



**CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY**

Name(s) Arjun V. Balasingam	Project Number 31367
Project Title M2D2 Mechatronic Medicine Dispensing Device Engineered from Scratch and Enabled with Computer Vision for Assisted Living	
Objectives/Goals I was motivated to build this device, because the population of older people in the United States is increasing rapidly. As people age, they tend to develop memory and motor skill issues, which can cause them to take incorrect doses of medications. This can result in serious health complications. Abstract Methods/Materials Problem Statement: Construct a device, which can reach into a container full of small tablets, pick one tablet, and place it in a cup. I addressed this problem by building a robot arm which works in two algorithmic stages: Dip/Grab and Pick/Vision. In Dip/Grab, the robot arm reaches into a table container, and grabs some tablets. These tablets are then scattered on a staging area. Then, in Pick/Vision, a webcam takes an image of the scattered tablets. Then the computer analyzes this image using computer vision and trigonometry. The results from this analysis are then used to drive the arm to a particular scattered tablet. The arm then picks this specific tablet and drops it in the patient's bowl. Then using Pick/Vision, the arm returns the remaining tablets to the bottle. Building from Scratch: I used several power tools to cut the plastic and wooden parts of my system. I repurposed a "Lazy Susan" to build a smoothly open base. I went through many design revisions until I created a robust gripper. While working on this project, I have deepened my knowledge in math, electronics, physics, computing, and my skills in craftsmanship. Results Physically my system consists of four main components: (1) a webcam, (2) a laptop computer, (3) the microcontroller, and (4) the robot arm. My software system consists of three key modules: (1) The vision system, which is built on OpenCV a public domain computer vision library. (2) The Trig Engine computes the joint angles of my arm. (3) The Command and Control Interface, which helps the laptop, cooperate with the microcontroller to control the servos on the arm. Conclusions/Discussion I integrated my system, calibrated, tested and debugged it and showed that my original goals were met. The system can be scaled to address as many tablet types as might be needed by a patient. I invented a device, which can help patients with motor skill issues take tablets.	
Summary Statement I invented a device which will benefit the growing population of older people in our nation; this has the potential to decrease the cost of healthcare.	
Help Received I would like to thank my advisors Mr. Nicoletti and Dr. Kucherov for their valuable advice, and encouragement. I would like to thank my dad Dr. Pratheep Balasingam, and my mom for all of their support.	