45678 SPIKE Prime Set Build: Kiki, the Dog
Adapted by Marcia McDonald-Scott and tested by Matthew Shifrin.

You will be building Kiki, an odd-looking robotic dog that has the Spike Prime hub for a body and the color sensor for a snout. When you are done, Kiki will be able to pivot on the platform to face each of the three brick stacks arranged in an arc in front of her - one blue, one yellow, and one green.

This build is 60 pieces, and 39 building steps.

Welcome to text-based instructions from Bricks for the Blind. Before you start building, here are some terms we'll be using:
- In Front of/Front: towards you.
- Behind/Back: away from you.
- Up: towards the ceiling.
- Down: towards the floor.
- Stud: the bump on a LEGO brick. Example: A 2x1 brick has two studs on it.
- Vertically: going from front to behind.
- Horizontally: going from left to right.
- Upright: pointing up towards the ceiling.
- That one/ppp: previously placed piece.
- Plate: piece with studs.
- Tile: smooth piece without studs (unless otherwise specified)
- Symmetrically: a mirror image. Example: If you place a 2x1 brick with technic connector on the front wall at the right, connector to the front, and then place another such piece symmetrically on the back wall, at the right, the technic connector of the second piece should point to the back, since it will be placed symmetrically.
- Centered-vertically: even amount of space in front of and behind the piece
- Centered-horizontally: even amount of space left and right of the piece.
- Row: studs lined up horizontally (left to right/side to side).
- Column: studs lined up upright or vertically (top to bottom/back to front).
- Standing upright: the piece is perpendicular to the ground, like a wall.
- Lying flat: the piece is parallel to the ground, like a piece of toast which fell off the table.
- Anti-stud: the portion of a piece which accepts studs, like the bottom of a plate.
- Jumper plate: a 1x2 plate with a single stud on top, or a 1x3 plate with only two studs on top.

A note on LEGO Technic™ part names. These parts are somewhat different from regular LEGO bricks. Here are some definitions in case the builder or helper is not familiar with LEGO Technic™.

Axles - An axle is a connector which has an X shaped cross-section. Because their cross section is not round, anything connected to an axle using an axle-hole will rotate with that axle. Axles are longer than they are wide, and the length of an axle corresponds with how many bricks long it is. Aka a 3L axle is three bricks long. Axles come in a variety of lengths, with a 2L axle being the shortest available. They may be combined with pins, or have circular stops on them. A stop prevents the axle from sliding through an axle-hole at a specific point on the axle.

Pins - A pin is a connector which has a circular cross section and a flanged notch out of one or both ends. This flanged notch allows them to click into bricks with a pin-hole. Pins come with and without friction ridges, which are small bumps on the pin which prevent them from rotating freely. For standard pins, black is a high friction pin, and gray is a low friction pin. A standard length pin is two brick lengths long, with a stop in the middle. This prevents a brick from being pushed from one side of the pin to the other. A 1L pin is one brick long and still retains the stop, however it also includes a hollow stud at the other end. A 3L pin is three bricks long, and only contains a stop at one side, allowing two bricks to be pushed onto the other side of the pin. Pins may also have one side which is an axle.

Lift-arms - A lift-arm is a basic structural element, similar to a brick or a plate, but usually without any studs. It is a beam with rounded ends and with holes in it, with the same spacing as the studs on a LEGO brick. lift-arms come in a variety of lengths, including a 1x1 lift-arm which looks like a cylinder. Thick liftarms are as wide as a LEGO brick, and thin lift-arms are half as wide as a LEGO brick, but not the same thickness as a LEGO plate! The holes in a lift-arm arm may accept axles or pins. They also come in a variety of shapes, including tees, ells and triangles.

Gears - A gear is a functional element. They are typically discs with teeth on the outside, there are also worm gears which look like a spiraling cylinder! Gears connected by axles transmit or even transform rotational motion!

Axle and Pin Connectors - These elements are typically smaller than lift-arms and are used to connect some combination of pins or axles. They might have pins or axles, as well as axle or pin-holes. They have a lot of different angle combinations! The simplest just connects two axles or pins together in a straight line.

Bushes/Bushings - LEGO Technic™ uses bushes largely as spacers, but they also can reduce friction between rotating parts, or can form useful elements such as handles. Bushes are typically light gray, generally cylindrical, and have an axle-hole running through the middle. They have a flange at the front and back to make them easier to pull on and off.

Technic™ Bricks and Plates – There are also regular bricks and plates that are adapted for use with Technic™ elements. Technic™ bricks have holes for either pins or axles on the sides and are only one brick wide. One of the most common of these is a 1x2 brick with a single pin hole. Most often, these bricks have pin holes, not axle holes. Technic™ plates have holes on the flat surface between the studs and are a minimum of two bricks wide. The holes in these plates can accept pins, or can allow an axle to pass through and still spin.

For builders with low vision, or a sighted building partner who may want to follow along with the visual instructions, you can find these instructions in the LEGO Spike app or at https://spike.legoeducation.com/prime/models/blt62abf63a7cbdc5f3. As low vision users may benefit from viewing the instructions on a personal device where they can zoom in on content and use assistive technologies to enhance the visuals.

Sorting the pieces:

To begin a successful build, it helps to sort the pieces into groups, bags or small containers. Have a sighted friend or family member do this in advance following the instructions below. You will see that the pieces should be sorted into groups according to the building steps in the set. Doing this in advance makes locating the pieces easier. See below on how to sort the pieces to correspond to the steps in this set. Number the containers using letters A-Z, numbers or meaningful names. The parts will be collected into a small number of steps in the instructions. Example: Steps 1-3 means collect all the parts used in steps 1, 2 and 3, and put them in one container.

The Spike Prime set is organized in a tote for use in an educational setting. There are two trays each with 4 labelled compartments for bricks and elements that sit at the top of the tote, with the tote itself being used for the robotics components and for larger elements. Sort the pieces into groups as described below. Note that where there are multiple colors of the same brick in a step, the colors will be split across two groups to make telling the difference easier for the builder!

Build: Kiki, the Dog (8 groups of bricks)
Group 1 contains the pieces for steps 1-2.
Group 2 contains the pieces for steps 3-10.
Group 3 contains the pieces for steps 11-19.
Group 4 contains the pieces for steps 20-30.

Group 5 contains the pieces for steps 31-36
Group 6 contains the blue bricks for steps 37 and 38.
Group 7 contains the green bricks for steps 37 and 38.
Group 8 contains the yellow bricks for steps 37 and 38.

Building Instructions:

Group 1

1.1. Start by building the platform. Find a magenta 7x11 frame. This is a rectangle made of lift-arms with perpendicular holes. These are like regular lift-arms, except that every hole is perpendicular to its neighbors. Place this piece in front of you so that the frame is lying flat vertically, with the short sides at the front and back.

1.2. Push two black 2L pins from the left into the front and back holes of the left face of the left lift-arm of the frame. This face has five holes and is otherwise smooth. There should be three free holes in between your pins.

2.1. Find a 11x19 yellow panel with holes and lay it flat, with the long side at the right, to the left side of the frame, centered-vertically. Line up the pins on the frame with the holes on the panel's right face so that the pins are at the third hole from the front and the third hole from the back of the panel's right face. Connect the panel and the frame by pushing them together. There will be two free holes at the front and two free holes at the back of the panel's right face.

2.2. Push a blue 3L pin, with the stop ring at the bottom, from the top into the hole in the top face of the panel in the second column from the right, centered-vertically. There will be nine free rows to the front and to the back of this pin.

2.3. Find two tan 2L axle/pin combos. Push one from the top with the pin side down into the leftmost column of the top face of panel in the seventh row from the front, and the other into the leftmost column in the seventh row from the back. There should be five free rows between these axle/pin combos.

Group 2

3.1. Now you will build Kiki's underbelly which will cradle the hub. Find a light blue 3x11x12 bowed panel. This piece has two pin holes separated by a gap on each short end and incorporates two 9L lift-arms - one with perpendicular holes and one with three holes at each end and a 3L gap in between. The lift-arms are connected by a gently rounded plate so that there are four spaced pin holes on one long edge of the smooth side of the panel and two sets of three pin holes separated by a 3L gap on the other long edge. On the non-bowed side of the panel, the pin holes of the lift-arms are perpendicular, except for the odd-numbered holes of the lift-arm with nine holes, which run the same direction as the holes of the lift-arm with two sets of three pin holes.

3.2. Place the bowed panel horizontally on the table with the smooth side down so that the lift-arm with two sets of three pin holes separated by a 3L gap is facing up and forward at a 45-degree angle from the table.

3.3. Find two light gray 3L pin connectors with four pins. These pieces approximate the shape of a capital letter H. Push one of the 3L pin connectors with four pins into the left set of three pin holes on the ppp so that the pins connect to the first and third holes, then push the second connector into the right set of three pin holes so that the pins connect to the first and third holes.

4.1. Find two magenta 1x3x3 biscuits. When lying flat, five of the pin holes on these pieces face up with a line of three pin holes centered vertically and a line of three pin holes centered horizontally forming a cross. Each corner has a single pin hole facing outward.

4.2. Push the biscuit onto the previously placed piece so that two adjacent outward facing pin holes on the biscuit connect to the two pin connectors that are sticking up at a 45-degree angle. Repeat for the second biscuit and the remaining pin connectors. The weight of the biscuits will pull the assembly so that the biscuits are lying flat.

5. Find two black 2L pins, pushing one down into the left pin hole and one down into the right pin hole of the top face of the left biscuit so that the pins point up and there is a column of three empty pin holes between them.

6. Find another magenta 1x3x3 biscuit and push it onto the two previously placed pins so that it matches the orientation of the biscuit beneath it.

7. Find two more light gray 3L pin connectors with four pins that approximate the shape of a capital letter H. Push the two pins of one of the connectors from the front into the two pin holes on the front face of the bottom left biscuit. Repeat with the second connector and the single biscuit on the right.

8. Find the second light blue 3x11x12 bowed panel and place it horizontally on the table in front of the panel/biscuit assembly with the smooth side down so that the lift-arm with two sets of three pin holes separated by a 3L gap is facing up and to the back at a 45-degree angle. Tilt this bowed panel so that the outer pin holes in each set of three pin holes line up with the four pins protruding forward from the panel/biscuit assembly. Push with even pressure so that all four pins click into the pin holes at the same time.

9. Find four light gray 3L pin/bushing combos. Insert two pins from the back into the leftmost and the rightmost back-facing holes on the back bowed panel, so that 1L of each pin and the 1L bushings stick out of the panel to the back. Symmetrically, insert the two remaining pins from the front into the left and right front-facing holes on the front bowed panel, so that 1L of each pin and the 1L bushings stick out of the panel to the front.

10. It's now time to connect the assembly from step 9 with the platform from step 2. Orient the platform so that the 11x19 panel is on the left side of the frame. Locate the pin that points upwards in the vertical center of the panel in the second row from the right. Now, take the assembly from step 9 and push the center hole of the stack of two biscuits onto the pin. The assembly will then be attached to the platform, and you will be able to pivot the assembly around the fixed pin.

Group 3

11. It's time to attach the color sensor to the hub. Start by finding a black 2L pin with friction ridges and a white 3L double bushing with a center pin hole that runs perpendicular to the axle holes of the bushings on either end. Insert the pin into the pin hole.

12. Find two tan 2L axle/pin combos. Insert the axles into the bushings so that both pins stick out of the same side of the double bushing.

13. Now locate the color sensor. This is a 3x3x3 cube with a circular sensor window on the front, and a flat 10-inch cable coming out of the back ending in a plug that fits the ports on the Spike hub. With the sensor window facing left and with either of the flat sides of the cable facing down, take the double bushing assembly from the previous step so that the single middle pin is facing to the right, and push the two pins from the back into the two pin holes on the back face of the color sensor.

14. You will now repeat your earlier steps to create a second connector for the other side of the color sensor. Find a black 2L pin with friction ridges and a white 3L double bushing with a center pin hole that runs perpendicular to the axle holes of the bushings on either end. Insert the pin into the pin hole.

15. Find two tan 2L axle/pin combos. Insert the axles into the bushings so that both pins stick out of the same side of the double bushing.

16. Symmetrical to the previous double bushing assembly, orient this double bushing assembly so that the single middle pin is facing to the right, and push the two pins from the front into the two pin holes on the front face of the color sensor.

17. The color sensor can now be mounted on the Spike hub to form Kiki's snout. The hub is a 5x9x3 rectangular prism with buttons, ports, and pin holes that contains the removable battery and the electronic components that power and control the inputs and outputs of your LEGO robotic creations based on the code you write in the LEGO Spike app. Place the hub horizontally so that the center button (the circular button with a 2L diameter) is on the right, facing up. There will be two upright vertical columns of three pin holes on the left face of the hub. Locate the middle hole of each column as these will receive the two pins of the color sensor assembly. Orient the color sensor assembly so that the two pins and the flat cable extend to the right. Make sure the cable hangs down underneath the hub before pushing the pins from the left into the middle holes of each column.

18.1. Now it's time to attach the hub/snout assembly onto the underbelly/platform assembly. Orient the platform so that the 11x19 panel is on the left side of the underbelly. With the color sensor facing left and the cable running along the underside of the hub, lower the hub down between the two bowed panels of the underbelly assembly, with the cable extending beyond the hub to the right.

18.2. Now for some tricky alignment: line up the left pin attached to the front bowed panel with the bottom hole of the left upright vertical column of pin holes on the front face of the hub and push in the pin. The symmetrical pin and hole on the back face of the hub should now be aligned, so go ahead and push in that pin. You may need to wiggle the hub up and down to align the holes on the hub with the remaining pins at the front and back on the right. Push in these remaining pins.

19. Plug the color sensor cable into port B, which is the leftmost of the three ports running along the top of the back face of the hub. You may need to flip the plug over if you're having trouble making the connection.

Group 4

20. It's time to give Kiki a head. Find a light gray 5L axle and a yellow axle and pin connector #6. This piece has two 1L axle connectors which form a right angle, and a perpendicular pin hole between them. Insert the axle into one of the cross holes.

21. Find a magenta 2x4 brick with a row of three cross holes centered vertically and horizontally between the two rows of four studs. Hold the yellow angle and pin connector #6 vertically upright so that the axle extends to the right and the empty cross hole points down, and the pinhole points to the front and back. Hold the brick vertically upright with the studs to the left. Push the axle from the left all the way into the bottom cross hole on the brick.

22. Find another magenta 2x4 brick with cross holes and push it onto the axle so that it is symmetrical to the first brick, meaning that the studs are facing right, the axle is passing through the bottom cross hole, and the bases of the bricks are touching.

23. Complete the symmetry of the assembly by pushing a yellow angle and pin connector #6 onto the protruding section of axle so that the empty cross hole points down, and the pinhole points to the front and back.

24.1. Find four tan 2L axle/pin combo pieces. Push the axle portion of two of the axle/pin combos into the downward pointing cross holes.

24.2. Now, push the pin portion of the remaining axle/pin combos, from the front, into the pin holes of the angle elements so that both 1L axles of the axle/pin combos extend forwards.

25. Locate the pin holes in the top left and bottom left corners of the top face of the hub. Push the downward facing pins of the assembly from the previous step down into these pin holes with the 1L axles now extending to the left.

26. It's time to make eyes for Kiki. Find two white 2x2 round bricks with cross holes and place them on the table.

27. Find two white 2x2 round tiles with center stud. Attach a round tile to the top of each of the round bricks from the previous step.

28. Now find two white 1x1 round tiles with black and white cartoon eye markings. Attach one of these to each of the open studs from the previous step.

29. Attach Kiki's eyes by pushing the cross hole at the bottom of each eye, from the left, onto the left-facing 1L axles from the step preceding the assembly of the eyes, so that Kiki is looking to the left.

30.1. To add more dimension to Kiki's head, find a light blue 3x8x2 left bowed plate with two studs. This piece is like a 2x3 slope brick that slopes to the right and that has been stretched forwards by 6L in a downwards curve, with its front right corner cut off on a diagonal. Orient this piece so that the studs are at the bottom left corner of the bowed plate, facing forwards. Attach the bowed plate from the front to the top four forward facing studs of the brick behind and to the right of Kiki's front eye. The tip of the slope of the bowed plate will stick up 1L above the brick, with the rest of the bowed plate curving to the right and back.

30.2. Now find a 3x8x2 right bowed plate with two studs, which is symmetrical to the previously placed left bowed plate. Attach it symmetrically from the back to the top four backward facing studs of the brick in front of and to the right of Kiki's back eye. Again, the tip of the slope of the bowed plate will stick up 1L above the brick, with the rest of the bowed plate curving to the right and forward to contact the right edge of the ppp. Kiki's unusual head is complete!

Group 5

31. Now to add a support for attaching bricks to the platform for the color sensor to analyse. Find a black 4x4 angled lift-arm that is angled at 120 degrees, and a yellow 3L axle. Lay the lift-arm flat with the opening of the wide 'v' shape facing backward and insert the axle into the axle hole at the left tip of the left arm of the wide 'v'.

32. Now find a black 3L axle/pin combo. Lift the angled lift-arm so that you can insert the axle of the axle/pin combo, from the bottom, into the cross hole at the right tip of the right arm of the wide 'v', so that the pin extends downwards.

33. Rotate the angle lift-arm assembly so that the opening of the wide 'v' is facing Kiki, then adjust as needed in order to insert the pin on the bottom of the lift-arm assembly into the pin hole in the leftmost column of the 11x19 panel, 9L from the back, making sure to line up the upward facing axle that protrudes from the panel 2L behind this hole so that the protruding axle fits into the pin hole of the angled lift-arm. The front arm of the angled lift-arm should now be flush with the left edge of the panel, and the back arm should be angled towards the back right of the panel.

34. You will now create a symmetrical support by finding another black 4x4 angled lift-arm that is angled at 120 degrees, and another yellow 3L axle. Lay the lift-arm flat with the opening of the wide ‘v’ shape facing backward and insert the axle into the axle hole at the right tip of the right arm of the wide ‘v’.

35. Find a black 3L axle/pin combo. Lift the angled lift-arm so that you can insert the axle of the axle/pin combo, from the bottom, into the cross hole at the left tip of the left arm of the wide ‘v’, so that the pin extends downwards.

36. Rotate the angle lift-arm assembly so that the opening of the wide ‘v’ is facing Kiki, then adjust as needed in order to insert the pin on the bottom of the lift-arm assembly into the pin hole in the leftmost column of the 11x19 panel, 9L from the front, making sure to line up the upward facing axle that protrudes from the panel 2L in front of this hole so that the protruding axle fits into the pin hole of the angled lift-arm. The back arm of the angled lift-arm should now be flush with the left edge of the panel, and the front arm should be angled towards the front right of the panel.

Groups 6, 7, and 8

37. The next step is to build a blue stack, a green stack, and a yellow stack of bricks. Place a blue 2x4 brick from group 6, a green 2x4 brick from group 7, and a yellow 2x4 brick from group 8 on the table horizontally. Note that these bricks all have a row of three cross holes centered vertically and horizontally between their two rows of four studs.

38.1. Take the second blue 2x4 brick from group 6 and attach it horizontally on top of the blue brick from the previous step. Likewise, take the second green 2x4 brick from group 7 and attach it horizontally on top of the green brick, and take the second yellow 2x4 brick from group 8 and attach it horizontally on top of the yellow brick.

39.1. Attach the green stack to the 2L length of axle that protrudes from the back angled lift-arm, by pushing the leftmost cross hole of the green stack, from the top, onto the axle. The length of the stack will follow the angle of the back arm of the lift-arm.

39.2. Attach the blue stack to the 2L length of axle that protrudes from the front angled lift-arm, by pushing the leftmost cross hole of the blue stack, from the top, onto the axle. The length of the stack will follow the angle of the front arm of the lift-arm.

39.3. Finally, push the outer cross holes of the yellow stack, from the top, onto the 1L lengths of axle protruding from each of the two lift-arms on either side of the gap that separates the lift-arms. You’re now ready to explore the code that controls Kiki, the robot dog!

Congratulations on finishing your build! Would you like to inspire other blind people to build LEGO sets? Let’s feature your build on our Builders page. It’s easy and we will do all the work! Just contact us at info@bricksfortheblind.org and together we will make it happen!

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