



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

## UNC Charlotte – Lee College of Engineering Senior Design Program Company Information

<b>Company Name</b>	Electrical & Computer Engineering	<b>Date Submitted</b>	11/8/2019
<b>Project Title</b>	Virtual Keyboard based on Vibration Localization (UNCC_KEYBOARD)	<b>Planned Starting Semester</b>	Spring 2020

### Funding:

What is the source of funds that will be used to cover all of the direct costs of this project?

Grant

Is this source of funds already secured? Yes \_\_\_\_\_ No X\_\_\_\_\_.

(anticipated expenses are minimal; most required supplies are already available in PI's lab)

### Technical Contact(s)\*

	Technical Contact 1	Technical Contact 2	Technical Contact 3
<b>Name</b>	Jeremy Holleman	Arnab Baruah	
<b>Phone Number</b>	704-687-8407		
<b>Email Address</b>	jhollem3@uncc.edu	abaruah@uncc.edu	

\*We would like to have more than one technical contact, so there is a back-up in case of travel, sickness, job re-assignment, etc.

### Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	0	Electrical	2
Computer	2	Systems	0
Other ()	0		



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## **Project Overview and Requirements:**

While mobile devices have become computationally powerful over the last decade, the input interface is still limited by the small screen. A standard keyboard remains the most efficient way to interface to a computer for writing documents, software development, and other productivity tasks. To address this deficit, the team will design and build a virtual keyboard, based on detecting and locating taps on a hard surface, such as a table. Using a virtual keyboard, a user could easily type as if on a full-size keyboard, without the bulk of carrying a physical keyboard.

The virtual keyboard will work by localizing vibrations from the user tapping on a hard surface. Vibrations can be detected by a microphone in contact with the surface. They travel at the speed of sound through the material. Appropriately placed microphones will record the vibrations at slightly different times. With at least three microphones, it is possible to triangulate the location of the tap, which can then be mapped to a key on the virtual keyboard.

While the final envisioned product would be packaged for easy integration into or direct connection to a smartphone or other mobile device, the prototype planned for this project will comprise just the signal acquisition electronics, a USB connection to a laptop, and processing software on the laptop.

## **Expected Deliverables/Results:**

Deliverables include:

- Prototype of the sensor sub-system, including multiple microphones, a method of coupling them to a hard surface, interface electronics (e.g. A/D converter), and a USB connection.
- Software running on a laptop to process the microphone signals, estimate tap location, and convert to a virtual key-press.
- Demonstration of the prototype system running with user input.

## **List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):**

- Basic Electronics – soldering, operation of standard components such as amplifiers, A/D converters, etc. Guidance will be provided by the PI.
- Embedded System Development. A microcontroller platform, such as Arduino, will be needed to collect the signals from the microphone, establish a USB connection to the laptop, and transmit the waveforms to the laptop.
- Software Development A program running on the laptop will be written to process the recorded waveforms.