



**Faculty of Engineering and Technology**

**Electrical and Computer Engineering**

**DSP Second Semester 20/21**

**Course project**

**About the course project:**

Teams of two students must do this project. The best arrangement is to choose a division of the project so that each of you can work on separate but interlocking parts. Individual work will not be accepted.

Learning teamwork is also one of the more general goals of this course, so team projects will pick up points for demonstrating a successful ability to work with others.

The projects will be graded based on a project report (of around 2-3 pages) as well as in E-Class short presentations or discussion in my office.

Project submission must be via Moodle only, but please use PDF format and **not** Word .DOC files if at all possible, since I often have formatting problems with Word files.

Your report must have the following structure, using these section headings :

**Introduction:** A general description of the area of your project and why you're doing it.

**Problem Specification:** A clear technical description of the problem you're addressing. Formulating a general problem (e.g., transcribing music) into a well-defined technical goal (e.g., reporting a list of estimated fundamental periods at each time frame) is often the most important part of a project.

**Data:** What are the real-world and/or synthetic signals you are going to use to develop and evaluate your work?

**Evaluation Criteria:** How are you going to measure how well your project performs? The best criteria are objective, quantitative, and discriminatory. You want to be able to demonstrate and measure improvements in your system.

**Approach:** A description of how you went about trying to solve the problem. Sometimes you can make a nice project by contrasting two or more different approaches.

**Results and Analysis:** What happened when you evaluated your system using the data and criteria introduced above? What were the principal shortfalls? (This may require you to choose or synthesize data that will reveal these shortcomings.) Your analysis of what happened is one of the most important opportunities to display your command of signal processing concepts.

**Development:** If possible, you will come up with ideas about how to improve the shortcomings identified in the previous section, and then implement and evaluate them. Did they, in fact, help? Were there unexpected side-effects?

**Conclusions:** What did you learn from doing the project? What did you demonstrate about how to solve your problem?

**References:** Complete list of sources you used in completing your project, with explanations of what you got from each.

The reason for this somewhat arbitrary structure is simply to help you avoid some of the more problematic weaknesses I've seen in past years. If you're having trouble fitting your work into these sections, you should probably think more carefully about your project.

### **Project description:**

The aim of this project is to build a hardware system by which LCD can be controlled by voice. When you say one of the following the words: "Hi", or "Bye". The spoken word with gender (Male or Female ) should be presented on LCD screen. In order to simplify the project and help you manage the project development, we divide it into two phases, as follow.

### **Part I: Building a simple Hi/Bye word recognition [40%]: (submission deadline Sun. 25/04/2021 11:55PM)**

In this phase, you need to develop and test a system (application) that can recognize the spoken 'Hi' and spoken 'Bye'. To do this, you need to have few samples of recorded Hi and Bye (each in separate .wav file and of the same sampling frequency). To make it gender independent, it is better to have a mix of male and female speech.

In order to distinguish Hi from Bye, the power spectral density which is based on FFT, energy and zero-crossing rate of the two signals should be studied.

To make the life easy, we build a tutorial for building yes/no speech recognition system using MATLAB, it would be very helpful for you to complete this task:

<https://www.youtube.com/playlist?list=PLnyw1IVZpaTsFgcU2QIK9x2jU8vIFaRB>]

In order to evaluate your system, you need to test (simulation) with a sufficient number of recorded (or live) Hi/Bye and find its accuracy (percentage of correctly identified tests). .

### **Part II: Hardware Implementation [40%] (submission deadline Tue. 25/05/2021 11:55PM)**

In this phase, you need to develop a hardware system (we recommend to use Raspberry Pi) with LCD and a microphone. You need to run your Hi/Bye system in Part I on the Raspberry Pi and show the spoken word with spoken gender on LCD as described earlier. You need to test your system carefully and report the accuracy in your report.

## **Project Deliverables:**

1- Mini-report as described above (**Report submission deadline Sat. 05/06/2021**

**11:55PM**)

2- 2- Your system implementation for phase I, phase II separately.

If you decide to use Raspberry PI, we recommend you to use Python to implement your Hi/Bye recognition system (Phase I) since it much easier to run python on Raspberry PI system. If you are planning to use different hardware kits, then you can use any programming language (including Matlab).

3- **Discussion deadline Sat. 05/06/2021 [20%]**