## **CHARGIN'**

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# Good Area Chargers are Hard!

- Apple abandoned the project
- Samsung's isn't great
- Only cover small areas
- Awkward in practice
- Take up desk space
- Requires precise positioning
- Impractical to scale up



#### **Use Case**

#### Existing Solutions

- Most only work in one position
- Others require a matrix of charging coils
- No product perfectly aligns a phone

#### Chargin's Solution

- Detect phone(s) or other devices that support wireless charging.
- Locates multiple devices and charge them sequentially.
- Translate a single coil to location of device.
- Screen provides user feedback/interface.
- User can monitor charge and set desired battery percentage
- Chargin's table-top design makes the surface multi-purpose



## ECE Areas & Design Technology

- <u>Sensing Circuits</u> IR transceivers, NFC sensors, Magnetometers
- <u>Charging Circuits</u> Qi charging protocol, integrating Qi coil and sensing circuitry, tapping power lines on Qi-PCB to get charging statistics
- Microcontrollers Arduino, RPi
- <u>Software</u> Front end UI, signal processing, control loops
- <u>Mechatronics</u> Stepper Motors, Motor-controllers

#### **Use Case Requirements**

- Reliably detects and distinguishes multiple devices
- Maintains desired state of charge for all devices
- Rejects non-smart devices
- Provides user feedback via LEDs and Screen
- Detects and translates rapidly enough to charge practically
- Attractive and rigid enough to use as a multi-purpose desk

### **Success Metrics**

Attribute	Target (SI)	Target (Imp.)	Notes			
Footprint	50cm x 50cm	20" x 20"	Not useful if too small			
Thickness	5 cm	2"	Cumbersome if too thick			
Weight	5 kg	11 lbs	Can't be heavier than the table itself			
Detection	0.5 sec	0.5 sec	Very rapidly determine phone location			
Accuracy	95%	95%	Correctly identify phones reliably			
Movement	1 m/s	2.2 mph	~1.5 seconds to traverse 50x50cm table diagonal			
Top Thickness	5 mm	0.2"	Can't charge if phone is too far from coil			
Surface Temp	50°C	122°F	Dangerous for phone and user if too hot			

## **Technical Challenges**

- Accurate device detection on flat surface
- Multi-device detection and queuing
- Provide charge state feedback
- Supplying sufficient power to device
- Reliably moving to detected device
- Rigid structure to prevent movement



## **Solution Approach**



#### **Testing & Verification**

- Sensor Selection & Density
  - Compare actual and measured phone locations
- Stage & Motor Control
  - Move stage back and forth several times and measure change in destination
- Software-Hardware Integration
  - Repeated troubleshooting to ensure smooth operation between systems
- User Interface
  - User interface will be reviewed for ease of use and redesigned as needed
- Detection accuracy
  - Place several chargeable and non-chargeable devices on table and count hits and misses
- Translation and detection speed
  - Place several devices on table, measure time to reach them all, repeat

## **Division of Labor**

#### • Anirud

- Sensing Circuitry
- Power Circuitry
- Component Wiring

#### Callum

- Sensing Matrix
- User-Interface
- Mechanical Integration

#### Luca

- Mechanical Integration
- Motor Control
- Software Control

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Anirud Durani	, Callum Bagnall,	& Luca Garlati				On track Low risk Med risk High risk Unassigned
Project start date:						February
Scrolling Increment:	•					1 4 5 6 7 5 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 23
Milestone description	Category	Assigned to	Progress	Start	Days	
Sensor Matrix	Milestone	All	28	7/%/2024	45	
Mag/Ind. Sensor Test						
Matrix Design						
Grout Design						
meliable Sensing						
Total Matrix Assembl	r On Trieck		0%	3/6/2024		
XV Stage	Milestone	.40	2%	2/5/2024	47	
Stege Design				2/5/2024		
Stepe Assembly	On Track		0%	2/15/2024		
Motor Connection						المحوور ووووي وووو وووو و و
Stage Venfication	On Track		0%	3/4/2024		
Working Rage						
Verify Stage Precision	On Track			8/16/2024		
U ser Interface	Milestone		<b>0%</b>	3/15/2024		
Simple LED Response						
Status Display			0%	2/28/2024		
	Gosi On Treck	C8	0% 8%	3/25/2024		
User Input/Control	On Treek	CB/LG	0%	3/25/2024	14	
Software						
DeviceMap						
Ut Link	On Track	CBA.6	<b>0%</b>	3/17/2024	14	
Charging Apparatus	Milestone	.41		2/15/2024	38	
Efficiency/Testing	On Treck	A0/08	0%	3/14/2024	10	
Final Build	Miestone	AI	0%	2/5/2024	59	
Frame Design						
Material Curation/Pre			0%	2/15/2024		
Frame Assembly						
Stage Integration	On Track		0%	2/24/2024		عدي وووو وووو وووووو
Matrix Integration						د د د د <mark>م د و و و و و و و و و و و و و و و و و و</mark> و
Soft ware Link	On Track	CB/LG		3/15/2024		
MMVP						
Ut Integration						
System Deougging	On Track	الم	U%	3/18/2024	25	
Logistics	Mestore	AU	18%	2/1/2024	81	
website Setup	Low Rosk	A41 الم	1879	2/1/2024		
Proposal Presentation			75%	2/1/2024		
Design Presentation	On Track		0%	2/12/3024		
Interim Demo						
Final Presentation	On Track		015	4/8/2024		

### **Scheduling Approach**

