COMPENG 2DX3 – Theme Report: Observe

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Theme

Within the modern world, there are revolutionary technologies that shape the present and will also shape the future. In the past 20 years alone, there has been more technological advancement than in the last 500 years which is pretty outstanding. Most of these "revolutionary technologies" use systems that are "intelligent," but what exactly makes a system "intelligent." An intelligent microsystem has 3 properties, Observe, Reason, Act. Within this report, the main focus will revolve around the property, **Observe**. Observing in an "intelligent" system refers to the capability of the system to gather information or data from its surroundings.

Background

The inherent significance of the "Observe" property lies in its pivotal role as the foundational mechanism that grants intelligent systems access to subsequent actions. Its indispensability is exemplified in various applications, such as automated locks, where unlocking necessitates the initial step of gathering data from the surroundings. In the intricate landscape of microsystems, the capacity to "observe" stands as a prerequisite for full functionality, providing the system with the critical ability to collect and process data. This fundamental process of data collection is universally optimal and finds extensive application in diverse fields, including but not limited to the medical sector and the technology industry [2].

Consider, for instance, the current interaction with this text. As you read, the central processing unit (CPU) of your computer engages in the process of observation, discerning instructions on what to display. This exemplifies the quintessential role of observation as the foundational step in myriad applications. In a broader context, the aerospace industry illustrates the paramount importance of the "Observe" property. Devices and applications such as drones, air traffic control, and advanced guidance and navigation systems all adhere to a fundamental process – the initial act of observation [1]. By first observing and collecting data, these systems subsequently derive optimal reasons and execute actions based on the discerned information. In essence, the "Observe" property is not merely a preliminary step; rather, it is the linchpin of intelligent systems, shaping their functionality and efficacy across diverse domains.

Exemplars

Theme Exemplars & Synthesis

Throughout the initial three laboratories in COMPENG 2DX3, a distinct thematic emphasis centered around meticulous data observation. One noteworthy exemplification of this emphasis manifested in Lab 3, specifically tailored for the exploration of Analog Signals. This particular lab stood out for its dedicated commitment to the scrutiny of data, and the synergy with the Keil debugger provided a platform for a meticulous examination of values extracted from the microcontroller embedded within the constructed circuit.

Illustrating the theme of observation, Lab 3's milestones were underpinned by Milestone 1's foundational premise - the meticulous scrutiny of data collected and stored within a register. This initial milestone laid the groundwork for subsequent tasks, necessitating the derivation of averages from the collected data and its conversion into hexadecimal form. This critical step proved instrumental in obtaining digital values through the implementation of the Successive Approximation Register (SAR) method.

As the subsequent milestones unfolded, the thematic focus seamlessly transitioned to the sampling of data from an analog signal. These milestones showcased a strategic integration of data from registers, employed to generate graphical representations. In adherence to the rubric, detailed examples from the lab work are presented, incorporating relevant elements such as code snippets, circuit diagrams, flowcharts, and results. This holistic approach, emphasizing insightful data examination in tandem with practical applications, spotlighted the intrinsic importance of observation within the broader realm of microcontroller applications.p

The chosen exemplar provides a detailed exploration of the theme of Observation. The task involved a careful examination of data fed into the registers, aiming to assess the accuracy of the chosen sampling rate. This observation proved pivotal in identifying issues with the sampling rate, noticeable through both graphical representation and the data within the registers. The insightful analysis of data deviations facilitated the swift detection of anomalies, a crucial aspect expected of modern "smart" systems. In today's context, these systems are required to adeptly identify irregularities in data patterns. The seamless integration of a debugger and the watch tab not only underscores the need for real-time monitoring but also mirrors practices commonly employed by "smart" systems in real-world scenarios, as previously emphasized. This understanding of the exemplar aligns cohesively with the theme of Observation, demonstrating a nuanced comprehension of how closely monitoring and analyzing data is crucial in both the lab work and the broader context of "smart" systems.

Debugging Exemplars

During this thematic report, my laboratory partner and I employed various debugging methodologies, with a particular focus on utilizing the Keil Debugger. Given the introductory nature of this course, our first encounter with a microprocessor posed challenges, especially when confronted with unforeseen complications. The Keil Debugger emerged as a pivotal tool in our troubleshooting efforts, enabling a comprehensive visual representation of collected data and aiding in the identification of potential issues. The step-by-step analysis, coupled with the insightful use of the watch tab to monitor register data, proved highly effective. This granular information facilitated a systematic approach, akin to the decision-making process of an intelligent system, guiding our subsequent actions. Additionally, even in instances where no apparent issues were present, the debugger served as a valuable tool for gaining detailed insight into the ongoing processes. The incorporation of the Keil Debugger played a crucial role in enhancing our understanding of microprocessor operations and troubleshooting strategies, thereby contributing to a more informed and proficient engagement with the course material.

Reflection

In my initial exposure to microprocessors, particularly within the comprehensive scope of 2DX3, I find myself navigating uncharted territory. While I've dabbled with an ARDUINO previously, the depth and intricacy of 2DX3 surpasses my prior encounters. This newfound venture has proven to be a fertile ground for absorbing a wealth of knowledge, particularly through hands-on activities such as the labs.

The analog signal labs, in particular, provided a comprehensive exploration of data handling, storage, and processing intricacies within the microcontroller. Concepts introduced in 2DI4, where registers were emphasized as a form of memory, gained practical clarity as I witnessed their application firsthand. The intersection of theory and practice allowed me to grasp the inner workings of these fundamental components. Real-time monitoring, a pivotal facet of the Observe stage, unfolded as a critical insight gleaned from the Analog Signal lab and other exercises. The tangible experience enhanced my understanding of how this aspect functions in practice. The debugger emerged as a valuable tool, guiding me in detecting anomalies based on the microcontroller's observations—a noteworthy illustration surfaced in the Analog Signal lab.

Delving into the realms of intelligent systems and microprocessors underscored the centrality of data. Every move and decision within these systems pivot on the data they receive, intricately tying into the overarching theme of observation in this report. Navigating unforeseen challenges within the microprocessor realm proved instructive, offering valuable lessons on adaptation to unexpected scenarios. The collective experience of labs and studio sessions

significantly contributed to my comprehension of the adaptability and operations of intelligent systems. The paramount importance of the Observe aspect in the intricate dance of these systems became vividly apparent, solidifying its role as a linchpin in their functionality.

References

[1] R. Sheldon and I. Wigmore, "What is an intelligent system and how does it work?," WhatIs, https://www.techtarget.com/whatis/definition/intelligent-system#:~:text=An%20intelligent%20system%20is%20an,adapt%20according%20to%20current%20data. (accessed Feb. 18, 2024).

[2] "Observational data," Observational Data - an overview | ScienceDirect Topics, https://www.sciencedirect.com/topics/computer-science/observational-data#:~:text=Observational%20data%20is%20important%20in,data%20is%20mostly%20from%20observations. (accessed Feb. 18, 2024).