



# CALIFORNIA STATE SCIENCE FAIR 2009 PROJECT SUMMARY

<b>Name(s)</b> <b>Kenny Lei</b>	<b>Project Number</b> <b>S1610</b>
<b>Project Title</b> <b>Improving Elevator Scheduling Efficiency by Implementing a Smarter Controller</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> This research considers how efficiently elevators can deliver passengers to their intended destinations. The director behind this process is the elevator controller, which evaluates many possible delivery scenarios and decides the most efficient plan. The problem becomes more complex and the possible plans grow tremendously when the scale of operation is increased. This project's objective is to create a smarter elevator controller designed to reduce the average waiting time (AWT), based on the Empty the System Algorithm (ESA), which calculates and minimizes expected waiting times over all passengers using a system of elevators.</p> <p><b>Methods/Materials</b> Due to the complex and costly nature of using and testing real elevator systems, this controller was implemented in an elevator simulator program. This project was conducted on a computer, which can be running on one of many operation system platforms since all software used are cross-platform. Software was developed by integrating the smarter controller into an existing simulator called ElevatorSim, which was written in the Java programming language. The smarter controller, called ESA, was written with five Java methods expected by the simulator. The most important Java method determines the best car for each car request using an AWT formula created in this project.</p> <p><b>Results</b> Over 10,000 elevator simulation trials were performed with ElevatorSim, and the AWT for the ESA controller was compared against the AWT for ElevatorSim's Default controller. Observations show that the smarter elevator controller outperforms ElevatorSim's Default controller by an average of 12 percent, significantly reducing passenger waiting time.</p> <p><b>Conclusions/Discussion</b> The ESA controller significantly surpasses the Default controller. The ESA controller can be applied to real elevator systems and improve elevator efficiency. More efficient operation can contribute to reducing energy consumption and operational costs. By including these new elevator scheduling strategies used in creating this project's controller, elevator efficiency will continue to improve and progress.</p>	
<b>Summary Statement</b> Create a smarter elevator controller within an elevator simulator program using the Java programming language.	
<b>Help Received</b> Research guidance provided by mentor Dr. Craig Rich of California State Polytechnic University, Pomona.	