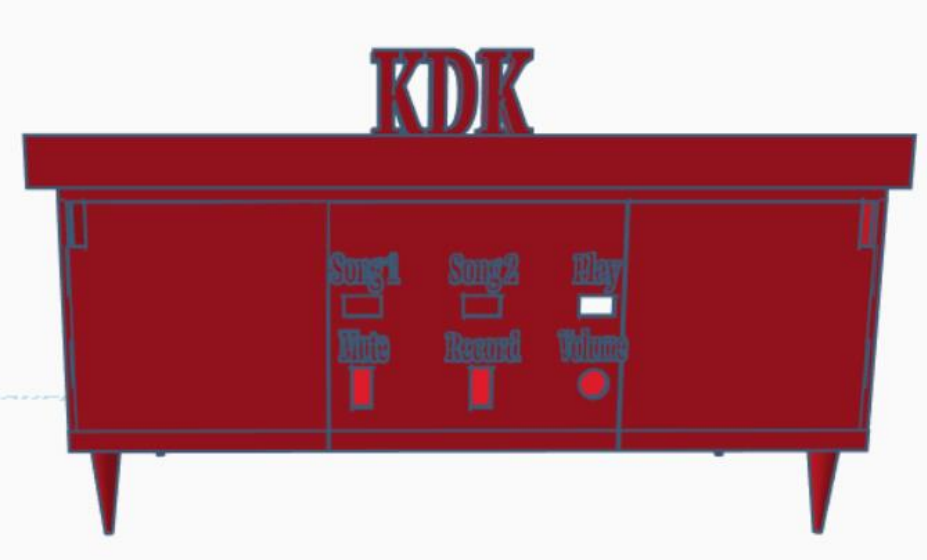
Battery Powered Melody Machine

KDK Designs

ECE 342



System Overview:

The product our group created was a Battery Powered Melody Machine. The machine can be used to play two pre-recorded songs, or the user can decide to record a song of their own. This is done by singing into the device's microphone on the top of the case and then the machine will interpret a play the user's song back to them. The pre-recorded songs can be accessed by pressing their according buttons on the front of the machine. The voice recording can be made by flipping the record switch down into the "Record" position. From there, the custom song can be played by pressing the play button. A mute switch and volume knob are also included on the front panel so the user can adjust the sound of the device to their own liking. The Melody Machine can also be powered either from an internal rechargeable battery or from a barrel plug. The Machine can operate for almost two whole hours on one charge.

Electrical Specifications:

Input Voltage(wired): 9 volts

Input Voltage(battery): 7.4 volts

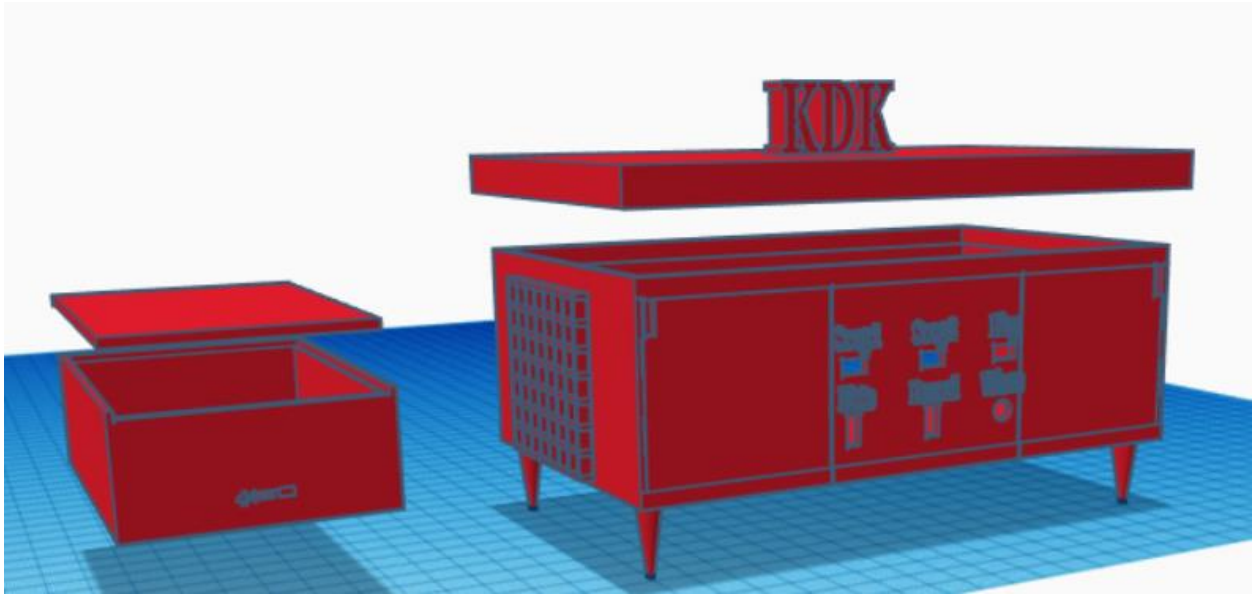
Component	**Max Current Draw**	
Arduino Uno	1000 mA	
LED Strip	300mA	50mA / LED
Audio Output	12mA	
Total:	1312mA	
Min Op. Time:	1.905	
Battery	**Charge**	
18650	2500mAh	

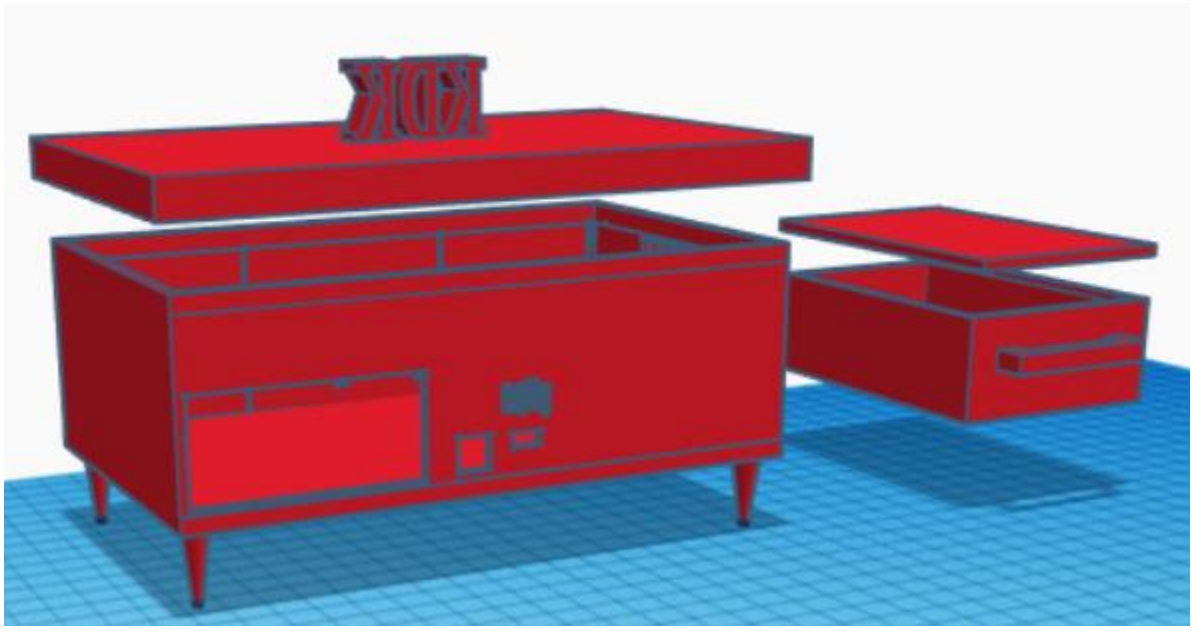
User Guide:

- To Turn on System: Plug in barrel jack and make sure power selector is switched to the 'Plug' side **OR** connect wires to battery pack (red to + and black to -) and make sure power selector is switched to the 'Batt' side
- To play Pre-recorded Songs: Press button on the front of the case entitled "Song 1" or "Song 2"
- To record and play song switch record switch downward and sing into mic on top of the machine (~20 second song). Pull switch upwards to end recording period and press the button entitled "Play" to play the custom song

- To mute: pull the “Mute” switch downward
- To alter volume: turn the “volume” knob

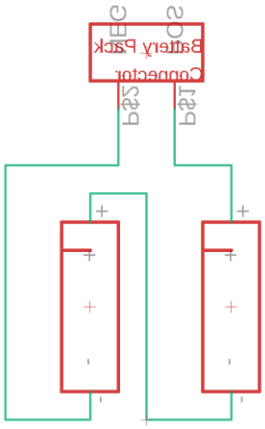
Design Artifact Figures:



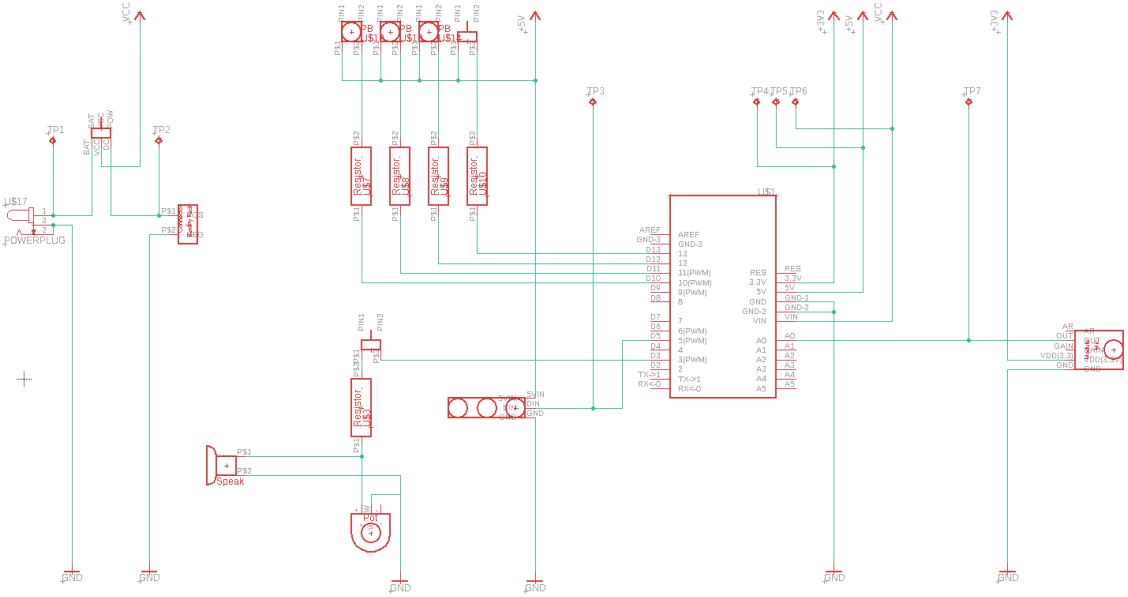


The above images are of the Melody Machine’s main housing and battery pack enclosure. In top image the front control panel of the main enclosure can be seen. The play buttons, record/mute switches, and volume knob are all contained there. The speaker can also be seen on the right side of the contained. On its lid is attached a stylish KDK designs emblem which can double as a handle to help remove the lid from the case. Next to the main enclosure is the

battery box with its connector visible on the front and its handle on the back. This is kept securely in the main housing using friction and Velcro patches to give a sturdy and cost-effective attachment. On the back of the main housing is the port for the battery pack, the port for the barrel plug, and the power switch to swap between battery and wall powered operation. Both the housing and the battery pack will be 3D printed and constructed out of sturdy ABS plastic.

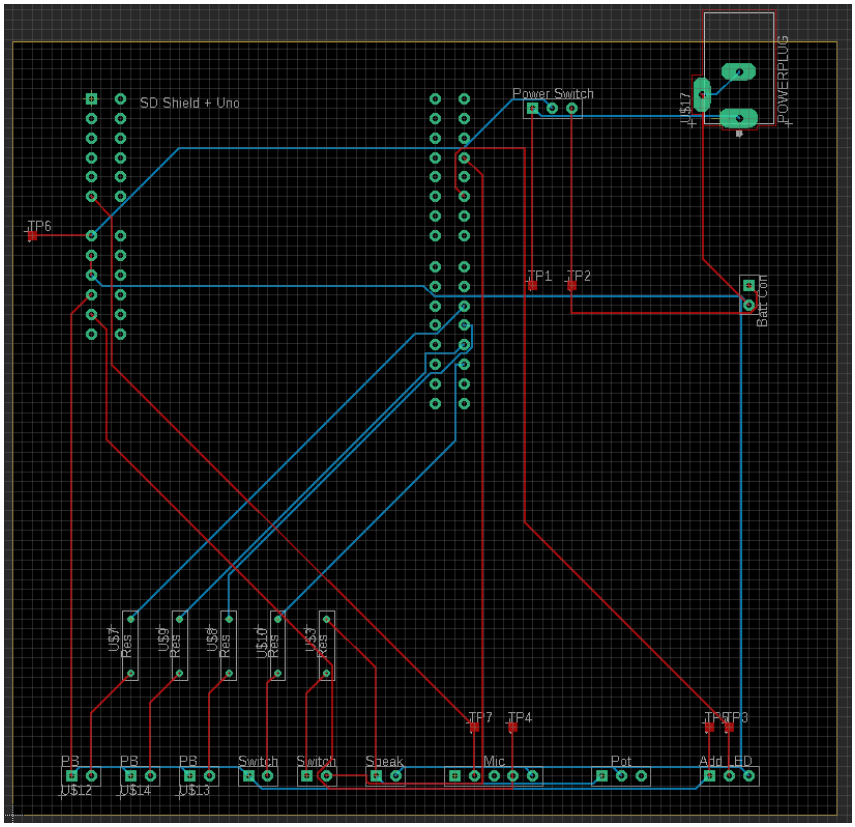


Above is pictured the schematic for the Battery Pack. It is a very simple circuit made out of two 18650 rechargeable Lithium Ion batteries connected in series to reach the desired 7.4 volts. They are connected to a female type plug with 100mil spacing which is typical industry style pinheader spacing.

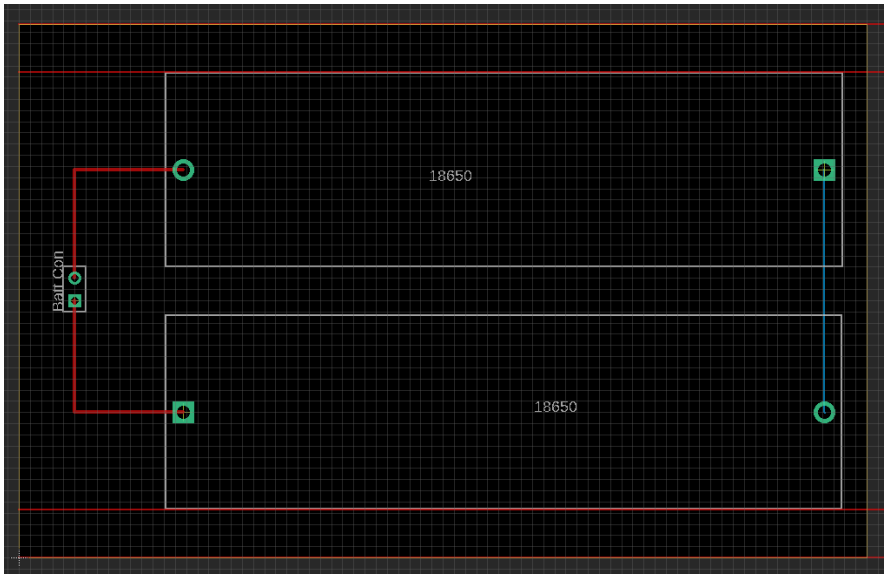


The main board's circuit schematic above is the final revision decided on for the Melody Machine. Starting from the left, the first portion we see is the piece of the circuit used to switch between the battery power and the wall power. It is a double pull double through toggle switch that connects to the Arduino voltage input, the barrel plug, and the battery terminals. Then to the right of it is the Arduino Uno circuit with connections to the audio circuit, the user interface buttons, the LED stip, and the microphone.

PCB INFORMATION:



Here we have the final revision of the main PCB. The Arduino Uno and SD shield both fit together then connect to pin headers placed in the top left of the board. The barrel plug battery connector can also be seen in the top right. Pull-up resistors and a voltage divider resistor for the audio circuit are located in the bottom left with various test points scattered about. All Components connect to the board via female-female wires so the component itself can be placed in the case housing which allows for both easy replacement and easy repositioning for possible future case revisions. These footprints lie within the general region of the circuit closest to their planned location on the inside of the main housing.



Finally, we have the simplistic battery pack PCB layout. Two 18650 holders will be soldered into position in the spots outlined above. The reason for this is so they can be easily removed and recharged without requiring the end user to de-solder or dispose of perfectly good batteries. Per the schematic the two batteries are connected in series to double the output voltage.

Part Information:

Component	Quantity	Price	Value	Part Num.	Manufacturer
Arduino Uno	1x	$22.00	N/A	DEV-11021	Sparkfun
Pushbutton (NO)	3x	$0.75	N/A	B3F-3000	Omron
SPST Switch	2x	$6.82	N/A	ATE1E-2M3-10-Z	Nidec Copal Electronics
Addressable LEDs (1m)	1x	$19.99	N/A	LPD-8803	Greeled Electronin Ltd.
10kΩ Resistor (1/4 w)	4x	$0.80	10000Ω	CFR25S	Yageo
100Ω Resistor (1/8W)	1x	$0.80	100Ω	299-10-RC	Xicon
Potentiometer	1x	$1.64	10kΩ	24N-10K-15R-R	Jamesco ValuePro
18650 Li-Ion Battery	2x	$7.98	3.7	INR18650-25R	Samsung
10kΩ Potentiometer	1x	$2.32	10000Ω	RK163	AlpsAlpine
8Ω Speaker (1/5 w)	1x	$3.26	8Ω	CSS-50508N	CUI Devices
Mic Module	2x	$7.95	N/A	MAX9814	Maxim integrated
Data Logging Shield	1x	$13.95	N/A	1141	Adafruit
SDHC Card	1x	$14.99	32GB	SDSDB-032G-AFFP	SanDisk
Speaker	1x	$1.95	0.3W	135694	Jameco
Slide Switch	1x	$0.80	N/A	MHSS1104	Apem
SPDT switch	1x	$3.41	N/A	ATE2D-2M3-10-Z	Nidec Copal Electronics
Total Cost:		$115.63			