**ABSTRACT**

Title: Parallel Processing with 8 Node Raspberry Pi Cluster

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We have built an eight node Raspberry Pi cluster computer which uses a distributed memory architecture. Our cluster uses all Raspberry Pi 3 Model Bs with 1 GB of RAM and a 4x ARM Cortex-A53, 1.2GHz processors. We have 3D-printed a case to hold the Pis in an easy to manage manner. One Pi acts as the head node of the cluster and is connected to the school’s wifi. The head node is connected to the seven remaining slave nodes through a Netgear 16 port 10/100 switch. We have configured NAT on the head node so that the slave nodes can access the internet and be accessed. Our primary method of interacting with the cluster is by SSH through the head node.

We believe Raspberry Pis have the potential to be a cost effective educational tool to teach students about parallel processing. With the cluster we have built we intend to run experiments using the Message Passing Interface (MPI) standard. Our experiments will revolve around how efficiency in computing increases or decreases as the number of nodes in the cluster increases. It is our prediction that as the number of nodes is increased the computing efficiency will increase up to a point but eventually the limitation of the 100 Mb Ethernet communication between the nodes will become the bottleneck and no more increase in efficiency will be seen. We plan to test this though running multithreaded computationally intensive tasks on the cluster such as calculating primes and various numerical methods. We will run the experiments with one through eight nodes. For a comparison, we will also run the computations on our personal laptops to determine how the speed of a Raspberry Pi cluster compares to today’s mainstream computers. Our primary goal is the demonstrate how Raspberry Pis are an effective yet comparatively cheap solution for learning about parallel processing. We will be making detailed instructions on how to set up a cluster and get started.