

NON-DISCLOSURE AGREEMENT

This Non-Disclosure Agreement ("Agreement") is entered into by and between

NOKIA SOLUTIONS AND NETWORKS INDIA PRIVATE LIMITED, a corporation validly organized and existing under the laws of India, having its registered office at 1507, Regus Business Centre, Eros Corporate Towers, Level 15, Nehru Place, New Delhi -110019 ("NSN") and ("Nokia") and

BMS College of Engineering - Bangalore, an engineering college validly organized and existing under the laws of India having its principal place of business at Bangalore, India, identity code TBD ("BMS")

corporation validly organized and existing under the laws of India having its principal place of business at Bangalore, business identity code [ ] ("Recipient")

hereinafter referred to as "Party" or "Parties" respectively

WHEREAS:

- (A) For the purpose of discussions concerning Nokia University consortium setup to discuss Telecommunications Cloud and Internet of Things to help improve virtualization, scaling and orchestration in mobile broadband networks, and the possible business relationship which is a consequence of said discussions (hereinafter "Purpose"),
(B) Nokia may, in conjunction with the Purpose disclose to the Recipient Information which Nokia regards as confidential and the Recipient is willing to undertake to restrict the use and further disclosure of such Information.

NOW THEREFORE IT IS HEREBY AGREED:

- 1. "Information" shall mean any technical and/or commercial information relating to Nokia or any of its Affiliates' businesses, facilities, products, services, techniques and processes in whatever form, including but not limited to oral disclosure, electronic communication, demonstration, device, apparatus, model, sample of any kind, computer program, optical or magnetic medium, document, specification, circuit diagram, or drawing (including but not limited to information of a general nature or information not necessarily in the form as applied to wireless or fixed telecommunications systems) and visual observation of the aforesaid which is proprietary to Nokia or to its Affiliates or to Nokia's or its Affiliates' licensors, contractors or customers (hereinafter "Information").
2. "Affiliate" of Nokia shall mean an entity
(i) which is directly or indirectly controlling Nokia;
(ii) which is under the same direct or indirect ownership or control as Nokia; or
(iii) which is directly or indirectly owned or controlled by Nokia.

For these purposes, an entity shall be treated as being controlled by another if that other entity has fifty percent (50 %) or more of votes in such entity, is able to direct its affairs and/or to control the composition of its board of directors or equivalent body.

3. The Recipient shall

- a. keep confidential all Information received by it from Nokia with the same degree of care as is used with respect to the Recipients' own equally important confidential information to avoid disclosure to any third party, but at least with reasonable care, and
- b. neither disclose Information received by it from Nokia to third parties nor use it for any purpose other than the above mentioned Purpose without the prior written permission of Nokia.

Subject to the foregoing the Recipient shall restrict access to Information received from Nokia to only those of its employees to whom such access is necessary for carrying out the Purpose and advise such employees of the obligations assumed herein.

4. The foregoing obligations shall not apply to any Information which
  - a. is in the public domain at the time of disclosure or later becomes part of the public domain through no fault of the Recipient; or
  - b. was known to the Recipient prior to disclosure by Nokia as proven by the written records of the Recipient; or
  - c. is disclosed to the Recipient by a third party who, to Recipient's knowledge, did not obtain such Information, directly or indirectly, from Nokia; or
  - d. was independently developed (i.e. by personnel having either no access to the Information or only under the exceptions as set out above) by the Recipient as proven by the written records of the Recipient.

For the purpose of the foregoing exceptions, disclosures which are specific, e.g. as to engineering and design practices and techniques, products, software, services, operating parameters, etc. shall not be deemed to be within the foregoing exceptions merely because they are embraced by general disclosures which are in the public domain or in the possession of the Recipient. In addition, any combination of features shall not be deemed to be within the foregoing exceptions merely because individual features thereof are in the public domain or in the possession of the Recipient, but only if the combination itself and its principle of operation are in the public domain or in the possession of the Recipient.

The Recipient may disclose Information received from Nokia if the Recipient is required to do so by any ruling of a governmental or regulatory authority or court or by mandatory law, provided that written notice of such ruling is given without undue delay to Nokia so as to give Nokia an opportunity to intervene and provided further that the Recipient uses reasonable efforts to obtain assurance that the Information will be treated confidentially. Information which is disclosed in such a manner must be marked "Confidential".

5. The Recipient shall not make any publicity on, press release of or any reference to this Agreement, to Nokia, or Information received from Nokia or the negotiations or cooperation between the Parties.
6. This Agreement shall come into force upon signature by both Parties and shall automatically terminate five (5) years later or at such time as the present Agreement is expressly superseded by a subsequent agreement between the Parties hereto, whichever is earlier.

Notwithstanding the above, the rights and obligations set forth in this Agreement which have accrued prior to termination shall survive the termination or earlier expiration of this Agreement for a period of five (5) years.

7. Nokia may at its discretion request at any time in writing from the Recipient that the Recipient either return or destroy all Information received from Nokia and stored electronically and/or on record-bearing media as well as any copies thereof. The Recipient shall confirm in writing such destruction or return the Information as well as any copies thereof to Nokia within fourteen (14) days after receipt of Nokia's request.

The provisions of Article 7 para. 1 hereof shall not apply to copies of electronically exchanged Information made as a matter of routine information technology backup and to Information or copies thereof which must be stored by the Recipient according to provisions of mandatory law, provided that such Information or copies thereof shall be subject to an indefinite confidentiality obligation according to the terms and conditions set forth herein.

8. Neither this Agreement nor disclosure or receipt of Information shall constitute or imply any promise or intention to make any purchase of products or services by Nokia or any commitment by Nokia with respect to the present or future marketing of any product or service or any promise or intention to enter into any other business arrangement.

9. No license to a Party hereto, under any trademark, patent, copyright or any other intellectual property right, is either granted or implied by the conveying of Information to such party.

10. None of the Information which may be disclosed or by Nokia shall constitute any representation, warranty, assurance, guarantee or other inducement by Nokia to the Recipient of any kind, and, in particular, with respect to the non-infringement of trade marks, patents, copyrights or any other intellectual property rights, or other rights of third parties.

11. In carrying out its respective obligations under the Agreement, each Party shall comply with all applicable laws and regulations of the local country and of any other applicable country, including any country of export. Each Party agrees not to pay, promise to pay, or authorize the payment of any money or anything of value, whether directly or indirectly, to any person (whether a government official or private individual) for the purpose of illegally or improperly inducing any government official or any political party or official thereof to make an award decision or illegally or improperly to assist either Party in obtaining or retaining business, or to take any other improper action favorable to either Party in connection with the award of a license, permit, contract or other form of award or approval. Any Party that fails to comply with this provision shall indemnify, defend and hold harmless the other Party from and against any claim, loss, damage, liability, expense, cost, of whatsoever nature arising out of or related to, or connected with such Party's failure to comply.

12. Nokia may assign any of its rights or obligations under this Agreement without prior written consent of the other Party to its Affiliates. This Agreement may not be modified or amended except by written amendments duly executed by the Parties. This requirement of written form can only be waived in writing. The Recipient shall adhere to any relevant export control laws and regulations with respect to the Information or products received from Nokia.

13. This Agreement shall be construed and interpreted in accordance with the laws of India.

14 All disputes arising out of or in connection with this Agreement, including any question regarding its existence, validity or termination, shall, unless amicably settled between the Parties, be finally settled by arbitration in accordance with the provisions of Arbitration and Conciliation Act 1996. The arbitrator(s) are to be appointed in accordance with the (Indian) Arbitration and Conciliation Act, 1996 and rules framed there under. The arbitration proceedings shall be conducted in English. The award shall be final and binding on the Parties hereto and enforceable in any court of competent jurisdiction.

The arbitration shall be held at New Delhi, India.

Each Party shall be entitled to seek necessary and appropriate injunctive relief to maintain the status quo depending on the outcome of the arbitration or any other temporary measures from the courts of competent jurisdiction to enjoin the other Party from taking certain actions which may infringe on the rights of the Party bringing such claim, provided that any proceedings and decisions as to the merits of the dispute, including permanent injunctions, are exclusively governed and resolved by arbitration in accordance with the first paragraph of this Article 14.

### NOKIA SOLUTIONS AND NETWORKS INDIA PRIVATE LIMITED

By: *[Signature]*

Name: Ponni K

Title: Head of Mobile Networks, R&D Laboratories

Date: 13.03.2017

Place: Bangalore

By: *[Signature]* 16/3/17

Name: Rupa Santosh

Title: Location Head – Nokia Bangalore

Date: 13.03.2017

Place: Bangalore

### BMS COLLEGE OF ENGINEERING, Bangalore

By:

Name: Dr. D. Seshachalam

Title: Professor, Dept of ECE

Date:

Place: Bangalore

By: *[Signature]*

Name: Dr. K R Sudhindra

Title: Associate Professor, Dept of ECE

Date:

Place: Bangalore

## Internet of Things

In association with Nokia Networks, Bangalore

Resource: Nokia Engineers-Mr. Vishnu Ram, Mr. Sudhesh

BMS Faculty: Dr. K R Sudhindra, Dr Suma M N

Report

### Need for the course

In present pace of changes in the domain of wireless communications industry , there is a need for Electronics and Communication Engineering graduate to learn Internet of Things which adds value in the communication domain. As such this necessitated introduction of IOT as elective course .

### Objectives of the course:

We have proposed "Internet of Things" as a cluster elective ( 3-1-0-0) for VII semester in association with NOKIA Networks,India Pvt Ltd.

Primary aim of this course is to provide End to End understanding of IoT concepts, including high level understanding on various Wireless/ IoT related communication technologies, GUI and Database concepts, SW design / implementation / testing concepts for Device Management and Analytics.

At the end of the course students should be able to design , implement and test projects of end to end IoT system including setting of devices/sensors, communication, GUI/Database, management and analytics of those sensors/devices.

### Course delivery

- Classroom sessions:
  - Nokia employees would conduct classroom sessions of all the modules facilitated by BMS faculty.
  - Session on introduction to Pi Kit should be conducted by BMS faculty.
  - Few BMS faculties would join this course, with the aim that most of the classroom sessions for future years could be conducted by BMS faculty with support from Nokia.
- Projects and Demos:
  - The classroom would be divided into groups of 5 or so , each group would take up a separate project.
  - Project preparation starts along with module-1 and would continue till the end of the course.

- Each group would have to demo their projects at the end of the course.
- Nokia guide would provide guidance to the teams starting from project preparations till the end of the projects.
- Q&A
  - Nokia and BMS jointly has setup one Blog site –[iotbmsce google groups](#) for all kinds of Question, Answers, Clarifications between the students and the Nokia employees delivering the courses.

## UNIT 1,3,4,5

### Conduction by Nokia

Discussion with open interaction by NOIKA resource persons .

Following Project abstracts are given covering entire syllabus and address entire end to end IOT implementation

#### Project Abstract-1: **Communication protocol extensions for low power IoT communications:**

IoT Communications require low power consumption from the devices. IoT devices (like sensors) require a battery life of atleast 10 years. The communication protocol between sensors and the service layers in the infrastructure has to be optimised in such a manner that the power utilization is minimized. This project includes a study of current literature on IoT connectivity protocols, current power requirements, optimization techniques and solutions.

These techniques will be prototyped in an IoT testbed and results will be published.

#### Project Abstract-2: **Analytics for smart city networks:**

Smart cities are envisioned and in progress in multiple countries including India. One of the major characteristics of smart cities is intelligent backend analytics system. Huge amount of data will be produced from various sensors and other entities in a smart city. These have to be analysed and intelligent algorithms designed for various scenarios. This project will include a study of various analysis techniques, learning algorithms and their usage in a Smart city framework.

These techniques will be prototyped in R computing language and results will be published.

#### Project Abstract-3: **Databases for IoT networks:**

IoT networks require a flexible database framework to store and retrieve information and also to relate information easily. Traditional SQL type databases have limitations in these modern usecases. This project studies these limitations, suggest NOSQL alternatives. Ability to interface with other systems, extract and visualise data and establish relationships are very important.

These DB techniques will be prototyped in neo4jdatabase and results will be published.

**Project Abstract-4: Services and visualization for Smart Cities and IoT networks:**

A common services layer is the backbone of smart cities and IoT framework. This will define the services layer, the corresponding APIs and how other entities can make use of these. A standards based approach will be used. Another important aspect is the ability to visualise and represent the information in a manner which can be consumed by customers such a local government agencies. This requires careful rethinking of visualization techniques.

These techniques will be prototyped in OneM2M framework and results will be published.

**Project Abstract-5: Cloud and virtualization for Smart Cities and IoT networks:** Cloud based hosting of virtualized services will be important for elastic deployment of Smart Cities framework. In this project, study the virtualization techniques, deployment options for those and management of such services under the context of smart cities. Networking using SDN will also be studied to the extent needed for this.

White Papers on said abstracts and papers on IOT standardization are Employed in classroom discuss. Students are asked to download all OPENSOURCE softwares to execute said abstracts and weekly demonstration on their progress in discussed.

## **Unit II**

### **Conduction by BMS Faculty**

As a part of couse delivery planned, we conducted workshop on RASPBERRY PI on 3rd and 4th September 2016. 21 students participated in the workshop.

### **Workshop Agenda**

Basics of Raspberry Pi  
Fundamentals of Linux  
Basics of python programing  
Raspberry Pi IoT basics

Students were introduced with Phython, Linux, HTML, Webserver hosting, GPIO programming. Using WebIOPI they controlled device connected to GPIO remotely

### **HW and SW requirement which department provided for students during workshop**

- Hardware requirements:
  - WiFi Modules
  - Raspberry Pi Modules
- Software requirements:
  - Open Source downloadable software

**Achievement of higher Pos from this workshop  
PO5, PO10**

Students were introduced about raspberry pi including the hardware specifications, the software required to work with it and its differences and advantages in comparison to other similar development boards like Arduino.

Students were divided into seven groups. Introduced with process of setting up and configuration of pi board, simultaneously executing the steps on laptops as well. Next, the idea of Secured Shell (SSH) was explained along with its importance and applications in the networking domain. An introduction to Python language was given in very basic sense which is employed to execute some basic programs involving glowing and blinking LEDs in some pattern.

Next setting up of web server on pi board using router was done where the commands of linux and their usage were explained. Then, an introduction to HTML language and its commands were taught along with the creation of basic web pages. Also, an insight to CSS was mentioned which helps in presenting better web pages. Finally, WebIOPi web framework was explained which is used to control the GPIO pins of the board remotely using the internet.

All the groups executed controlling sensor with their webiopi. This group activity has helped students work in team, Use modern tools and how to go for documentation/ report writing.

**Conduction of CIE/ assignment/AAT /SEE and evaluation  
CIE****CIE- 50 Marks**

Test-1, Test-2, Test-3 and Quiz are conducted as Quiz-1, Quiz-2, Quiz-3 and Quiz-4.  
Question paper is set by Nokia Networks and evaluated by BMS faculty.

**Mode of Conduction**

: **Open-book Quiz -I,II**, in class,

Hints: crisp, to-the-point answers are expected with reasoning,

Evaluation: copying as-is from reference - negative marks,

Network Diagrams - bonus marks.

**Quiz -III,IV** - Five teams were made and abstracts were given for implementation of IOT protocols-M2M, COAP, cloud virtualisation, smartcity framework, R-based analytics, NoSQL- using open source software and Raspberry Pi hardware.

**SEE-100 Marks**

Semester End theory written exam will be carried out for 100 Marks

BMS faculty in association with Nokia would prepare required question papers

Question paper covering all units for 3hrs is given to students with two internal choice.



Evaluation by BMS Faculty and by Nokia Resource persons

#### OUTCOME

1. Students are prepared for new technology concepts with few hands on experience of protocols /hardware through miniprojects towards end to end IOT implementation.
2. Visit to Nokia labs and interaction helped to understand real time implementation issues, challenges.
3. Nine of our students were selected in Vodafone based on IOT /4G learning