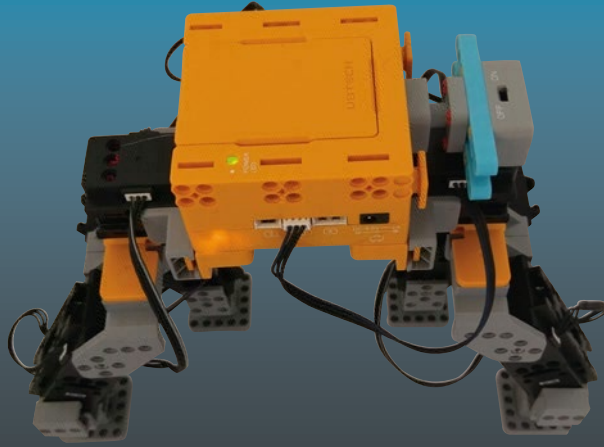


TECHNOLOGY IN ACTION™



# The UBTECH Jimu Robots Builder's Guide



How to Create and Make Them  
Come to Life

—  
Mark Rollins

Apress®

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How to Create and Make Them  
Come to Life



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***The UBTECH Jimu Robots Builder's Guide: How to Create and Make Them Come to Life***

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Pullman, Washington, USA

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# About the Author

**Mark Rollins** has written six books for Apress, three of them about LEGO. Mark worked at Wal-Mart and Schweitzer Engineering Laboratories before deciding to devote himself to being a full-time writer. Since then, he has written for many tech and gadget blogs including coolest-gadgets.com, gadgetell.com, gamertell.com and many other journals that have since gone offline. In 2009, he started his own tech and gadget blog known as [TheGeekChurch.com](http://TheGeekChurch.com). In addition to his career in tech, Mark recently wrote a science fiction/fantasy known as *The Labyrinth House*, and he intends to write the next two books in the trilogy. He currently lives in Pullman, Washington with his wife and three children.



# CHAPTER 1



# Jimu Robots in STEM Education

We live in an age that was science fiction only decades ago. Clearly this technological and information age began with the necessity of a computer in every business and household. Now, computers that were once the size of houses have been miniaturized into a smartphone with easy-to-use apps that are accessible to almost every consumer. Surely this younger generation, being raised by this ever-advancing technology, needs to be prepared for even greater technological achievement.

Fortunately, there is a way to make the next generation advance to the next technological level with hands-on training with actual and applicable technology. This is where STEM education comes in.

## STEM Education

STEM is one of those buzzwords that is making its way just about everywhere in higher and lower education. STEM is an acronym for Science, Technology, Engineering, and Mathematics, and it has become an umbrella term for any kind of educational curriculum that is very hands-on when it comes to science and technology. For example, a typical STEM program would have an emphasis on having students programming and building robots.

## Introduction to Jimu Robots and UBTECH

UBTECH (pronounced You-Be-Tech) Robotics is a company born out of Shenzhen in China. In the company's own words: "UBTECH Robotics is dedicated to bringing a robot into every home and integrating intelligent robots into your daily life, creating a more intelligent and human-friendly way of leisure life."

UBTECH developed Jimu Robots as something of a toy, but it is easily something that adults can use. In fact, building even the most basic Jimu Robots constructions can be seriously challenging to both children and adults.

Using the Jimu Robots pieces that fit together, as well as Servos that can literally power a creation, the user can create many machines or robots that can be programmed to do all sorts of actions. It is possible for the user to sync their creations with a smartphone or tablet, in order to take control of them with a common mobile device.

## What This Book Is

This is a book that is about how to build with Jimu Robots. Within these pages are several creations that you can build, and also instructions on how to program them to do all kinds of commands at the touch of a button. The user can use this information to learn more about programming and coding as well.

The best part about the creations within this book is that they are very basic, and I mean that in two ways. First, they are very simple to build, and the instructions are mostly pictures with written directions for the details. Second, many of the creations can be applied to other creations that the user/reader can create on his or her own. For example, Chapter 4 details how to make a four-wheeled creation, which can easily be applied to making bigger or smaller four-wheeled creations without literally having to “reinvent the wheel.”

In the end, I hope that the reader gains a better understanding of how to build and program their Jimu Robots creations, which will advance their technological intellect. I would love it if you, the reader, is later inspired to create the next automobile, microwave, smartphone, or whatever technology that we can’t live without in the future.

## What This Book Is Not

If you flip through this book, you will notice a lot of illustrations. Yes, this is a book that shows you how to build your own interesting creations, but honestly, you are required to take the next step.

In other words, don’t limit yourself to the instruction manual like Will Ferrell’s human character in *The Lego Movie*. Yes, I will show you how to build things like wheeled vehicles and walking robots, but you will get much more of an experience from this book if you use the methods to develop your own creations.

With Jimu, you can bring your imagination to life! However, I am going to deliver a warning that in addition to the building, which is already very hard, there is an element of programming that can sometimes be a lot harder. If you have ever programmed anything before, then you know that there is more to programming than just creating a program that can run. After all, you might end up creating a program that does not do exactly what you programmed it to do, because you unintentionally programmed it to do something else. In other words, garbage in, garbage out.

Most of the problems that you will have with your creations can be solved by building and rebuilding, but I won’t lie when I tell you that it can be a difficult and time-consuming process.

## Similarities and Differences Between Jimu Robots and LEGO Technic/MINDSTORMS

Even though this section of this chapter could be edited out of my final draft, I felt that this topic is worth bringing up. On the surface, Jimu Robots may look like certain pieces of LEGO with their Technic or MINDSTORMS editions.

If you are not familiar with the LEGO Technic or the MINDSTORMS collections, they are specialized parts that reject the traditional blocks and slate pieces with their studs (the circular bumpy parts with the LEGO logo) for beams, connectors, axles, and other parts that I will define later.

I bring this up because I have written three books devoted to LEGO Technic and MINDSTORMS EV3. And if you are interested in those for STEM education, here are the titles.

*Practical Lego Technics* (Apress, 2013)

*LEGO Technic Robotics* (Apress, 2013)

*Beginning LEGO MINDSTORMS EV3* (Apress, 2014)

Please understand that just because I have written three books on LEGO and just this one book on Jimu Robots, I am not saying that any construction kit is “better” than the other. I found that both of these construction kits are similar and different, and I can honestly say that I enjoyed working with them equally.

## The Differences Between Jimu Robots and LEGO

The first thing I am going to say is something that I want to make clear: LEGO AND JIMU ROBOTS ARE NOT COMPATIBLE!!!

Yes, there are beams, connectors, and axles that are very like LEGO, but I tried them out, and I can’t make the pieces fit together. The LEGO pieces are slightly bigger than the Jimu Robots pieces, and this difference is obvious when they are put side by side.

I also have no intention of trying a workaround to get them to work. It’s like using metric tools for British standard units, so pick one or the other. Another one of the biggest differences is how some of the pieces fit together. The Jimu Robot kits have some pieces that can “slide” (for lack of a better word) together, which are not found in LEGO at all. Jimu Robots calls these pieces connectors, and they also snap together and come apart with the ease of the other kinds of pieces.

## The Similarities Between Jimu Robots and LEGO

As I have said before, Jimu Robots and LEGO have pieces that look the same. They have straight beams that always have an odd-number of holes, to insert fasteners (tiny pieces that can join beams together). Overall, most of the pieces of Jimu Robots, with the exception of the sliding pieces (connectors) have the same look and function as LEGO pieces.

Jimu Robots has a Main Control that is like the EV3 control box, but unlike the EV3 control box, the Main Control (MC) Box has no buttons for control and must be controlled via smartphone or a tablet, thanks to the iOS and Android apps.

The Jimu Robots also have motors that come in the form of Servos, which can be programmed to spin or rotate from 118 degrees to -118 degrees, as well as be controlled to specific speeds. The motors for Jimu Robots are smaller than the ones for LEGO MINDSTORMS, and they also have a distinct way that they need to be oriented, which I will explain in later chapters. These motors require a wired connection to the MC Box to function, and a switch is required to be connected for the MC Box to work.

# Introduction to Jimu Robots: The Pieces

Jimu Robots always come in a complete set, which has boxes classified by several terms, including character parts, connectors, fasteners, Servos, and more.

## Character Parts

“Character Parts” is a pretty vague term, but it describes a lot of interesting pieces that apparently have a lot of character, hence the name. It includes some parts that I will classify as beams, wings, flats, axles, rubber pieces, not to mention some gears/wheels.

## Beams

These are essentially girder-like pieces, with holes made for fasteners, which I will describe later in this chapter. There are a lot of great uses for these, and the basic beams come either straight or at certain angles. Most of the Jimu Robots include some kind of variation of the following, as seen in Figure 1-1.

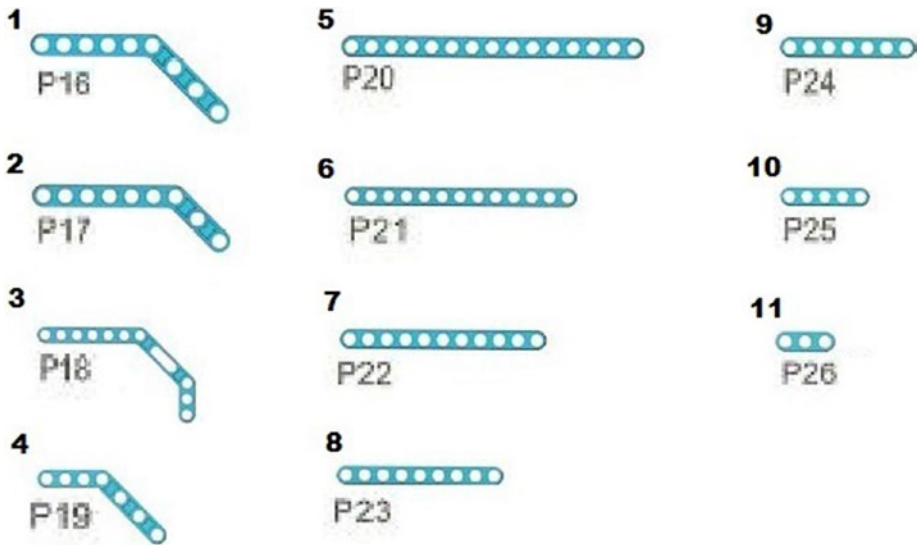


Figure 1-1. The beam pieces from Jimu Robots

1. The P16 is a  $4 \times 6$  beam that is bent at an angle.
2. The P17 is a  $3 \times 7$  piece at the same angle.
3. The P18 has two angles, but is essentially a 90-degree turn with 7 holes on one leg and 3 on the other.
4. The P19 is another angle piece at the same angle but is  $4 \times 4$  with a shared hole on the corner.
5. The P20 is a straight beam with 15 holes.
6. The P21 has 13 holes.
7. The P22 has 11 holes.
8. The P23 has 9 holes.
9. The P24 has 7 holes.
10. The P25 has 5 holes.
11. The P26 has 3 holes.

Those are just the straight and oddly-angled pieces of beams, but there are some that come in even greater variety, as seen in Figure 1-2.

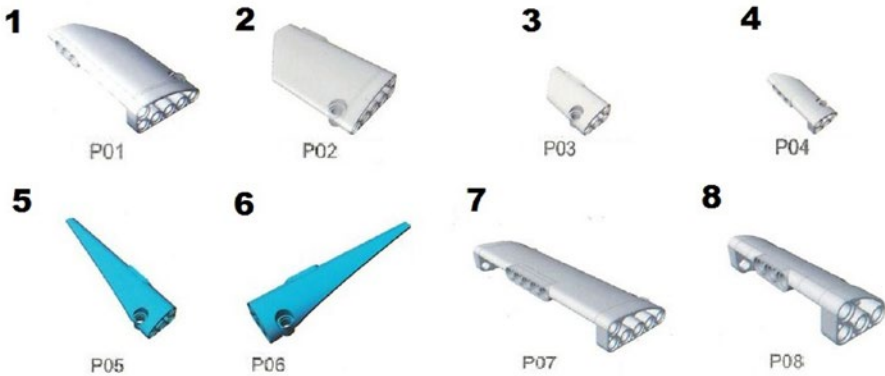


**Figure 1-2.** Other variations of beams

1. The P37 is a  $3 \times 3$  beam in a T shape.
2. The P38 is a  $4 \times 2$  beam at a right angle.
3. The P67 is a  $3 \times 3$  square.
4. This is a  $3 \times 5$  part that has a curve joining it. In the corners are holes with a “plus” shape, which I will describe when we get to the section about axles.

## Wings

These pieces I call wings because they are often flat in their construction with a shape that looks like it could work as a wing. There are samples of this in Figure 1-3.

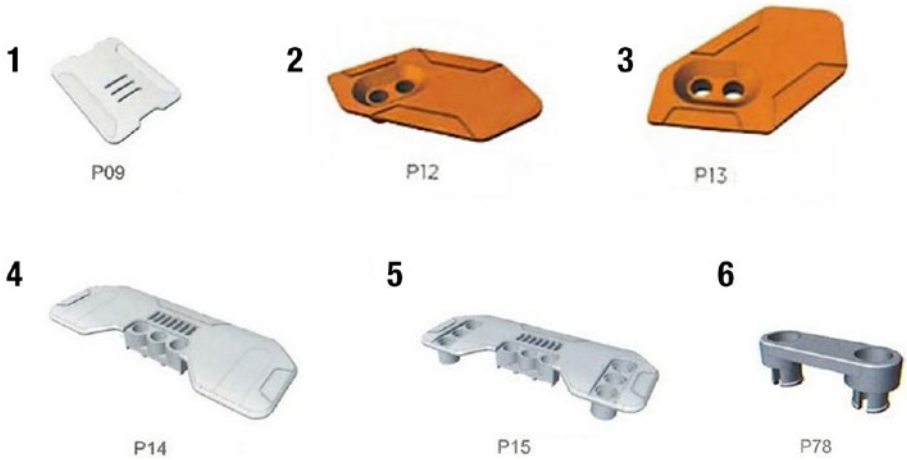


**Figure 1-3.** Variations of wing pieces

1. The P01 is an interesting wing piece with  $5 \times 1$  on one formation, 3 holes on the side, and one on top. This one would be made for the left side as it has an “L” marking on the inside.
2. The P02 is another wing that is a mirror image of the PO1, and would look good on the right side of a plane. Like the P01, there is a marking for right with an “R.”
3. The P03 is a smaller version of the PO1 but with a  $1 \times 3$  in the corner, 3 holes on the side, and one hole on top. It has a marking of an “L” on it.
4. The P04 is the mirror image of the PO3, and it has the “R” on it.
5. The P05 is a thinner wing piece that looks like it is a small 747 wing. It has the  $1 \times 3$  on the corner, 3 holes on the side, and one on top, not to mention the “L” marking.
6. By now, you have noticed a pattern and seen that the P06 is a mirror image of the PO5, but with an “R” on it.
7. The P07 is a flat and rectangular piece with  $1 \times 5$  holes on each corner, 5 holes on the back, and two on each side on top. It is about 15 holes wide, and doesn’t have the “L” or “R” designation.
8. The P08 is another flat and rectangular piece with  $1 \times 3$  holes on each corner, 3 holes on the back, and two on each side on top. It is about 9 holes wide and also gets rid of the “L” and “R” designation.

## Flat

Jimu Robots have a subgroup of character parts I call flat, because they are, for the most part, flat. Some of them are made to hold fasteners, and some made for the sliders. Here are some samples of them in Figure 1-4.

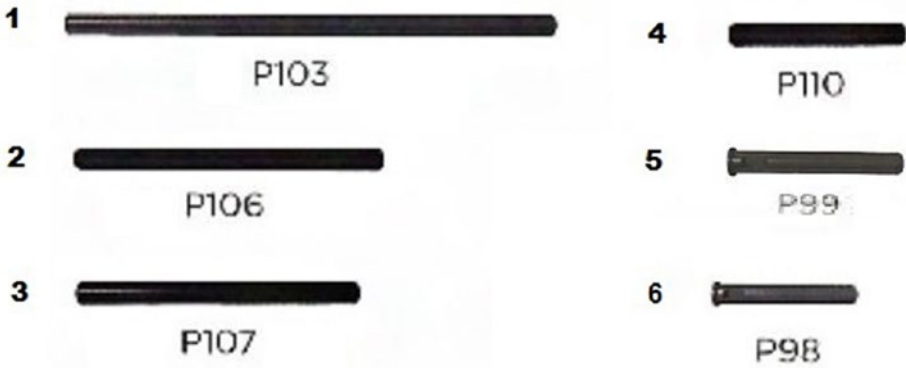


**Figure 1-4.** Variations of flat pieces

1. The P09 is a rectangular flat piece that can slide into place. It is very handy for holding a wire in place for a Servo.
2. The P12 is an interesting diagonal shape of a piece that has two holes in the corner, and has an "L" engraved on it.
3. The P13 is made to be a mirror image of the P12, with the "R" engraving.
4. The P14 is a long, flat piece with small vent-like lines in the center and three holes on the bottom.
5. The P15 has a similar shape of the P14, and it has three holes on the left and right sides.
6. The P78 is a flat strip with two fasteners, and can be used to hold a wire in place.

## Axles

The axles are essentially pieces that are plus shaped on the side, but they are perfect for locking something into place. Here’s a sample of a few in Figure 1-5.



**Figure 1-5.** Samples of axles

1. The P103 is an axle that is about 15 holes long, meaning it is about as long as the P20 beam.
2. The P106 is about 9 holes long, as long as the P23 beam.
3. The P107 is about eight holes long.
4. The P110 is about 5 holes long, as long as the P25 beam.
5. The P99 is also about 5 holes long, but it has a “stopper” on the end that will keep it from sliding forward any more in one direction.
6. The P98 is about 3 holes long, and it also has a “stopper.”



## Cross Blocks

These particular pieces are unique because they have holes on one side and then others at 90 degrees. They are useful for all kinds of constructions, as one can always use a good turn in a construction. Figure 1-6 has some good examples of them.



**Figure 1-6.** Various cross blocks of parts

1. The P34 is essentially a beam that is four holes long, but two of them on one side are 90 degrees from each other.
2. The P35 is a  $3 \times 4$  beam but the holes are on the other sides 90 degrees with  $2 \times 3$  formation.
3. The P36 is a 3 hole beam with a hole on the top at ninety degrees.
4. The P68 is essentially a  $3 \times 3$  piece like the P67, but this has one center hole on top, then a hole in each corner.
5. The P46 has an axle hole, and then a through hole at 90 degrees.
6. The P89 is a piece with a through hole in the middle, and then two axle holes at an angle.
7. The P97 has a spot to pass through an axle, and an axle hole 90 degrees from that.

8. The P69 has two through holes with a half of one on the other side, creating a terrific effect when linked together.
9. The P70 is a  $5 \times 7$  rectangular piece with 3 holes on one side, and then four holes on the ninety degrees.
10. This is another version of the P70 that appears in some Jimu Robots kits, with the only difference being the two beams in the center.
11. This is a  $5 \times 11$  piece with five through holes on two sides, and seven centered on the other. There are through holes on the top and bottom.

## Rubber Pieces

The rubber pieces are parts that add character to your robot. They are often used as hands and feet, but can also be used to absorb shock and create traction. Here are some variations of them in Figure 1-7.

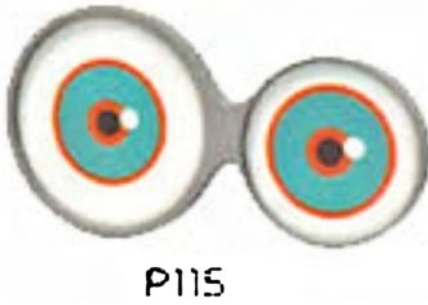


**Figure 1-7.** Rubberized pieces from UBTECH

1. The P27 is a claw that has two holes on the end and another hole 90 degrees of them in the center.
2. The P28 is a claw that has two holes on the end.
3. P78 is a  $5 \times 5$  rubberized plate, which is good for projects that make contact with the floor.

## The Eyes

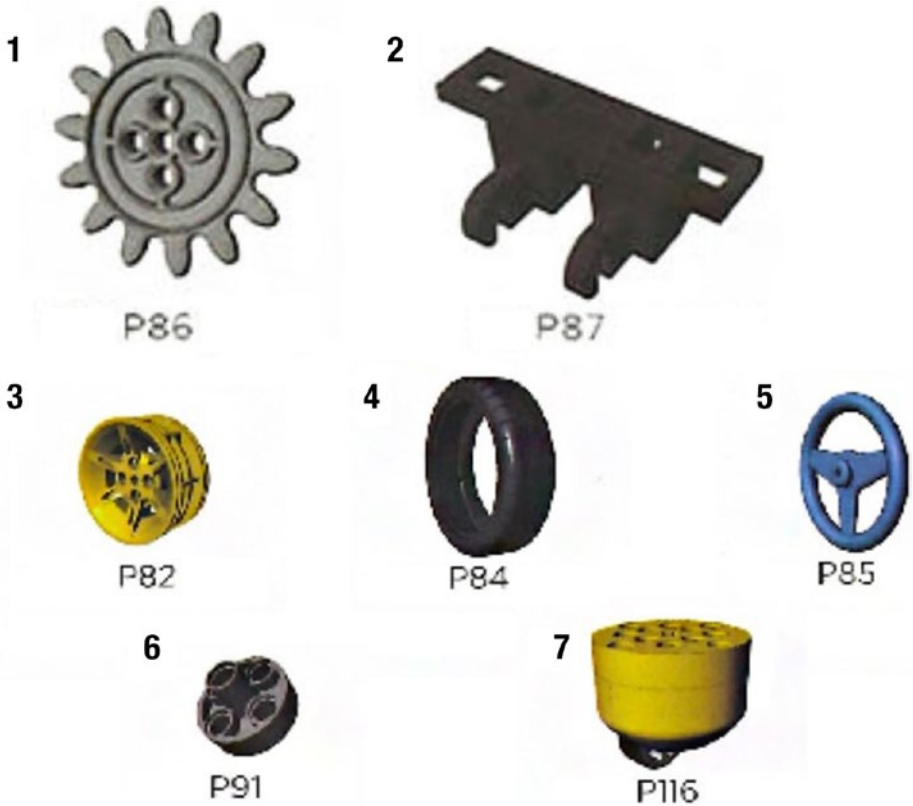
This set of eyes came with the character parts in the Tankbot set (see sets later in this chapter). They serve as a decoration piece that connects via fastener holes on the back. This piece adds a lot of character to your robot. Decoration pieces vary per set. Figure 1-8 displays the eyes that come in the Tankbot set.



*Figure 1-8. Character part eyes from Tankbot set*

## Gears and Wheels

Here are some gears and wheels that are made to spin. I'll talk about them in greater detail when we get to the vehicles chapter, but here is a sample of them in Figure 1-9.



*Figure 1-9. Samples of gears and wheels in Jimu Robots*

1. The P86 is made to interlock with another gear, and it can also be used for the tank treads.
2. The P87 connects together to form a tank tread, and is made to work with the P86.
3. P82 is essentially a rim for a tire.
4. P84 is a rubber tire that mounts on the P82.
5. The P85 is a steering wheel.
6. The P91 is a handy piece that is a perfect piece for a wheel.
7. The P116 is a thing that you can mount on a vehicle that allows for very efficient turning.

## Fasteners

The holes in the beams and other parts are made for beams and more, such as these fasteners, which come in many different colors. Here are some samples in Figure 1-10.



**Figure 1-10.** Samples of the fasteners for Jimu Robots

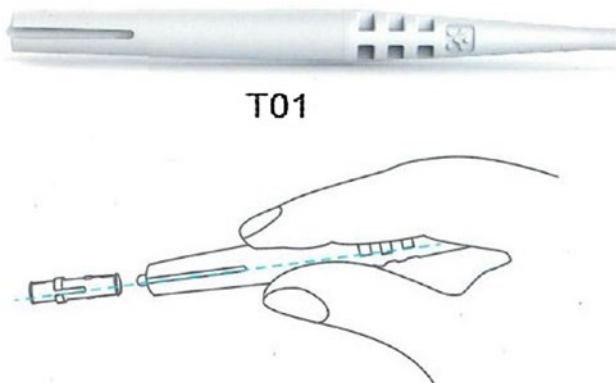
1. The P47 is a connector that can go through three beams. It has a ring through 1/3 of it that blocks it from going in any further.
2. The P48 is a connector peg that can latch two beams together.
3. The P49 is half a connector peg that can fit through half a beam.

4. The P50 is half a connector peg that can also fit through half a beam, but it is different because the other half of it is slightly bigger to hold a P51.
5. The P51 is a circular hole that can fit on a P50.
6. The P53 has a piece with both an axle and a connector peg.
7. The P54 has a ball on one end and it is usually only used on the MC Box, which I will talk about later.

## Disassembly Tool

This piece can be found in the same container as character parts; however, its function serves you beyond that. There is only one of these included in each set, but trust me, it is worth it to have it.

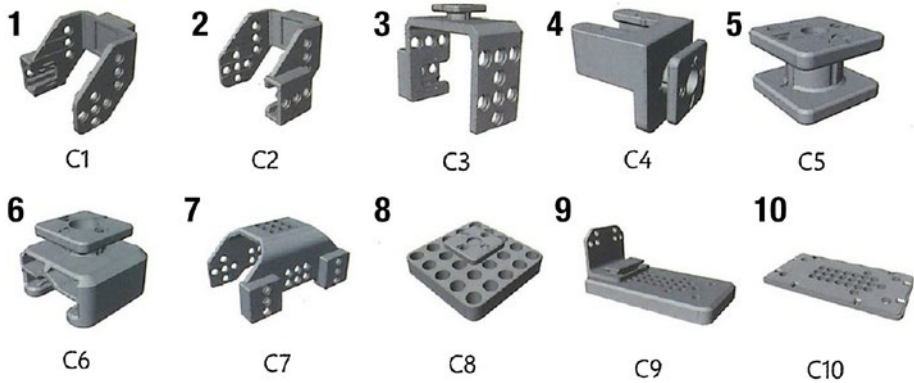
Not only is the thing able to push through fastener pegs to knock them out with the pointed end, but you can also use the other end to grab troublesome fasteners. All you need to do is put the other end on a fastener, grip with your fingers, and give a good pull. See a sample of how in Figure 1-11.



**Figure 1-11.** *The Disassembly Tool and how to use it*

## Connectors

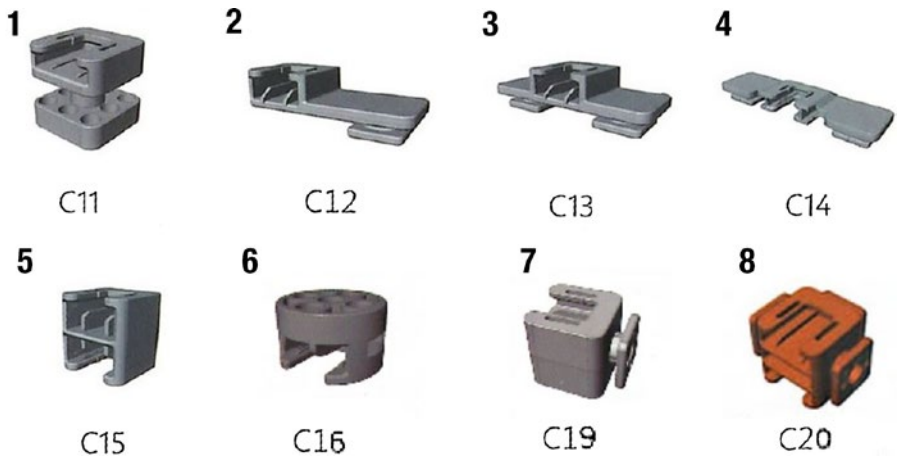
Connectors are the “joints” of your robot, as many of them come in handy when it comes to installing the Servos of your creation. Unlike the character parts, they slide and snap into each other, but some are compatible with the fasteners. Figure 1-12 has some samples of them, and you can see that there are both male and female versions of the sliders.



**Figure 1-12.** Some samples of connectors for the Jimu Robots

1. The C1 is a piece that is often used as a joint on a leg or arm and made to connect well to a Servo. It has an “L” listed on it, which I will assume means that something is on the left side.
2. The C2 is a mirror image of the C1, and it has an “R” on it.
3. Like the C1 and C2, the C3 is a good place for a Servo. Unlike the C1 and C2, this doesn’t have any kind of “L” or “R” on it because there is no mirror image piece.
4. The C4 is a great sliding piece, as it has a female sliding end and then has the male portion immediately 90 degrees from it.
5. C5 is essentially a double-ended male slider.
6. The C6 has a female slider on one side and a male slider on the other.
7. The C7 is a large piece that has the female sliders ready on one side, and ready to hold two Servos.
8. The C8 is essentially a 5 × 5 area with a male slider on top.
9. The C9 is a very flat piece that looks like a foot with a large flat area on it, and has a spot for two male sliders together.
10. The C10 is a very flat piece and fits very well in the C9.

There are other types of connectors as well, and you may notice that some of them have holes that can hold fasteners, which can then join with beams. There is a sample in Figure 1-13.



**Figure 1-13.** Several different types of connectors

1. The C11 is a female slider with a  $3 \times 3$  piece on the other side.
2. The C12 is an asymmetrical piece that is flat with a female slider on one end and then flipped and male on the other.
3. The C13 is three squares with a female slider in the middle on one side, then two males on the opposite side at each end.
4. The C14 serves the same functions as C13, but the male sliders have more space in between them so the female slider is accessible from either side.
5. The C15 has a female connector on each side.
6. The C16 is a circular shaped piece made to work well with wheels.
7. The C19 is like a C15 but with an additional male slider 90 degrees from the female sliders.
8. The C20 is like a C15 but with male sliders on each side.

## Main Control Box

The Main Control Box is a box with sliders and holes on all sides, and holds the battery and controller for the kit. You can see what it looks like in Figure 1-14.

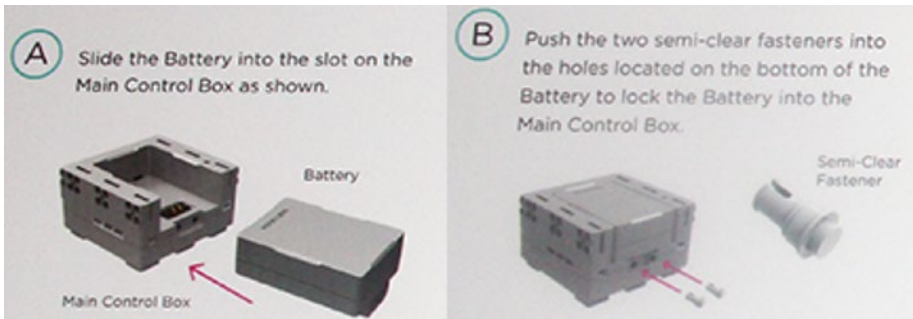


**Figure 1-14.** The Main Control Box

You will note that the number of through holes on each side, as well as the ports. The ports labeled 1-3 and 4-5 on each side are made for the wires for the Servo motors and the Sensor, which have three pins. As for Port 6, it has four pins and is currently idle, but could be used for other types of Sensors in the future.

Port 7 is made for the Switch, and it has only two pins. Port 8 is currently idle and should not be used, with the Switch wire (W4), as the size of the hole is different.

As for charging the battery, your MC should come with a charging cord that connects on the side and plugs into the wall. Switching out the battery is pretty simple, as shown in Figure 1-15. Simply detach the fasteners in the two through holes, and you will be good.



**Figure 1-15.** How to install the battery in the Main Control Box