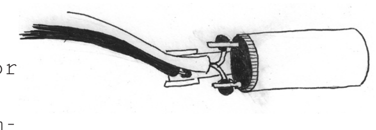
4. Prepare the wire coil. Using the 1/8" mini plug (such as that on the end of a set of consumer headphones), wrap the 20 gauge wire tightly around the tip four times. Bend 3 mm feet and cut the wire. Solder as shown in the circuit drawing.

5. Prepare the transistor. The transistor, labeled T1 on the drawing, controls a change in the voltage running through the transmitter. It has three leads, labeled C, B, and E. With the flat side facing you, the left lead is "C," the middle "B," and the right "E." Using the needle-nose pliers, bend the central lead "B" straight toward the flat face of the transistor. Bend the other two leads about a 45 degree angle to the sides, and bend feet in all. Double check that the leads are arranged as in the drawing before soldering in place.

6. Place the voltage regulator, IC1. The voltage regulator reduces the flow of voltage from the solar panel to help ensure that the battery does not get overcharged. Because it reduces the voltage to 5 volts, which is less than the 6 needed to run the transmitter, over time the battery will be slowly discharged. The panel, however, vastly increases the length of battery life.



It's important to connect the voltage regulator in the proper direction. With the label on the component facing you, the left pin is the input and the right pin is the output. Connect the input pin to the pad shared with the red wire of the solar panel, while connecting the output pin to the pad where the wire to the battery will go. The center pin connects to ground

IV. Connect the Inputs.

Kogawa's original design runs off a 9 volt battery. It was not well suited for extended use because, as the battery ran down, less power would get to the transmitter and the transmission frequency would drift. This plan uses a small solar panel to continually recharge the battery to extend its life, allowing the transmitter to be left on 24 hours per day. Rechargeable batteries do not, however, last forever, and since the voltage of the solar power is regulated and low, the panel will not fully recharge the battery. However, it should allow the transmitter to run constantly for several weeks.

The solar panel I suggest is weather resistant and comes equipped with a power cord and alligator clips for charging batteries, a diode to prevent the panel from sucking the charge from batteries at night, and a nice mount. If you don't want to spend the $15 on this model and want to make your own solar panel using solar strips, you will have more work to do, but it's not hard--look it up online. I'm not sure you could buy the components for less than this model, anyway.
The battery needs to connect to both the DC in pad of the transmitter and the DC out pad of the voltage regulator in order to both provide power to the transmitter and be recharged by the solar panel. To do this, you will have to add a wire to the battery clip.

Cut the alligator clips off the solar panel's power cord, leaving a length of 12-18." Using the extra cord you cut from the solar panel, cut a piece about 4 cm long. Clip the plastic between the black and red sides of the cord enough that you can grasp the sides and pull them completely apart. Using only the red wire, strip the plastic with your wire strippers about 1/2 cm on either end, and tin both exposed tips. To tin the tips, twist the metal filaments together and melting a little solder on the tip of the soldering iron and painting it on the wire ends of the cord. The objective is to lightly coat the ends so they don't fray and connect easily to the pads.

Carefully cut the black plastic covering off the back of the battery clip. Peel it back to expose the metal rims connecting to the battery. Using just a small amount of solder, tack the prepared red wire to the metal circle where the battery clip's positive (red) wire is connected.

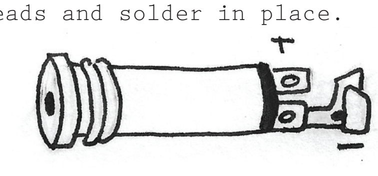
Try not to fill the hole with solder. Carefully re-cover the back of the clip in electrical tape.

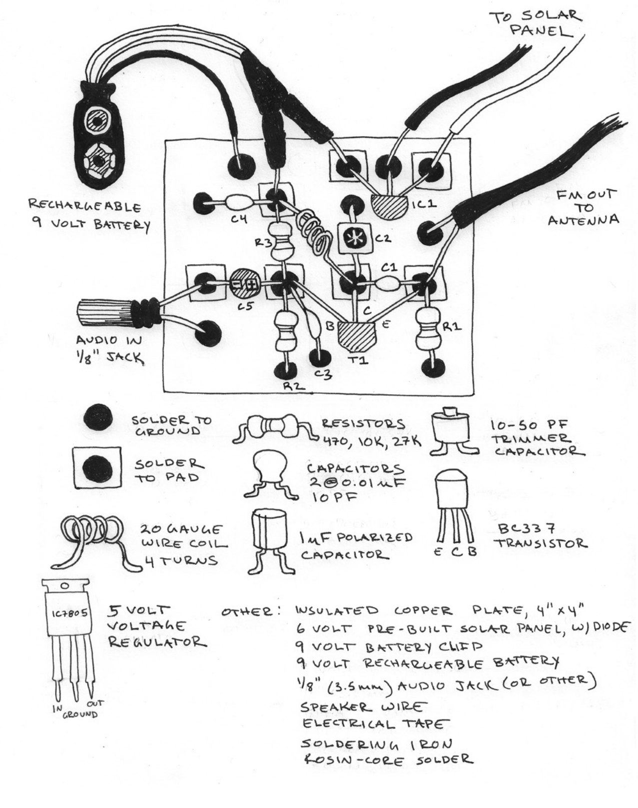
Connect the other side of the new red wire to the pad shared with the IC1 left pin. Solder the original red wire from the battery clip (which should be narrower gauge than the new wire) to the main DC in pad (where C4, R3 and the coil connect) on the board. Solder the black wire to ground.

For neatness, you may wish to tape the two red wires together, as I have done in the main circuit drawing. You will attach the solar panel later, when you are ready to set the board in the circuit box.

3. Connect the 1/8" (3.5 mm) mini jack. Depending on the model of connector you bought or repurposed, this may work slightly differently. I used a straight-type connector that could easily be cut from a headphone splitter or bought for about $0.30. The metal plate at the top of the tup screws out to reveal the connectors, as shown below in the drawing. The two connectors emerging straight and attached to the black shield are the positive leads, while the L-shaped piece attached directly to the barrel is the ground. It should have a tiny "-" sign etched in it.

Cut a 3 cm length of wire off the leftover cord from the solar panel, separate, and strip all ends. Separate the red wire tips into two and twist the filaments together tightly. Slip the ends into the holes in the positive leads and solder in place. Then, twist the wire filaments on the black wire together, slip through the negative connector, and solder.





BASED ON TETSUO KOGAWA'S DESIGN. SEE HTTP://ANARCHY.TRANSLOCAL.JP

Push the wires back into the jack's black plastic casing and screw the metal barrel in place. Tin the exposed tips and solder the red wire to the pad shown in the circuit diagram and the black wire to the ground.

V. Attaching the Antenna and setting the frequency.

Although not strictly necessary for a micropower transmitter, the antenna vastly increases range. You can use any kind of shielded wire for the antenna, but it must be cut to the proper length for the frequency you wish to use and placed as high as possible. To calculate the length of antenna, use the following formula:
length (in meters)=300/frequency x 1/4
For example, if you planned on broadcasting at 100 mHz (in the heart of the FM range)
length=300/100 x 1/4
length=3/4 meters, or 75 cm

Once you have determined the length of your antenna, cut the antenna from either speaker wire or the leftover cord from the solar panel. Cap one end in a little electrical tape to keep the wire from getting wet. Separate, strip, and tin the opposite ends of the wire, and solder the red side to the pad indicated in the circuit drawing and the black side to the ground.
Next, attach a fully-charged battery to the clips. Plug a source (such as an mp3 player) into the audio in jack. You should be transmitting now. Tune a radio to your desired frequency and set it several feel from your antenna. Using a tiny screwdriver, slowly turn the top of the trimmer cap until you hear what's playing on your mp3 player. Your transmitter is now tuned.

VI. Building the box.

First, drill holes in the box to accommodate your in and outputs. With the lid of the box facing you and a solid side on top, place the transmitter board on the bottom of the box. Using a permanent market, mark on the exterior sides of the box the approximate place where the solar panel power wires, the antenna, and the audio in jack will lie. Getting the audio in jack right is the most important thing, as it provides the least room for error. Remove the transmitter from the box.

Drill a 5/8" hole for the audio in jack. If you have machine oil, oil the end of your drill bit before you drill in order to reduce friction. Go slowly but steadily. The resultant hole will be quite rough, and you can file it down a little after wiping off the oil.

Double-check your markings for power and antenna now that the jack hole is cut. Drill those with a 3/8" bit, wipe, and file. Place the rubber grommets on the holes. You should also drill holes for the solar panel mount.

Prior to attaching the solar panel, run the solar panel's power cord through the hole on the top of the box that you drilled for it. Connect the solar panel to the voltage regulator by soldering the red wire to the top right pad shared with IC1 and black to ground. Mount the solar panel to the top of the circuit box and screw in place.

Place the transmitter back into the circuit box and carefully position the audio jack in the grommet. It should fit snugly. Run the antenna through the hole on the other side of the box. Depending on the size of the box, you may need to tape the batter to the back so that it won't lay on the components. You could also get fancy and drill or glue your transmitter board to the base of the circuit box or raise it with spacers, but you don't really need to. It will only make the box sturdier. Re-attach the front of the box.

VII. Using the transmitter.

Your transmitter is now ready for use. It will constantly broadcast a "carrier signal" on the frequency you selected when in the sun or attached to a battery. It is designed for outdoor applications where it might be left for extended periods of time to broadcast a message constantly or to act as a node in a network of informal transmitters just waiting for passersby to plug in and become radio pirates. It should be attached to a utility pole or building at the right height for people to plug in to the audio jack, and the antenna should be raised and secured as straight as possible.

Solar-Powered Microradio Transmitter
Modification of design by Tetsuo Kogawa

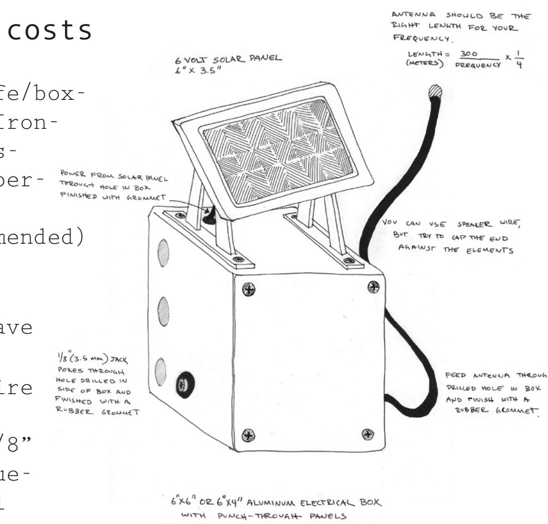
This microradio transmitter is designed to flood the airwaves of the immediate area with homegrown music, voices, noise, and sound. It is powered by a rechargeable battery and solar panel and housed in an ordinary circuit box to be mounted outside and left to its own devices for days or weeks at a time. Possible applications include covert political speech, alternative historical or environmental education stations, and direct public participation in the electromagnetic spectrum. Deploying a network of these low-cost transmitters around a neighborhood or a city opens up many practical and symbolic possibilities.

Contents

I. Materials, supplies, and costs

Tools:
Sharp utility knife/box-cutter-Soldering Iron-Needle-nose pliers-Wire cutter/stripper-Electric drill-Metal file (recommended)

Other Stuff (that you might have lying around):
speaker wire or wire stereo antenna-electrical-tape-1/8" mini plug-superglue-sponge-machine oil (recommended)



You Will Need:
- -Insulated, single-sided copper pc board [4" x 4" or 4" x 6"] $2 at allelectronics.com
- -6 volt pre-built solar panel with diode $15 at allelectronics.com
- -20 gauge galvanized wire ~$1 for 50 feet at your local hardware store
- -Resistors: 470 Ohm, 10K Ohm, 27K Ohm, all 1/8 Watt 100 packs of ea. will set you back ~$3 at jameco.com
- -Capacitors: 2 x 0.01uF, 10 PF, you can buy a mess of these for under $2 at allelectronics.com
- -Trimmer Capacitor: 10-50 PF ~$0.50 at jameco.com
- -Polarized/Electrolytic Capacitor: 1uF ~$0.50 for 10 at jameco.com
- -BC337 Transistor ~$1 for 10 at jameco.com
- -5 volt voltage regulator, such as IC7805 ~$0.50 at jameco.com
- -1.8"/3.5 mm audio jack ~$0.50 at allelectronic.com
- -9 volt battery clip ~$0.50 at jameco.com
- -9 volt rechargeable battery $6 at batterybarn.com
- -Rosin core solder, 0.8mm $1.50 for a tube at jameco.com
- -Outdoor junction box, about 4" x 6" ~$10-15 at your local builder's supply
- -Rubber grommets, 2@3/8" and 1@5/8" ~$1.50 at your local hardware store

Total Cost for parts: ~$50

Although the transmitter is relatively inconspicuous, especially when mounted near a building's junction boxes, given the pervasive atmosphere of fear and vigilance against anything out of the ordinary in the urban environment, anyone who builds and deploys this transmitter should be prepared to answer some possibly serious questions. Sorry to break it to you, but there it is.

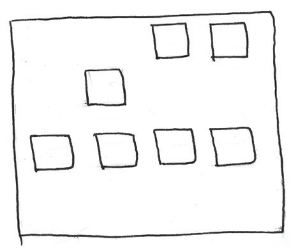
Additionally, this transmitter is best suited for experimental and artistic uses because it doesn't have a very stable frequency and is subject to interference from other electrical fields and devices. The frequency is more stable in the short term with steady voltage from a new or fully charged battery. Rather than looking at this instability as a drawback, however, builders are encouraged to think of creative and subversive applications that resist the dominant desire for a Clear Channel.

sarah kanouse 2007

II. Preparing the board.

First, mark 1 cm off one edge of the copper plate and score deeply with the utility knife. Place the board on the edge of your worktable and bend the against the score until the board snaps. Cut the larger portion of board in a similar fashion into a square somewhere between 3 x 3 and 4 x 4 inches. This board will be the ground for your transmitter.

Mark the 1 cm strip of copper board into 1 cm squares and score deeply with the knife. You will need a total of 7 squares. Holding the strip with the needle-nose pliers, use the wire cutter to cut through the board along the scores. These squares (which may be quite uneven - it doesn't matter) will be the pads for the current in your transmitter.



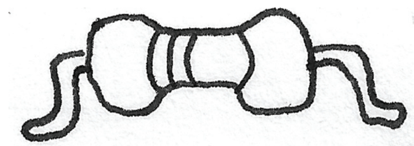
Glue the pads to the plate using superglue in the arrangement shown in the circuit drawing. Four pads should be in a line with about 1/2 cm spacing between them. Another pad should be 1 cm above the second pad from the left, while the final two pads are placed about 2 cm above the third and fourth pads in the first row.
(refer to above image.)
Heat up your soldering iron, moisten the sponge, and unroll a 4" length of solder. Hold the tip of the soldering iron on one of the pads for a couple of seconds and push the solder into the hot tip. It should pool slightly on the pad. Remove both solder and iron quickly. The pool of solder should be bright and shiny. This will help you to make a good connection with the components. Keep the tip of the soldering iron clean by touching it to the moistened sponge after each component is soldered.

III. Placing the components.

1. Prepare the resistors. The resistors are the slightly dumbbell-shaped parts with color-coded stripes. They reduce flow of electricity in the circuit, and the amount of resistance they offer is measured in a unit called an Ohm. The three stripes closest together tell you the value of the resistors. The fourth stripe is usually gold. On the diagram, the resistors are identified by the letter R plus a number.
R1=470 Ohm (yellow-purple-brown)
R2=10k Ohm (brown-black-orange)
R3=27k Ohm (red-purple-orange)

The resistors, like most electrical components, have really long wires called leads. You will need to cut the leads down to a more manageable size and bend them into little feet (as shown in the drawing below) to help you place them. With the needle-nose pliers, grasp the wire lead right where it emerges from the resistor. With your free hand, bend the wire down sharply so it is perpendicular with the resistor.

Move the needle-nose pliers a bit further down the lead and bend the wire perpendicularly again. With the wire cutters, cut the wire about 3 mm from this last bend so you have little feet to solder to the pad. You will have to make feet on all the components prior to soldering them.



To solder the resistors in place, hold them with the needle-nose pliers. Heat up the solder on the appropriate pad until it melts slightly and push the foot of the resistor into the melted solder. Remove the iron and hold the resistor in place for a few seconds until the solder hardens.

Only one foot of the resistor is attached to a pad. The other foot is soldered to the copper plate or ground. To solder the resistor to the ground, touch the soldering iron to the ground and touch the tip with solder until it melts and pools slightly around the foot of the component. Remove the soldering iron quickly. The pool of solder should harden shiny, not dark.
Solder the remaining resistors in place.

2. Next, prepare the capacitors for soldering. To prepare them, grasp the lead just below it bends slightly after emerging from the cap with the needle-nose pliers and bend the wire sharply outward. Cut, leaving about 3 mm for feet.

The transmitter has three ceramic capacitors, abbreviated on the drawing at C plus a number. Capacitors (or "caps") store small amounts of current that help smooth out disruptions in a circuit. Their capacity is measured in units called farads, abbreviated with an F. Farads are really large units, so most caps in electronics are measured either in microfarads (uF) or picofarads (pF). Because this component is extremely small, take care to keep your caps labeled, as it can be difficult to identify them if they get mixed up.
C1=10pF
C3=0.01uF
C4=0.01uF

Solder these capacitors in place as you did with the resistors.
3. You probably noticed two other capacitors (C2 and C5) in the drawing. These are special capacitors. C2 is a 10-50pF trimmer capacitor that is used for tuning the transmitter; it stores a different amount of electricity depending on the frequency you would like your transmitter to use. If yours didn't already come with feet, bend feet and solder in place as in the main drawing.
C5 is a 1uF polarized electrolytic capacitor. This means that one lead is positive and one negative. The negative lead is marked with a band on the side of the cap that, appropriately enough, has a "-" sign on it. Solder this component as shown on the diagram, with the negative lead on the pad furthest to the left.