Temperature Recorder System

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Abstract. A temperature recorder system is based on the changes of the patients' temperature over a fixed time that uses the advantages of a smartphone. This paper proposes a wirelessly controlled system to achieve reliability and mobility of the user. The wireless system was achieved by utilizing a smartphone, PIC Controller and Bluetooth to a device that's been installed with the temperature sensors. This system can be used for medical purpose to monitor and record 24/7 of the patient's temperature consistently which can systematically save manpower, time and lives.

1 Introduction

Body temperature is affected due to many reasons that give us a sign of the condition of a person. Heart beat rate, blood pressure, sugar level and so on are also an indicator that gives general information on the condition of a person [1]. In this paper, body temperature is measured and recorded as the main indicator to monitor a certain patient. This body temperature readings and patterns can indicate the severity of a patient's illness.

Dengue fever is a common disease that easily leads to death. Research already came with a common pattern of dengue fever and effects to the patient body temperature. The sequence of rise and decline of body temperature gives us as a sign either the patient is in a severe condition or not [2]. This also allows the doctors to give the exact amount medicine need of the particular patient.

The main problem is when the body temperature is monitored manually, the medical assistants or nurses would have to contact with the patient directly and numerously that would affect the patient's quality time of recovery physically, mentally and emotionally. If the body temperature could be monitor wirelessly, it would defiantly give an opportunity to the patient to have quality time to recover. Thus, this project is tested to overcome this matter.

As the Bureau of Labor Statistics (2012) report that the medical field and health care careers with the most projected employment are increasing. Some of these jobs need less than one year of medical field education. Based on the Fig. 1, medical field education

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reduces the period of training and learning to fulfil the high demands of people in social market these days.

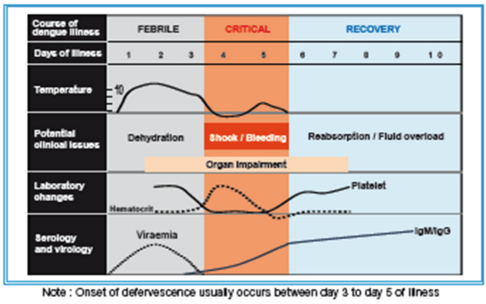


Fig. 1. Clinical course of DHF12 [2]

This points out the reason for the medical field carrier expected to rise at a yearly rate of 2.6%, accumulating 5.0 million jobs between the year 2012 and 2022 stated by the Bureau of Labor Statistics (2012) [4]. Form this statement is true that employees in the medical field are a high demand, but the quality of employees in this field is very essential. It's unreasonable to produce employee that is trained for 1 year to have a standard quality. Thus tools and devices are developed to overcome errors occurring in treating a patient.

2 Technologies

2.1 Smartphones

A smartphone is a portable phone with an innovative mobile operating system which syndicates features of an individual computer operating system with other useful features for handheld or mobile use. Smartphone usually combines the features of a telephone with those of other famous mobile devices, such as a media player, personal digital assistant (PDA), and GPS navigation unit [3]. Most of the smartphones have a touchscreen user interface, can access the Internet and run third-party apps, camera phones and music players. Furthermore, smartphones that's been produced from 2012 ahead have high-speed mobile broadband which called as the 4G LTE internet, mobile payment mechanisms, and motion sensors.

2.2 Mobile Operating System

Android is known as an open-source platform by Andy Rubin, founded in October 2003 and supported by Google, along with major hardware and software developers such as HTC, Intel, Motorola, LG, and Samsung and ARM that create the Open Handset Alliance.

IOS is a portable working framework created by Apple Inc. and appropriated only for Apple equipment. It is the working framework that powers the organization's i-Devices. In 2007, Apple presented the iPhone, the primary gadget to utilize iOS and one of the principal cell phones to utilize a multi-touch interface. The iPhone was remarkable for its utilization of a vast touch screen for direct finger contribution as its principal method for cooperation, rather than a stylus, console, or keypad as regular for cell phones at the time. Windows Phone this product stage runs the Microsoft Mobile cell phones, and has gotten some positive gathering from the innovation press and been lauded for its uniqueness and separation.

2.3 PIC Microcontroller

In this paper, the controller for the development is PIC microcontroller. This paper contains gadget particular data about the accompanying gadgets. PIC16F737/767 devices are available in 28-pin packages only. Meanwhile, PIC16F747/777 devices are available either in 44-pin and 40-pin packages. All the devices in the PIC16F7X7 family share common architecture and ideas with the following differences as shown in Table 1. Thus, (Fig. 2) shows the pcb schematic circuit for temperature recorder system.

Table 1. PIC16F7X7 Device Features [5]

Key features	PIC16F737	PIC16F747	PIC16F767	PIC16F777
Operating frequency	DC–20 MHz	DC–20 MHz	DC–20 MHz	DC–20 MHz
Resets (and Delays)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)	POR, BOR (PWRT, OST)
Flash program memory (14-bit words)	4 K	4 K	8 K	8 K
Data memory (bytes)	368	368	368	368
Interrupts	16	17	16	17
I/O Ports	Ports A, B, C	Ports A, B, C, D, E	Ports A, B, C	Ports A, B, C, D, E
Timers	3	3	3	3
Capture/ Compare/PWM modules	3	3	3	3
Master serial communications	MSSP, AUSART	MSSP, AUSART	MSSP, AUSART	MSSP, AUSART
Parallel communications	–	PSP	–	PSP
10-bit analog-to-digital module	11 Input channels	11 Input channels	11 Input channels	11 Input channels
Instruction set	35 Instructions	35 Instructions	35 Instructions	35 Instructions
Packaging	28-pin PDIP 28-pin SOIC 28-pin SSOP 28-pin QFN	40-pin PDIP 44-pin QFN 44-pin TQFP	28-pin PDIP 28-pin SOIC 28-pin SSOP 28-pin QFN	40-pin PDIP 44-pin QFN 44-pin TQFP

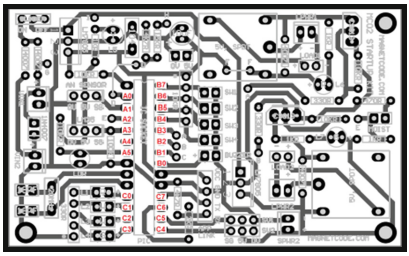


Fig. 2. Schematic circuit diagram

2.4 Bluetooth

Bluetooth is a wireless innovation standard for trading data over short distances (using short-wavelength UHF radio waves in the ISM band between 2.4 to 2.485 GHz) from settled and cell phones, and building personal area networks (PANs). Developed by telecom merchant Ericsson in 1994, it was initially considered as a remote other option to RS-232 data cable. It can interface a few gadgets and thus, overcoming issues of synchronization [7].

Furthermore, the Bluetooth Special Interest Group has managed more than 25,000 members of an organization in the areas of computing, telecommunication, consumer electronics, and networking. Bluetooth has been standardized using IEEE standardized as IEEE 802.15.1. However, the Bluetooth is no longer followed and maintains the standard. The Bluetooth Special Interest Group supervisory manages the qualification program, development of the specification, and protects the trademarks. The manufacturer must create a device that meets the Bluetooth Special Interest Group standards to commercialize it as the Bluetooth device. Besides that, a system of patents has utilized to the technology, which are registered to personal qualifying devices.

3 Methodologies

3.1 Overall Process and Components

In this paper, the system produced consists of a PIC-16f767 micro controller on a circuit board with a heartbeat detector, App Link Bluetooth module, and an Android smartphone using the Magnet code application. All these components are the most important aspect to ensure that the aims of the paper were attained.

If observed in Fig. 3, basically the project works with a device assembled with a PIC-16f767, App Link Bluetooth module and a temperature detector on a circuit board which attached to a person and connected wirelessly by Bluetooth connection to an Android smart phone. The android smart phone can orientate the data of the device by installing an application known a Magnet code and programming the PIC-f767 to track either the heart is beating using two program which are PIC compiler and PIC kit 2 v2.55. Figure 4 summarized the overall process.

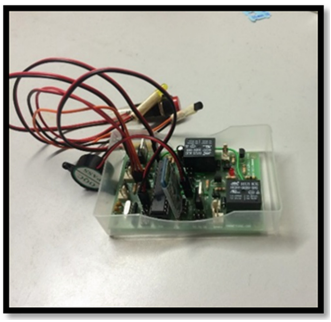


Fig. 3. Temperature recorder device without casing

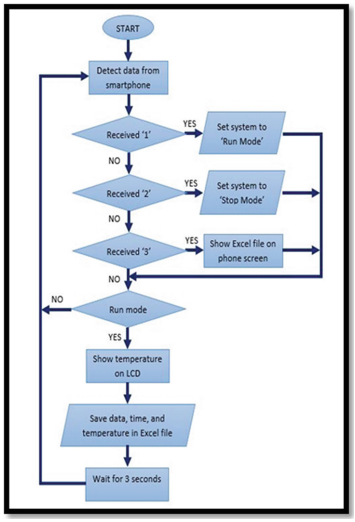


Fig. 4. Flow chart

3.2 Assembling

Assembling the project are based two elements that are hardware & software. In the hardware assembling process the components of the device were collected & fitted onto the mother board [5].

Meanwhile, the assembling process in software is planned, checked & installed into the PIC micro-controller using two Software Program which are 'PIC C Compiler' to construct the program logic & PIC kit 2 v2. 55 to install the program logic into the PIC [6]. The logic of the program can be viewed in Fig. 5.

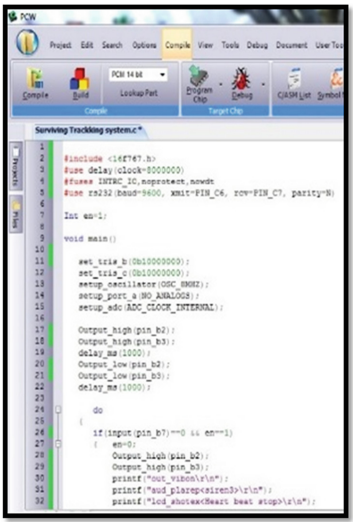


Fig. 5. Program logic in PIC C compiler

3.3 Testing Method

The test was tested out on the assembled temperature recorder attached to a user. Meanwhile the smart phone is held by another user to examine the reliability of the system based on connection, responds, and accuracy of the system reacting to the different variable and situation conducted [8]. The data sheet provided by the software is also verified to obtain reliable results.

4 Discussion and Analysis

Table 2 shows the data that were gained from the test. The data for the communication part assembled firstly and continued by detection of the body temperature. After that, the device will respond by record the temperature detected.

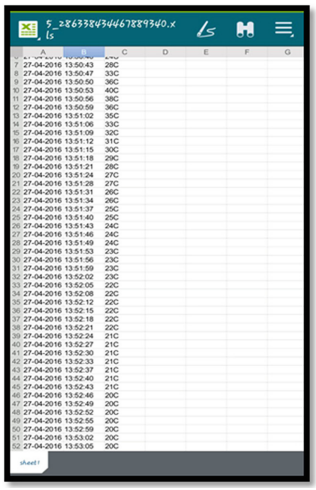
Table 2. Test results

	Yes	No	Comment
Connection			
Communicate	✓		
Lagging	✓		0.2 s
Accuracy	✓		0.5–1°C

Although we've archived promising results, facing the facts, there a few restrictions on this project that need to be improved in future. All the way through the experiment, the most suitable place for the device to detect a body temperature. But still, it's reliable

to calculate one's body temperature due to the sensitivity of the sensor used in the device itself.

Based on the data sheet shown in Fig. 6, there are a few adjustments that could be made to improve to optimize the capability of the project. One of the issues is the fixed time laps can only be adjusted by changing the setting in the PIC software. If the fixed time laps can be adjusted by the smartphone would be much friendly user.



	A	B	C	D	E	F	G
1							
2	27-04-2016 13:50:43	28C					
3	27-04-2016 13:50:47	33C					
4	27-04-2016 13:50:50	36C					
5	27-04-2016 13:50:53	40C					
6	27-04-2016 13:50:56	38C					
7	27-04-2016 13:50:59	36C					
8	27-04-2016 13:51:02	35C					
9	27-04-2016 13:51:06	33C					
10	27-04-2016 13:51:09	32C					
11	27-04-2016 13:51:12	31C					
12	27-04-2016 13:51:15	30C					
13	27-04-2016 13:51:18	29C					
14	27-04-2016 13:51:21	28C					
15	27-04-2016 13:51:24	27C					
16	27-04-2016 13:51:28	27C					
17	27-04-2016 13:51:31	26C					
18	27-04-2016 13:51:34	26C					
19	27-04-2016 13:51:37	25C					
20	27-04-2016 13:51:40	25C					
21	27-04-2016 13:51:43	24C					
22	27-04-2016 13:51:46	24C					
23	27-04-2016 13:51:49	24C					
24	27-04-2016 13:51:53	23C					
25	27-04-2016 13:51:56	23C					
26	27-04-2016 13:51:59	23C					
27	27-04-2016 13:52:02	23C					
28	27-04-2016 13:52:05	22C					
29	27-04-2016 13:52:08	22C					
30	27-04-2016 13:52:12	22C					
31	27-04-2016 13:52:15	22C					
32	27-04-2016 13:52:18	22C					
33	27-04-2016 13:52:21	22C					
34	27-04-2016 13:52:24	21C					
35	27-04-2016 13:52:27	21C					
36	27-04-2016 13:52:30	21C					
37	27-04-2016 13:52:33	21C					
38	27-04-2016 13:52:37	21C					
39	27-04-2016 13:52:40	21C					
40	27-04-2016 13:52:43	21C					
41	27-04-2016 13:52:46	20C					
42	27-04-2016 13:52:49	20C					
43	27-04-2016 13:52:52	20C					
44	27-04-2016 13:52:55	20C					
45	27-04-2016 13:52:59	20C					
46	27-04-2016 13:53:02	20C					
47	27-04-2016 13:53:05	20C					

Fig. 6. Screen shot on data sheet

Finally, the temperature recorder system has limited range of Bluetooth connection, this is basically because the budget provided. Bluetooth range of connection is limited due to the type of inserted.

5 Conclusion

The designed temperature recorder system was capable to function either some minor glitches along the duration of taking body temperature. Moreover, this paper also succeeds to recognize the limitations to the design and recommendations in enhancing it. This early design shows the possibility of the usage which have the opportunity to make this research proceed to another level in nanotechnology. In addition, the device could enhance the capabilities by inserting other input sensors such as heart beat, blood pressure and other detectors that would increase various information on the condition of the patient. The design could be improved with more researches on the subject to gain high possibilities of success. This research also would benefit the health and care industry and have high potential due to the nature leveraging on the smartphone technology able to reduce the components used. The recorded data in real time would give many insights for any drugs impact introduce by pharmaceutical industry.

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