Touchscreen-based virtual keyboard

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Abstract— This proposal describes a touchscreen-based virtual keyboard that is intended as a replacement for hardware keyboards in industrial environments.

I. Introduction

The proposed device is a robust, wired, touchscreen virtual keyboard system designed for use in industrial control room environments.

Its use case is as a replacement for hardware keyboards, specifically those that fall into either of the following two categories:

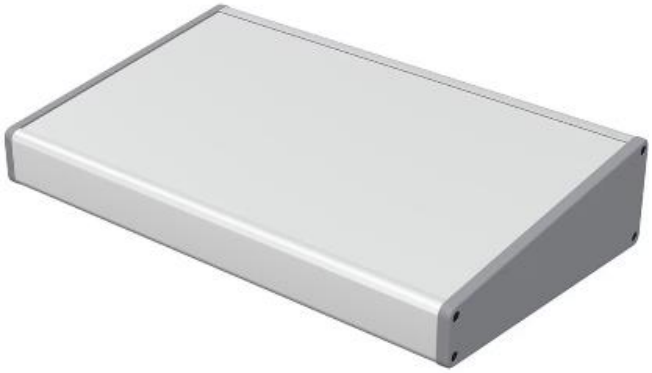
1. Keyboards that are used on computer systems which pre-date the USB protocol.
2. Keyboards that are not available off-the-shelf, e.g. those with custom keys or which send keypress data using non-standard encodings.

Such keyboards typically cannot easily or cheaply be remanufactured in their original hardware form.

II. Prototype Sketches

A. The keyboard enclosure

The product will use an aluminium sloped control box designed by TAKACHI (https://www.takachi-enclosure.com); part number CF45-28BB. This provides robust housing that has been designed for a control room, as well as a 10° angle that is appropriate for use as a keyboard. Prior to any modifications being made the enclosure appears as follows:



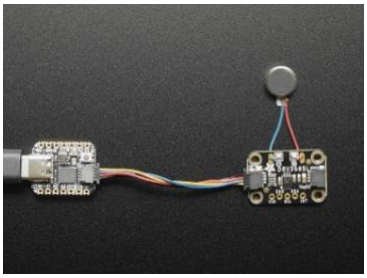
B. The touchscreen display

Within this box will sit an 18.5 inch 10-point touchscreen monitor. The top aluminium panel of the enclosure will either be machined out or removed entirely, so that the touchscreen can be made visible and usable. The monitor will display a software keyboard that is designed to look exactly like the original hardware keyboard it replaces, e.g. something like this:

C. The software

The software keyboard will be a fullscreen application that runs on a Raspberry Pi. When the device is powered up the keyboard will be displayed automatically — the end-user must be free of any need to understand the operating system, or how the device works at a low level. It should require no more knowledge to use than the keyboard it replaces. The software can be coded to send data in the same format as the original keyboard.

It is also important that the device *feels like the original keyboard* to the end user.



This will be achieved by incorporating a haptic-feedback module, to be activated on every keypress. This will be prototyped using the DRV2605L Haptic Controller Breakout board by Adafruit. This board drives an ERM motor, which will be attached either to the case or the monitor. This prototype design will determine whether the motor is powerful enough to provide sufficient physical feedback, for what will be quite a large and heavy device when compared against something like a mobile phone.

III. Responsible innovation

The main benefit of this product is its usefulness to legacy and large-scale industrial computer systems. A good use case would be critical infrastructure systems, for example nuclear energy. These systems must remain in operation for centuries rather than decades. This time period spans the lifecycle of not only computer operating systems, but the companies that develop them. Such infrastructure systems are typically very large, not only in terms of the number of hardware devices they contain, but also geographically. There may be multiple sites located across the country, perhaps all networked together in some form. Their size, complexity, and legal requirements make it infeasible to update all of the infrastructure hardware and software on a particular release cycle, e.g. when the next new operating system is released.

Allowing part of such systems to be on a separate upgrade cycle — the keyboard in this case — helps make upgrades much more manageable, and contributes to keeping critical infrastructure in safe operation.

IV. Author biography

I am a software engineer with 22 years experience in the computing industry, after graduation from Sheffield Hallam University in 2004 with an upper second class degree. Having spent the first 17 or 18 years of my career working exclusively with software, my time at Like Technologies has opened up a new avenue for me in terms of electronics. A part of my job now involves hardware repair, as well as continual training in electronics to improve my knowledge.

I have also spent the last few years working with single board computers in my spare time, and have developed a solar powered thermal camera for monitoring remote locations. It uses a Raspberry Pi and a low powered line of sight radio transmitter to send thermal images to a central location, where they can then be processed.

My main motivation is to educate and challenge myself, and to produce useful devices that solve real-world problems.

V. Acknowledgements

Thanks go to my manager at Like Technologies, Andy Davy, for providing me with the opportunity to develop this virtual keyboard.