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Review Article

Block Chain Based Service in Maternity Health Care Sector in Bangladesh to Ensuring Holistic Health Services

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Abstract

The purpose of this paper is to investigate the current paddy procurement system in Bangladesh and find out the consciousness of the farmers towards it. In this paper, quantitative research methodology was followed. To assess the consciousness the perception and satisfaction of farmers were measured. For the measurement, a survey was conducted on 210 farmers of three Upazilas using a pre-tested and close-ended questionnaire. Data analysis was done using SPSS software version 20. The study finds that about 67.6% of respondents are not happy with the current paddy procurement system. This study found that about 69.10% of respondents think there are the middle man in the current system of paddy procurement, about 94.30% of the respondent opined regarding the need for an improvement of the current system, 99.0% thinks about new paddy procurement system may be helpful. Moreover, these findings led to conclude that there is a huge scope of improvising the current paddy procurement system which will make the activities of the paddy procurement more transparent to all including the farmers. The study may significantly contribute to the policymaking in the paddy procurement system in Bangladesh and similar paddy procurement problems have been faced in many other countries in the world.

Key words: maternity; blockchain based maternity; pregnancy; service; bangladesh

Introduction

In recent years, Information Technology based services are increasing in many different sectors, even in the health sector in Bangladesh. As individuals transition from one life stage to the next there are some specific needs that are recognized by the researchers and designers. Therefore, many technologies were developed and adopted to meet those needs. For instance, learning tools designed for formal education, aiding both the teacher and the student. Notwithstanding all the trend and fast paced developments and research in various stages of life, but very few have investigated the first life stage that is when a woman becomes pregnant. There are serious risks associated with pregnancy and child birth as maternal and child health has been overlooked for a long time in the healthcare system. Lack of awareness, inadequate healthcare facilities, scarcity of skilled personnel, infrastructure, emergency facilities and access to medicine could be the probable reasons. According to the maternal mortality fact sheet published by World Health Organization (WHO) in 2015, Most of the women deaths are due to treatable complications related to pregnancy and childbirth arising from infections, severe blood loss, transmission of sexually transmitted diseases to newborns, high blood pressure, post-delivery complications and unsafe abortion and the number amounts to eight hundred deaths every day. This is mostly seen in lower socioeconomic conditions. Inequities in the availability of emergency obstetric care, care after delivery, newborn care, training to improve overall health, diet intake, lack of preparation for an emergency such as selected blood donor, transportation system, newborn feeding and care and hygiene behaviors are the types of antenatal and postnatal care are missing which may lead to neonatal deaths. These problems can be avoided by taking proper care during pregnancy and after the birth of the baby. For solving these several problems, maternity service is not enough. In this situation, an electronic device system is badly needed which will give a guideline in the daily life of a pregnant woman, change the whole experience of pregnancy and help to change the current perspective about pregnancy care and child care.

Methods and materials

Application of Blockchain based Model

For analyzing this system and to understand the working procedure, we have to divide the whole system into three diagrams. They are:
- Use Case Diagram (For admin)
- User Activity Diagram (For mother)

- User Activity Diagram (For baby)

Use Case Diagram (For admin)

Use case diagrams are usually referred to as behavior diagrams which are used to describe a set of actions of a system in collaboration with one or more external users.
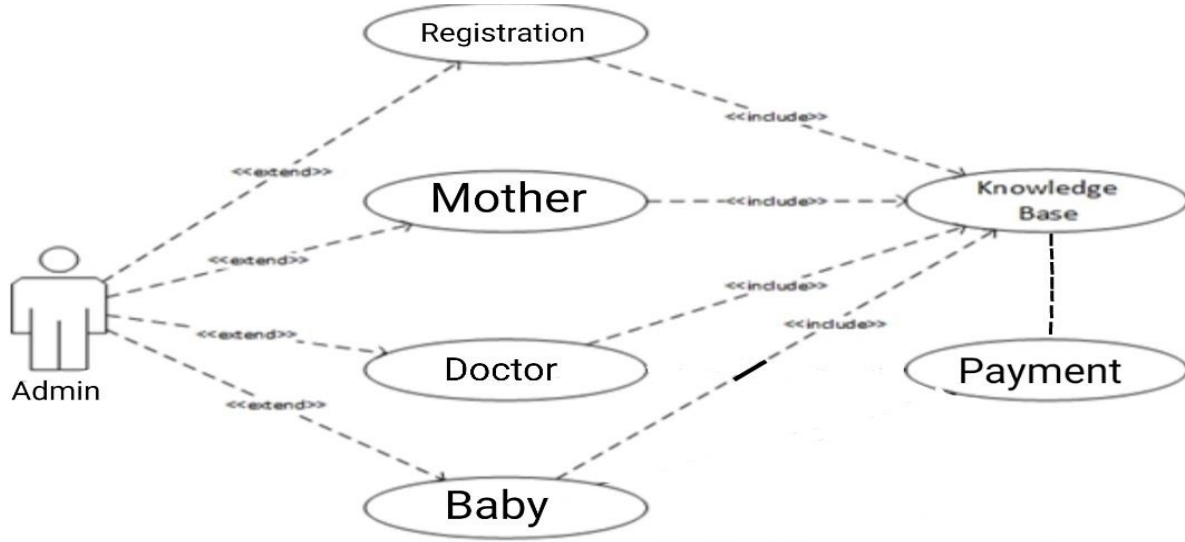

Figure 1: Users Activity Diagram.

The admin's working procedure has shown with a use case diagram. In the use case diagram admin is the actor. An actor is a user that interacts with the system. In the use case diagram admin interacts with our system to describe a set of actions of use cases. Use cases represent a different set of actions that a user or an actor may need. Search user activates user list, update the main database, check notification, send a message is the use case of the system which will be needed by the admin.

An activity diagram visually presents a series of actions or flow of control in a system which is similar to flowchart or data flow chart. In our system, we use an activity diagram to show the data flow or working flow of the system. The activity has started at the initial point of the system. To access previously stored information about the mother the user has to login to the system. Then the activity or action state will start working with the action flow in the system.
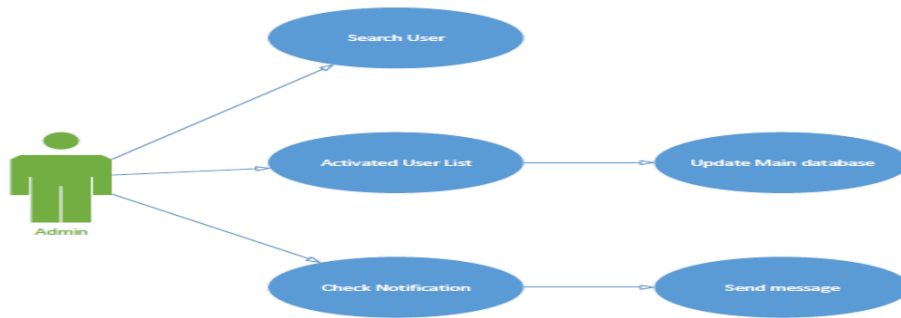
User Activity Diagram (For mother)

Figure 2: Use Case Diagram for admin.

Add first checkup information of a mother and then set reminder for the next checkup. At the next checkup date, if the user would complete the checkup and add new checkup info the system will take the next reminder for checkups. If the user wouldn't complete the checkup, a message will come from the system for the expired date of checkup. And the system will not work until when the user has added the checkup info.

This system suggests nutritious food items for everyday in breakfast, brunch, lunch, snacks, dinner. For this the user has to select food for the relevant time and also select under which condition of health, then our system will process all the info and give them suggestion for food.

Vaccination process and Delivery section will work in the same way. First the user has to add the vaccination and set a reminder. Our system will give reminder for the next vaccination date if the previous vaccination has

completed. If not, then a message will come from the system for the expire date of vaccination. The Delivery section will be work in this way.

For any critical situation blood donor's information will be stored in the blood donor list and also stored some blood donor group or page link of Facebook. The user needs to select donor and then call. If the user gets donors, then they have to confirm the system and if not, the system will take them to the user list again.

In transportation list, the system will be suggesting the nearest transport system by UBER, PATHAO (local apps-based transport company) or in case of an emergency there will be a list of ambulance service. The user needs to select the preferable transport system and then call. If the user gets transport, they have to confirm the system and if not, the system will take them to the transport list again.
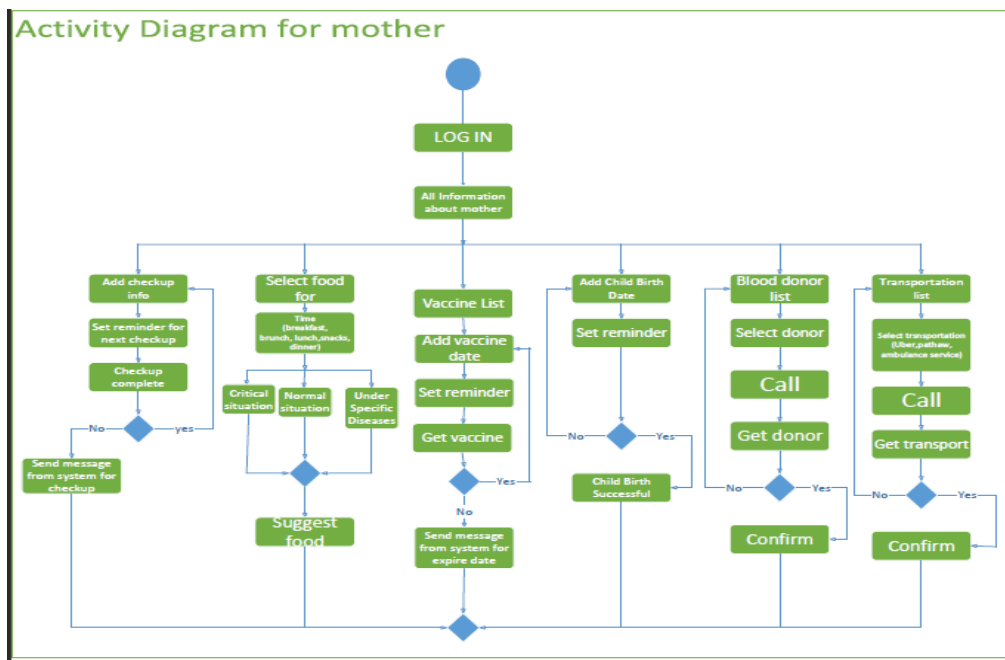
Figure 3: Use Case Diagram for Mother.

When all the processes of the user activity diagram (for mother) have completed the process will be connected with another user activity diagram (for baby) for further procedure of the system.

User Activity Diagram for baby

The user activity diagram for baby will start working when the baby is delivered. After the delivery of the baby the information will require all the information about baby. When the user or the mother will give all the information related to the baby the information will require the completion of baby's automatic birth registration. At this process, if the baby's automatic birth registration system has done the system will allow the user to go to the next process. If a user wouldn't complete the baby's automatic birth registration, the system will not allow the user to proceed and send message to complete the automatic birth registration system.
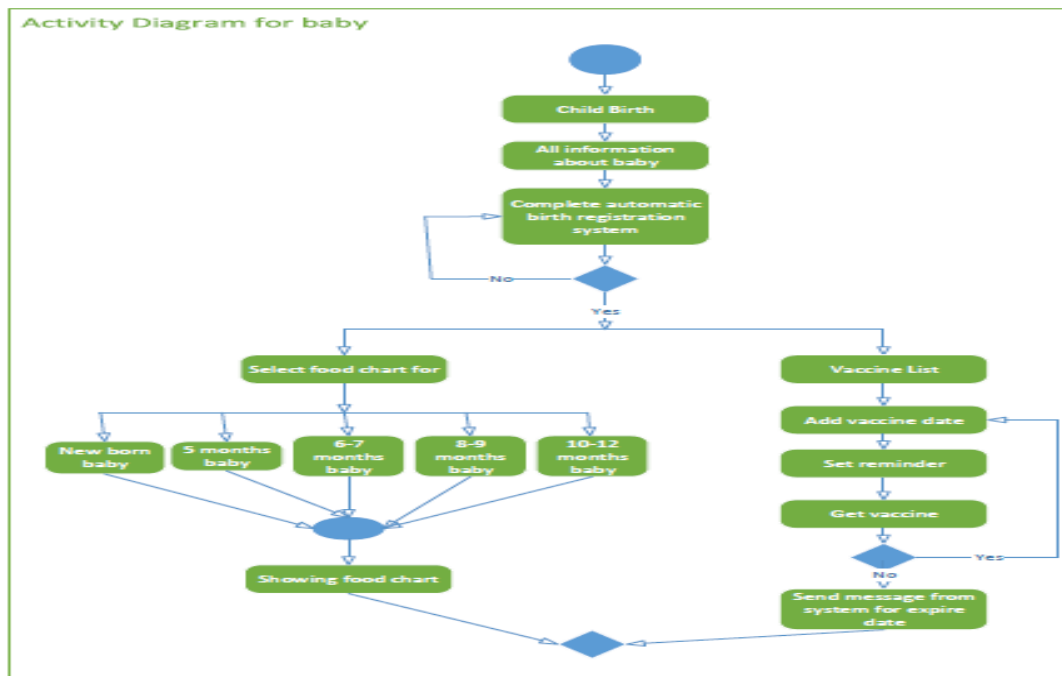

Figure 4: Use Case Diagram for Baby.

Now, when a baby's automatic birth registration will be complete, the user can see the food chart for baby by selecting the food chart and then the system will show the food chart for the selected area. Now at this stage, the activity diagrams are done partially for this partial study of the system. The process will not be completed, the process will be open for further study and research and adding more functions in future.

Blockchain Based Activities

Proposed Blockchain Based solution of Current problems of Maternity Health care services in Bangladesh. After going through with the relevant work of others, a system architecture is proposed in this paper. It will give an overview of how a user obtains a block chain by registering to the system, how new nodes are added based on user's permission along with shading light on the process of data sharing and finally explaining the distributed interoperable healthcare data sharing system.

Registration within the System and attain Block chain

The mother's activities begin by registering to the system. Upon successful registration, the mother becomes the owner of her blockchain. The same process for the doctors and baby also. The genesis block is created after registration is completed. Figure 5 demonstrates the data flow of the registration process. Registration within the System and attain Block on successful registration, the other becomes the owner of her blockchain. The same process for the doctors and baby also. The genesis block is created after registration is completed mother information form. As this form's design is in line with FHIR format, it becomes interoperable to all who get access to

the mother's blockchain. To access their data, mothers would need to log into the system. Therefore, upon registration, mothers would receive their username and password on their email addresses and update them later on to maintain security. It should be noted that after inserting data in a blockchain, they become indisputable. Therefore, not all information of a mother can be added to a block chain. Otherwise, the need for maintaining a local database arises, which contradicts the idea of a distributed ledger system. To mitigate this problem and have all general information of mothers in the block chain, moving the storage system to the cloud is suggested, so that it can be accessible by any node connected to the blockchain, and the mother's general information can be stored in the cloud database. Block chain ensures that sharing of medical information takes place without involving a trusted mediator. This helps to avoid performance degradation, and a single point of failure. Mothers will have command of their data by having the ability to permit trusted authorities like doctors to access and share their information. Medical history as a block chain data also assures integrity of data and it is also non-disclaim and distributed in decentralized manner. All data inputs are verifiably unchangeable and if there are any changes all the members of the mother network are notified. Moreover, any kind of unauthorized alterations can be easily spotted.
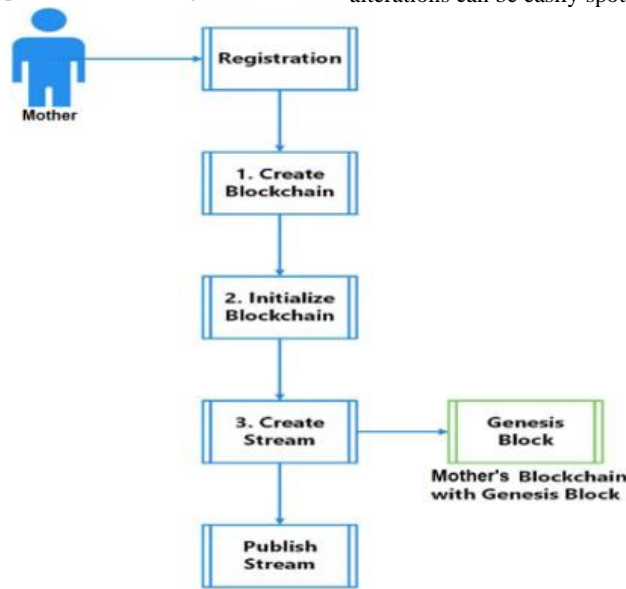

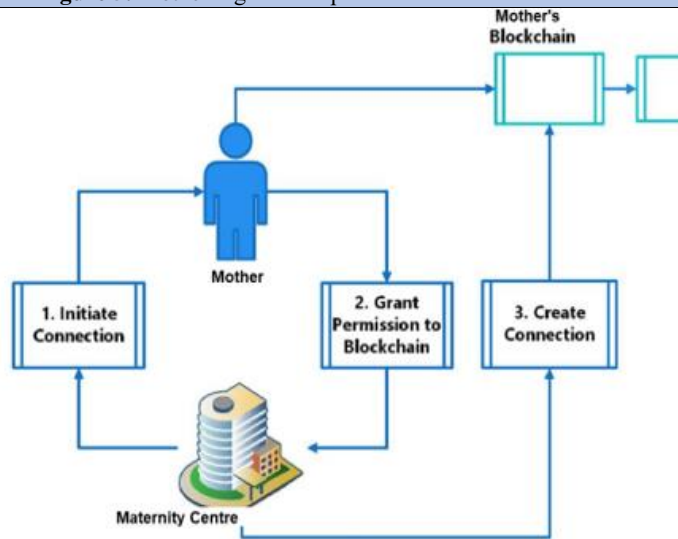**Figure 5:** Mother registration process to Mother's Blockchain.

Figure 6: The process of connecting and creating genesis block.

Adding New Block to Block chain

When the user, in this case, the mother goes to a mother care centers to receive healthcare service, the mother care centers authority requests for accessing the mother's blockchain. The mother care centers need to been listed or registered in the system in order to be eligible to request access to the mother's data. The mother or any person, having authority to provide permission, can use a smart contract and Proof of Authority to grants access to the blockchain. After getting access the care center authority uses the smart contract to assign or give access to a doctor who can now view all the medical records. Consequently, the record is added to the blockchain as a new block. See the below figure 7 and 8.
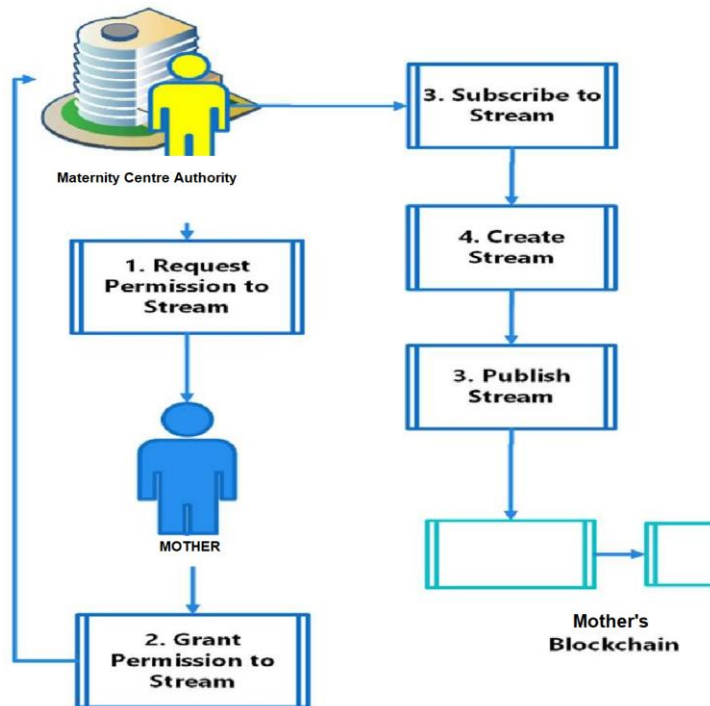
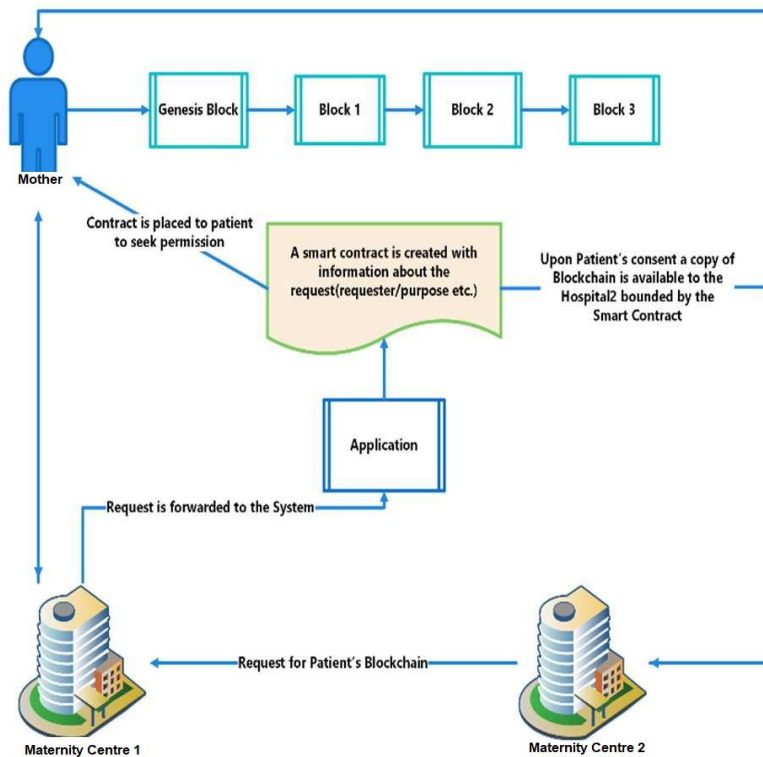**Figure 7:** Addition of the new block in the blockchain with mother's record.

Figure 8: Sharing Blockchain Using Smart Contracts.

Sharing the Block chain

Mechanisms will be established for inter-operability and permission-based access control to the mothers' blockchain, a technique to share the information among healthcare organizations to increase mother care and easing mother's hurdles to provide necessary information whenever they visit any mother care centers is also proposed. Sharing mother information helps healthcare organizations to reduce readmissions, avoid medication errors, and even lessen the amount of duplicate pathological testing (Esposito et al., 2018). The goal of this framework is to enable the sharing of interoperable mother data among healthcare organizations in a secure way by keeping the permission granting instrument to mothers. Figure 8 explains the data sharing process, it is in assuming mother care centers-2 would like to access the mother's record from mother care centers-1. In such a case, upon placing the request for access, mother care centers -1 has to forward the request to the mother or her nominated authority using a smart contract that will mention who is willing to access the blockchain for what purpose. If permission is granted, mother care centers 2willreceiveacopyofthemother'sblockchainas well. Once received, the later one will be able to access data according to the permission set by the first party during the grant process. The second party can only use data dictated by the rules set by the contract, which is reviewed by the mother or her authorized nominee.

Distributed System

Instead of keeping data in a centralized traditional database block chain works like a distributed ledgers using independent computers to record, share and synchronize transactions electronically. Blockchain sort out data blocks by chaining them together in an append-only mode (Azaria et al., 2016). The block chain, are stored by many authorities in the decentralized network. As it is the encrypted information in the blockchain, mothers' privacy is secured when it is transferred between stake holders, and each of the stakeholders' only access information to which they are specifically allowed by receiving permission granted by proper authorized entities. Each stakeholder can rely on the information he received to be accurate, because each hasan immutable chain that is identical to the other chains, and that they can perform audit to test its integrity (Li et al., 2018). In my proposed system, the built-in attributes of blockchain's distributed ledger have been utilized, which will make sure that whenever a new block is added to the blockchain, the system will broadcast the update. Upon receiving the update, each copy of the block chain will have a newly added block making it a decentralized and distributed.
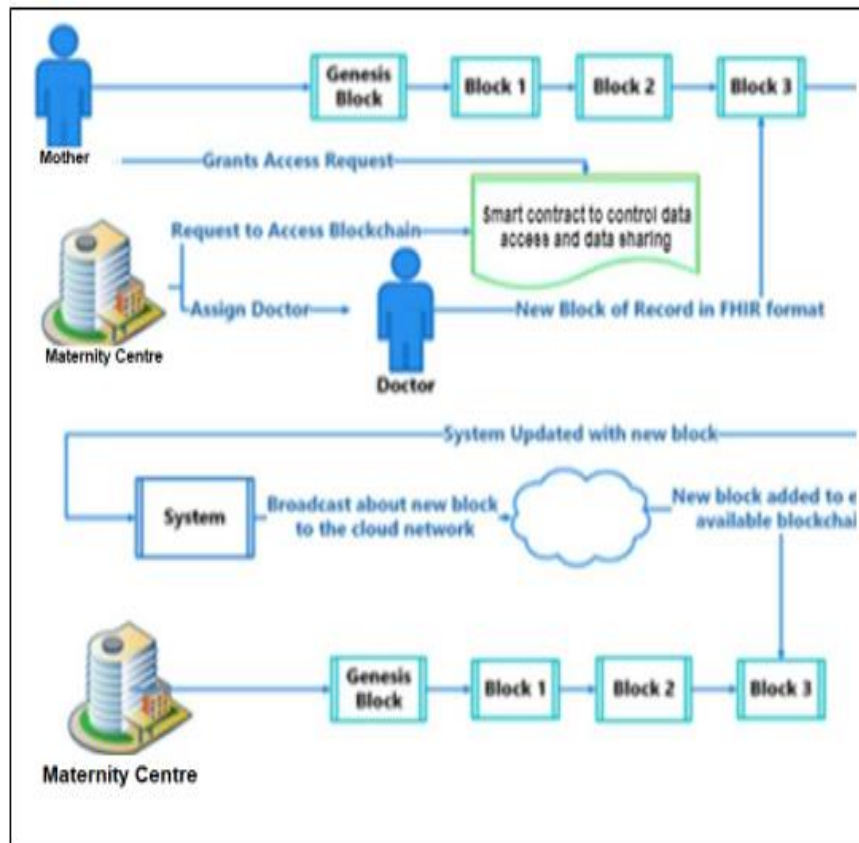

Figure 9: The Proposed distributed system.

Discussion

Research limitations/implications – This research has several limitations that need to be taken into consideration. Here, the respondents generally believe that the people who come to them usually facilitate them. When they are informed that this is only for research work that time they were scared and are not ready to provide actual information.

Conclusion

The study concluded that the proposed system will be very beneficial and effective on the current circumstances of this country when the government and its different organs are struggling for reducing the mortality rate during pregnancy of the mother and the baby. This system will take care of mother with technology from the beginning stage of the pregnancy, create awareness and make a mother conscious about her checkup, nutrition, vaccine, delivery, transportation system.

Originality/value – A few studies on findings of the consciousness of the farmers towards the current paddy procurement system was found but it is apprehensive that a vast scope is there to work on a comprehensive level of farmers consciousness to improve the current paddy procurement system to make suitable and sustainable for the country and supportive to farmers which may help to make their life easier and comfortable.

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