

## Robotic Parking Technology for Congestion Mitigation and Air Quality Control Around Park & Rides

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What if you didn't have to worry about the dreaded problem of finding a parking spot once you have arrived at your destination? Imagine the peace of mind coming from the fact that at your crowded destination a robotic system awaits your arrival, ready to receive your vehicle and park it without any human involvement. Even better, when it is near time to return, all you need to do is to send a message to the robotic system and invoke the retrieval of your vehicle.

This study focuses on the utilization of robotic parking technology to mitigate a plethora of issues, including congestion and air quality control, specifically around park-and-ride zones. Automated parking systems have been deployed more commonly in other countries, such as Germany, Italy and Japan, but they have not received much attention in the USA. This report, written from a design and engineering perspective, focuses mainly on the development of a low-cost robotic structure for vehicle transfer, which is a key component of any robotic parking

system. The new design incorporates a robotic platform for lift and transfer of vehicles inside the parking structure.

### Study Methods

Consisting of a pallet and a shuttle, the robotic platform for transferring vehicles presents a number of innovative ideas. In this design, vehicles rest on pallets, isolated from the shuttle that transports them. The shuttle positions itself under the vehicle, and two retractable arms swing out to make contact with the tires. The shuttle's design matches the shape of the pallet, and as such no calibration is necessary for different types of vehicles. This ensures the platform is functional for virtually any street legal vehicle.

### Findings

The prototype was tested on a full scale-scale car (3,000 lbs of weight) and was able to lift the car and move it in linear and circular motions. For the control of the linear actuators and rollers, a robust control algorithm was developed using color sensor and distance sensor as feedback. The system is

able to follow a line however image processing will be added in the future to make it fully autonomous. This design is particularly attractive because it simplifies the operational aspects of vehicle placement and retrieval. The total cost of the development of the latest prototype was approximately \$5,000. This was a very economical investment since the prototype is used in a number of studies.

Automated parking systems achieve efficient land use, increased availability of parking, reduced fuel consumption and emissions, and curtailment of car theft and other crimes.

### Policy/Practice Recommendations

Numerous studies have confirmed that quick and convenient automobile access to park-and-ride lots can be essential to making public transit competitive with the automobile in suburban areas. Historically, automated parking systems have been very common and successful in Europe and Asia, particularly in highly populated areas. However, the USA has not been as enthusiastic about deploying this more sophisticated, but affordable, solution. Local government interventions may be instrumental as a catalyst for public-private partnerships toward more proactive deployment of automated parking facilities in close proximity to park-and-ride areas, specifically in congested zones.

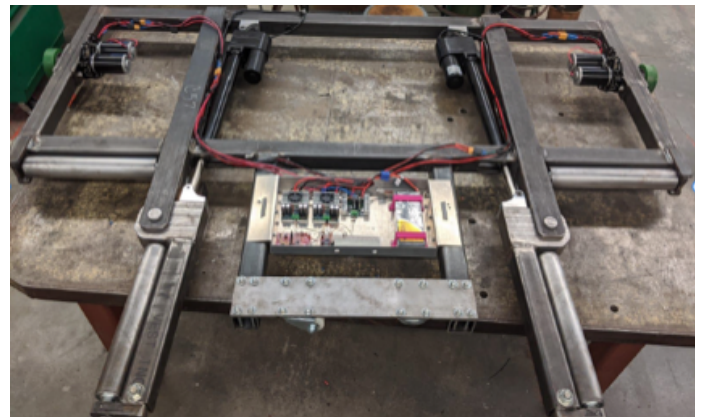
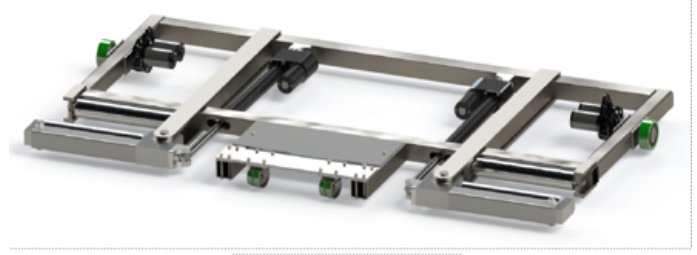


Figure 1 and 2. Automated Parking Platform — Second Iteration Prototype for Testing and Validation

### About the Authors

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### To Learn More

For more details about the study, download the full report at [transweb.sjsu.edu/research/1936](https://transweb.sjsu.edu/research/1936)



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