

# LONG RANGE AND SELF POWERED IoT DEVICES FOR AGRICULTURE BASED ON MULTI-HOP TOPOLOGY

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**Abstract:** This project presents the prototype design and testing of long-range, secured IOT devices for use in precision agriculture environment. A line-of-sight range of up to 1.8km is achieved with the use of transmissions. However, the coverage area and range can be extended significantly by deploying the devices in multi hop network topology. The custom multi-hop protocol provides energy efficient communication from any device in a wireless sensor network. The sensor data is transmitted to a gateway, which then forwards it to a local server or cloud service, where the data can be analyzed to optimize the production in agriculture. IOT network system can monitor environmental parameters. The proposed network system incorporates multiple sensors to monitor environmental parameters. The sensors on different subjects can communicate with each other and transmit the data to a gateway via RF. The sensor node will provide an effective notification. A smart IOT gateway is implemented to provide data processing, local web server and cloud connection. After the gateway receives the data from sensors, it will forward the data to an IOT cloud for further data storage, processing and visualization.

**Keywords:** Temperature sensor, microcontroller, RF module, LCD display, ESP8266MCU, Cayenne app.

## I. INTRODUCTION

Internet of things is a system of inter-related computing devices, mechanical and digital machines. The term "Internet of Things" was coined by Kevin Ashton of procter and Gamble in 1999. Long range is a low power wide area network technology. It is based on self spectrum modulation Technique. It uses license free sub-giga hertz radio frequency banks. 868MHz(Europe), 915MHz(Australia and North America) and 923MHz(Asia). Radio frequency module is used to transmit or receive radio signals between two devices. The main aim of this paper is to collect the information in the agricultural fields or in any other environment and transmit through wireless communication. IoT devices for agriculture and aquaponics have been designed and tested based on the nRF52840 with a multi-hop protocol and energy harvesting. The multi-hop protocol

is highly efficient with ranges upto 1.8km per hop and a maximum hop by hop delay of 0.6s assuming successful transmission. The data are displayed in LCD as well as in Cayenne app and the temperature is measured by temperature sensor.

## II. LITERATURE SURVEY

In the year 2018 a paper "Design and Implementation of long range self-powered wireless IoT devices" was written by Rolf Arne Kjelby, they detect using nRF52840 based on energy harvesting. The test-bed is setup in both star and multi-hop configurations with optimized custom protocols. The average power by which the battery was charged during the test was 941.94μW in an indoor environment. Based on measurements, a line of sight range of 1.8km is obtained using coded transmissions. Sensors of temperature, relative humidity and visible light are integrated into the nodes.

In the year 2018 a paper "Design and prototype implementation of an ultra low power wakeup Audio for wireless IoT devices" was written by Anders froylog. This project focus on reducing the overall power consumption of the battery powered and energy harvesting based devices. The prolonged life time of the devices can reduce the overall costs when deployed in large scale.

In the proposed system we designed the "Long range and self powered IoT devices for agriculture based on Multi-hop topology". This project is useful in agricultural field. This project is based on multi-hop topology and focus on the longer transmission of data without loss in transmission. With the help of ESP8266MCU module the data is send to Cayenne app. Thus, the data can be analyzed to optimize the production in agriculture.



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