

System Software Design and Documentation

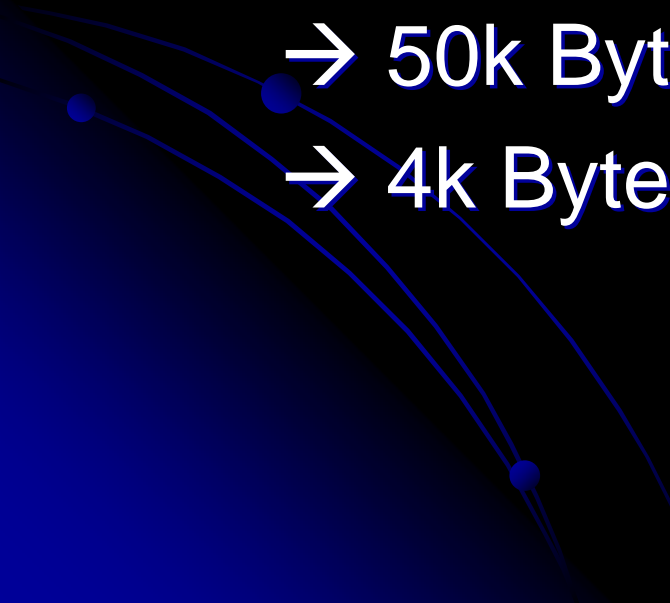
Western Washington University

ETEC 474

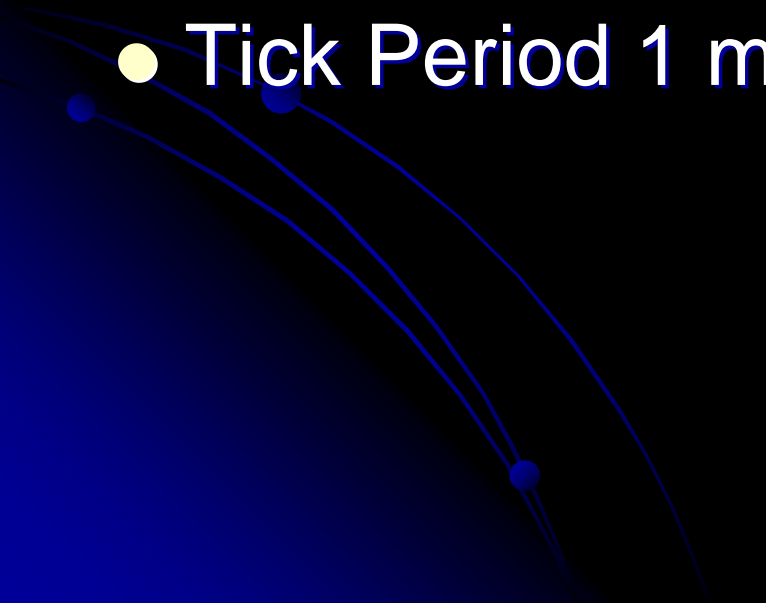
By Dale Nelsen



General System Design

- MC9S12DP256B
 - Bus Frequency 24MHz
 - Memory
 - 50k Bytes Ram
 - 4k Bytes Rom
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Kernel Task Design

- MicroC/OS-II
 - Real-time preemptive multitasking kernel
 - Tick Period 1 ms
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Priority of Tasks

- 4 → StartTask
 - 5 → ClockTask
 - 6 → UITask
 - 7 → KeyTask
 - 8 → RelayControl
 - 9 → MainTask
- 

Start Task

- Description

- Initialize System
- Create other tasks
- Displays initial startup screen
- Priority 4

-This runs once at startup and the execution time is 10ms

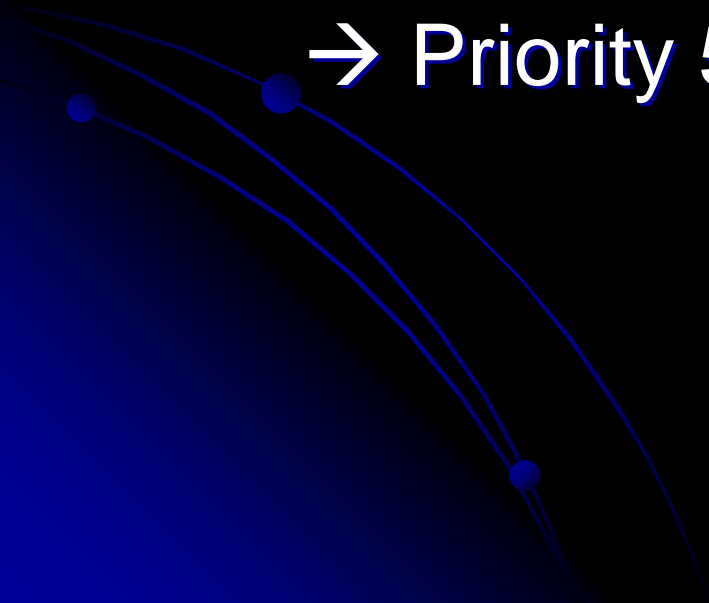
Clock Task

- Description

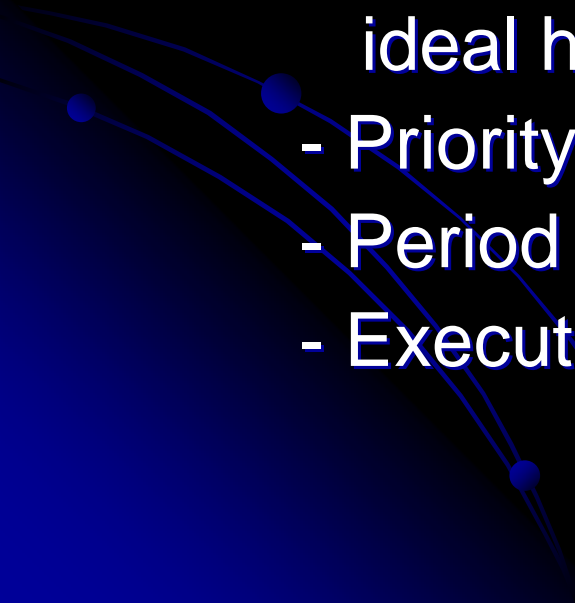
- Calculates time of day and date

- Period will be one second with an execution time of 40us

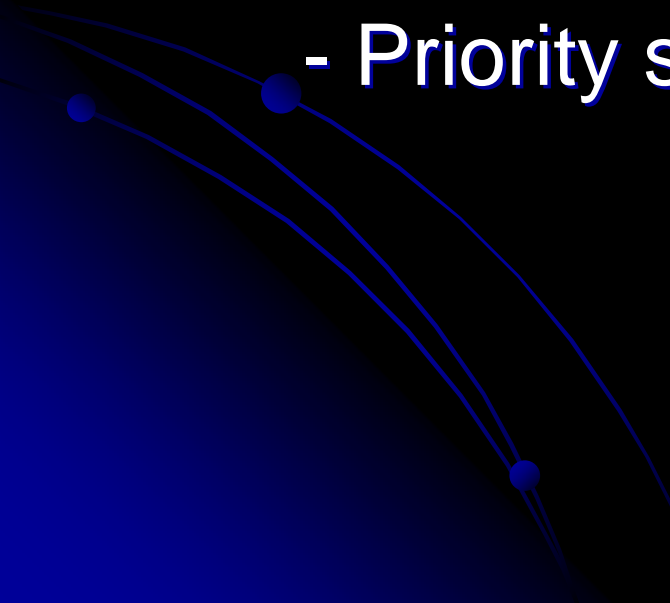
- Priority 5



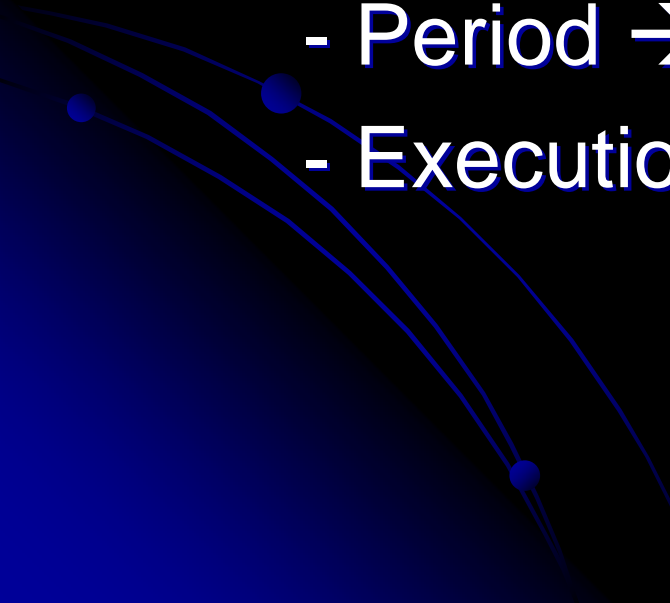
UITask

- Description
 - This handles the user inputs
 - Allows user to navigate through different settings options
 - User can set time, date, ideal temp, ideal humidity and watering times
 - Priority six
 - Period → .5s sporadic
 - Execution time → 1ms
- 


KeyTask

- Description
 - Reads the keypad
 - Period → 10ms
 - execution time → 2us
 - Priority seven
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MainControlTask

- Description
 - Reads from inputs and Controls relays and output LEDs
 - Priority eight
 - Period \rightarrow 1s periodic
 - Execution Time \rightarrow 2 μ s
- 

MainTask

- Description
 - Updates the LCD
 - Receives the Sensor Data
 - Receives User inputs
 - Priority nine
 - Period = 10ms
 - Execution Time = 2ms
- 

ISR

- Description

- = This will generate a semaphore every one second for the clock task to update the clock and also to check temperature and humidity inputs

- = Period \rightarrow 1ms periodic

- = Execution Time \rightarrow 1us

CPU Load

$$\text{CPU Load} = 10\text{ms}/2\text{ms} + 2\text{us}/1\text{s} + 2\text{us}/10\text{ms} + 1\text{ms}/.5\text{s} + 40\text{us}/1\text{s} + 1\text{us}/1\text{ms}$$

L Max \rightarrow 20 %

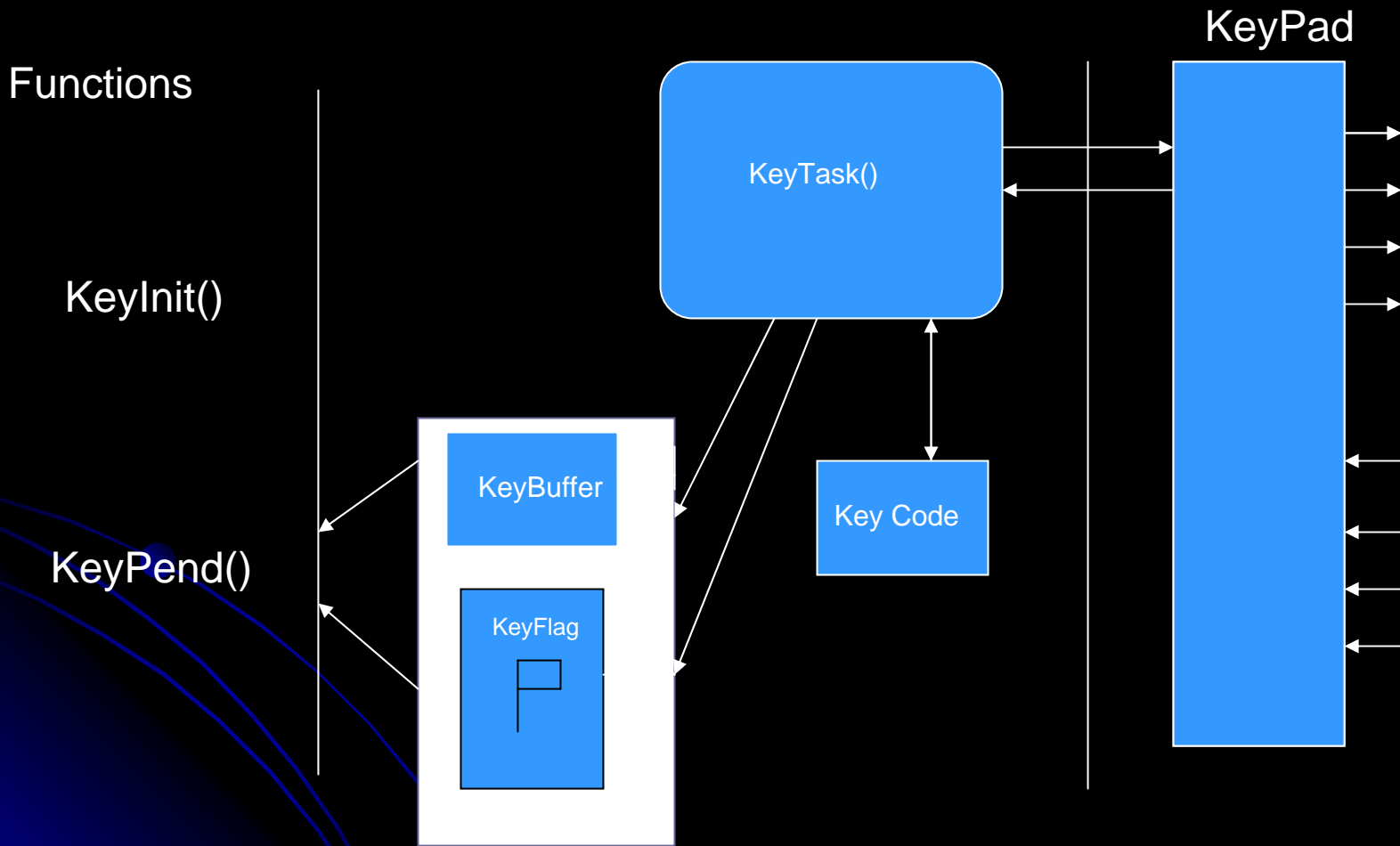
L Avg \rightarrow 10%



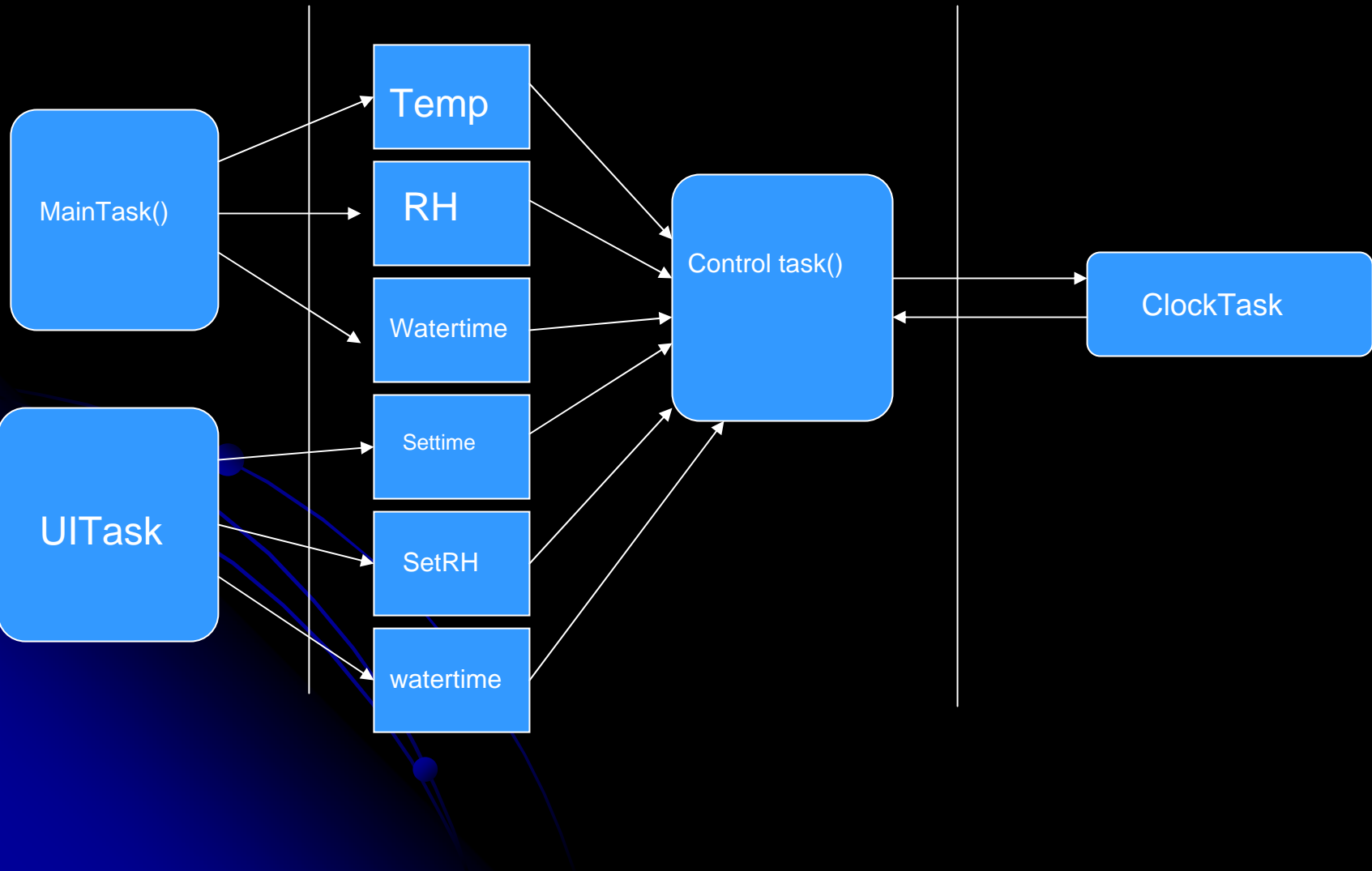
Modules

Modules	Tasks	Functions
Main.c	UITask, StartTask, UITask	
LCD.c		LcdInit() LcdClrDisp() LcdMoveCursor() LcdDispStrg() LcdDispTime() LcdDispTemp() LcdCursor()
Key.c	Keytask	
SPI.c		ReadSPI() WriteSPI() InitSPI()
Control.c	RelayControlTask	
ATOD.c		AtdInit() AtdTempRead()
Clock.c	ClockTask	

Data Flow Diagrams



Data Flow Diagram



Data Flow Diagram

