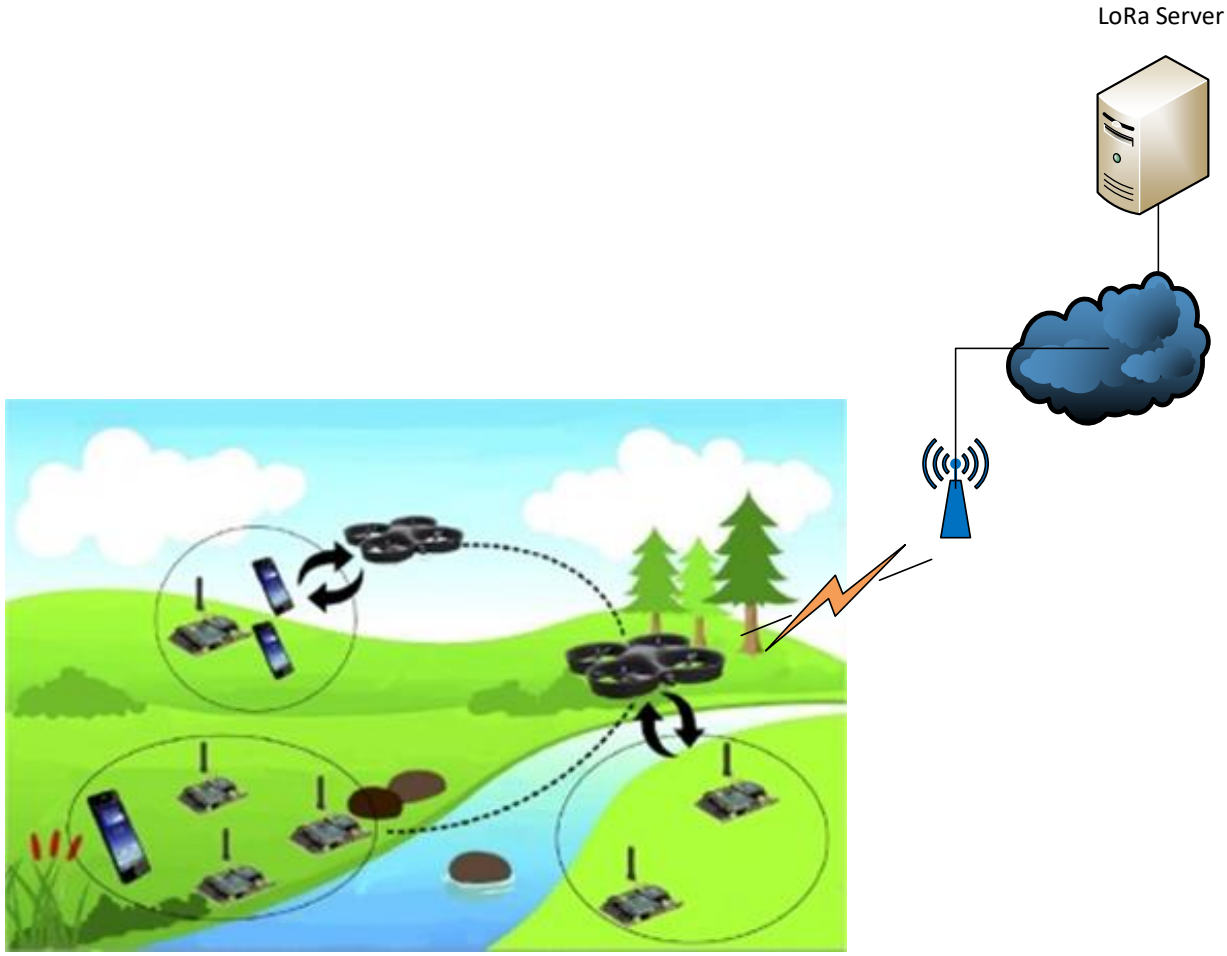
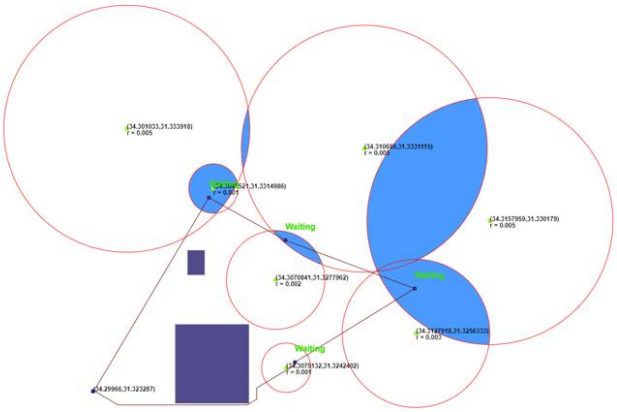
Smart Mobile LoRaWAN Gateway

Abstract:

Low-power WAN (LPWAN) is a wireless wide area network specification that interconnects low-bandwidth, battery-powered sensors with low bit rates over long ranges.
To meet the challenges of long range, low power consumption and secure data transmission, the sensors are based on LoRa Technology and on LoRaWAN media access control (MAC) layer protocol that manages communication between LPWAN sensors and the Gateway.
Not in all circumstances its possible for an end node sensor to communicate with the outside world. This requires to use mobile gateway utilized on drone. The drone on its flight path can reach the remote location where the sensor device is running and collect its data. The challenge in this solution is to establish a communication link with every sensor node, by being at the correct location at the right sensor duty cycle time.





Goals:

1. Learn about LoRa and LoRaWAN.
   Refer to:
   https://www.lora-alliance.org/
   https://www.link-labs.com/blog/what-is-lorawan
   https://books.google.co.il/books?id=iSE6DwAAQBAJ&pg=PT108&lpg=PT108&dq=LoRaWAN+systems+can+receive+eight+messages+simultaneously&source=bl&ots=4uDTCW0rVm&sig=IIcolgkwCe0EiSRtFfqegns2cy0&hl=iw&sa=X&ved=0ahUKEwje2qS777nZAhVP26QKHU4pCbIQ6AEIJjAA#v=onepage&q=LoRaWAN%20systems%20can%20receive%20eight%20messages%20simultaneously&f=false
   https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5038744/

   https://medium.com/home-wireless/testing-lora-radios-with-the-limesdr-mini-part-2-37fa481217ff

2. Refer to Mobile-LoraWAN-Gateway project - https://gitlab.cs.technion.ac.il/lccn/s2019-mobile-lorawan-gateway and implement the following:

   a. Sensors should operate in Class A with duty cycle of X seconds
   b. The Gateway will communicate with LoRa Server in the cloud via LTE Dongle as LTE modem.
   c. Path Planning algorithm should calculate the sensor radii according to last flight RSSI / SNR.
   d. Input before flight: Waypoints (and delay) , Sensors location
   e. Flight mode should implement the following logic:
      - Fly to sensors waypoints and wait time in each - according to the path planning algorithm.

- In each waypoint – the GW should verify with the server that uplink data received from the related sensors.
- If not - wait up to 2*X seconds in the waypoint to receive the missing signal(s). If not – fly towards the location of the closest missing sensor.
- Path planning algorithm should be updated with the needed wait time and last flight results.

f. Stretch goal – refer to https://ubuntu.com/blog/single-node-kubernetes-on-raspberry-pi-microk8s-ubuntu and install Ubuntu with microk8s on the RP and run on it the LoRa Server as micro-service.

Requirements:

Introduction to Networking (236334 or 044334)

C Programming

Collaboration with:

Avironautics

Guided by:

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