# CALIFORNIA STATE SCIENCE FAIR
# 2015 PROJECT SUMMARY

**Name(s)**
Nikhil Kalita

**Project Number**
35529

**Project Title**
## Volumetric 3-D Display

**Abstract**

**Objectives/Goals**
The objective of the experiment was to use an inexpensive mirror with an anisotropic holographic diffuser, rotating at 5 times a second by being mounted on a 300RPM motor synchronized with the projecting tablet, to display a non-flickering 3D image, viewable from 4 different angles without correcting for parallax and other visual artifacts.

**Methods/Materials**
The experiment involves using a system that consists of a spinning mirror, a tablet display, and a synchronized stepper motor. The tablet is made to display 20 image frames per second with interleaved blank frames, showing the object from 4 different angles 5 times a second, forming 4 different viewing angles. The mirror is placed at a 45 degree angle on a motor which spins synchronized relative to the images displayed by the tablet. As the mirror rotates and displays at 5 times per second , persistence of vision creates the illusion of an almost non-flickering object at the center of the mirror.

**Results**
The challenge was to synchronize the two key components, the tablet display and the mirror motor. The display frame rate as detected by a photosensor closely matched the expected frame rate of the composed video i.e. 200us between the start of each frame sequence. It required several attempts to adjust the stepper motor micro-stepping delay to 230us in order to get the motor speed to approximately match the targeted 200ms interval. A final step required making small changes (400us) to the motor speed on-the-fly to track the display frames. The resultant spinning mirror system was able to display stable views to viewers on 4 sides.

**Conclusions/Discussion**
This experiment proved to be surprisingly effective in exploring new ways of displaying images specially, in three-dimension. It was accomplished by using a regular off-the-shelf tablet with a synchronized rotating mirror. This exercise has demonstrated that with readily available consumer tablets and simple electronic components one can implement a volumetric display at a very low cost. Mass production and fine tuning of such a low-cost device will bring in a new age of displays. Viewers would be able to inspect, observe, and interact with an image in live space from any angle. Clearly these technologies can be deployed widely and at a low cost today instead of remaining in the realm of science-fiction.

**Summary Statement**
A low-cost 3D volumetric display that can be seen from four different angles around the apparatus creating the impression of observing an object in real space.

**Help Received**
My Dad helped wire the apparatus, gave pointers for key concepts.