Multiprocessor Systems (DV2544) – Project Assignment II

POSIX Threads – Implementation Report

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Task: Implementation of Gaussian Elimination (parallel) Using PThreads

POSIX Threads, usually referred as PThreads, is a POSIX standard for threads. The IEEE POSIX 1003.1c has standardized C language threads interface for UNIX systems. These implementations are called as POSIX threads. Threads can generally be used to implement parallelism, in shared memory of multiprocessor architectures.

Gaussian elimination algorithm is used for solving system of linear equations. The co-efficients in the equations are taken as elements in the matrix.

The equations,

8x+3y+2z=10
4x+4y+3z=20
2x+5y+7z=40 would be written as,

$$\begin{bmatrix} 8 & 3 & 2 \\ 4 & 4 & 3 \\ 2 & 5 & 7 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 10 \\ 20 \\ 40 \end{bmatrix}$$

Division and elimination is done in order to form a upper triangular matrix. The system of linear equations is obtained by comparing the final values. In this assignment, Gaussian elimination is done parallel with the help of PThreads. The type and size of the matrix are declared first. Initialization is done randomly. Threads are created after the barrier function is initialized. The threads are synchronized using the *mutex_variable*. The threads undergo elimination after division is completed. The rows are repeatedly assigned in a cyclic model.

Implementation of Gaussian elimination parallely improves the performance of the CPU at an enormous rate and comparatively takes less time than the sequential method.

Measurements:

Time	Gaussian Elimination (sequential In Seconds)
User	24.20s
System	0.04s
Elapsed	0:24:25s
CPU Usage	99%

Time	Gaussian Elimination (Parallel In Seconds)	
No. of CPU's	**1 CPU**	**8 CPU's**
User	42.06s	31.06s
System	0.37s	0.26s
Elapsed	0:12:48s	0:04:30s
CPU Usage	339%	728%

The matrix size assumed: 2048*2048