

Wind Riders of the Lost River Range



Spring
2018

A SYSTEMS DEVELOPMENT CASE

Wind Riders of the Lost River Range is a challenging hands-on semester project for systems analysis and design. It is extensive enough to provide a stimulating exercise, but not so large as to be overwhelming. It is sufficiently detailed to challenge students as they apply design concepts to a situation that closely simulates a real-world problem.



Wind Riders of the Lost River Range

A SYSTEMS DEVELOPMENT CASE

BACKGROUND

Many of our upper-division Informatics and Computer Science courses include an applied educational component in the form of a collaborative semester project. This applied educational component is designed to serve two primary purposes:

- To provide students with an opportunity for practical application of knowledge, i.e., a hands-on component
- To help students develop their collaborative skills.

The project is designed to engage students in tasks that apply the skills and content learned in class within a real-world context for learning. Project-based learning requires students to deal with complex questions and undertake projects that involve synthesizing understandings and considering real-world issues. The opportunity to apply learning to a real-life situation facilitates the transfer of learning.

Group work is required for those intending to enter any IT-related profession and is necessary to derive maximum benefit from courses, particularly those involving systems analysis and design. The prevalence of teamwork in industry makes it incumbent upon universities to better prepare students for real life projects. The “Ability to work in a team structure” leads the Forbes list of ten skills employers most want in 2015 graduates. In another study, Inside Higher Ed reports that the Association of American Colleges and Universities (AACU) surveyed employers and found they are more concerned about new graduates having a range of skills in areas like communication and team work than they are with a student’s major. Clearly employers want new hires that have developed the skill necessary to work in teams, and it is essential that group work be incorporated into a variety of courses.

It is difficult to find a project that is broad enough to cover all the topics but at the same time also narrow enough to cover them thoroughly in a one semester course. One alternative is the use of individual “toy” problems for each concept, but that approach has been criticized as simplifying problems to the point where they are no longer realistic and lack useful substance. Another alternative is to use real-world projects in a class, but that approach can introduce unmanageable complexity or ambiguity into the classroom.

Over the course of several years the professor has developed and refined a course project that provides a project-based learning component to cover and reinforce every major concept in a systems analysis and design course. It provides students with experience with each concept, and has been refined over the course of multiple semesters.

Unlike a “live” or real-world problem, project complexity is controlled by the professor and the project is able to involve all course concepts that the professor wants to reinforce. Unlike most toy problems this project takes an imposing system to completion. Because of the complexity and size of the project it is made up of a series of deliverables. Students start with one deliverable and continue to build upon and enhance that deliverable through each stage of the requirements. In this way students gain experience developing a larger, more realistic system than most course projects allow.

Teams will consist of four students. Since individuals are best at determining those whose schedules and personalities meshes best with yours, students will arrange their own teams. Be sure to seek out teammates with similar goals and work ethics. For example, ask if the potential team members are willing to work hard for an A or are more than happy to settle for a C. Having similar goals and willingness to work make a huge difference in whether the team is compatible!

INTRODUCTION

Serenity. Solitude. Freedom. Silence. Spirituality. These dreams (hopes? aspirations?) and more can be found in the Lost River Range of the Rocky Mountains, one of the most remote and primitive areas in the United States, with deep gorges, high mountains, swift rivers, and frigid lakes. Heaven’s Gate, the Seven Devil Mountains, and King Mountain are just a few Idaho locations that are ideal for free-flight sports. Wind Riders of the Lost River Range (WRLRR) is a specialty sports shop in central Idaho that specializes in wind-powered sports, like hang gliding, paragliding, snowkiting. The shop’s logo appears in Figure 1.



FIGURE 1. WIND RIDERS OF THE LOST RIVER RANGE LOGO

Hang gliders, as seen in Figure 2, are non-motorized, foot-launched rigid frames maintaining the shape of a wing constructed of rip-stop nylon or Mylar over an aluminum frame, with the pilot suspended in a prone position from a strap connected to the glider's frame.

Paragliders, like those shown in Figure 3, are non-motorized, foot-launched inflatable canopies or wings constructed of rip-stop nylon from which the pilot is suspended by sturdy Kevlar lines called risers, and a harness.

Both hang gliders and paragliders soar on currents of air, able to stay aloft for 3 hours or more, climb to elevations up to 15,000 feet, and travel vast distances. Hang gliders have a "cleaner" aerodynamic profile and generally are capable of flying at much higher speeds than paragliders.



FIGURE 2. HANG GLIDER ACTION SHOTS



FIGURE 3: PARAGLIDER ACTION SHOTS

Snowkiting, shown in Figure 4, is an outdoor winter boardsport that combines the airfoil and techniques used in kitesurfing with the footgear and gliding surface used in snowboarding. Large highly controllable foils or inflatable kites propel boarders across the snow with just the power of the wind, allowing the snowkiter to travel uphill with ease if the wind is blowing in the right direction.

PROJECT SUMMARY

Lost River Winder Riders, a free-flight sports shop in central Idaho, opened in 1990 to sell and service hang gliding, paragliding, and snowkiting equipment. The company started as a co-op to allow the owners and a few of their friends to buy top name equipment and accessories for

their hang gliding and paragliding hobbies at a reduced rate. As more enthusiasts became involved in free-flight sports, the owners saw an opportunity to leverage their hobby into a full-time business while still doing what they loved.

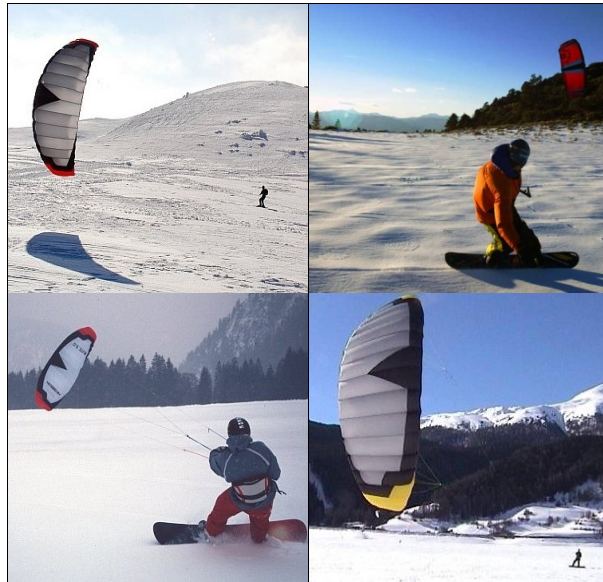


FIGURE 4: SNOWKITING ACTION SHOTS

Goods and Services

The market for free-flight sporting equipment in the central Idaho area has been booming and annual sales have increased from \$20,000 in 1990 to more than \$1,200,000 in 2004, to \$2,300,000 in 2013.

The company's primary focus is on the sale of hang gliding, paragliding, and snowkiting equipment. However, free-flight sports are seasonal, so the company extended their sales line into winter sports. In keeping with the theme of wind-propelled vehicles they decided to add snowkiting equipment to their line of offerings in order to insure year-round business. The latest addition to their company line came in 2006, when they began sales and service of powered ultralight aircraft.

Facilities

LRWR's facilities are nestled in a pristine setting with a nearby escarpment that can be used for hang gliding and paragliding takeoffs for those who want to "test drive" the equipment. Facilities include a showroom, a warehouse, and repair facilities. The showroom is a four thousand square foot expanse, allowing sufficient room to examine the various models that are available. The state-of-the-art warehouse features catalogued and indexed parts ready for installation. The company has both indoor and outdoor repair areas, allowing for several repairs to be performed simultaneously. The company employs approximately twelve people in various capacities including sales, management, general support, and repair and maintenance.

Problems

As their customer base and sales increased, they began to experience problems with inventory control, missing reorder points and experiencing inventory stock-outs that resulted in lost sales. Company records were maintained using an off-the-shelf accounting program, with additional information derived using Excel spreadsheets. While this was sufficient in the company's early days when volume was lower, the company complained that the rapidly increasing volume of business made it necessary to improve information access and record keeping. The company was unable to determine sales history and trends from the current system, and needed better control of capital by insuring that needed items were purchased and less popular items were not. In 2005 *Lost River Wind Riders* engaged the services of a consultant who specialized in systems analysis and design to analyze and update their system.

Strategic Moves

Also in 2005, *Lost River Wind Riders* expanded their product line and also began to offer new services. The company added various lines of ultralights to their sales offering. Ultralights (Figure 5) are single-seat aircraft used for recreation or sport. Ultralights range from powered parachutes and trikes to traditional fixed wings and rotorcraft, and flying any type of ultralight can lead to some of the most accessible, affordable, and exhilarating experiences that aviation has to offer. Ultralights are affordable, require minimal training, and take the flier back to simple "stick and rudder" flying.



FIGURE 5: ULTRALIGHT AIRCRAFT IMAGES.

The owners of *Lost River Wind Riders* were pleased with the system modifications, product expansions, and service offerings. The company was booming, but the owners were in their mid-30s when they started the company in 1990, and they wanted to spend more time in the air rather than in the office. Although the company was still highly successful, when the owners were approached by a potential buyer, they eventually reached the decision to sell.

New Owner

Hence, in 2015 the company was purchased by Nick Lovick, an Australian who visited the Lost River to try his hand at hang gliding, and decided to make his home in Idaho. Nick decided to rename his company *Wind Riders of the Lost River Range*, to differentiate it from its predecessor, but still maintain continuity and help it to remain easy to find for existing customers.

Resulting Changes

In 2016 Nick faced some critical business decisions. He ultimately decided to discontinue sales of ultralight aircraft for a variety of reasons. While the sale of ultralights had attracted a small number of new customers to the company, company files included many complaints by existing customers about the intrusion of engine noise and annoying daredevil sport fliers on their peaceful, wind-powered flights. Further, the addition of powered ultralight aircraft to their sales line was accompanied by the increased complexity of government regulations regarding strict record keeping. Although the Federal Aviation Administration regulations do not require pilot certification, vehicle certification, and vehicle registration, Part 103 notes that the FAA prefers that the ultralight community assume the initiative for the developing safety programs in a timely manner and gain FAA approval for their implementation, or face further regulatory action. Hence, the owners of LRWR took great pains to keep stringent records on vehicle certification and registration, and required that their customers take training courses before purchasing a powered ultralight. Eventually the increased workload and noise complaints more than offset the sales from the ultralight line.

Details of the current system configuration are provided in the following section.

CURRENT SYSTEM DESCRIPTION

The 2005 system upgrade addressed the storage of customer information such as credit cards, address, etc., so the company could access the information to quickly process new sales orders or provide quick service. Inventory control had also been problematic because the original system was not automated. Reorder points were being missed and inventory stock-outs occurred, resulting in lost sales. The managers needed to be able to generate a report that indicates not only the items that are below the reorder points, but will also include sales history and trends to allow for better control of capital as needed items are purchased and unnecessary or duplicated items are not.

The new owners continue to be concerned about improving their customer service and equipment sales system because they want to maintain the high goals and standards for the company. The existing system supports the core business requirements of the enterprise. WRLRR provides standard retail services for customers through the following business processes:

- Customer purchases equipment
- Generate purchase agreement
- Customer returns defective/unwanted equipment
- Customer requests equipment service or maintenance

- Generate service agreement
- Generate service detail report

WRLRR needs additional "back office" services to support business requirements. All of the reports in the following list are sent to management and archived in a report archive file. (Note: It may be one archive file or one for each report.)

- Process returned inventory
- Generate current equipment inventory report
- Order new inventory (equipment)
- Process new inventory
- Generate sales report
- Generate salesperson sales/commission report
- Generate service summary report
- Generate technician service report

PROCESSING DESCRIPTIONS

The WRLRR computer system makes use of barcodes to record information. Each piece of equipment is assigned a unique ID for inventory control.

Customer Purchases Equipment

A customer may purchase one or more items. A purchase follows the script below:

1. The customer provides a picture ID and credit card for an imprint. Alternatively, the customer may pay with cash or check, although WRLRR discourages the use of personal checks for the big ticket items that they sell.
2. Employee selects "Equipment Sale" from the main menu.
3. Employee requests customer phone number to determine if the customer is in the customer list.
 - a. If the phone number is not found, then the Customer Entry Form is displayed and their personal information is entered and added to the customer file, including:
 - Name
 - Address (include city, state, zip)
 - Phone number
 - E-mail address
 - b. If the phone number is found then the customer may be in the list and the Equipment Sale Form is displayed.
4. The Equipment Sale Form allows the following items to be entered
 - a. Salesperson number
 - b. Customer number
 - c. Payment type
 - d. Credit Card type (if appropriate)
 - e. Credit Card number (if appropriate)
 - f. Expiration date (if appropriate)
 - g. Verification code (if appropriate)

5. For each item purchased, the following information is entered into a form and stored:
 - a. Equipment type (selected from a drop-down box listing each product category in alphabetical order followed by model numbers)
 - b. Model number
 - c. Description
 - d. Serial number
 - e. Price
6. The employee saves a digital copy of the purchase agreement and prints two copies, which the customer signs. One copy is retained in a paper file and one copy given to the customer as a receipt. The purchase agreement is detailed below.

Generate Purchase Agreement

A purchase agreement must be generated for every equipment sale. The purchase agreement contains the following information:

- Header Section: Current date/time, salesman number, customer name, customer address, customer city/state/zip, customer phone, customer e-mail
- Detail Section (for each item): Model number, description, serial number, sales price
- Footer Section: Sales subtotal, sales tax (see business rules), grand total, payment method, masked credit card number.

Customer Returns Defective/Unwanted Equipment

When a customer returns defective or unwanted (and unused) equipment the following events take place:

1. The customer indicates they he/she wishes to return defective/unwanted equipment.
2. The customer provides a receipt or purchase agreement and the defective/unwanted equipment to be returned.
 - a. If no receipt can be provided then the system can be queried for proof-of-purchase by entering the customer number, or customer name/date-of-purchase.
 - b. If proof-of-purchase cannot be confirmed, the return cannot be completed.
3. The customer indicates whether the item is defective.
 - a. The employee checks the item to confirm the defects and that the item has not been damaged by the customer.
4. The employee next checks the date of the receipt (or proof-of-purchase) to determine if the product is being returned within the 90-day period referenced in the business rules.
 - a. If the item is defective and is being returned within the 90-day period, the customer will be issued a refund.
 - b. If the item is defective and is returned beyond the 90-day period, the customer will be issued a store credit.
 - c. If the item is not defective and is being returned within the 90-day period, but there is damage to the item, no refund will be issued.

- d. If the item is not defective and is being returned undamaged within the 90-day period, the customer will be issued a refund.
 - e. If the item is not defective and is returned beyond the 90-day period, no refund will be issued.
5. If a refund can be processed, the employee selects "Equipment Return" from the main menu. The Equipment Return Form contains the following items:
 - a. Date returned
 - b. Employee number
 - c. Customer number
 - d. Reason for return
 - e. Model number
 - f. Description
 - g. Serial number
 - h. Price
 - i. Notation indicating refund or store credit
6. The date returned is provided by the system. The employee number is provided when the employee logged in. The customer number, model number, description, serial number, and price are obtained by scanning the receipt or from retrieving the proof-of-purchase. The employee checks the reason for the return on the form and whether the customer will receive a refund or store credit.
7. A digital copy of the equipment return form is saved.
8. If the transaction results in a store credit, the credit is associated with the customer record in the customer file.
9. If appropriate, the customer is provided with a refund. The customer will receive a receipt indicating the refunded amount and the type of refund.
10. If the product was not defective, then it is flagged to be returned to inventory. If it is defective, then the item will be flagged to be returned to the supplier.

Customer Requests Equipment Service or Maintenance

The customer brings equipment in for service if it has been damaged or fails to work properly. The customer may also bring equipment in for regular maintenance. There is no requirement that the equipment was purchased at LRWR.

1. Employee selects "Equipment Service" from the main menu.
2. Employee requests customer phone number to determine if the customer is in the customer list.
 - a. If the phone number is not found, then the Customer Entry Form is displayed and their personal information is entered and added to the customer file. See Customer purchases equipment for details.
 - b. If the phone number is found then the customer may be in the list and the Equipment Service Form is displayed.
3. The employee records the problem as described by the customer.

4. The list of repair services is consulted, and the customer is given a rough estimate (non-binding) of the price and time required.
5. The following information is entered via a service entry form:
 - a. Repair number
 - b. Customer number
 - c. Model number
 - d. Description (list box)
 - e. Serial number
 - f. Problem description
6. A service agreement with the above information is printed and signed by the customer to authorize the repairs. One copy is retained and another provided to the customer. The service agreement is detailed below.
7. When service personnel work on the item their employee number is recorded as the technician of record. Generally, only one technician works on a single piece of equipment, and even in those situations that require multiple technicians, only the primary technician is recorded. (Note: Each technician must have proper certification before being hired, and technicians can be full time, part time, or contractors.)
8. The technician records the repair service applied.
9. The technician records the total time required to complete the repair, as well as the parts used to complete the repair. Multiple parts may be required to complete a repair. The technician records the remaining information on the service entry form:
 - a. Technician number
 - b. Repair service applied
 - c. Parts needed
 - d. Parts Cost
 - e. Hours labor
 - f. Labor cost
10. When the customer returns to pick up the item, payment information is entered:
 - a. Payment type
 - b. Credit card type (if appropriate)
 - c. Credit card number (if appropriate)
 - d. Expiration date (if appropriate)
 - e. Verification code (if appropriate)

11. A repair service detail report is generated and signed by the customer. One copy is retained and one copy given to the customer as a receipt. The service detail report is detailed below.

Print Service Agreement

A service agreement must be printed prior to every repair. The service agreement contains the following information:

- Header Section: Current date/time, customer name, customer address, customer city/state/zip, customer phone, customer e-mail
- Detail Section (for each item): Repair number, model number, serial number, problem description, estimated parts, estimated labor, estimated cost
- Footer Section: Estimated total cost

Print Service Detail Report

As noted above, a repair service detail report is generated and provided to the customer. It includes the nature of the problem as well as the parts required and their associated cost, as well as the total labor charge, and total charge. The Repair Service Detail Report contains the following information:

- Header Section: Current date/time, technician number, customer name, customer address, customer city/state/zip, customer phone, customer e-mail
- Detail Section (for each item): Model number, description, serial number, problem description, repair service applied, parts needed/cost, hours labor/cost
- Footer Section: parts and labor subtotal, sales tax (see business rules), grand total, payment method, masked credit card number.

Process Returned Inventory

Any returned items must be processed:

1. Non-defective products are placed back in inventory.
 - a. The UPC is scanned along with the Equipment ID, and the item record is moved from the sales file back into inventory. The inventory count for that item type is incremented.
 - b. The item is taken to the warehouse and stored in its proper location.
2. Defective products are returned to the supplier.
 - a. The UPC is scanned along with the Equipment ID.
 - b. The supplier is contacted offline to arrange return of the defective item.
 - c. The supplier receives the returned item and sends a credit memo to Accounts Payable (AP) for processing (beyond the scope of this project).

- d. If you are interested, see <https://supplychain.ucsf.edu/how-return-goods> for more details about the reverse logistics portion of the supply chain. This is enlightening as well: <http://www.inboundlogistics.com/cms/article/managing-retail-returns-the-good-the-bad-and-the-ugly/>

Generate Current Inventory Report

Periodically an employee may find it necessary to generate an inventory report. Such reports are used when it is necessary to take inventory of current stock, and also when restocking inventory. The report includes the following:

- Header Section: Current date/time
- Detail Section (for each item): Model number, description, count, reorder quantity, serial number, retail cost, purchase date

Order New Inventory (Equipment)

An order for new equipment is generated under the following circumstances:

1. Periodically an employee runs an inventory report (as indicated above) that indicates the total number of items in stock. If the number falls below a preset limit, a reorder request is generated for a number of items equal to the limit minus the current number. The preset limit is based on projected demand for a particular equipment type and is outside the scope of this system.
2. Before an order is actually placed, this reorder request is compared with projected demand for this particular equipment type, with the remaining sales season taken into account, and order quantities can be adjusted. Price is obtained from the supplier (outside the bounds of this system) for each item and entered into the purchase order. Shipping charges are also provided by the supplier. The tax rate is obtained from local governmental tax regulations, and the subtotal, total tax and total are all calculated.
3. Orders for the same supplier are combined together into a single purchase order.
4. These purchase orders are sent via email to suppliers who have provided an email address for their contact (the sales representative). Otherwise they can be faxed or mailed to the appropriate supplier.

Process New Inventory

Assume that all orders placed to a given supplier are received in full, and there is no need to make an allowance for partial shipments and backorders.

1. When a shipment is received, an employee enters the following information into the system for each item:
 - a. Serial number
 - b. Model number
 - c. Equipment description (selected from a product category list)
 - d. Retail cost
 - e. Purchase date
2. The system creates a new record in the inventory table for each item, and initializes additional fields as follows:

- a. Equipment ID is automatically generated by the system in sequential order, and is used as an inventory tag.

Generate Sales Report

The sales report can be generated on a daily basis or periodically, depending on business rules. As noted above, the report is sent to management and archived in a report archive file. It includes a listing of all sales for a specified period, including:

- Header Section: Begin date, end date
- Detail Section: Model number, description, quantity sold, unit price, total sales
- Footer Section: Grand total

Generate Salesperson Sales/Commission Report

The salesperson sales/commission report can be generated for one or all salespersons as needed, depending on business rules. It includes a listing of all sales and commission data, including:

- Header Section: Begin date, end date
- Detail Section: Salesperson number, commission percent, sales count, sales amount, commission amount
- Footer Section: Total count, total sales, total commission

Generate Service Summary Report

The service summary report can be generated on a daily basis or periodically, depending on business rules. It includes a listing of all service jobs performed for a specified period, including:

- Header Section: Begin date, end date
- Detail Section: Service performed, quantity performed, hours labor, labor cost, parts cost, total cost
- Footer Section: Total performed, total hours, total labor, total cost, grand total

Generate Technician Service Report

The technician service report can be generated for one or all technicians as needed, depending on business rules. It includes a listing of all service jobs performed, including:

- Header Section: Begin date, end date
- Detail Section: Service performed, quantity performed, hours labor, labor cost, parts cost, total cost
- Footer Section: Total performed, total hours, total labor, total cost, grand total

ADDITIONAL BUSINESS RULES

A partial list of business rules associated with WRLRR includes the following:

- An employee is assigned an employee number, which may be referred to as a salesperson number for salespersons or as a technician number for technicians. Designating employee numbers occurs beyond the scope of this system; assume they have one and use it when necessary.

- Lost River does not sell parts directly.
- The return period for purchases is ninety days.
- Each transaction will be charged a 7.5% sales tax.
- Each product category can have multiple pieces of equipment in stock.
- Labor on repairs will be billed at a set rate of \$45 per hour.
- A general list of product categories includes:
 - hang glider
 - paraglider
 - snowkite

OVERLOOKED FEATURES

Part of a systems analyst's responsibility is to recognize if anything has been overlooked. For example, in adding training services, were any necessary associated processes left out? This is where your familiarity with the normal functioning of businesses can come in useful. If you suspect something has been overlooked, diplomatically bring it to the attention of the individual(s) who is responsible for commissioning this project as a possible oversight.

STUDENT RESPONSIBILITIES

Once the project is distributed students are responsible for turning in intermediate deliverables throughout the remainder of the semester, generally one per week. Note the approach used, in which a large project is divided into a series of milestones or deliverables. This is a form of project management that forces the developer to meet deadlines or run the risk of falling farther and farther behind. The completed project, presented via a technical report and web site, is due near the end of the semester.

Updated: 1/15/2018 6:45 PM