Itasdi

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9th Balkan Open Competition in Software-designed Instrumentation

– individual competition

University of Belgrade, School of Electrical Engineering
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- Create a folder on desktop named PC xx (where xx is the number of PC) and save all files there
- Competition duration: 4hours

General application requirements

- Functionality
    - The application works when it is run
    - The application meets specifications listed in the following section
    - The application works in real-time
    - The application does not utilize 100 % of CPU time
    - In the case of an error, application operation ends automatically
    - Enable error handling
- Programming style
    - Ensure transparency in Block diagram
    - It is preferable to use Design Pattern (State machine, Events,...)
    - Be hierarchical in nature. All major functions should be performed in SubVIs
    - Create a clear user interface
- Documentation
    - All VIs should be well documented in English
    - Comments written in Block diagram
    - Descriptive names of controls, indicators, constants, VIs, SubVIs
    - Descriptive icons in VIs and SubVIs
    - Application organized in a Project file

Your task is to develop a software for our new product. It is an Isometrics system which consists of a load cell, an acqusuition box and software. USB-6008 is a part of acqusition box and software should be capable to acquire analog signal from this device. In the meantime, while we are waiting for our hardware design team to finish the development of acquistion box, you will use our demonstration box and USB-600x. For simulating the signal from load cell, potentiometer VR-1 should be used. Connect it with the analog input 0 of USB-600x. For this first version a fixed sample rate of 1kS/s will be used.

At the main screen 3 buttons are visible: *Calibration*, *Measurement* and *Open*. When the button *Calibration* is pressed a new screen for calibration is displayed. The title of this screen should be *Calibration*. Sensor (load cell) is linear, so two point calibration (y=A*x+B) is used. For calibration a known weight tag (kg) will be used. Upon finishing the calibration of the sensor, the calibration coefficients (A, B) are stored in a file. Beside the control for entering the weight, indicator with the force value should be displayed, where the last saved coefficients are used for the force calculation.

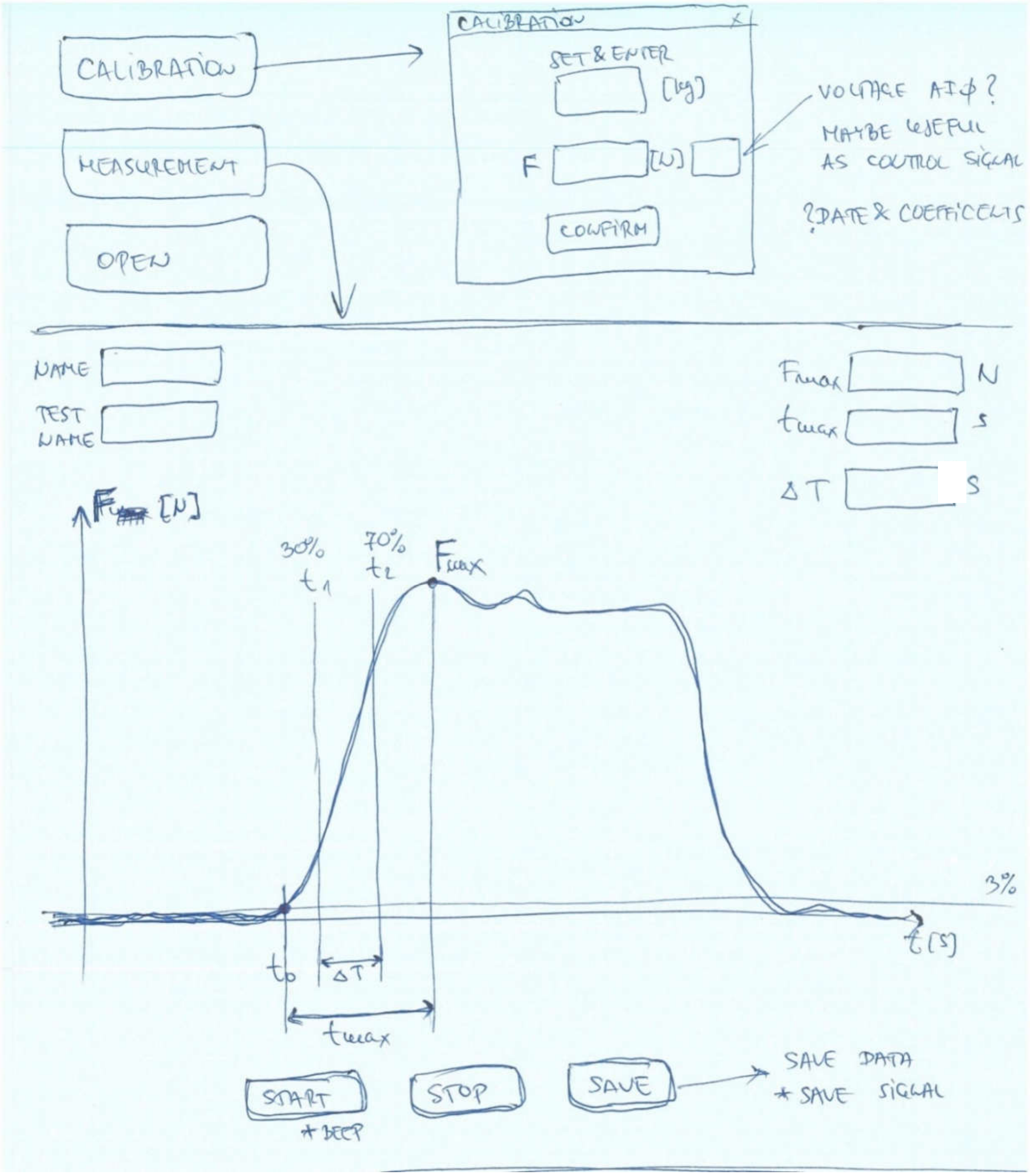
Upon starting the application, the button *Measurement* is disabled and grayed out if there is no file with calibration coefficients (if calibration was never done). When calibration is finished this button will become enabled. By pressing the *Measurement* button, a screen for measurement is shown. The title of this screen is *Measurement*, of course. On this screen there are the controls for entering the name of the examinee and test name. On the central part of the screen measured signal is displayed. The measured signal is the force of the muscle and its change in time should be shown on the graph. In the top left corner there are indicators: *Fmax* and *tmax*. You can see below the paper we got from the customer. There are also the control buttons: *Start*, *Stop* and *Save*.

After starting the *Measurement* screen, there is no data on the graph and all other controls and indicators. By pressing the *Start* button acquisition should start. By pressing the *Stop* button, acquisition is finished and *Fmax* and *tmax* values are calculated. *Fmax* is the maximum value of the signal in Newton [N], while *tmax* is the time when *Fmax* is reached calculated from *t0*. Horizontal cursor, with light blue color and without anotation, should be displayed. Position of this cursor is 3% of *Fmax* and calculation time *t0* is the time when signal cuts this 3% line. So, calculated *Fm* is *Fmax-F0*, where *F0* is the force value in *t0*. By pressing the *Save* button, name of the examinee, name of the test, *Fm* and *tmax* are stored in txt file where the file name is in this format: name_date.txt. If the *Measurement* screen is still open, by pressing the *Start* button again, the acquisition would start from the beginning, so graph and calculated parameters are cleared. If the signal is too noisy think about using a filter.

This is the version which our customer needs in the next few hours. After that we should do some upgrades:

- Milestone 2: set and display cursors *t1* and *t2* where *t1* is the time when 30% of *Fm* is reached and *t2* is the time when 70% of *Fm* is reached. New parameter *delta T=t2-t1* should be calculated and stored in the file. On the calibration screen date of calibration and analog value in volts as control signal should be displayed. This date should be saved into file together with the calibration coefficients.
- Milestone 3: one button should be visible, *Start* or *Stop* or one button with different text could be used. If the acquisition is not running the button *Start* (text Start) is visible. When it is running the button *Stop* is visible. By pressing the *Start* button beep sound with duration of 500 ms should be activated to indicate the start of the measurement.
- Milestone 4: In addition to the previous data, complete signal should be saved in a file.

- Milestone 5: By pressing on the button *Open*, user should choose the file and saved signal with all parameters should be displayed. This screen should be the same as measurement screen after acquisition is finished. Add configuration part, where name of the examinee, test name and sample rate would be entered.



Of course you can make some additional modifications if you have good ideas. For everything not defined, please use a reasonable assumption.