Progress Report #2

Project Banner here. (Manuel)

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1 Block Diagram Version 2

Contents of Block Diagram V2 section will be written here

2 MCU Selection

For the selection of our microcontroller, we started by considering various factors. These were:

- **Architecture** - At first we did not consider the architecture was a factor we should heavily worry about. However, once we realized the labs of the course will be made exclusively with assembly language (ASM), we had to verify how said language varied between architectures. The ASM of the ARM architecture is different from that of the MSP430 architecture, so we had to learn various things of the language if we wanted to select an MCU with ARM architecture.
- **Data Bit Length** - *Aerobal* will be doing constant calculations and transmission of data. In theory, the data the system will process will not be excessively large. Therefore, the group thought that 16 bits should be enough. *Warning*: We will use a prototype miniature wind tunnel in the lab. *Aerobal* will work with out model, which will have a small home fan. It should work just as well with the wind tunnel in the Wind Tunnel Laboratory. However, we are aware that the data in the real wind tunnel will be bigger than the one we get in the lab. For this reason, more than 16 bits might be good just to make sure we have enough space.
- **Universal Asynchronous Receiver Transmitter (UART) Pins** - *Aerobal* needs two UART pins. One for Bluetooth connectivity, and another one for the LCD screen.
- I^2C **Pins** - We need an MCU with I^2C pins to interface with the barometric pressure sensor. Two pins should suffice.
- **Clock Speed** - Our slowest component will be the temperature sensor, which we have seen usually run at around $10\mu s$. Thus, we need an MCU that has a clock speed of at least $1/10\mu s = 100kHz$.
- **Analog-to-digital Converters (ADC)** - The wind vane and load sensors both are analog and need analog-to-digital converters to work with our MCU. Ideally, we would need four converters because there is one vane sensor and three load sensors. If not, then we would have to multiplex one of the converters.
- **General Purpose Input/Output Pins (GPIO)** - The following components of our embedded systems are connected through GPIO:
  1. Wind Speed Actuator
  2. Anemometer Sensor
  3. Humidity Sensor

4. LED's of User Interface
5. Buttons of User Interface

Thus, we will probably need more than 6 GPIO's for *Aerobal*.

- **Cost** - Besides the cost of the MCU, we also need to consider if we wanted to have a JTAG debugger. This was a huge factor, because not many MCU's come in a board (or a "launchpad") with an integrated JTAG debugger. Thus, if it does not come with it, we would need to buy a development board to have this functionality.
- **FLASH and RAM** - Although having big amounts of memory in our system is always great to have, it is not something we necessarily need. The MCU we select should be able to do all of it's processing with 8 kB of RAM. As of right now, we do not have any plans of storing data in FLASH memory.

	Tiva	MSP430F5528	PIC	Piccolo TMS320C2000
Architecture	ARM	MSP430	PIC	C28x
Data Bit Length	32	16	16	32
UART Pins	8	2	2	1
I^2C Pins	4	2	2	1
Clock Speed	80 MHz	25 MHz	7.37 MHz	100MHz
ADC's	2	1	2	1
GPIO	43	47	85	35
Cost (w/ JTAG)	$13	$175	$155	$100
RAM	32kB	8kB	16kB	12kB
FLASH	256kB	128kB	256kB	64kB

After considering all the points mentioned above, it is clear that our best option would be the Tiva C Series MCU. Primarily, it come with a JTAG debugger in it's launchpad (unlike the MSP 430), so we don't need to spend $149 on it's development board. Besides that, it also has more bits, more pins, higher clock speed, and more converters than most of the other options.

We add to that it's price of $13, so we can buy various MCU's in case we have accidentally burn the ones we have. Our main problem with this model is it's ARM architecture, so programming it in ASM will not be as easy as it would have been with the MSP 430.

MCU Selected: Tiva C Series TM4C123GE6PM

3 Operating Chart

Contents of Operating Chart section will be written here