Knowledge Assessment

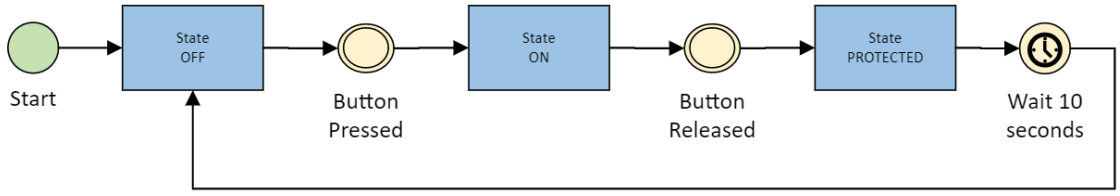
Embedded Electronic Systems

Version	Date	Created/ Modified by	Comment
01	2022-05-13	Caio Cordeiro Eloi Filho	
02	2022-05-16	Eloi Filho	Question 2 state machine definition updated.
03	2023-03-27	Eloi Filho	Questions 5 and 6 included.
04	2023-03-28	Eloi Filho	Version with emphasis on motor control

Contents

1. Question 1

Imagine a situation where you have an electronic board with a microcontroller and a button. You are required to check if the button is pressed (state ON) or not (state OFF) and for how long the button is kept pressed. If the button gets pressed, you also need to have a clear state definition ranging from ON, PROTECTED and OFF; as per the state diagram below. The protected state is defined as an intermediate stage between the transition from the ON state to the OFF state, so that each time the button is released, the button state changes to PROTECTED for 10 seconds before going to the OFF state. Implement this logic in a generic way using the C language and share this code through a public repository on GitHub. Low-level methods can be abstracted. If you prefer, use frameworks like Arduino, ESP32 or even other market platforms in this low-level code abstraction.



2. Question 2

Implement a function able to calculate and return the average, maximum and minimum value of an array with “n” positions. This function must also return a copy of the input array containing only the even numbers of the original array, as well as the new array size. Implement this logic using the C language and share this code through a public repository on GitHub.

3. Question 3

Field-Oriented Control (FOC) is a method that models and controls three-phase voltages/currents applied to a load as vectors. These vectors are generally split in two components: direct axis (denoted by "d") and orthogonal axis (denoted by "q"). Explain in simple words the advantages and disadvantages of such transformation, taking in consideration such implementation on a microcontroller.

4. Question 4

Describe how to control the speed of a permanent magnet synchronous motor without a speed sensor on the motor shaft. Represent your proposal in the form of a block diagram and explain each step.