XinuPi: Audio and USB Keyboard Support
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**Project Overview**
- This project is an effort to improve the usefulness of Xinu on the Raspberry Pi as an educational tool.
- Add audio output functionality
- Add USB keyboard support
- Other efforts include:
  - USB/Ethernet support
  - Graphics support

**Audio Support**

**Motivation**
Provide audio functionality that is made possible by the Raspberry Pi and has never been fully supported by Embedded Xinu.

**PCM Module**
- PCM = Pulse Code Modulation
- Three output signals
  - PCM_CLK (Bit clock)
  - PCM_FS (Frame Sync)
  - PCM_DOUT (Data out)
- 9 interface registers for module
- 2 audio clock control registers

**USB Keyboard Support**
- With our newly implemented lightweight USB drivers, XinuPi can now support various USB devices.
- Devices of interest may include:
  - USB data storage
  - HID devices (keyboard, mouse, ...)

**Why?**
Along with graphics support, a USB keyboard will allow Xinu to act as an experimental embedded laboratory platform that does not rely on remote booting or serial output. A "standalone" system like this might be better suited for smaller educational environments.

**Future Work**
- Continue work on PCM audio
- Complete HID driver that is simple enough Xinu and allows for expansion
- Implement simple keyboard-specific structure so that a USB keyboard can be read from like other devices in Xinu.

**References**

Systems Lab - Department of Mathematics, Statistics, and Computer Science - Marquette University - Milwaukee, WI, USA
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