Building Small Robots: Making One Cubic Inch Micro-Sumo Robots and Smaller

by **mikey77** on June 12, 2008

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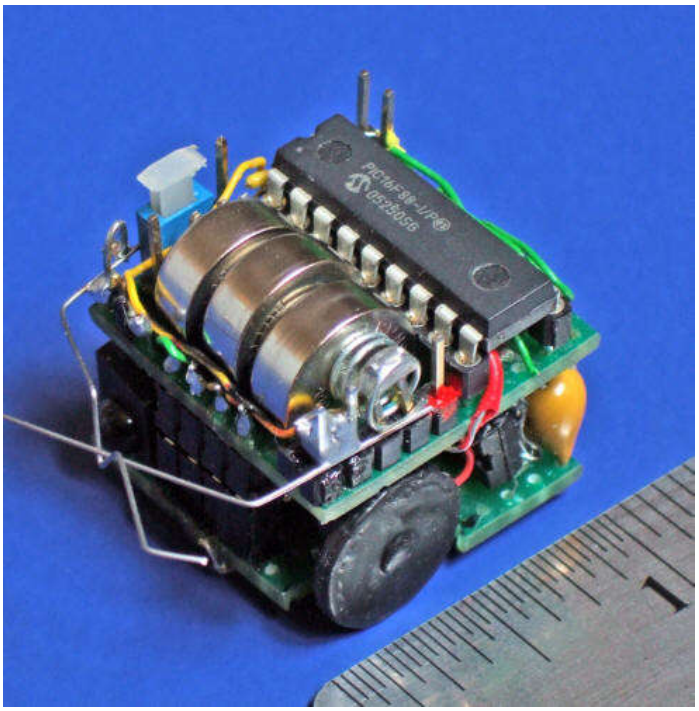
intro: Building Small Robots: Making One Cubic Inch Micro-Sumo Robots and Smaller

Here are some details on building tiny robots and circuits. This instructable will also cover some basic tips and techniques that are useful in building robots of any size.

For me, one of the great challenges in electronics is to see just how small a robot I can make. The beautiful thing about electronics is that the components just keep getting smaller and cheaper and more efficient at an incredibly fast pace. Imagine if automobile technology were like that. Unfortunately, mechanical systems at this time, are not advancing nearly as fast as electronics.

This leads to one of the main difficulties in building very small robots: trying to fit in a small space, the mechanical system that moves the robot. The mechanical system and batteries tend to take up most of the volume of a really small robot.

pic1 shows Mr. Cube R-16, a one cubic inch micro-sumo robot that is capable of reacting to its environment with music wire whiskers (bumper switch). It can move and explore the perimeter of a small box. It can be remote controlled using a universal TV infrared remote control that is set up for a Sony TV. It can also have its Picaxe microcontroller preprogammed with reaction patterns. Details begin on step 1.



step 1: Components of a One Cubic Inch Robot

Mr cube R-16, is the sixteenth robot that I have built. It is a one cubic inch robot that measures 1"x1"x1". It is capable of autonomous programmable behavior or it can be remote controlled. It is not meant to be anything that is very practical or particularly useful. It is merely a prototype and proof of concept. It is, however, useful in the sense that building a tiny robot allows you to hone your miniaturization skills for robots and other small circuits.

Building Small Robots and Circuits
Keep in mind that building as small as possible means that it may take twice as long as it would normally take to build the same circuit in a larger space. All kinds of clamps are needed to hold the small components and wires in place while soldering or gluing. A bright work light and a good magnifying headset or a fixed magnifying glass are a must.

Small Motors
It turns out that one of the biggest obstacles to making really tiny robots is the gear motor that is required. The control electronics (microcontrollers) just keep getting smaller. However, finding low rpm gear motors that are small enough is not so easy.

Mr. Cube uses tiny pager gear motors that are geared at a 25:1 ratio. At that gearing, the robot is faster than I would like and a little twitchy. To fit the space, the motors had to be offset with one wheel more forward than the other. Even with that, it moves forward, backward, and turns fine. The motors were wired on to the perfboard with 24 gauge wire that was soldered and then glued with contact cement. At the rear of the robot a 4-40 sized nylon bolt was screwed into a tapped hole underneath the bottom circuit board. This smooth plastic bolt head acts as a caster to balance the robot. You can see it in the lower right of pic 4. This gives a wheel clearance at the bottom of the robot of about 1/32".

To mount the wheels, the 3/16" plastic pulleys mounted on the motors were powered up and then, while spinning, were sanded to the right diameter. They were then inserted into a hole in a metal washer that fit inside of a nylon washer and everything was epoxied together. The wheel was then coated with two coats of Liquid Tape rubber to give it traction.

Small Batteries
Another problem with the smallest robots is finding small batteries that will last. The gear motors used require fairly high currents (90-115ma) to operate. This results in a small robot that eats batteries for breakfast. The best I could find at the time, were 3-LM44 lithium button cell batteries. The battery life in very small robots of this type, is so short, (a few minutes) that they usually cannot do anything close to practical.

There was only room for three 1.5v batteries, so they ended up powering both the motors and the Picaxe controller. Because of electrical noise which small DC motors can create, one power supply for everything, is usually not a good idea. But so far it is working fine.

The space in this one inch robot was so tight that the thickness of the 28 gauge wire insulation (from ribbon cable) turned out to be a problem. I could barely put the two halves of the robot together. I estimate that about 85% of the volume of the robot is filled with components.

The robot was so small that even an on-off switch was problematic. Eventually, I might replace the crude whiskers with infrared sensors. I have literally run out of easy to use space, so fitting anything more, without resorting to surface mount technology, would be an interesting challenge.

I like to use clamshell construction for really small robots. See Pic 2. This consists of two halves that hook together with .1" strip headers and sockets. This gives easy access to all the components, making it easier to debug the circuits or make changes.

Pic 3 shows the location of some of the major components.

MATERIALS

2 GM15 Gear Motors- 25:1 6mm Planetary Gear Pager Motor: http://www.solarbotics.com/motors_accessories/4/

18x Picaxe microcontroller available from: http://www.hvwtech.com/products_list.asp?CatID=90&SubCatID=249&SubSubCatID=250

L293 motor controller DIP IC: http://www.mouser.com

Panasonic PNA4602M infrared detector: http://www.mouser.com

30 AWG Beldsol heat strippable (solderable) magnet wire: http://www.mouser.com

3 LM44 1.5V. Lithium button cell batteries: http://www.mouser.com

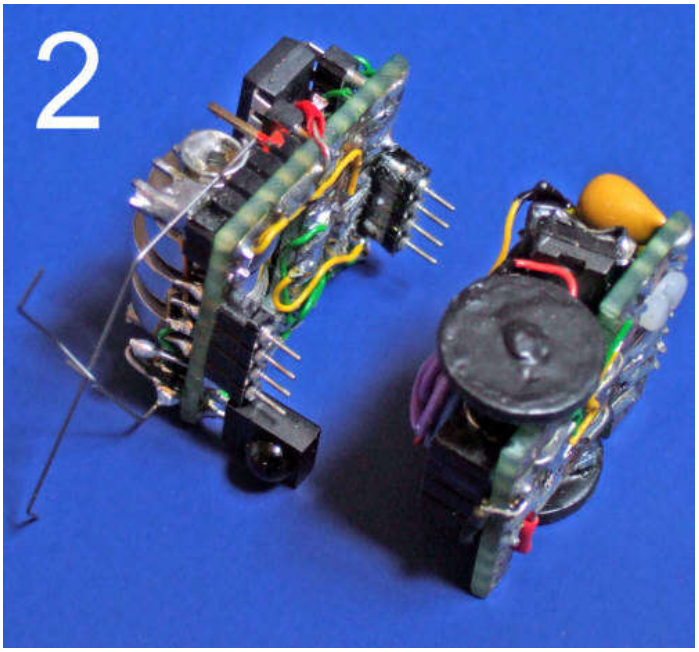
Small blue on-off switch: http://www.jameco.com

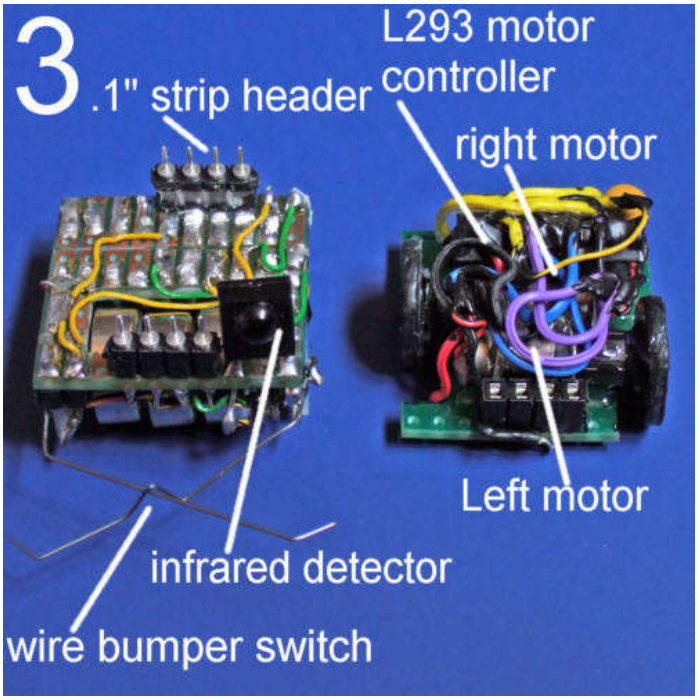
Thin solder- .015" rosin core solder: http://www.mouser.com

Resistors and a 150 uf tantalum capacitor

.1" fiberglass copper traced perfboard from: http://www.allelectronics.com/cgi-bin/item/ECS-4/455/SOLDERABLE_PERF_BOARD,_LINE_PATTERN_.html

Performix (tm) liquid tape, black-Available at Wal-Mart or http://www.thetapeworks.com/liquid-tape.htm





step 2: Circuit of a One Cubic Inch Robot

Pic 4 shows the location of the 18x Picaxe microcontroller and the L293 motor controller which are the main circuits of the robot. At the time of construction, I could not obtain the surface mount versions of the Picaxe or the L293. Using the surface mount ICs would certainly leave more room for additional circuits and sensors.

18x Picaxe Microcontoller
Picaxe microcontrollers are still my favorite controllers to use on experimental robots. While they have less memory and are not as fast as PicMicros, Arduino, Basic Stamp, or other microcontrollers, they are fast enough for most small experimental robots. Several of them can be easily connected together when more speed or memory is needed.

They are also very forgiving. I have directly soldered them, shorted them and overloaded their outputs and I have yet to burn one out. Because they can be programmed in the BASIC programming language, they are also easier to program than most microcontrollers. If you want to build really small, the 08M and 18x Picaxe controllers are available in surface mount form (SOIC-Small Outline Integrated Circuits).

To see some of the projects you can do with Picaxe microcontrollers you can take a look at:
http://www.inklesspress.com/picaxe_projects.htm

L293 Motor Controller
The L293 motor controller is an excellent way to control two motors in any small robot. Four output pins from the microcontroller can control the power to two motors: forward, reverse, or off. The power to the motors can even be pulsed (PWM-pulse width modulation) to control their speed.

Dead Bug Style

There was not room on the perfboards to mount the L293 controller so it was installed using the dead bug technique. This simply means that the IC is turned upside down and thin wires soldered directly to the pins which have been bent or clipped short. It can then be glued onto a circuit board or fitted into any available space.

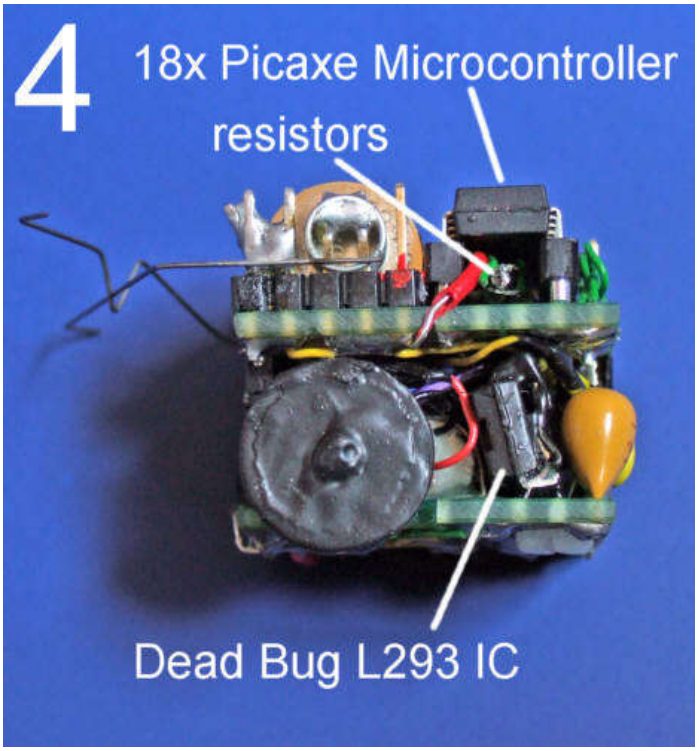
In this case, after the L293 was soldered and tested, I coated it with two coats of the ever handy Liquid Tape rubber to insure that nothing shorted out when it was crammed into the available space. Clear contact cement could also be used.

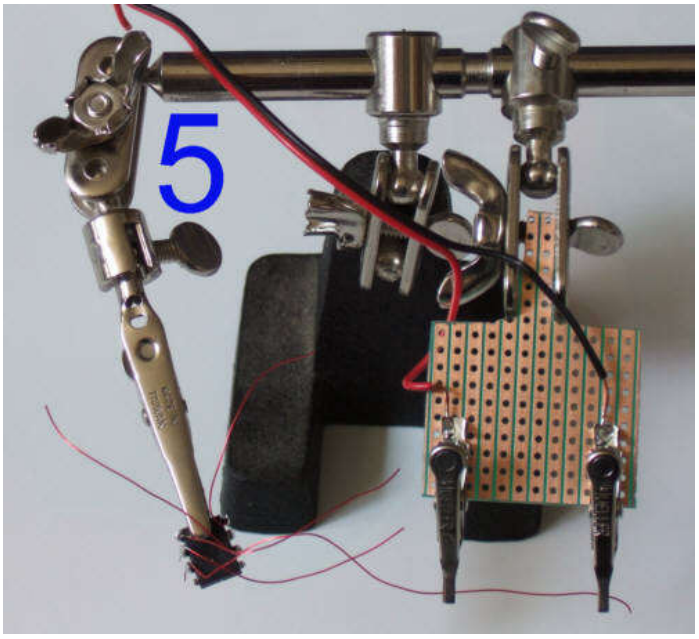
For a very good example of building circuits using the dead bug style, see here: http://www.bigmech.com/misc/smallcircuit/

Pic 5 shows a helping hands solder jig I have modified by adding small alligator clips to a perfboard to aid in soldering small wires to ICs in the dead bug style.

Pic 6 shows the schematic for the Mr. Cube robot.

You can see a video of Mr. Cube doing a short programmed sequence by clicking on the inch-robot-sm.wmv link below.
It shows the robot at about 30% of top speed which has been reduced using pulse width modulation on the motors.





step 3: Robot Building Tips and Tricks

After building 18 robots, here are some of the things I have learned the hard way.

Separate Power Supplies
If you have the space, you will save yourself a lot of trouble if you use separate power supplies for the microcontroller and its circuits and the motors. The fluctuating voltage and electrical noise that the motors produce can wreak havoc with the microcontroller and sensor inputs to produce very inconsistent responses in your robot.

Trouble Shooting
I find it best to first build the complete circuit of the robot on a breadboard. Components rarely fail or are defective. If your design is valid, and the circuit does not work, it is almost always a mistake in your wiring. For information on how to do fast circuit prototyping, see here: http://www.inklesspress.com/fast_circuits.htm

I then mount all the motors and sensors on the robot body and program the microcontroller to control them. Only after everything is working well, do I try and make a permanent soldered version of the circuit. I then test this while it is still separate from the robot body. If that works, I then mount it permanently onto the robot. If it stops working, it is often the fault of noise problems.

Noise Problems
One of the biggest problems I have encountered is electrical noise that renders a circuit useless. This is often caused by the electrical or magnetic noise that can emanate from DC motors. This noise can overwhelm the sensor inputs and even the microcontroller. To solve this, you can make sure the motors and the wires to them, are not close to any input lines going to your microcontroller.

Pic 7 shows Sparky, R-12, a robot I made that uses a basic Stamp 2 as the microcontroller. I first tested it with the main circuit board away from the robot and after doing the basic programming, everything worked fine. When I mounted it right above the motors, it went crazy and was totally inconsistent. I tried adding a grounded copper clad board between the motors and circuit but that made no difference. I eventually had to physically raise the circuit 3/4" (see blue arrows) before the robot would work again.

Another common source of devastating noise in small robots can be pulsating signals. If you send PWM signals to servos or motors, the wires can act like antennas and send signals that can confuse your input lines. To avoid this, keep microcontroller input and output wires separated as much as possible. Also keep wires carrying power to motors away from input lines.

Magnet Wire
The problem of wire thickness in very small circuits can be solved by using 30-36 gauge magnet wire. I've used 36 gauge wire for some projects, but found it so wispy, it was hard to strip and use. A good compromise is 30 gauge magnet wire. Regular magnet wire can be used, but I prefer the heat strippable magnet wire. This wire has a coating that can be stripped by merely soldering it with enough heat to melt the insulation. It takes up to 10 seconds to strip the coating while soldering. For some delicate

components such as soldering to LEDs or ICs, this can be a damaging heat.

The best compromise for me, is to use this heat strippable magnet wire, but strip it somewhat first. I first take a sharp knife and slide it across the magnet wire to peal off the coating and then rotate the wire around until it is stripped fairly well around its diameter. Then I solder the stripped wire end until it is well tinned. Then, you can solder it quickly to any delicate component with less chance of heat damage.

Thin Solder
When components are very close together, it can be difficult to solder them without blobbing over and shorting nearby pads and wires. The best solution is to use a small tipped adjustable heat soldering iron (1/32") and the thinnest solder you can find. Standard solder is usually .032" in diameter which works fine for most things. Using thinner .015" diameter solder allows you to easily control the amount of solder on the joint. If you use the least amount of solder necessary, it not only takes up the smallest volume, but it also allows you to solder a joint as quickly as possible. This reduces the chance of overheating and damaging delicate components like ICs and surface mount LEDs.

Surface Mount Components
Surface mount components are the ultimate in miniaturization. To use SOIC sized ICs I usually use thin solder and magnet wire. To see a fairly easy way to make SOIC breakout boards or circuits see here: http://www.inklesspress.com/robot_surface_mount.htm

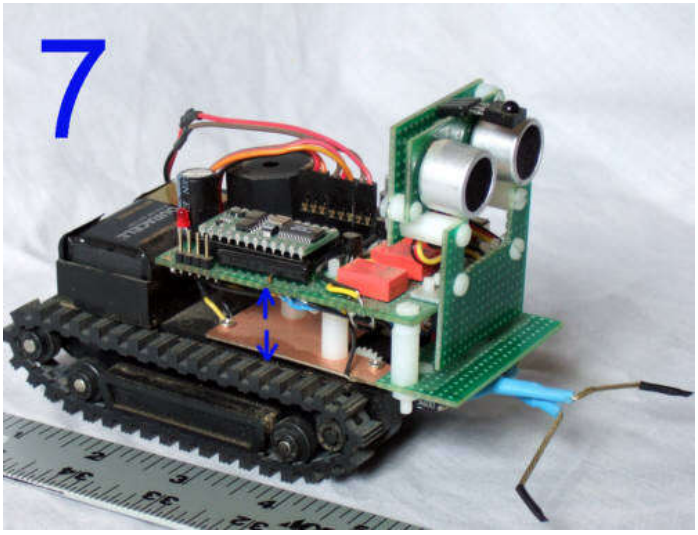
Gluing on Components Instead of Soldering
Some surface mount components can also be directly glued onto circuit boards. You can make your own conductive glue and use it to glue on LEDs and ICs. See: http://www.instructables.com/id/Make-Conductive-Glue-and-Glue-a-Circuit/

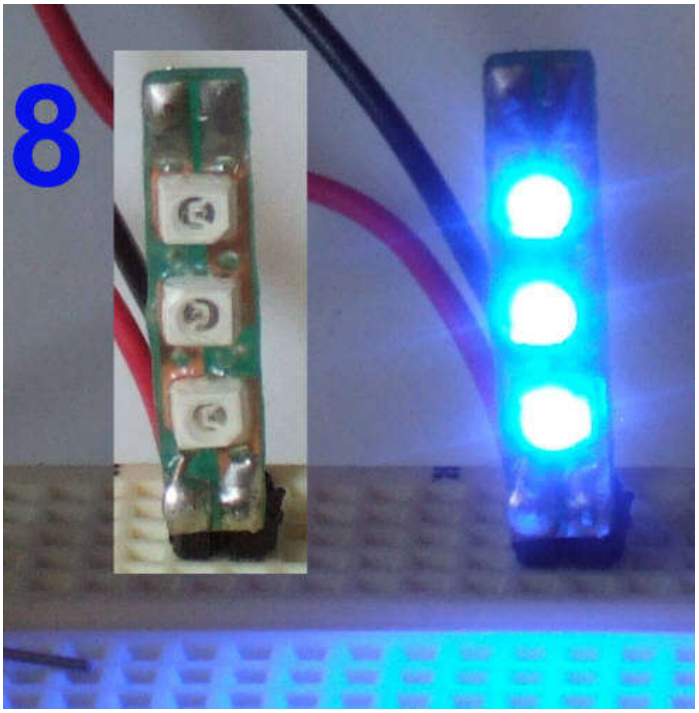
While this works, it can be somewhat difficult because capillary action tends to wick the conductive glue under the surface mount LEDs and other components and short them.

Gluing On Components Using Non-Conductive Glue
I have been recently experimenting with gluing on components onto copper circuits boards and conductive fabrics using glue that does not conduct.

See Pic 8 for a picture of a 12 volt light bar (unlit and lit) using surface mount LEDs that were glued on with non-conductive glue. I discovered that if you put a thin film of clear nail polish on the copper traces and then physically clamp on the LED and let it dry for 24 hours, you will be left with a good mechanical joint that is electrically conductive. The nail polish glue effectively shrinks and clamps the led contacts to the copper traces forming a good mechanical connection. It must be clamped for the full 24 hours. After that, you can test it for conductivity. If it lights up, you can then add the second layer of glue. For the second layer I use a clear contact cement such as Welders or Goop. This thicker glue surrounds the components and also shrinks as it dries to securely insure a good solid connection to the copper traces. Wait 24 hours for it to dry before testing again.

Being dubious about how long it would last, I left the blue LED light bar in Pic 8 on for seven days and nights. The resistance of the circuit actually decreased over time. Months later, the bar still fully lights with no evidence of increased resistance. Using this method, I have successfully glued very small surface mount LEDs--0805-- size and larger onto copper clad perfboard. This technique shows some promise in making really small circuits, LED displays and robots.





step 4: Breaking The Rules

To make really tiny robots, you may have to break many of the rules mentioned above. To make Mr. Cube I broke the following rules:

1- I used a single power supply instead of one for the motors and one for the microcontroller.

2- I mounted the Picaxe microcontroller very close to a motor.

3- I used batteries that are rated for low current draw and ran them at much higher currents than they were designed for. This severely limits the life of the batteries.

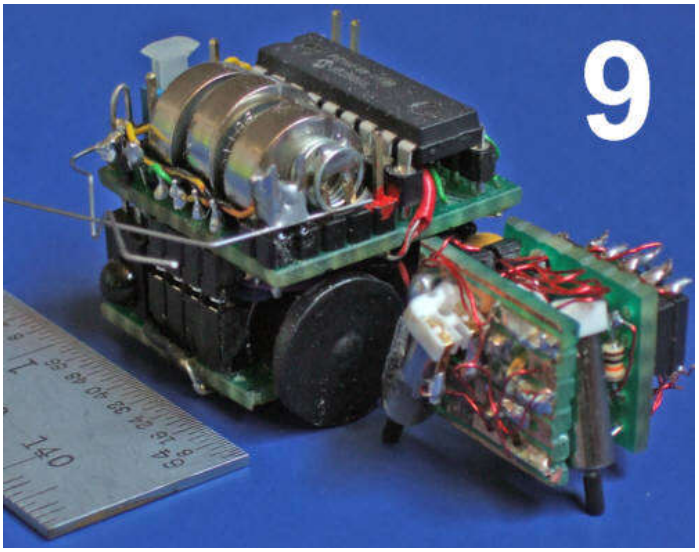
4- I crammed all the wires together in a hodgepodge which can create crosstalk and electrical noise problems. I was simply lucky that it did not.

5- I hardwired the circuit onto the robot without breadboarding it first. This can make debugging the circuit very difficult.

You can download the Picaxe programming code for Mr. Cube at: http://www.inklesspress.com/mr-cube.txt

If you are interested in seeing some of the other robots I have built, you can go to: http://www.inklesspress.com/robots.htm

Pic 9 shows Mr. Cube and Mr. Cube two, R-18, a 1/3 cubic inch robot that I have started to build. Details on step 5.



step 5: Mr. Cube Two: Making a 1/3 Cubic Inch Robot

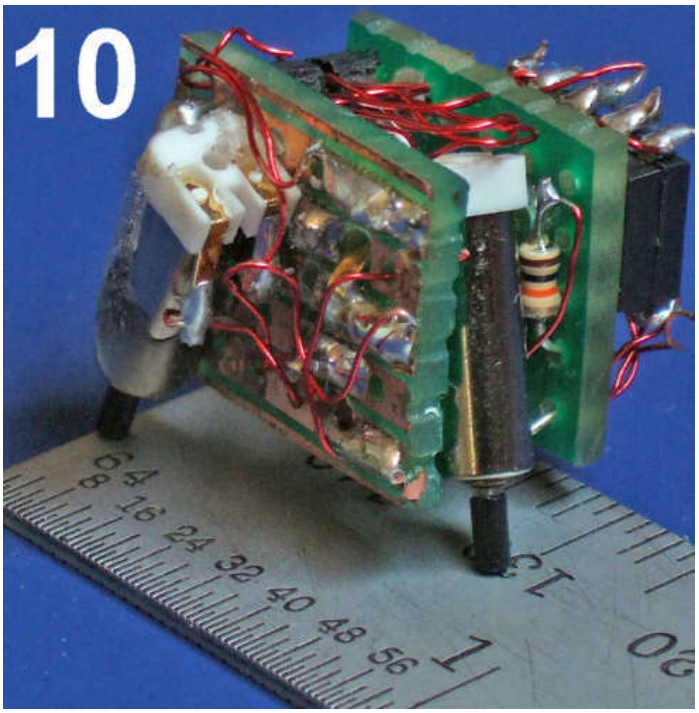
After making a one cubic inch robot that worked, I had to try something smaller. I am aiming for a robot around 1/3 cubic inch. At this point, Mr. Cube Two is about .56"x .58" x.72". It has a 08 Picaxe microcontroller that will allow it to move autonomously. Pic 10 shows the robot on a ruler. Pic 11 shows the other side of the robot on a quarter. The two batteries are cr1220 3volt lithium batteries and it remains to be seen if they will have enough capacity to power the Picaxe and the motors. More batteries may be needed.

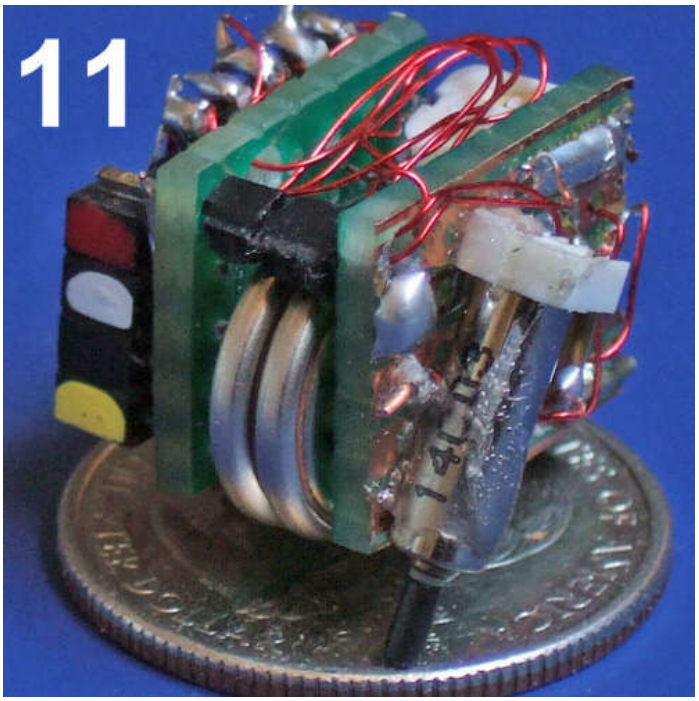
It is a work in progress. So far the two pager motors work fine to move and turn the robot on smooth surfaces. The Picaxe microcontroller is installed and has been programmed and tested. Still to be added are the SOIC L293 motor controller and the infrared reflector sensor.

When finished, this will be one of the smallest autonomous robots around with sensors and a microcontroller. While this is a tiny robot, are there smaller amateur robots that are programmable? Yes indeed. See:

1cc Robot: http://diwww.epfl.ch/lami/mirobots/smoovy.html

Pico Robot: http://poor-robot.com/pico/





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Conductive Glue And Conductive Thread: Make an LED Display and Fabric Circuit That Rolls Up. by mikey77

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Comments

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Kopolis777 says: Jun 13, 2008. 10:15 AM REPLY
Wait, if they made solar panels small enough could you use those instead of batteries?

rak says: Jun 13, 2008. 6:00 PM REPLY
just look at the input-output ratio
the output should be 4.5 volts

darkmuskrat says: Jun 13, 2008. 9:44 PM REPLY
To Kopolis777, solar panels may be enough to power it, but any size small enough to fit on the mini-robot wouldn't (most likely) be enough to power it...
(Maybe it could recharge the batteries however....)

pyreoutof says: Jul 3, 2008. 3:49 AM REPLY
nah...that prob wouldnt work. 1-there are no rechargable batteries that small and 2-if u use regular batteries, they might ezplode. Now maybe someone could customly create a rachargeable battery that small...i would like to see that as an ible though...an electrical transformer could be used, but that problably wouldnt work

DIY-Guy says: Jan 7, 2009. 12:14 AM REPLY
I've got an MP3 player, recorder, FM radio, 1GB memory storage device that is packed inside a one cubic inch package. It used a Lithium Polymer battery that is very thin and flat. Maybe one of these rechargeable batteries would do the job?

http://kokam.com/english/product/battery_main.html

Hope there's something usefull at that site for you guys.
Sincerely,
DIY-Guy

rak says: Jan 7, 2009. 5:44 AM REPLY
there might be another way -- if these robots dont use up batteries that quick:

get a 1 farad 5.5. volt supercap like in the usb torch,

and maybe theres something that does the opposite of the coils made in the joule thief instructable to slowly let out the voltage (not a resistor)

acer73 says: Jul 7, 2008. 10:00 PM REPLY
You could use a Capacitor though, one with a high farad rating.

[ReinventingYourExit] says: Jul 4, 2008. 2:51 AM REPLY
I politely disagree with you:] There are rechargeable batteries that small. See? And if you have the right connections and/or cash...

rak says: Aug 26, 2008. 7:26 AM REPLY
thats cheap
is shipping expensive?

bikerbob2005 says: Jun 20, 2008. 7:20 AM REPLY
just a quick math ref
the sun perovides 60 watts per sq ft (this is the rule of thumb) so 1sq in is .4166 watts at 100% a cell at 60% effc would yeald .25 watts at 4.5 vdc that is .055 amps,roughly it wont jump a 2 ohm gap .
Quote "you failed to take into account i suck at math"

rak says: Aug 26, 2008. 7:13 AM REPLY
so what does that mean?

rbhavanirao says: Dec 25, 2008. 3:35 AM **REPLY**

Dear Sir,

You're invention can be modified so that can be utilized in surgery
I am Dr.R.Bhavani Rao from India. I'm a surgeon of nineteen years surgical experience. I have seen the small robot you have developed. With some modifications this can be very useful for looking inside the human body. With some more modifications the small robot or a swarm of robots can be utilized for performing minimal access surgery. For convenience of discussion I am put forwarding my ideas in two sections.
1. The first phase: Let the robot see the inside of stomach and intestines
The robot you developed can be swallowed. If you have developed the 1/3 cubic inch robot the swallowing process will be more easier. If this robot is fitted with a camera we can see the interior of the oesophagus, stomach and intestines. The robot need not have the batteries attracted to it. The power supply can be from a cable. You can utilize the space that was previously occupied by the battery for fitting extra cameras. The data cable and the power cable can be attached to the robot. The data cable can transmit signals from camera to computer and another data cable can transmit programs from computer to the robot.
The limiting factors
While the robot is being swallowed it may damage the inside of the oesophagus and stomach. So it should be placed inside a small casket. This Casket should have an attached hallow cord by which the Casket can be opened and closed. The hallow cord will also harbour the power cord and data cord.
The casket along with the cord (which is also transmitting power and data cables) is swallowed by the patient. Once the casket is inside the oesophagus it is opened. The data cable is attracted to a serial port of the computer. The power cable is attached to the power source. With the aid of computer the robot's movement can be controlled. The Camera transmits images to the computer. A lot of Clinical information like cancer, ulcers, bleeding and tumours can be made out by just looking inside the oesophagus and stomach.
The Inside of stomach and intestines is wet. So the circuits of the robot should be well as insulated.
On successful completion of the first phase, the second phase of the project can be commenced.
2. The second phase: Minimal access surgeries can be performed.
Minimal access surgeries can be performed by a team of robots. Each robot is modified in such a way for a specific purpose. A camera robot is already in place. Another robot has two arms with pliers. With each arm it can hold tissues. It should also hold suture material and needles. The arms can be programmed for making a knot. Another robot is fitted with a needle and connected to a diathermy that is regularly used in routine surgery for cutting tissues.

This communication is only to give you a concept and a broad idea. your invention can be modified to perform surgeries. If you're interested please let me know so that we can exchange views for developing robots for performing surgeries.
The detailed explanation for the second phase is below.

****

I am presenting a detailed view of my idea of using small robots for performing two commonly performed surgeries viz. Appendectomy and Cholecystectomy. No new technology need to be invented. The available technology can be modified and customized to perform these surgeries. With small financial investment, millions of people from all over the world can be relieved of their suffering.

I got the idea of developing a robot for surgery after my 7 year old son playing with remote controlled toy. The toy is a Bulldozer. With remote control he can move the truck forward, backward and sideways. It has a container also. This container can also be moved up and down.
If the size of this of toy reduced and fitted with a tiny camera and placed inside the abdominal cavity, then the inside of the abdominal cavity can be visualized. The image gives the doctor a lot of information about the type and extent of the disease process. Of course the container part has to be removed for fitting the camera. These images will let us know about the extent of a disease like cancer. (Camera robot)
I know that tiny camera the size of a shirt button is already there. I will discuss how to place this robot into abdominal cavity later.
Another small bulldozer with its container removed can be fitted with one grasper (forceps) and a pair of scissors. A grasper should hold a tissue of 0.5cm-1.0cm thickness. The purpose of this robot is to hold tissue, pull a tissue in desired directions. While the grasper pulls up to display a plane of tissue the scissors cuts the tissue. All these maneuvers are under direct vision of camera robot. The scissors can be attached to a diathermy cable so that cutting of tissue can be accomplished with minimum blood loss. (Dissection robot)
Another small bulldozer with its container removed can be fitted with two graspers (forceps).This is for tying a blood vessel, cystic duct stump or Appendix stump. One grasper passes the suture material under a blood vessel or viscous, the other grasper pulls out the suture from other side .A knot is tied by crossing the ends of the suture and pulling one end of the suture through the loop thus completing the knot. Such repeated acts like making a knot can be made into a program.
Instead of using knots to tie the cut ends, clips can also be applied. (Clips are routinely used in laparoscopy). (Knotting robot)
A suction tube can be placed in desired position by Knotting robot. The suction tube is passed through the mouth. The suction tube is necessary to suck away spilled blood and secretions.
A total of three mini robots are ideal for performing simple surgeries like Appendectomy and Cholecystectomy.

Ideally each of these robots should be easy to swallow. The size of 2.5cm to 3.5cm X 2cm X 2cm. should be adequate. To avoid injury to inside of esophagus (gullet) while swallowing these robots can be placed inside a small casket. The Robots are placed inside the casket and the casket with a manipulating string attached is swallowed. One end of the string is attached to the casket and the other end is outside the mouth. The casket should be designed in such way that it can be opened or closed with a string attached to it. After the casket reaches the stomach it is opened with the device on the other end of the string. The Robot comes out of the casket. The casket is pulled out with the attached string. The process is repeated for other Robots also. Once the robot completes its job it will return into the casket. The casket can be closed and pulled out with the help of the string.
Robotic cholecystectomy can be performed in the following way.
The casket containing Camera robot is swallowed. Once in the stomach cavity the casket is opened with the help of attached string. The robot is either remote controlled or controlled with an attached power & Data cable. Remote signals can reach the stomach cavity with a small diameter cable. The robot is made to climb out of the casket with remote signals. The empty casket is closed and pulled out of esophagus and mouth. The camera sends out the visual signals so that the inside of the stomach is seen on monitor.
Next the casket containing Dissection robot is swallowed followed by Knotting robot.
Once all the robots are inside the stomach, the patient is sedated or anaesthetized. The abdominal cavity is insufflated with carbon dioxide up to a 12 mm of Hg pressure with a Veress needle. Usually it needs about 4.5lit-6 lit with a flow rate of 1lit- 2lit. This practice is followed in standard laparoscopy.
The Dissection robot makes an incision on the anterior wall of the stomach. Through the opening in the anterior wall of the stomach the Dissection robot, Knotting robot and lastly the camera robots make their entry into the abdominal cavity.
If the power and data cables are present (non remote operated) the cable from dissection robot is detached by knotting robot and a new power and data cable is passed through the anterior abdominal wall. This cable is attached to the dissection robot by knotting robot. Same procedure can be followed for the other robots.
The camera robot gives signal to the computer to see inside of the abdominal cavity on a monitor. The dissection robot dissects the cystic duct. The knotting robot places two knots on the cystic duct. The dissection robot cuts between the knots. Same procedure is repeated for cystic artery also. The gallbladder is dissected out from liver by the dissection robot. The knotting robot pulls out the gallbladder into the stomach. Other robots also follow the same path. The gallbladder is placed in the casket. The casket is closed and pulled out. The opening in the stomach is closed by knotting robot. Each robot is placed into the casket and pulled out of the mouth.

In essence you have to develop 3 small robots. If the data cable is attachable to a computer, then the surgeon can be away from the patient. Surgeon in Vizag can perform a surgery on a patient in USA.

If it is possible to develop a remote controlled robot, then blue tooth technology may be the better choice. Because the blue tooth technology is computer compatible.

I am really happy to sustain your interest so far. I am available on 98481 90952. If necessary I will be available for chatting on the net. Kindly inform me two days in advance for chatting.

I thank you very much for your encouragement, time and attention.

mikey77 says: Dec 27, 2008. 1:55 PM **REPLY**

Thank you for your very interesting and thoughtful ideas.

Perhaps you already know this, but Phase 1 of your idea has been done by medical robotic researchers. Here is a link to a camera pill that goes through the esophagus, stomach and intestines, transmitting images as it goes.
http://news.cnet.com/8301-17938_105-9075-1.html?tag=mncol;txt

Here is a link to a tethered pill (fiber optic) that can be held in place in the esophagus and stomach to send images.
http://www.sciencedaily.com/releases/2008/01/080124161613.htm

Here is a link to a camera pill that is untethered but can be controlled by electromagnets to rotate it and point it in the right direction.
http://www.upi.com/Science_News/2008/06/05/Controlled_pill_camera_is_created/UPI-60051212691495/

That said, the next phases of your idea will be the hardest to do. As you know, bloody tissues and wet intestines are extremely slippery places. Getting any kind of mechanical system that would get enough traction to maneuver without damaging the surrounding tissues will be extremely difficult.

To get the power needed to maneuver and grasp slippery tissues and cut them cleanly would be almost impossible with batteries. So a tethered power line would most likely be necessary to get enough power in such a small place.

The question is, how deep can you go with a thin tethered line before it starts cutting into surrounding tissues? At some point, the whole thing has to be pulled out the way it went in or cut loose and allowed to pass through the system. Would the tether wires go through smoothly or cause damage on the way out?

Obviously, I am an amateur robotics experimenter and do not have the resources to create the kinds of robots you are considering. But, I have no doubt that such robots will eventually be built and used successfully.

Wishing you the best in your medical work.

Mikey77

Winterz117 says: Nov 23, 2008. 12:09 PM **REPLY**

ok do u really need to use the magned wire over normal wire? its really expensive...

mikey77 says: Nov 24, 2008. 6:07 PM **REPLY**

You don't have to use magnet wire, but it makes it much easier to make really small robots. Magnet wire is not expensive, you can just take apart a relay and get the magnet wire that way. Generally, the smaller the relay, the thinner the wire.

Winterz117 says: Nov 26, 2008. 6:13 PM **REPLY**

oh ok gotcha. Yeah I was looking for it on digitec and it was like 50$ a spool, so the spools must have held alot of wire. Ok thanks for the reply if inget a mini robot built I'll send u some pics!

Homebuilder says: Nov 17, 2008. 12:12 PM **REPLY**

Hi there

I'm Erik and i'm come from holland. My quastion is were is the Serin and Serout for? is there something to connect to it?
Hire in holland is the 150uf very hard to get. So i bought an 220. Can i juste it to with out distrubing the working of the circuit?
I'f reed about the 25:1 gearmotors. I can't find them on the link. I only find the 30:1. Bit slower but i think its juisefull.

I like to know more about this robot circuit :)

Greetings
Erik

mikey77 says: Nov 17, 2008. 6:57 PM **REPLY**

A 220uf capacitor will work good. A 30:1 gear motor will work good also.
The Serin and Serout pins are used to program the Picaxe microcontroller. The Picaxe is programmed using the serial port of a Windows PC. Read the comments below to find out where you can get a Picaxe microcontroller and information on how to program it with your PC.

Read the comments below to find out more about this circuit.

This looks like a simple circuit and a simple robot, but it actually requires fairly advanced electronic and programming skills to build it.

wolfy_9005 says: Oct 13, 2008. 10:50 PM **REPLY**
Maybe make it 2x2 and attach a small controllable propellor to the top for a heli-bot? It would be able to drive on land, then when it reaches an obstacle, can fly over it :)

leet hacker says: Oct 30, 2008. 4:50 PM **REPLY**
That would be fun. However you would need another propeller to counteract the torque from the first propeller.

moesboy says: Oct 31, 2008. 9:07 AM **REPLY**
you would also have to have a strong motor and big prop to get lift

mausdesign says: Oct 13, 2008. 11:29 AM **REPLY**
Very nice design. With SMT technology it could be even smaller. I'm currently working on my own 1/4 inch robot that I will post here when it is done. You can check it out at http://microrobotics.50webs.com/

Kopolis777 says: Jun 13, 2008. 10:11 AM **REPLY**
If only they could fly.

rak says: Jun 13, 2008. 6:14 PM **REPLY**
that might be possible
new product called the bladestar, in target -- well we all know it sucks, but it could be recreated in a better way

i was actually woking on something similar ------- specs on combined idea
dual propeller thrust with high output, yet lightweight motor
ir sender and receiver -- beam and reflect for obstacle navi
ir navi interface -- follow me idea -- see ir pen under wiimote whiteboard
pc control via rc frequency -- leading to wiimote control via glovepie
and possibly more, like surveillance with a small camera

cormac3050 says: Jun 22, 2008. 11:43 AM **REPLY**
If only...

rak says: Aug 26, 2008. 7:21 AM **REPLY**
no, it can be done
i just dont know how and cant

Deception says: Aug 26, 2008. 7:56 AM **REPLY**
of course it can! if you can make a small helicopter and a small sumo robot then of course you can make a small sumo heli-bot...

rak says: Sep 2, 2008. 1:19 PM **REPLY**
i meant that i cant but good luck with that

evilgenius 398 says: Aug 20, 2008. 1:16 PM **REPLY**
wicked
small bots are really hard to make

Pumpkin$ says: Aug 17, 2008. 7:22 PM **REPLY**
little complicated for me but.... IT'S AMAZING! I LOVE IT could it carry one of thos micro-cams?

nathanzhang says: Aug 10, 2008. 5:22 PM **REPLY**
I could use this for my business!

Jahoovi says: Aug 9, 2008. 9:59 PM **REPLY**
where u get all the small stuff?

ebay?

mikey77 says: Aug 10, 2008. 11:31 AM **REPLY**
I listed links to all of the sources for all of the parts in step 1.

sonicX says: Aug 5, 2008. 9:51 PM **REPLY**
dude, whered you get those tank treads for that bot in pic. 7?

mikey77 says: Aug 6, 2008. 4:49 PM **REPLY**
The tank treads came from a remote controlled desk-top tank that was sold by Plantraco. Unfortunately, they do not seem to sell it anymore. Your best bet is to find a remote controlled toy tank and hack it.

stolenhert says: Jul 24, 2008. 1:06 AM **REPLY**
how much it costs?

mikey77 says: Aug 6, 2008. 4:47 PM **REPLY**
I answered that question. Read the comments below.

Erobots says: Jul 16, 2008. 10:41 AM **REPLY**
You live in the US right?

I also do , I suggest you look at Jameco . They have a nice selection of electronics. I use them all the time.

Cool robot too!

mikey77 says: Jul 21, 2008. 5:41 PM **REPLY**
Yes, Jameco is a good source for robot parts. That is why I put a link to them in step 2. The very small blue on-off switch on this robot is from Jameco. They also have very nice 12 volt gear motors with a 1/4" shaft that are fairly inexpensive and useful for robot arms and grippers.

culepet says: Jul 15, 2008. 8:55 PM **REPLY**
hi! can you post your block diagram? 'cause my friend ask me how it works in a systematic way ,thnx

kk khrab says: Jul 15, 2008. 5:17 AM **REPLY**
WOW dude that is one of the best thing i have seen in my life i am looking forward to make one if i could get a little bit of help

alex.v says: Jul 14, 2008. 11:29 PM **REPLY**
great work ! would like to see a swarm of those ...

racecar says: Jul 9, 2008. 5:13 AM **REPLY**
which picaxe did you use? a 18x picaxe or a pic16f88-l/p 052505g??????????

mikey77 says: Jul 9, 2008. 5:37 PM **REPLY**
As I said in step 1, I used the 18x Picaxe which is in fact a PicMicro-Pic16f88 microcontroller which has been modified to allow it to be programmed in the easy to use BASIC programming language. So the Picaxe chips that are sold are simply PicMicros with some initial programming that makes it easy to program using the serial port of your PC.

You can buy an 18x picaxe chip and serial programming cable and instructions on programming and hooking them up from: www.Sparkfun.com or www.hvwtech.com

You might also check out the new Picaxe projects group for more details on what you can do with this inexpensive microcontroller.

racecar says: Jul 10, 2008. 6:17 AM **REPLY**
Thank you so much! i am building this robot now its awesome Great Project! :)

culepet says: Jul 10, 2008. 2:58 AM **REPLY**
nice work

mackjr says: Jul 9, 2008. 9:51 AM **REPLY**

check out my spirograph i made watch them in order

number 1.AVI(320x240) 4 MB

number2.AVI(320x240) 2 MB

Gjdj3 says: Jul 8, 2008. 5:08 PM **REPLY**

As much as I disagree with you about the detonator thing, this is some really nice work. If you apply these techniques to some other circuits it could work really nicely.

5 stars and favorited.

mikey77 says: Jul 8, 2008. 5:58 PM **REPLY**

Technology and intellect can be beautiful in its own way. It can improve the world or make it worse. It depends on our intention. We can use it to become creative. Or, we can use it to become destructive. It all depends on how much we actually care about life.

Knowledge is knowing how to do things.

Wisdom is knowing what is worth doing.

Gjdj3 says: Jul 8, 2008. 7:10 PM **REPLY**

Well said.

view all 103 comments