



Multi-Criterion Decision Making for Wireless Communication Technologies Adoption in IoT

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ABSTRACT

There is an unprecedented growth of internet and internet-based technologies in the recent times. We are now switching to 5G as the most recent wireless communication technology. The internet of things has become a blessing for Industry 4.0 by challenging all the existing technologies in its utility for contributing to the industrial growth. There are a lot of wireless communication technologies for IoT, and it becomes difficult choice to select one suitable for an application. Authors have presented multi-criteria decision-making techniques which are very instrumental in making a confirmed decision on the choice of appropriate technology. This choice is done based on a number of deciding parameter which are used to differentiate between all the available options. The authors have identified 11 wireless communication technologies and seven parameters to evaluate the performance of the WCT's. All the seven parameters are considered in ranking and rank matrix is obtained. This technique can be very helpful for application designers so as to choose the right platform for their applications.

KEYWORDS

Absolute Rank, Hasse Average Rank, Internet of Things, Multi-Criterion Decision Making, Simple Additive Ranking, Wireless Communication Technologies

INTRODUCTION

In this era of technological advancement, we are facing massive disruption in all domains of our existing Industrial setup. Lampropoulos *et al.* (2019) explored that there is a lot of quest for the changes next industrial revolution, Industry 4.0 is going to have on our current state of practice. The most significant change that we have already started facing is role of internet and omnipresence of

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human reach due to it. Internet of Things (IoT) has started expanding its wings in all spheres of Human Technological progression. There has been a wide acceptance of IoT driven technology in the recent past, as instanced by Alam (2018), there will be 75.44 billion connected devices by the year 2021. The internet has expanded its wings and is now collaborating with data science and artificial intelligence to make our machines even smarter and talking to us all the time. It is a new era of thinking about smart machines and smarter technologies. The world is changing the dimensions of communication through use of IoT and smarter technologies. There are various wireless technologies available for communication in IoT and even newer technologies are evolving with changing needs of the market. Each of the technology has inherent advantages and limitations. There are various factors that impact the use of one technology over the other in terms of security, availability, applicability, reliability etc. It becomes a very complex task to take a decision on adoption of one technology over other as all technologies are competing with each other on their specific advantages to support the applications. In this paper the authors have presented a multi criterion decision making approach based on Hasse diagrams presented by Mao (2010) and Voigt *et al.* (2006), absolute reference discussed in research work of Keller *et al.* (1991), Hendriks *et al.* (1992) and average ranking techniques explored by Lewis *et al.* (1992) to select the best Wireless Communication Technology (WCT) from available options. This approach may be very instrumental for taking into account the impact of each of the contributing factors for choosing the right technology.

LITERATURE REVIEW

WCT has been the most widely used media for communication in the recent times replacing the old wired communication systems which suffered from the basic limitation to reach the remote areas. Gomez *et al.* (2010) explored various wireless various home automation protocols and architectures. Hussain *et al.* (2017) in their work identified the internet of things building blocks. Johari (2015) has discussed the various protocols for IoT communication. Garcia *et al.* (2018) concluded that popular Wireless options including WiFi, ZigBee, Bluetooth, WiMax, Z wave, NFC have grown as acceptable solutions to the IoT based communication requirements of current Smart City initiatives. Ramadan & Altamimi (2017) have used IoT wireless networks for a case study of disease production and the efficiency lies on how network forwards and interprets data. Waleed *et al.* (2016) discuss about the scope and opportunities of wireless 5G technologies in the Internet of Things and highlight the need of security in the Internet of Things as a major stakeholder to establish trust in adoption of wireless 5G networks. Pau *et al.* (2018) in their work summed up various available options for the wireless domain to cater to the needs of IoT. Authors summed up that every application domain needs specific requirements relating to the range, throughput, power consumption, and network topology. Besides, further considerations include the cost, ease of integration, and security. In Dhanda *et al.* (2019), the authors state that the outcome of a reliable communication broadly depends on the availability and reliability of the IoT application. The requirements pertaining to scalability and heterogeneity stage striking challenges to the research community. Mobility maintenance, packet delay and signal load are the primary attributes that inhibit reliable communication and affect the quality of service parameters in IoT. This paper presents the various types of wireless technologies available for the IoT and discusses the open challenges and research issues in IoT. Salman *et al.* (2017) in their research gave a brief overview of all the protocols available for IoT communication. A similar paper by Krejci *et al.* (2017) provides a comparative analysis to the developers, designers and the service felicitates with options for various layers of protocols specific for IOT and criteria's of how to choose between them. In Sabaei *et al.* (2015) the authors have made a comprehensive effort to identify the decision making in an environment where multiple attributes are required to be taken into consideration for decision making. Galli (2019) gave a system engineering approach to decision making using 17 evaluation criteria and gave some newer techniques to make a better decision in multiple parameters affecting the final outcome. Koksalan *et al.* (2011) presented a detailed analytical introduction to

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