Chapter 11

Real Time Operating System

Lesson 04

RTOS Example- Keil Software Inc. RTX51 RTX51Tiny and Full

Keil Software Inc. RTX51 Basic Features

- RTX 51 for 8051, Extended, MX
- Standard ANSI C constructs
- Compiles with C51 compiler
- os_ used as prefix for all OS functions
- isr_ used as prefix for all ISR functions

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Keil Software Inc. RTX51 Basic Features

- Creating multiple tasks and each task codes in infinite loop

- os_create_task ( ) - creates a task

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Tasks Creation

```
#include <rtx51tiny.h>

job0 () _task_0{os_create_task (1);

while (1){..... };}

job0 () _task_1{os_create_task (2);

while (1){..... };}

job0 () _task_2{os_create_task (3);

while (1){..... };}
```

Keil Software Inc. RTX51 Tiny Basic Features

- Running multiple tasks in time slicing cyclic (Round robin) mode
  - Delay each task by t_n clock ticks using K_TMO timer's *timeout* mode function

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Tasks Cyclic Round robin scheduling

while(1) {...

os_wait(K_TMO, tn, 0)};

task_0 delay

while(1) {...

os_wait(K_TMO, tn, 0)};

task_1 delay

while(1) {...

os_wait(K_TMO, tn, 0)};

task_2 delay

Keil Software Inc. RTX51 Tiny Basic Features

- Running multiple tasks in time slicing cyclic (Round robin) mode
- **using K_signal function to signal a waiting task**

Tasks Cyclic Round robin scheduling

send signal task 0

os_send_signal(0); job0() _task_0 {....;
while(1){os_wait(K_Sig,0, 0);.....
.......................os_send_signal(1)};};

task_0 signal wait

send signal task 1

Tasks Cyclic Round robin scheduling

job0() _task_1 {....; while(1){
os_wait(K_Sig,0, 0);.....
.......................os_send_signal(2)};};

task_1 signal wait

send signal task 2

Tasks Cyclic Round robin scheduling

job0() _task_2 {....; while(1){

   os_wait(K_Sig,0, 0);.....

   ....os_send_signal(3)};};

task_2 signal wait

send signal task 3

Tasks Cyclic Round robin scheduling

job0() _task_3 {....; while(1){

  os_wait(K_Sig,0, 0);.....

  ....os_send_signal(0)};};

task_3 signal wait

send signal task 0

RTX51 Tiny Features

900B codes

7-bytes on-chip internal-RAM

3 indirect RAM memory for counts

Off-chip/on-chip memory support

Only round robin scheduling

No off-chip mem

Only signal as IPC

timer use needs off-chip memory

timeout wait, interrupt wait

RTX51 Tiny Functions

os_create_task (i)

os_task_delete (i)

os_send_signal(i)

isr_send_signal(i)

os_clear_signal()

os_wait (x, tn,0) Event x waited for tn ticks of timer

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Keil Software Inc. RTX51 Full Features

6 kB to 8 kB code

Minimum 650B External data RAM

Use timer0 or 1

Off-chip/on-chip memory support

CAN/other controller functions support

Preemptive scheduler, priorities assignable

interrupt (ISR) in parallel support

Needs off-chip memory

IPCs in RTX51 Full

- **Signal**

- Eight one-bit semaphores

- Message 8 mail boxes

- Eight integers each mailbox

- Semaphore from interrupt or task awaited for infinite or fixed periods

RTX51 Full Functions

os_create_task (i)

os_task_delete (i)

os_send_signal(i)

isr_send_signal(i)

os_clear_signal()

os_wait (x, tn,0) Event x waited for tn ticks of timer

RTX51 Full Functions

os_set_slice(tn)

os_disable_isr (); os_enable_isr ();

os_send_token(s);

os_send_message (msg);

isr_send_message(msg);
   isr_recv_message(msg);

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RTX51 Full Functions

os_check_tasks();
os_check_task (i)

os_check_mailbox(i);

os_check_mailboxes(i);

os_check_pool ();

os_get_block ();

os_free_block ();

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RTX51 Full Functions

os_check_semaphore(s);

os_check_semaphores ( );

os_attach_interrupt();
os_detach_interrupt ( );

os_set_mask ();
os_reset_mask ();

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Summary

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We learnt

Keil RTX 51 Two versions

- Tiny- Only round robin scheduler, only create, timeout, signal, internal RAM data, 900 B code

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We learnt

Keil RTX 51 Two versions

- Full - Create, Preemptive scheduler, timeout, Signal, 8 Semaphores, 8 message mailboxes,message size8 integers,ISRs, Timers, internal RAM data, 6kB-8kB code

End of Lesson 04 on

**RTOS Example- Keil Software Inc.
RTX51Tiny and Full**