Integrated Weather Station, News and Messaging System for Remote Places using Long Range Wide Area Network (LoRaWAN)

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Chapter 1: Introduction

Weather information can be used greatly by the public as it gives a heads up on what will be people's activities on the coming days. An automatic weather station automatically transmits and records data from various sensors that can help provide weather updates from a long distance. Having an AWS on remote areas greatly help to save human work. Issues with weathering condition updates on places that has no signal or Internet can be solved by the use of the LoRaWAN technology. The Long Range (LoRa) module is a wireless, low-power, low cost sensor that has the capability to receive and transmit long-range transmission which goes as far as ten kilometers on rural areas while the LoRa Wide Area Network (LoRaWAN) serves as the communication system between end-devices and the cloud to provide such weather updates. The main advantage of LoRaWAN is that the weather station to be implemented on rural and remote areas does not need to have GSM or satellite communication as LoRa provides low-cost data transfer.

A recent study on automatic weather station shows that real-time AWS that is connected through the internet has a lot of benefits for weather forecasting and data analysis for the daily news [1]. The use of the Internet of Things (IoT) has become an advanced communication technology that can be implemented to different end-devices to be connected to the internet and be able to communicate with each other [2]. There are many data gathering weather stations across the world, the Citizen Weather Observer Program (CWOP) in North America provides 7000 stations that transfers 50,000 to 75,000 weathering updates every hour [3]. The commercial weather gathering data today uses very expensive weather stations and can be inconvenient to countries. Due to this, inaccurate data may lead to wrong weather predictions [4].

A specialized communication system is needed for weather stations on remote areas to transmit and receive data. A country needs a lot of data gathering devices on weather information to provide accurate weather forecasts and that is why the LoRa comes into play. Not many weather stations across the globe uses this kind of technology that is very cost-efficient for weathering updates as the LoRa is cheap and has a low power consumption that can last for years. The people behind this research also shows that there is an advantage in a two-way communication between the weather station sited at remote areas and the city. A messaging system is used to provide updates from the city and this can also be used as a disaster preparation for the people on remote areas that has no internet or cellular connection to have information regarding the news especially on extreme weather conditions or there may be massive storm coming in in the upcoming days.

The general objective of this research is to be able to make use of the LoRa's technology capability to transmit sensor data in a long range making a bidirectional communication system for a remotely deployed weather station and a main receiver hub located at a more urbanized location. The integrated weather station will be able to transmit data or messages to the main receiver hub for data gathering and research while the receiver hub has also the ability to transmit news or messages to the weather station. Next will be the specific objectives of this research: (a) To create a prototype system that is capable of two-way communication between the weather station and the remote area receiver hub (b) to be able to fully utilize the LoRa's technology in transmitting and receiving data from a long range (c) to create an efficient and low-cost alternative for deploying additional weather station to remote areas.

This research study will contribute to the advancement of the applications Long Range Wide Area Network (LoRaWAN) specifically on sensor data and message transmission. The

number of weather stations in the Philippines is much less compared to other neighboring countries and being normally placed on more urbanized areas like government buildings or universities. Using this technology will help to add new weather stations the country to contribute for data gathering and research at a low cost compared to other options. As described the system will have the ability to communicate at both end devices, the target area for deployment is remote places to maximize the capability of the system at both data collecting and messaging. Monitoring weather conditions on these remote areas will help specialist to have a more detailed picture of a certain area's climate within it, which can help to more accurately predict and forecast the weather. Keeping track and predicting the weather has a big impact to communities on remote areas specially those who are residing on areas that is prone to hazards like flash floods and landslides. The messaging capability will be also serving as an immediate warning system where government agencies can send messages to these remote areas warning for approaching storms or other dangerous weather conditions.

The study is only limited to the development of the communication system for the weather station and the main hub. The implementation of the LoRaWAN protocol to be able transmit and receive data from a long distance should cover the needs of a person who is from a remote area without cellular or internet connection to gather news and updates on the things that he/she needs information from. The weather station will use various weather instruments to be able to forecast and predict the weather conditions depending on what is needed and where it is deployed as the main objective of this study is to be able to provide two-way communication between end devices and the hub.