

ScholarChain: The Scholarship Management Platform with Blockchain and Smart Contracts Technology

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Abstract: A smart contract is a set of computer code that works on a blockchain and creates set of rules that are agreed upon by all the entities involved in the contract. It means that when a milestone of a contract is reached and the payments are made, it is registered in the blockchain so that neither party can manipulate the truth or validity or registration. All of these provide additional security, transparency and efficiency. In the higher education sector, although there are blockchain studies that are focusing mainly on the originality of documents and information, studies involving smart contracts are less common. In this study, a blockchain and smart contracts-based platform is presented as scholarship management model in order to create and store contracts between students and the Credit and Hostels Institution (CHI) in Turkey. Then it is confirmed on the Higher Education Information System of Turkey that the student fulfills the continuation requirements at the end of the academic year and automatically authorizes the scholarship. The proposed scholarship management model involves many parties and processes, provides transparency and document integrity, and the most importantly, provides authorization of those who are entitled to receive a scholarship by automated rules.

Keywords: Blockchain, higher education, smart contracts, scholarship management.

Introduction

Blockchain is a technology developed to create and store distributed ledger with a high degree of security and reliability. The blockchain is built with the idea of providing a model for changing values without intermediaries or reliable third parties. The classification of the blockchain-enabled applications based on the literature are; financial applications (Casino, 2019; Haferkorn and Quintana Diaz, 2015), business and industrial applications (Tapscott and Tapscott, 2017; Kshetri, 2018; Kogure et al., 2017), healthcare management (Zhao et al., 2017; Mamoshina, 2018), education (Bedi et al., 2020; Bdiwi et al., 2017; Spearpoint, 2017), travel and tourism (Ozdemir, 2019; Calvaresi, 2019), integrity verification (Bhowmik and Feng, 2017; Dupont, 2017), governance (Reijers et al., 2016; Hou, 2017), internet of things (Adler et al., 2018; Lin et al., 2017), privacy and security (Dorri et al., 2017; Chanson et al., 2017), data management (Asharaf and Adarsh, 2017; Zhang, 2016). It provides opportunities for digitizing traditional practices in these sectors, reducing costs, increasing efficiency and security, and reducing disputes between interested parties.

A smart contract is a set of computer code that works on a blockchain and creates a set of rules that are agreed upon by all the entities involved in the contract. It means that when a milestone of a contract is reached and payments are made, it is registered in the blockchain so that neither party can manipulate the truth or validity or registration. All of these provide additional security, transparency and efficiency. Smart contracts allow “verifiable operations to be executed in blockchains”, bringing new opportunities for trust establishment in trustless scenarios (Shao et al., 2020).

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This paper aims to propose a scholarship management model which involves many parties and processes, provides transparency and document integrity, and most importantly, provides authorization of those who are entitled to receive a scholarship by automated rules.

Background Information

CHI Scholarship Process

Credit and Hostels Institution (CHI) is the government institution at Turkey that manage scholarship, credit and hostel services for higher education. The scholarship is given free of charge to successful and needy students pursuing the provisions of Turkey's law on "Granting Scholarships / Loans to Higher Education Students" (CHI, 2020a, CHI, 2020b).

Scholarship Application

Currently, scholarship applications are accepted from the CHI's web address. Priority certificate is required from the students who apply for a scholarship. Priority Documents are as follows (CHI, 2020a):

- Martyr / Veteran's child,
- Those who certify that they have a disability of 40% or more with a medical board report,
- Those who have completed their high school or equivalent education by staying in orphanages
- Those who graduated from Darüşşafaka High School in Turkey,
- Amateur national athletes,
- Those whose mother and father died.

Evaluation

CHI is evaluating applications based on students having priority documents and students who are in the top 100 in the score type determined based on the raw scores as a result of the Higher Education Entrance exam of Turkey. Students are ranked, and then, depending on the budget of CHI, determined numbers of students are chosen from the top of the list (CHI, 2020a.).

Scholarship Awards

Scholarship awarded students are announced on the website of the institution and can withdraw money with their ATM cards issued in their names. Payment is made between 6th and 10th days of the month (CHI, 2020a).

Conditions of Continuation of Scholarship

In order for an applicant to continue its scholarship, an applicant must be an active and successful student at the educational institution she is registered. Students with a diploma score of 2 and above on the 4-point system and 53.33 and above on the 100-point system are evaluated as successful. Unsuccessful students or students that left, dismissed or on leave will not be able to continue to have a scholarship (CHI, 2020a, CHI, 2020b).

Technologies

Blockchain technology was introduced as an infrastructure with bitcoin. It is distributed ledger on participating computers. Adding a new block requires consensus and cannot be altered (Nakamoto, 2008). Nick Szabo proposed smart contracts that in the 1990s (Szabo, 1997). Ethereum is created as a blockchain platform. Turing complete language of Ethereum allows the development of smart contracts (Buterin, 2020). Smart contracts can be considered as significant breakthroughs in blockchain technology. (Ream & Yang, 2016). Blockchain is a closed network, and this is the major limitation of the blockchain (Adler et al., 2019). Interacting with external

data is not possible since having a consensus on untrusted external data. Data feeds or Oracles are needed to bring external data into the blockchain. Oracles are external data providers.

Related Works

Rashid et al. (2019) proposed a platform called TEduChain that allows Fundraisers to manage the funding of college students from sponsors with blockchain. Proposed work differs from theirs in that our system has one sponsor institution instead of multiple sponsors. Their platform is keeping transparent tracks of operations with blockchain, whereas our proposed platform uses smart contracts to manage application and payment operations.

Bedi et al. (2020) proposed a system that manages scholarship applications of higher education students in India. The proposed method uses a smart contract to get student application, and the state education board verifies the applicant information. Then, the system uses blockchain to keep track of payments. Compare to that work, proposed work differs in the payment part, and the proposed platform uses smart contracts for payments. On the other hand, their system uses blockchain to keep track of payments only.

Proposed Platform

We propose a scholarChain platform (Figure 1) that transpose CHI scholarship system into a blockchain and smart contract-based transparent system. The proposed platform is based on two smart contracts. First smart contract collects applications of candidate students, then evaluates and awards the scholarship. The second smart contract continues to track and reissue in case of continuation of scholarships.

CHI needs to verify documents and information from corresponding parties. The proposed systems use Oracle services of those parties, so that, automated verifications could be done. Data flow is required from Turkey's authorities "Mernis", "Minister of Youth and Sports", "Ministry of Health", "Ministry of Family, Labor and Social Services", "ÖSYM" and "YÖK Student Information System (YÖKSİS)".

The process starts with deploying "Scholarship Application Smart Contract (SASC)" by CHI. Applicant students need to apply to SASC. SASC will get information by trigger inbound Oracle services to verify provided information of applicants. Whenever scholarship application deadline reached, SASC evaluates applications and determines the candidates to be awarded a scholarship. For each scholarship awarded student, a distinct smart contract is deployed by SASC. Those "Scholarship Payment Smart Contracts (SPSC)" are for the payment operations. Students are expected to accept the agreement to be able to get the payment.

SPSC is getting student success information from YÖKSİS oracle service at the end of each academic year to evaluate the continuation of the scholarship. If a student is not successful, SPSC is terminated. Otherwise, SPSC continues to process the applications.

Conclusion

Verifying applicants' documents and information, and then checking the success of students at the end of each academic year is a time-consuming job and open to doubt since it is not transparent. The proposed platform ensures that CHI's scholarship processes are transparent and automatic, as well as payments are made through smart contracts.

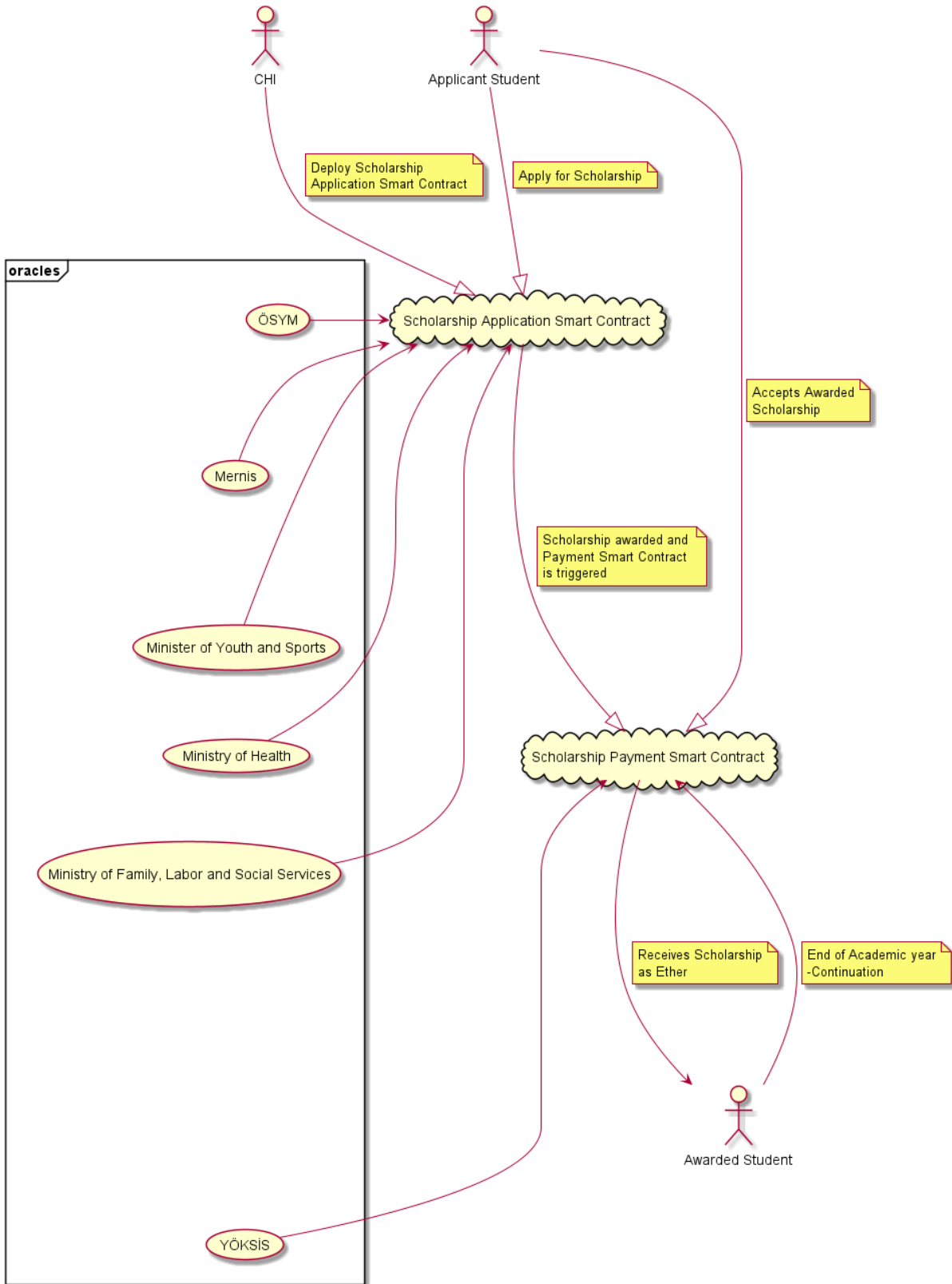


Figure 1. The Proposed ScholarChain Platform.

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