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A Blockchain Prototype to Support Academic Advisors to Record and Track Various Student Requests related to their Studies

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Abstract

Every student enrolled in a college or university is assigned an Academic Advisor. The advisor discusses the policies and procedures related to the curriculum and the institution and support the student in planning their educational career. When a student wishes to apply for postponement, repetition of courses, change of specialization etc. s/he approaches his/her academic advisor. And most of these processes are handled by the advisors manually through undertaking forms. So, later, it becomes difficult to keep track of all these student requests. Also, in some situations, the advisor is changed when the student proceeds to next level of study. So, there is a chance of information gap. This issue is addressed in this paper by proposing a blockchain framework to store the data related to academic advising. Blockchains are immutable, secured transparent and decentralized. They store a series of time-stamped blocks of data, secured and linked by a chain. There is no single owner for a blockchain, instead all the nodes in a blockchain are responsible for their actions. Many innovative blockchain applications are being developed in the domain of education. Using this model, students can add their request to the blockchain, and the advisors are able to track the requests to take appropriate actions. All the transactions will be transparent, immutable and secured. Assets, participants, and transactions of the proposed framework are presented in this paper.

Keywords: Blockchain, Student advisor, Private blockchain, Hyperledger composer, Permissioned

Background

Blockchain technology can be adopted in Educational domain to assist the students in a better way (Hileman and Rauchs 2017). Educational sector has lot of opportunities in utilizing the facility of immutable record-keeping in blockchain. Many educational institutions have started using Blockchain to verify student transcript and certifications (Chen 2018, Pearce 2019). But as per the literature review, we didn't come across an article related to blockchain based student advising applications.

Here the goal is to develop a blockchain prototype to store all the requests made by a student related to his/ her study such as the number of times the student have applied for postponement, change of specialization, transfer, repeating courses, etc. The student can place all types of request through the blockchain, and once it is approved, it will be updated in the blockchain. Later, the advisor will be able to track all the student requests from the blockchain. The student records will be saved securely in the blockchain.

The case study of Higher College of Technology (HCT), Muscat, Sultanate of Oman is addressed in this paper. In HCT, student requests for postponement, withdrawal, etc. is handled by College Information Management System (CIMS). But for processes such as repetition of courses, change of specialization, registering for more than 15 credits, make-up exam request, transfer request etc. still the students must apply manually. Since these procedures are manual, it is difficult to keep track about the above requests. The goal of this research is to introduce a blockchain prototype to track the student requests related to their study.

The rest of the paper is organized as follows: - Section 2 presents the research objectives, and research methodology is given in Section 3. The architecture of the proposed prototype is shown in Section 4. Section 5 presents the implementation details of the prototype. Section 6 describes the conclusion and the future followed by the references.

Research Objectives

The objectives of the research are as follows: -

- To identify the manual procedures currently followed in HCT for student requests through interviews, focus group discussions, surveys, etc.
- To identify such procedures related to student requests that can be recorded in blockchain.
- To build the blockchain prototype.

Research Methodology

Research methodology includes identification of data sources, data sampling, data collection methods, design of data collection instruments, data analysis etc. Here the case study of HCT to track student requests is considered. The proposed blockchain prototype would not necessarily apply to other institutions, although they may generate insights that can be helpful to develop such systems in those institutions.

The primary data is collected from Student Affairs department, registrars and selected advisors of Department of IT. Random sampling and convenience sampling are used in this research study. Interviews, surveys, review of existing student request forms and focus group discussions are the methods used here. Here convenience sampling is used where the details of the existing procedures are collected from staff of Student Affairs department, and advisors.

Interviews - Initially, an interview was conducted with the Student Affairs department personnel to know about the manual procedures followed in the case of student activities. The registrar(s) in the department was also communicated to study about the specific procedures adopted in the department.

Surveys - Surveys were conducted among the advisors to study the existing problems regarding these activities. As per the details collected, the procedures were reviewed and then categorized.

FGD - A focus group discussion was conducted among the selected advisors of Department of IT to know about the procedures of their advisees on such activities.

Review existing literature - Desk research was conducted by reviewing relevant research papers. Similar studies or projects conducted in other Universities and Colleges were reviewed from the literature collection to know about the procedures followed for such student activities.

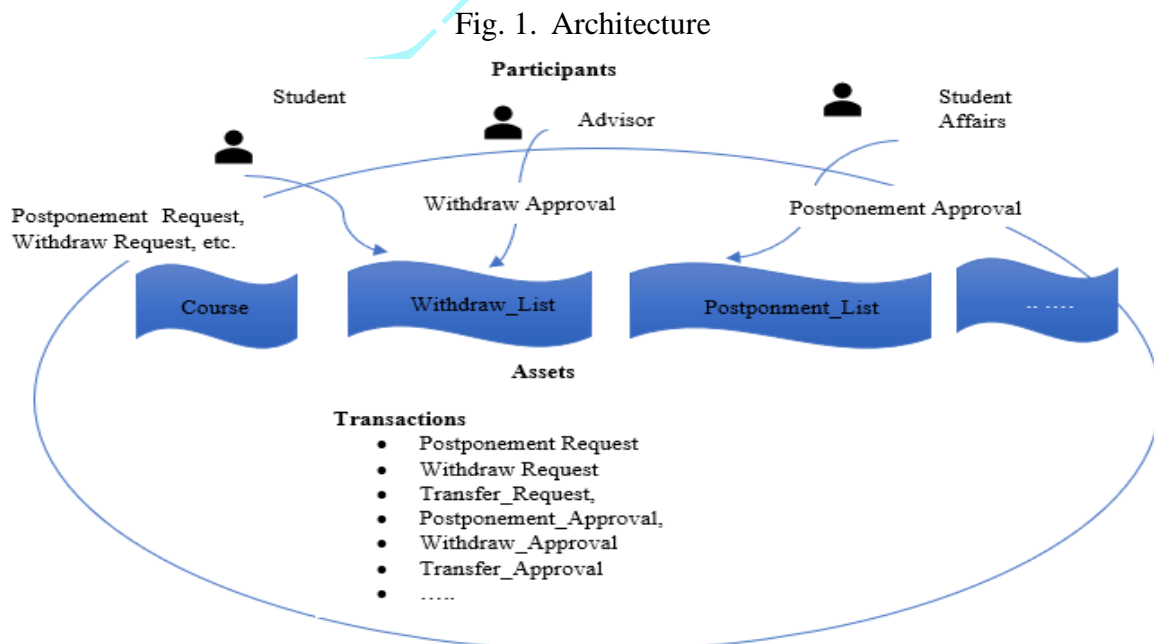
The procedures prepared for every student activity were validated again with the Student Affairs staff and the Department Registrars to ensure about the accuracy of the procedures.

Review existing reports from CIMS - Student details, advisor details, withdrawal details etc. is collected mainly from CIMS reports.

Consult Key Staff - Other data of student activities such as specialization change request, course repetition details, postponement requests etc. is collected from the Registrar, Advisors and Student Affairs department of HCT. Current policies and procedures adopted for implementing the student requests are identified. These were analyzed and then business rules are developed.

Prototype Architecture

Figure 1 shows the architecture of the proposed blockchain framework. It consists of participants, assets and transactions. The participants include Student, Advisor, and Student affairs staff. The assets in the blockchain include Course, Postponement_List, Withdraw_List, Specialization_Change_List, Transfer_List, etc. The transactions include Postponement_Request, Withdraw_Request, Transfer_Request, Postponement_Approval, Withdraw_Approval, Transfer_Approval, etc.



Implementation

Hyperledger Composer tool is used to build the prototype (Github, Hyperledger Composer). Every business network definition consists of model files, script files, access control files and query files. Model files defines the domain model of the business network and it includes the participants, assets and transactions of the business application. Composer Modeling language is used to define the model file. Script files include the business logic of the application, written in JavaScript. Access control file includes the rules to check the authenticity of the users who can access the network. Different queries can be written inside the query file which queries the data from the blockchain.

Figure 2, 3 and 4 show the Student, Advisor, and the Student affairs participant type.

```
participant Student identified by StudentId {
  o String StudentId
  o String FirstName
  o String LastName
  o String Department
  o String Specialization
  o String Email
  o Integer Phone
  o DateTime Dob
  o String Address
  o UserStatus userStatus default="Active"
}
```

Fig. 2. Participant – Student

```
participant Advisor identified by AdvisorId {
  o String AdvisorId
  o String AdvFirstName
  o String AdvLastName
  o String AdvDepartment
  o String AdvSpecialization
  o String AdvEmail
  o Integer AdvPhone
  o String AdvCountry
}
```

Fig. 3. Participant – Advisor

```
participant StudentAffairStaff identified by StaffId {
  o String StaffId
  o String StaffFirstName
  o String StaffLastName
  o String StaffEmail
  o String StaffEmail
  o Integer StaffPhone
}
```

Fig. 4. Participant – StudentAffairsStaff

Figure 5 shows few assets of the blockchain prototype. The asset Course will be registered by the Students. The asset Postponment_List contains the list of students postponed in a semester in an Academic Year. The asset Withdraw_List contains the list of students and the courses withdrawn.

```
asset Course identified by CourseId{
  o String CourseId
  o String CourseName
  o Integer Credits
}

asset Postponment_List identified by Postponment_List_Id {
  o String Postponment_List_Id
  --> Student student
  o Integer SemesterNo
  o String AcademicYear
}

asset Withdraw_List identified by Withdraw_List_Id{
  o String Withdraw_List_Id
  --> Student student
  --> Course course
  | o Integer SemesterNo
  o String AcademicYear
}
```

Fig. 5. Assets

Figure 6 shows the implementation of some of the transactions of the proposed blockchain prototype. Transactions are used to interact with the participants and the assets.

```
transaction assignAdvisor {
  --> Student Student
  --> Advisor Advisor
  o DateTime from
  o DateTime to
}

transaction registerCourse {
  --> Student Student
  --> Course Course
  o Integer SemesterNo
  o String AcademicYear
  CourseStatus coursestatus default="Studying"
}

enum CourseStatus {
  o Withdraw
  o Passed
  o Failed
  o Studying
}

transaction PostponementApproval {
  --> Student Student
  --> StudentAffairStaff Studentaffirstaff
  o Integer SemesterNo
  o String AcademicYear
}
```

Fig. 6. Transactions

The assignAdvisor transaction is used to assign an advisor to a student. Sometimes, the advisors can change, so the time period (from and to) is also recorded. The registerCourse is a transaction triggered when a student register for a course. The AcademicYear and SemesterNo is also recorded in the transaction. CourseStatus is an enumerated list of the four states – Withdraw, Passed, Failed, Studying. PosponementRequest transaction is initiated by the student. The PostponementApproval transaction is triggered when the postponement is approved by the StudentAffairs staff. Similarly, WithdrawRequest can be made by the student and WithdrawApproval will be done by the Advisor.

Conclusion & Future

Blockchain applications are getting more and more popular in almost every industry. It is a hot topic for industries, institutions and people. Many innovative applications are proposed in educational domain. The immutability and traceability features of blockchain eliminates the option of updating educational records, which is otherwise happening in some institutions. Since bitcoin

or other currencies are integrated in blockchain, it can also be considered as a platform for earning for students.

The prototype proposed in this research is used to track the student requests. In the case of student requests such as applying for postponement, course withdrawal, change of specialization etc., sometimes the advisors are not notified about the updates, sometimes the students deny about the requests, and sometimes there is no statistics on the number of times the students have applied for these types of requests. Also, if the advisor changes, there is no proper transfer of records regarding these requests, except few which are available in college information management systems. This happens mainly because of the manual handling of some of these requests through student undertaking forms. Hyperledger was introduced to develop inter-organizational blockchain applications. The proposed blockchain prototype efficiently stores the records of student requests, and later the decisions regarding these requests can be tracked to know about the history. The testing of the prototype using sample student data is identified as the future work of this research.

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