CS598-Senior Design 1

FINAL PRESENTATION

The Raiders
Ali Alfadhli, Isuru Yapa, Dallas Stroud, Julian Tee

Orientation video: https://youtu.be/A2CJxnj86ag
Teams Link: https://teams.live.com/meet/9366297715227

TEAM COMPOSITION - MAJORS

Electrical Engineering	Computer Science
• Ali Alfadhli • Isuru Yapa	• Julian Tee • Dallas Stroud

Collision Detection Football helmet

Why did we choose a helmet?

According to Vox.com, 80% of football concussion goes unreported.

What is concussion?

A concussion is a traumatic brain injury that affects your brain function.

Concussion Symptoms

Headaches

Nausea

Fatigue

Blurry vision

Confusion or feelings amnesia surrounding the traumatic event

Dizziness

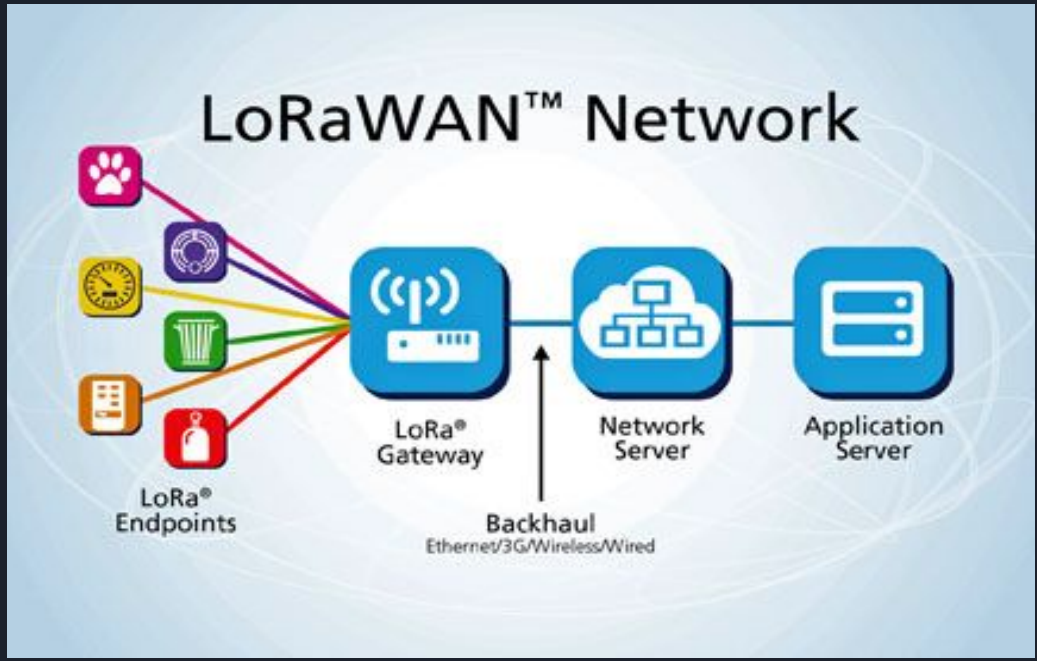
Hardware Implementation

Components:

- Arduino Uno
- Adafruit BNO-055 9 axis accelerometer
- Battery 3.7V 500 mAh

LoRaWAN Network

- Low Power Use
- Low Bandwidth
- Gateways have long connection ranges
  - Urban Area Avg: 2 to 3 km
    - Up to 5 km
  - Rural Area Avg: 5 to 7 km
    - Up to 15 km



LoRaWAN Features vs Other Wireless networks

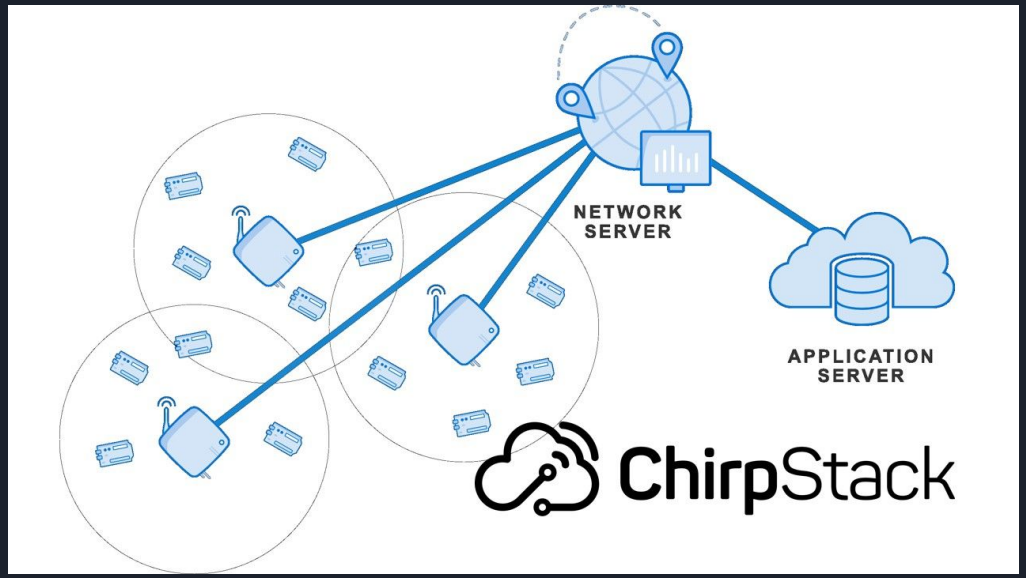
Feature	LoRaWAN	Narrow-Band	LTE Cat-1 2016 (Rel12)	LTE Cat-M 2018 (Rel13)	NB-LTE 2019(Rel13+)
Modulation	SS Chirp	UNB / GFSK/BPSK	OFDMA	OFDMA	OFDMA
Rx bandwidth	500 - 125 KHz	100 Hz	20 MHz	20 - 1.4 MHz	200 KHz
Data Rate	290bps - 50Kbps	100 bit/sec 12 / 8 bytes Max	10 Mbit/sec	200kbps – 1Mbps	~20K bit/sec
Max. # Msgs/day	Unlimited	UL: 140 msgs/day	Unlimited	Unlimited	Unlimited
Max Output Power	20 dBm	20 dBm	23 - 46 dBm	23/30 dBm	20 dBm
Link Budget	154 dB	151 dB	130 dB+	146 dB	150 dB
Batery lifetime - 2000mAh	105 months	90 months		18 months	
Power Efficiency	Very High	Very High	Low	Medium	Med high
Interference immunity	Very high	Low	Medium	Medium	Low
Coexistence	Yes	No	Yes	Yes	No
Security	Yes	No	Yes	Yes	Yes
Mobility / localization	Yes	Limited mobility, No loc	Mobility	Mobility	Limited Mobility No Loc

LoRaWAN Restrictions

	Europe	North America	China	Korea	Japan	India
Frequency band	867-869MHz	902-928MHz	470-510MHz	920-925MHz	920-925MHz	865-867MHz
Channels	10	64 + 8 +8	In definition by Technical Committee	In definition by Technical Committee	In definition by Technical Committee	In definition by Technical Committee
Channel BW Up	125/250kHz	125/500kHz				
Channel BW Dn	125kHz	500kHz				
TX Power Up	+14dBm	+20dBm typ (+30dBm allowed)				
TX Power Dn	+14dBm	+27dBm				
SF Up	7-12	7-10				
Data rate	250bps- 50kbps	980bps-21.9kpbs				
Link Budget Up	155dB	154dB				
Link Budget Dn	155dB	157dB				

ChirpStack

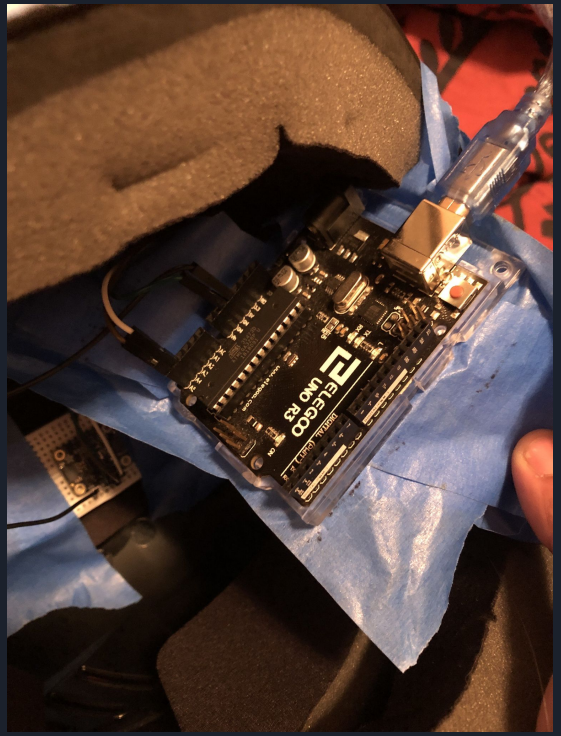
- Formerly known as LoRa Server
- Utilizes Open-Source software
- User friendly UI
- AES-128 Encryption for data
- Live logs for data transmission/events
- API Integration/Web-Interface for existing infrastructures



ChirpStack Requirements

- MQTT Broker to publish and receive application payloads
- PostGreSQL for persistent data storage
- Redis Datastore for non-persistent data storage

NOCSAE
Rawlings
VAPOR T-BALL


ELEGOO
UNO R3