

Electronics Design Club LED Cube

Project Summary

Objective

To create a 12x12x12 pixel, full-color, three-dimensional display.

Problem

Three-dimensional displays are ideal for any application dealing with the representation of real-world objects. These displays are very hard to build because they require light sources in a three-dimensional (3D) arrangement that are visible from any angle. Adding gradient or color effects to such a display further complicates the design because these features require a high degree of electrical manipulation.

Research

Extensive research was done on 3D displays to determine the most feasible design. The LED cube design was deemed most appropriate. Other types of 3D displays exist. One alternative design uses a fan-like structure with lights on spinning arms. This design takes advantage of the persistence of vision (POV) effect to generate 3D images. This design was deemed infeasible because of its mechanical intricacy.

Constraints

E-Club's LED Cube was designed and constructed under the following constraints:

- 12x12x12 resolution
- Full-color operation
- No perceptible flicker
- Bright enough to be visible in a well-lit room
- Frame rate above 27 Hz
- Cost-effective

Solution

E-Club's LED cube satisfies all of the original design criteria. It consists of a 12x12x12 matrix of full-color LEDs, multiplexing circuitry, and a microcontroller. The microcontroller is able to render images on the display via the multiplexing circuitry. Although the LEDs are multiplexed, they are still bright enough to be seen in virtually all lighting conditions.

Conclusion

The Electronics Design Club has constructed a full-color LED Cube consisting of 1728 multiplexed LEDs. This project is the result of two years of work by a team of students. The completion of the cube required extensive skill in soldering, woodworking, circuit design, programming, and troubleshooting. The end result is an impressive 3D display that showcases both the technical ability and creativity of K-State engineering students.