

**Design and Implementation of a  
Secure Web Platform  
For a Building Energy Management Open Source Software**

Kruthika Rathinavel

Thesis submitted to the faculty of the  
Virginia Polytechnic Institute and State University  
In partial fulfillment of the requirements for the degree of

Master of Science  
In  
Computer Engineering

Saifur Rahman, Chair  
Manisa Pipattanasomporn  
Chang-Tien Lu

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Arlington, Virginia

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## **Virginia Tech ETD Fair Use Analysis Results**

*This is not a replacement for professional legal advice but an effort to assist you in making a sound decision.*

Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 2 1 Percent of total commercial buildings and floor space by building size [2013, Public Domain] Source:  
[http://www.eia.gov/consumption/commercial/reports/2012/buildstock/images/fig2\\_bg.png](http://www.eia.gov/consumption/commercial/reports/2012/buildstock/images/fig2_bg.png)

Report generated on: 07-29-2015 at : 16:37:06

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

**Draft 09/01/2009**

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## Virginia Tech ETD Fair Use Analysis Results

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 2.2 Model-View-Controller pattern © [Used under fair use, 2015]  
Source: [http://commons.wikimedia.org/wiki/File:MVC\\_Diagram\\_\(Model-View-Controller\).svg](http://commons.wikimedia.org/wiki/File:MVC_Diagram_(Model-View-Controller).svg)

Report generated on: 07-30-2015 at : 10:15:17

### Based on the information you provided:

#### Factor 1

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### Factor 2

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### Factor 3

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### Factor 4

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in***

*favor of fair use*



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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 2 3 SQL injection prevention techniques [57] [Used under fair user, 2015] Chandrashekhar, R., Mardithaya, M., Thilagam, S. & Saha, D. 2012, "SQL Injection Attack Mechanisms and Prevention Techniques" in Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 524-533.

Report generated on: 07-29-2015 at : 16:39:44

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 4 2 Specifications of BeagleBone, PandaBoard and Odroid  
Source: Beagleboard:<http://www.beagleboard.org>; Pandaboard: <http://pandaboard.org>; Odroid:  
<http://www.hardkernel.com> ; [Used under fair use, 2015]

Report generated on: 07-29-2015 at : 16:47:24

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 4 3 BEMOSS user platform architecture Source: <http://www.htc.com>; <http://www.apple.com/>; <http://www.sonymobile.com/us/products/tablets/xperia-tablet-z/>

Report generated on: 07-29-2015 at : 16:53:04

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

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Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 5 1 UI design cycle [71] Lauesen, S. 2005, User interface design: a software engineering perspective, Pearson/Addison-Wesley, New York; Harlow, England )

Report generated on: 07-29-2015 at : 17:04:26

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 5 2 Vector icons (Source: <http://www.webiconset.com/minimal-vector-mini-icon-set/>)

Report generated on: 07-29-2015 at : 16:55:18

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

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Description of item under review for fair use: Figure 5 4 Objects grouped together Source: <http://architectingusability.com/2011/05/26/using-the-gestalt-laws-of-perception-in-ui-design/>

Report generated on: 07-29-2015 at : 17:17:04

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 5 5 Objects farther apart - appear as arranged in rows and columns Source: <http://architectingusability.com/2011/05/26/using-the-gestalt-laws-of-perception-in-ui-design/>

Report generated on: 07-29-2015 at : 17:18:42

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 8 1 CIA triad [77] Source: <http://www.cyber-51.com/cyber51-blog/145-cia-triad> [Used under fair use, 2015]

Report generated on: 07-29-2015 at : 17:21:14

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

**Draft 09/01/2009**

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Description of item under review for fair use: Figure 8 2 Iterative threat modeling Source: <https://msdn.microsoft.com/en-us/library/ff648644.aspx> [Used under fair use, 2015]

Report generated on: 07-29-2015 at : 17:25:07

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

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Description of item under review for fair use: Figure 8 17 CAPTCHA example Source: <http://www.captcha.net/images/recaptcha-example.gif> [Used under fair use, 2015]

Report generated on: 07-29-2015 at : 17:31:31

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: ***in favor of fair use***

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: ***in favor of fair use***

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: ***in favor of fair use***

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: ***in favor of fair use***

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

**Draft 09/01/2009**

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 8 18 Math CAPTCHA to distinguish humans from computer bots Source: <https://www.gachisites.com/files/imce-shared/features/CaptchaMath.gif> [Used under fair use, 2015]

Report generated on: 07-29-2015 at : 17:33:30

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: ***in favor of fair use***

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: ***in favor of fair use***

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: ***in favor of fair use***

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: ***in favor of fair use***

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**Draft 09/01/2009**

(Questions? Concerns? Contact Gail McMillan, Director of the Digital Library and Archives at Virginia Tech's University Libraries: [gailmac@vt.edu](mailto:gailmac@vt.edu))

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 8 21 Types of PUB/SUB mechanism [93] Source: <http://learning-0mq-with-pyzmq.readthedocs.org/en/latest/pyzmq/patterns/pubsub.html>

Report generated on: 07-29-2015 at : 17:27:10

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

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**Draft 09/01/2009**

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Name: Kruthika Rathinavel

Description of item under review for fair use: Figure 9 1 Performance evaluation process ource:  
<https://msdn.microsoft.com/en-us/library/bb924356.aspx> [Used under fair use, 2015]

Report generated on: 07-29-2015 at : 17:29:04

### **Based on the information you provided:**

#### **Factor 1**

Your consideration of the purpose and character of your use of the copyright work weighs: *in favor of fair use*

#### **Factor 2**

Your consideration of the nature of the copyrighted work you used weighs: *in favor of fair use*

#### **Factor 3**

Your consideration of the amount and substantiality of your use of the copyrighted work weighs: *in favor of fair use*

#### **Factor 4**

Your consideration of the effect or potential effect on the market after your use of the copyrighted work weighs: *in favor of fair use*

**Based on the information you provided, your use of the copyrighted work weighs: *in favor of fair use***

August 2015

3/8/2015

Saifur Rahman  
Virginia Tech – Advanced Research Institute  
900 North Glebe Road  
Arlington VA 22203

Dear Dr. Rahman,

I, Kruthika Rathinavel, am in the process of preparing my thesis document. I am seeking permission to include the following material in my thesis titled ‘Design and Implementation of a Secure Web Platform for a Building Energy Management Open Source Software’:

- BEMOSS user interface screenshots and images

Please indicate your approval of this request by signing the letter where indicated. The above-described materials are intended to be used for academic and non-commercial purposes only.

Yours truly,  
Kruthika Rathinavel  
Email: kruthika@vt.edu

For copyright owner use:

**PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:**

By: Saifur Rahman

Title: Director, Virginia Tech Advanced Research Institute (PI of the BEMOSS project)

Date: 03 August 2015

Additional Comments: