

MADISON COUNTY GOVERNMENT CAPSTONE

What was this capstone all about? Here's what you need to know:

My team, Valley Vision, won first place in our competitive senior capstone project at James Madison University.

Media Arts and Design (SMAD) and Computer Information Systems (CIS) majors collaborated in 8 teams of 10 students to develop a system for the Madison County Government. Our solutions were to address Madison County's rising annual costs by aiming to enhance financial management and promote sustainability in their community. My team's system was chosen as the best implementation.

I worked alongside two SMAD students to conduct user research and design the system. We began by conducting a survey on members of the Madison County Government to understand our client's frustrations and desires. As the system was developed, we met regularly with the client to ensure that it met their needs and supported a positive user experience. User testing was invaluable in evaluating how our system performed in the hands of its users. Our observation of their navigation within the system helped us to identify pain points in our design. From this process we were able to adapt the system to best fit all of their needs.

Below you will find the supplemental documentation we shared at our final presentation.

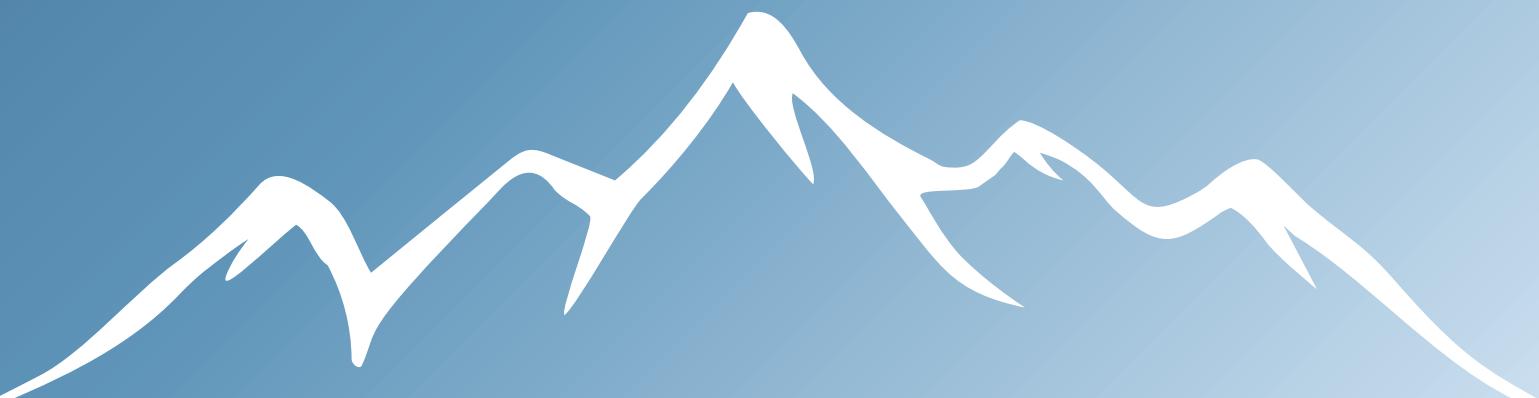


FINAL SUPPLEMENTAL MATERIALS

Saturday, April 27, 2024

Presented by Valley Vision

Tomas Castro	Alexandra Meyers
Carey D'Atre	Heather Moore
Connor Fitzsimmons	Nick Patterson
Rachel Gordon	Alex Saunders
Thomas Hodges	Jessica Shamloo



MEET THE TEAM



Tomas Castro
System Architect



Alexandra Meyers
Prototype Designer



Carey D'Atre
Full-Stack Developer



Heather Moore
Project Manager



Connor Fitzsimmons
Full-Stack Developer



Nick Patterson
Data Analyst



Rachel Gordon
Interactive Designer



Alex Saunders
Visual Designer



Thomas Hodges
Data Analyst



Jessica Shamloo
Client Liaison & Full-Stack Developer

TABLE OF CONTENTS

1	OVERVIEW
	Project Description
	Project Goals
	Methodology
4	USER RESEARCH
5	AUDIENCE PERSONAS
6	VISUAL DESIGN
7	VALUE PROPOSITIONS
	Strengths of Spending Projection Model
	Feature Highlights
8	USER NARRATIVES
11	VISUAL ARTIFACTS
	Government Official - User Flow Diagram
	Admin - User Flow Diagram
15	SYSTEM PLANNING & DOCUMENTATION
	Detailed Use Case Diagram of Strategic Planning System
	Low-Level Activity Diagram for Spending Projection
	Entity-Relationship Diagram (ERD)
18	CLOUD DEPLOYMENT
19	PRICING
20	SECURITY MEASURES
21	FUTURE DEVELOPMENT

OVERVIEW

PROJECT DESCRIPTION

Madison County faces the complex challenge of escalating annual costs mandated by state and federal authorities. Valley Vision is dedicated to creating an innovative solution in response, one that will help the county manage these financial strains and promote community sustainability and resilience. This initiative will provide county officials with advanced, yet intuitive tools for proactive financial oversight. By incorporating historical data, current metrics, and predictive analytics, the system will provide a seamless and comprehensive analysis platform.

Our proposed system is designed to improve the budgeting process by providing advanced, data-driven insights. Through a variety of visualization tools and predictive analytics, it facilitates well-informed decision-making and optimizes financial operations by offering a more comprehensive understanding of economic scenarios. This improved clarity will support strategic planning and the prioritization of critical economic development projects.

Additionally, our solution will boost community engagement and simplify administrative workflows by creating a transparent platform that ensures residents are well-informed and actively participate in county affairs. Our system incorporates industry-standard security protocols and offers the flexibility to integrate data from various formats. Designed to be both robust and scalable, it is equipped to meet the changing needs of Madison County.

Overall, this strategic implementation will markedly improve financial precision and enhance operational efficiency across county departments. This transformation will enable Madison County to uphold exemplary fiscal stewardship and foster economic growth, ultimately elevating the quality of life for its residents. Valley Vision is committed to delivering a comprehensive system that aligns with the long-term objectives of Madison County, ensuring its continued prosperity and development.



OVERVIEW PROJECT GOALS

A cornerstone of our project is developing a user-friendly system that caters to all demographics within Madison County. Emphasis is placed on creating an intuitive, accessible, and scalable platform, meticulously designed to address the varied needs of Madison County. Through extensive consultations and ongoing interactions with county officials, our approach has been deeply informed by the specific requirements and challenges identified by the client.

To further tailor our solution to the county's needs, we have implemented analytical models designed to project spending patterns and revenue forecasts, enabling more informed financial decisions. This feature exemplifies our commitment to providing Madison County with a tool that not only meets but anticipates their evolving needs. It offers a clear path toward sustainable growth and enhanced administrative efficacy.

1 INTUITIVE

Develop a user-friendly interface that simplifies complex budgeting processes, making it easy for all county officials to engage with the system effectively. Our goal is to ensure that users can navigate and utilize the system with minimal training, thereby enhancing their ability to make informed decisions quickly.

2 SCALABLE

Build a robust platform that not only meets current needs but is also capable of adapting for future growth and challenges. This involves implementing a modular design that allows for easy updates and expansions as the needs of Madison County evolve, ensuring long-term relevance and usability.

3 CLIENT CENTRIC DESIGN

Engage continuously with Madison County officials to gather feedback and adapt the system to their specific needs. By integrating their insights from the outset, we ensure that the solution directly addresses the challenges they face, resulting in a system that is fully tailored to their operational requirements.

4 SECURE

Prioritize the security of all stored data to protect against unauthorized access and potential breaches. Implement industry-standard security measures to safeguard sensitive information pertaining to the county's employees, budgeting, and financial planning processes.

OVERVIEW METHODOLOGY

Valley Vision adopted Extreme Programming (XP) to develop high-quality software for Madison County, focusing on the core values of communication, simplicity, feedback, and courage. Key practices like Test-Driven Development (TDD), continuous integration, and pair programming are employed to ensure responsiveness to the county's needs.

Development Cycle and Key XP Practices

Our approach emphasizes simplicity and frequent feedback, essential for maintaining system relevance and effectiveness. By focusing only on immediate, known requirements, we avoid over-engineering and ensure efficient use of resources. By integrating TDD, our programmers write tests for new features before the actual code, ensuring each feature is necessary and correctly implemented from the start. This method not only streamlines development but also enhances maintainability and scalability.

Team Collaboration and Stakeholder Engagement

We foster close collaboration with stakeholders, including regular updates and meetings with Mr. Jewett and other key personnel. This ensures that development aligns closely with Madison County's requirements and allows for swift adaptations to feedback. This direct engagement model has significantly enhanced our ability to adapt quickly to feedback and refine our approach continually.

Team Composition and Dynamics

Our project team consists of ten members, optimized for XP's dynamic and collaborative environment. Regular, in-person meetings and problem-solving sessions promote a cohesive and agile team dynamic, crucial for rapid development cycles and high-quality outcomes. We prioritize in-person interactions to strengthen team dynamics and ensure a clear understanding of tasks and goals.

Scalability and Long-Term Sustainability

Our strategic use of XP practices such as user stories, pair programming, and continuous testing allows our software to not only meet current requirements but also adapt to future growth. These practices align our work with real user needs, enhance code quality through collaboration, and embed quality assurance into our development process, ensuring the system evolves without losing stability or performance.

USER RESEARCH

User research is essential to fully understanding user needs. To begin our project, we conducted a survey on 8 members of the Madison County government. These surveys helped us to understand the client's pain points and desires. As we built the system, we met regularly with the client to ensure that it met their needs and supported a positive user experience. During these meetings, conducting user testing was necessary to assess our assumptions of the user and identify new opportunities to improve the system.

User Survey

We asked participants to answer 12 questions which prioritized getting to know our users' daily tasks and identifying what needs and difficulties they encounter. These responses helped to further our understanding of the problem and to establish their expectations of the system.

Sample Q&A's

What is the main function you need for this system?

- *"To assess spending trends and provide projects for out years...with data points to look ahead with their fiscal planning."*
- *"A road map of how to accomplish providing the health, welfare, and safety of the citizens without destroying the rural Madison lifestyle and scenic beauty."*
- *"To provide a separate, organized system for strategic assessment and planning."*

What pain points (difficulties) do you currently experience with your current operations?

- *"We are in a reactive state to make budgetary decisions... We need to analyze past years expenditures with past revenues as well as predictive revenue forecasting."*
- *"Inability to locate and/or retrieve reliable and useable financial and demographic information specifically related to Madison County."*
- *"Need to find a way to get everyone on the same page so we know how to move forward."*

User Testing

After receiving feedback from Sprint 2 and 3, we prioritized the process of user testing on several participants to evaluate how our system performs in the hands of the users. Each participant was given a series of tasks within the system to complete on their own. Our observation of their navigation within the system helped us to identify pain points in our design. From this process we were able to adapt the system to better meet their needs.

AUDIENCE PERSONAS



RYAN THOMPSON
Government Official



TIMOTHY GRAYSON
System Administrator

Primary Persona

ABOUT ME

Ryan Thompson has lived most of his life in Madison County and works as the Budget Process & Tourism Director. He is passionate about promoting Madison County locally, regionally, statewide, and internationally.

VALUES: Productivity | Collaboration | Self-sufficiency

FRUSTRATIONS

- Rising government spending
- Lack of a systematic strategic planning and assessment system

NEEDS

- A system that enables their county to improve goal attainment and planning
- A site that has a simple but efficient structure

Digital Literacy

Secondary Persona

ABOUT ME

Timothy Grayson is a resident of Madison County and has ten years of experience in the field of Information Technologies. He currently works for the local government and is responsible for maintaining the Madison County internal website.

VALUES: Organization | Communication | Efficiency

FRUSTRATIONS

- Lack of singular system to update and maintain

NEEDS

- A secure and organized system that can be managed and protected with ease

Digital Literacy

AUDIENCE PERSONAS



AGATHA ELLSON

Citizen

Tertiary Persona

ABOUT ME

Agatha Ellson is a lifelong resident of Madison County. She retired a few years ago from teaching at Madison County High School. She is now actively involved in local community activities, eager to contribute to positive changes within Madison County.

VALUES: Democracy | Community | Accountability

FRUSTRATIONS

- Increasing taxes
- Lack of access to local government meetings

NEEDS

- A way to access information about her local government's plans

Digital Literacy



VISUAL DESIGN

Official Color Palette

Primary

#EDF3F6

Secondary

#D3D3D3

#6096BA

#808080

#274C77

#1C3451

Conditional

#C61E1E

#23A620

#FFDF35

Graphs

#B9D18A

#AEAED4

#FFBE5B

Official Font

Montserrat

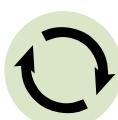
Madison County Government

VALUE PROPOSITION

SPENDING PROJECTION MODEL STRENGTHS



Uses an exponential expression to better model how inflation effects expenditure over time. Linear Regression is a poor predictive model that our system avoids.



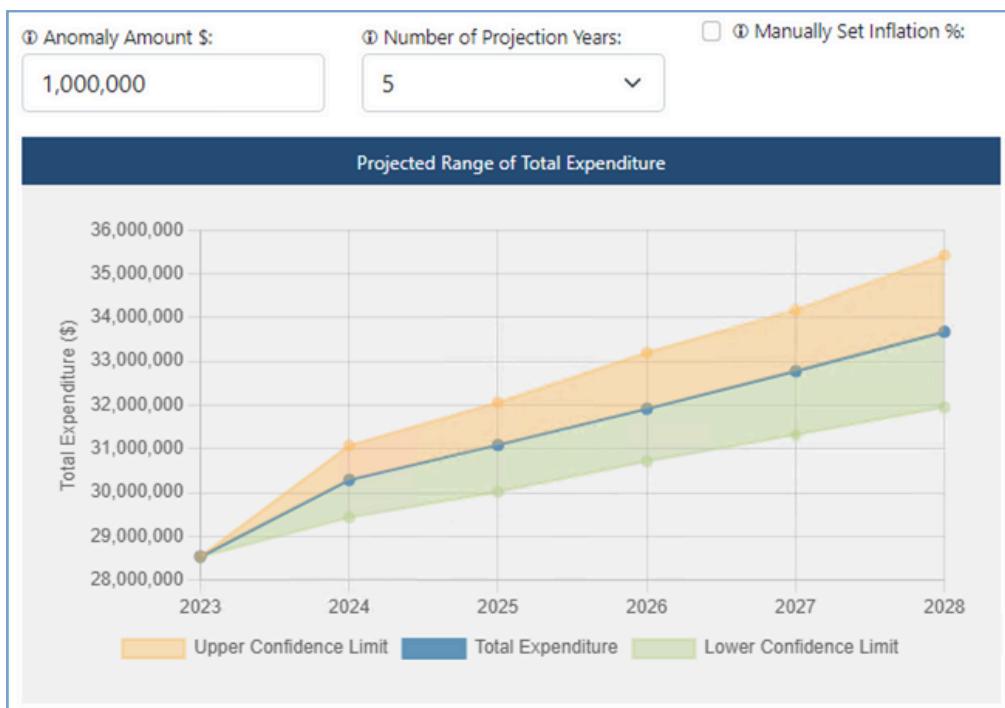
Runs 1000 simulations to predict inflation rate and related expenditure for every projected year to remove guess work.



Shows 95% confidence range for projected expenditures for each projected year.

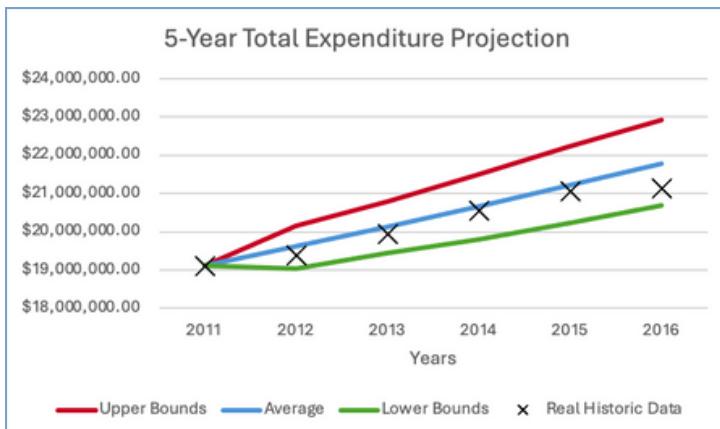


Removes interest rate as a parameter to more accurately project expenditure.

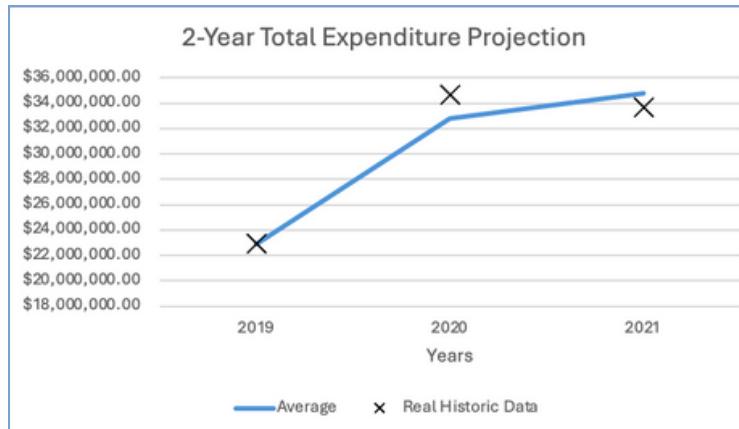


*The graph displayed is from the Spending Projections page, part of the Budget Process Initiative.

Accuracy of Model



Auto-Inflation rate for times of economic stability



Manual-Inflation rate for times of economic instability

VALUE PROPOSITION

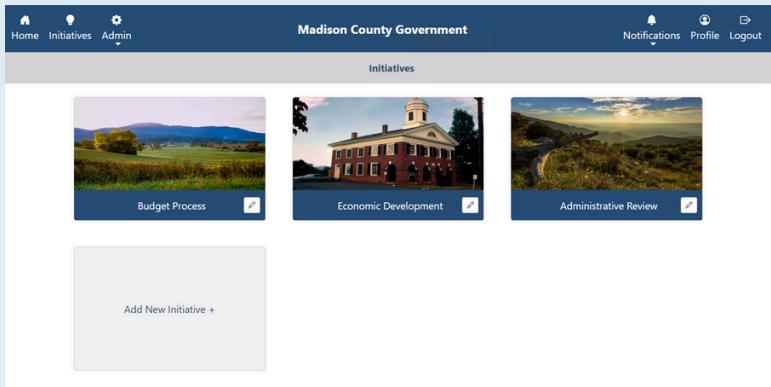
FEATURE HIGHLIGHTS



CITIZEN VIEW

The Citizen View page provides access to resources published by government officials, making them readily available to the citizens of Madison County.

The Government's Official homepage mirrors the Citizen View in layout and design, with the added functionality of a login option for authorized users.



The interface for administrators features a dedicated '**Admin**' dropdown menu, providing quick access to essential management functions. This menu includes options for '**Manage Resources**' and '**Manage Users**', allowing admins to efficiently oversee resources and user permissions within the platform.

INITIATIVES PAGE (ADMIN VIEW)

After logging in, users are directed to the 'Initiatives' page, which serves as the hub for managing various pages grouped under different initiatives. Each initiative is assignable to specific users, allowing for customized access tailored to the needs of Madison County.

Administrators have the flexibility to modify existing initiatives or create new ones, ensuring the system remains adaptable and responsive to the county's evolving requirements.

PROPOSED DEVELOPMENTS

Within the Economic Development Initiative, users have the capability to create Proposed Developments.

During the creation process, users can provide a detailed description of the potential development and categorize it based on its impact level. Once a development is established, users can add related resources to further support and detail the proposed development.

VALUE PROPOSITION

FEATURE HIGHLIGHTS



HISTORICAL SPENDING

Located in the Budget Process Initiative

- Presents a comprehensive visualization of Madison County's spending since 2009.

Features:

- A detailed breakdown of expected expenditures by year, organized by spending categories.
- A line chart that illustrates the correlation between expenditure trends and fluctuations in interest/inflation rates.



SPENDING PROJECTION

Located in the Budget Process initiative

- Offers a visual representation of future spending forecasts for Madison County.
- Allows users to predict expenditure 1-5 years out, using either an automatically simulated inflation rate or a manually inputted inflation rate.
- Categorizes the expected total spending into segments that include Public Safety, Schools, Other Expenses, and an Anomaly figure, each identified according to Madison County's classification system.



REVENUE PROJECTION

Located in the Budget Process initiative

- Provides a visual analysis of projected revenues for Madison County
 - Leverages a multivariable expression based on growth rates for key revenue sources, including real estate tax, personal property tax, fees and licenses, and state funding.
 - Forecasts revenue trends over the next 1 to 5 years.
- Vividly illustrates expected contributions from various sources such as real estate taxes, personal property taxes, fees, licenses, and state funding, ensuring stakeholders can easily grasp the financial outlook.

VALUE PROPOSITION

FEATURE HIGHLIGHTS

The screenshot shows the 'Resources' section of the Madison County Government website. At the top, there's a navigation bar with links for Home, Initiatives, Budget Process (selected), Dashboard, Historical Spending, Spending Projection, Revenue Projection, Resources (selected), Task Manager, and Discussion Board. Below the navigation is a search bar with placeholder text 'Search files...' and buttons for 'Search' and 'Upload File'. A table lists three files: 'FY0 TO FY21 GENERAL FUND REVENUE.xlsx' (xlsx, 03/28/24 02:05 PM, Tiffany Grayson, actions: download, publish), 'FY22 TO FY23 GENERAL FUND REVENUES, EXPENDITURES.xlsx' (xlsx, 03/28/24 02:14 PM, Ryan Thompson, actions: download, publish), and 'Budget Process Goals.docx' (docx, 03/25/24 02:16 PM, Tiffany Grayson, actions: download, publish). At the bottom of the page, a footer notes '© 2024 - ValleyVisionSolution - Privacy'.

RESOURCES

On the Resource page, users can manage files specific to each initiative. This includes viewing files that have been saved directly to 'Resources,' uploading new files, and controlling their publication status.

Users have the ability to publish or unpublish files, making them available or unavailable on the citizen-facing page. This feature is integrated into all initiatives, with unique functionalities tailored to each specific initiative.

The screenshot shows the 'Task Manager' section of the Madison County Government website. The interface includes a navigation bar with links for Home, Initiatives, Budget Process (selected), Dashboard, Historical Spending, Spending Projection, Revenue Projection, Resources, Task Manager (selected), and Discussion Board. On the left, a 'Task Manager' sidebar has tabs for 'To Do', 'In Progress', and 'Completed'. The 'To Do' tab shows tasks like 'Download Historical Spending' (due Apr 08) and 'Upload revenue projection' (due May 01). The 'In Progress' tab shows 'Run revenue projection' (due Apr 23). The 'Completed' tab shows 'Upload historical spending to ...' (due May 09). On the right, a 'My Tasks' panel lists tasks with due dates: 'Run revenue projection' (due Apr 23), 'Download Historical Spending' (due Apr 08), 'Message group about meeting' (due May 14), and 'Upload historical spending to ...' (due May 09).

TASK MANAGER

The Task Manager enables users to efficiently track and manage their assignments. Each user can view their assigned tasks and monitor their current statuses, organized under categories such as 'To Do,' 'In Progress,' and 'Completed.'

While this feature is available across all initiatives, it is uniquely configured to meet the specific requirements of each individual initiative, ensuring tailored functionality to enhance productivity.

The screenshot shows the 'Discussion Board' section of the Madison County Government website. The navigation bar includes links for Home, Initiatives, Budget Process (selected), Dashboard, Historical Spending, Spending Projection, Revenue Projection, Resources, Task Manager, and Discussion Board. On the left, a sidebar titled 'Users' lists 'Timothy Grayson', 'Ryan Thompson', and 'Elizabeth Bennet'. The main area is titled 'Discussion Board' and contains a message from 'Timothy Grayson': 'Hello everyone in the Budget Process initiative!' and 'Hi, I will update the to-do items in the task manager for this week.' At the bottom, there's a text input field labeled 'Type message...' and a 'Send' button.

DISCUSSION BOARD

The messaging feature enables users to communicate directly with other members of their initiative through a group chat format.

On the interface, a list of users associated with the current initiative is prominently displayed on the left, allowing for seamless access and fostering effective communication among team members.

VISUAL ARTIFACTS

Government Official User Flow Diagram

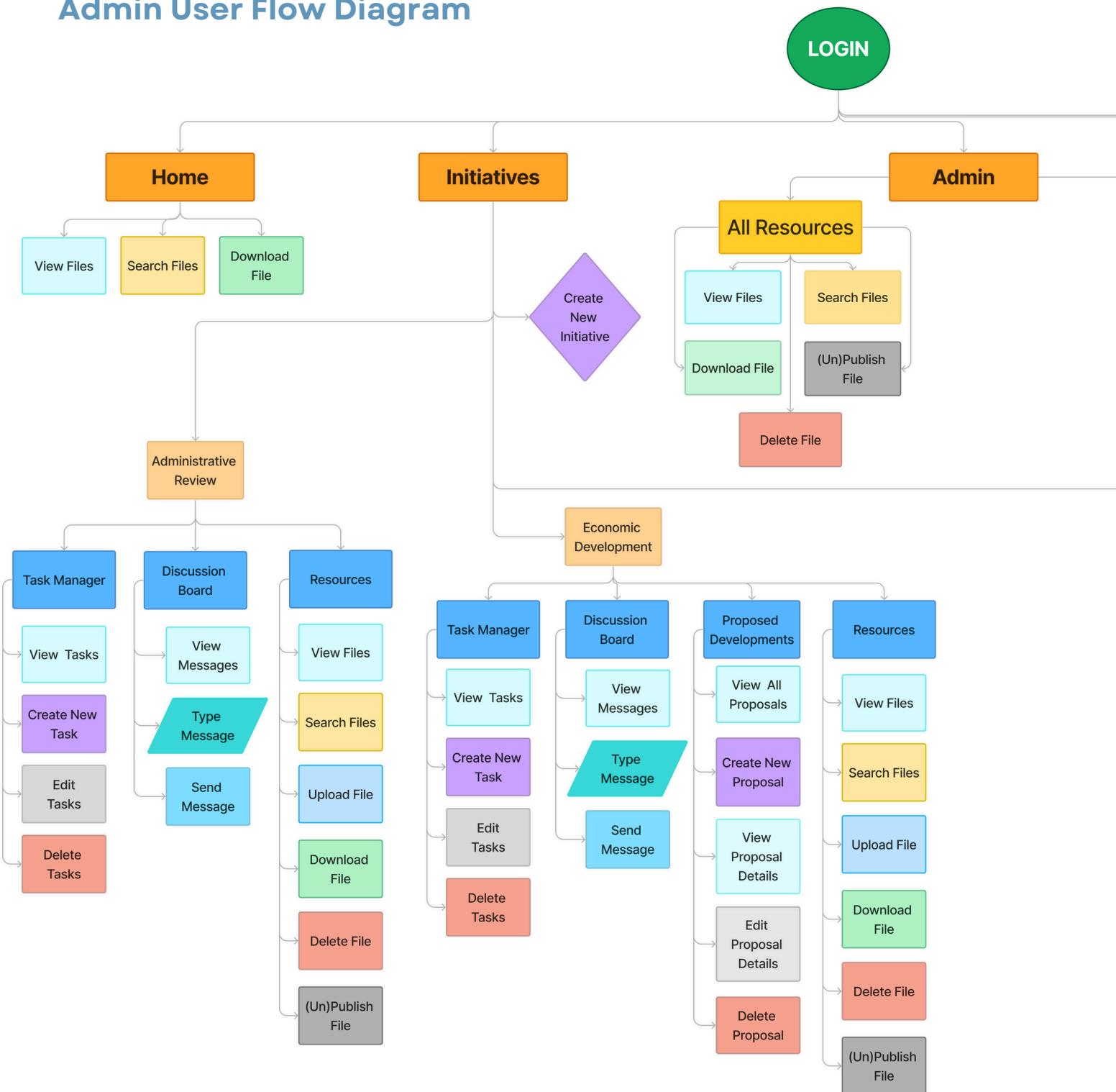


VISUAL ARTIFACTS



VISUAL ARTIFACTS

Admin User Flow Diagram



VISUAL ARTIFACTS

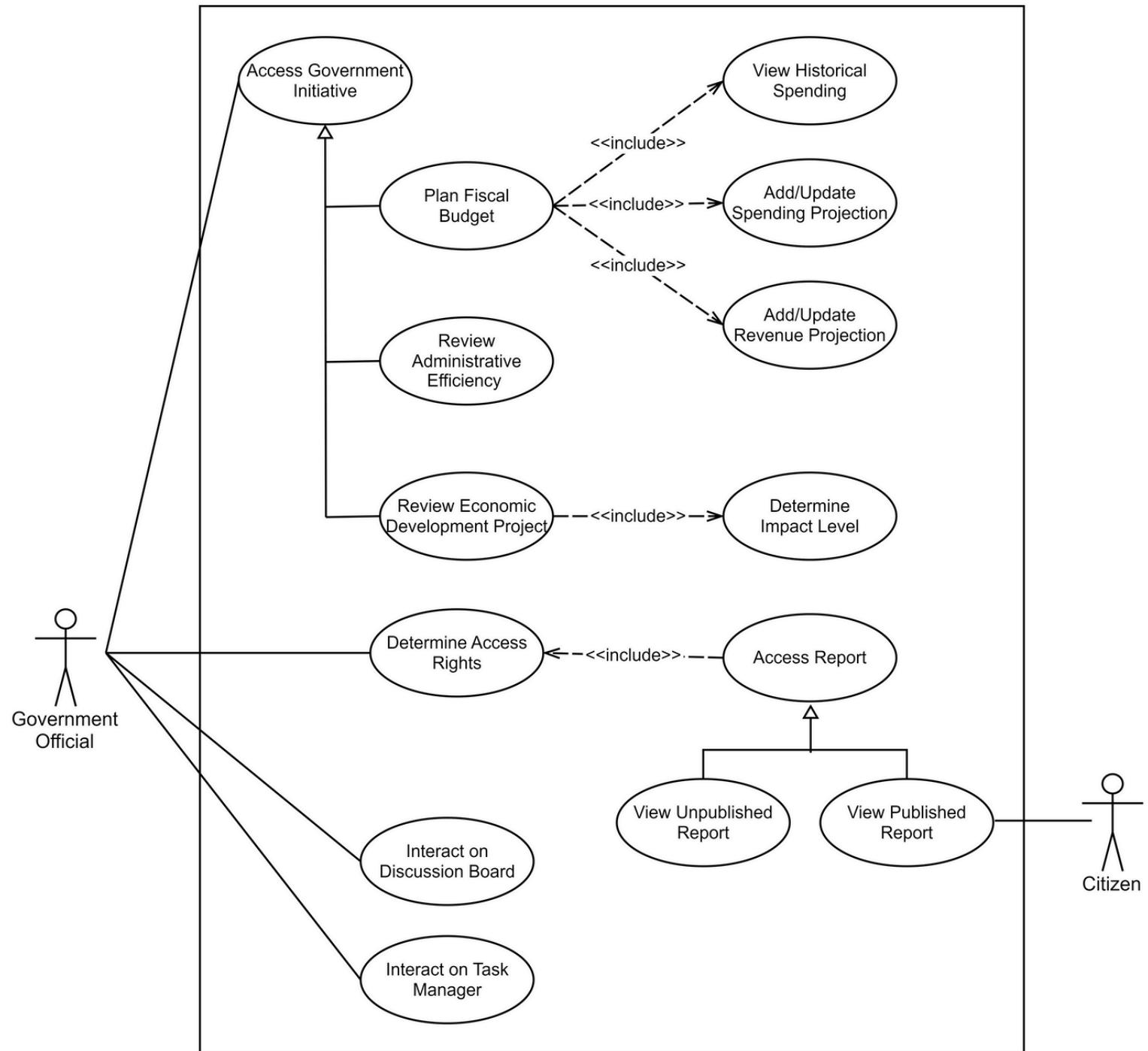


Color Key

	Delete		Sub-Menu		Text Input		Activity Page		Edit
	Main Menu		Search		View		Create		(Un)Publish
	Initiative Board		Download		Upload/Save		Run Projection		

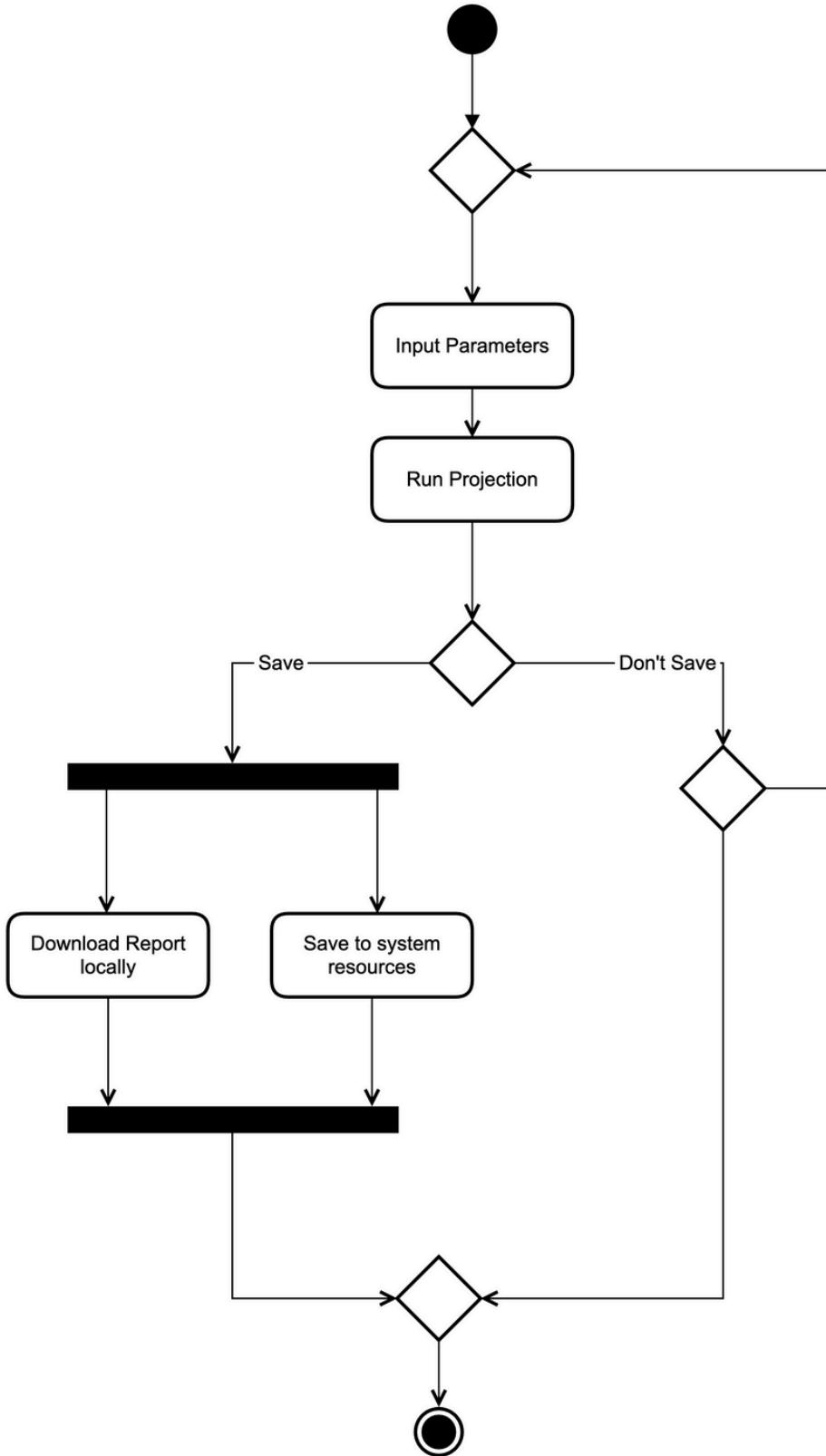
SYSTEM PLANNING & DOCUMENTATION

Detailed Use Case Diagram of Strategic Planning System



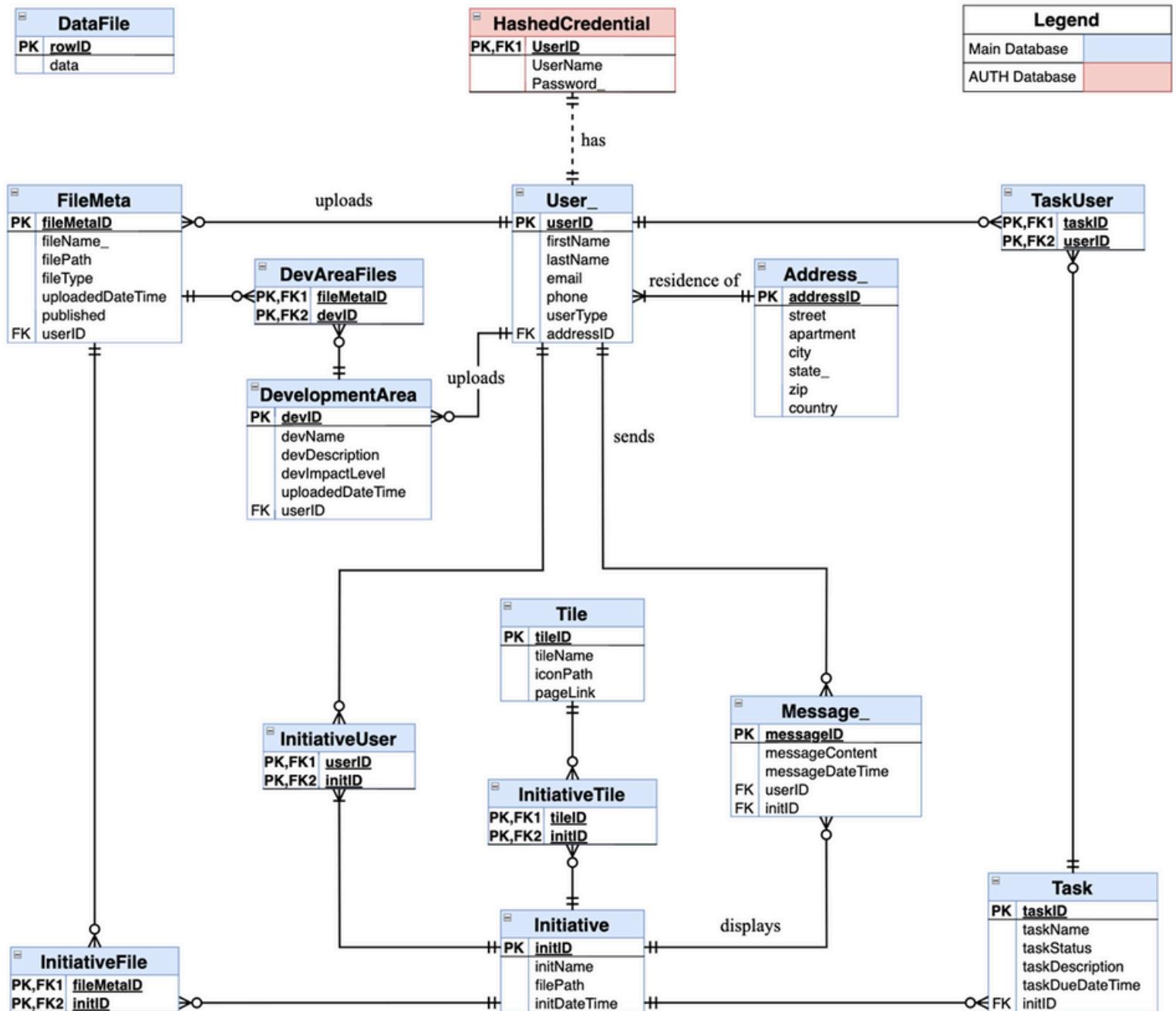
SYSTEM PLANNING & DOCUMENTATION

Low-Level Activity Diagram for Spending Projection



SYSTEM PLANNING & DOCUMENTATION

Entity-Relationship Diagram of Strategic Planning System



CLOUD DEPLOYMENT

Object-Oriented Nature

The Valley Vision Strategic Planning System is developed using the ASP .NET Core Razor Pages Framework, making it inherently object-oriented as the .NET Core Framework supports encapsulation, inheritance, polymorphism, and abstraction.

Cloud Hosting with Azure

The Valley Vision Strategic Planning System is hosted on the Azure Microsoft Cloud. Our instance of an Azure App Service for Windows provides a managed infrastructure that is easy to scale and is supported by the .NET Core framework. This service enables us to seamlessly connect to a SQL Server database without needing a system administrator to assist with set-up. At this point in time, the system is expected to host the needs of 6-12 users working together, and the current service plan has ample space for the needs of a small team. The payment model is currently a pay-as-you-go and additional storage can be purchased through Azure.

Cloud Storage Service with Blob

The web application portion of the Strategic Planning System is built using Razor Page .NET Core which is easily supported by Azure Blob Storage. Azure Blob Storage is a service provided by Microsoft's Azure platform and is compatible for .NET framework solutions. Blob storage is designed for the cloud; it is optimized for applicants requiring access to data from anywhere over HTTP or HTTPS. Blob Storage supports storing large amounts of unstructured data, like text and media. The service is highly accessible and prevents data loss by storing all files on the back-end unless configured to delete (similar to the Windows “recycle bin”). Lastly, it supports security measures to be configured for accessing files stored through Blob Storage.



PRICING

After reviewing the requirements and discussing implementation with the client it seems there are two options Madison County could take. Madison County currently pays a third-party provider, Magnify, for Microsoft services which includes Azure accounts. Magnify also provides Madison County with virtual machines they can run on-premises and IT staff are able to spin up new instances of virtual machines per team that requires one.

The Cloud (Azure) Cost Estimates

	Item	Cost	Description
Set Up	Azure Accounts	\$0	Madison County has existing Azure accounts. No additional purchases are required.
	Data Transfer	\$0	Minimal to no cost
	Labor	\$150	Cost for 1-hour of IT Director to create the new Azure instance.
<hr/>			
Monthly	App Service	\$74	Pricing Tier of S1 (Standard) (max 10 instances, 1 core processor, 50GB storage, 1.75GB RAM, Daily Back-ups, SSL Support, custom domain)
	SQL Server Database	\$9.60	Per each SQL Server Database (2)
<hr/>			
Maintenance	IT Director Support & Updates	\$3,000	\$150 Hourly Rate * 5 hrs/week * 4 weeks = \$3,000
	Mid-Level SQ for System Optimization	\$1,600	\$40 Hourly * 10hrs/week * 4 weeks = \$1,600

Locally Hosted Server Cost Estimates (VM On-Prem)

	Item	Cost	Description
Set Up	New VM Windows Server instance	\$800	Estimated cost from Madison County IT Director for a new SQL server in VM (64GB, 2 processors)
	SQL Server License	\$850	Magna, SQL License Reseller
<hr/>			
Monthly	Storage on VM	\$0	Estimated cost from Madison County IT Director. Current VM storage plan with ample room for Project Solution.
	Software Engineer	\$3,000/month	\$150 Hourly Rate * 5 hrs/week * 4 weeks = \$3,000 Responsible for optimizing and continuing to build out program as required
<hr/>			
Maintenance	SQL Server Admin	\$200-400	\$40 Hourly * 5-10 hrs/week Responsible for ensuring the database is operational, secure, and searchable.

SECURITY MEASURES

Hashed Passwords

We have implemented hashed passwords using PBKDF2 encryption to protect all users' sensitive information. Password hashing ensures that even if our database is compromised, the actual passwords remain stored as a random string of characters. To pair with this, the PBKDF2 encryption method increases the complexity and time required to crack these passwords, which will result in unsuccessful brute force attacks.

Parameterized Queries

The addition of parameterized queries is mainly used to prevent SQL injection attacks on the system. SQL Injection attacks happen when malicious code is placed in the system and disguised as user input, resulting in the alteration of SQL queries. Parameterized queries allow the system to differentiate between plain-text user input and executable code, so that the execution of SQL queries cannot be altered in any way.

Session State

The introduction of session state allows the system to bypass the use of cookies and store sensitive user information on the server side, not the client side. This helps to minimize the exposure of sensitive data to potential interception or manipulation by unauthorized parties. While using session state, it is much more difficult for outsiders to access data, as the tracked session is cleared every time the user logs out or closes the browser.

Login-Aware Pages

Using login-aware pages ensures that only authenticated users can access sensitive information and the functionalities necessary for their role. This is also known as role-based access control. Within our specific application, this prevents Madison County citizens from accessing the government's strategic planning system and all resources related to it. It also prevents normal government staff from accessing important admin functions.

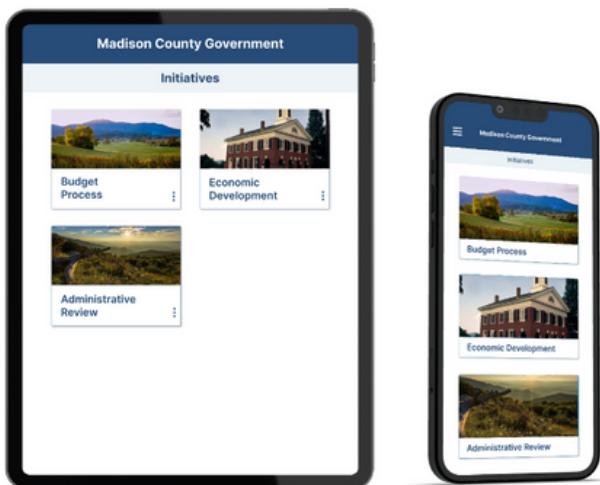
FUTURE DEVELOPMENT

MADISON COUNTY

ABCDEFGHIJKLMNPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

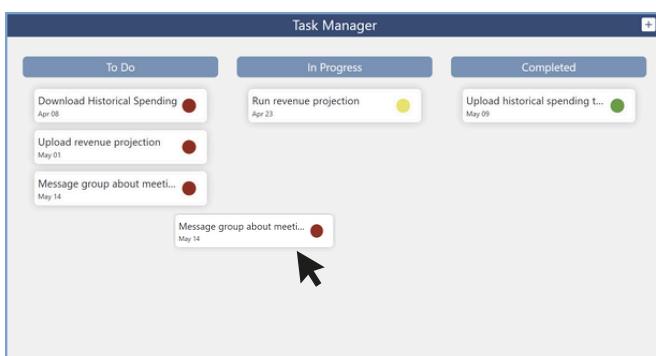
DESIGN ELEMENTS

In addition to small CSS improvements such as fixing padding, colors, and design, we will be changing the system font to Montserrat so it is in unison with the Madison County Website. This will help the Madison County Government stay consistent with their branding and image.



RESPONSIVE SYSTEM

We are committed to enhancing accessibility and convenience by optimizing our system for responsiveness on all devices. This ensures that whether users access the system via phone, tablet, or desktop, they experience a consistent and seamless interface. This adaptability allows for greater flexibility and efficiency, enabling users to manage tasks effectively from any location.



DRAG AND DROP

We'd like to further enhance this system by introducing a drag-and-drop feature to the Task Manager, similar to Trello. This addition will allow users to interact more intuitively with their tasks by moving them between categories, thereby improving user experience and operational efficiency.

MODEL IMPROVEMENTS

Continue collaborating with the broader Madison County Team to refine the ERP Typer Data by introducing additional categories into our spending and revenue projections. We plan to incorporate new parameters, such as the anticipated percentage growth in 503c non-profit contribution requests and appropriations, to enhance our financial analysis capabilities.

