Faculty of Computer Science and Information Technology

BODY TEMPERATURE AND HEART BEAT MONITORING SYSTEM FOR DENGUE PATIENTS USING IOT TECHNOLOGY

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Bachelor of Computer Science with Honours
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ABSTRACT

Dengue is a mosquito-borne viral disease that is transmitted by female mosquitoes mainly of the species Aedes aegypti and, to a lesser extent. There is no specific treatment for dengue, but early detection and access to proper medical care lowers fatality rates below 1%. Monitoring the patient's temperature, heartbeat and body fluid volume is critical to severe dengue care. Regular body temperature and heart pulse check are important to prevent dehydration and irregular heart rate pattern. Negligence of this regular check- up may lead to even more severe dengue fever and even lead to fatality if there is no intensive care. However, to constantly monitor both temperature and heartbeat of the patient in a short period interval requires a load of labour and can waste much disposable equipment during the check-up. In this era, IoT is a smart approach to overcome this situation. The nurse who is taking care of the patients can monitor the patient's status in a real-time situation using the approach of IoT, mobile application and web-based system. If the patient's status is in a critical situation, the system will alert the nurses for them to perform a necessary procedure.

ABSTRAK

Denggi ialah penyakit bawaan sejenis nyamuk Aedes aegypti dan seumpama dengannya. Sehingga kini, tiada lagi penawar yang khusus bagi merawati penyakit ini, namun begitu, dengan pencegahan awal dan rawatan pemulihan yang kondusif, kadar kematian dapat diturunkan sebanyak 1%. Mengawasi suhu badan, kadar nadi dan kandungan air dalam badan adalah penting untuk penjagaan pesakit denggi. Pengawasan ketara bagi suhu badan dan kadar denyutan nadi amatlah penting untuk mengelakkan dehidrasi dan bacaan nadi yang tidak setara. Pengabaian pemantauan ini boleh mengakibatkan penyakit ini menjadi lebih parah sehingga boleh menyebabkan maut. Tetapi, pengawasan yang kerap untuk kondisi suhu badan dan kadar nadi dalam kadar yang kedap amatlah susah, kerana banyak alat pakai buang yang terpaksa dibazirkan. Oleh yang demikian, pendeketan IoT sangatlah berguna untuk mengatasi masalah ini. Bagi petugas yang mengawasi pesakit denggi ini, mereka dapat mengawasi keadaan pesakit dengan kadar yang pantas.Tambahan pula, dengan bantuan applikasi mobil dan sistem laman sesawang, dapatlah masalah ini dihadapi dengan lebih mudah. Jika kondisi pesakit berada dalam keadaan luar biasa, maka, dapatlah tindakan awal diambil supaya langkah yang sepatutnya dapat dilaksanakan dengan lebih berkesan.

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INTRODUCTION

1.1 Project Title

Body Temperature and Heart Beat Monitoring System for Dengue Patients using IoT Technology

1.2 Introduction

Dengue is a mosquito-borne viral disease that is transmitted by female mosquitoes mainly of the species Aedes aegypti and, to a lesser extent. Dengue is widespread throughout the tropics, with local variations in risk influenced by rainfall, temperature and unplanned rapid urbanization. The global incidence of dengue has grown dramatically in recent decades. About half of the world's population is now at risk. Severe dengue is a leading cause of serious illness and death among children in some Asian and Latin American countries. There is no specific treatment for dengue, but early detection and access to proper medical care lowers fatality rates below 1 percent. Monitoring the patient's temperature, heartbeat and body fluid volume is critical to severe dengue care.

1.3 Problem Statement

Even though there is no cure for dengue, an intervention can help, depending on how severe the disease is. Regular body temperature and heart pulse check are important to prevent dehydration and irregular heart rate pattern. Negligence of this regular check-up may lead to even more severe dengue fever and even lead to fatality if there is no intensive care. However, to constantly monitor both temperature and heartbeat of the patient in a short period interval requires a load of labour and can waste much disposable equipment during the check-up. In this era, IoT is a smart approach to overcome this situation. The nurse who is taking care of the patients can monitor the patient's status in a real-time situation using the approach of IoT, mobile application and web-based system. If the patient's status is in a critical situation, the system will alert the nurses for them to perform a necessary procedure.

1.4 Objectives

Main objective of this project is to design and develop a system that monitor the body temperature and heart-beat pattern of the dengue's patient with the help of IOT device and mobile application. Other objective included:

1.To save and retrieve records of status.

2.Generate report of the patient's status.

1.5 Scope

This project is focusing on the person who are monitoring patient that are infected with dengue virus. The system can be used to monitor any changes of the patient heart-rate and body temperature in a short interval time period. With the instant data transfer from the system, it eliminate delay to take the patient's body temperature and heart-beat measurement. The reading will be shown as beats per minute (bpm) for heart-rate and Celsius (°C) for temperature. .

1.6 Methodology

Methodology is a system that covering large and wide scope of rules or principle which consists of specific method consist a set of practices that can be used to solve problems within particular scope. For this project, Iterative and incremental development methodology is selected to develop **Heart beat and body temperature pattern monitoring system for Dengue Patients**. This methodology can reduce development time and reusability of component which can help to speed up the development for this project and also able to deliver and making modification if needed without repeating previous phase.

The basic idea behind this method is to develop a system through repeated cycles (iterative) and in smaller portions at a time (incremental), allowing software developers to take advantage of what was learned during development of earlier parts or versions of the system. Learning comes from both the development and use of the system, where possible key steps in the process start with a simple implementation of a subset of the software requirements and iteratively enhance the evolving versions until the full system is implemented. At each

iteration, design modifications are made and new functional capabilities are added.

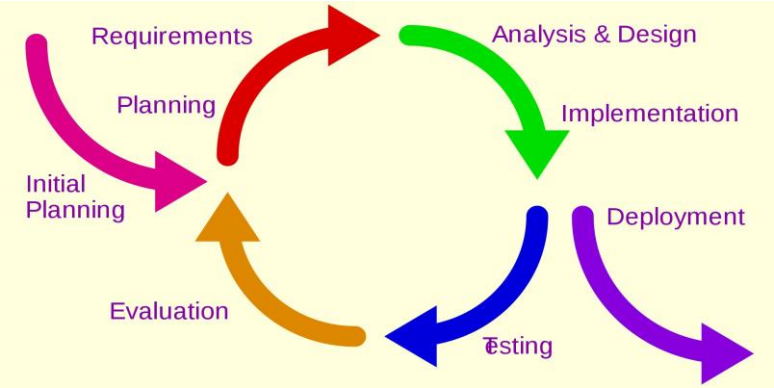

Figure 1.1: Iterative and incremental development

Based on Figure 1.1, Incremental development slices the system functionality into increments (portions). In each increment, a slice of functionality is delivered through cross-discipline work, from the requirements to the deployment. The Unified Process groups increments/iterations into phases: inception, elaboration, construction, and transition.

1.7 Significance of Project

The proposed system will help the nurse or doctor monitoring the patient temperature and heart-beat reading during the patient intervention in order the patient to recover from dengue. The System will provide an accurate reading of the patient temperature and heart-beat reading. Furthermore, the interval gain of the patient body temperature and heart-beat reading can be achieve in a short period of time. The system will also alert the person in charge monitoring the patient if there is any irregularity of the patient temperature and heart-beat reading.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, a literature review of similar features of the existing system with the proposed system will be discussed. But prior of explaining the existing system, the circumstance of the dengue patients need to be elevated first. Dengue infection is a systemic and dynamic disease. It has a wide clinical spectrum that includes both severe and non-severe clinical manifestations. Dengue illness management is relatively simple, inexpensive and very effective in saving lives so long as correct and timely interventions are instituted. The key is early recognition and understanding of the clinical problems during the different phases of the disease, leading to a rational approach to case management and a good clinical outcome. Reducing dengue mortality requires an organized process that guarantees early recognition of the disease, and its management and referral when necessary. The key component of the process is the delivery of good clinical services at all levels of health care. Intervention process by monitoring the patient's health parameter such as body temperature, blood count, pulse rate, and blood pressure is crucial for the patients to survive the illness.

2.2 Courses of dengue illness

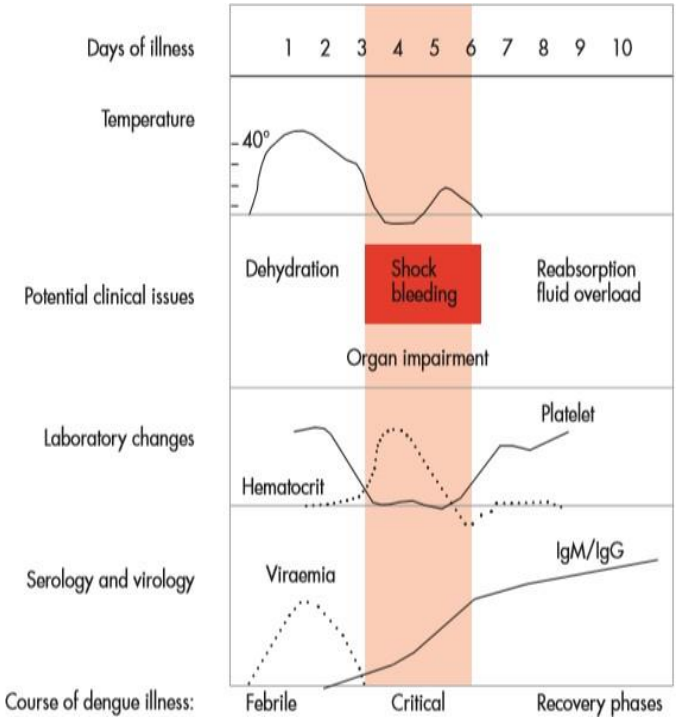

Figure 2.1: Course of dengue illness

(DENGUE GUIDELINES FOR DIAGNOSIS, TREATMENT, PREVENTION AND CONTROL ,2019)

Figure 2.1 shows the phase of the dengue illness. After the incubation period, the illness begins abruptly and is followed by the three phases which is the febrile, critical and recovery phase. Referral centres receiving severely ill dengue patients must be able to give prompt attention to referred cases. Beds should be made available to those patients who meet the admission criteria, even if elective cases have to be deferred. If possible, there should be a designated area to cohort dengue patients, and a high-dependency unit for closer monitoring of those with shock. These units should be staffed by doctors and nurses who are trained to recognize high-risk patients and to institute appropriate treatment and monitoring. A number of criteria may be used to decide when to transfer a patient to a high dependency unit. These

include:

- abnormalities in body temperature reading
- undetectable pulse and blood pressure
- severe plasma leakage and/or shock
- organ impairment (such as hepatic damage, cardiomyopathy, encephalopathy, encephalitis and other unusual complications).

2.2.1 Febrile Phase

During the febrile phase, patients typically develop high-grade fever suddenly. This acute febrile phase usually lasts 2–7 days and is often accompanied by facial flushing, skin erythema, generalized body ache, myalgia, arthralgia and headache. The patient's body temperature might went up as high as 40 ℃. Therefore monitoring for warning signs and other clinical parameters is crucial to recognizing progression to the critical phase.

2.2.2 Critical Phase

During the critical phase, the temperature usually drops around 37.5–38℃ or less and remain below this level for usually on days 3-7 of illness. This marks the beginning of the critical phase and plasma leakage may usually last 24–48 hours. Shock occurs when a critical volume of plasma is lost through leakage. It is often preceded by warning signs. The body temperature may be subnormal when shock occurs. For the patient whose symptom prolonged after the critical phase they hardly recover and these will lead to severe dengue.

2.2.3 Severe Phase

Severe dengue should be considered if the patient is from an area of dengue risk presenting with fever of 2–7 days and the fever does not subside. Severe dengue is fatal as it cause plasma leakage that can cause circulatory shocks where the patient's pulse is weak or even undetectable. There will also be significant bleeding and several altered level of consciousness. There is still no cure for dengue, but intervention might help to recover a patient from the illness.

2.2.4 Recovery Phase

If the patient survives the 24–48 hour critical phase, a gradual reabsorption of extravascular compartment fluid takes place in the following 48–72 hours. General well-being improves, appetite returns, gastrointestinal symptoms abate, haemodynamic status stabilizes and diuresis ensues.The haematocrit stabilizes or may be lower due to the dilutional effect of reabsorbed fluid. White blood cell count usually starts to rise soon after defervescence but the recovery of platelet count is typically later than that of white blood cell count.

2.3 Review on Similar Existing Systems

There are several parameter that can be monitored during the intervention process which is body temperature, plasma count, blood pressure, and heart-beat measurement. But in this project only the heart-beat and temperature reading is being monitored. The existing system that have the selected parameter are Wi-Mon, Kardia Mobile, and Simultaneous Monitoring

of Health Parameters System.

2.3.1 Wi-Mon

A wireless continuous patient monitoring system for dengue (Wi-Mon) is a device used to monitor some of the human vital information such as heart-rate, blood pressure, temperature, and $SpO2_2$. Wi-Mon is a new concept which combines sensor nodes with wireless network and Wi-Mon software. This system had been used to monitor the status of the dengue patients. For the sensor, the system use $SpO2_2$ sensor, Body Temperature sensor, ECG Sensor, Heart rate sensor, and Blood Pressure meter. $SpO2_2$ sensor can detect the oxygen level of a patient's blood, the body temperature sensor is to read the patient's temperature, the ECG sensors is to collect the electric signals generated by the heart, heart rate sensors is for reading the heart rate and the blood pressure sensors is to read the blood pressure. Figure 2.2 shows the sensors that are beingused.

Figure 2.2: Wi- Mon sensors

(Wi-Mon,2017)

For monitoring record purposes, it use Wi-Mon software. Wi-Mon is integrated software that retrieve data from a database to view the data conveniently. The software view

all the reading from the sensors in a real-time environment. The software consist of features like admission of new patient, creating doctor profiles, ward list and many more. Figure 2.3 shows the GUI interface of Wi-Mon software.

(Wi-Mon,2017)

Wi-Mon uses the Wireless Body Area Network (WBAN) and Wireless Local Area Network (WLAN) connectivity. The sensors will detect all the information of a patient's body using the WBAN then send the data to a Raspberry-pi, then send the data to a wireless router and then to the internet. The Hospital that are surrounded by a WLAN connection can retrieve the data from the internet from the access point available. Figure 2.4 shows the network architecture of Wi-Mon connectivity.

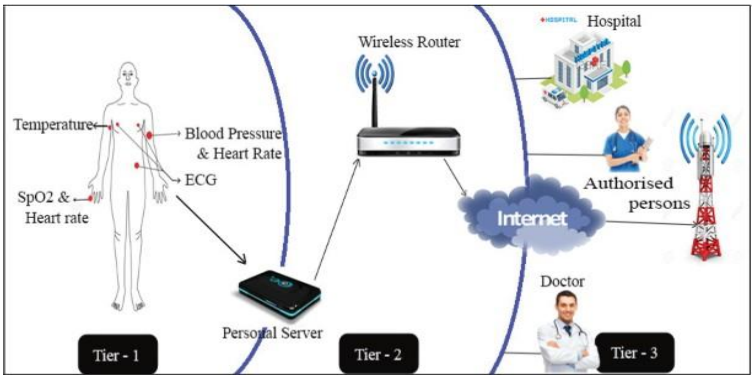

Figure 2.4: Wi- Mon Software

(Wi-Mon,2017)