Research Project
Design, Implementation and Testing of Microprocessor Based Systems for Real-World Applications

I. **Research objectives:**

For a specified digital system, it is required to address the following issues:
1. System requirements and Specifications.
2. Theoretical design of the desired system.
3. Implement the system using Proteus.
4. Test plan and Output verification.

II. **Deliverables:**

1. System' Proteus files.
2. System's source code.
3. A Soft copy of the technical report includes the following:
   a. Problem Statement
   b. Objectives and Aims
   c. Proposed Solution
   d. Software Designs (Block Diagrams, Flow Charts)
   e. Implementation and test cases
   f. Output simulation results and discussion.
   g. Conclusion, Design issues.
   h. Future work

Note: Compress and send the whole files on one compressed folder.

III. **Assessment Criteria (100-Points)**

- 40-Points for the well formatted technical report and the oral discussion (see the template)
- 10-Points for the output simulation results
- 50-Points for the software application design.

IV. **General Notes**

- Plagiarism as Copying codes, Copying reports, Copying information from the internet or of any other form results in obtaining a grade F in the course.
- Proper Referencing should be done using IEEE format.

V. Selected Topics are:

1. Garage System

Project description: You should design a microcontroller based garage system that has a maximum capacity of 90 cars. The garage has 2 gates, one at entrance and the other at exit. Each gate has a sensor to sense if a car goes in or out of the garage. Each gate can be controlled by a motor, to open if a car needs to exit of the garage (exit gate) or enter the garage (entrance gate) while there's still free spaces in the garage. The garage also has a 2-digit 7-segment display to show the remaining number of free car slots (at start, all slots are free). Design simulation hardware and required software

Notes:

1. Use Atmel ATMega328PA or ATMega32 as the microcontroller.

2. You can use push buttons instead of gate sensors.

3. Use DC Motors at gates, that are activated by applying logic high on one pin of the motor and stopped by applying logic low, while the other pin is connected to ground.

4. Use External Interrupts.

2. Measurement system

Project description: You should design a microcontroller based voltmeter/temperature system. The system has 2 modes, mode 1 is to measure voltage and mode 2 is to measure temperature, a push button is used to switch between both modes. System has 2 LEDs, one for each mode, to indicate the running mode. In Mode 1, system measures volt applied on one of its ADC inputs and show the voltage reading on 2-digit 7-segment display as a floating number with 1 digit after the decimal point. While in mode 2, system reads temperature using a temperature sensor connected to one of the ADC inputs, and show the result on the 2-digit 7-segment display too. Over-heat alarm must be included, to keep giving beep sounds when the measured temperature exceeds 60 Celsius degrees, until temperature is back below 60 Celsius degrees.

Notes:

1. Use Atmel ATMega328PA or ATMega32 as the microcontroller.

2. You can use LM35 temperature sensor.

3. Use buzzer for providing the beep sound.

4. Use a potentiometer for providing variable voltage for testing the system.