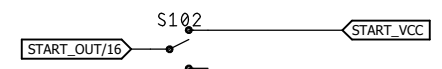
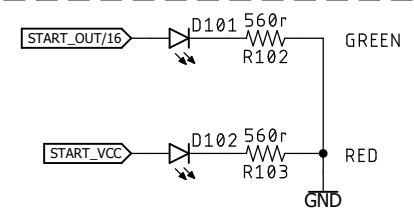
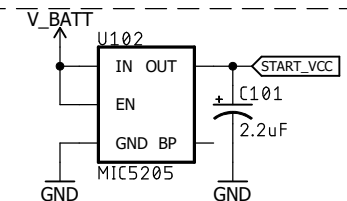


A reed switch is released by a magnet. The switch outputs a signal to begin the next transfer.

"Participants must detach and remove a magnet from the device; this action of detaching the magnet must begin the chain of events due to the removal of the magnetic force."



STARTING ACTION

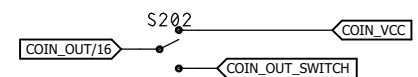
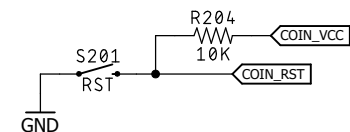
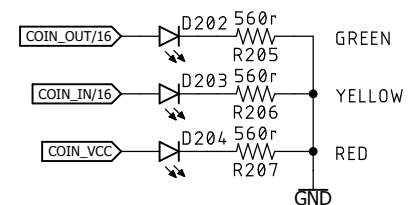
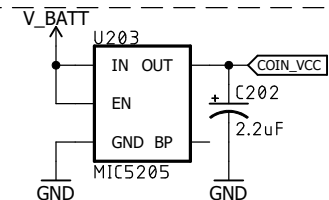
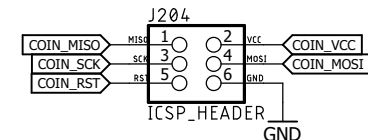
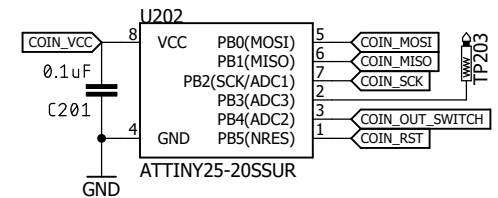
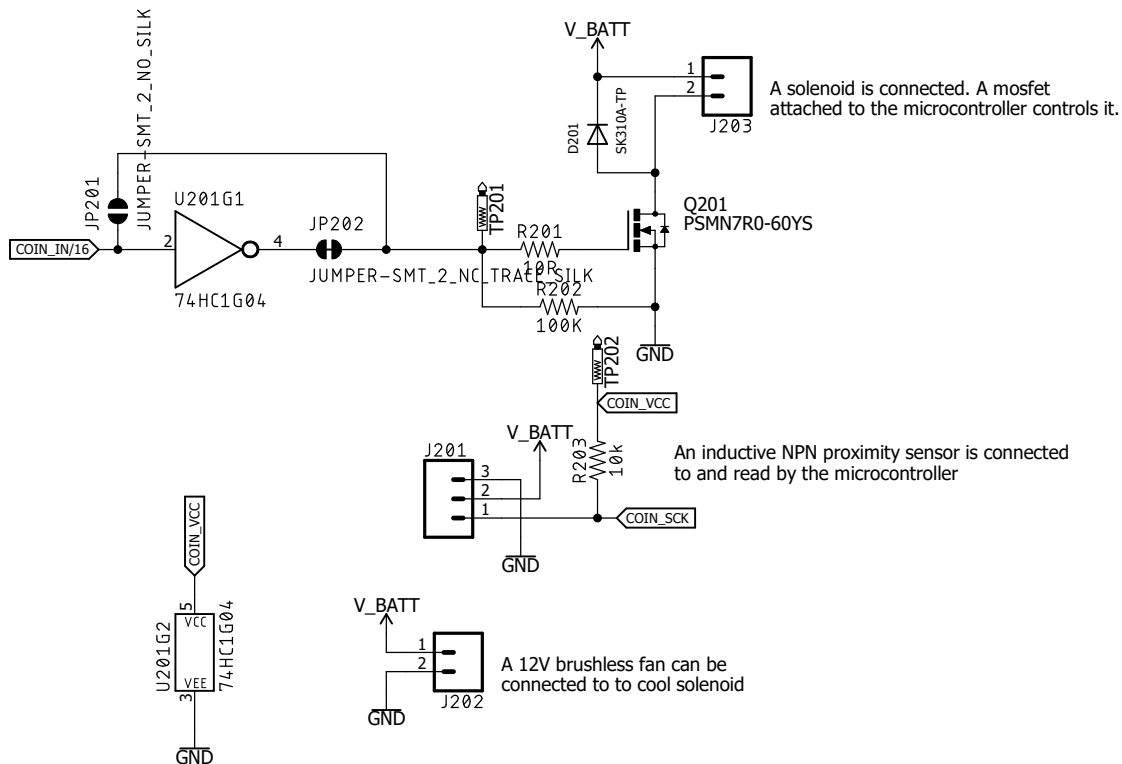
TITLE: WMHS Eastern LI Invitational Circuit Board

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Sheet: 1/16



COIN FLIP ACTION

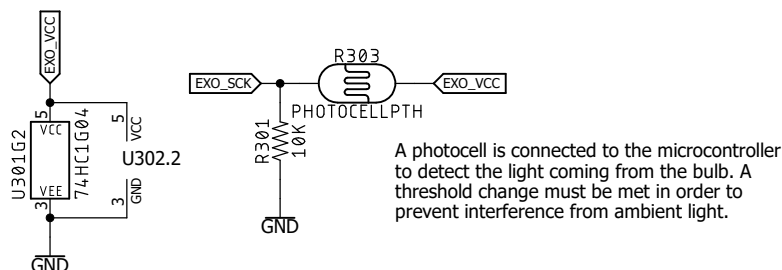
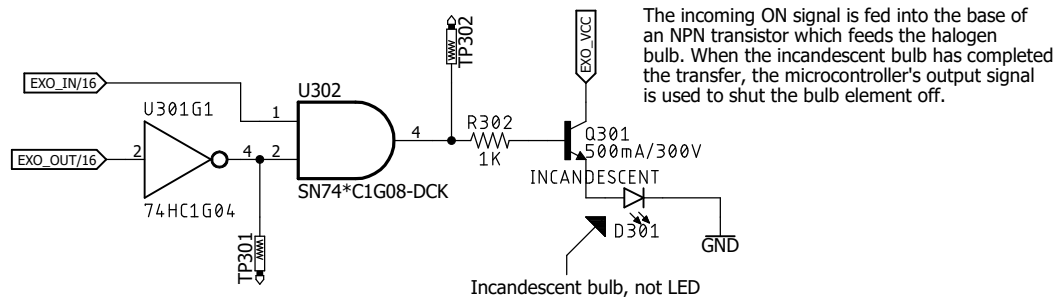
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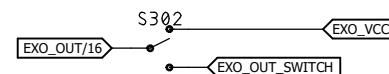
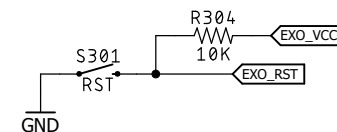
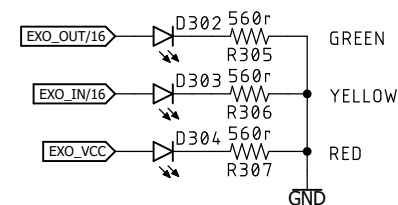
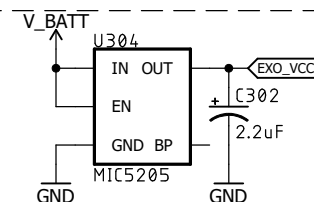
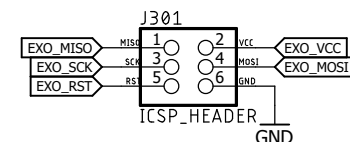
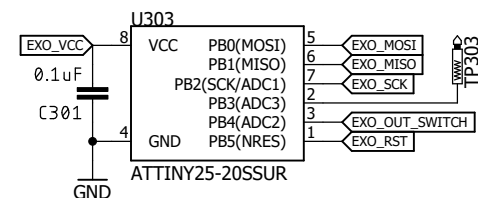
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Sheet: 2/16



An incandescent bulb is turned on by the previous transfer and turned off by the output of the transfer. The microcontroller turns on the output when the photocell resistance drops a certain amount.

"Use an exothermic action that produces light to activate a photocell and begins the next action."



EXOTHERMIC ACTION

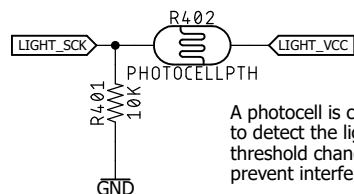
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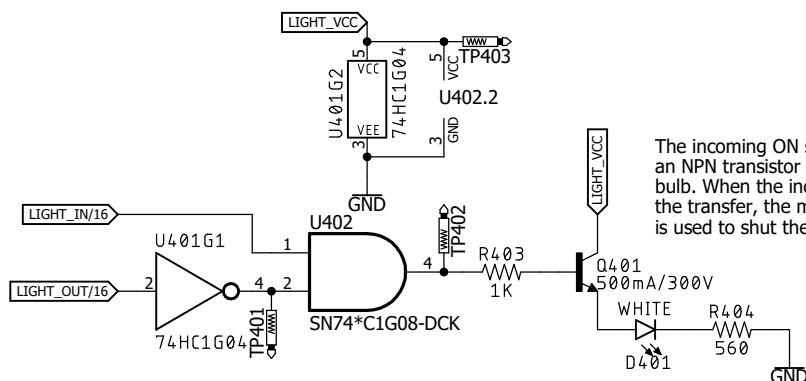
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Sheet: 3/16



A photocell is connected to the microcontroller to detect the light coming from the bulb. A threshold change must be met in order to prevent interference from ambient light.

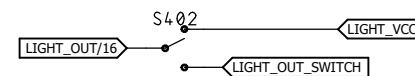
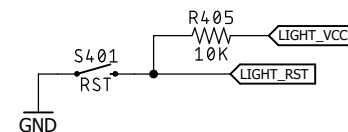
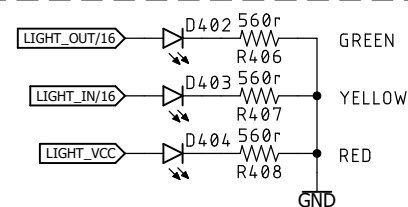
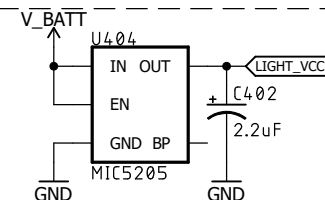
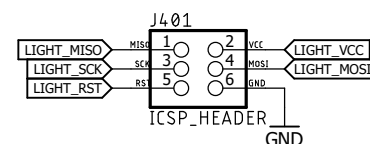
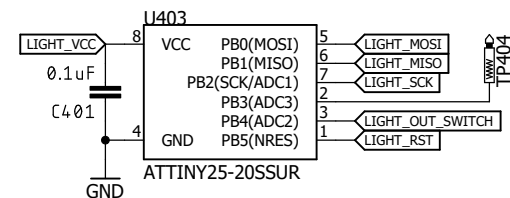


The incoming ON signal is fed into the base of an NPN transistor which feeds the halogen bulb. When the incandescent bulb has completed the transfer, the microcontroller's output signal is used to shut the bulb element off.

An LED is turned on by the previous action. The LED makes the phototransistor change its resistance, signaling the microcontroller to proceed to the next action. The output signal turns the LED off again.

"Use light to initiate a chemical reaction to begin the next action."

CLARIFICATION:
"Use light to initiate the next action."



LIGHT TRIGGERED ACTION

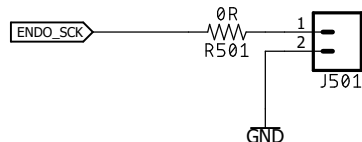
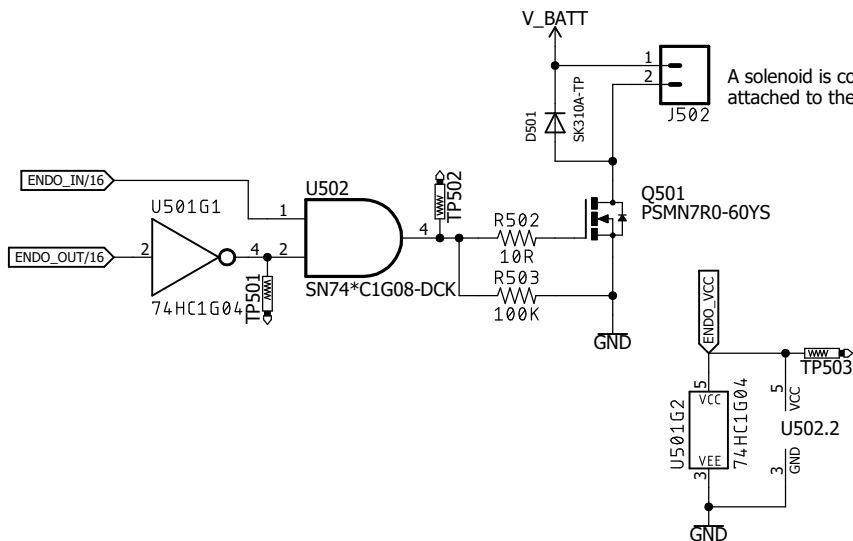
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Document Number:

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Sheet: 4/16

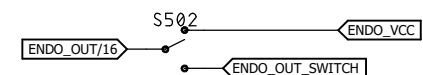
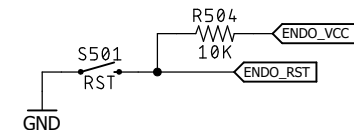
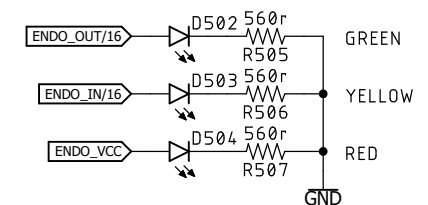
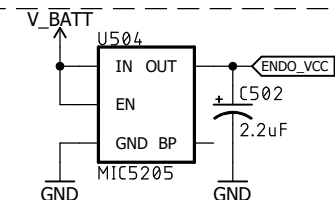
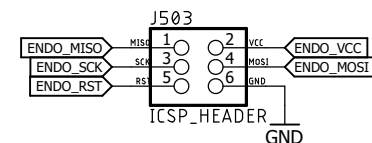
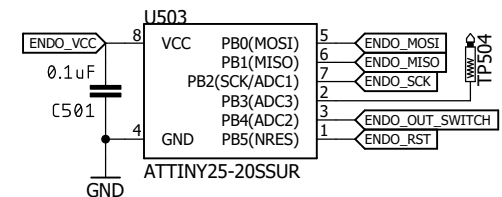


A thermistor is monitored continuously to detect when the endothermic action happens.

Revision Jan 2018: Add 10K resistor to back of PCB between ICSP pins SCK and VCC on this action only (nets ENDO_SCK and ENDO_VCC). Voltage divider resistor was improperly placed.

A solenoid dunks a thermistor into a container of ice water. The endothermic action of heat being transferred from the thermistor casing to the water is detected by the microcontroller which begins the next action.

"Use an endothermic action that begins the next action as a result of the reduction in temperature."



ENDOTHERMIC ACTION

TITLE: WMHS Eastern LI Invitational Circuit Board

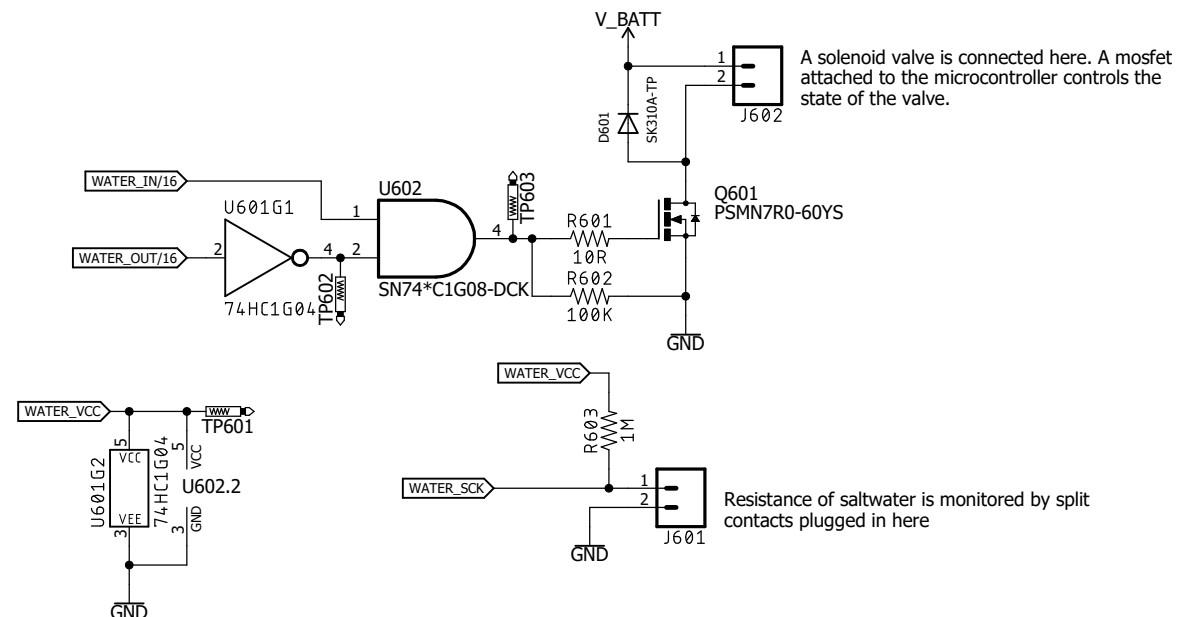
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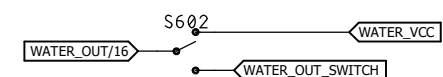
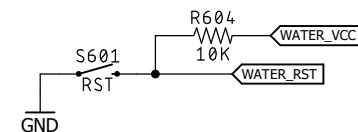
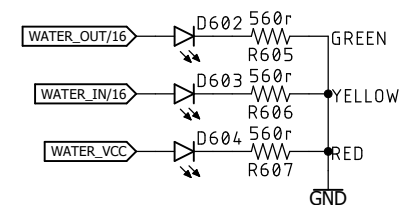
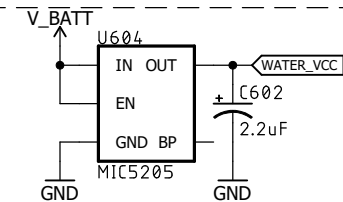
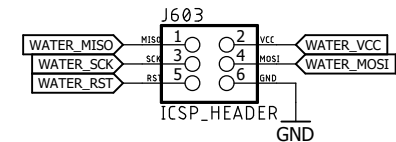
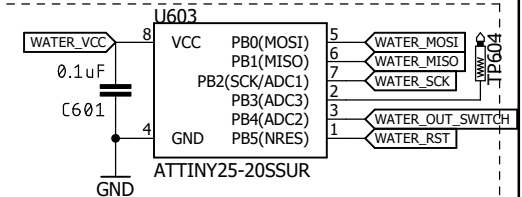
Sheet: 5/16

Update 1/26/2018: Action has been combined with timer action. The mosfet is no longer required, but the microcontroller is being used as a switch with the water level and two probes.



A solenoid valve is connected here. A mosfet attached to the microcontroller controls the state of the valve.

Resistance of saltwater is monitored by split contacts plugged in here



WATER ACTION

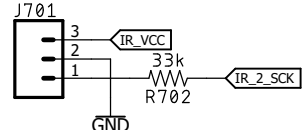
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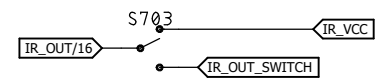
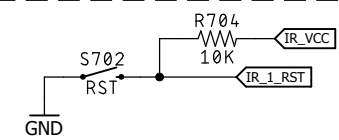
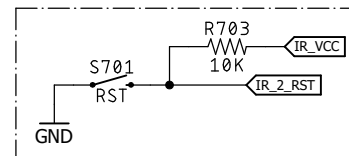
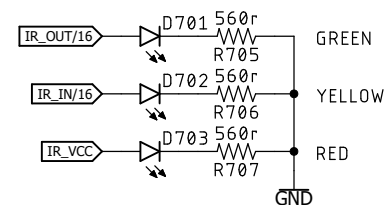
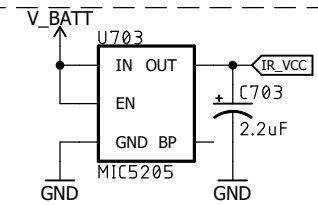
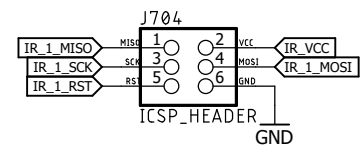
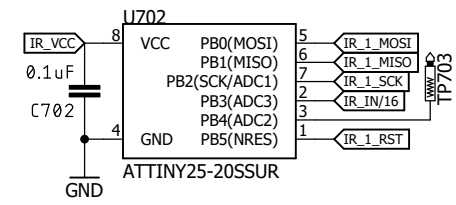
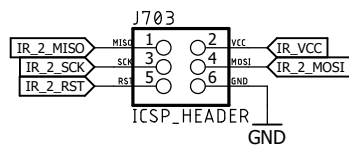
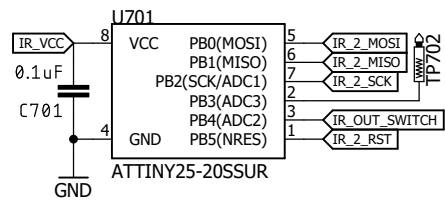
Sheet: 6/16



An IR diode receives the LED pulses, which are then decoded by the microcontroller.



An LED connected to the first microcontroller pulses out a certain sequence of pulses.

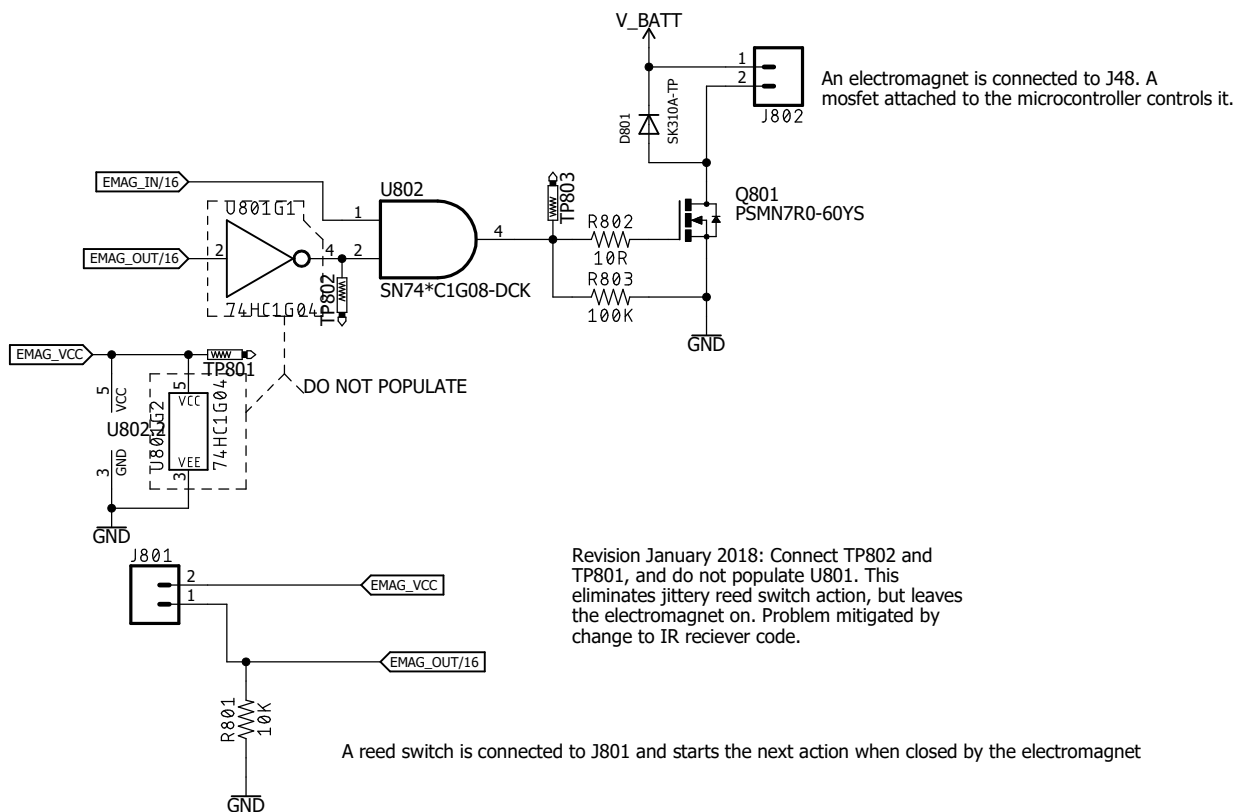


IR ACTION

TITLE: WMHS Eastern LI Invitational Circuit Board		
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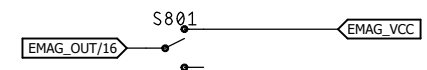
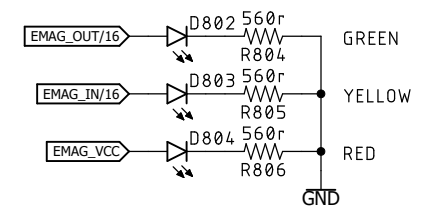
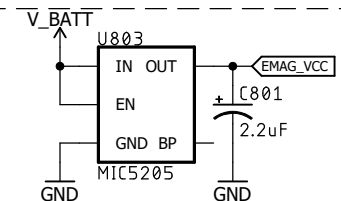
An LED is turned on by the previous action. The LED makes the phototransistor change its resistance, signaling the microcontroller to proceed to the next action. The output signal turns the LED off again.

"Use an infrared beam where the transmitter and receiver are at least 20 cm apart to begin the next action."



A reed switch triggers the next action after it is closed by the electromagnet.

"Activate a student-made electromagnet that begins the next action."



ELECTROMAGNET ACTION

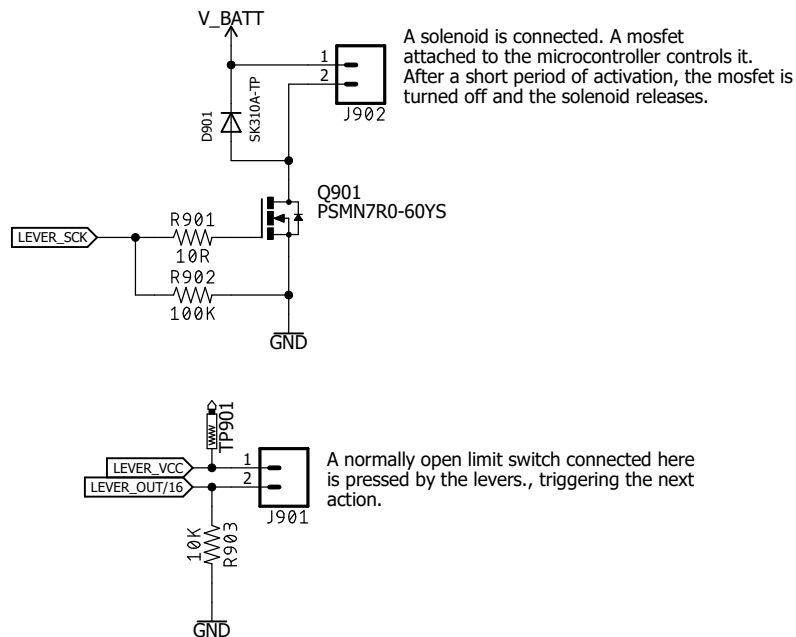
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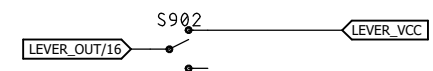
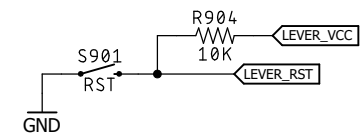
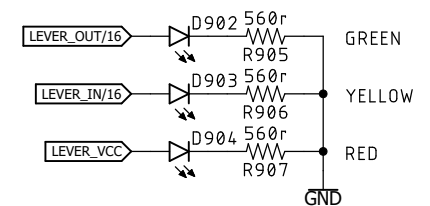
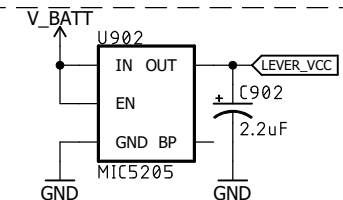
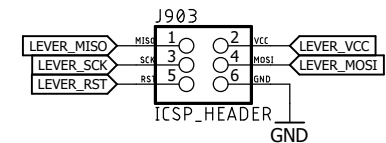
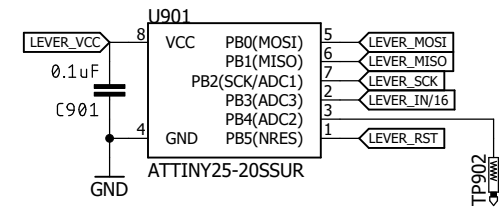
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Sheet: 8/16



A reed switch triggers the next action after it is closed by the electromagnet.

"Use the mechanical advantage of all 3 classes of levers in sequence to begin the next action."



LEVER ACTION

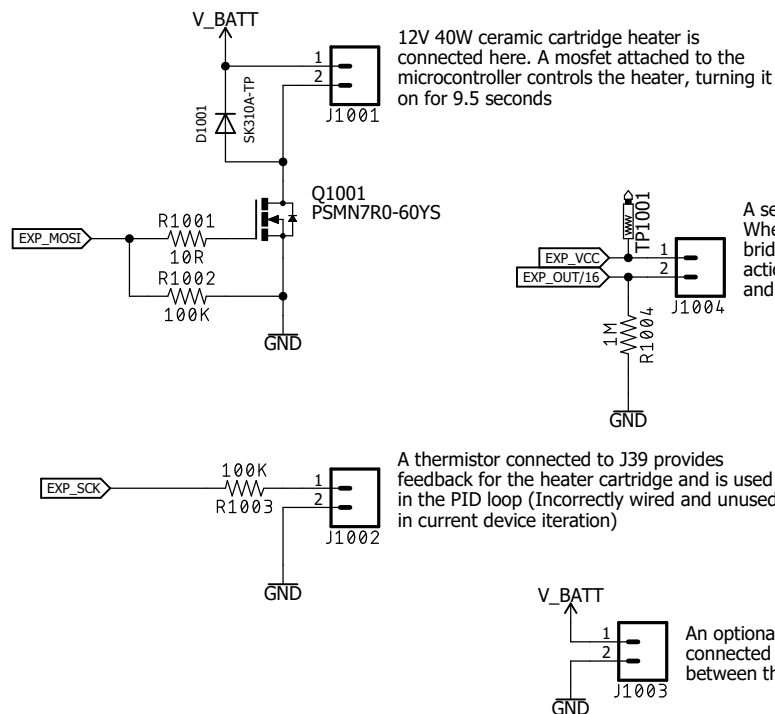
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Sheet: 9/16

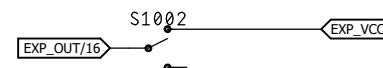
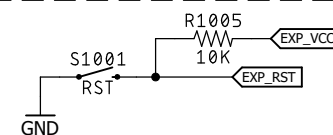
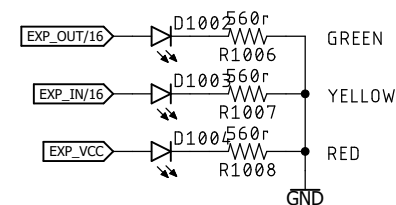
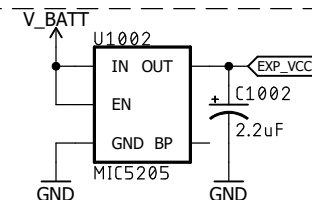
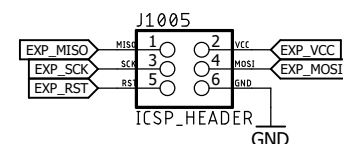
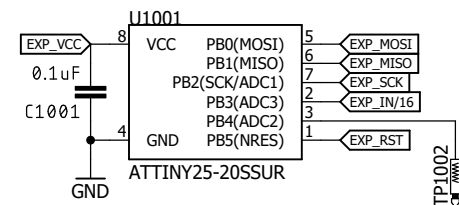


A sealed pressure chamber has an open capillary tube extending out of it that is filled with salt water. When a heater inside the pressure vessel turns on, it pushes the salt water out of the capillary tube and onto a pair of electrodes.

"Use a thermal reaction which expands a gas to activate the next action."

CLARIFICATION:

"Use a change in temperature which expands a gas to activate the next action."



GAS EXPANSION ACTION

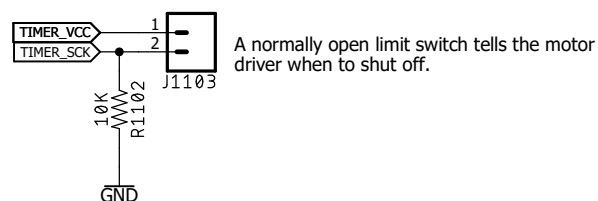
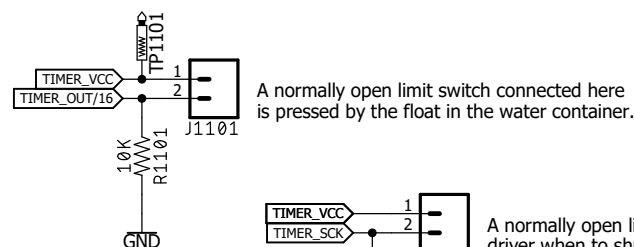
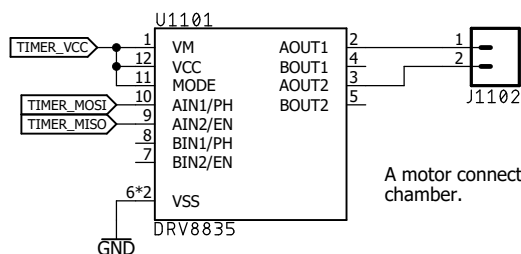
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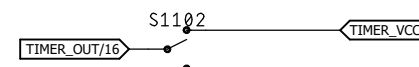
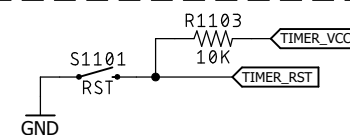
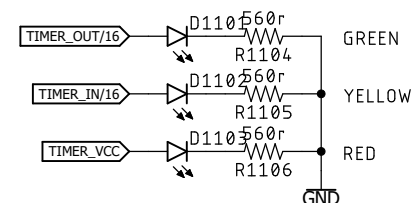
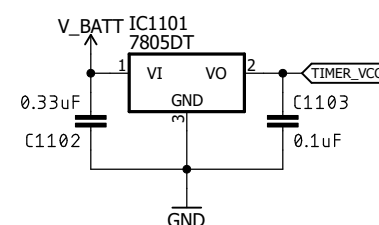
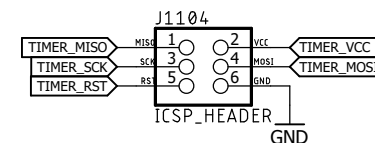
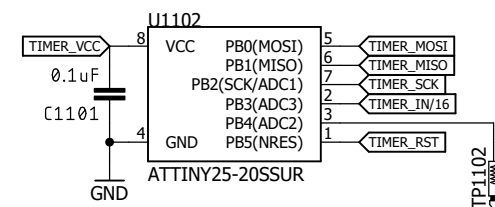
Sheet: 10/16



Alkaseltzer and water start uncombined in pressure chamber. Chamber flips, combining them and beginning action. Tube connected to chamber contains water that is pushed through and into closed container by pressure. Water level raises, pushing up on a float switch.

"Add water to a closed container so that it completes an electric circuit and begins the next action."

"To receive Bonus Points, participants must designate an action, either scorable or non-scorable, taking over 30 seconds that does not use electricity or springs for power."



CHEMICAL TIMER/WATER

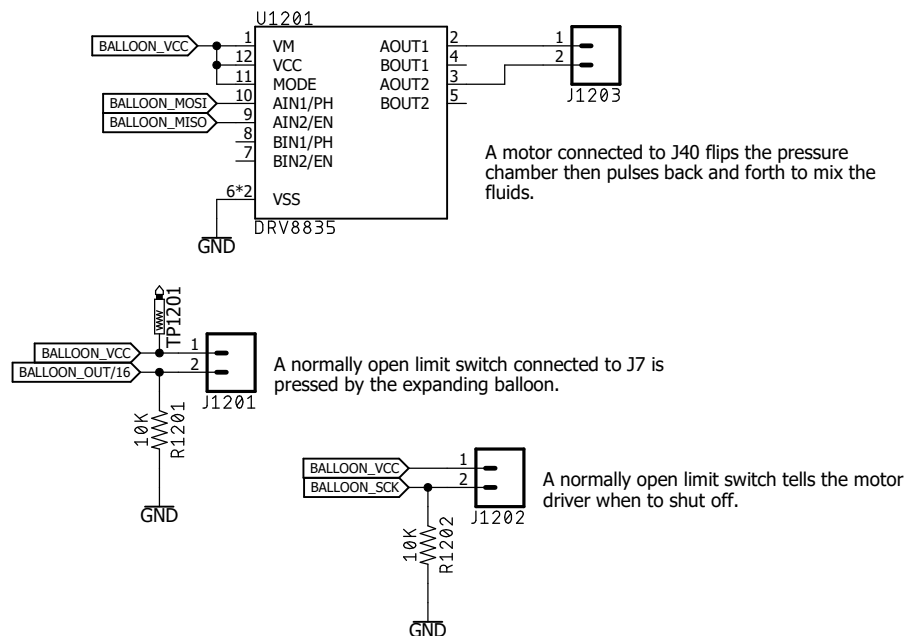
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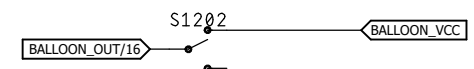
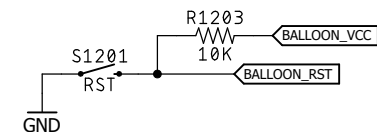
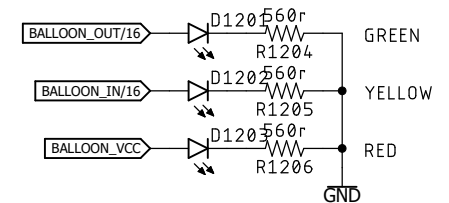
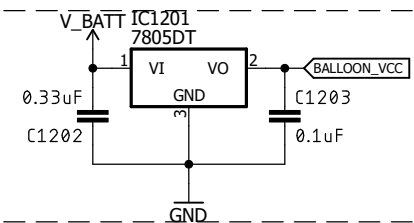
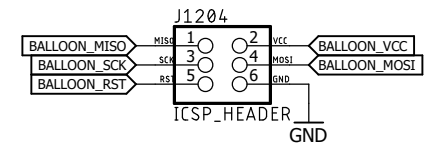
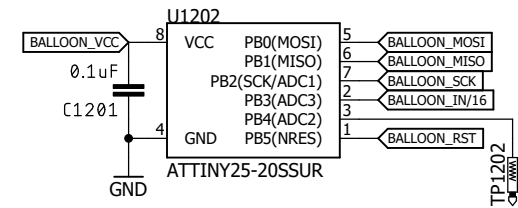
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Sheet: 11/16



Pressure chamber with baking soda and 30% warm vinegar is flipped, the two react and the resulting reaction inflates a balloon which hits a limit switch 20cm away.

"Use a chemical reaction that inflates a balloon so that the balloon strikes an object that originally was at least 20 cm away from the balloon, so that the action of striking the object continues the sequence of events."



BALLOON ACTION

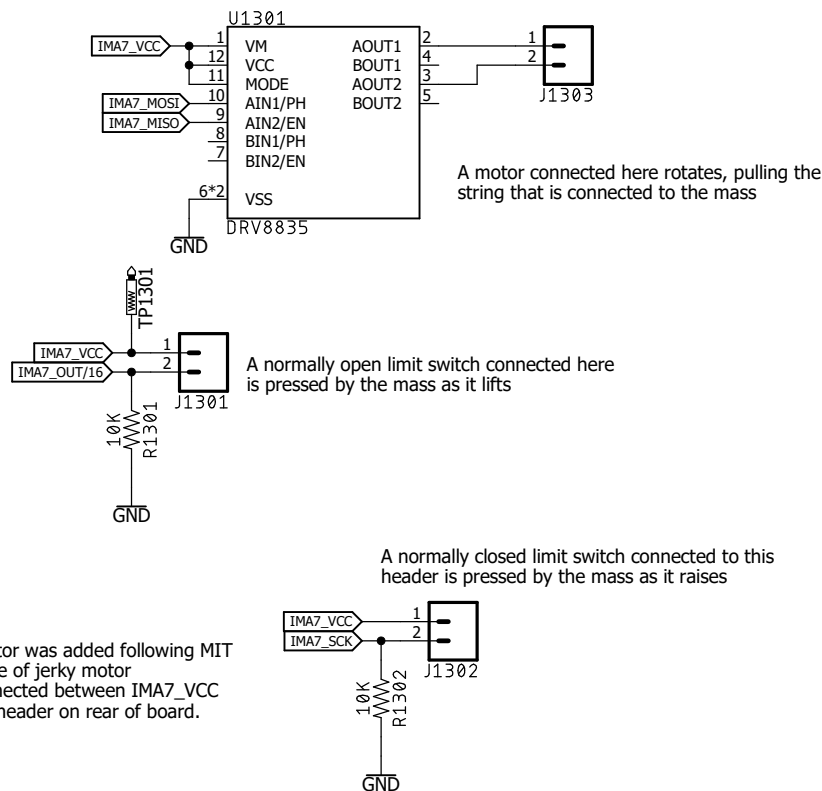
TITLE: WMHS Eastern LI Invitational Circuit Board

Document Number:

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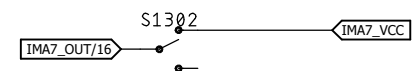
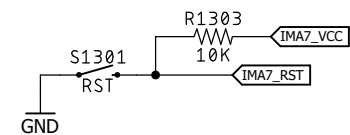
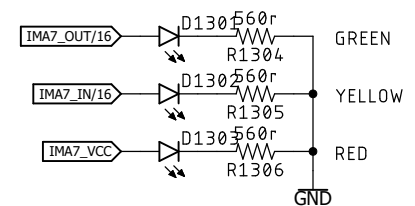
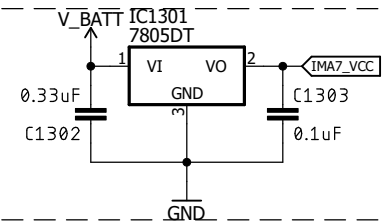
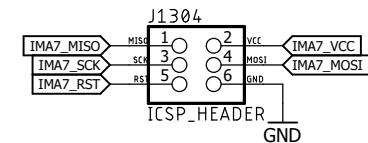
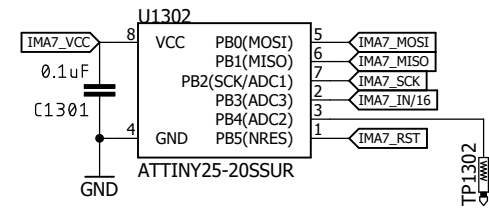
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Sheet: 12/16



The pulley system, powered by the motor, lifts a mass up 10cm and hits two limit switches, one turns off the motor and the other triggers the next action.

"Use a Pulley system with an ideal mechanical advantage (IMA) of at least 7, that lifts an object that is at least 500 g at least 10 vertical cm before the object initiates the next action."



IMA 7 PULLEY ACTION

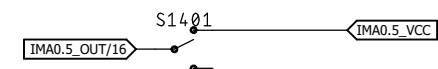
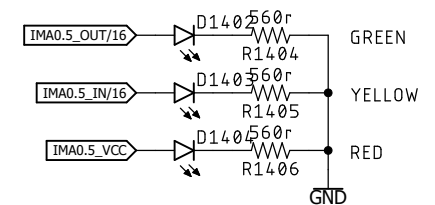
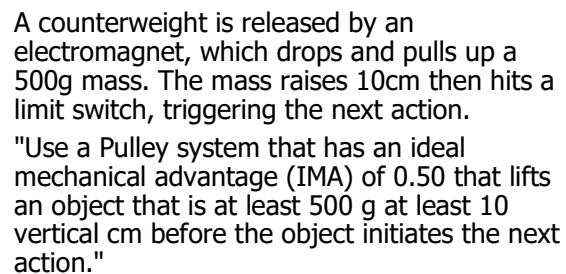
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Sheet: 13/16



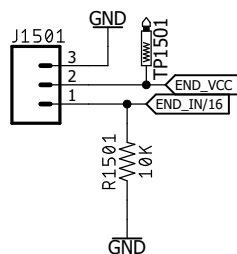
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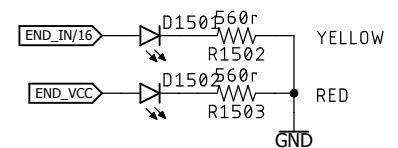
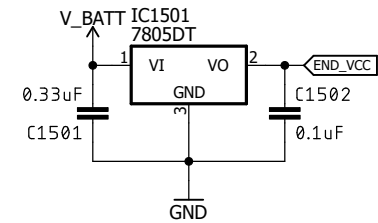
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Sheet: 14/16



Previous transfer triggers DFrobot sound recording module (connected to J6), which then plays the end recording.



END TASK

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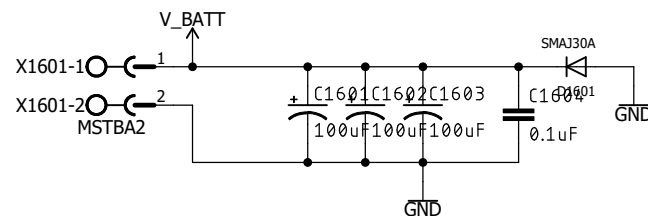
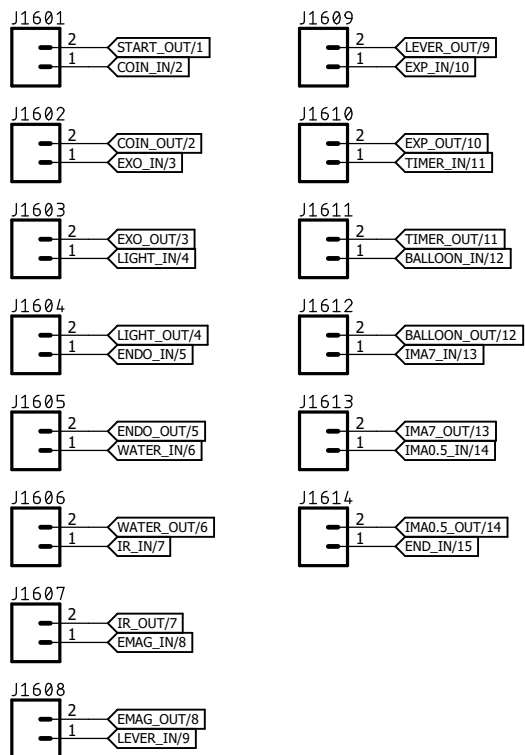
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Sheet: 15/16

"The device must play a recording of the phrase "The End" to signal the end of the run. This phrase must be clearly audible, and demonstrated for the judges prior to the run."



Jumpers are installed on all of the above headers, with the following exceptions:

J1605 ENDO_OUT -> J1606 IR_IN
J1606 WATER_OUT -> J1611 BALLOON_IN

Power and Inter-Action

TITLE: WMHS Eastern LI Invitational Circuit Board

Document Number:

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Sheet: 16/16