



**CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY**

Name(s) Josh R. Taylor	Project Number S0716
Project Title The Accuracy of a Handy Board Barcode Reader as a Function of Sampling Frequency per Bit of Data	
Abstract Objectives/Goals The purpose of this project was to build a bar code reader using a handy board and an infrared device and determine how many readings per bit were necessary to accurately read a bar code. Methods/Materials Using Legos, a platform was built for a motorized wheel and an infrared sensor. A barcode was attached to the wheel, and the motor and sensor were attached to the handy board. Software was written to read the bar code and convert it into zeros and ones. The zeros and ones were then tested to see if they matched the expected values and the results were recorded. This process was repeated eight hundred times at nine different motor speeds. The results for each motor speed were recorded and then graphed. Results At frequencies of greater than 3 readings per bit the accuracy was 98.3 percent, while it dropped down to 90 percent at frequencies of 2.39 to 2.48 readings per bit and then jumped back to 97 to 98 percent at around 2.3 readings per bit. A significant decrease occurred at around 2.16 readings per bit with accuracy levels ranging from 43.5 to 58 percent. The standard deviation of the accuracy ranged from .46 percent at the high frequency readings to 1.75 percent at the low frequency readings which means that the two dips that occurred were greater than should be expected from experimental standard error. Conclusions/Discussion The results supported the hypothesis that the accuracy of the bar code reader would drop significantly as the frequency of the readings approached one per bit. A reader of uniform frequency that was perfectly able to discern black from white with an arbitrarily narrow infrared beam would be expected to plummet in accuracy as the frequency of the readings dropped below 1.5 readings per bit. With an infrared beam about one millimeter wide however, the reader is subject to error at the boundary between white and black stripes causing the error rate to dive at a frequency of about 2.2 readings per bit. Additional error was introduced due to the inaccuracy of the time stamp.	
Summary Statement This project is about exploring the limiting factors of data retrieval from a storage device.	
Help Received I received help from my neighbour Marc Leavit who taught me how to use a handy board, as well as the basics of IC.	