Proposal / Application

for

Final Year Project

Computer & Information Systems Engineering Department

"Health-Block"

A block-chain solution for HealthCare

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1. Project Identification

A. Reference Number (for office use only)

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B. Project Title

Health-Block – A Block-Chain Solution for Healthcare

C. Project Internal Advisor

Name	**Syed Zaffar Qasim**
Designation	**Assistant Professor**

D. Student Team

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E. Keywords

Interoperability | Immutable | Decentralized | Privacy | Authenticity

F. Project Idea

New

2. ABSTRACT

The concept behind the block-chain is similar to that of a database, except that the way you interact with that database is different. A block-chain is a chain of blocks that contains information where, each block contains some data, the hash of the block and the hash of previous block. It is intend to timestamp digital documents so that it's not possible to backdate them or to temper with them. A block-chain is a distributed ledger that is completely open to anyone. Once some data has been recorded inside a block-chain, it becomes immutable. Smart contract is new addition in block-chain features. These contract can help in sharing data and coins with others.

In this project, we are creating Health-Block – a healthcare solution via block-chain. Our system will help patients to access their immutable medical records easily and can also help them for sharing their medical reports with other doctors, physicians etc. Through Health-Block, medical stakeholders can store their medical records in a decentralized database. It will protect data from getting changed or deleted and can save from single-point of failure problems.

In our system, medical organizations/institutes shall be registered by the Government regulator only, whereas public can freely join our network. Health-Block will also help public to share their data with researchers and in return they will be rewarded with ethers coins. All this sharing and rewarding will be controlled by our Smart Contract. Through our system, patients can verify that the medicine they are consuming is authentic. Similarly, doctor, retailers and wholesalers can also verify that the medicine they are prescribing and selling is authentic.

Health-Block is a complete solution for health-care sector where, immutable and authentic data can be used for big data engineers and researchers and empowers them to find solutions.

3. Project Background and Literature Review

In the current health-care sector, patient data and information is present in the fragmented form across different department system and hospital. Due to this, crucial data is not accessible and readily available, when needed. The current health-care system cannot be considered complete as participants in the system do not have a system for smooth process management. Moreover, the current health-care system is considered inadequate for handling the exchange of information. Similarly, in medicine counterfeit, billions of dollars are being spent to solve this problem.

Despite being economically well, the organizations are not able to fulfil patient requirements. Due to this, patients do not have control over their data, which causes the chance of identity theft and financial data crimes in our society.

Block-chain can bring out a massive revolution in the health-care sector as it can bring effective changes in the health-care management system. Through this technology, the power will come back to public control. Meaning that individuals can handle their own records thus, giving them the power to control their own data.

Using block-chain technology, people can share their medical records for health studies and can monetize their data in terms of tokens/ether coins. Moreover, better and accurate data can help data scientist to analyze the widespread risks of population health. All this can be done by implementing a block-chain ecosystem across the system. Similarly, block-chain can also help in identifying counterfeit medicines and can help users to track its products and ensure that the medicine they are consuming is authentic.

The potential of block-chain for healthcare is totally dependent on current health-care ecosystem if the health-care system accepts this new technology then it can bring a vast improvement.

4. Motivation and Need

Modern technology allows people to communicate directly. Voice and video calls, emails, pictures and instant messages travel directly from A to B. Maintaining trust between individuals no matter how far apart they are. When it comes to money and sensitive data, people have to trust a third party to be able to complete a transaction. Block-chain technology is changing this system in a radical way. By using math and cryptography, block-chain provides a decentralized database of every transaction involving value and data. Creating a record whose authenticity can be verified by the entire community. It is intend to timestamp digital documents so that it's not possible to backdate them or to temper with them.

Data in healthcare is placed in fragmented form hence it is very difficult to maintain and carry. critically-ill people carry around thick binders full of their diagnosis, medications, testing, research, insurance, genetics literally every aspect of their health profile, everywhere they go. They do this because the industry is failing them by not providing a means to efficiently store, share, or analyze their data in a globally unified way.

Block-chain innovation can possibly change healthcare, expanding the security, protection, and interoperability of wellbeing information. Through block-chain a user in this system would have complete control over their healthcare profile. They dictate who can read and what access another individual may have to their data. It's not that these things aren't already happening, but that block-chain offers an efficient, cheaper, and drastically simpler process.

Block-chain can also help in solving medicine counterfeit problem. Through block-chain technology, manufacturers can store medicine data on the block-chain at the time of their production and patient, wholesalers, retailers and doctors can verify that the medicine they are consuming, selling or prescribing is authentic.

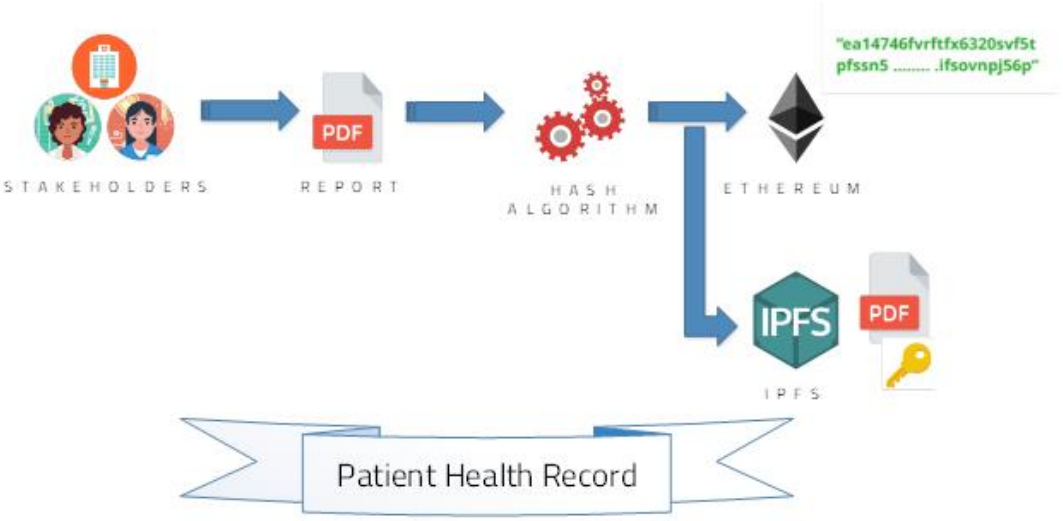
Through block-chain, the researchers or pharmaceuticals could potentially requests medical records of patients and in return they can offer tokens/coins. On the basis of hypothesis, no one give anything for free so, how patient can share his medical record with others for free. In order to encourage them to share their data, the researchers will offer tokens/coins and in return patient will share their data. The token/coins is a very efficient payment method and transaction engine of choice. In the near future, we can be sure that ICO and the crypto-currency market will surely going to come in existence in future and then public can spend their tokens/coins to avail services in the near future.

5. Objectives

1. To develop a decentralized application with opportunities to detect fraud, reduce operational costs, smoothen processes, remove duplication of work and apply transparency in the healthcare ecosystem.
2. To implement a trustworthy environment in health-care sector via block-chain technology.
3. To determine medicine/drug authenticity via block-chain technology.
4. To develop an Ethereum based rewarding system where, patients will be encouraged to share their data with authentic stakeholders.
5. To apply a cost-effective and time saving solution for medical records verification.

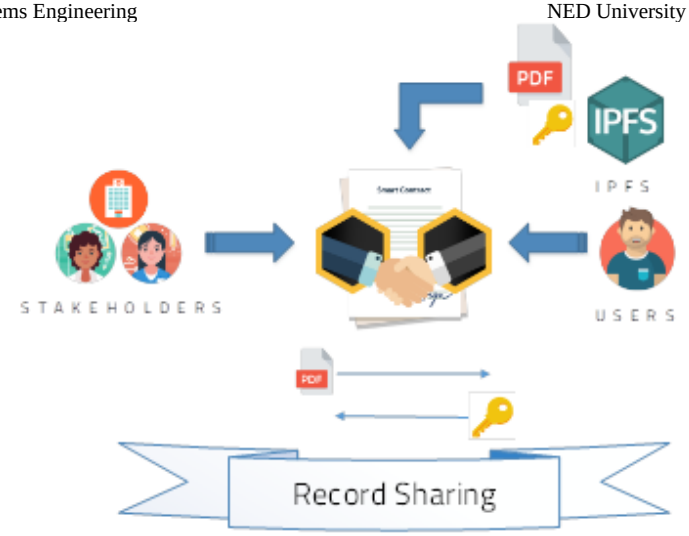
6. Methodology and Equipment/Tools

To empower health-care sector with block-chain features, we will create a decentralized application 'Health-Block'. Patient, Researchers, manufacturers, wholesalers and all medical organization will be connected together through Ethereum Block-chain network.



Medical Record Storing Flow – diagram. Fig (1)

Through our system, hospitals or clinics can store their patient reports in IPFS – interplanetary file sharing. We have choose IPFS because of block-chain poor file storing system. When a file is stored in IPFS, a transaction key is generated and that transaction id will then be stored in the ethereum network in the form of hash value, as shown in Fig 1. In this way, patient can get their digital medical report through our system. All this file sharing system will be controlled by our Smart contract as shown in Fig 2.



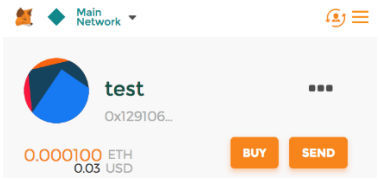
File Retrieving System Flow – diagram. Fig (2)

Similarly, patients will also be able to share their data with other doctors and physicians, who do not have their patient medical history records. In this way, a trustworthy ecosystem can be established where, doctor can also trust patient reports.

Our System will also help Researchers for their researches. They can broadcast their need of information in our system and those patients which have the information can share their data in a secured way through our smart contract. Patients will also get ether coins as a reward when they share their data with researchers and with medical organizations as shown in Fig 3.

Record Sharing system for Researches Flow – diagram. Fig (3)

All transactions will be stored in their Ethereum Meta-mask account.



Meta-Mask Transaction – A Google Chrome Extension Fig (4)

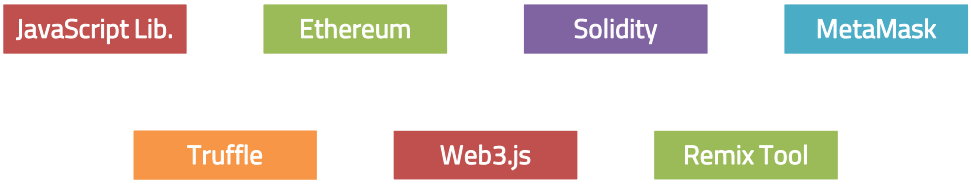
Our system will also going to provide medical report verification system where, patients and researchers can verify medical reports. All they have to do is just upload his/her digital report and the transaction ID then our verification algorithm will identify whether the report/document is authentic or not as shown in Fig 5.

Medical Report Verification System Fig (5)

Medicine counterfeit has also been a big problem, in which billions of dollar are being spent to solve these problems. Through our application patients, doctor and wholesalers can identify medicine authenticity when consuming, prescribing and selling. When a medicine is produced, the manufacturers can upload medicine data on the block-chain and its transaction id can be printed on the back-side of the medicine. Through that distributors, pharmacist and patient can verify that medicine they are having is authentic through our medicine authenticity system.

Our aim is to show the potential of block-chain technology in health-care sector through our application ‘Health-Block’.

Tools:



Solidity is a contract-oriented, high-level language for implementing smart contracts. Solidity is a high level language for public Ethereum block chain and all the Ethereum based applications are written in this language.

JavaScript library like React.js, angular is used to create front end developing of projects.ee are not decide yet what we are going to use for this application.

Ethereum is a decentralized platform that runs smart contracts: applications that run exactly as programmed without any possibility of downtime, censorship, and fraud or third-party interference. These apps run on a custom built block chain, an enormously powerful shared global infrastructure that can move value around and represent the ownership of property.

MetaMask is a browser plugin that allows users to make Ethereum transactions through regular websites. Metamask a mask is a Chrome extension or a browser extension that allows people Common people to interact with the Ethereum network.

Web3.js The first is technologies that are used by developers or essentially used created for developers So this is going to be technologies that we use to create actual applications that talk to the network through code for that we're going to make use of a library called web 3**.**

Remix is a powerful, open source tool that helps you write Solidity contracts straight from the browser. Remix also supports testing, debugging and deploying of smart contracts and much more.

Truffle is used to create online smart creation and doing some automated testing.

IPFS is used for uploading digital file. Block-chain is very poor for storing file on its network. That's why we are using IPFS because it supports Ethereum network for file sharing.

7. Key Milestones and Deliverables

No.	Elapsed time (in months) from start of the project	Milestone	Deliverables
1.	0.5	Completion of Design Documents	-
2.	2	Coding and development of medical stakeholders file upload system	File upload System for medical stakeholders
3.	2.5	Coding and development of patient portal	Patient portal
4.	3.5	Coding and development of medical stakeholders file sharing system	File sharing System for medical stakeholders
5.	4	Integration and Testing of medical stakeholders decentralized application with patient portal	A Decentralized Application for patient and medical stakeholders record sharing
6.	5	Coding and development of patient file sharing system	File sharing System for patients
7.	5.5	Develop a reward system when patients share their data for researches	A Decentralized Application for patients with reward system
8.	6	Development of digital wallet mobile app for saving hash values.	Digital wallet
9.	7	Development of medicine authenticity application	Medicine authenticity application
10.	8	Testing and fixing bugs	A complete Decentralized application for health-care

8. Expected Outcome

Health-Block application will create a trustworthy environment across healthcare sectors. Patients can now have the digital copies of their medical reports instead of bundles of hard-copy reports. Researchers can have patient authentic data for clinical trials. Medicine counterfeit problems can be solved from our application. Billions of dollars can be saved that were being spent on drug counterfeit and medical record protection through our system.

9. Direct Customers / Beneficiaries of the Project:

1. **Patients:** can now carry authentic digital copies of their medical reports. They can also verify that the medicine they are consuming is authentic.
2. **Doctors:** can also verify patient medical reports. They can also verify that the medicine they are prescribing is authentic.
3. **Researchers:** can now analyze population health problems with authentic data and can come up with new solutions.
4. **Medical Organizations:** are now able to share their data with others without any fear of malicious attacks.
5. **Data Scientists:** can implement Artificial Intelligence and Machine Learning technology because they will have authentic and immutable dataset from our application.

10. Consent of Advisors

Consent of the Internal Advisor Signature: _____

Consent of the Co-Internal Advisor Signature: _____

Consent of the External Advisor (if any) Signature: _____

11. Reviewers Committee's Comments

12. Project Schedule / Milestone Chart

ID	Task Mode	Task Name	Duration
1		**Health-Block**	**261 days**
2		**Initialization**	**30 days**
3		Learning	30 days
4		Completion of Learning	0 days
5		**Plan**	**9 days**
6		Design Documents	9 days
7		Completion of Documentation	0 days
8		**Execution**	**222 days**
9		**Medical Organization Record Sharing System**	**86 days**
10		Medical Organization Registration System	5 days
11		Authorization by Endorsers	5 days
12		Medical Organization Dashboard	5 days
13		Completion of Medical Organization Dashboard	0 days
14		**File Upload System**	**33 days**
15		Storage of File in blockchain	15 days
16		Storage of File in IPFS	15 days
17		Testing	3 days
18		Completion of File Upload System	0 days
19		**Patient Portal**	**30 days**

Sep 9, T F

Project: FYP Project Plan v1.0
Date: Mon 10/1/18

Task
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Start-only
Finish-only
External Tasks
External Milestone
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ID	Task Mode	Task Name	Duration
20		Patients Registration System	5 days
21		**File Sharing System for Hospitals/Clinics only**	**25 days**
22		Smart Contract for File sharing	15 days
23		Integration	5 days
24		Testing	5 days
25		Completion of Sharing System	0 days
26		Verifcation System for Medical Records	8 days
27		Completion of verification system	0 days
28		**Patient Record Sharing System**	**38 days**
29		Researchers Registration System	5 days
30		Smart Contract for File sharing	15 days
31		Reward System for Patients	15 days
32		Testing	3 days
33		Completion of Patient Record Sharing System	0 days
34		**Medicine Authenticity Application**	**58 days**
35		Manufacturer Registration System	5 days
36		Authentication by endorsers	5 days
37		Insertion of Medicine info in blockchain	15 days
38		Medicine Authentication System	10 days

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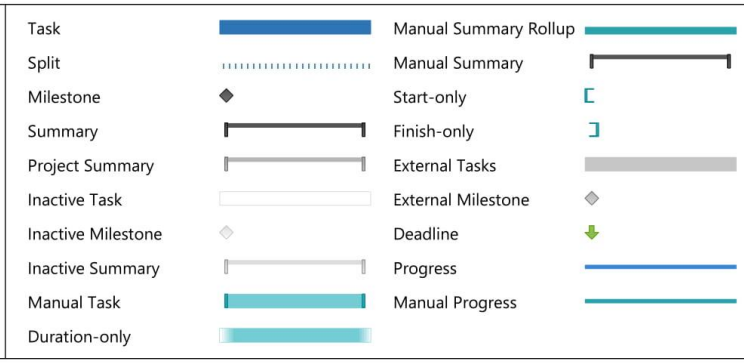

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ID	Task Mode	Task Name	Duration	Sep 9, T F
39		QR code generation for medicines	5 days	
40		Digital Wallet	15 days	
41		Testing	3 days	
42		Comletion of Medicine Authenticity Application	0 days	
43		Integration of all Modules	15 days	
44		Testing and Fixing Bugs	15 days	
45		GUI Improvements	10 days	
46		Completion of Project	0 days	

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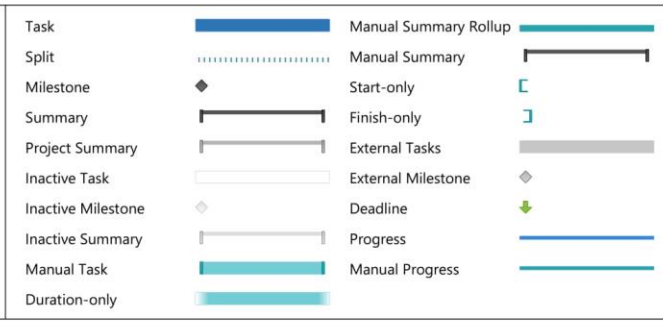

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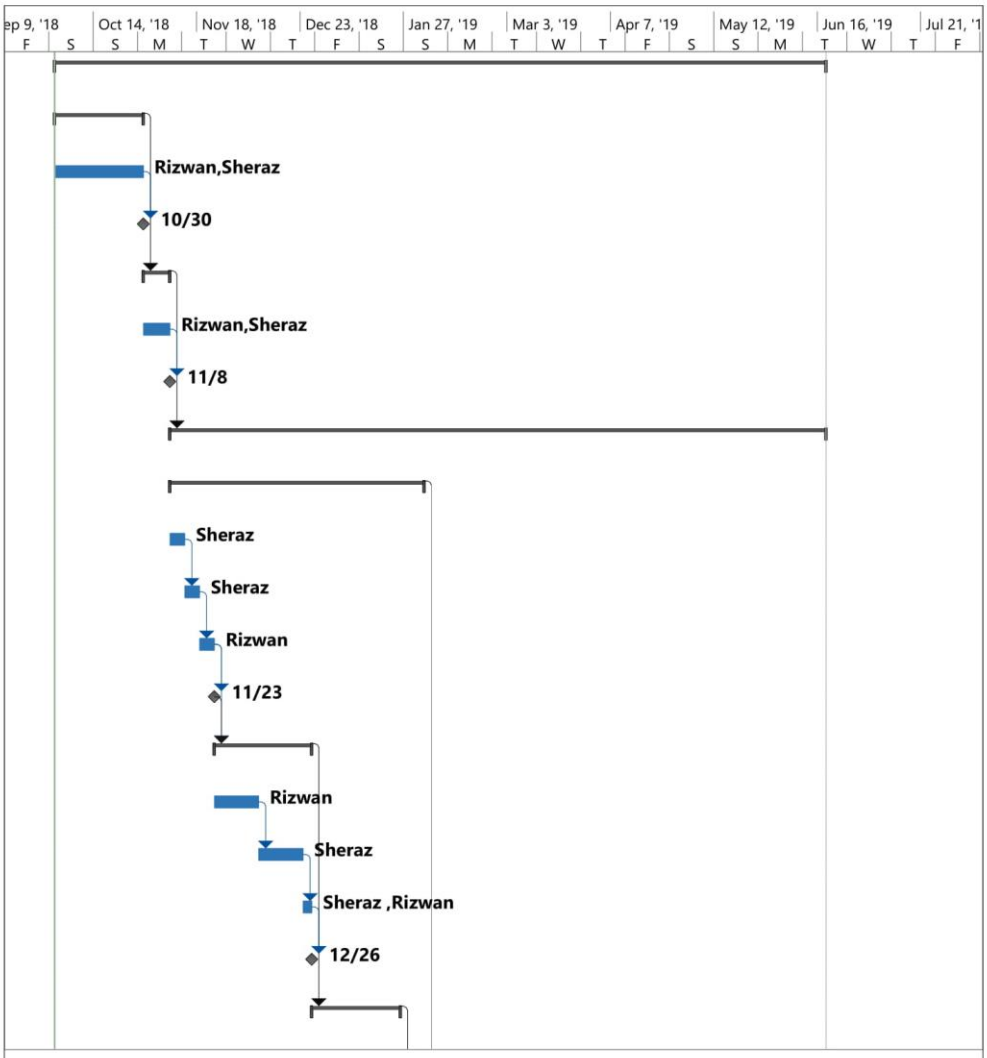
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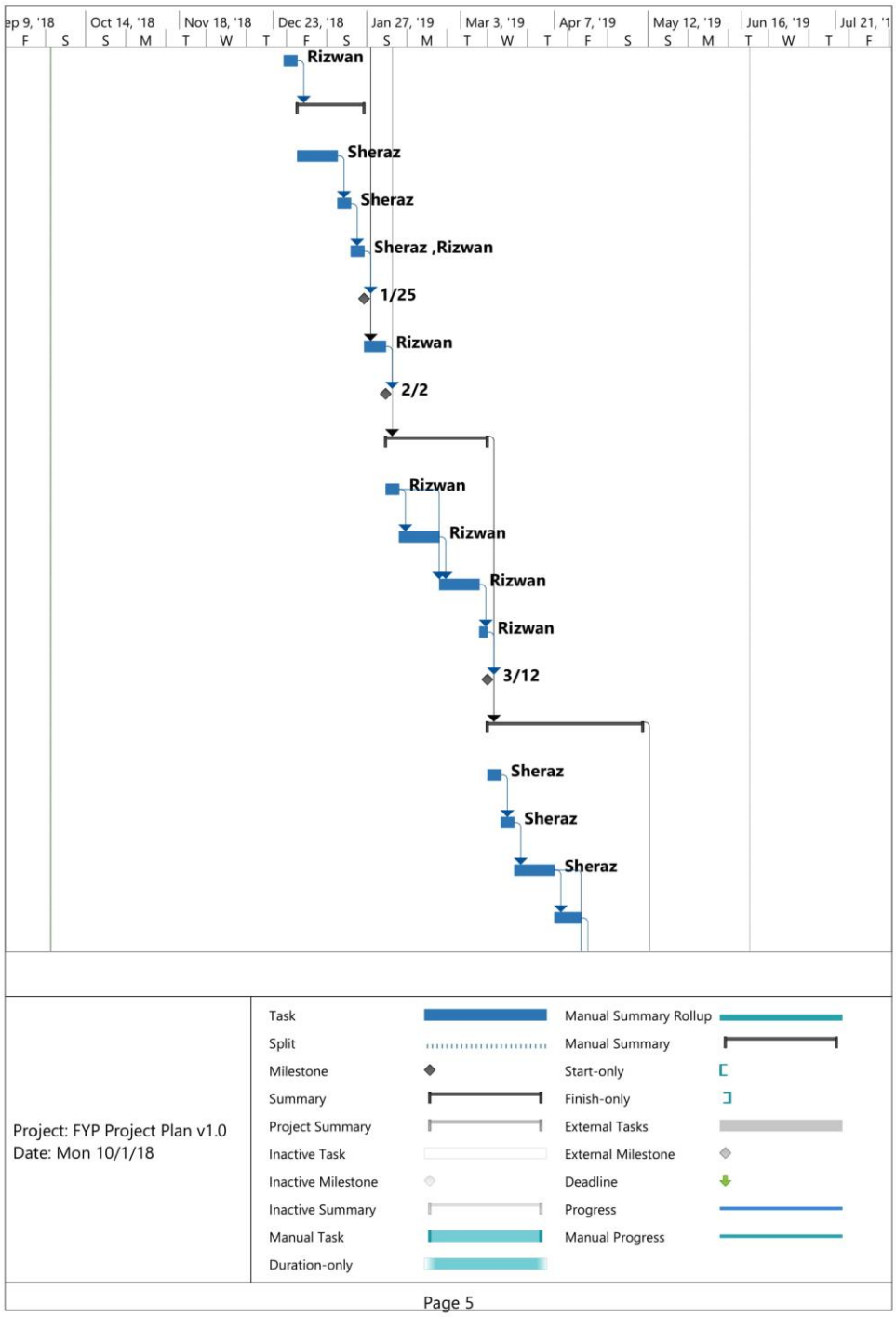
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13. Project Approval Certificate

Recommendation of FYP Coordinator Signature: _____

Approval by the Chairman Signature: _____