Levin Heimgartner, 16.11.2003
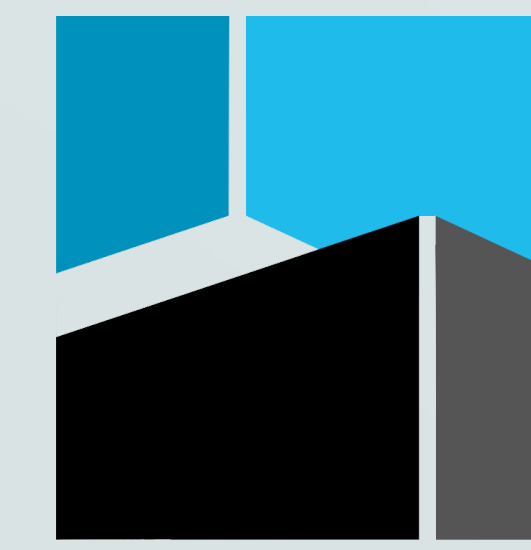
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# Building a Decentralized E-Voting Application on Ethereum

Introduction

Since the launch of Ethereum in 2015, which made it easily possible to also run applications on blockchains, so-called decentralized applications have become more and more popular. A few years later, in 2019, suddenly both available e-voting systems in Switzerland were shut down, meaning that there currently aren't any e-voting solutions available in Switzerland. With the rise of decentralized applications and the need for secure e-voting systems in Switzerland, the following question arises, which the paper tries to answer:

Is it possible to build a decentralized e-voting system that can be used for governmental elections in Switzerland on initiatives and referendums?

Process

The practical process in the paper can be divided into four parts, between which there were also overlaps. The first part consisted of learning the Solidity programming language, which is necessary to program the smart contract, the central component running on the blockchain. In the second part, the legal and practical requirements that an e-voting system must fulfil were elaborated. Based on these requirements, I then designed my own e-voting system, by working out all the necessary processes, security measures, applications and more. In the fourth part, all applications necessary for the e-voting system were programmed.
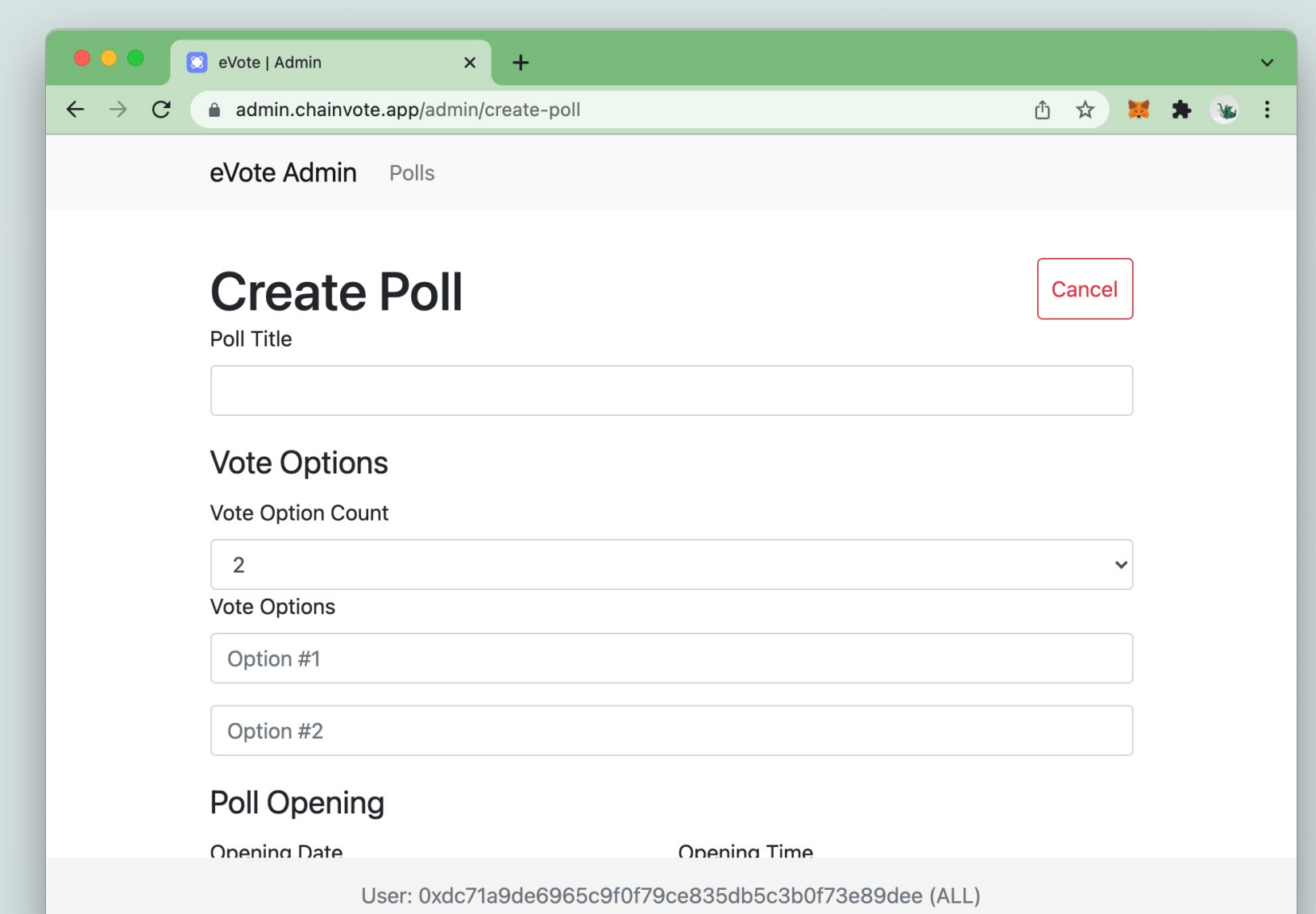

Admin Web App

Results

The final product of the paper is an e-voting system consisting of 6 applications. The core of the system is a smart contract, where the votes are stored and counted among other things. To allow administrators to manage the system, there is an Admin Web App and a CLI Tool. To create user accounts, there is a Registration App. Voters can vote and view the status of their vote through a web interface with the Voting Web App. To ensure that all votes arrive, there is also a relay that forwards the votes to the smart contract. The system implements all the relevant requirements given by the government, which are trivial for an e-voting system, such as preserving the secrecy of the vote or being universally verifiable.
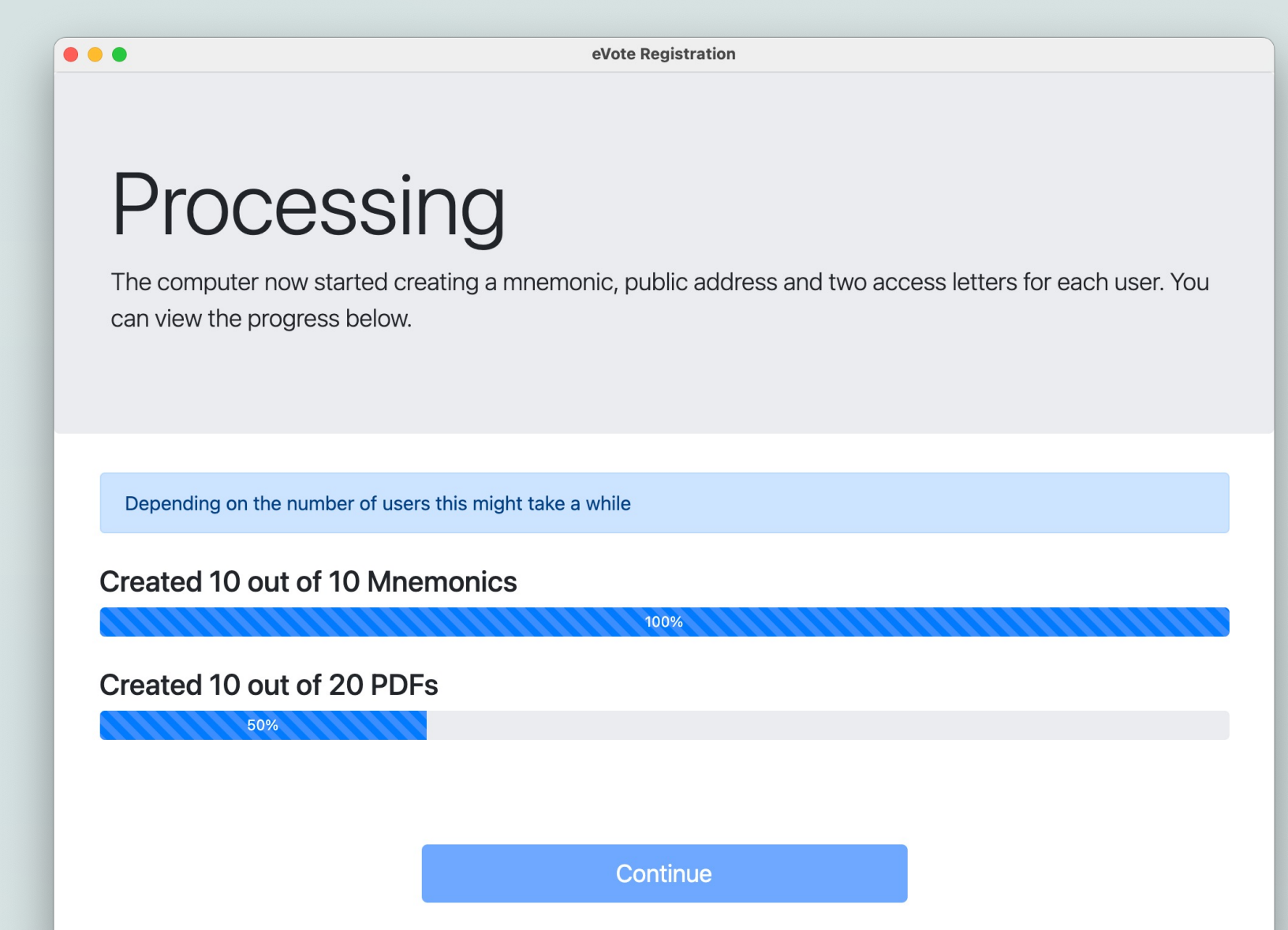
Registration App
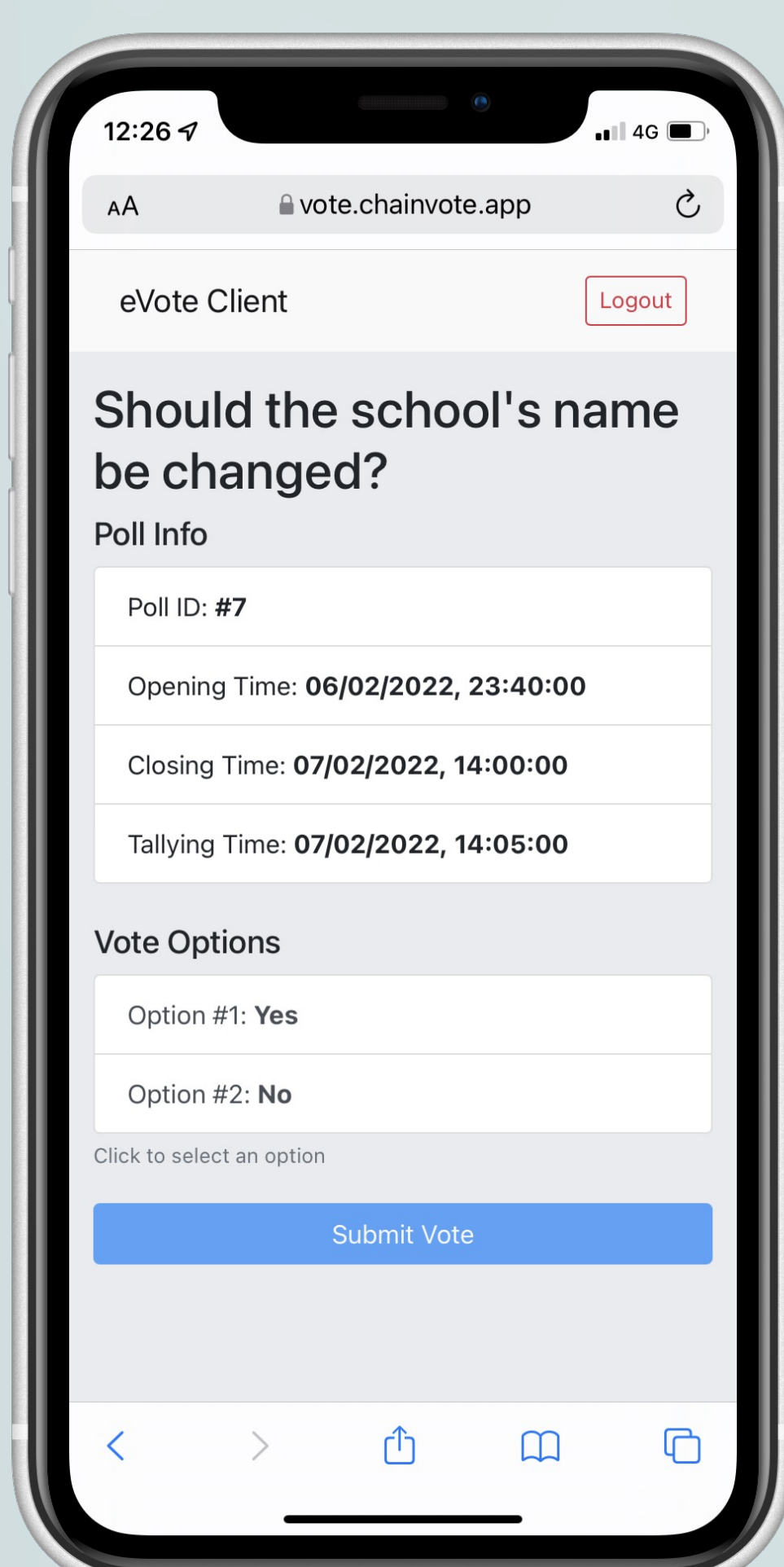
Voting Web App

Conclusion

The paper shows that it is possible to build a decentralized e-voting system that could be used for governmental elections in Switzerland on initiatives and referendums. It was possible to conduct multiple small elections with the system without any problems. However, the exact same system that was coded in the paper could not yet be used for real political elections, because there would still need to be a lot more improvements made, security audits would be necessary, additional tests would need to be conducted and more. A further step would be to expand the system to handle elections, where voters can enter their own input, so the system could also be used, for example, to elect members for the national council.

Source Code

To view the source code of the e-voting system, scan the QR code on the right or visit:
https:/bit.ly/evotesystem-code