A Proposal for Mobile E-Care Health Service System Using IOT for Indian Scenario

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Abstract – The premise of this research idea is to develop smart health centers in India. The proposal basically exploits the idea of Internet of things and aims to use the existing technology and background. The work has been motivated by the fact that India is lacking in terms of number of health centers corresponding to the population of country and in villages especially. More prominently if a health center is available, Doctors generally either are not willing to serve the rural areas or they are not available 24x7 leading to rural population turning to cities even for casual ailments. This adds to long queues in hospitals and lot of annoyance to patients. In order to avoid above mentioned limitations, the proposed model aims to address the patient without even physically visiting the health center and also prescription can be generated in the absence of Doctor. It is expected that such a smart system would not only facilitate sick but also will add prosperity indirectly to villages. The proposed framework would definitely bring a significant change in the health care sector of India.

Index Terms – IoT, RFID Tag, 6LoWPA, Mobile Technology.

1. INTRODUCTION

Internet of Things (IoT) is gaining widespread popularity among research community because of its potential to digitize real world physical objects around us. IoT has emerged due to present wireless telecommunication services and ubiquitous presence of Internet. Wireless sensor networks, RFID tags, actuators and various handheld intelligent devices such as mobile phones, PDAs, Tabs etc. are leading to the emergence of IoT. IoT seems appealing and its emergence is being accepted by research and industries, due to its impact on our day to day life both in production and consumption processes. It has opened up wide spectrum of innovative scenarios to improve quality of human life. Sensor networks have already proved their excellence in making human life easy in routine tasks such as controlling water tanks, to save electricity at public places like museums, libraries as well as critical tasks such as habitat monitoring, controlling/ assisting industrial processes etc. Intelligent devices such as mobile phones have been transformed from embedded keypad based traditional phones to lightweight touch screen based devices. Applications of sensors in our day to day life are numerous which indicates their importance, however they are constrained due to limited battery life which limits their use. Radio Frequency Identification Tags (RFID) [1] technology provided substitute to sensors as these tags can be used to identify , track and locate any object using unique Electronic product code (EPC) which is encoded in these tags.

RFID tag comprises of a small chip, an antenna and a cover for encapsulating chip and antenna. Antenna receives signal from RFID reader device and transmits the tag ID to it. These tags can be either active or passive based on power source. Active tags are associated with a battery life and thus depend on it for their lifetime, just like sensors. However, passive tags acquire energy from reader device either through magnetic induction or electromagnetic wave capture techniques [8]. Signal received by RFID antenna, produces a current in it through induction, which is further utilized by the antenna to revert back the tag ID to the reader. This technique can help transmit tag Id to a radio range of few kilometers. Thus RFID tags eliminate battery limitation of sensors, further being small in size they can be embedded in any real life object for its monitoring. Thus RFID tags are helping great deal to convert every real life physical object into digital entity. Such RFID sensing objects will form their RFID sensor networks with reader devices as sinks of data generated. Emergence of these RFID sensor networks, in our day to day life will fill the gap in omnipresence of Internet and will help IoT spread its roots in our society. *'Anytime, anywhere, anymedia'* computing has turned into reality with every object embedded with either RFID tag or sensors, these when combined with already existing wireless communication technologies make everything digitized and on Internet. This gives avenue for large range of innovative applications such as smart homes, E-healthcare, traffic monitoring and route management, resource management at retail stores, automated checkouts at shopping centers, condition based maintaince of vehicles are some possibilities. Applications of IoT has been divided into four categories [1] i.e.:

- Transportation and logistics domain
- Healthcare domain
- Smart environment (home, office, plant) domain
- Personal and social domain

The current proposal focuses on developing smart healthcare centers and it outlines a framework for mobile based portable health care services for ruler population in India. Next section provides an overview of relevant literature in this field. Section 3 provides proposed framework and section 4 finally concludes

with requirements to develop the proposed smart healthcare center and its future scope.

2. RELATED WORK

This section explores work already done in the field of IoT. Atzori et al. [1] presented a survey on Internet of Things highlighting the most appealing point of IoT which is the integration of several technologies and communication solutions. Their work emphasized that any contribution towards advancement of IoT must be a result of synergetic activities in various fields such as telecommunications, informatics, electronics and social science.

Coetzee and Eksteen [2] have elaborated IoT domain and emphasized that various application domains such as Green IT, energy efficiency and logistics have already started gaining benefits from it. Because of large potential of this domain, IoT has grabbed higher priority on the research agenda of academia, industry and governments such as IBM's Smarter Planet, Microsoft's Eye-on-Earth platform and HP's Earth initiative, just to list a few. European commission and Chinese Government is also making efforts in this direction. However, advancements in IoT is also raising trust and security issues simultaneously. Standardized protocols and governance strategies are required for IoT to work at global level. Survey on IoT presented by Mckinsey Global Insitute [6] highlighted that most IoT data being captured today is not used currently. Presently the captured data is used only for anomaly detection and control, however it may be used for optimization and prediction which is of more importance. Further, they pointed that there is large scope for IoT in developing economies such as India. The critical investigation of available literature clearly reflects that IoT is the demand and strong requirement of developing countries and there is a huge gap prevailing between theory and practice. The proposal submitted aims to fulfill this gap in one of the domains i.e. health care.

Next section presents a proposal for Mobile E-care Health Services using IoT for Indian Scenario.

3. PORPOSED MOBILE E-CARE MODEL

From literature review it is clear that IoT has large possibilities for innovative applications to help improve human life. Among four main categories of IoT applications listed above, healthcare domain [6] is the one, most beneficial for common people, especially in India. In India large population still lives in villages and is deprived of good healthcare facilities. However, in villages also, the Internet facility is being made available (Owing the credit to Scheme Digital India) and rural population is already making use of mobile phones to its maximum extent. This factor motivates the present proposal that using basic internet or telecommunication services, RFID tags and existing dispensaries in villages, we can facilitate promising basic healthcare services to everyone. This proposal can also contribute towards Government of India Digital India initiative.

Presently, all most all villages in India have at least one health center to provide basic healthcare services, however there is scarcity of doctors in those dispensaries, due to which people have to visit nearest urban cities to avail medical facilities. Because of limited number of government hospitals in urban cities and still limited doctors in those hospitals, creates bottleneck in providing satisfactory medical facilities to all citizens. Long queues at all hospitals in India, clearly indicates demand for a better alternative.

Using IoT and its enabling technologies, existing government health centers can provide services for common diseases, such as common flu, cold, cough, typhoid, malaria etc. This meagerly requires establishing one computer system with internet connectivity to healthcare server established at nearest urban government hospital or the server may be established in cloud. Villagers will be required to visit local health center once where with the help of a medical assistant they will undergo registration on healthcare server. On registration, present status of vital organs will be recorded along with any medical history and a unique RFID tag will be issued to the person, containing registration identity of that person. While RFID tag being very small can be embedded within a wrist band, the RFID reader will remain available online at the health center itself.

Now whenever a person is sick, instead of visiting the health center physically, the patient will only be required to press a button in RFID band which in turn transmits the identity information to RFID reader at health center. On this call, RFID reader identifies the patient with its registration number and will access patients health card from healthcare server. The health card along with present symptoms of the patient will be submitted to an expert medical system such as Mycin (a new software may also be developed), which will be installed at healthcare server. This expert system is capable of generating a prescription to the patients, even in the absence of a doctor based on present symptoms and past medical history of the patient. Based on generated prescription, medical assistant may provide medicines to the patient (in the absence of Doctor too). This Expert system and health care database may be kept on cloud, so as to make it accessible everywhere in the country.

Thus, the patient can move anywhere in India and can avail medical facilities using that RFID tag, which will help any doctor to become familiar with patient's history and medicines already prescribed and taken. Further, common problem of villagers will get timely identified and resolved avoiding long queues which in turn would save lot of time, money and energy. Figure 1 provides high level view of proposed Mobile E-Care Health Services System.

4. CONCLUSION

The proposed model can be easily implemented using existing RFID technology and an expert health care system such as Mycin. A new intelligent e-health system can also be designed considering the Indian health issues and environments. The proposal would act as an aid to sick and would also contribute towards Digital India.

REFERENCES

[1] Atzori, L., Iera, A., & Morabito, G. (2010). The internet of things: A survey.*Computer networks*, *54*(15), 2787-2805.
[2] Coetzee, L., & Eksteen, J. (2011, May). The Internet of Things-promise for the future? An introduction. In *IST-Africa Conference Proceedings, 2011* (pp. 1-9). IEEE.
[3] Babar, S., Stango, A., Prasad, N., Sen, J., & Prasad, R. (2011, February). Proposed embedded security framework for internet of things (iot). In *Wireless Communication, Vehicular Technology, Information Theory and Aerospace & Electronic Systems Technology (Wireless VITAE), 2011 2nd International Conference on* (pp. 1-5). IEEE.
[4] Ukil, A., Sen, J., & Koilakonda, S. (2011, March). Embedded security for Internet of Things. In *Emerging Trends and Applications in Computer Science (NCETACS), 2011 2nd National Conference on* (pp. 1-6). IEEE.
[5] Weber, R. H. (2010). Internet of Things–New security and privacy challenges.*Computer Law & Security Review*, *26*(1), 23-30.
[6] Jara, A. J., Zamora, M. A., & Skarmeta, A. F. (2011). An internet of things---based personal device for diabetes therapy management in ambient assisted living (AAL). *Personal and Ubiquitous Computing*, *15*(4), 431-440.
[7] The Internet of Things: Mapping the Value Beyond the Hype, Executive Summary by Mckinsey Global Institute, June 2015. Available online at http://www.mckinsey.com/~/media/McKinsey/dotcom/Insights/Business%20Technology/Unlocking%20the%20potential%20of%20the%20Internet%20of%20Things/Unlocking_the_potential_of_the_Internet_of_Things_In_brief.ashx
[8] ant, R. (2006). An introduction to RFID technology. *Pervasive Computing, IEEE*, *5*(1), 25-33, January-March,2006.
[9] Istepanian, R. S., Zitouni, K., Harry, D., Moutosammy, N., Sungoor, A., Tang, B., & Earle, K. A. (2009). Evaluation of a mobile phone telemonitoring system for glycaemic control in patients with diabetes. *Journal of Telemedicine and Telecare*, *15*(3), 125-128.
[10] Istepanian RSH, Jara A., Sungoor A, Philips N. (2010). Internet of Things for M-health applications (IoMT). AMA-IEEE medical technology conference on individual healthcare, Washington.

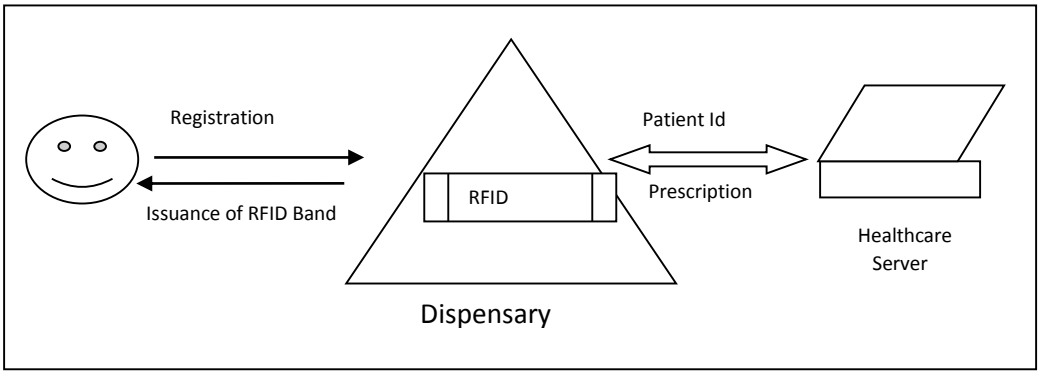

Figure 1: High Level view of Mobile E-Care Health Service System using IoT