Demonstration of GuitarFins: Triggering Input with a Guitar Pick

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Abstract

Controlling digital interfaces (e.g., navigating in a tablature interface via mouse and keyboard) or configuring physical audio equipment (e.g., on the floor) can be challenging with a guitar strapped on, as it impedes physical access to the input devices. In addition, guitarists typically use a guitar pick, which can be a hindrance when trying to interact with physical input components that are not designed around the fact that the index finger and thumb are occupied by the pick. We demonstrate GuitarFins, which turn the guitar pick from a hindrance into an opportunity. GuitarFins are physical input components that are integrated into the guitar corpus and designed to be operated with a guitar pick, thereby utilizing the skill and dexterity of guitarists with a pick.

CCS Concepts

• **Human-centered computing** → **Interaction devices**.

Keywords

Electric Guitar, Guitar Pick, Augmented Guitar, Musical Instrument

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1 Introduction

Using an electric guitar occupies both hands and restricts upper body movement. Hence, the guitar itself can become a hindrance when interacting with digital interfaces in between, e.g., when configuring tablature playback on laptops or tablets while practicing with the guitar. In addition, the guitar pick occupies the thumb and the index finger of the picking hand, meaning that when switching between playing and using input devices [7, pg. 4], the guitarist needs to tuck or put down the pick. In order to facilitate interface control during guitar play sessions (also referred to as an instance of *encumbered interaction* [6]), previous works have physically augmented the guitar [1, 7, 9] or the guitar pick [2, 8]. Another approach is to utilize the audio signal of the electric guitar for interaction [3]. However, the guitar's raw audio signal is inherently ambiguous because different strings can generate the same pitch at different frets. Furthermore, distinguishing between playing and menu interaction is challenging, and reliably sensing note onsets at high BPM (to be used as a user input signal) is difficult.

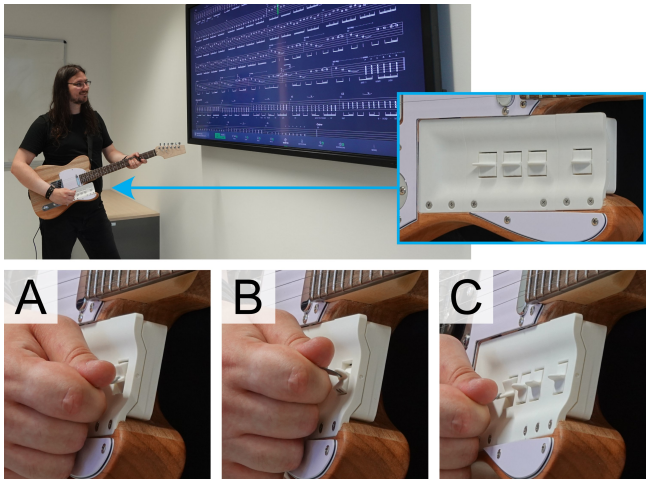

Figure 1: Top: Our GuitarFins prototype can be connected as a BLE keyboard, e.g., to control tablature interfaces. Bottom: A fin can be triggered via down strokes (A) or up strokes (B). Different functions can be mapped to different fins (C).

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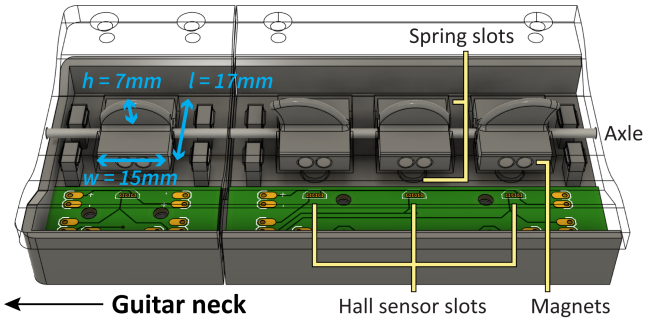

Figure 2: The hardware components and 3D printed parts of our GuitarFins demo-version prototype. The prototype consists of a single fin module and a triple fin module. The microcontroller, together with the battery, is located next to the PCBs to the right (not included in the picture).

Instead of seeing the guitar pick as a hindrance for digital interface control, we utilize the guitarists' dexterity with a guitar pick for fast and convenient physical user input. We focus on input *triggers*, i.e., binary input events (analogous to button presses). The main attraction of our demonstration is an improved version of our *GuitarFins* prototype [4]. Figure 1 shows our demo prototype integrated into a guitar corpus. Fins can be triggered with down strokes (Figure 1 A) and up strokes (Figure 1 B). Our prototype device features a three-plus-one fin layout with different functions assigned to different fins (Figure 1 C). We are going to demonstrate two use cases: (1) controlling an existing tablature interface for guitar practice (using the *Songsterr* website [5], also see Figure 1 top), and (2) choosing the effect of an effect pedal via fins.

2 Demo Prototype

In this section, we describe the components of our prototype, their usage, and the most important implementation details. The descriptions below are adjusted contents from the "GuitarFins Prototype" section of our GuitarFins paper [4], plus additional descriptions about the main differences between the demo prototype and the paper's prototype.

2.1 Guitar Integration

We integrated our GuitarFins prototype into an assembled *Harley Benton* guitar kit. Specifically, we milled out a rectangular area below the neck and inserted screw holes at 20 mm steps. We cut out the same rectangle from the pickguard. Our demo prototype consists of two modules (one module for a single fin and one for three fins), each with a base element to hold the electronics, a plate, and a number of fins. An ABS rod acts as an axle for the fins to rotate around. Each fin has two magnets on each side and is resting on two springs each (connected to the base) so that they are pushed back to their neutral state when no other force is acting on them.

Notably, one of the main takeaways from our GuitarFins paper [4] is that participants often accidentally hit the fins when strumming chords. Hence, we improved the design for this demo by recessing the fins into the corpus (5 mm deeper, also see recessed device in Figure 1 and inward curved plates in Figure 2).

2.2 Microcontroller Processing

The triggering logic runs on an ESP32 microcontroller (MCU), which acts as a Bluetooth Low Energy (BLE) keyboard, meaning it can be connected to any BLE-supporting device to trigger specific key press and release events. In our prototype, the key presses *Left*, *Right*, *Up*, *Down*, *Space*, and *Backspace* are supported. *Left* and *Right* have dedicated fins, meaning that they can be used with alternate picking. *Up* / *Down* and *Space* / *Backspace* each share a fin, meaning that the actual key code also depends on the stroke direction.

The input triggering concept is based on simple thresholding relative to the sensing range of each fin. Hereafter, 0% corresponds to the sensed value in the resting state of the fin (neutral value), 100% to the maximum possible value, and -100% to the minimum possible value. The neutral value is the average of the first 20 sensed values upon startup and the min/max values are calibrated by pushing the fins fully in both directions. Once a hall sensor senses a signal that exceeds 65%, the MCU sends a key press event (with the fin's assigned key code for up strokes). Once the signal goes below 35%, the MCU sends a key release event. A key release event must be sent, before another key press event can be sent. For negative percentages, we use the same approach (with flipped signs).

2.3 Conventional Button Input

For comparison, visitors will also be able to try out ordinary button or key press input. Figure 3 shows one device with salvaged buttons of a gamepad and one with mechanical mini-keyboards. Instead of using the pick, those are operated with the fingers that are free when holding the pick (middle, ring, and pinky finger).

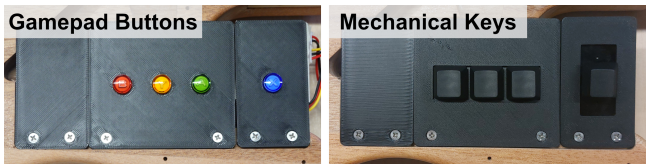

Figure 3: Visitors will also be able to try out conventional buttons or keys on the guitar so that they can compare them to the interaction with fins. We built simple alternative modules with gamepad buttons (left) and mechanical keys (right).

3 Conclusion

In this demo, we present GuitarFins, a novel physical input component that utilizes the dexterity of guitarists with a guitar pick. Instead of being a hindrance, the guitar pick becomes the end-effector for fast and enjoyable skillful input. We present two use cases: (1) controlling a tablature interface without letting go of the guitar or pick, and (2) choosing the effect settings of a foot pedal on the floor. Our demo prototype is a slightly improved version based on participant feedback from our GuitarFins paper.

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