

*Case studies from classes led by Dr. Ron Fulbright, University of South Carolina Upstate.*

# INNOVATIVE ANALYSIS

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EASY TO MOUNT/DISMOUNT JAZZY

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## 1. BRIEF DESCRIPTION OF THE SITUATION

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A Jazzy is an electric-powered vehicle designed for use by people unable to walk for long periods of time (but not totally unable to stand or walk). A Jazzy can be transported by one's personal automobile using a lift platform that is attached to the bumper of the car (see the images below).



A typical scenario follows: Betty, who has multiple sclerosis, drives her car to the mall. She parks the car and then goes to the back of the car where the Jazzy is located on the lift attached to the bumper of the car. Betty pushes a button which causes the motorize lift to drop to street level. The Jazzy is fastened to the lift via four straps with hook-and-cable assemblies and ratcheting tension handles. Betty must first release the buckle on each strap by lifting the seat-belt-style handle. This is difficult for Betty because of her reduced hand and upper-body strength. Betty then must engage the “gear” on the ratchet handle for “loosen” and pump the handle back and forth a few times. This releases the tension on the strap allowing Betty to un hook the strap from the Jazzy. Once all four straps are removed and stowed, Betty jumps on the Jazzy and drives away. Upon her return, Betty must repeat the above process in reverse. She must first park the Jazzy on the platform, then attach the four straps and ratchet them down to tighten. Betty's lack of hand and upper-body strength makes it difficult to tighten the straps. Once all straps are tightened, Betty pushes the button and the raises the lift to the transport height. To protect the Jazzy from the elements and road dirt while transporting, Betty spreads a plastic tarp over the Jazzy after it is on the lift and secures the tarp with several bungee (stretchable) cables. The entire process of mounting and dismounting the Jazzy requires Betty about 5 minutes to dismount and 6-8 minutes to mount which is inconvenient and hazardous in bad weather such as rain or cold.

Desired, is a better way for the Jazzy to be mounted and dismounted, preferably by one person who may very well have limited strength and range of motion of their extremities.

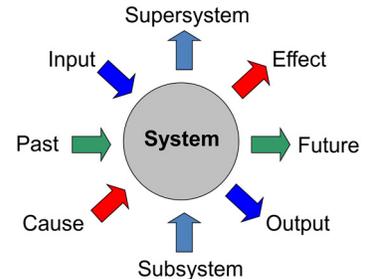
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## 2. DETAILED DESCRIPTION OF THE SITUATION

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### 2.1 SUPERSYSTEM/SUBSYSTEM ANALYSIS

In this situation there are actually two objects over all that need to be reviewed. These objects are the Jazzy (1) and the lift (2) that allows the user to transport the Jazzy vehicle. The Jazzy has many components that make up the electric power vehicle. The Jazzy has a seat for the handicapped user to sit down. This seat has arm rest on the left and right side for the user to rest their arms. This vehicle has two large tires in the front and two smaller tires in the back to help drive the system. The Jazzy has a motor that drives the four tires, an electric battery that supplies power to the motor, and a control joystick on the arm rest that allows the user to control the movement of the Jazzy. For safety, the Jazzy is equipped with a safety belt or a seat belt that allows the user to strap them in so they will not fall out. The lift that allows users to transport the Jazzy consist of a ramp to let the user drive up and park the Jazzy on it, a motorized arm to allow the ramp to move up and down, a control to make the arm lift up and down off the ground, an arm to attach the vehicle on the back of the car or truck, and straps that hold the Jazzy in place on the ramp. The arm that controls the ramp to go up and down is controlled by a motor that is powered from the car's battery. The ramp also is covered by a tarp that has to be strapped down by the user to cover the Jazzy.



### 2.2 INPUT/OUTPUT ANALYSIS

The first input that a Jazzy has to have to run is someone sitting in the vehicles seat. The weight from this allows the user to press a button that turns the Jazzy's motor on. The next input that the users must do is control the joystick that is on the arm rest. For safety, the next input that users go through is placing the seatbelt around their waist, fastening the harness, and making sure they are securely strapped to the vehicle. The joystick allows the user to move forward, backwards, left, or right depending on which way the joystick is moved. The user has to add put tarp on after they are finished using it. User has to put tarp on Jazzy. User has to drive the Jazzy on and off of the Lift Platform

## 2.3 CAUSE/EFFECT ANALYSIS

An uncharged battery will result in the Jazzy having little to no usage.

An unaligned joystick causes the Jazzy to go in directions that the user does not want to go.

Flat tires causes the Jazzy to move slower than desired or even not allow the Jazzy to move at all

The button that causes the lift to drop is dysfunctional which makes the lift unusable.

The clamps on the seat belt somehow will not fasten together which reduces the safety of the person using the Jazzy.

The motor has a short life span, which, calls for motor replacements.

Someone who is with the owner of the Jazzy does not properly mount the Jazzy back on the lift. When the owner goes back to take it down by him or herself, it is difficult to loosen the straps that hold the Jazzy on the lift.

Pressing the joystick in the way you want it go causes the Jazzy to move in the direction desired.

Loosening the clamps that hold the Jazzy on the life allows user to take Jazzy off of lift.

Plugging the battery into in the AC adapter recharges battery when needed.

## 2.4 PAST/FUTURE ANALYSIS

The Jazzy motor vehicle is essentially a newer design to benefit handicapped people in society. The Jazzy evolved from the wheelchair. The wheelchair was a design that combined a seat for sitting, an armrest on each side, and a pair of wheels. Since handicapped users were forced to use their arms to control the wheelchair, their arms would often to get tired. This would restrict how much movement they could do without another person's help pushing the wheelchair. The cost of the Jazzy has reduced over the years. When the Jazzy was first released, the cost was very expensive, but now people can get help from their healthcare to help them afford this motorized vehicle. The popularity of the Jazzy has grown over the years because of the way that the Jazzy is advertised. The advertisement for the Jazzy shows people that they vehicles are easy to use and are affordable to almost everyone. The T.V. advertisements also inform handicapped people that they can go places and do things that they would never be able to do with an average wheelchair. This just goes to show that the Jazzy is more useful and shows more performance than its predecessor, the wheelchair.

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## 3. RESOURCES, CONSTRAINTS, AND LIMITATIONS

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### 3.1 AVAILABLE RESOURCES

Human Strength	Buckle for straps on life
Weight of Jazzy	Lift platform
Energy to loosen straps	External hitch mount
Head rest	AC battery charger
Tires	Battery for Jazzy
Energy to maneuver	Motor cover
Joystick	Tarp to cover the Jazzy
Foot rest	Electrical Power
Arm rests	Gravity
Back rest	Car Power
Wheels	
Motor for Jazzy	
Motor for lift	

### 3.2 ALLOWABLE CHANGES TO THE SYSTEM

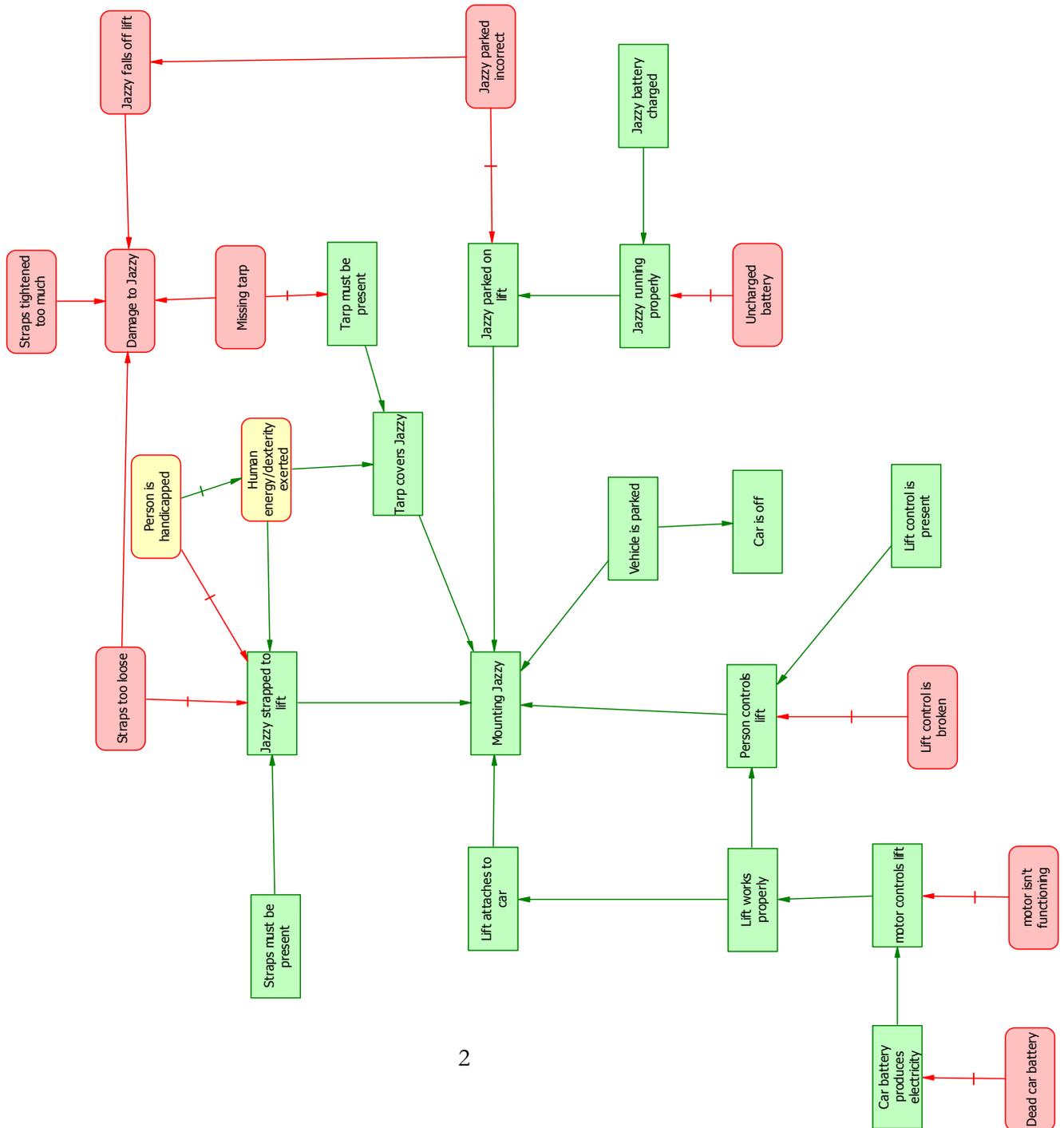
- We can change the material of the platform.
- We can the way that the Jazzy is secured onto the platform.
- We can add arms or some sort of harness to the Jazzy that will be able to hook to the platform.
- We can change the way the Jazzy is strapped down.
- We can change the way the Jazzy is covered on the platform.
- We can add a control to the Jazzy that controls the lift platform on the Jazzy.
- We can change the material the straps are made of
- We can change the way the Jazzy goes up onto platform
- We can change how the Jazzy is powered
- We can change how the Lift is powered.

### 3.3 CONSTRAINTS AND LIMITATIONS

The materials that the straps are made out of are designed for durability and reliability. This can cause an inconvenience for the user, who more than likely will be physically handicapped, because the materials are often heavier and more difficult to move. A material that can be light

and durable will be desired for the straps. The straps will have to be tightened in some way to secure the Jazzy and make sure it does not fall off. The Jazzy will need to be covered in some way to be protected from the elements. The cover will also need to be placed securely onto the Jazzy to make sure it does not come off in the middle of transportation and cause a danger to other drivers. The Jazzy can be a very heavy object and its four wheels can cause problems of not wanting to stay stable during transportation and place strain on the lift.

#### 4. PROBLEM FORMULATION



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## 5. IDEAS

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Find an alternative way to obtain *Mounting Jazzy* that does not require *Person controls lift*, *Lift attaches to car*, *Jazzy strapped to lift*, *Jazzy parked on lift*, *Vehicle is parked* and *Tarp covers Jazzy*.

When the car is off, the Jazzy automatically goes down and goes back up when car is started. (Counteraction)

Find an alternative way to obtain *Jazzy strapped to lift* that offers the following: provides or enhances *Mounting Jazzy* does not require *Human energy/dexterity exerted* and *Straps must be present* is not influenced by *Straps too loose* and *Person is handicapped*

Straps made of a tight springy material. A bungee cord would be an example.  
(Enhance strength of material)

Make straps that are inflatable so that they tighten onto Jazzy when inflated.  
(Synthesize)

Find a way to eliminate, reduce, or prevent *Dead car battery*.

Have a solar powered alternative battery. (Integration)

Find a way to eliminate, reduce, or prevent *Jazzy parked incorrect* in order to avoid *Jazzy falls off lift*.

Tracks make sure that Jazzy is parked on the platform correctly. (Counteraction)

Magnet underneath the platform to make sure that the Jazzy is parked in the right position. (Counteraction)

Hooks underneath platform to catch Jazzy and make sure its stable.  
(Counteraction)

Make platform on lift V-shaped like a boat trailer. Winch in place to pull it up.  
(Counteraction)

Put a fiberglass encasing that covers Jazzy on lift that person drives into.  
(Synthesize)

Find a way to eliminate, reduce, or prevent *Missing tarp* in order to avoid *Damage to Jazzy*.

Put the tarp on Jazzy so it can be pulled over. (Protect)

Find an alternative way to obtain *Straps must be present* that provides or enhances *Jazzy strapped to lift*.

Have a bunch of different straps. (Increase)

Find an alternative way to obtain *Lift control is present* that provides or enhances *Person controls lift*.

Implement a Jazzy iPhone app. (Synthesize)

Person asks OnStar to let lift up and down. (Intergration)

Find an alternative way to obtain *Jazzy battery charged* that provides or enhances *Jazzy running properly*.

Use a PowerMat technology on the lift platform. (Intergration)

Allow the Jazzy to have a back up battery. (Intergration)

Find an alternative way to obtain *Lift attaches to car* that offers the following: provides or enhances *Mounting Jazzy* does not require *Lift works properly*.

Have a trailer instead of a lift that Jazzy goes up on. (Synthesize)

Find a way to eliminate, reduce, or prevent *Uncharged battery*.

Put a generator on Jazzy (Counteract)

Put straps on tarp and make tarp inflatable. Equip lift with pump. (Integration)

Weave straps into tarp that covers Jazzy. (Integration)

Implement a gas powered lift to eliminate the problem of running into a dead battery on car. (Integration)