INNOVATIVE and SECURE IoT SYSTEMS

Internet des OBJETS

HOW TO SELECT WORK FOR YOUR

portfolio

Advanced   Masters

Innovative and Secure IoT

2019-2020

INSA | INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

Index…….

Part -A
Generalities

1A) Overview:

This document intends to portray the skills that I have acquired over the period of our classroom training of Advanced Masters of Innovative and Secure IoT to deploy a system of sensors which track the air pollutants and other properties of atmosphere and inform the public through mobile application called Social Networking for Pollution.

Further, the document tells the various technical aspects we that we learned to achieve various milestones.

1B) Personal Details:

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1C) Curriculum Vitae

KRISHNA SUJAN INUGANTI *(3+ years of Work Experience in IT)*

ADVANCED MASTER'S IN INTERNET OF THINGS

Objective:

Looking for opportunity to do internship in IoT, Cloud computing, DevSecOps and IoT security with knowledge in program management to augment the university education at INSA, TOULOUSE and industrial experience for better understanding and implementation in day to day life.

WORK EXPERIENCE

EXPERIAN INDIA [SENIOR SOFTWARE DEVELOPER

[2018 NOV 09 – 2019 SEPT]

1) Cloud Automation IN AWS
2) Research & implementation
3) Trainings
4) AWS Cloud Security
5) DevOps Consultant
6) Agile & Scrum

CA TECHNOLOGIES [SOFTWARE ENGINEER]
[2016 FEB 24 - 2018 NOV 08]

1) Build and Release.
2) Team Lead for product scan
3) DevOps Engineer
4) Agile & Scrum
5) Infrastructure Admin & SAAS
6) Product Security
7) Linux and Bash
8) AWS Cloud Consultant

EDUCATION DETAILS

INSTITUT NATIONAL DES SCIENCE APPLIQUEES (INSA), TOULOUSE, FRANCE
Advanced Master's in Innovative and Secure IoT *[Sept 2019 – Sept 2020]*

1) IoT devices and sensors
2) Equipment management
3) IoT security
5) Network devices & protocol
6) Project Management
7) Cloud Computing
8) Nanotechnology
9) Microservices

K.R.E SOCIETY'S KARNATAKA COLLEGE OF P.SCIENCES, KARNATAKA, INDIA
[OCTOBER 2007] – [SEPT 2011]

1) Have completed Graduation in sciences with 63 %.
2) Have studied chemistry as main subject and Computer science as an inter-discipline of subjects.
3) Worked on various instruments such as infrared analyzer, dissolution etc.

SRI CHAITANYA JUNIOR COLLEGE, HYDERABAD INDIA

[APRIL 2005] – [MARCH 2007]

1) As part of high school education, I have studied Biology, physics and Chemistry
2) Participated in various activities in physics practical like pin-hole camera, earth magnetic fields and its impact on animals and humans.

THE HYDERABAD PUBLIC SCHOOL, HYDERABAD, INDIA

[JUNE 1996] – [MARCH 2005]

1) Pursued primary, middle and high school education.
2) Passed matriculation with 65 %
3) Studied Computer Science, Commercial applications, sciences, Geo-sciences and international relations

HOBBIES

SOCCER   TRAVELLING   dj

PERSONAL INFORMATION

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TECHNICAL SKILLS

- *INTERNET OF THINGS*
- *LoRaWAN, PYCOM*
- *DEVOPS*
- *CLOUD COMPUTING (PUBLIC {AWS} AND PRIVATE)*
- *AWS CLOUD SECURITY*
- *CONTAINERISATION*
- *SHELL SCRIPT & PYTHON*
- *CLOUD NETWORKING*
- *AWS IoT*
- *OPENSHIFT*
- *DOCKER*

PROJECT MANAGEMENT

- *CLOUD RESOURCE MANAGEMENT*
- *SCRUM MASTER & AGILE*
- *CAPACITY MANAGEMENT OF INDIVIDUALS*
- *LEADING A TEAM FOR PRODUCT SCANS*

LANGUAGES

FRENCH
ENGLISH
GERMAN
HINDI
TELUGU

1D) Acquired Training & Units

COURSE	TIME DURATION	YEAR
Smart Devices	**61.7**	
Microcontrollers and Open-Source Hardware (M&OSH)	25	
Optical Sensors	7.5	MSIoT, 2019-2020
CAD, manufactiuring and integration of nano-technology sensors	15.45	
Sensors introduction	11.25	
Analog electronic labs	2.5	

COURSE	TIME DURATION	YEAR
Communication	**63.75**	
Protocols for connected objects	33.25	
Digital Wireless Communications for connected objects	5	MSIoT, 2019-2020
Energy for connected objects (recovery, transfert)	7.5	
Security for network of connected objects	7.5	
Emerging network (SDN, NGN)	10.5	

COURSE	TIME DURATION	YEAR
Middleware and Service	**62**	
Service architecture	31	MSIoT, 2019-2020
Middleware for Internet of Things	14.75	
adaptability : cloud and autonomic management	16.25	

COURSE	TIME DURATION	YEAR
Analysis and data processing, business applications	**37.5**	
Software engineering	6.25	
Semantic data	8	MSIoT, 2019-2020
big data	15	
SPOC/Hackathon/Seminaries	8.25	

COURSE	TIME DURATION	YEAR
Innovative project	**80.75**	
Innovative project	37.5	MSIoT, 2019-2020
Portfolio	8.25	
English	35	

COURSE	TIME DURATION	YEAR
Innovation and humanity	**85**	
Innovation	20	
Creativity methods / TRIZ method	10	MSIoT, 2019-2020
Team Management / Social Acceptability	20	
Individualized Professional Development	10	

Part –B
Descriptive

Earlier to pursuing MSIoT here at INSA, Toulouse, I have been working with IT companies back in India. In 2016, I have started my professional career as an Associate Cloud Administrator with Magna Infotech a part of Quess Corp and was working with CA Technologies. During this period, I was involved in working with various product teams to enable their product to be deployed in public cloud. Later, in the same year, after 8 months, I was given a bigger role as a Cloud consultant and was involved in designing cost effective solutions. One of the major achievements during the period was, I helped in reducing the cloud expenditure by 59% by providing optimised solution.

During the same phase, I was also given the additional task of handling the cloud security and design the solutions based on the CCSK organisations.

Due to my enthusiasm, I was completely absorbed by CA technologies in 2017 and was made a part of the software development team. During this time, I got opportunity to work various DevOps applications. I was handed the responsibility of delivering 4 SaaS products of the company to the business customers. Because of my contribution, I was awarded above and beyond award twice within a quarter which is a rear achievement in the business unit.

Later, I also got an opportunity to implement new ideas of DevSecOps to make sure the product that we were delivering were safe, secure and reliable. Due to successful implementation of the concept, I was delivered a task to form a team which would implement the idea of DevSecOps.

I also got opportunity to work on detecting security threats and code related issues as part of my job.

Later, in 2018, I moved to a new company called Experian, based out of Europe. Here, I was given the role of Senior Software Developer where I was involved in providing consultation services in Cloud and DevOps technologies.

I was made to be a single point of contact for various teams in Asia Pacific region.

Apart form this I was also involved in program management and participated in the agile practices.

PART-C
TECHNICAL PART

Introduction:

In this section, I would like to mention how various classes have helped in solving the issues and completing my MSIoT academic project, Social Networking for Pollution (SNP) as I mentioned at the starting of the portfolio.

In short, the project was about creating an IoT solution to track pollutants like NO2, CO, O3 and SO2 along with atmospheric parameters like pressure, humidity etc. The project was designed as it can be seen below.
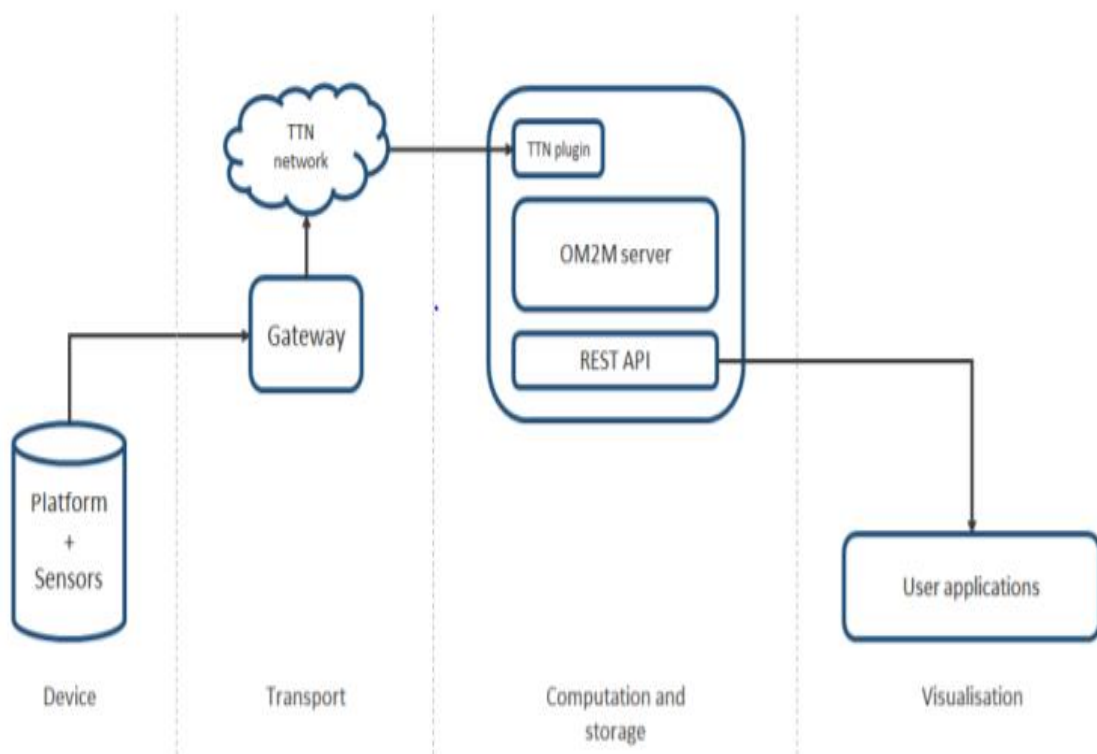
The solution as structured consists of sensors which would be connected to the gateway where it would then send data to TTN network. From here through plugins the data would be sent to the middleware, OM2M. From here the metrics would be made available for access through the mobile application.

Scenario 1:

Presentation:

The project was started with full enthusiasm and we started to identify the possible challenges we could face during the implementation. The first issue for me while working on the project was about the sensors. So here the question raises as whether I have to use open source sensors or to create my own sensors?

Resolution:

Though we have used the readily available gas sensor it is important for me to learn as to how I can make my own gas sensors. So, fifteen and half hours of course where we worked on creating nano-particles based gas sensors in the AIME lab at INSA.

Basically, it involved many steps which are mentioned as follow.

● Low power consumption

● Easy-to-use ● Small size

● Low Cost

● Short response time

● Detection of NH3

● Detection of C2H6O

● Temperature sensor included

● 2 Integrated gas sensors

● Heater included (resistor)
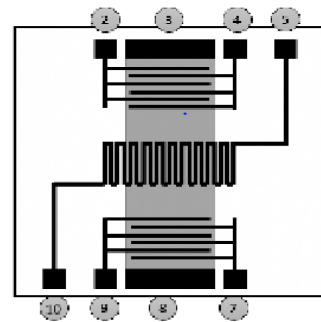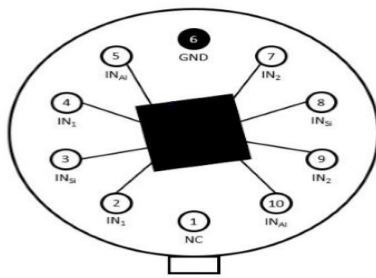
Skills Gained:

Through this practical, I have learned as to how to create our own gas sensors to be used for the SNP project.

Beside this, we have also learned the precautions that I need to take in the process of extraction of nano particles while performing centrifugation.

Scenario 2:

Presentation:

After creating our own gas sensors, now the question arises as to how to utilise the sensors for sensing the gases. I was confused to use the sensors. The question arises whether the sensors were ready to use. What are the other devices to be used along with sensors for proper functioning of the sensors?

Solution:

Thanks to timely schedule of the KiCAD and M&OSH classes. In these classes, I have learned about various Open Source hardware structure and various micro-controllers and their utilisation. At this stage, I got to learn the elements to create its own electronic circuits (the schematic to the routing to pull its PCB), presentation of the language syntax of programming and development environment.

Skills Gained:

During these lessons I have learned to draw sensor architectures and design using the eeschma and kiCAD tools. I have also learned how low pass filters can help is reducing the noise and avoid the damage of PCB. Further, I have also learned the transfer of the signal from sensor to the PCB using the analogue clock.

Scenario 3:

Presentation:

Wireless network connectivity plays a major role in Internet of Things (IoT). During the project, once we had the sensors and the LopY4/Pycom expansion ready, we need an appropriate wireless network to enable the communication between the sensor nodes and master and different gateways and other installations. Further, we are made to consider the energy efficiency and consumption along with the security feature that the wireless networks provide along with the area of utilization of the network.

Solution:

Over sixty-three and half hours, we have spent our time studying about different types of wireless communication technologies in details. We had class about BLE, Wi-Fi, Zigbee, LoRa etc. During this time, we were made to analyse the various aspects of different WSNs in terms of area coverage, energy consumption, number of nodes that could be added to the network of sensors network. localisation feature and mobility flexibility etc. We, further, also leaned about different MAC protocols and their presences in various sensors to receive the communication over the network.

Further, we also studied about various possible ways available to provide energy to the IoT sensors and devices by learning about super capacitors, energy harvesting through gradient in temperature and pressure in the surrounding environment.

However, this knowledge would not be sufficient to chose the network. One of the major criteria whole selecting WSN is the security being offered by the particular network. Hence, during the Security for network of connected objects in this module, we studied about various types of cyber attacks like passive eavesdropping, man-in-the-middle etc, its impacts on the IoT solutions. We further also learnt the possible ways of mitigating the attacks.

Further, we also learned about Software Defined Network for IoT and its importance in future for development of scalable IoT solutions.

Knowledge gained:

It could clearly be seen that all the above issues can be solved using various technologies. One such solution to address the above issues is the MAC protocol. By choosing appropriate MAC protocol, all the challenges related to energy consumption, security and efficiency could be addressed.

Finally, depending on different parameters, we choose to use LoRa network as it is a Long-Range Wide Area Network which is available at free cost. Further, we also have LoRa gateway in INSA which would help us in our solution.

Scenario 4:

Presentation:

For the IoT solutions, middleware has an important role to play. The middleware helps in joining different or heterogenous domains of applications to different interfaces. Middleware deals with structuring the data, providing security, have access controls, formatting and encoding of data between various layers.

As the project solution requires a middleware, I had to implement middleware in our project.

So, we decided to use OM2M for our project.

Solution:

OM2M implements oneM2M and SmartM2M standard. It provides a horizontal Service Common Entity (CSE) that can be deployed in an M2M server, a gateway, or a device. Each CSE provides Application Enablement, Security, Triggering, Notification, Persistency, Device Interworking, Device Management, etc.

The TPs of OM2M have given us the idea about the architecture and structure tree of OM2M components, IN-CSE. During this time, we learned to integrate the IoT with OM2M. I also learned how to manage hue bulb from OM2M along with using REST API.

Further, as OM2M helps in integration of various components of different domains, it would be important for us to learn service-oriented architecture as SOA helps to build multi domain and organisational collaboration. SOA further, also enables interoperability which is also a feature of OM2M. It is an interface that provides data and services. So, the TPs and INSA classroom management project have helped us in understanding the SOA, REST API and its integration with OM2M.

Skills Acquired.

OM2M exposes a RESTful API providing primitive procedures for machines authentication, resources discovery, applications registration, containers management, synchronous and asynchronous communications, access rights authorization, groups organisation, and re-targeting.

OM2M is a Java implementation running on top of an OSGi Equinox runtime, making it highly extensible via plugins. It is built as an Eclipse product using Maven and Tycho. Each plugin offers specific functionalities, and can be

remotely installed, started, stopped, updated, and uninstalled without requiring a reboot.

Scenario 5:

Situation:

As part of middleware and services, we are also required to know about the infrastructure to host the applications and the code related to the OM2M project. Further, one of the plans was to try to install OM2M in the form of docker.

Solution:

The cloud classes which also had classes and exercises about cloud and docker, have dealt with topics of OpenStack and docker both theoretically and practically. During the TPs we have learned to work on OpenStack and implementation of node applications. Further, we have also tried to work on implementation of PaaS in OpenStack.

Skills acquired:

So far, I have the experience of working on AWS, MS Azure and google Cloud. However, these classes and TPs have made me learn OpenStack which I have planned to learn since long time.

Scenario 6:

Situation:

Here, one question has arisen. As MSIoT students we should be aware of performing data analysis of the data being generated by the IT sensors and devices over the globe.

Solution:

We learned about the web-semantics and the TPs which involved analysing the data from a specific site reporting about the metrics of whether forecast.

Also, we have learned R language which is essential for data analysis.

Skills acquired:

I have acquired the skills of using R language and R studio for the purpose of Data Analysis which could used in Fog Computing.

Scenario 7:

Situation:

Though we have learned java to build SOA application for various solutions, one should also be aware of the industrial practices followed by developers.

Solution:

To learn about the industrial practices the software engineering classes have helped to learn about the unit testing to code testing and code security.

Skills acquired:

Through these classes, we have learned about the unit test cases and configuring test cases to verify the code quality.

Scenario 8:

Situation:

Though we have the project to implement as part of the innovative project, we'll also have to work on managing and dividing the work among the team members. This was not only for the innovative project but also for other TPs which are performed in the form of a group. It was important for us to manage and divide the work based on the skills of the team member. This was also important for us while participating in the hackathons.

Solution:

Twenty hours of class of team management and the project management classes have introduces us to the agile methodology and the human resource management for better, successful competition of various tasks related different tasks.

Skills acquired:

Through the project management classes, we learned to use ICE-SCRUM tool using which we gained knowledge about scrum framework and agile methodology of project implementation. Through the programme of team management, we learned to deal with real time practical problems like skill mismatch in the projects. Further, we learned about how to tackle the issue enhancing skill of an employee to produce better results.

Part -D
Analysis

As I have been working before coming here, I have a hobby of reading Gartner's report and analyse the trend of the technological shift in the industry. The Gartner's report forecasted the IoT as one the top technologies in the coming year. However, it also talked about the storage in the form of cloud computing to store huge amount of data, analysing and IoT as well as data security would be a great challenge. The report also talked about the security of the sensors and data generated by IoT.

When I applied for this program, I could find all the required skills to fulfil the conditions reported by Gartner's publication.

The program has a holistic approach of developing the skills of an individual in all the directions. Right from the beginning of creating our own sensors to calibrating them and practically using them to get the gas metrics. The program also focused on various WSN technologies, which according to me is very much important when we are designing a solution and implementing it in our professional life. I would also like to mention that, the course has helped me in recollect the graduation topics like chemical extractions, nano-particles and centrifugation that I have used around 8 years back during my graduation. So, it was an opportunity for me to recollect and implement the knowledge I gained few years back.

In the program, I also liked the middleware application OM2M, which according to me can be scaled to the level of IoT-as-a-Service.

The data analytics, web semantic topics actually helps us in analysing the data form various sources which is very much important in the present-day analytical world where data is treasure.

According to me, the course also addresses the concept of FOG computing for IoT implicitly, which is the upcoming solution for the IoT deployments. Adding of topics explicitly related to FOG computing could be really help us to have the skill that other students would not have.

For me, the best of the program was learning java and R language. This was so because I never tried my hand on scripting. I would further, like to add that more classes of R and java would help students like me. Also, it would be great to teach python's data analytical tool modules like numpy, scipy, maptlab, etc and Go language as in the real-time analysis GO is more preferred compared to R.

On the security aspect, I personally felt that we should having more and in-depth classes and practices about mitigating the security threat to the IoT ecosystem as security would be a great challenge to IoT industry.

The project management courses, I liked it a lot as it helps us with great insights into how the project management would be implemented.

The additional programmes like lecture from industry experts coming from companies like continental, sierra wireless, orange, continental, etc helped us in understanding what the industries are trying to implement and achieve.

Since ever, every technology starts as a physical solution but it slowly moves towards being a virtual appliance. The trend has been in the compute technologies, where they started with physical desktops to host the software applications and moved towards virtual compute machines. In the same way, from traditional networking, the industry started developing SDN solutions to make the network flexible and scalable.

In similar way, I felt it would be great if we could also learn about virtual sensors and devices where presently companies are involved in.