Intelligent Recreation System (IRiS)

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Summary and Introduction:

Current trends in outdoor recreation have created unsustainable demands on our public lands and roads, and the covid-19 pandemic has only exacerbated the problem as the population looks for new ways to recreate in outdoor situations. As a result, we are rapidly degrading natural resources and experiencing untenable levels of trail use, traffic, and infrastructure strain.

Historically, the tools land managers have used to track outdoor use have included such things as counting trail users by hand, parking lot vacancy rates, how often the toilet paper needs replacing at a trailhead or how frequently pit toilets need to be pumped. But all these tools measure land use by looking backwards in time. This can result in strikingly divergent predictions of future use across various land management agencies.

IRiS looks to change this by conceptualizing the capturing of dynamically produced data, such as location-based services, social media, and website metrics, IRiS provides land and transportation managers with new tools for measuring and managing recreation demand.

Using machine learning and/or artificial intelligence techniques to analyze these large and diverse datasets, land managers and policymakers can then quantify recreation demand before it hits the roads and trails.

With this information, strategic interventions can then be applied to balance recreation use in real time by nudging land users to recreational areas which are less congested.

Economic and Environmental Impacts of IRiS

In an era of decreasing public land management budgets and increasing public land use, IRiS can eventually take the place of comprehensive, and cost prohibitive, 'boots on the ground' approaches to tracking land use currently done by public land managers. As IRiS 'learns,' only minimal physical trail counts will be needed. (Mainly to confirm the IRiS projections.) Thereby freeing up personnel resources to proactively address land resource management.

In addition, as land use increases, the surrounding local communities roads, sewers, and emergency services, which recreationists use on their way to and from the public lands, can also be stressed. By accurately counting land users, sustainable infrastructure can be built and maintained in areas which see a high influx of recreational visitors.

IRiS can have an impact on the environment as well. By attempting to distribute public land visitors over a wider area, the long term negative effects of overwhelmed ecosystems can be mitigated.

Technology:

The IRiS platform was built using three technologies:

1. React.js
   Used to implement the user interface, React.js is a JavasScript library developed by Facebook to efficiently implement user interface components.

2. Django
   Used to implement the middleware of the application, Django is a high-level Python based web framework. We chose to use Django/Python because of Python's rich machine learning ecosystem.

3. Relational database hosted by Amazon Web Services
   Used to store the IRiS data, we chose a traditional relational database for its overall ease of use, the ability to avoid redundancy, and it uses a well established language (SQL).

Design:

The application is divided into two separate user interfaces,

1. Land User
2. Land Manager

which seamlessly work together to give land managers and policy makers new tools to visualize both historical and future data about our roads and trails and ultimately nudge land users to areas which are less congested. Thereby not overwhelming public land resources.

To do this, we devised a system of two key statistics attached to each individual trail in the IRiS database, a *current score*, and a *threshold.*

The *current score* is an aggregation of the data sets we are conceptually capturing . These novel datasets include such metrics as social media, mobile phone GPS data, and web content views. When combined, these data points give us the current score of a trail which is a 'real time' depiction of recreational traffic each trail is currently experiencing. The higher the score, the higher the traffic is thought to be.

The *threshold* is what land managers determine the carrying capacity, or number of recreationalists the land can sustain at each individual trail. While the *current score* of a trail is calculated by demand found on the trails, the *threshold* is manually set by land managers to nudge recreationalists away from overcrowded trails.
The relationship between the *current score* and the *threshold* then determines which trails are returned when recreationalists search for trail information in the *search trails* page on the public facing user interface.

Features and Functionality

Land User Interface

1. Trail Display
    a. Land users can view information, including trail length, elevation gain, and difficulty, about trails in their area.

2. Search Trails
    a. Land users can search for specific trails.
    b. The search displays the trail the user searched for (if it is in the IRiS database) and displays information (trail length, elevation gain, and difficulty) about the trail.
    c. A list of similar trails is also displayed. These similar are returned based on the proximity to the searched trail, and are of similar length.
    d. The user can click on any similar trail to display the full description.

Land Manager Interface

1. Overview
   State Table which displays the 'state' of traffic on each trail in the database.
   Here, land managers can also make predictions of future use for each trail.
2. Monthly Visitors
   Displays visitor counts for each month of a given year.

3. Location Based Services

Displays the number of GPS signals on a given trail at three time intervals for a selected date.

4. Trail Scores
   Displays a bar graph of a side by side comparison of the current score and threshold of each trail.
   Land Managers can change the threshold via this page.

5. Data Gathered
   Displays a pie chart of the number of social media mentions, offline data, web content views and trail counter amounts for a specific trail on a selected date.

Testing:

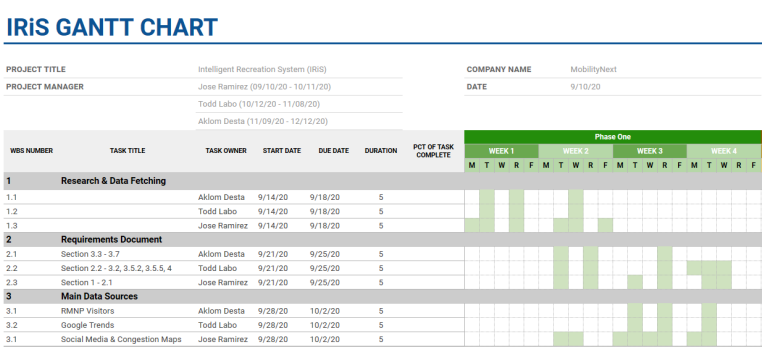
IRiS underwent two testing phases where individuals were asked to evaluate the usability, simplicity, and suitability of the platform.

- *Phase One*: Tester feedback came back pointing out a couple of bugs on layout and reactiveness.
- *Phase Two*: Feedback came back positive with 90% of the original bugs resolved.
- *Outcome:* Software scaled efficiently and overall quality improved

Project Management:

Each team member was given the opportunity to lead the team through the project. With three team members, each member was team team leader for 33% of the time, once in the fall semester and once in the spring semester for a six week stretch each time.

The team used a simple gantt chart to assign tasks and track development progress.



IRiS GANTT CHART

PROJECT TITLE	Intelligent Recreation System (IRiS)			COMPANY NAME	MobilityNext
PROJECT MANAGER	Jose Ramirez (09/10/20 - 10/11/20)			DATE	9/10/20
	Todd Labo (10/12/20 - 11/08/20)				
	Aklom Desta (11/09/20 - 12/12/20)				

WBS NUMBER	TASK TITLE	TASK OWNER	START DATE	DUE DATE	DURATION	PCT OF TASK COMPLETE
1	Research & Data Fetching					
1.1		Aklom Desta	9/14/20	9/18/20	5	
1.2		Todd Labo	9/14/20	9/18/20	5	
1.3		Jose Ramirez	9/14/20	9/18/20	5	
2	Requirements Document					
2.1	Section 3.3 - 3.7	Aklom Desta	9/21/20	9/25/20	5	
2.2	Section 2.2 - 3.2, 3.5.2, 3.5.5, 4	Todd Labo	9/21/20	9/25/20	5	
2.3	Section 1 - 2.1	Jose Ramirez	9/21/20	9/25/20	5	
3	Main Data Sources					
3.1	RMNP Visitors	Aklom Desta	9/28/20	10/2/20	5	
3.2	Google Trends	Todd Labo	9/28/20	10/2/20	5	
3.1	Social Media & Congestion Maps	Jose Ramirez	9/28/20	10/2/20	5	

Phase One

WEEK 1 WEEK 2 WEEK 3 WEEK 4

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