



29<sup>th</sup> June 2019

Dear [REDACTED]

Subject: Letter of Evaluation

This is with reference to the Global Academic Internship Programme (GAIP) conducted by Corporate Gurukul from 1<sup>st</sup> June 2019 to 29<sup>th</sup> June 2019 on 'Designing and Implementing Secure IOT Applications'. The course work for internship included the following:

IoT high level concepts, platforms and standards

- Demystifying the Internet of Things - Introduction, Challenges, Architectures
- Taxonomy of protocols and standards for enabling IoT and M2M
- IETF, OMA and OneM2M IoT Standards and their relationship with Internet's TCP/IP stack
- Understanding CoAP protocol
- Hands-On: Introduction to Programming Raspberry Pi installation and Headless Mode Set-up, CoAP Client/Server Data Communication

IoT Protocols

- Refresher on IPv6, Understanding 6LoWPAN, IPv6 Routing Protocol for Low-Power and Lossy Networks, MQTT
- Hands-On: 1: MQTT Client/Broker Data Communication

Secured IoT Applications

- Introduction to security and privacy
- Refresher on SSL/TLS, Using TLS/DTLS transport for securing IoT data
- Securing IoT data with JSON Object Signing and Encryption (JOSE), CBOR (Concise Binary Object Representation), COSE (CBOR Object Signing and Encryption)
- Hands-On: Secured IoT data collection and dissemination, communication over Raspberry Pi-USB/Bluetooth

IoT Data Privacy

- Privacy Preserving Data Correlation (Personal and population privacy, Privacy enhancing techniques, Data service monetisation)
- Data publication, Privacy implication of data quality, Data ownership, Data lifecycle management
- Hands-On: Measurement and monitoring tools for IoT networks

Types of sensors and applications

- Introduction to sensing and wireless network
- Understanding common sensor types and their applications - smart home, smart city, health care & fitness, agriculture, etc., sensor data processing.
- Introduction to programming on SensorTags and Contiki
- Hands-On: Introduction to programming on SensorTags and data collection

#### MAC protocols design and implementation

- Introduction to sensors on mobile devices
- Understanding power characteristics on mobile devices
  - Network
  - Sensing
  - Computation
  - Screen
- Processing of sensor data
- Introduction to wireless MAC protocols and network technologies (ALOHA, CSMA, TDMA, Bluetooth, Wifi, Cellular)
- Hands-On: Programming SensorTags to collect sensor data and communicates with gateway

#### Low power MAC Protocols

- Low power MAC protocols and network technologies (eg. S-MAC, B-MAC, X-MAC, BLE, ZigBee, LoRA)
- Evaluating and Designing MAC protocols for given application requirements

#### Basic Solution Development

- Introduction to IoT Solution Design and Development
- Cloud Computing and Fog/Edge Computing Architectures
- General Purpose Microcontroller (I):
  - Introduction to Micro:bit
  - Reactive System and Event-driven Programming
  - Programming Methodology with Microcontroller
  - Working with Onboard Sensors
  - Wireless Communication
  - GPIO Programming with Microbit
  - Working with Shield Device
  - Working with Add-on Sensors
- General Purpose Microcomputer (II):
  - Introduction to Raspberry Pi
  - GPIO Programming with Raspberry Pi
  - Breadboarding
  - Integration with External Devices
- Hands-On: Working with Micro:bit, GPIO Programming with Micro:bit, GPIO Programming with Raspberry Pi

#### Advanced Solution Development (II)

- General Purpose Microcomputer (II)
  - Working with Bluetooth Low Energy (BLE)
  - Wireless Communication with BLE
  - Wireless Communication with 2.4 GHz Radio
  - Wired Communication
- Server-side Backend Integration
  - Fog/Edge Processing with Raspberry Pi
  - Building Web Application in Python with Flask
  - Database Processing in Python with SQLite
  - Service-Oriented Architecture.
  - Building REST API in Python with Connexion



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- IoT Analytics
  - General Concepts of IoT Analytics
  - Data Mining and Machine Learning in Python with SciPy Libraries.
  - Building a Data Pipeline
- Hands-on: Wireless Communication with Micro:bit and Raspberry Pi, Building Data-driven Web Application, Building REST API, Mining IoT Data

Your performance in GAIP was evaluated based on theoretical understanding and application of concepts in practical data analysis with **GRADE A-**.

We encourage you to further your knowledge, skills and research in the above areas and wish you the very best for a career ahead!

Sincerely,

Senior Lecturer  
Strategic Technology Management  
Institute  
National University of Singapore

Senior Lecturer  
Strategic Technology Management  
Institute  
National University of Singapore

Associate Professor  
Strategic Technology Management  
Institute  
National University of Singapore

**SAMPLE COPY FOR ILLUSTRATION ONLY**

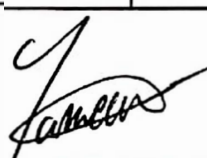







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## TRANSCRIPT

<b>GLOBAL ACADEMIC INTERNSHIP PROGRAMME</b> <b>JUNE 2019</b> <b>DESIGNING AND IMPLEMENTING SECURE IOT APPLICATIONS</b>	
Name: ABHISHEK CHANDRAMOULI	Date: 29 <sup>th</sup> June 2019

Assessment Component	Score	Topic/Parameter
In-Class Assessment	24/40	IoT High Level Concepts, Platforms and Standards
	32/40	Security on IoT
	32/40	Types of Sensors and Applications
	32/40	MAC Protocols - Design and Implementation
	24/40	Solution Development
Final Comprehensive Assessment	48/80	Comprehensive Assessment for the Course
Project Assessment	37/50	Final Project Work

	Assessment			Overall Percentage (Out of 100%)
	In-Class Assessment	Final Comprehensive Assessment	Project Assessment	
	30% weightage	20% weightage	50% weightage	Grade
Percentage	18/30	12/20	37/50	67 A-
Faculty Assessor Signature				
Faculty Assessor Name				

Grading Guideline:

- |              |              |
|--------------|--------------|
| O 100 - 90   | B 54.9 - 50  |
| A+ 89.9 - 80 | B- 49.9 - 45 |
| A 79.9 - 70  | C 44.9 - 40  |
| A- 69.9 - 60 | F <40        |
| B+ 59.9 - 55 |              |