Project

As a System Engineer you were asked to design a function generator to generate different wave signals to drive an autonomous robot. The system is using the 8051 microcontroller as to generate the waves, an overview of the system is presented in Figure 1.

The output functions needed for the robot are Rectangular, Sawtooth and Triangular waves with different frequencies.

The frequency of the wave is determined by four input bits (P3.0 to P3.3), the frequency range of the wave is 1kHz to 16 KHz. The type of wave is determined by two digital inputs (P3.4 and P3.5) as follows:

P3.4	P3.5	f(t)
0	0	Output is logic 0
0	1	Rectangular wave
1	0	Sawtooth wave
1	1	Triangular wave

The is a group project, each group is composed of 2 to 3 students. In this project you must design and implements the assembly code to generate the proper wave and frequency based on the user selection.

In your report you must:

a. Specify all parameters and assumptions used in your implementations.
b. Present the overall design of the system.
c. Show the assembly code to solve the problem.
d. Sample inputs and outputs with explanation and discussion
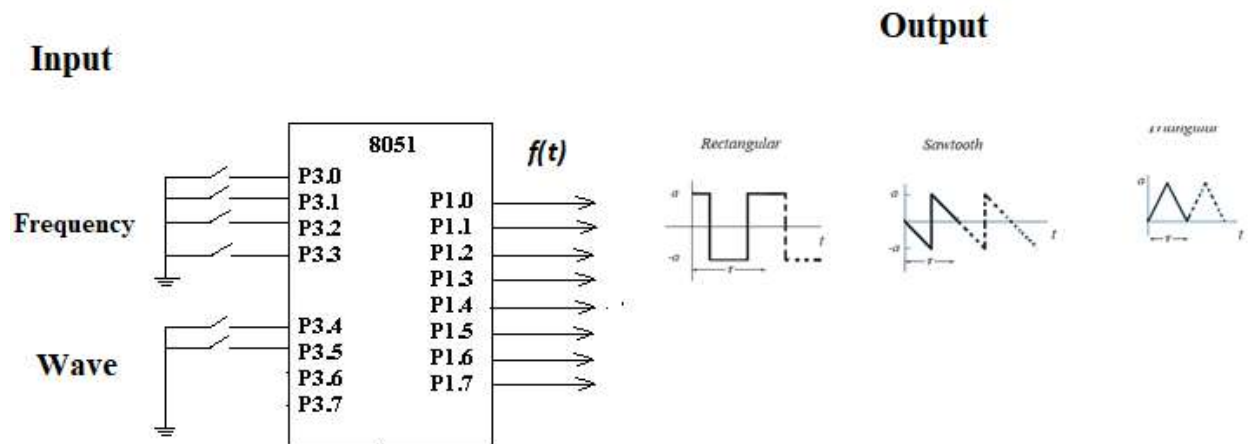
Figure 1: Function generator using the 8051 microcontroller.

Project Assessment rubric

Your project will be assessed base on the following rubric:

Aspect/Level	1 (Failed)	2 (Unsatisfactory)	3 (Meet with Restriction)	4 (Meet)	5 (Exceed)
Program correctness (4 points)	Majority of requirements was missing, incomplete and/or extremely inaccurate.	• Some basic requirements were implemented, with however several inaccuracies. • The product is not operational and/or producing incorrect results.	• Most requirements were implemented accurately. .	• Accurate implementation of requirements. • The product is operational and ready for deployment. • It works and produces the correct results and displays them correctly.	The product exceeds its expectation. Outstanding contribution, which showed exceptional perception and implementation of key ideas.
Readability, Coding Standards, Efficiency (2 points)	• Code is not readable, not efficient and does not produce any results	• The code is poorly organized, and very difficult to read.	• It is readable only by someone who knows what it is supposed to be doing.	• The code is fairly efficient without sacrificing readability and understanding. • It is fairly easy to read and understand.	The code is extremely efficient without sacrificing readability and understanding. It's exceptionally well organized and very easy to understand.
Report Structure (4 points)	Not organized and not well written (many grammatical mistakes)	Report is not well organized and not well written. Code and results are presented but with no explanation or discussion.	Report is organized and well written. Code and results are presented but with limited explanation and discussion.	Report is well organized and well written. Code and results are presented with explanation and discussion.	Report is exceptional: very well organized and is very well written. Code and results are presented with full explanation and discussion.

Report template

For your report use the IEEE template presented in the link:

https://www.ieee.org/conferences/publishing/templates.html

Suggested tool: Keil C51 assembler (student version available)

To download the assembler, please follow this link:

https://www.keil.com/c51/demo/eval/c51.htm

References:

[1] Mazidi & Mazidi. The 8051 Microcontroller and Embedded Systems: Prentice-Hall. ISBN 10- 1292027266, Nov 2013

[2] Craig Steiner, The 8051/8052 Microcontroller: Architecture, Assembly Language, And Hardware Interfacing : Universal Publishers,2005,ISBN-10: 1581124597