

SPY_RTOS

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INTRODUCTION

Development of real time kernel for ARM Cortex -M4 based processors with priority based pre-emptive scheduling which can be used to efficiently manage processes in complex embedded systems. A interactive two player game has been implemented to show the multi-tasking and resource sharing ability of the Real Time Operating System.

OBJECTIVES

- * To implement hard real time operating system (*RTOS*), that runs the tasks in a purely deterministic nature.
- * To create *Pre-emptive Priority Scheduler*, which schedules the tasks based on the priorities assigned to them.
- * To implement synchronisation primitives like *Semaphores and Mutex* which allows the system to achieve resources sharing among multiple tasks.
- * To create the driver file for interfacing and making the game with *Nokia 5110 LCD* screen.

METHODOLOGY

Task Management System :

To manage the process and store the previous states of the tasks , Task Control Block(TCB) has been created. Task_create() and Task_delete() are used to create and delete the tasks in the Operating System.

Scheduling and Synchronisation:

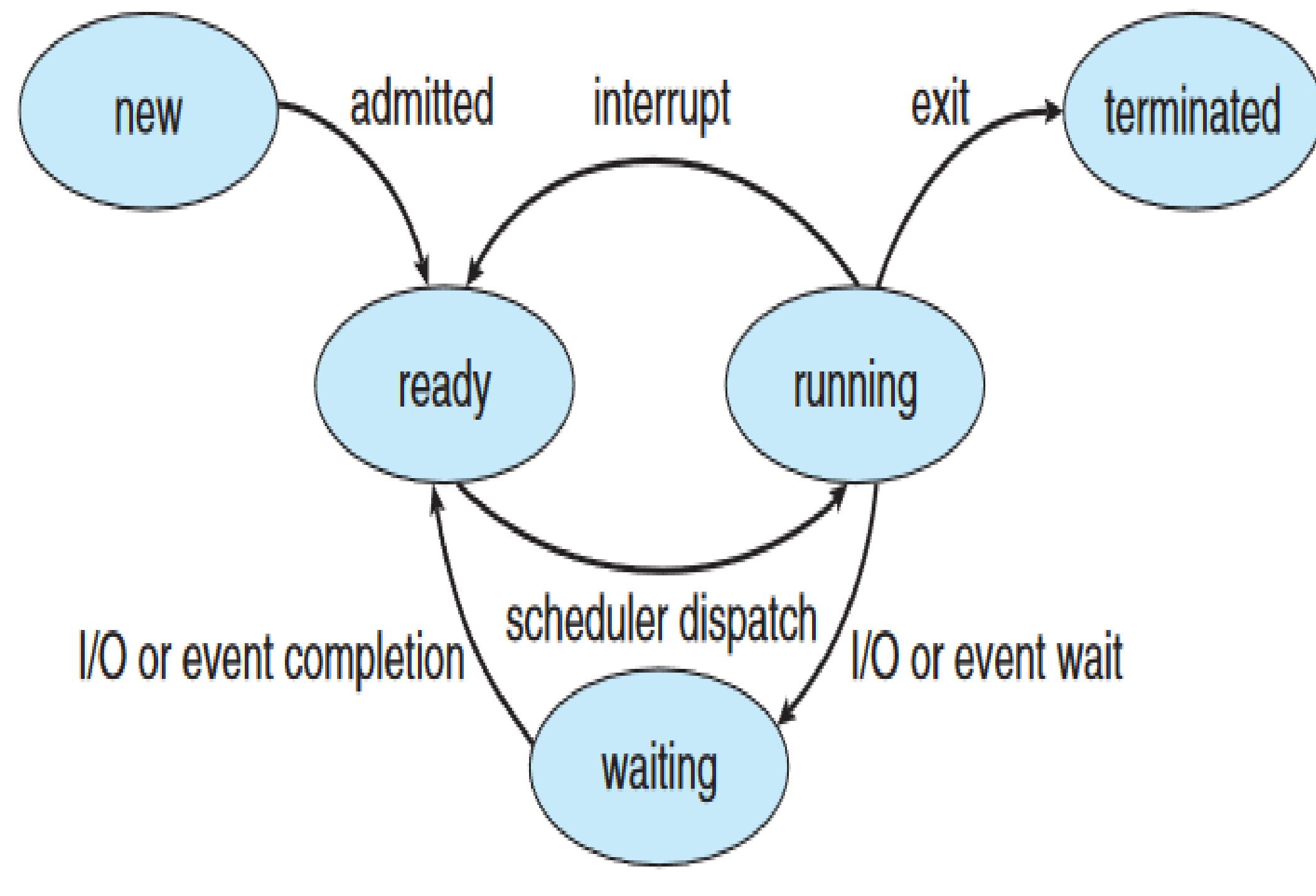
The task created are pushed into the ready queue and the scheduler picks the highest priority task from the ready queue and dispatches into the CPU. Waiting list contains all the tasks which have been blocked by the synchronisation modules.These tasks wait for the signaling condition to occur. Once the conditions are met ,the tasks are removed and pushed into the ready queue .

APIs like - semaphore_create ,semaphore_wait , semaphore_signal has been implemented .

Peripheral Interfacing:

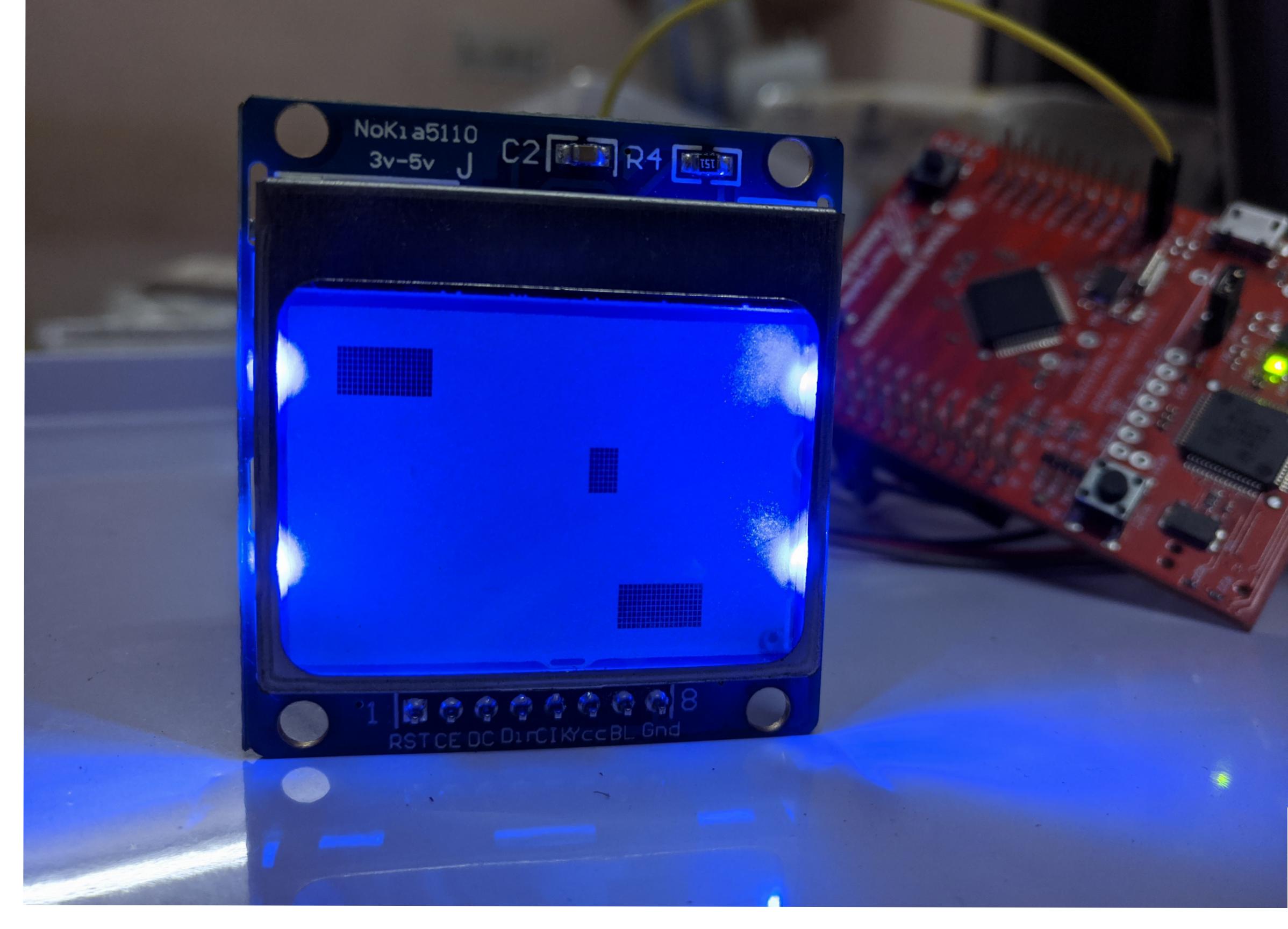
The edge triggered interrupt has been implemented for the buttons which are necessary for the game.The driver files for Nokia 5110 LCD has been created.

State Diagram:



RESULTS

- * As a proof of concept, a Ping Pong game has been implemented using the Operating System's APIs.
- * The scheduling algorithm has $O(1)$ time complexity.



CONCLUSION

A user friendly Ping Pong game has been implemented in *Nokia 5110 LCD*. A deterministic real time kernel has been implemented for TM4C123GH6PM Texas Instruments microcontroller. High portability is achieved by separating the processor specific and processor independent source code files.