



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**SOFTWARE DEVELOPMENT OF NEONATAL
MONITORING SYSTEM BASED ON ANDROID
APPLICATION**

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Computer Engineering Technology (Computer System) with Honours.

By

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I hereby, declared this report entitled Software Development of Neonatal Monitoring System Based on Android Application is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours. The member of the supervisory is as follow:

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ABSTRAK

Tujuan Projek Tahun Akhir ini adalah untuk melaksanakan Sistem Pemantauan Neonatal berdasarkan aplikasi Android yang menghubungkan “Internet of Thing” (IoT) yang, bayi pramatang perlu mendapat perhatian penuh dari doktor dan jururawat kerana kurang kemampuan ekspresi. Sindrom Kematian Bayi Mendadak (SIDS) adalah kejadian yang wujud di kalangan bayi di bawah umur satu tahun. Selepas itu, menjaga neonat melalui inkubator menjadi cabaran kepada banyak jururawat dan doktor dalam tugas harian mereka. Dalam kes ini, doktor dan jururawat berasa tidak selesa untuk memantau dengan menggunakan komputer untuk memeriksa keadaan neonat ketika mereka dalam masalah perubatan. Tambahan pula, doktor dan jururawat akan mengalami kesukaran untuk mendapatkan data masa nyata dari sensor. Oleh itu, untuk menyelesaikan masalah ini, keadaan bayi dalam inkubator dapat diketahui melalui aplikasi Android untuk memudahkan doktor dan jururawat mendapatkan data masa nyata yang diambil oleh “cloud” IoT, ThingSpeak. Pembangunan aplikasi Sistem Pemantauan Neonatal memerlukan perisian Android Studio versi 3.2.1 sebagai platform untuk aplikasi Android. Nilai sensor ini telah dihantar ke “cloud” IoT, ThingSpeak dan aplikasi ini perlu mengambil data sensor dari “cloud” dengan menyambungkan mana-mana Wi-Fi berdekatan untuk memaparkan data masa nyata secara grafik pada telefon pintar. Aplikasi ini dibuat dengan empat antara muka yang berbeza. Antara muka pertama adalah laman utama yang memaparkan dua menu; “About Me” dan “Sensor Status”. Paparan antara muka kedua mengenai biografi pemaju. Sementara plot antara muka ketiga dan keempat graf masa nyata pada sensor suhu dan sensor kadar nadi masing-masing. 85% responden dalam analisis tinjauan bersetuju tahap kemudahan apabila aplikasi ini dapat memaparkan nilai data suhu dan kadar nadi dalam bentuk graf masa nyata. Akhirnya, pelaksanaan aplikasi Sistem Pemantauan Neonatal datang kepada kesedaran, aplikasi itu berjaya dijalankan pada semua telefon bimbit Android.

ABSTRACT

The aim of this Final Year Project's was to implement Neonatal Monitoring System based on Android Application that connect by Internet of Thing (IoT) technology which, the premature baby needs to get full attention from doctors and nurses due to lack of expression ability. Sudden Infant Death Syndrome (SIDS) is an incident exists among infants below the age of one year. Subsequently, taking care the neonate through the incubator has become a challenge to many nurses and doctors in their daily tasks. In this case, the doctors and nurses feel uncomfortable to monitor by using the computer for checking the condition of a neonate when they were in medical issues. Furthermore, the doctors and nurses will experience difficulty to get the real-time data from the sensors. Therefore, to solve the problem, the condition of an infant in the incubator can be known via Android application to facilitate the doctors and nurses to obtain the real-time data captured by IoT cloud, ThingSpeak. Development of Neonatal Monitoring System application requires Android Studio software version 3.2.1 as a platform for Android application. The value of these sensors have been sent to IoT cloud, ThingSpeak and this application need to fetch the data of sensor from the cloud by connecting with any Wi-Fi nearby to display the real-time data graphically on smartphone. The application was created with four different interface. First interface is the homepage which displays two menus; About Me and Sensor Status. Second interface displays about developer biography. While third and fourth interface plot a real-time graph on temperature sensor and pulse rate sensor respectively. 85% of respondents in survey analysis agreed the convenience level when this application can display the data value of temperature and pulse rate in real-time graph form. Finally, the implementation of the Neonatal Monitoring System application came to realization, the application ran successfully on all Android mobile phone.

DEDICATION

To my beloved parents who always there for me

Hassan Bin Akis and Salasiah Binti Zakaria

To my siblings

Zuliyana Binti Hassan

Suhana Binti Hassan

Suzana Binti Hassan

To my lecturer and supervisor, for their guidance and encouragement

Dr. Suhaila Binti Mohd Najib

To my friends, for their unconditionally support to complete this final year project.

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The experience was novel one and I would like to thank all the people who have lent their valuable time for the recording of the data and completion of the report. Without their consideration, it would have been difficult to complete the project.

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LIST OF ABBREVIATIONS

BLE	Bluetooth Low Energy
BSN	Body Sensor Network
CCTV	Closed-Circuit Television
CPU	Central Processing Unit
ECG	Electrocardiogram
GSM	Global System for Mobile Communication
GUI	Graphical User Interface
IoT	Internet of Things
LCD	Liquid Crystal Display
M2M	Machine-to-Machine
MCC	Mobile Cloud Computing
MMS	Multimedia Message Service
NICU	Neonatal Intensive care Unit
OS	Operating System
PIR	Passive Infrared
RAM	Random Access Memory
SIDS	Sudden Infant Death Syndrome
SMS	Short Message Service
SpO₂	Oxygen Saturation

USB	Universal Serial Bus
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
XML	Extensible Mark-up Language

CHAPTER 1

INTRODUCTION

The introduction discusses project background, problem statement, project scope, and objective. This section will explain the overall view to guide and development of an application for neonatal monitoring at the NICU by displaying the data of the sensor on the smartphone.

1.1 Background

A preterm birth which is also known as premature birth means the birth of the baby at least 37 weeks gestational age (Islam and Nadi, 2018). 25% of the deaths are cause due to complications of prematurity, most often heat and water (Mathew, Ashish Gupta, 2015). Sudden Infant Death Syndrome (SIDS) is an incident exists among infants below the age of one year. These dangers are seeing as it were within the prior a neonate is born. Subsequently, taking care the neonate through the incubator has become a challenge to many nurses and doctors in their daily tasks. The nurses and doctors need to closely monitored the neonates' condition continuously. Figure 1.1 shows the current monitoring system at the NICU to show the neonate's condition especially for a neonate in the incubator of NICU that really needs comprehensive care.

The equipment that the doctors and nurses can own is the smartphone. In recent years, usage of a smartphone is not just to connect the people as the communication tools, but it also can be a platform and medium to create an application for neonatal monitoring system. Nowadays, the technology provides better features and designs in the

smartphone. Besides, the smartphone has remarkable power in computation as well as an awfully helpful operation such as wireless internet access by Wi-Fi. With the state-of-the-art mobile applications, the system gets to be more intelligent and smarter. Moreover, the purpose of neonatal monitoring based on Android application is to monitor the neonatal by putting the additional sensors such as temperature and pulse sensor that help in monitoring neonate accurately at any time. The application will display gathered from the sensors and displayed it on the smartphone via any Wi-Fi nearby and ThingSpeak. Furthermore, the abnormal condition can be rapidly been notified and solved within less time. This project can assist the nurses and doctors monitoring the neonates frequently.



Figure 1.1: Current Monitoring System in NICU.

1.2 Problem Statement

Current neonate's monitoring device displays the neonate's vital parameters through the main computer. It makes the doctors and nurses feel uncomfortable to monitor by using the computer for checking the condition of a neonatal when they were in medical issues. Therefore, the best way for neonatal monitoring closely for doctors and nurses is

to create an application based on Android application to detect any sensor on the neonate in the incubator. Furthermore, the doctors and nurses will experience difficulty to get the real time data from the sensors. In that case, this project creates an application of neonatal monitoring that will displayed the real time data from the sensors. Besides, to ease the medical team, all the real-time data will be illustrated in graph.

1.3 Objective

The objectives of this project are as follows:

1. To develop neonatal monitoring based on Android application.
2. To retrieve data from the IoT cloud, ThingSpeak and display the real-time graphically data of neonatal temperature and pulse sensor via Android application.

1.4 Project Scope

The scopes of work for the project include the following areas:

The monitoring system can display the vital parameters of a temperature sensor and pulse sensor via an Android application in real-time by connecting to any Wi-Fi. Besides, this system is for a newborn infant, which is under 28 days and the neonate with health issues. Therefore, the nurses and doctors will be the user of this application monitoring system while the location of monitoring is at incubator of NICU. In addition, a software of Android Studio will be used in order to program and design the interface of the layout for this monitoring application. An Android Studio will be sent the apk file by

connecting to a smartphone through USB. The developer can choose either to use Android Studio Emulator or smartphone along the testing process.

1.5 Project Significant

This project will be a significant in helping the doctors and nurses to take care of the neonates in the incubator of NICU by using the multi sensor such as temperature sensor and pulse rate sensor. The mobile application is easy to be accessed by the new user (e.g: doctors, nurses). In addition, the vital parameters will plotting the real-time data which have been retrieved the data from the IoT cloud, ThingSpeak.