Project Proposal Group C14

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1 Core idea

We are interested in this project as the two of us like to listen to music, but sadly neither of us is capable of playing an instrument. Hence, when we stumbled upon this idea online we were immediately interested and tried to find a way on how to adapt and improve the base project. The main use of the guitar will be experimenting. Because the mechanism that we will build can reach a note on the top end of the neck and a note on the bottom at the same time, it will be possible to play things humans are not physically capable of. Another useful thing that the mechanism will make possible is to instantly be able to play anything on the guitar. A human player would need to practice a song and memorise all of the notes of it while our project can just get midi streamed to it and play the song instantly.

2 Project features

1. Core Features
   (a) one working string
   (b) one string fretted
   (c) the seven nation army riff can be played
2. Project Aim
   (a) get 3 strings working
   (b) get 3 strings fretted
3. Possible Extension
   (a) get remaining strings working + fret them
   (b) voice control
   (c) website control

3 Approach to the build

1. Week 6
   Here we plan on spending the whole week on building the mechanism.

With building the mechanism we mean to frame the servos, secure the servos, attach the frame to the guitar, possibly adapting the servo to be able to pick a string and lastly power the sevos.

2. Week 7
   In this week we want to finish the mechanism and begin the code for the servos. So that we get the servo move. In the end of the week we want to test the code on one string and if it works already begin to multiply the amount of working strings. If not we will continue to work on the code.

3. Week 8
   In this week we want to use the Tuesday to finish the work on multiplying the amount of working strings. If every thing goes accordingly to plan (most likely not the case) we will start on Friday with the most difficult and challenging part, which would be to fret the strings.

4. Week 9
   This whole week we will spend on fretting one string. We will also need to make our video presentation in this week, but we hope it will not take to long to finish this presentation.

5. Week 10
   This week we would like to finish the fretting of one string and begin to write the necessary code for that one string. If time remains (we have our doubts) we would also like to start with multiplying the amount of working fretted strings.

6. Week 11
   We think that we will most likely also need this whole week to fret some more strings.

7. Week 12
   In this week we would start with midi and start to turn midi into music an also start with voice control for our device

8. Week 13
   In this week we would like to finish the voice control and the controlling web page. This would then also conclude our project.

9. Week 14
   As of now we do not have anything planned for this week, but we see it as a good thing. We already planned with a lot of things not going as planned, but this week could be used for either finishing the project up as we needed to move some parts back or to round the project up and make it nicer.

We decided to follow this plan as the mechanical side or our project is rather difficult and and a potential breaking point. Furthermore, a working mechanism is the base that we need to have a working project. Because of that we wan

to start with this part and then get the core features working (one string + one fretted string). As soon as we manage this we then can move on tho work on our project aim, which means to reproduce our current work on perhaps adjusting small parts if we realize that we might encounter size problems. In our current plan we also leave the for us easiest part (voice control + web page) control till the end. Firstly, we want to get the remaining parts of our project working/produce music. As the voice and web page control do not need any new mechanical sides. It would "only" mean that we probably need to put our current code into an loop and replace some before hand specific values with blank values, which will be produced by the web page and the voice control.

4 Shopping List

We didn't found enough SG92R Digi Hi TORQUE Servos hence we put them both for NDL stock and need to brought. In total we need 15 servos.

1. Pre existing (NDL stock)
   (a) Raspberrry Pi 4
   (b) Adafruit 16- Kanaals PWM / Servo Hat voor Raspberry Pi - Mini Kit
   (c) SG92R Digi Hi TORQUE Servos
2. Need to be bought
   (a) SG92R Digi Hi TORQUE Servos + `https://www.hobbyelectronica.nl/product/sg92r-digital-servo/`
   (b) probably also ReSpeaker 2-Mics Pi HAT + `https://www.kiwi-electronics.com/nl/respeaker-2-mics-pi-hat-3140?country=NL&utm_term=3140&gclid=CjwKCAjw9-6oBhBaEiwAHv1QvCBA9sLcDvmmchQCcUQNTL62Mw-Fk1EKcvuBJjjT5Th733Fq31_ZvRoC5qwQAvD_BwE`
   (c) ALITOVE 5V Power Supply 10A 50W Universal Adapter 5V LED Transformer 5.5x2.5mm Plug for WS2812B SK6812 5050 LED Strip WS2811 Pixels Light Raspberry + `https://www.amazon.nl/ALITOVE-voeding-universele-transdp/B08SVX1TH5/ref=sr_1_5?__mk_nl_NL=%C3%85M%C3%85%C5%BD%C3%95%C3%91&crid=26KU39VCGHMWX&keywords=adapter%2B5v%2B10a&qid=1696603497&sprefix=adapter%2B5v%2B10a%2Caps%2C159&sr=8-5&th=1`

5 Mechanical and electronic architecture

The mechanism consists of two parts, the part that attaches to the body of the guitar, and the part that attaches to the neck. On the body there will be a frame screwed down onto the body of the guitar that goes over the strings. This frame has to have place for both the raspberry pi 4 as well as the servo motors.

The raspberry pi 4 will be attached with some screws to the lower part of the frame. On top of this will be the servo controller connected to the raspberry pi 4 with the 2x20 GPIO pins on the raspberry pi, and secured with some screws. Both the raspberry pi and the servo controller will be powered by cables going to an outlet. Above the strings on the frame the servo motors will be screwed to the frame. The servo motors will be connected to the servo controller with the wires that come attached to the servos. Attached to each servo motor will be a guitar pick in such a way that it plays the string when the servo is powered. Then on the neck there will be another frame clamped on to it. On this frame will be more servos, that push down on the strings. Each servo will be attached to this frame with screws and connected to the servo controller with wires. Each servo motor on the neck hang above a string between two frets. Attached to the moving part of the servo, will be two sticks with with slots at their ends. These will push down on the strings when the servo is powered. We use two sticks per servo so we can use one servo to push down in two different frets by turning the servo in different directions.

6 Sustainability

From the side of used parts our project is not sustainable, because we use more servos then needed if we for example move the servos up and down along the strings to fret them. We decided to not go that way as we aren't sure that we will manage to implement this with the products which we can use as we don't see how to get the needed speed with the power that we can/plan to use. If we look at the side of power consumption our project is sustainable as we use the less amount of power by relying on more servos. As already mentioned above, if we would decide to use less servos then we would need to use more power as we do right now.

7 Challenges

1. Biggest risk
   (a) The by far worst thing that could happen would be that we somehow manage to break the guitar, while screwing stuff on it or using the servos to move the strings.
   (b) A possible risk would also be that we need to find a way on how to connect the picks to the servo. Here we might need to 3D print parts, which can be a big challenge and also quite a danger of not going as planned. That would mean, that we have to work with picks which might play a sound when they not supposed to or we hear a not clear musical note.
2. Things we are unsure about

   (a) We are still unsure on how we plan to fret the strings correctly
   (b) Turn Midi into music. More specifically stream Midi

3. Specificially
   (a) Here would be to mention the aspect of making more then one string move + fret them. We might encounter the problem that we didn't plan small enough and get problems