SECURE BADGE AWARDING SYSTEM USING BLOCKCHAIN

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COMPUTER SCIENCE AND ENGINEERING

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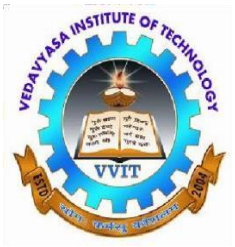

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VEDAVYASA INSTITUTE OF TECHNOLOGY

KARADPARAMBA, MALAPPURAM

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VEDAVYASA INSTITUTE OF TECHNOLOGY,

KARADPARAMBA

CERTIFICATE

This is to certify that the report entitled **'SECURE BADGE AWARDING SYSTEM USING BLOCKCHAIN'** submitted by '**SHEBIN KP'** to the APJ AbdulKalam Technological University in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology in Computer science and engineering is a bonafide record of the seminar work carried out by her under my/our guidance and supervision. This report in any form has not been submitted to any other University or Institute for any purpose.

Internal Supervisor External Supervisor

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DECLARATION

I undersigned hereby declare that the seminar report **"SECURE BADGE AWARDING SYSTEM USING BLOCKCHAIN"**, submitted for partial fulfillment of the requirements for the award of degree of Master of Technology of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of **Dr. Kavitha Murugesan.** This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

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TABLE OF CONTENTS

ABSTRACT

Badge awarding system for performance assessment in education using blockchain technology. Learners will be awarded badges, which are certified for a predetermined level of progress in terms of learning. All the badges are stored in a backpack, which is an environment for storing and presenting the obtained badges. Badges are immutable and verifiable as well as rigid. The use of badges in the education system makes education more interesting, skill-based, and adaptable to changes. The key contribution of our work is in terms of compatibility with Openbadge specification and integrated cooperating platform between digital badge awarding and blockchaining. Our system implementation is compatible with Open Badges of IMS Global Learning Consortium, which is used to earn, issue, and award badges across various platforms. The badges are trusted by the IMS standard, the criteria to earn a badge is verified through the network, and the overall process is transparent compared to the traditional education system. Moreover, all badge awarding events in our system are recorded in a blockchain. Once stored, the contents cannot be tampered with. Thereafter, anyone can check the validity of the badge through the blockchain. Our platform will be useful for distance learning as well as time and location independent learning. The experimental results are as follows. On a Bitcoin-based digital badge publishing platform, the execution time required to award the badge is 24.53 s, while on the Ethereum-based digital badge publishing platform, the execution time to award the badge is only 3.86 s. It can also be used for career management and personal history. The learners can obtain the current knowledge required for a job. Lifelong learning will be also possible with this platform.

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

MySQL	MY STRUCTURED QUERY LANGUAGE
PHP	HYPERTEXT PRE_PROCESSOR
SQL	STRUCTURED QUERY LANGUAGE
HTML	HYPERTEXT MARKUP LANGUAGE
API	APPLICATION PROGRAMMING INTERFACE
DFD	DATA FLOW DIAGRAM

CHAPTER 1
INTRODUCTION

Block chain technology is used as the base technology in many fields because it uses a distributed, decentralized database without any central control over the system and is highly secure owing to the use of the SHA 256 algorithm. A survey conducted by the World Economic Forum in 2015 found that those polled believe that there will be a tipping point for government use of block chain by 2023. Governments, large banks, software vendors, and companies involved in stock exchanges, especially the Nasdaq stock exchange, are investing heavily in this area. For example, the UK Government recently announced that it is investing £10 million for block chain research and Santander has identified 20–25 internal use cases for technology that can predict a reduction in banks' infrastructure costs by up to £12.8 billion a year. To understand the relevance of block chain in the education system, it is important to understand its components and implementation on educational networks. Block chain is a distributed record of digital events that are linked together to maintain the link and hash values of previous events. In this way, all the events are liked with the chain and stored on each computer in the same network. Everyone can see the events, but no one can change the information not even the owner of the event. Public block chains are accessible to everyone and have the potential to add new blocks to the chain, whereas private block chains are used by organizations. The best known block chain is the one at the heart of the Bitcoin system of digital money. "Proof of work" is an important feature of the block chain technology, where a new block is checked for legitimacy and is added to the chain of blocks. This is done using special notes for the benefit of incentives. This is a verification process, which is also called as mining, and in an education system, the badges are verified using the mining method. It is nearly impossible for any hacker to hack a block chain, and this makes the Bitcoin block chain a highly trusted platform. Mining requires considerable amount of power and electricity, and even if a hacker has all these things, he/she will still need to spend a considerable amount of time on the network.

A block chain is formed by linking many blocks together, and each block can hold nearly 1 Mb of data in it. In the Bitcoin network, the blocks contain the timestamp, transactions, and hash of the previous block; however, in our educational network, the blocks contain course credit, assignment, skills, etc. Every student and teacher can see the skills of the student, but they cannot make any changes. The students are able to show their skills by referencing backpack websites containing all the acquired badges. The badges are compatible with most of the internet platforms and can be shared over the internet or social media. IMS Global provides the certification of badges and Open Badges provides the configuration of the badges. In this research, the issuance of badges and verification is done using the Badgr platform. Originally, a badge in the Badge platform is only a trust relationship between two parties. This means that so far we have not been able to create chains of trust and networks of trust. However, in this study, we extended and implemented the trust relationship among all participants in the distributed environment of block chain with regard to the following concerns. (1) Elimination of the inefficiency and social cost problems of various certificate issuing systems: There are some inefficiencies and inconveniences in the certificate issuing systems of educational and public institutions, provided through the existing information system. There are costs related to the issuance of certificates, transcripts, and diplomas for online and offline education and training courses. In order to resolve these problems, we provide a technique for the certification creating/issuing/awarding system by using simple REST (Representational State Transfer) APIs (Application Programming Interfaces). (2) Difficulties in managing subdivided qualifications: Our system can be easily extended to establish a management system capable of coping with segmentation and short learning contents such as micro learning. We focus on the issuance and management of competency unit certificates as an authentication method for detailed educational and training courses. (3) Establishment of an effective management system for individual education and training history of learners: We established a backpack system to gather and manage the experiences and achievements in official

and informal activities obtained from individual and offline education and training. In this way, our system can establish a system to officially certify the collected information, so that the information can be used for future learning and career planning.

In a later section, we describe in detail the implementation of the platform using Open Badges' specifications. Distance education is possible with this technology, which will lead to the possibility of lifelong learning for all learners. The learner will be able to show his badges online to a recruiter, and the recruiter will able to understand his or her skills in detail. The traditional education system is boring for some students as it mainly focuses on books and exams. On the other hand, by using badges, education becomes skill-based and self-learning-based as well as interesting. By using the Mozilla Open Badges framework, any organization can issue badges, and the badge receiver can use it to showcase his or her skills and work experience. With our platform, everyone will get the opportunity to share knowledge though the social networking system. The experimental details will be explained in the experiment section.

Today's education is still controlled by educational institutes or administrative bodies, which offer quality, credibility, and knowledge. The current model is not flexible for all learners because of time, money, and distance constraints. To make the learning process easy, flexible, and trustworthy we established an educational network based on block chain technology. In this paper, we present the establishment of a test bed for issuing, verifying, and storing badges in the form of blocks of a chain. Block chain is irreversible and static: once a change is made, it remains forever. It means that all badges saved on the block chain remains with the issuer forever. In the 21st century, Satoshi Nakamoto's Bitcoin has become the most popular cryptocurrency, and it has received considerable attention.

1.1 BLOCK CHAIN

Block chain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system. A block chain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the block chain. Each block in the chain

contains a number of transactions, and every time a new transaction occurs on the block chain, a record of that transaction is added to every participant's ledger. The decentralised database managed by multiple participants is known as Distributed Ledger Technology (DLT). Block chain is a type of DLT in which transactions are recorded with an immutable cryptographic signature called a hash This means if one block in one chain was changed, it would be immediately apparent it had been tampered with. If hackers wanted to corrupt a blockchain system, they would have to change every block in the chain, across all of the distributed versions of the chain. Blockchains such as Bitcoin and Ethereum are constantly and continually growing as blocks are being added to the chain, which significantly adds to the security of the ledger.

1.2 ETHERIUM

Like other block chains, Ethereum has a native cryptocurrency called Ether (ETH). ETH is digital money. If you've heard of Bitcoin, ETH has many of the same features. It is purely digital, and can be sent to anyone anywhere in the world instantly. The supply of ETH isn't controlled by any government or company - it is decentralized, and it is scarce. People all over the world use ETH to make payments, as a store of value, or as collateral. But unlike other blockchains, Ethereum can do much more. Ethereum is programmable, which means that developers can use it to build new kinds of applications. These decentralized applications (or "dapps") gain the benefits of cryptocurrency and blockchain technology. They are reliable and predictable, meaning that once they are "uploaded" to Ethereum, they will always run as programmed. They can control digital assets in order to create new kinds of financial applications. They can be decentralized, meaning that no single entity or person controls them.

1.3 CURRENT BADGE AWARDING SYSTEM

The Today's education is still controlled by educational institutes or administrative bodies, which offer quality, credibility, and knowledge. The current model is not flexible for all learners because of time, money, and distance constraints. To make the learning process easy, flexible, and trustworthy we established an educational network based on blockchain technology. In this paper, we present the

establishment of a testbed for issuing, verifying, and storing badges in the form of blocks of a chain. Block chain is irreversible and static: once a change is made, it remains forever. It means that all badges saved on the blockchain remains with the issuer forever.

1.4 ANDROID APPLICATION

This android application provides a user interface. New users will register their details through this application. By entering the details in to the application, Two type of users are served using this app, User official and user normal. The admin will accept their registration request and grant them to login in to their account by entering the username and password. By checking the user type They will directed in to their home page, The homepage of user official contains a drawer with two options. One for Notification and another for Building maps. The notification option will save all the incoming notification in to the application for a period. The building maps will provide google maps of all the registered buildings. The home page of user normal also contains a drawer with two options. One notification option for storing the incoming notification and another Building status option. This will provide the current Status of all floor in the user's building. At the time of fire occupant the web server safest path for the exit in the form of notification. Only the user in the floor of the fire occupied building will receive the notification. The safety officers always receive the fire alert in their android application regardless the building.

1.5 NEED FOR STUDY

The traditional education system is boring for some students as it mainly focuses on books and exams. On the other hand, by using badges, education becomes skill-based and self-learning-based as well as interesting. By using the Mozilla Open Badges framework, any organization can issue badges, and the badge receiver can use it to showcase his or her skills and work experience. With our platform, everyone will get the opportunity to share knowledge though the social networking system.

1.6 SCOPE OF STUDY

By using badges, education becomes skill-based and self-learning-based as well as interesting. With our platform, everyone will get the opportunity to share knowledge though the social networking system. Every student and teacher can see the skills of the student, but they cannot make any changes. The badges are compatible with most of the internet platforms and can be shared over the internet or social media.

1.7 SUMMARY

This chapter has given an overview about Badge awarding s and its need and scope in system using block chain. we present the establishment of a test bed for issuing, verifying, and storing badges in the form of blocks of a chain. Block chain is irreversible and static: once a change is made, it remains forever. It mean that all badges saved on the block chain remains with the issuer forever. In the 21st century, Satoshi Nakamoto's Bitcoin has become the most popular crypto currency, and it has received considerable attention.

CHAPTER 2
RELATED WORKS

There Blockchain technology has a wide range of applications, such as education, engineering, administration, medicines, elections, construction, and e-government. In this research, we primarily focus on the education field. Therefore, we present some research cases of the using of block chain technology.

2.1 EDSA

The European Data Science Academy (EDSA) is a good example of the application of blockchain technology for providing data science skills to job seekers. EDSA also helps provide training to a new generation of world leading data scientists. In the 21st century, data is being produced from all industries at a phenomenal rate, which has introduced numerous challenges regarding the collection, storage, and analysis of the data. However, as the amount of available data continues to increase, so does the demand for professionals who have the necessary skills to manage and manipulate this data. Owing to this necessity, the EDSA was established to provide a platform to manage the demand and supply of data science experts by providing skill training in real time. Automated tools have been developed to extract data from job posting portals, such as Indeed ,Jooble , XING , and Adzuna. To acquire real-time market need the data of the last 18 months is considered. EDSA provides detailed recording of accreditations in digital form, for both formal and informal learning contexts. In order to facilitate accreditation, personalized recommendations are provided to learners studying data science courses. The learners studying various data science subjects earn badges upon reaching certain milestones in their studies, e.g., completing a part of a course or an entire course The learner will get job recommendations based on full and partial matches with geographical location. Everything is displayed on the dashboard. Partially matching jobs are shown along with course recommendations that fully match that job requirement. Figure 2.1 shows the details of the EDS working framework.

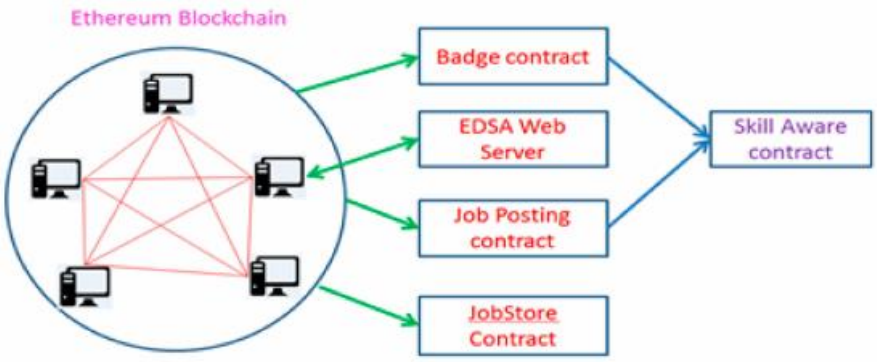

Fig. 2.1 EDSA's approach using blockchain.

2.2 LEARNER-CENTERED BLOCKCHAIN OF OPEN UNIVERSITY IN U.K

The Open University of United Kingdom has published a learner-centered approach for learning using blockchain technology. In that paper, they presented a learner-centered ecosystem using blockchain. This ecosystem includes the learner, teachers, courses, learning material, and validation system with learner's connection as shown in Figure 2.2. The learners are enrolled on a number of courses and they can utilize the additional learning resources. The tutors and other teaching staff provide both informal and formal feedback as the complete summative and formative assessment of the learner. Central administrative bodies issue formal certificates according to their institutional processes. Each learner has a badges and achievement visualization space called passport; it can be used instead of a traditional resume to present his or her skills to the employer. This system provides transparency, trust, privacy, and security.

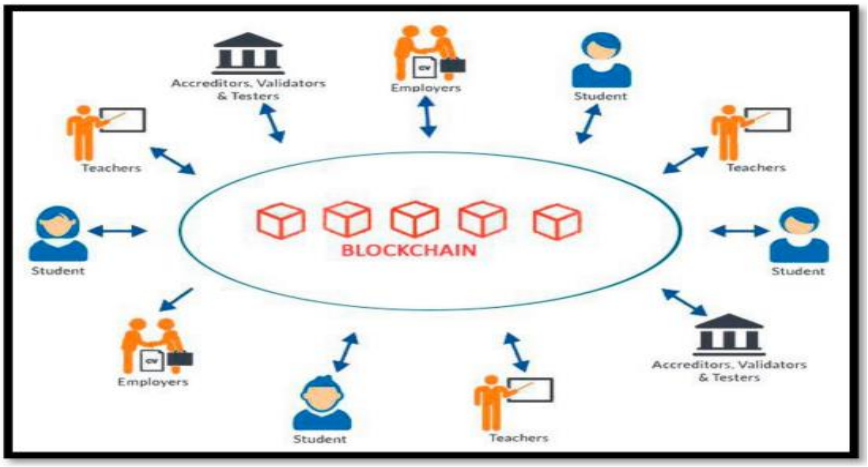

Fig. 2.2 Learner centered blockchain approach.

2.3 U.C DAVIS' DIGITAL BADGE

In the 21st century, we need new talents with various practical skills. For example, the establishment of a life sciences, economics, and humanities course, which enables students to experience on-site learning by combining eight different departments, can create talent required to develop a sustainable agriculture and food system. The new curriculum should be run mainly on the basis internships or field practice outside the classroom. One of the methods designed to allow students to express themselves differently is the 'digital badge' system. The core competencies required for college graduates are 'systematic thinking', 'experiment and questionability', 'value comprehension', 'human communication ability', 'strategic management ability', 'citizen participation ability', and 'development ability'. These core competencies are expressed as a 'digital badge' in U.C. Davis's Digital Badge , and each competency is divided into five stages: skill, knowledge, honor, experience, and competence. As shown in Figure 2.3, the 'digital badge' system is an evaluation criterion for human capital that verifies widely and accurately the adequacy of the necessary capabilities in the mobile connected society.

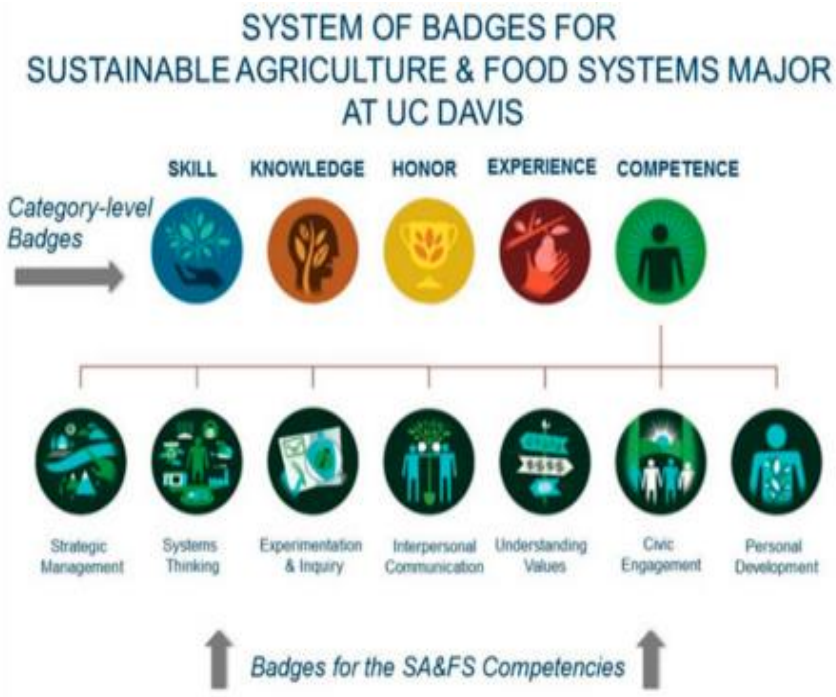

Fig.2.3 Digital badge system for sustainable agriculture and food systems major at U.C. Davis.

2.4 CISCO'S DIGITAL BADGE SYSTEM

Cisco is a partner of Acclaim—Pearson View's badge platform—and provides the following services through Acclaim; web version of credentials that can be shared online labor market insight to understand the individual's technical ability and connection with the profession, and credible checking of credentials in real time. The individual's credentials are displayed in a digital image with proven metadata describing the credentials and the process required to achieve the qualification. Marking the credentials with a badge is a simple, easy, and reliable way to share a person's achievements online in real time. This is concrete evidence of what the individual has done for the company and its colleagues, and it provides employment information based on this to the individuals.

2.5 SWARM AND IBM'S OPEN BADGE

The badges are suitable for team building games and attendee motivation, as well as for recruitment decisions and other important staff considerations. Receiving the badge demonstrates that the attendees are representing their skills and knowledge to others outside their traditional working environment and participating in a broader expert community in the field. David Leaser, chief program manager at IBM, said in an essay on the Open Badge program, "Whether your employer is hiring new employees or planning on-site promotion, badges are a way to verify employee skills." Badges are a great way to encourage attendees to motivate themselves to learn new things and develop new skills.

2.6 MICROSOFT EXAM AND CERTIFICATION BADGE

Microsoft partnered with Pearson VUE's Acclaim platform to provide a badge for certification acquisition. The badge is a Microsoft certification mark that is available on the web and consists of images and unique metadata associated with the certificate holder. The badge provides the owner detailed information about the

technology and demonstrates possession of the technology. The benefits of Microsoft badges are as follows;

1. easily share certification and test results with an expert network
2. identify who employs the technology holder
3. identify the expected salary of the workplace that requires the Microsoft skills possessed by the badge holder, and search for job-related announcements related to certification details and complete support with just a few clicks.

The blockchain technology has been implemented in education by Oxford academics by launching the 'Blockchain University' in 2018. A blockchain-powered government means that all its services including visa applications, bill payments, and license renewals are digitized. A paperless government equates to enhanced productivity, less time wasted, and less money spent per year. In the next section, we present our approach using a tested and the regtest mode.

CHAPTER 3
DIGITAL BADGE SYSTEM WITH BLOCKCHAIN SUPPORT

Explain the detailed architecture and implementation of the digital badge platform based on blockchain.It consist of the following major components or steps; badge award, badges repository such as backpack, distributed storages in the form of blockchain, and verification.

3.1. SYSTEM ARCHITECTURE

The Badge platform, which is compatible with Open badge specification, is used as an underlying platform for the digital badge management system. The most important information to be described when creating a badge are badge class, badge award criteria, issuer, name, description, etc. Badge creation should be preceded by badge awarding for digital badge issue. The process of issuing a digital badge is

1. A badge should be created (digital badge creation) unless the badge already exists.
2. The digital badge issuer generates badge assertion and digital signature through a public key-based cryptosystem.
3. The digital badge issuer delivers the image of the badge to the recipient (or pushes it to the recipient's backpack account).
4. The recipient decides whether to receive and disclose the corresponding digital badge in his/her backpack.
5. The digital badge recipients can view/manage the digital badges they have acquired (backwards compatible according to the IMS Global standard).

Using the backpack web page or Mozilla backpack that will be developed and the badges can be shared with the outside world. Figure shows the behavior of each system component used in this study and the resulting change in data.

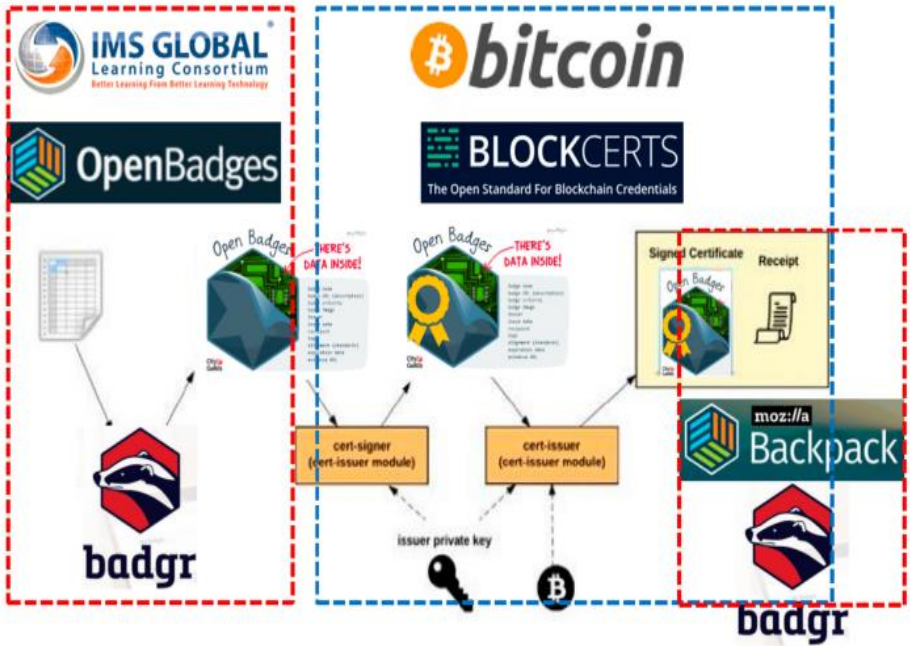

Fig.3.1 Digital badge issuing process on our system implementation.

For issuing a badge, information about the recipient should be provided as

1. The web server that provides the JSON-LD file, including the profile of the badge issuer, badge class, and assertion for stable URL, should work.
2. The badge is issued to the email address of the digital badge recipient.
3. In the case of a signed assertion in the above process, a public/private key pair must be created to host the public key.

3.2. BLOCKCHAIN IMPLEMENTATION SUPPORT WITH BADGE ISSUANCE

Now, we describe the details of the digital badge platform based on blockchain. Originally, the Badgr platform itself did not support block chain. Therefore, in this study, we have implemented an upgraded digital badge platform to operate in conjunction with the block chain. The issuing and backpack management system can create, issue, and manage badges conforming to the Open Badge specification. Therefore, in this study, a block badge-based digital badge issuance and backpack management system was implemented in conjunction with block chain support, and the block badge-based digital badge issuance and backpack management system, which was originally aimed at, was constructed. The digital badge assertion

information, which is issued by the digital badge management system, is displayed through the JSON viewer as shown in Figure 3.2.

The information within the assertion are as follows.

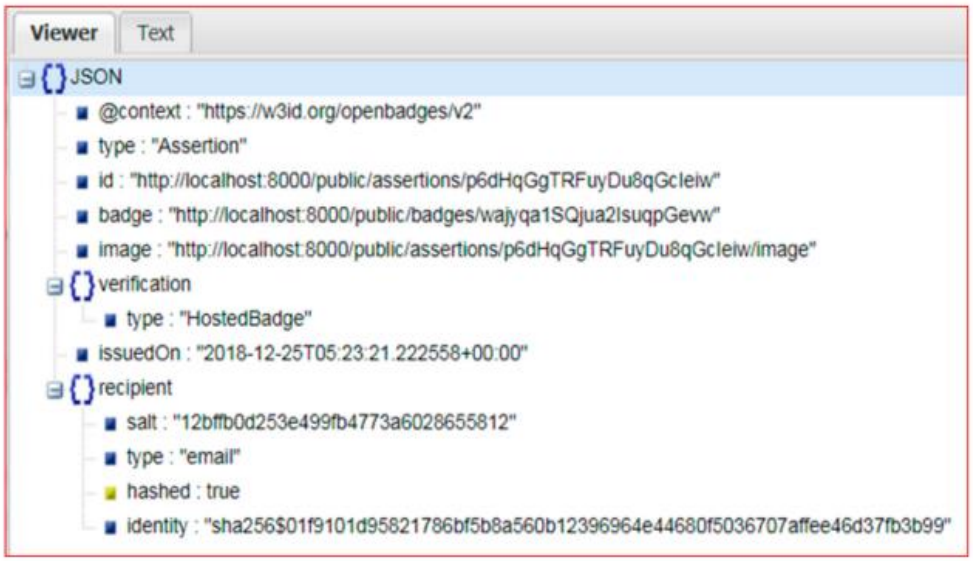

Fig.3.2. Digital badge assertion information

The digital badge is a combination of an image and the metadata associate with it. The image of the badge is a pictorial format of the achievement, and the metadata includes details of the achievement, such as issues, skills, credits, or microcredits gained by the student. The badges in an education network works like traditional university certificates, but the badges are more trustworthy and fairly compared to university certificates. A detailed view of a badge is shown in Figure 3.3; it is also called as split view of the badge.

1. id: a unique identifier for the badge; this is expected to be locally unique, not globally unique.
2. recipient: the recipient of the achievement
3. badge: URL that describes the type of badge being awarded. The endpoint should be a Badge Class.
4. verify: data to help a third party verify this assertion
5. issued On: date on which the achievement was awarded

6. image: URL of an image representing the user's achievement. This must be a PNG image, and if possible, the image should be prepared via the baking specification.

7. evidence: URL of the work that the recipient did to earn the achievement. This can be a page that links out to other pages if linking directly to the work is infeasible.
8. expire: if an achievement has some notion of expiry, this indicates when a badge should no longer be considered valid.

Fig.3.3. A digital badge example and baked information within the badge instance:

Published digital badges are available in two types (JSON or PNG): The first is the previous assertion/JSON format, in which the information of the badge is expressed in the form of text and URL. The second format is in the form of a PNG image file containing the information of the badge. The image file is a normal PNG file, as shown in the figure above. The badge assertion information is baked inside the PNG file by the iTxt format of the png file. In this work, we utilize both types of badges at the same time. The badge baking is the process of embedding the assertion into the badge image. We can simply say "attaching information with the image", but the difference is that the associated information is always attached with the image and is compatible on many platforms. Our platform bakes the information of "id", "image", and "recipient" to the digital badges. The iTxt chunk provides support for

international text, and is represented using the UTF-8 encoding of UCS. The badge image is in PNG (Portable Network Graphics) format; therefore, the information associated with it must be compatible to the image file format. The iTxt format is compatible with the PNG encoder, and therefore baking is only possible with the iTxt format.

Figure 3.4 shows the results of the digital badge award in accordance with the Merkle Proof 2017 protocol, Merkle Tree, and storing Merkle path information. The above type is BTCOp Return, because the underlying platform indicates that Bitcoin is used among Bitcoin and Ethereum. In particular, it can be seen that the OP Return field performs Merkle Proof-based existence verification on the document through the OP Return field, while the OP Return field conventionally stores money transaction information in the existing Bitcoin block chain.

In this research, we use two basic platforms: The first is the Badgr platform for creating the Open Badge standard-based digital badge, and the second is the Blockcert platform, for managing the digital badge generated through the block chain. The generated digital badge is managed via backpack repository (compatible with Mozilla Open Badge backpack). These digital badges can be shared via e-mail, cell phone, etc. In addition, these digital media can be promoted to a third party through a social networking service (SNS).

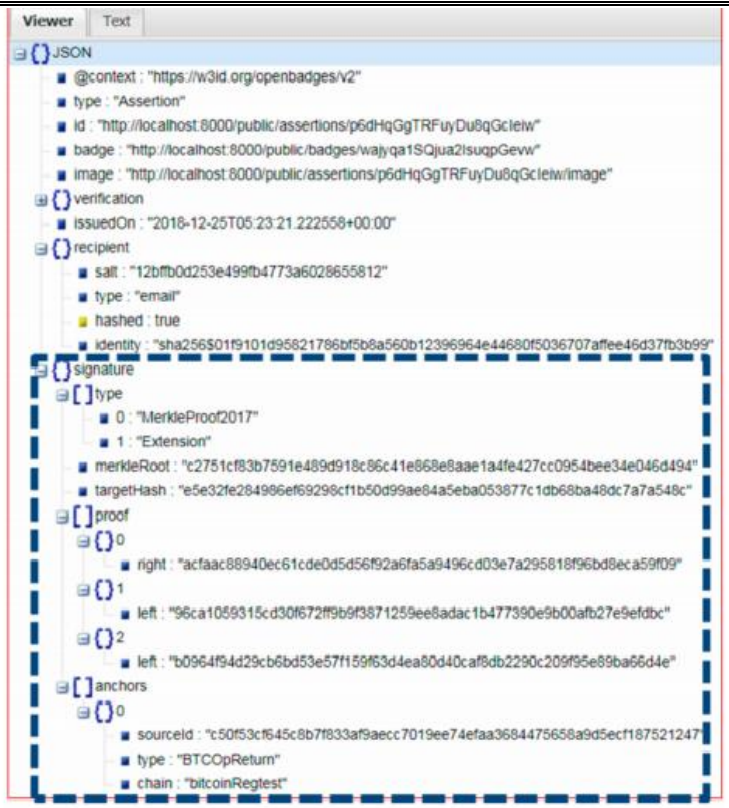

Fig.3.4. Digital badge assertion information with extension of block chain in this research

3.3. DIGITAL BADGE INSTANCE

Originally, there is two types of methods to distinguish assertion information: hosted type and signed type. Also, conventional Badge does not natively support the ability to store data in the block chain. That is, conventional Badge manages the information of the badge itself and stores the information according to the specification defined by Open Badges.

1. If an assertion uses “hosted” verification and there is no cryptographic signature to verify that the full document here is the exact one published by the issuer, the verifier and displayer platforms will likely discard the embedded Badge Class and issuer Profile here and replace them with the values discovered at their id URIs, because only those hosted documents can be trusted to be created by the issuer.

2. If an assertion uses “signed” verification, the validator may accept the embedded values as the intended Badge Class and issuer Profile, and if they have multiple records for those entities that use the declared id, the validator may choose how to index and present that information. The issuers should change the ids of their Badge Classes when they make edits if they wish the edits to be essentially understood as a different achievement than the one published under the original id.

Figure 3.5 shows the flow chart of the platform operation developed in this study. As shown in the figure, the digital badges and certifications are issued by the issuing authority to the student, and they are also recorded by the issuing authority to generate block chain transactions. Backpack is a badge repository, the original concept of which was proposed by Mozilla. Digital badges and certifications are verified by the certification verifier on the Bitcoin block chain in regression test mode or the Ropsten Ethereum network. The regression test mode of Bitcoin is used to establish a new block chain with private control but has the same rules as the public Bitcoin network. This mode is specially used for research and development purposes, where the rules are predefined. Any individual or organization can create an Issuer profile and begin defining and issuing digital badges. Any entity that can be described with a name, description, URL, image, and email address is a possible candidate to become an Issuer. To issue a digital badge, we need a technology platform that is compatible with the Open Badges specification .

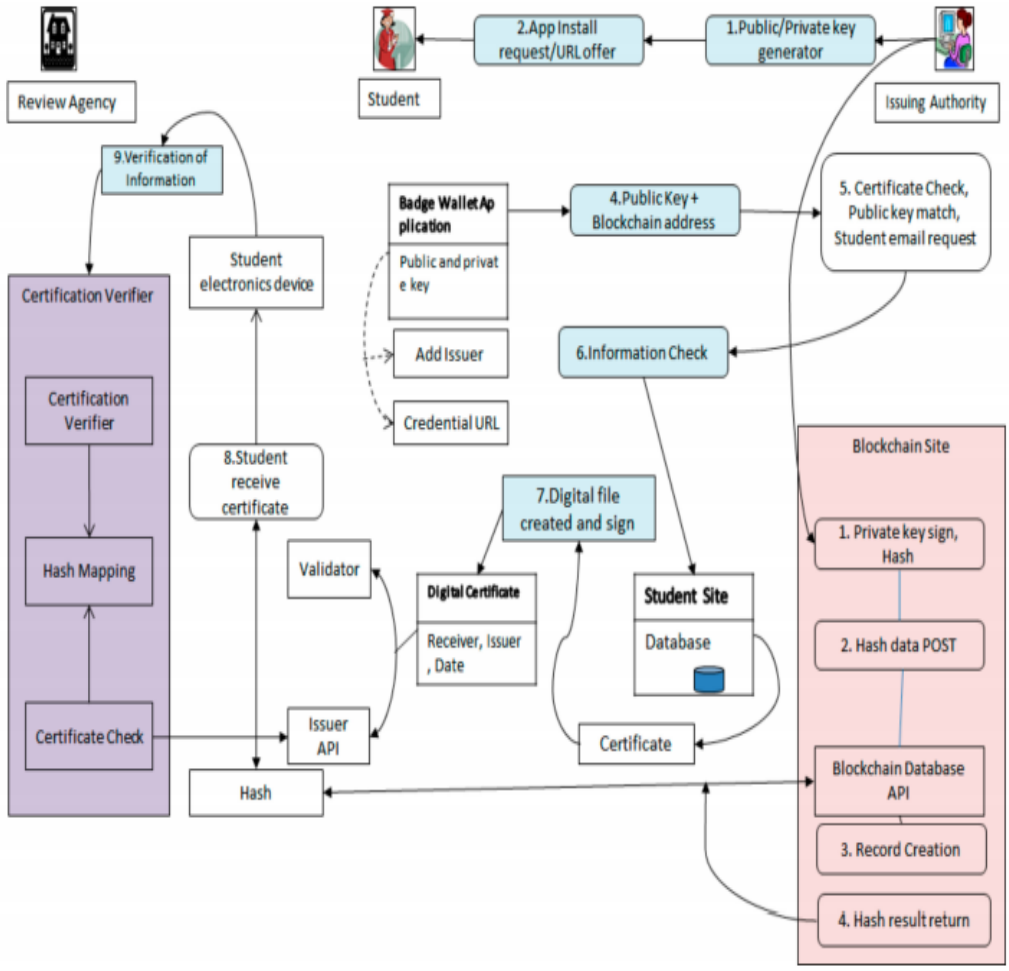

Fig.3.5. Flowchart of digital badge award and verification on our system implementation

We used a total of four servers to develop the proposed system. The first is a web server for providing the user UI. The second is a REST API server for performing operations conforming to the Open Badge standard. The third is a blockcert server for recording transactions in the blockchain. The fourth is a blockchain network. In this study, the Bitcoin server in the regression test mode is used for Bitcoin and the Ropsten test network is used for Ethereum. In this study, all the servers were implemented in the AWS EC2 cloud platform as shown in Figure 3.6.

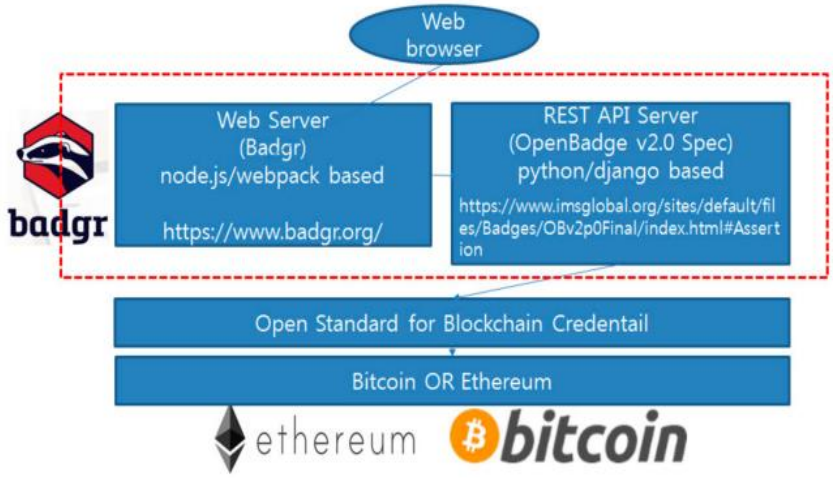

Fig.3.6. System components and interfaces for blockchain based digital badge award

3.4 TB OF DATA

- Compatible on many operating systems: MySQL is compatible to run on many operating systems, like Novell NetWare, Windows* Linux*, many varieties of UNIX* (such as Sun* Solaris*, AIX, and DEC* UNIX), OS/2, FreeBSD*, and others. MySQL also provides a facility that the clients can run on the same computer as the server or on another computer (communication via a local network or the Internet).
- High Performance: MySQL is faster, more reliable and cheaper because of its unique storage engine architecture.
- High Flexibility: MySQL supports a large number of embedded applications which makes MySQL very flexible.
- High Productivity: MySQL uses Triggers, Stored procedures and views which allows the developer to give a higher productivity.

3.5. VISUAL STUDIO CODE

Visual Studio Code combines the simplicity of a source code editor with powerful developer tooling, like IntelliSense code completion and debugging. First and foremost, it is an editor that gets out of your way. The delightfully frictionless edit-build-debug cycle means less time fiddling with your environment, and more time executing on your ideas. Available for macOS, Linux, and Windows. Visual

Studio Code supports macOS, Linux, and Windows - so you can hit the ground running, no matter the platform.

At its heart, Visual Studio Code features a lightning fast source code editor, perfect for day-to-day use. With support for hundreds of languages, VS Code helps you be instantly productive with syntax highlighting, bracket-matching, auto-indentation, box-selection, snippets, and more. Intuitive keyboard shortcuts, easy customization and community-contributed keyboard shortcut mappings let you navigate your code with ease.

For serious coding, you'll often benefit from tools with more code understanding than just blocks of text. Visual Studio Code includes built-in support for IntelliSense code completion, rich semantic code understanding and navigation, and code refactoring.

And when the coding gets tough, the tough get debugging. Debugging is often the one feature that developers miss most in a leaner coding experience, so we made it happen. Visual Studio Code includes an interactive debugger, so you can step through source code, inspect variables, view call stacks, and execute commands in the console.

VS Code also integrates with build and scripting tools to perform common tasks making everyday workflows faster. VS Code has support for Git so you can work with source control without leaving the editor including viewing pending changes diffs.

3.5.1 Make it your own

Customize every feature to your liking and install any number of third-party extensions. While most scenarios work "out of the box" with no configuration, VS Code also grows with you, and we encourage you to optimize your experience to suit your unique needs. VS Code is an open-source project so you can also contribute to the growing and vibrant community on GitHub.

3.5.2 Built with love for the Web

VS Code includes enriched built-in support for Node.js development with JavaScript and Type Script, powered by the same underlying technologies that drive Visual Studio. VS Code also includes great tooling for web technologies such as JSX/React, HTML, CSS, SCSS, Less, and JSON.

3.5.3 Robust and Extensible Architecture

Architecturally, Visual Studio Code combines the best of web, native, and language-specific technologies. Using Electron, VS Code combines web technologies such as JavaScript and Node.js with the speed and flexibility of native apps. VS Code uses a newer, faster version of the same industrial-strength HTML-based editor that has powered the "Monaco" cloud editor, Internet Explorer's F12 Tools, and other projects. Additionally, VS Code uses a tools service architecture that enables it to integrate with many of the same technologies that power Visual Studio, including Roslyn for .NET, TypeScript, the Visual Studio debugging engine, and more.

Visual Studio Code includes a public extensibility model that lets developers build and use extensions, and richly customize their edit-build-debug experience.

3.5.4 Ready, set, code

If you prefer a code editor-centric development tool or are building cross-platform web and cloud applications, we invite you to try out Visual Studio Code and let us know what you think.

3.6. *MySQL*

MySQL, the most popular Open Source SQL database management system, is developed, distributed, and supported by Oracle Corporation. The MySQL website provides the latest information about MySQL software.

- MySQL is a database management system.

  A database is a structured collection of data. It may be anything from a simple shopping list to a picture gallery or the vast amounts of information in a corporate network. To add, access, and process data stored in a computer database, you need a database management system such as MySQL Server. Since computers are

very good at handling large amounts of data, database management systems play a central role in computing, as standalone utilities, or as parts of other applications.

- MySQL databases are relational.

  A relational database stores data in separate tables rather than putting all the data in one big storeroom. The database structures are organized into physical files optimized for speed. The logical model, with objects such as databases, tables, views, rows, and columns, offers a flexible programming environment. You set up rules governing the relationships between different data fields, such as one-to-one, one-to-many, unique, required or optional, and "pointers" between different tables. The database enforces these rules, so that with a well-designed database, your application never sees inconsistent, duplicate, orphan, out-of-date, or missing data.

  The SQL part of "MySQL" stands for "Structured Query Language". SQL is the most common standardized language used to access databases. Depending on your programming environment, you might enter SQL directly (for example, to generate reports), embed SQL statements into code written in another language, or use a language-specific API that hides the SQL syntax.

  SQL is defined by the ANSI/ISO SQL Standard. The SQL standard has been evolving since 1986 and several versions exist. In this manual, "SQL-92" refers to the standard released in 1992, "SQL:1999" refers to the standard released in 1999, and "SQL:2003" refers to the current version of the standard. We use the phrase "the SQL standard" to mean the current version of the SQL Standard at any time.

- MySQL software is Open Source.

  Open Source means that it is possible for anyone to use and modify the software. Anybody can download the MySQL software from the Internet and use it without paying anything. If you wish, you may study the source code and change it to suit your needs. The MySQL software uses the GPL (GNU General Public License),

to define what you may and may not do with the software in different situations. If you feel uncomfortable with the GPL or need to embed MySQL code into a commercial application, you can buy a commercially licensed version from us. See the MySQL Licensing Overview for more information.

- The MySQL Database Server is very fast, reliable, scalable, and easy to use.

  If that is what you are looking for, you should give it a try. MySQL Server can run comfortably on a desktop or laptop, alongside your other applications, web servers, and so on, requiring little or no attention. If you dedicate an entire machine to MySQL, you can adjust the settings to take advantage of all the memory, CPU power, and I/O capacity available. MySQL can also scale up to clusters of machines, networked together.

  MySQL Server was originally developed to handle large databases much faster than existing solutions and has been successfully used in highly demanding production environments for several years. Although under constant development, MySQL Server today offers a rich and useful set of functions. Its connectivity, speed, and security make MySQL Server highly suited for accessing databases on the Internet.

- MySQL Server works in client/server or embedded systems.

  The MySQL Database Software is a client/server system that consists of a multithreaded SQL server that supports different back ends, several different client programs and libraries, administrative tools, and a wide range of application programming interfaces (APIs).

  We also provide MySQL Server as an embedded multithreaded library that you can link into your application to get a smaller, faster, easier-to-manage standalone product.

- A large amount of contributed MySQL software is available.

MySQL Server has a practical set of features developed in close cooperation with our users. It is very likely that your favorite application or language supports the MySQL Database Server.

The official way to pronounce “MySQL” is “My Ess Que Ell” (not “my sequel”), but we do not mind if you pronounce it as “my sequel” or in some other localized way.

3.6.1 PHP My Admin

PHP MyAdmin is a popular and free open source tool used for administering MySQL with a web browser. Typical operations such as the management of databases, tables, indexes, permissions, and so on are executed with the user interface. Administrators can also use php MyAdmin to directly execute any SQL statement.

3.7. HARDWARE REQUIREMENTS

- Processor
- Intel or ryzen
- Processor Speed: 2.4GHz
- Hard Disk min : 50GB
- RAM: 1GB

3.8. INSTALLATION REQUIREMENTS

- Windows or Linux Operating System
- Browsers

3.8.1 Browsers

A browser is an application program that provides a way to look at and interact with all the information on the World Wide Web. This includes Web pages, videos and images. The word "browser" originated prior to the Web as a generic term for user interfaces that let you browse (navigate through and read) text files online. Many people will use web browsers today for access to the internet and is seen almost as a necessity in how many navigate their daily life.

A Web browser is a client program that uses HTTP (Hypertext Transfer Protocol) to make requests of Web servers throughout the Internet on behalf of the browser user. Most browsers support e-mail and the File Transfer Protocol (FTP), but a Web browser is not required for those Internet protocols and more specialized client programs are more popular.

Web browser history

The first Web browser, called World Wide Web, was created in 1990. That browser's name was changed to Nexus to avoid confusion with the developing information space known as the World Wide Web. The first Web browser with a graphical user interface was Mosaic, which appeared in 1993. Many of the user interface features in Mosaic went into Netscape Navigator. Microsoft followed with its Internet Explorer (IE).

Common Web browser Features

Most Web browsers share standard features such as:

- A home button- which, when selected, will bring a user to a pre-defined homepage.
- A Web address bar, which allows users to input a Web address and visit a website.
- Back and forward buttons- which will take the user to the previous or the next page they were on.
- Refresh- a button which can be used to reload a Web page.
- Stop- a button which makes a Web cease communication with a Web server, stopping a page from loading.
- Tabs- which allow users to open multiple websites in a single window.
- Bookmarks- which allow a user to select specific, predefined-by-the-user websites.

Many browsers also offer plug-ins, which extend the capabilities of the browser. These plug-ins can allow users to, for example, make use of tasks such as adding security features.

How a Web Browser Works

Web browsers work as part of a client/server model. The client is the browser which runs on the user's device and makes requests to the Web server, while the server-side is the Web server which sends information back to the browser. The browser then interprets and displays the information on the user's device.

Web browsers are normally made up of a number of interworking parts. This includes the user interface (UI), which is the level in which the user interacts with the browser. The browser engine is what queries the rendering engine, and the rendering engine is what renders the requested web page interpreting the HTML or XML documents. Networking is what handles internet security and communication. A JavaScript interpreter is used to interpret and execute JavaScript code in a Website. The UI backend is used to make widgets such as windows. Additionally, a persistence layer, called data persistence or storage, manages data such as bookmarks, caches and cookies.

Popular Web Browsers

Google Chrome is currently one of the most commonly used browsers. Other browsers include:

- Firefox- which was developed by Mozilla.
- Microsoft Edge- used a replacement for Internet Explorer, with Windows 10.
- Internet explorer- relegated to the past, Microsoft has mostly replaced Internet Explorer with Edge.
- Safari- a browser for Apple computers and mobile devices.
- Lynx- a text-only browser for UNIX shell and VMS users.
- Opera- a fast and stable browser that's compatible with most relatively operating systems.

- Flock- an open source browser based on Firefox and optimized for Web 2.0 features such as blogging and social bookmarking.

3.9. PROCESS ANALYSIS

Process analysis is a detailed study of process that looks at everything that is going on in the process. Process Analysis is the documentation and detailed understanding of how work is performed Goals of process Analysis are:

- Reduce the time, cost and effort of the process.
- Improve process efficiency.

3.9.1 Module Description

The main modules in the task include:

- Issuing Authority
- Student
- **Issuing Authority Module**

  The Issuing Authority Module is used to issue the certificate to the student.

- **Student Module (user)**

  The student Module is used by the student to give the information about the certificate and the students can getting an online certificate.

3.10. DATA FLOW DIAGRAM

A data-flow diagram (DFD) is a way of representing a flow of a data of a process or a system (usually an information system). The DFD also provides information about the outputs and inputs of each entity and the process itself. A data-flow diagram has no control flow, there are no decision rules and no loops. Specific operations based on the data can be represented by a flowchart. There are several notations for displaying data-flow diagrams. The notation presented above was described in 1979 by Tom DeMarco as part of Structured Analysis. For each data flow, at least one of the endpoints (source and / or destination) must exist in a process. The refined representation of a process can be done in another data-flow

diagram, which subdivides this process into sub-processes. The data-flow diagram is part of the structured-analysis modeling tools. When using UML, the activity diagram typically takes over the role of the data-flow diagram.

3.10.1 Components of Data Flow Diagram

There are only four different symbols that are normally used on a DFD. The elements represented are:

- External entities
- Processes
- Data stores
- Data flow

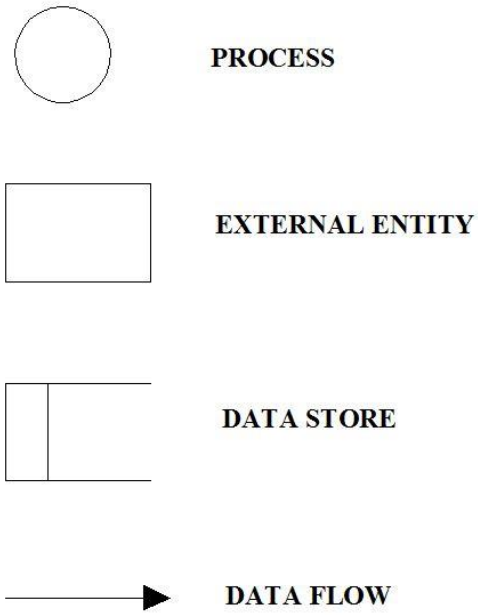

Fig.3.7. DFD Symbols

Level 0 DFDs also known as context diagrams, are the most basic data flow diagrams. They provide a broad view that is easily digestible but offers little detail. Level 0 data flow diagrams show a single process node and its connections to external entities

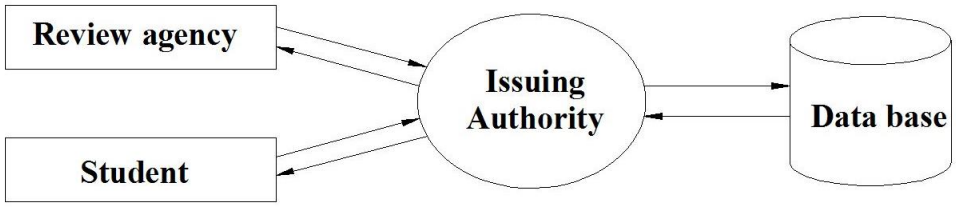

Fig.3.8. Level 0 DFD

3.11 DATABASE DESIGN

The database design is a collection of stored data organized in such a way that the data requirements are satisfied by the database, The general objective is to make information access easy, quick inexpensive and flexible for the user. There are also some specific objectives like controlled redundancy from failure, privacy, security, and performance. A collection of relative records make up a table. To design and store data to the needed forms database tables are prepared. Two essential settings for a database are:

- Primary key: The field that is unique for all the record occurrences.
- Foreign key: The field used to set relation between tables.
- Normalization is a technique to avoid redundancy in the tables.

Database design requires managing the large bodies of information. The management of data involves both the definition of structure of the storage of information and provision of mechanism for the manipulation of information. In addition the DB system must provide for the safety of information handled, despite the system crashes due to attempts art unauthorized access. For developing an efficient db, we will have to fulfill certain condition such as:

➢ **Control redundancy:** Redundancy is the duplication of critical components or functions of a system with the intention of a increasing reliability of the system. There are two types of redundancy; known as passive redundancy and active redundancy. Both functions prevent performance decline from exceeding specification limits without human intervention using extra capacity.

- **Data independence:** Data independency is the type of data transparency that matters for a centralized DBMS. It refers to the immunity of user applications to changes made in the definition and organization of data. The physical data independence deals with hiding the details of the storage structure from user applications. The data independence and operation independence together gives the feature of data abstraction.

- **Accuracy and integrity:** Data integrity refers to maintaining and assuring the accuracy and consistency of the data over its entire life cycle, and is a critical aspect to the design, implementation, and usage of any system which stores, processes, or retrieves the data. Accuracy refers to getting the extracted data.

- **Avoiding inordinate delays:** Difficulties in managing DBMS delays managing performance are more challenging. DBMS stores information on hard disks. This has different types of delays.

- **Ease of use:** It is also referred to as usability. It is the ease of use and learn ability of a human made object. It also includes methods of measuring usability, such as needs analysis and the study of the principles behind an object's perceived efficiency or elegance.

- **Recovery from failure:** In DBMS failures are generalized into various categories. They are transaction failures, system crash, disk failures etc. When a DBMS recovers from a crash, it should maintain some characteristics. It should check the states of all the transactions, which were being executed, it should check whether the transaction can be completed now or it needs to be rolled back etc.

- **Private and security:** Database security concerns the use of a broad range of information security controls to protect databases against compromises of their confidentiality, integrity and availability. Security risks to database system include unauthorized or unintended activity or misuse by authorized database users, database administrators or network/systems managers or by unauthorized users or hackers etc.

3.11.1 Tables

There are thirteen tables on the server side. They are the user_table, Area_table, Subject_table, Subject grade_table, Score record_table, Attendance_table, Grade_table, Level_table, Student_table, Grade paralelo_table, Staff_table and staff type_table. The main tables are user_table, area_table, subject_table and student_table. The user_table is to store the user's ID, name and password. Area_table is to store id, name and subject. Subject_table is to store the area, id area and so on. student_table will store all the information about student.

AREA TABLE

ID	Name	Subjects

SUBJECT TABLE

ID	Name	Abbreviations	ID Area	Area	Score Records	Subject Grades

USER TABLE

ID	Username	Password

SUBJECT GRADE TABLE

ID	ID Grade	ID Subject	Grade	Subject

SCORE RECORD TABLE

ID	ID Subject	ID Student	First Trimester	Second Trimester	Third Trimester	Final Grade	Year	Student	Subject

ATTENDANCE TABLE

ID	ID Student	Attended	Date	Student

GRADE TABLE

ID	Name	ID Level	Observation	Grade Paraleloes	Level	Subject Grades

LEVEL TABLE

ID	Name	Principle	Grades

STUDENT TABLE

ID	ID Grade Paralelo	Rude	Name	Last Name Father	Last Name Mother	Date of Birth	Place of Birth	Sex	Carnet	Telephone

Mobile Phone	Address	Father name	Mother name	Father Mobile Phone	Mother Mobile Phone	Father Profession	Mother Profession

Father Place of Work	Mother Place of Work	Observations	Attendances	Grade Paralelo	Score Records

GRADE PARALALELO TABLE

ID	ID Grade	ID Staff	Name	Grade	Students	Staff

STAFF TABLE

ID	Name	Last Name Father	Last Name Mother	Date of Birth	Place of Birth	Sex	Carnet	Telephone	Mobile Phone	Address

Father name	Mother name	Father Contact	Mother Contact	Father Place of Work	Mother Place of Work	Date of Hiring

Years of Service	Formation	Speciality	Category	Salary	ID Staff Type	Staff Type	Grade Paraleloes

STAFF TYPE TABLE

ID	Name	Staffs

3.12 SYSTEM TESTING

The scope of system testing is not only limited to the design of the system but also to the behavior and believed expectations of the business. In accordance with the software test cycle, system testing is performed before acceptance testing and after integration testing. Independent users or testers are given the tasks to perform in the system testing phase. Importance aspects of system testing:

- In accordance to the software development lifecycle, system testing is considered as the first level of testing where the entire system is checked or tested.
- Proper evaluation of the system meeting the functional requirements is done in system testing.
- Validation, verification and testing of business requirements and application architecture is done during the system testing phase.
- System testing provides users with an effective environment which more or less resembles the live or production environment. As such any testing done provides more reliable and efficient results.

3.13 SYSTEM MAINTENANCE

Software maintenance is widely accepted part of SDLC now a days. It stands for all the modifications and updations done after the delivery of software product. There are number of reasons, why modifications are required, some of them are briefly mentioned below:

- Market Conditions - Policies, which changes over the time, such as taxation and newly introduced constraints like, how to maintain bookkeeping, may trigger need for modification.
- Client Requirements - Over the time, customer may ask for new features or functions in the software.
- Host Modifications - If any of the hardware and/or platform (such as operating system) of the target host changes, software changes are needed to keep adaptability.

- Organization Changes - If there is any business level change at client end, such as reduction of organization strength, acquiring another company, organization venturing into new business, need to modify in the original software may arise.

CHAPTER 4
RESULT ANALYSIS AND DISCUSSION

In order to implement a functionality that works with the block chain platform, the most rational thing to do would be to use the dedicated REST API. It allows users to save time and the financial expenditure needed for the development of systems from scratch and focus on aspects that are more significant and essential for the core services or tasks. With this approach, the users will not be obligedto stick to a single programming language or SDK. That, in turn, will take o_ some of the limits from the team of developers. For this purpose, our blockchain-based digital badge publishing system proposed in this study also provides the REST API for linking with external systems. We can look up the transaction ID based on block chain (Ethereum).

In this research, we implemented a digital badge issuance and backpack management platform with block chain (Ethereum and Bitcoin) support. It enables digital badge issuance in conjunction with blockchain by using a badge issue API. After badge award, our system provides a transaction ID value (within a field named as txid) in the response of the badge issuing API (JSON—extensions field) as extensions field The REST APIs in detail. Ethereum block chain provides Ether Scan to search block information. In particular, Ropsten is a test network widely used by developers, and it also provides a home page for the Ropsten network Therefore, it is possible to access the transaction information and inquire the corresponding transaction information. we call the badge by issuing the REST API with POSTMAN, and the block chain transaction ID in the extensions field is 0x98c400... txid. When calling the REST API, we need to list some arguments as headers. The first is the authorization key required for OAuth2 authentication. The second is the setting of the content type. The authorization key is issued through OAuth2 and is a valid key value only for a certain period of time. It is compatible with OAuth2; therefore, the user can log in using the login account and password of another system that uses Oauth2 (Twitter, Facebook, etc.). the transaction recorded in the Ethereum block chain at the same time as the badge was issued. We provide the transaction id as the return value of

the REST API for issuing the badge in this study. The id value is provided as an extension field of the return value of the bad issuing REST API. The demonstrates badge issuance and verification on our developed platform. The first screen is the screen for badge award. Enter the information, such as the name, e-mail address, badge award condition, etc., of the badge recipient and press the Badge issue button. Then, as shown in the second screen, information on the issued badge is displayed. The third screen is used to share the badge with a third party after the badge is issued. It can be shared through social networking services such as Facebook, LinkedIn, and Twitter so on, through this menu. The screen when the "VERIFY BADGE" button is pressed in the. In order to validate the digital badge issued by our platform, we enter information about the path (URL) or image (PNG) of the badge, and the recipient of the badge. Actually, we input the badge path (URL) as Then, we get as the following information about the badge. This badge verification and validation is based on principles of easy testing of modular components and consistent patterns of interaction between those components. It relies on the Redux pattern from the ReactJS community. There are several important characteristics that together make for predictable operation and division of responsibilities: O_1 Single source of truth: There is one object tree that represents the entire state of the application. It is managed in a "store" and expressed in simple data types. O_2 this state is read-only and can only be modified by submitting "actions" that are handled by the store one at a time, always producing a new copy of the state. Because python variables are pointers to memory space, this makes for e_cient storage and comparison. Actions are simple dictswith a "type" property. O_3 The mechanism for changing state occurs through "reducers", which inspect incoming actions and return a new copy of the portion of the state they oversee. In order to verify the integrity of digital badges, the validator must take input from the user, analyze that input, access the relevant badge resources, and ensure that each of them are well-formed and that they are linked together appropriately before packaging up the results and returning them to the user. This entails the ability to handle a wide variety of di_erent inputs and configurations of badge resources. The validator keeps track of not only the badge data but also the processing tasks. All application state for a request is in a state objectdict managed by a store created upon user input. We implemented a block chain platform to record the history of digital

badges. Therefore, we can query the block chain transaction history by using etherscan.io after issuing the badge. when we search a transaction with txhash value

after a block time. The block time is 12.6 s: it is the mean time required to propagate a new block across a vast majority of nodes in a P2P network. An Ethereum transaction is recorded into Ethereum's block chain faster than a Bitcoin transaction would be recorded into Bitcoin's block chain. (Bitcoin's block time is roughly 10 min)

CHAPTER 5
CONCLUSION AND FUTURE SCOPE

Our system implementation is compatible with Open Badges of IMS Global Learning Consortium, which is used to earn, issue, and award badges across various platforms. The badges are trusted by the IMS standard, the criteria to earn a badge is verified through the network, and the overall process is transparent compared to traditional education systems. Moreover, all badge awarding events in our system are recorded into a blockchain. This is one of the most distinguishing features of our system with other systems. Once the badge award information stored in blockchain, the contents cannot be tampered with. Thereafter, anyone can check the validity of the badge through the block chain. The results of the test evaluation are as follows. On a Bitcoin-based digital badge publishing platform, the execution time required to award the badge is 24.53 s, while on the Ethereum-based digital badge publishing platform, the execution time it takes to award the badge is only 3.86 s. This research can be utilized for certificate issuance and management of educational and training courses. It is applicable to online and online educational and training courses conducted by the Ministry of Labor. The education and training courses are divided into microlearning units, and students who have completed them can receive digital badges. The certificate issuance requirements for large units of education and training courses, such as courses or degrees, are made up of digital badges of appropriate microlearning units for each certificate and can be issued when these requirements are met. The issued digital badge can be registered in the block chain. This research can also be used for career management using e-portfolio. The digital badge acquired by individual students is collected and managed by the e-portfolio. Each collected history can be viewed by other organizations or individuals who need it, but with the student's permission. By analyzing the collected information, future plans can be developed for each student, which can be utilized for employment and career guidance. Point-based royalty rewards program can also be realized using tokens. The royalty rewards system can be operated according to the instructor's discretion in order to improve educational e_ectiveness. In this way, we can use a token issued by a blockchain as a point.

Royalty points can be rewarded to encourage student participation in learning activities during education and training programs. Thus, the students can substitute a part of the tuition fee with the royalty points.

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