

Initial Project and Group Identification
Document
Divide and Conquer, Version 1.0

Group 26

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Project Goals and Objectives

Music is enjoyed by many on a daily basis, both by people who listen or play music. Aside from people's general intimidation of learning an instrument, the cost to enter this field acts as another deterrence. This holds especially true with electric instruments such as an electric bass guitar which requires an amplifier to produce aurally appealing sounds. However, these amp headers can cost an absurd amount of money, leading some to never venture into the world of music.

Our project and objective is to make an affordable bass amp header. We aim to make an efficient, yet quality amp header that does not have unnecessary engineering and features to ramp up the price. This amp header would have multiple outputs such as a headphone jack, a speaker output, as well as bluetooth output. An inevitable part of advancing your techniques on an electric bass guitar would be the use of pedals and effects. Instead of leaving these features off, only for the customer to later go on and buy it themselves, they will be implemented in the header amp.

Some standard effects, such as distortion, do not have a lot of variability so it will be implemented using analog circuitry. Whereas other effects will be implemented using digital circuitry, allowing for customizability and unique effects to be implemented in the header. The user would be able to control these effects through a touch screen interface built into the amp header.

The touch screen interface would be user intuitive and would allow a large degree of customization over how the effects are applied. The ability to interface between digital effects, generated by a DSP, and analog effects, from analog circuitry, at the same time would be the main feature of the project. Providing these advanced effects at a low cost would help satisfy the goal of creating an affordable bass amp.

Project Specifications

Specifications:

| Attribute | Description |
|---------------------------------|---|
| Size | 24" x 12" x 12" (W x H x D) |
| Weight | 12lbs |
| Output Power Rating | 50W @ 8Ω |
| Input Power Rating | 120VAC 60Hz |
| Frequency Response | 40Hz - 3.5kHz |
| THD (Total Harmonic Distortion) | 0.5% |
| Input Impedance | 1MΩ |
| Output Impedance | 8Ω |
| SNR (Signal to Noise Ratio) | 80dB |
| Analog Effects | 4 |
| Digital Effects | 4 |
| Inputs | ¼" (6.35mm) Audio Input Jack ¼" (6.35mm) Effect Input Jack |
| Outputs | ¼" (6.35mm) Speaker Pass Through ¼" (6.35mm) Effect Send Jack ⅛" (3.5mm) Aux Output |
| Bluetooth Connectivity | Yes |

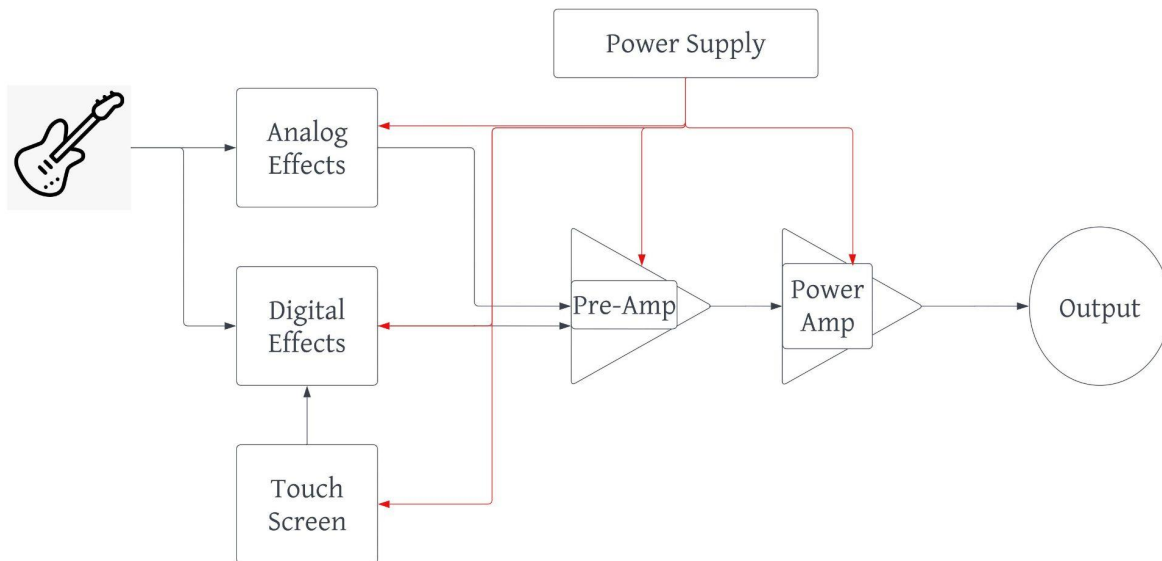
Constraints:

| Constraint | Description |
|----------------------|--|
| Cost | Maximum limit of \$400 spread across the team. This project will be self-funded so being below budget would be acceptable. |
| Time | The deadline for SD1 is approximately 12 weeks away. The SD2 Final report is due 31 weeks. Budgeting the group's time will be pertinent to the success of the project. |
| Product Availability | Due to global events, many electronic components are on backorder. Being able to order the components and have them in-hand before certain deadlines will constrain the project. |

Standards:

| Standard | Description |
|-----------------|---|
| Bluetooth | Would comply with Bluetooth 5.0 Standards |
| RoHS Compliant | All components will be compliant with the RoHS standard for hazardous materials |

Project Block Diagram



Analog Effects:

1. James Howell
2. Apply Analog Effects to the signal.
3. Status: Research
4. Inputs: Bass Guitar
Outputs: Pre-Amp

Digital Effects:

1. Armon Eghbali
2. Apply Digital Effects to the signal.
3. Status: Research
4. Inputs: Bass Guitar

Outputs: Pre-Amp

Touch Screen:

1. Kristofer Edstrom
2. Provide a touch screen and knobs to allow the user to control the various effects.
3. Status: Research
4. Inputs: User input

Outputs: Digital Effects

Power Supply:

1. Jeremy Nelson
2. Supply power to the rest of the amplifier.
3. Status: Research
4. Inputs: None

Outputs: All

Pre Amp:

1. James Howell
2. Bring the output of the Bass Guitar/Effects up to line level.
3. Status: Research
4. Inputs: Analog Effects, Digital Effects, Bass Guitar

Output: Power Amp

Power Amp:

1. Kristofer Edstrom
2. Takes the line level input and applies a gain to it in order to drive the output.
3. Status: Research
4. Inputs: Pre Amp

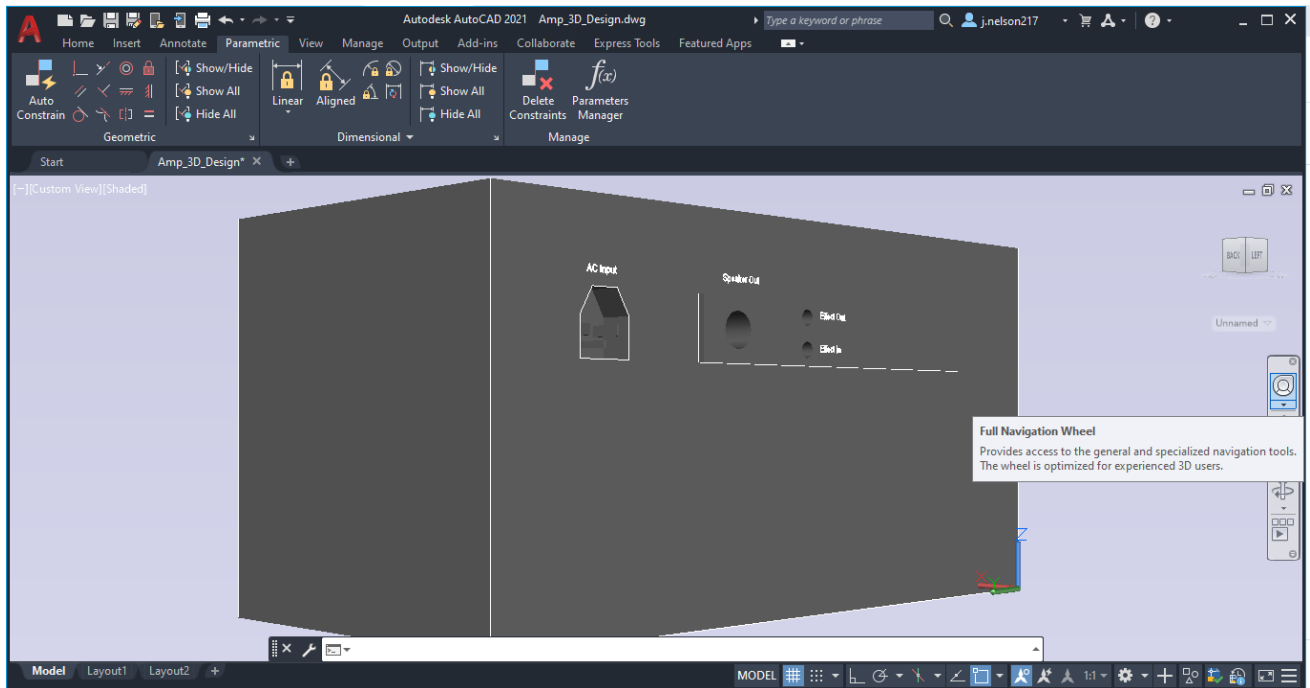
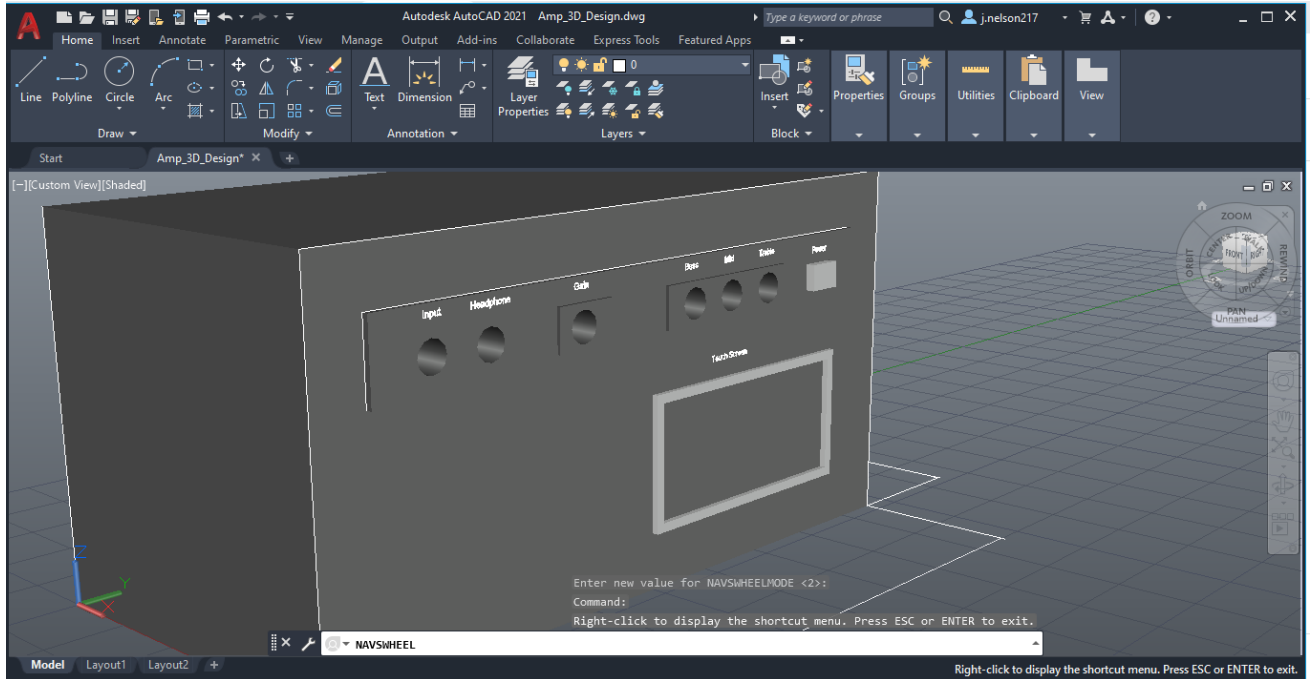
Output: Output

Output:

1. Jeremy Nelson
2. Interface the device with a variety of outputs.
3. Status: Research
4. Inputs: Power Amp

Output: External Device

Prototype Illustration



Estimated Project Budget

| Item | Quantity | Cost |
|--------------------------------------|-----------------|--------------------------|
| DSP Processor Dev Board | 1 | \$25 |
| Microprocessor Dev Board | 1 | \$50 |
| Housing | 1 | \$50 |
| Analog Effects PCB (with components) | 1 | \$25 |
| Power Supply PCB (with components) | 1 | \$35 |
| Pre Amp PCB (with components) | 1 | \$25 |
| Power Amp PCB (with components) | 1 | \$25 |
| Misc Components | X | \$20 |
| Audio Connectors | X | \$20 |
| Resistive Touchscreen | 1 | \$40 |
| PC Fan | 1 | \$5 |
| Cad Software License | 2 | Free (Education Version) |
| PCB Design Software | 4 | Free (Education Version) |
| Total | | \$320 |

Milestones

Senior Design I:

| Milestone | Task | Due | Status | Responsible |
|------------------|--------------------------|--------------|--|--------------------|
| 1 | Divide and Conquer V1 | Sep 16, 2022 | In Progress (complete when submitted) | Group 26 |
| 2 | Technology Investigation | Sep 30, 2022 | In Progress | Group 26 |
| 3 | Divide and Conquer V2 | Sep 30, 2022 | Pending | Group 26 |
| 4 | 60 Page Draft | Nov 4, 2022 | Pending | Group 26 |
| 5 | 100 Page Draft | Nov 8, 2022 | Pending | Group 26 |
| 6 | Finish PCB Design | Nov 18, 2022 | Pending | Group 26 |
| 7 | Final Document | Dec 6, 2022 | Pending | Group 26 |

Senior Design II:

| Milestone | Task | Due | Status | Responsible |
|------------------|--------------------------------|------------|---------------|--------------------|
| 1 | Order PCB | TBD | Not Started | Group 26 |
| 2 | Prototype Completed | TBD | Not Started | Group 26 |
| 3 | Test and Revise | TBD | Not Started | Group 26 |
| 4 | Senior Design 2 Draft | TBD | Not Started | Group 26 |
| 5 | Senior Design 2 Final Document | TBD | Not Started | Group 26 |