

ROBÓTICA EDUCACIONAL

Atividades com o
Kit Criatecno CT100

2ª Edição

FIGURAS



Figura 1.1 - Placa Arduino Uno.

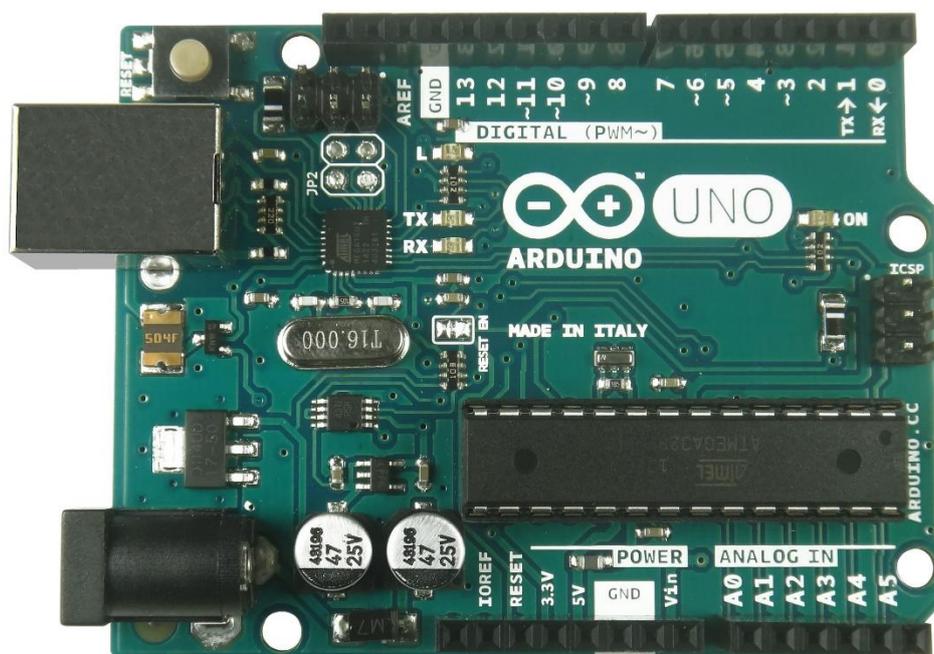


Figura 1.2 - Interface gráfica do Arduino IDE.

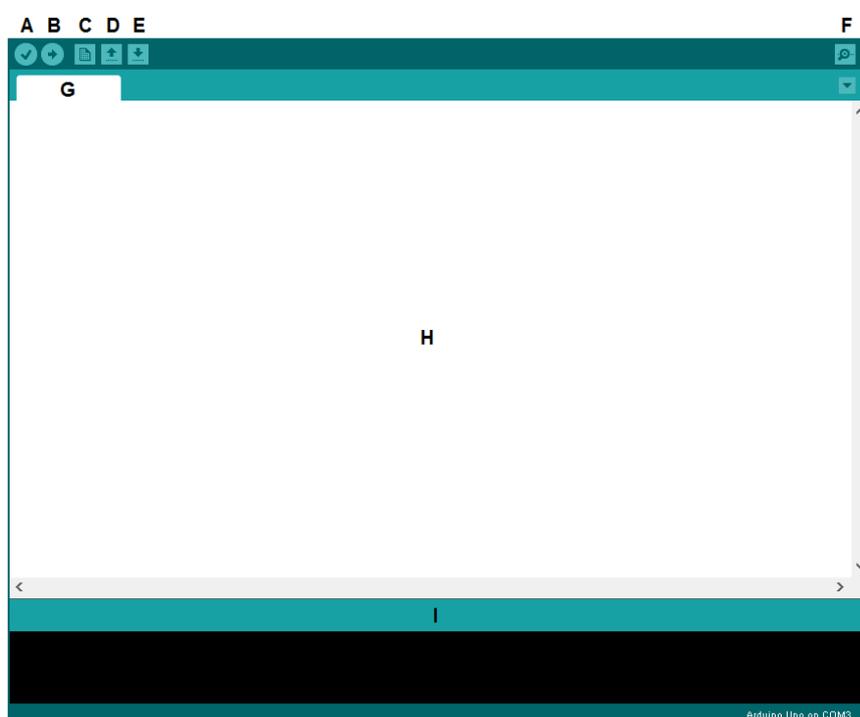


Figura 1.3 - Conectando a placa Arduino no computador.

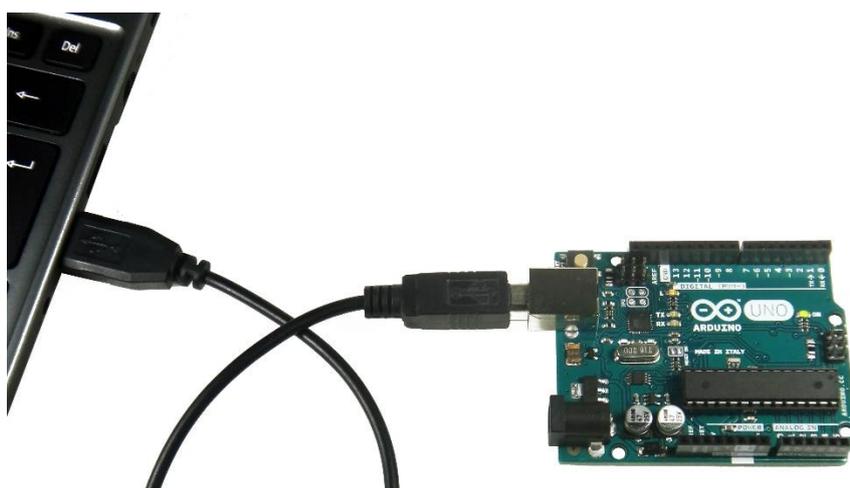


Figura 1.4 - Definindo a placa Arduino a ser utilizada.

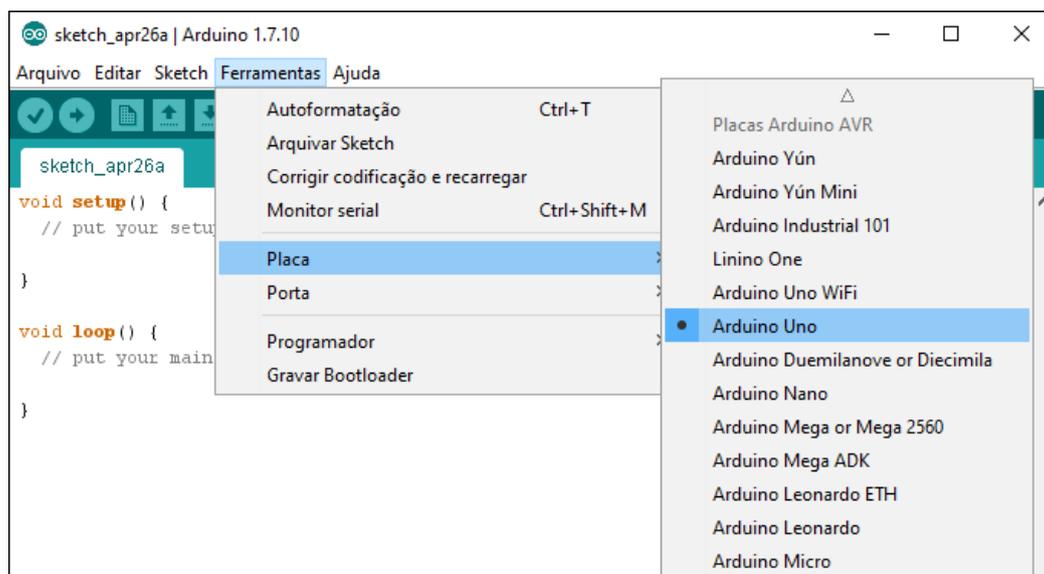


Figura 1.5 - Selecionando a porta serial onde a placa Arduino está conectada.

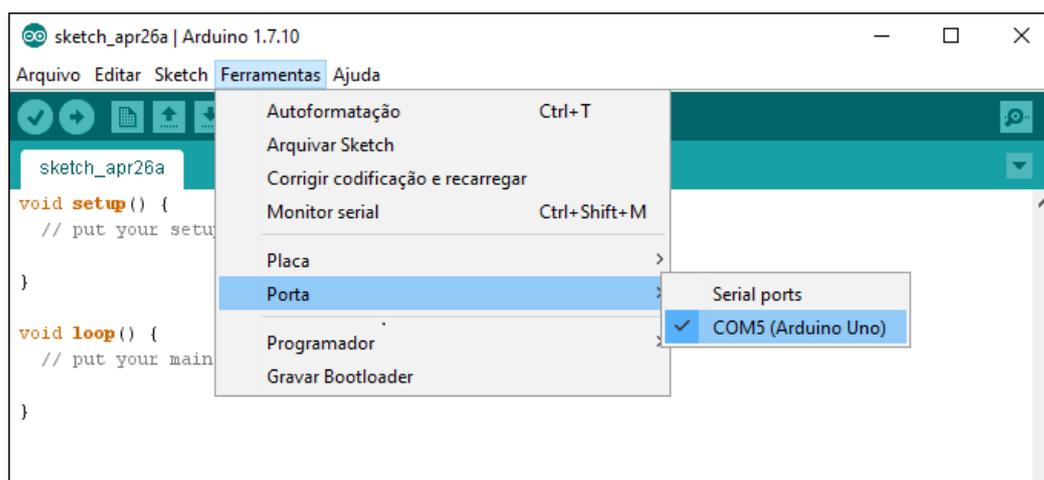


Figura 1.6 - Abrindo o sketch Blink.

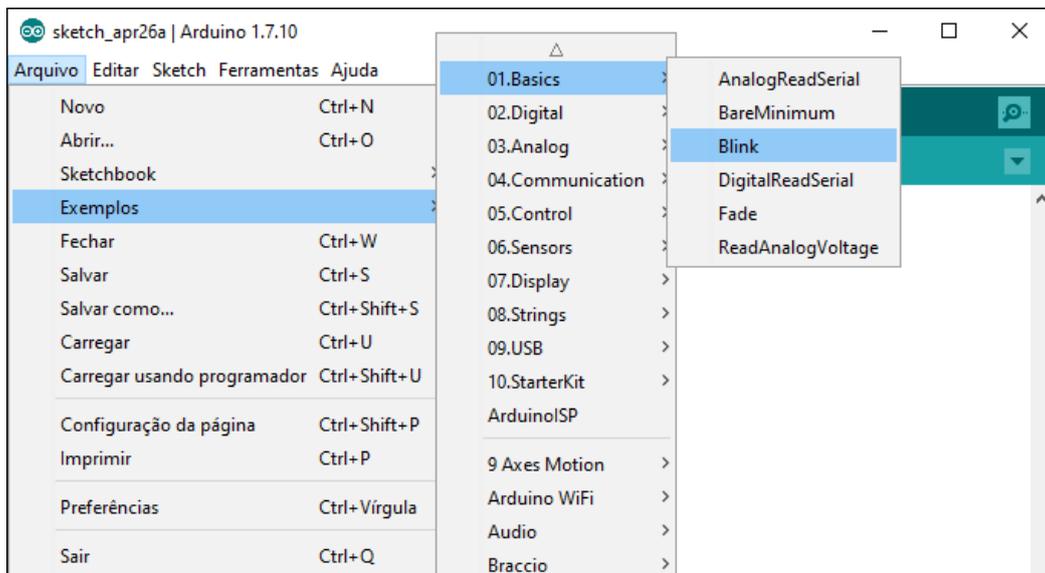


Figura 1.7 - Posicionando a placa controladora Arduino sobre a base de prototipagem.

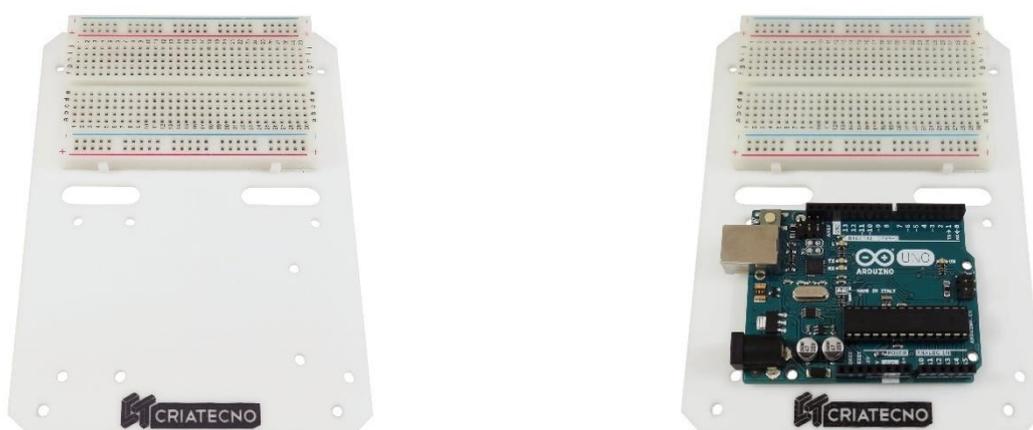


Figura 1.8 - Posicionando um espaçador entre a placa Arduino e a base de prototipagem.



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

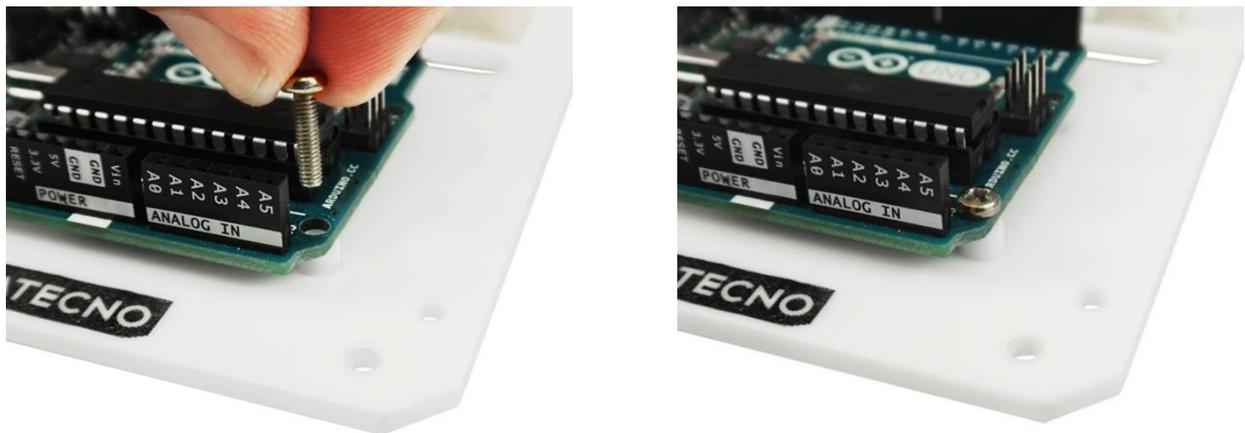


Figura 1.10 - Prendendo uma porca no parafuso.



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



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

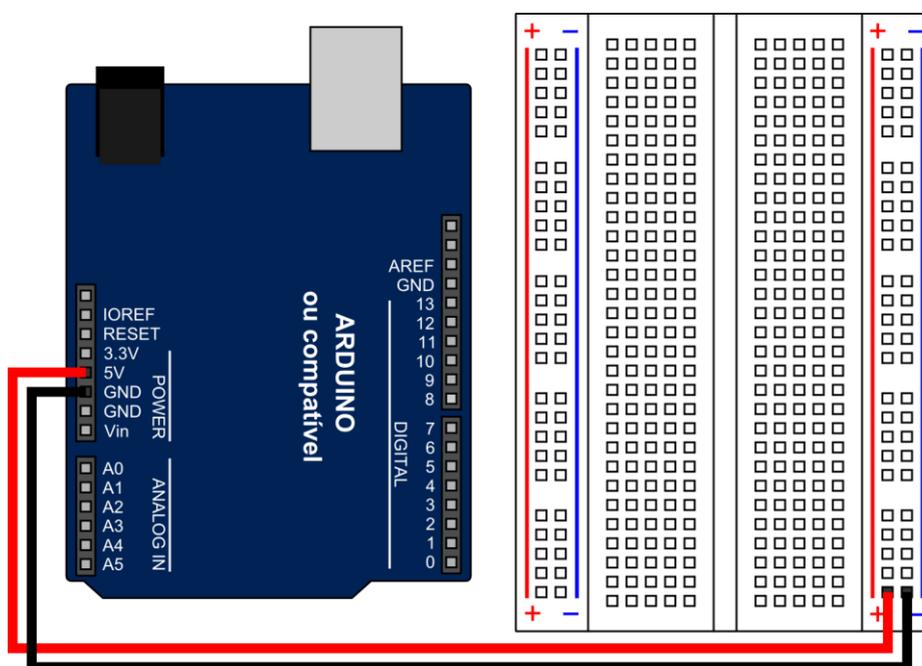


Figura 1.13 - Placa Arduino ligada na protoboard.

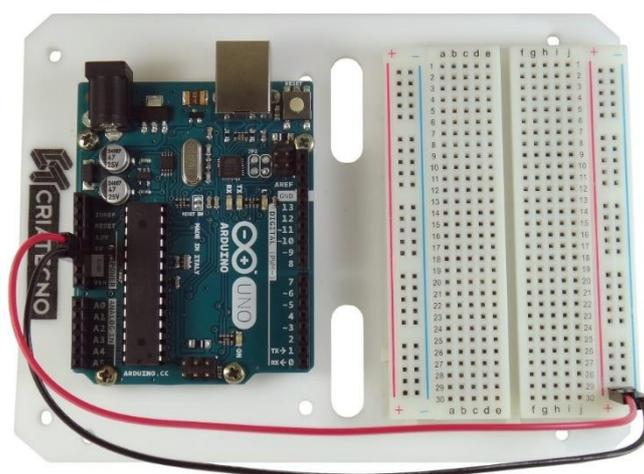


Figura 1.14 - Placa Arduino sendo alimentada por pilhas recarregáveis.

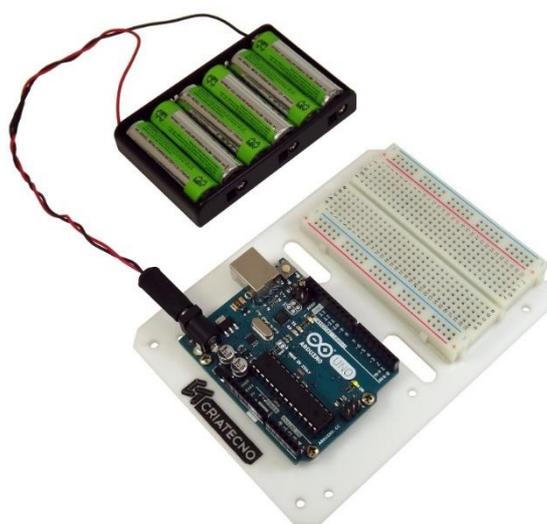
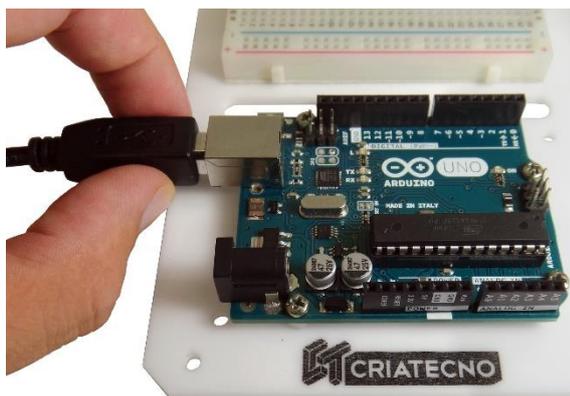
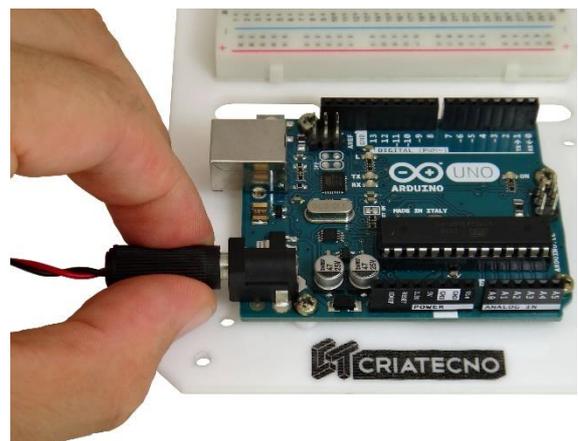


Figura 1.15 - Desconectando (a) o cabo USB e (b) o cabo do suporte de pilhas.

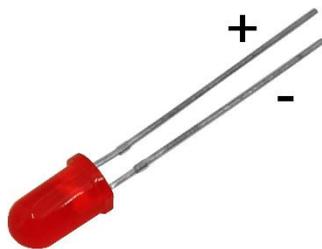


(a)



(b)

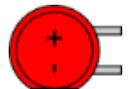
Figura 2.1 - (a) Imagem de um LED, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(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)

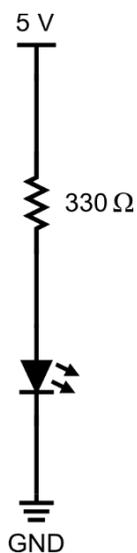


(b)

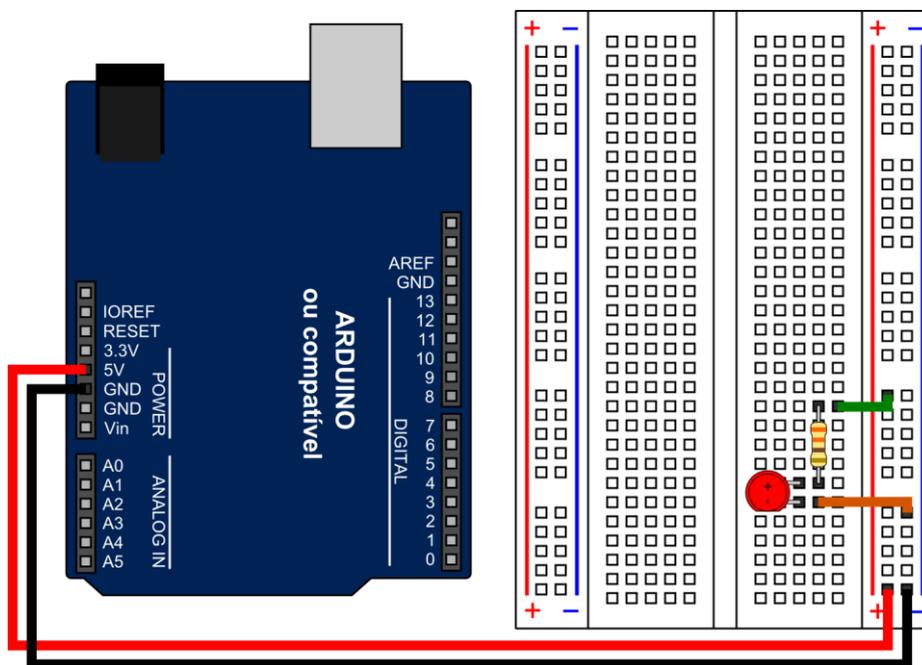


(c)

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



(a)



(b)

Figura 2.4 - Circuito eletrônico montado na protoboard.

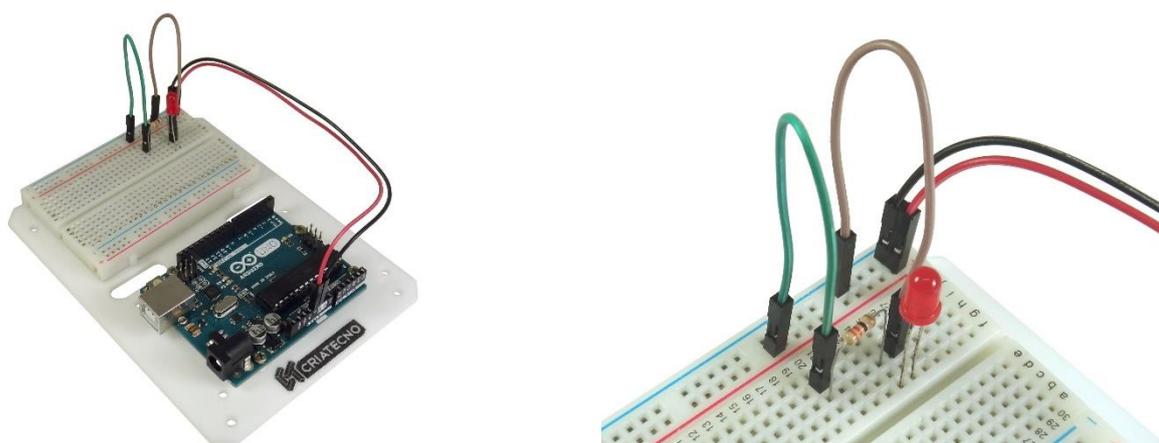
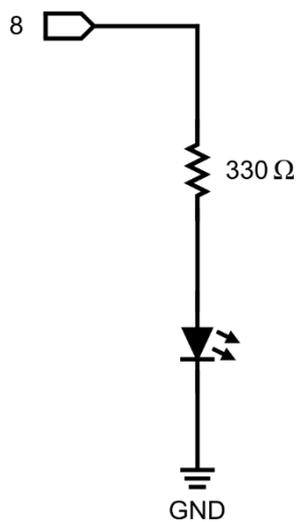
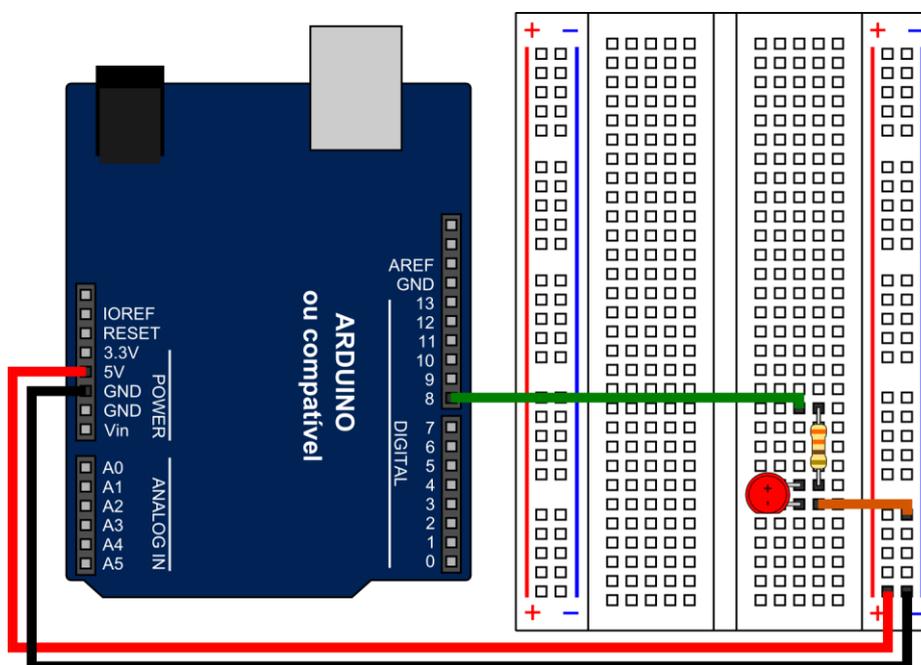


Figura 2.5 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 2.

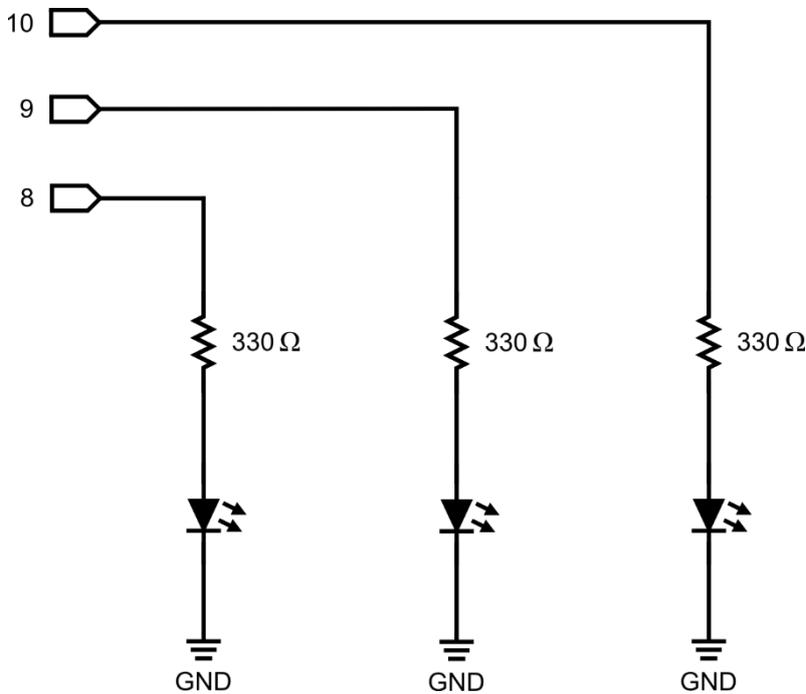


(a)

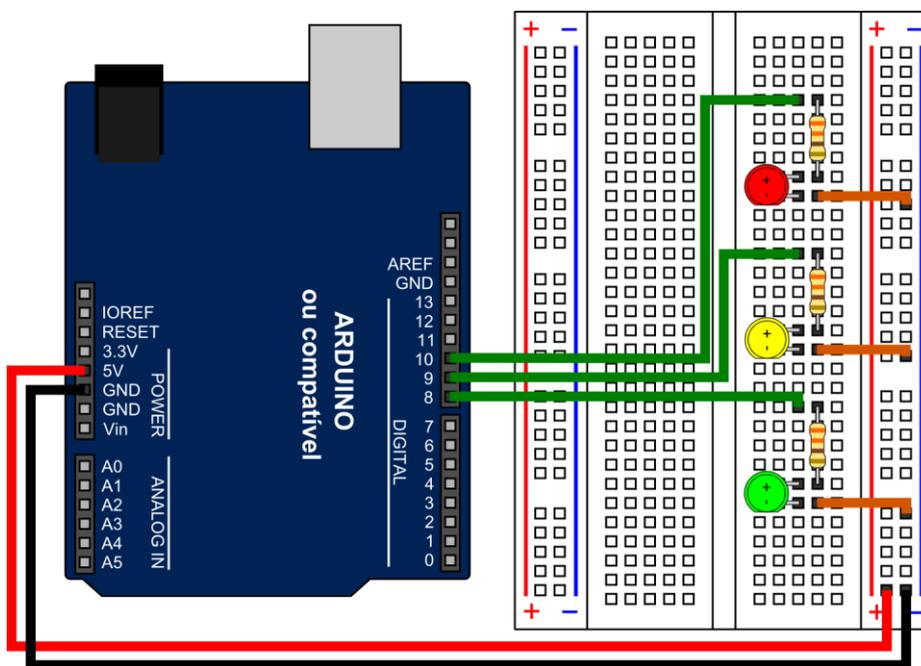


(b)

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



(a)

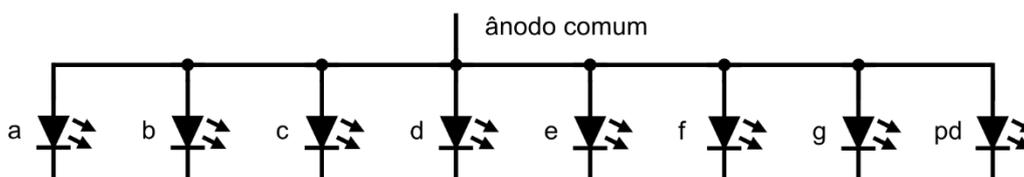


(b)

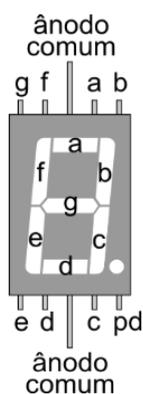
Figura 2.7 - (a) Imagem de um display de sete segmentos, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

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

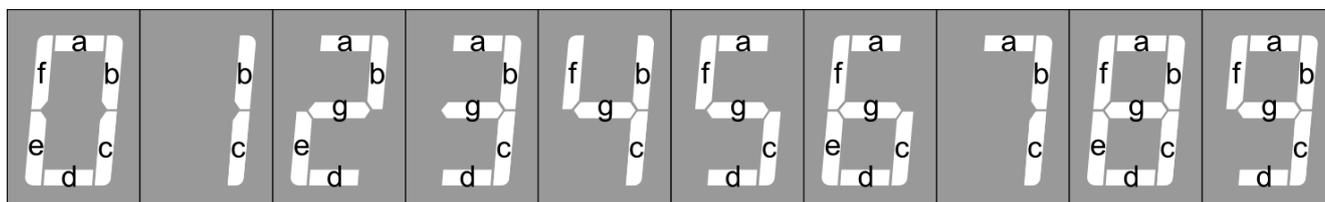
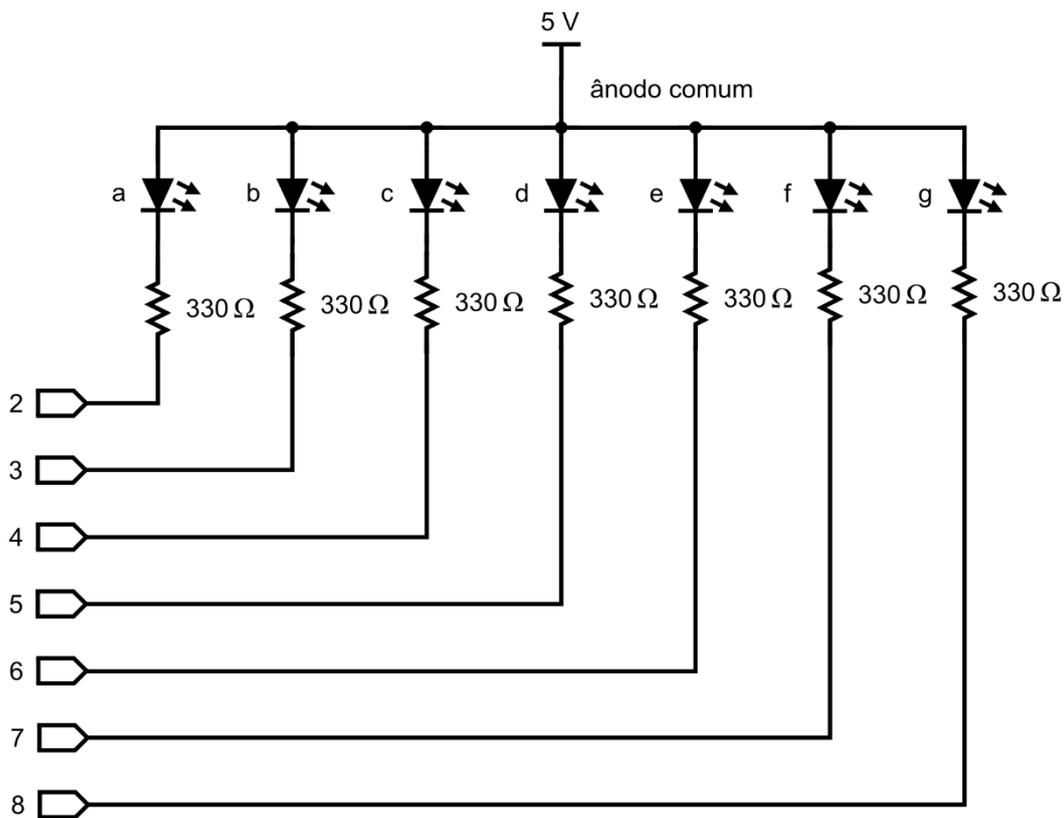
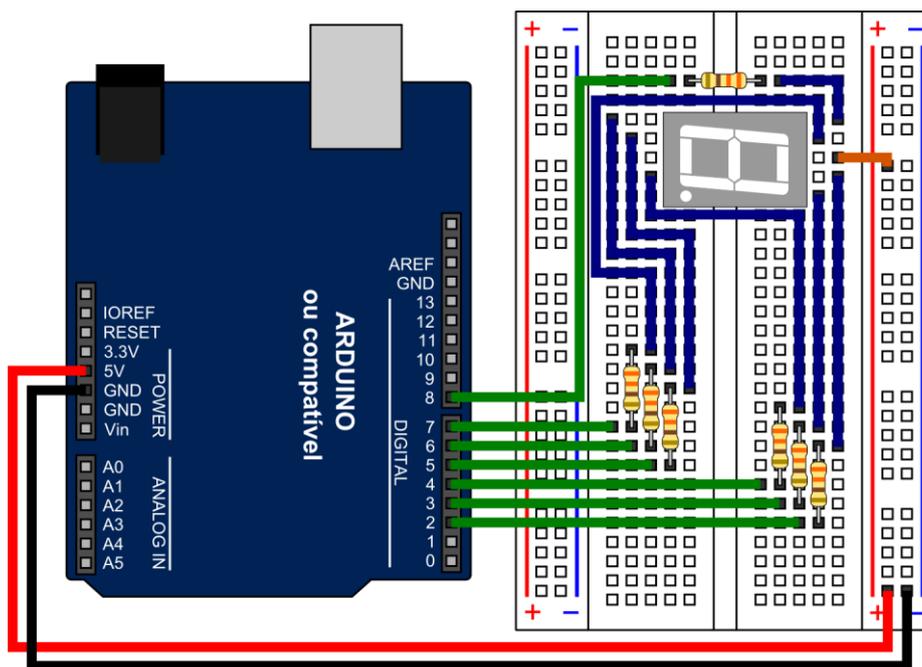


Figura 2.9 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 5.



(a)

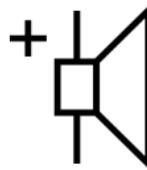


(b)

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)

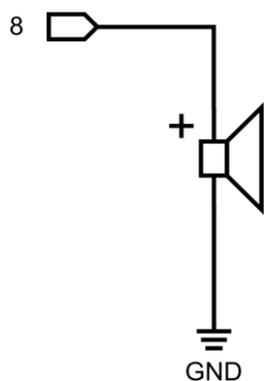


(b)

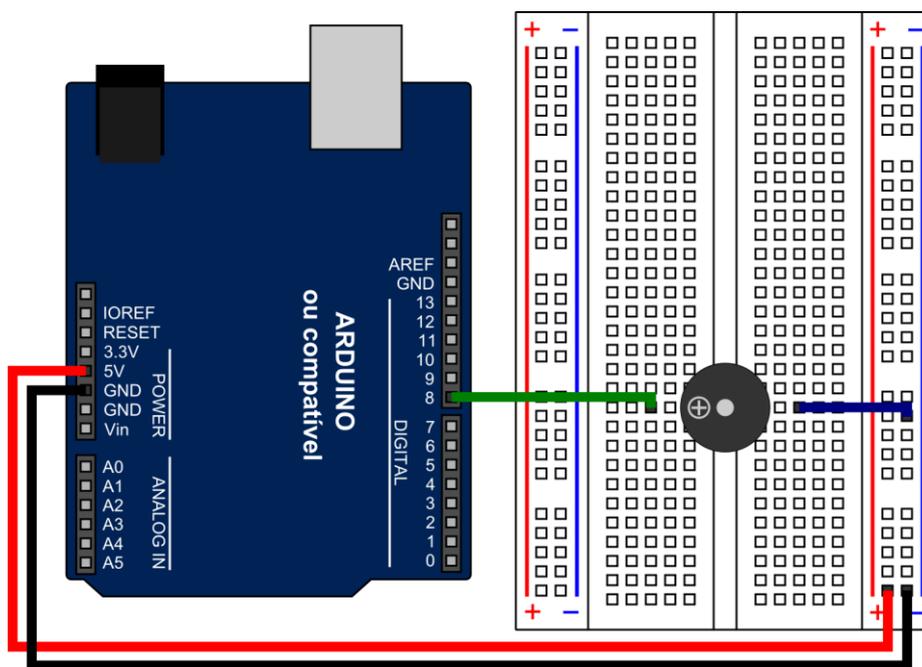


(c)

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



(a)

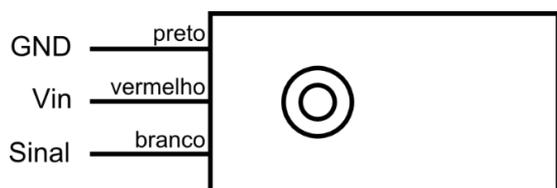


(b)

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.

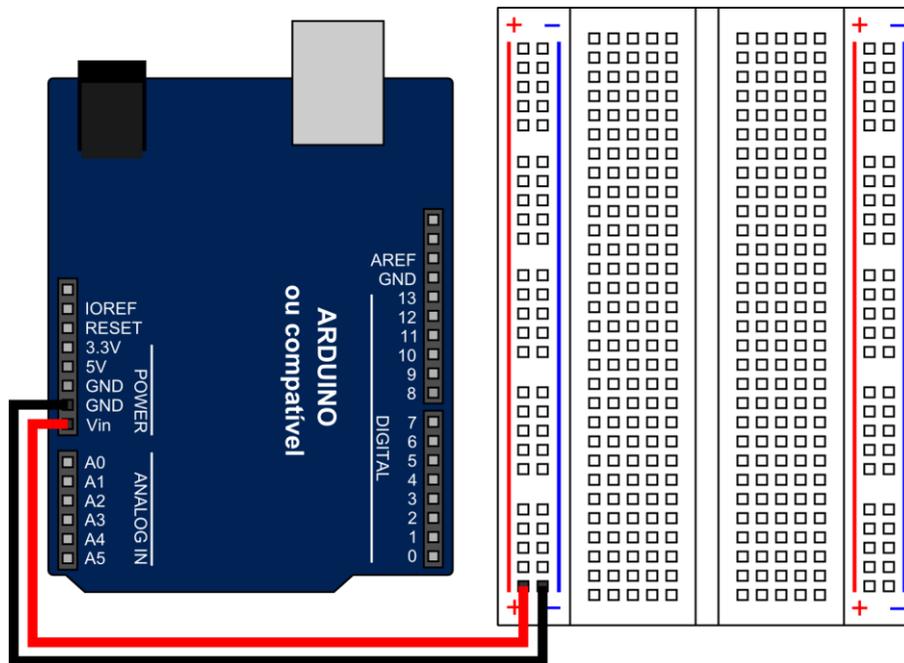


Figura 3.3 - (a) Esquema e (b) ilustração do circuito de ligação de um servo.

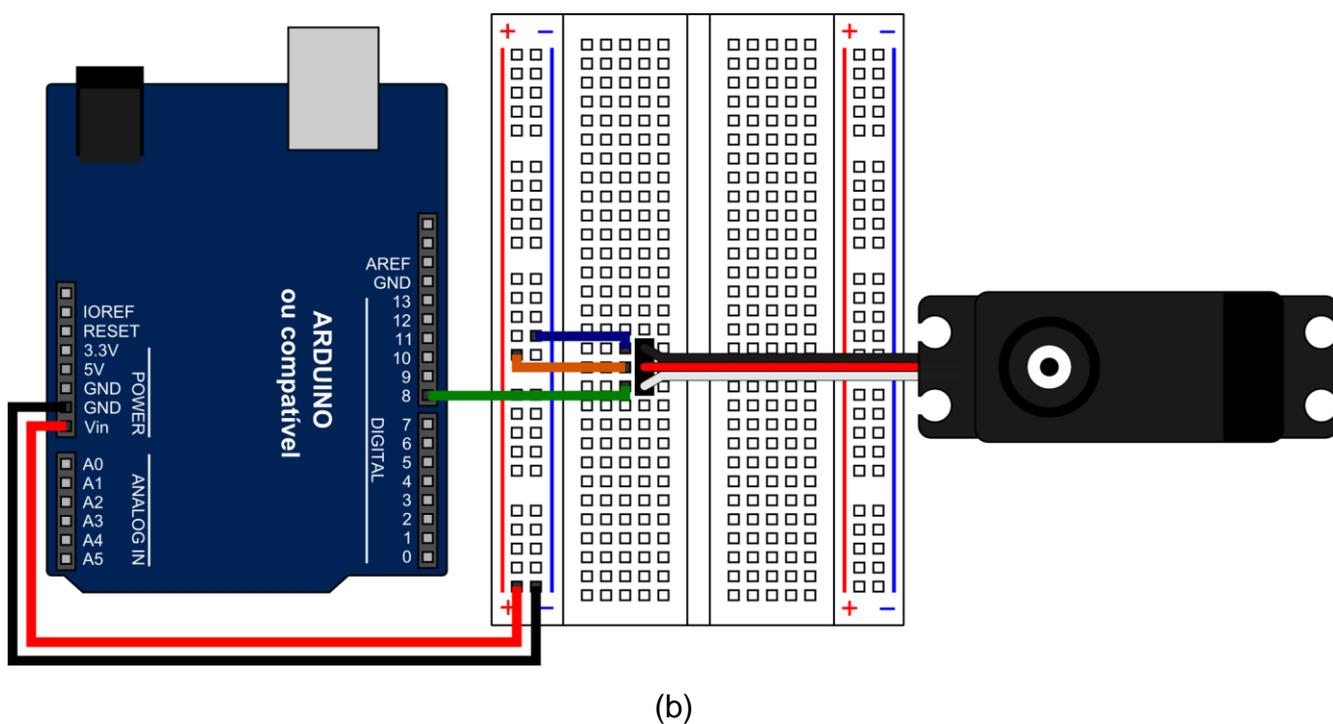
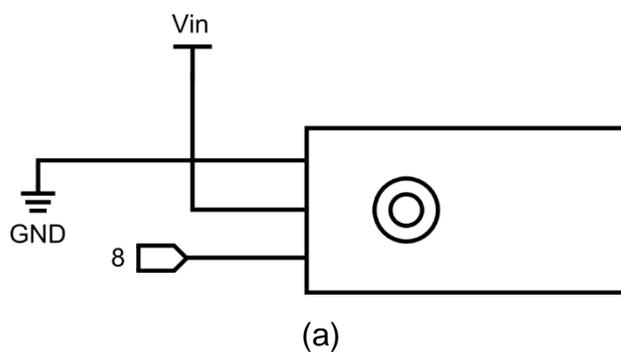


Figura 3.4 - Usando a barra de pinos para conectar um servo na protoboard.

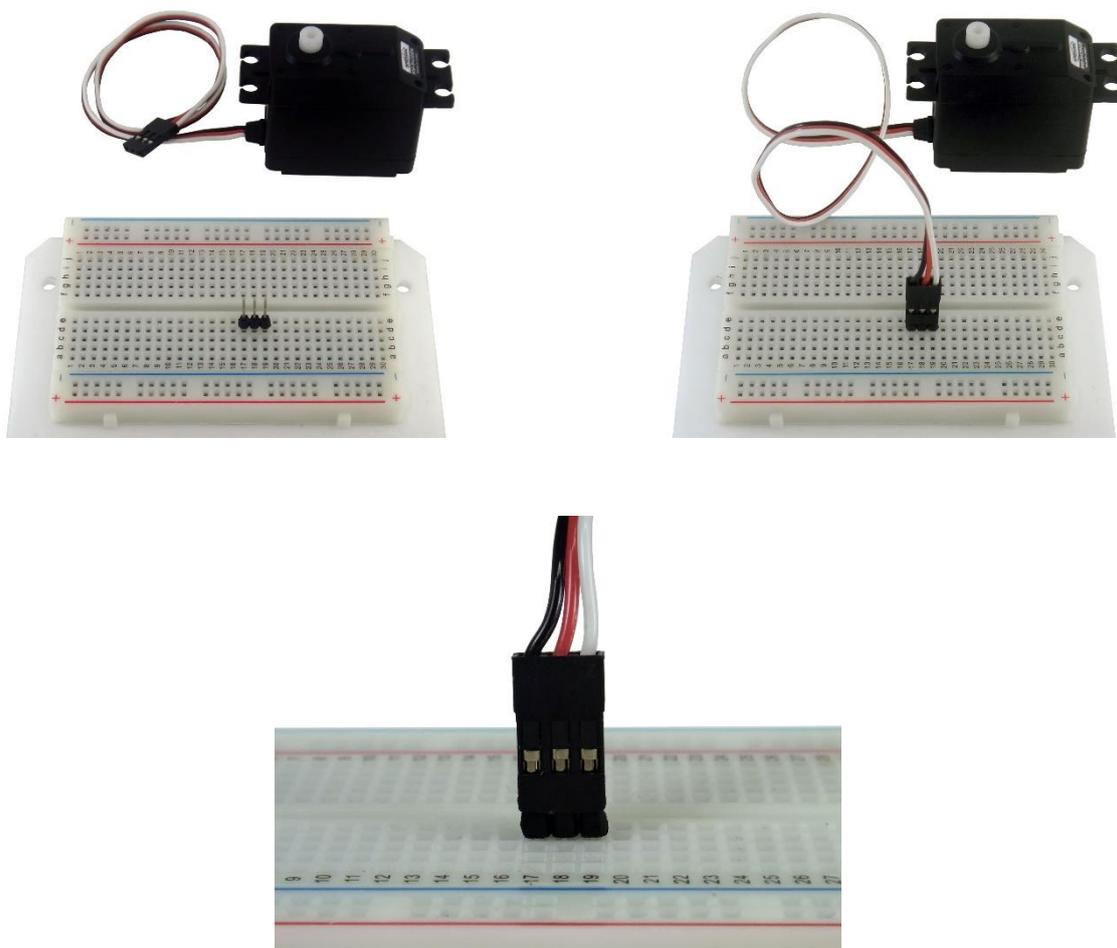


Figura 3.5 - Pulsos com larguras diferentes e os movimentos que eles provocam.

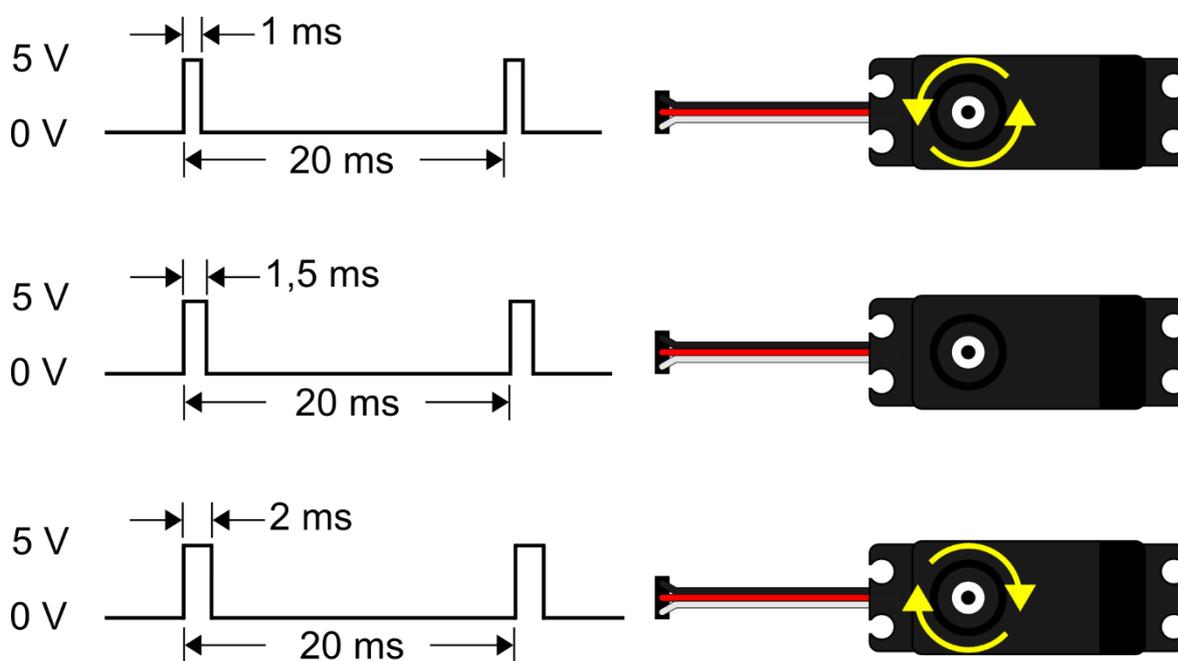


Figura 3.6 - Calibrando um servomotor.

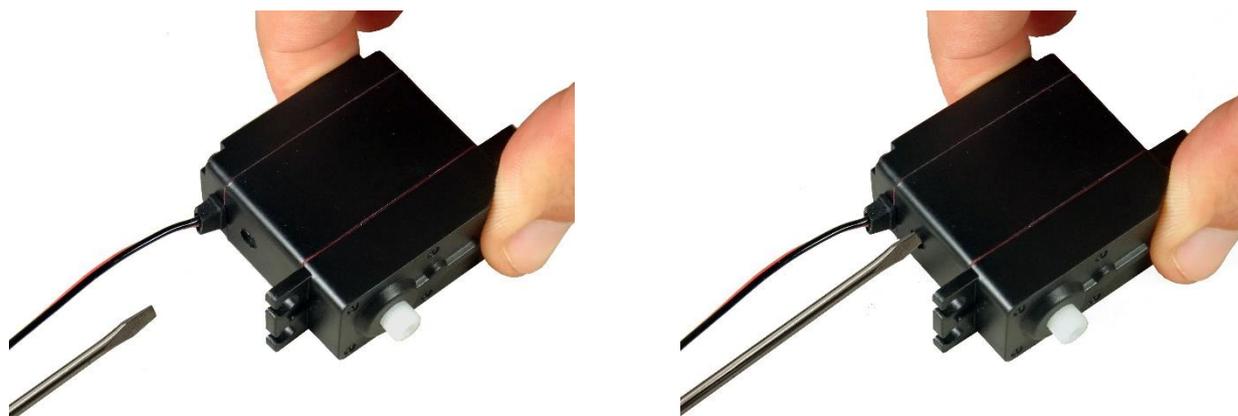
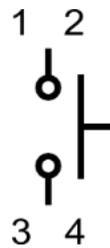


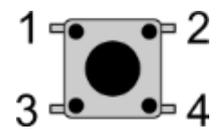
Figura 4.1 - (a) Imagem de uma chave táctil, (b) seu símbolo no esquema dos circuitos e (c) a figura que a representa na ilustração dos circuitos montados.



(a)

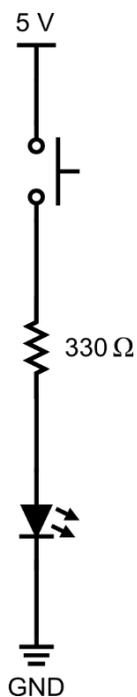


(b)

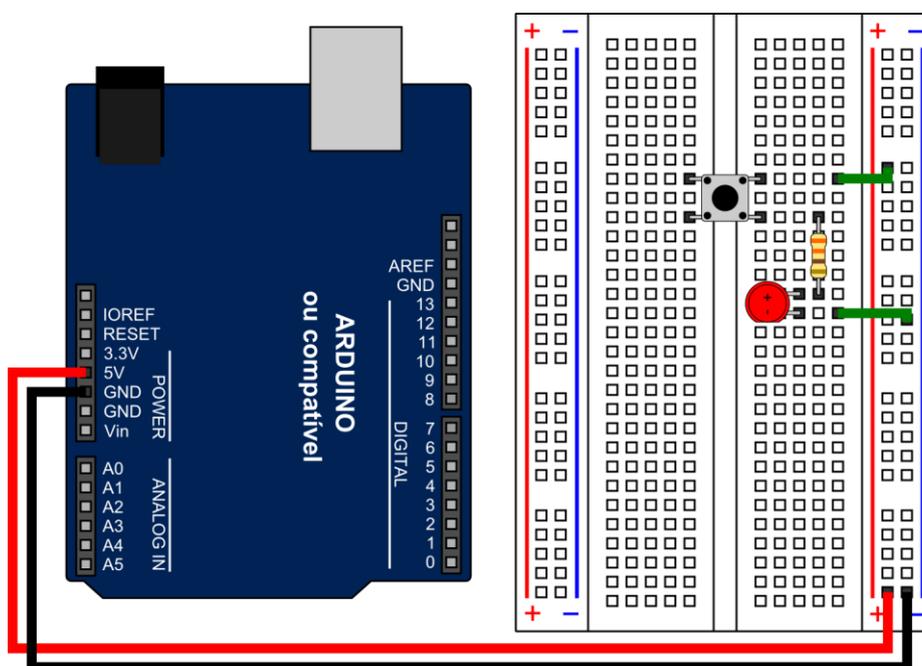


(c)

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

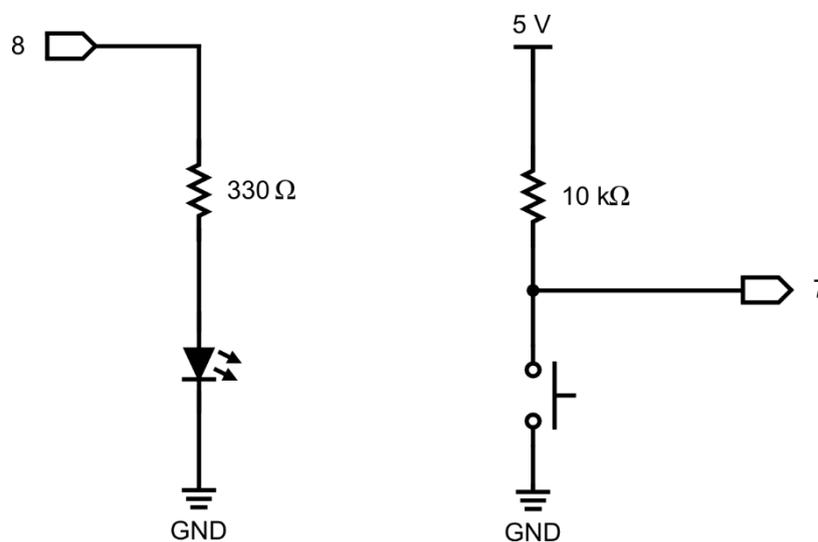


(a)

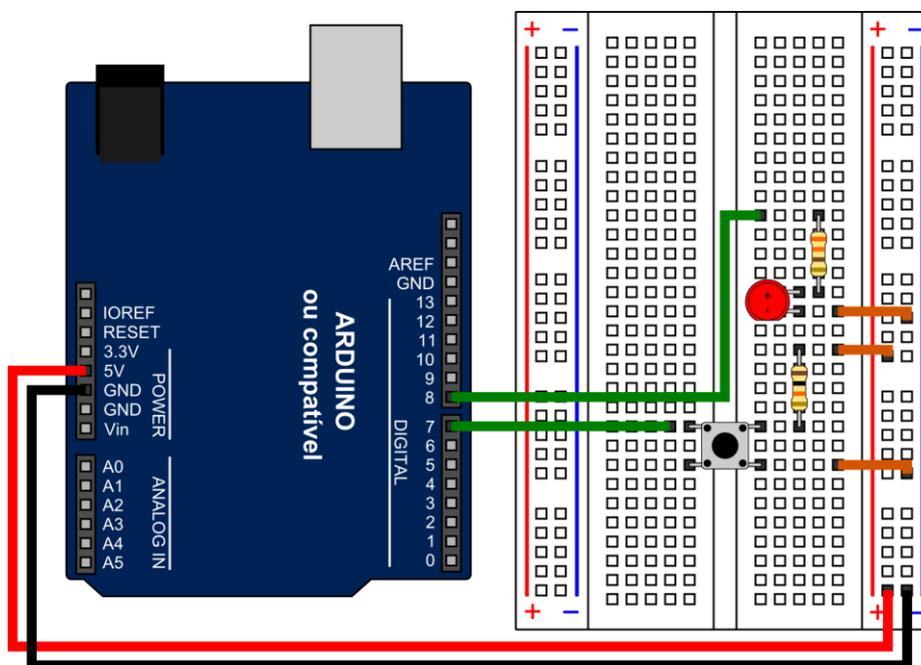


(b)

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

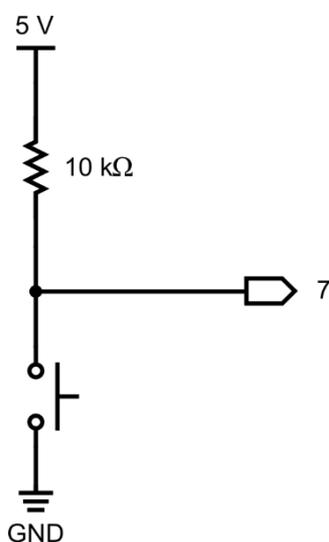


(a)

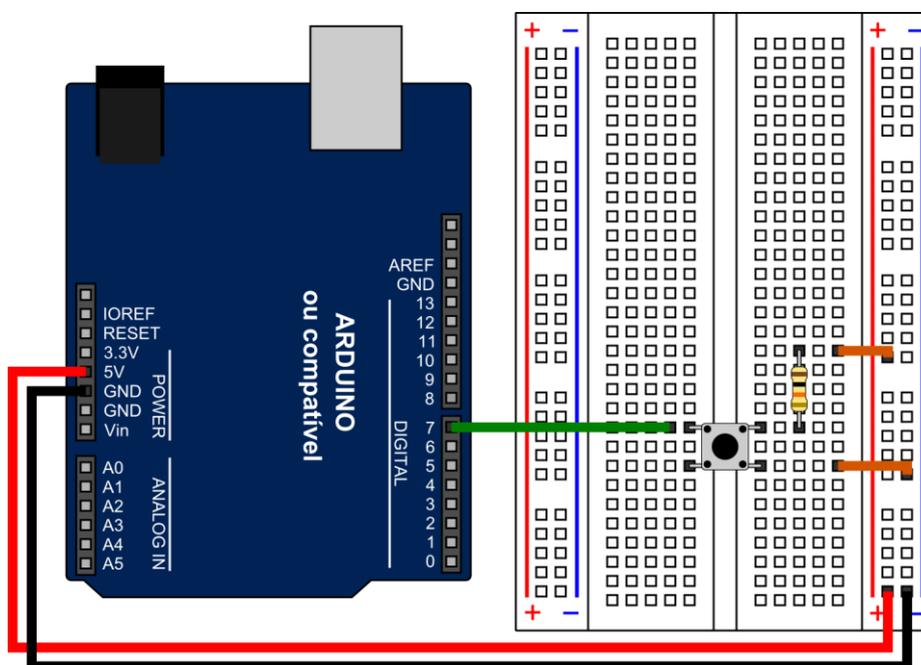


(b)

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.

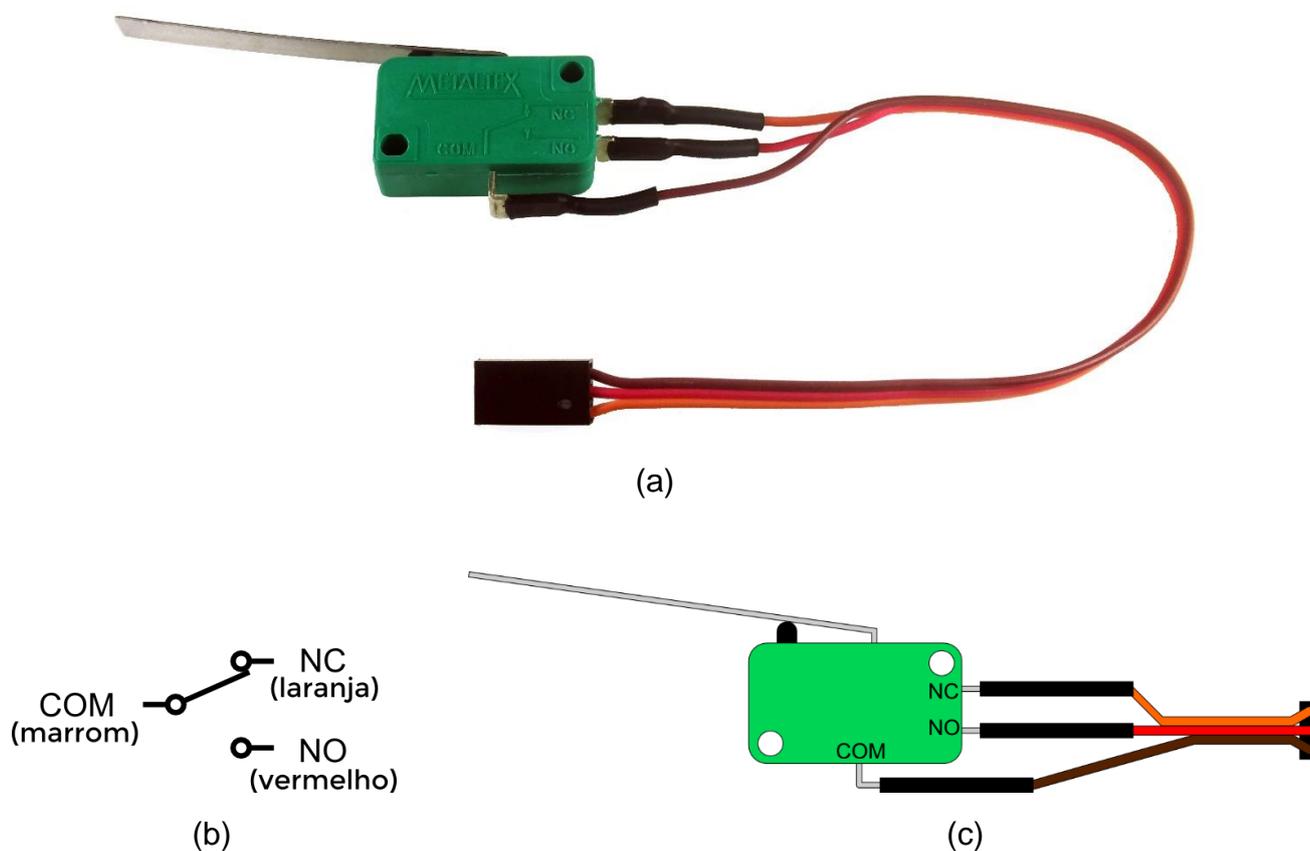


Figura 4.6 - Usando uma barra de pinos para conectar uma micro chave na protoboard.

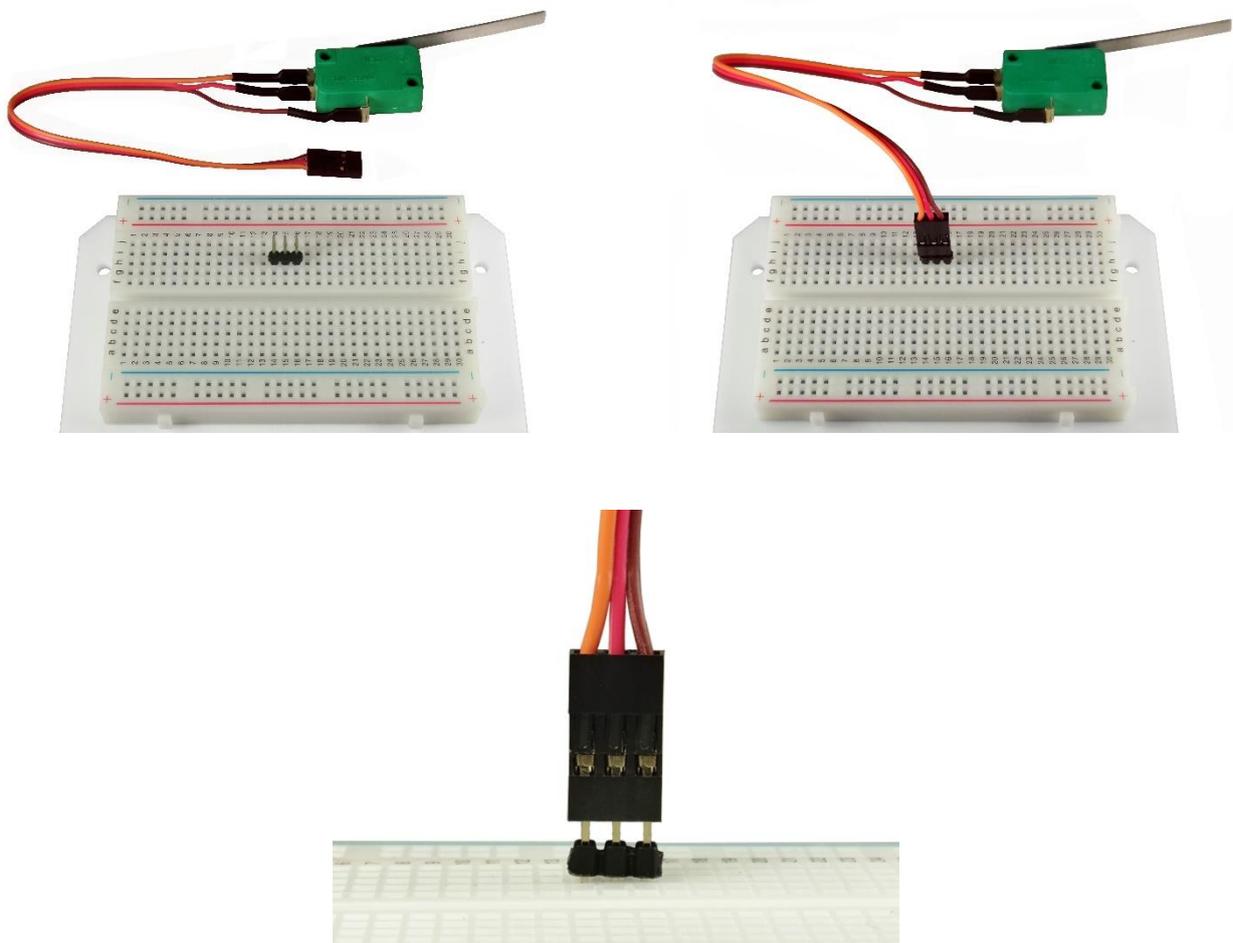
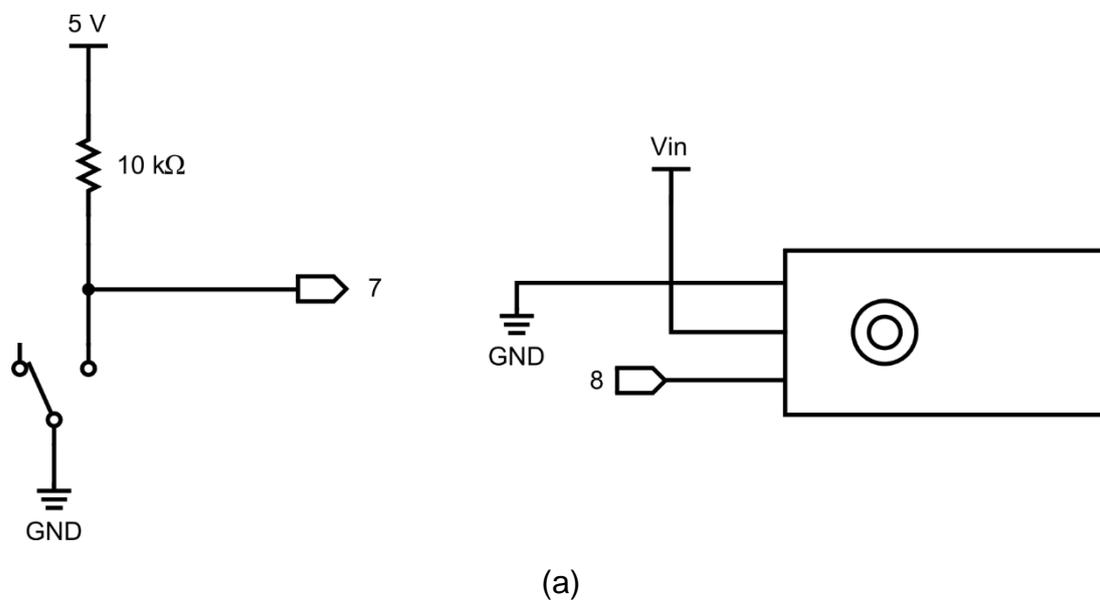
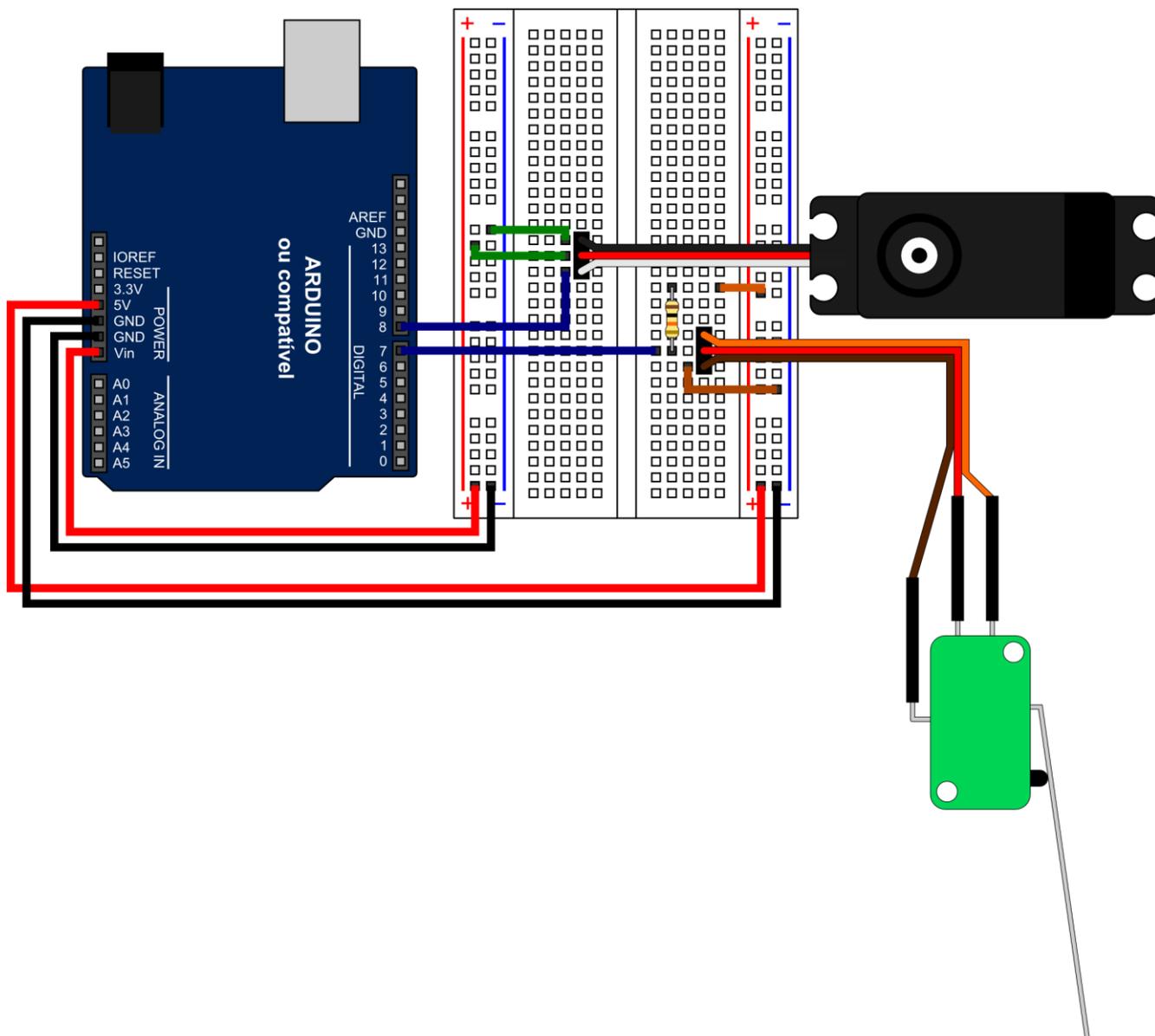


Figura 4.7 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 14.



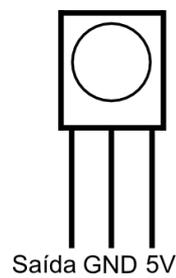


(b)

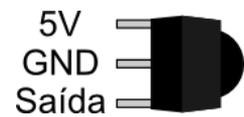
Figura 4.8 - (a) Imagem de um receptor de infravermelho, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

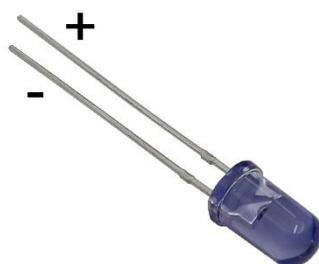


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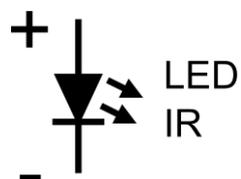


(c)

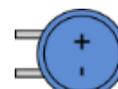
Figura 4.9 - (a) Imagem de um LED infravermelho, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

Figura 4.10 - Suporte para LED.



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

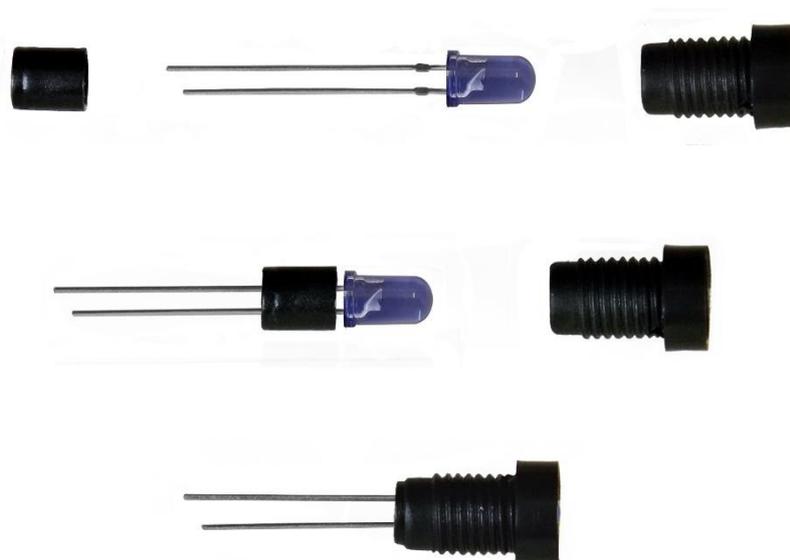


Figura 4.12 - Usando uma barra de pinos para conectar um cabo extensor na protoboard.

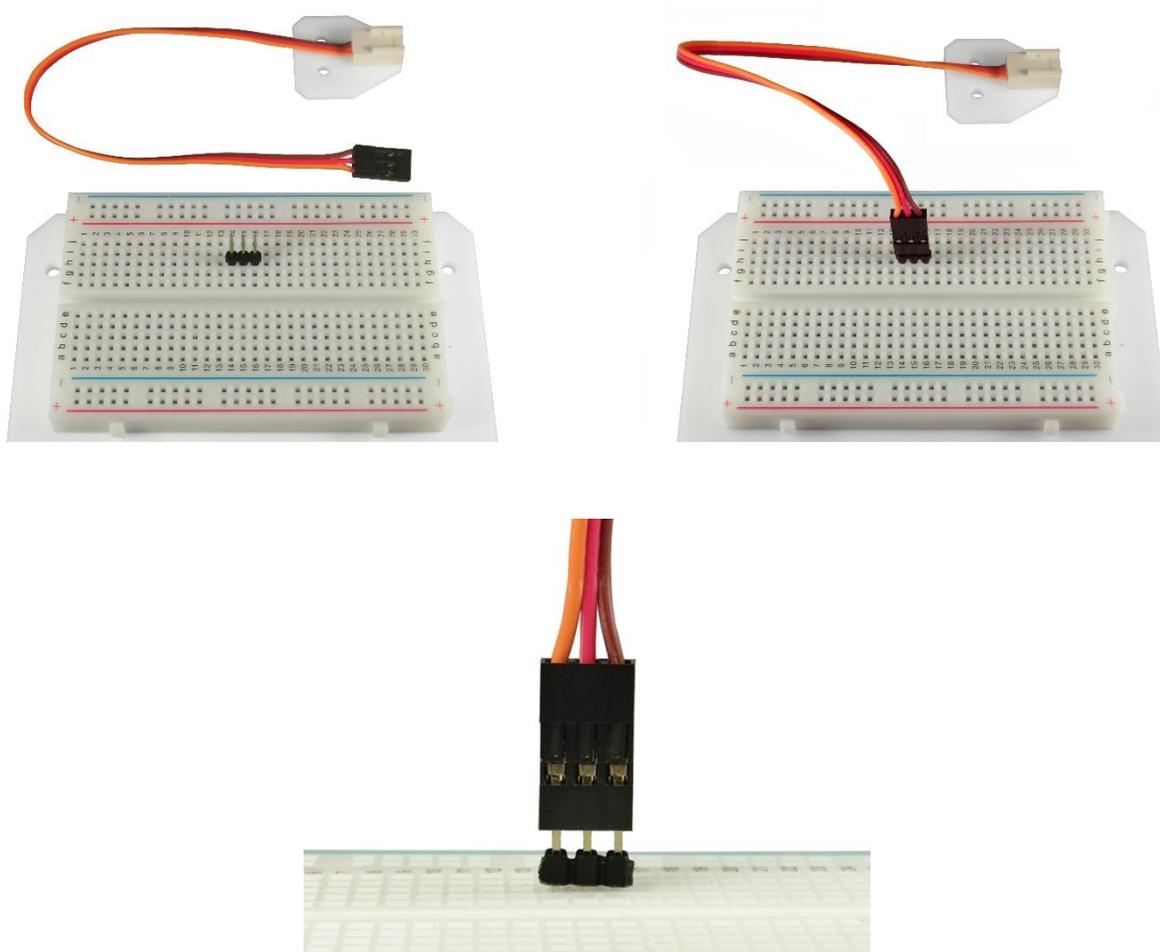


Figura 4.13 - Conectando um receptor de infravermelho em um cabo extensor.



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

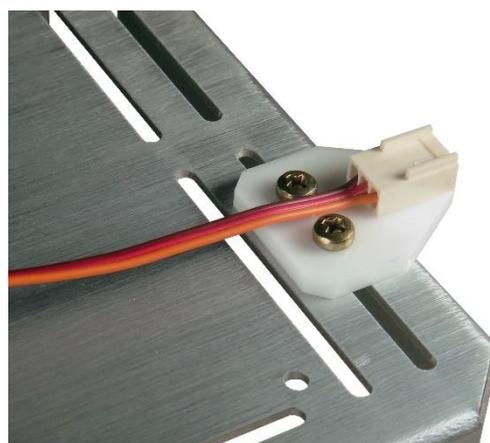
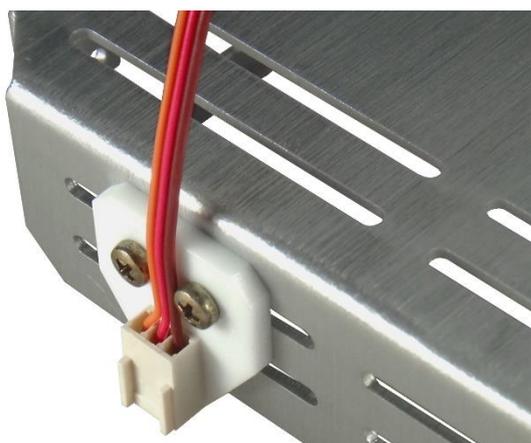


Figura 4.15 - Diferentes maneiras de fixar os suportes no chassi.



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



Figura 4.17 - Prendendo os cabos extensores no suporte.

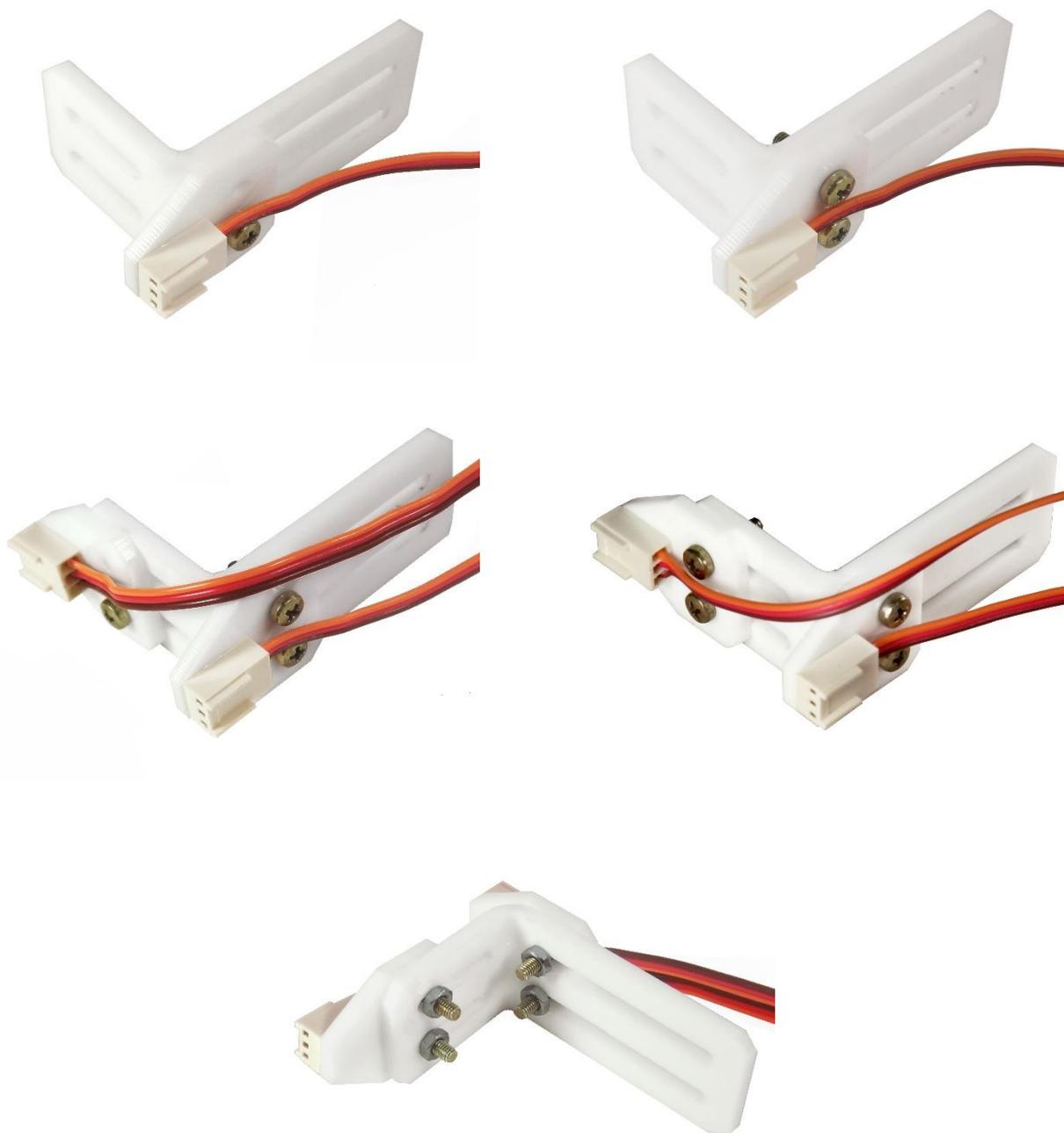


Figura 4.18 - Montando o LED infravermelho dentro do suporte para LED.



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.

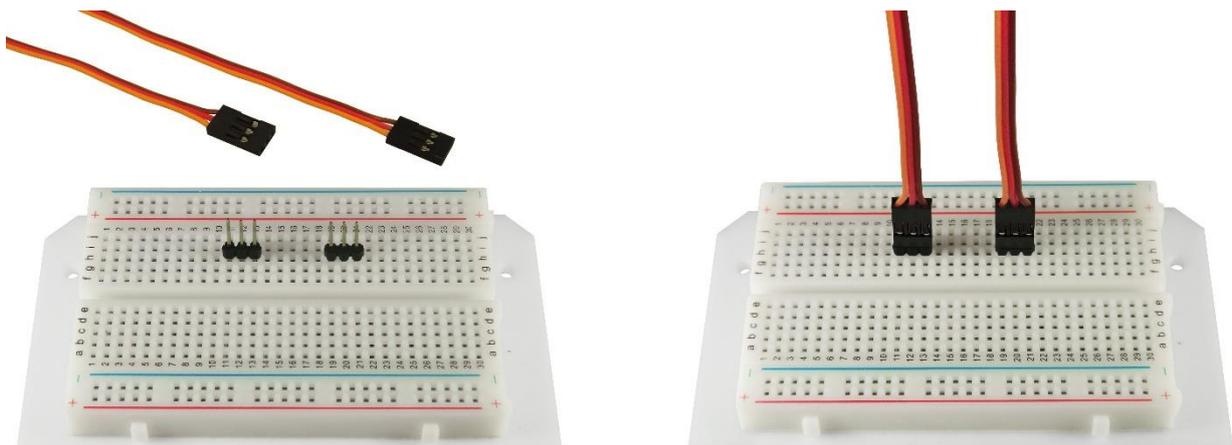


Figura 4.22 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 15.

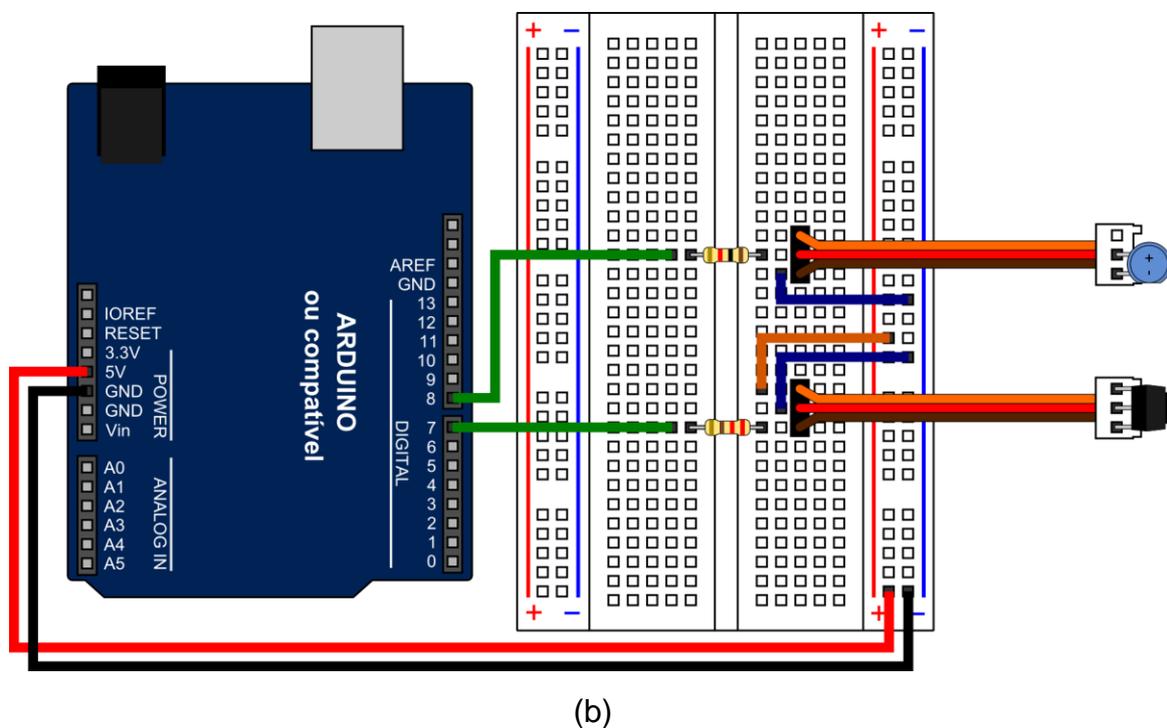
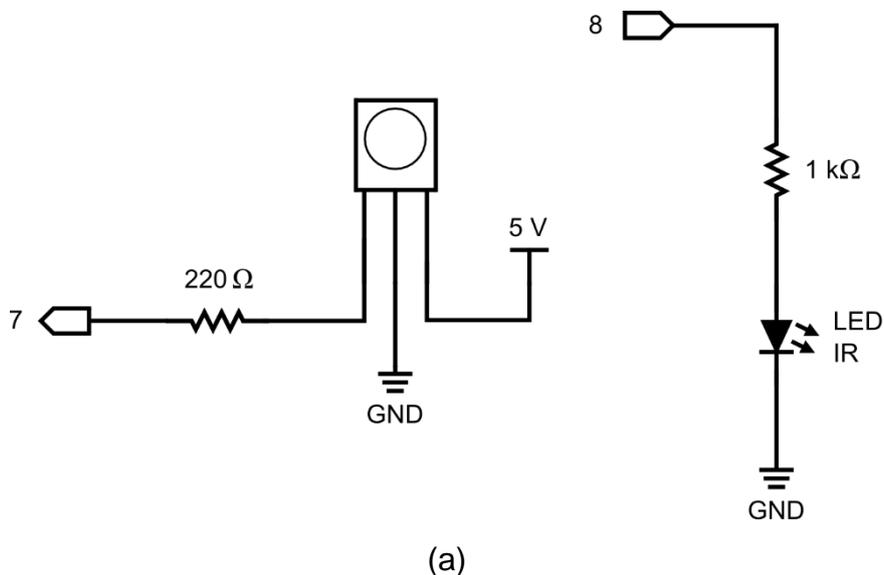


Figura 4.23 - Luz infravermelha sendo (a) refletida e (b) não refletida por um objeto.

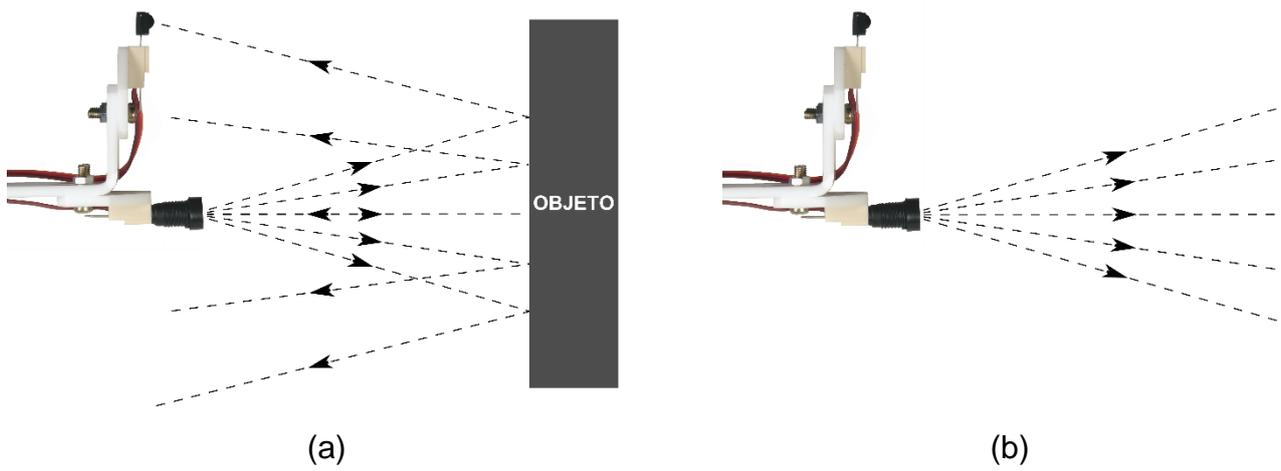


Figura 4.24 - Identificação de regiões de detecção.

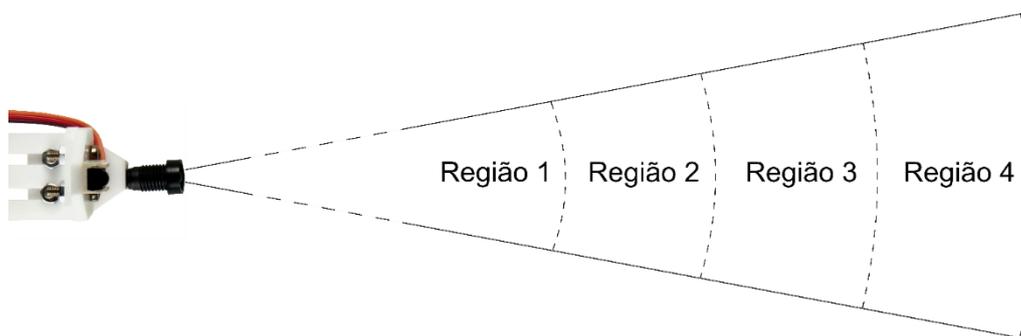


Figura 4.25 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 17.

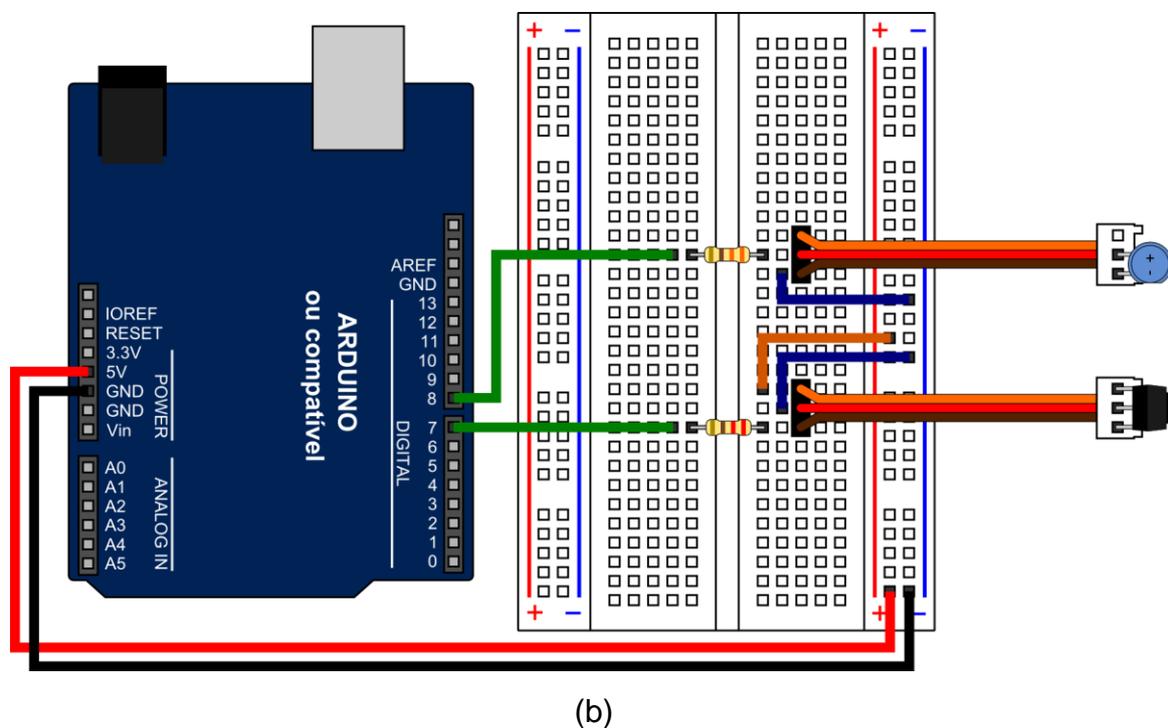
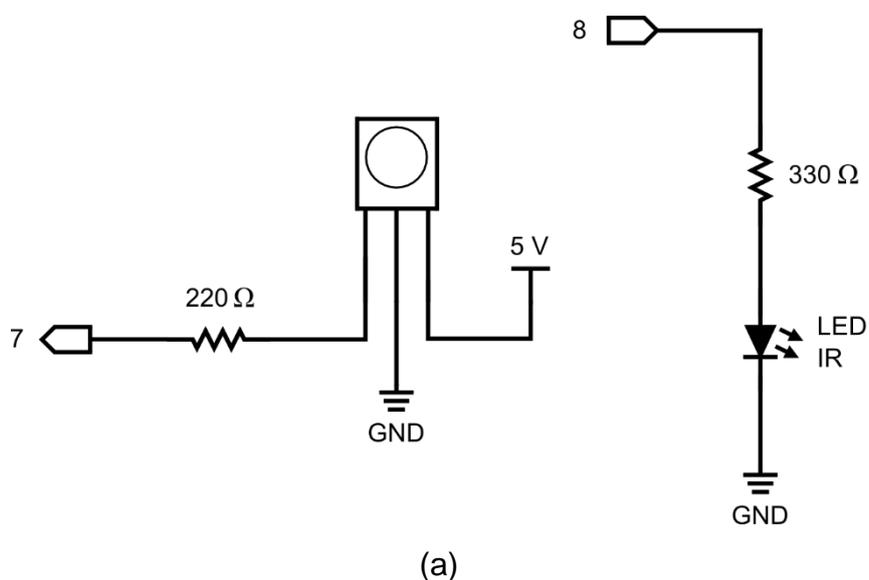
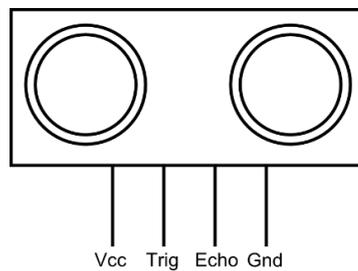


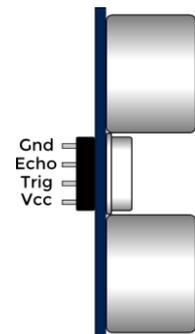
Figura 5.1 - (a) Imagem de um sensor de ultrassom, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

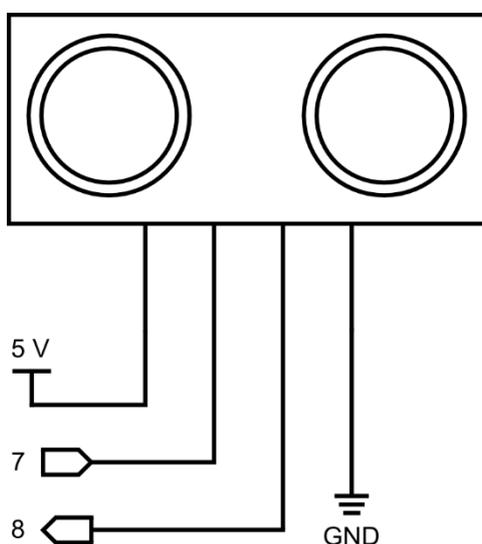


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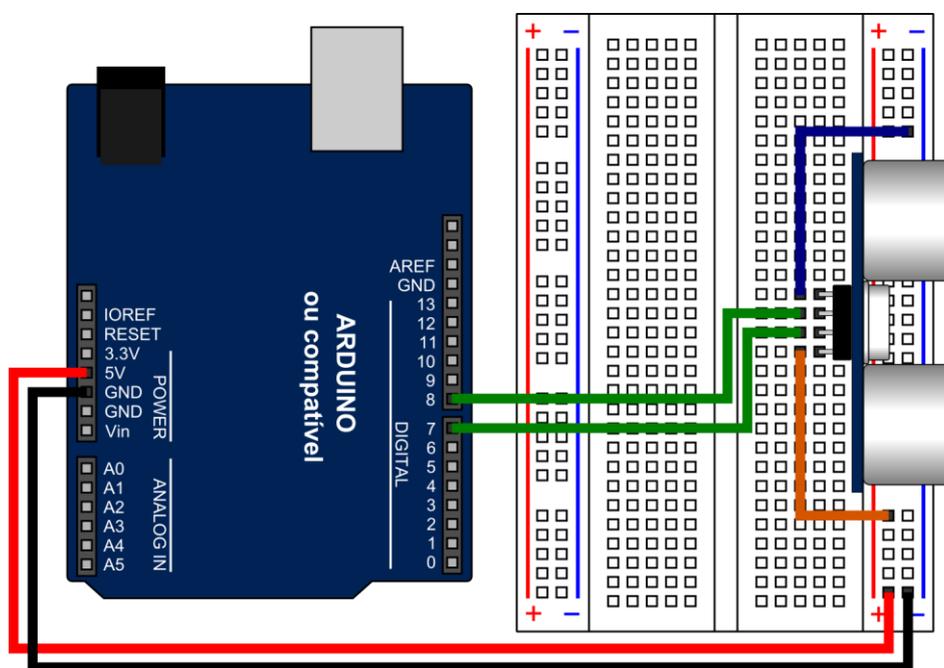


(c)

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.

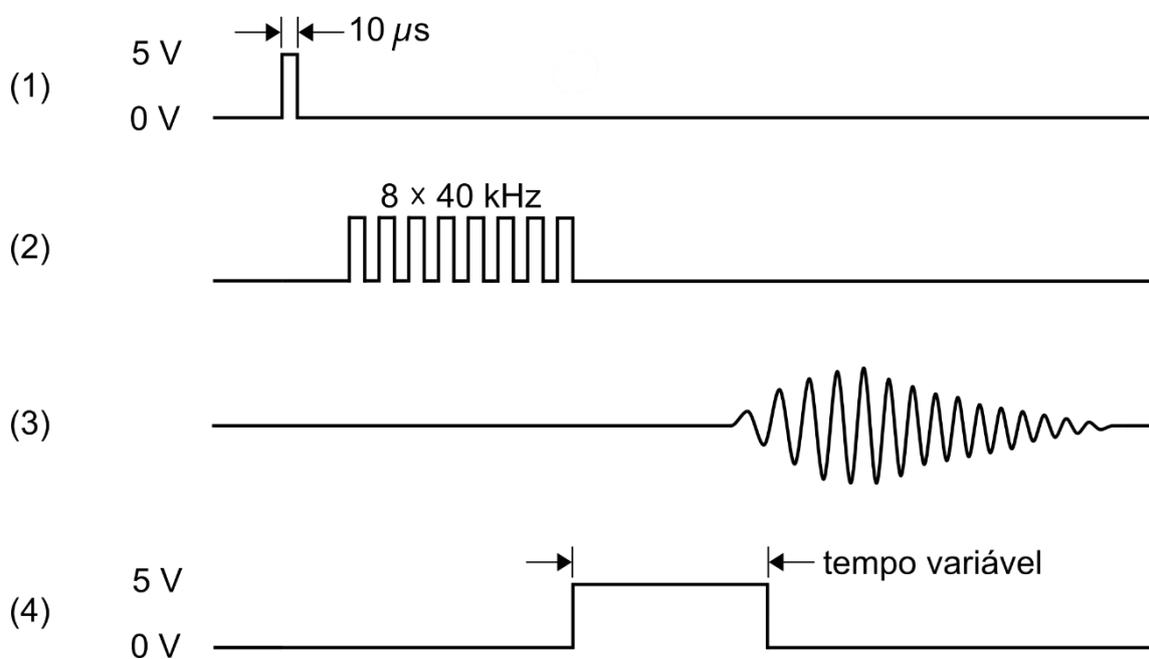


Figura 5.4 - Ondas de ultrassom sendo (a) refletidas e (b) não refletidas por um objeto.

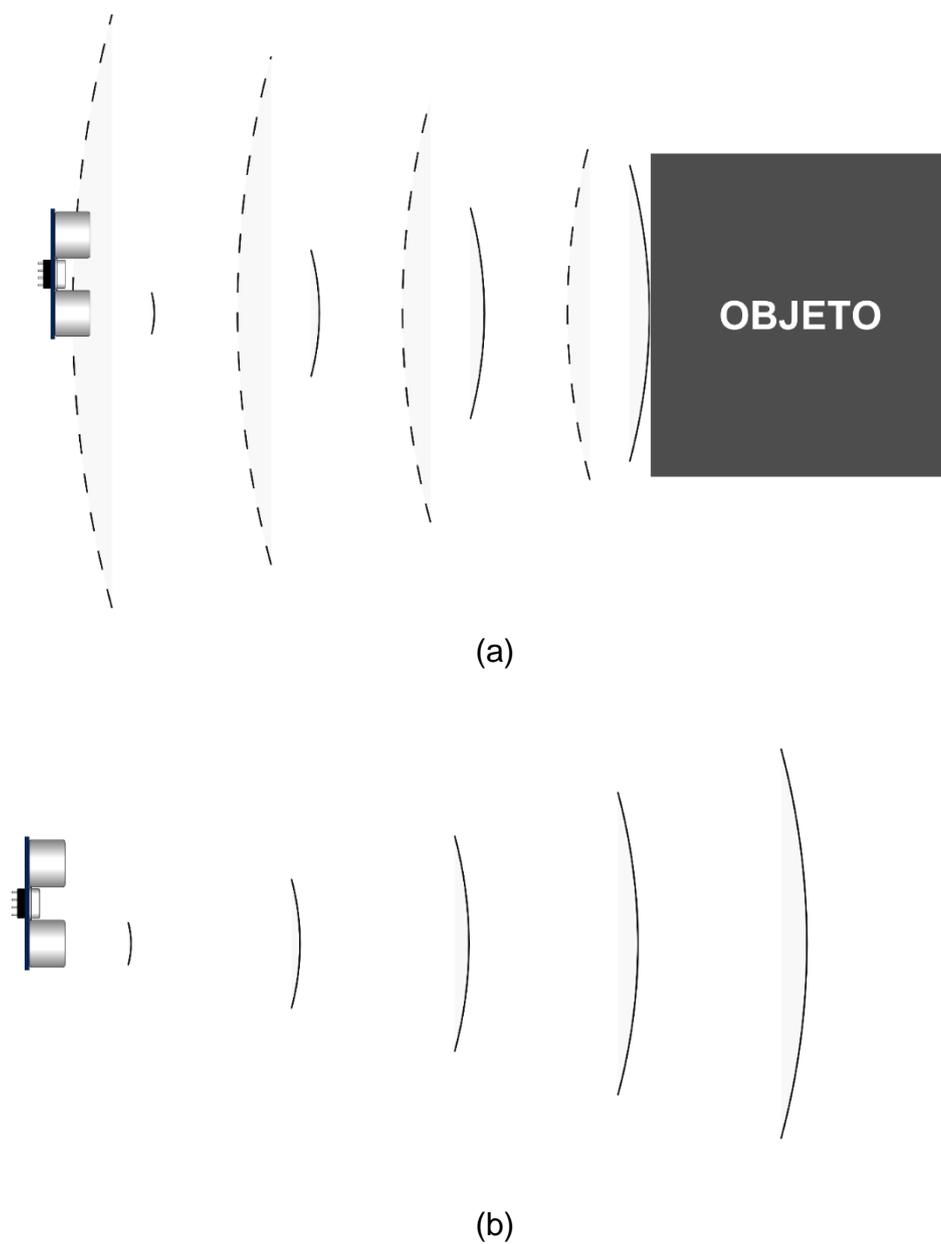


Figura 5.5 - Região onde objetos podem ser detectados pelo sensor de ultrassom.

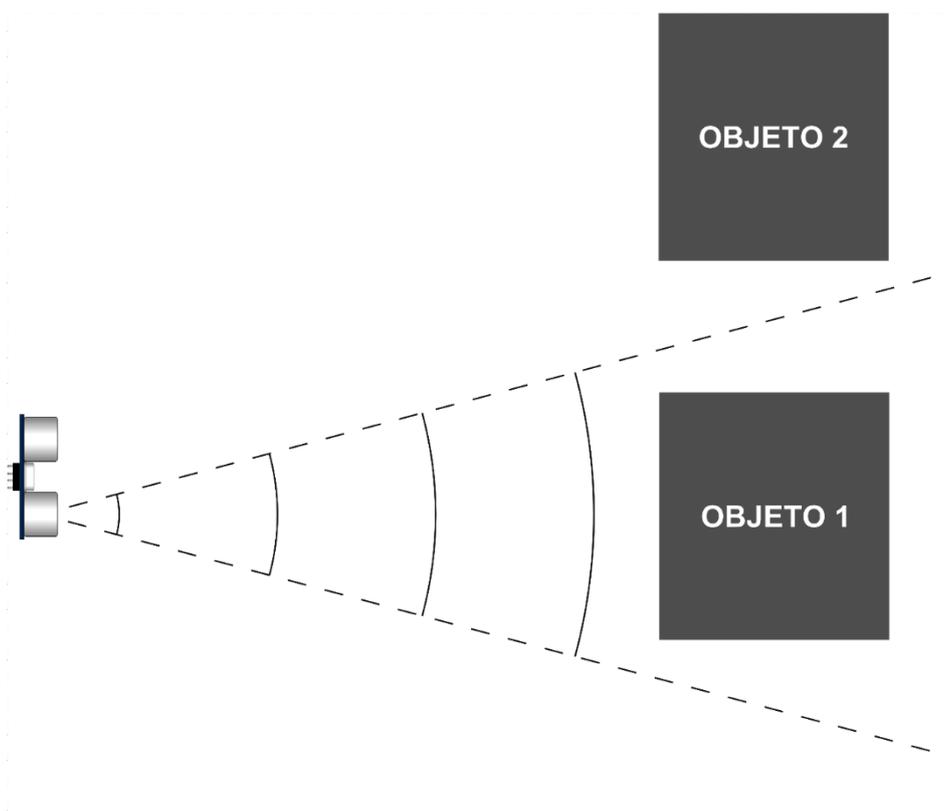
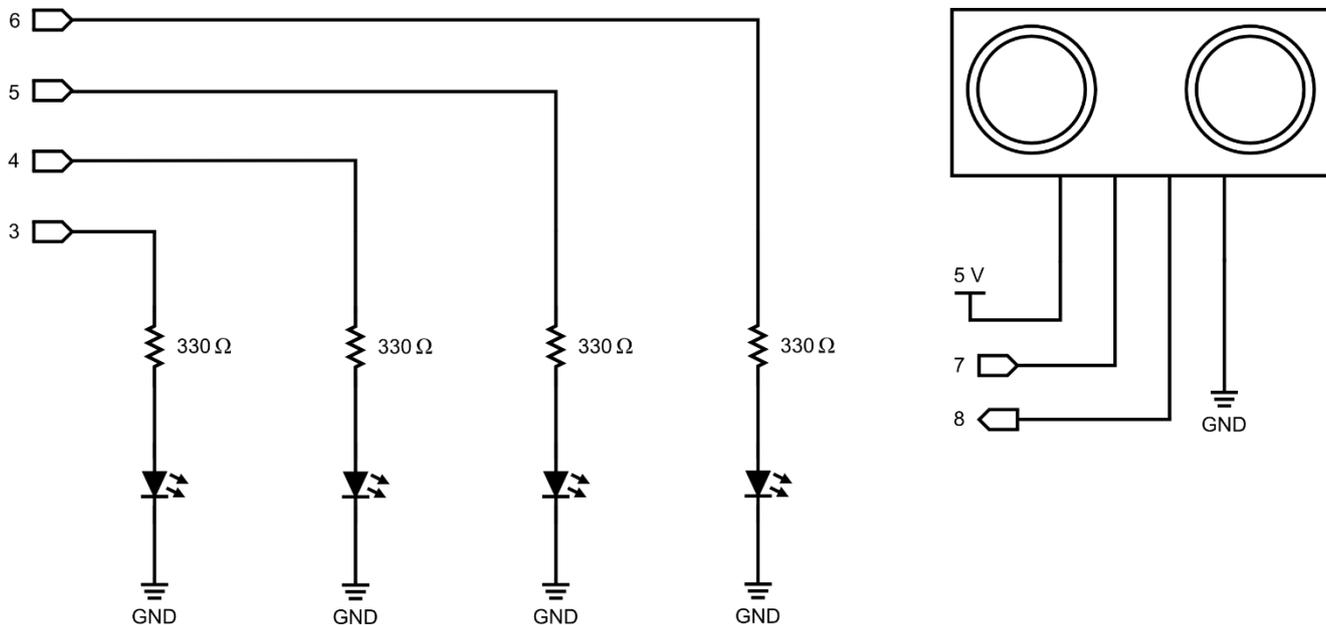
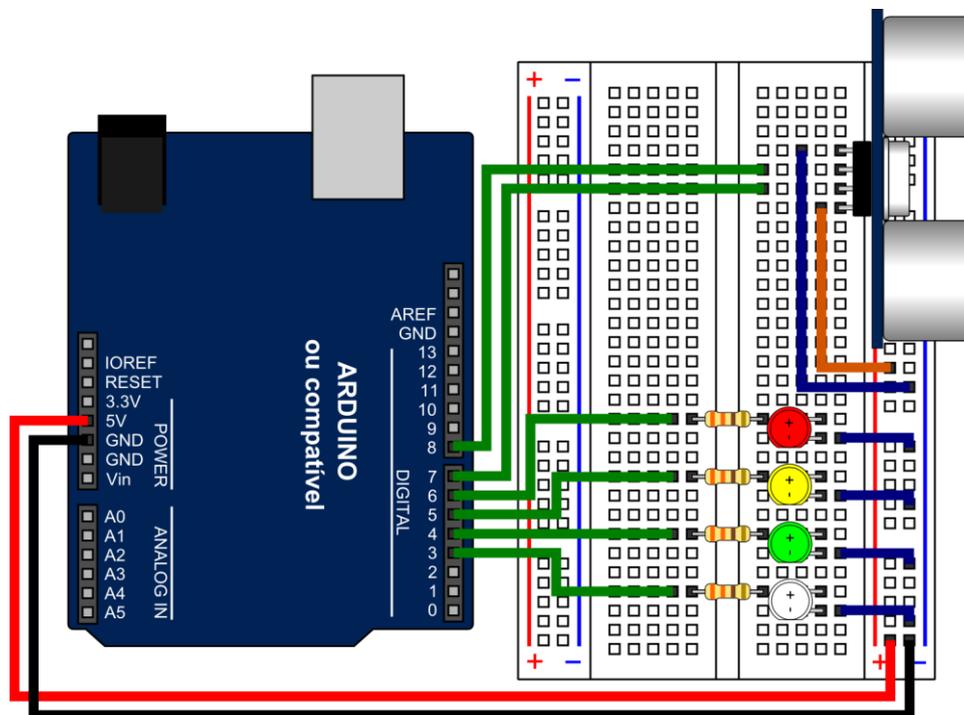


Figura 5.6 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 19.

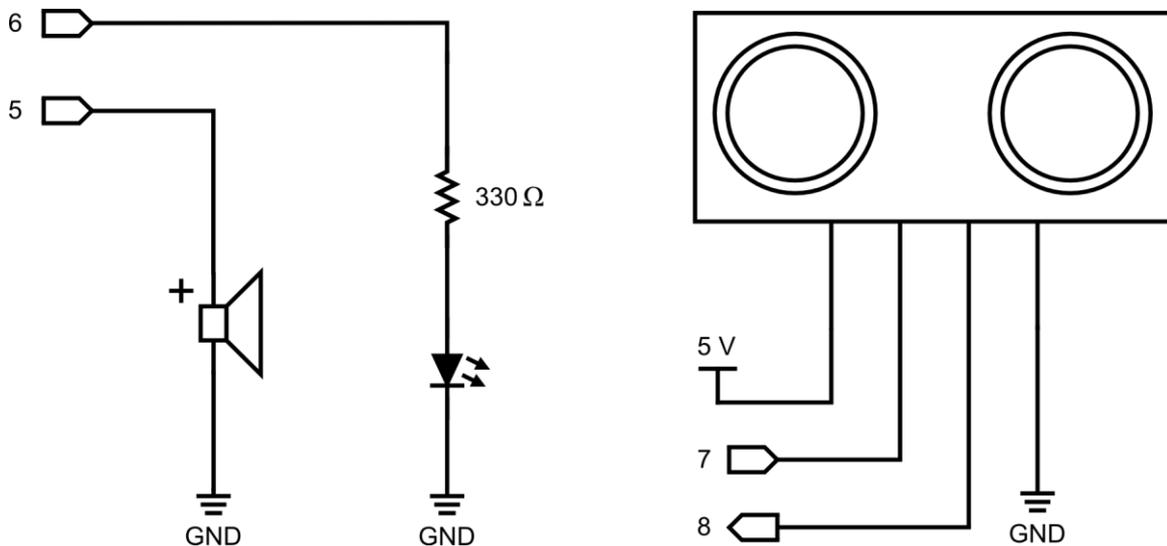


(a)

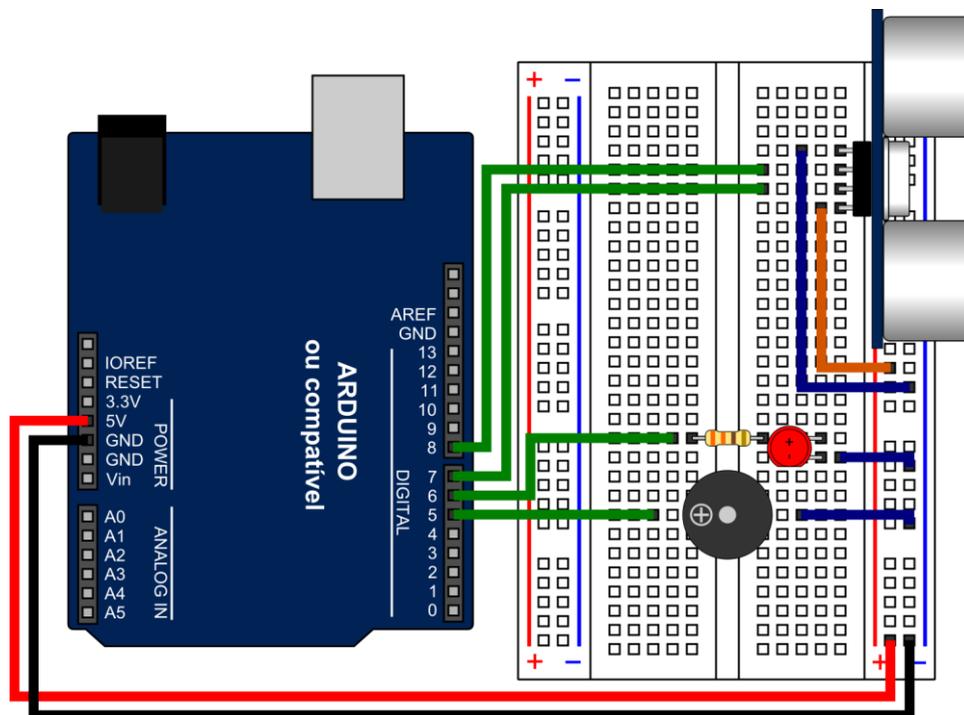


(b)

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

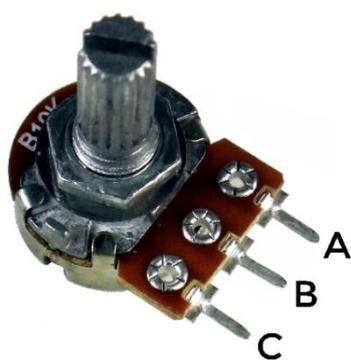


(a)

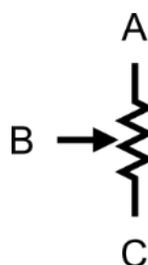


(b)

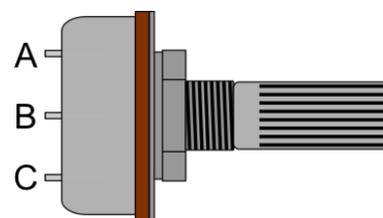
Figura 6.1 - (a) Imagem de um potenciômetro, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)

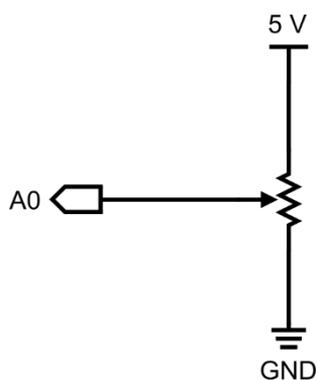


(b)

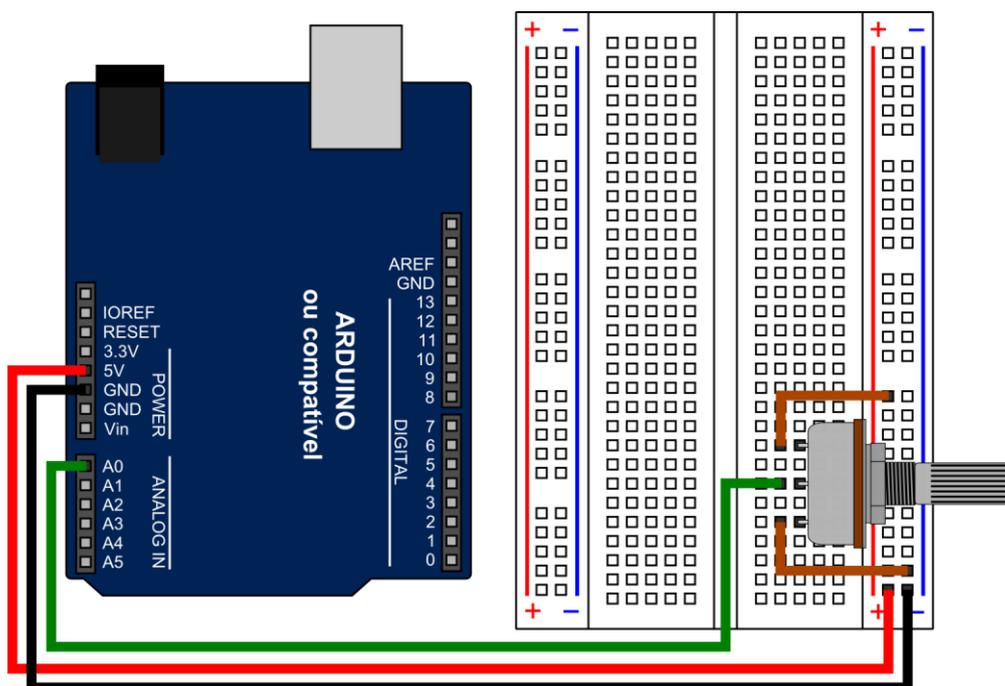


(c)

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

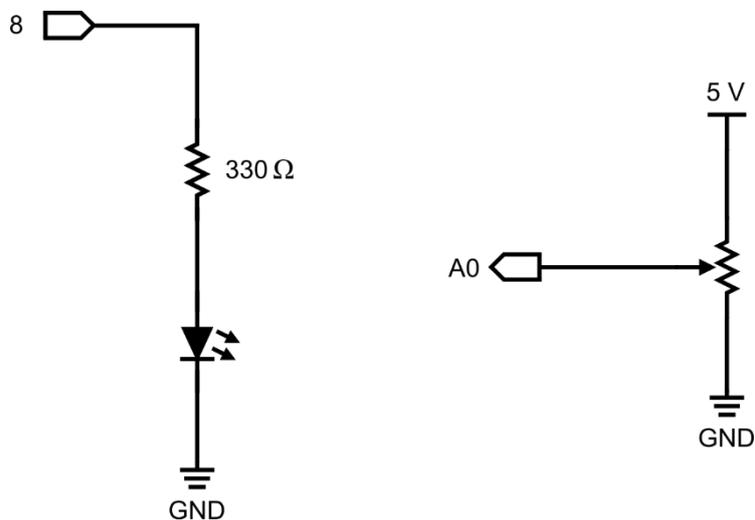


(a)

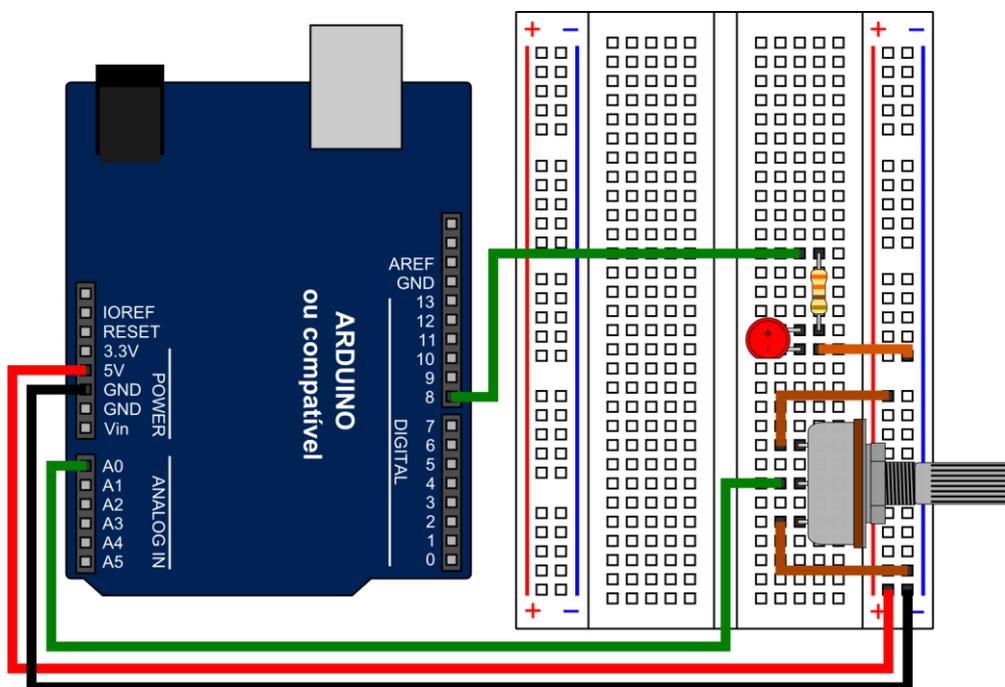


(b)

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.

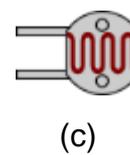
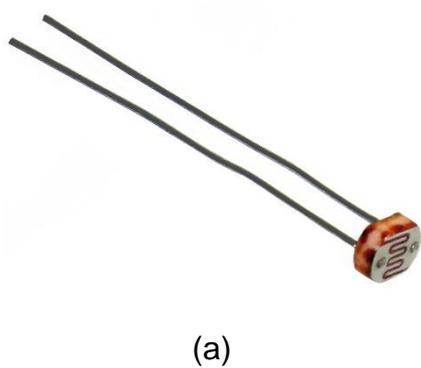
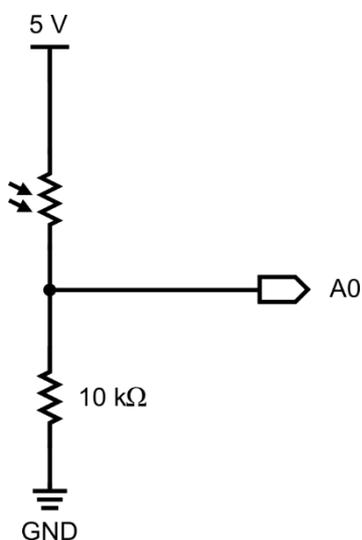
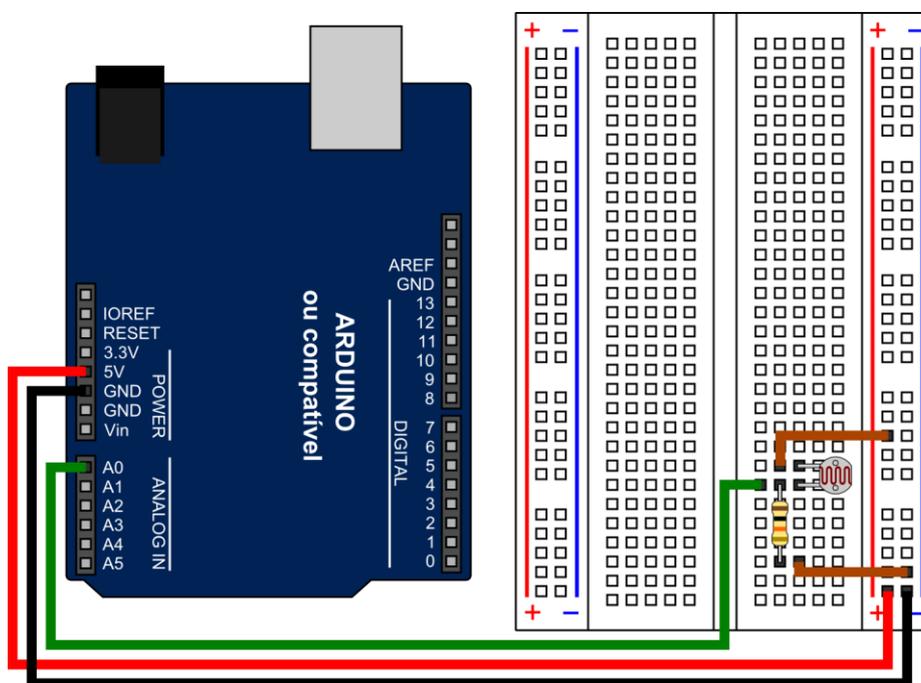


Figura 6.5 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 24.

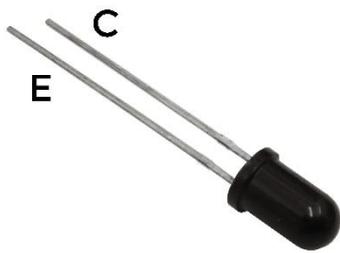


(a)

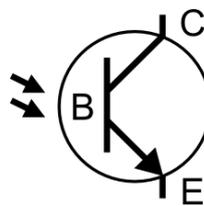


(b)

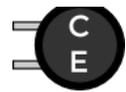
Figura 6.6 - (a) Imagem de um fototransistor, (b) seu símbolo no esquema dos circuitos e (c) a figura que o representa na ilustração dos circuitos montados.



(a)



(b)



(c)

Figura 6.7 - Prendendo os cabos extensores nos suportes.

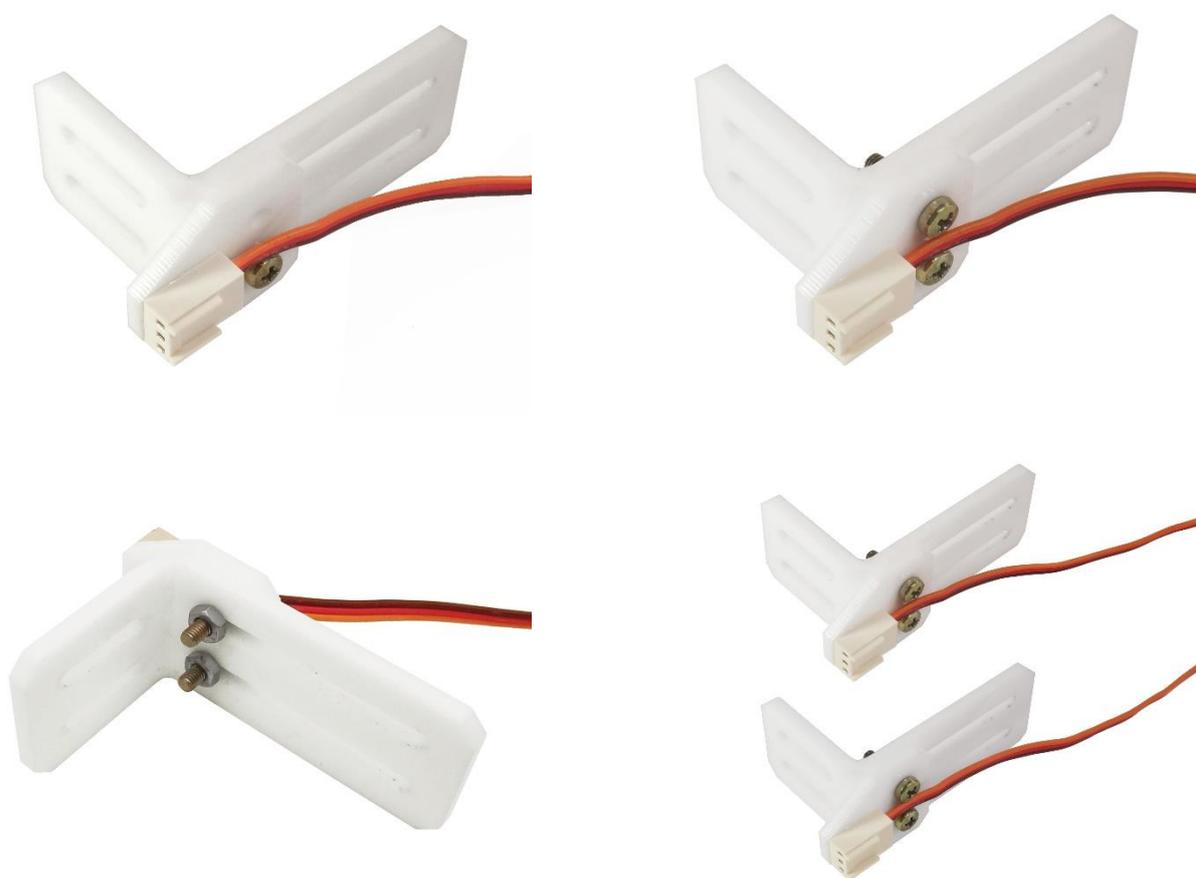


Figura 6.8 - Conectando o fototransistor no cabo extensor.

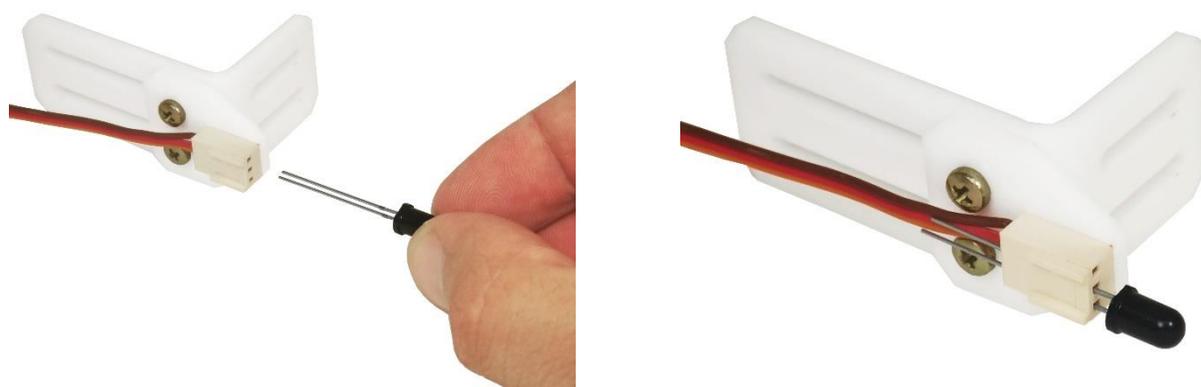


Figura 6.9 - Conectando o LED infravermelho no cabo extensor.



Figura 6.10 - Ligando os cabos extensores na protoboard.

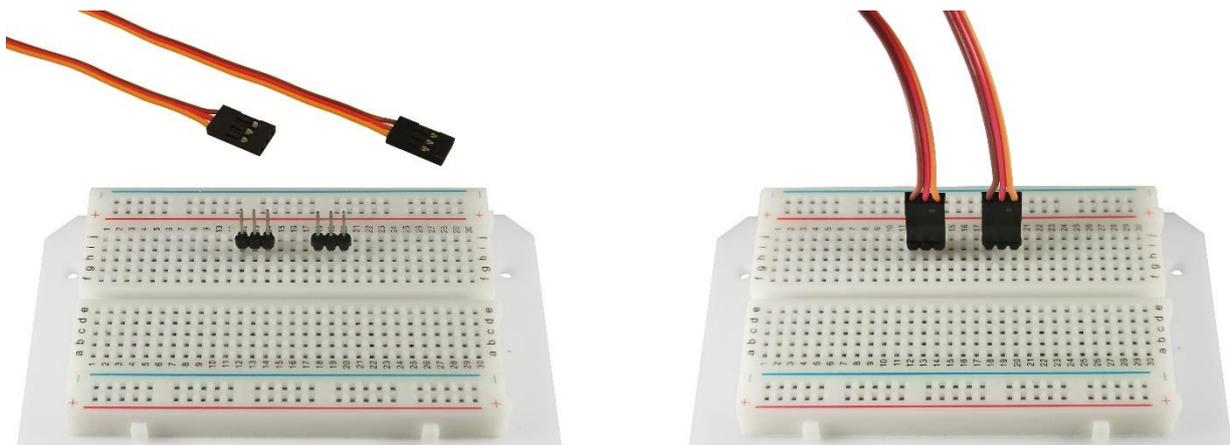
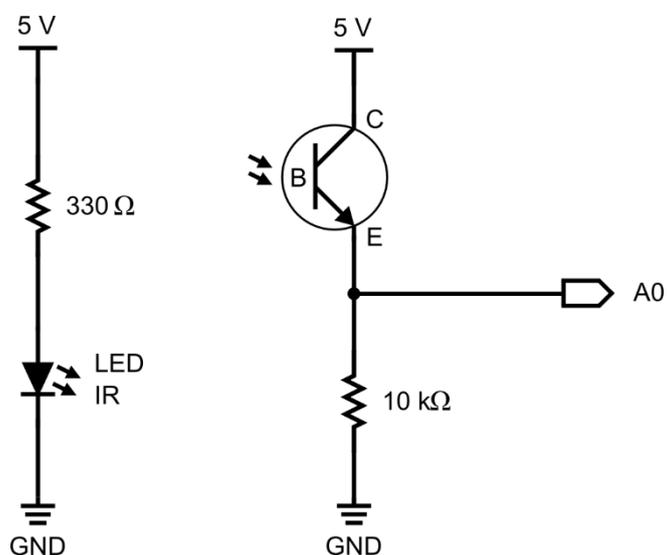


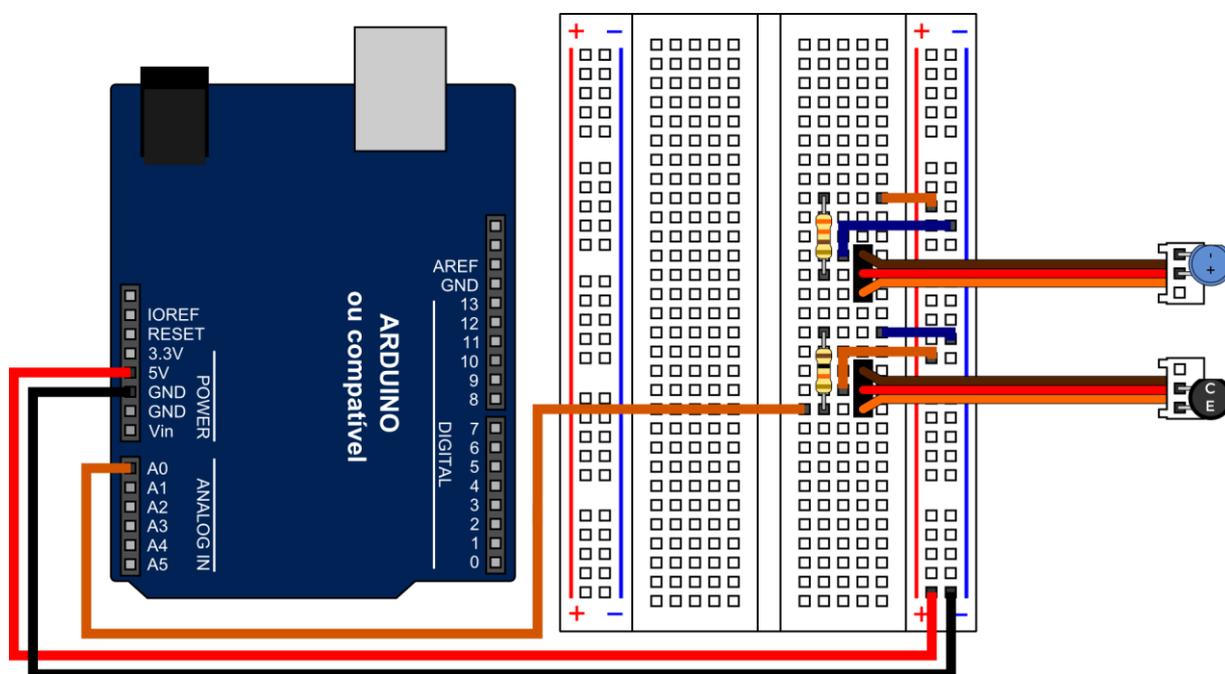
Figura 6.11 - Posicionando o LED infravermelho e o fototransistor.



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.

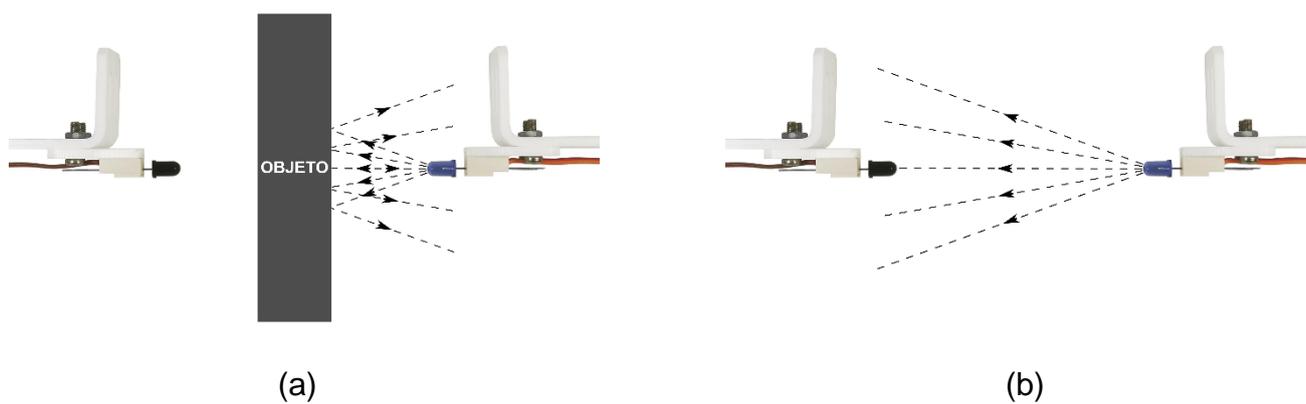


Figura 7.1 - Chassi.



Figura 7.2 - Prendendo os espaçadores no chassi.



Figura 7.3 - Prendendo os servos no chassi.

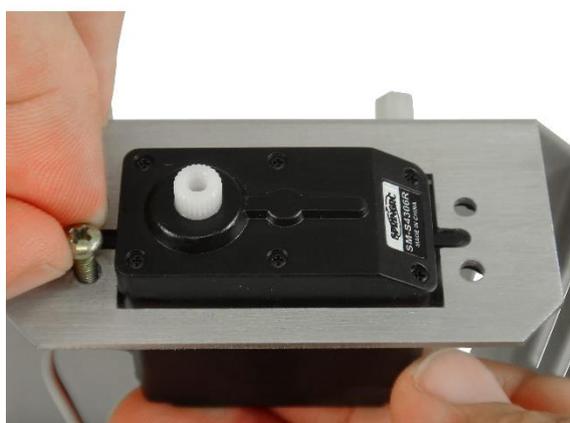


Figura 7.4 - Passando os cabos dos servos pelo furo do chassi.

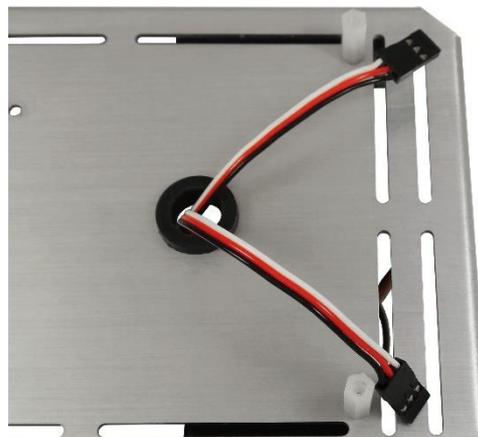
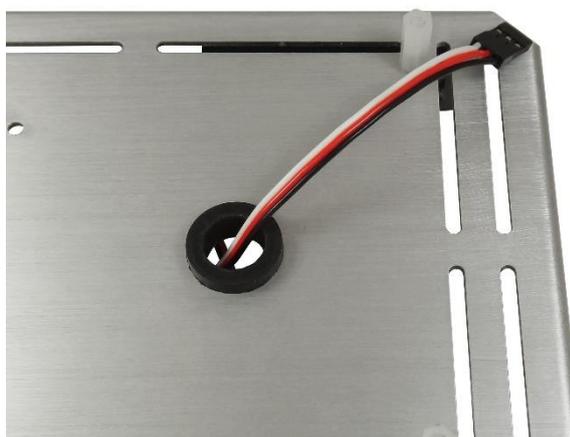
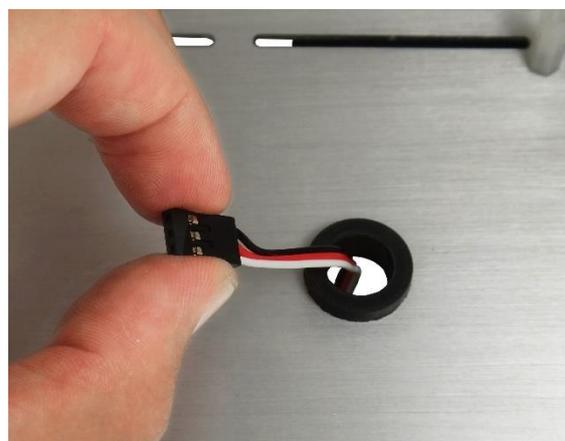


Figura 7.5 - Posicionando a presilha de pilhas sobre o chassi.



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.

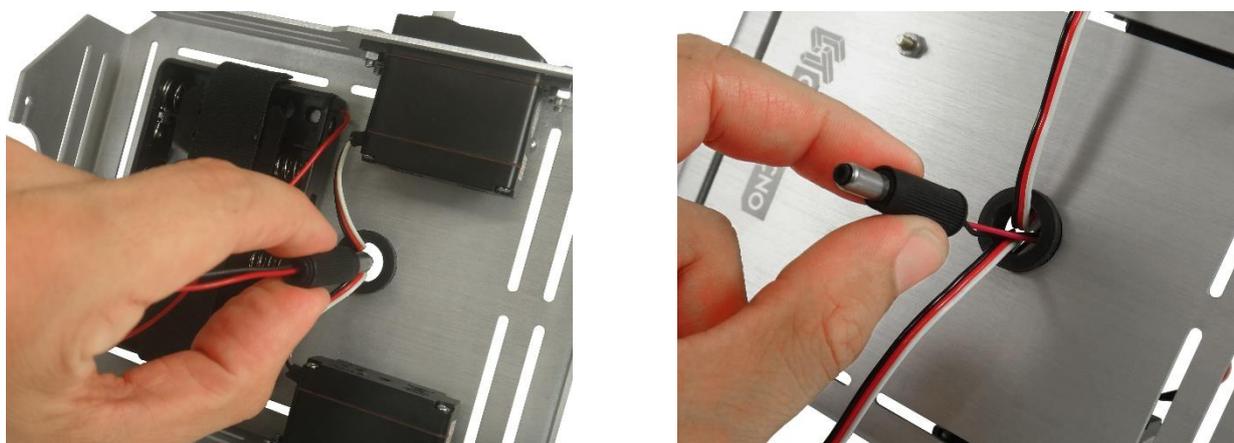


Figura 7.9 - Inserindo o eixo no furo da esfera.



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.

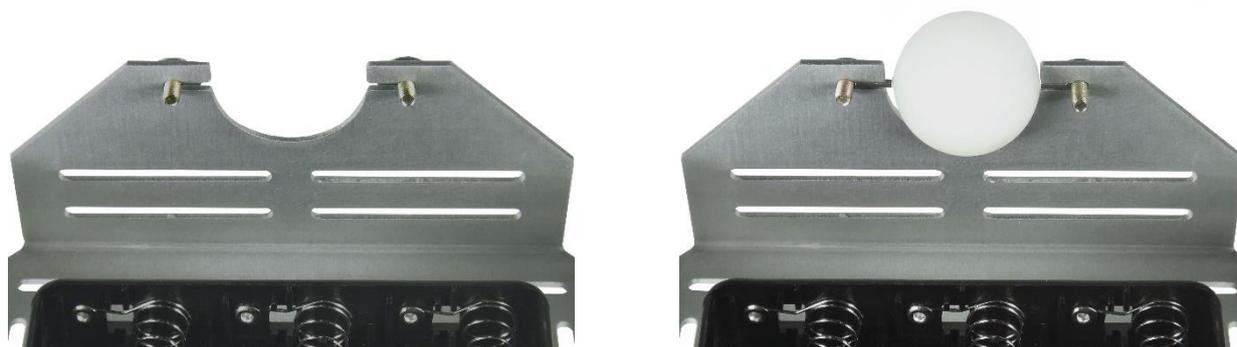


Figura 7.12 - Prendendo o eixo da esfera.



Figura 7.13 - Verificando se a esfera gira livremente.

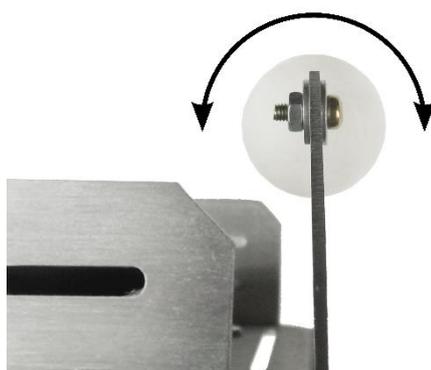


Figura 7.14 - Passando os cabos dos servos pelos furos da base de prototipagem.

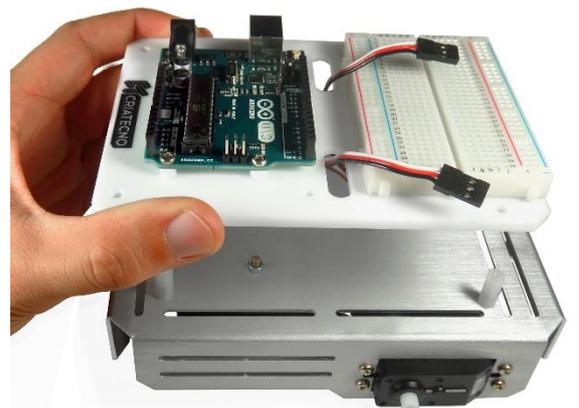
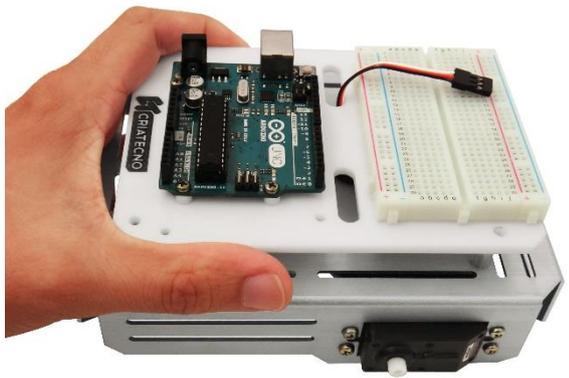
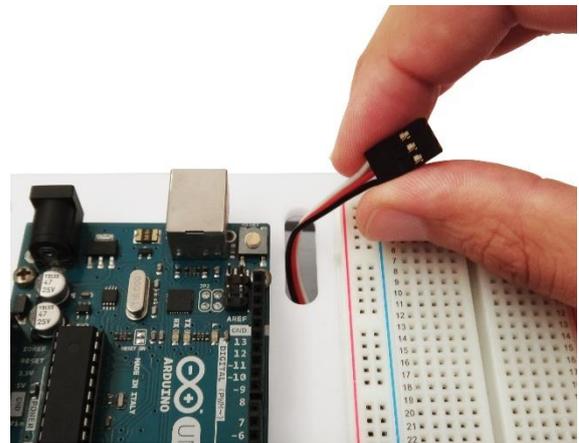


Figura 7.15 - Prendendo a base de prototipagem nos espaçadores.

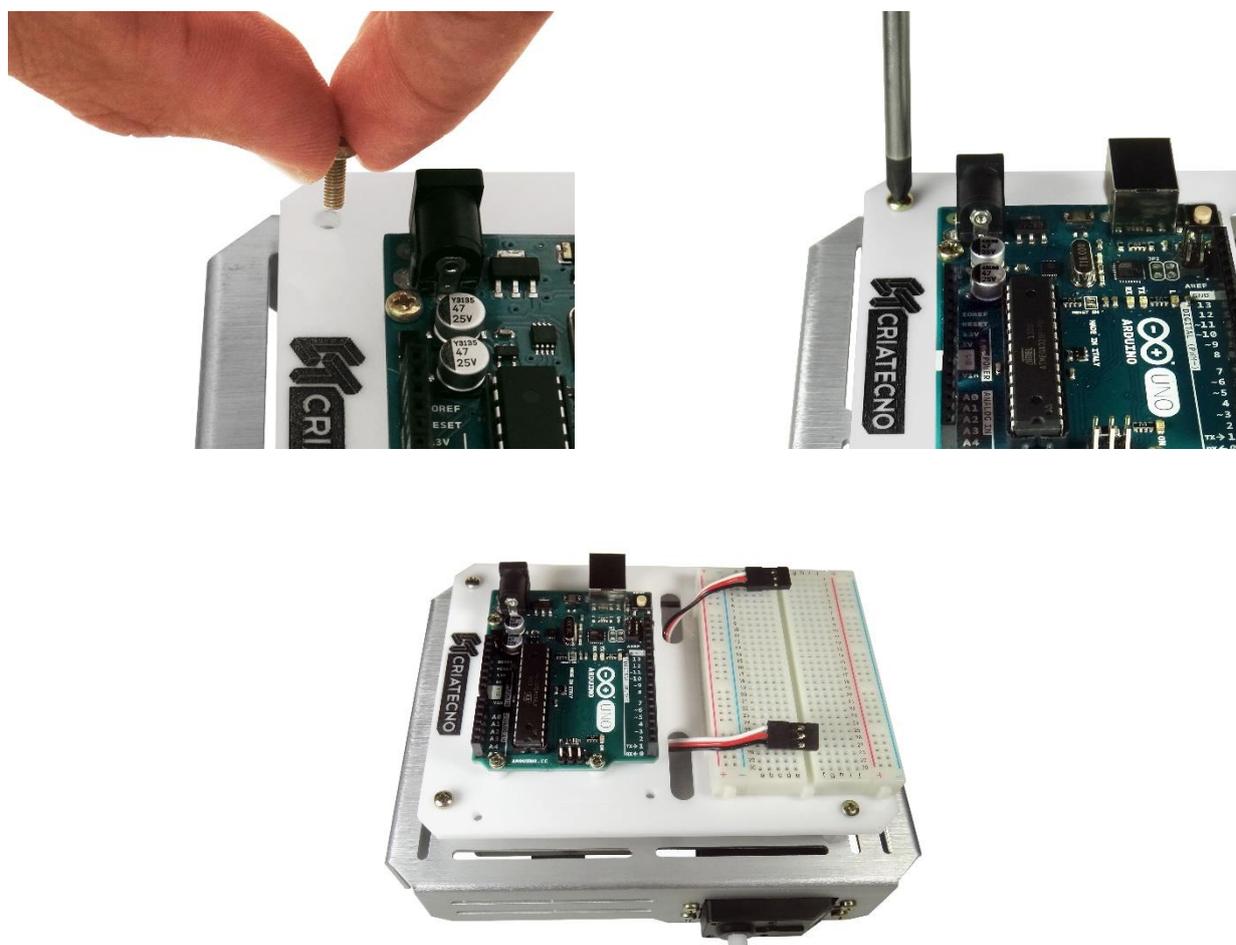


Figura 7.16 - Encaixando os anéis de borracha nas rodas.

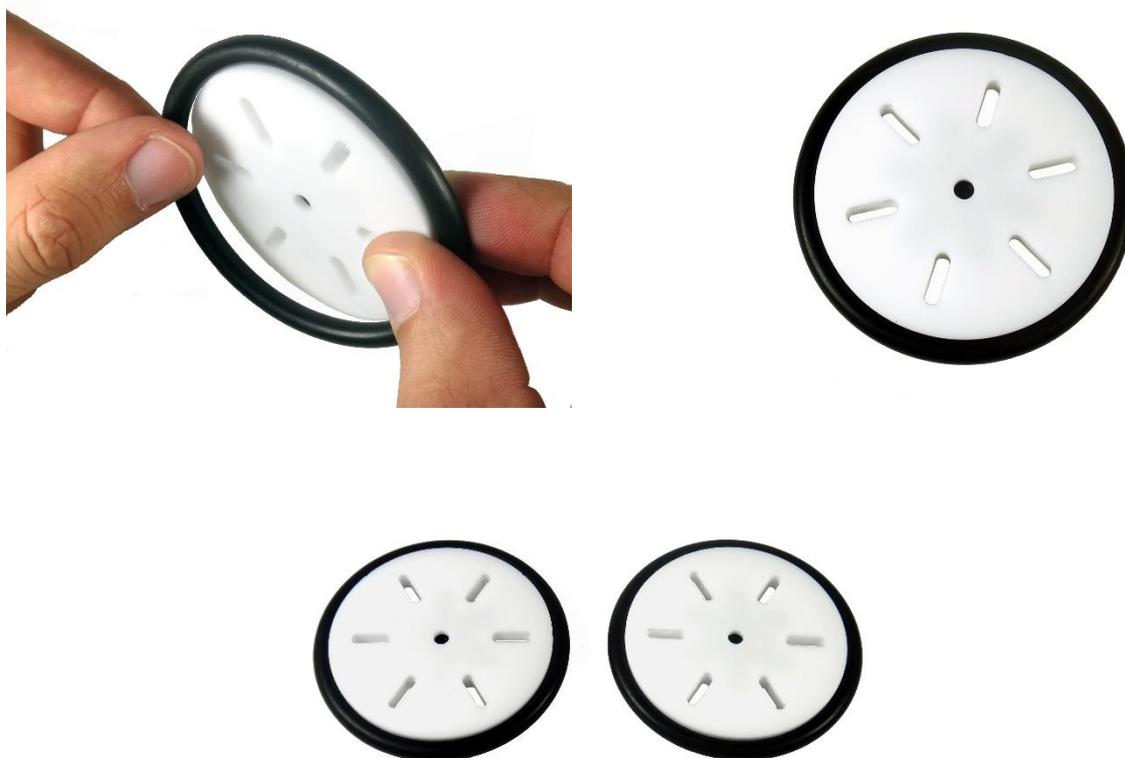


Figura 7.17 - Parafusos específicos para prender as rodas nos servomotores (parafusos para eixo de servomotor).



Figura 7.18 - Prendendo as rodas nos servos.



Figura 7.19 - Ligando os conectores dos servos na protoboard.

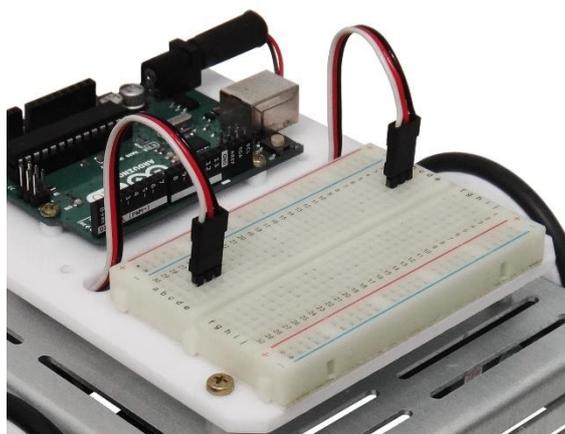


Figura 7.20 - Robô pronto para a realização das próximas atividades.

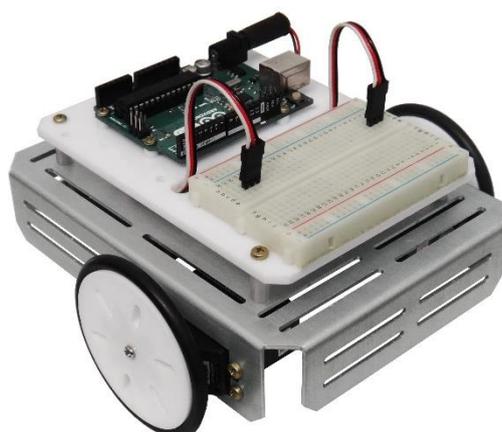
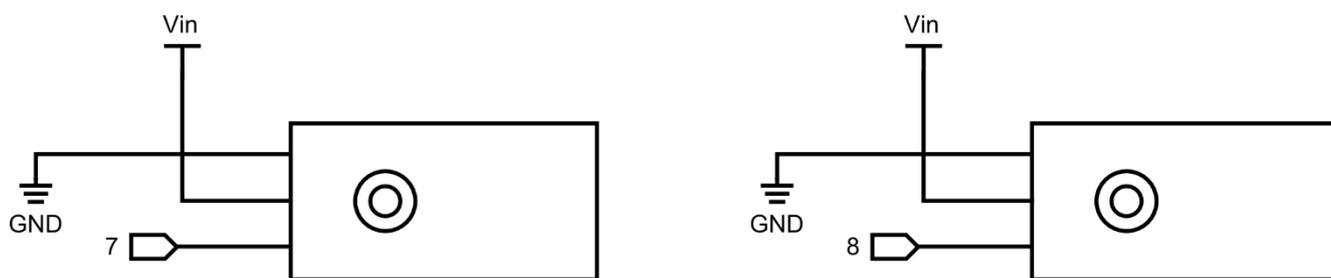
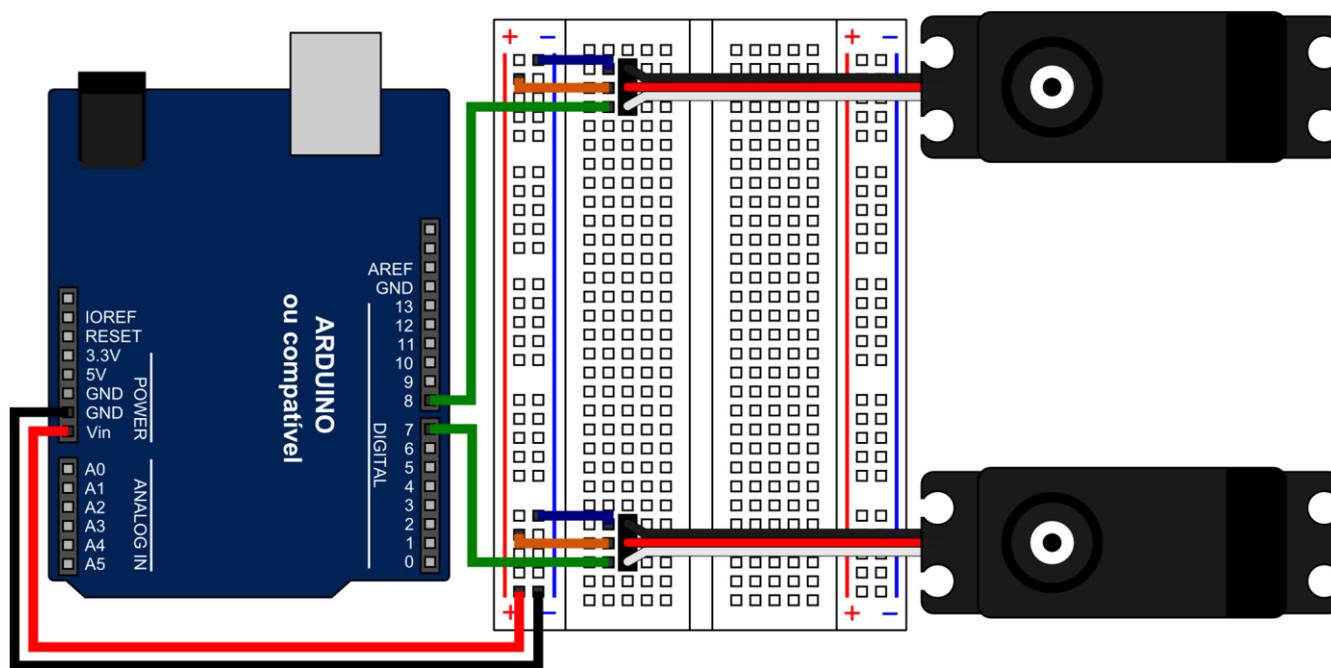


Figura 7.21 - (a) Esquema e (b) ilustração do circuito eletrônico usado para a ligação de servos.



(a)



(b)

Figura 7.22 - Vista superior do robô.

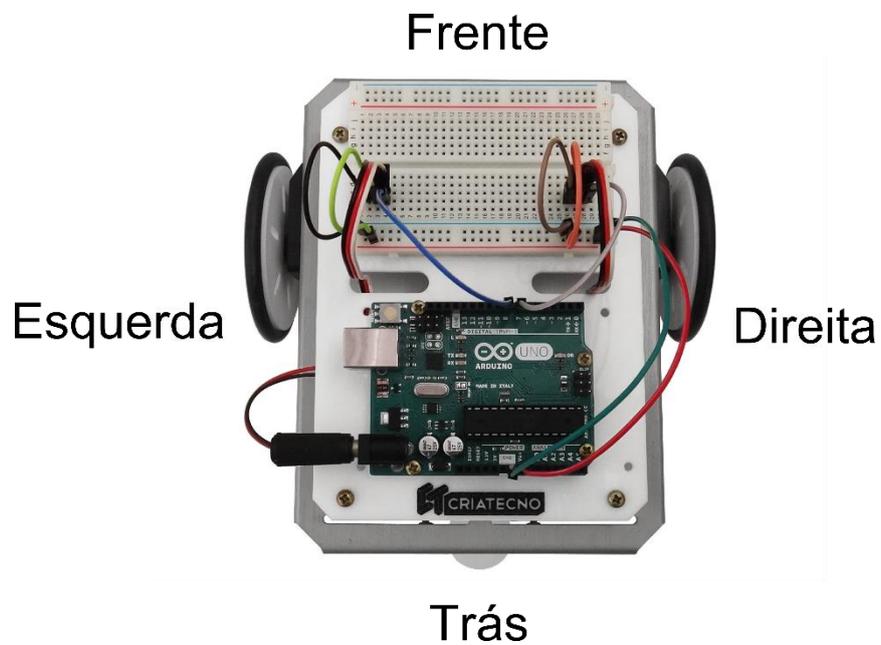


Figura 7.23 - Convenção adotada para o movimento das rodas.

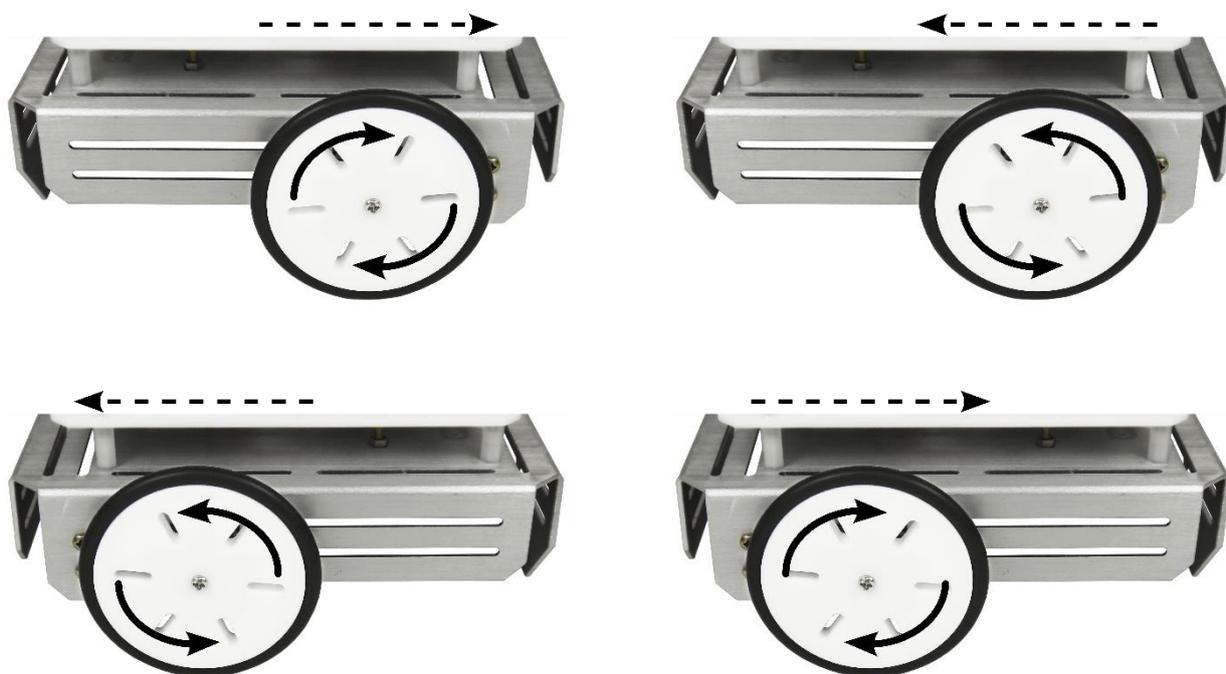


Figura 7.24 - Giro das rodas para que o robô se movimente (a) para frente e (b) para trás.

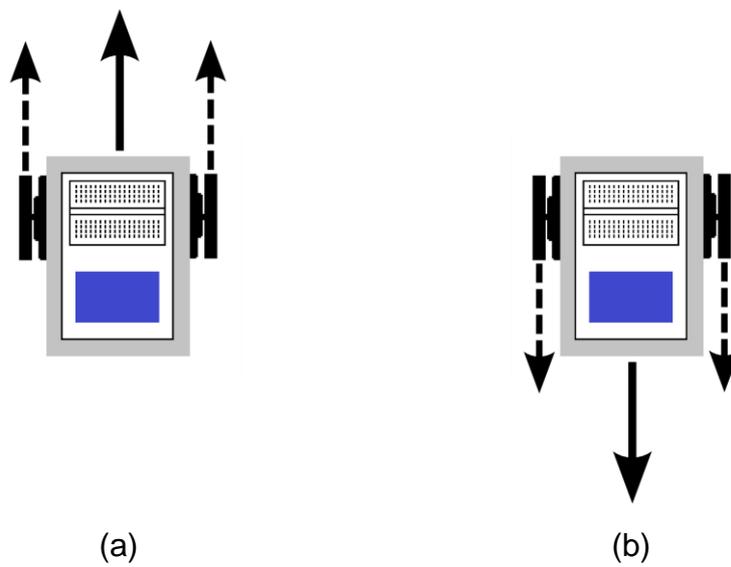


Figura 7.25 - Giro das rodas para que o robô gire (a) para a direita e (b) para a esquerda.

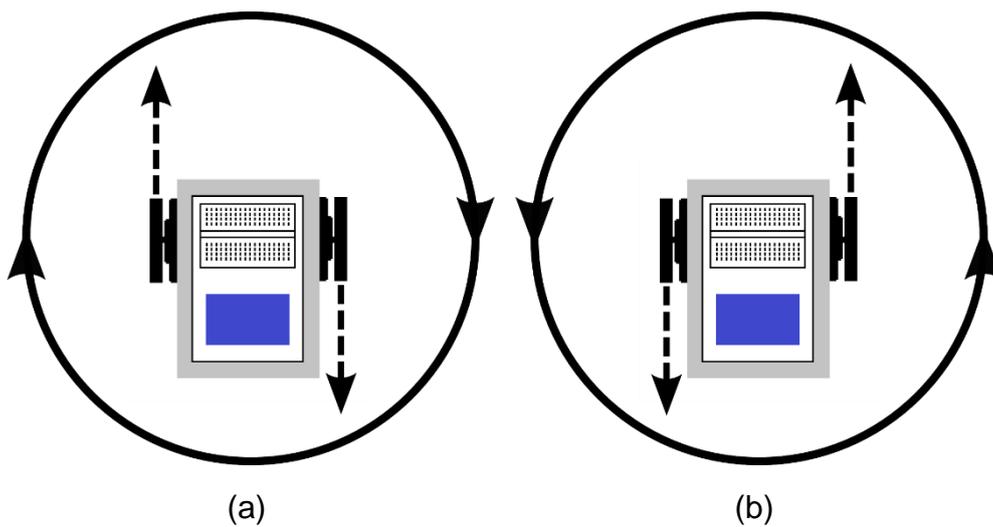


Figura 7.26 - Giro das rodas para que o robô realize curvas
(a) para a esquerda e (b) para a direita.

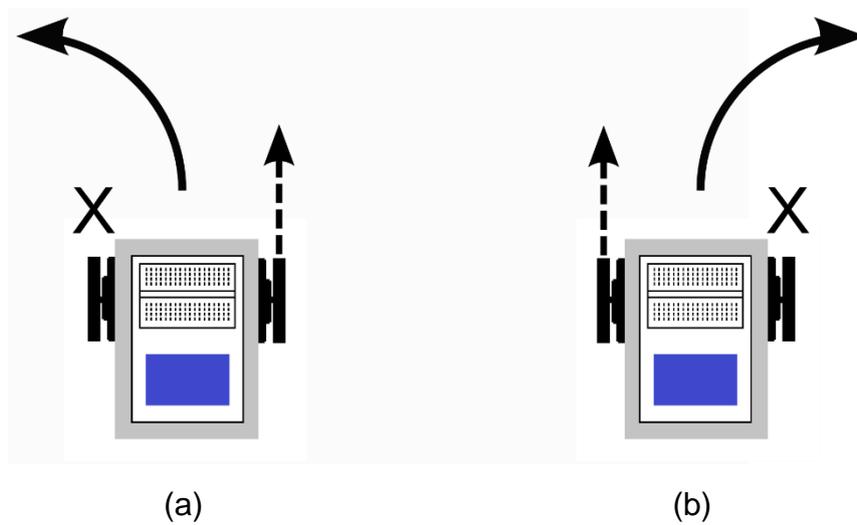


Figura 7.27 - Deslocamento de 10 cm para frente.

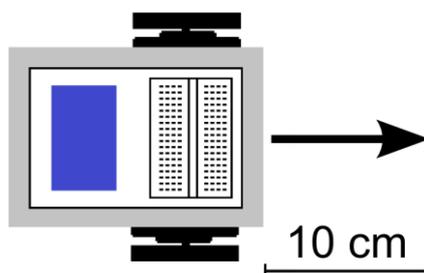


Figura 7.28 - Curva de 90° para a direita.

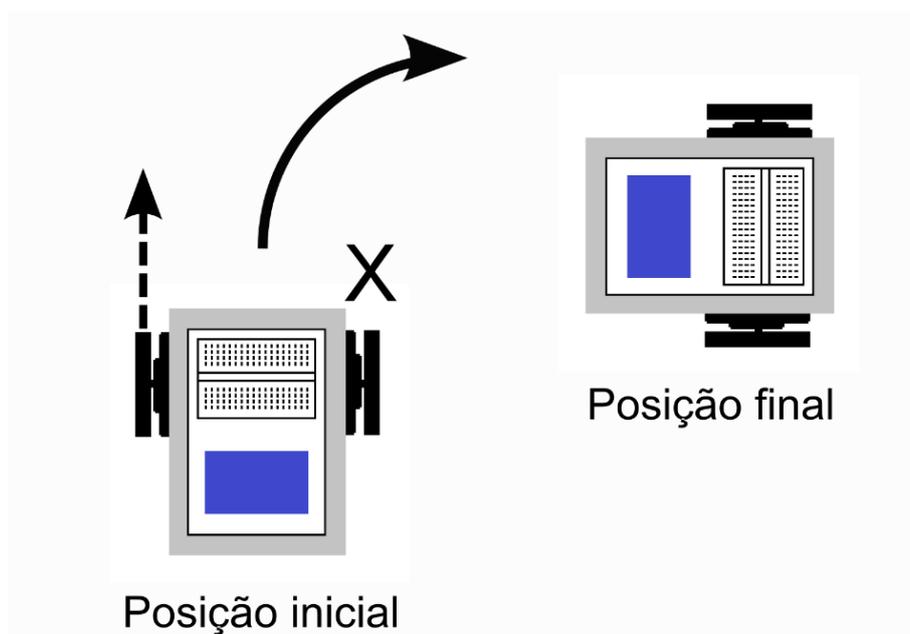


Figura 7.29 - Curva de 90° para a esquerda.

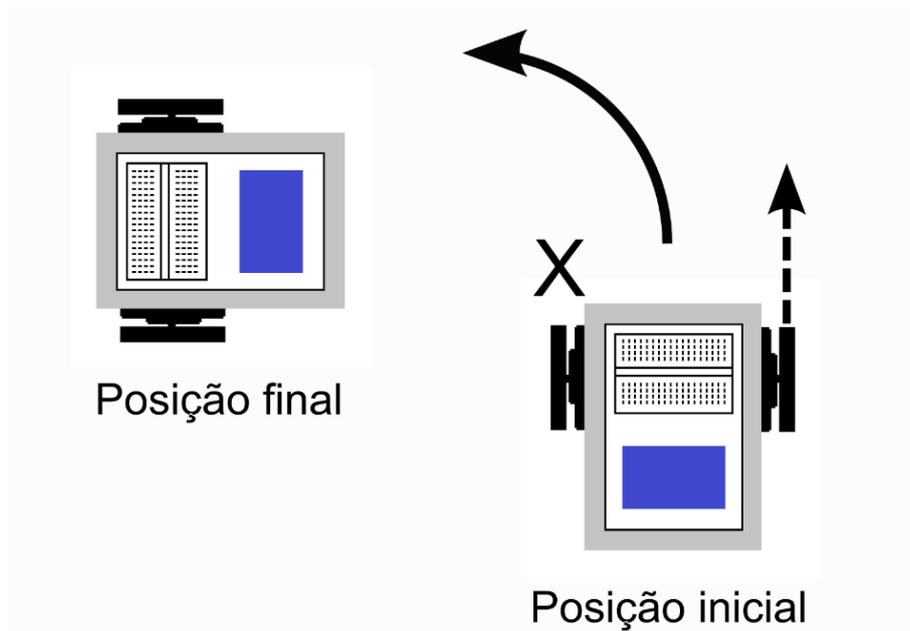
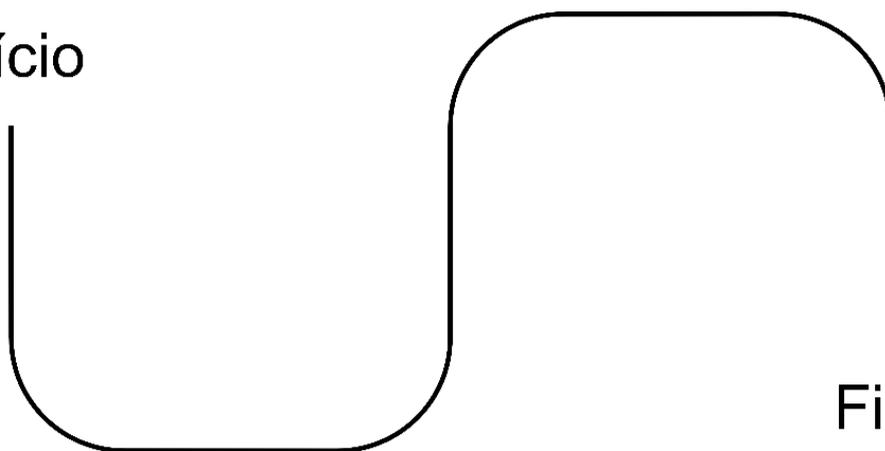


Figura 7.30 - Trajetória a ser percorrida pelo robô.

Início



Fim

Figura 7.31 - Trajetória dividida em trechos distintos.

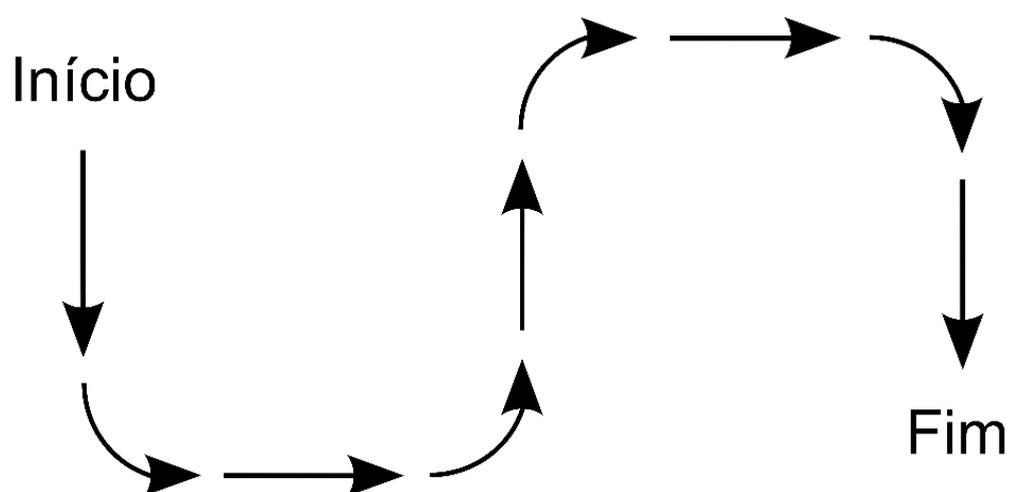


Figura 8.1 - Prendendo os suportes no chassi.



Figura 8.2 - Prendendo a micro chave nos suportes.

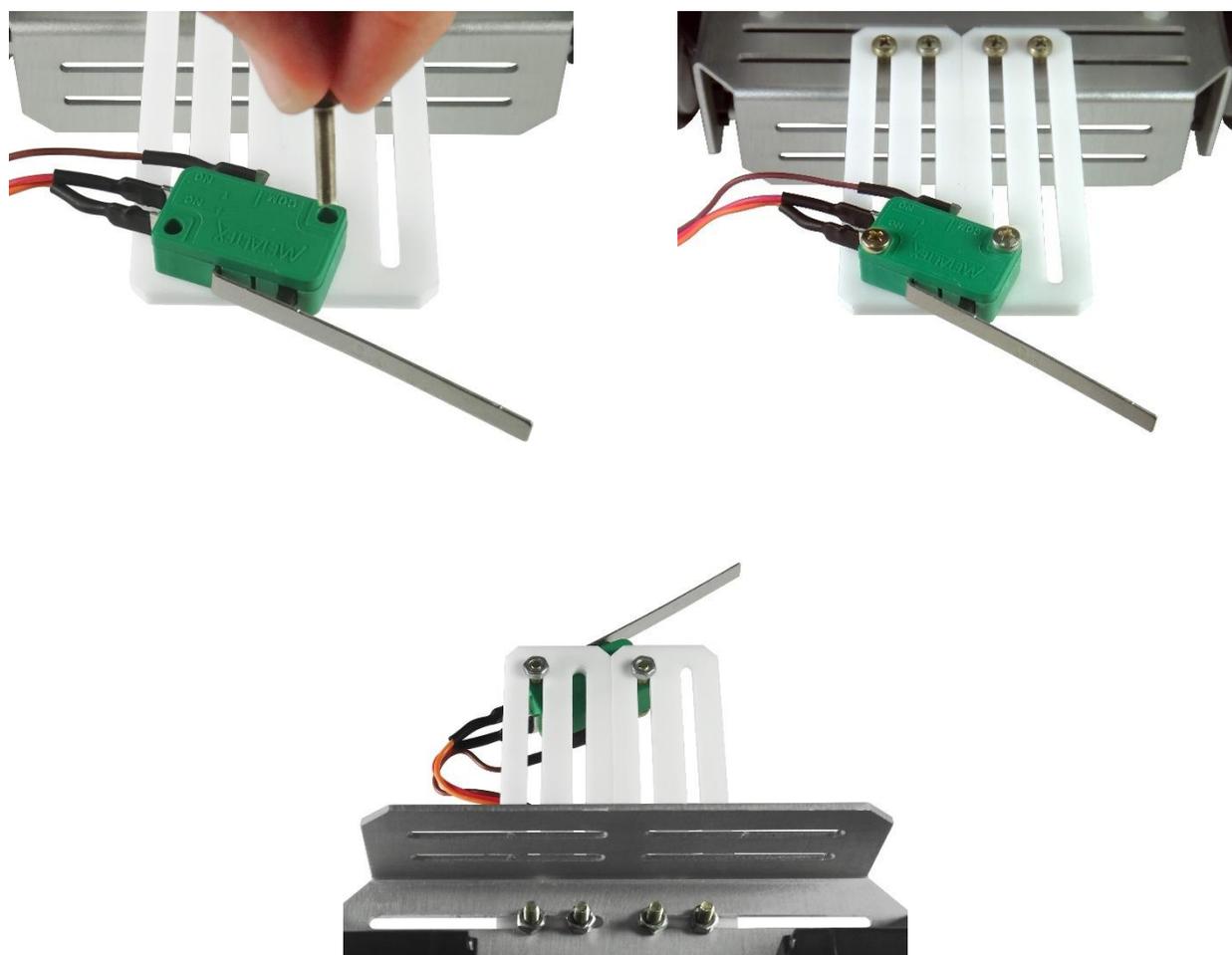


Figura 8.3 - Ligando a micro chave na protoboard.

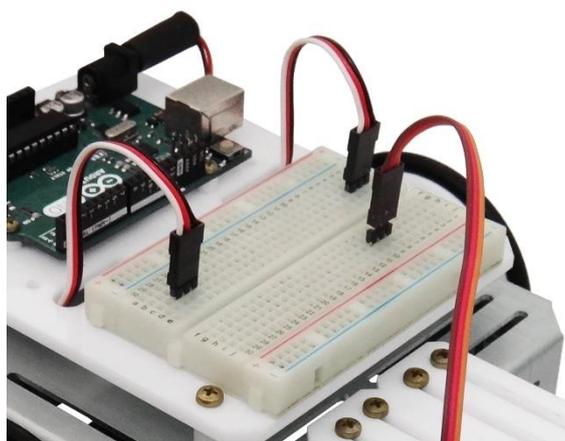


Figura 8.4 - Robô pronto para a realização da atividade.

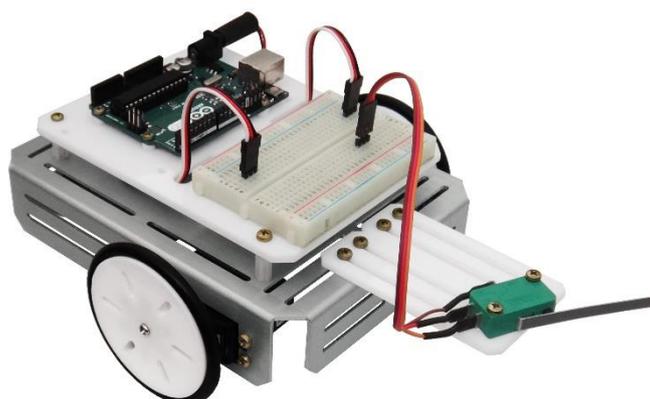
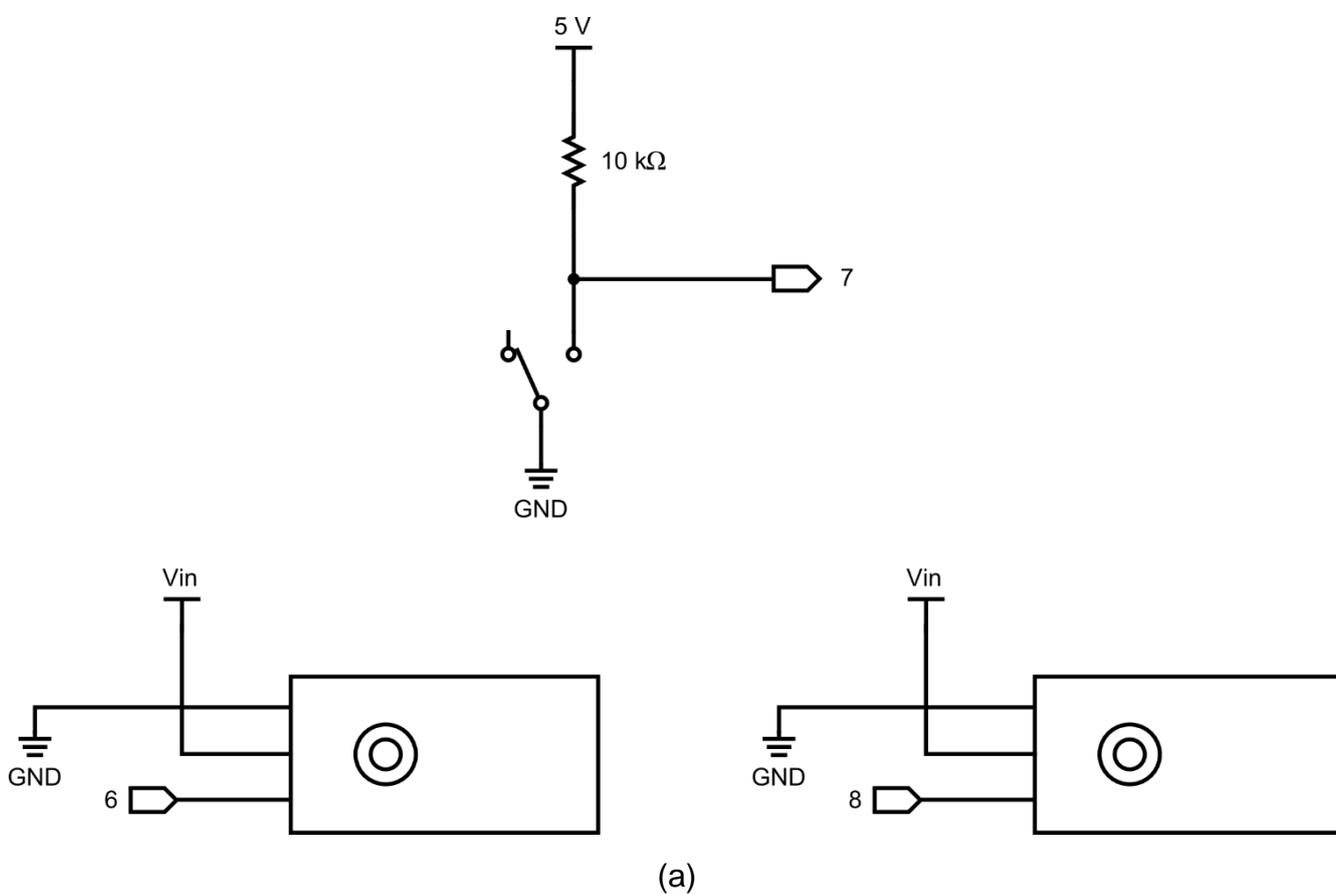
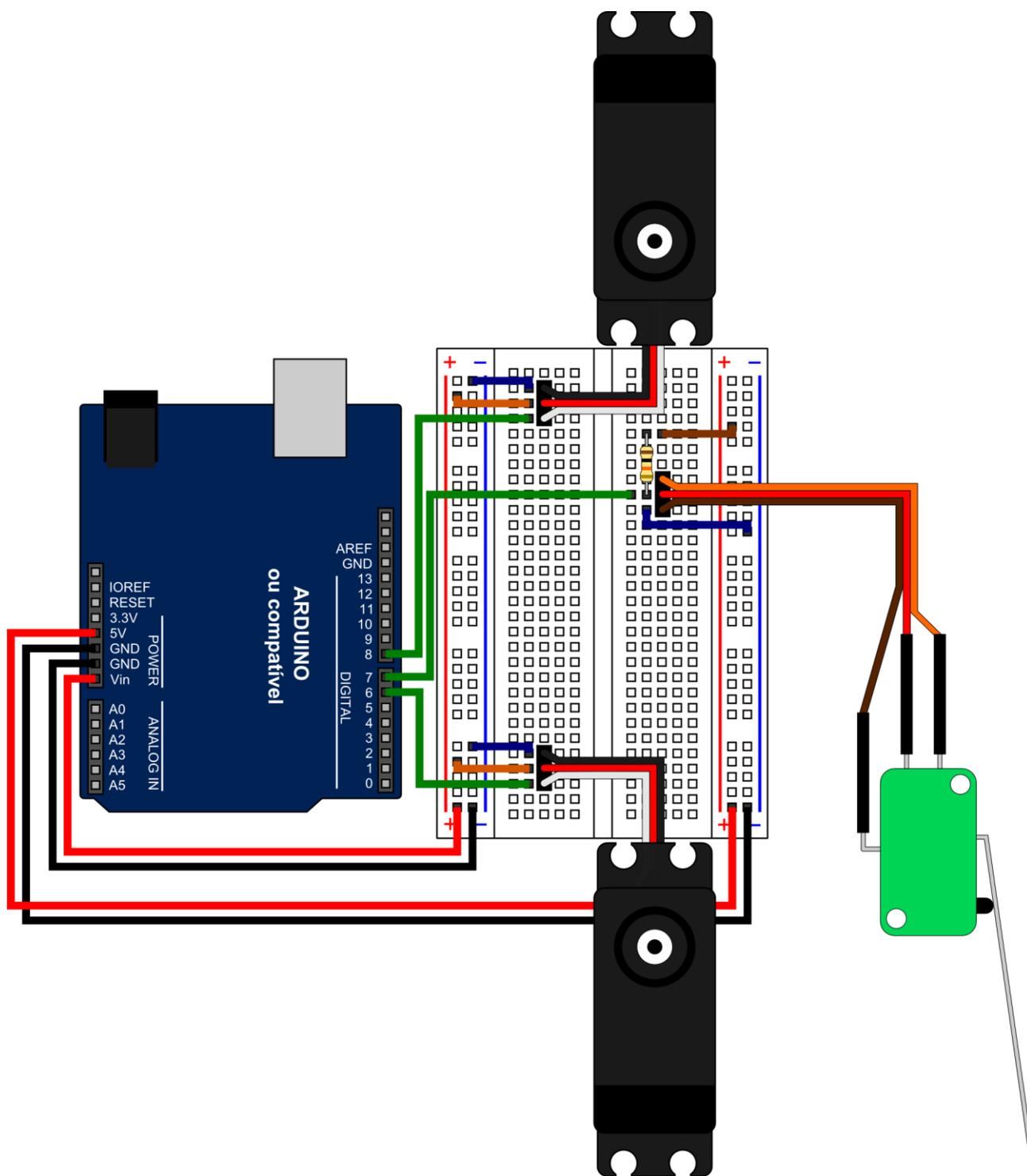


Figura 8.5 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 31.





(b)

Figura 8.6 - Prendendo os suportes no chassi.

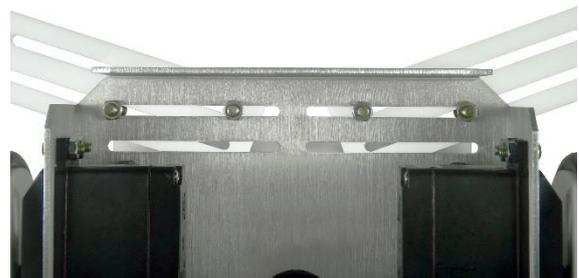


Figura 8.7 - Prendendo as micro chaves nos suportes.

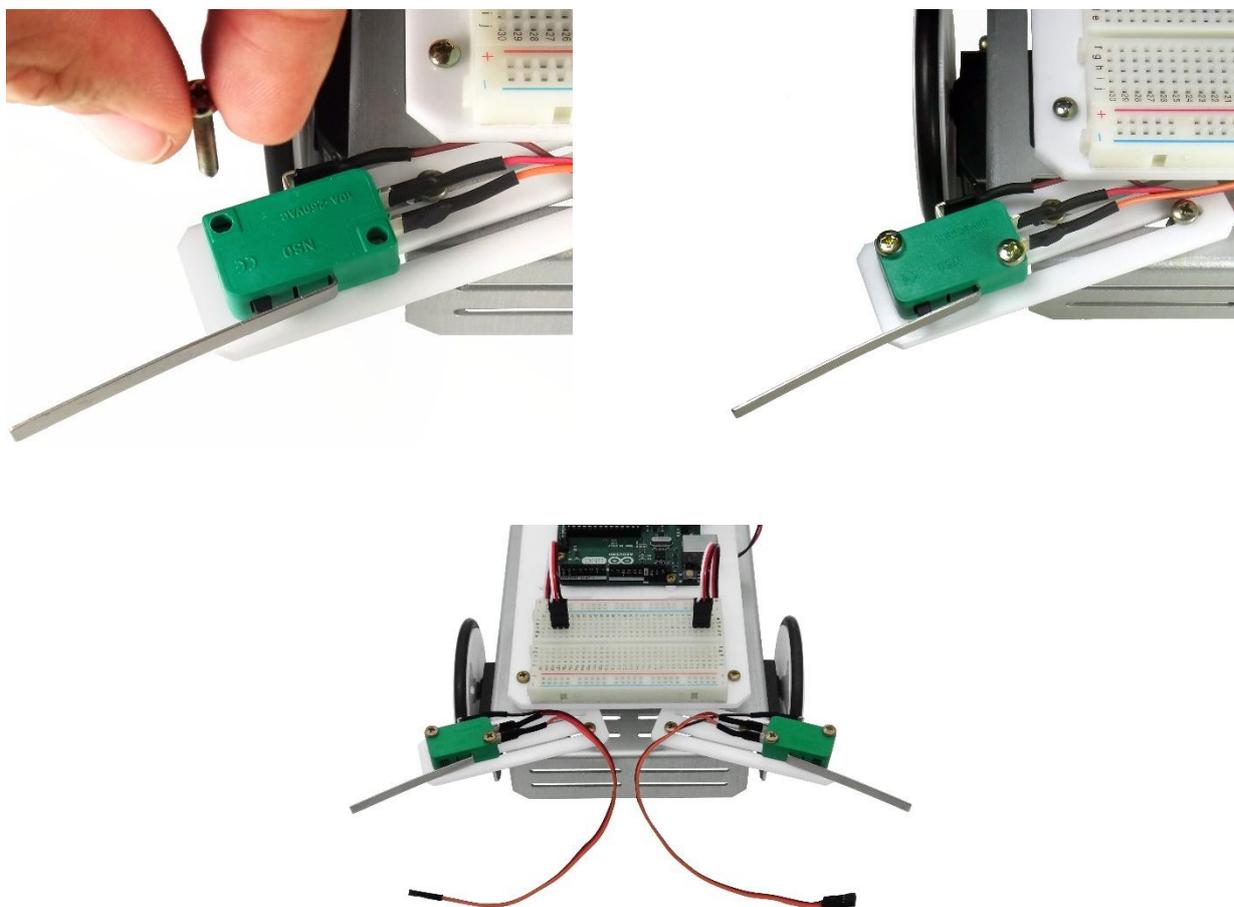


Figura 8.8 - Ligando as micro chaves na protoboard.

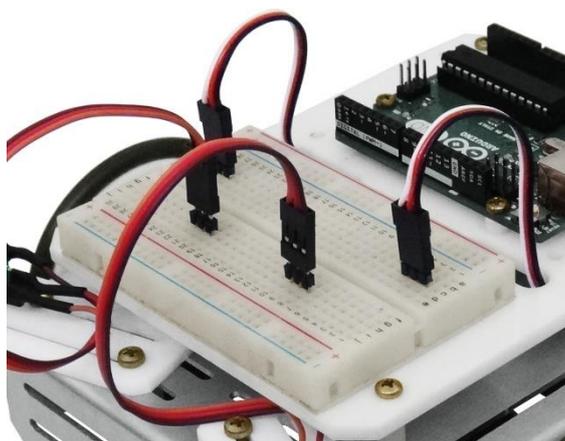


Figura 8.9 - Robô pronto para a realização da atividade.

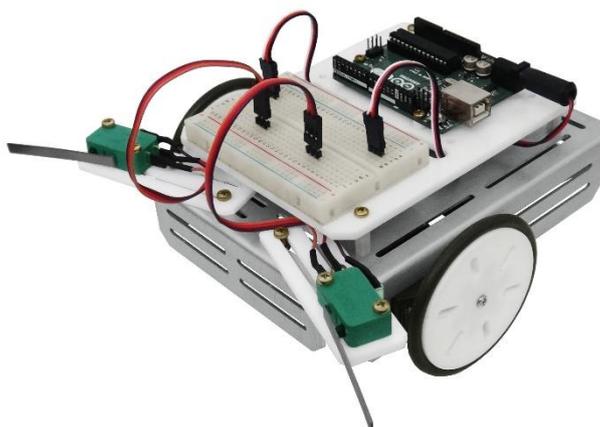
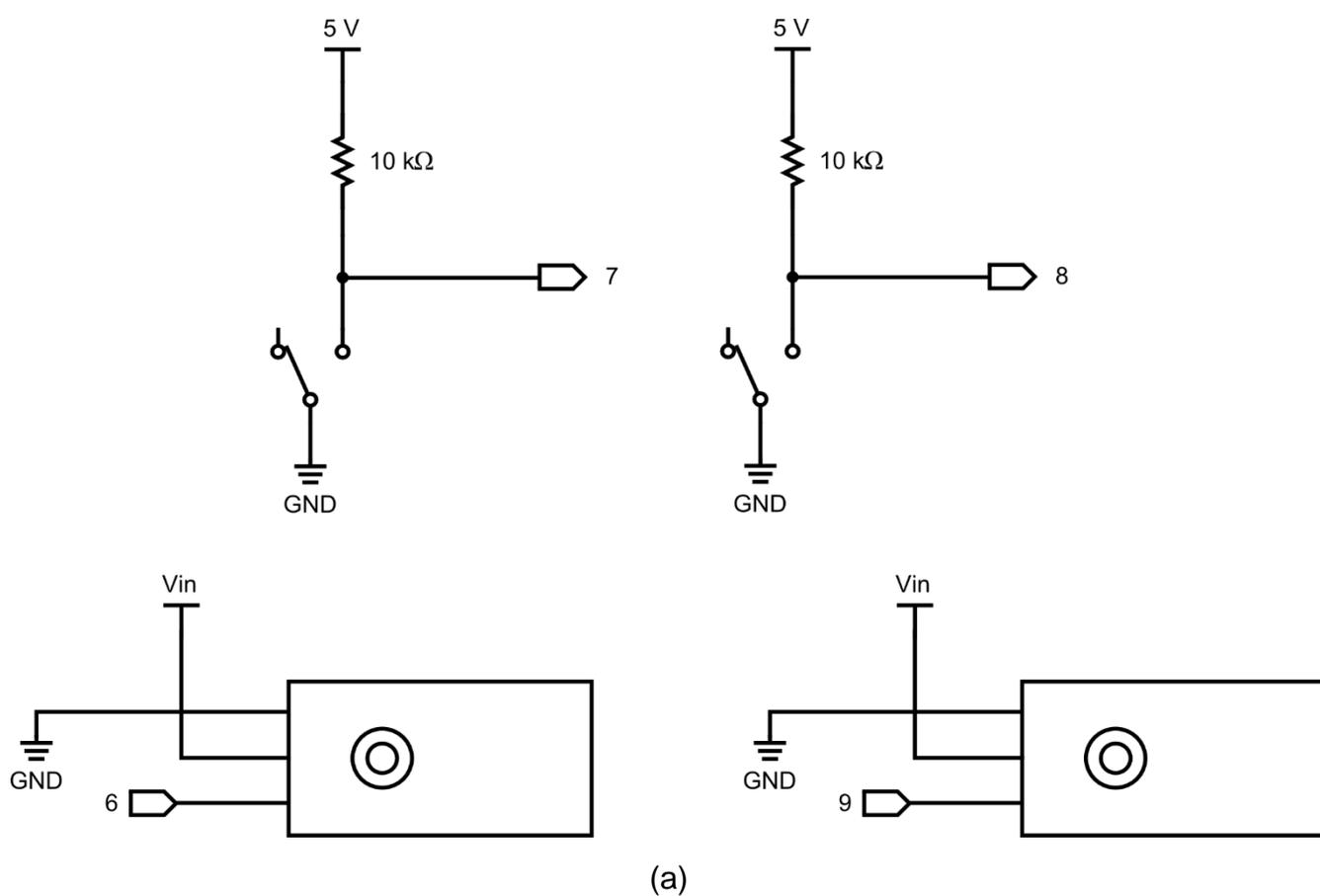
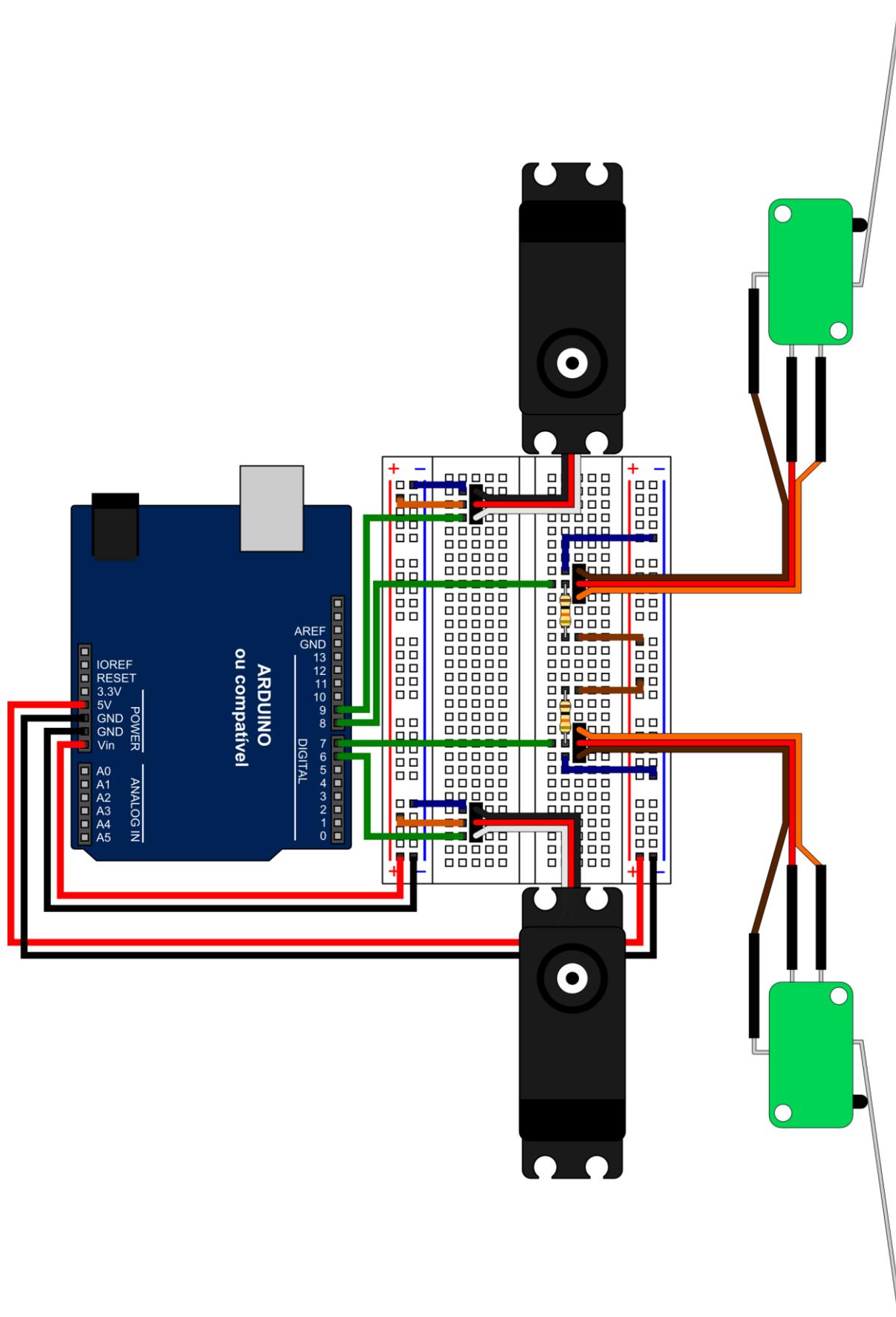


Figura 8.10 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 32.





(b)

Figura 9.1 - Prendendo os cabos extensores no suporte.

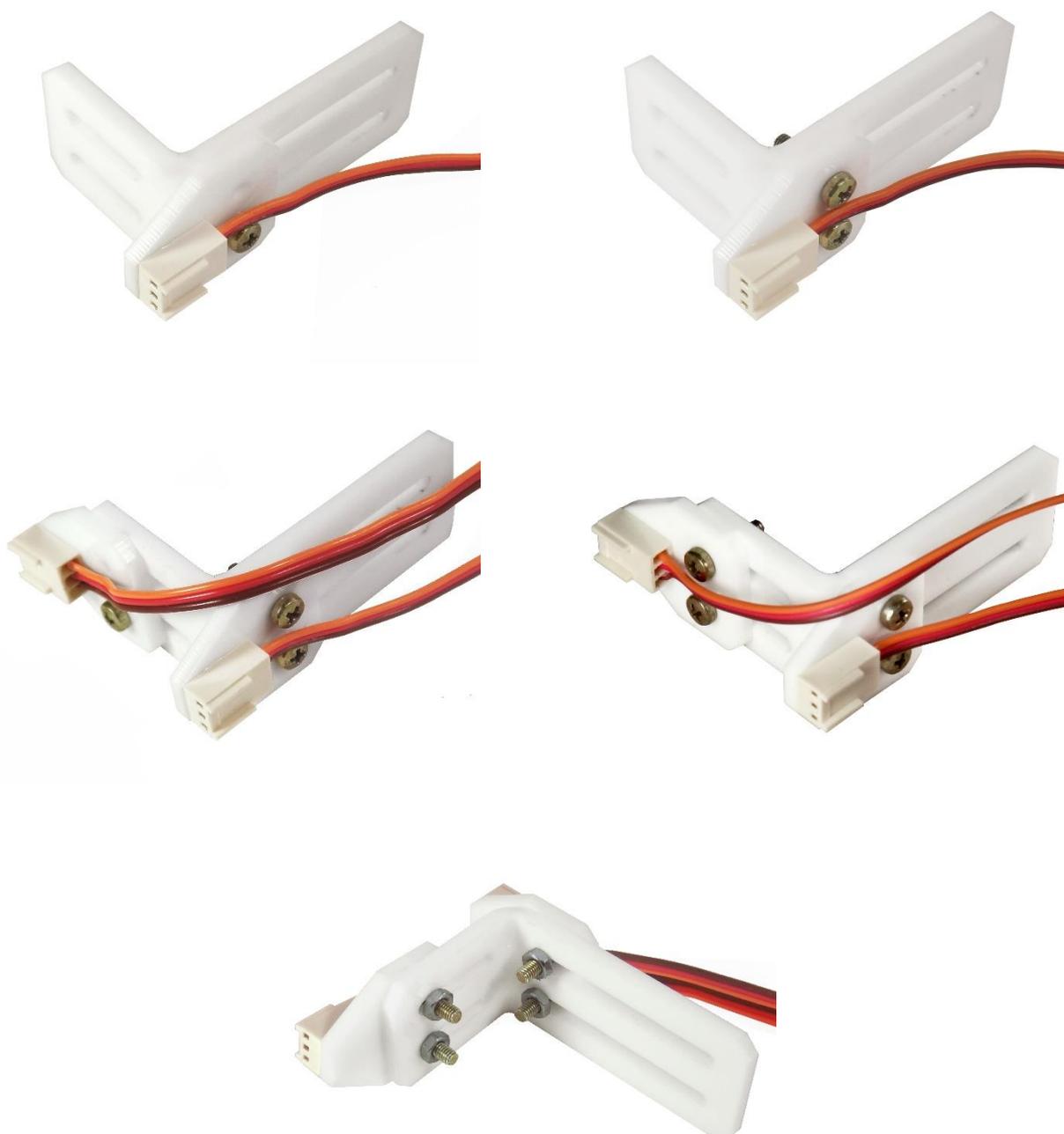


Figura 9.2 - Prendendo o suporte no chassi.

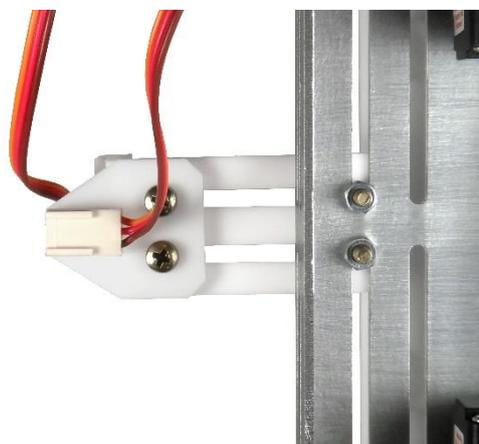
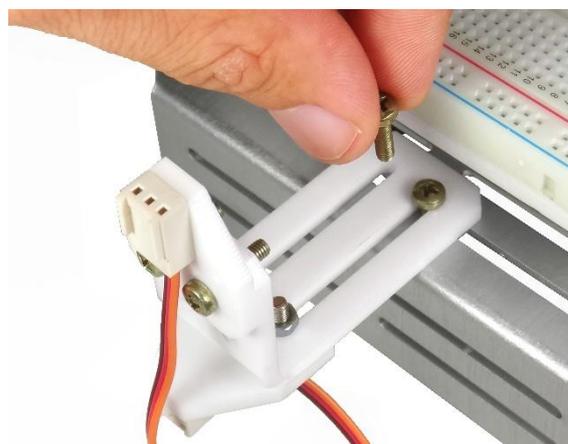


Figura 9.3 - Montando o LED infravermelho dentro do suporte para LED.



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.

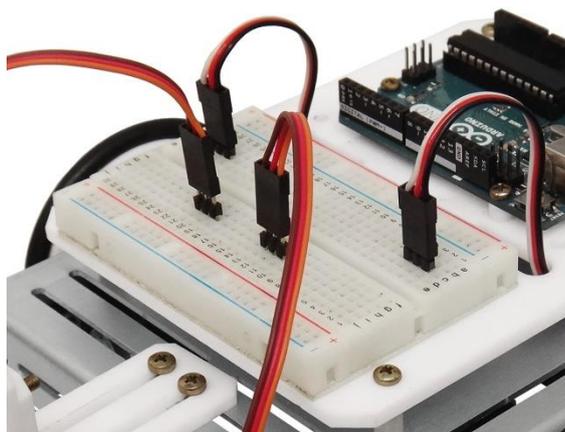


Figura 9.7 - Robô pronto para a realização da atividade.

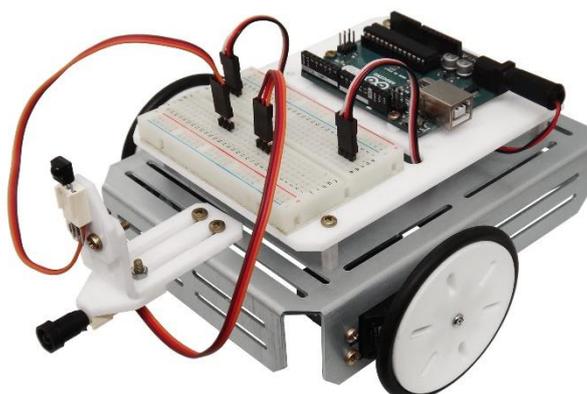
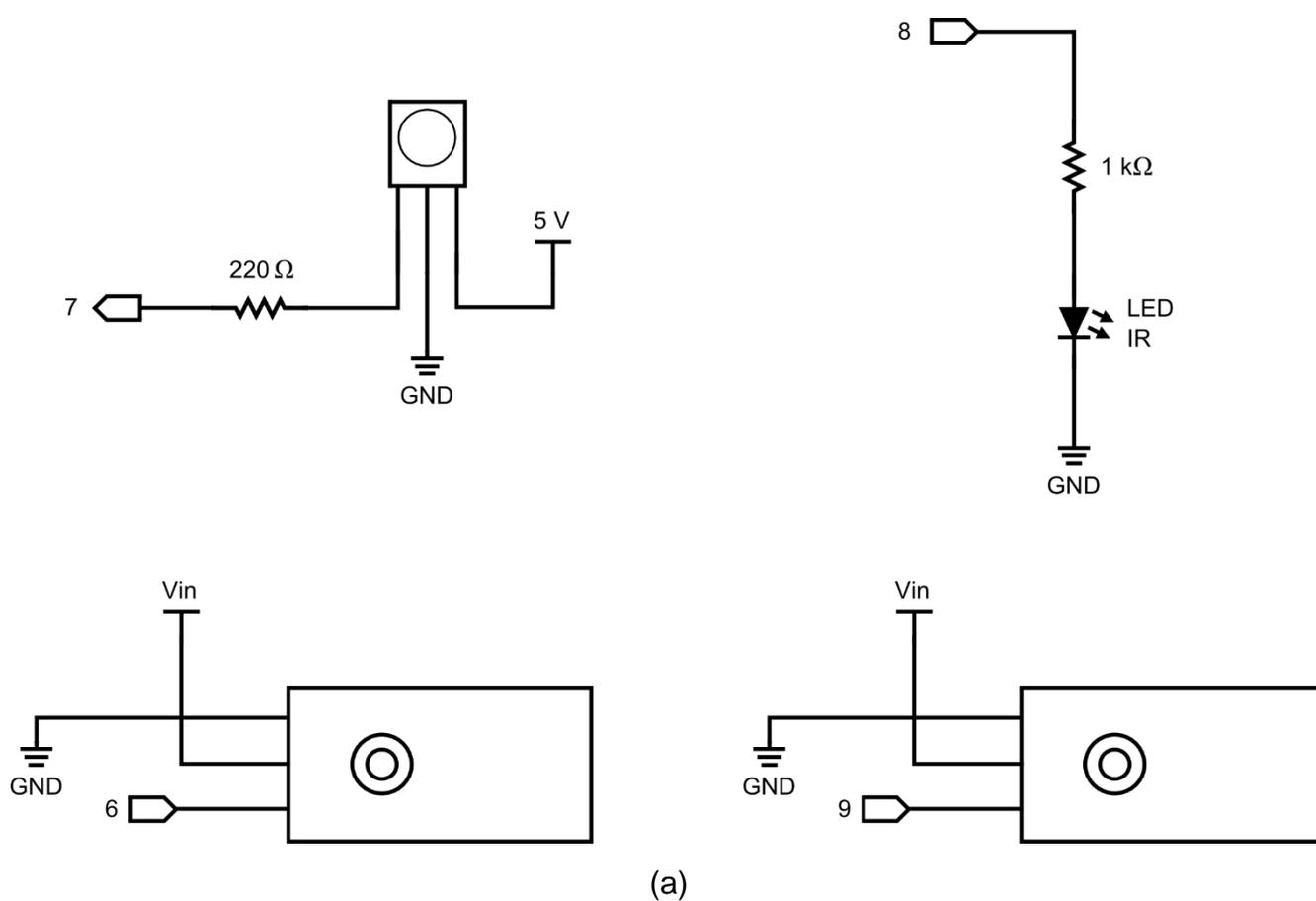
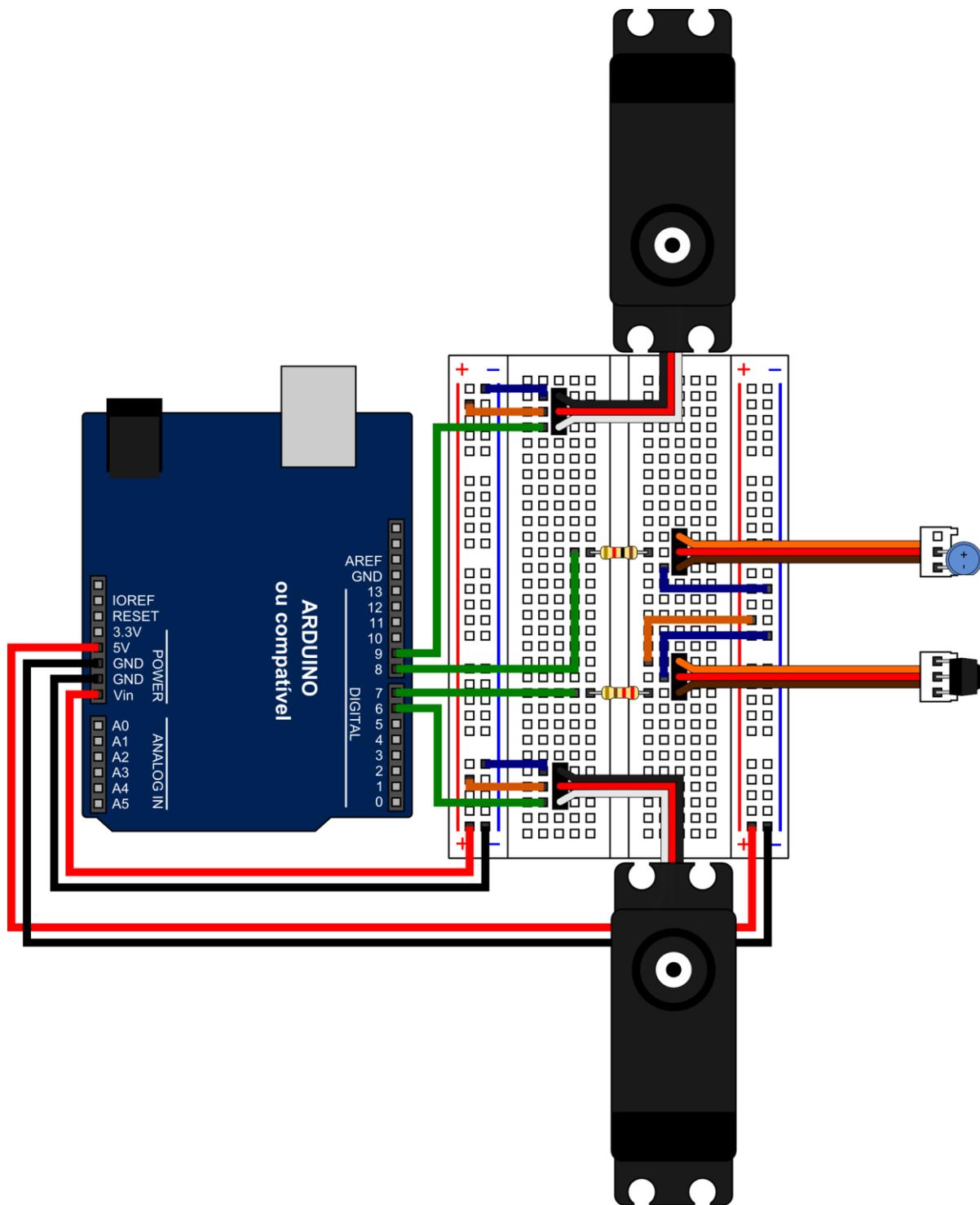


Figura 9.8 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 33.





(b)

Figura 9.9 - Prendendo os cabos extensores nos suportes.

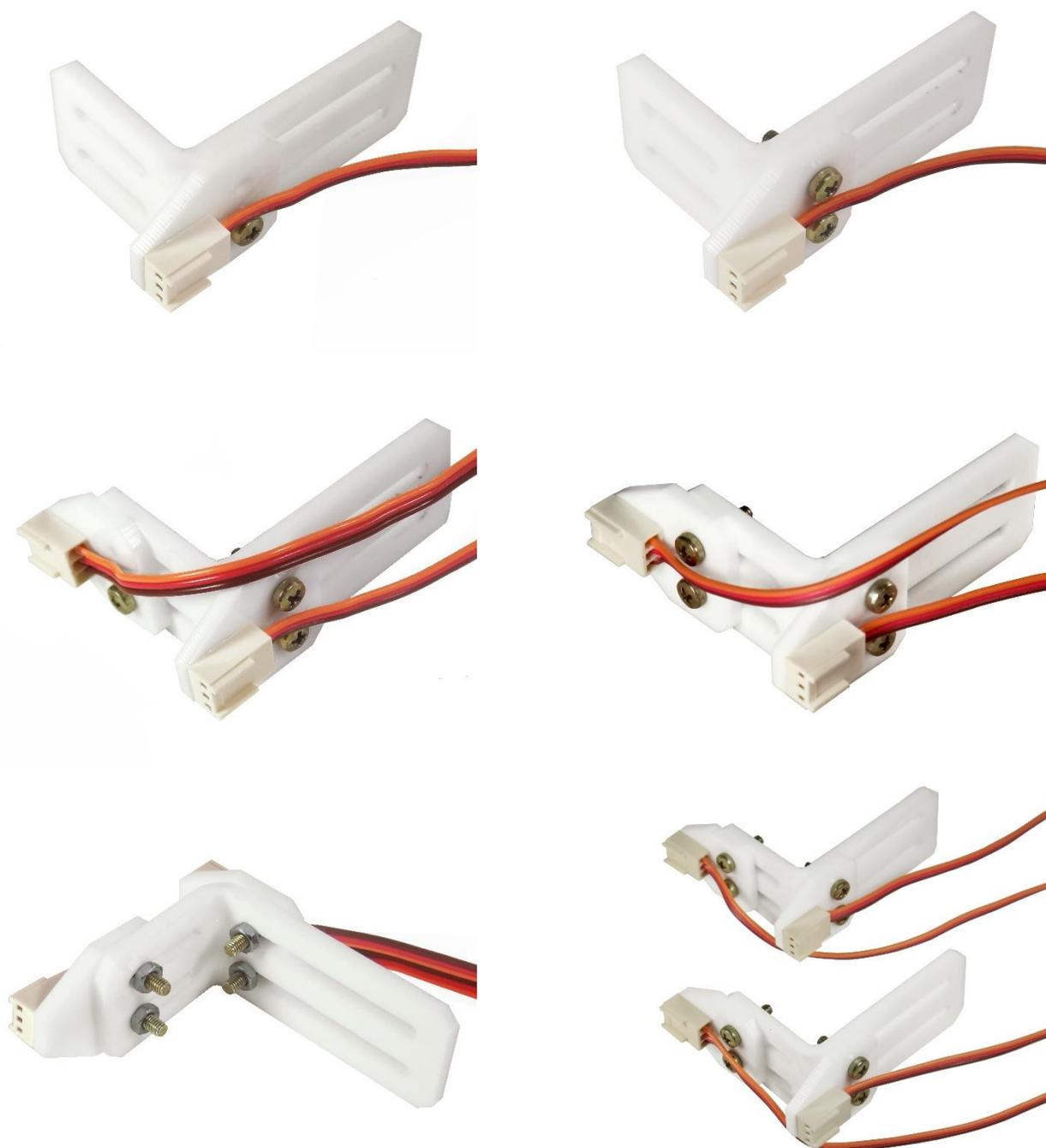


Figura 9.10 - Prendendo os suportes no chassi.

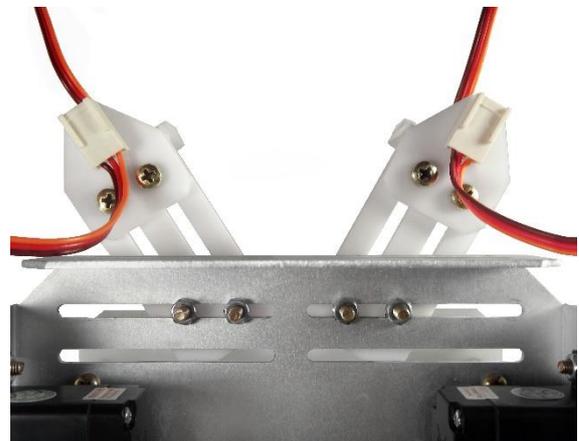
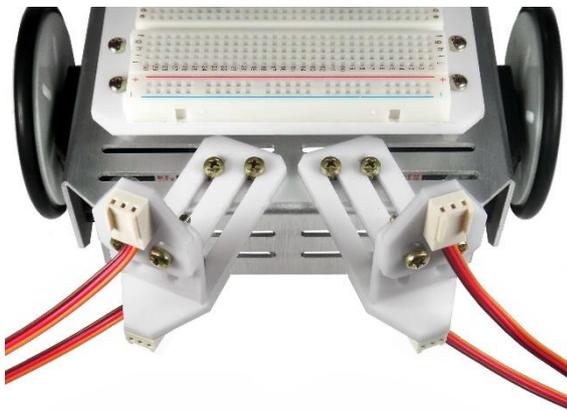


Figura 9.11 - Montando os LEDs infravermelhos dentro dos suportes para LED.



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.

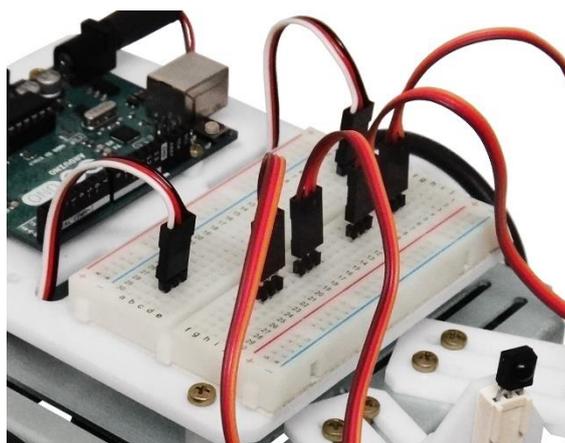


Figura 9.15 - Robô pronto para a realização da atividade.

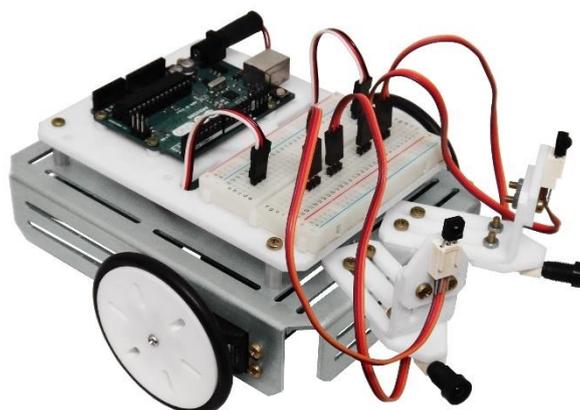
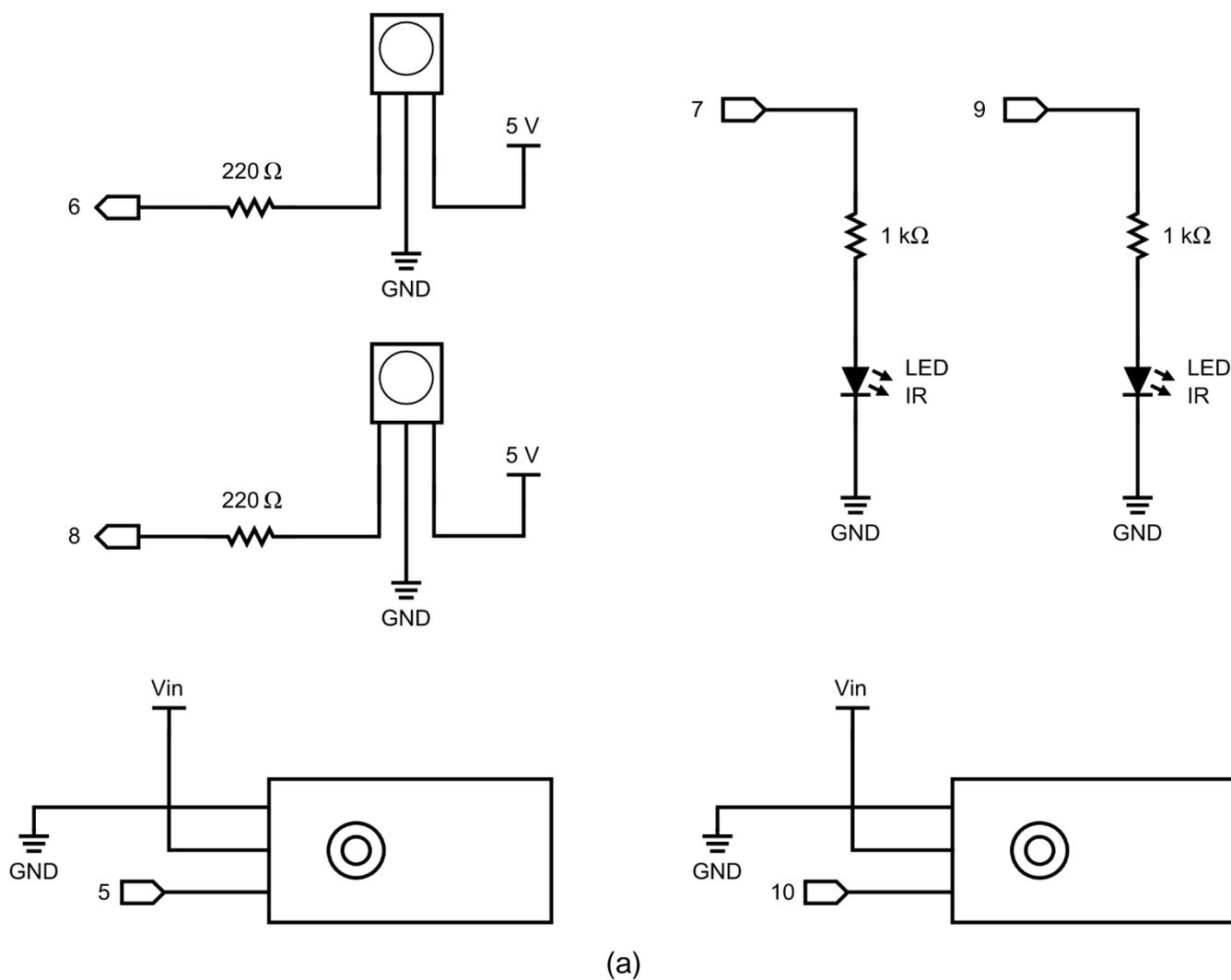
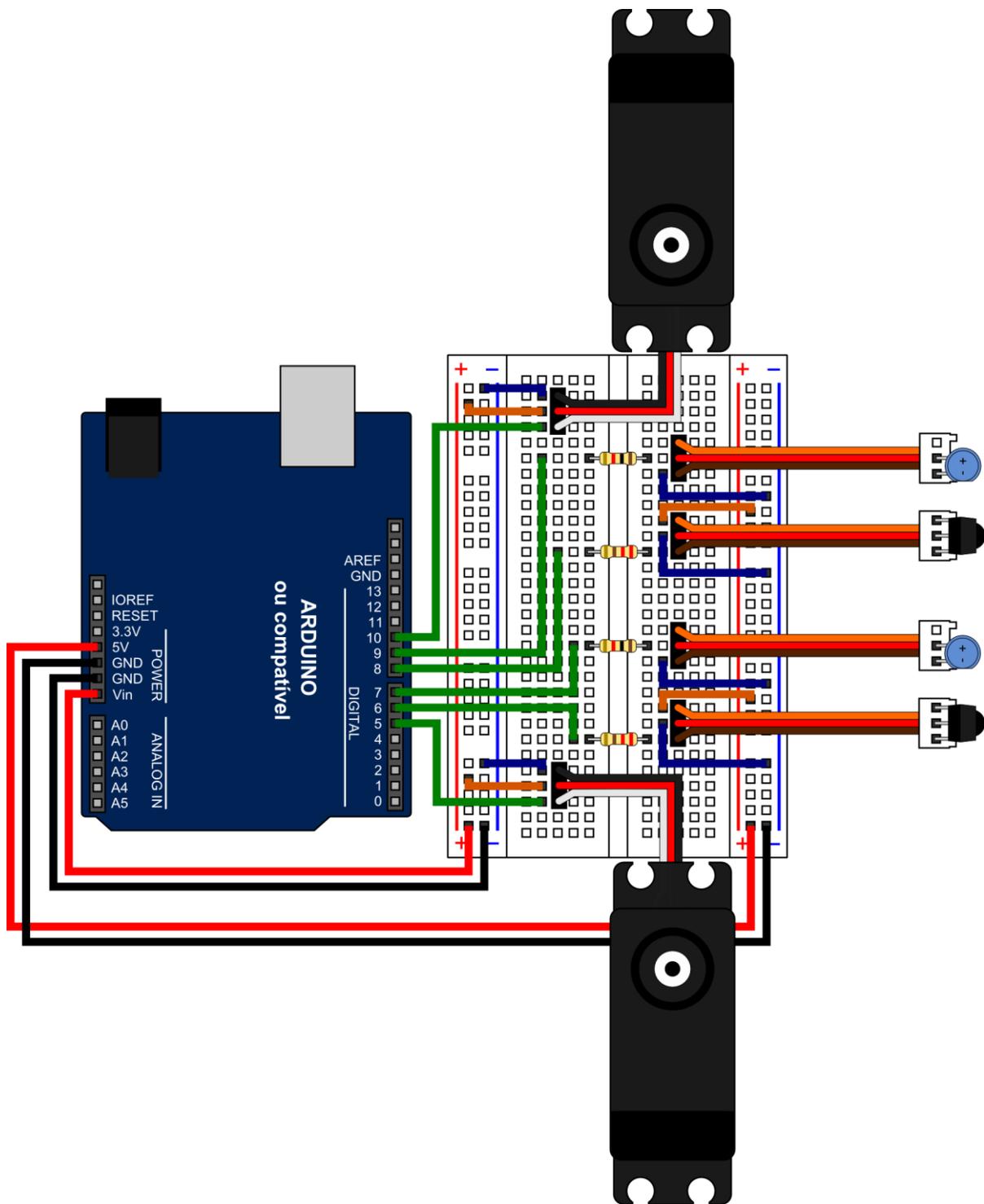


Figura 9.16 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 34.





(b)

Figura 10.1 - Suportes do sensor de ultrassom.



Figura 10.2 - Ligação dos fios no sensor de ultrassom.

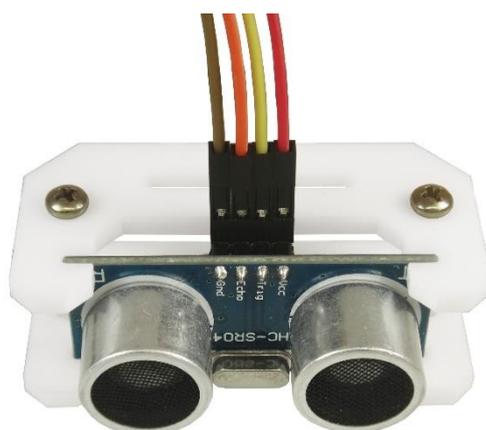


Figura 10.3 - Prendendo os espaçadores no suporte.



Figura 10.4 - Prendendo o suporte no chassi.

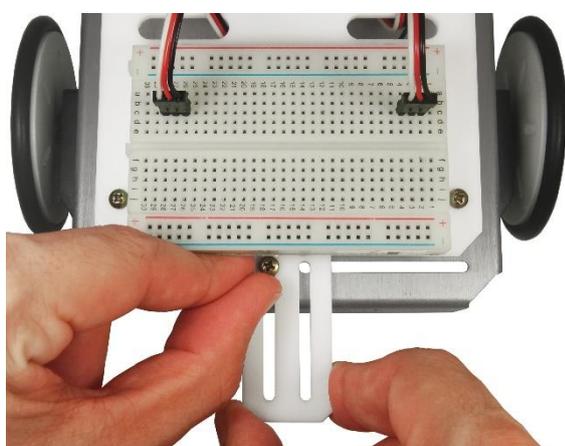


Figura 10.5 - Prendendo o suporte do sensor de ultrassom no suporte curto.

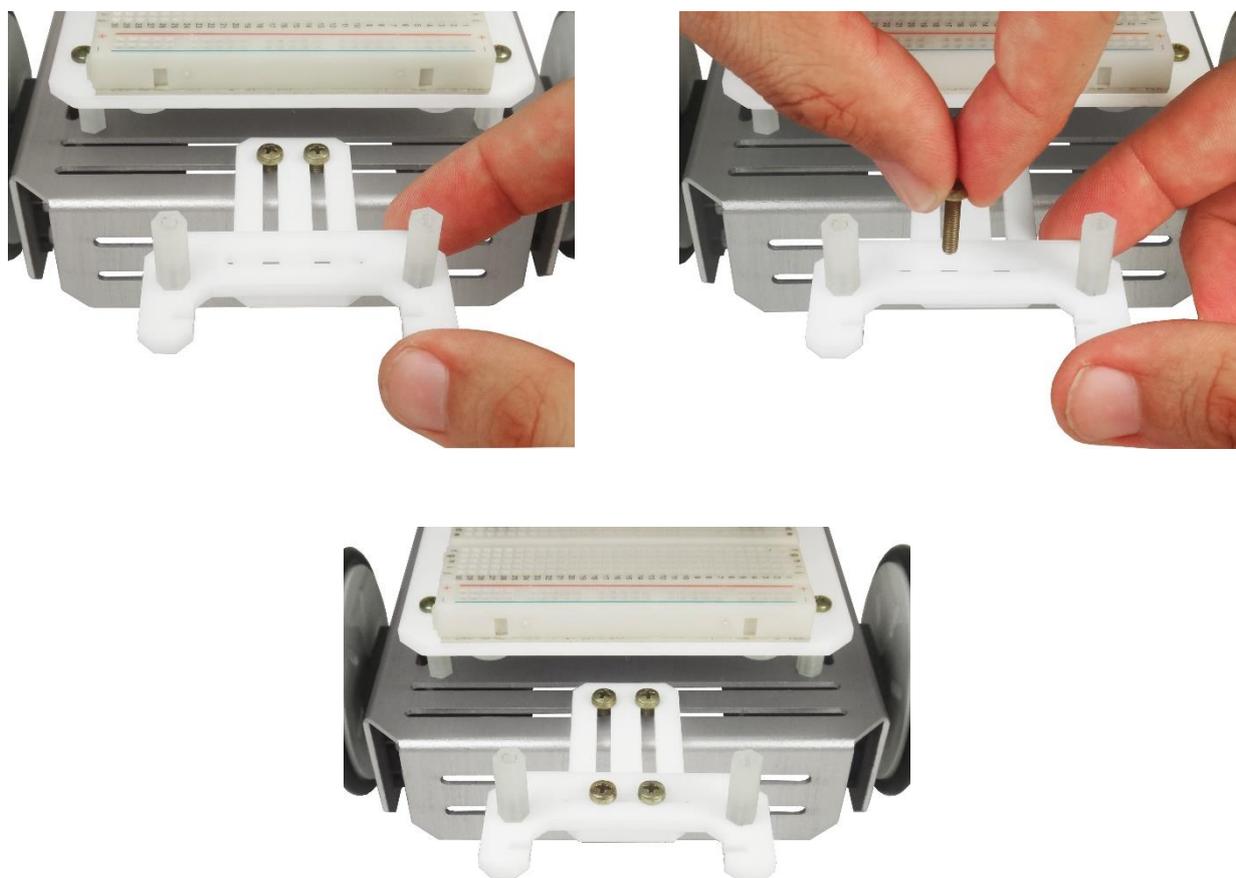


Figura 10.6 - Encaixando o sensor de ultrassom no suporte.



Figura 10.7 - Prendendo o suporte nos espaçadores.

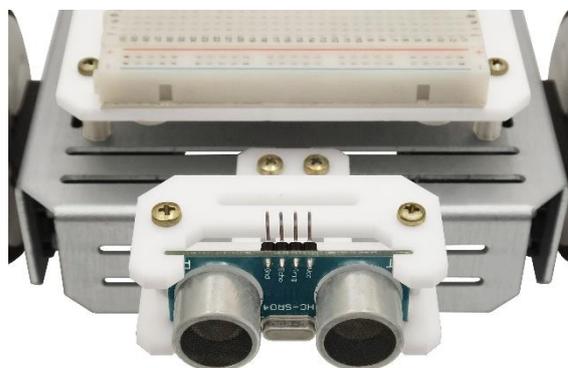
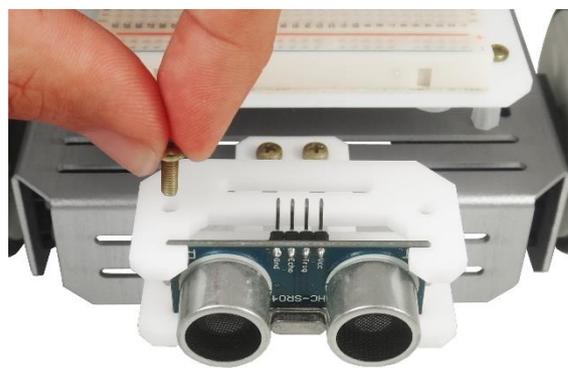


Figura 10.8 - Robô pronto para a realização da atividade.

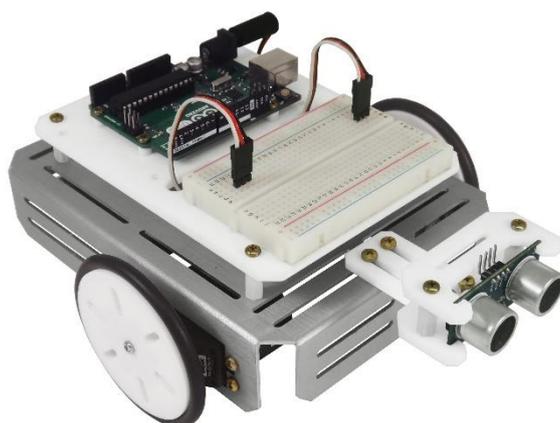


Figura 10.9 - Conectando os fios no sensor de ultrassom.

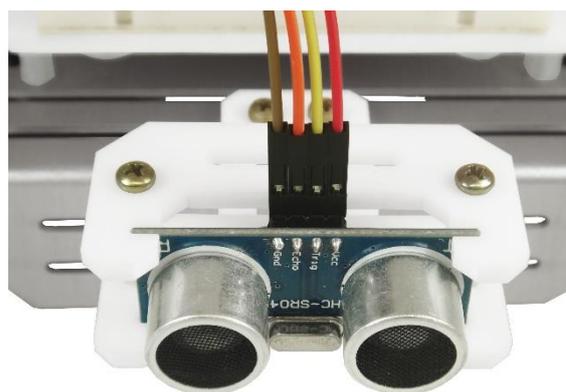
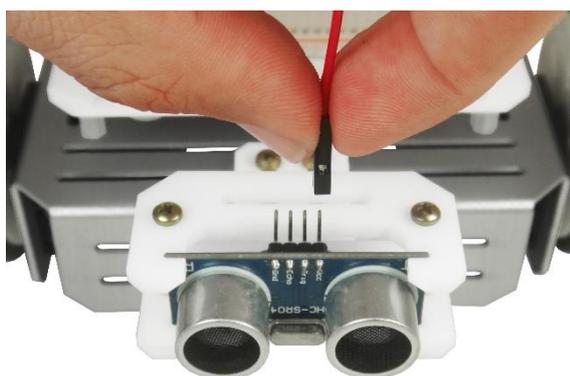
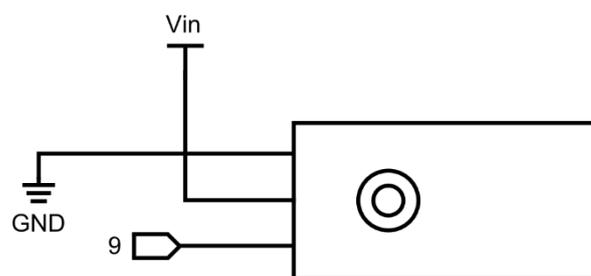
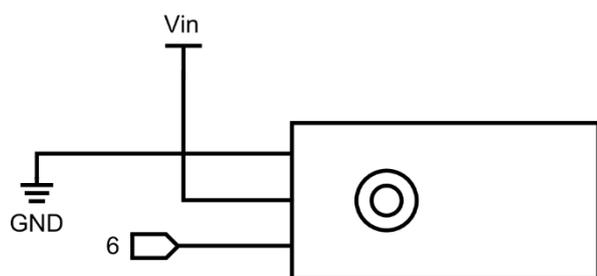
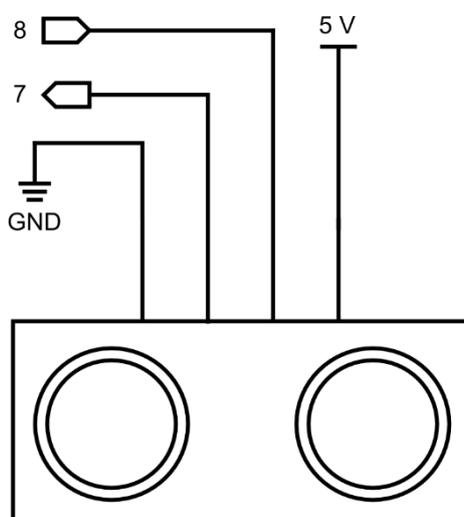
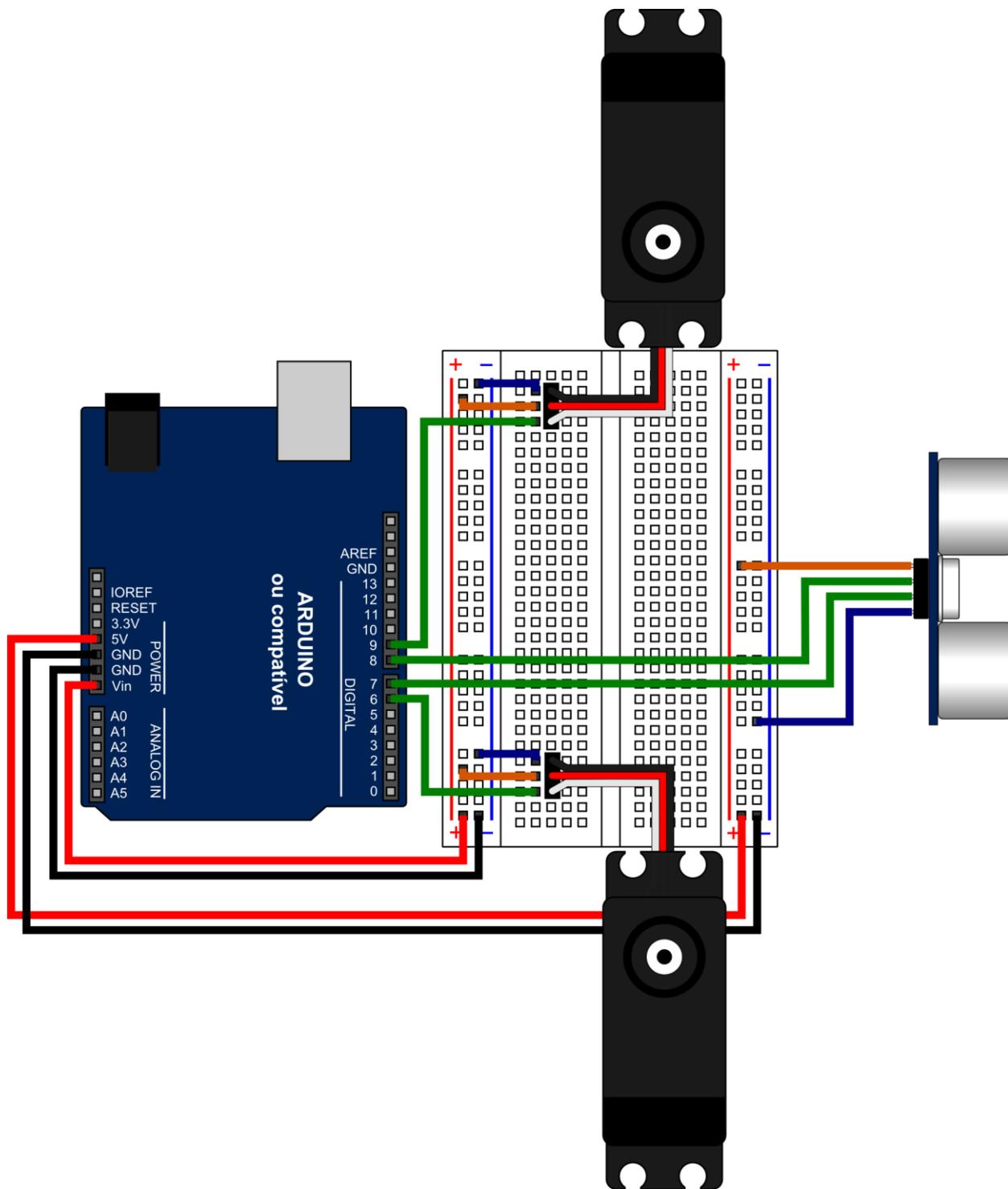


Figura 10.10 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 35.



(a)



(b)

Figura 10.11 - Prendendo os espaçadores no suporte.



Figura 10.12 - Prendendo o suporte no chassi.

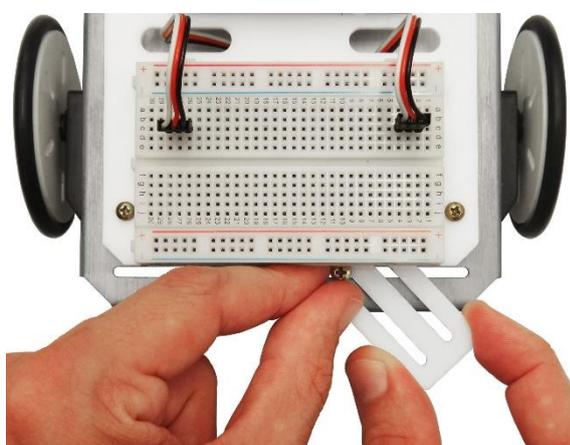


Figura 10.13 - Prendendo o suporte do sensor de ultrassom no suporte curto.

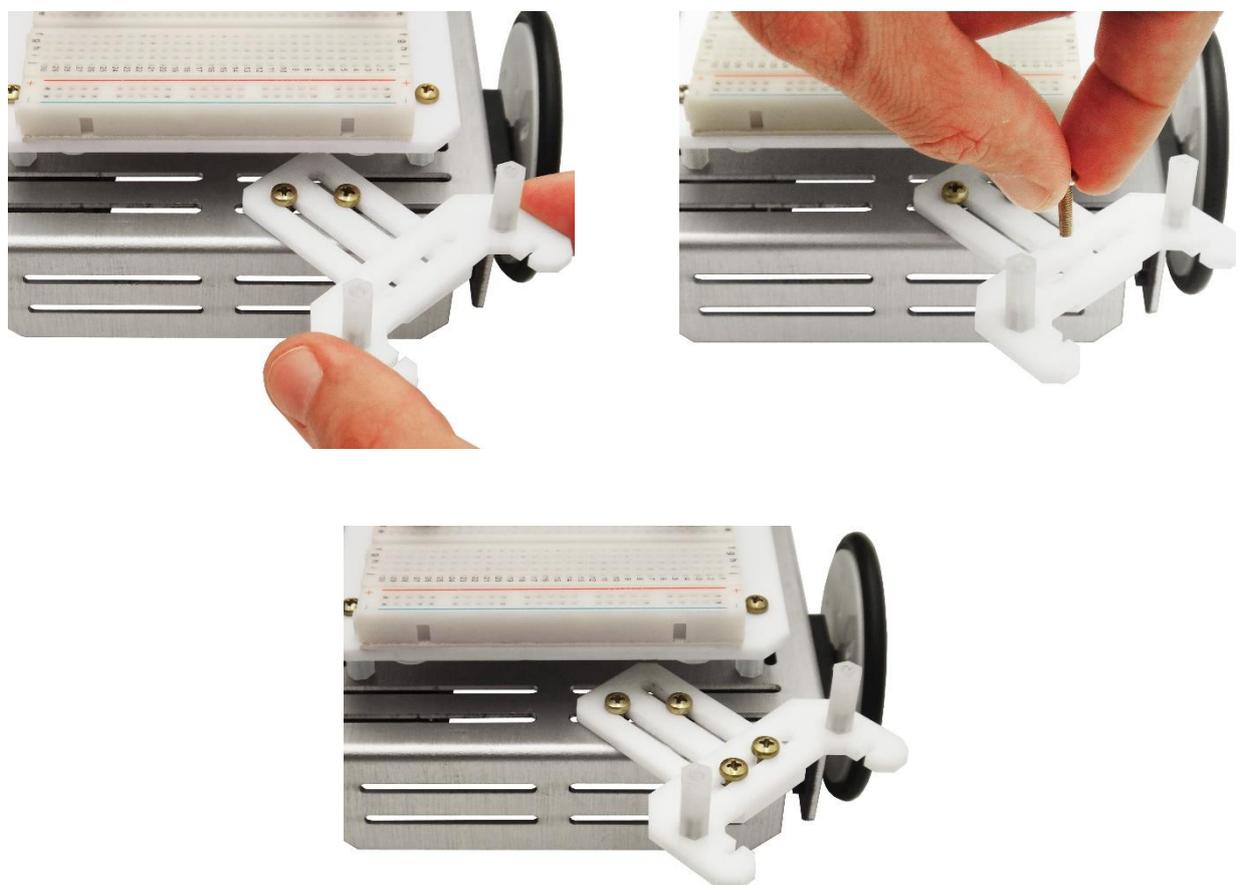


Figura 10.14 - Encaixando o sensor de ultrassom no suporte.



Figura 10.15 - Prendendo o suporte nos espaçadores.

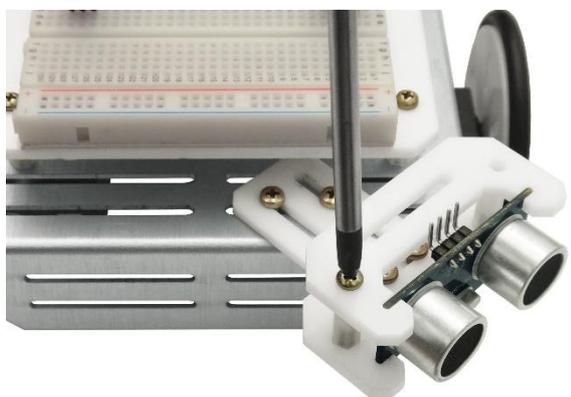


Figura 10.16 - Robô pronto para a realização da atividade.

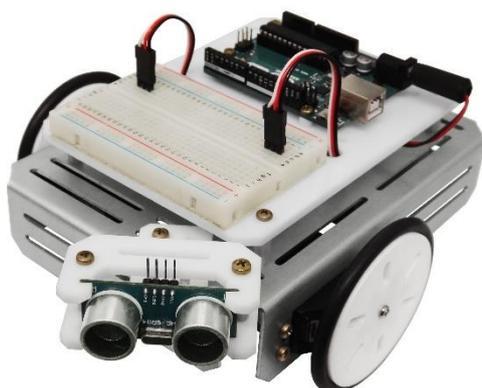
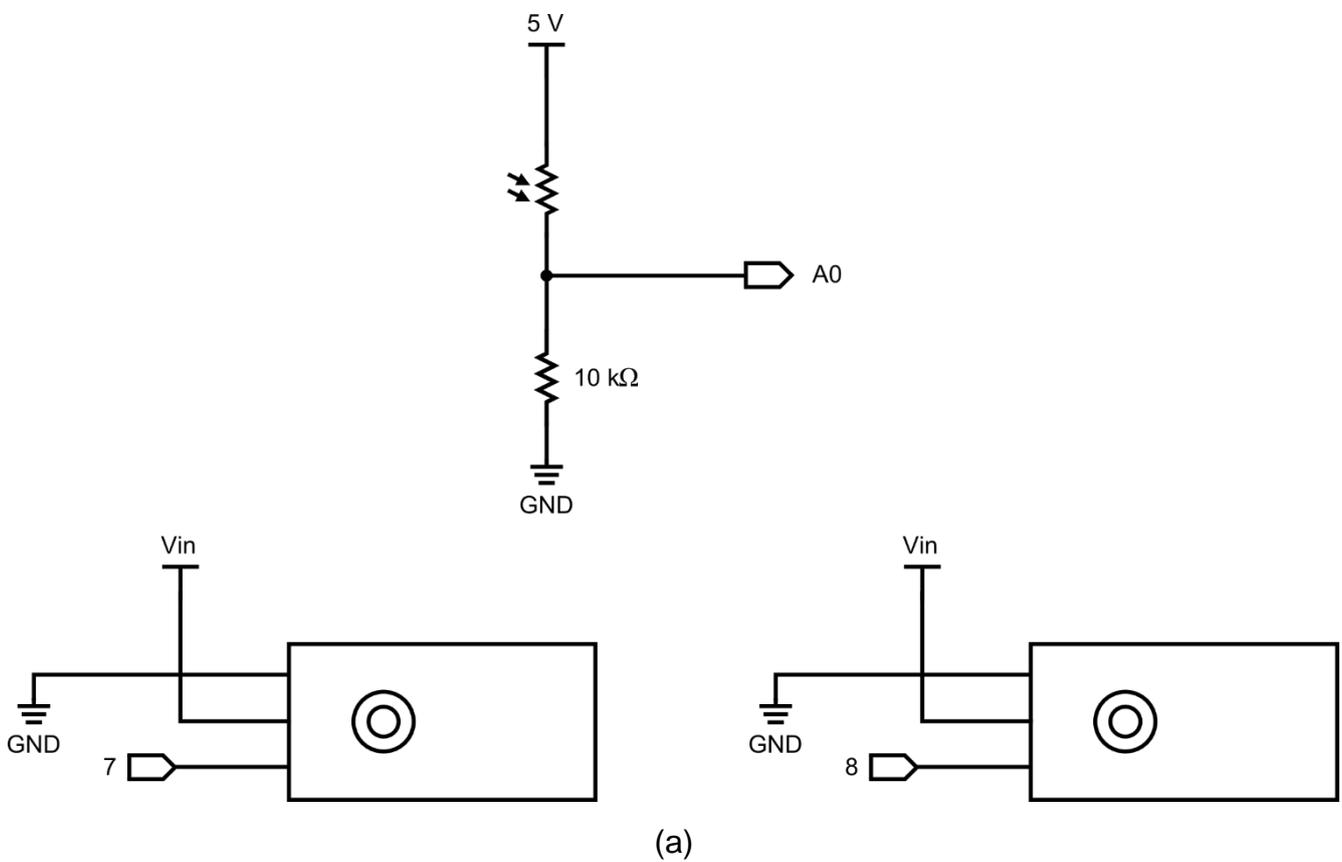
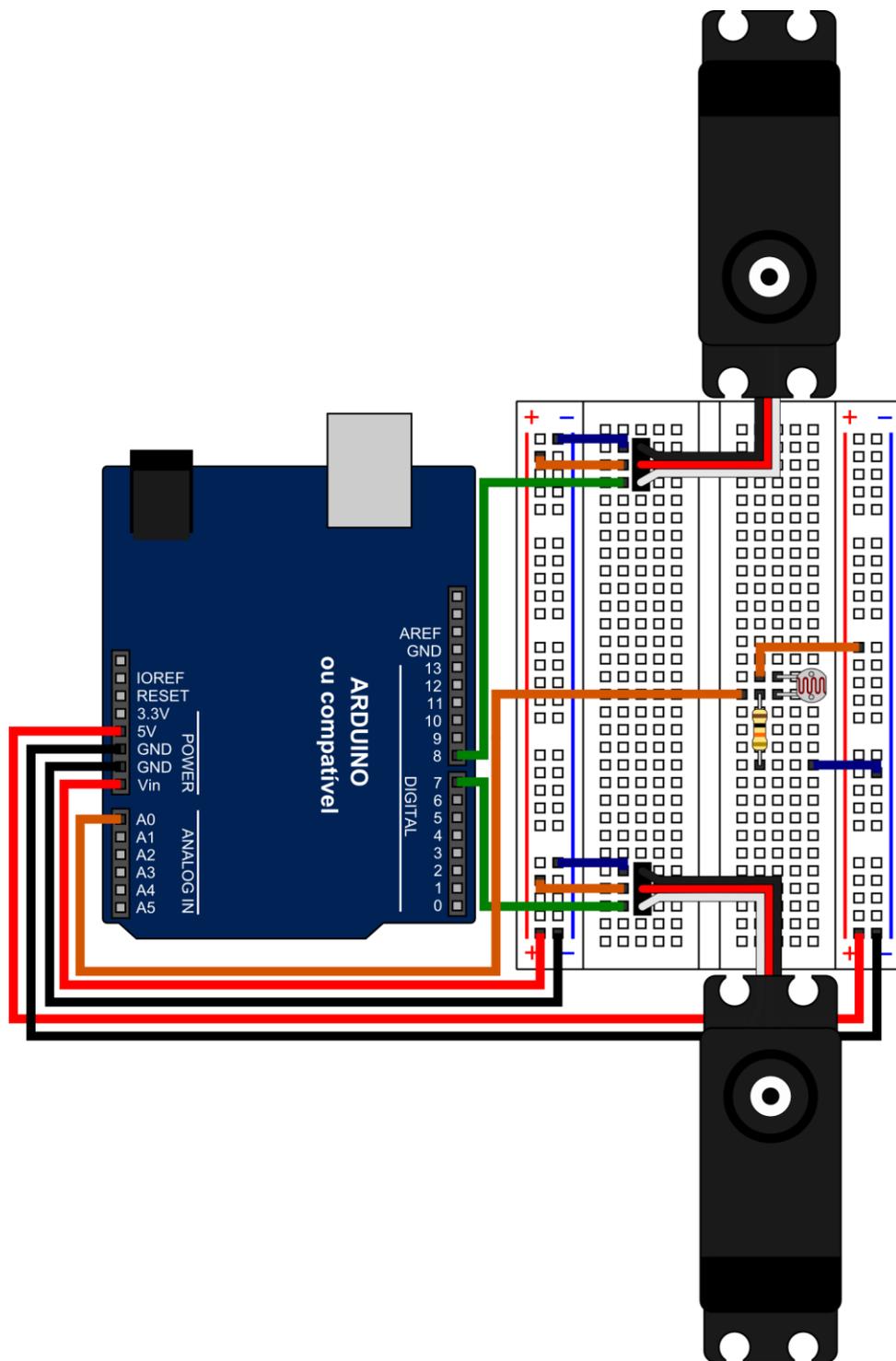


Figura 11.1 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 38.





(b)

Figura 11.2 - Prendendo os cabos extensores nos suportes.

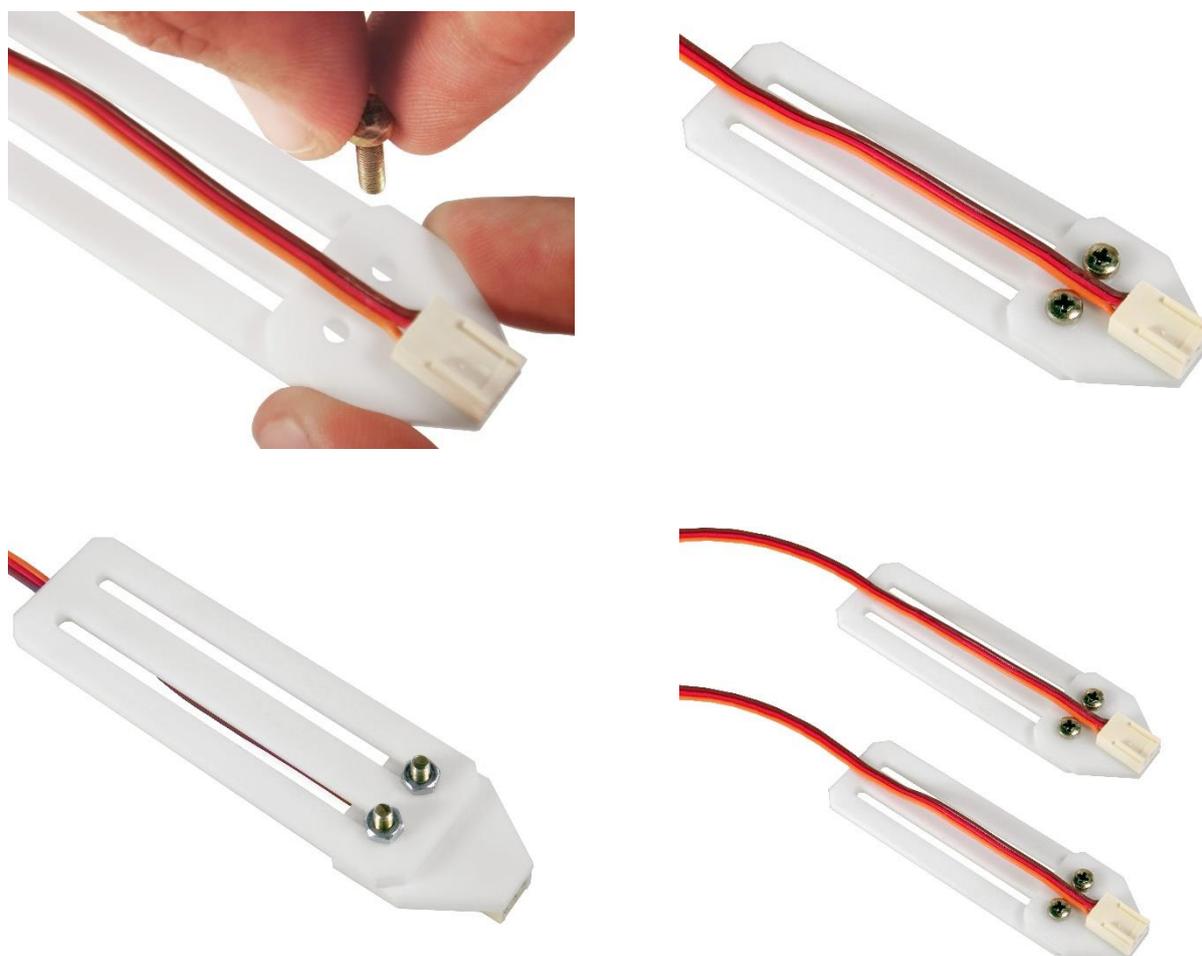


Figura 11.3 - Prendendo os suportes no chassi.

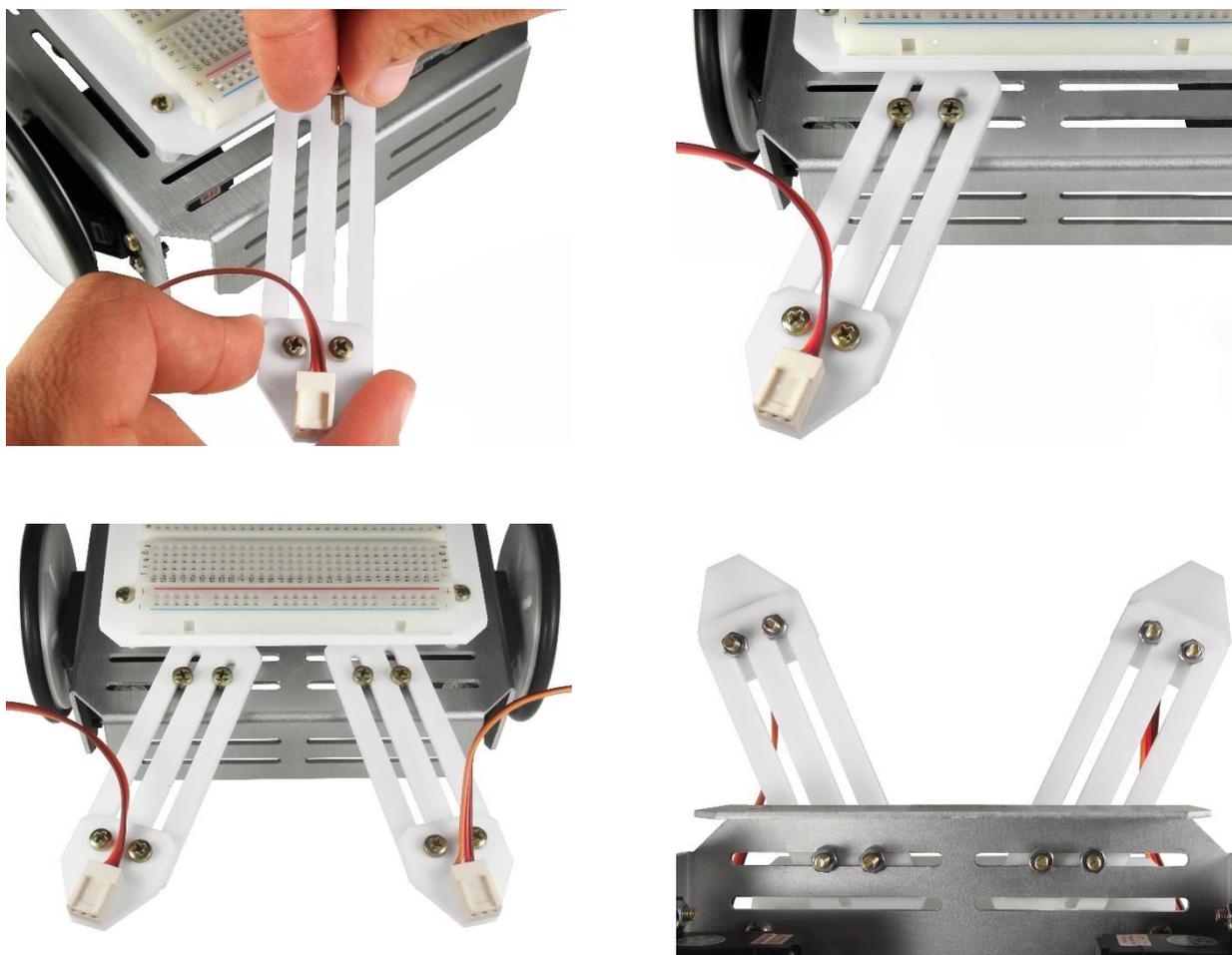


Figura 11.4 - Conectando os fotoresistores nos cabo extensores.

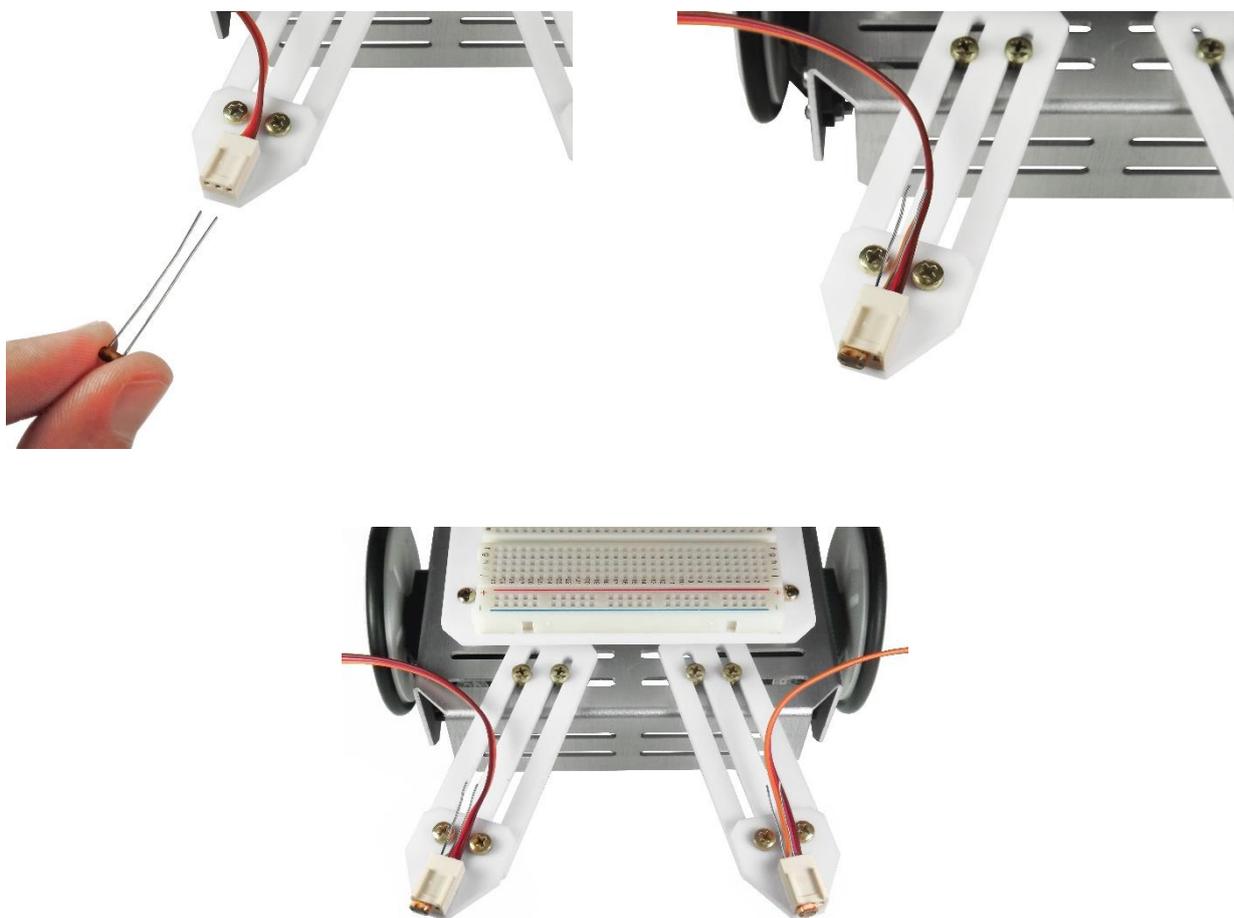


Figura 11.5 - Ligando os cabos extensores na protoboard.

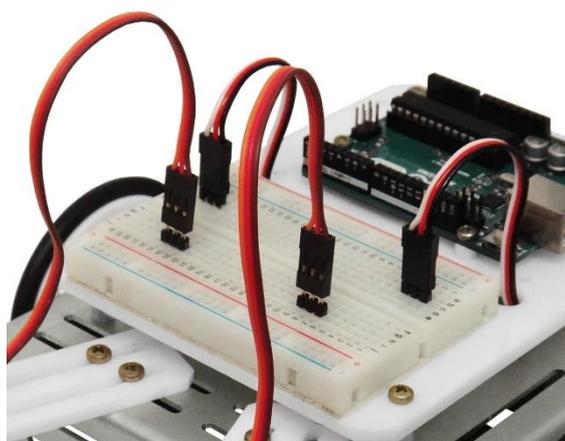


Figura 11.6 - Robô pronto para a realização da atividade.

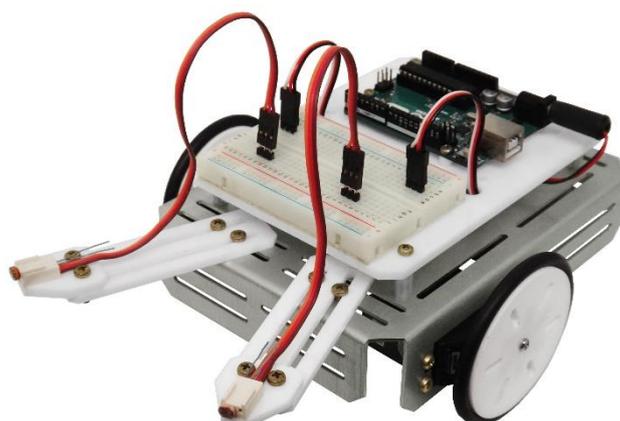
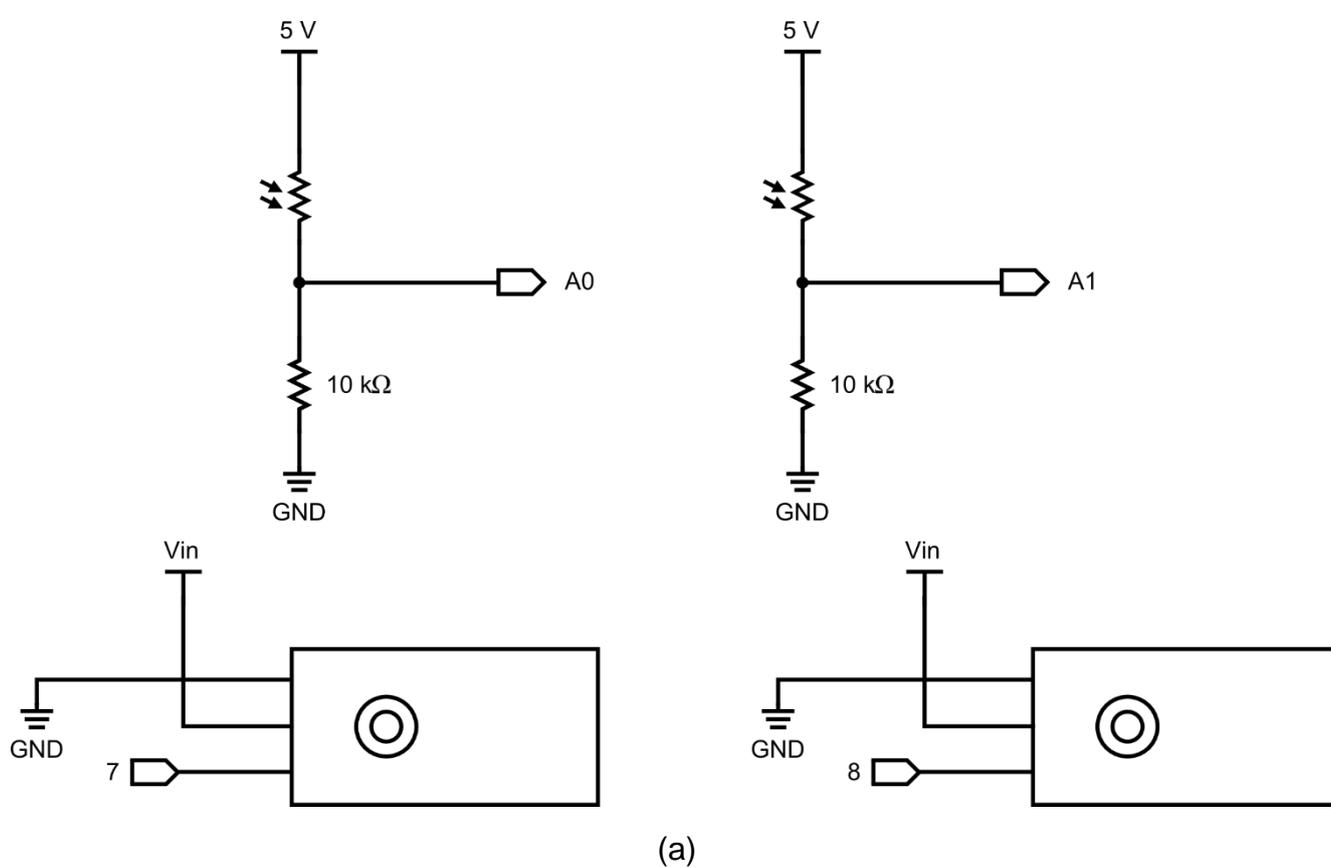
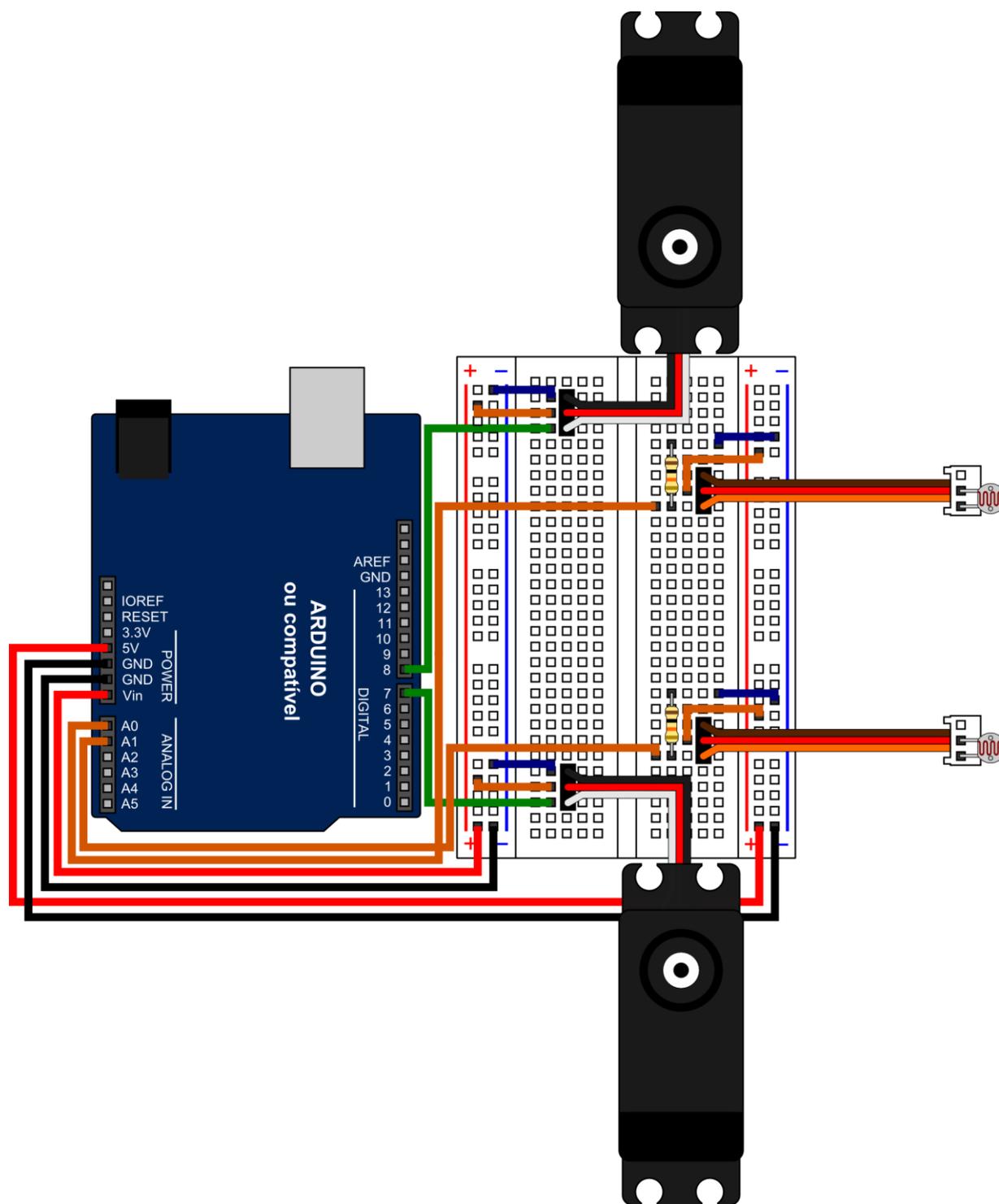


Figura 11.7 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 39.





(b)

Figura 12.1 - Exemplo de traçado feito com fita preta.



Figura 12.2 - Prendendo os cabos extensores no chassi.

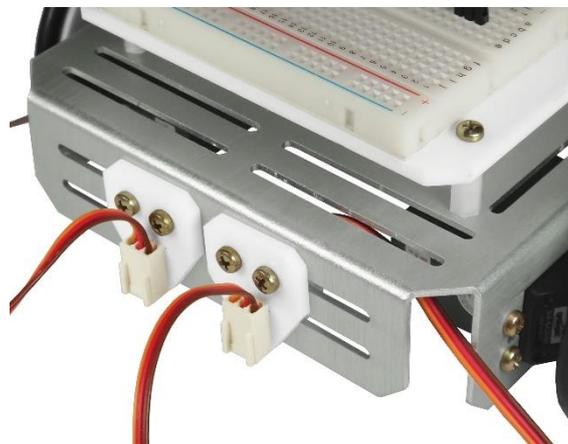
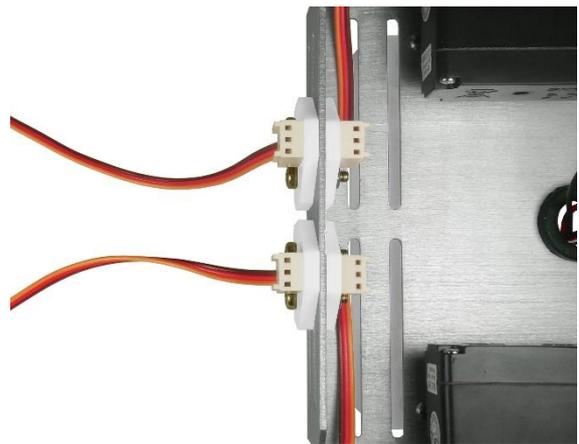
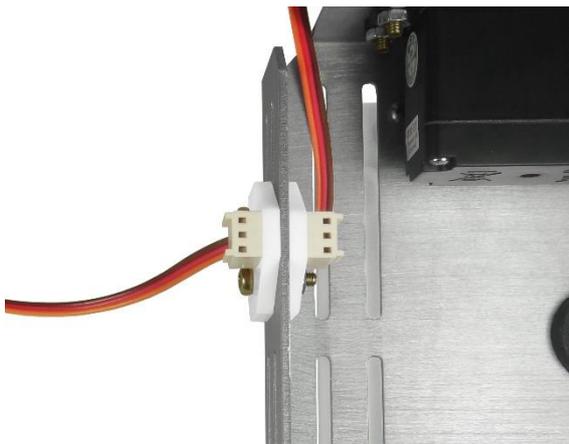
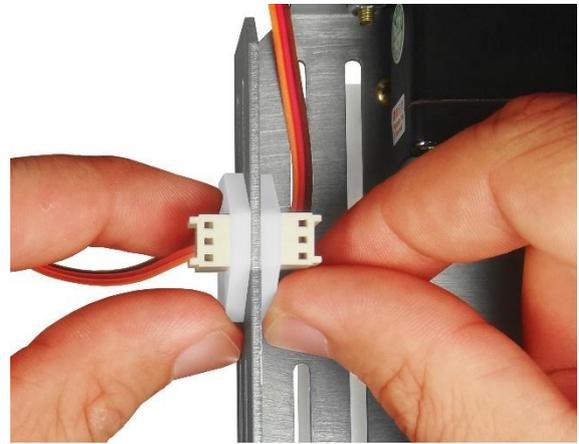
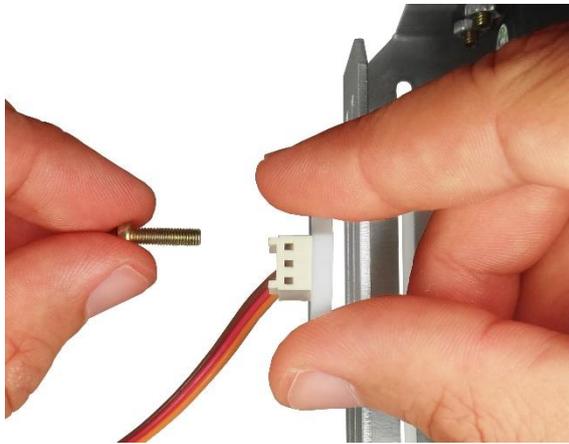


Figura 12.3 - Conectando os LEDs brancos nos cabos extensores.

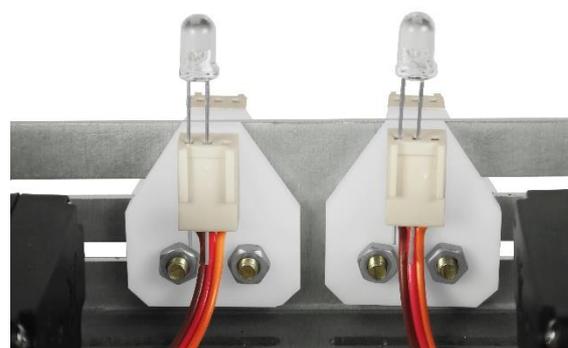
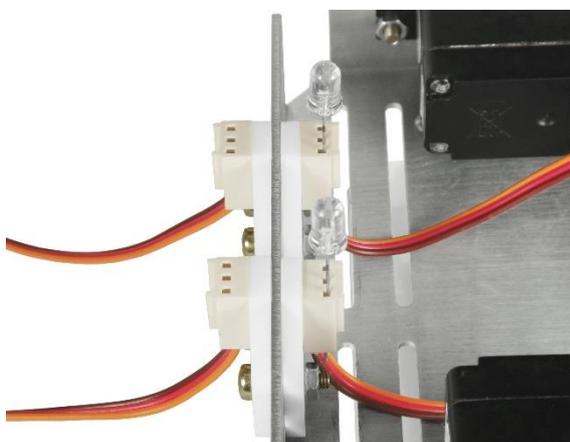
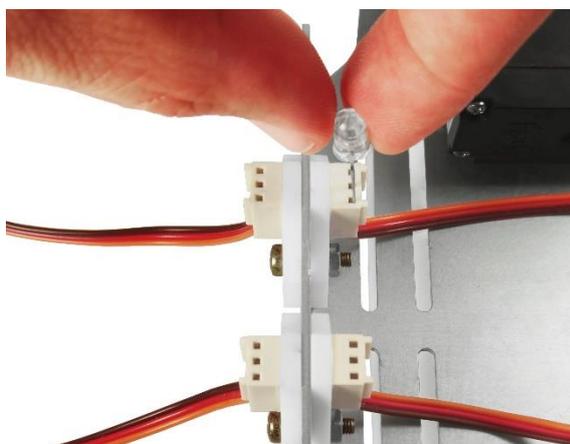


Figura 12.4 - Montando os fotoresistores dentro dos suportes para LED.

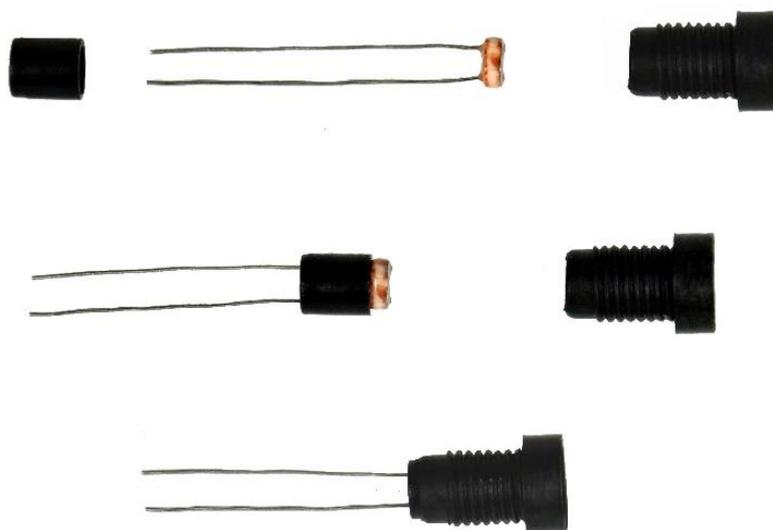


Figura 12.5 - Conectando os fotoresistores nos cabos extensores.

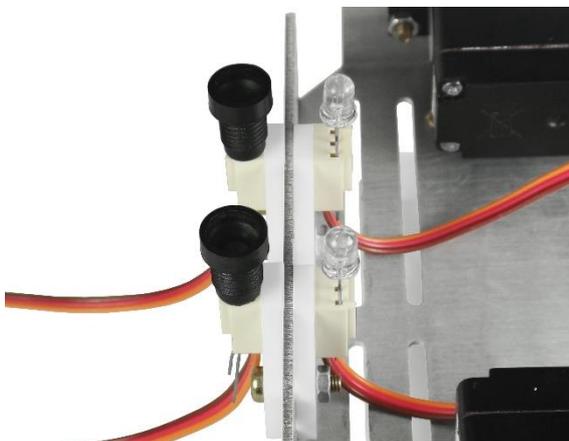
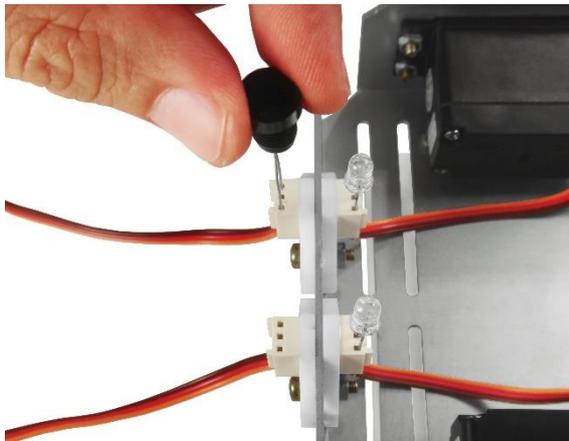


Figura 12.6 - Ligando os cabos extensores na protoboard.



Figura 12.7 - Robô pronto para a realização da atividade.

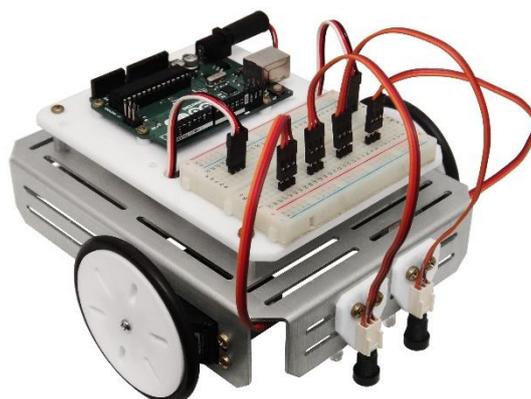
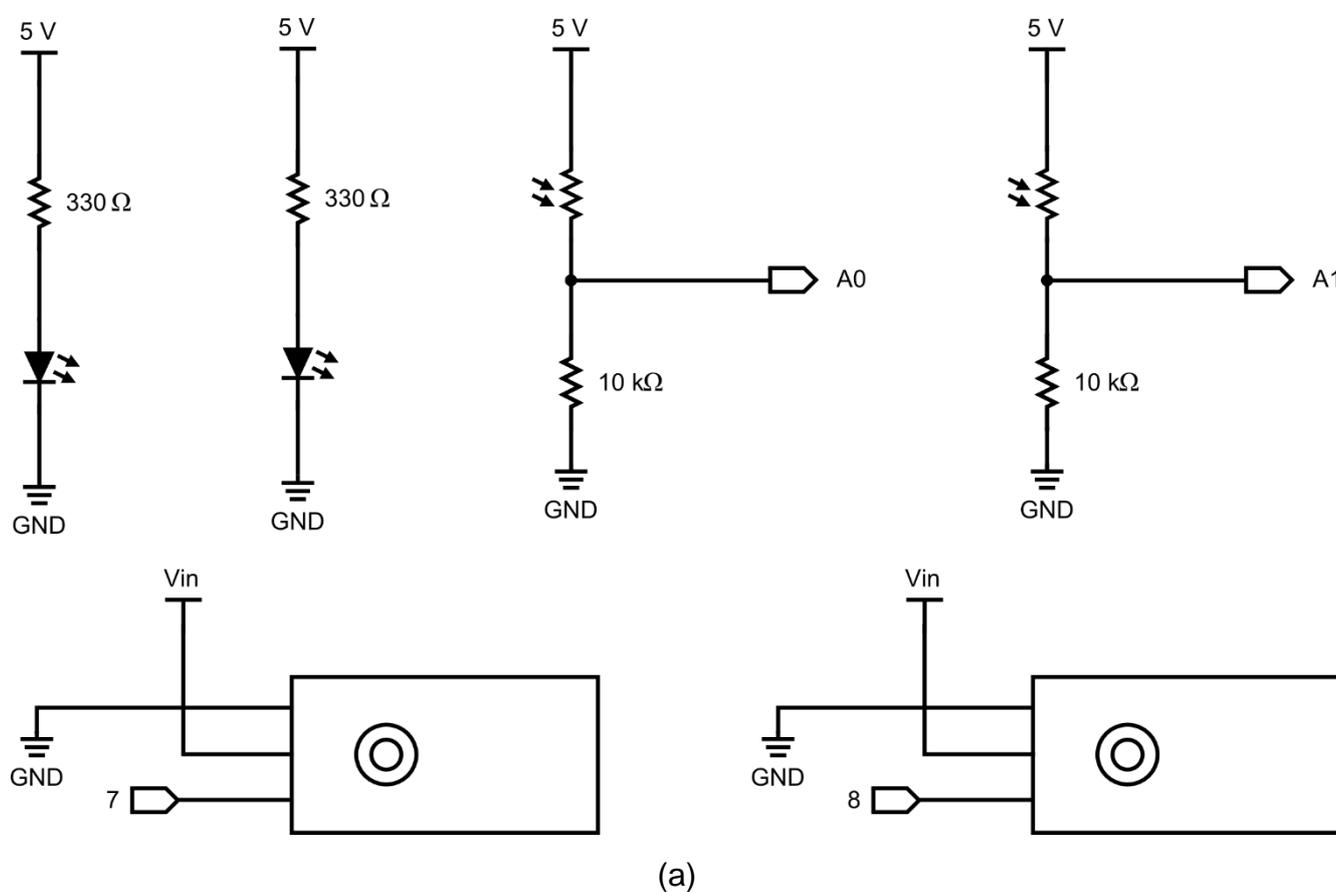
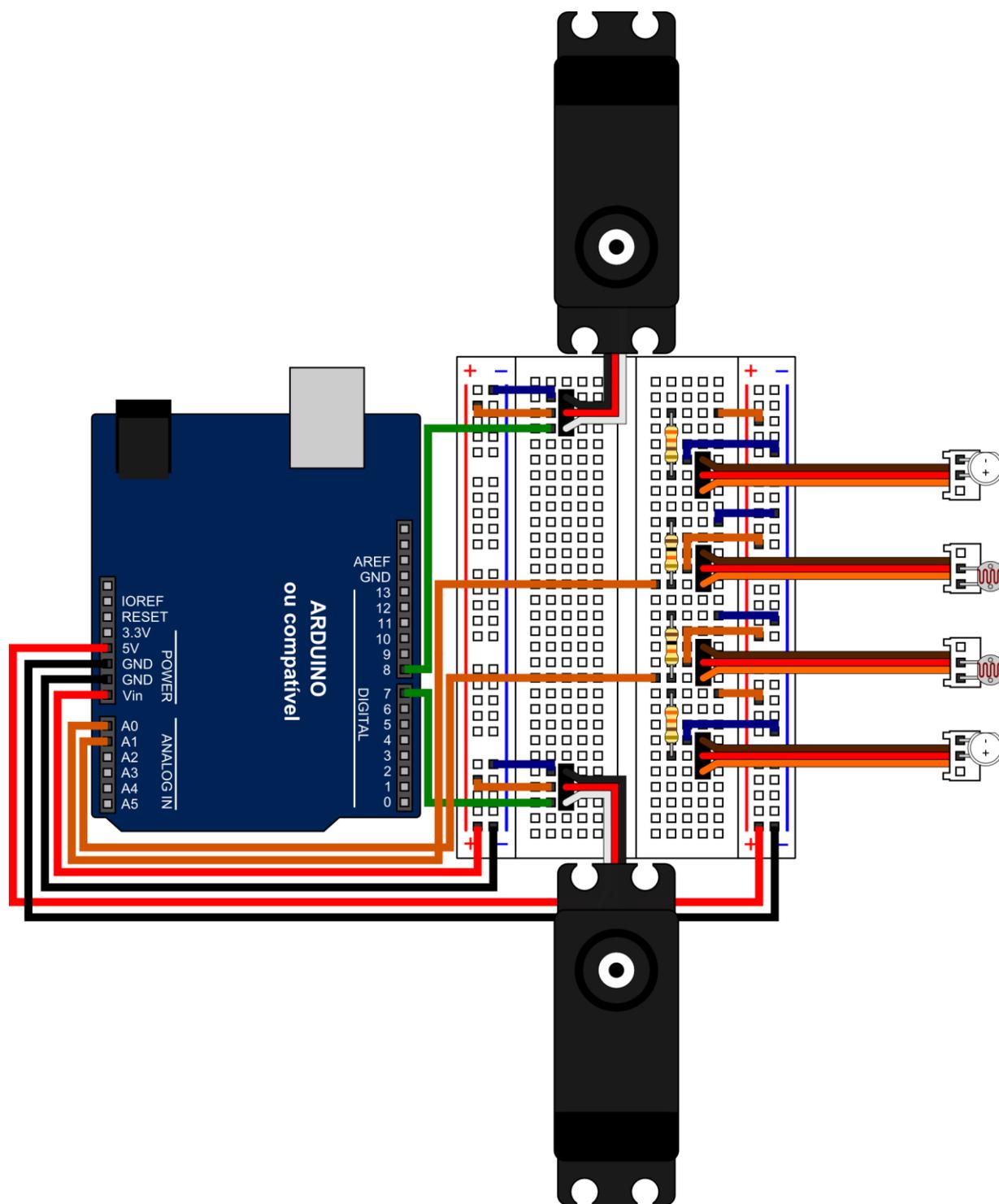


Figura 12.8 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 40.





(b)

Figura 12.9 - Prendendo os cabos extensores no chassi.

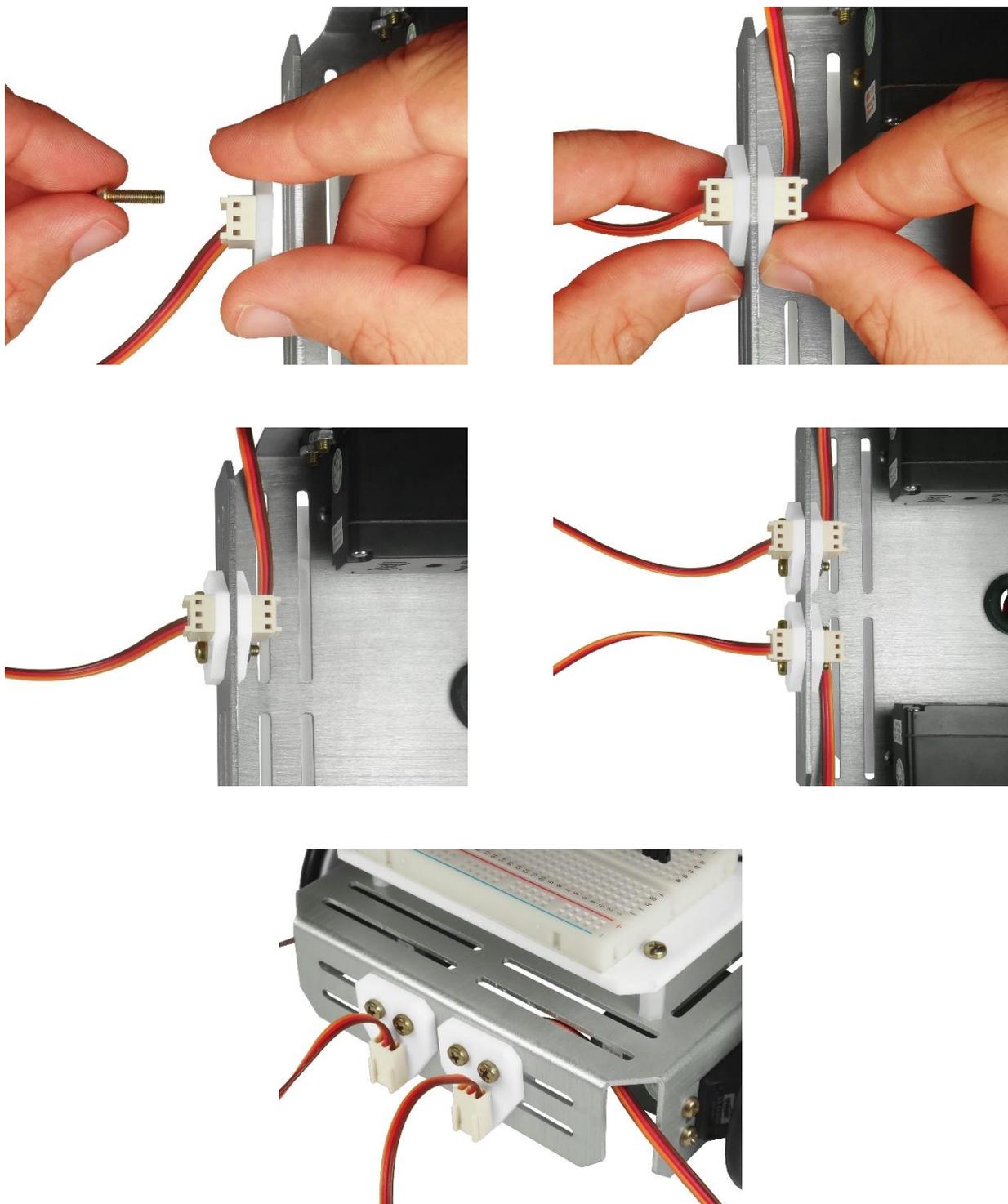


Figura 12.10 - Conectando os LEDs infravermelhos nos cabos extensores.

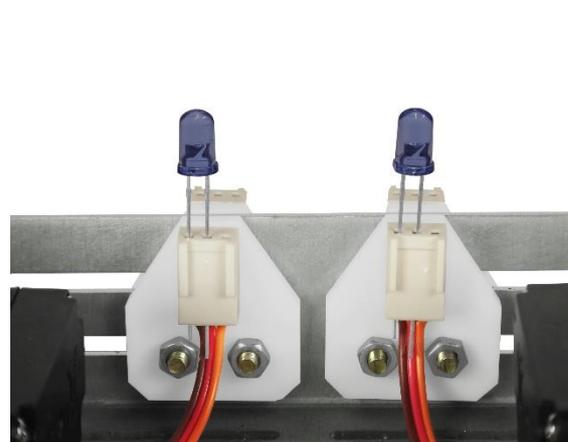
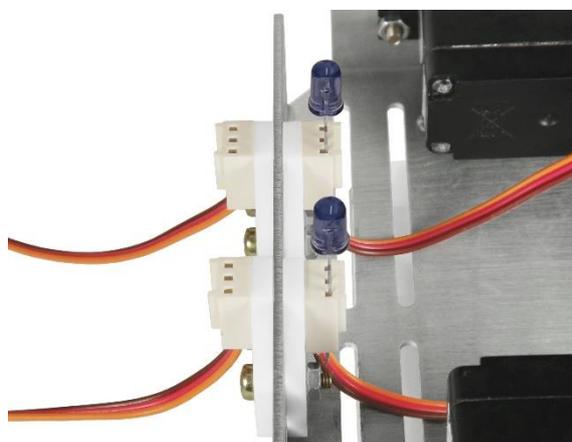
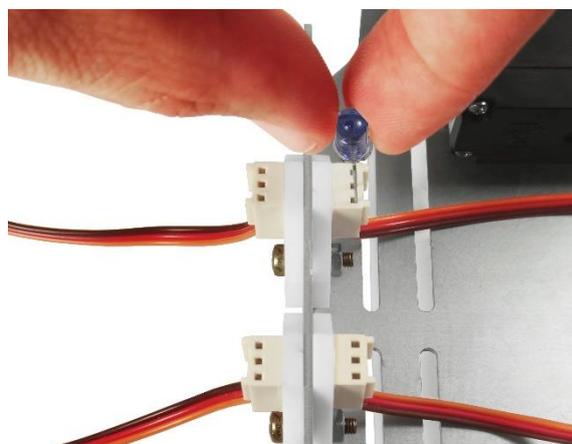


Figura 12.11 - Conectando os fototransistores nos cabos extensores.

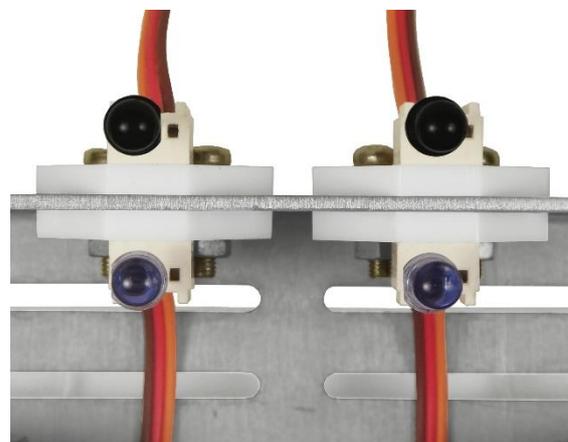
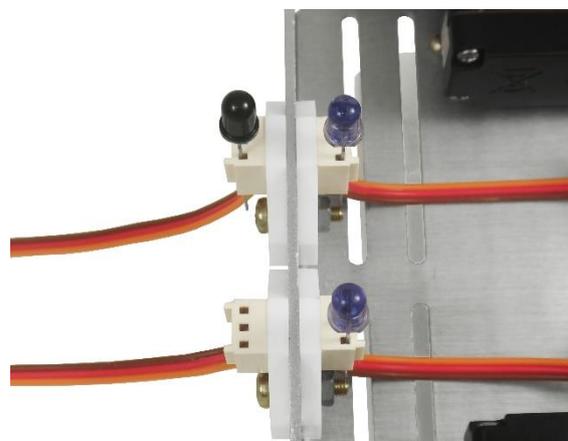
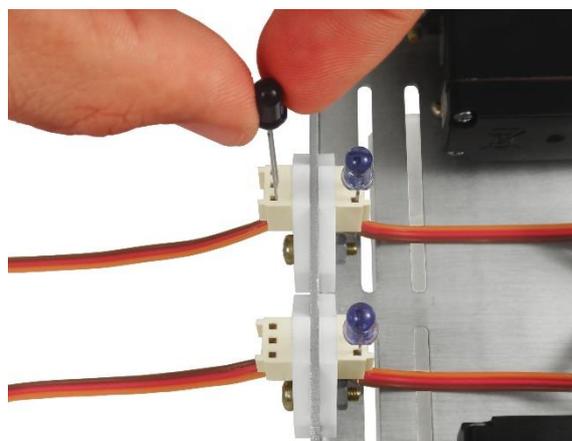


Figura 12.12 - Ligando os cabos extensores na protoboard.

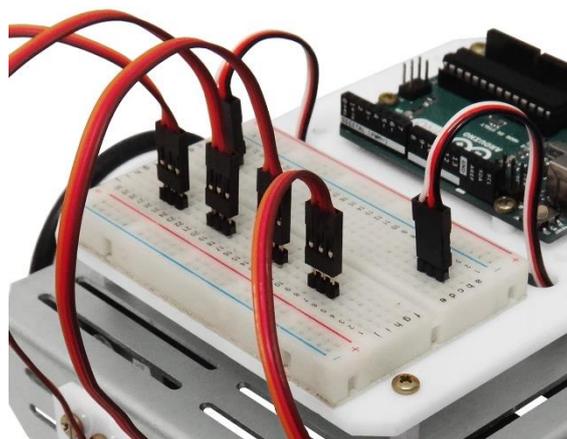


Figura 12.13 - Robô pronto para a realização da atividade.

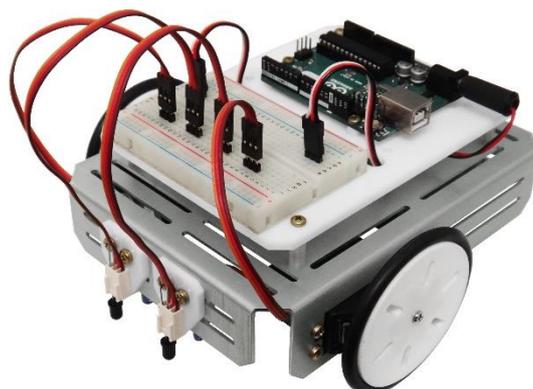
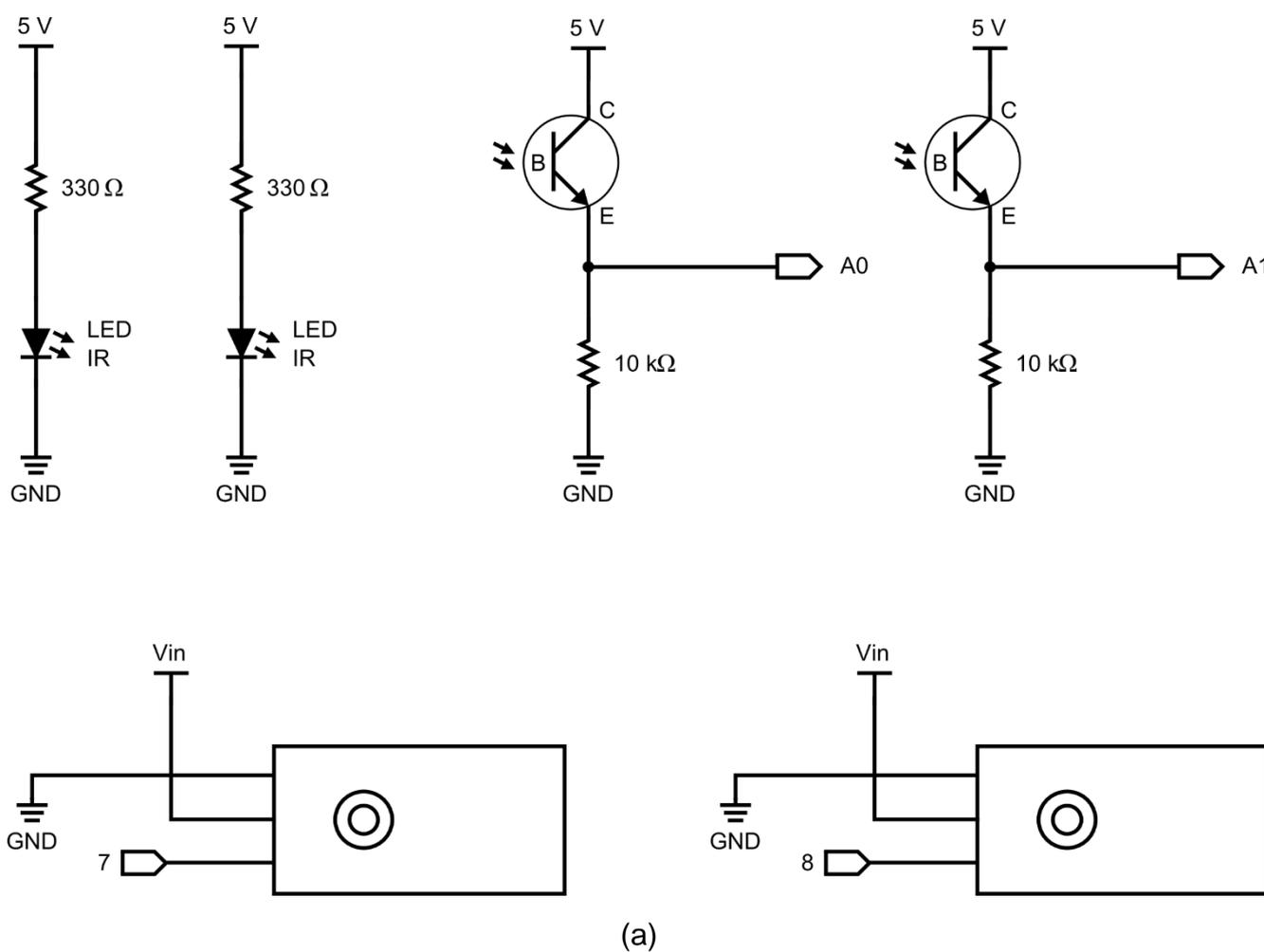
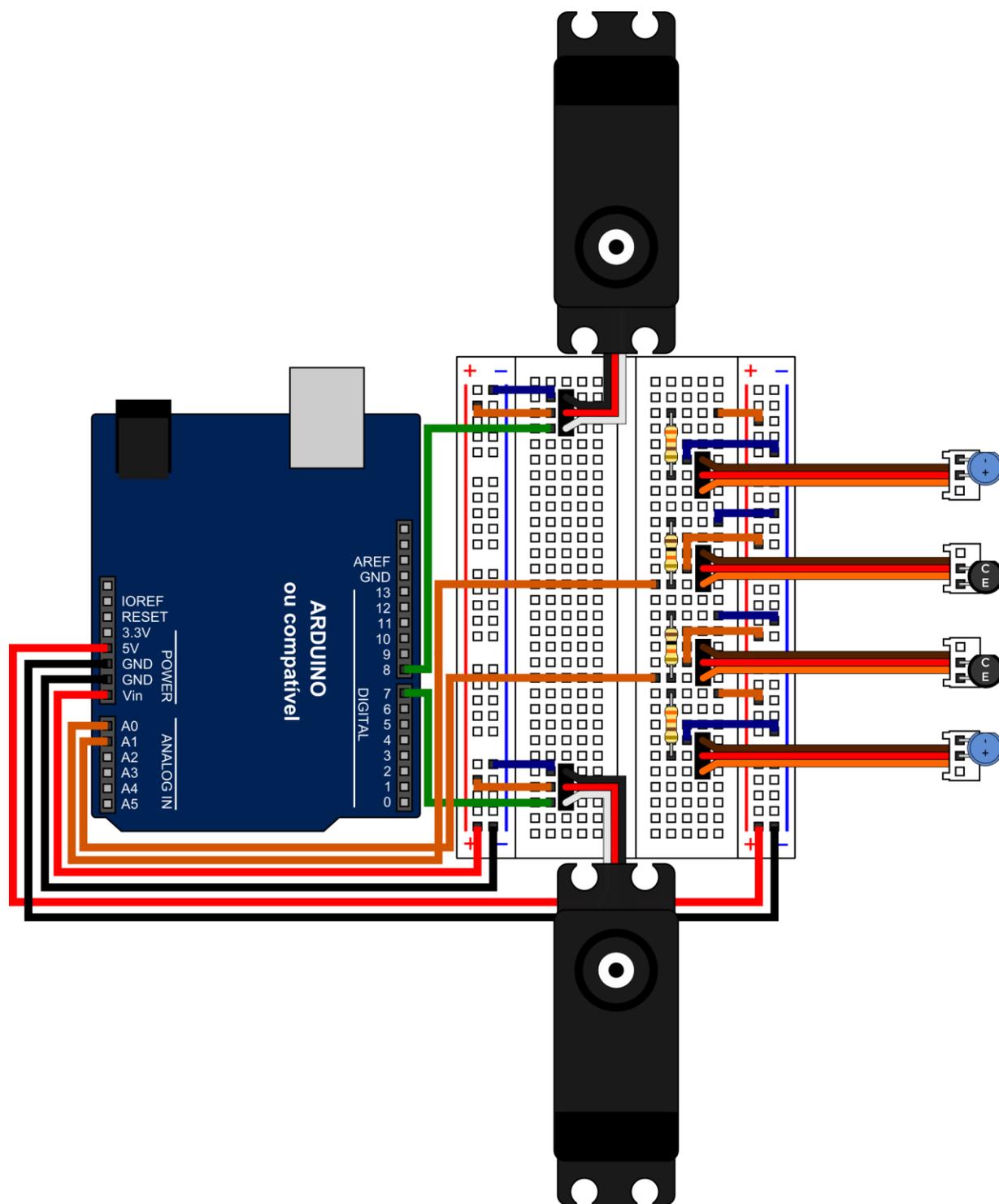


Figura 12.14 - (a) Esquema e (b) ilustração do circuito eletrônico da Atividade 41.





(b)

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

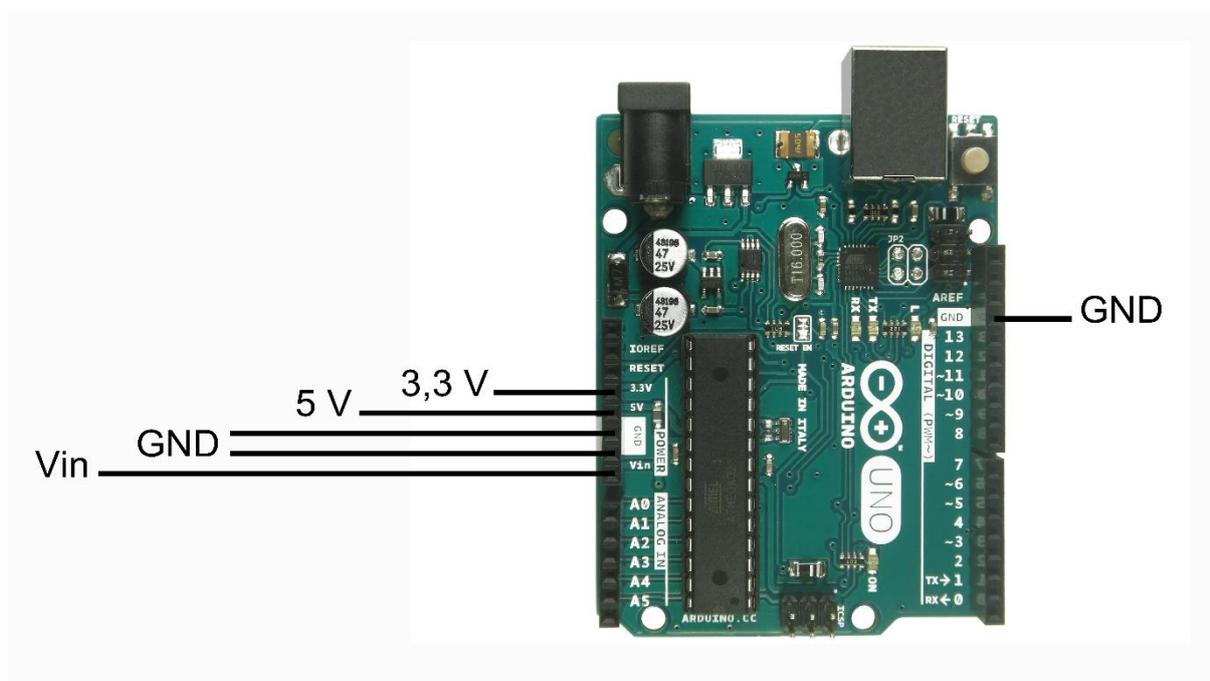


Figura A.2 - Circuito eletrônico da Atividade 1 (Capítulo 2).

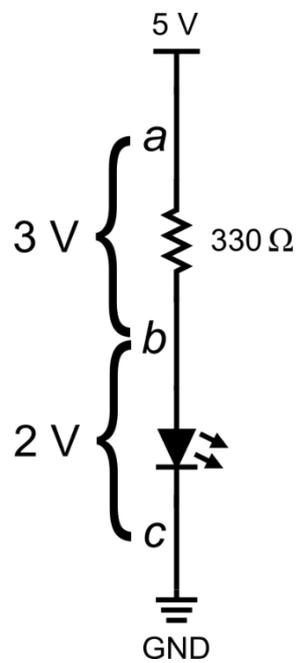


Figura A.3 - LED diretamente polarizado.

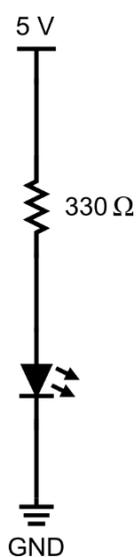


Figura A.4 - LED reversamente polarizado.

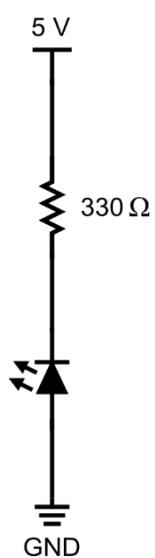
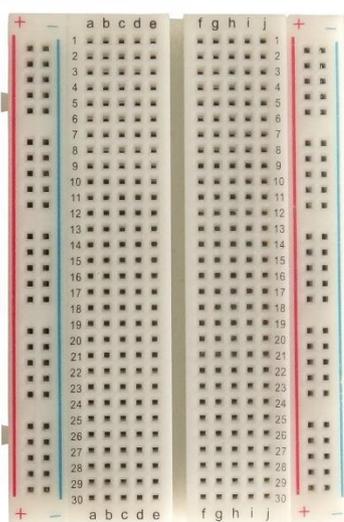
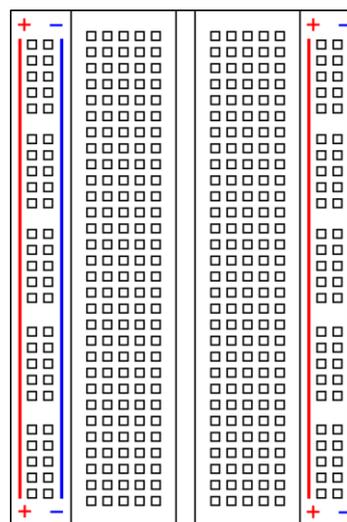


Figura B.1 - (a) Imagem de uma protoboard e (b) a figura que a representa na ilustração dos circuitos montados.

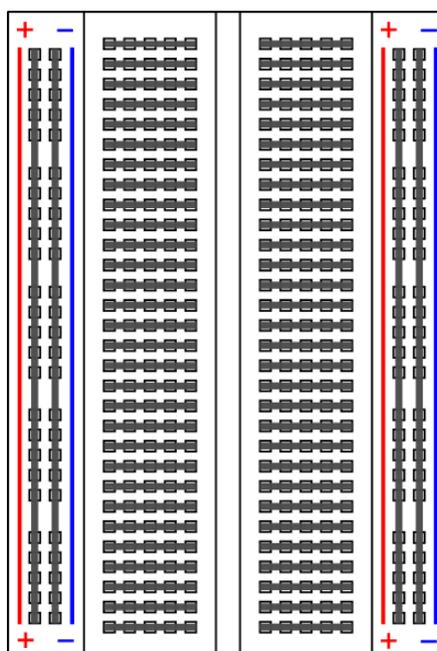


(a)

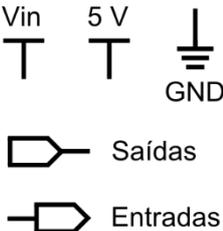
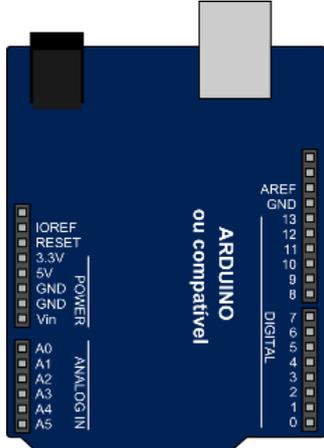
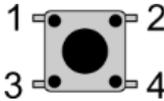
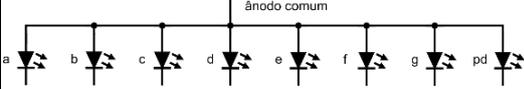
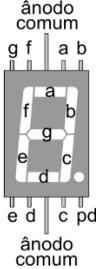
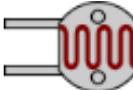


(b)

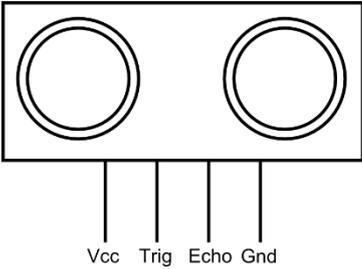
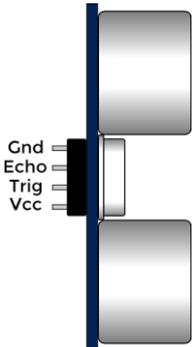
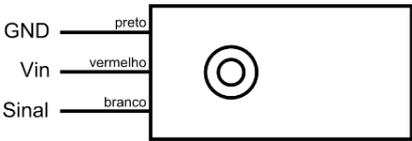
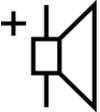
Figura B.2 - Forma como estão interligados os furos da protoboard.



APÊNDICE C – SÍMBOLOS UTILIZADOS NOS CIRCUITOS ELETRÔNICOS

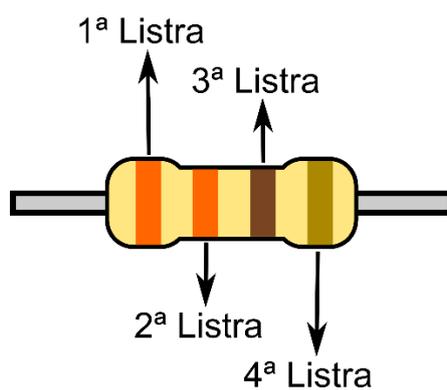
Elemento	Representação nos esquemas dos circuitos	Representação nas ilustrações dos circuitos
Arduino Uno	 <p>Vin 5 V GND</p> <p>Saídas</p> <p>Entradas</p>	
Cabo extensor		
Chave tátil (pushbutton)	 <p>1 2</p> <p>3 4</p>	
Display de 7 segmentos	 <p>ânodo comum</p> <p>a b c d e f g pd</p>	 <p>ânodo comum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

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

<p>Sensor de ultrassom</p>		
<p>Servomotor</p>		
<p>Sonorizador piezo (buzzer)</p>		

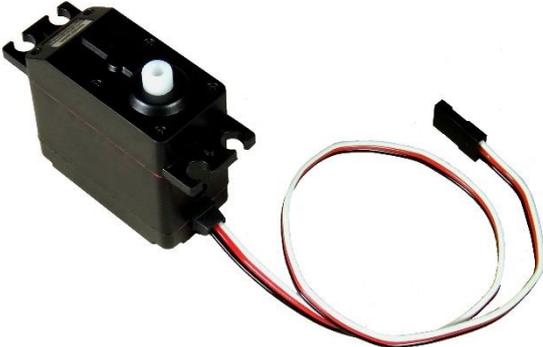
- 1 - A cor dos fios varia.
- 2 - A cor dos LEDs varia.
- 3 - As cores das listras dos resistores variam.

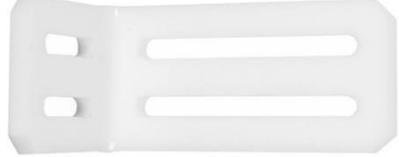
Figura E.1 – Resistor



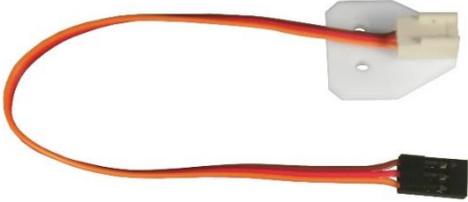
APÊNDICE F – ITENS QUE COMPÕEM O KIT CRIATECNO CT100

Item	Imagem
Arduino Uno	
Base de prototipagem	
Cabo USB	
Chassi	

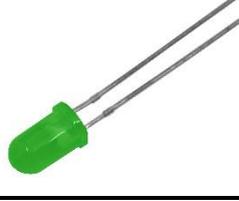
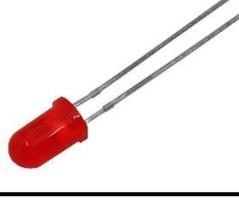
Servomotor	
Conjunto de acessórios do servomotor	
Roda	
Anel de borracha	
Esfera	
Eixo da esfera	

<p>Suporte de pilhas</p>	
<p>Presilha de pilhas</p>	
<p>Suporte curto</p>	
<p>Suporte longo</p>	
<p>Suporte em L</p>	
<p>Suporte do sensor de ultrassom</p>	
<p>Espaçador 3 mm</p>	
<p>Espaçador 15 mm</p>	

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	

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

<p>Resistor 1 kΩ</p>	
<p>Resistor 2,2 kΩ</p>	
<p>Resistor 10 kΩ</p>	
<p>Potenciômetro</p>	
<p>Fotoresistor</p>	
<p>Fototransistor</p>	
<p>Receptor de infravermelho</p>	

<p>LED infravermelho</p>	
<p>LED branco</p>	
<p>LED amarelo</p>	
<p>LED verde</p>	
<p>LED vermelho</p>	
<p>Suporte para LED</p>	
<p>Display de 7 segmentos</p>	

Sonorizador	
Sensor de ultrassom	

1 - A cor dos fios varia.