

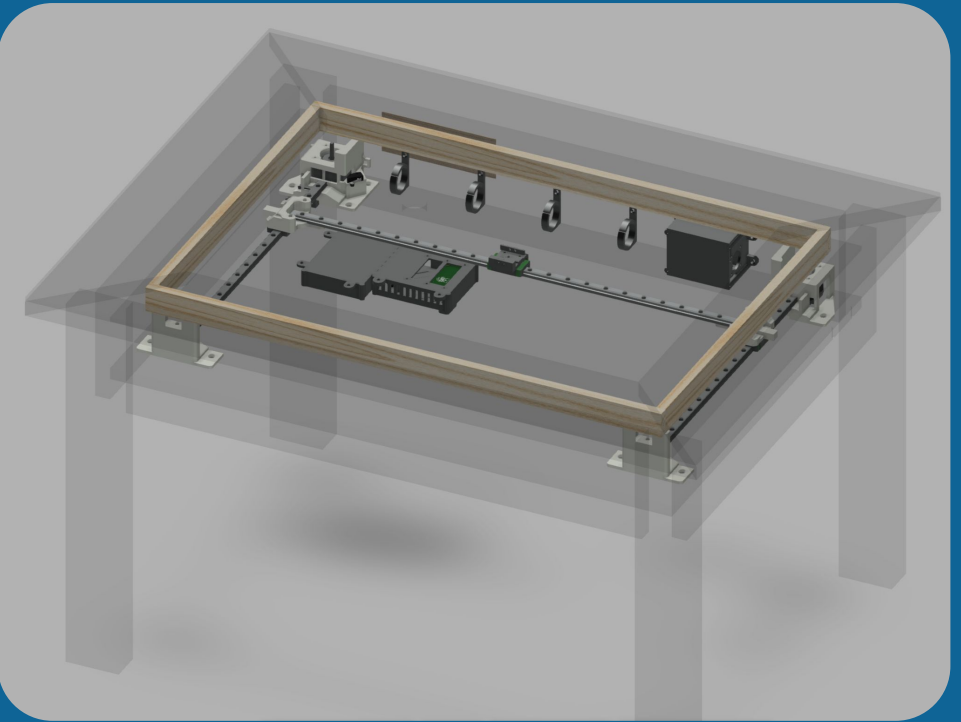
CHARGIN'

TEAM A5:

Anirud Durani

Callum Bagnall

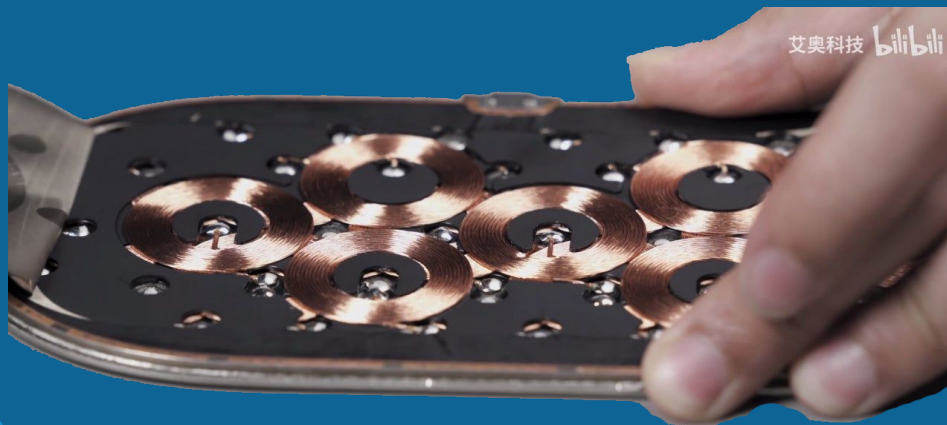
Luca Garlati



<https://www.diy machines.co.uk/kinetic-sand-art-coffee-table-self-drawing>

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

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

Use Case Requirements

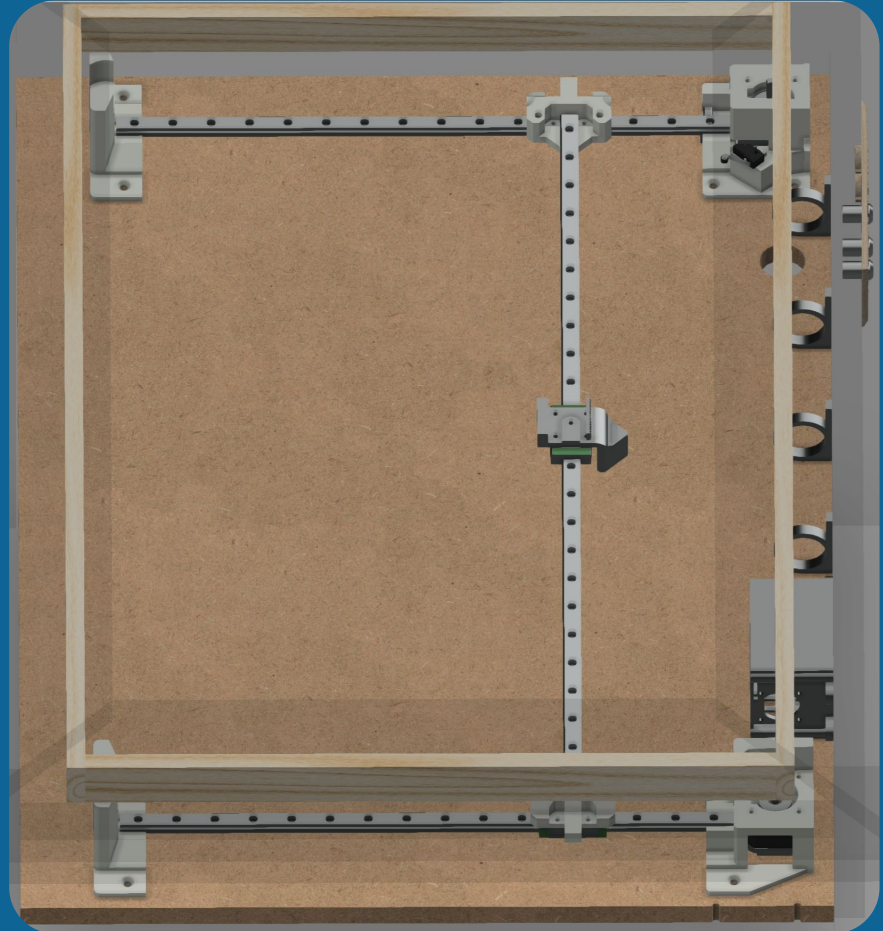
- Reliably detects and distinguishes multiple devices
- Maintains desired state of charge for all devices
- Rejects non-smart devices
- Provides user feedback via LEDs and Screen
- Detects and translates rapidly enough to charge practically
- Attractive and rigid enough to use as a multi-purpose desk

Success Metrics

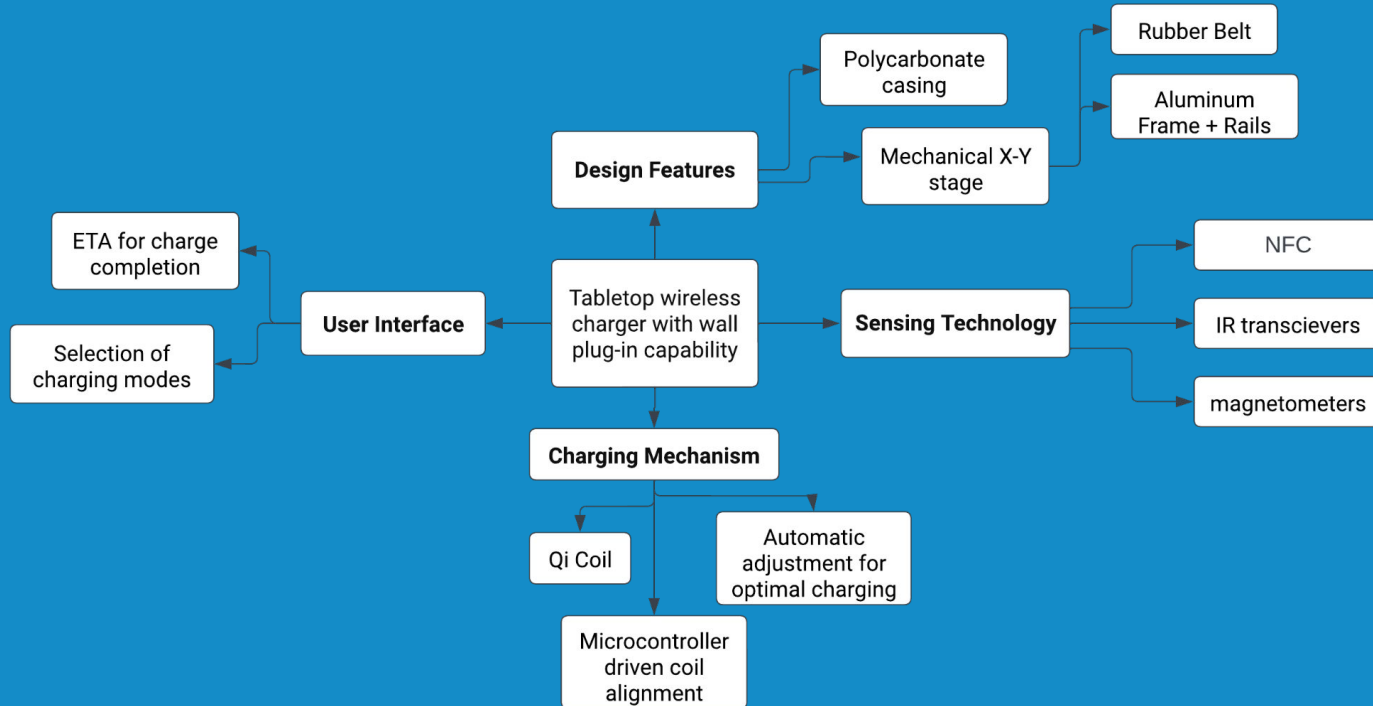
Attribute	Target (SI)	Target (Imp.)	Notes
<i>Footprint</i>	50cm x 50cm	20" x 20"	Not useful if too small
<i>Thickness</i>	5 cm	2"	Cumbersome if too thick
<i>Weight</i>	5 kg	11 lbs	Can't be heavier than the table itself
<i>Detection</i>	0.5 sec	0.5 sec	Very rapidly determine phone location
<i>Accuracy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

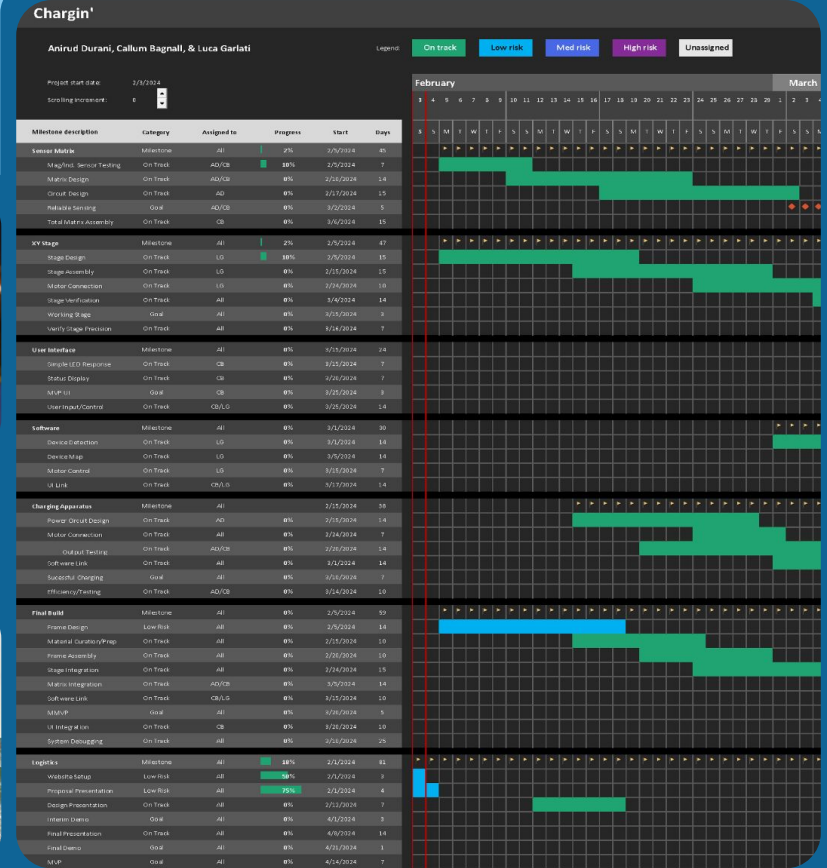
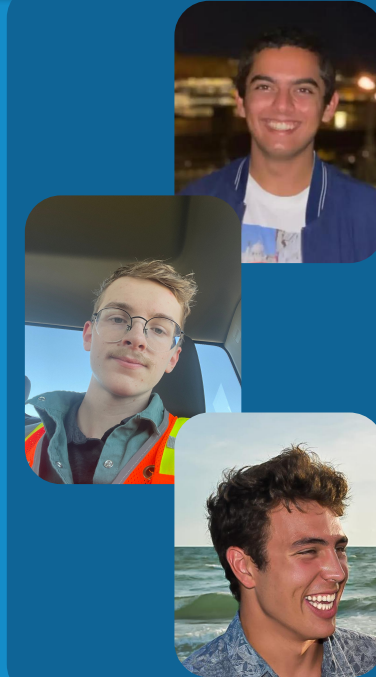
- Sensing Circuitry
- Power Circuitry
- Component Wiring

- Callum

- Sensing Matrix
- User-Interface
- Mechanical Integration

- Luca

- Mechanical Integration
- Motor Control
- Software Control



Scheduling Approach

