Automatic Guitar Tuner

**INTRODUCTION**

The Automatic Guitar Tuner is a mobile, compact device that mounts onto the head of a guitar and automatically tunes the guitar by rotating each peg. This device is designed to operate quickly and accurately, providing a convenient method of tuning for guitarists. Implemented as a real-time embedded system, the device processes the sound generated by a plucked guitar string and tunes it by using a mechanical arm to rotate the peg. Due to its efficiency, this device could especially benefit beginning guitarists who haven't built up the necessary ear training to tune their instrument correctly.

![Image of Automatic Guitar Tuner](image1)

**SYSTEM DIAGRAM**

![System Diagram](image2)

**MATERIALS AND METHODS**

- A Raspberry Pi 3 is used for the controls and processing of the system
- A microphone is used to detect the sound generated by a guitar string
- An Analog-to-Digital-Converter is used to convert the voltage output of the microphone to a digital signal
- A gooseneck tube is used as the mechanical arm of the device
- A stepper motor is used to rotate the pegs
- A drill bit peg winder is used to attach the motor to the peg
- A battery pack is used to supply power to the device
- A 3D printed box is used to enclose the electrical components

**RESULTS**

- Estimated freq: 228.184 cents
- Error (cents): 136.754
- Steps: 25

Output of system during operation. A frequency detection algorithm estimates the frequency of the input signal and a controls algorithm decides how many steps to move the motor according to the error.

![Image of Frequency Detection](image3)

**CONCLUSIONS**

The final prototype has proven to tune each guitar string with an accuracy within 10 cents, which is an acceptable standard for most guitar tuners. The objectives of the project have also been mostly met. The device is compact and battery-powered, which makes it portable and convenient. Any user can easily mount the device and operate it wherever he or she may need to. The device is also constructed safely with no exposed wires or potential pinch points. Another goal of this project was to implement it as a real-time system, which is accomplished by its ability to tune a single string in about a minute. For a beginning guitarist with no experience tuning a guitar, this is a potentially useful product to ensure the accuracy of tuning and can provide convenience for any guitarist that wishes to save time tuning their instrument.

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