Agriculture IoT

Team 8corn

PURDUE UNIVERSITY | IITP

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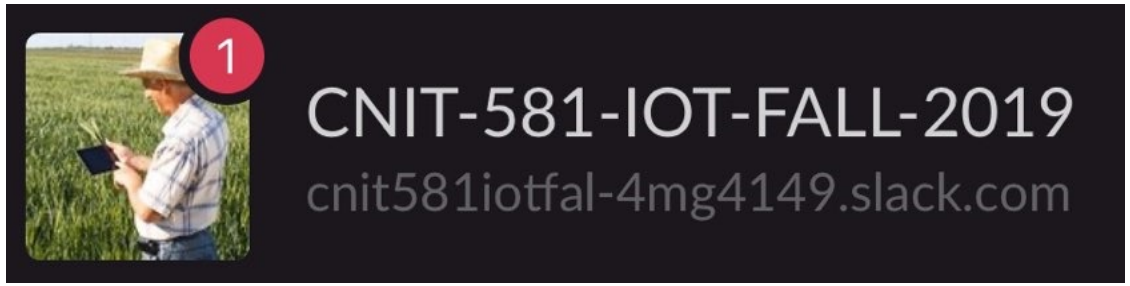
2 Introduction

Project Background



Feasibility of LoRa versus APRS in AgIoT

CONTENTS

Feasibility
of LoRa versus APRS
in AgIoT

Introduction

LoRa and APRS

Long Range

915 MHz

Low Power Wide Area Network (LPWAN)

Long-range transmissions with low power consumption
(more than 10km in open area)

1 Introduction

LoRa and APRS

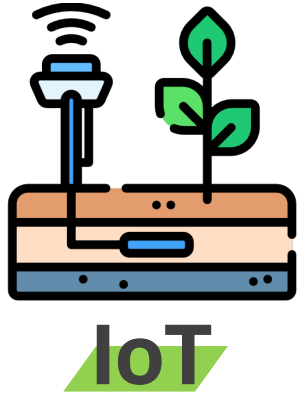
Automatic **P**acket **R**eporting **S**ystem

144.39 MHz

Amateur radio based system for real time digital communications of immediate value in the local area

1 Introduction

LoRa and APRS



LoRa

2 DESIGN

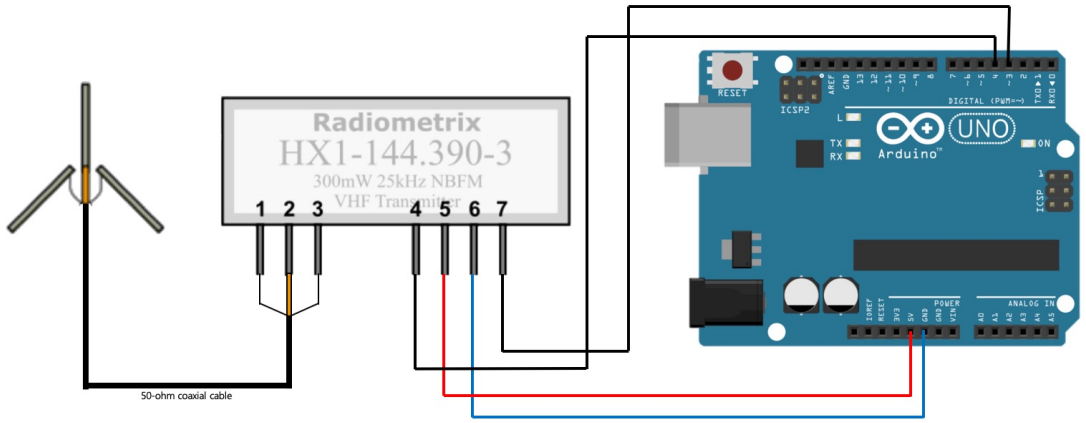
LoRa Circuit

Transmitter

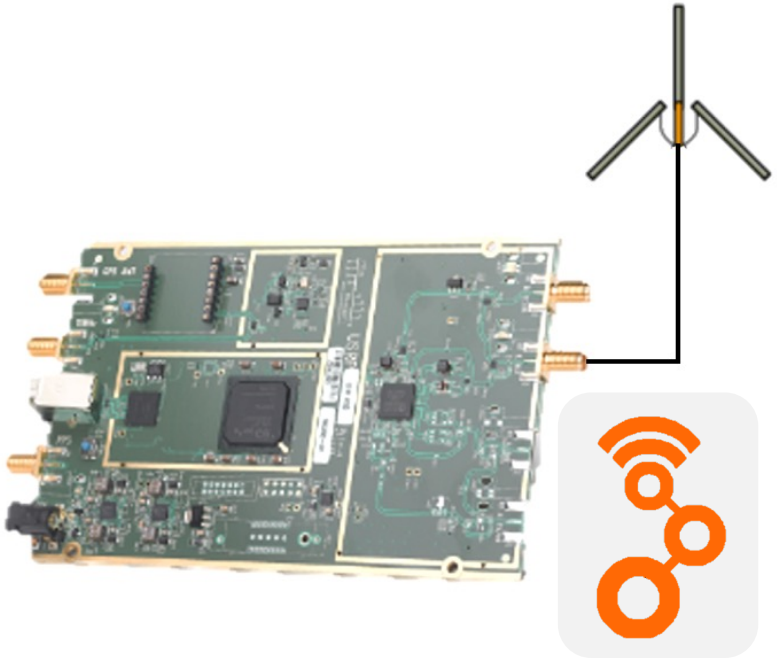
Receiver

2 DESIGN

APRS



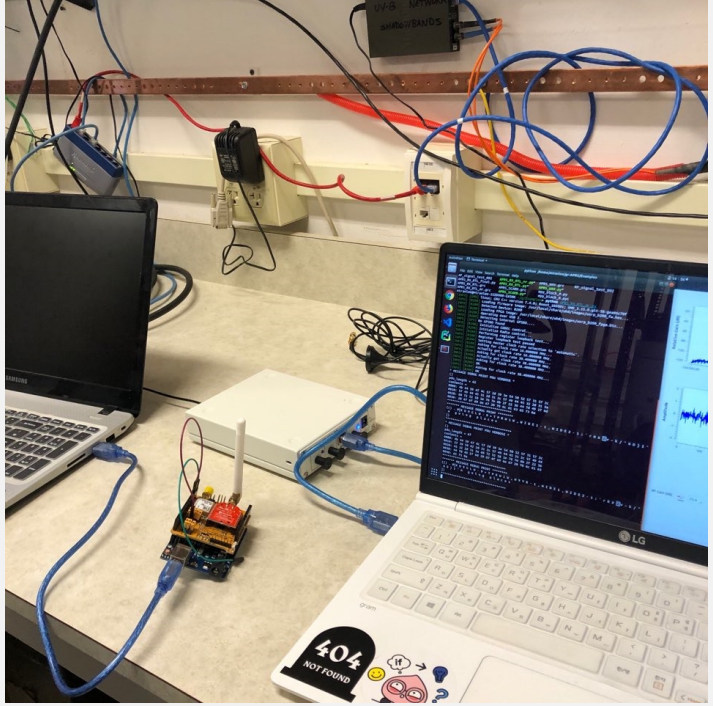
Transmitter



Receiver

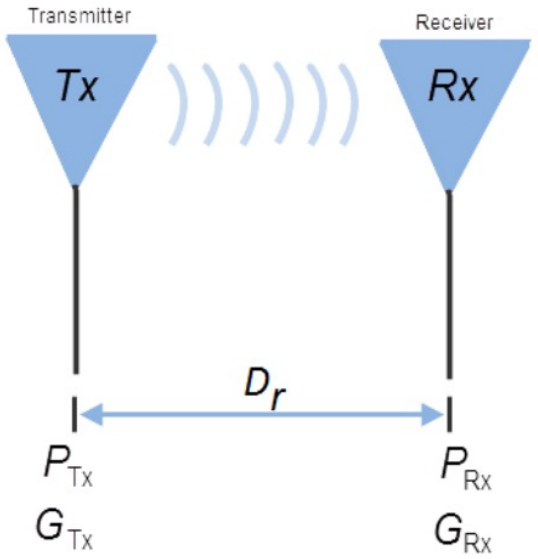
3 Result

Test



3 Result

Friis transmission equation



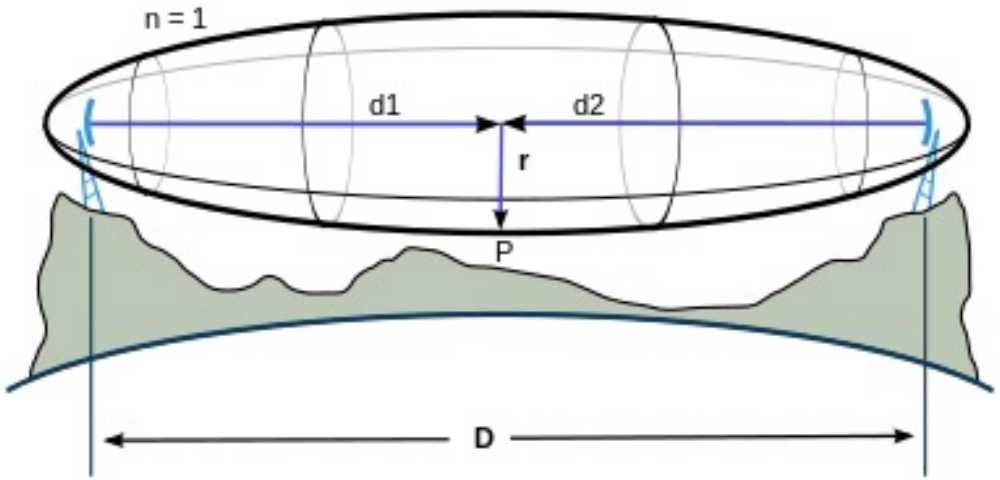
$$P_{rx} = P_{tx} G_{tx} G_{rx} \left(\frac{c}{4\pi D_r f_0}\right)^2$$

$$D_r = \frac{c\sqrt{P_{tx} G_{tx} G_{rx}}}{4\pi f_0 \sqrt{P_{rx}}}$$

Friis transmission equation

3 Result

Fresnel Zone



Fresnel Zone

$$r_n = \sqrt{n \frac{d_1 d_2}{d_1 + d_2} \lambda}$$

$(d_1, d_2 \gg n\lambda)$

3

Result

Test Result

LoRa

Transmitter Power	16 dBm
Transmitter Gain	9 dBi
Receiver Gain	6 dBi
Theoretical Distance	9.3 km (5.78 mile)
Height Needed	27.79m (91.17 ft)

Transmitter Antenna Height	2.1 m (6.89 ft)
Receiver Antenna Height	2.7 m (8.86 ft)
Tested Distance	4.2 km (2.6 mile)
Efficiency Constrained by Height	45.16%

“

for distance 4.2 km
antenna height should be 18.67m

”

APRS

Transmitter Power	24 dBm
Transmitter Gain	1.17 dBi
Receiver Gain	7 dBi
Theoretical Distance	67.1 km (41.70 mile)
Height Needed	186.58m (612.14 ft)

Transmitter Antenna Height	2.1 m (6.89 ft)
Receiver Antenna Height	3.2 m (10.50 ft)
Tested Distance	0.84 km (0.52 mile)
Efficiency Constrained by Height	1.25%

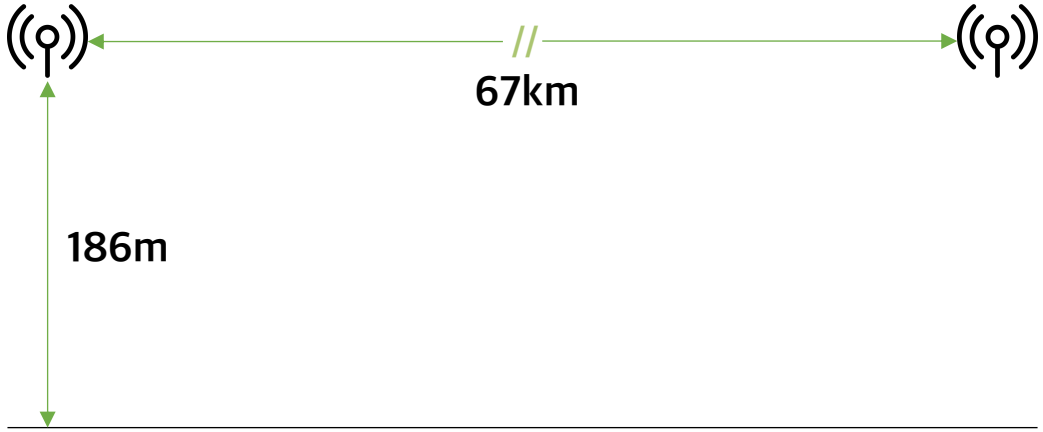
“

for distance 0.84 km
antenna height should be 20.88m

”

4 Conclusion

Limitation and Conclusion



Transmitter and Receiver place 186m height for 67km coverage distance

by Fresnel Zone

LoRa

★ ★ ★ ★ ★

5 Future Works

APRS and LoRa

- Test LoRa and APRS distance coverage with same gain antennas
- Install antennas on taller structure and test

QnA

Thank You !