Liquid Democracy for Rating Systems

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Abstract

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A project to enhance rating systems with liquid democracy features, focusing on implementing and analyzing various delegation mechanisms within the Vodle decision making system.

Contents

Chapter 1

Introduction

1.1 Vodle

Vodle is an online platform where users participate in polls to vote on subjects through user created polls. Each poll contains a set of options, and users provide ratings for each option from 0 to 100, where a larger number means that they prefer the option more, using a slider (below). When the poll ends, the ratings submitted by voters are then aggregated and a result is calculated.

INSERT IMAGE OF SLIDERS

1.2 Liquid Democracy

Liquid democracy is a decision-making system that combines elements of both direct and representative democracy that offers a voter more flexibility than traditional voting models.

In direct democracy, every participant votes individually on each issue. This model offers the most individual input but can become impractical for large-scale decision-making due to the high level of participation required from each individual. As Ford (2002) states, direct democracy assumes that all individuals are both willing and able to engage meaningfully with every decision, which is often not the case in large groups due to the variance in both the interest and knowledge of voters. The cognitive demand of staying informed on all matters, combined with the time commitment necessary for constant participation, makes direct democracy unmanageable at scale.

In a representative democracy, citizens elect officials to deliberate and decide on legislation and policies on their behalf. While this system is more scalable than direct democracy, it introduces certain limitations:

Liquid democracy addresses these limitations by allowing voters to either cast their votes directly or delegate them to someone that they trust or to abstain from voting entirely (Blum and Zuber (2016)). These delegations can be updated or revoked at any time, giving users control over how their vote is used. Delegations are also transitive, meaning a vote can be passed through multiple levels of trusted participants. For example, if Alice delegates to Bob who in turn delegates to Charlie, Charlie's vote would then represent three individuals (Alice, Bob and Charlie).

1.3 Motivation

Liquid democracy holds considerable potential, but practical applications face notable challenges. Common issues include delegation cycles, where voting authority becomes circular and unresolved; voter abstention, where users choose not to vote; and disproportionate influence by super-voters.

Current systems rarely implement solutions like ranked delegation (allowing users to specify multiple, ranked delegates) or the ability to allocate voting power across multiple delegates.

This project aims to address these gaps, specifically within platforms like Vodle, to improve rating accuracy and reliability.

1.4 Project Goal

The project's main goal is to integrate liquid democracy into the vodle platform.

Key features include ranked delegation, weighted voting, and backup votes. Addressing technical challenges such as delegation cycles and disproportionate influence is critical to enhancing rating accuracy, increasing user trust, and boosting engagement.

While the project explores theoretical aspects, its primary focus remains practical implementation and technical effectiveness.

1.5 Project Outline

This report is structured to clearly illustrate the project's progression and outcomes:

Chapter 2 presents background research, including existing variations of liquid democracy, real-world implementations, and relevant aspects of vodle's design and system architecture.

Chapter 3 defines the system specifications and outlines the project's objectives in detail.

Chapter 4 discusses the methodology used, including the iterative approach, planning, and risk assessment strategies.

Chapter 5 describes the design and implementation process of integrating liquid democracy into vodle.

Chapter 6 evaluates the implemented system through unit testing, user feedback, and commentary from the project customer.

Chapter 7 covers project management aspects such as legal and ethical considerations, a reflection on risk management, and personal reflections on the development process.

Chapter 8 concludes the report and discusses potential directions for future work.

Chapter 2

Research

This chapter provides background context for the development of a liquid democracy system within Vodle. It builds on the concepts introduced earlier, focusing on more detailed research into known limitations of liquid democracy and potential solutions proposed in academic literature. Additionally, the technical foundations and design philosophy of Vodle as a platform are explored.

2.1 Liquid Democracy

Liquid democracy, or delegative voting, allows voters to either cast a vote directly, delegate it to someone they trust, or abstain (Blum and Zuber (2016)). A key feature is that delegations are transitive - a chain of users that all delegate to each other sequentially ends with a single final voter who casts their vote on behalf of all those in the chain.

Whilst the transitivity property enables concentration of voting power with trusted individuals, it can also lead to unintended consequences. Chains of delegations may result in cycles that prevent votes from being cast, or allow certain individuals to accumulate an excessive share of influence, creating so-called super-voters. These problems amongst others motivate the need for alternative delegation mechanisms, as discussed in the following subsections.

2.1.1 Issues with Liquid Democracy

Delegation cycles

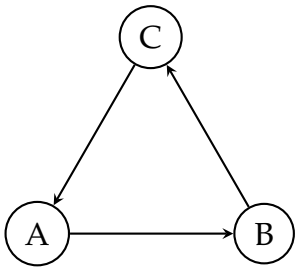

Figure 2.1: Delegation cycle: A delegates to B, B to C, and C back to A.

Delegation cycles occur when a vote is delegated in such a way that it ends up forming a loop Brill et al. (2022), preventing the vote from reaching a final, resolvable destination. For example, if Alice delegates her vote to Bob, Bob delegates to Charlie, and Charlie delegates back to Alice, the votes become trapped in a cycle (seen above) and can be treated as a loss of representation (Christoff and Grossi (2017)).

This issue is particularly problematic because it can nullify votes without the affected users ever realising. In systems where cycles are not explicitly detected

and handled, these votes are discarded silently, potentially changing the final outcome of the votes.

Delegation cycles are increasingly likely to emerge in dynamic voting systems, where delegations can be added, removed, or modified at any point in time. Delegations that initially did not form part of a cycle may later contribute to one as other voters add a new delegation or alter an existing one.

Paragraph on how size of the system affects the possibility of cycles?

Abstentions

In liquid democracy, abstention is where a voter neither casts a vote nor delegates their vote to another user (Brill et al. (2022)). This includes both deliberate abstention, where a voter knowingly chooses not to participate, and passive abstention, where a voter may be unaware of an ongoing poll or are unable to engage with it.

Super-voters

: Individuals who accumulate significant influence may skew results, as seen in the German Pirate Party's experiments with liquid democracy (Sven Becker, 2012).

2.1.2 Existing Variations of Liquid Democracy

Ranked delegation: Allows voters to specify fall-back delegates in order of preference (Brill et al., 2022).

Vote splitting: Voting power is distributed across multiple delegates to reduce reliance on any single individual (Gölz et al. (2021)).

Backup votes: Voters may provide a direct vote to use in case delegation fails.

Cycle resolution mechanisms: Detect and resolve loops in the delegation graph to preserve vote validity.

2.2 vodle

Vodle is a web-based platform for participatory group decision-making. Users participate in polls that allow them to rate a set of options using sliders. These sliders enable users to express degrees of preference rather than make binary choices. The platform aggregates these ratings to derive results that reflect the collective input of the voters in each poll.

2.2.1 MaxParC

Maximal Participation and Consensus (MaxParC): A proportional decision-making method that encourages widespread involvement and compromise.

Conditional commitments: Voters can condition their support based on how others are expected to vote, supporting consensus-building.

Role in Vodle: MaxParC is used as the primary aggregation mechanism within Vodle.

2.2.2 Architecture

Client-server model: Facilitates real-time voting through a web interface.

Poll-based interaction: Users rate options in predefined polls.

Extensibility: The platform's architecture supports the integration of new decision-making models, such as liquid democracy.

2.2.3 Design Philosophy

Minimalism: Designed to reduce friction and make participation intuitive.

Flexibility: Supports a range of decision models.

Legibility: Users can understand and trust how results are derived.

2.3 Summary

This chapter reviewed the structure and challenges of liquid democracy, explored enhancements found in recent literature, and outlined Vodle's technical and conceptual foundation. These insights inform the design and implementation decisions discussed in the next chapters.

Chapter 3

Design

In this chapter, we describe the overall design of our solution to the problem identified in Chapter 1, building on work described in Chapter 2.

Chapter 4

Implementation

In this chapter, we describe the implementation of the design we described in Chapter 3. You should **not** describe every line of code in your implementation. Instead, you should focus on the interesting aspects of the implementation: that is, the most challenging parts that would not be obvious to an average Computer Scientist. Include diagrams, short code snippets, etc. for illustration.

Chapter 5

Evaluation

Describe the approaches you have used to evaluate that the solution you have designed in Chapter 3 and executed in Chapter 4 actually solves the problem identified in Chapter 1.

While you can discuss unit testing etc. you have carried here a little bit, that is the minimum. You should present data here and discuss that. This might include *e.g.* performance data you have obtained from benchmarks, survey results, or application telemetry / analytics. Tables and graphs displaying this data are good.

Chapter 6

Conclusions

The project is a success. Summarise what you have done and accomplished.

6.1 Future work

Suggest what projects might follow up on this. The suggestions here should **not** be small improvements to what you have done, but more substantial work that can now be done thanks to the work you have done or research questions that have resulted from your work.

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