BABY HEALTH BAND

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Sesi Pengajian : | 1 | 5 | / | 1 | 6 |

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To my beloved project supervisor, family and friends

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ABSTRACT

In the interval of after birth to age six which is the early years of a child is very important. This is because a healthy babies are more likely to grow into a healthy children, and a healthy children are more likely to develop into healthy teenagers and healthy adults. Many type of baby health monitoring system are implement in the market nowadays, and most of the monitoring system consists of heartbeat sensor and temperature sensor where it is strongly agree that detecting the heartbeat and temperature of a baby is important to know the status of the baby. In this project, two objectives are assign which are to detect any unusual affair condition of the baby immediately and to give notification regarding to the health of the baby to the parent. Two sensors are used which are pulse sensor and Lilypad temperature sensor. The sensed data from the sensors are send to the cloud using Internet of Things (IoT) and visualize in the ThingSpeak's channel. When the sensors detected any unusual affair condition from the baby, notification will send to alert the parent using Twitter. This project had achieved the objective with the tests of replacing adult instead of baby by wearing the prototype at the hand. Data that sensed using the sensors are send to the cloud and users are able to view the data in chart. Lastly, Twitter are able to perform by sending notification to the users when either one or both of the sensors detected unusual values.

ABSTRAK

Tahun awal untuk bayi adalah penting dalam selang selepas lahir ke tahun enam. Hal ini demikian kerana bayi yang sihat lebih cenderung untuk membesar menjadi kanak yang sihat, dan kanak yang sihat lebih cenderung untuk berkembang menjadi remaja yang sihat dan orang dewasa yang sihat. Banyak jenis sistem pemantauan kesihatan bayi sudah dilaksanakan di pasaran pada masa kini dan kebanyakan sistem pemantauan terdiri daripada pengesan denyutan jantung dan pengesan suhu badan bayi di mana ia adalah sangat bersetuju bahawa mengesan denyutan jantung bayi adalah penting untuk mengetahui status bayi. Dalam projek ini, dua objektif telah diserahhakkan iaitu untuk mengesan status bayi dalam situasi normal dan situasi tidak normal dengan segera dan memberitahu ibu bapa mengenai status kesihatan bayi. Dua sensor yang digunakan ialah sensor nadi dan sensor suhu. Data yang dikesan dari sensor akan menghantar kea wan menggunakan Internet of Things (IoT) dan menggambarkan dalam saluran ThingSpeak. Apabila sensor mengesan sebarang keadaan yang tidak normal dari bayi, mesej pemberitahuan akan dihantar menggunakan Twitter kepada telefon pintar ibu bapa untuk mereka berwaspada terhadap bayi. Projek ini telah berjaya memenuhi syarat objektif dengan memakai prototaip ini di tangan orang dewasa sebagai gantian ujian. Data yang dikesan daripada sensor dapat dihantar ke awam dan pengguna dapat melihat data-nya dalam carta. Akhirnya, Twitter mampu menghantar pemberitahuan kepada pengguna apabila salah satu atau kedua-dua sensor mengesan data yang tidak normal.

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CHAPTER 1

INTRODUCTION

This chapter gives an overall overview of the project which including project background, problem statement, objective and scope of project.

1.1 Project background

Most of the parents want their children the best and will work hard to make sure their progeny have the best of everything. But, knowingly or unknowingly, parents may get careless in the care of their children even their children is in the baby state.

The baby might suffer from diseases such as influenza, fever, cough, and vomiting when parent are not around to take care of him. Critically, the baby might die due to sudden unexpected infant death (SUID) or sudden infant death syndrome (SIDS) [1]. According to the research, in a phenomenon which is difficult to explain in babies die where nobody knows its origin is called sudden death [2]. In year 2013, there are 5.96 infant deaths per 1000 live births [3], this shows that a good care and attend of a parent to a baby is very important to a baby live.

A greater and healthier of life are the new challenges for both the babies and the parents in order to have a protected and also no worried in relation between the parents and their babies. In this real time situation, the probable prediction can be make when there is any unusual affair happened to the baby in order to prevent it even death. In this

project, proposes a system that detect the situation and status of the baby, at the meanwhile inform and alert the parent when the sensors detected any unusual affair happen to the baby. The system uses Wi-Fi module, which include Internet of Thing (IoT) to alert the parent or nannies in real time so they can react immediately, check the state of the baby, and take any action in needed. Smart phone is use as the output of the alert signal. The sensors used to measure and detect the status or condition of the baby are connected to the devices like desktop and smart phone through the internet.

1.2   Problem statement

There are many type of baby health monitoring system in the world nowadays. The monitoring system in the form of band or vest are invented to give a more accurate and deliver a real-time notification to the parent regarding to the health of their baby. Most of the monitoring system consists of heart beat sensor and temperature sensor where it is important to notify the parent when the heart rate and the body temperature of the baby drop or rise significantly.

In this project consists of two sensor where the sensors can be sewn on the baby clothes. Referring to other marketed products, a band should be in a small wearable bracer-like form. In this case, an Arduino UNO [4] and design of sewn-able two sensors have to be done in order to fulfill the title of this project which is baby health band even the final product is in a prototype form.

1. 3   Objectives of study

The objective in this study is to detect the status and condition of the baby in normal condition and also in unusual affair condition. Besides that, to give notification regarding to the health of the baby to alert the parent when unusual affair condition is meet in real-time.

1. 4   Scope

The purpose of this project is to design and carry out a system that can help to detect any unusual affair of the baby and help the parent to avoid any careless in attending their baby. This section is important to know the limitation and boundary of this project. In this project, two sensors are used to check the status of the baby. Microcontroller, Arduino UNO is used as the intermediate device to connect between sensors and smart phone. ThingSpeak are used as the platform for building IoT between the Arduino and Wi-Fi module to send information from Arduino UNO to smart phone. The user or the parent or nanny needs to have a smart phone before applying this project.

In the hardware part, it consist of two sensors which are heartbeat sensor and temperature sensor.

i.   Heartbeat sensor: This sensor is used to detect the heartbeat of a baby. The normal heart rate of a baby is 130 to 150 beats per minutes in resting. The baby's heart rate normally will change due to some degree, which involve fever, crying, or other vigorous activity makes their heartbeat faster [5].

ii.   Lilypad Temperature sensor: This sensor is used to sense the body temperature of the baby. The normal temperature of a baby is between 36 degree Celsius and 38 degree Celsius. When the baby undergoes fever or flu, the temperature will drop or rise according to the state of illness.

Other than sensors, Arduino UNO is used as a microcontroller to execute a certain command that has been coded. Furthermore, ESP8266 Wireless Transceiver Serial Wi-Fi module is used as wireless module to send data from Arduino UNO to smartphone using IoT platform from ThingSpeak.

In the software part, which consists of programming, Arduino IDE is used to do the coding for Arduino. ThingSpeak is used to visualize the data collected from the sensors. Lastly, Twitter is used as notification to the parent.

CHAPTER 2

LITERATURE REVIEW

This chapter will highlight the past studies which related with baby health monitoring system. Other than that, research on the hardware components is also studied.

2. 1   Previous researches

Reading the researches from the previous paper had gave ideal of continuing this project.

2.1.1   A Sudden Infant Death Prevention System for Babies

The purpose of this paper is to recommend a solving method by monitoring the biofeedback that tried to avoid sudden death in baby [6]. This system used real-time data collection from sensors to sense and detect the health problem of a baby. When abnormal data is detected, the system will warn the corresponding people who responsible to the baby.

The signal processing algorithms used in this system is in real-time in order to avoid any sudden death of a baby. The data that sense via sensors such as heartbeat sensor, respiration sensor, temperature sensor, and position sensor are send to mobile devices to process and monitor the performance of the baby and give alerts and warns to the parent when detected any abnormal situation.
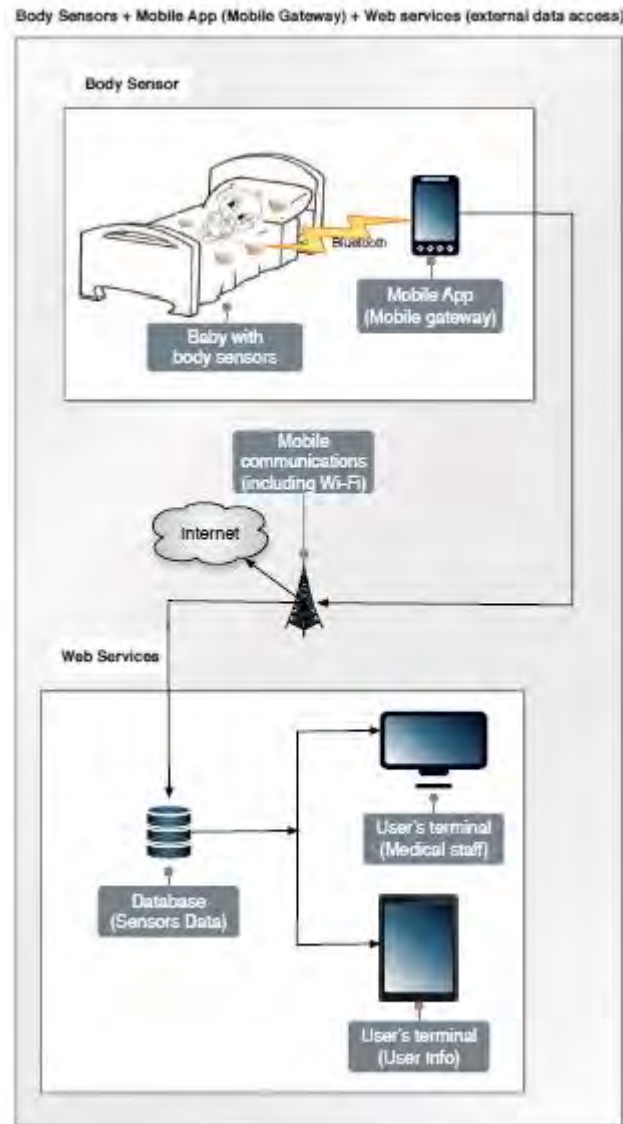
Figure 2.1: Body sensors, storage and, Web services for a baby SIDS prevention and monitoring system [6]

In future, this paper may continue propose a work which integrate a camera beside the baby in order to view the situation of the baby. Furthermore, crying detector are suggested to detect and give notification to the parent when the baby is crying. Nevertheless, humidity sensor are also suggested to sense the humidity around baby's diaper in order to let parent know when the baby pee.

2.1.2 Ultra-Wide Band (UWB) Baby Monitor

Sleep apnea is a common sleep disorder where the baby will have one or more pauses in breathing while the baby is sleeping. This breathing pauses can last from few seconds to few minutes, in case it often cause SIDS to happen. This paper uses a Nano Pulse Baby Sleep Guard (BSG) to control the respiration and heart beat rate and also the body motion in the baby sleep time [7]. Temperature sensor and microphone is also embedded in this BSG to inform and notify the parent about the baby's condition when there is any dangerous situation which triggering the limitation value of the system.
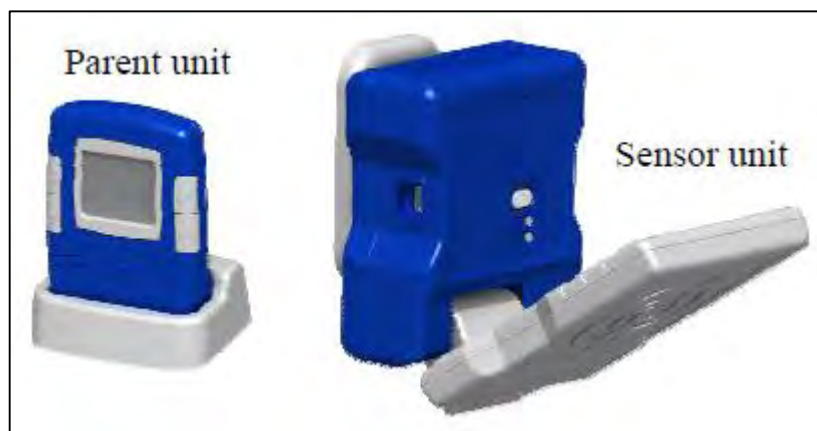

Figure 2.2: Nano Pulse Baby Sleep Guard [7].

The conditions of the baby that allow the device to detect are:

- Sleep: the device count the frequency of respiration of the baby when he sleep with no motion. The parent will be notify by a message when there is any slightly motion done by the baby.
- Awake: the baby with long term movement indicate with high amplitude.
- Alarm: respiration rate is abnormally high or low.

2.1.3 Non-invasive blood oxygen saturation monitoring for neonates using reflectance pulse oximeter

This paper propose and show a design of a blood saturation monitoring system by using wireless and wearable method. They are using a technique called Near Infrared Spectroscopy (NIRS) to improve the flexibility of measured data [8]. The blood oxygen saturation in a baby is important to known because it is the key parameter to check about the arterial hemoglobin rate in baby's blood.
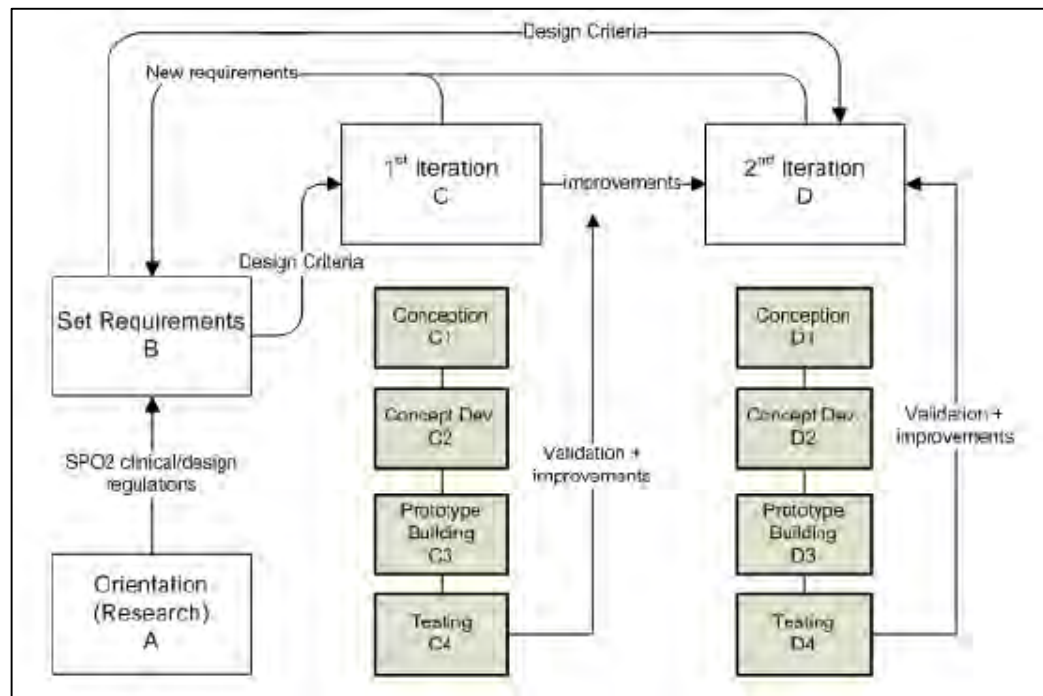

Figure 2.3: Block diagram of the design process [8].

The design of the prototype has the purpose of determining the possible location for the sensors in order to decide the most suitable sensing position at the baby's body.
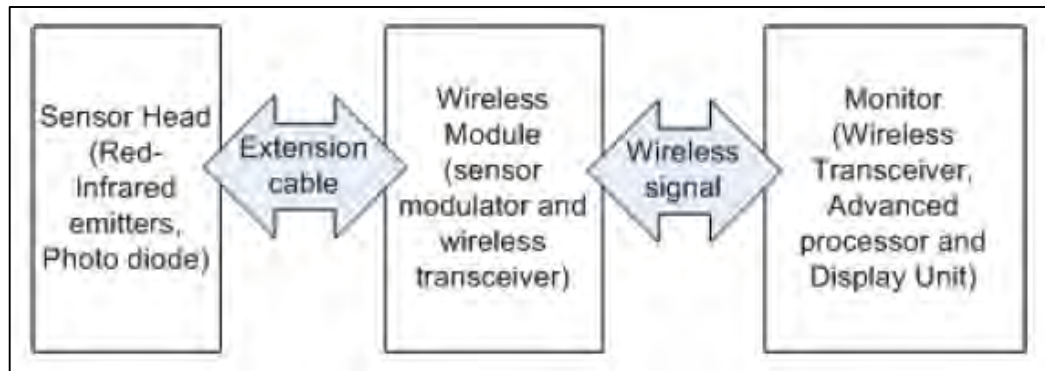
Figure 2.4: Block diagram of prototype design [8].

Sensor head: Consist of photo diode and red-infrared emitter.

Wireless module: Act as local processor to sends signal to the host system without wire.

2.1.4 Low Cost Infant Monitoring and Communication System

A low cost monitoring system is proposed in this paper. The system will keep update to the mother regarding to the health condition of the baby. The information received by the server will process and if the baby's health condition appear to be at abnormal status, an alert message will send to the mother to increase her awareness against the health condition of the baby [9].

Body temperature	Location	Normal temperature	Fever temperature
	Armpit	35.5 – 37.0 °C	> 38.5°C
	Skin	29.0 – 34.0 °C	> 35.2 °C

Child Heart Rate	Age	Normal Heart Rate
	Newborn	100-160 BPM
	0-5 months	90-150 BPM
	6-12 months	80-140 BPM
	1-3 years	80-130 BPM

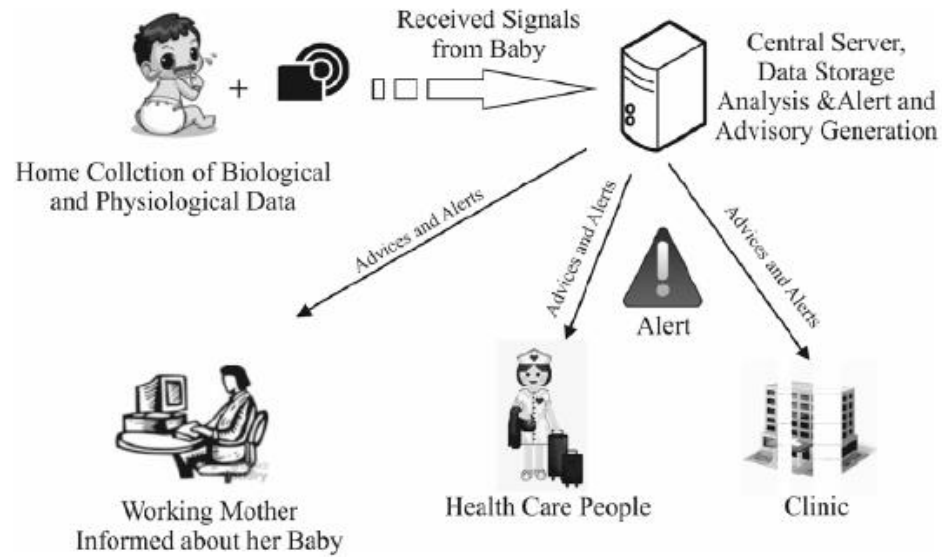Figure 2.5: Child body temperature and heart rate benchmarks.

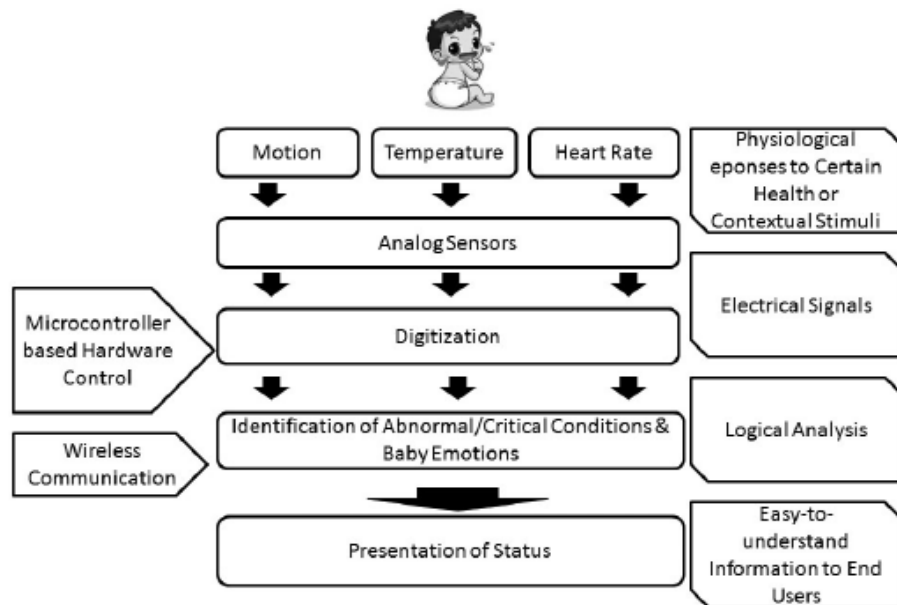Figure 2.6: Monitoring system architecture [9].

Figure 2.7: Hardware flow diagram [9].

The sensors used in this paper is motion sensor, temperature sensor and heart rate sensor. Two state was taken which are calm and excited state, where these two state have the difference data obtained in term of environment.

The plan in the future in this paper is that add in GSM technology instead of using Bluetooth to send biological data of baby to the mother. Cry analysis and position monitoring is plan to add in to the system.

2.1.5   Sensory baby vest for the monitoring of infants

The motivation of this paper is to develop an easy-handle system compare to the medical system [10] commonly used and increase the awareness of parent to apparently life threatening events (ALTE) and sudden infants death syndrome (SIDS).

Figure 2.8: Multi-sensory vest with data acquisition unit.

The sensors used in this paper is heart rate sensor, respiration sensor, temperature and humidity sensor to monitor the baby continuously under home or clinic. When the sensors detect abnormal situation, health protection and lifesaving will function in time.

The future development for this project will replace the cable type of connector to wireless type for more practical purpose.