Design and Possible Implementation of Lego Factory

Overview
Our sponsors Dr. Yang, and Dr. Kurama have a vision of building entire Automobile Manufacturing Factory using LEGO. The previous team initiated the idea and built an assembly line that assembles cars consisting of three subassemblies: a windshield (clear and white), a body (red), and a chassis (black). Our team’s challenge was to build a packaging line that sorts these three subassemblies and feeds them separately to each gripper on the assembly line. In order to do so, our team faced challenges such as designing packaging line, programming sensors to read different colors, and designing means to transfer parts from packaging line to assembly line.

Objectives
● Design and build automobile packaging line
● Use color sensor to detect different parts
● Transfer sorted parts to assembly line gripper location
● Build SIMIO model to track parts moving through the system

Approach
Initially, the team created several ideas to solve this issue, all including a sorting station with conveyor belts transporting the automobile parts to their respective locations. Based on the cost of the LEGO parts and the limited budget, a single conveyor belt system was decided upon as it was simplest model to construct and it used the least number of parts. After the design period, the model was quickly constructed, with an ultrasonic sensor telling the LEGO Mindstorms EV3 intelligent brick that a subassembly has been placed on the line, a color sensor identifying the subassembly, and the intelligent brick sending it to its correct location. The intelligent brick was coded using a proprietary LEGO graphical coding software. Finally, the entire model was analyzed in Simio.

Outcome
● Team met its goal of creating a line that sorts three different subassemblies and transports them to their respective locations
● Team stayed under budget, with the total cost of the project coming to $808.45
● Model was simulated using Simio software
● Throughput is approximately 2800 subassemblies per 8-hour workday
● Next group needs to integrate the packaging and assembly lines