

DESIGN AND DEVELOPMENT OF A MODULAR INTERNET OF THINGS
CURRICULUM

by

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Submitted in partial fulfillment of the requirements

For the degree of Master of Science

Electrical, Computer and Systems Engineering

CASE WESTERN RESERVE UNIVERSITY

Month ?, 2021 ?

Design and Development of a Modular Internet of Things Curriculum

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Abstract

Design and Development of a Modular Internet of Things Curriculum

Abstract

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This thesis presents a modular curriculum developed to teach problem solving using the Internet of Things (IOT). The Internet of Things is a broad concept dealing with devices communicating to other devices over the Internet often with no human intervention. Examples of connected "things" exist all around us in the world today with an estimated 30 billion IOT devices currently active¹. The requirements to create an end-to-end IOT solution are diverse and require knowledge and experience to integrate properly. The curriculum is designed to be customized for a given audience based on prior knowledge and available resources. The curriculum is broken down into modules with each module exposing the student to a complete end-to-end solution. Project based hardware modules are presented using microcontroller based devices and single board computer based devices. A software only simulation module is included as well. The modular curriculum can be used as an introductory course which includes basic programming and problem solving or as a higher level course which focuses more on application specific problems that are common when developing an Internet of Things solution.

(WORKING IDEAS: problem solving is key - project based learning - hands on/experiential- modular - low cost/no cost)

1 Introduction

1.1 Motivations for an Internet of Things Curriculum

1.1.1 Research Objective 1 identify, synthesize, evaluate all necessary IoT components

1.1.2 Research Objective 2 Propose a detailed modular curriculum

1.1.3 Research Objective 3 Provide a complete modular curriculum for use

1.2 An Introduction to Curriculum Development

1.3 An Introduction to the Internet of Things

Here is an arbitrary cite

2 The Internet of Things

2.1 History

2.2 What are Things?

2.3 How Do Things Connect?

2.4 How Do Things Communicate?

2.5 IOT Services

2.6 IOT Security

2.7 Future Directions of IOT

3 A Modular Framework

3.1 Modular Motivations

3.2 Module Descriptions

3.2.1 Python

3.2.2 Microcontroller based Remote Control

3.2.3 Microcontroller based Remote Monitoring

3.2.4 Microcontroller based Data Collection

3.2.5 Single Board Computer Remote Control

3.2.6 Single Board Computer Remote Monitoring

3.2.7 Single Board Computer Data Collection

3.2.8 Simulation

4 Python Module

4.1 Intro to Python

All computer languages contain the same six basic programming abilities: math, make and use variable, use inputs, use outputs, make decisions and repeat tasks. Python was

After a programmer learns the syntax for these basic abilities they should spend some time learning about more advanced ways to store information/data using the language.

4.1.1 Math

4.1.2 Make and use variables

4.1.3 Inputs and Outputs

4.1.4 Make decisions

4.1.5 Repetition

4.1.6 Functions

4.1.7 Data Structures

4.1.8 Object-Oriented Python

4.1.9 Python Modules

4.2 MicroPython/CircuitPython

5 Microcontroller based Remote Control Module

5.1 Introduction

5.2 Hardware

5.3 Software

6 Microcontroller based Remote Monitoring Module

6.1 Introduction

6.2 Hardware

6.3 Software

7 Microcontroller based Data Collection Module

7.1 Introduction

7.2 Hardware

7.3 Software

8 Single Board Computer Remote Control Module

8.1 Introduction

8.2 Hardware

8.3 Software

9 Single Board Computer Remote Monitoring Module

9.1 Introduction

9.2 Hardware

9.3 Software

10 Single Board Computer Data Collection Module

10.1 Introduction

10.2 Hardware

10.3 Software

11 Simulation Based Module

11.1 Simulating a Thing

12 Conclusions

Appendix A

The Internet of Things

1 IOT Transports

2 IOT Protocols

3 IOT Services

4 IOT Security

Complete References

- [1] C. Stracener, Q. Samelson, J. Mackie, and M. Ihaza. The internet of things grows artificial intelligence and data sciences. IT Professional, 21(3):55–62, 2019.