

Forest Fire Detection Using GPU Implementation

Angusundaresh Krishnakumar
University of Houston-Clear Lake
Kangu10@yahoo.com

Dr. Liwen Shih
Professor at University
Of Houston-Clear Lake
shih@uhcl.edu

Trung Pham
Professor at Universidad de
Talca, Chile
t_robo@alumni.rice.edu

Matthew Bardeen
Professor at Universidad de
Talca, Chile
mbardeen@utalca.cl

Mohammed Abdul Moid
University of Houston-Clear Lake
mohd.abdulmoid13@gmail.com

Gowtham Manoharan
University of Houston-Clear Lake
mggowtham25@gmail.com

Harsha Patil
University of Houston-Clear Lake
patilharsha92@gmail.com

ABSTRACT:

Forest fire is one of the major reasons for mass depletion of natural resources. Instantaneous detection of forest fires can aid the fire mitigation team to suppress the fire on time, and avoid spreading of the fire over large areas. The existing image recognition based forest fire detection algorithms consume a lot of computation resource and are comparatively slow. We propose a Fire Detection System based on digital image processing using modern Graphical Processing Units (GPUs) and multi-core Processor Elements (PEs) with vector processing capabilities. The aim of the project is to increase the speed of Fire Detection Systems as well as increasing their accuracy. Proven to provide very high degree of parallelism in performing the pixel based image processing, graphical processing units are optimal candidates when implementing the digital image processing based Forest Fire Detection. We propose a two-phase fire detection system protocol, where in the first phase; we separate out the red pixels from the image and compare these red pixels with the mean of red component values of all pixels in the whole RGB image. Afterwards, we match patterns in the captured image with several fire and smoke patterns in the second phase. Here the proposed fire detection system makes a truth table with the two phases. If both of the fire detection phases are true, then the fire authorities are signaled for fire rescue in “alarm mode”, or if both fire detection phases are false, the image is deem in a “safe mode” and bypassed. In the cases where it is partially true, the system goes into a “caution mode” and that image area is continuously monitored for the next 15 minutes, with a repeat sampling of the image every one minute. If the detection system finds a complete true state during repeat sampling, then appropriate fire alarm signaling to fire monitoring authority is activated.

Keywords: Forest fire detection, Image processing and GPU