Integration of a Customizable, Modular Payload into a Pixhawk-Based Unmanned Aerial Vehicle (UAV)

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Introduction & Motivation

- Development of payload for intelligent radiation mapping compatible with Pixhawk-based drones
- Training and simulation using Wi-Fi sensor as radiation simulator
- Capacity as standalone unit for any sensor for research, education and outreach

Technical Approach

- Enclosure designed with SolidWorks, manufactured using Bambu Lab X1 Carbon 3D printer
- Multilayered payload with customizable walls and plates
- Raspberry Pi 4B microprocessor compatible with various sensors
- Modular layers allow sensors to be changed quickly

Figure 1: Bambu Lab X1 Carbon 3D printer

Results

- Components compatible with design
- Easy wiring with removal of sides and layers
- Not weather resistant

Figure 2: Computer-aided design model of modular payload

Conclusion

- Payloads compatible with commercial UAVs
- Reduced cost and development time due to modularity
- UAV applications expanded

Next Steps

- Selecting radiation detector
- Weatherproofing
- Test flight with payload
- Engage outside students

Preliminary Design of a WiFi-Sensing Payload for an Intelligent Radiation Awareness Drone (iRAD)

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Introduction & Motivation

- WiFi signals and gamma rays both 1-over-r-squared
- Need to test radiation search and mapping approaches (HazNav), WiFi simulates radiation
- Integration of WiFi sensor into payload useful in research, training, education

Technical Approach

Arduino IDE

- Coding studio
- Serial monitor
- Micro USB to sensor

Search/Mapping System

- Raspberry Pi 4B
- C++ or Python
- Interface to Pixhawk

Sensor

- Espressif Systems ESP32 MCU
- C++ programmable
- Integrated continuous WiFi scan

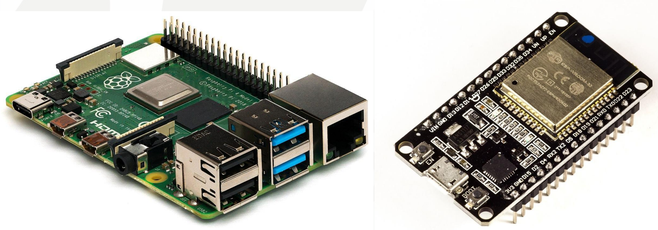

Figure 3: Raspberry Pi 4B (left) and ESP32 (right)

Results

- ESP32 successfully scanned nearby WiFi networks
- ESP32 and Raspberry Pi 4B communicated effectively

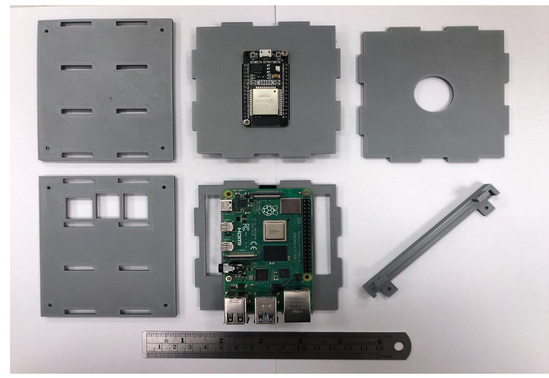

Figure 4: Disassembled modular payload with Raspberry Pi 4B and ESP32

Conclusion

- WiFi-sensing is low cost and effective for testing
- MCU-IDE- Raspberry Pi triad compatible with customizable modular payload

Next Steps

- Test payload on iRAD
- Ensure output compatible with algorithms & navigation
- Field tests

Mission Relevance

- *Applications in monitoring and response*
- *Opportunities for student research*
- *STEM education in nuclear engineering*

Expected Impact

A versatile payload enabling widely available drones to be used to map radiation and WIFI signals

MTV Impact

- *Student research and support*
- *Presentations*
- *Publications*

This work was funded in-part by the Consortium for Monitoring, Technology, and Verification under DOE-NNSA award number DE-NA0003920

National Nuclear Security Administration