Good afternoon, Hasim,

As I mentioned on Friday, I am sending you a description of the new project!

The project's goal will be to prepare software to measure the basic performance parameters of the UAV. The key attributes are reliability, low weight of the developed device, and appropriate sampling frequency of the measured data. On this topic, I did a lot of pre-study as experiments, but I found some trouble all the time. The critical measure value is RPM.

As I mentioned above, the device will be used on a UAV (drone); therefore, hardware should contain the lowest number of modules with minimal size and weight. What must be measured? The first is time; it doesn't matter if it will be real or machine time. Other parameters are DC and voltage of the battery, accelerations in all axis, rotations in all directions (roll, yaw, and pitch), barometric pressure, temperature, turn of 4 motors each separately, airspeed and GPS data – see attachment.

I tried some sensors in the pre-study, and I would like to use them in a new solution. To measure DC in the battery output, use Hall sensor WCS 1700 or WCS 1800; for accelerations and rotations of drone measured, I recommend using the GY-87 module with MPU6050 sensor. GY-87 module also consists of a BMP180 sensor for measured pressure and temperature, which are excellent pros! To measure motor turns, we can use a Hall sensor or measure turns indirectly via the current frequency (engine is fed through ESC). The airspeed sensor I recommend MS4525DO. I didn't choose any specific module/sensor to measure GPS data, but Neo-7 will be the best choice because it has a high sample rate. The device can measure the battery voltage through a voltage bridge on analog input of PCB. Another question is the sample rate.

I am not sure, but I think that the sample rate of all measurement parameters must be the same - all depend on the "slowest" module ... Therefore, I suggest Neo-7 because it has 10Hz (in comparison model Neo-6 has a sample rate of just 5Hz). The measurement data can be as in .txt as in .csv format, don't matter, the most important is still that recorded data must be measured synchronic in time!

How will it be working? Straightforward control and signalization. The device will be on a UAV – like a power source will be used a battery of UAV. If I turn on the UAV (insert a battery), a developed device will have energy and turn on. The hallmark will be a 2 second light of red diode. After 2 seconds, the light turn off and start initializing and calibrating sensors. Essential is the calibration of the MPU6050 chip for a correct measure of rotations around x, y and z axis (roll, yaw and pitch). If initialization and

calibration are done (and correctly) red diode will continually shine. If I click on the button, I start with recording data.

The recorded file will consist of record time – real or machine time [ms or s]; direct current of battery [A]; voltage of battery [V]; airspeed via MS sensor [m/s], GPS data like longitude, latitude, number of satellites, altitude and ground speed; accelerations in axis x, y and z [m/s2]; rotations - roll, yaw, pitch [°]; barometer pressure [Pa], temperature [°C or K], turns of motor 1 [RPM]; turns of motor 2 [RPM]; turns of motor 3 [RPM]; turns of motor 4 [RPM]. Sample rate 10Hz. During recording time must blink red diode. After the second push of the button, data recording will end, and files will be closed. When the device is ready for another measure red diode again will shine continually. I suggest used Arduino Nano RP2040; what do you think? As I read, if we use this Arduino, we can use machine time of Raspberry processor which is integrated on Arduino so we won't need external real time module.

In the attachment is a table with parameters which are necessary recorded, units, suggested sensors, and down are a small tips on how can be measured turns in RPM with high accuracy – once again, turns are one of the essential parameters, so please test it on the motor which has range of turn to 6.500 RPM. Figure 1 shows an elementary diagram of how it should work. Also I sent you old code of device; I think that you find there a lot of information how code MS4525DO sensor and also a logic of device.

What is your time and price estimation? Honest I am a little bit under time pressure. Thank you for your quick answer.

Best regards,

Stanislav

Link for inspiration of RPM measure:

https://www.youtube.com/watch?v=u2uJMJWsfsg&ab_channel=InterlinkKnight

https://solarduino.com/how-to-measure-ac-frequency-with-arduino/#:~:text=I%20highly%20recommend%20to%20use,use%20one%20of%20the%20pins