**Networked Embedded Systems**

**Practicum 2: Accessing GPIOs**

**Group number: 8**

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# Theory Questions

*Answer the questions below in your own words, add diagrams, formulas, and calculations if necessary*

1. **Describe in your own words Timer Mode, PWM Mode, and Counter Mode. Which own use cases do you come up with?**
2. **Operation Mode: Timer with counter register**

*Describe verbally how this mode works. Then discuss the following example based on the diagram:*

*Ein Bild, das Text, Schrift, Screenshot, Electric Blue (Farbe) enthält.

Automatisch generierte Beschreibung Clock frequency: 10 kHz*

*Divider: 250*

*16-bit Counter Register at t = 0s: 65*

*When will the overflow occur? What happens after this overflow?*

1. **Operation Mode: Timer with capture event**

*Ein Bild, das Text, Schrift, Screenshot, Reihe enthält.

Automatisch generierte BeschreibungDescribe verbally how this mode works. Then discuss the following example based on the diagram:*

*Clock frequency: 200 MHz*

*Divider: 500 000*

*Capture Event: after 2 s*

*Capture the state of all registers at t = 2s, when the capture event happens? What is the state of these registers? How can the board calculate the time span from this register - as it doesn’t know that 2 s have passed?*

1. **Operation Mode: Timer with compare register**

*Ein Bild, das Text, Screenshot, Schrift, Reihe enthält.

Automatisch generierte BeschreibungDescribe verbally how this mode works. Then discuss the following example based on the diagram:*

*Clock frequency: 20 kHz*

*Divider: 10 000*

*Counter: 0*

*Capture Register: 0*

*Compare Register: 10*

*Specify all steps until the compare action is triggered, i.e., counter register, capture register and compare register - and relevant time stamps when any of these registers is updated.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time** | **Counter** | **Capture** | **Compare** | **Actions** |
| 0 us | 0 | 0 | 10 | none |
|  |  |  |  |  |

# Task A: Blink an LED with Timer Module

## Calculations

*All formulas have to be listed and explained. All parameters of this formula have to be listed and described in detail. Also list all values that you use for these parameters. For values that can be chosen by a developer, discuss why you chose a certain value.*

## Implementation

*Describe your solution. Add all relevant code snippets into a listing or as screenshots and describe their purpose.*

## Discussion

*Describe your experiences (e.g., design decisions, problems, lesson learned). Which part of the code will be reusable? Specify the difference between this task and task A from Practicum 1.*

# Task B: Vary the Brightness of an LED

## Calculations

*All formulas have to be listed and explained. All parameters of this formula have to be listed and described in detail. Also list all values that you use for these parameters. For values that can be chosen by a developer, discuss why you chose a certain value*

## Implementation

*Describe your solution. Add all relevant code snippets into a listing or as screenshots and describe their purpose.*

## Results

*Show the board with your LED on two different light intensity levels.*

## Discussion

*Describe your experiences (e.g., design decisions, problems, lesson learned). Which part of the code will be reusable?*

# Task C: Count Pulses of a Blinking LED

## Implementation

*Describe your solution. Add all relevant code snippets into a listing or as screenshots and describe their purpose.*

## Discussion

*Describe your experiences (e.g., design decisions, problems, lesson learned). Which part of the code will be reusable?*

# Index

## Figures

**Es konnten keine Einträge für ein Abbildungsverzeichnis gefunden werden.**

## Code Segments

**Es konnten keine Einträge für ein Abbildungsverzeichnis gefunden werden.**

## Tables

**Es konnten keine Einträge für ein Abbildungsverzeichnis gefunden werden.**