In this research project I will design and build a demo model of Professor Sun’s patented camless valve actuator device. Modern internal combustion engines rely on valves in each cylinder to open and close at precise times to allow for the intake of gasoline and emission of exhaust. The manner in which these valves are opened and closed, however, is purely mechanical, resulting in strict times at which the valves open and close relative to piston position. Professor Sun’s device removes the camshaft from the engine and instead replaces it with electronic actuators that can be precisely controlled by the onboard computer to open and close whenever desired. If the valves are able to open and close at any arbitrary time, they can be programmed to allow much more efficiency in the combustion cycle at any engine speed, with any fuel source. By designing and building a demo model of this device, Professor Sun and I will be able to analyze the device and improve its design for commercial use. Most importantly, we will be able to determine the conditions under which the most efficiency can be brought to the combustion cycle.

This project has great potential to benefit all of humanity. The camless valve actuator can improve the efficiency of every engine on the road, whether it burns gasoline, ethanol, or diesel. The future benefits are even more promising. As a plethora of new renewable energy sources become available to market in the next years, decades, or even centuries, a camless valve actuator will allow the engine to burn any conceivable fuel source at its maximum efficiency. For example, say that a new energy source burns most efficiently when the intake valve is open for thirty microseconds longer than it is for a gasoline engine. A camless valve actuator will allow
the car’s onboard computer to keep the valve open this extra time, maximizing efficiency. An
engine without a variable valve actuator, however, is mechanically linked to open the intake
valve only for the length of time corresponding to gasoline. In this way the camless actuator
promises not only to improve the efficiency of engines burning gasoline, but engines burning any
future fuel source such as ethanol, hydrogen, or anything conceivable. Most importantly to the
consumer, the camless system will allow the vehicle’s owner to burn whichever fuel source is
most convenient or the cheapest without requiring a new engine. The potential benefits of more
efficient engines are cheaper transportation for vehicle owners and users, as well as a reduction
in atmospheric pollution for all of humanity.

In my project I expect to begin by reading and analyzing Professor Sun’s patent along
with other relevant literature to valve actuators and electronic controls. I will then acquire the
parts to make the actuator, and begin assembly of the device. I expect the 120 hours allocated for
this project to be sufficient for building the actuator. If I find roadblocks along the way I will
work with Professor Sun and graduate student John Dixon from Mechanical Engineering to
determine the source of the problem and to explore potential solutions. Even if my project does
not go as desired, it will be a good starting block for continued research in a future semester.

This project will attempt to determine if Professor Sun’s camless valve actuator device
has potential in the marketplace. With a demo model of the actuator, Professor Sun and I will be
able to analyze how environmental impacts and engine conditions affect the product’s
performance. This will allow for improvement of the device until the point that it is ready for the
marketplace. The camless valve actuator has potential to improve engine efficiency for nearly
every vehicle in the world, and this project is a critical first step in preparing it for commercial
use.