Re: Small low−cost embedded board for model airplane

Source: http://coding.derkeiler.com/Archive/General/comp.arch.embedded/2006−09/msg01542.html

- *From*: paul$@pcserviceselectronics.co.uk (Paul Carpenter)
- *Date*: Mon, 25 Sep 2006 12:07:40 +0100 (BST)

On 25 Sep, in article
<1159180320.180108.71190@xxxxxxxxxxxxxxxxxxxxxxxxxxxx>
gnuarm@xxxxxxxxx "rickman" wrote:

> CBFalconer wrote:
>
> > Robert Adsett wrote:
> >
> > > Paul Carpenter wrote:
> > >
> > > > albertgoodwill@xxxxxxxxx "Albert
> > > > Goodwill" wrote:
> > > >
> > > > > * ADC (Analog to Digital
> > > > > Converter)
> > > > > 13 channel (simultaneous
> > > > > sample hold is desirable)
> > > > > 16 bits resolution
> > > > > it will be used to capture
> > > > > 1000 samples/ second
> > > >
> > > > <snip>
> > > >
> > > > I would have expected for these types of
> > > > sensors a sampling rate
> > > > of 10 to 20Hz per channel giving 130 to 260
> > > > samples per second.
> > > > Considering the nature of the sensors being
> > > > slow response and the
> > > > application simultaneous sample and hold
> > > > seems unnecessary.
> > > >
> > > > <snip>

> Following are the sensors to
> be connected to the
> embedded board
> Sensors with analog outputs
> * 3 axis accelerometers
> (0−5v or 0−3.3v analog
> outputs)
> * 3 axis gyros (0−5v or
> 0−3.3v analog outputs)
> * 3 axis magnetosensors
> (0−5v or 0−3.3v analog
> outputs)
> * 2 pressure sensors (0−5v
> or 0−3.3v analog outputs)
> * 2 current sensor
> (0−500mv outputs)
>
> Except for the current sensors, the rest have
> response times,
> that mean the output changes if you are
> lucky at 10Hz. See
> comments above about A/D. I actually doubt
> that the current
> sensors (probably for measuring power
> supply load to this
> board and main radio control) actually need
> to be monitored
> more than 1Hz anyway.
>
> I would also question the need for 16bits of resolution. I doubt any of these sensors have more than 10 or at most 12 bits worth of signal. Actually I wouldn't be surprised if 8 bits was overkill.
>
> Albert, you need to ask what is the resolution you need for acceptable results and also what resolution the sensors are capaple of.

The OP might also reconsider the need for sample and hold. A characteristic of successive approximation a−d converters built out of d−a conversion is that they always measure a value that existed somewhere withing the conversion period. A further advantage is that the multiplexing can be done entirely digitally, so that the cost of an added channel is that of a single comparator (and possibly a front end op−amp). D−a converters are generally much cheaper. The front end op−amp can easily implement anti−aliasing filtering, besides the gain and impedance matching.

> I think the reason he wants the sample and hold circuits is to measure
> the values at the same time. I am sure he is going to merge the data
> to calculate his position and orientation. I expect this is easier if
> you have data that is updated at that same moment rather than data that
> is spread out in time.

Considered the response time of the sensors, along with all the other issues
a 10Hz to 100Hz per channel sample BURST at 10 bits then averaged will be
so close to same instant as to make no difference. I doubt he will see large
changes on most of his signals anyway, without venturing in most countries
into CONTROLLED AIRSPACE.. (usually above 1500 feet).

Most of his signals will need front end amps to amplify the region he is
interested in, as well as deal with all the other issues.

Basically his initial requirements, have many issues not least to get all
that in, with its batteries (even for very short flight time) will be
a large weight, so without knowing the payload[1] capacity of the airplane
and then flight time it is difficult to achieve any sensible answers.
His other major issue is the position of three aerials (Radio control, data
and GPS) to not interfere with each other and best position for normal use.
E.G. GPS on top, others below and spaced away from each other, GPS and
anything they could foul.

[1] Be interesting to see about how this is mounted to not affect the
stability and performance of the airplane.

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