Investigation on Data Acquisition Accuracy for Long Range Communication using RFM LoRa

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2022 8th International Conference on Control, Decision and Information Technologies (CoDIT) | 978-1-6654-9607-0/22/$31.00 ©2022 IEEE | DOI: 10.1109/CODIT55151.2022.9804036

***Abstract*—Low Power Wide Area Network (LPWAN) is a new wireless technology which is designed for low power with long-range communication. Long Range (LoRa) is one of the primary solutions of the technology. The objective of this work is to build a simple prototype device for the purpose of testing the long-range communications by means of Radio Frequency Modulation (RFM) LoRa and to investigate the accuracy of data transmitted using this technology by varying the distance between transmitter and receiver as well as data packet size. LoRa SX1276 is used for the testing purpose as it is mostly available in our country, Malaysia. For that purpose, LoRa transmitter and receiver node are integrated with small and simple microcontroller Arduino Uno and Raspberry as an interface of the communication. Consequences, data has been transmitted and received by both devices transmitter and receiver to investigate the effects related to their distance and different data packet. With the fixed value of spreading factor of 7, it could be observed, that, as the size of transmitted data is bigger, the longer the time required is and the accuracy is reduced. It could be seen that, for a small data size (200bytes), the accuracy is considerable good with the value around 90%.**

Keywords—LPWAN, LoRa, Wireless communication

I. INTRODUCTION

Communication becomes very important and essential element in our daily life to complete our tasks. The advancement of technologies facilitates the communication process to be able to share data and information among people. Common communication protocol such as Wi-Fi and Bluetooth have already established by means of wireless technology as they easy-to-use protocol and receives high demand and popularity. Although this protocol has been mostly used, the technologies is limited by the distance and range between the receiver and the transmitter. Consequences, the data transmission could be done within the short range [1].

Currently, there are a wide selection of technologies that are used for wireless communications. Among the most regularly used technologies are Wi-Fi, Bluetooth, ZigBee and cellular network [2]. Research about long distance communication based on LPWAN has been increase among the community especially in the implementation of Internet of Things (IoT) because of it many advantages. Nevertheless, recent technological advancements allow compact radio signals modulation to communicate or transmitted with minimal power consumption over long distances. Thus, it could dramatically change the way of IoT devices interact in the near future. As alternative to the well-established wireless technologies, there is a communication protocol called as Long Range (LoRa). LoRa is a technology for radio modulation which was developed by a company named Semtech [3]. It is a modern wireless protocol primarily designed for low-power, long-range communications [2]. The protocol use sub-gigahertz radio frequency as communication medium to transmit the required data. LoRa is the physical layer that designs to support the long-distance wireless transmission or in other words, LoRa is a radio frequency carrier signal that converts the transmitted data into signals.

On the other hand, Long Range Wide Area Network (LoRaWAN) is a Low Power Wide Area Network (LPWAN) networking standard that is designed by LoRa Alliance, whereas, the system architecture for the network and the communication protocol can be defined as LoRaWAN. The open source protocol is located in the Media Access Control (MAC) layer that supports LoRa signal to broader applications. Through the use of the unlicensed sub-GHz radio frequency, industry, science and medical (ISM) radio band available around the world for the communication purpose. Therefore, contact between LoRa radios occurs. The implementation of LoRa frequencies differ with different regions or countries. For instance, 868MHz is generally used in Europe for LoRa communications, while 915MHz is used in North America. As for Malaysia the frequencies range from 919MHz to 924MHz with channel plan of AS923-S1 as of Nov 2021 [4]. These frequencies range are regulated by the regulatory body of respective countries.

With low power consumption, LoRa is able to transmit data for a distance up to 5km in urban area and around 15km in suburban area without considering the obstacles [2]. In addition, the data transmission rate could be achieved between 0.3 kbps to 50 kbps [1]. As designed, LoRa network consists of several gateways and nodes. For each gateway, LoRa has the ability to handle multi-nodes and gateways[5].

LoRaWAN network architecture contains four major parts which are end nodes, gateway, network server and