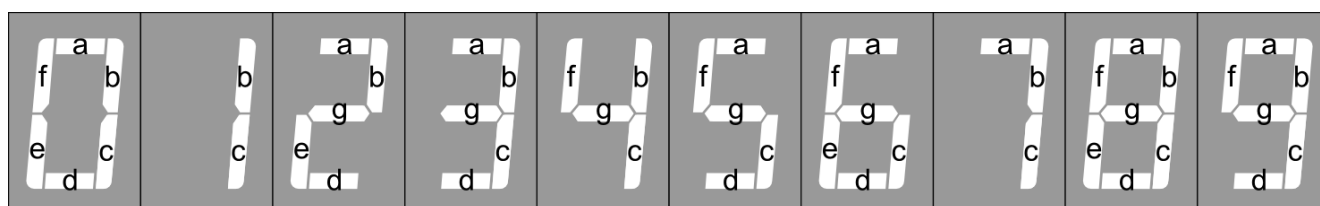
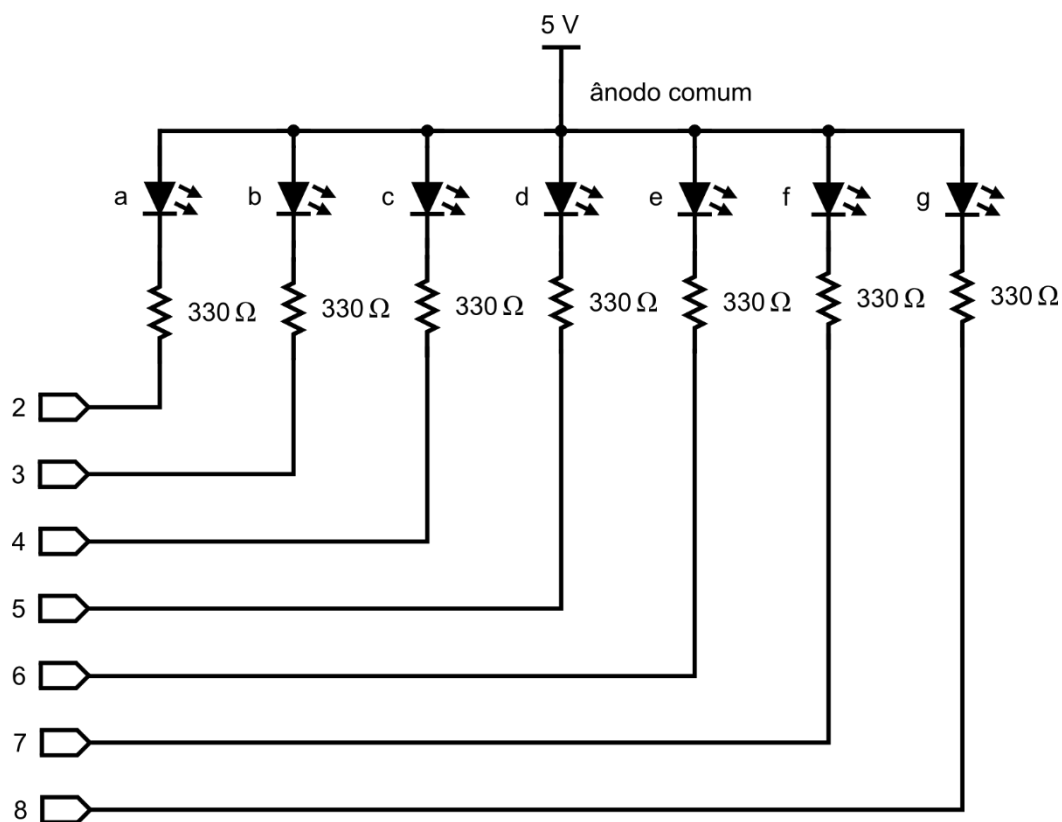
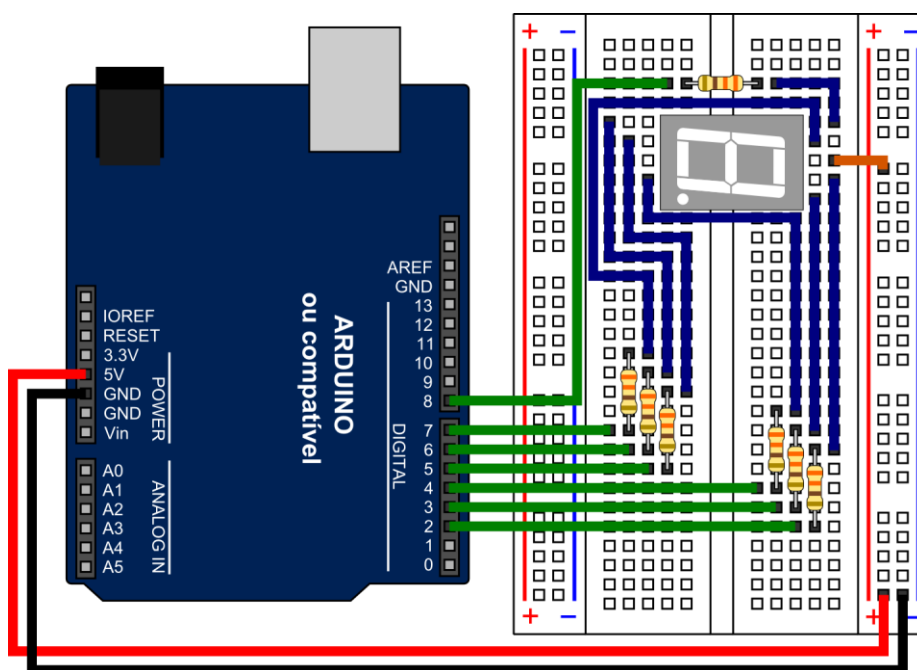


Figura 2.9 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 5.



(a)

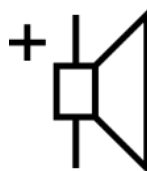


(b)

Figura 2.10 - (a) Imagem de um sonorizador piezo, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

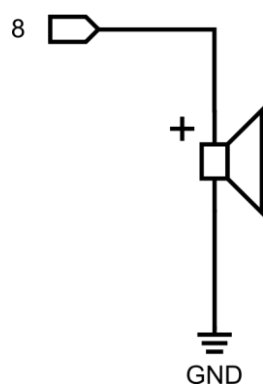


(b)

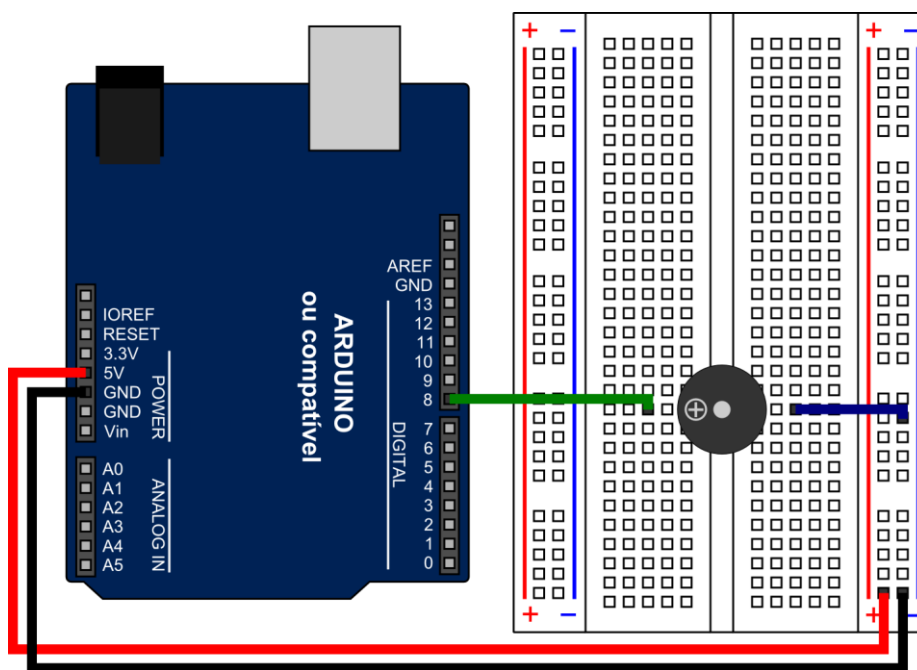


(c)

Figura 2.11 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 7.

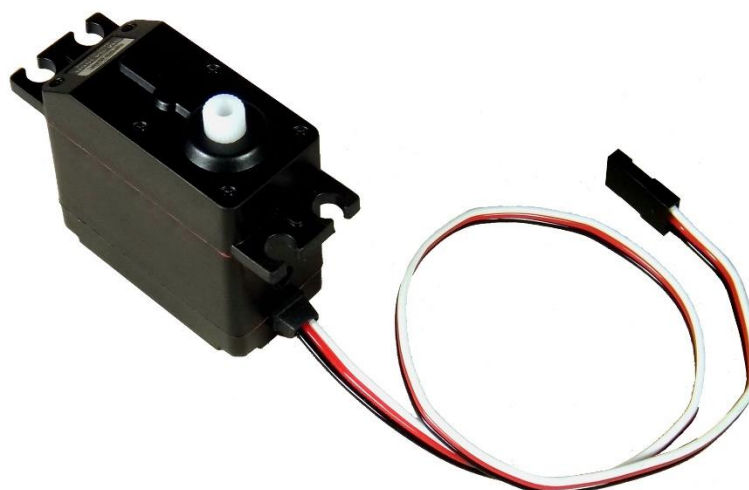


(a)

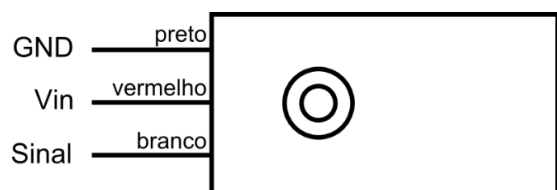


(b)

Figura 3.1 - (a) Imagem de um servomotor, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

Figura 3.2 - Ligação entre a placa e a protoboard.

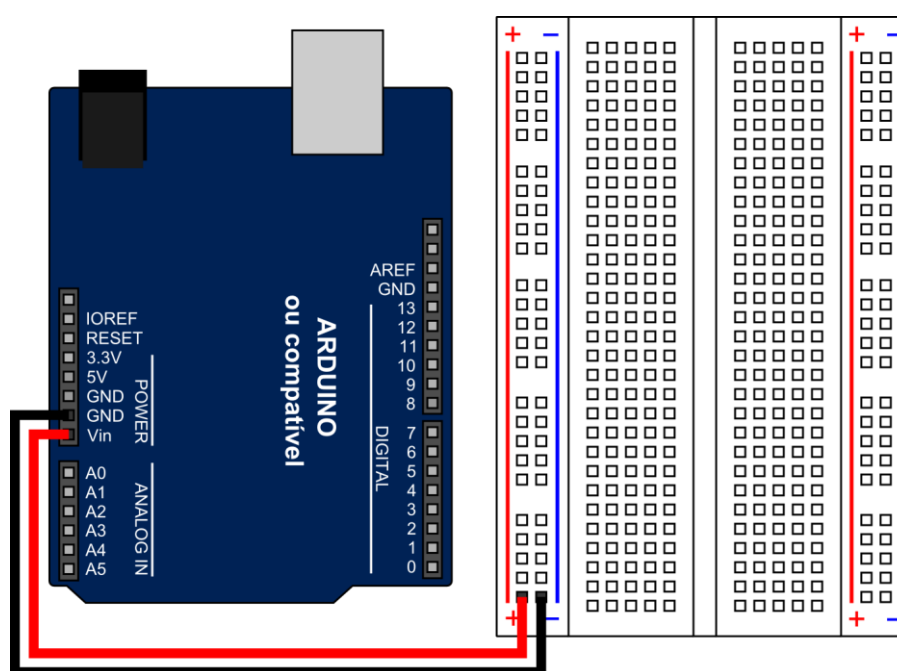


Figura 3.3 - (a) Esquema e (b) ilustração do circuito de ligação de um servo.

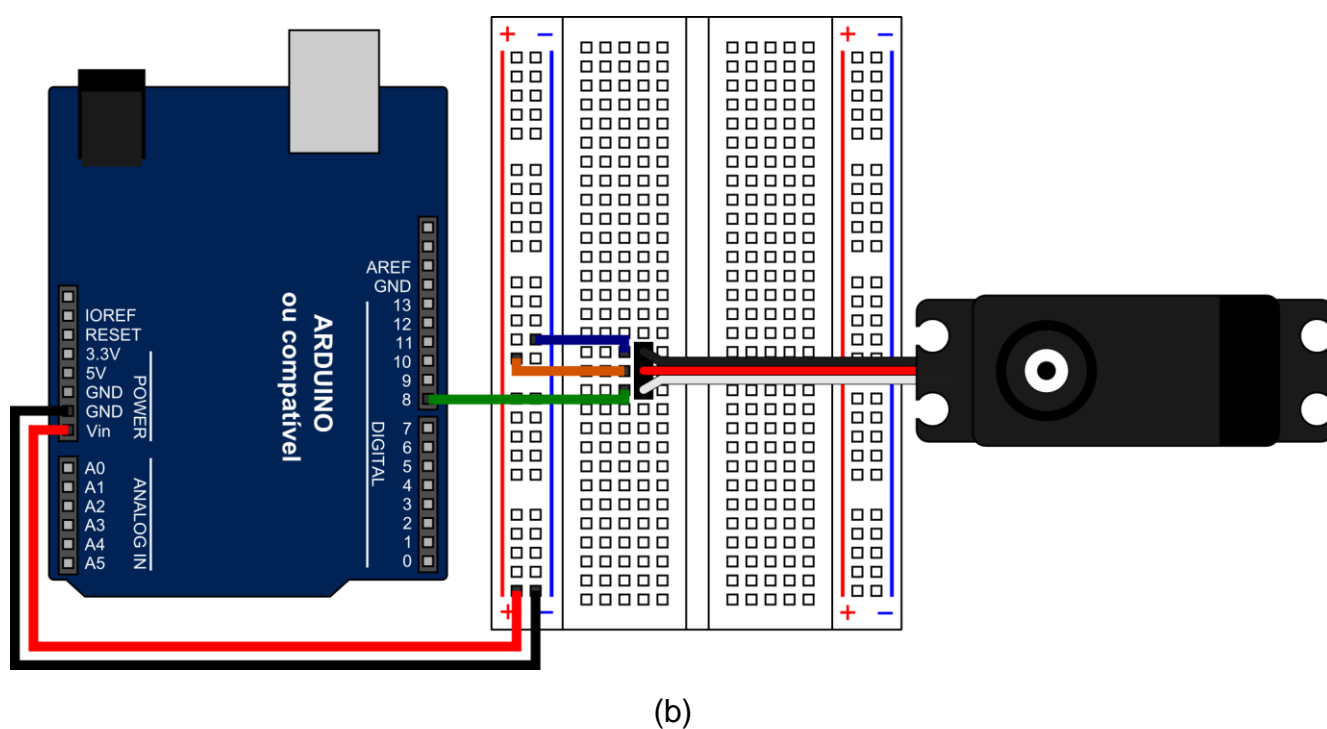
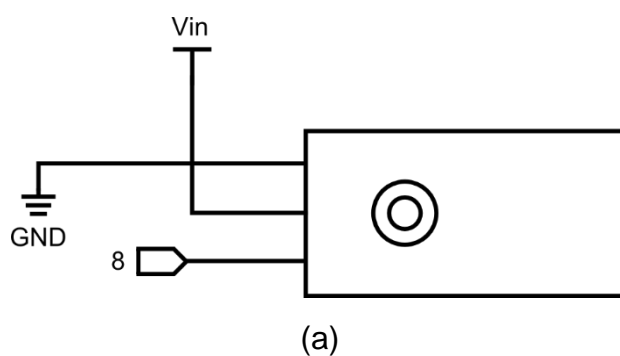


Figura 3.4 - Usando a barra de pinos para conectar um servo na protoboard.

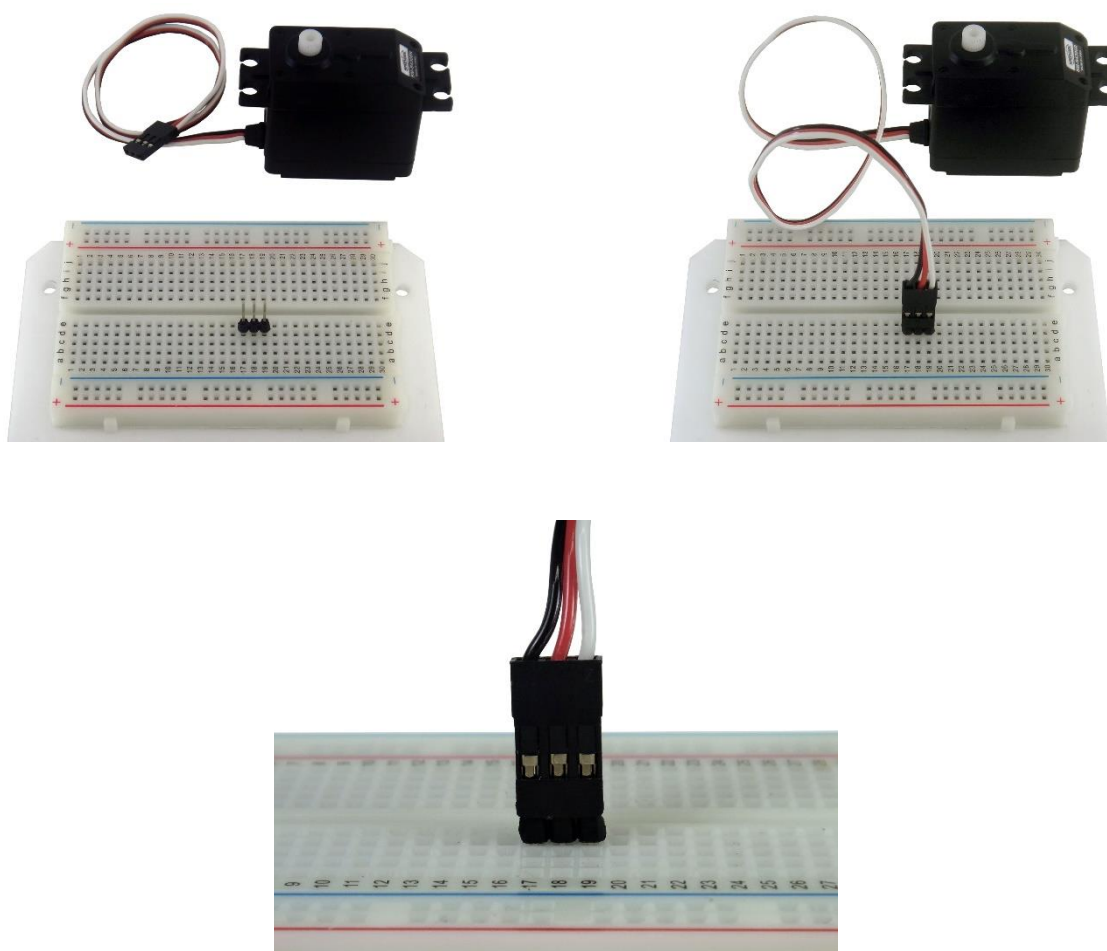


Figura 3.5 - Pulsos com larguras diferentes e os movimentos que eles provocam.

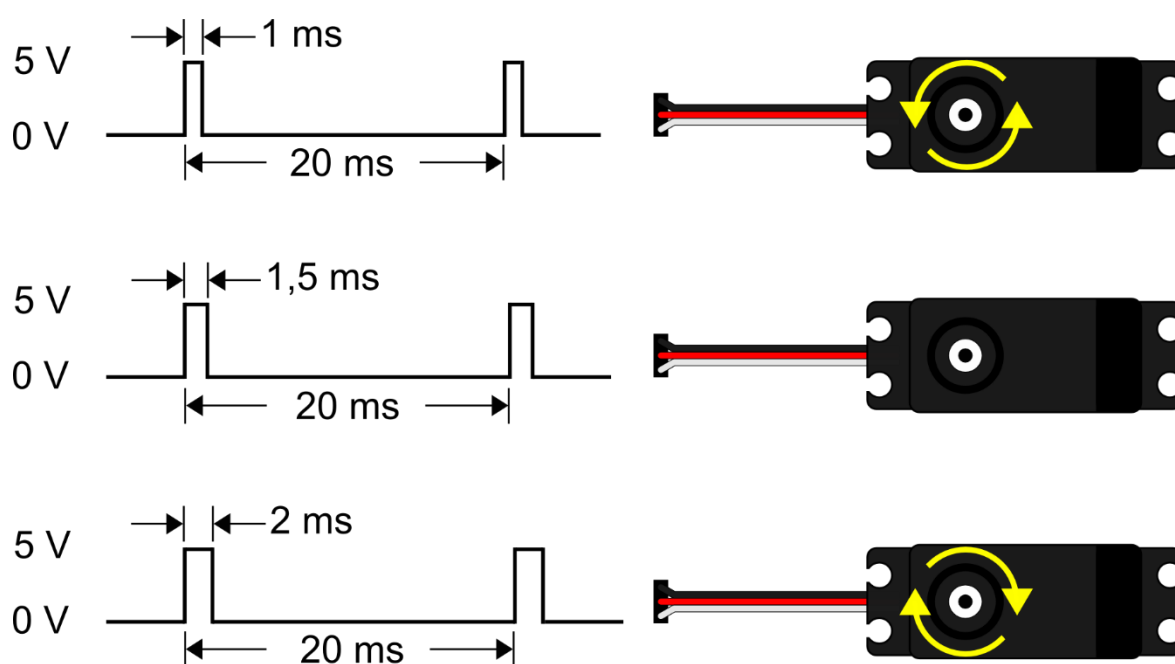


Figura 3.6 - Calibrando um servomotor.

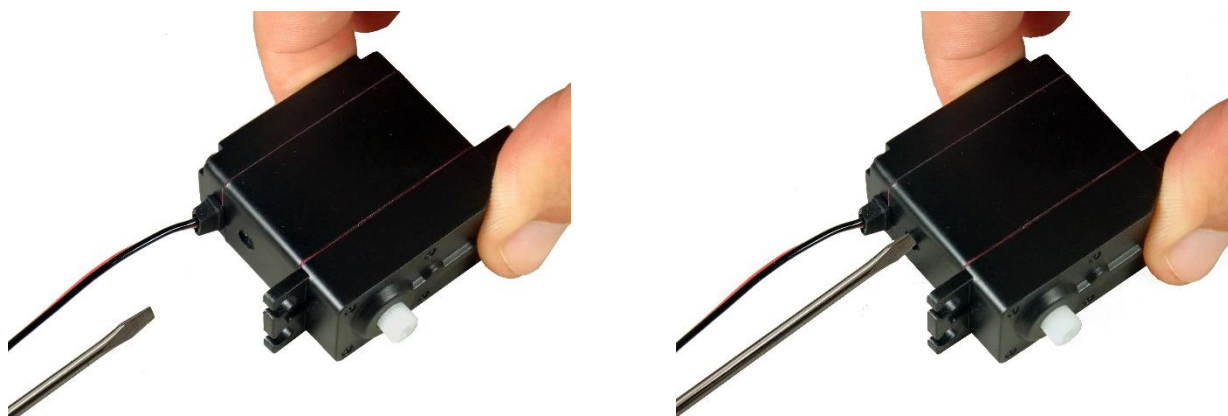
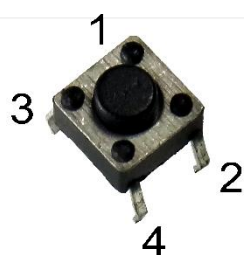
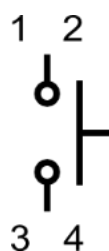


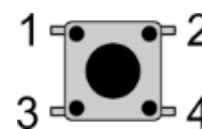
Figura 4.1 - (a) Imagem de uma chave táctil, (b) seu símbolo no esquema dos circuitos e (c) a figura que a representa na ilustração dos circuitos montados.



(a)

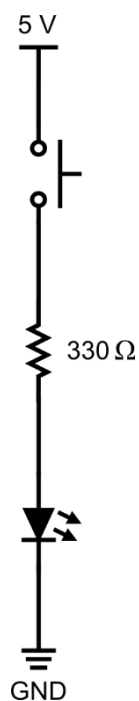


(b)

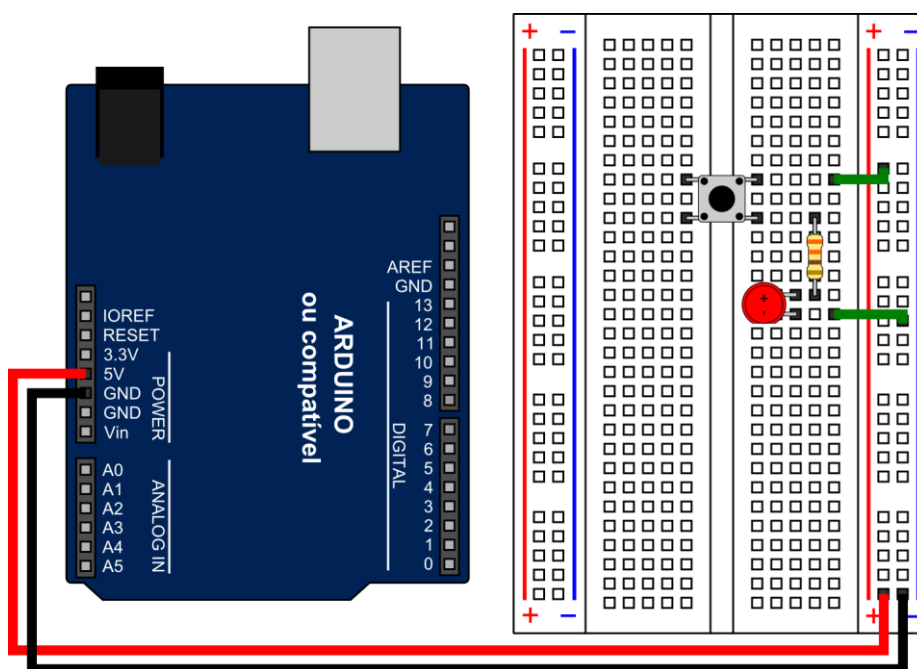


(c)

Figura 4.2 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 11.

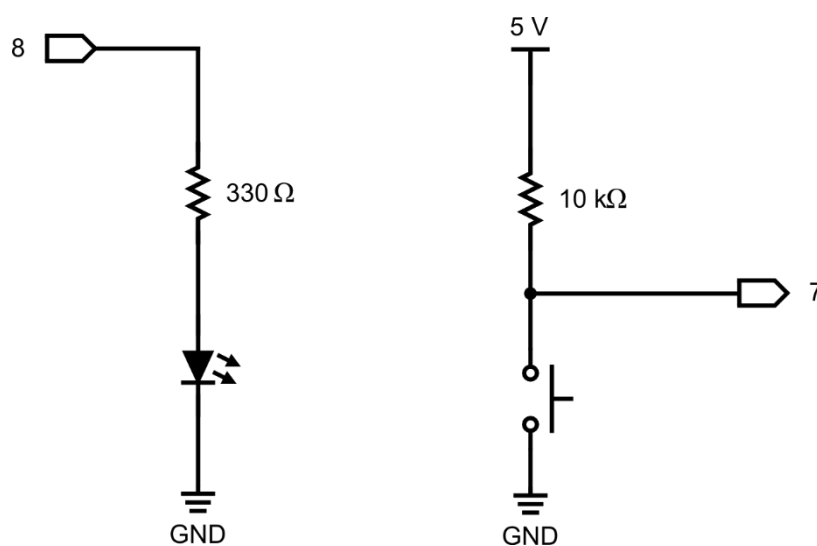


(a)

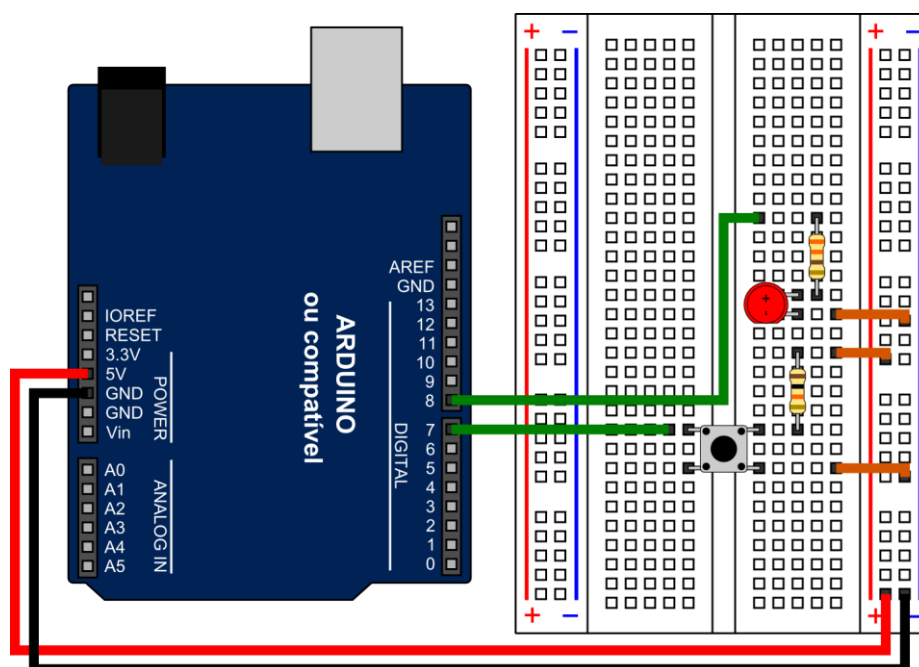


(b)

Figura 4.3 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 12.

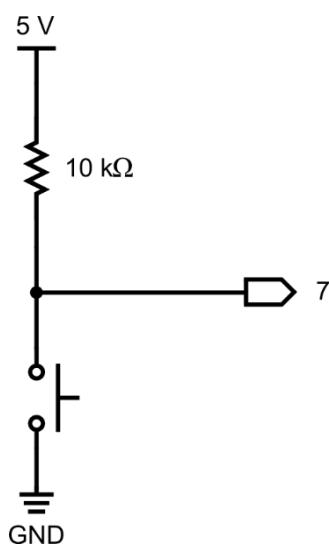


(a)

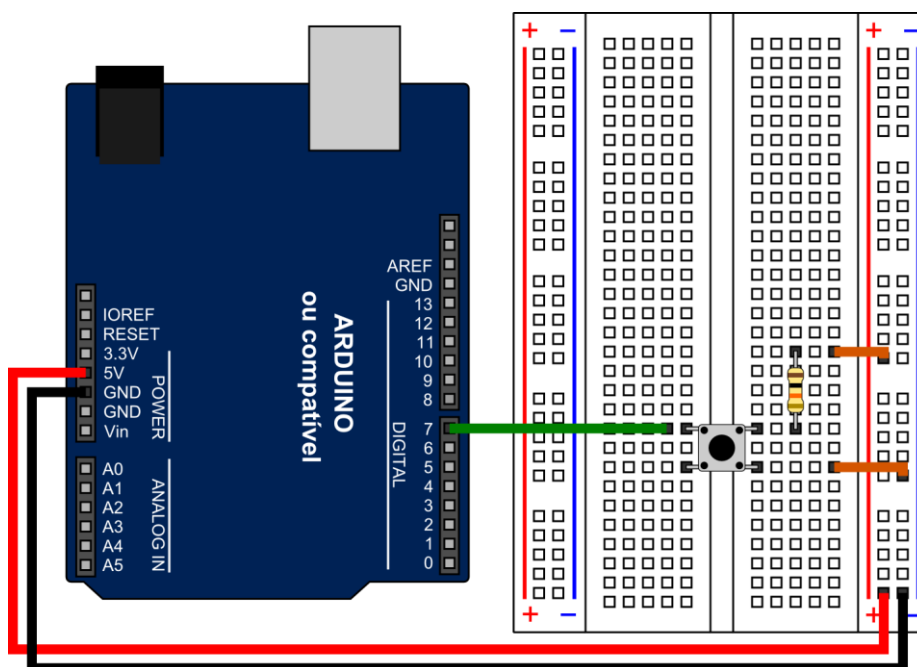


(b)

Figura 4.4 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 13.



(a)



(b)

Figura 4.5 - (a) Imagem de uma micro chave, (b) seu símbolo no esquema dos circuitos e (c) a figura que a representa na ilustração dos circuitos montados.

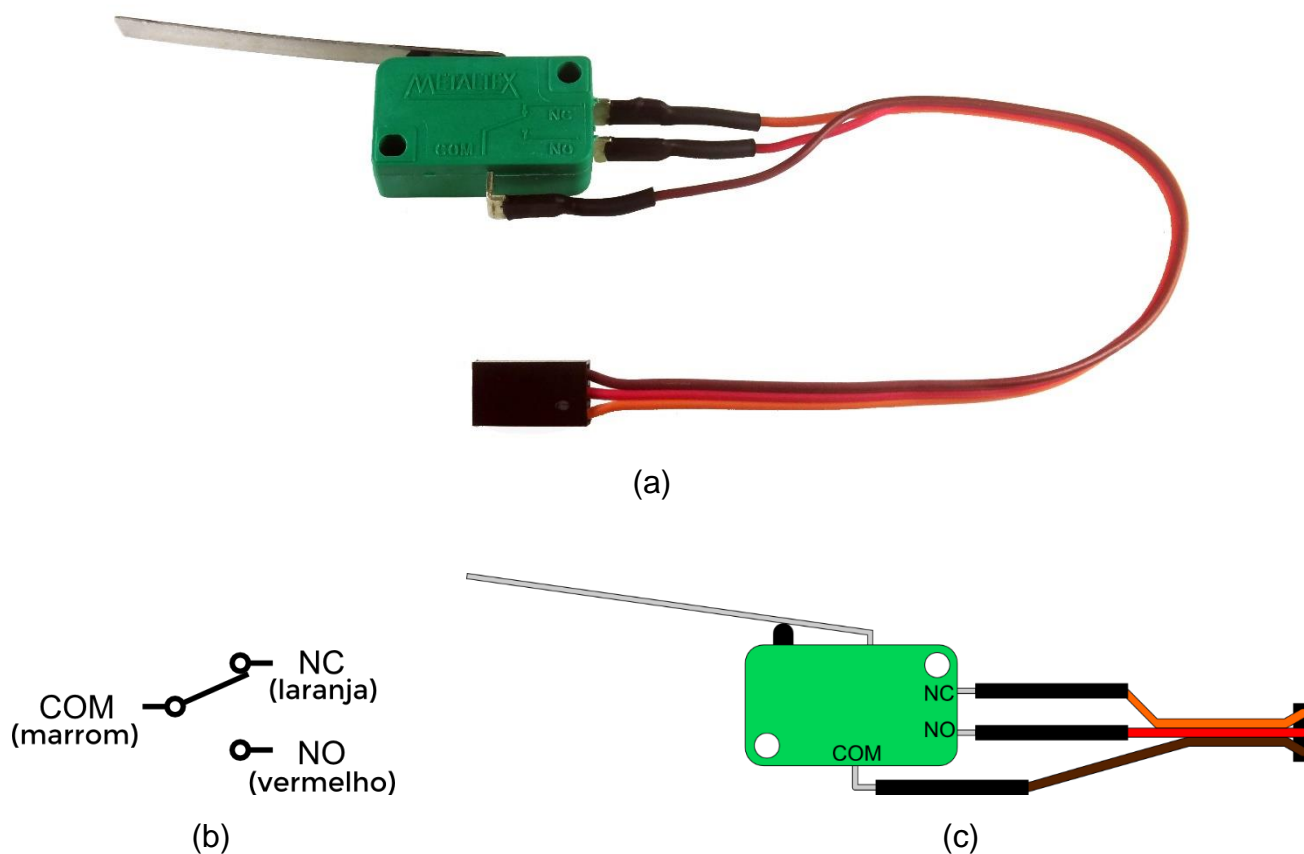


Figura 4.6 - Usando uma barra de pinos para conectar uma micro chave na protoboard.

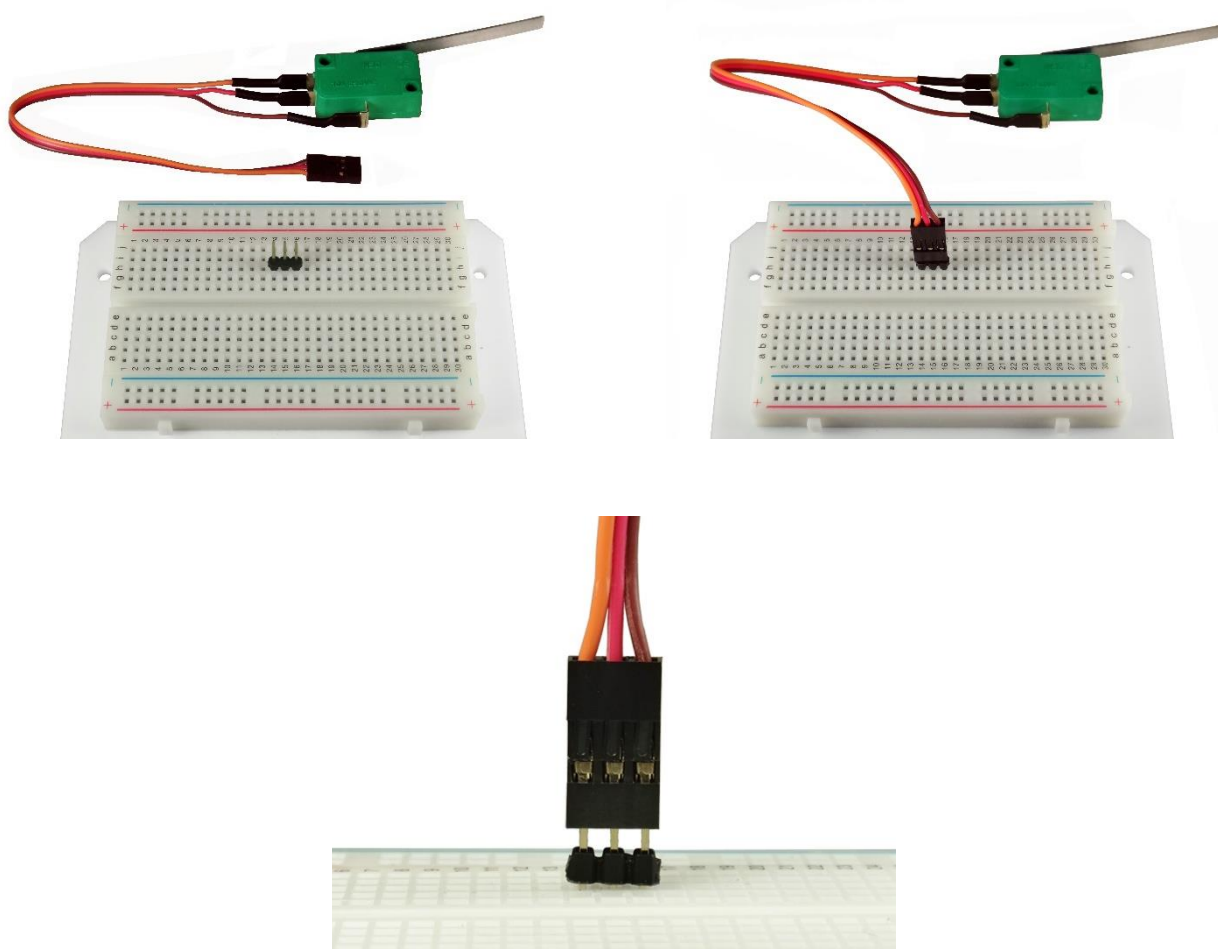
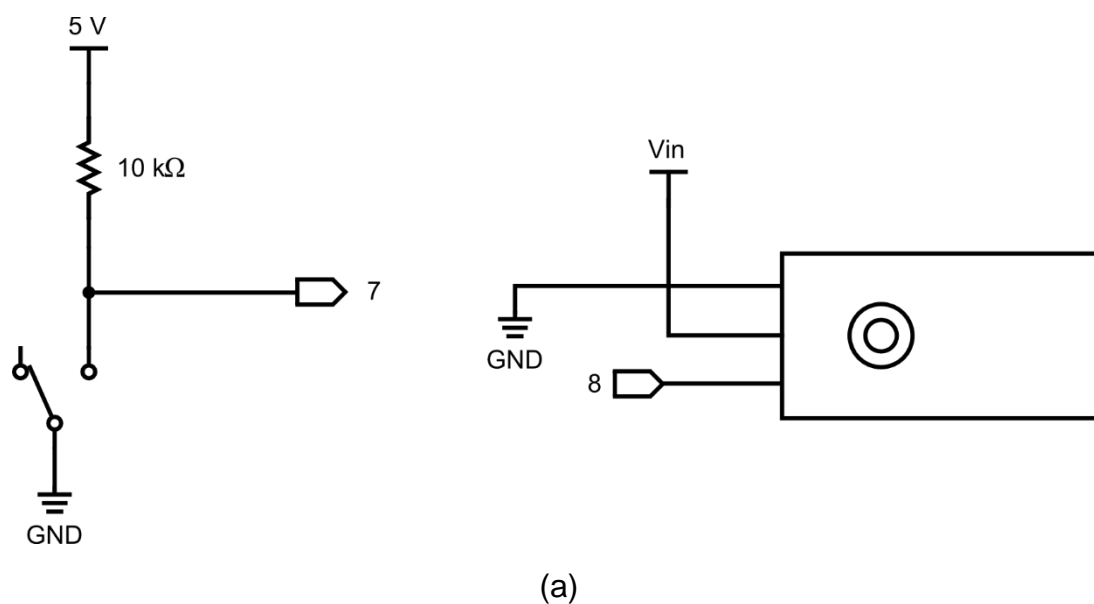
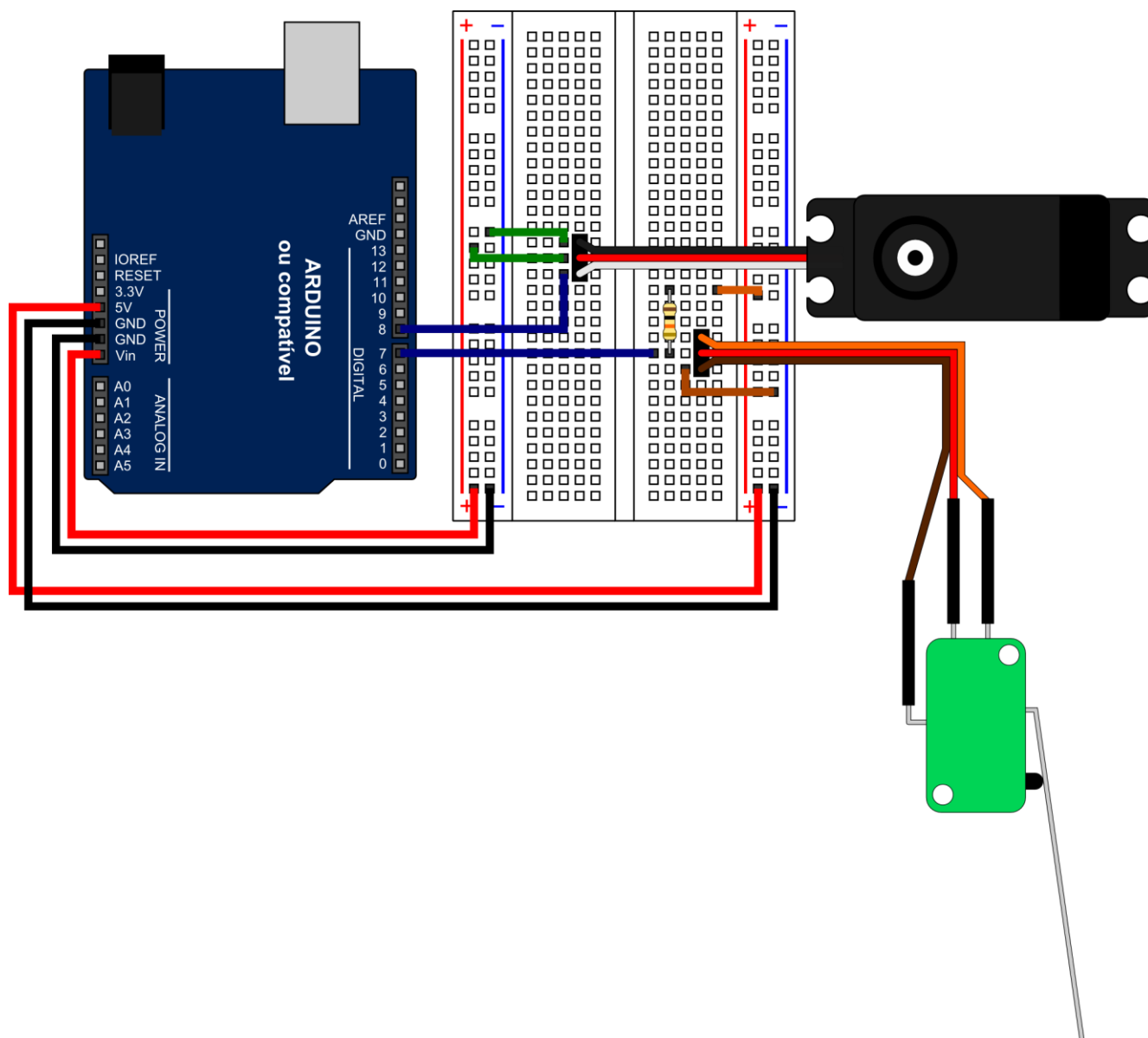


Figura 4.7 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 14.



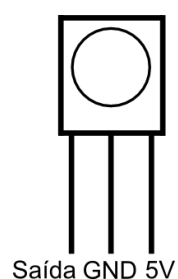


(b)

Figura 4.8 - (a) Imagem de um receptor de infravermelho, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

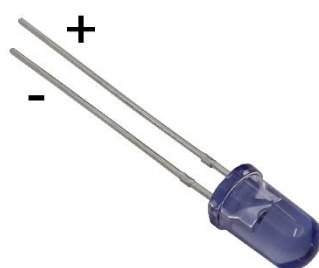


(b)

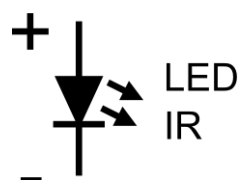


(c)

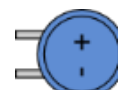
Figura 4.9 - (a) Imagem de um LED infravermelho, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

Figura 4.10 - Suporte para LED.



Figura 4.11 - Montagem do LED infravermelho dentro do suporte para LED.

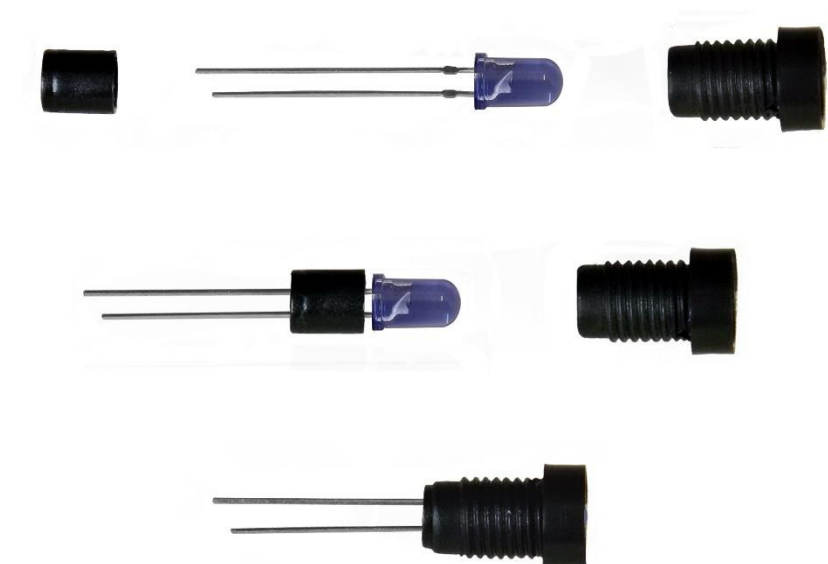


Figura 4.12 - Usando uma barra de pinos para conectar um cabo extensor na protoboard.

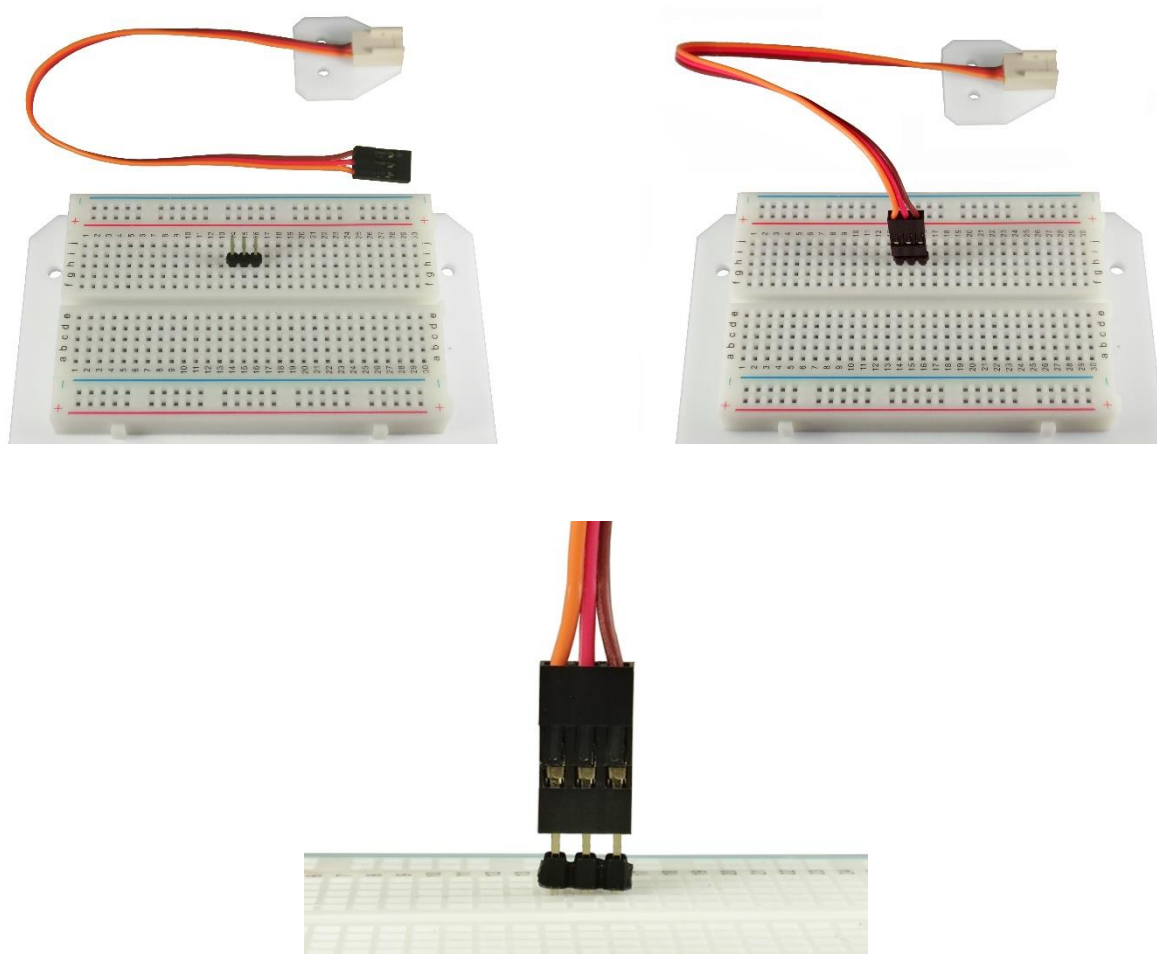


Figura 4.13 - Conectando um receptor de infravermelho em um cabo extensor.



Figura 4.14 - Diferentes formas de prender um cabo extensor no chassi.

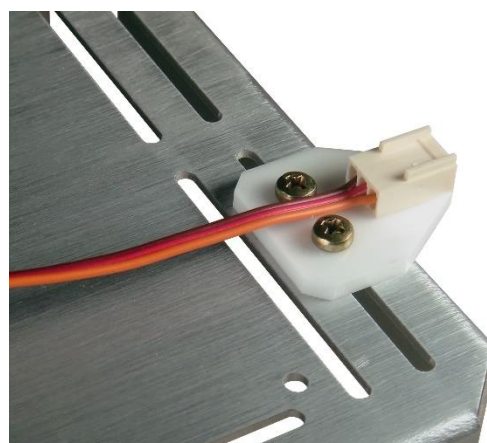
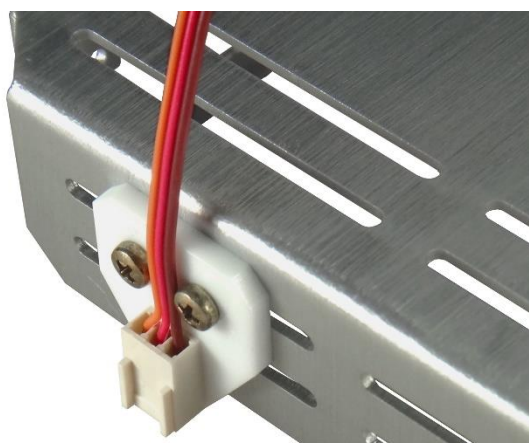


Figura 4.15 - Diferentes maneiras de fixar os suportes no chassi.



Figura 4.16 - Diferentes maneiras de fixar os cabos extensores nos suportes.



Figura 4.17 - Prendendo os cabos extensores no suporte.

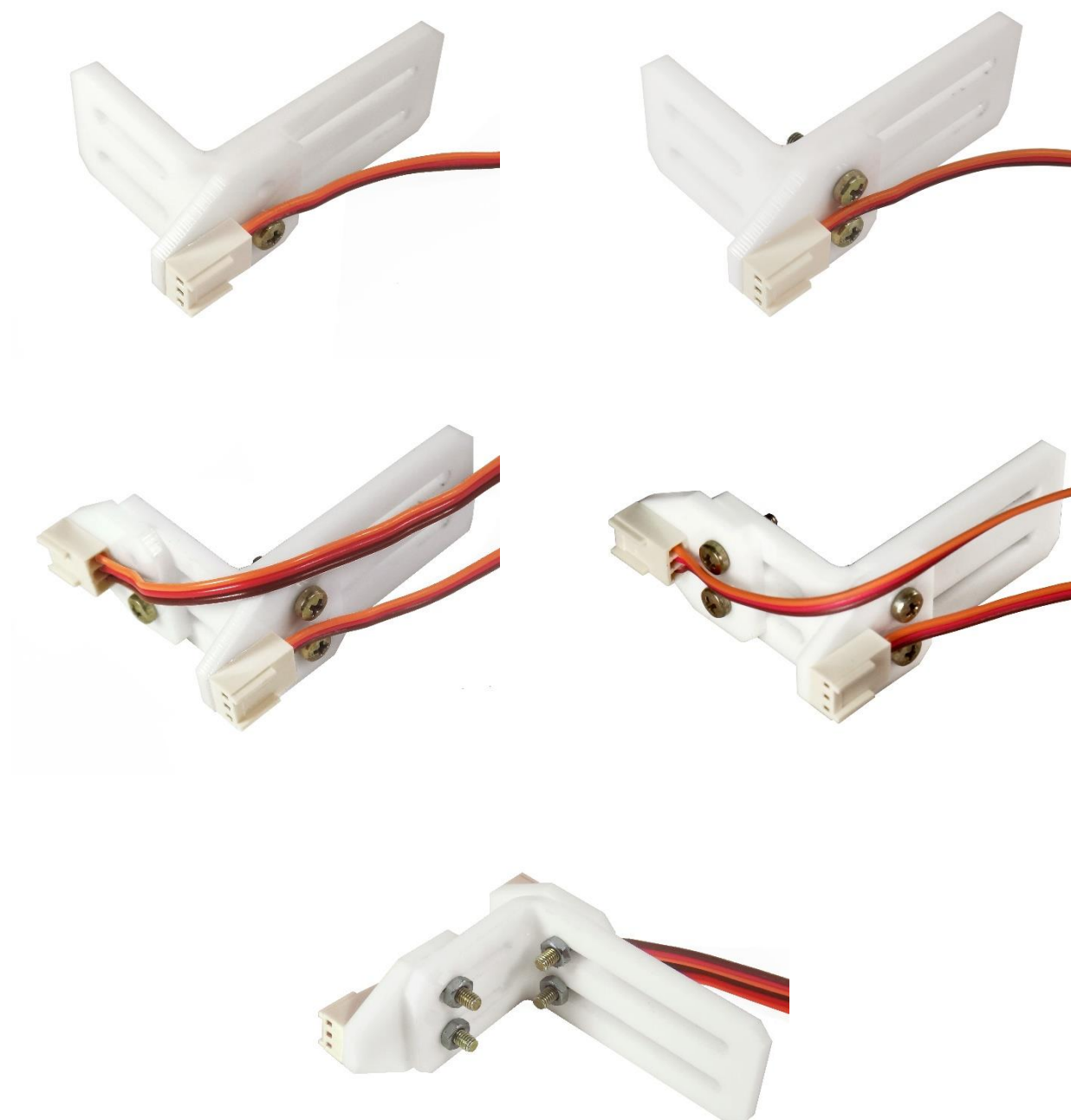


Figura 4.18 - Montando o LED infravermelho dentro do suporte para LED.

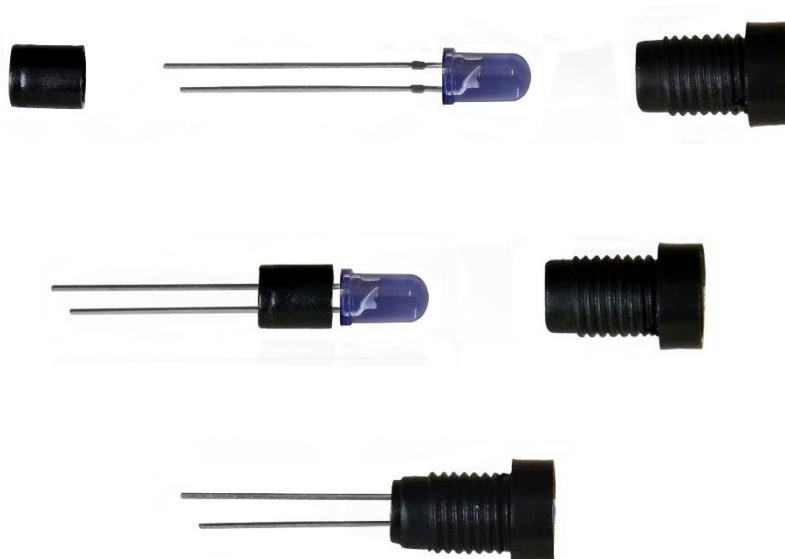


Figura 4.19 - Conectando o LED infravermelho no cabo extensor.

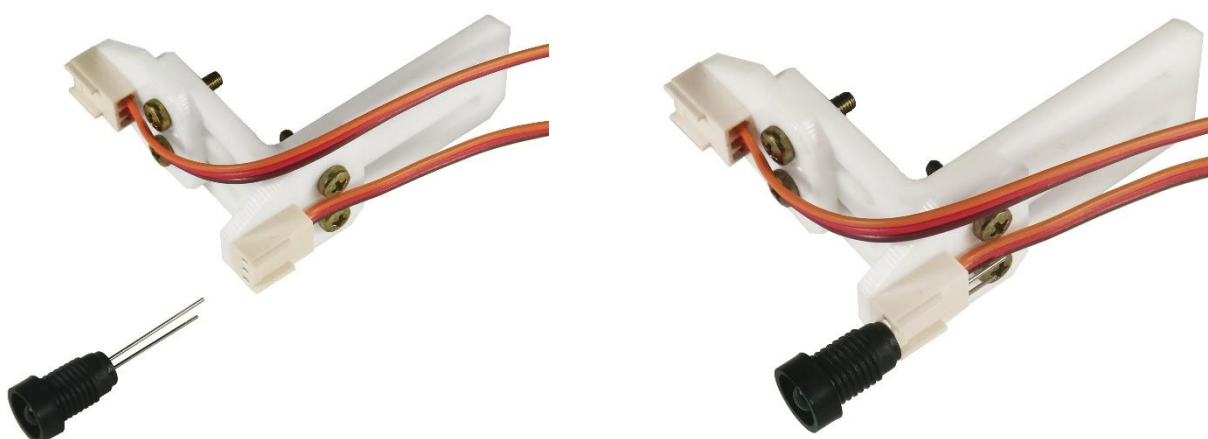


Figura 4.20 - Conectando o receptor de infravermelho no cabo extensor.



Figura 4.21 - Ligando os cabos extensores na protoboard.

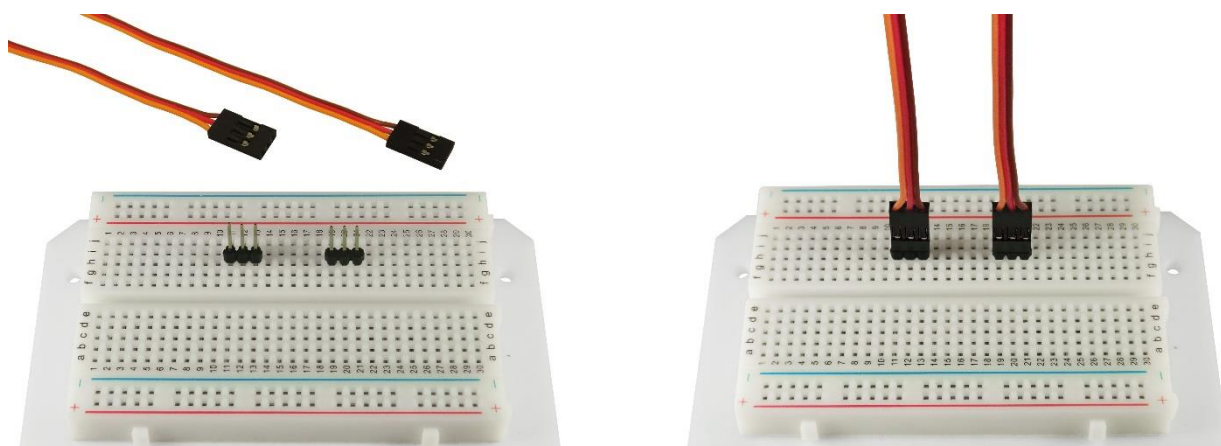


Figura 4.22 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 15.

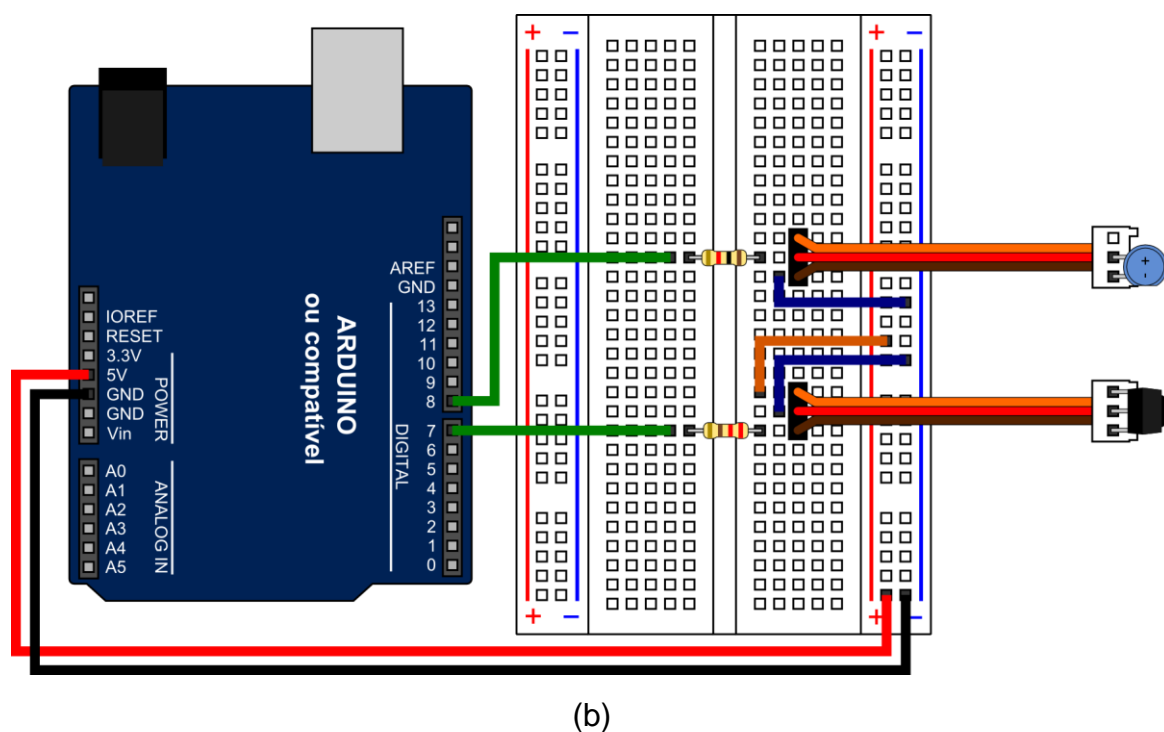
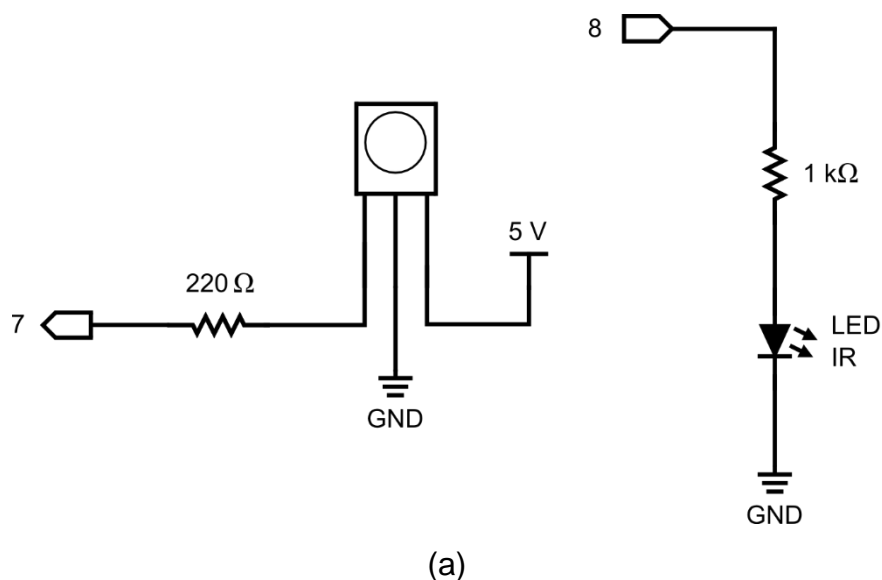


Figura 4.23 - Luz infravermelha sendo (a) refletida e
(b) não refletida por um objeto.

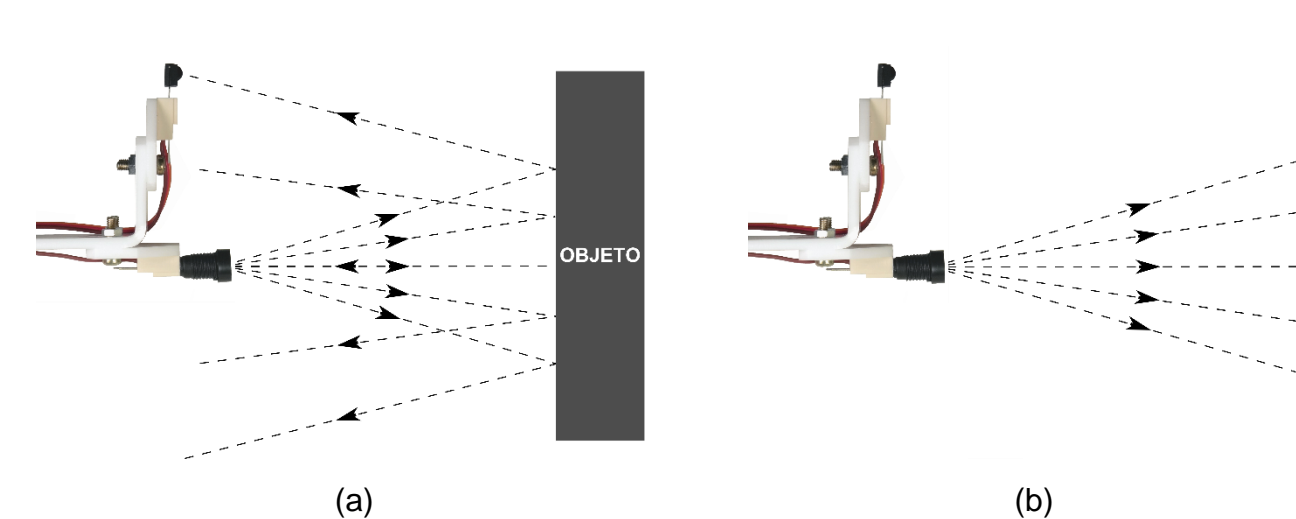


Figura 4.24 - Identificação de regiões de detecção.

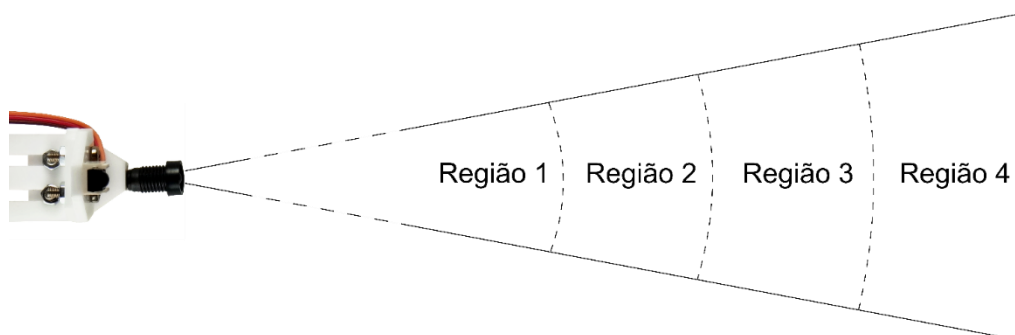


Figura 4.25 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 17.

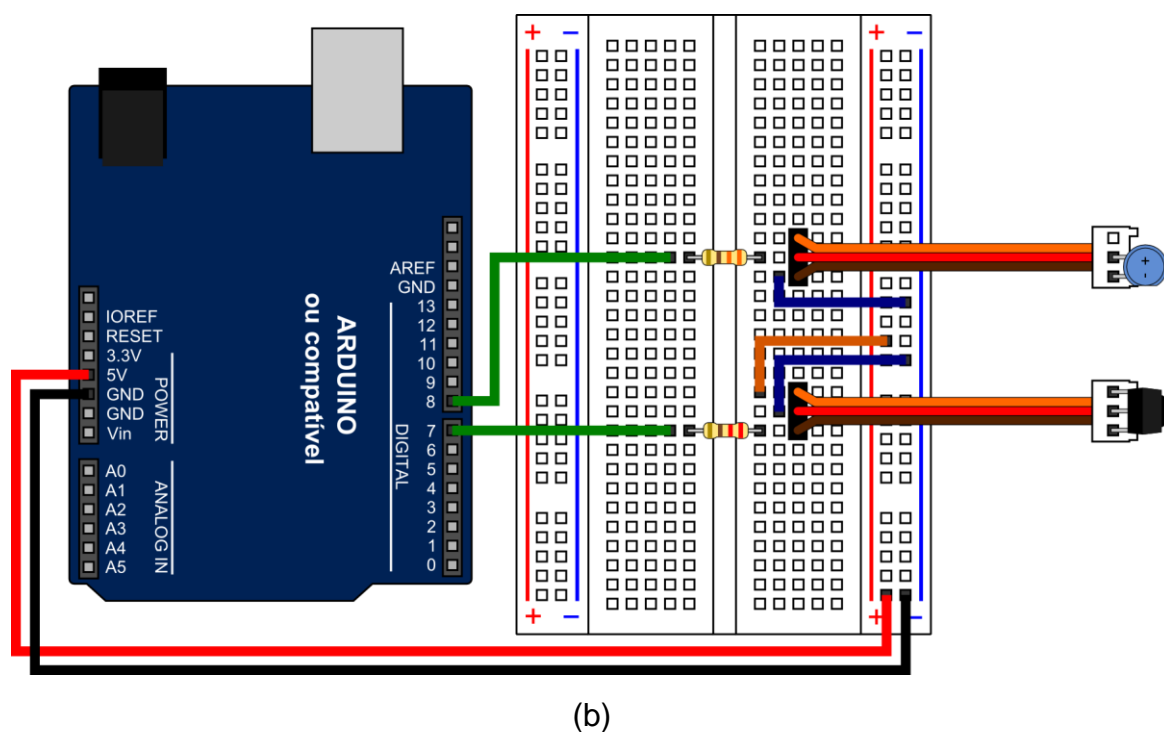
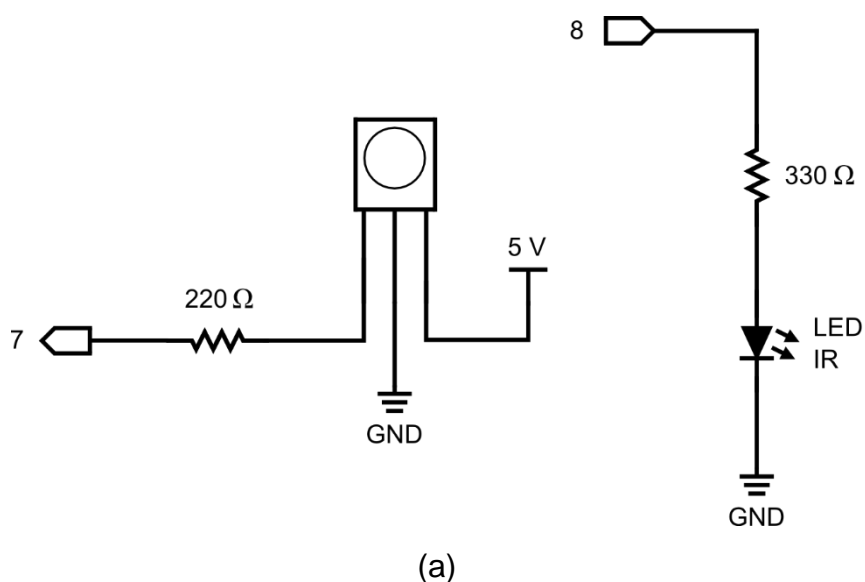
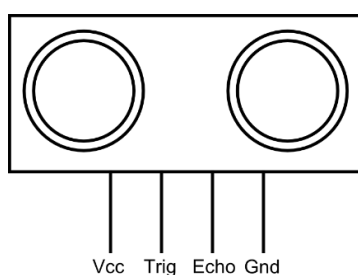


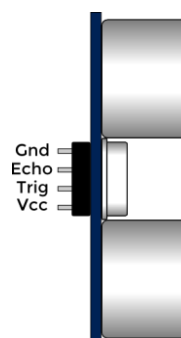
Figura 5.1 - (a) Imagem de um sensor de ultrassom, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

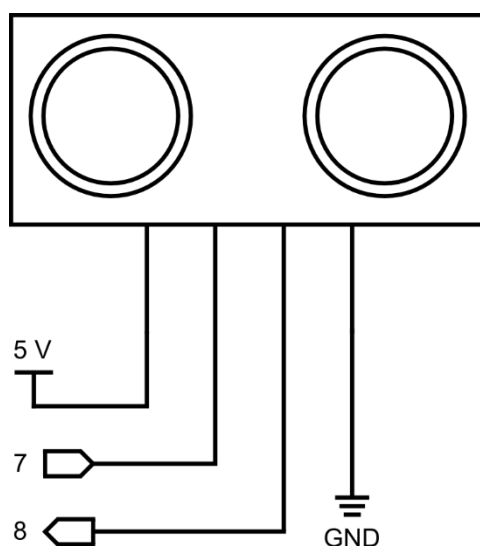


(b)

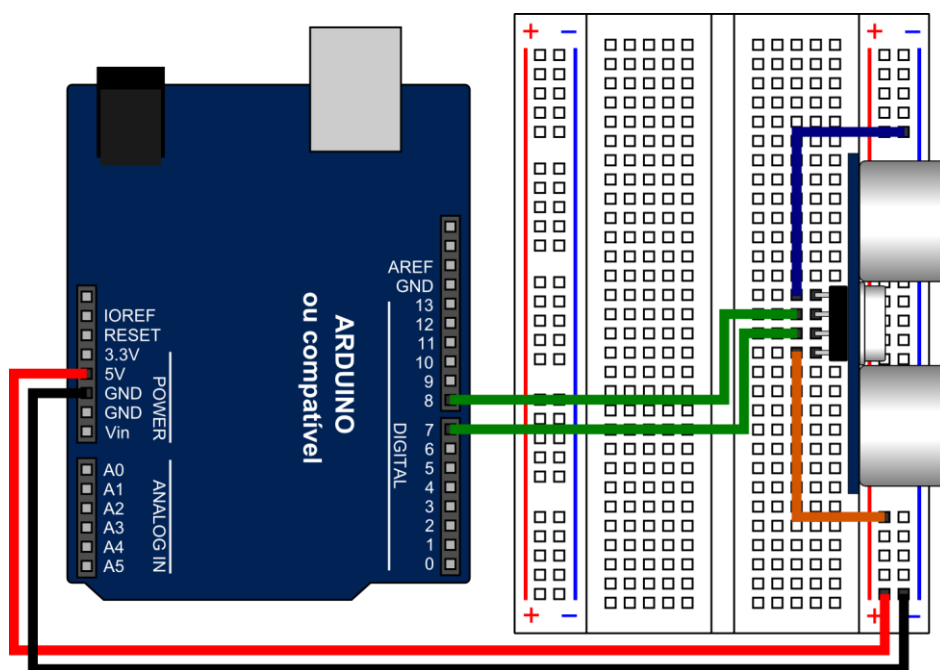


(c)

Figura 5.2 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 18.



(a)



(b)

Figura 5.3 - (1) Pulso no pino Trig, (2) sinal no transmissor, (3) sinal no receptor e (4) pulso no pino Echo.

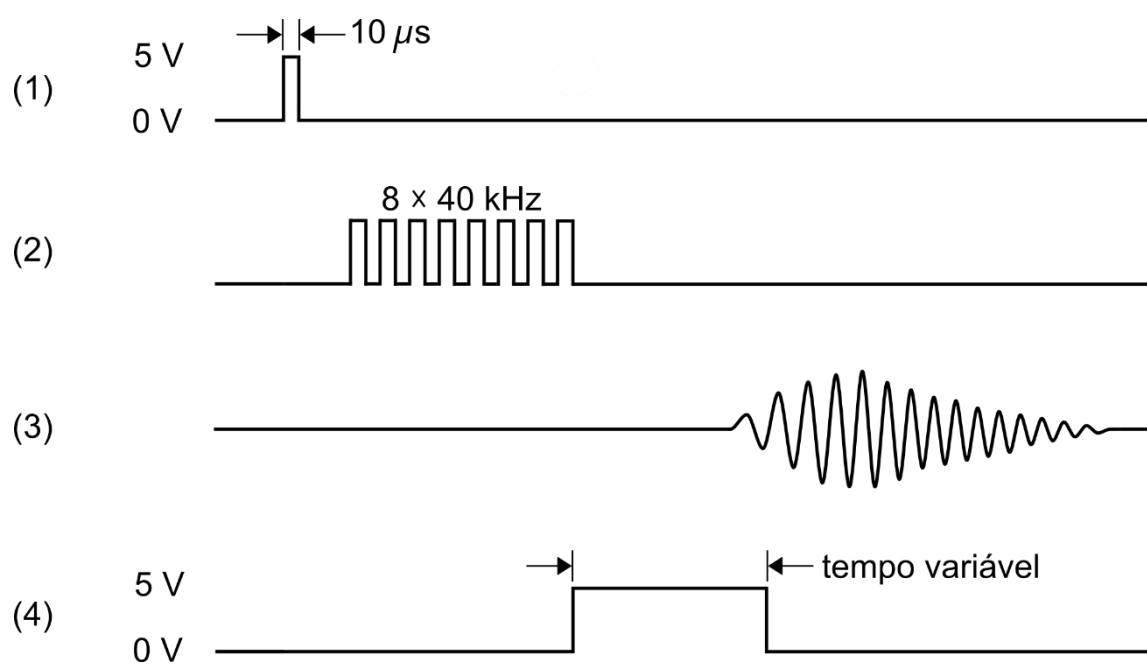


Figura 5.4 - Ondas de ultrassom sendo (a) refletidas e (b) não refletidas por um objeto.

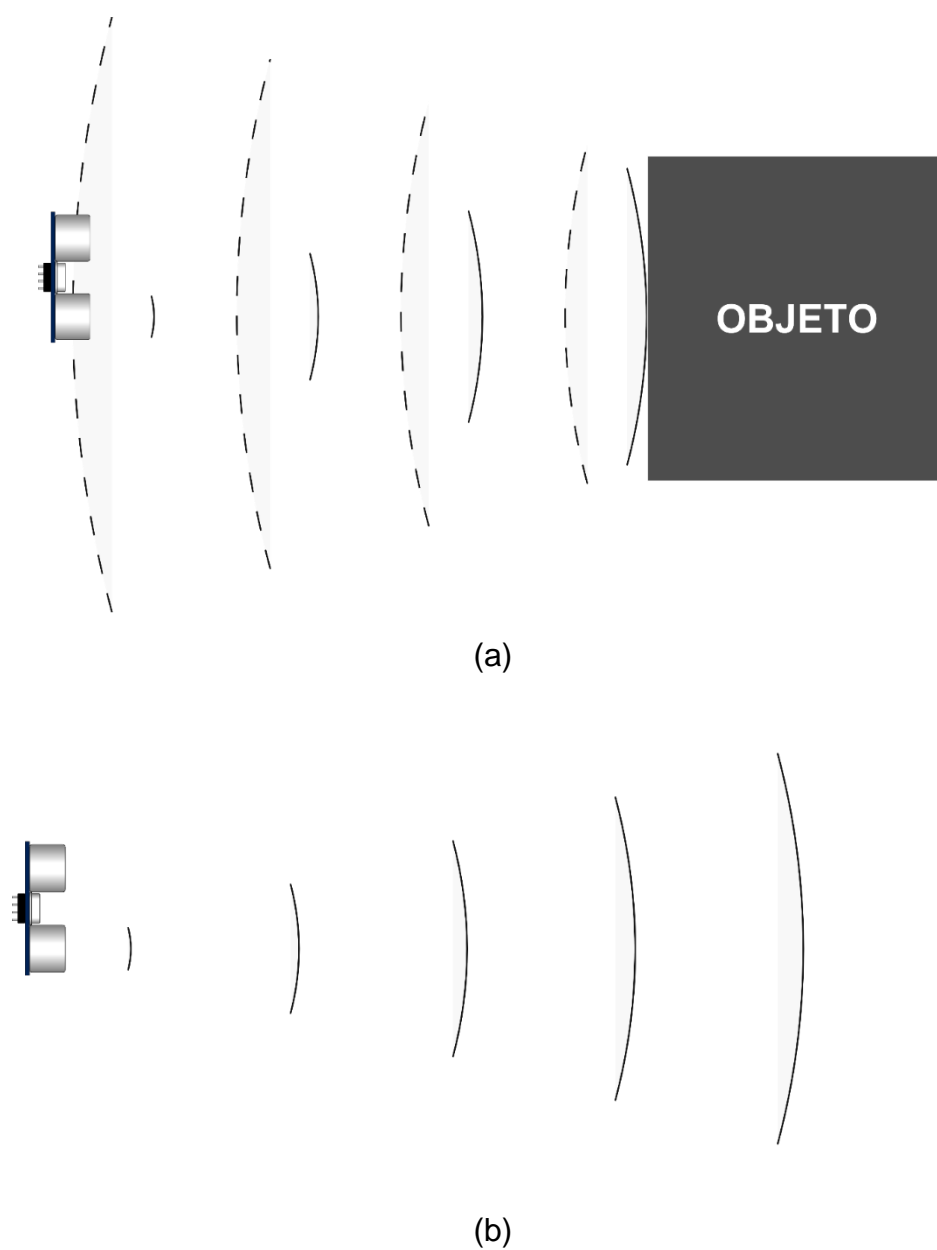


Figura 5.5 - Região onde objetos podem ser detectados pelo sensor de ultrassom.

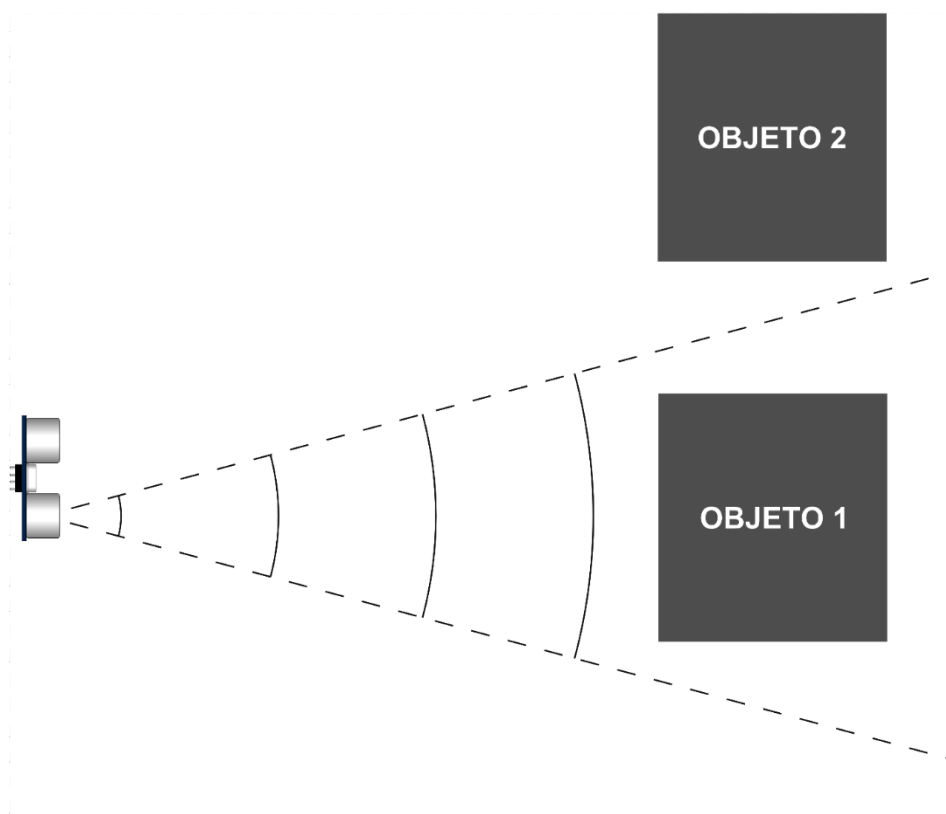
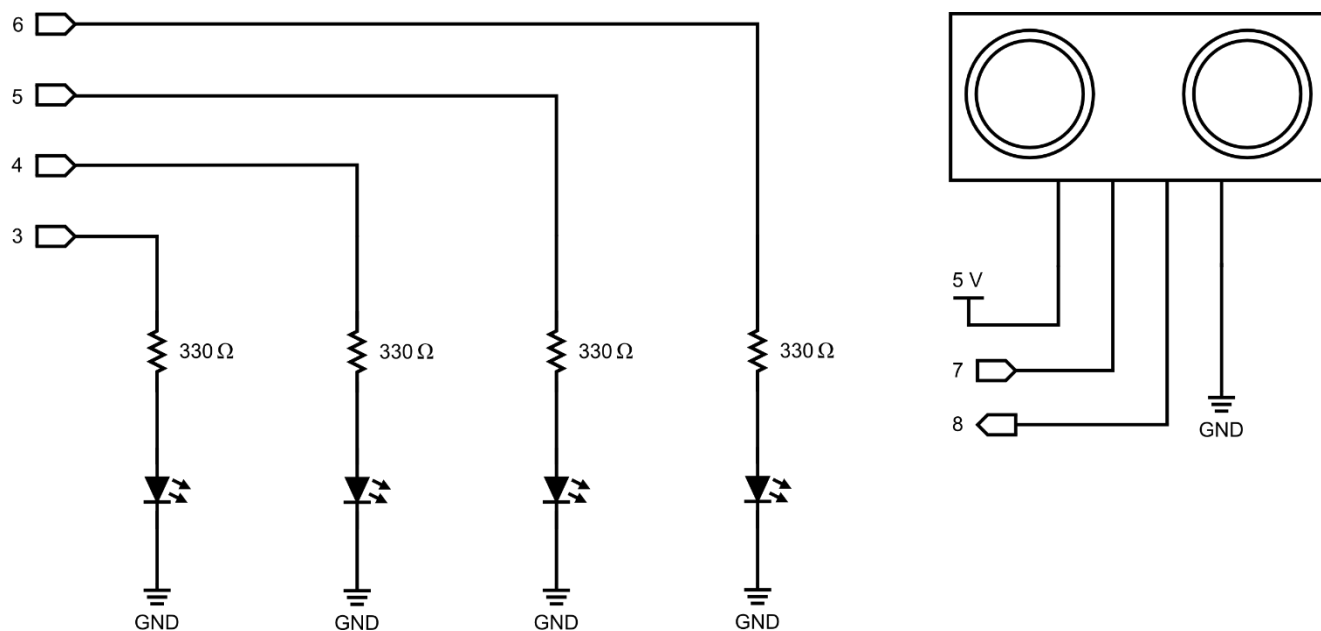
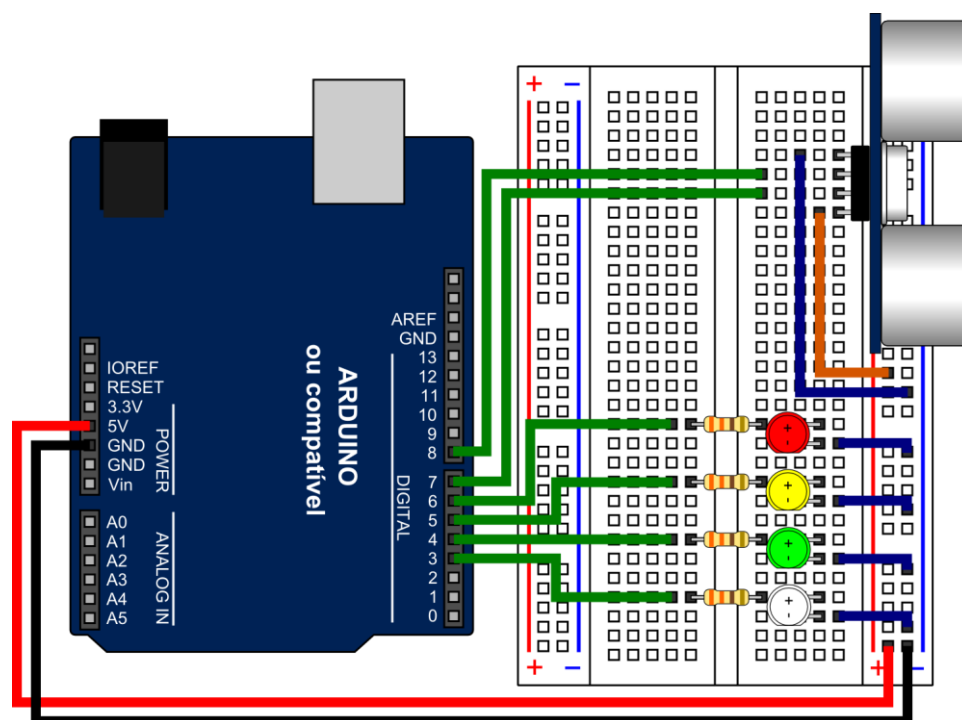


Figura 5.6 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 19.

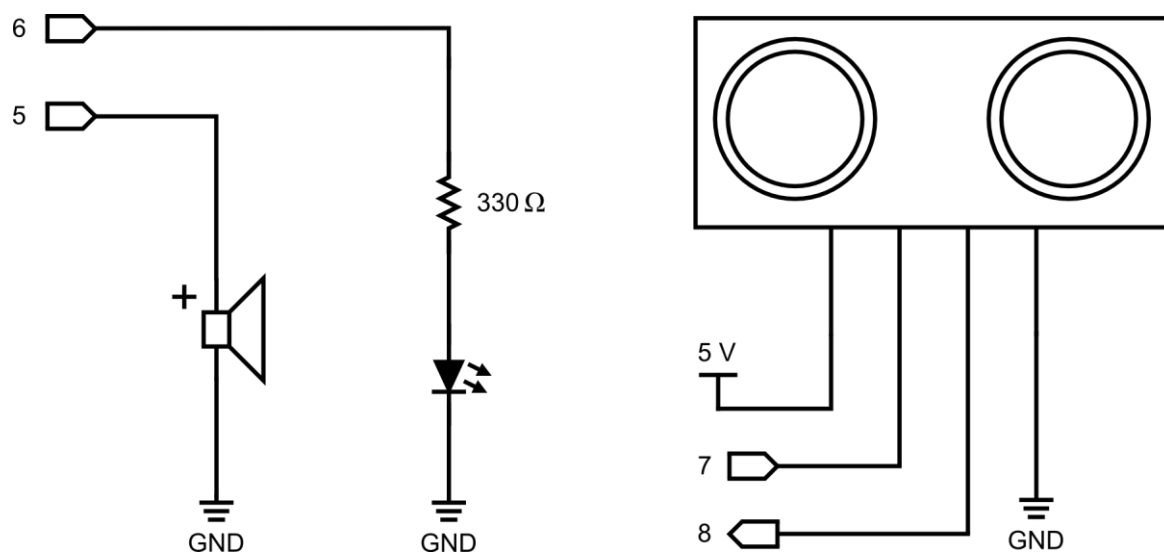


(a)

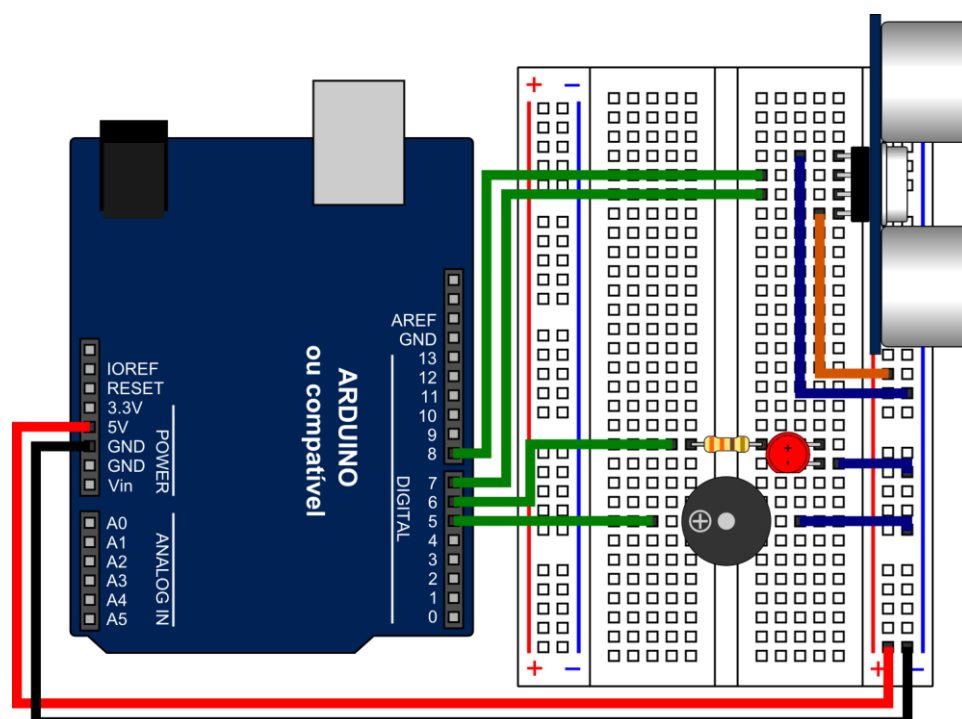


(b)

Figura 5.7 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 20.

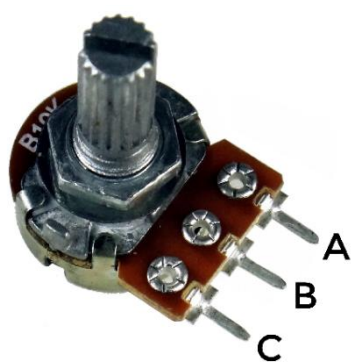


(a)

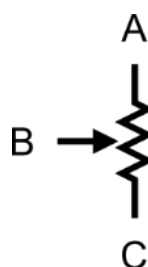


(b)

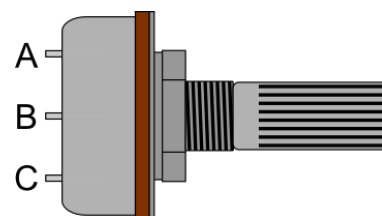
Figura 6.1 - (a) Imagem de um potenciômetro, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

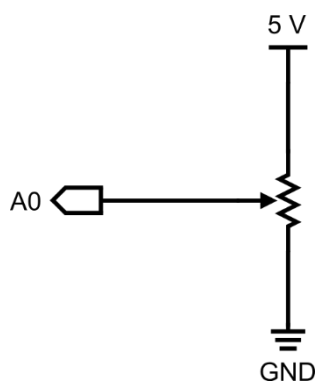


(b)

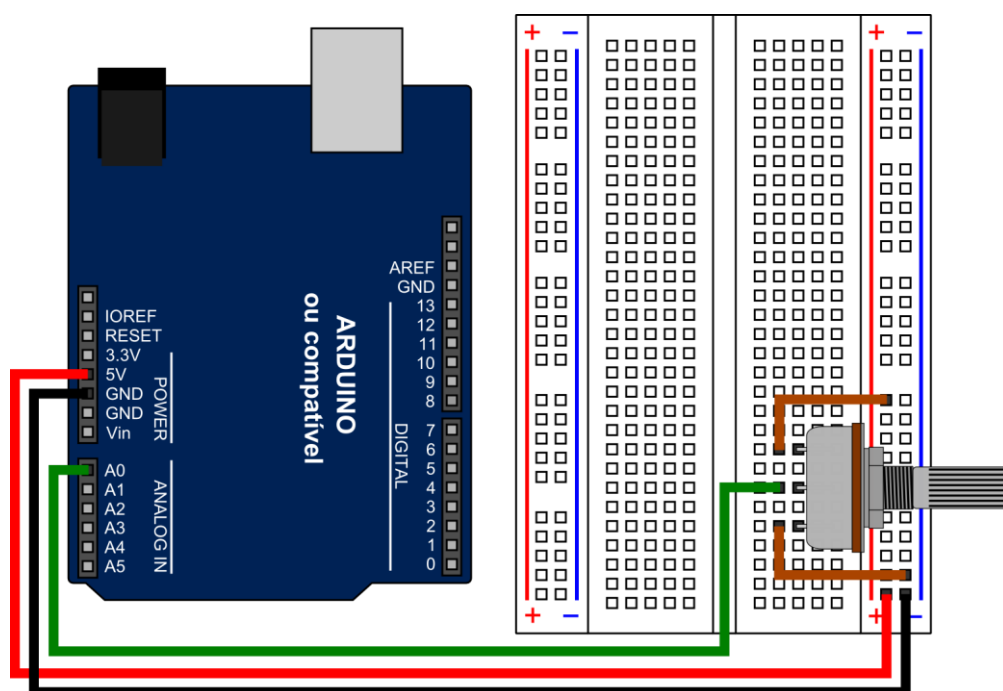


(c)

Figura 6.2 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 21.

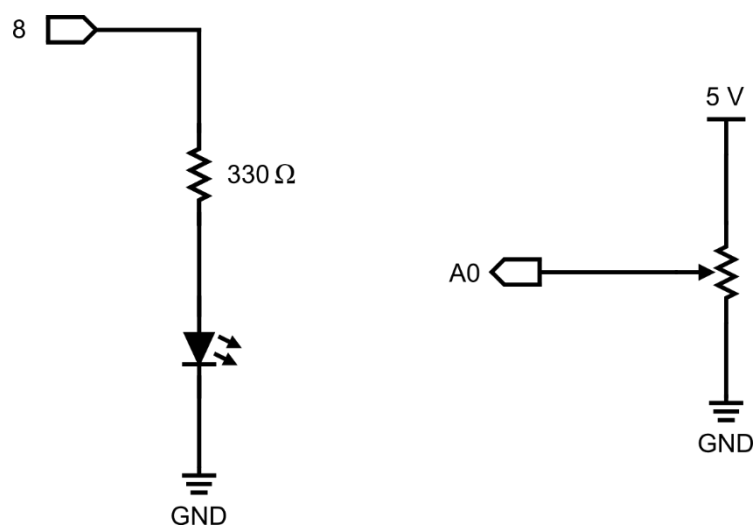


(a)

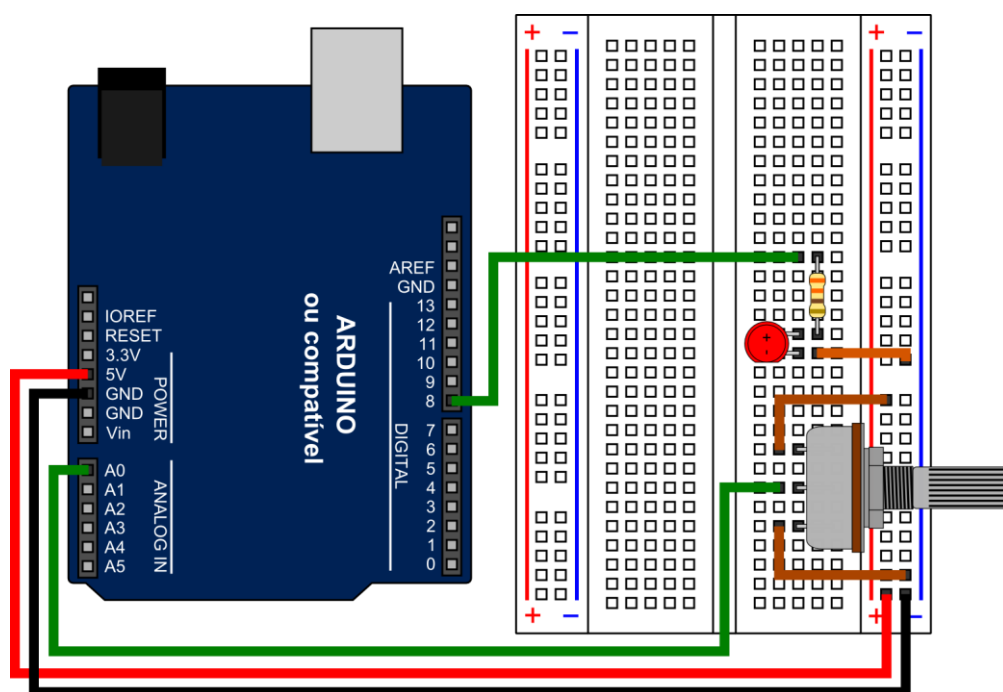


(b)

Figura 6.3 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 23.

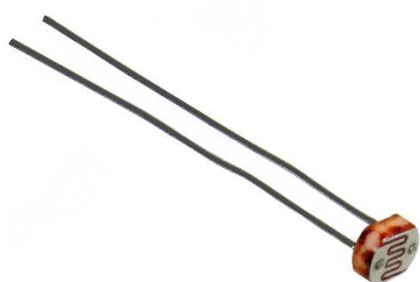


(a)



(b)

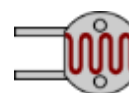
Figura 6.4 - (a) Imagem de um fotoresistor, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

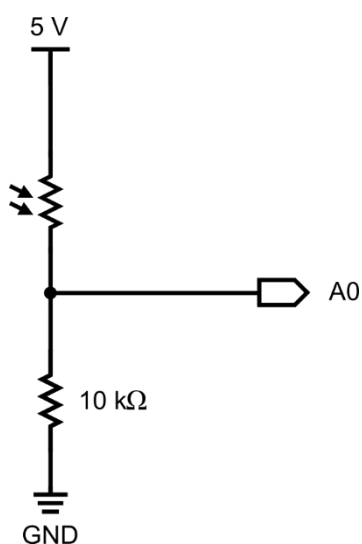


(b)

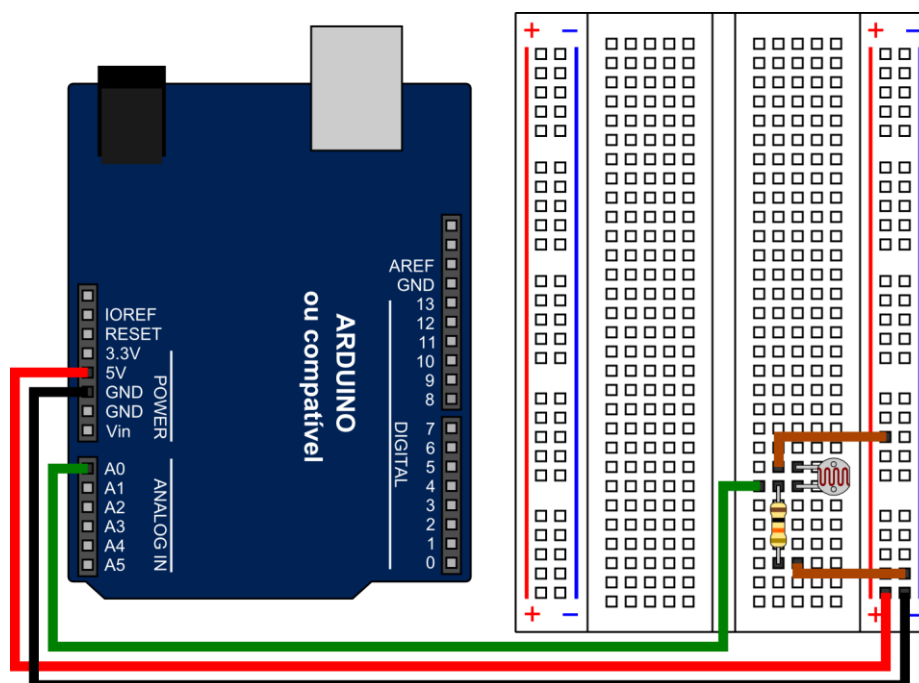


(c)

Figura 6.5 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 24.

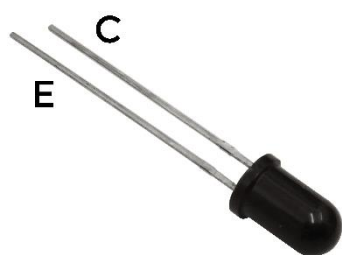


(a)

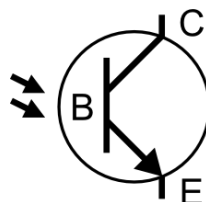


(b)

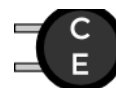
Figura 6.6 - (a) Imagem de um fototransistor, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

Figura 6.7 - Prendendo os cabos extensores nos suportes.

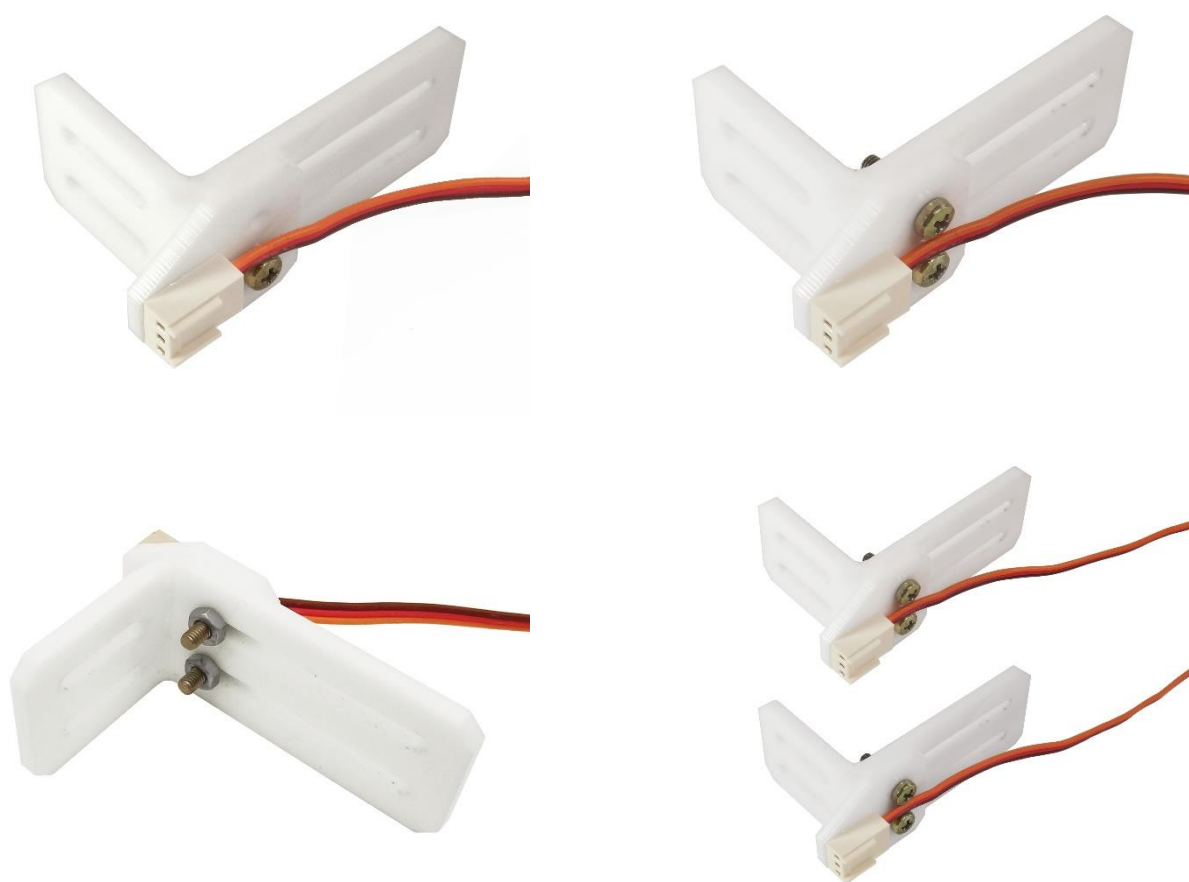


Figura 6.8 - Conectando o fototransistor no cabo extensor.

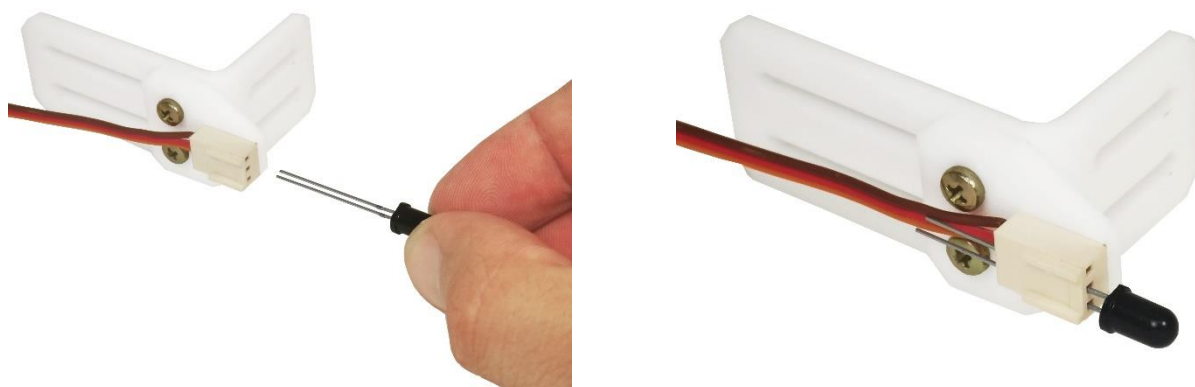


Figura 6.9 - Conectando o LED infravermelho no cabo extensor.

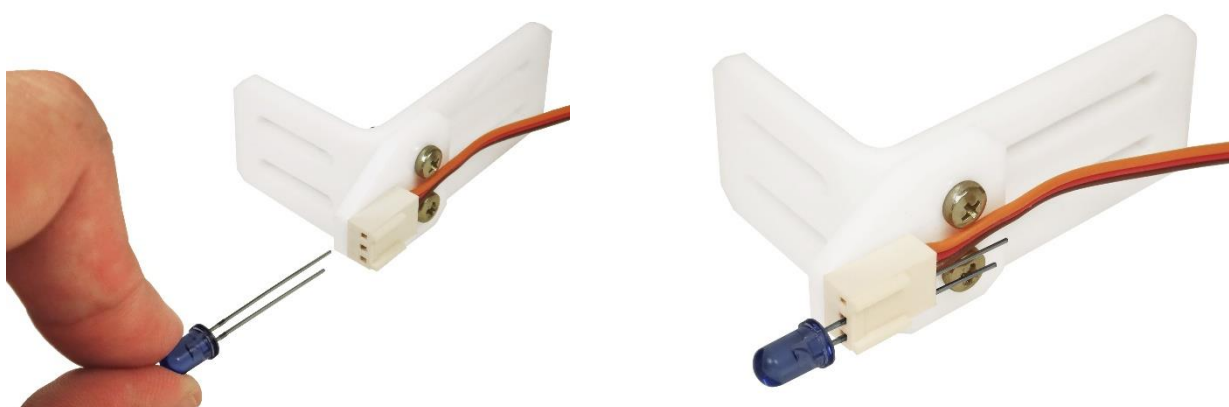


Figura 6.10 - Ligando os cabos extensores na protoboard.

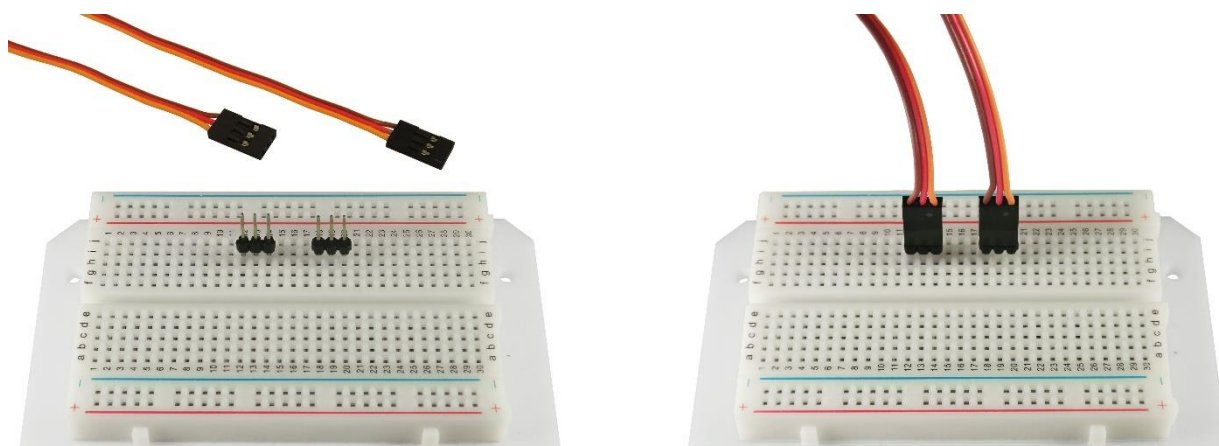
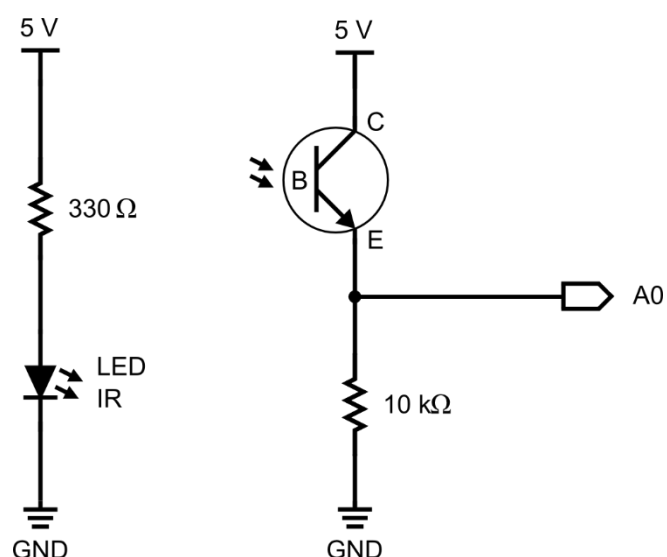


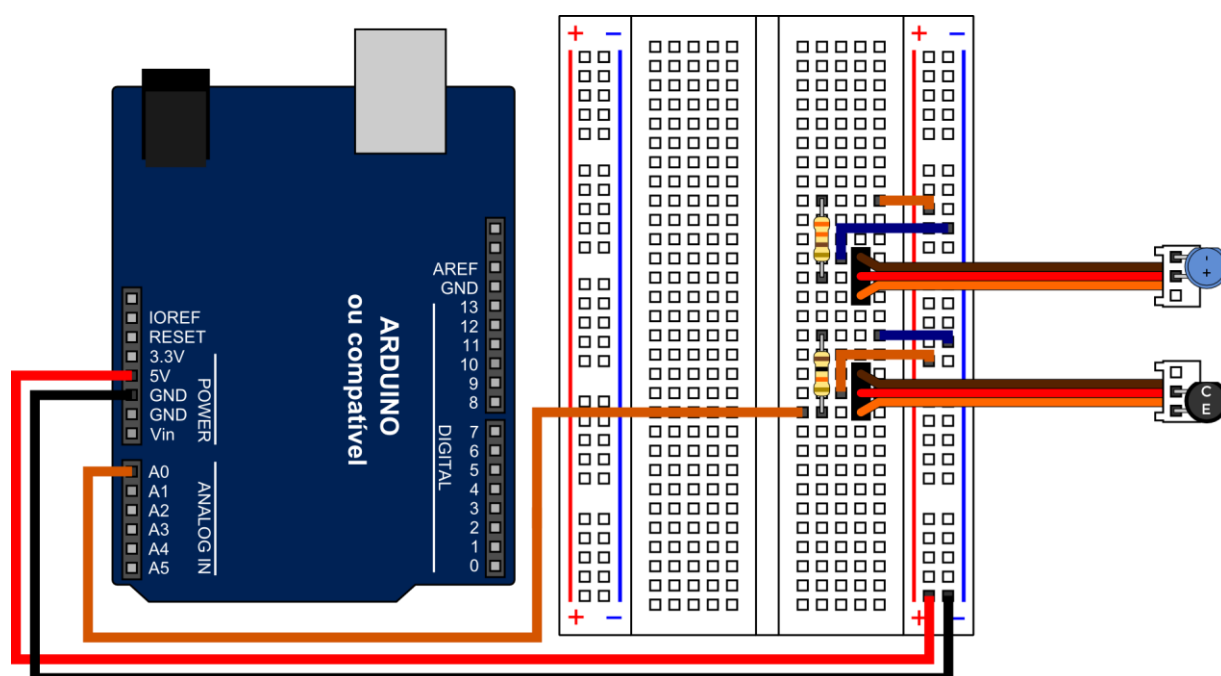
Figura 6.11 - Posicionando o LED infravermelho e o fototransistor.



Figura 6.12 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 25.



(a)



(b)

Figura 6.13 - Luz infravermelha sendo (a) obstruída e (b) não obstruída por um objeto.



Figura 7.1 - Chassi.



Figura 7.2 - Prendendo os espaçadores no chassi.



Figura 7.3 - Prendendo os servos no chassi.

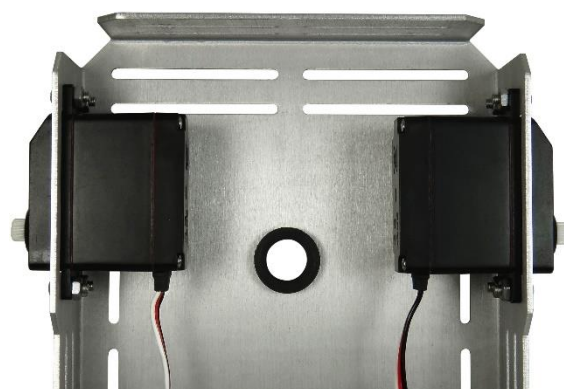
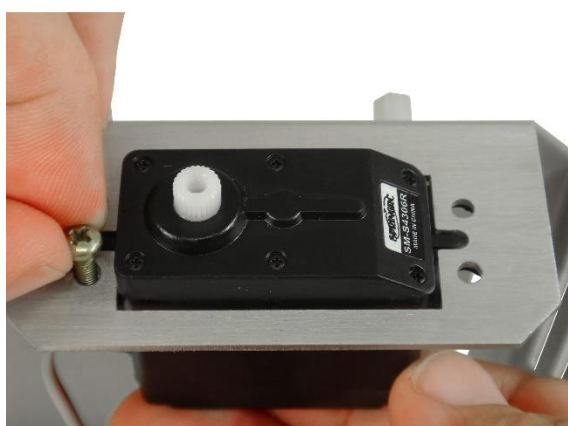


Figura 7.4 - Passando os cabos dos servos pelo furo do chassi.

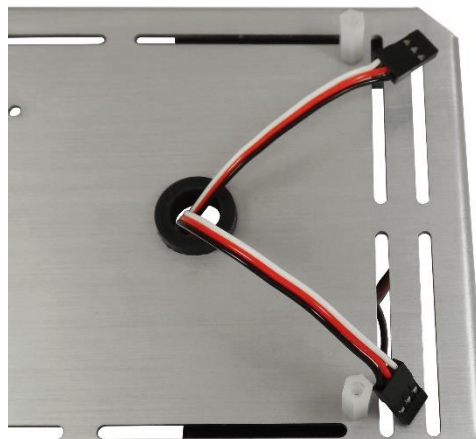
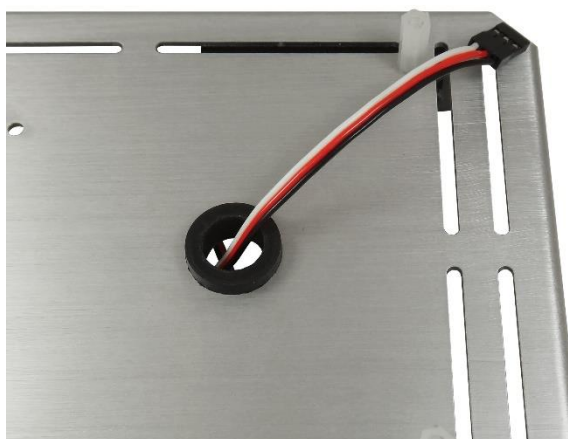
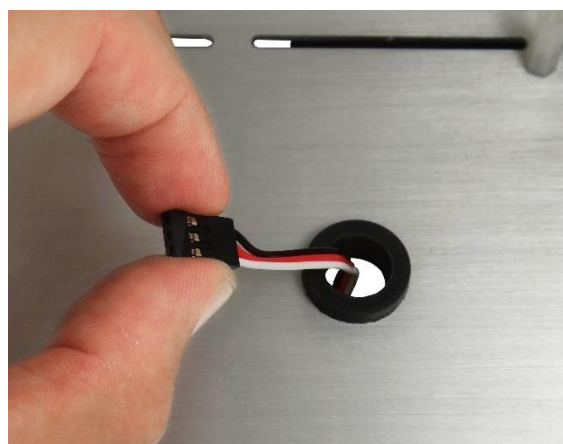
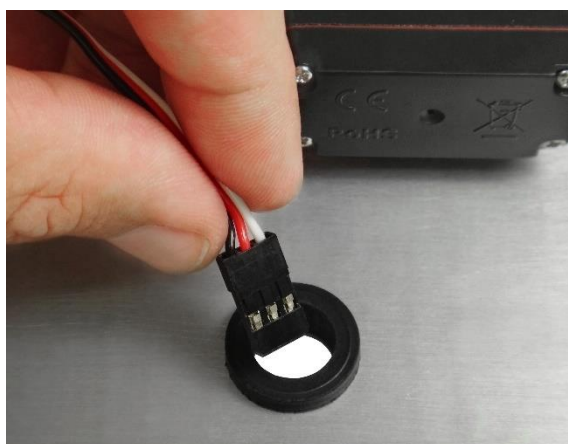


Figura 7.5 - Posicionando a presilha de pilhas sobre o chassi.



Figura 7.6 - Prendendo o suporte de pilhas no chassi.



Figura 7.7 - Unindo as extremidades da presilha de pilhas.



Figura 7.8 - Passando o conector do suporte de pilhas pelo furo do chassi.

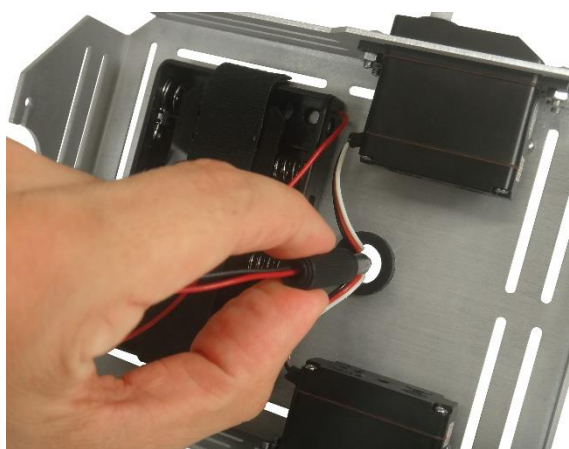


Figura 7.9 - Inserindo o eixo no furo da esfera.



Figura 7.10 - Inserindo parafusos com arruelas na parte traseira do chassi.

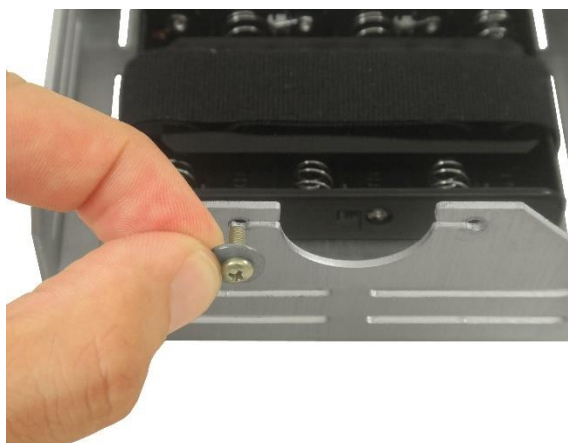


Figura 7.11 - Encaixando a esfera com eixo na parte traseira do chassi.

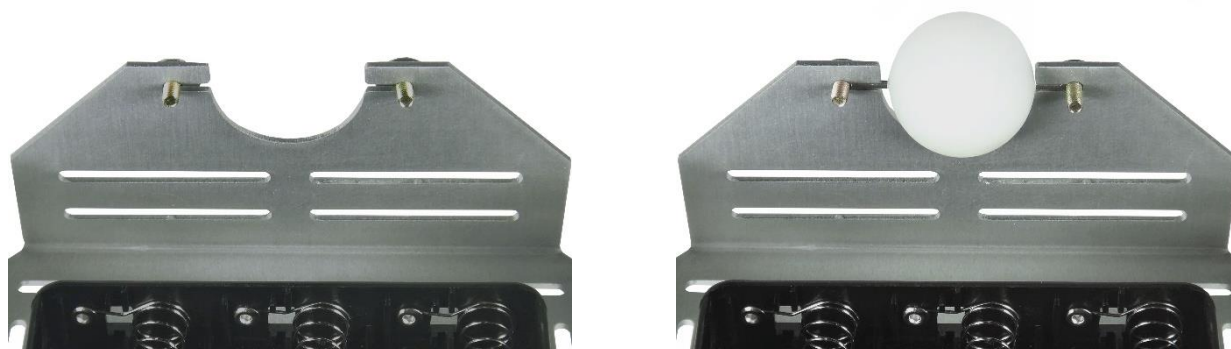


Figura 7.12 - Prendendo o eixo da esfera.



Figura 7.13 - Verificando se a esfera gira livremente.

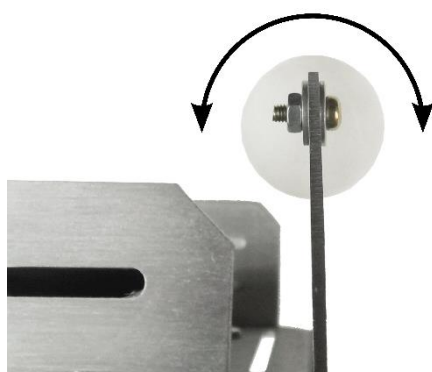


Figura 7.14 - Passando os cabos dos servos pelos furos da base de prototipagem.

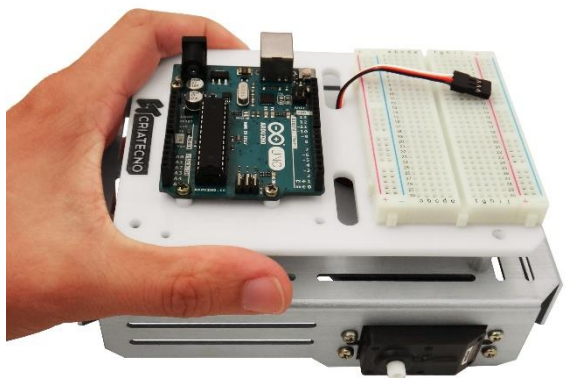
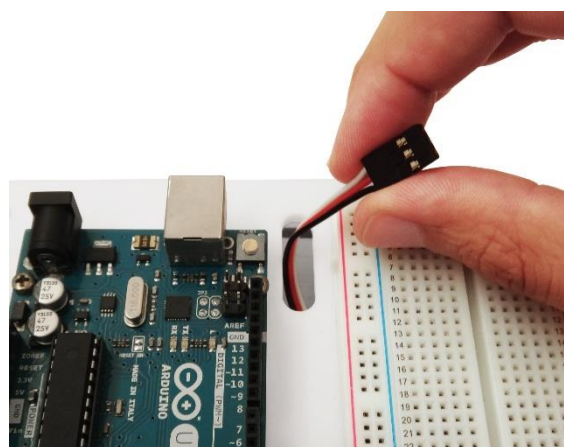


Figura 7.15 - Prendendo a base de prototipagem nos espaçadores.

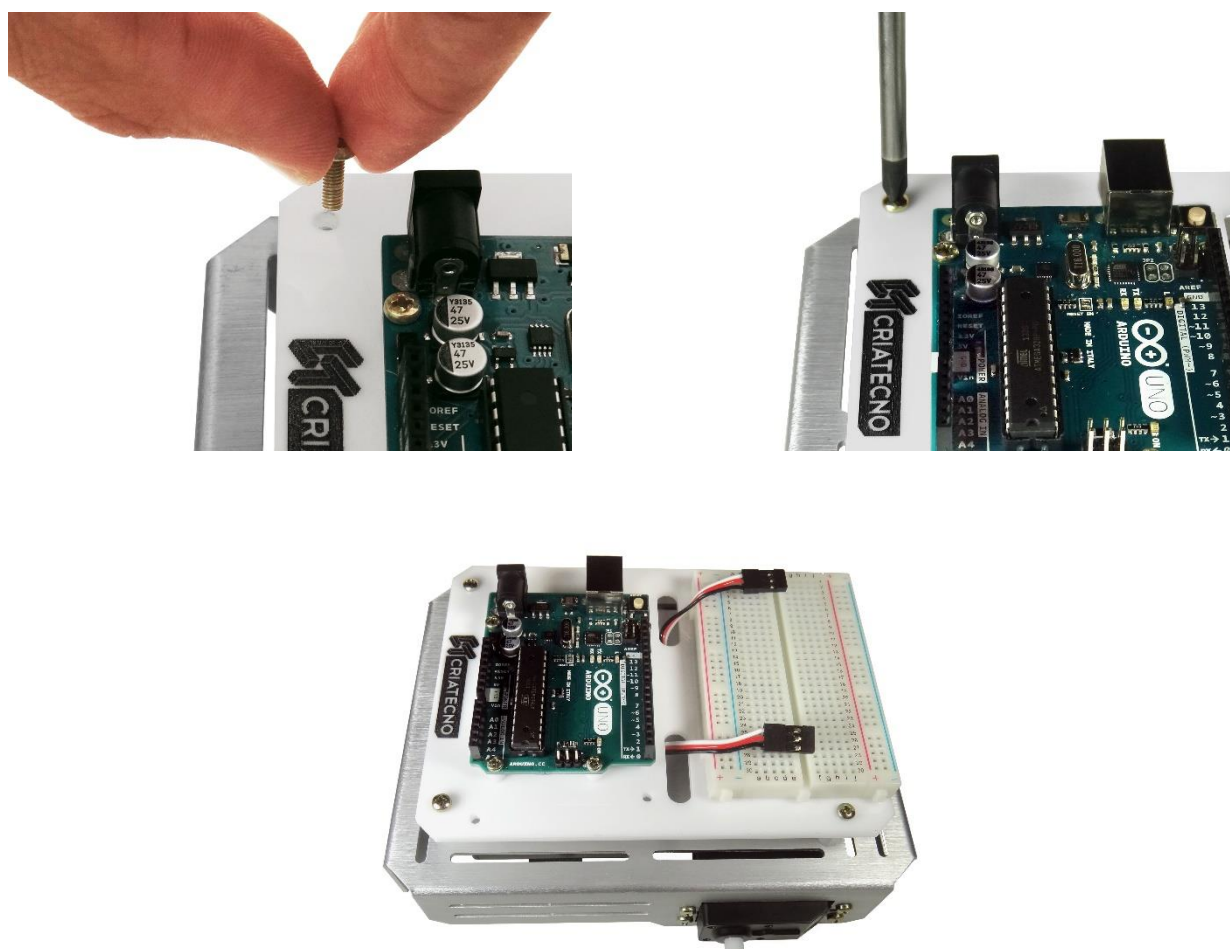


Figura 7.16 - Encaixando os anéis de borracha nas rodas.

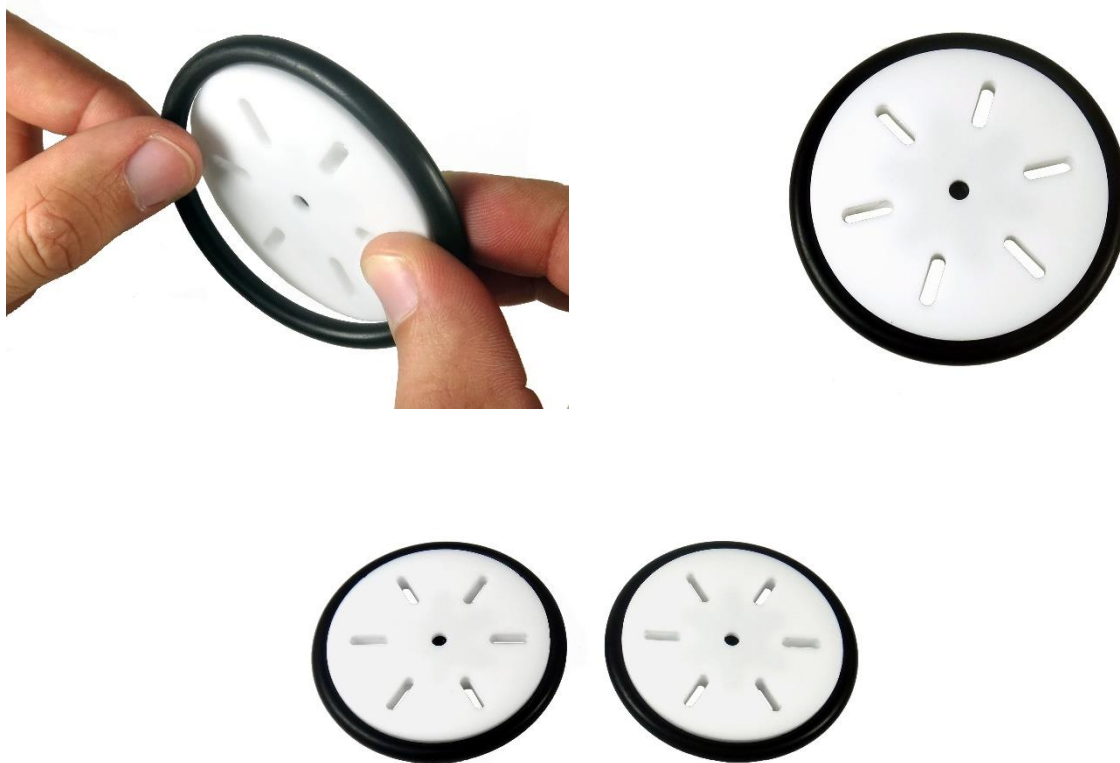


Figura 7.17 - Parafusos específicos para prender as rodas nos servomotores (parafusos para eixo de servomotor).



Figura 7.18 - Prendendo as rodas nos servos.



Figura 7.19 - Ligando os conectores dos servos na protoboard.

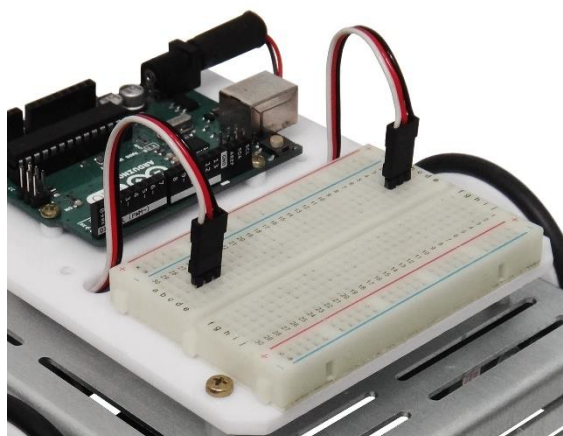


Figura 7.20 - Robô pronto para a realização das próximas atividades.

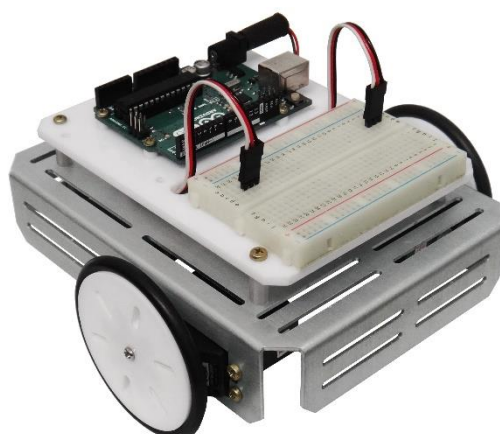


Figura 7.21 - (a) Esquema e (b) ilustração do circuito eletrônico usado para a ligação de servos.

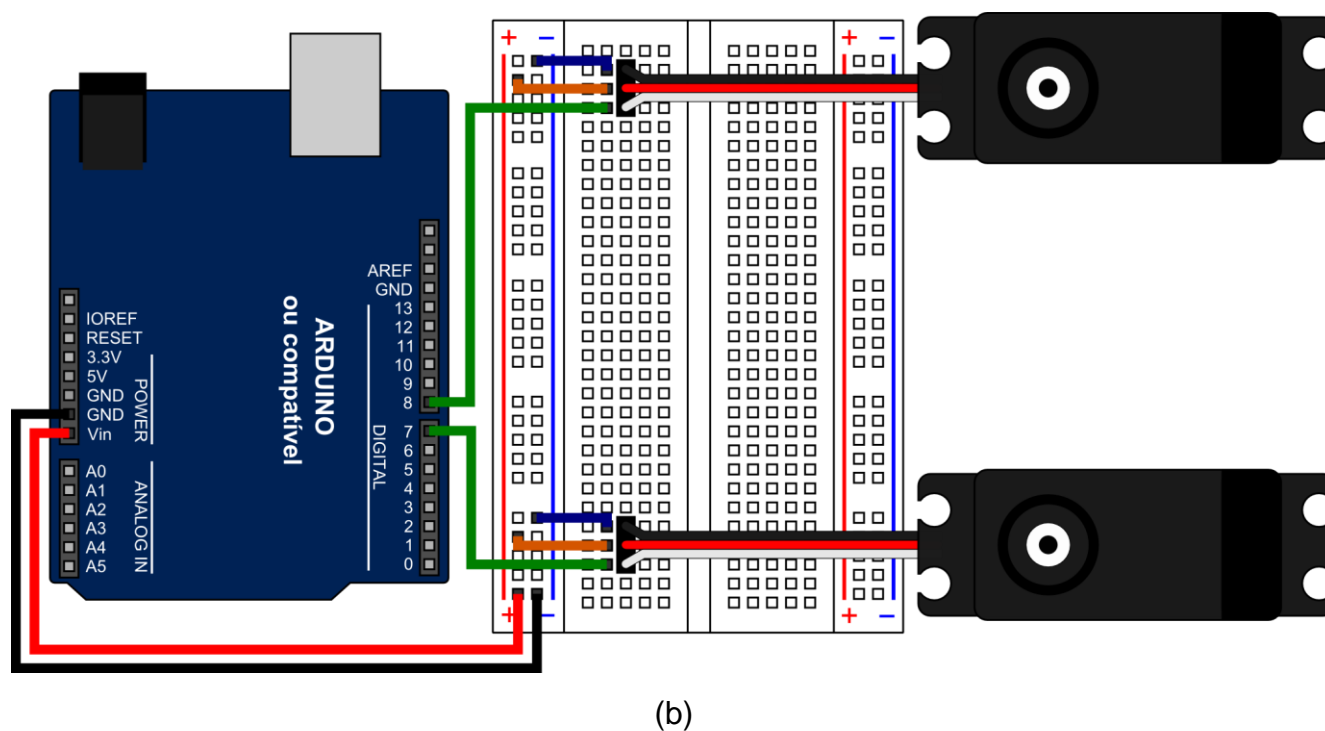
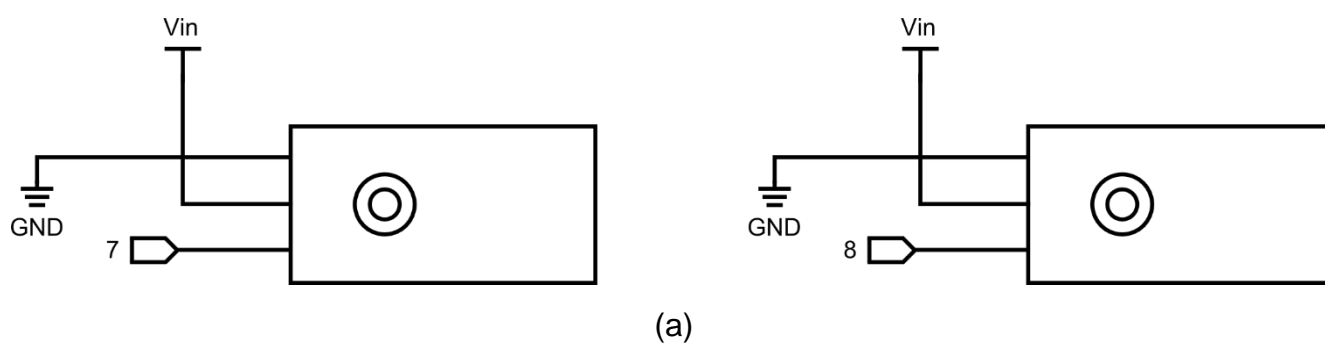


Figura 7.22 - Vista superior do robô.

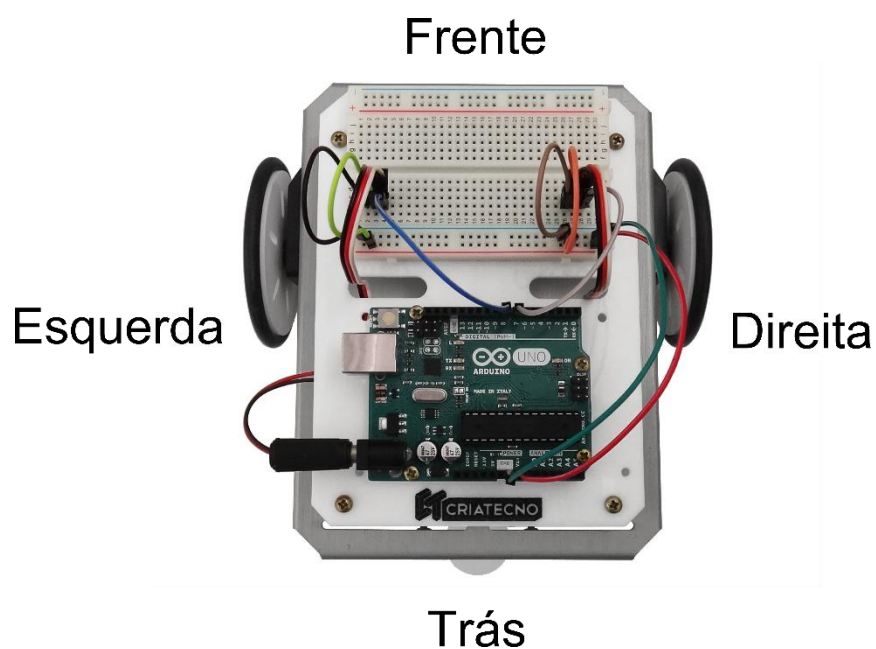


Figura 7.23 - Convenção adotada para o movimento das rodas.

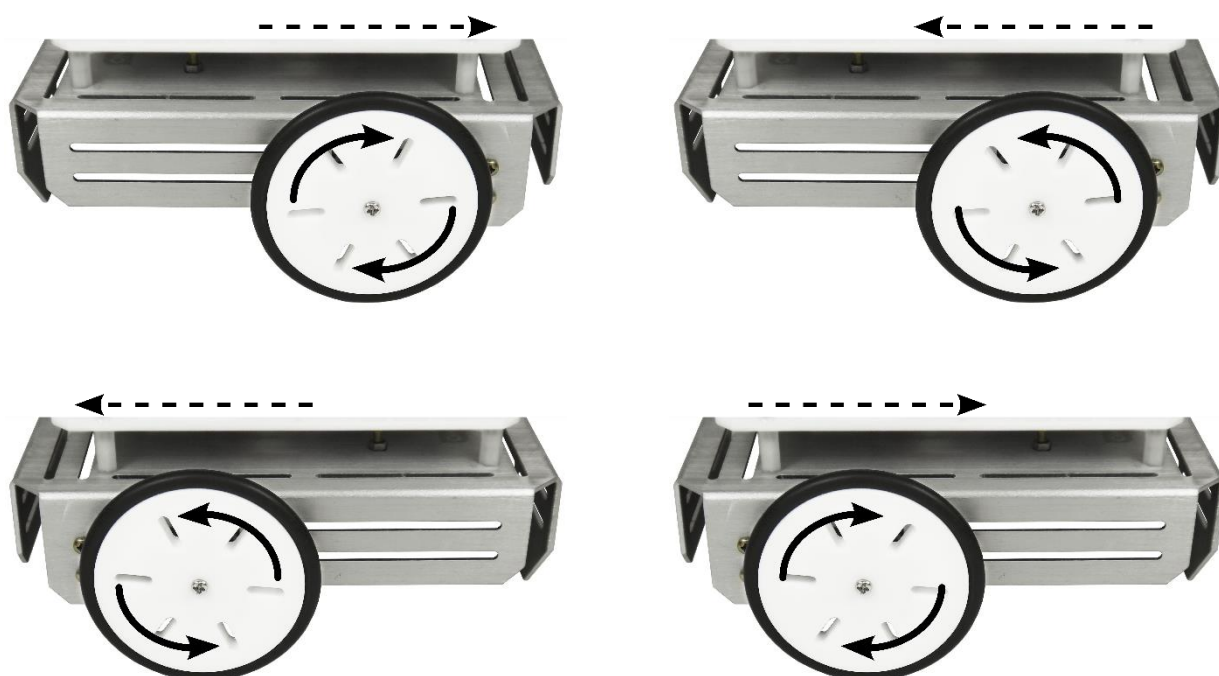
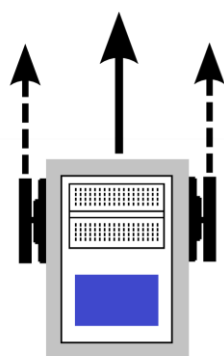
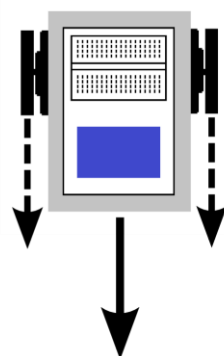


Figura 7.24 - Giro das rodas para que o robô se movimente
(a) para frente e (b) para trás.



(a)



(b)

Figura 7.25 - Giro das rodas para que o robô gire (a) para a direita e (b) para a esquerda.

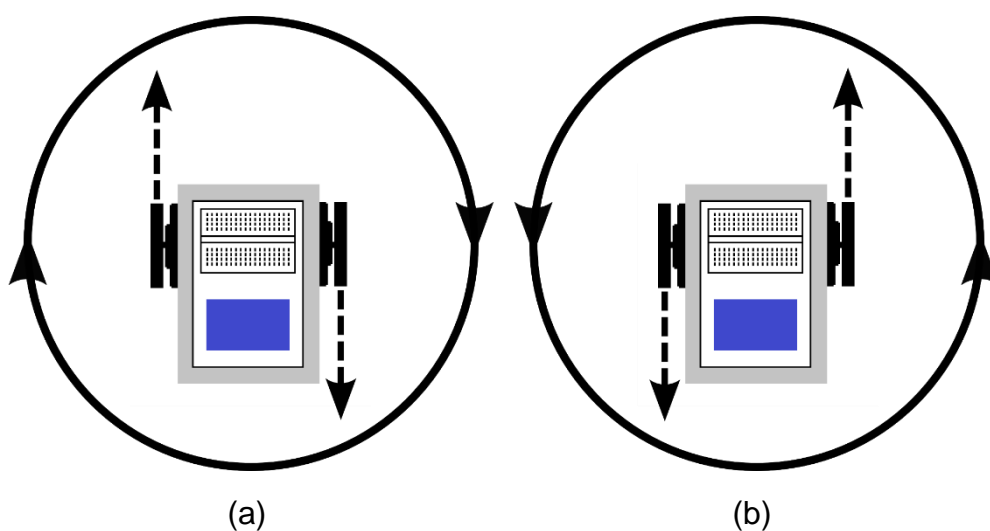


Figura 7.26 - Giro das rodas para que o robô realize curvas
(a) para a esquerda e (b) para a direita.

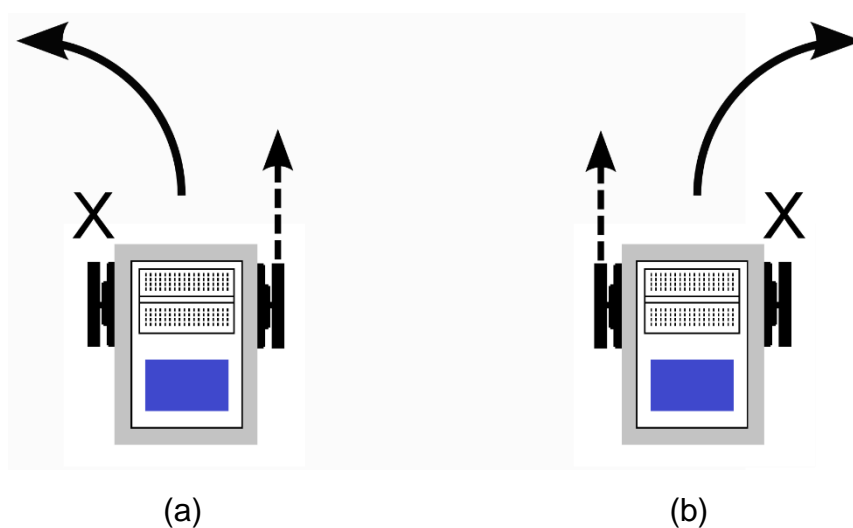


Figura 7.27 - Deslocamento de 10 cm para frente.

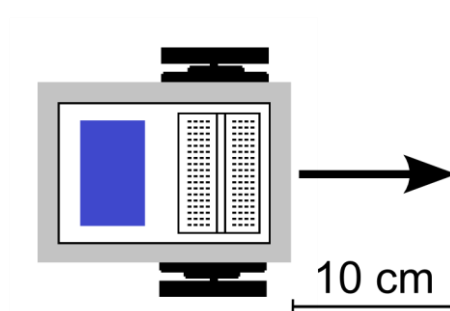


Figura 7.28 - Curva de 90° para a direita.

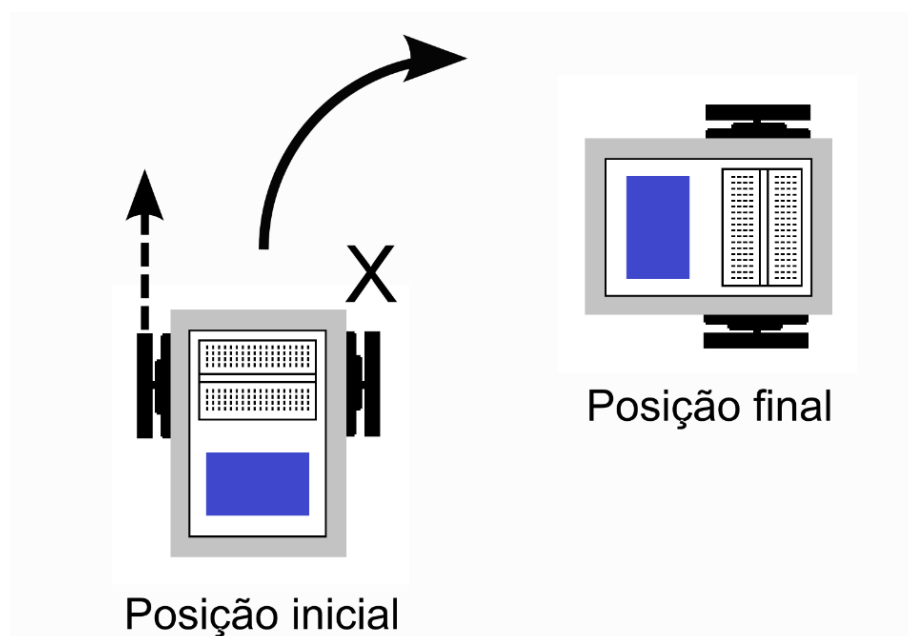


Figura 7.29 - Curva de 90° para a esquerda.

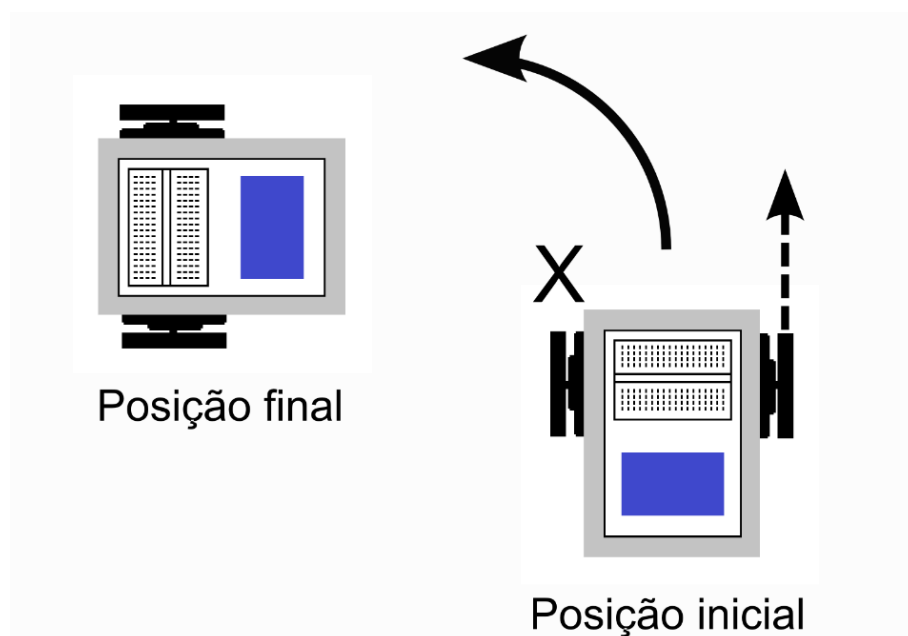
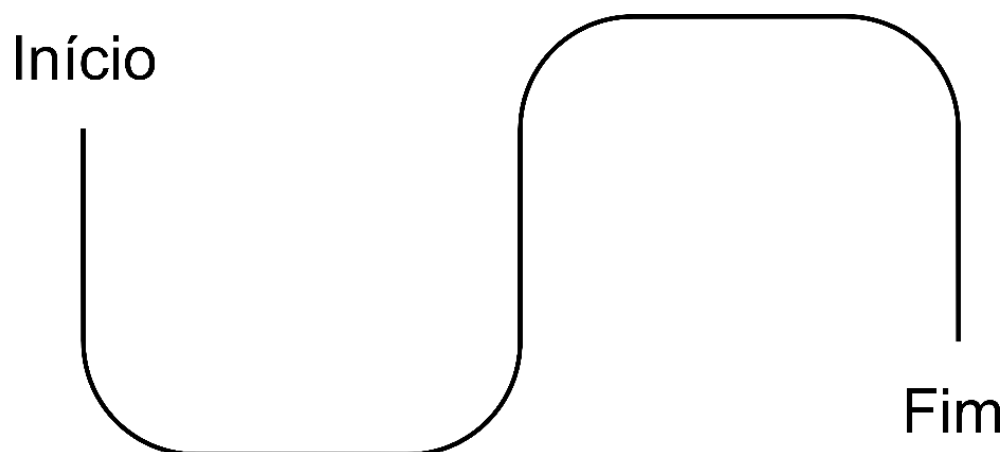


Figura 7.30 - Trajetória a ser percorrida pelo robô.



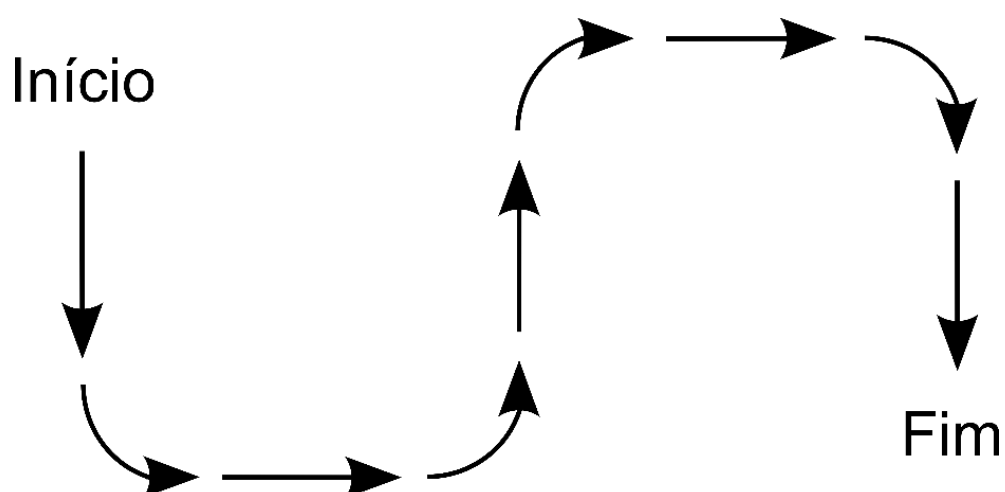


Figura 8.1 - Prendendo os suportes no chassi.

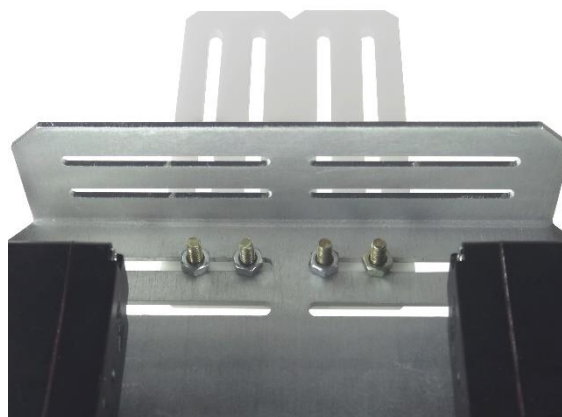
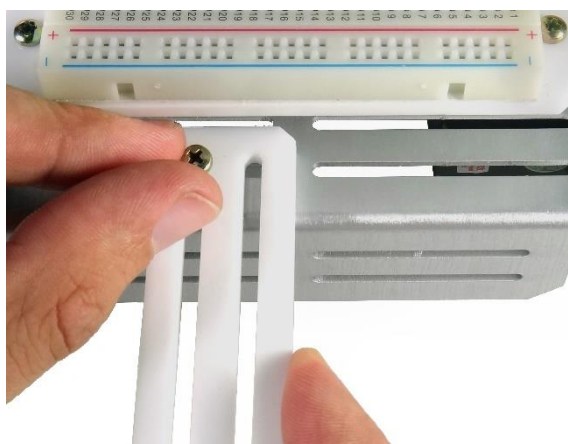


Figura 8.2 - Prendendo a micro chave nos suportes.

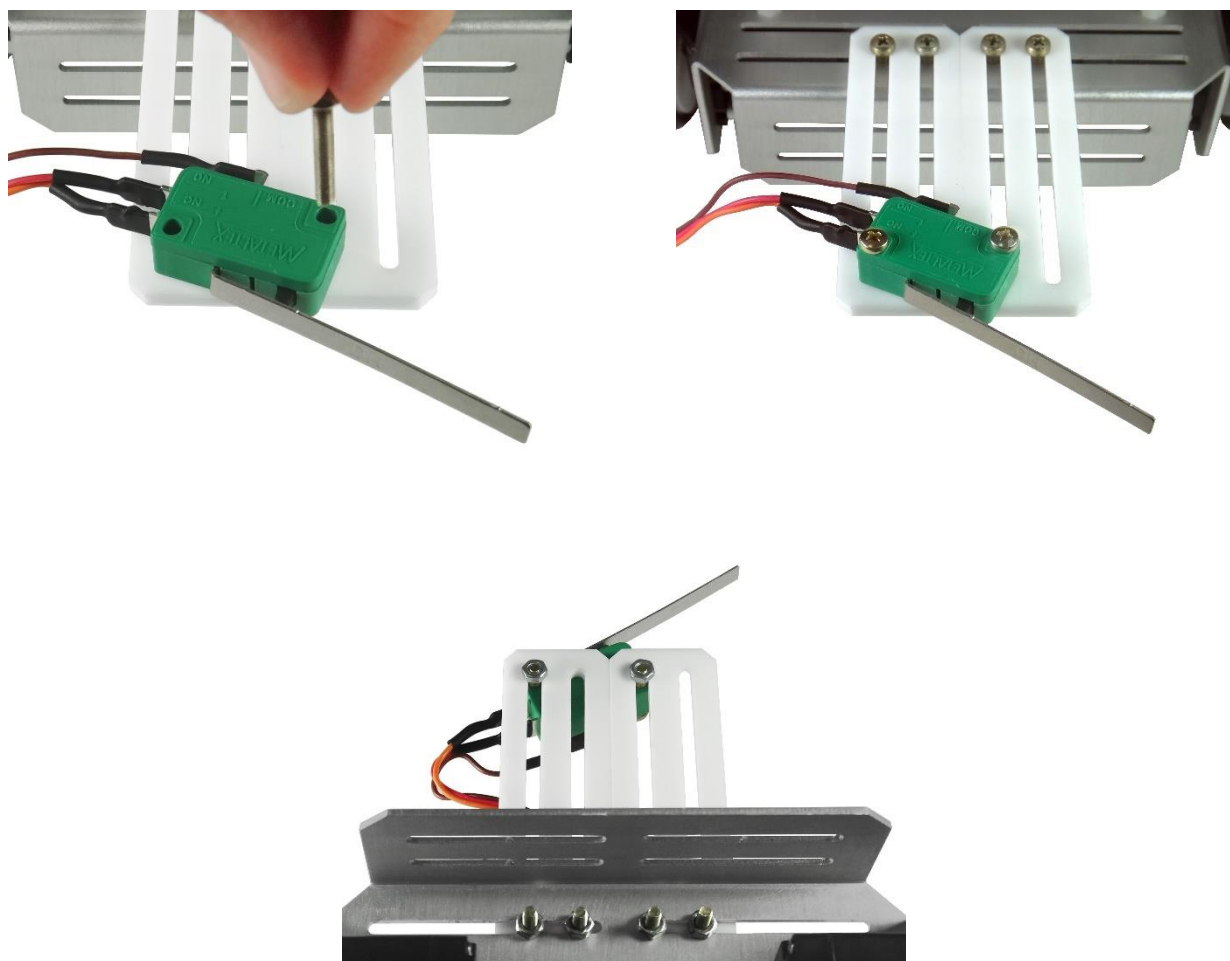


Figura 8.3 - Ligando a micro chave na protoboard.

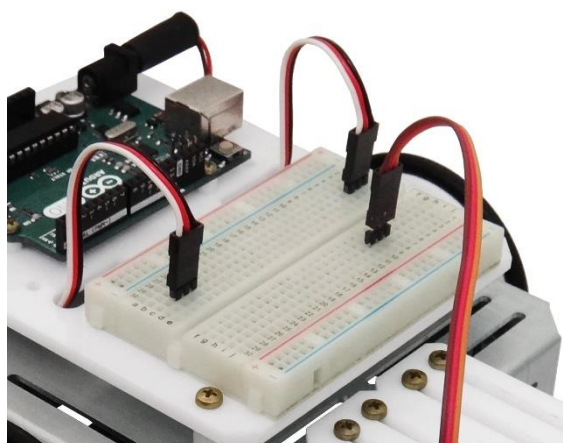


Figura 8.4 - Robô pronto para a realização da atividade.

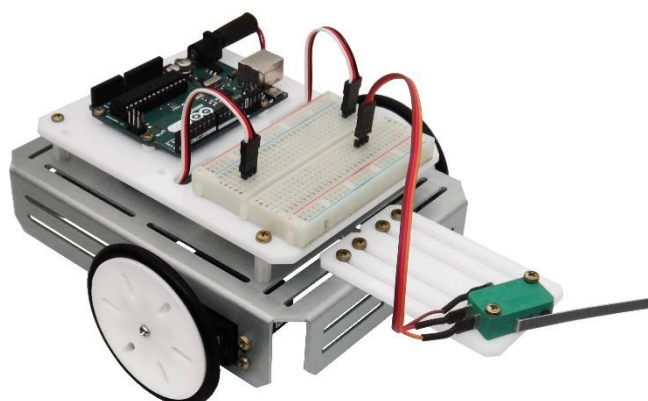
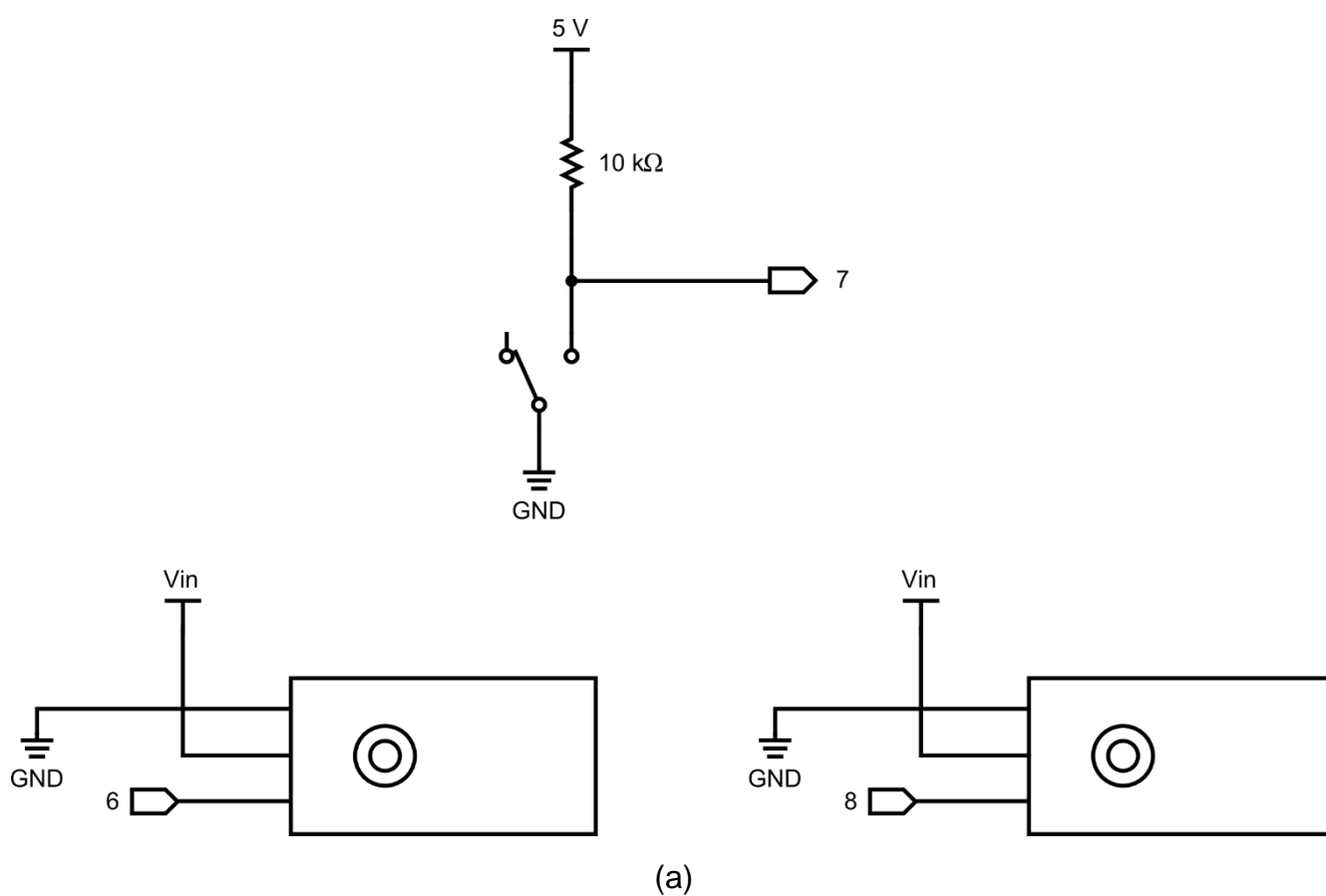
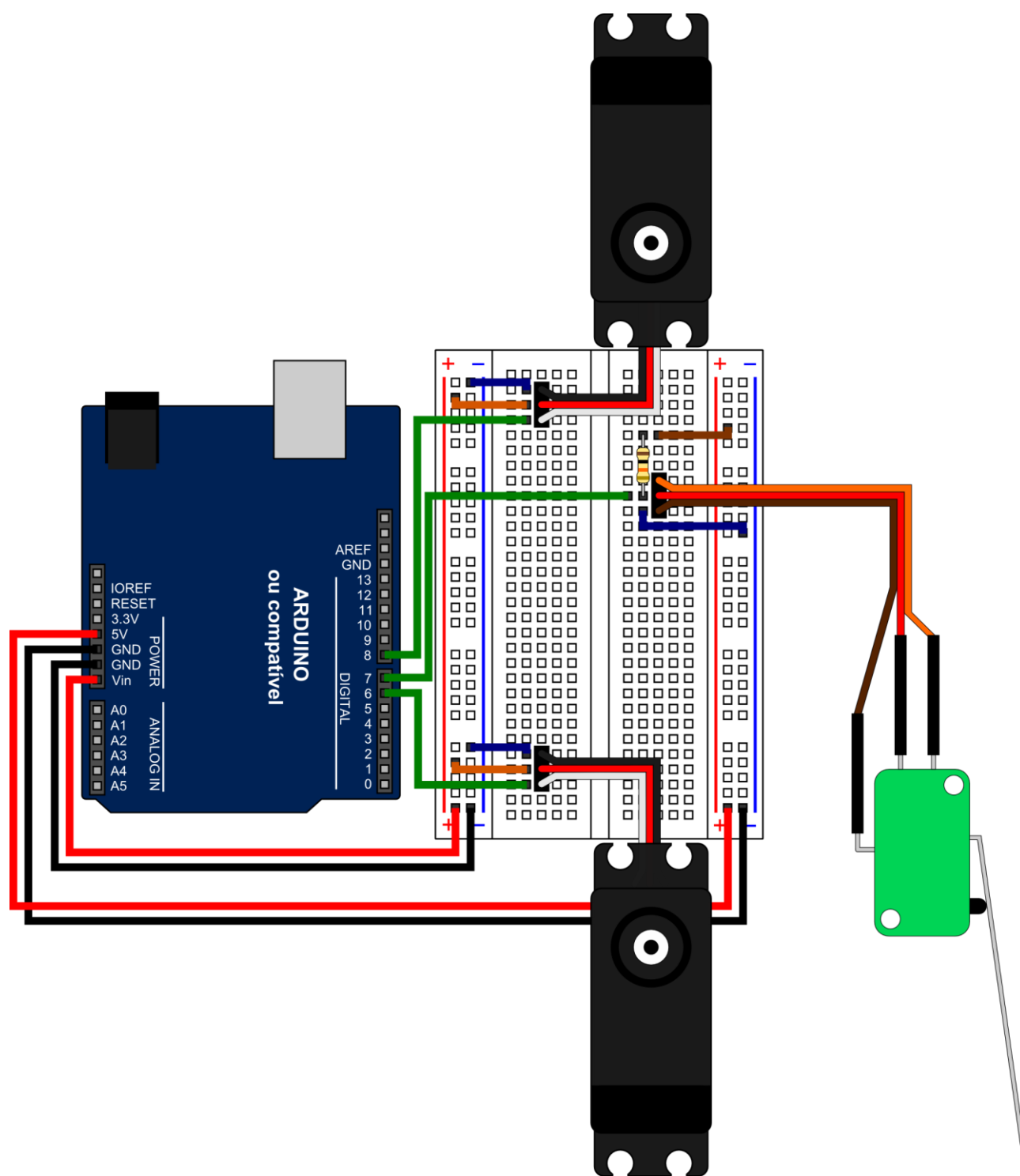


Figura 8.5 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 31.





(b)

Figura 8.6 - Prendendo os suportes no chassi.

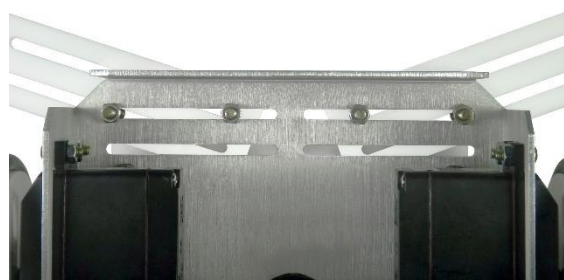
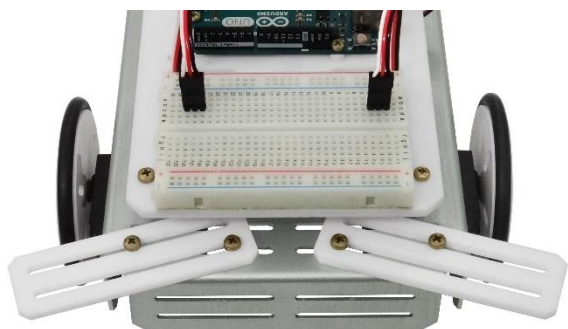


Figura 8.7 - Prendendo as micro chaves nos suportes.

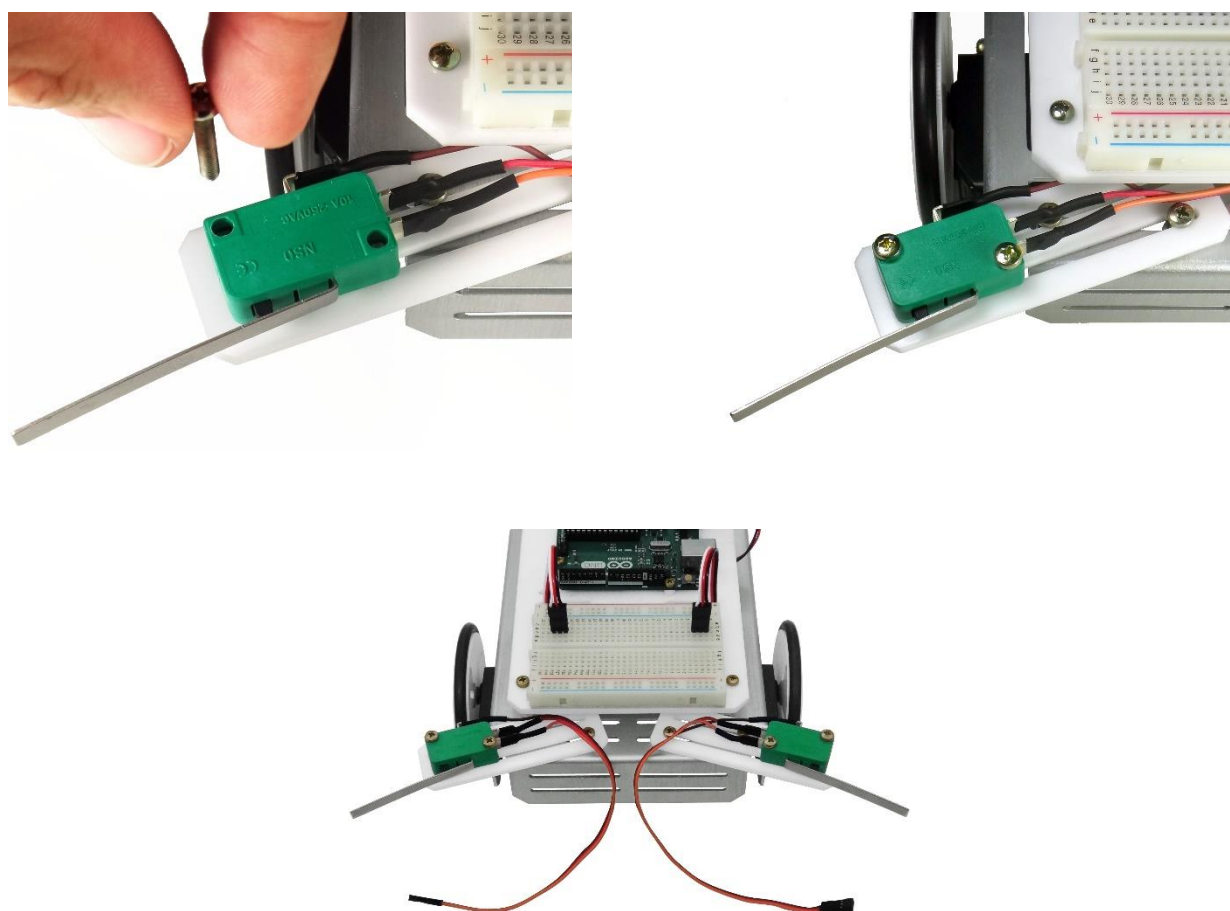


Figura 8.8 - Ligando as micro chaves na protoboard.

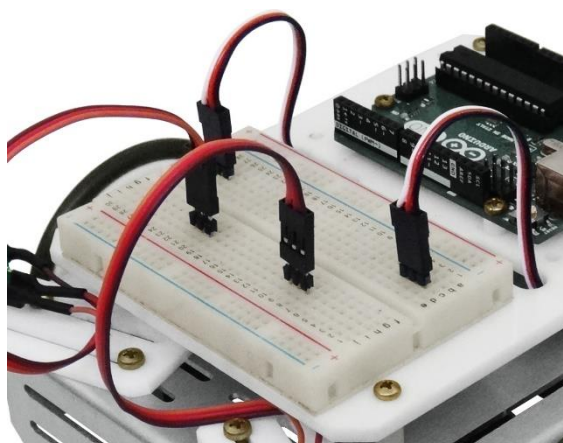


Figura 8.9 - Robô pronto para a realização da atividade.

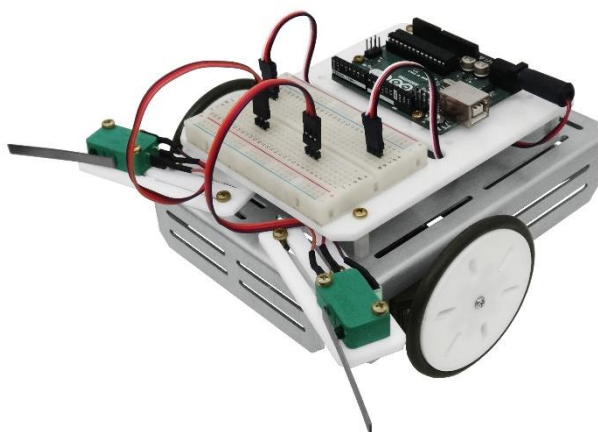
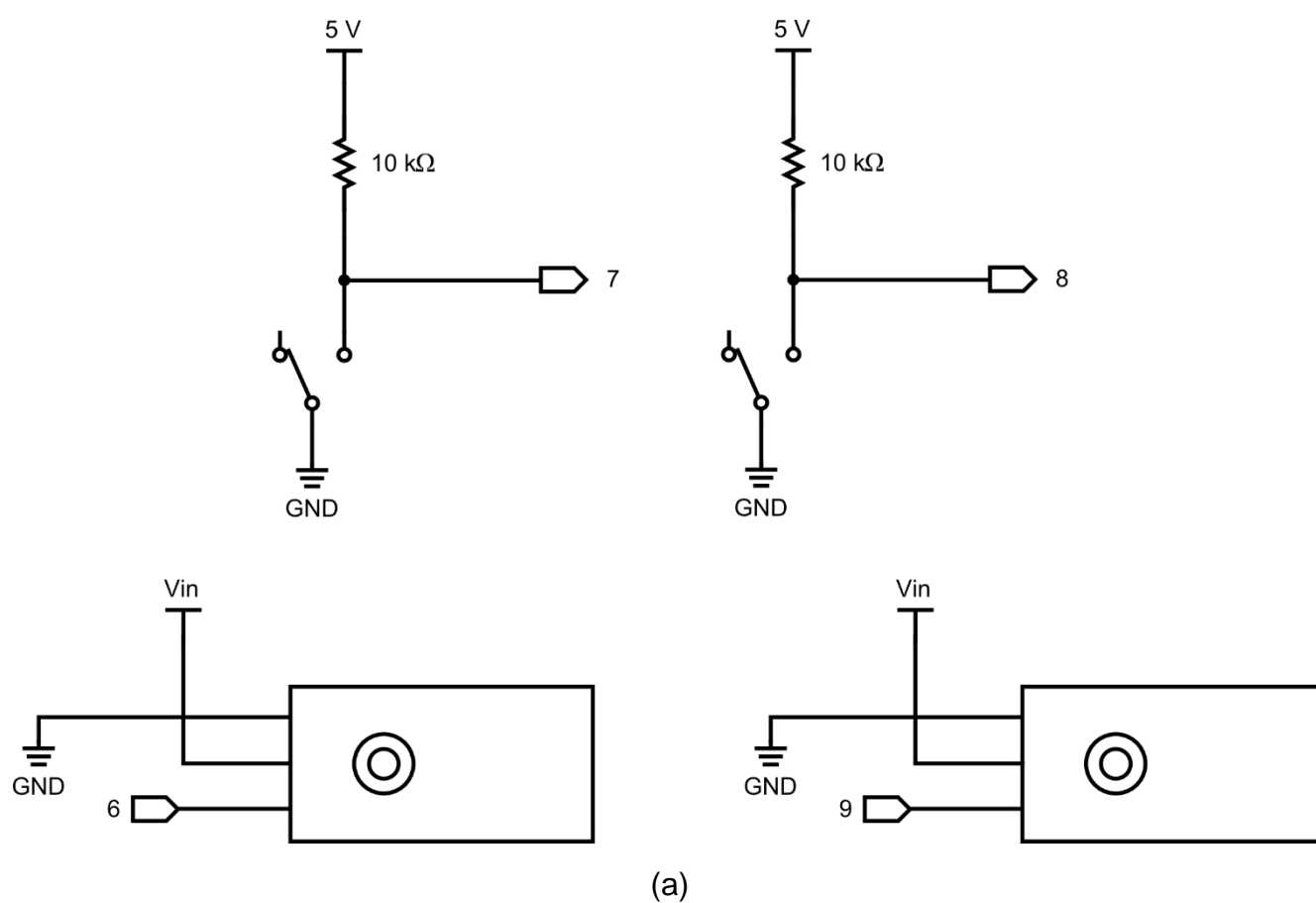
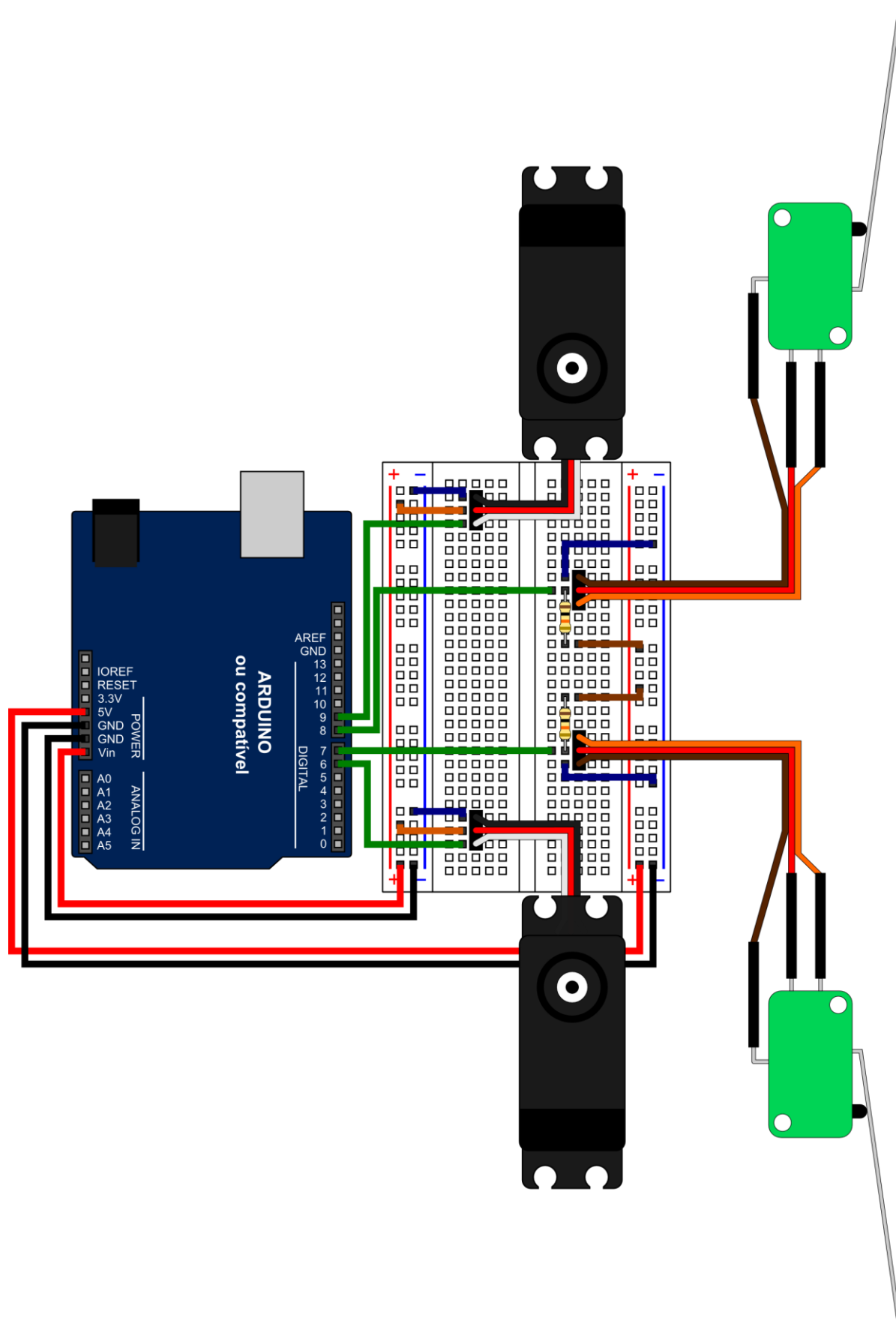


Figura 8.10 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 32.





(b)

Figura 9.1 - Prendendo os cabos extensores no suporte.

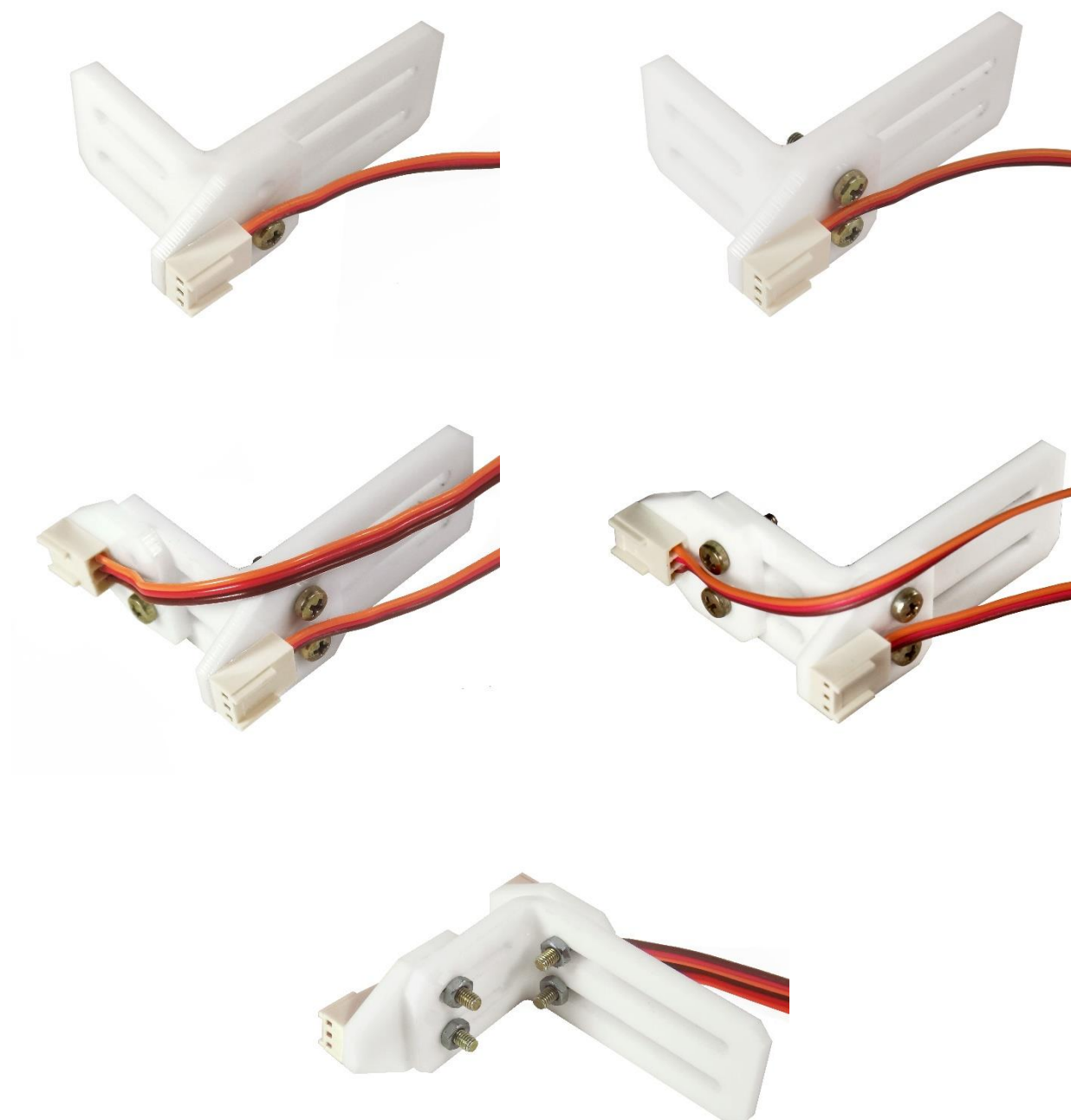


Figura 9.2 - Prendendo o suporte no chassi.

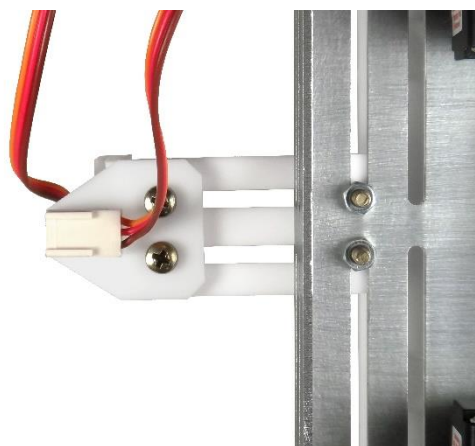
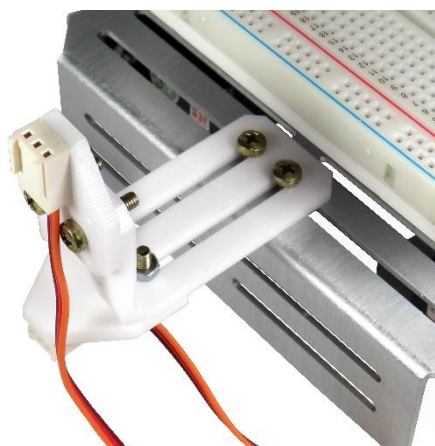
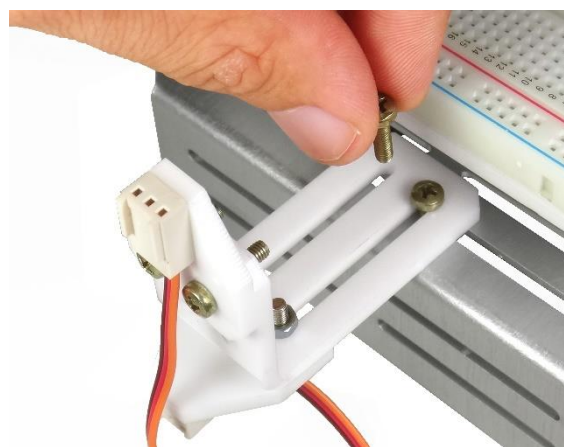
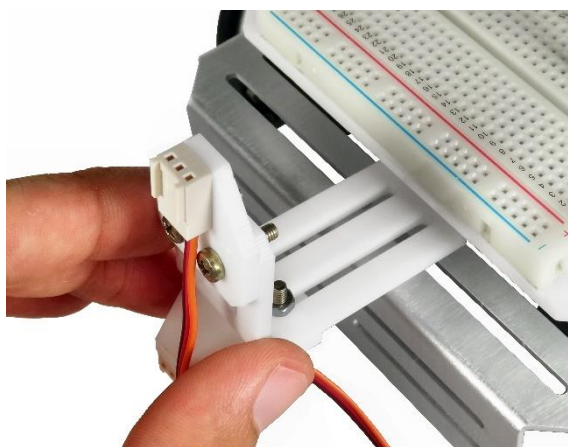


Figura 9.3 - Montando o LED infravermelho dentro do suporte para LED.



Figura 9.4 - Conectando o LED infravermelho no cabo extensor.

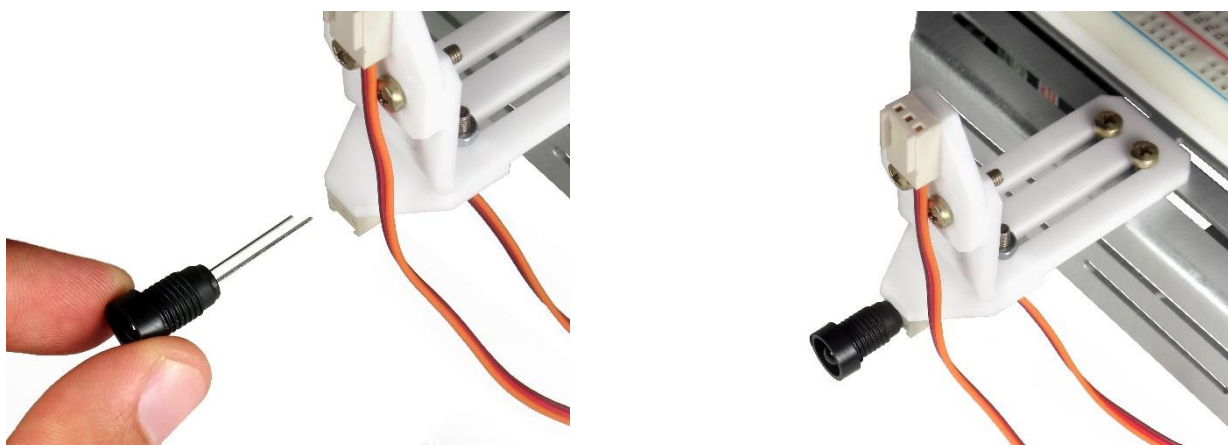


Figura 9.5 - Conectando o receptor de infravermelho no cabo extensor.

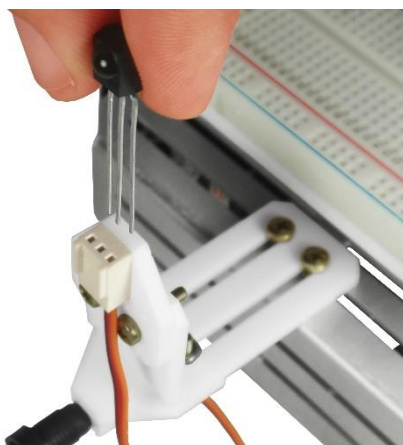


Figura 9.6 - Ligando os cabos extensores na protoboard.

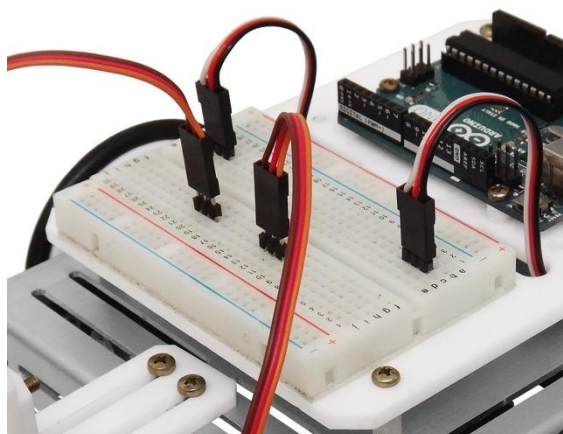


Figura 9.7 - Robô pronto para a realização da atividade.

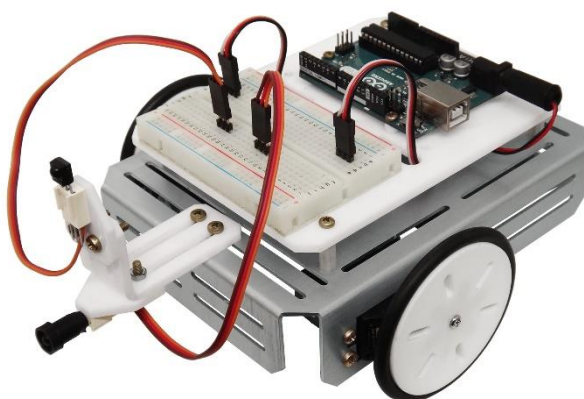
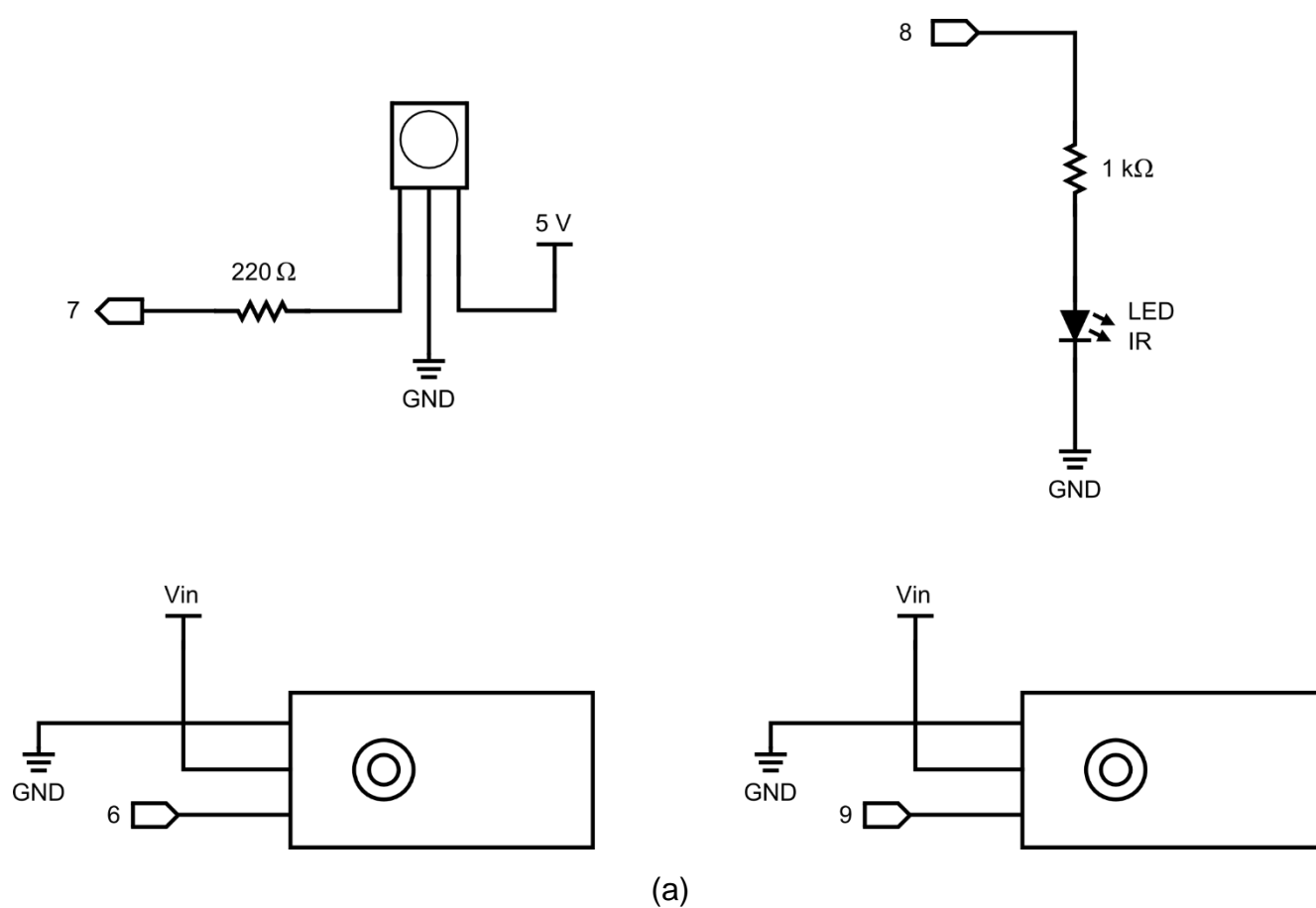
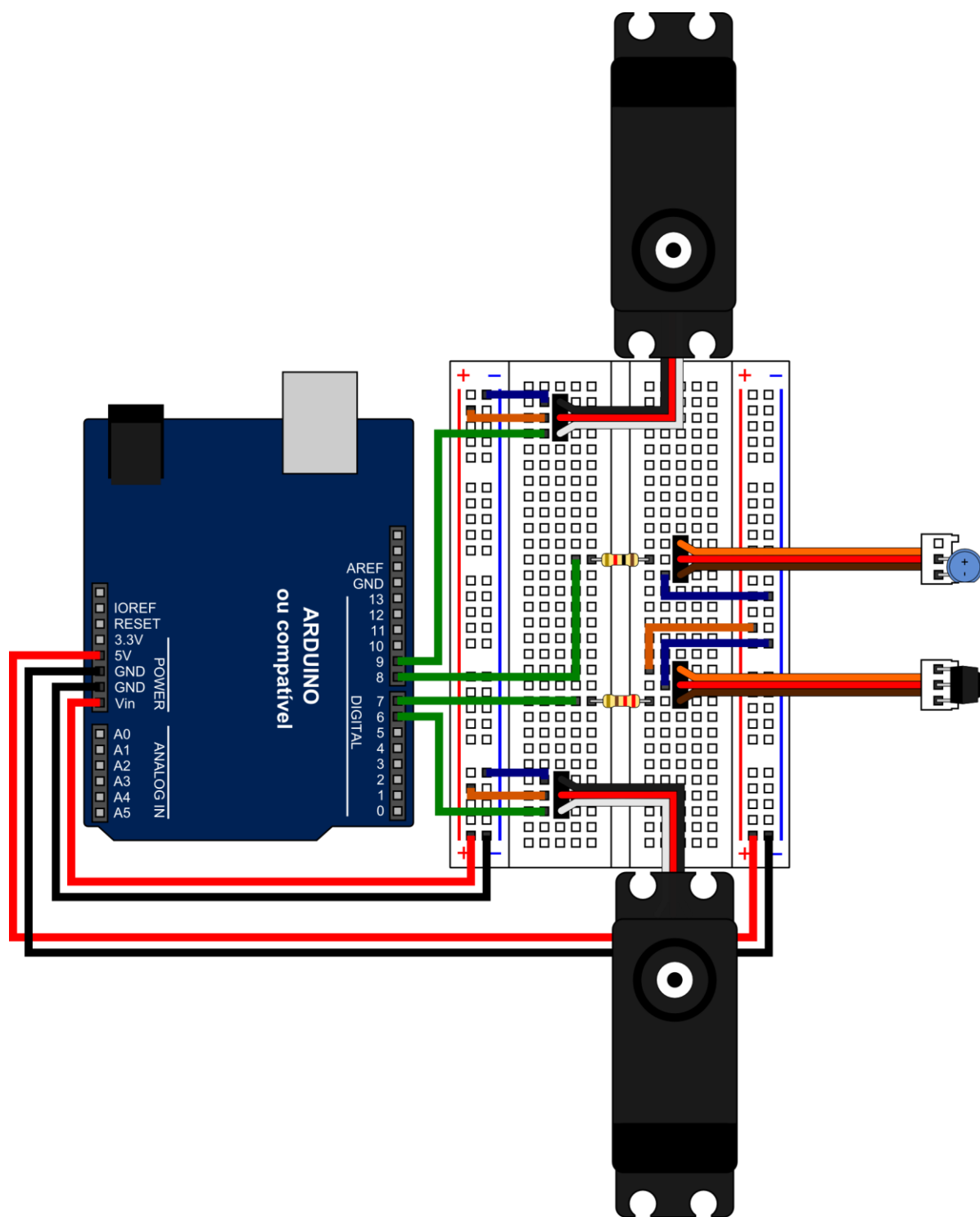


Figura 9.8 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 33.





(b)

Figura 9.9 - Prendendo os cabos extensores nos suportes.

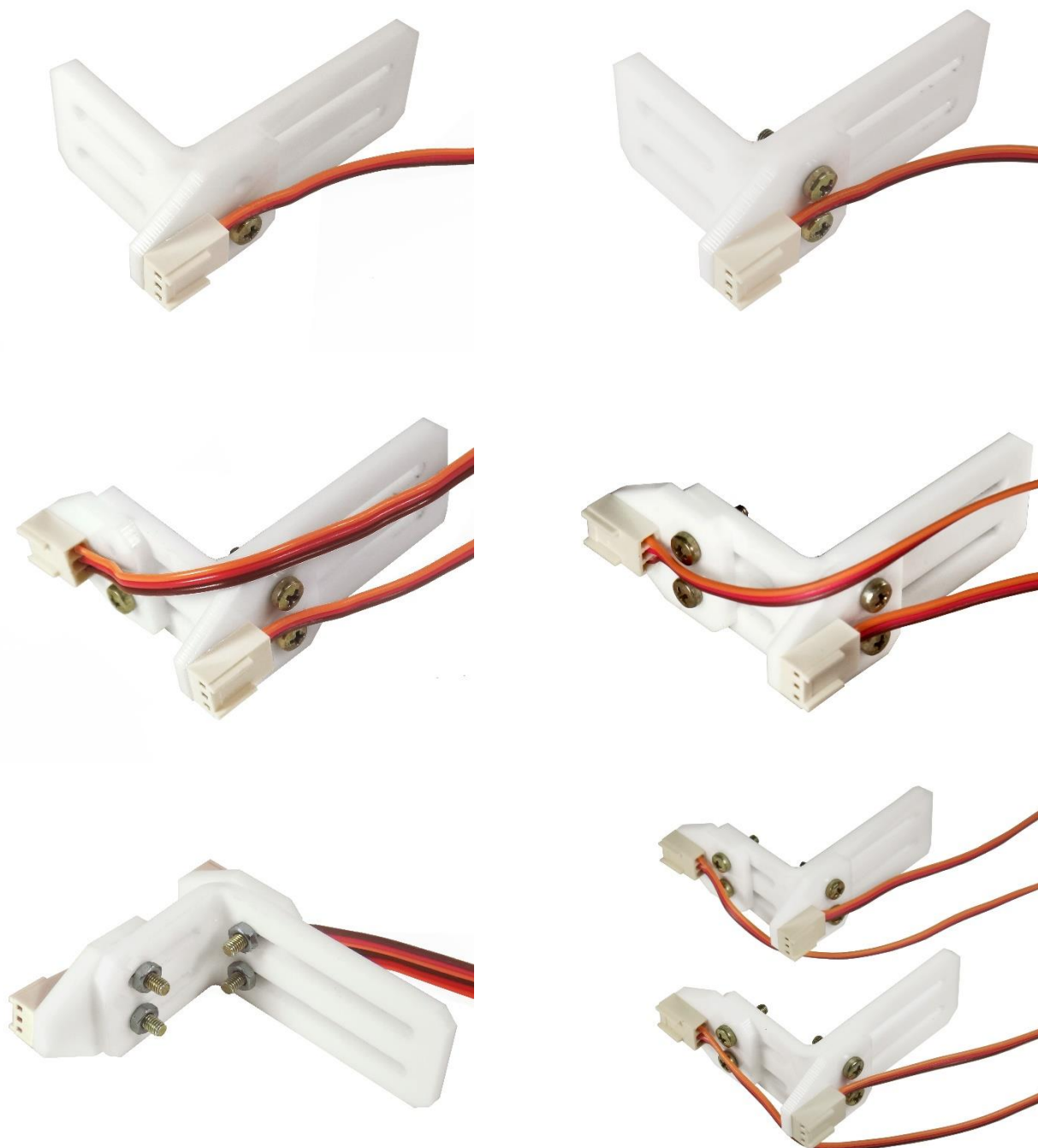


Figura 9.10 - Prendendo os suportes no chassi.

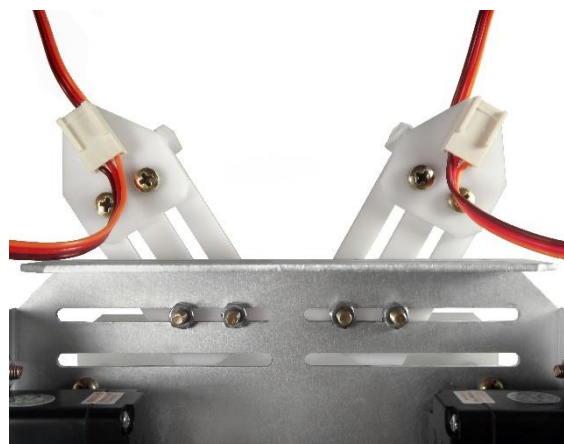
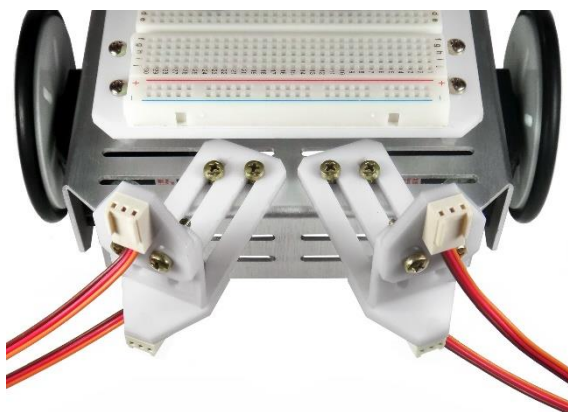


Figura 9.11 - Montando os LEDs infravermelhos dentro dos suportes para LED.

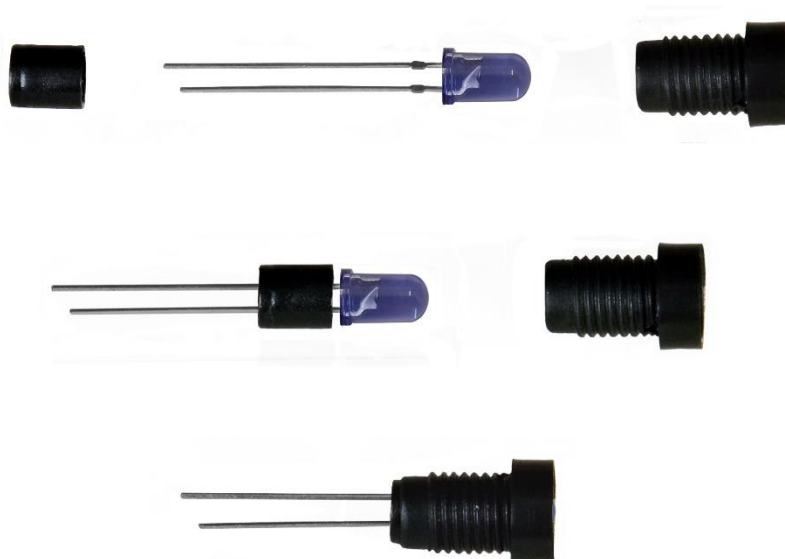


Figura 9.12 - Conectando os LEDs infravermelhos nos cabos extensores.

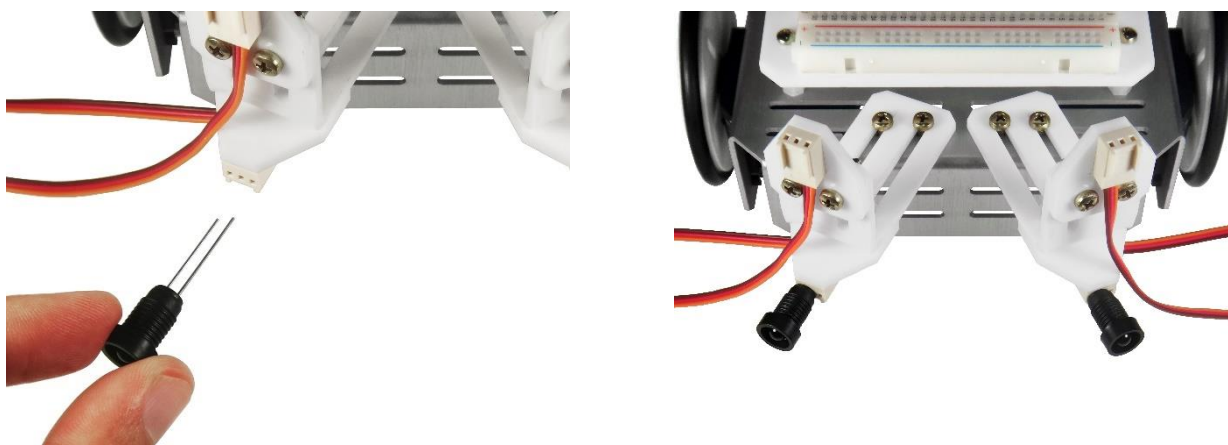


Figura 9.13 - Conectando os receptores de infravermelho nos cabos extensores.

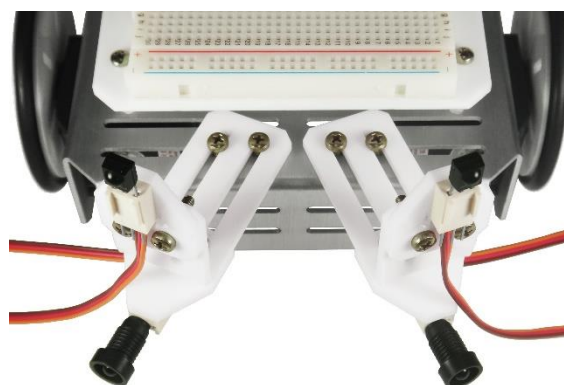
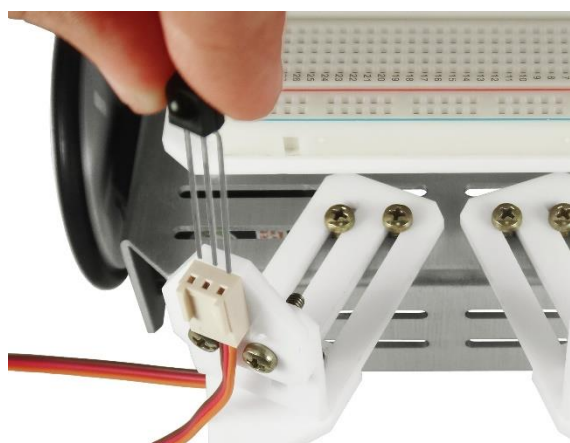


Figura 9.14 - Ligando os cabos extensores na protoboard.

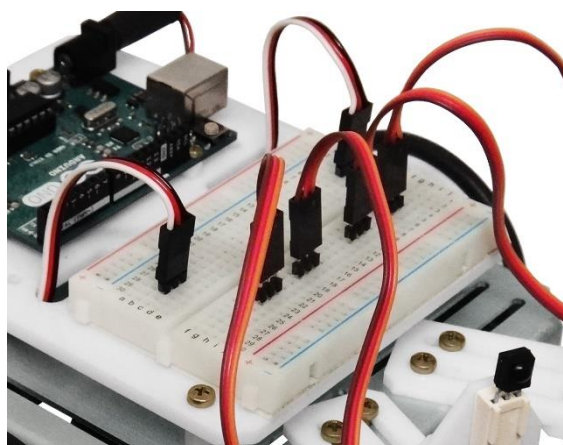


Figura 9.15 - Robô pronto para a realização da atividade.

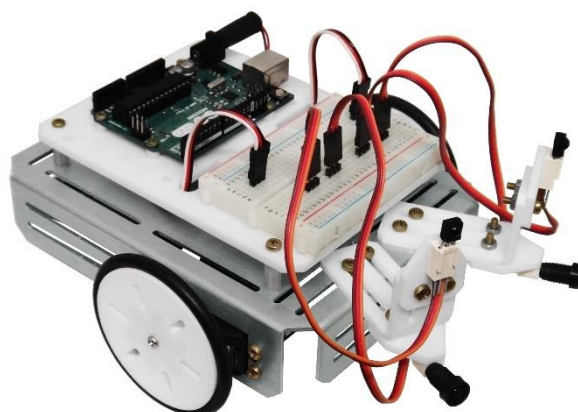
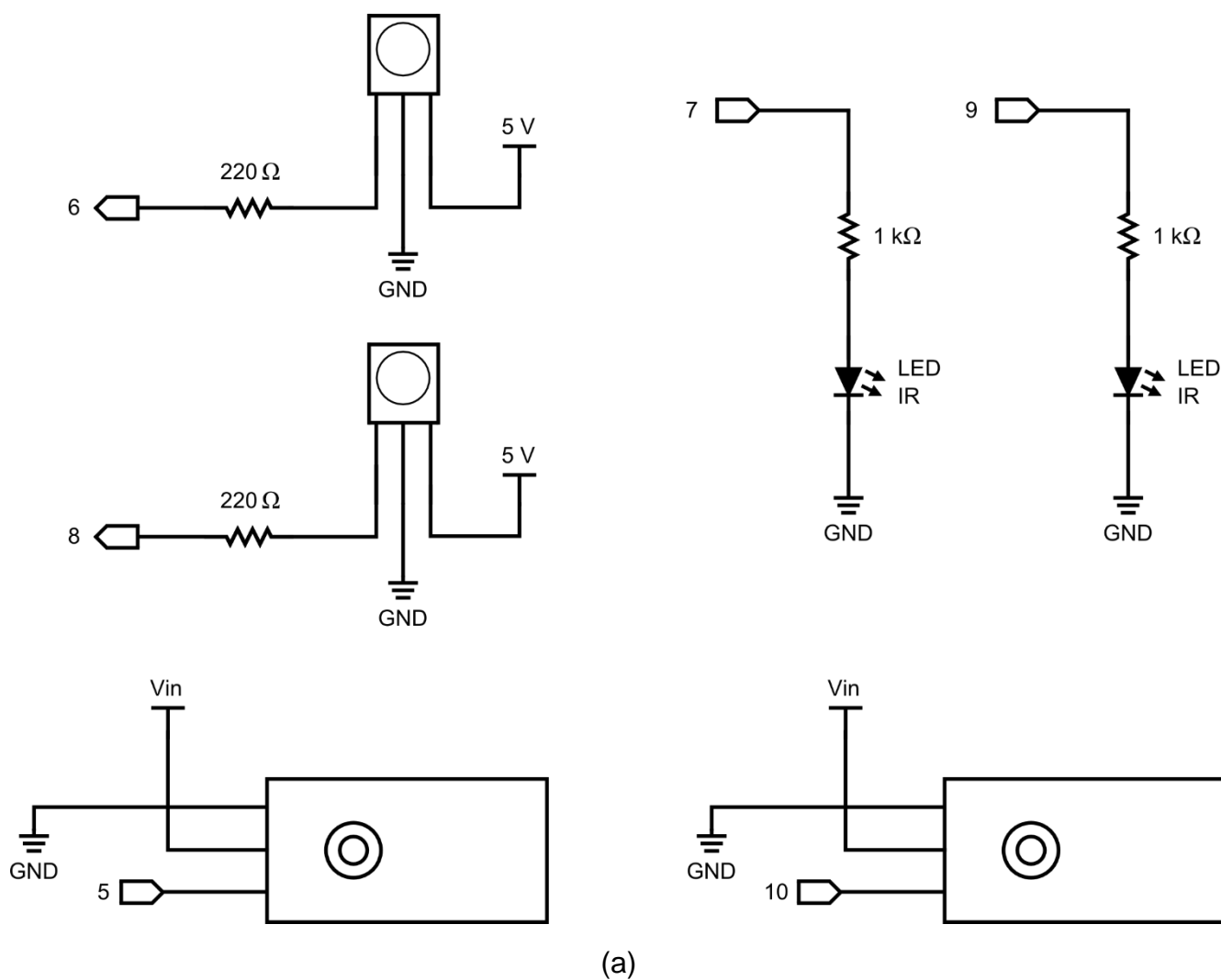
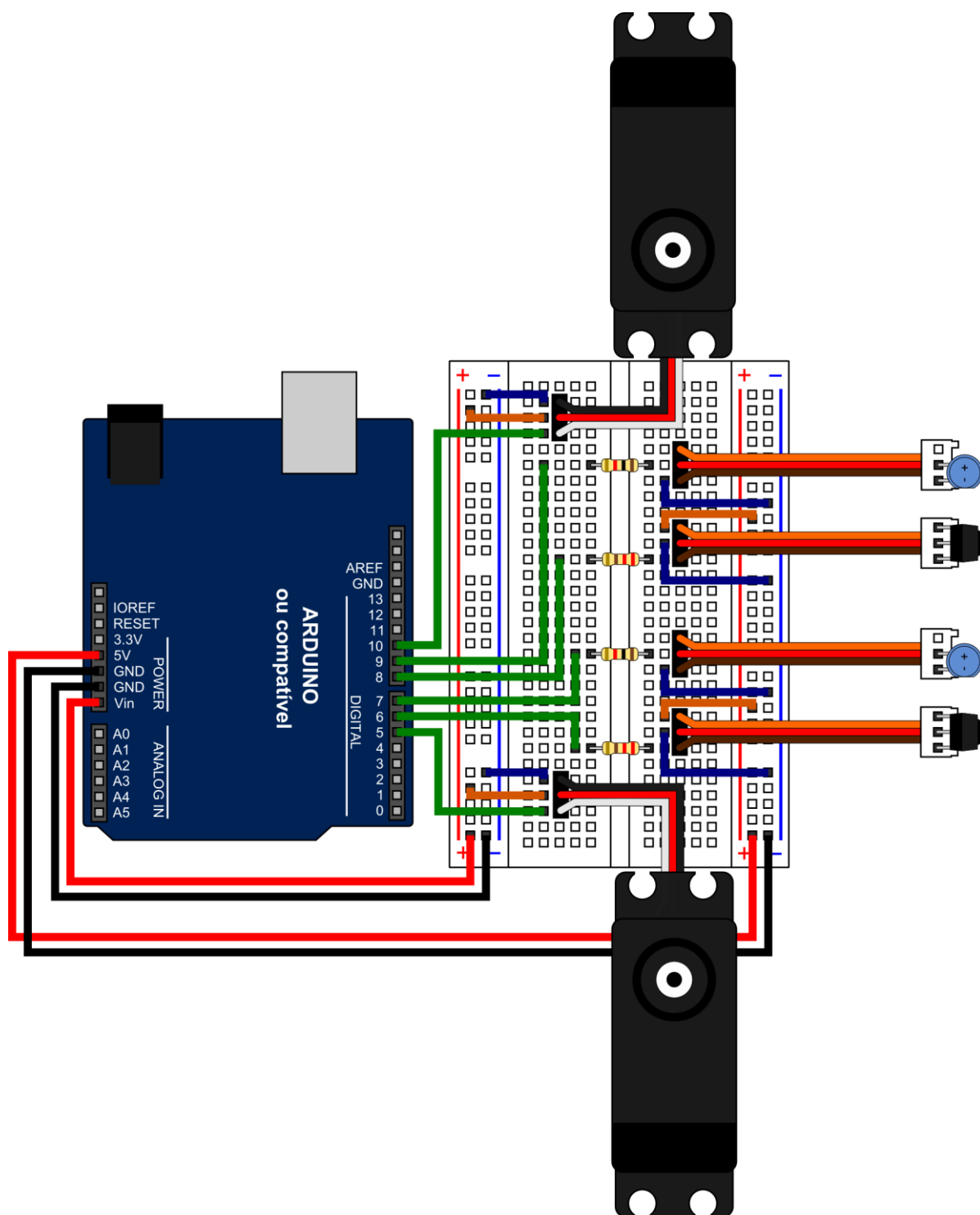


Figura 9.16 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 34.





(b)

Figura 10.1 - Suportes do sensor de ultrassom.



Figura 10.2 - Ligação dos fios no sensor de ultrassom.

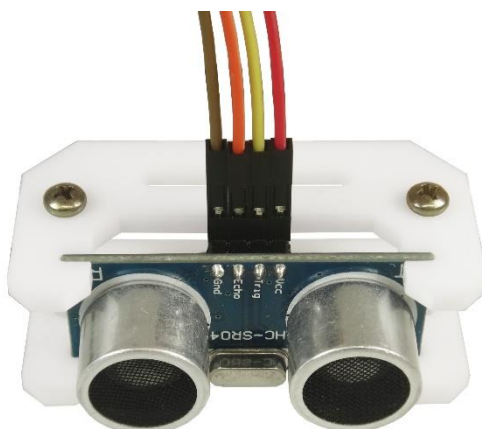


Figura 10.3 - Prendendo os espaçadores no suporte.



Figura 10.4 - Prendendo o suporte no chassi.

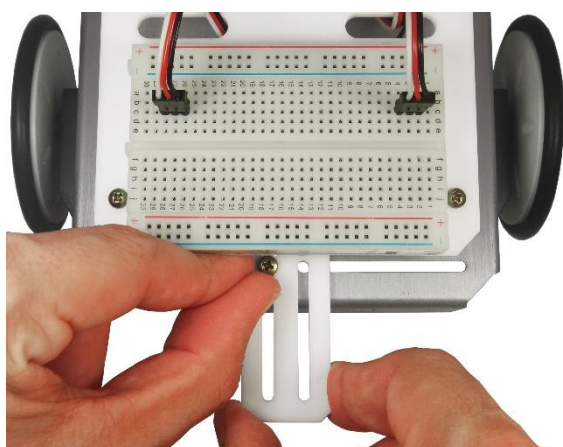


Figura 10.5 - Prendendo o suporte do sensor de ultrassom no suporte curto.

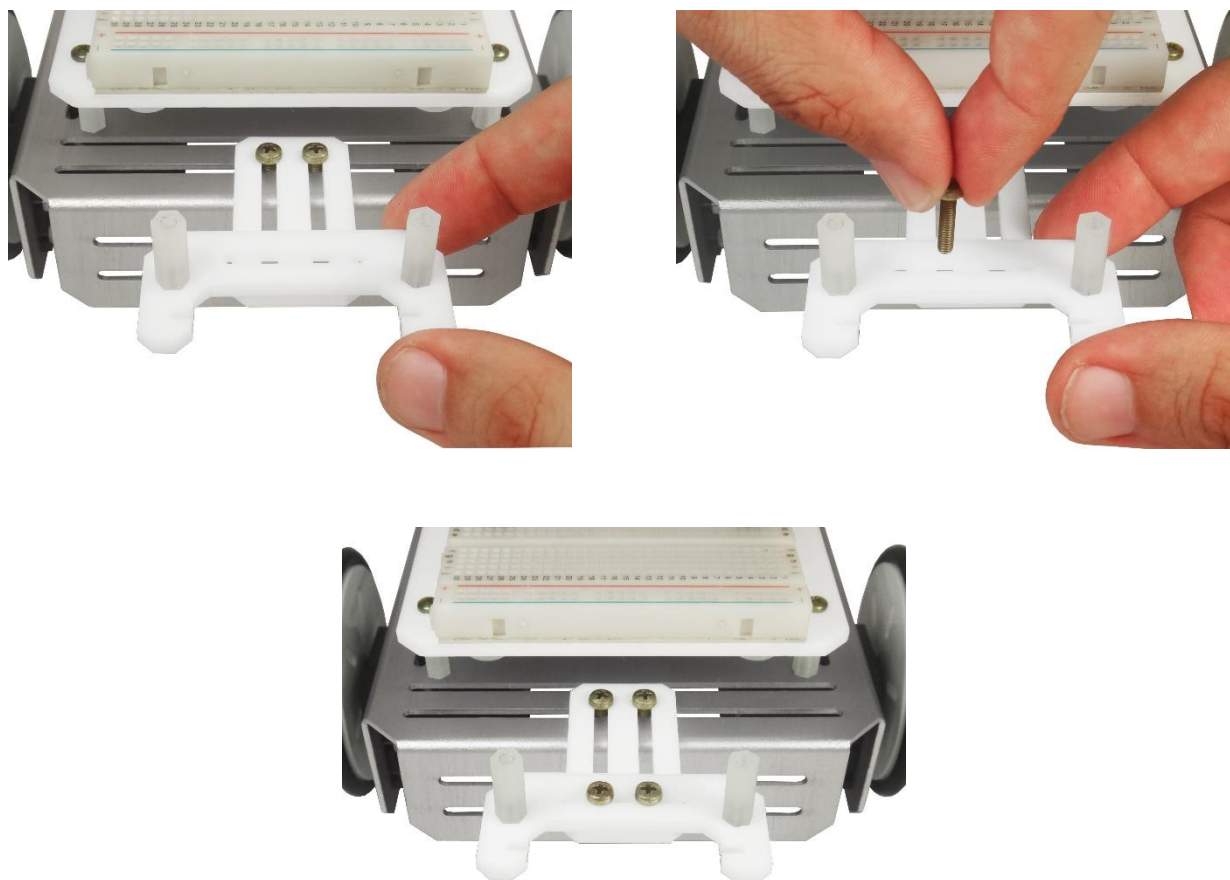


Figura 10.6 - Encaixando o sensor de ultrassom no suporte.



Figura 10.7 - Prendendo o suporte nos espaçadores.

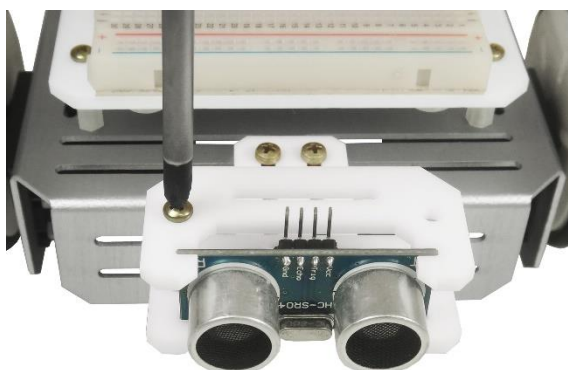
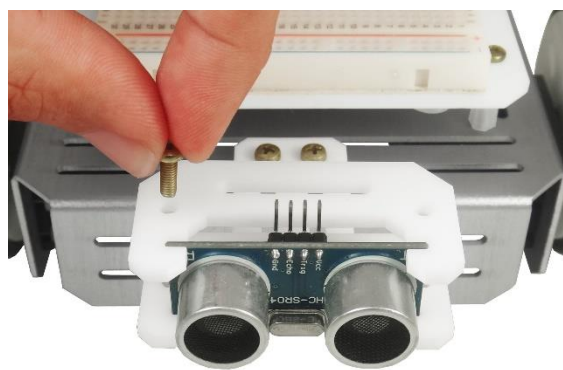
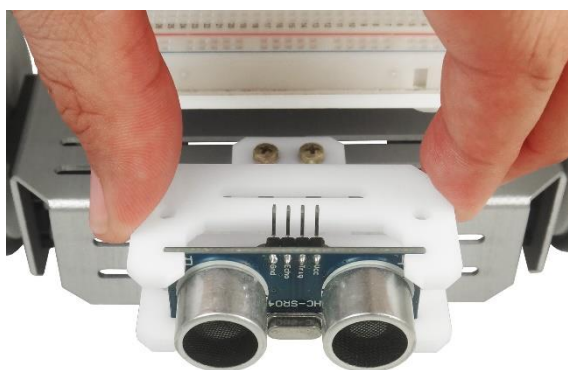


Figura 10.8 - Robô pronto para a realização da atividade.

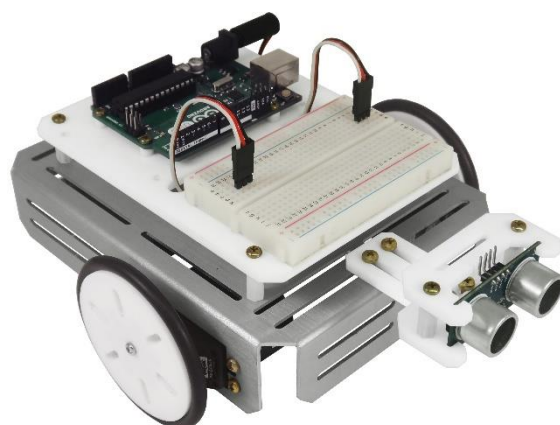


Figura 10.9 - Conectando os fios no sensor de ultrassom.

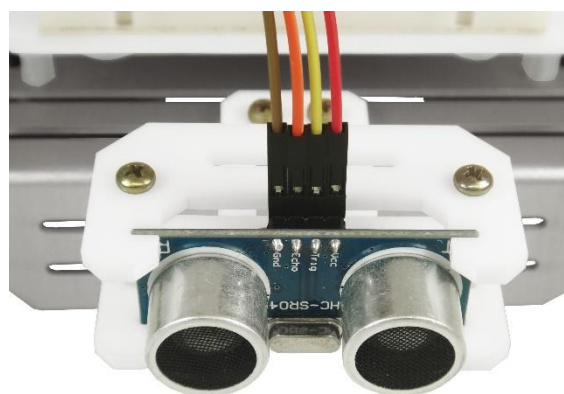
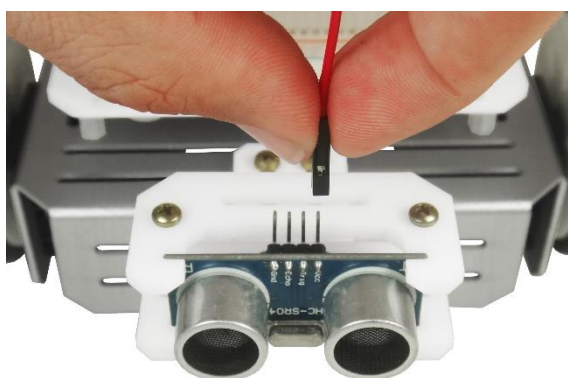
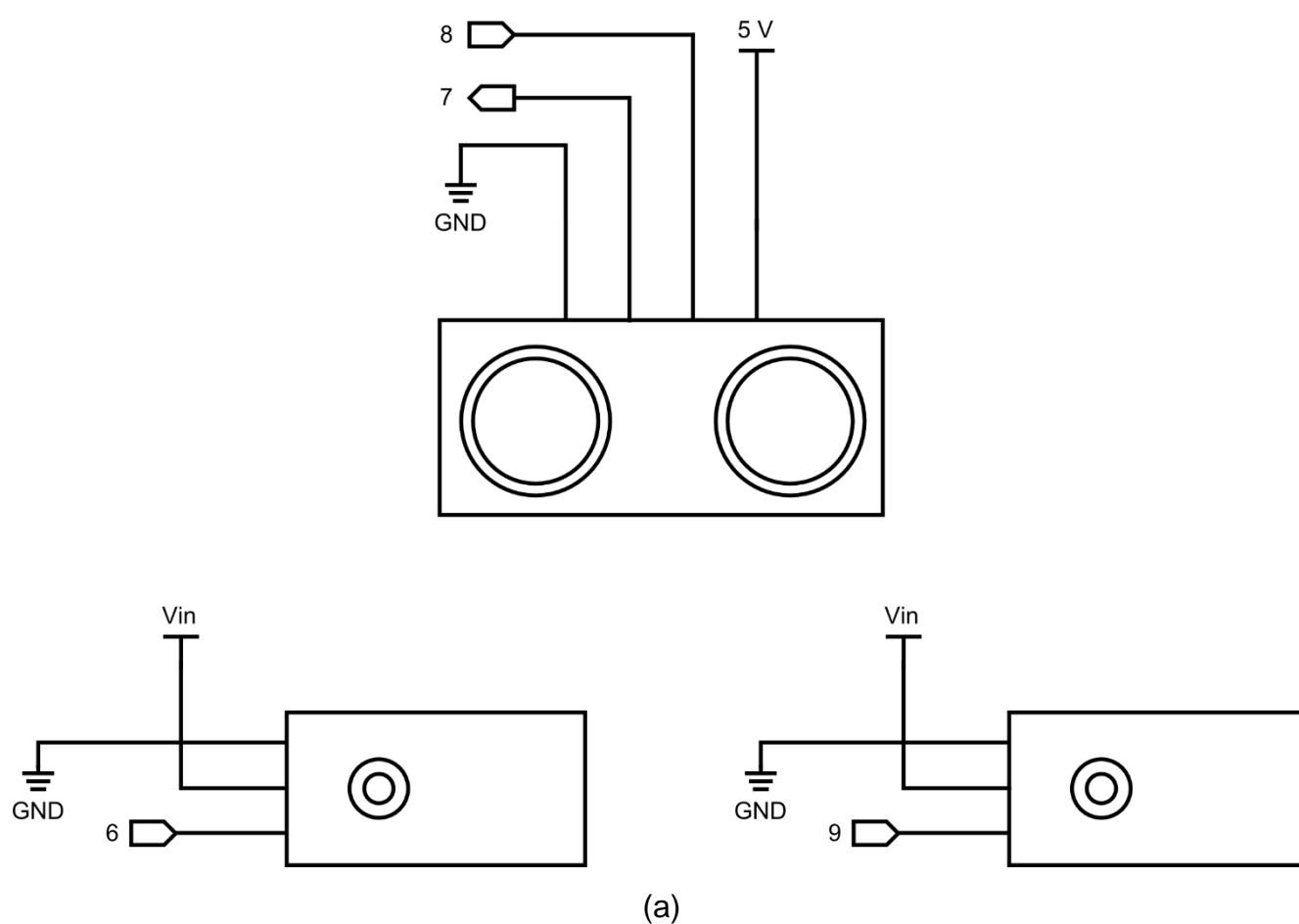
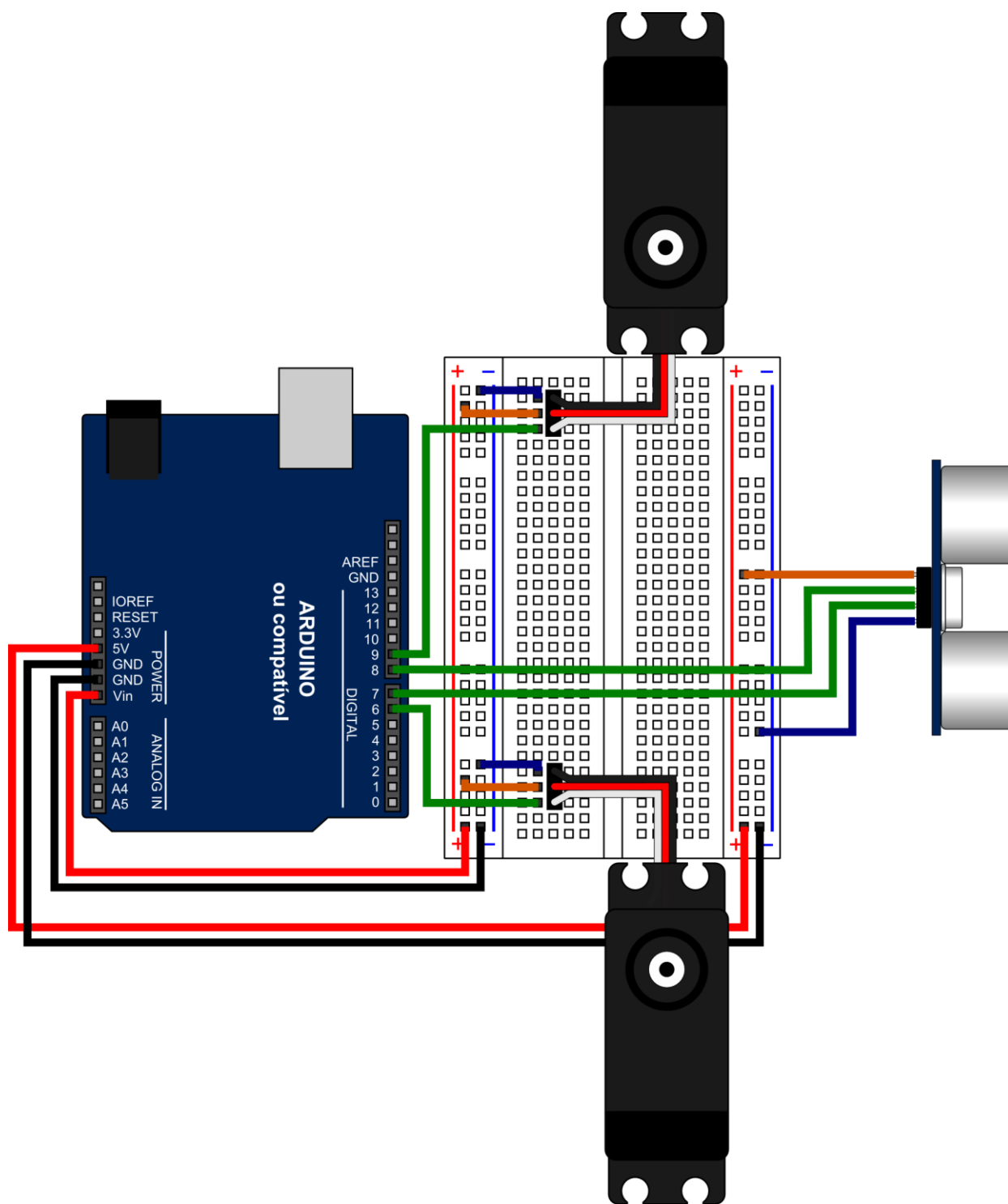


Figura 10.10 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 35.





(b)

Figura 10.11 - Prendendo os espaçadores no suporte.

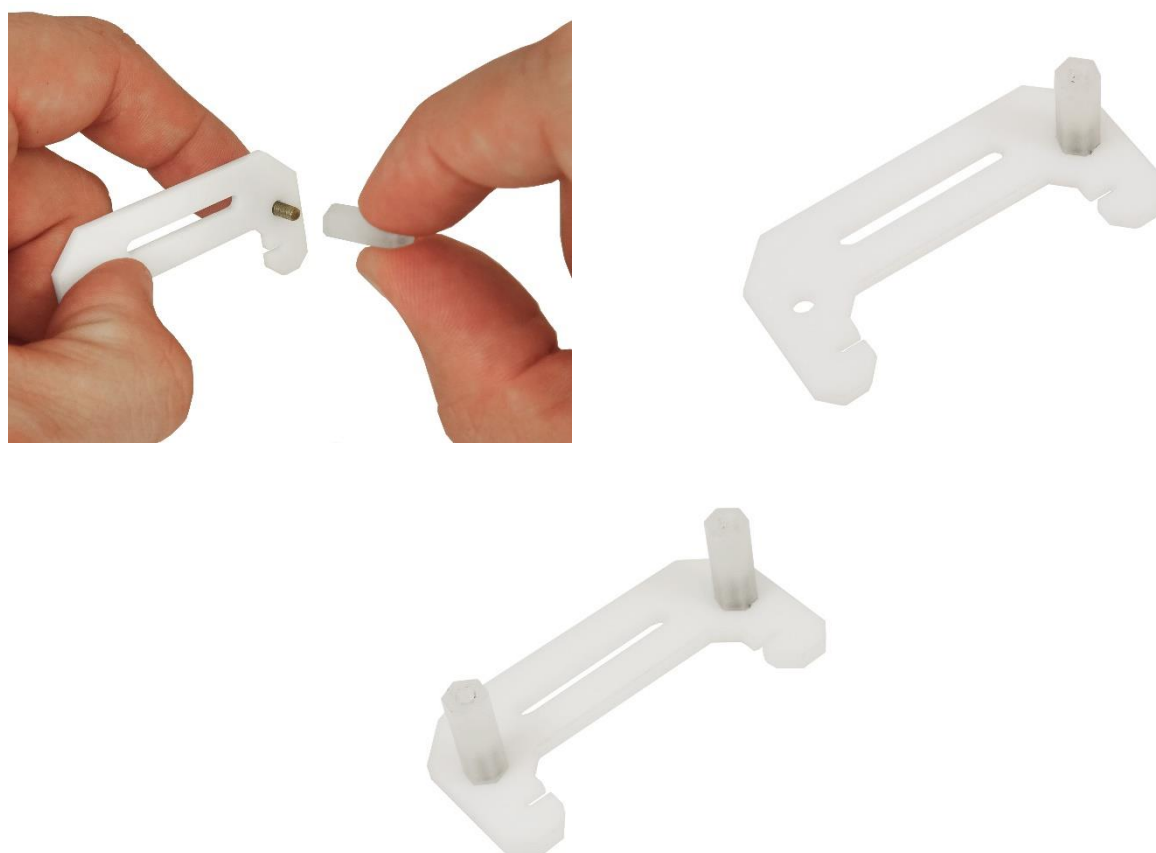


Figura 10.12 - Prendendo o suporte no chassi.

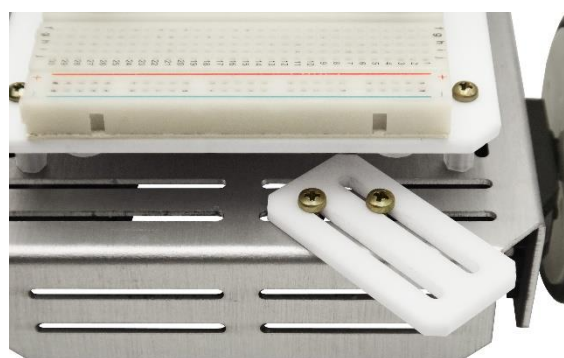
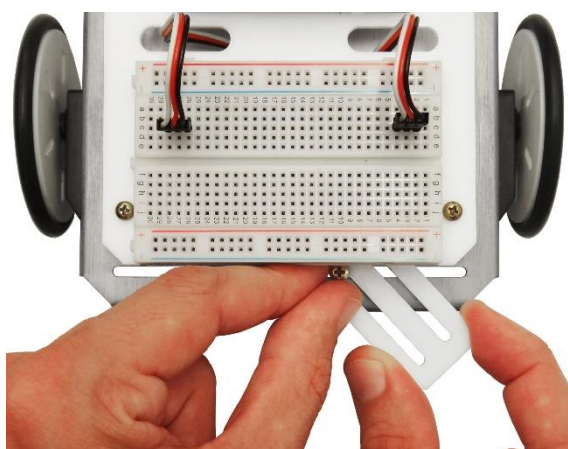


Figura 10.13 - Prendendo o suporte do sensor de ultrassom no suporte curto.

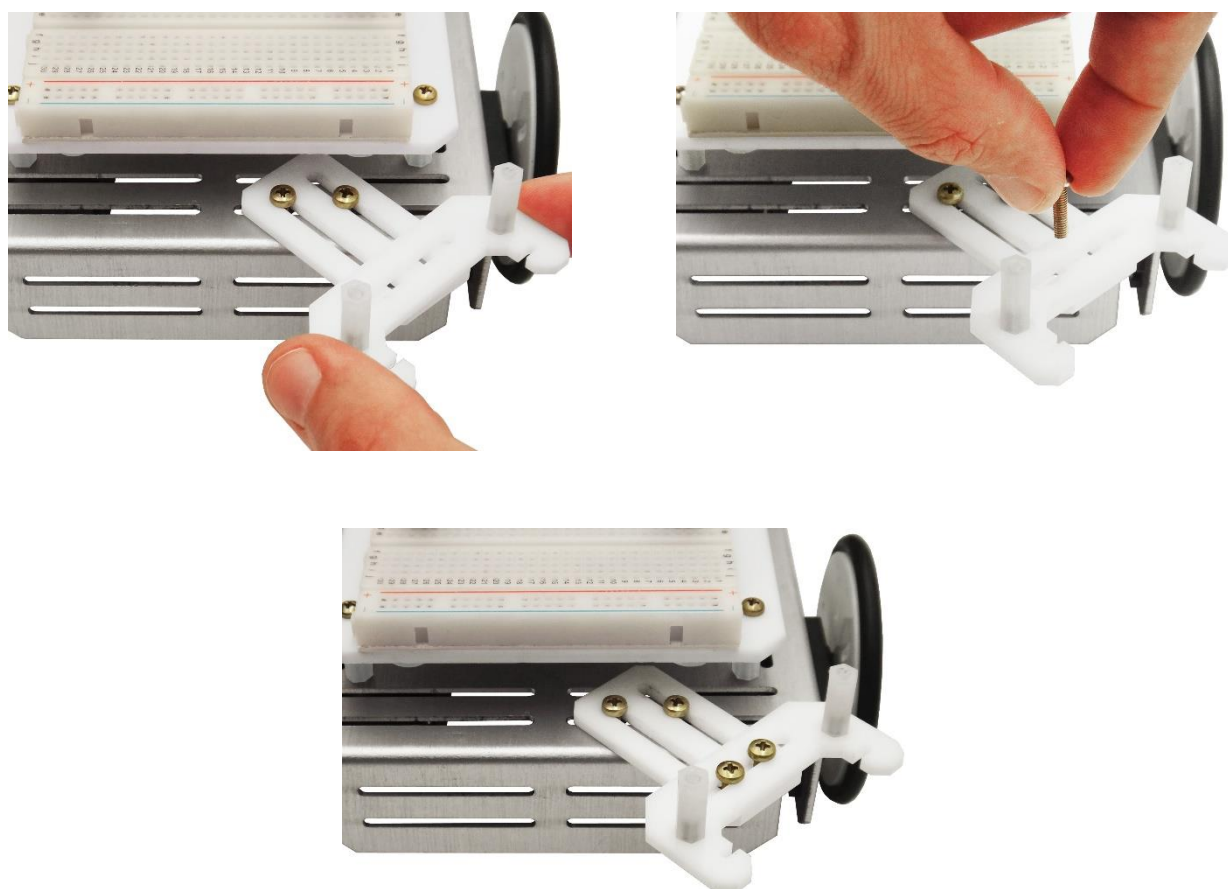


Figura 10.14 - Encaixando o sensor de ultrassom no suporte.



Figura 10.15 - Prendendo o suporte nos espaçadores.

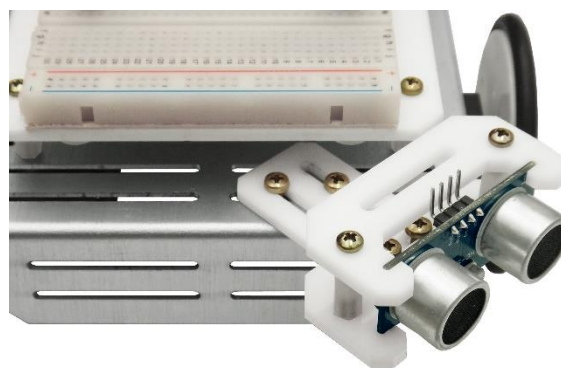
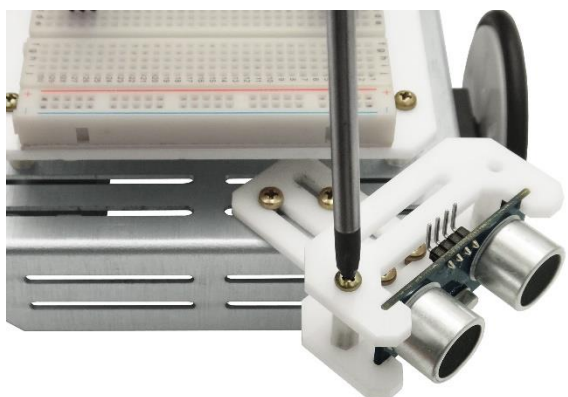


Figura 10.16 - Robô pronto para a realização da atividade.

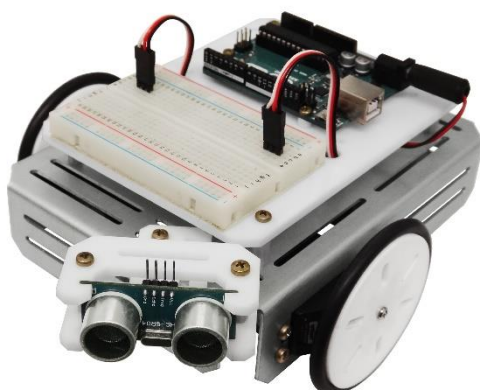
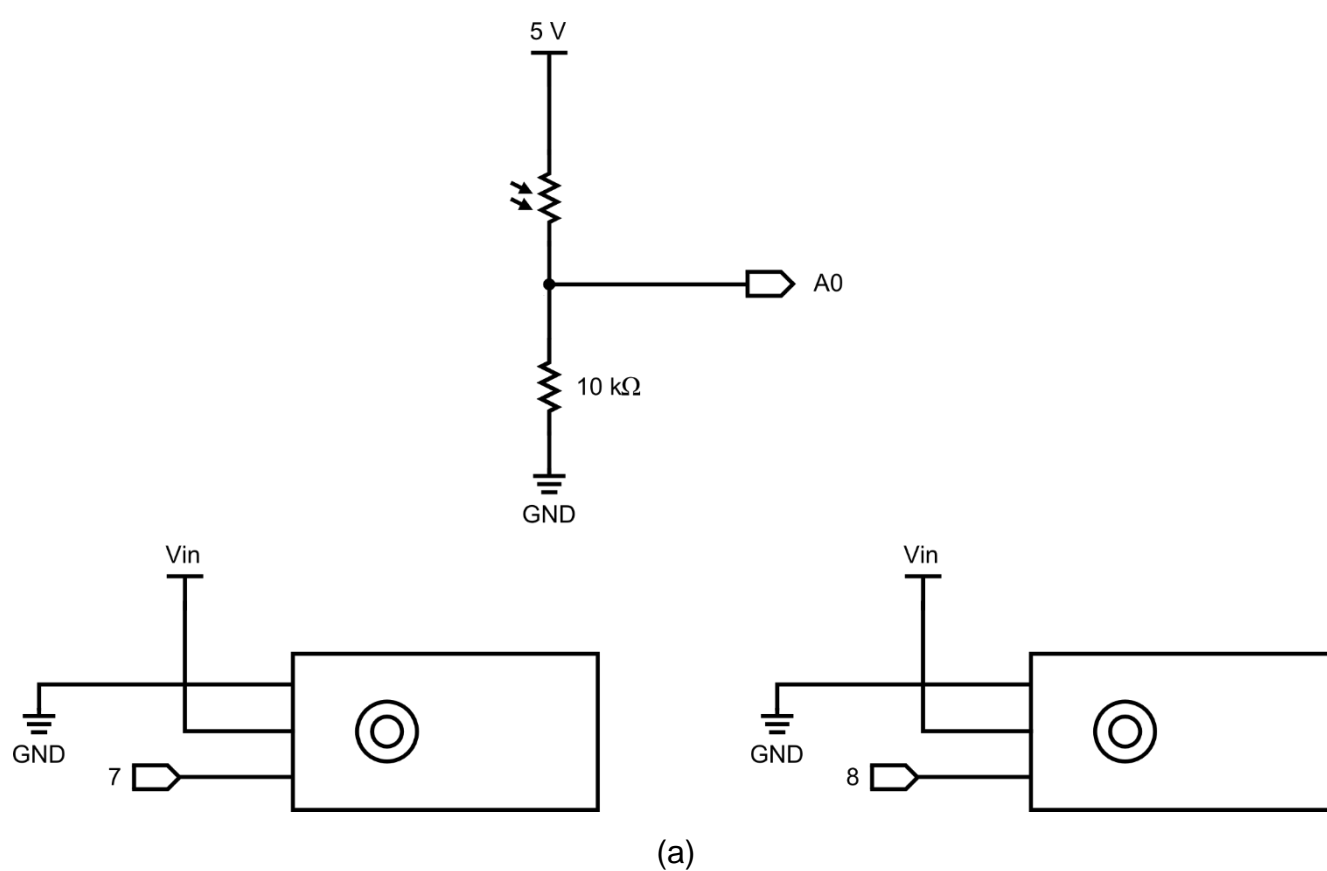
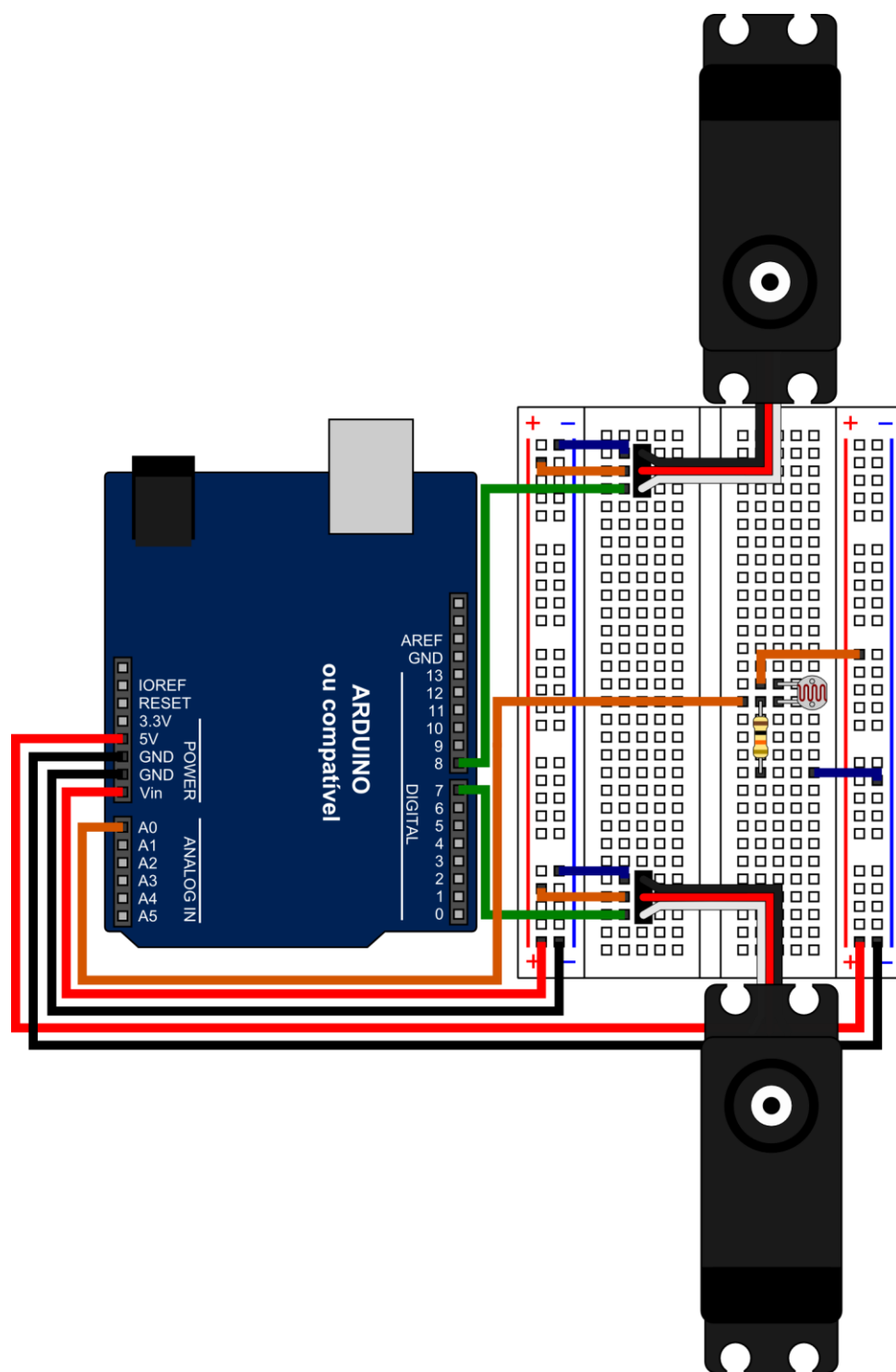


Figura 11.1 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 38.





(b)

Figura 11.2 - Prendendo os cabos extensores nos suportes.

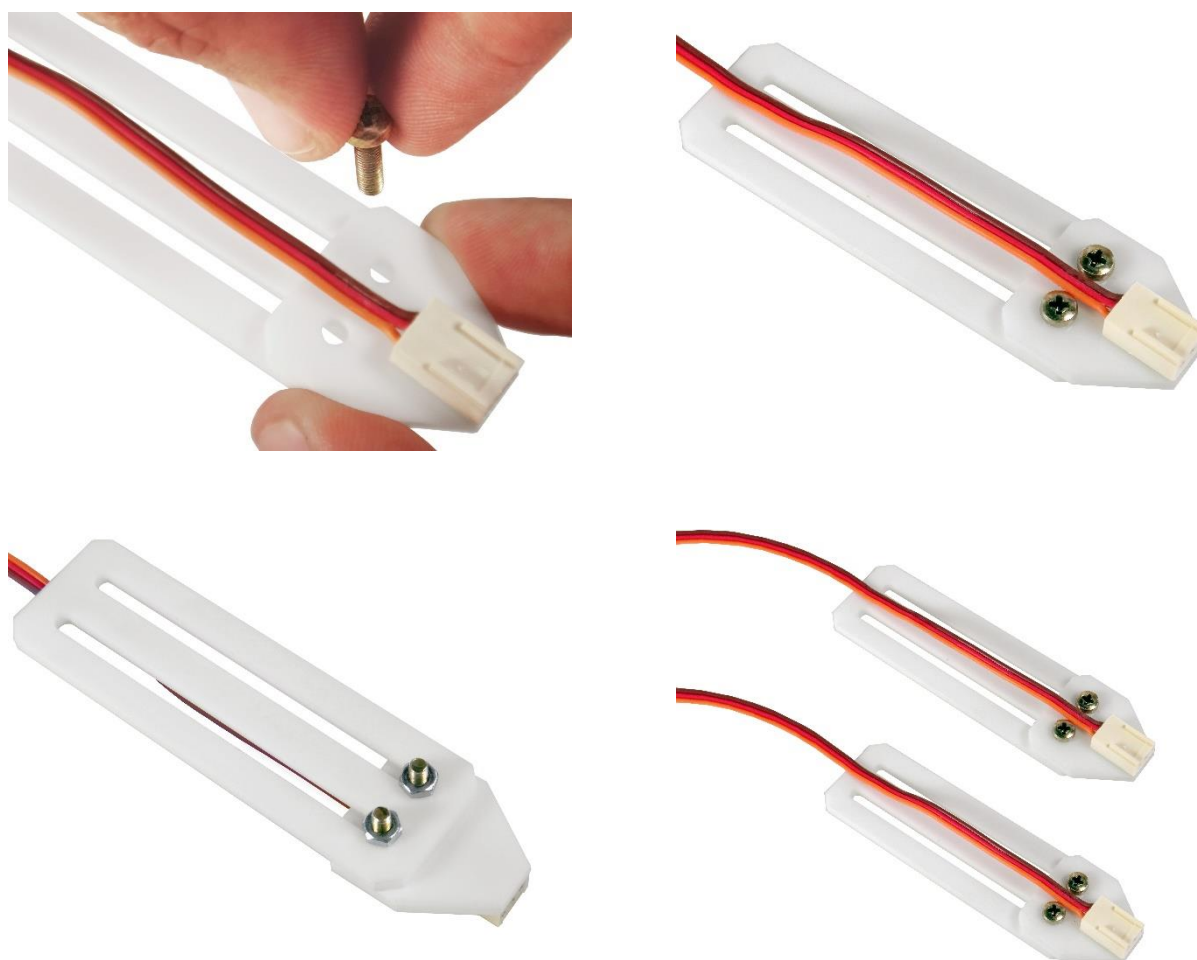


Figura 11.3 - Prendendo os suportes no chassi.

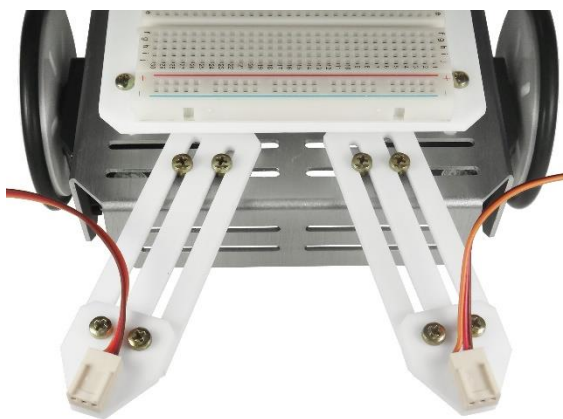
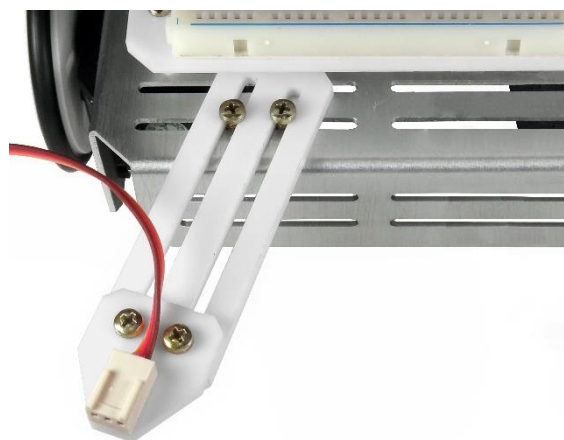


Figura 11.4 - Conectando os fotoresistores nos cabo extensores.

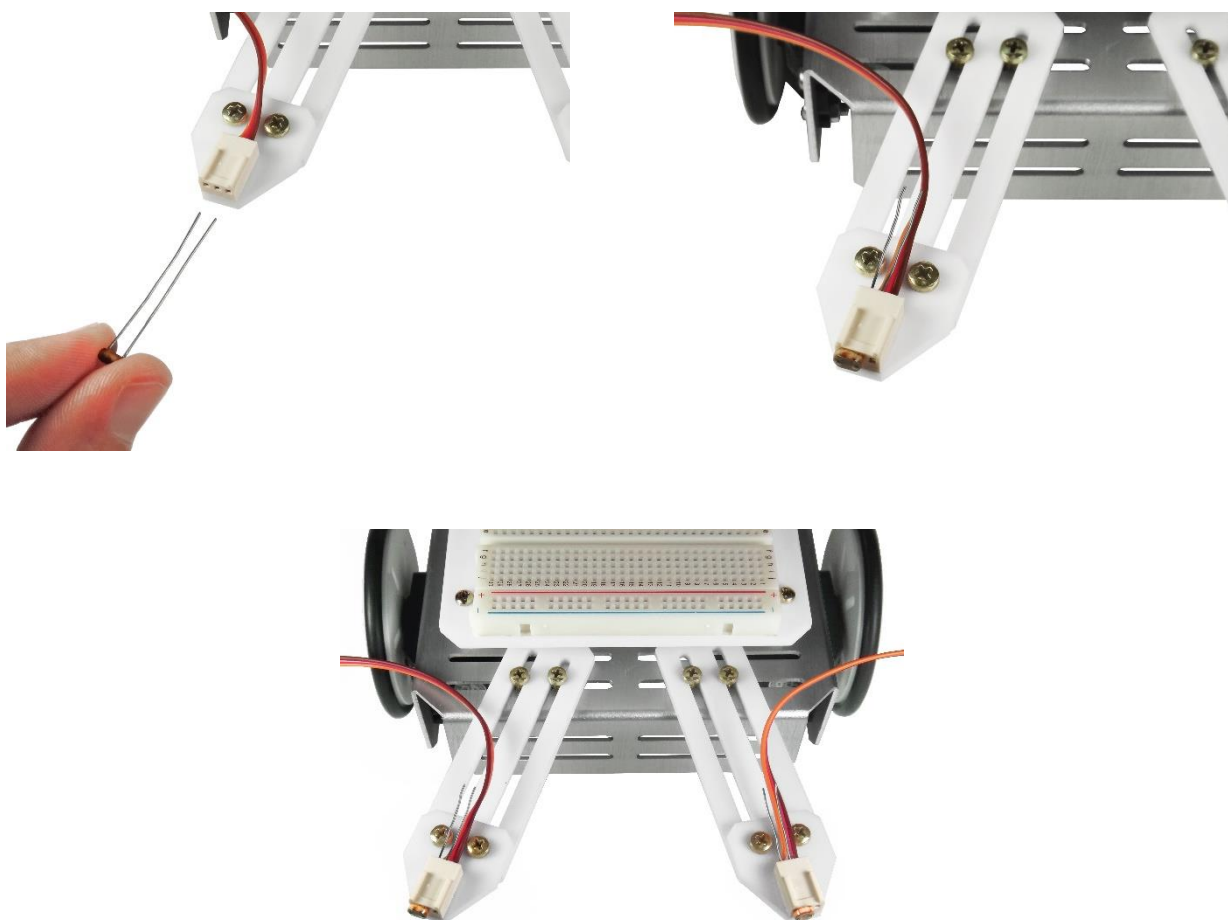


Figura 11.5 - Ligando os cabos extensores na protoboard.

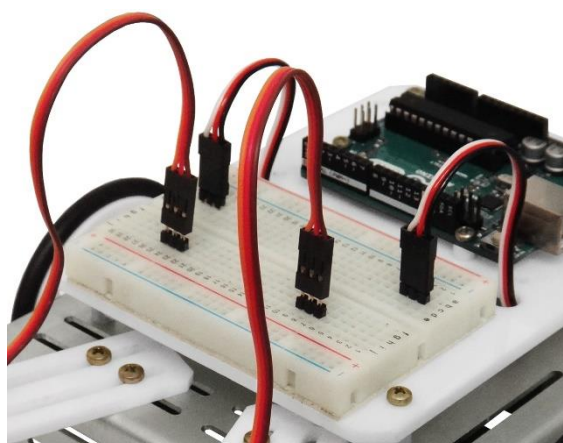


Figura 11.6 - Robô pronto para a realização da atividade.

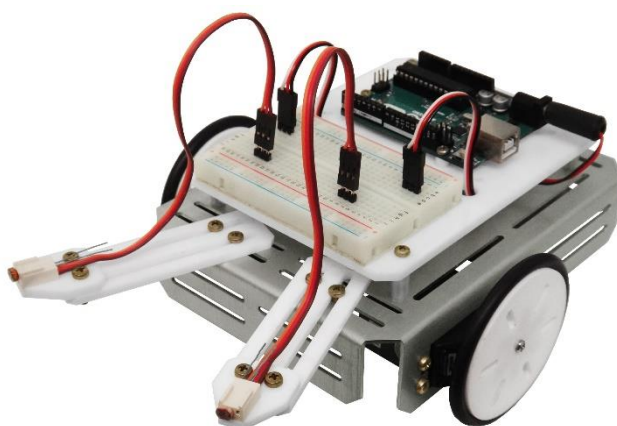
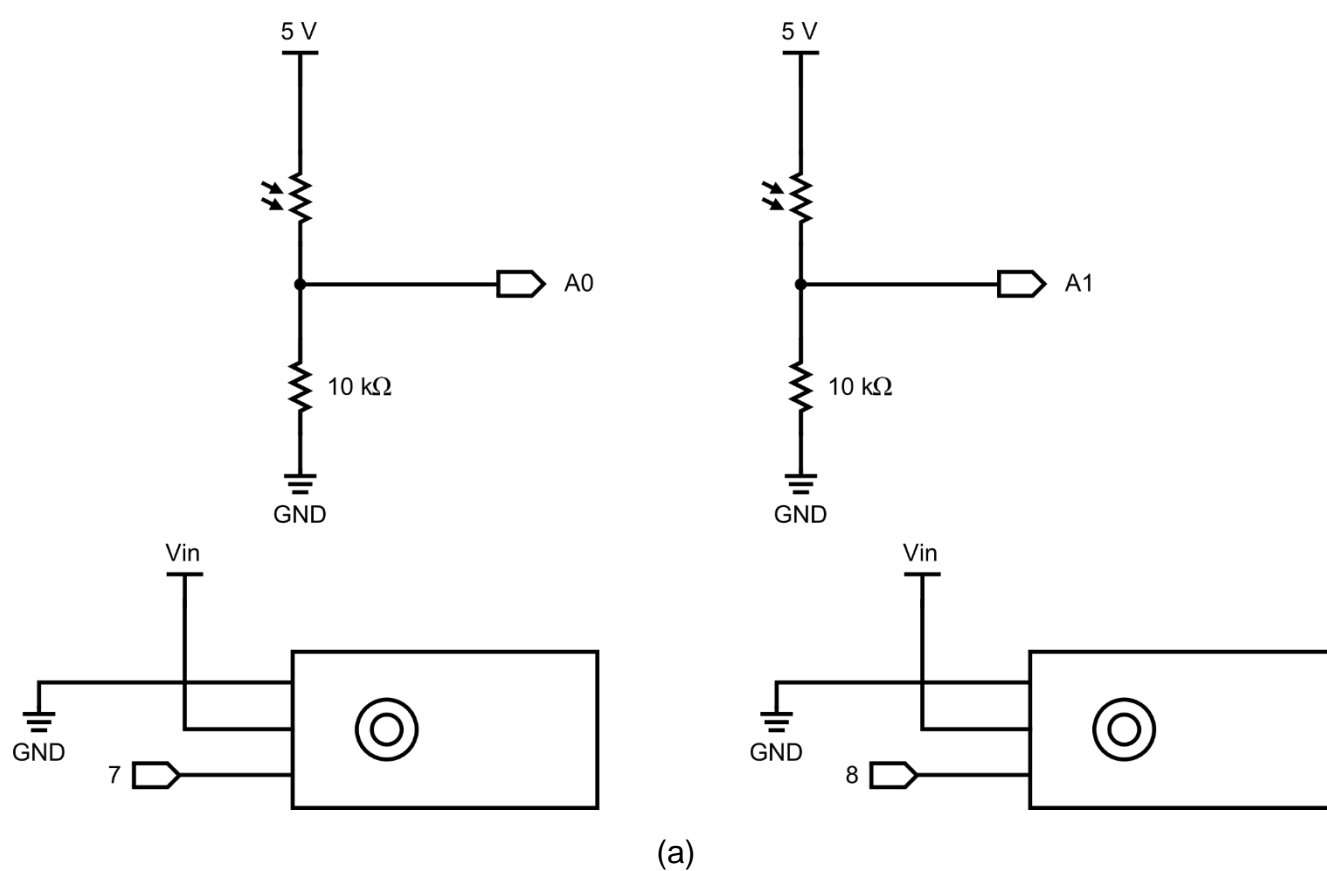
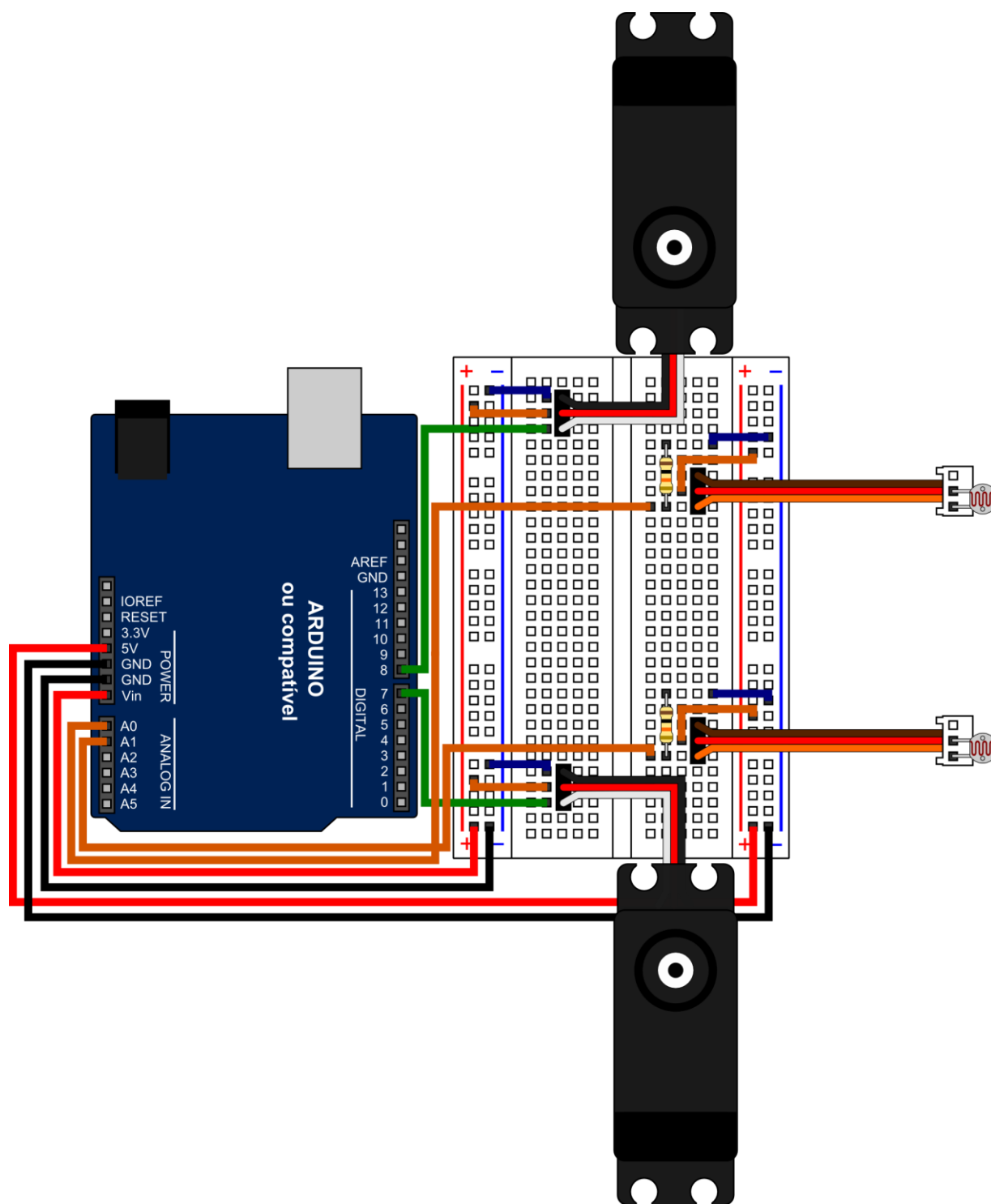


Figura 11.7 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 39.





(b)

Figura 12.1 - Exemplo de traçado feito com fita preta.



Figura 12.2 - Prendendo os cabos extensores no chassi.

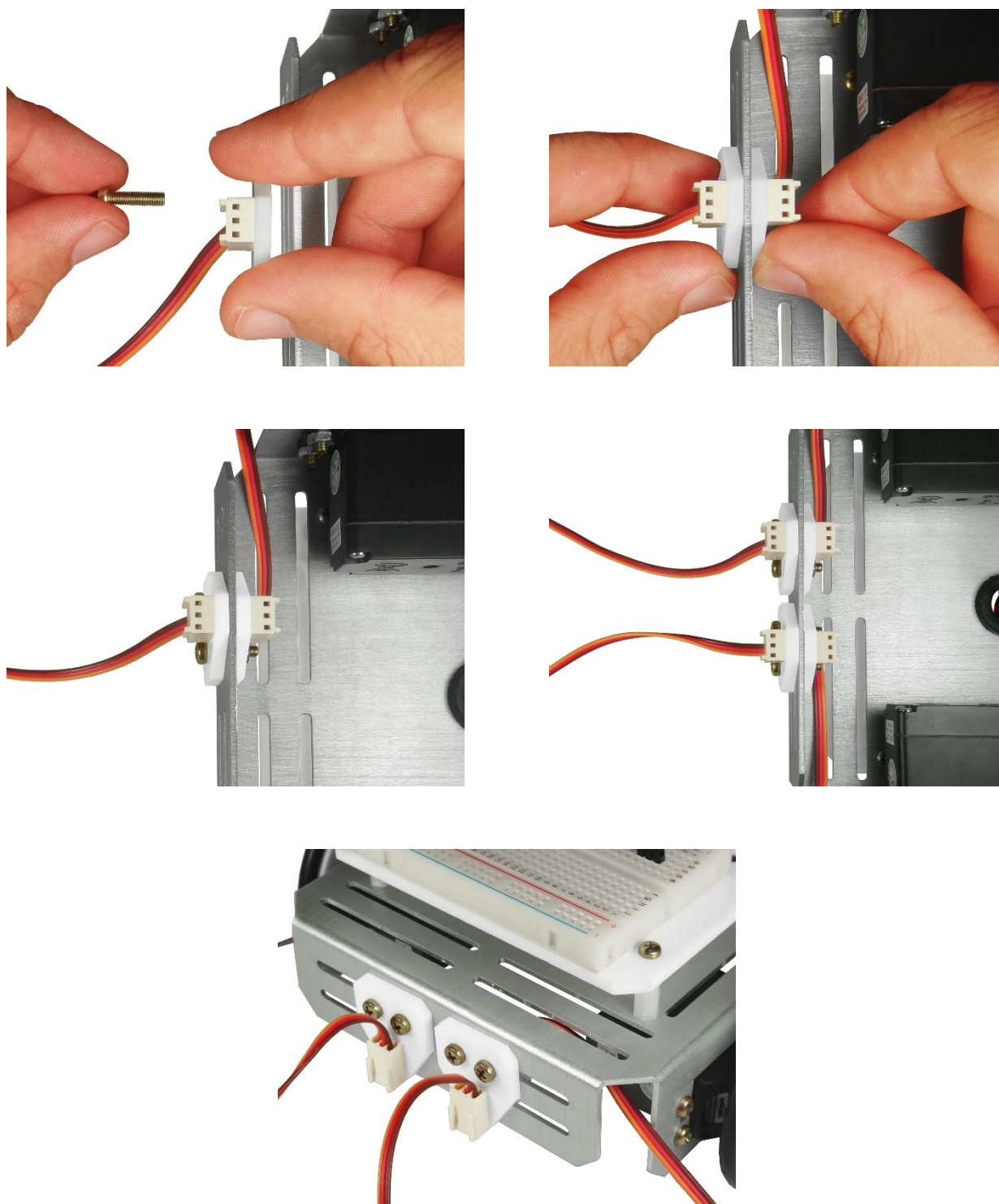


Figura 12.3 - Conectando os LEDs brancos nos cabos extensores.

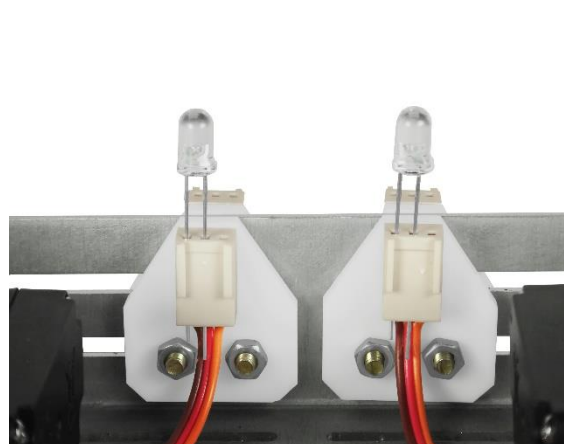
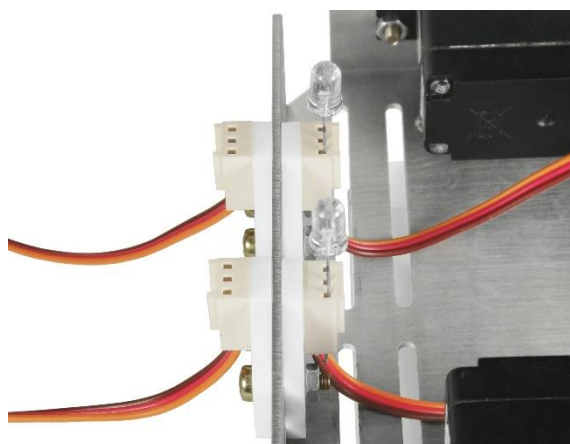
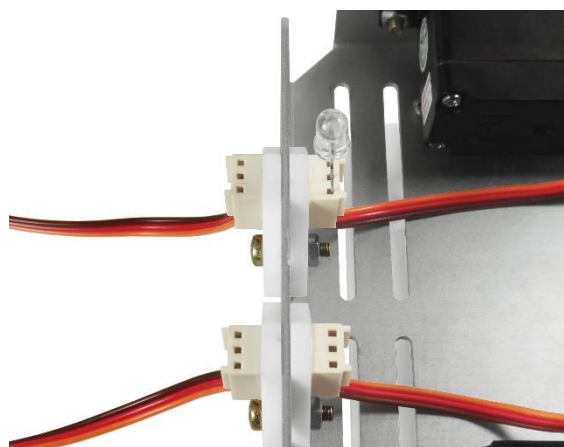
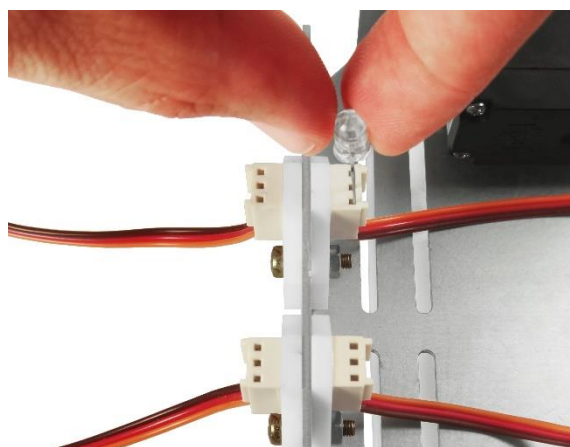


Figura 12.4 - Montando os fotoresistores dentro dos suportes para LED.

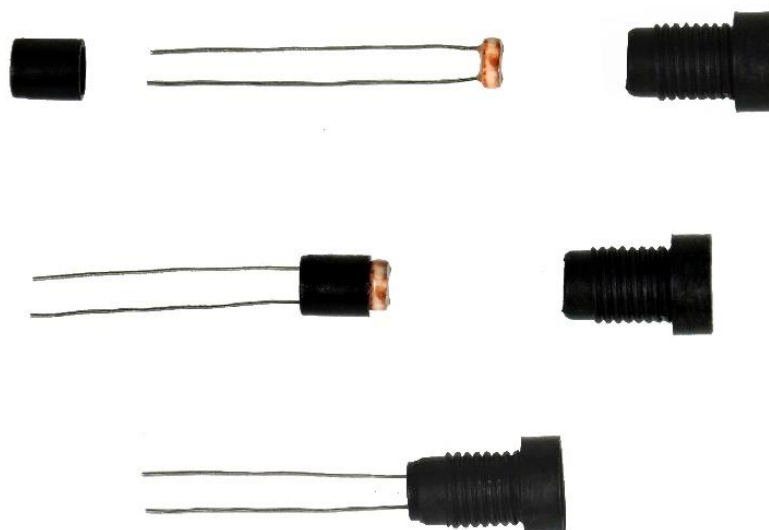


Figura 12.5 - Conectando os fotoresistores nos cabos extensores.

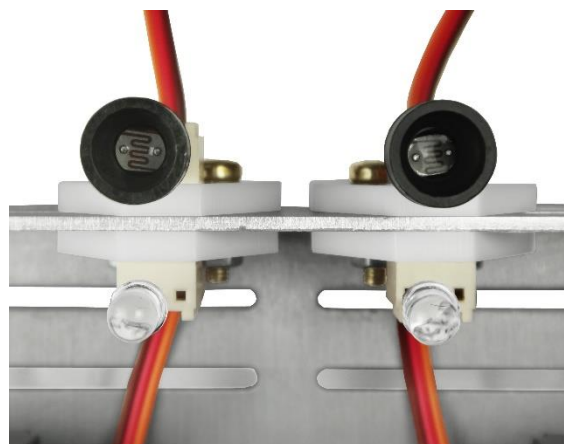
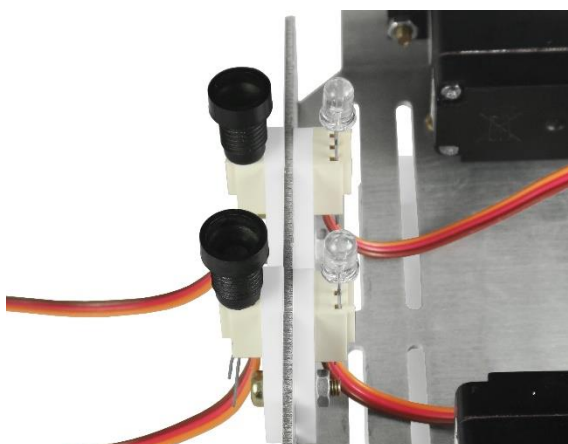
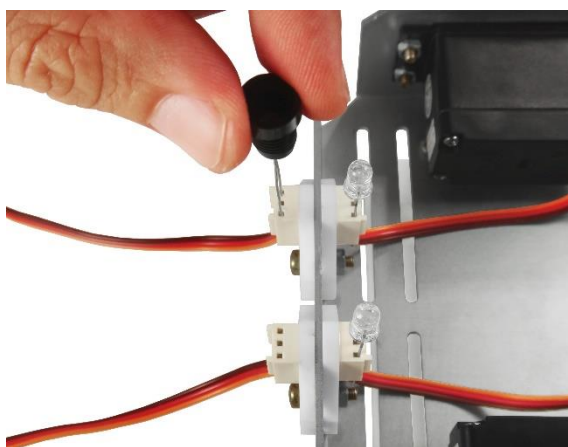


Figura 12.6 - Ligando os cabos extensores na protoboard.

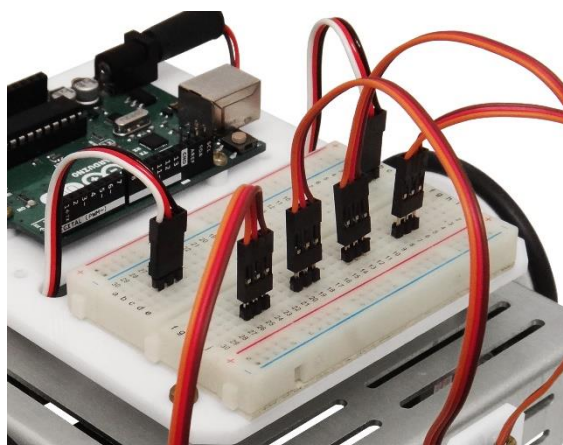


Figura 12.7 - Robô pronto para a realização da atividade.

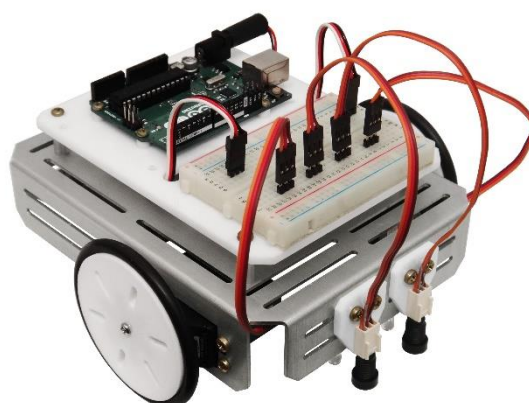
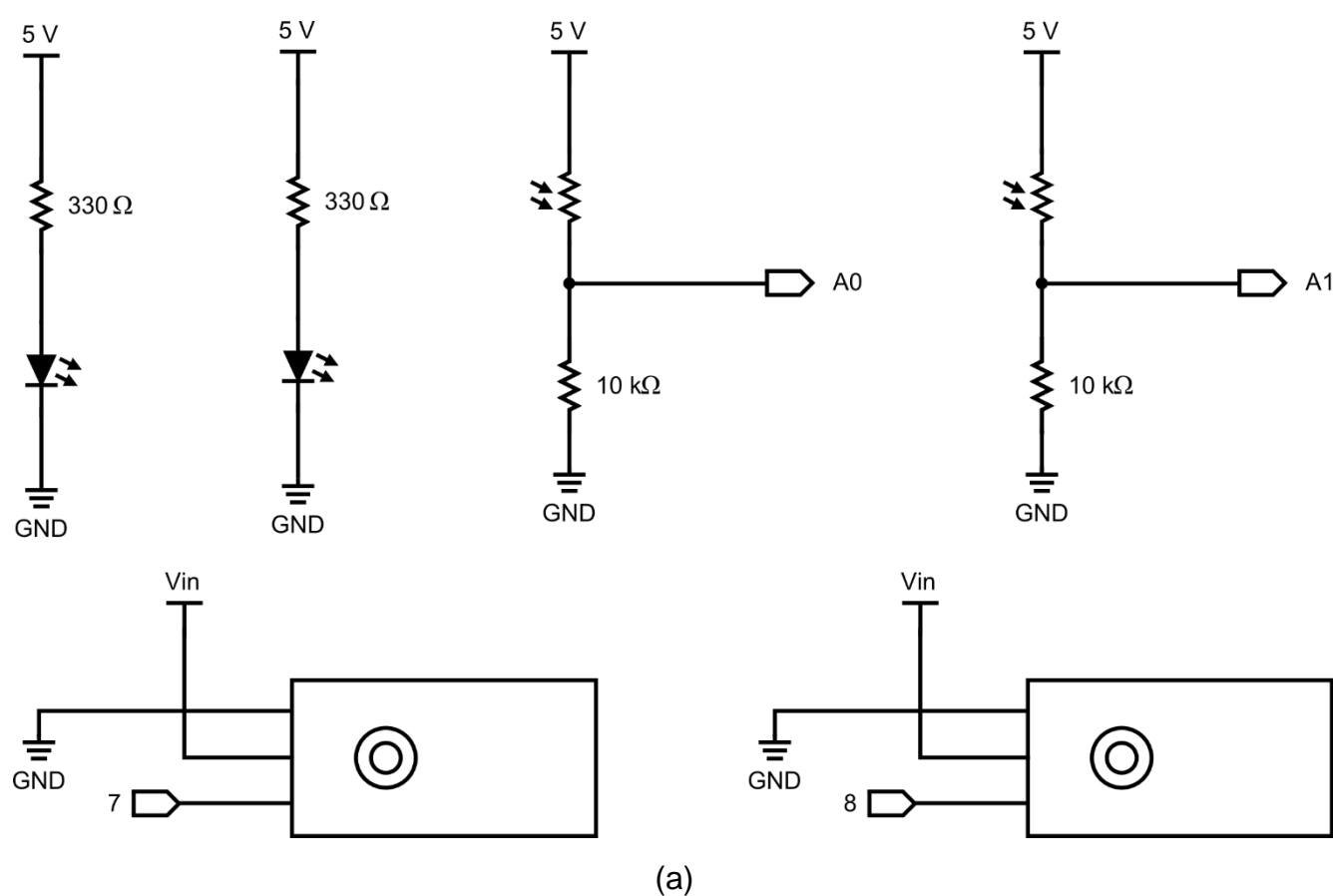
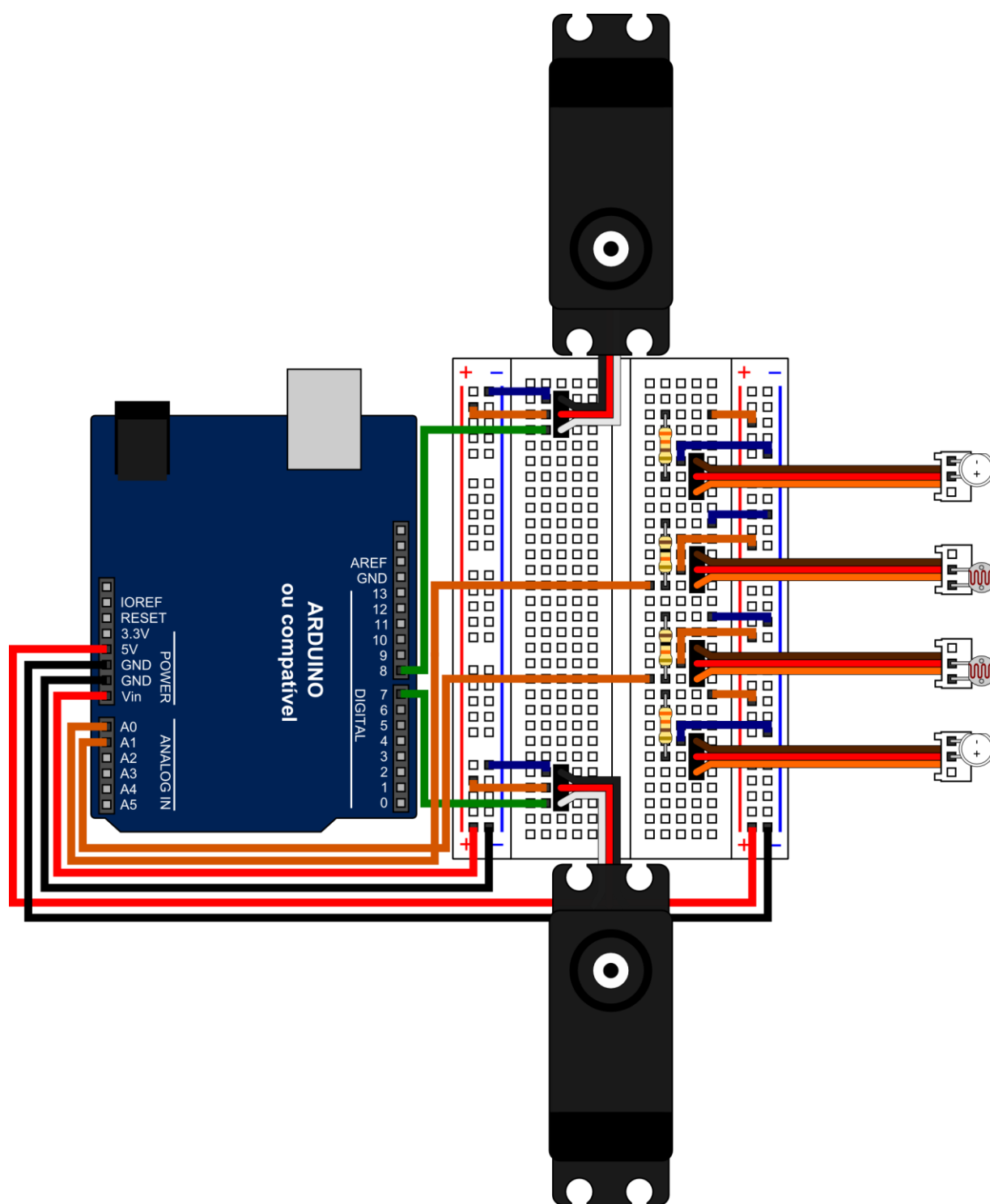


Figura 12.8 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 40.





(b)

Figura 12.9 - Prendendo os cabos extensores no chassi.

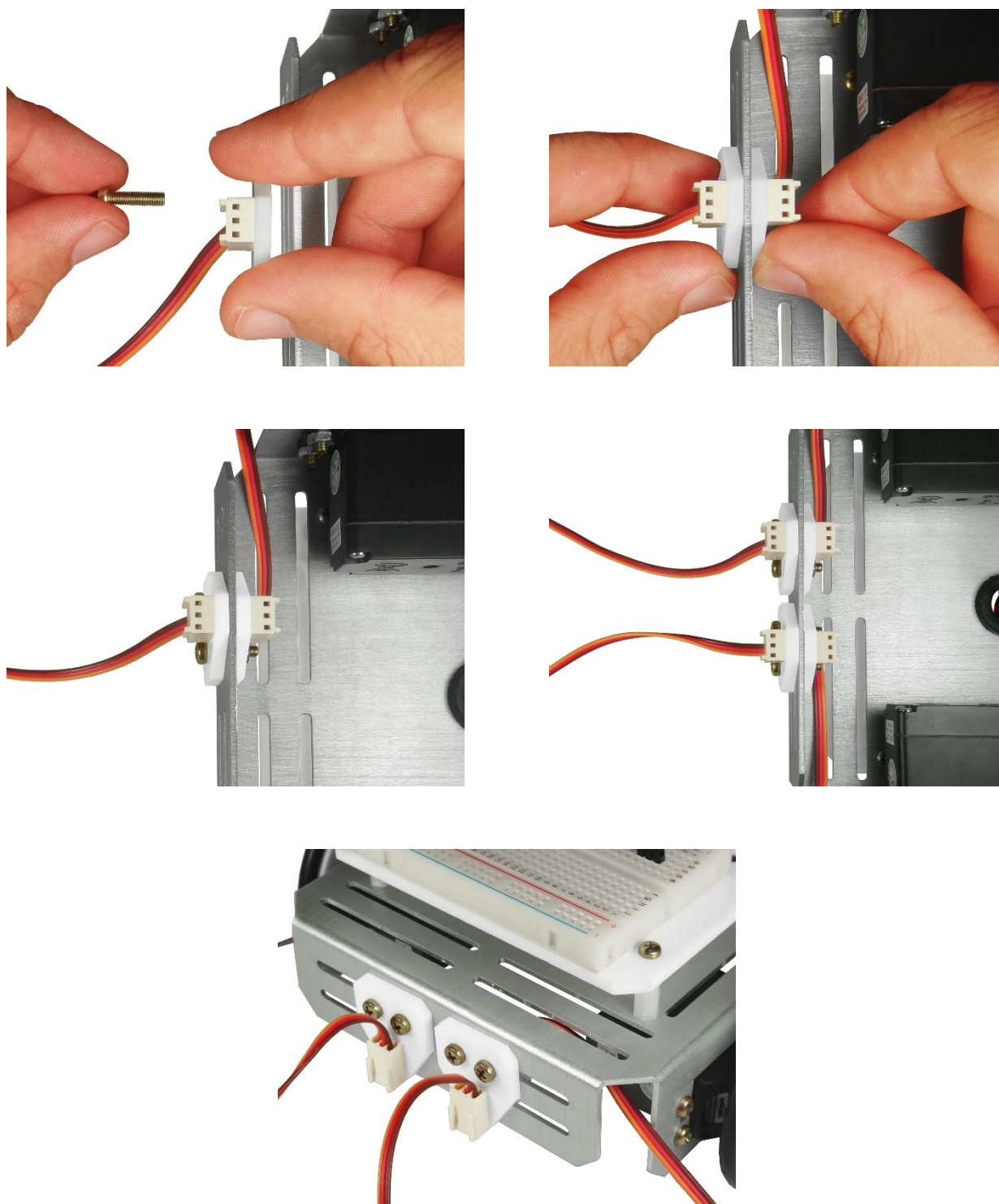


Figura 12.10 - Conectando os LEDs infravermelhos nos cabos extensores.

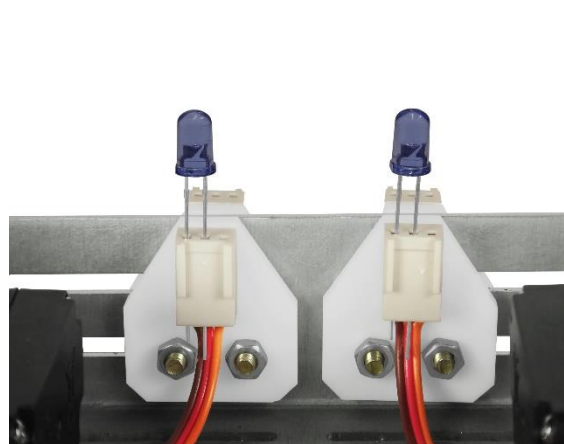
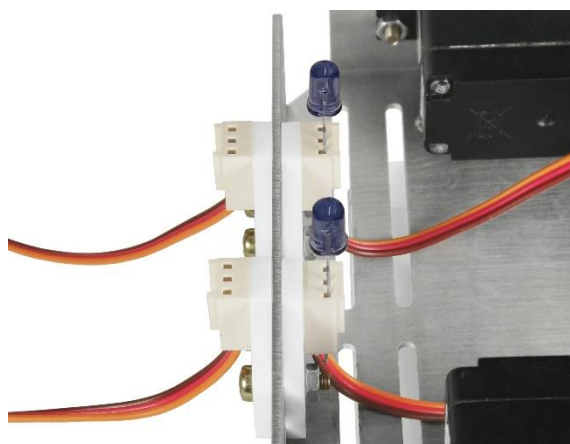
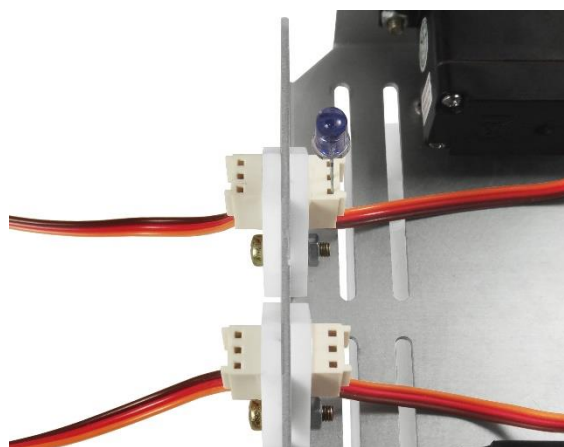
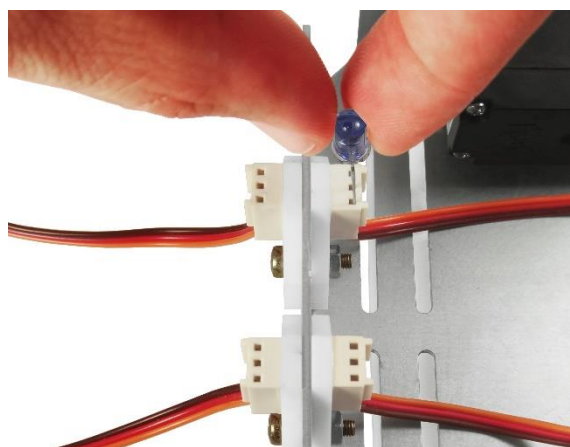


Figura 12.11 - Conectando os fototransistores nos cabos extensores.

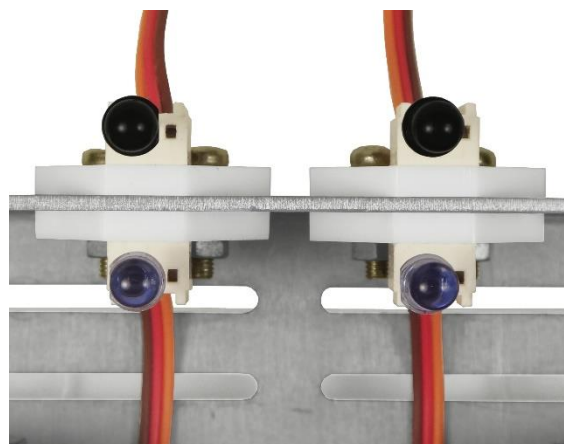
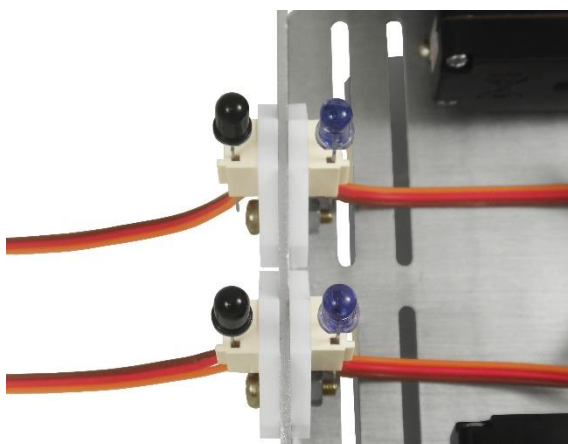
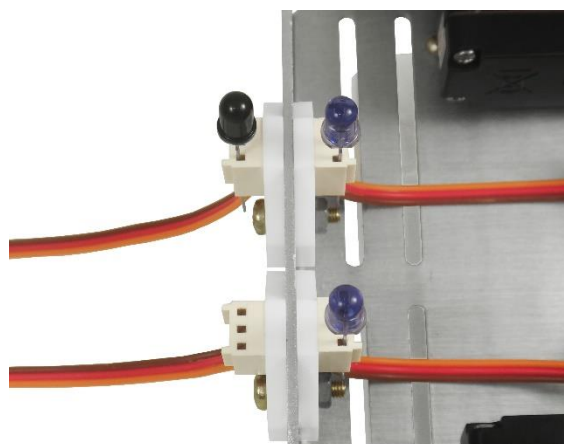
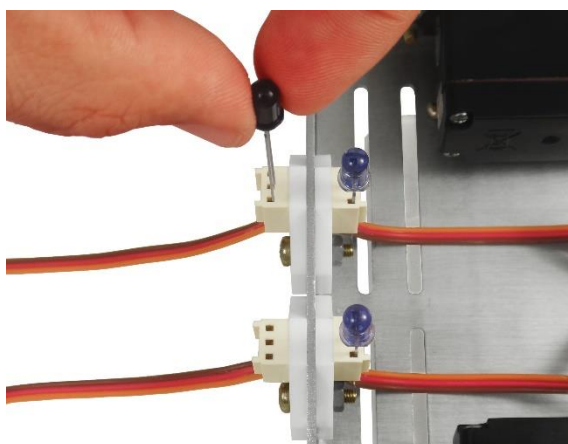


Figura 12.12 - Ligando os cabos extensores na protoboard.

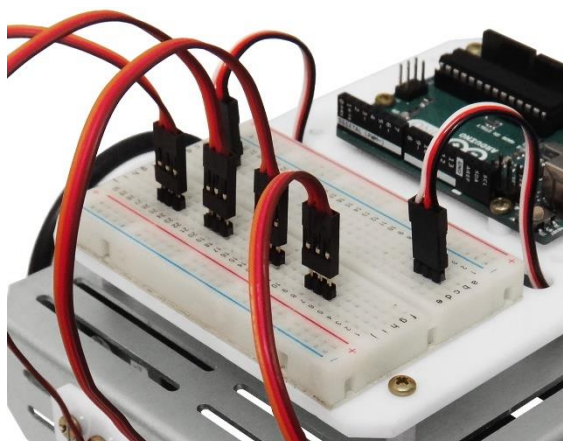


Figura 12.13 - Robô pronto para a realização da atividade.

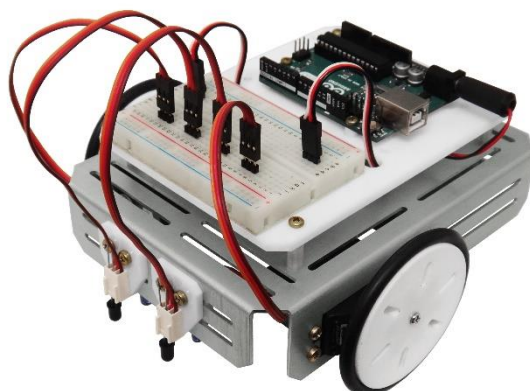
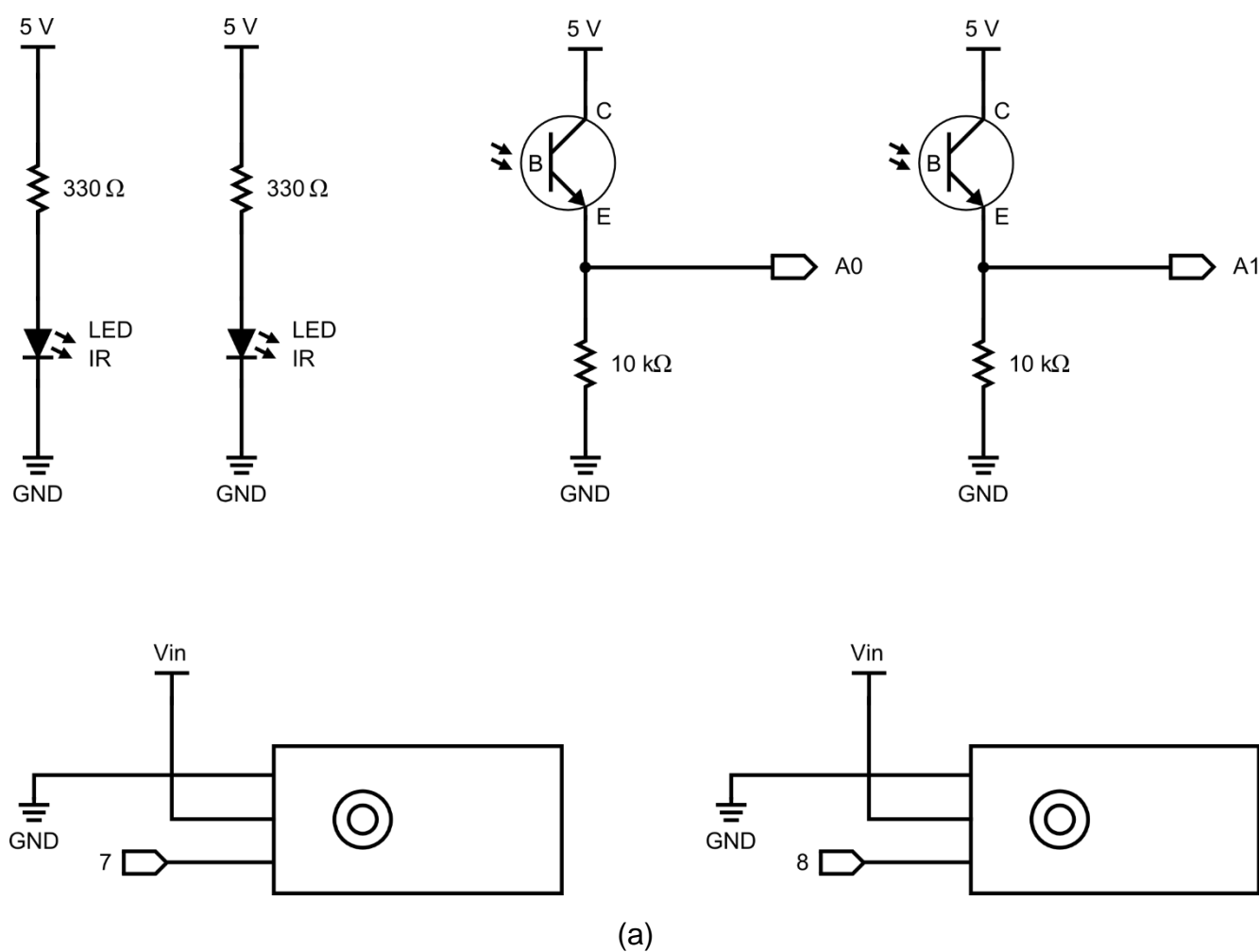
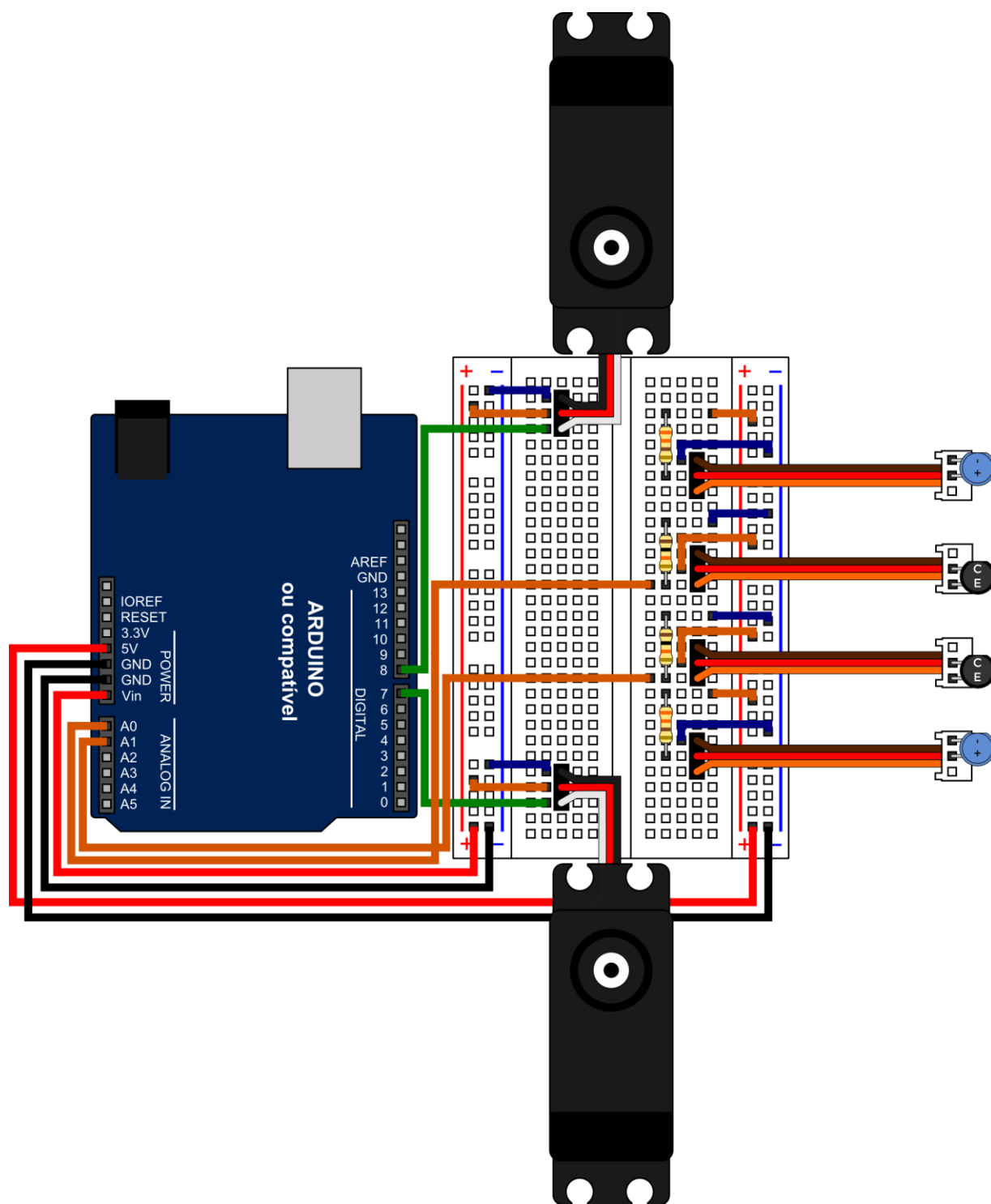


Figura 12.14 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 41.





(b)

Figura A.1 - Tensões elétrica existentes nos pinos da placa Arduino.

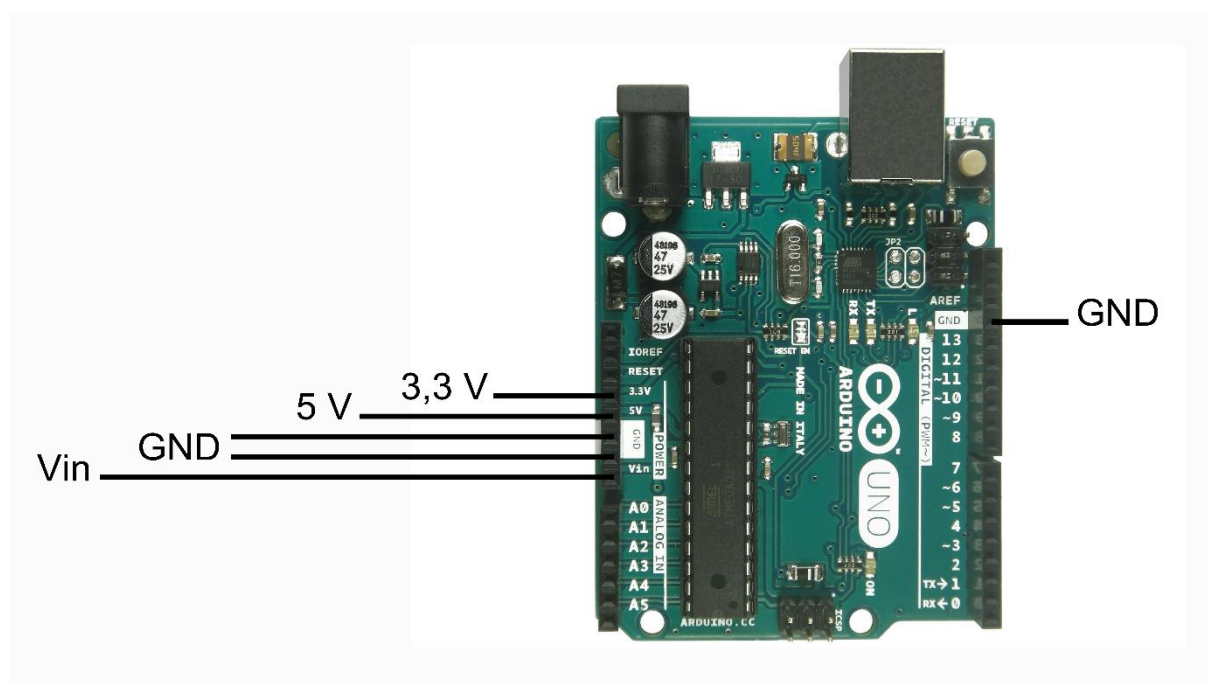


Figura A.2 - Circuito eletrônico da Atividade 1 (Capítulo 2).

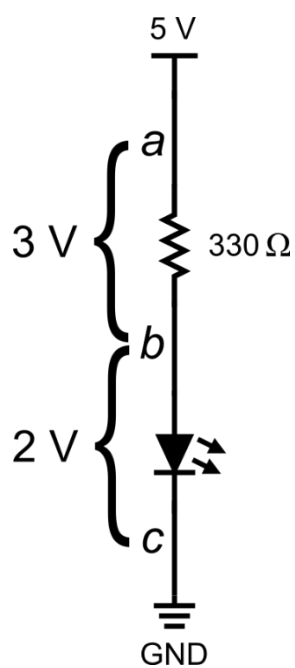


Figura A.3 - LED diretamente polarizado.

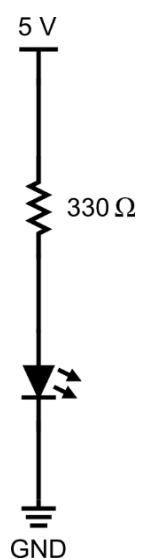


Figura A.4 - LED reversamente polarizado.

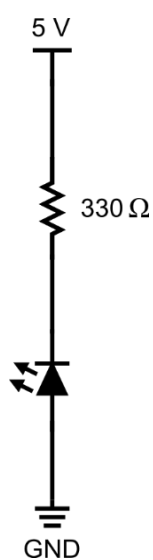
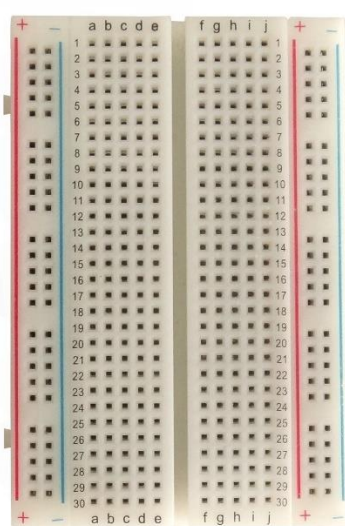
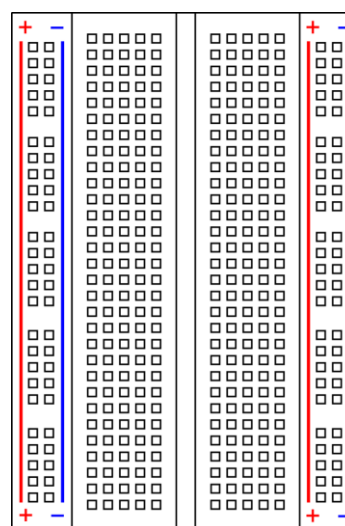


Figura B.1 - (a) Imagem de uma protoboard e (b) a figura que a representa na ilustração dos circuitos montados.

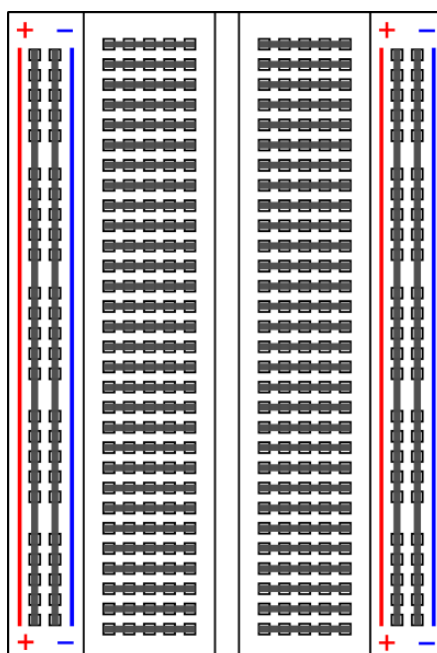


(a)

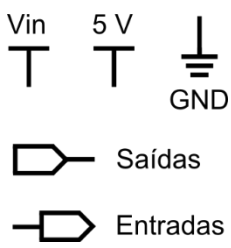
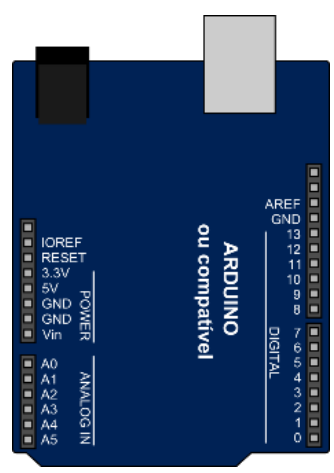


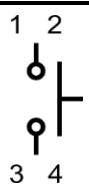
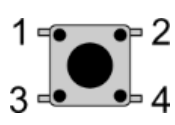
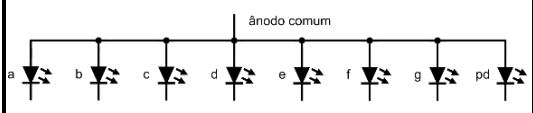
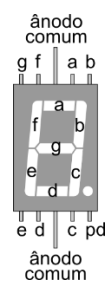



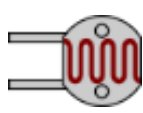


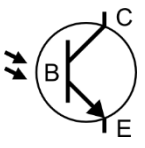
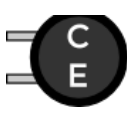

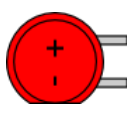
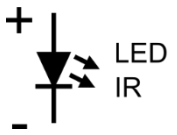
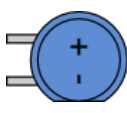
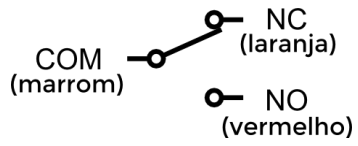
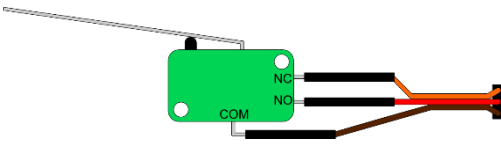
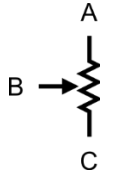
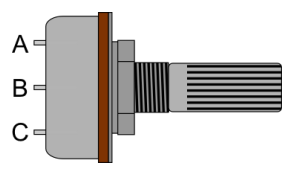

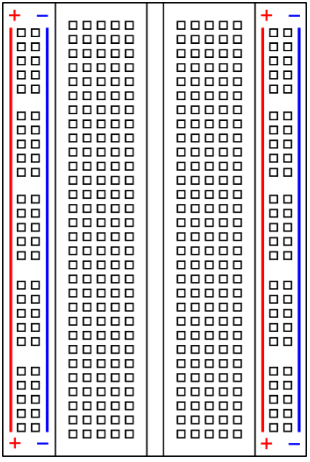
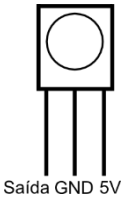
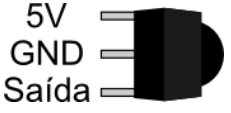


(b)

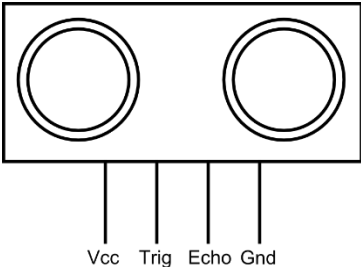
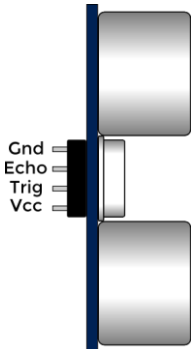
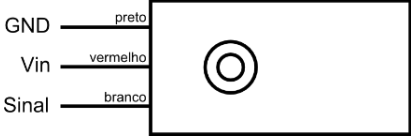

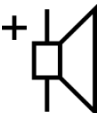

Figura B.2 - Forma como estão interligados os furos da protoboard.



APÊNDICE C – SÍMBOLOS UTILIZADOS NOS CIRCUITOS ELETRÔNICOS

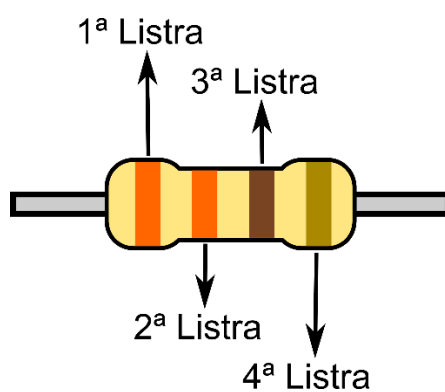
Elemento	Representação nos esquemas dos circuitos	Representação nas ilustrações dos circuitos
Arduino Uno	 <p>Vin 5 V GND</p> <p>Saídas</p> <p>Entradas</p>	
Cabo extensor		
Chave tátil (pushbutton)	 <p>1 2</p> <p>3 4</p>	
Display de 7 segmentos	 <p>ânodo comum</p> <p>a b c d e f g pd</p>	 <p>ânodo comum</p> <p>a b c d e f g pd</p> <p>ânodo comum</p>
Fio M/M ou M/F ⁽¹⁾		
Fotoresistor (LDR)		

Fototransistor		
LED ⁽²⁾		
LED infravermelho		
Micro chave		
Potenciômetro		
Protoboard (matriz de contatos)		
Receptor de infravermelho		
Resistor ⁽³⁾		




Sensor de ultrassom		
Servomotor		
Sonorizador piezo (buzzer)		

- 1 - A cor dos fios varia.
- 2 - A cor dos LEDs varia.
- 3 - As cores das listras dos resistores variam.

Figura E.1 – Resistor





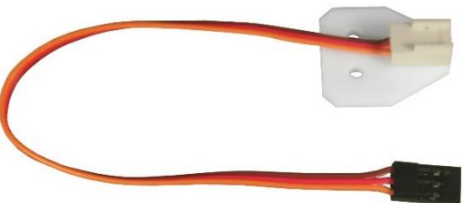





APÊNDICE F – ITENS QUE COMPÕEM O KIT CRIMATECNO CT100








Item	Imagem
Arduino Uno	 A photograph of an Arduino Uno microcontroller board. It is a green printed circuit board (PCB) with various electronic components. Key features include a USB Type-B port on the left, a DC power jack, a reset button, and two rows of pin headers (digital and analog) on the right. The text "ARDUINO UNO" and "MADE IN ITALY" are visible on the board.
Base de prototipagem	 A photograph of a white, rectangular prototyping base. It has a grid of holes for electronic components and a central slot for a breadboard. The "CRIMATECNO" logo is printed at the bottom.
Cabo USB	 A photograph of a black USB cable. It has a standard USB-A connector on one end and a USB-B connector on the other. A small white label with a barcode is attached to the cable.
Chassi	 A photograph of a grey metal chassis. It is a rectangular enclosure with a central circular hole and several slots on the sides for components. The "CRIMATECNO" logo is visible on the top surface.




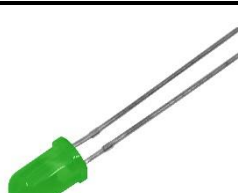


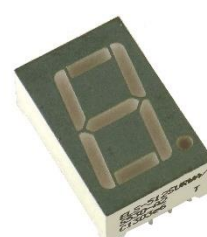
Servomotor	
Conjunto de acessórios do servomotor	
Roda	
Anel de borracha	
Esfera	
Eixo da esfera	

Suporte de pilhas	
Presilha de pilhas	
Suporte curto	
Suporte longo	
Suporte em L	
Suporte do sensor de ultrassom	
Espaçador 3 mm	
Espaçador 15 mm	

Parafuso M2,5 x 10mm	
Parafuso M3 x 8mm	
Parafuso M3 x 12mm	
Parafuso M3 x 16mm	
Porca M2,5	
Porca M3	
Arruela M3	
Chave de fenda cruzada (tipo Philips)	
Fio M/M ⁽¹⁾ 10 cm	
Fio M/M ⁽¹⁾ 15 cm	
Fio M/M ⁽¹⁾ 20 cm	

Fio M/F ⁽¹⁾ 20 cm	
Barra de pinos	
Cabo extensor	
Micro chave	
Chave tátil	
Resistor 220 Ω	
Resistor 330 Ω	
Resistor 560 Ω	

Resistor 1 k Ω	
Resistor 2,2 k Ω	
Resistor 10 k Ω	
Potenciômetro	
Fotoresistor	
Fototransistor	
Receptor de infravermelho	

LED infravermelho	
LED branco	
LED amarelo	
LED verde	
LED vermelho	
Suporte para LED	
Display de 7 segmentos	

Sonorizador	
Sensor de ultrassom	

1 - A cor dos fios varia.