<table>
<tr><td>Project Title</td><td colspan="4">FPGA as a Microprocessor</td></tr>
<tr><td>Track</td><td colspan="4">School of Engineering & Applied Science, Electronics & Communication Dep.</td></tr>
<tr><td>Supervisor</td><td>Dr. Samah El-Shafiey</td><td>Mentor Name</td><td colspan="2">Dr. Samah El-Shafiey</td></tr>
<tr><td>Team Name</td><td colspan="4">Wireless</td></tr>
<tr><td rowspan="2">Team Members</td><td>Yousef Khaled</td><td>Mohamed Essam</td><td>Abdelrahman Hatem</td><td>Omar Ragab</td></tr>
<tr><td>Yousef Elbably</td><td>Khaled Hamed</td><td>Michael Hany</td><td></td></tr>
<tr><td>Problem Summary</td><td colspan="4">When startups begin to make their own microprocessor they will face the problem of microprocessor designing as it costs a lot of money and time due to its high complexity that any mistake could cause huge losses, While FPGA comes as a brilliant solution for this problem as it offers a cost-effective and flexible solution. FPGAs offer advantages such as re-programmability which is huge for correcting mistakes, reconfigurability, rapid prototyping which is beneficial if you want to jump from one project to another, parallelism and lower Non-recurring engineering (NRE) costs. This not only enables startups to develop innovative solutions at a lower cost but also contributes to technological advancements and the achievement of Sustainable Development Goals (SDGs) such as industry innovation and infrastructure, and decent work and economic growth.</td></tr>
<tr><td>Methodology</td><td colspan="4">ALU is an example of essential MPU circuits which startups need. The process of implementing an Arithmetic Logic Unit (ALU) involves designing and building a digital circuit that can perform arithmetic and logical operations on binary numbers. The first step is to determine the specific requirements for the ALU, including the types of operations it needs to perform, the range of numbers it needs to support, the precision of the results, and any other constraints or considerations. Next, the technology to use for building the ALU is chosen, such as a programmable logic device like an FPGA or discrete logic gates. The ALU circuit is then designed on software such as Intel Quartus, and implemented using block diagrams. Once the ALU is working correctly, it can be optimized for performance, power consumption, or other factors. Finally, the ALU is integrated into a larger system, such as a microprocessor or digital signal processor, and the interface between the ALU and the rest of the system is designed and tested to ensure it operates correctly. Throughout the process, following best practices for digital circuit design, testing and verification is crucial to ensure the ALU meets the requirements and operates correctly.</td></tr>
<tr><td>Achievements and Skills Gained</td><td colspan="4">Research
exploring FPGAs properties
Deal with Quarts application
Microprocessor basic design
Gain software tools Skills as VHDL programing
Team work
Design skills</td></tr>
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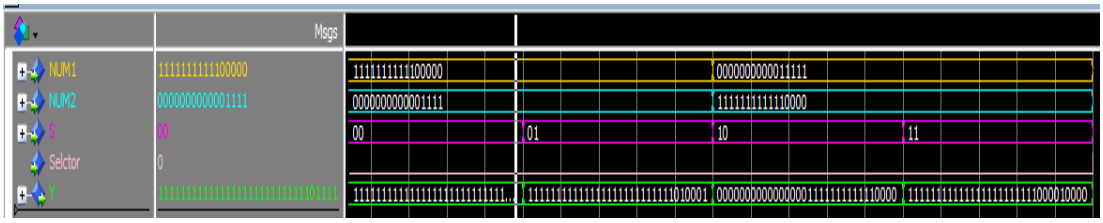
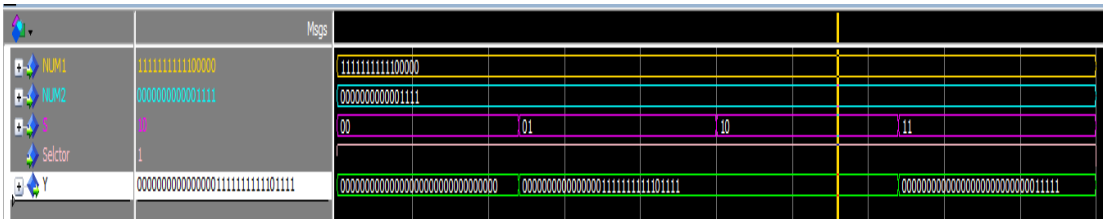
(Cont.)

Project Title	FPGA as a Microprocessor
Main Results	 *Figure 1 Arthemitic Operation Result*  *Figure 2 Logic Operation Result*
Discussion and Conclusion	on the academic and startups scale the fields that requires designing a microprocessor. people with lack of experience at designing the processors face a huge problem where small mistakes will lead to huge problems. some chips will require to be changed. so the reprograming option in FPGAs offers a huge advantage for those who want to try and redesign with a small risk of changing the whole chip. So, Our project aims to shine a light on the FPGA and how it is so flexible that it can change digital design industry. Recent research papers indicate a significant shift towards using FPGAs, allowing startups to customize microprocessors for their specific needs. In conclusion, FPGAs are incredibly versatile and powerful hardware devices. They offer a unique combination of flexibility, speed, and cost-effectiveness that makes them ideal for a wide range of applications.
References	Veselko Gustin, “An FPGA extension to ALU functions,Microprocessors and Microsystems,”Volume 22, Issue 9, 1999, Pages 501-508, ISSN 0141-9331, https://doi.org/10.1016/S0141-9331(98)00115-X. J. Rose, A. El Gamal and A. Sangiovanni-Vincentelli, "Architecture of field-programmable gate arrays," in Proceedings of the IEEE, vol. 81, no. 7, pp. 1013-1029, July 1993, doi: 10.1109/5.231340. https://drive.google.com/drive/folders/1TfYPgF7VigeH6u_6wzAC4buPc6pxHSg3?usp=drive_link
Future Work and Suggestions	Explore advanced optimization techniques to enhance the performance and efficiency of FPGA-based ALUs. This could involve exploring new algorithms, circuit designs, or architectural improvements to achieve higher speeds, lower power consumption. Investigate the integration of FPGA-based ALUs with other key components of microprocessors, such as registers, memory units, and control units.
Group Photo	