

Week 11

Keel Bone Chicken Project

11/07/25

This Week

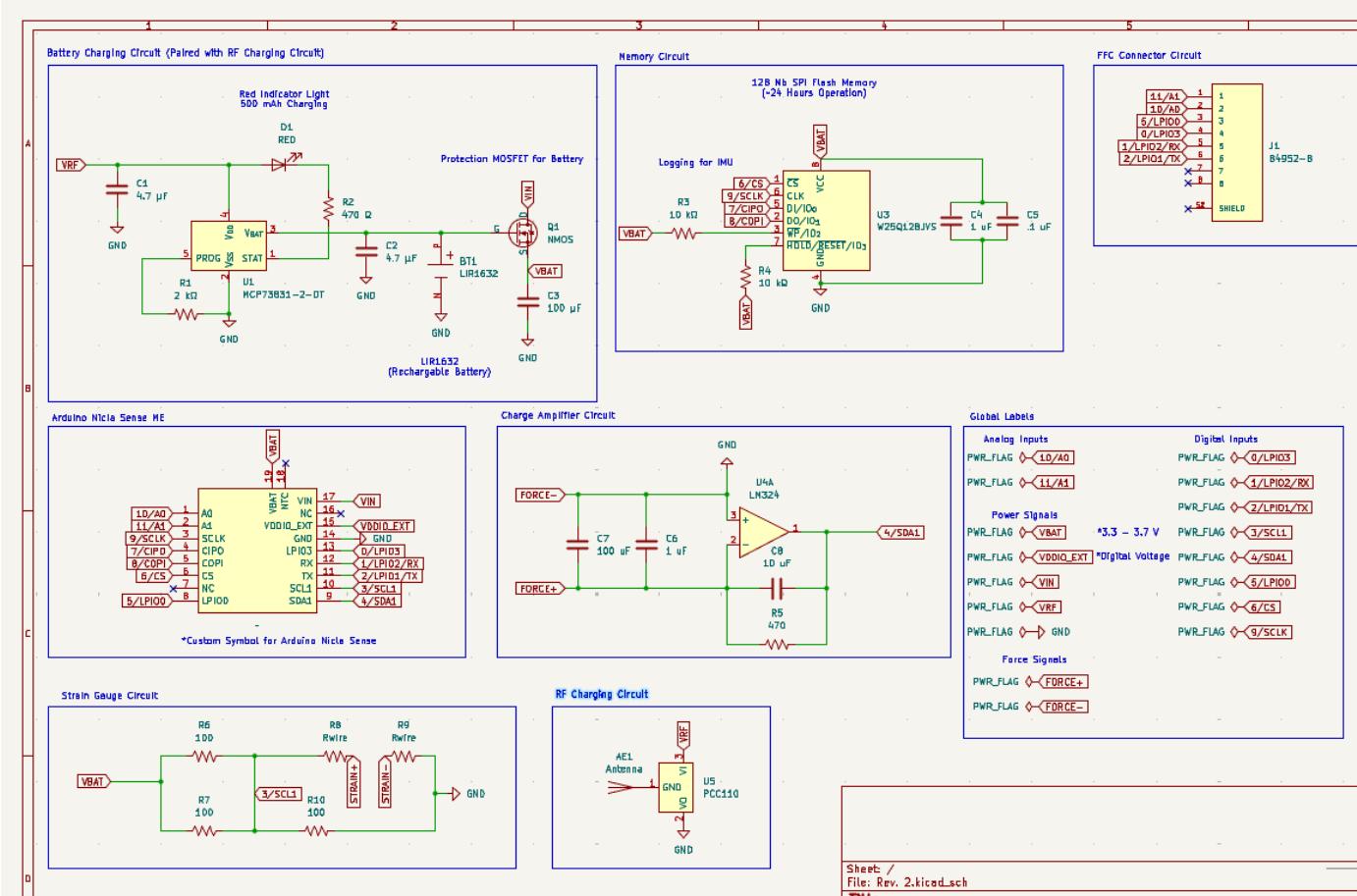
Progress this week

- Revision 2 for Circuit Design
- Remote Power Transmission with Battery
- Improved Data Logging
- Calculations for Remote Charging

Revision 2 for Circuit Design

Introduction of RF harvesters onto board design

- Multiple (10+) Transmitters on Floor boards for chickens equipped with PCBs



Remote Power Transmission with Battery

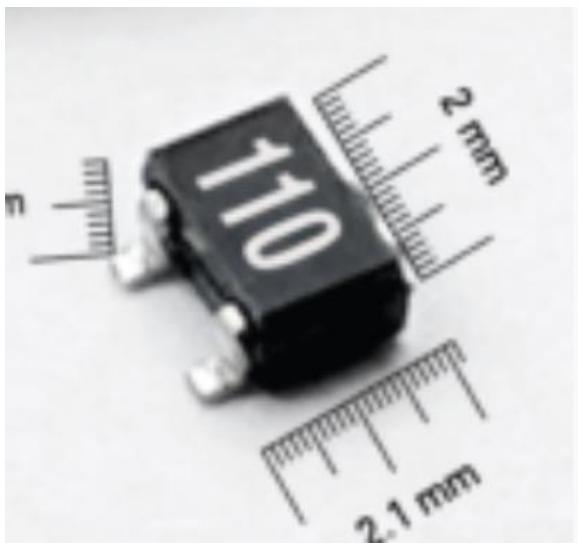
Power Harvester System

Power Transmitters Under Floorboards:

- <https://www.powercastco.com/products/rf-power/powerspot-transmitter>

Power Transceivers on System:

- <https://www.powercastco.com/products/rf-power/pcc110>



Improved Data Logging

Data logging now works for values > 60 seconds on the web interface

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
109	2025-11-0	28.3	30	999.9444	273	424	-4115	-8	50	13				0.533629	-0.84344	-0.01837	0.058716	25	500
110	2025-11-0	28.29	30	999.9444	367	379	-4028	0	-10	-4				0.533568	-0.84344	-0.01813	0.059143	25	500
111	2025-11-0	28.27	30	999.9444	327	389	-4059	-3	19	8				0.533568	-0.84344	-0.01813	0.05896	25	500
112	2025-11-0	28.25	30	999.921	327	393	-4076	-8	-23	-8				0.533629	-0.84344	-0.01819	0.05896	25	500
113	2025-11-0	28.23	30	999.9054	317	414	-4031	2	31	10				0.533629	-0.84344	-0.01819	0.059021	25	500
114	2025-11-0	28.21	30	999.9444	288	400	-4102	-1	-42	-11				0.53369	-0.84338	-0.01831	0.058777	25	500
115	2025-11-0	28.19	31	999.96	320	374	-4061	4	28	10				0.533629	-0.84338	-0.01819	0.05896	25	500
116	2025-11-0	28.17	31	999.921	350	369	-4003	1	-10	-2				0.533568	-0.84344	-0.01813	0.059082	25	500
117	2025-11-0	28.17	31	999.921	329	391	-4081	0	16	5				0.533629	-0.84344	-0.01813	0.059021	25	500
118	2025-11-0	28.17	31	999.9444	323	387	-4075	1	-17	-5				0.533629	-0.84338	-0.01819	0.058899	25	500
119	2025-11-0	28.16	31	999.9444	329	389	-4060	-11	-6	-8				0.533629	-0.84344	-0.01813	0.058899	25	500
120	2025-11-0	28.13	31	999.96	323	385	-4079	1	-6	-4				0.533629	-0.84344	-0.01813	0.05896	25	500
121	2025-11-0	28.13	31	999.96	378	341	-3938	5	-6	0				0.533568	-0.84344	-0.01782	0.059265	25	500
122	2025-11-0	28.13	31	999.9834	358	375	-4032	-2	-30	-8				0.533568	-0.84344	-0.01801	0.059021	25	500
123	2025-11-0	28.11	31	999.9834	358	413	-4113	-10	48	12				0.533629	-0.84338	-0.01813	0.05896	25	500
124	2025-11-0	28.11	31	999.96	348	368	-4086	-7	-16	-7				0.533629	-0.84338	-0.01813	0.059082	25	500
125	2025-11-0	28.09	31	999.96	323	375	-4073	1	31	9				0.533629	-0.84344	-0.01807	0.058899	25	500
126	2025-11-0	28.09	31	999.9834	322	389	-4069	-3	-4	-3				0.533629	-0.84338	-0.01819	0.05896	25	500
127	2025-11-0	28.07	31	999.96	352	410	-4014	5	16	6				0.533629	-0.84338	-0.01813	0.059143	25	500

Calculations for Remote Charging

Estimate harvested DC available per PCB and for 20 PCBs at D = 1.0 m.

- Devices:
 - Transmitter: Powercast TX91501, EIRP = 3.0 W.
 - Receiver: Powercast P2110 / P2110B (compact SMD Powerharvester).
- Friis Free Space Equation:
 - $P_r = EIRP \times G_R \times \left(\frac{\lambda}{4\pi d}\right)^2$
 - D = 1.0, 0.5 (Realistic)
- Frequency = 915 MHz (Powercast specified)
- RX antennas:
 - Dipole (1.0 dBi → 1.2589 mW)
 - Patch (6.1 dBi → 4.0738 mW)
- Confidence Levels (Efficiency Ratings)
 - 10% (Conservative), 50% (Realistic), 75% (Very optimistic)

Calculations for Remote Charging

Data found for Remote Charging

Efficiency	Rx Antenna	RF (mW)	DC (mW) per PCB (1.0 m)	DC (mW) per PCB (0.5 m)	20 PCBs (@ 1.0 m) (mW)	20 PCBs (@ 0.5 m) (mW)
10%	dipole	2.571	0.257	1.028	5.14	20.56
10%	patch	8.320	0.832	3.328	16.64	66.56
50%	dipole	2.571	1.285	5.140	25.71	102.84
50%	patch	8.320	4.160	16.64	83.20	332.80
75%	dipole	2.571	1.928	7.712	38.56	154.24
75%	patch	8.320	6.240	24.96	124.79	499.16

Next Week

Projection of next week's work

- Analysis of cost for successive RF Transmitters
- Finalized BOM for PCB components
- Analysis of Data collected from agriculture department
- Video/README of walkthrough for data collection
- Full Power Analysis of PCBs

References

- Powercast Corporation. (n.d.). *P2110B RF Powerharvester datasheet* (Rev. 3). Retrieved November 7, 2025, from <https://www.powercastco.com/hubfs/Products/RF%20Power/P2110B-Datasheet-Rev-3.pdf>
- Powercast Corporation. (n.d.). *TX91501 transmitter user manual*. Retrieved November 7, 2025, from <https://www.mouser.com/datasheet/2/329/User-Manual-TX-915-01-Rev-A-4-151111.pdf>
- Powercast Corporation. (n.d.). *P2110-EVB evaluation board information*. Retrieved November 7, 2025, from <https://www.powercastco.com/products/development-kits/p2110-evb>
- Mouser Electronics. (n.d.). *P2110 Powerharvester product listing*. Retrieved November 7, 2025, from <https://www.mouser.com/ProductDetail/Powercast/P2110?qs=kw8vCQu8LVcM8eL3CmnLwQ%3D%3D>
- Texas Instruments. (n.d.). *BQ25570 energy harvesting PMIC datasheet*. Retrieved November 7, 2025, from <https://www.ti.com/product/BQ25570>
- Pozar, D. M. (2011). *Microwave engineering* (4th ed.). Wiley.
- Electronics. (2023). *Zero-energy IoT devices in smart cities: A survey of RF energy harvesting approaches*. *Electronics*, 12(1), 148. <https://doi.org/10.3390/electronics12010148>

Thank You

Purdue Polytechnic Institute