Proposal to introduce a new MS program on “Cyber-Physical Systems”

College of Engineering
October 17, 2018

Prepared by:
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Proposal
The College of Engineering (COE) proposes to offer a new MS program on Cyber-Physical Systems.

Need for a MS Program on Cyber-Physical Systems

The NSF [1] defines cyber-physical systems (CPS) as engineered systems that are built from, and depend upon, the seamless integration of computational algorithms and physical components. CPS systems are already widely deployed and used today. Examples include cars that sense impending crashes and perform various actions to protect passengers, and medical devices that sense glucose levels and intervene to restore normal body functions. A CPS may be small and closed, such as an artificial pancreas, or large, complex, and interconnected such as a regional energy grid. In fact, as part of its exploration of CPS, NSF asked the National Academy of Sciences, Engineering and Medicine to study the topic and prepare reports examining the need for a CPS education [2].

A MS degree program in Cyber-Physical Systems has been recently announced by the University of Virginia while a MS degree in Embedded/Cyber-Physical Systems was recently initiated by UC-Irvine. Furthermore, a specialization in CPS is offered by the IIT (Illinois) and a concentration in CPS by CMU.

Cyber-Physical Systems (CPS) integrate sensing, computation, control and networking into physical objects and infrastructure, connecting them to the Internet and to each other. Thus, Cyber-Physical Systems encompasses the Internet-of-Things (IoT) as well as many other areas that integrate computation, networking, and physical processes. As a result, it is proposed that the existing IoT a concentration in the Computer Systems Engineering program become a concentration instead in the CPS MS program. As a concentration in CPS, the IoT concentration has a more natural home, should get even more visibility and attract more applications. However, whereas CPS and the IoT have a lot in common, they are not synonyms. For example, not all CPS applications require a network infrastructure.

Until more concentrations are added, all students in the MS in CPS program will be automatically students in the IoT concentration, which of course already exists. No changes to this concentration (see Appendix) are being proposed at this time – except updates to the prefix codes for appropriate courses.

References
Appendix: MS Degree Requirements – Internet of Things Concentration

Complete all course and requirements listed below unless otherwise indicated. Students may not register for more than 10 hours in the fall and spring terms, and 4 semester hours in each of the three summer terms. Any exceptions must be approved by the program director.

**Required Core**

**Course List**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CSYE 6200</td>
<td>Concepts of Object Oriented Design</td>
<td>4</td>
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<tr>
<td>CSYE 6510</td>
<td>Fundamentals of the Internet of Things (CPS 6510)</td>
<td>4</td>
</tr>
<tr>
<td>CSYE 6530</td>
<td>Connected Devices (CPS 6530)</td>
<td>4</td>
</tr>
<tr>
<td>TELE 5330</td>
<td>Data Networking</td>
<td>4</td>
</tr>
<tr>
<td>and TELE 5331</td>
<td>and Lab for TELE 5330</td>
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**Electives**

Complete four of the following. A maximum of 8 semester hours of non-technical electives may be taken. Students may take elective course work outside these lists only with the prior approval of the program director. A maximum of 9 semester hours may be taken outside of the College of Engineering.

**Technical Electives**

**Course List**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>CSYE 6225</td>
<td>Network Structures and Cloud Computing</td>
<td></td>
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<tr>
<td>CSYE 6230</td>
<td>Operating Systems</td>
<td></td>
</tr>
<tr>
<td>CSYE 7215</td>
<td>Foundations of Parallel, Concurrent and Multithreaded Programming</td>
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<tr>
<td>CSYE 7374</td>
<td>Special Topics in Computer Systems Engineering (Internet of Things) (CPS 7374)</td>
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<tr>
<td>CSYE 7945</td>
<td>Software Engineering Project (Internet of Things) (CPS 7945)</td>
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<tr>
<td>CSYE 7978</td>
<td>Independent Study (Internet of Things) (CPS 7978)</td>
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DS 5220  Supervised Machine Learning & Learning Theory
DS 5230  Unsupervised Machine Learning & Data Mining
EECE 5155  Wireless Sensor Networks and the Internet of Things
EECE 7390  Computer Hardware Security
IE 5640  Data Mining for Engineering Applications

Or

IE 7275  Data Mining in Engineering
INFO 6101  Data Science Engineering with Python
INFO 6105  Data Science Engineering Methods and Tools
INFO 6150  Web Design and User Experience Engineering
INFO 6205  Program Structures and Algorithms
INFO 7290  Data Warehousing and Business Intelligence
TELE 5360  Internet Protocols and Architecture

Non-Technical Electives

EMGT 5220  Engineering Project Management
INFO 6640  People, Processes and Products: Ethics for Engineers
INFO 6650  People, Problems and Patents: Basics of Intellectual Property
INFO 6660  Business Ethics and Intellectual Property for Engineers