**Digital Signal Processing (DSP) Lab**

**DSP topic:** Study of application autocorrelation function for analysis of signals

**Date of Experiment: 27th January 2020**

**Objective**: Compute pulse rate (PR) from a PPG signal and pitch period of a speech signal using autocorrelation function (ACF) in real time Arduino prototype platform. (Use both offline and real-time test signals)

1. For PPG signal, assume sampling rate of 100 Hz, and resolution of 10 bit, and frame duration of 5 seconds to compute the pulse rate from a PPG signal
2. For speech signal, assume sampling rate of 8000 Hz, and resolution of 10 bit, and frame duration of 30 ms to compute the pitch period from a speech signal

**Procedure**:

1. Compute autocorrelation function (ACF) for each frame with a specific frame duration by using the following expression

Rm= where m=0, 1,………N-1.

1. Find a maximum amplitude of ACF and its location from a first zerocrossing point (FZCP) as by following procedures as given below:
2. Compute location of a first zerocrossing point (FZCP) of the ACF sequence
3. Construct a window having the ACF values from a first zerocrossing point to last values of ACF vector
4. Compute maximum value of a window and also obtain its maximum location, Lmax
5. Compute the maximum amplitude location as given below,
   1. Lmax1 = FZCP + Lmax.
6. Compute a period of a signal as given below

P = Lmax1 / Fs.

1. Display period of a PPG/speech signal for each frame
2. Store the estimated period of a PPG/speech signal for 1 minute

**Experimental Result Verification (27th January 2020)**

**Pre-preparation for Completion of this Experiment**

* Autocorrelation function and its properties
* Generation of speech signal (speech production system) and PPG signal
* Pulse period range and pitch period range for different genders and age groups

**Final Submission (3rd February 2020)**

* Video demo of this experiment including the description of both concept and the source code.