Dissembling a V4 Controller

We are from an all girls school that recently went remote, so we decided to do an online competition. Our team took apart the old Vex Cortex Joysticks because we upgraded to the new V5 equipment. Individually, our team researched parts and then came together to report our findings. We were interested in how our old hardware worked, and being remote was the perfect time to find out.

The printed wiring board is the main component of the VEXnet Joystick. It delivers the power from the batteries to the buttons and microchips. One microchip is the Static RAM which stores data that is being used in the moment or needs to be refreshed frequently. This allows quicker function in the microcomputers. Another chip found was a microcontroller, specifically a System on-chip, that enables the CPU to execute sequential instructions from flash memory at high speeds. Microcontrollers work to support serial communication interfaces between different chips such as the oscillator, RAM, and External Memory Controllers. Microcontrollers are microcomputers which control the function of the embedded systems and the device. We found a TI line drive and receiver on the motherboard. It provides the electrical interface between an asynchronous communication controller and the serial-port connector. Another opponent was the unshielded drum core which is a fixed inductors that works as a part of the circuit that manages voltage. There is a black wire and a red wire that runs from the batteries to the wiring board and gives power to the motherboard. This power is controlled by an on-off switch at the front of the controller. Next to the switch are plug-ins for cords that would connect the controller to the brain.

Another component researched was the Printed Circuit Board that controls the two 4-button directional pads. Printed Circuit Boards (PCBS) are part of the foundation of many electronic devices as they help other devices communicate with each other. The sensor under the button has a number that corresponds to a numbered wire that links it to the motherboard. The component that connects the controller to the brain of the robot is called the USB Printed Circuit Board; which is a PCB with an USB attached. The parts of the USB PCB are contacts, shielding, and terminations. The connector the VEX Controller has is the vertical through hole, meaning they are positioned vertically and the terminations pass through plated thru holes of the PCB before they are put on. The USB PCB connects to the motherboard through J5. When you plug something into the USB, it goes through the circuit board to the wires that carry it to the motherboard.

It was hard to research parts our team did not know the names of, but after a while we learned about what we had taken apart. Through this we have a better understanding of the basics of electronic devices. Without this competition, none of us would have thought to take apart a controller and learn how it works.
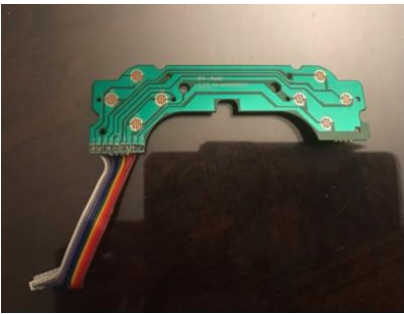
Photos

Fully Dissembled Controller

- ❖ The controller was a VEXnet joystick that was compatible with cortex products.

Motor Circuit Board

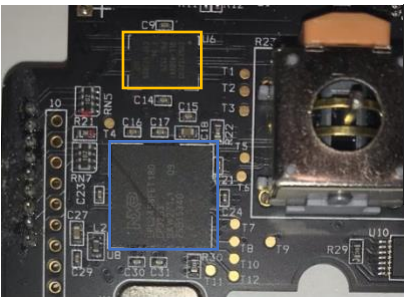- ❖ Motherboard that controlled the entire controller

Printed Circuit Board

- ❖ Controlled the two 4-button directional pads on either side of the controller
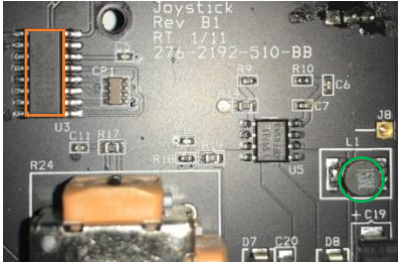

USB Printed Circuit Board

- ❖ Controlled the USB port that helps connect the Vex Cortex to the controller and helps transfer programming.

Chips on Left Side of Circuit Board

- ❖ Blue outlines the microcontroller by NXP Semiconductors. Yellow outlines the static RAM by CYPRESS.

Chips on Right Side of Circuit Board

- ❖ Orange outlines the line drivers and receivers by Texas Instruments. Green outlines the unshielded drum core by Pulse.

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