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ORIGINAL RESEARCH

A Framework for Exchanging Stem Cells and Allied Treatment Information among Expertise Hospitals Using Federated Clouds

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Abstract – The Stem cells in human being is used to treat and cure many diseases such as leukaemia, heart, Parkinson's disease. In the recent scenario, the stem cell transplant and treatment procedures are incorporated in many multi-speciality hospitals. In general, few stem cell collection and preservation centres are very limited. So, it is intended to propose the framework to share the information pertaining to the stem cell availability for major multi-speciality hospital who implements the procedures for treating the patients for various disease by using Federated Cloud.

***Index Terms* –** Federated Cloud, Stem cell, hospital, stem-cell exchange.

I. INTRODUCTION

The history of stem cell research dates back to the mid-1800s when the concept of stem cells was first introduced. The term "stem cell" was coined in 1868 by German scientist Ernst Haeckel. In the early 1900s, the first real stem cells were discovered, when researchers found that certain cells could generate blood cells. The use of stem cells for medical purposes began to gain traction in the late 20th century. In 1968, a successful bone marrow transplant between siblings treated severe combined immunodeficiency (SCID). In 1978, researchers discovered hematopoietic stem cells in human cord blood, which opened up the possibility of using stem cells from cord blood as a treatment for diseases.

One of the most significant breakthrough in stem cell research occurred in 1998 when James Thomson and colleagues derived the first human embryonic stem cell line at the University of

Wisconsin-Madison. This discovery opened up a new avenue of research, as embryonic stem cells were found to have the potential to differentiate into almost any type of cell in the body.

In 2005, scientists at Kingston University in England identified a new category of stem cells, known as cord blood embryonic-like stem cells, which originate in umbilical cord blood. These stem cells were found to have the ability to differentiate into more cell types than adult stem cells, which offered greater possibilities for cell-based therapies. In the same year, Korean researcher Hwang Woo-Suk claimed to have created several human embryonic stem cell lines from unfertilized human oocytes. However, his work was later discredited due to ethical violations and fraud.

In 2006, scientists at Newcastle University in England created the first artificial liver cells using umbilical cord blood stem cells. This break through demonstrated the potential of stem cells for the treatment of liver disease.[2] In early 2007, researchers led by Dr. Anthony Atala claimed to have isolated a new type of stem cell in amniotic fluid. These stem cells were found to have similar properties to embryonic stem cells but did not require the destruction of embryos, offering a potential alternative to the controversial use of embryonic stem cells. Finally, in 2007, the Nobel Prize for Physiology or Medicine was awarded to Mario Capecchi, Martin Evans, and Oliver Smithies for their work on embryonic stem cells from mice using gene targeting strategies, which led to the production of genetically engineered mice (known as Knockout mice) for genetic research. Overall, the history of stem cell research has been marked by important discoveries and break through that have opened up new avenues of research and offered hope for the development of new treatments for a wide range of diseases and conditions.[10]

The first published study of successful cartilage regeneration in the human Knee using autologous adult mesenchymal stem cells is published by clinicians from Regenerative Science in 2008.Embryonic stem cells isolated from a single human hair was reported in 2008,Australian scientists(2009) found a way to improve chemotherapy of mouse muscle stem cells, Kimetal 2009.Announced that they had devised a way to manipulate skin cells to create patient specific “induced pluripotent stem cells”(iPS),claiming it to be the ‘ultimate stem cell solution’. For the first time, human embryonic stem cells have been cultured under chemically controlled conditions without the use of animal substances, which is essential for future clinical uses in 2010.[2] Over the last few years, there has been significant debate and controversy surrounding stem cell research, particularly regarding the use of embryonic stem cells. As a result, various laws and procedures have been put in place to regulate stem cell harvesting, development, and treatment for research or disease purposes. The goal of such policies is to promote responsible and ethical research while protecting the public from unethical stem cell use. The National Institutes of Health and the Food and Drug Administration regulate stem cell research in the United States, while other countries have established permissive laws for embryonic stem cell research with strict regulations to ensure ethical standards are maintained. These policies will continue to evolve as scientific and ethical considerations develop.[6]

Regenerative medicine is an emerging field that holds promise for repairing damaged tissues and organs that can't heal themselves. One approach to regenerative medicine involves using stem cells to promote the growth of new healthy tissue. Stem cells can be harvested from various sources, such as bone marrow, umbilical cord blood, or even adult tissues, and then grown in a lab before being transplanted into patients [3].

Scientists are exploring different ways to use stem cells to promote tissue regeneration, including treating spinal cord injuries in rats. In this approach, stem cells are transplanted into the site of the injury, where they can differentiate into various types of cells and promote the growth of new healthy tissue. Somatic stem cells, which can differentiate into various cell types, are also being used to regenerate tissues in animals. Researchers are developing techniques to grow these cells in the lab and then transplant them into patients to promote the growth of new tissues and organs. While regenerative medicine is still in its early stages, it holds tremendous potential for treating a range of conditions and injuries that are currently difficult or impossible to treat. As the technology continues to advance, it may become possible to regenerate damaged tissues and organs, improving the quality of life for millions of people.

Stem cells have indeed come a long way since their discovery in the 1950s, and they have become a valuable tool in modern medicine. Stem cell therapy has been used to treat various diseases, and it has been found to be fast, safe, and effective for pain management. Stem cells have also helped us to gain a better understanding of various diseases, such as cancer, leukaemia, and Alzheimer's disease, and have opened up new possibilities for treating them.

Furthermore, stem cells have shown great potential in restoring functions in the heart and strengthening muscles, which can help replace damaged muscle tissue. Stem cells are also being studied for their potential in curing baldness, deafness, diabetes, multiple types of cancer, muscular dystrophy, myocardial infection, osteoarthritis, Parkinson's disease, spinal cord injury, stroke, and wound healing. As research into stem cells continues, we may discover even more applications for these remarkable cells in the future.[13]

Cloud technology refers to the delivery of computing resources and services through a virtualized pool of easily accessible and usable resources such as hardware, software, and development platforms. This approach enables customers to access network-based tools and applications over the internet, as if they were installed locally on their own computers. Cloud computing is a shift from the traditional model of purchasing and maintaining physical computing infrastructure, to a model where resources are provided as a service on a pay-as-you-go basis. This enables businesses and individuals to scale up or down their computing resources based on their needs and demands, without having to invest in additional hardware or software. Cloud computing offers several benefits, including flexibility, scalability, cost-effectiveness, and accessibility, making it a popular choice for businesses of all sizes and industries.[11]

Federated Cloud

Cloud federation is the practice of interconnecting the cloud environments of multiple service providers to create a more scalable, flexible, and cost-effective cloud computing environment. By connecting private, community, and public clouds, organizations can take advantage of the benefits of each cloud type while avoiding their drawbacks. Users can interact with the architecture either centrally or in a decentralized manner, depending on their needs, through a broker or by directly accessing resources. Cloud federation provides organizations with greater flexibility and scalability by enabling them to integrate multiple cloud environments into a single computing platform, leading to a more efficient and effective cloud computing environment.[1]

II. LITERATURE REVIEW

Python Implementation in Stem Cells

The increasing number and complexity of transplants made it difficult to manage and coordinate care. To address this challenge, the team turned to the Python data analysis library, PANDAS, which is known for its data manipulation and analysis capabilities. Using PANDAS, the team developed custom Python scripts that generate reports and automatically send them via email to members of the transplant team. This has greatly improved the efficiency and effectiveness of transplant management by providing real-time data analysis and reporting, allowing for more informed decision-making and better coordination of care.[9]

AI Implementation in Stem Cells

The use of AI in stem cell biology involves various applications such as understanding stem cell behaviour, identifying individual cell types, characterizing stem cells using mathematical models, and predicting mortality risk associated with stem cell transplantation. These applications can help researchers gain insights into stem cell biology and improve patient outcomes.[12]

ML Implementation in Stem Cells

The use of ML in stem cell biology is gaining momentum, particularly in molecular and genomic studies. ML can accelerate the discovery of new insights with reasonable accuracy and help to identify IPS progenitor cells to understand their origin and mechanism. ML models have also been applied in cancer diagnostics and prognostics.[8]

DL Implementation in Stem Cells

Deep learning (DL) models are being increasingly used in stem cell research to better understand the behaviour and characteristics of stem cells. To train these models, it is crucial to collect large amounts of data that describe the self-state of stem cells. This requires close collaboration between experimental and computational researchers to ensure that the data generated is suitable for DL models and that the resulting models are biologically meaningful. One of the challenges of using DL in stem cell research is to effectively leverage public data, which may not always be applicable to specific research questions. By overcoming these challenges and generating high-quality data, DL models can provide new insights into stem cell biology and lead to the development of more effective therapies.[7]

Federated cloud

In enterprise computing, federation refers to a group of servers that act as a single system, much like a distributed network. This concept has been successfully applied to email systems, where users can communicate with each other regardless of the email service they use, such as a private or public server. By applying this idea to cloud-based file sharing, users can continue to benefit from their local, on-premise service while also being able to communicate with other users across servers and organizations. This federation enables secure and easy collaboration with external parties, removing the final barrier that has prevented private clouds from reaching their potential. Federated cloud services combine the benefits of centralized consumer services with the security and privacy benefits of on-premise deployments. This approach has the potential to be extremely powerful, providing organizations with a scalable, flexible, and cost-effective cloud computing environment that meets their specific needs. By leveraging the benefits of federation, organizations can take advantage of the strengths of multiple cloud types, leading to a more efficient and effective cloud computing environment.

Types of federated cloud

Permissive federation - Permissive federation is a cloud federation method that allows interconnection of two service providers' cloud environments without verifying the identity of the peer cloud using DNS lookups. This approach increases the risk of domain spoofing, where attackers can impersonate legitimate domains to gain unauthorized access.

Verified Federation - Verified federation allows interconnection of the cloud environment, two service providers, only after the peer cloud is identified using the information obtained from DNS. Though the identity verification prevents spoofing the connection is still not encrypted and there are chances of DNS attack.

Encrypted Federation - Encrypted federation allows interconnection of the cloud environment of two services provider only if the peer cloud supports transport layer security (TSL). The peer cloud interested in the federation must provide the digital certificate which still provides mutual authentication. Thus, encrypted federation results in weak identity verification.

Trusted Federation - Trusted federation allows two clouds from different provider to connect only under a provision that the peer cloud support TSL along with that it provides a digital certificate authorized by the certification authority (CA) that is trusted by the authenticating cloud. The Above Diagram Describes that The Structure of Federated Cloud and Management of Cloud how we Use in Hospital to Store the malicious DATA.[4]

III. PROPOSED FRAME WORK

The below diagram describes that the structure of federated cloud and management of cloud how we use in hospital to store the malicious data.

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The diagram shows a federated cloud structure with a cloud broker in the middle, which serves as the central point of contact between different cloud providers and the hospital's database. The cloud broker manages the interactions between the different clouds and ensures that the appropriate data is securely transferred to the hospital's database. This allows the hospital to securely store and access sensitive data, such as patient health records and medical research data, while taking advantage of the benefits of cloud computing. This Structure mainly describes that The Cloud Broker will acts as a main person and he will connect to the Multiple Hospitals and The Database Servers in the Hospital Organization then he collects the Information and He Stores the Stem cells data in the cloud Storage and Cloud Computer Such that the Stem Cells data is preserved very Secure and Safely, so that the Unauthorised Persons Can't access the Data

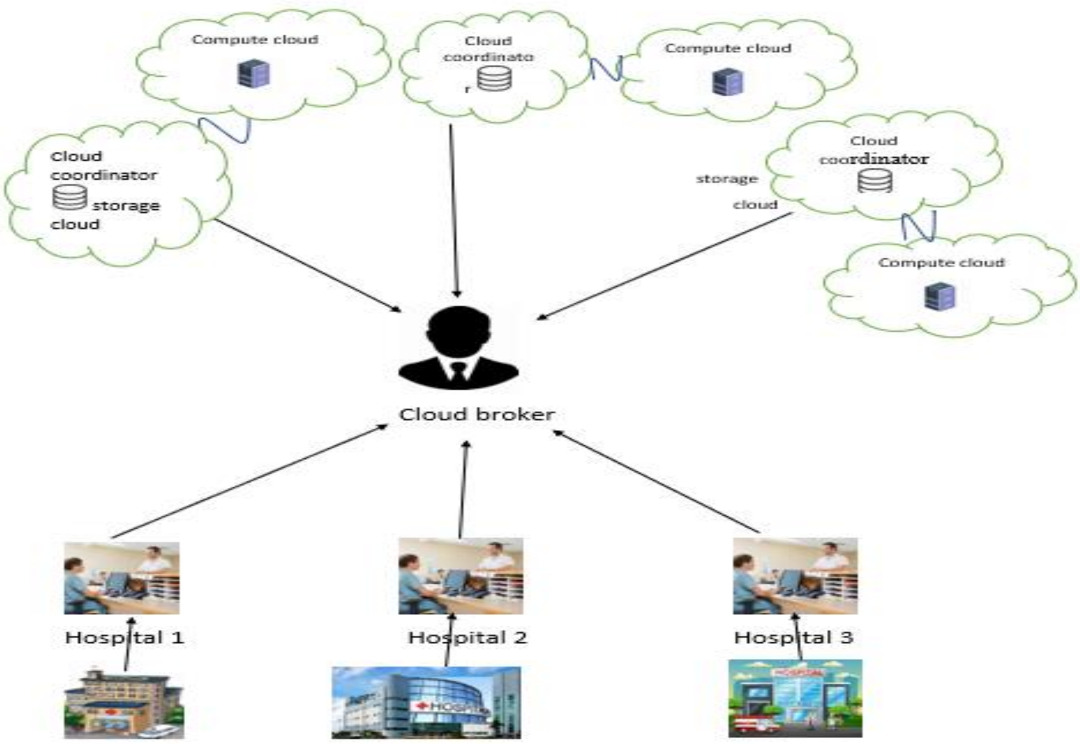

Fig.1 : Proposed system diagram

This Describes us How the Federated Cloud is Implemented in Hospitals and How the Data is Stored Safe abs and Securely in Cloud

Cloud Coordinator: The cloud controller manages the cloud enterprises and their membership. The cloud coordinator allocates the cloud resources to the remote users based on the quality of service they demand and the credits they have in the cloud bank. Based on the policies of SLA the marketing and pricing policies are developed by the cloud coordinator.

Cloud Broker: On behalf of the customer, it is the cloud broker who interacts with the cloud coordinator, analyses the SLA agreement, resources offered by different cloud providers in cloud exchange. Cloud broker finalized the most appropriate deal for their client.[5]

REFERENCES

1. Almishal, A., & Youssef, A. E. (2014). Cloud service providers: A comparative study. *International Journal of Computer Applications & Information Technology*, *5*(II).
2. Coghlan, A. (2014). Stem cell timeline: the history of a medical sensation. *New scientist*, *20*.
3. Casado-Díaz, A. (2022). Stem Cells in Regenerative Medicine. *Journal of Clinical Medicine*, *11*(18), 5460.
4. Rani, B. K., Rani, B. P., & Babu, A. V. (2015). Cloud computing and inter-clouds–types, topologies and research issues. *Procedia Computer Science*, *50*, 24-29.
5. Fernández-Susavila, H., Bugallo-Casal, A., Castillo, J., & Campos, F. (2019). Adult stem cells and induced pluripotent stem cells for stroke treatment. *Frontiers in neurology*, *10*, 908.
6. Vadakara, J., & Basu, S. (2019). Python Tools for Stem Cell Transplantation. *Biology of Blood and Marrow Transplantation*, *25*(3), S269.
7. Ahmed, S. T., & Sankar, S. (2020). Investigative protocol design of layer optimized image compression in telemedicine environment. *Procedia Computer Science*, *167*, 2617-2622.
8. Murry, C. E., & Keller, G. (2008). Differentiation of embryonic stem cells to clinically relevant populations: lessons from embryonic development. *Cell*, *132*(4), 661-680.
9. Mell, P., & Grance, T. (2011). The NIST definition of cloud computing.
10. Patel, H. B., & Kansara, N. (2021). Cloud Computing Deployment Models: A Comparative Study. *International Journal of Innovative Research in Computer Science & Technology (IJIRCST)*.
11. Ahmed, S. T., Basha, S. M., Arumugam, S. R., & Patil, K. K. (2021). *Big Data Analytics and Cloud Computing: A Beginner's Guide*. MileStone Research Publications.
12. Raja, D. K., Kumar, G. H., Basha, S. M., & Ahmed, S. T. (2022). Recommendations based on integrated matrix time decomposition and clustering optimization. *International Journal of Performability Engineering*, *18*(4), 298.