Application Exploration of 5G-and-Beyond Wireless Systems and Rural Broadband

ECpE 491: Senior Design

Client and Advisor: Professor Hongwei Zhang

Team 12: Caleb Kitzelman, Cristofer Espinoza, Andrew French, Jake Roskopf, Samuel Rettig, and Vibhu Dhavala

sddec23-12@iastate.edu

Problem Statement

5G allows us to not only transfer large data efficiently, but at faster speeds. We are looking to make commercial farming more efficient through the capabilities enabled in 5G.

Requirements & Constraints

- Connect to the ARA 5G wireless network

- Provide an application that uses 5G to help meet an agricultural need by creating a new solution to the problem or by making an existing solution more efficient.

- Use a data rate high enough to show that our application is utilizing the full power of '5G' capabilities.

Engineering Standards

Intended Uses and Users

- People and communities who benefit:
  - Commercial Farmers (directly)
    - How will they benefit?
      - Higher crop yields → increase supply → maximize profit
      - Less physical labor involved, not as physically taxing
      - Diversity in produce/product, farm expansion
      - Saves time and money (precision farming)
    - How will they use it?
      - Automation
        - Crop fertilizing, planting and harvesting
        - Pesticide control
        - Trucks or drones
      - Crop health
        - Soil health, alerts and maintenance using IoT sensing
        - Drone imaging (NDVI or RGB maps)
        - XR display on tractors
  - Growing Population (indirectly)
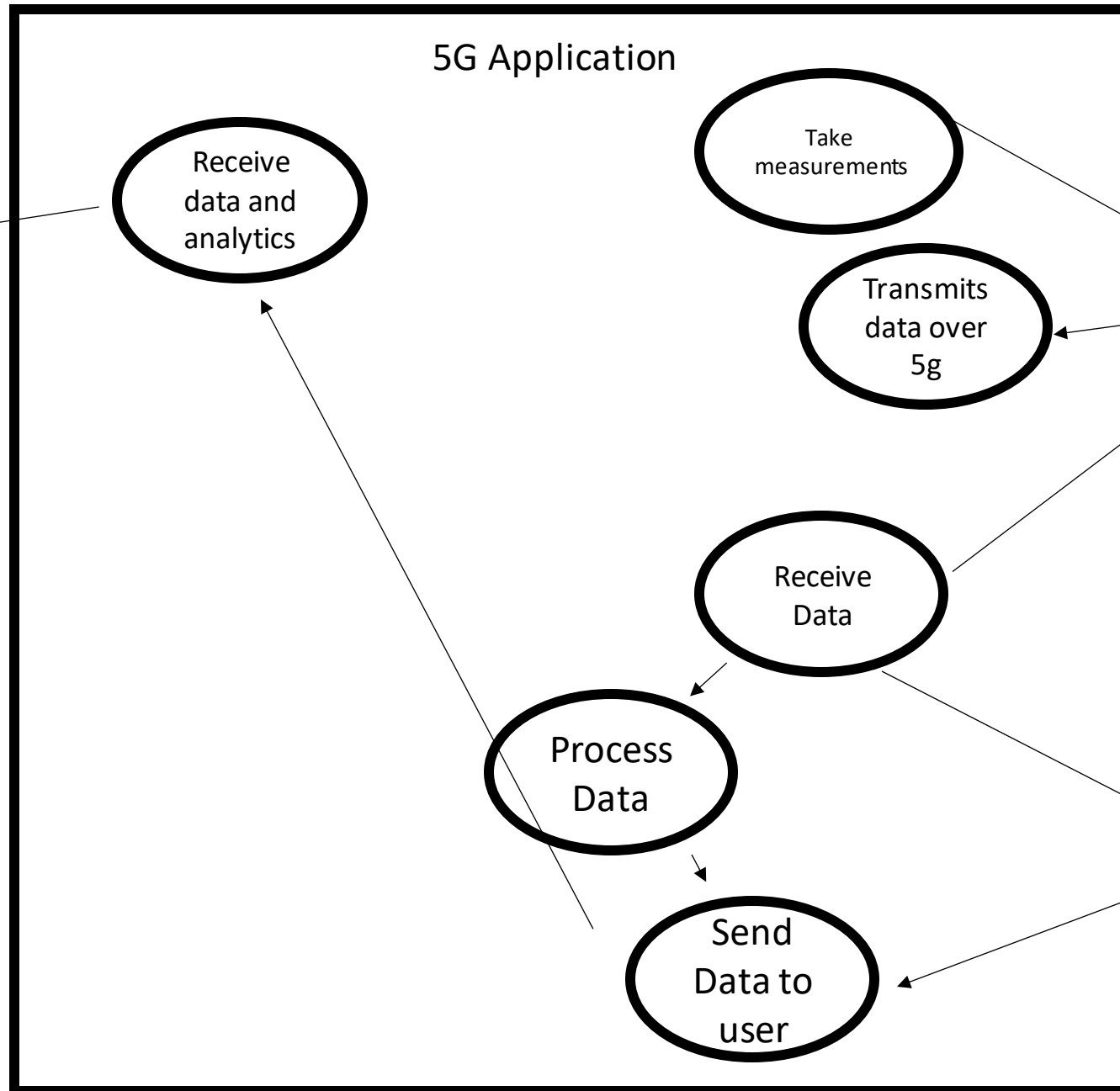   - Higher crop yields to sustain a growing population

Use-Case Example Diagram
Application of IoT sensing and ARA network for precision/smart farming