Raspberry Pi Powered Quadcopter

About

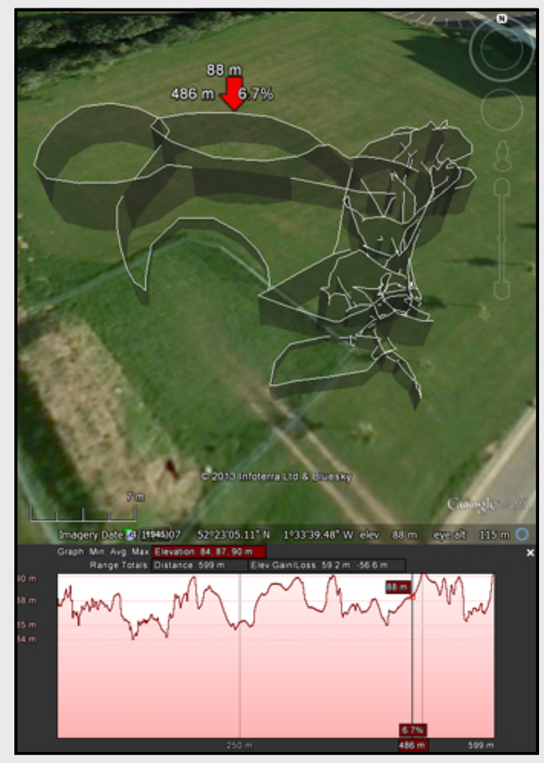
The project investigated the feasibility of using a Raspberry Pi to control a quadcopter in a rural environment for agricultural purposes where GPS signal is strong and cm accuracy would not be required. The project involved designing electronics to support the Raspberry Pi and integrating sensors before programming the control system and conducting test flights.

Raspberry Pi

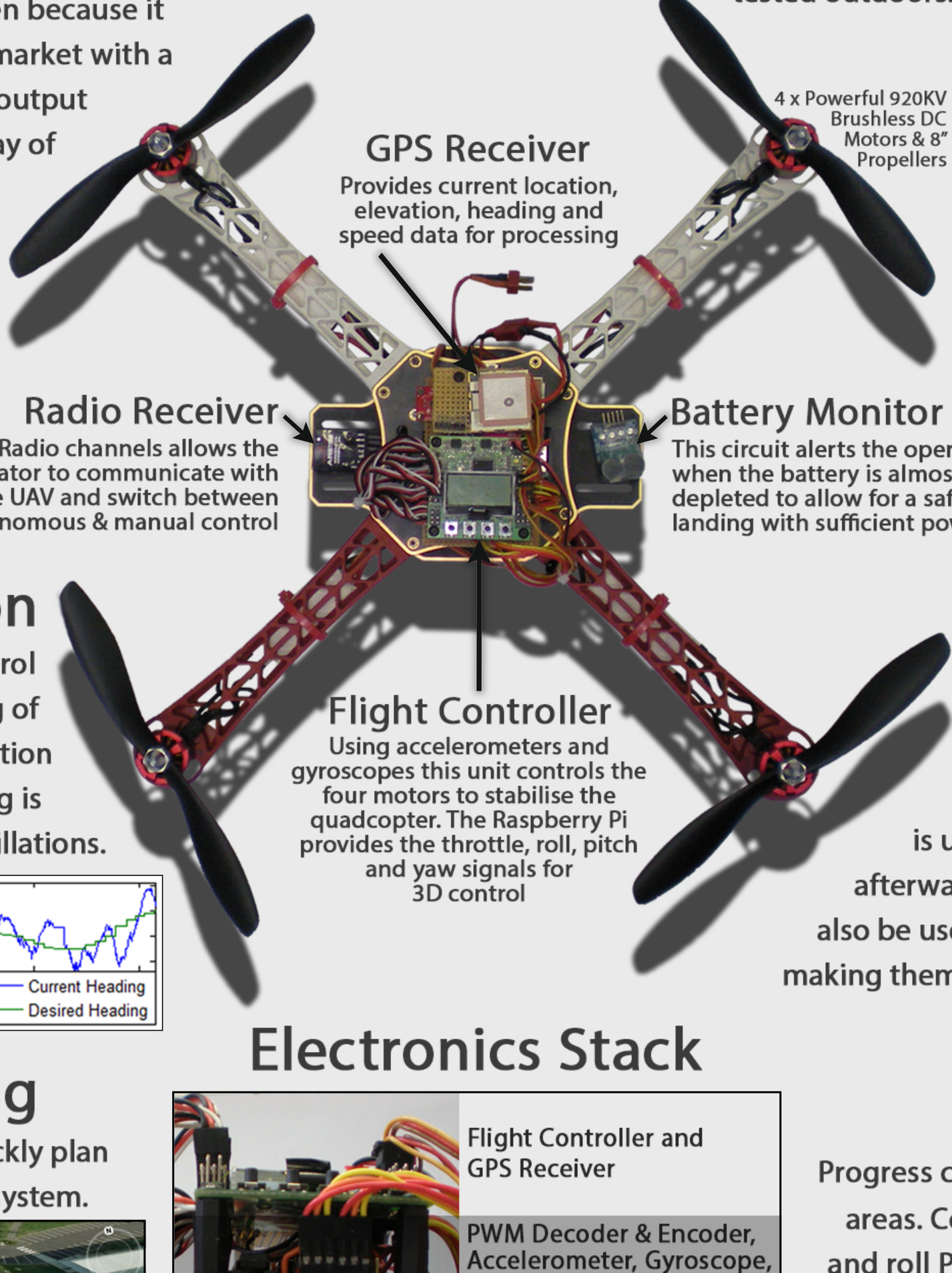
The Raspberry Pi was chosen because it was a new product on the market with a diverse range of input and output connectors allowing an array of sensors to be attached and processed by the 800MHz internal processor. Being a complete computer, advanced features could be added such as its own WiFi network.

Autonomous Flight Progress

The control system understands waypoint information from Google Earth and calculates the distance between waypoints and the bearing to the next waypoint. It changes direction to head towards the next waypoint but currently requires user input to move forwards towards it. Control loops for pitch and roll have also been written but further analysis is required before these can be field tested outdoors.

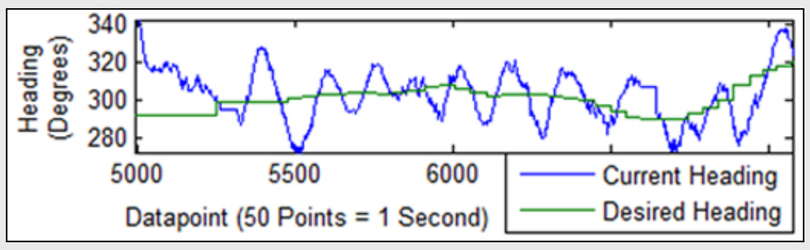


Flight path of the quadrotor plotted on Google Earth over 8 minutes during semi-autonomous flight with elevation data graphed



Yaw Correction

The graph displays the control system altering the heading of the quadcopter to the direction of the next waypoint. Tuning is still required to remove oscillations.



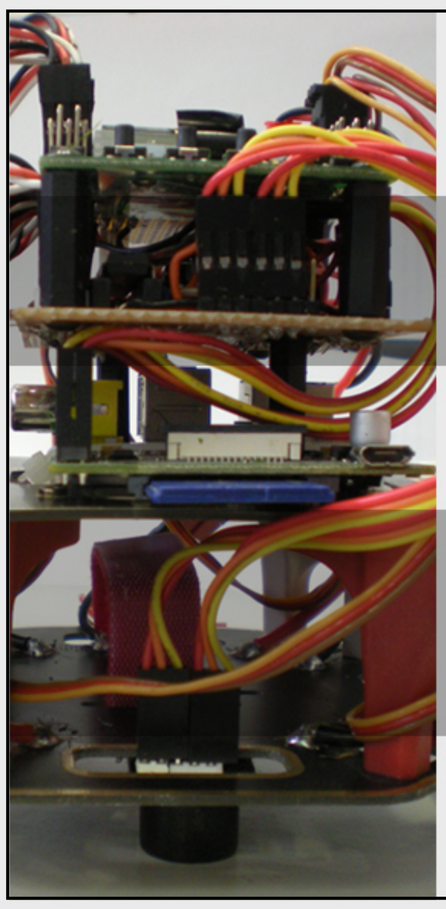
Data Logging

As well as controlling the flight of the quadcopter, the Raspberry Pi also logs all of its sensors data which is useful in analysing the flight afterwards. This information could also be used to geo-tag photographs, making them easier to work with during analysis or photo stitching.

Flight Planning

Google Earth is used to quickly plan flight paths for the control system.

Electronics Stack



Flight Controller and GPS Receiver

PWM Decoder & Encoder, Accelerometer, Gyroscope, Magnetometer & Power Conversion

Raspberry Pi Onboard Computer with WiFi Access Point

Lithium Polymer (LiPo) Battery Housing

Ultrasonic Rangefinder (15 cm to 5 meters)

Future Work

Progress can be made in a number of areas. Continued work on the pitch and roll PID loops would enable safe autonomous flight. Addition of a pressure sensor would provide accurate altitude information above 5m allowing accurate throttle to be applied to maintain its altitude during hover or forward flight.

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