# GENERAL ONTOLOGY FOR INTERNET OF THINGS (GoIoT) TO ACHIEVE SEMANTIC INTEROPERABILITY USING SENSOR, OBSERVATION, SAMPLE AND ACTUATOR (SOSA) APPROACH

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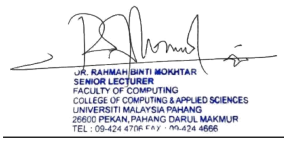


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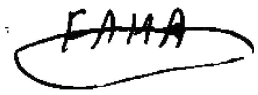

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# ABSTRAK

Peranti Internet Pelbagai Benda (IPB) bertambah dari hari ke hari, dengan itu ianya memerlukan kosa kata piawai untuk memastikan peranti dari pelbagai pengeluar boleh berkomunikasi diantara satu sama lain dikenali sebagai saling kendali semantik. Ontologi diperlukan untuk menyelesaikan masalah saling kendali semantik bagi IPB. Ontologi menyediakan perwakilan objek yang asas untuk domain yang spesifik. Pengelasan, nilai dan hubungkait merupakan komponen-komponen yang diperlukan untuk membina ontologi. Masalah-masalah yang wujud dalam ontologi IPB adalah seperti berikut: (i) Konsep-konsep IPB yang tidak lengkap; (ii) Tiada satupun ontologi yang memasukkan kesemua elemen-elemen kritikal IPB; (iii) Tidak dibina dalam piawai bahasa ontologi terkini yang dicadangkan oleh W3C iaitu Bahasa Ontologi Web (OWL); (iv) Tidak mengikut mana-mana penilaian pengukuran seperti penaakulan atau kejituan. Objektif penyelidikan ini adalah untuk mengkaji literatur sedia ada mengenai IPB dan Ontologi dan hubungkait antara keduanya; membina dan menilai GoIoT dengan menggunakan perisian Protégé dan pentaakulan palet masing-masing. Metodologi kajian ini dibahagikan kepada tiga bahagian iaitu Analisis, Pembinaan dan Implementasi, dan Penilaian dan Pengukuran. Di dalam bahagian analisis, konsep asas IPB dan ontologi dibincangkan. Di dalam pembinaan dan implementasi, Ontologi SOSA (Sensor, Observation, Sample, and Actuator) digunapakai untuk menghasilkan ontologi baru yang dinamakan GoIoT. Ianya menerangkan mengenai konsep IPB guna semula sedia ada dan bagaimana tambahan gabungan konsep baru IPB. Selanjutnya, ianya membincangkan bahasa dan alatan mana yang digunakan untuk membina ontologi ini. GoIoT baru yang dibina dinilai melalui penaakulan semantik dan pakar bidang. Dari penaakulan semantik menunjukkan tiada kesilapan dalam ontologi GoIoT yang dibina, ini menunjukkan tiada isu yang dijumpai diantara komponen-komponen ontology. Lima (5) pakar bidang juga telah menilai ontologi melalui sembilan (9) kriteria penilaian. Nilai Purata gabungan dari lima (5) orang pakar bidang adalah sebanyak 83.059 % dan nilai ini menunjukkan Ontologi yang dibina boleh diterima sebagai Ontologi yang mewakili Ontologi Umum bagi IPB.

## ABSTRACT

Internet of Things (IoT) devices are increasing day by day, thus a common vocabulary is required to make sure these devices from a different manufacturer can communicate with each other by themselves known as semantic interoperability. Ontology is required to solve the semantic interoperability problem of the IoT. Ontology provides a base to represent objects in a specific domain. Classes, Instances, and Relationships are the components required to built ontology. Problems with existing IoT ontologies are as follows: (i) Incomplete IoT Concepts; (ii) Most of the Existing IoT ontologies did not includes all critical elements of IoT; (iii) The existing ontologies are not built on the latest ontology language standard recommended by W3C which is Web Ontology Language (OWL); (iv) The IoT ontologies in literature did not follow any Evaluation Measurement such as Reasoner. The objective of this research is to study the existing literature about IoT and Ontology and their relationship. Then to develop and evaluate GoIoT by using Protégé and pallet reasoner respectively. The methodology is divided into three portions which are Analysis, Development and Implementation, and Evaluation and Measurements. In the analysis part, basic concepts of IoT and Ontology are discussed. In Development and Implementation, SOSA is adopted to create a new ontology, namely GoIoT. It talks about the existing reused IoT concept and how new IoT concepts are further integrated. Further, it discusses which language and tools are used to build this ontology. The newly constructed GoIoT is evaluated via semantic reasoner and experts. The reasoner results showed zero error in GoIoT ontology which simply means that no issue is found among ontology components. Five (5) experts have also evaluated ontology in terms of nine (9) evaluation criteria. The mean value of five (5) expert combine is 83.059 % and this value shows that the Ontology developed can be accepted as Ontology that represent General Ontology for IOT.

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