To the 60s and Back

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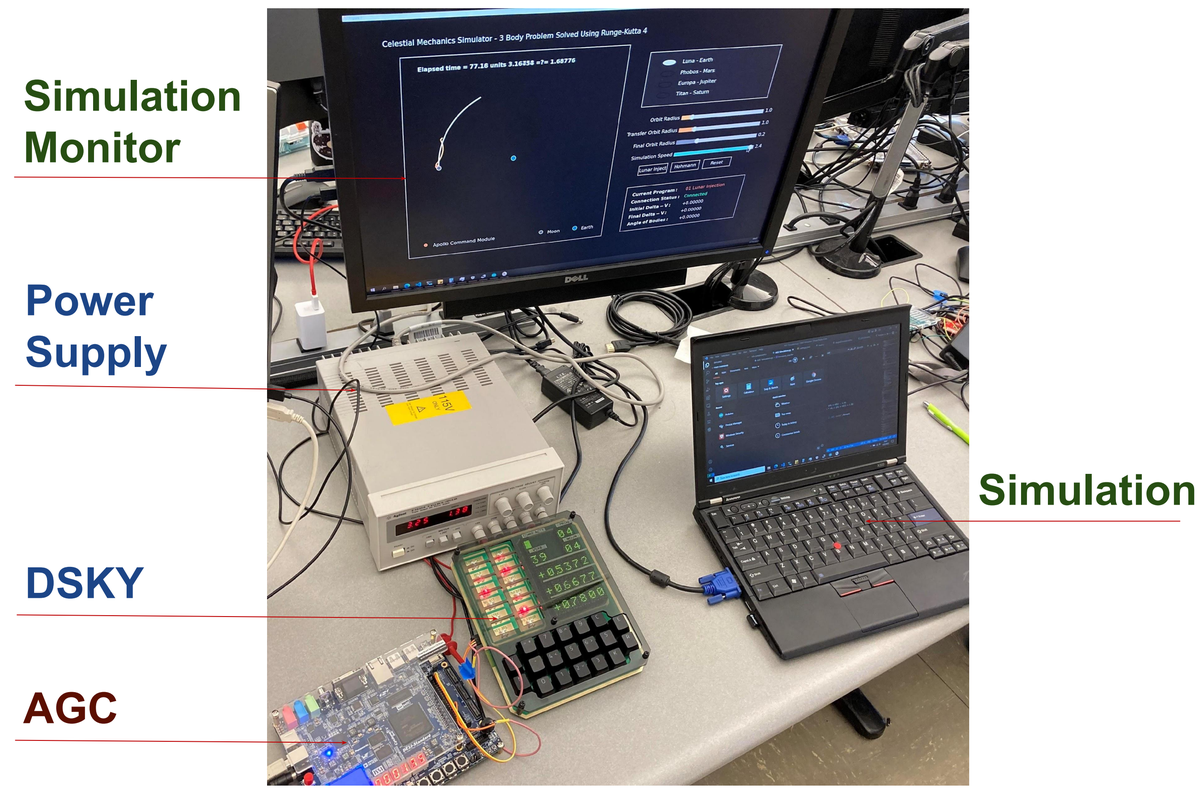
Product Pitch

An implementation of the Apollo Guidance Computer (AGC) developed as an educational exhibition piece.

- **A custom AGC architecture** running on an FPGA.
- A **custom PCB implementation** of the original AGC's Display Keyboard (DSKY) user interface.
- **An interactive simulation** that responds to user inputs and provides *orbital mechanics/lunar injection* demonstrations.
- A light and portable hardware that is under 3.5 pounds.
- A fast-responding AGC CPU implementation (5 Mhz).

System Description

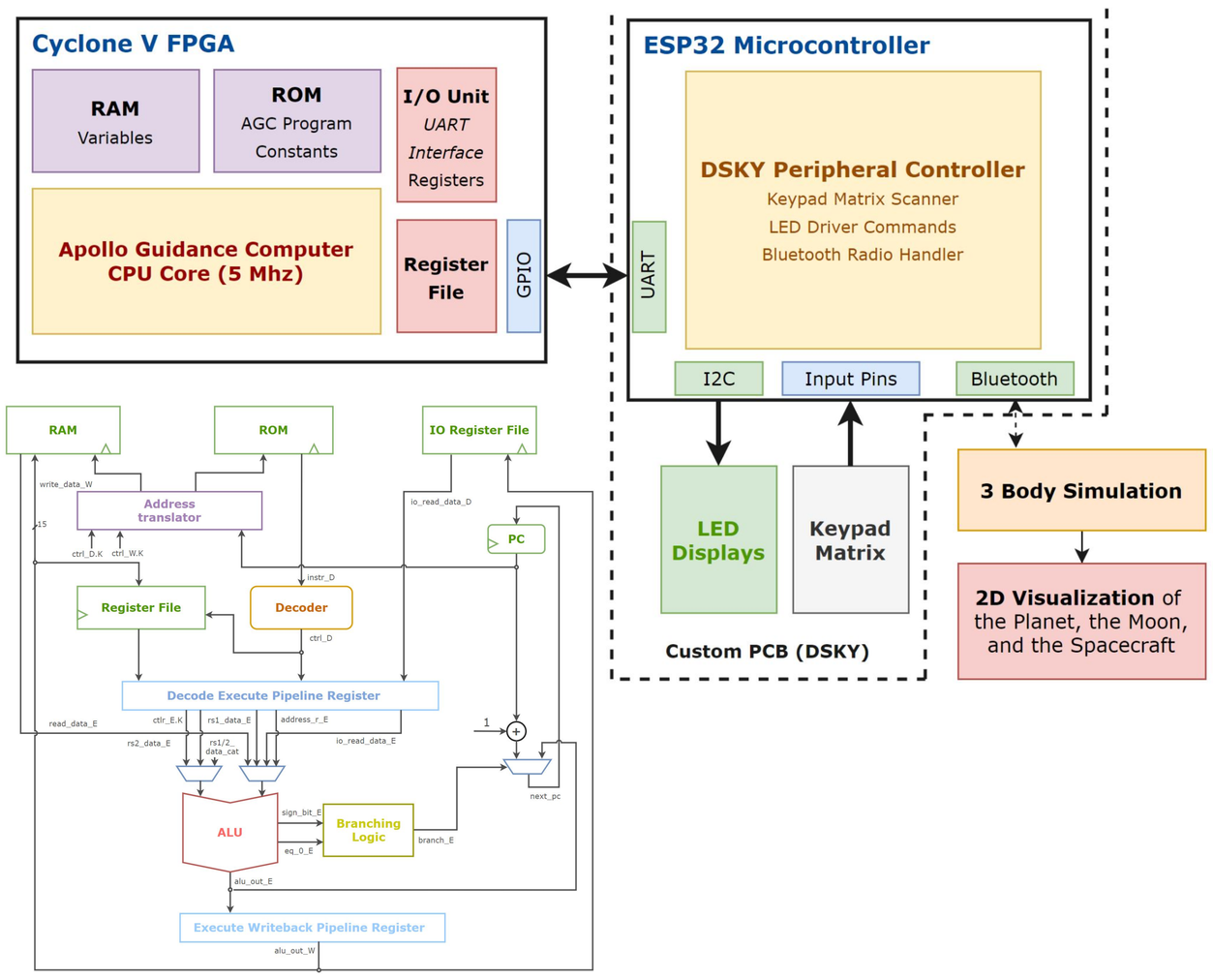
- The system composes of a custom designed **AGC architecture CPU** instantiated on a DE10 **Cyclone-V FPGA**.
- **The AGC CPU core** communicates with the **ESP32 microcontroller** over UART.
- **The ESP32** controls the LED lights using the I2C Bus and receives input from the keypad.
- **The ESP32** then communicates with a laptop running the simulation script over Bluetooth.
- **The Python simulation** is a 3-Body simulation with 4th Order Runge-Kutta ODE Solver.



The Entire System

System Architecture

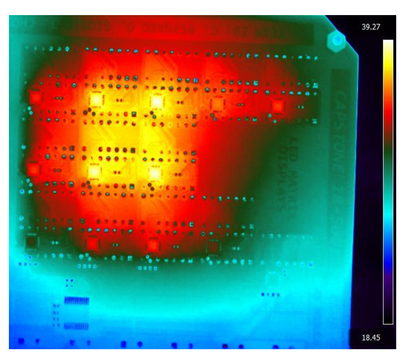
- **The Python 3-body simulation script** sends positions and velocities of orbiting bodies to the ESP32 via Bluetooth.
- **The DSKY Peripheral Controller (ESP32)** sends the received data and program number to the AGC.
- **The AGC CPU** runs the programs and updates the DSKY, and simulation displays orbital transfers of the spacecraft.



System Evaluation

Our system evaluation included:

- Functional correctness verification of the AGC *(34/34 Instructions Verified)*
- Performance validation of the AGC *(±0.5% Error for calculations)*
- Operating temperature validation of the DSKY PCB *(Max. 45°C)*
- Full stack verification with Lunar injection program.



Conclusions & Additional Information

Scan to see more information about our project!
Video, Documentations, and Project Logs

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