UAVPayloadTAQ

Interface Control Document

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Revision Record

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1.0	Initial Issue	23 October 2020	Alexander Iftene

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Definitions

UAVAQ	Unmanned Aerial Vehicle Payload
UAV	Unmanned Aerial Vehicle
QUT	Queensland University of Technology
ConOps	Concept of Operations
PMP	Project Management Plan
RC	Radio Controlled
USB	Universal Serial Bus
FTP	File Transfer Protocol
RxTx	Receiver
UART	Universal Asynchronous Receiver and Transmitter
GCS	Ground Control Station
ICD	Interface Control Document

1 Introduction

The Interface Control Document (ICD) details the hardware and software interface points within a system. Its objective is to provide an understanding of underlying communications and connections between subsystems that allow the system to operate correctly. By understanding the interfaces within the system, one can recreate or modify subsystems independently without affecting other subsystems within the system. Any changes in the interfaces of the UAVPayload^{TAQ} system will be reflected in updated versions of this document.

1.1 Scope

This document is to serve as a guideline for all the connections and interfaces of the UAVPayload^{TAQ} project. The ICD serves as a lower level description of the system compared to the system architecture. The ICD will identify individual connectors and data mediums and their purpose eg. Power, data etc. It will cover only the systems and subsystems that are in the scope of the project and not external systems like the UAV.

1.2 Background

The client QUT Airborne Sensing Systems have commissioned group 2 from EGH455 to design and build a system capable of providing continuous air quality sampling and pre-defined target identification data to a Ground Control System (GCS). The system is to be comprised of a standalone payload enclosure which will contain the necessary sensors and low power computer to process and relay the data from the sensors to the GCS. The enclosure is to be mounted onboard a UAV. The GCS is to provide visualization of the air quality data and target information data via a web interface in real time. The system is to be able to detect the two different types of targets in any arbitrary order. The air quality data to be sampled from on board the UAV includes air temperature, humidity and $C0_2$ levels. More detailed client requirements can be found in RD/1 and RD/2.

2 Reference Documents

2.1 QUT Documents

RD/1	UMPAYLG2-SUP-Customer Needs	UAVPayLoad Project: Customer Needs for 2020
RD/2	UMPAYLG2-PM-System Requirements	UAVPayLoad Project: System Requirements for 2020
RD/3	EGH455 Lecture Slides	EGH455 Lecture Notes – Felipe Gonzalez
RD/4	UMPAYLG2-IP-FD-01	Image Processing Subsystem Final Design
RD/5	UMPAYLG2-AQ-FD-01	Air Quality Subsystem Final Design

3 Interface Architecture

The system architecture below displays the system broken down by subsystems and demonstrates the interfaces between. The interfaces incorporate physical connections for data transmission and for power transfer. Wireless interfaces for data transmission across large distances is also accounted for. These interfaces form the basis for the interface control document.

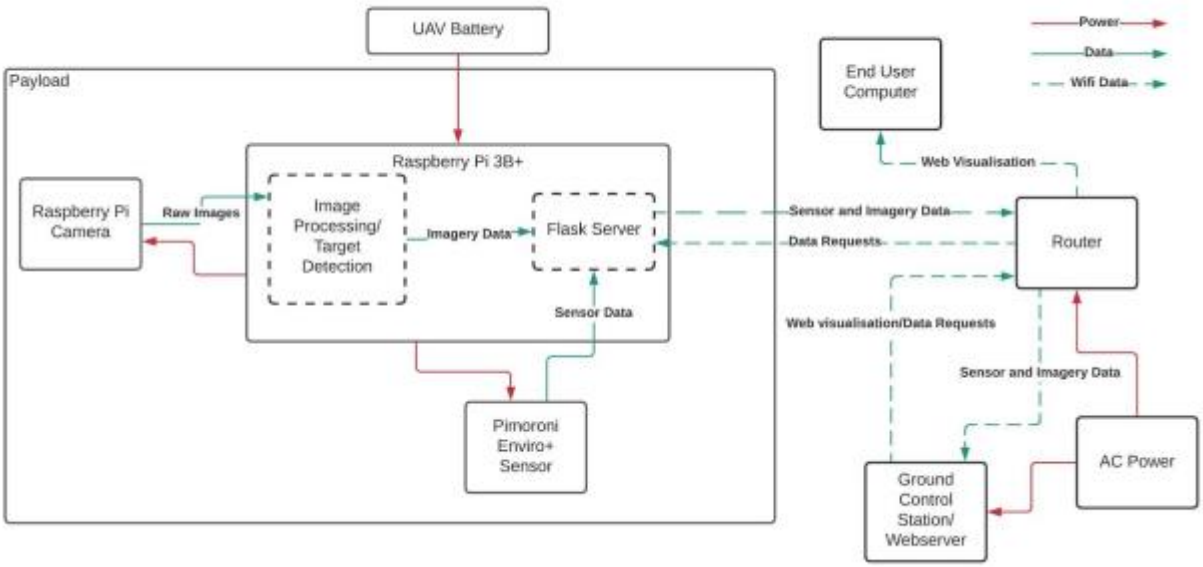
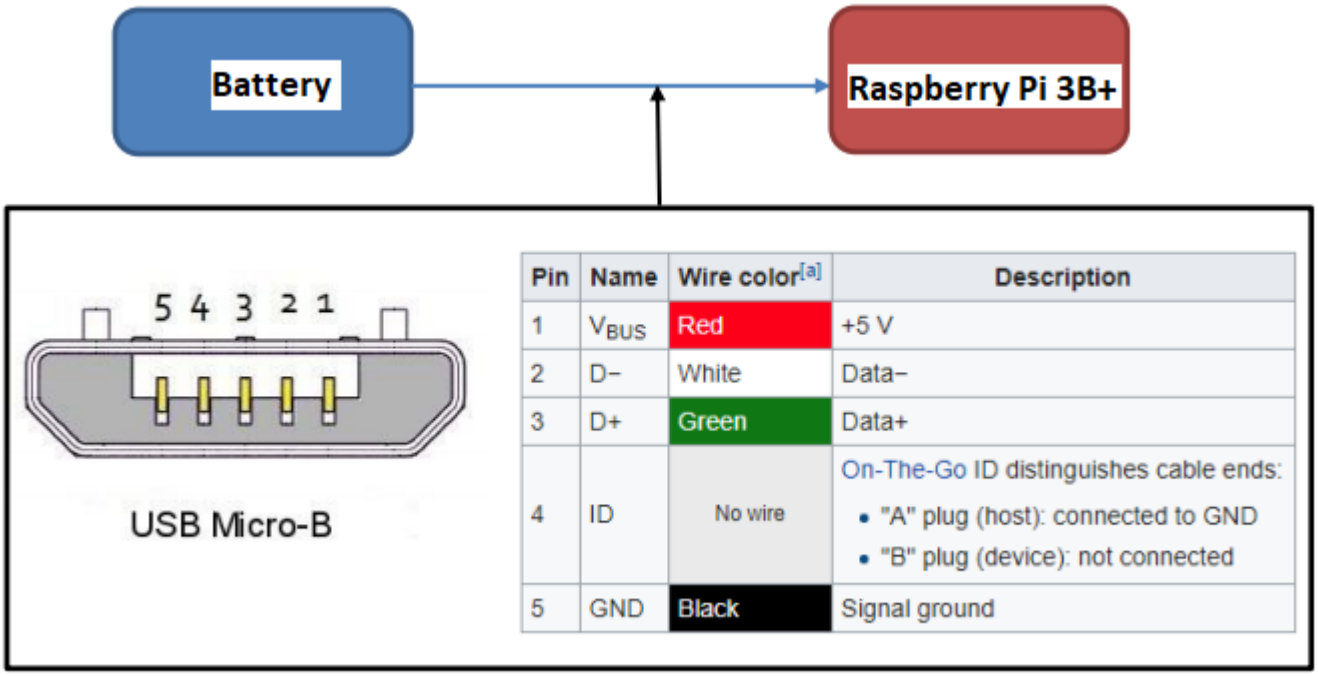


Figure 1: System Architecture with labelled Interfaces.

4 Subsystem Interface Specification

4.1 External Power Supply with Raspberry Pi 3B+ Board

The interface below utilizes an external power supply which is in this case a rechargeable battery which is attached to the UAV. The Pi itself is also a power interface for other interfaces that will be discussed later. The interface is only required to supply power from the external battery to the Raspberry Pi at a minimum of 2 Amps at 5V. This power is supplied via a micro USB type B cable as shown below. The only pins used for this interface to operate are 1 and 5 which direct 5V of power to the VCC.



Pin	Name	Wire color[a]	Description
1	V_{BUS}	Red	+5 V
2	D−	White	Data−
3	D+	Green	Data+
4	ID	No wire	On-The-Go ID distinguishes cable ends: • "A" plug (host): connected to GND • "B" plug (device): not connected
5	GND	Black	Signal ground

Figure 2: External Power Supply with Raspberry Pi 3B+ Board Interface

4.2 Raspberry Pi Camera with Raspberry Pi 2 Board

The interface between the Raspberry Pi camera and the Raspberry Pi 2 board is a proprietary interface developed by Raspberry Pi. It is both a power and data interface system. The connector is a flat cable ribbon with pish pin on both ends. The pinout is shown in the diagram below which has been sourced from RD/4.

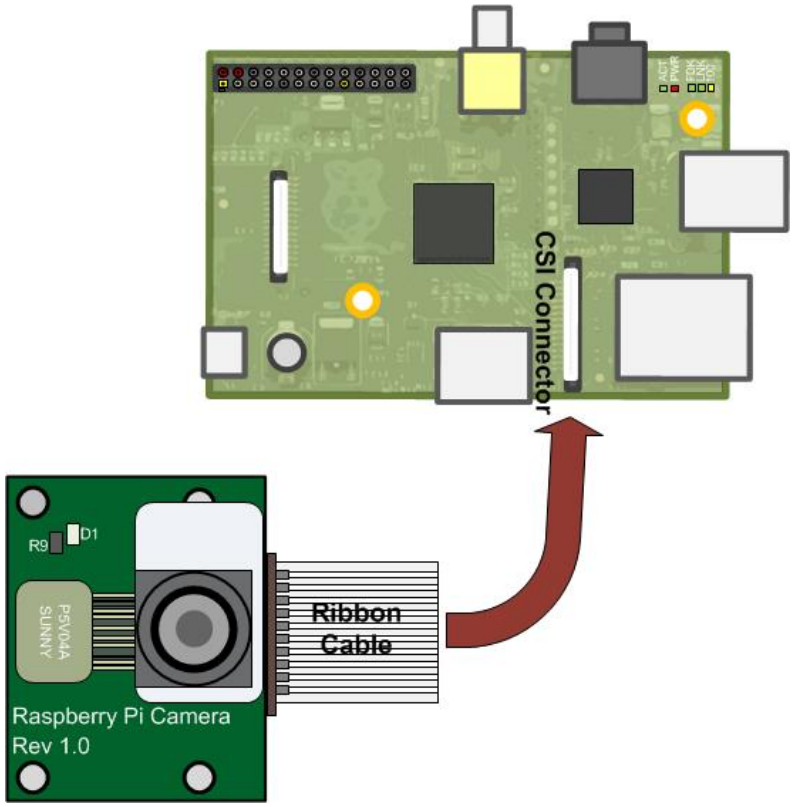


Figure 3: Raspberry Pi Camera with Raspberry Pi 3B+ Board Interface.

4.3 Pimoroni Enviro+ Sensor Hat with Raspberry Pi 2 Board

The Pimoroni Enviro+ Sensor Hat interfaces with the Raspberry Pi 3B+ board with a power and data interface. The sensor receives power from the Raspberry Pi 3B+ via the 3.3V line and transmits data containing current temperature and humidity of the air to the Raspberry Pi via an I^2C communications interface. It is a simple plug and play into the male GPIO headers which the Enviro+ uses power from the Raspberry Pi.

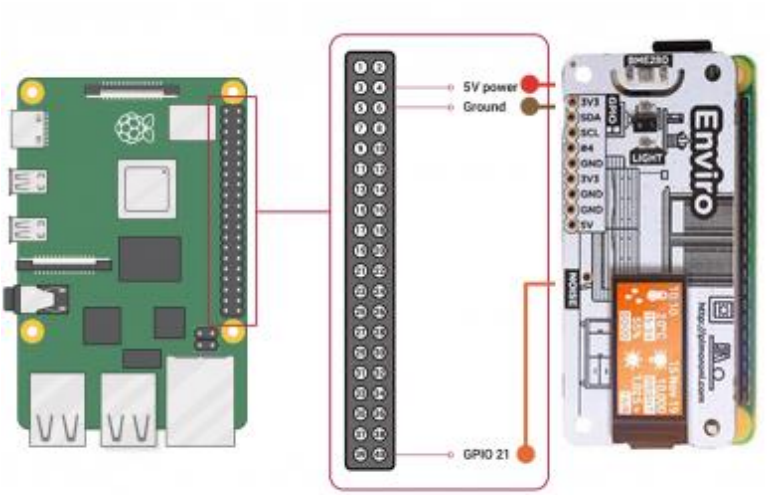


Figure 4: Pimoroni Enviro+ Sensor Hat with Raspberry Pi 3B+ Board Interface.

4.4 Mains Power with WiFi Router

The mains power interface with the WiFi router is for power transfer only. It operates on the standard Australian mains power specification AS/NZS 3112 which operates at 230V RMS at 50Hz.

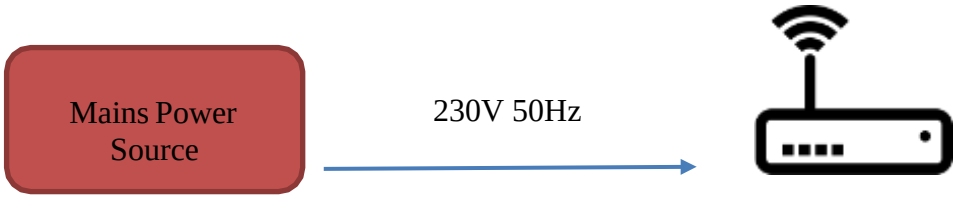


Figure 5: Mains Power with WiFi Router Interface

4.5 Mains Power with Ground Control Computer

The mains power interface with the ground control computer is power transfer only. The power is received by the in built battery of the computer which then powers the on board systems of the computer. It also operates on the standard Australian mains power specification AS/NZS 3112 which operates at 230V RMS at 50Hz.

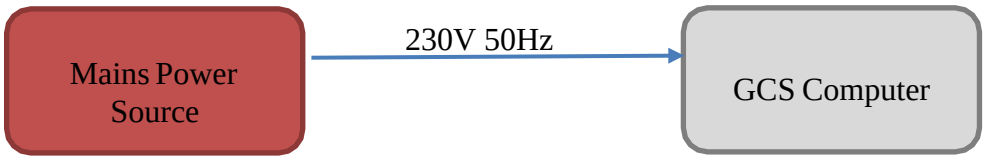


Figure 6: Main Power with Ground Control Computer Interface

5 Conclusion

The ICD document is designed to demonstrate the interfacing of all the peripherals located on and off the payload. The interfaces allow for the full functionality of the peripherals and for them to receive the necessary power and data communications internally and externally to the system. This document allows for the reproduction of the system and makes the modification process simpler and more available.