



MAKER: Star Car 2014

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Star Car 2014 is an interactive art car that was originally designed and created by an interdisciplinary team of graduate students for a local engineering and art festival. Designed around space exploration and aliens, the car served an educational purpose in addition to its artistic elements. Three interactive stations were placed around the car, allowing festival-goers to explore different elements of mechanical and electrical engineering through hands-on activities. This handout will summarize the three interactive stations featured on the art car, and outline detailed instructions for creating a conductive circuit to be completed by human touch.



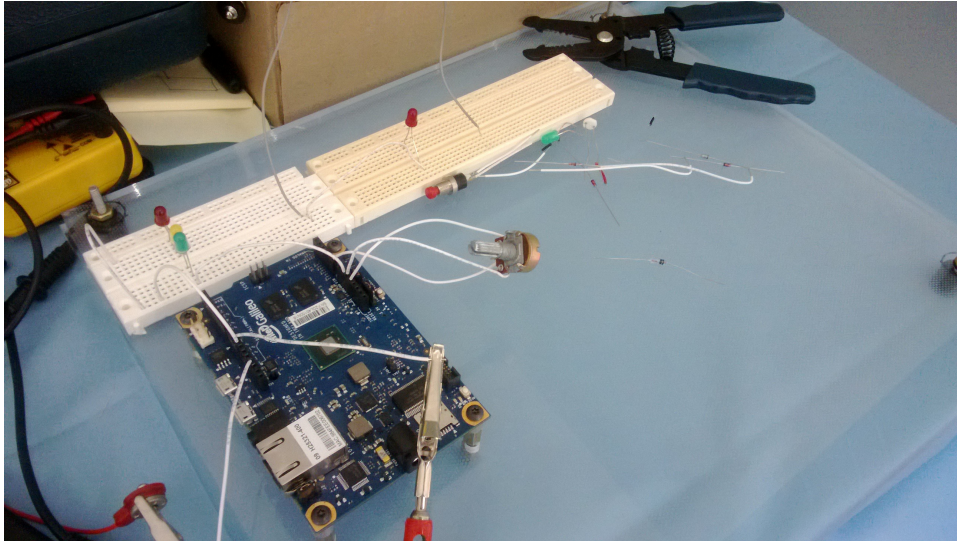
- 1) The primary focus for younger audience members (K-9) is an alien creature or mascot that can be customized to match any theme or presentation. Two mechanical systems are incorporated to give the creatures, in this case a two-headed alien, two separate vocal systems. The public can interact with the creature by pumping air into its lungs and modifying the vocal sounds while learning about acoustics, vibration, and biology.



- 2) The second interactive station teaches audience members about basic circuit connectivity and conductive materials. A conductive circuit is set up on the side of the car and integrated with thematic elements, such as a baby alien and a rocket ship. When both elements are connected through touch, the lights and alien sounds begin to play because the circuit is completed. Groups of people can also join hands to create a larger circuit, using the conductivity of human skin to complete the circuit.



- 3) The final station is the most technically complex, and uses basic programming to create a light-sensitive planet that will emit varied tones, depending on the amount of light measured. This activity uses an Intel Galileo board, which can also be substituted with any Arduino or similar system. Older students and adults may be interested in the programming and electronics behind the scenes, while audience members of all ages enjoy creating simple tunes through the use of light.



These three elements can be used for any educational or hands-on presentation, and are not exclusive to art cars. This Maker session display will include instructions for creating the second of the three interactive stations, photos of the final art car, and demonstrations. The primary demonstration focus will be on creating a conductive circuit that can be controlled by human touch, and how to integrate it with artistic principles.

Steps for Creating a Conductive Circuit

- ❖ Art cars and other educational displays are meant to be engaging for audience members. To help create a cohesive look for your final design, choose a theme that is relevant to the intended audience or students. For example, K-12 students respond well to themes that follow their own curriculum content, such as weather science or sky science. Repeating classroom lessons helps to reinforce the educational and informational content of your display.
- ❖ Decide what elements of your design will be conductive. In the Star Car example above, a baby alien and a rocket ship are used as the two contact points for the circuit.
- ❖ To create your circuit, you will need four primary elements: a power source, a load, distribution, and contact points. These are most simply fulfilled by using a battery pack, LEDs or a buzzer, wire, and metal contacts of some kind (paperclips, aluminum foil, conductive tape, etc.). You can also purchase pre-made circuits contained within tubes, usually called conductivity sticks or “magic sticks”. These clear plastic tubes contain lights and sounds that only play when the two metal contacts are connected by a conductive material (i.e. human skin).
- ❖ For safety reasons, you should choose a low voltage and current appropriate to the load you have selected. When in doubt, check the safety specifications on your equipment before using.
- ❖ Aluminum foil is the most powerful tool for creating craft circuits. It can be used to reinforce loose connections, increase the size of a conductive circuit, or increase the conductivity of a particularly resistance surface or material.
- ❖ Connect your circuit elements together, making sure to tightly bind any loose connections. A “touchy” circuit is very frustrating for people to use, particularly younger audience members.
- ❖ Use your artistic vision to hide the power source and wires. Battery packs can be disguised with multiple craft products, and should be integrated into the chosen theme. Wires can be camouflaged into the surface of your art car or educational display depending on the chosen wire colour. The lights/sound elements of your circuit should be prominently displayed as a feature in your thematic design.
- ❖ To create a contact surface, use a metallic material to design two separate handholds. These contact points must be secure enough to withstand multiple uses, ideally thousands if exhibiting for several days. Along the back of the contacts, connect your circuit wires tightly. You should now have an open circuit where connecting the two contact points will result in completion. Your human skin will act as a switch to control the circuit.
- ❖ Carefully integrate your contact surfaces into the design elements you chose earlier. In Star Car, the baby alien was created from metallic thread so that just touching his body

was enough to connect to the circuit. The rocket ship was decorated with conductive aluminum tape, requiring users to hold the main shuttle.

- ❖ Once your design has been reinforced (this is very important), test your circuit by holding the two contact points at the same time. If the lights/sound begin to flash/play, you know your circuit is working!
- ❖ Encourage audience members to try holding hands to create a giant human circuit. Skin-to-skin contact is necessary, but not limited to hands. Feet, foreheads, and elbows are other fun places to try. Remember that younger audience members may need a reminder about appropriate touching boundaries, and about mature behaviour when asked to hold hands with the opposite gender!
- ❖ Note: Human skin is more conductive when warm. If this experiment is done outside, cold hands may increase the resistivity of the circuit.

Create!



Official festival photo: <http://beakerhead.com/>

References for tips, tricks, and similar projects:

1. Arduino. (2015). Getting started with Arduino. <http://arduino.cc/en/Guide/HomePage>
2. Intel Education. (2015). Tools for student-centered learning. <http://www.intel.com/content/www/us/en/education/k12/teachers.html>
3. E²S². (2015). U of C Engineering Education Students' Society. <https://e2s2ucalgary.wordpress.com/>