



Real time implementation of remote rover training system

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Scope of the Project

- Implementation of a mobile robot with a compact and responsive real-time operating system (RTOS).
- Four core hardware components – electromechanical system, WiFi module, GPS module & processor board.
- Both Wifi & GPS module would transmit data over UART (Universal Asynchronous Receiver/Transmitter).
- Project functionality is comparable to mobile robotic platforms such as Pathfinder and Curiosity, but with reduced cost and complexity.

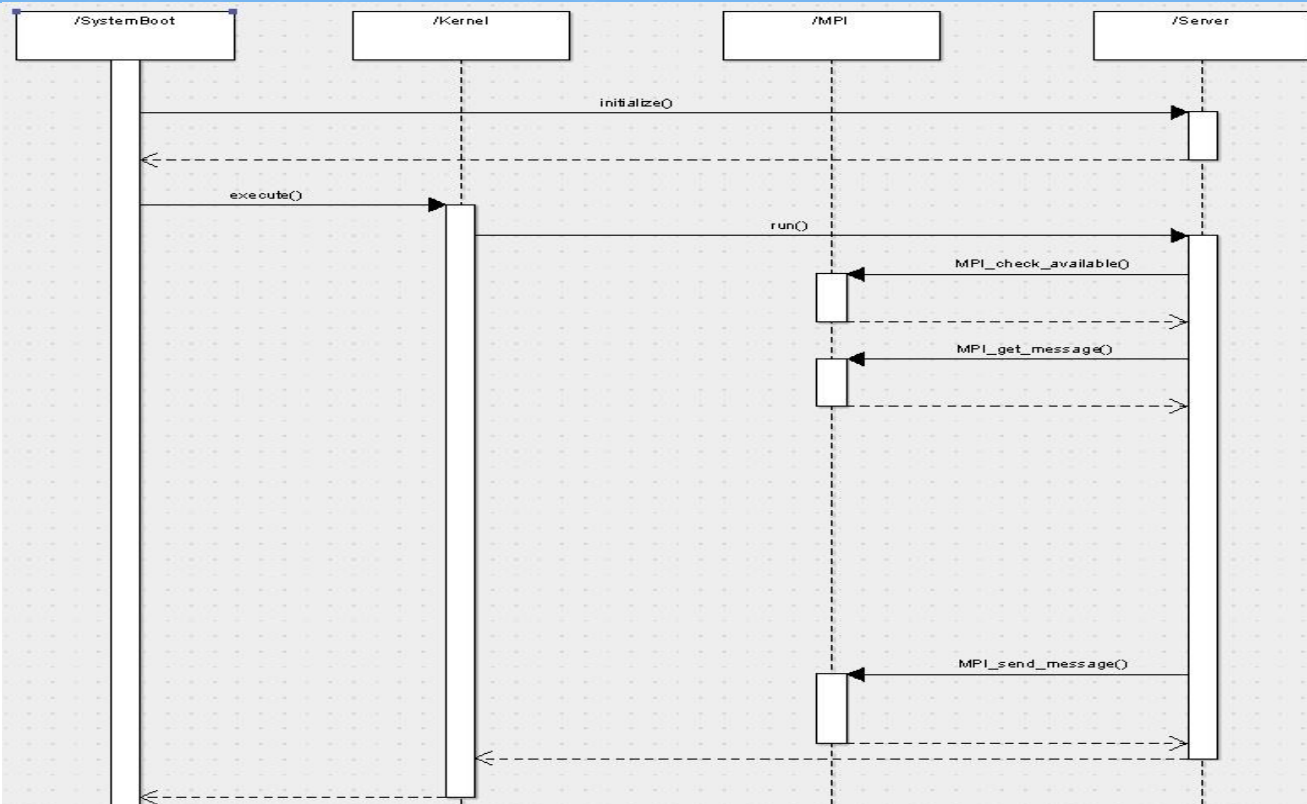


Modules used in Remote Rover

- Main processor – Tiva-C development module consists of ARM Cortex M4F processor.
- Wireless Functionality – ESP8266 Wi-Fi module, configurable as a client or ad-hoc hotspot and also acts as Wi-Fi to UART bridge.
- GPS Functionality – U-Blox Neo-6M GPS module, transmits GPS data consists of longitude, latitude, orientation, velocity and altitude.
- Four motor controllers mounted on steel chassis.

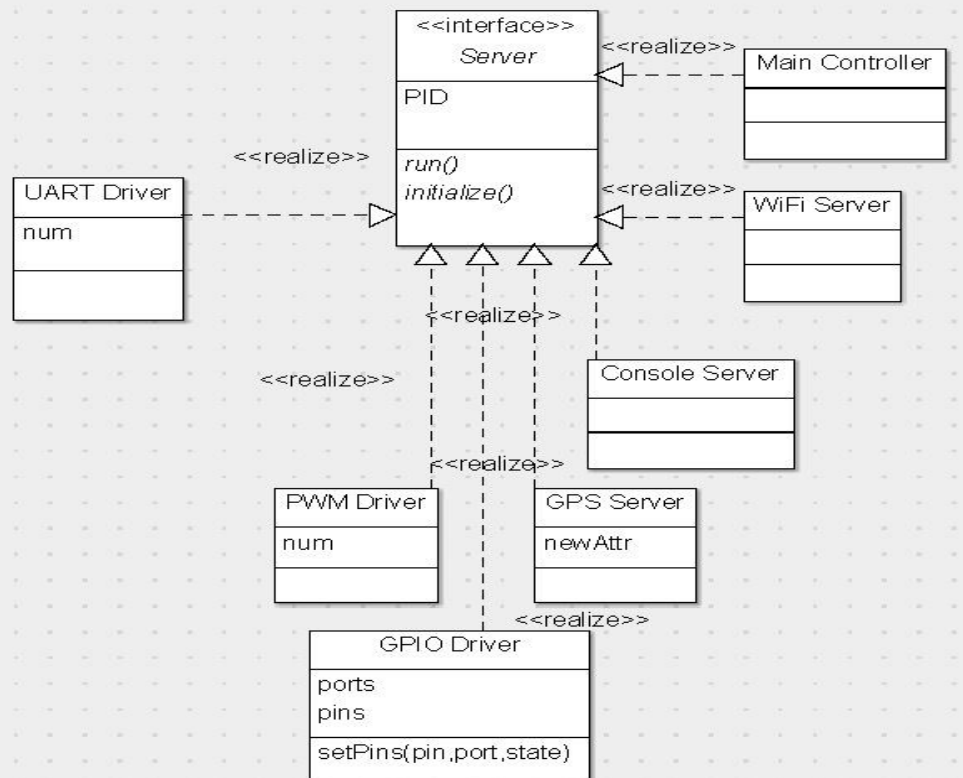


Generic Task Sequence Diagram



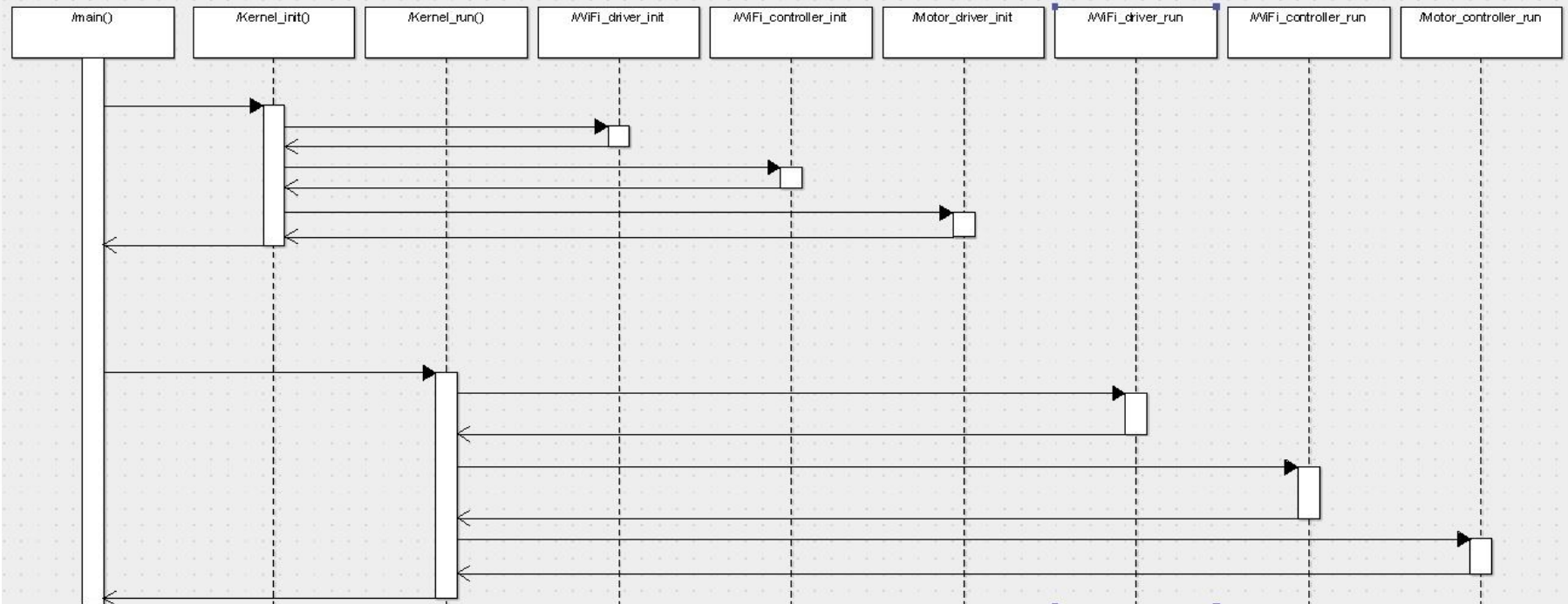


Task Interface Diagram





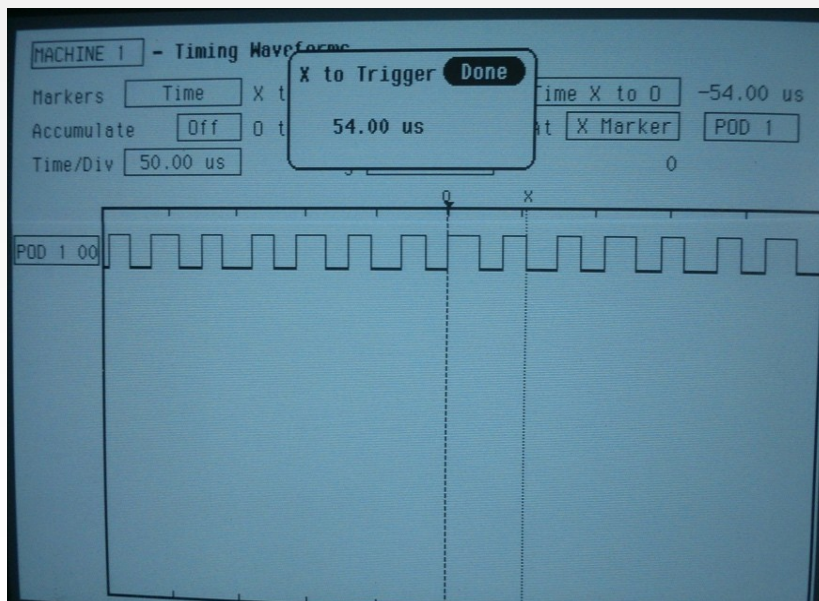
Kernel Sequence Diagram



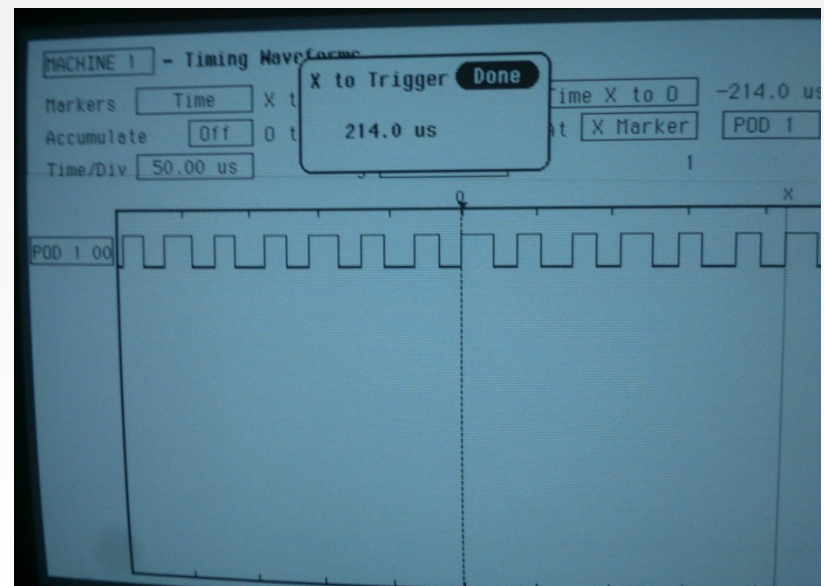


Average case execution time analysis

Single Hyperperiod



4 Hyperperiods





Deadlines

- Three independent UART modules (0.08ms @ 9600 baud)
- sensors (order of tens of milliseconds)
- TCP connection timeout (order of seconds)
- User responsiveness (order of hundreds of milliseconds)



WCET Analysis Challenges

- ARM cortex-M4F != ARM7
 - M4F (ARMv7-M) circa 2010
 - ARM7 (ARMv3) circa 1994
- Forward compatibility (or lack thereof)
 - SFRs
 - Thumb states vs. ARM states
- Software abstraction



Demo with IP address & Web server



Questions?