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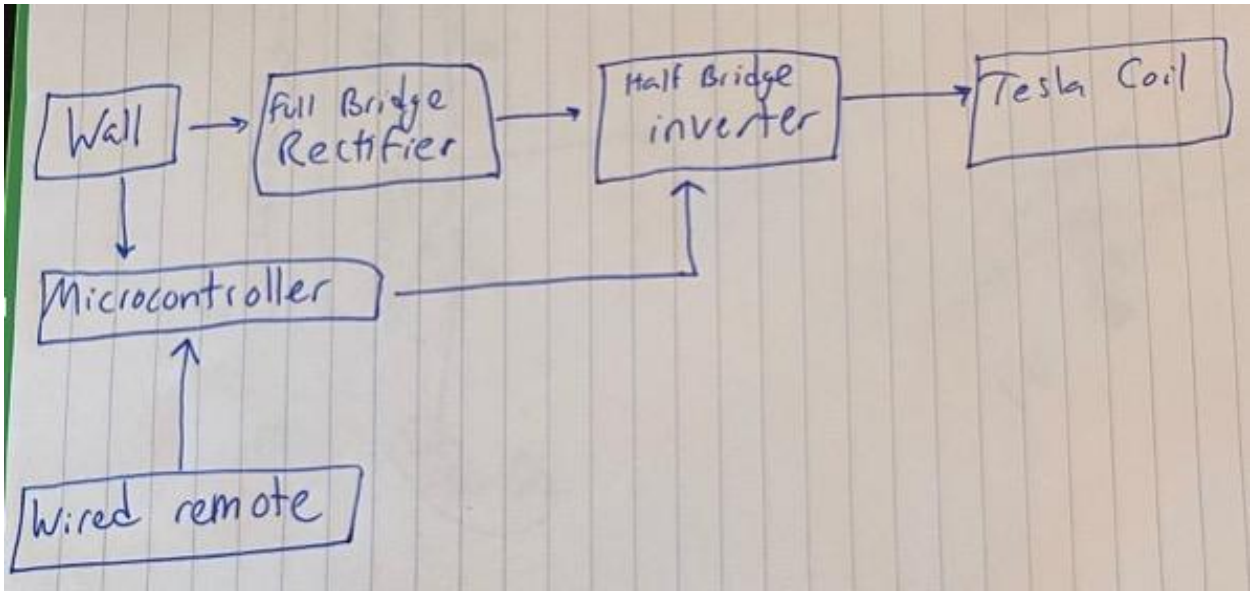
Senior Design Review Meeting 0 - Musical Tesla Coils
Tuesday, February 9, 2021 11:00 a.m.

Agenda (Leader- Leo):

Since we haven't been at school we don't have any progress updates from individuals for scheduled tasks or updates on action items from previous meetings

- Present high level design block diagram
- Address concern about wired remote as potential safety hazard from Prof. Schafer
- Present major subsystems and their requirements
- Present and discuss our plan to achieve our first design review on March 2
- Discuss our set of problems we are not sure how to solve at the moment
- Ask Prof. Schafer for any feedback

System Block Diagram:



Potential Safety Hazard:

Sidenote - addressing concern about wired remote to control the coils: We will use a breaker and the operator will wear electrically insulated rubber gloves. This should sufficiently protect the operator against any potentially dangerous current.

Need to actually isolate - opto isolation between half bridge inverter and microctonroller

Major Subsystems and Requirements:

- Wired Remote
    - Allow the user to choose a song
    - 5 buttons will correspond to 5 different songs programmed in our microcontroller
- Microcontroller (programming)
    - Read input from remote (selects song)
    - Output square wave that corresponds to frequency of note in song to control our switching circuitry (alternating operation of our IGBTs)
      IGBT driver chips to input to inverter
- Full Bridge Rectifier
    - Convert 120 V_{RMS} to 170 V_{DC}
    - Break above a certain current (TBD)
- Half Bridge Inverter
    - Receives input DC voltage from full bridge rectifier
    - Receives amplified input square wave from microcontroller (at frequency of note we want to play) and applies to gate of our IGBTs
    - Output a +170 V_{DC} or 0 V_{DC} signal to the primary coil
- Tesla Coil
    - Receive 170 V amplitude square wave from half bridge inverter into primary coil
    - Achieve sufficient voltage on surface of toroid (100,000s of Volts) through oscillations at resonant frequency
    - Output electric arcs at specified frequencies to generate selected melody
    - Safely discharge upon completion of operation
    - Portable

DRIVER FOR IGBTs (current)
Driver chips
Prof. Chisum
Hackaday Tesla coil wand
Hardest one first

Documentation
IGBTs won't be on PCB

Plan to Achieve First Design Review:

- Done by February 16
    - Place proposal and high level design documents on the team website
    - Design full bridge rectifier in circuit simulation software
        - Describe how it works and why it's needed in our design
        - Calculate values (input/output voltage/current/power)
        - Done by February 23
    - Have wired remote selected, understood, and ordered
    - Design microcontroller board on KiCAD
- Done by March 2
    - Design half bridge inverter in circuit simulation software
        - Describe how it works and why it's needed in our design
        - Calculate values
    - Design Primary and secondary of Tesla Coil based on constraints of the subsystems
        - Calculate values

Set of problems that we are not sure how to solve:

- Solid state vs. spark gap Tesla coil arc size
- Where to test it? A month or two down the road

Where to test subsystems?
Getting Fitz basement room
One hand in pocket rule

List of actions to answer these uncertainties:

- Research main differences of outputs between solid state and spark gap Tesla coils for producing music
- Ask Prof. Schafer and perhaps other members of EE department where we should test given the high voltage and potential for interference with electronics of 205 lab