DYNAMIC DUTY CYCLE MECHNISM FOR MOBILITY IN WIRLESS SENSOR NETWORKS

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DEDICATION

I dedicate exclusively to my family, especially to my father, Mr. Ali jasim altoblany. Not forgetting to my colleagues that never give up to support and encouragement me until to the end. Also for those who have been praying for me afar to keeps me stable facing the difficulty in the journey as a student at the University Tun Hussein Onn Malaysia. May Allah bless all of you. Amin.

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ABSTRACT

Appeared in previous years to connect the physical environments with the digital world Wireless sensing networks (WSN). There are several small sensor units through which small devices are created in which WSN is configured and can sense the physical environment properties such as heat, pressure, light, soil formation, location, and others. Physical environment properties. Through receivers and transmitters, the sensor nodes send the data hop by hopto the sink node or base station, and these devices have a short-range and a very low frequency. Through a very precise complement, the sensors are small size but at the same time contain sensors as well as radio transmitters and receivers with microprocessors that can implement local data processing that done as well as operate networks using. Besides,through a wireless medium that has been Sensing the data of the wireless transceiver in the process of transmitting and receiving data that will take place in the network.The increased demand for mobility within different applications raises the increasing question about power consumption and how to reduce itin nodes of the WSN. An example of these applications is the application of environmental monitoring, medical observation, and automation of home and this is why wireless sensor networks (WSN) usually consist of a fixed node. The aim of this project is to design a dynamic duty cycle mechanism for mobility as well as fixed nodes within wireless sensor networks through a Contiki simulator through which power consumption, Packet Delivery Ratio (PDR) and duty cycle aremeasured by nodes under the mobility and fixed condition. Done through two diverse scenarios that are the sink and the sensor nodes fixed, and the sink nodes and the nodes are the mobility that occurs. We analyze the performance of the mechanism that will be produced by Contiki on three different measures: Excel extracts PDR, power consumption and duty cycle, to reduce power consumption and these percentages.

ABSTRACT

Muncul pada tahun-tahun sebelumnya untuk menghubungkan persekitaran fizikal dengan rangkaian digital Digital sensing WSN (WSN). Terdapat beberapa unit sensor kecil di mana peranti kecil dicipta di mana WSN dikonfigurasikan dan dapat merasakan sifat persekitaran fizikal seperti haba, tekanan, cahaya, pembentukan tanah, lokasi, dan lain-lain. Sifat persekitaran fizikal. Melalui penerima dan pemancar, nod sensor menghantar hop data dengan hopto node sink atau stesen pangkalan, dan peranti ini mempunyai jarak pendek dan frekuensi yang sangat rendah. Melalui pelengkap yang sangat tepat, sensor adalah saiz kecil tetapi pada masa yang sama mengandungi sensor serta pemancar radio dan penerima dengan mikropemproses yang boleh melaksanakan pemprosesan data tempatan yang dilakukan serta mengendalikan rangkaian menggunakan. Di samping itu, melalui media tanpa wayar yang mengesan data penerima transceiver dalam proses penghantaran dan penerimaan data yang akan berlaku dalam rangkaian. Permintaan yang semakin meningkat untuk mobiliti dalam aplikasi yang berbeza menimbulkan persoalan yang meningkat tentang penggunaan kuasa dan bagaimana untuk mengurangkan tempat nodus WSN. Contoh aplikasi ini adalah penggunaan pemantauan alam sekitar, pemerhatian perubatan, dan automasi rumah dan inilah sebab mengapa rangkaian sensor tanpa wayar (WSN) biasanya terdiri daripada nod tetap. Matlamat projek ini adalah untuk merekabentuk mekanisme kitaran tugas dinamik untuk mobiliti serta nod tetap dalam rangkaian sensor tanpa wayar melalui simulator Contiki di mana penggunaan kuasa, Packet delivery ratio (PDR) dan kitaran tugas diselesaikan oleh nod di bawah pergerakan dan keadaan tetap. dilakukan melalui dua senario yang berbeza iaitu wastafel dan nod sensor tetap, dan nod sink dan nod adalah mobiliti yang terjadi. Kami menganalisis prestasi mekanisme yang akan dihasilkan oleh Contiki pada tiga langkah yang berbeza: PDR, penggunaan kuasa dan kitaran tugas, untuk mengurangkan penggunaan kuasa dan peratusan ini diekstrak oleh Excel

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LIST OF ABBREVIATIONS

LLN	-	Low Power and Lossy Networks
RPL	-	Routing Protocol for LLN
DIO	-	DODAG Information Object
CCA	-	Clear Channel Assessment
ContikiMAC	-	Contiki Medium Access Control
Contiki OS	-	Contiki Operating Systems
CPU	-	Central Processing Unit
PDR	-	Packet Delivery Ratio
LPL	-	Low Power Listening
LPM	-	Low Power Mode
LPP	-	Low Power Probing
PDR	-	Packet Delivery Ratio
RDC	-	Radio Duty Cycle
UDGM	-	Unit Disk Graph Medium
ETX	-	Expected Transmission Count
DIS	-	DODAG Information Solicitation
WSNs	-	Wireless Sensor Networks

CHAPTER 1

INTRODUCTION

1.1 Background of Study

All over the world, one of the most important technologies that have received a lot of interest in academia and industry is the wireless sensor network (WSN) [1]. WSN usually consists of a very big number of wireless sensor nodes that are least-cost as well as low power and multifunctional, the sensor nodes participate to perform a common mission with the capabilities of wireless communication and sensing capabilities over a low distance through a wireless medium. The capacity of each sensor node is limited in WSNs, and the power by which the mission is completed for entire networks is sufficient for the task that was requested. Power is saved by providing a connection that is wireless sensor network protocol designs. This is the main challenge. It is impossible to recharge batteries or replace batteries because most nodes in the sensor networks have restricted battery energy. There are many levels of power consumption in sensor networks, for example:

I. Idle Listening: The power consumption source for WSNs
II. Resend resulting from jostle
III. Packet Control overhead
IV. Unnecessarily raise transmitting energy
V. Sub-optimal exploitation of the available resources.

The sensor nodes are propagated in a dedicated manner by definition [2], for long periods the individual nodes remain inactive. Some nodes can be placed in order to reduce the power consumed while attention to the inactivity that occurs, and we can say that it is more than the need

for use during the sleep mode. For this reason, the power of the nodes is preserved as well as the power of the network. Stop schedules are created by sensors where these devices duty dynamically, so that the nodes when needed are only awake [3].It will reduce collisions that consume energy.

Energy efficiency is the best way to reduce power consumed and this should be the main consideration for power, but we must take into account the quality that we will get during the use of energy [4].

1.2 Problem Statement

Through the studies that were studied previously, the researchers paid special attention to the fixed nodes scenarios. As for the nodes mobility, it has been studied by a few researchers, and they conclude in their studies that the static nodes are better comparison with mobility nodes for sensor networks works in terms of power consumption, packet delivery rate (PDR), latency and other execution metrics that are obtained during the study. There are two scenarios studied in this project namely fixed nodes and other mobility nodes. This project will be studied by using the Cooja Simulator, performance of the new technique in terms of power consumption and how to decrease power consumption in mobility and fixed nodes, which will be performed in two different simulation scenarios, sink node, the sender nodes are static, sink node, and the sender nodes are mobility. we will then study the results and analyze for all scenarios using a different (CCA).The dynamic duty cycle technique for mobility and fixed nodes will be design within the wireless sensor networks to reduce energy comparison.

1.3 Objective

The purpose of this project is as described below:

I. To design and propose a dynamic duty cycle technique for mobility and static nodes in wireless sensor networks.
II. Measure the execution dynamic duty cycle technique of power consumption, duty cycle and PDR by using Cooja simulation.
III. Analyse the simulation result that we will get to determine the execution of the proposed dynamic technique for this project.

1.4 Scopes of Project

I. As a network simulation, review the previous studies on how to use Cooja simulator.
II. By installing the mobility plug-in, mobility for the node is enabled in the Cooja simulator.
III. Mobility nodes are simulated by enabling the mobility Plug-in for Cooja simulator.
IV. Bonnmotion emulator can be used to create mobility scenarios that are called by "position.dat", which is done through Cooja simulator.
V. Build up a basic network arranging that all simulation scenarios can use.
VI. In wireless sensor networks the dynamic duty cycle mechanism design for mobility and fixed nodes.
VII. Measure the power consumption, PDR and duty cycle.
VIII. The performance of the dynamic mechanism studied is determined by analysing the simulation result.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In general, employ abundant types of MAC in ContikiOS. Wireless alarms are implemented by MAC protocols. Some protocol applications have been developed specifically for ContikiOS.
In this chapter, (WSN)[5] wireless sensor networks are reviewed. Each part will be expounding in detail and illustrated to comprehend and survey the project.

2.2 Wireless Sensor Network (WSN)

One of the technologies that amalgamate compact computing, automatic sensor and smart wireless networks within small-integrated devices is WSN wireless sensor networks. However, early research focused on WSNs [6] primarily and notably in surveillance-related applications such as cultivation and environmental monitoring, and this is done based on the low rate of data collection. More complex processes such as health care, industrial monitoring, and automation can be supported by existing WSN applications. Cameras and microphones contain a category of WSN that is provided by low-cost devices and very rapid development: WSN and multimedia. This category has worked to contribute to potency WSN applications such monitoring [7]. The sensor nodes contain a large number of WSN wireless sensor networks. A small wireless device known as the sensor node causes where the sensor node is defined as the response of one of the stimuli or many stimuli and the transfer of important information over short distances by radio frequencies or laser methods, and all of this. The sensor senses the physical phenomenon that occurs close to where it occurs. Certain characteristics of the phenomena in the area surrounding

these sensors can be revealed by converting the measurements into signals used for this treatment.Photonics, light, humidity, temperatures, imaging, and seismic activity are a type of phenomenon that causes a transducer's response.

Sensors and processor; memory, communication system, positioning system as well as all these power units are made bysensor devices. Data is collected from the target area towards the infrastructure treatment node or BS base station via WSN networks. The BS node and/or it can become mobile and may be fixed. Thousands of nodes of high-density WSN networks can be deployed indoors, highways, buildings, infrastructure, and cities as well for control and surveillance purposes. Figure 2.1 shows a drawing the WSN node and its components [8].

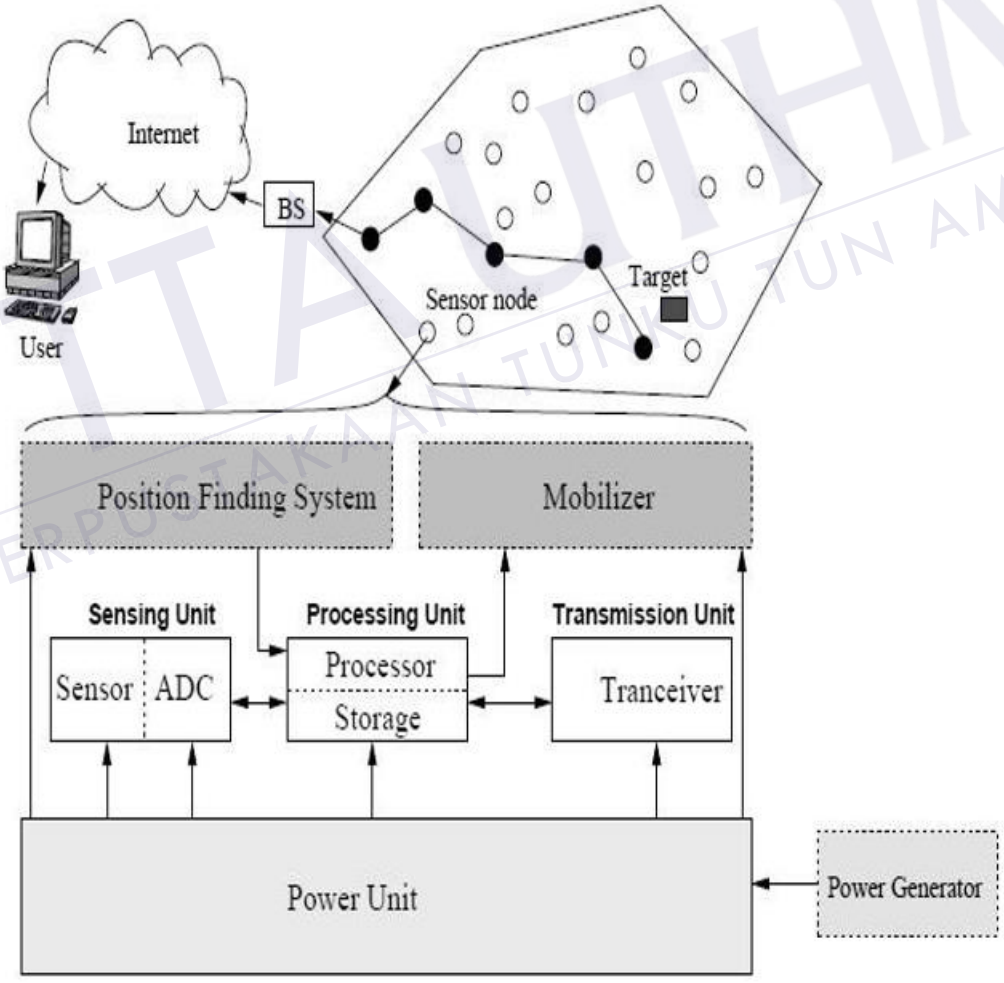

Figure 2.1: The ingredient of a sensor node and WSN

In recent years WSN sensor wireless networks have given very much interest in the specialization of the MEMS [9] technology electronic technology and make the use of smart sensors smartly developed.

The sensors require resources and compliance resources as they are small, inexpensive compared to traditional sensors. Information can be collected and measured and transferred to the user in the user in the process of the sensor depending on the decisions and its construction. In a particular environment, thousands of small computers are published by a sensor. After the self-intended sensors are available, and the data is available.In almost every field of life, electronic devices change dramatically by the trend towards wireless communications. Facilitating observation and analysis of some intricacy phenomena over large regions and long periods employing small sensor nodes networks. Through the most recent developments that have occurred in sensor networks research, a small and sleazy sensor nodes have been developed that can acquire large offset of data that contain physical values. WSN is anexpert, distinct type found in dedicated networks that has a big number of nodes armed with different sensors.Through technological advancement, this type of network within low-energy wireless connections and the silicon complete that occurs between different functions is supported. Physical conditions and the environment are monitored by independent sensors that WSN configures. Each node inside the sensor is equipped with a wireless transmitter and receiver or any device that can be used that has a small power source and controller [9]. Figure 2 illustrates a mechanism for how WSN works.

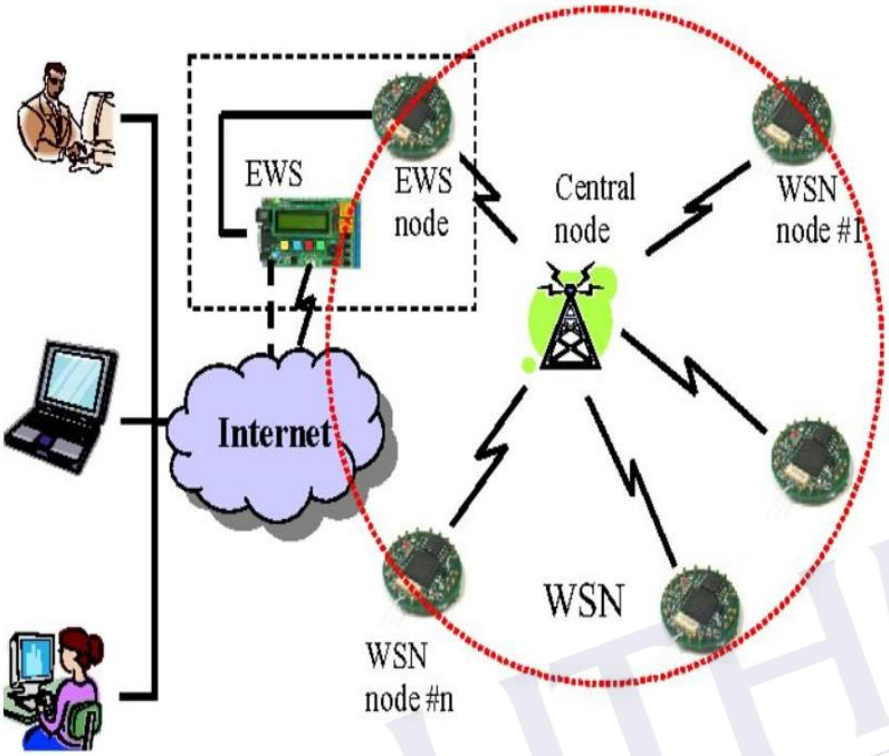

Figure 2.2 shows a set of WSN and how to operate it

2.3 Scheduling

The rest scales of the nodes must be scheduled between the source and the face to preserve a joint network topology as well as to ensure packet delivery. We should design the MAC layer protocols very carefully [4].

2.4 comparison of protocols and algorithm used in duty cycle

The still convene becomes outside the network and not part of it due to the effect of the contract mode on the sleep mode and because of this thing he cannot participate in the direction that occurs. Where there are topological changes produced by the sleep schedules. If the two nodes are active, the link between the two nodes will also be buoyant. The algorithm affects energy consumption and for this reason, a very precise engineering path is chosen. Table 2.1 shows simile of protocols and algorithms that could be used in procedure for this duty cycle [4].

TABLE 2.1: Comparison of Protocols & Algorithms

NO	Routing Protocols	Sleep Decision
1	S-MAC	Predefined duty-cycle
2	MS-MAC	Predefined duty-cycle
3	RMAC	Synchronization using Pion packets
4	The Cross-Layer Scheduling Algorithm	Each node adjusts its duty cycle dynamically according to load.
5	A Topology Discovery Algorithm	Each node decides to sleep according to the network topology, its location, and the residual energy.

2.5 Application of WSNs:

Applications consist and are classified according to their external influence on the individuals, industries used, and the external community as well. In this type of category [10], some good and important applications are explained and discussed where it is very important to distribute tasks and data from the used sensors. Applications of, WSNs are discussed and understood [11], including:

I. Temperature.
II. Humidity.
III. Motion of the car.
IV. Pressure.
V. Fanfare Levels.
VI. Military.
VII. Health.

2.5.1 Health applications

The BSN sensor network that refers to the (WSN) network which in turn contains a large individual application contains medical monitoring. (BSNs) are deployed to monitor medical conditions in sports as well as human execution in sports. Sensors, which are electrical acceleration devices, gyroscopes, electromagnets, and other devices used for medical study needs. The demonstration lies with social safety nets side by side and some technologies are offered for hardware, data mining, security, communication, and energy issues as well as software.TBI is defined as a disease that affects the brain, which works on a lack of focus, planning, and memory as well. It is also difficult for those carrying this disease to complete activities and implementation, and it is difficult for them to move, which is a very painful disease. It is recovered by providing them with the first treatment in hospitals, but there is a stage in this disease in which people with this disease are transferred to their homes. A system that can access data has been developed to assist carriers of this disease (TBI) as it assists them in their daily activities. This system integrates systems with a fixed wireless sensor that can be worn on them. These devices work to locate the subject used in the home. Where these devices can work through wearing them and they are tracking the patient's activity where these devices send signals to track the patient and treatment is done through sensor networks that contain an intelligent algorithm and these devices are directed to the appropriate place for the patient to give dynamic reactions to those who use it when that is required by the device [10].

2.5.2 Military applications

By any wherewithal, time and area should be preserved as needed. In general, these methods should determine the direction and resist interference and other threats through electronic wars. Where security is provided for messages from one party to another. WSN connections apply to this type of device. Within the military operations of the joint combat scenario, there is a known enemy and an enemy well known to some on land, air or sea. With all this, the recent experience contained many scenarios, such as green environment operations, real global operations, and operations in which there are no OTW wars such as relief and disaster situations that occur as well as peacekeeping.OTW intersects with three scenarios where WSNs are seen in very large arenas but this is not the whole world. WSN contains capabilities and these capabilities build not only on

wireless intercourse that fulfills all the up matters, but the ability of sensors. Sensors gauge all physical phenomena [11].

2.5.3 Rescue

People buried with snowstorms can be helped by using WSN. By informing the rescue team of the victims' state of the snow blasts, people buried under the blasts are found, and the damage as a result of these blasts can be limited. The rescue team can prioritize the victims of these explosions, through breathing and awareness activities as well as the heart rate. Because of this thing, a sensor node with an oximeter that measures oxygen and its level in the blood carries people at risk of such collapses as hikers and snowboarders. The knot gauge the heart rate as well as breathing activity. The victim is exposed to air through an oxygen sensor. Accelerometers are used. The PDA team receives sensory data for buried victims. Fire network, there are requirements for fire rescue found in WSN such as firefighting accounting, on-time monitoring, smart metrics and scheduling, services that can work with the web and integration as well as resource allocation. The scanning is done through new protocols and hardware and software support [10].

2.6 IPv6 in Wireless Sensor Networks

With beginning 1995, the improvement of IPv6 began, the future, it is emphasized that several problems related to Ipv4 (such as enlarging the routing table, very complex configuration, and security issues) will increase. When comparing between IPv4 and IPv6, the latter provides very important improvements, including a simplified but fixed head, 128-bit address space, automatic provisioning mechanisms, and security adjustments. A continuous process represents the transition between IPv 4 to IPv6 from the WSN wireless sensor network. Dedicated mobile networks contain a subset of which are MANETs, but despite their existence, they are very different from traditional devices due to the strong ability and sensitive restrictions in them. There are a very large number of sensing nodes that are inexpensive and very capable of sensing, as well as data processing and wireless communications with the rest of the nodes, and these large numbers consist of WSN.

These functions within WSN communicate directly between collaborative algorithms and nodes. We cannot apply the existing algorithms or the technical tons that exist in MANETs

directly to WSN due to the reason for the limitations mentioned above, and for this must be adapted and appropriate to existing solutions and the development of new solutions that can solve these problems. Affecting the design of network protocols and algorithms significantly and noticeably strong demands for least costs and power efficiency as well as a small node. It is designed with reduced consumption in order to extend the network life.WSN contain a considerable assortment of applications since the nodes may become equipped with many different types that are very different from the sensors. The event that took place can also be located and located, as well as other discoveries. Various types of motors can be connected with the sensor nodes. Today, military, health, environmental, household, and manufacture applications rely on the use of WSN. The enforcement of the IP stack that existed everywhere in WSN is not good and is not appropriate at all. The work of IP depends on many works done correctly with very limited resources [12]. For this reason, some of the solutions that are being replaced using WSN (several protocols developed specifically for WSNs have been developed). Unfortunately, there is a large variety of protocols and the absence of communications that are unique and standard, as well as the possibility of sensor networks working with other networks of high quality. Emphasis has been placed on the work of Internet Protocols in the past years in the past few years, with some important adjustments being made because network protocols for traditional internet are moving from IPv4 to IPv6 and attention is given to installing IPv6 in the WSN program. There are groups of IPv6 identified over wireless low-power networks as a layer with the adaptation needed to implement the IPv6 protocol stack in WSN. The size of the frame that was used in the WSN physical layer is very smaller than the frame in the IP networks due to the adaptations that cannot be dispensed with. IEEE 802.15.4 is the most prevalent standard within the WSNs layer. Because of this, the 6LOWPAN layer adapts to the IPv6 package to be within the IEEE framework. IEEE-based networks 802.15.4 are ways in which the Adaptive Layer 6LoWPAN in frame format forms local linking and automatic configuration. Transfer over IEEE 802.15.4 and saving resources include additional specification methods for IPv6 compression. There are four types of frames defined within IEEE 802.15.4 (Identification tires, data frames, beacon frames and frames for MAC commands within the data frames, IPv6 packets can be transported. The received packets use notifications. The IEEE 802.15 frame 4 which contains 127 bytes of the physical layer has a very large and integrated IPv6 packet. The 33 bytes available for the application layer have been left without any methods used for compression

(better overhead) and with AES (which is a very advanced coding standard). To transfer data more and better, fragmentation is very necessary. The 6LOWPAN layer focuses on where the head pressure is to obtain bundles that in most cases can mix with the IEEE 802.15.4 frame and this concentration occurs due to the consumption of additional resources. 6LoWPAN can be defined for UDP head compression and at its best (unicast and local transmission) we can compress IPv6 and UDP to six bytes. The work of the IETF for some groups was determined by networks of poor energy and great loss. RPL is the first protocol that supports IPv6 support and is very suitable for sensor networks. It has been worked out and designed and is considered a standard protocol, with features that can be chosen by the application. In all analyzes and scenarios WSN was used as an IPv6-based protocol [13].

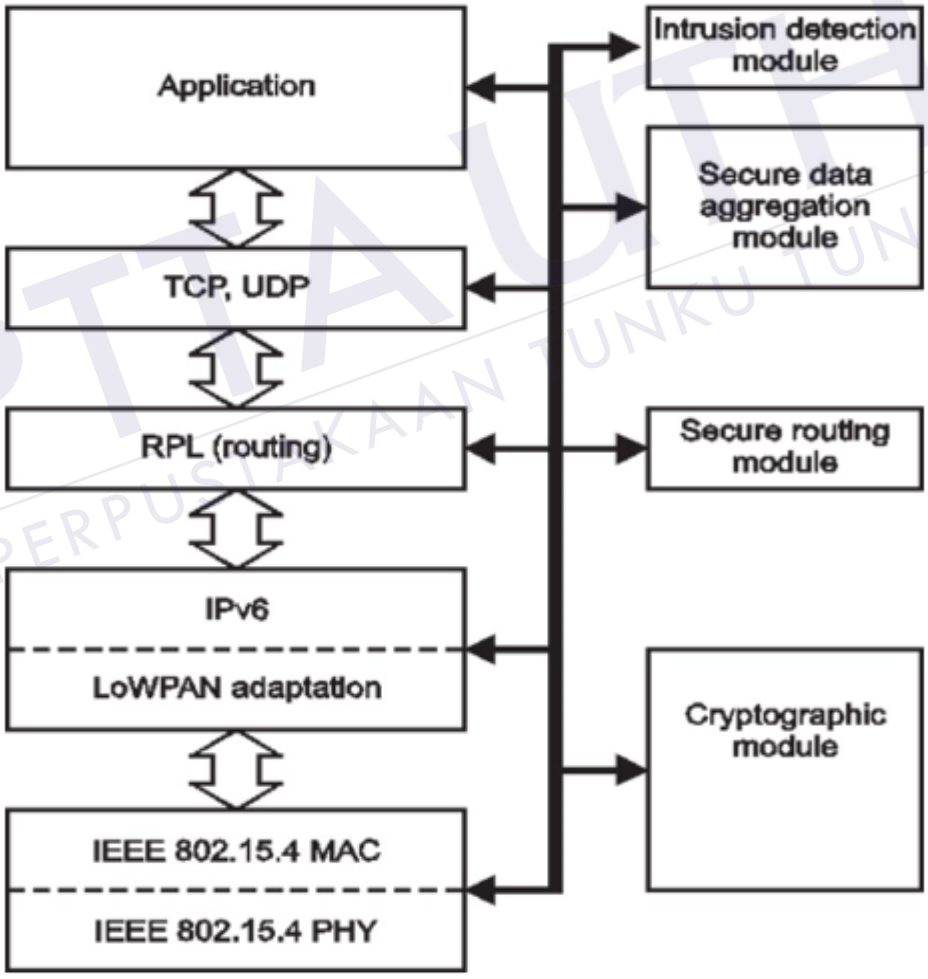

Figure 2.3: IPv6-based WSN protocol stack requisite

2.7 ContikiMAC:

ContikiMAC is an unrealistic but virtual mechanism for cycling that runs ContikiOS by holding sensors. To determine sleep periods as well as drop times, this does not require additional signal messages or packet headers, because it is an asynchronous mechanism. The periodic awakening of the network nodes as well as the waking frequencies depends on the ContikiMAC duty system throughout the life of the network.

In addition, the Contiki radio duty cycling mechanism. While being able to relay multi-hop packets, ContikiMAC allows the shutdown of the radio and most of the time (> 99%). To save energy, the receiver and wireless transmitter must be turned off or in low power networks.

The energy in the Contiki is provided by the radio cycling layer which is Radio Duty Cycling (RDC). Contiki provides various properties in the RDC. ContikiMAC is the default mechanism. The most considered high layer in the RDC is the MAC layer (through which medium access control is completed). In the event of a collision, the responsibility for avoiding collisions in the radio is the MAC layer and is also responsible for resending the packets. There are two layers of the Contiki in the MAC: The first mechanism is the CSMA, it is a multi-access mechanism, a carrier, and a second mechanism, the NULLMAC, which is blank and cannot perform any processing in the MAC. This study explains the changes that occur in the RDC as well as in the MAC within Contiki.

Contiki offers two MAC drivers, CSMA and NullMAC. CSMA is the default mechanism. The MAC layer receives packets from the RDC layer and uses the RDC layer to transmit packets. If the RDC layer or the radio layer detects radio signal conflicts, the MAC layer may then resend the packet. The CSMA mechanism is currently the only MAC layer that sends packets if a collision is discovered [14].

Energy consumption and energy behavior when the network is congested is an important part of Contiki and also the RDC and MAC ride protocols are an important part. RDC and MAC are changed inside the Contiki project by adding a project - conf file. h The necessary expressions are added to the project [15].

2.8 Duty cycle

It is defined as part of a single period in which the signal and the system are activated as the duty cycle or it is called the energy cycle. How to work is expressed as a percentage. There is a period it takes for the signal to complete the on-and-off cycle as well. We can write the working formula like this (%).

$$D = (PW / T) * 100\%$$

Evenly, a duty cycle (ratio) may be expressed as:

$$D = (PW / T)$$

We can use the duty cycles to find out or describe the current time used for an active signal in a used electrical appliance such as the power switch in the power supply by switching with it or the action of the capabilities of the verb present by a living system present, for example neurons.

The duty factor for periodic indication in it may be expressed in the same idea that we have known, but at times it is measured to a single large extent rather than 100%.

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