

### Computer Science

DISCOVERING RASPBERRY PI. Bruce C. Chittenden, Department of Computer Science, Hampton University, 100 E. Queen Street, Hampton, Virginia 23668. The Raspberry Pi is a low cost, credit-card sized single-board computer that plugs into a HDMI monitor and uses a standard USB keyboard and mouse. The design is based around a **Broadcom BCM2835 SoC**, which includes an ARM1176JZF-S 700 MHz processor, VideoCore IV GPU, and 512 Megabytes of RAM. The design does not include a built-in hard disk or solid-state drive, instead relying on an SDHC card for booting and long-term storage. Currently there are several versions on Linux that runs on the Raspberry Pi. The most popular is Raspbian which is based on a version of Debian Linux. Several Programming Languages are also available for the Raspberry Pi including C, C++, FORTRAN, Java, Python, Scratch. Last summer I worked with a student from Hampton University on an Externship from the National Center for Atmospheric Research, NCAR. Over the summer we created a cluster using four Raspberry Pi computers and a Western Digital Router. We ported Message Passing Interface mpich2 to interconnect the Raspberry Pi computers. This configuration is now referred to as Raspberry Pi Bramble. With the experience I gained over the summer I introduced Raspberry Pi into CSC 301 - Operating Systems. There were four assignments using the Raspberry Pi. The first assignment was to download a Raspbian Image from raspbian.org and get the Raspberry Pi up and running and become familiar with Linux running of the Raspberry Pi. The second assignment was to download source code for the Linux Raspbian kernel from github.com and build a kernel from source code. The third assignment was to develop a System Call and add it to the Linux kernel that they had just built. And the fourth assignment was to write a device driver for the Linux Operating System. This gave the students some real hands-on Operating System development experience and the chance to work closely with the hardware. In all I would say that the class was a real success. This summer I plan on another Externship with a student from Hampton University at NCAR and we are going to build a Cloud Computing environment using the Raspberry Pi Bramble.

DYNAMICAL SYSTEM MODELING. Yen-Hung Hu, Department of Computer Science, Norfolk State University, Norfolk VA 23504. A dynamical system is a mathematical model which combines an abstract state space and a dynamical rule. In a system, we could describe the dynamical state at any time of this system and to specify the future trend of all states by giving only the present values of those states. In brief, dynamical system is an evolution rule that defines a trajectory as a function of time on a set of states. The evolution rule can be deterministic or stochastic. If the system is deterministic, every state in

the system will have a unique consequent state. Otherwise, it is stochastic. Network traffic used to be one feasible source for network administrators and researchers to study potential network malicious activities. However, due to the growing use of open source software and the asynchronous and anonymous nature of the Internet, identity of a malicious connection could be easily forged to increase the difficulty and complexity in analyzing abnormal characteristics of the malicious connection and cause a false negative. To resolve this issue, this paper proposes a dynamical systems approach to monitor network activities. We assume that every state of a network characteristic in a certain period of time would be deterministic and will present dynamical behaviors since network resources associated with this characteristic are bounded. We have described our dynamical approach in detail and included several examples to demonstrate it. Meanwhile, performance study of the approach is studied as well.

USING OPEN SOURCE VULNERABILITY ANALYSIS TOOLS TO ASSESS CODING SECURITY AND QUALITY. Yen-Hung Hu, Department of Computer Science, Norfolk State University, Norfolk VA 23504. Security and quality are two vital attributes of any software application no matter how infinitesimal it might be. Software is created using a programming language, so when a programming language has a security issue it affects its product, which is the software. Tackling a problem by its source is one of the most trusted models used in problem solving approaches. However, since the complexity of a software, it is inefficient and costly to manually examine the source codes of the software. In this paper, we want to ensure that all undergraduate Java learners write codes based on the security and quality guidelines expected in the industry right from the day they start learning the first program in Java. Therefore, a tool that can automatically identify security and quality vulnerabilities of any Java code and create a report for fixing them will be crucial. In the research, sample codes getting from several Java books used in teaching Java concepts for undergraduate courses were used as the case study. These sample codes were tested using an open source tool named findBugs which was developed based on security and quality guidelines. The tool determines the vulnerability level in any Java source code passed as an input to it then it analyzes the source code and generates a report indicating the threat level and suggestions based on the vulnerabilities in the code. The results of this paper will be published and those vulnerabilities in the sample codes along with suggestions for fixing them will be included as well.

INTELLIGENT PARKING SYSTEM (IPS) – LEVERAGING THE INTERNET OF THINGS. Syed R. Rizvi, Susan Zehra & Stephan Olariu, Dept. of Computer Science, Old Dominion University, Norfolk, VA 23529. The Intelligent Parking System (IPS) is proposed in an Internet of Things (IoT) environment for drivers by exploiting the ubiquitous sensing and transmitting nature of these systems for Areas of Interest (AoI). IPS is an end-to-end software infrastructure that automates the procedures of obtaining spatio-temporal parking-related data from IoT at public and private parking facilities, processes these spatio-temporal parking-related data to promote IoT synergy (data correction, data resolution enhancement, and registration), provides an analysis framework for software agents for making parking reservations. The IPS leverages a number of cutting-edge computing technologies, frameworks, and novel algorithms. Utilizing IoT provides significant benefits to both the parking facilities as well as the driving community. First, the quantity and quality of spatio-temporal parking-related data from IoT allows for rapid determination of available parking spots in an AoI. Second, the sensing and connectivity of IoT can facilitate parking enforcement of cars that are violating parking restrictions. Lastly, the vast amount of data obtained from IPS can be leveraged for active and focused AoI monitoring in order to build optimal parking pricing policies. The automation capability of IPS will enable efficient processing of a vast amount of data, allowing multiple AoI to be simultaneously monitored, ultimately providing decreased waste of time and fuel for drivers looking for parking, lower traffic congestion, and better utilization of public and private parking facilities.