March 2021

Welcome Message from Editor and Team!

Happy Spring!

We welcome you to March issue of IEEE Newsletter, Toronto section.

In this issue, you will read an article “Patient Self-Service Protection of Their Healthcare Data Using Blockchain”. **(Page 3)**

Meet Maryam Davoudpour in our IEEE supporters section. Enjoy and appreciate her contributions to IEEE and specially in IEEE WIE.

By launching this newsletter, we intend to cover IEEE achievements and success stories specific to the Toronto area.

If you have any questions, suggestions, or concerns, please address them to the editor; Fatima Hussain at fatima.hussain@ryerson.ca. We hope to hear from you, and we welcome your feedback!

Meet Our Distinguished IEEE Supporters

Professor Maryam Davoudpour

Dr. Maryam Davoudpour received the MASc and PhD degrees from the Moscow State Technical University of Bauman in Information Technology and Control Complex Systems. She also completed a NSERC post-doctoral fellowship. She is a member of the DMZ (Digital Media Zone) at Ryerson University. Dr. Davoupour is with Ryerson University since 2008 and has joined Humber College. She has extensive industrial and academic experience and has been involved in various successful R&D projects.

Dr. Davoudpour's research interests are in the areas of Nonlinear Modeling, Knowledge-Based Expert Systems, Petri Nets, Digital Signal Processing, Modeling Context Aware Systems and Internet of Things. She is an active reviewer of various IEEE publications and conferences. Her recent research is to create novel smart textile garments, (leg stocking and arm sleeves), enabling automated, sustained Neuromuscular Electrical Stimulation (NMES) therapy to prevent Intensive Care Unit Acquired Weakness (ICUAW).

Dr. Davoudpour is the chair of the IEEE Instrumentation, Measurement, Robotics and Automation chapter in Toronto and she is the Chair of Women in Engineering (WIE) at IEEE Toronto, as well as the vice chair of WIE IEEE Canada

Dr. Davoudpour was selected as an Honorable Mention for the 2018 WIE Inspiring Member of the Year Award by the IEEE Women in Engineering Committee (WIEC), for her inspirational leadership and outstanding contributions to the IEEE WIE and IEEE communities. The purpose of this award is to recognize a professional member of IEEE Women in Engineering (WIE) who has made an outstanding contribution to WIE, their community and the engineering community, through dedication and involvement in projects or activities directed toward fulfilling one or more of the WIE goals and objectives.

The WIE IEEE also selected the IEEE Toronto WIE Affinity Group as the recipient of an Honorable Mention for the 2017 and 2018 WIE Affinity Group of the Year Award.

Patient Self-Service Protection of Their Healthcare Data Using Blockchain

Steven Delaney and Doug Schmidt

A patient centric unified view of a patient's healthcare data promises to lower healthcare costs which averages 10% of the Gross Domestic Product (GDP) of most developed countries. Rapid access to a patient's healthcare history can be used to improve patient treatment. Therefore, there is significant interest from governments to unify healthcare records. Indeed, some countries have achieved this by introducing a nation-wide system that integrates data from all healthcare providers to provide a common record of healthcare data for each patient. In

addition, as the digitization of society progresses, regulators have an increased focus on the protection of privacy of personal information. This shows in the European Union's GDPR regulations and the introduction of Canada's Bill C-11 to name a few. These regulations define personal data and the requirements of organizations to collect, use and protect personal data.

A patient's healthcare data is identified as personal data in both the GDPR and C-11 regulations. These regulations spell out when organizations must obtain a patient's approval to collect and use their healthcare data. Also, it provides provision to allow access to a patient's healthcare information without authorization when life is at risk. In Canada, a patient's healthcare data can reside in multiple Electronic Health Records (EHR) hosted by many different organizations, each with their own separate privacy and security controls. This presents challenges to the application of privacy regulations to the retrieval of a patient's healthcare data. Specifically, (1) Providing the patient with the ability to easily have their healthcare privacy choices applied consistently across multiple organizations. (2) Healthcare data interrelationships can be highly complex, and many patients will not understand what data or combination of data should be set private to achieve their privacy expectations. (3) Not every healthcare organization will host the same data on the same patient. The onus is therefore placed on the patient to manage and track their privacy decisions separately for each organization using differing administration processes. (4) Differences between the EHR systems used by each organization may make it difficult for the patient to identify with confidence, the same data to be protected in each organization.

A holistic patient centric view of the patient's healthcare data would reduce the complexity of addressing the challenges cited above. Countries like Australia and Estonia have implemented patient centric healthcare systems but for some countries like Canada, it would take several years to implement such as system even if there were an initiative to do so. We propose a simpler and less costly approach using a Patient Control Privacy System (PCPS), which each healthcare organization would utilize, to provide consistent adherence to each patient's privacy choices.

The concepts displayed in Figure 1 are (1) Development of a common standardized EHR format to be used for recording patient data privacy decisions on a blockchain. This EHR format is designed to store data and associated privacy settings for the purpose of filtering viewing of their data. It need not cover the same scope as EHR's used by service providers. (2) Service providers can continue to utilize their own EHR formats. (3) A conversion component that can translate data to and from the standardized EHR and the service providers EHR's. (4) A Data Privacy & Access Check component compares retrieved EHR data, translated to standardized format, to the patient's privacy decisions recorded in the blockchain. Only permissioned data is allowed to be viewed. (5) The patient can set their own privacy decisions on the blockchain and has full transparency into who has viewed their data. Figure 1 describes the basic concepts of the PCPS approach. It is recognized that there are a multitude of use cases that will affect what patient data can be viewed by the clinician. For example, perhaps only data relevant to the clinician's specialty should be viewable or, all the patients' data should be allowed to be viewed in the event the patient's life is at risk.

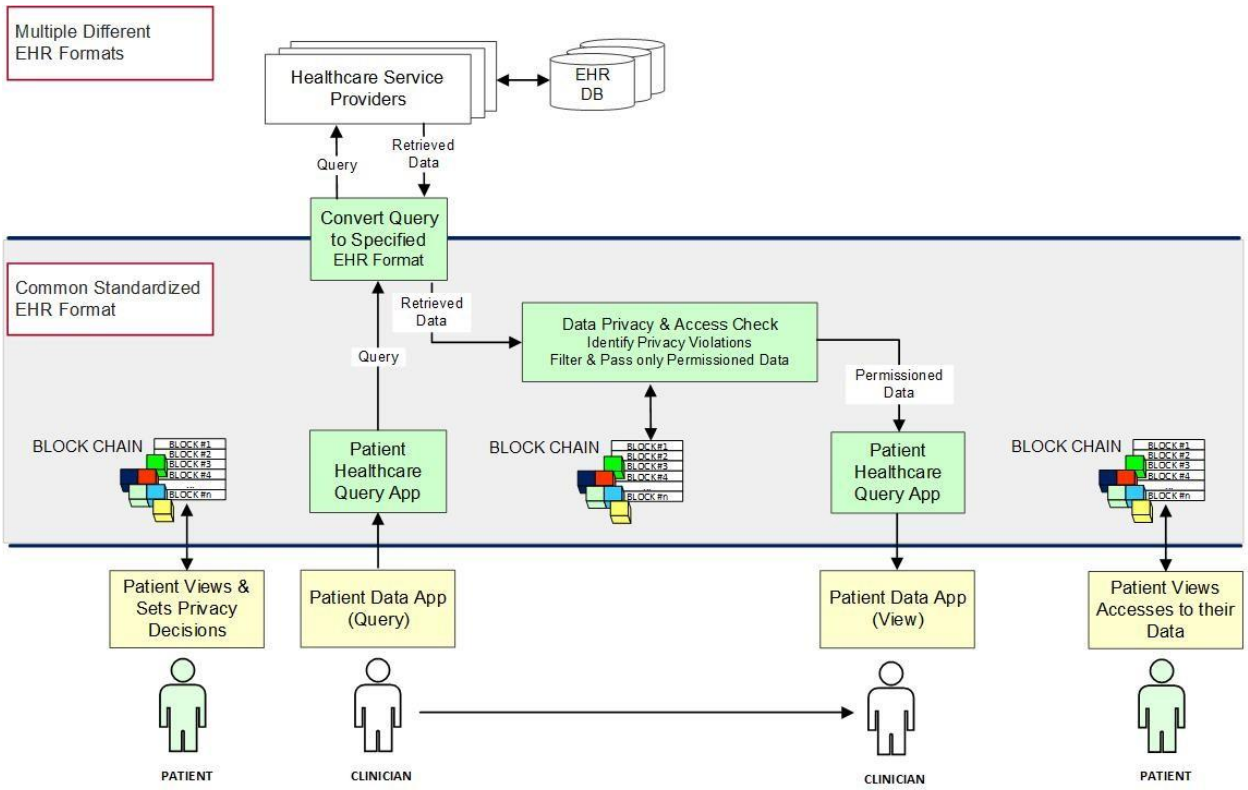

Figure 1: Process flow for a Patient Control Privacy System (PCPS) where a healthcare query is initiated by a system external to the EHR System.

In summary, by standardizing on a common EHR format that can convert selected data to and from other EHR formats, this enables interoperability with multiple EHR services to provide a holistic view of a patient's healthcare data. This, in turn, allows the use of a common blockchain to record and apply a patient's privacy decisions to clinicians viewing their data. Healthcare services retain the freedom to implement privacy regulations in their own manner. However, it may be beneficial for the services to access the blockchain as a source of the patient's healthcare data privacy decisions and permissions. The advantage to the patient is that they can edit and maintain their privacy decisions in one system knowing that it will be applied consistently throughout the healthcare jurisdiction. The PCPS is a key component in our work that combines blockchain, semantic, and graph database technologies to allow clinicians to quickly obtain the right patient data at the right time to improve treatment of the patient at lower cost.

Get Involved with Us!

IEEE Toronto section is looking forward to hearing from you. your contributions are welcome to this monthly newsletter. We invite our members to share and submit:

- Short Story (about IEEE members, WIE members)
- News items and Affinity group reports
- Technical Articles/Blogs (Brief discussions of cutting edge research, new technological tools, topics of your choice)

Submission

Articles should be submitted in Word format. Word count for News items, Affinity group reports is 50 to 200 words and for blogs/ articles is 500 to 800 words.

Editor: Fatima Hussain

Contact: fatima.hussain@ieee.org

Coordinator: Ameera Karkhi

Contact: ameera.karkhi@gmail.com

Webmaster: Melanie Soliven

Contact: msoliven@ieee.org