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Mobile ICU Using Android

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Abstract: Today, though technology is increasing rapidly in one hand, the health issues are also increasing in the other hand. So the proposed work defines a concept to ease hospital work. This work addresses a mini-ICU as it observes all the necessary parameters of the patient that could be employed both in home and hospitals. At the same time, the patient is able to get remote treatment from the doctor which could automatically be stored in the database. This work is found to be more useful at the time of natural disaster where there are numerous patients who need intense care. Also when the patients get back home they might again get infected with that disease so it is used to monitor continuously in their home itself. The main objective of this work is to monitor the patient continuously wherever they are and also to get remote treatment. The main high light is that it is able to work with solar power during power shut downs.
Keywords: Continuous monitoring, Remote treatment, Android

I. INTRODUCTION

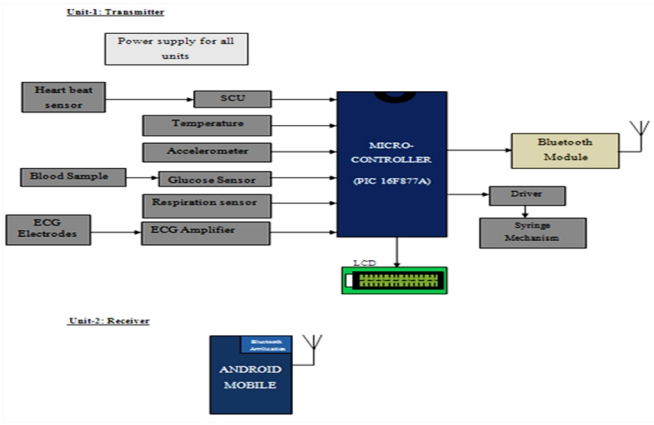
In this Nano world, though technology growing very rapidly to facilitate human life style, but on the other hand health issues are increasing rapidly. Due to current life style, it's difficult to monitor the dependants if they are not placed together. This leads to continuous monitoring of a person. This makes us to provide a smarter solution to monitor the dependants. In that aspect, we young budding engineers proposed a concept to ease hospital people work and to monitor the person using android mobile". This work addresses a mini-ICU as it observes all the necessary parameters of the patient that could be employed both in home and hospitals. At the same time, the patient is able to get remote treatment from the doctor which could automatically be stored in the database.

II. PARAMETERS TO BE MEASURED

The following parameters are measured.

A. Heart beat rate
B. Body temperature
C. Coma patient recovery
D. ECG
E. Blood glucose level
F. Saline level monitoring

III. BLOCK DIAGRAM



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A. Advantages

1) Monitors the patient status continuously.
2) All the necessary parameters are monitored
3) Remote treatment immediately.
4) Even coma patient status can be monitored continuously.
5) When patients gets well and come back to home from hospital might get infected again, so this is found to be very useful.
6) Ability to run with solar power
7) Applicable for all android mobile.

IV. SYSTEM ARCHITECTURE

The system architecture consists of hardware and software as follows:

A. System Hardware

The following describes the system hardware.

1) *Heart beat sensor*



FIG-1: Shows the heart beat sensor

Doctors measure our heart rate manually. We also can feel the pulse on our finger. Our heart does this around 72 to 84 times a minute for a healthy person. But here, we will pass light (using an LED) from one side of the finger and measure the intensity of light received on the other side (using an LDR). Whenever the heart pumps blood more light is absorbed by increased blood cells and we will observe a decrease in the intensity of light received on the LDR. As a result the resistance value of the LDR increases. This variation in resistance is converted into voltage variation using a signal conditioning circuit usually an OP-AMP. The signal is amplified enough to be detectable by the microcontroller inputs. The microcontroller can be programmed to receive an interrupt for every pulse detected and count the number of interrupts or pulses in a minute. To save time, only the number of pulses for ten seconds are counted and then multiplied by 6 to get pulse count for 60 seconds/1 minute.

2) *Body Temperature:* The LM35 is precision integrated-circuit whose output is linearly proportional to the Celsius temperature. The scale factor is +10.0mv/°c. Hence temperature is equal to Vout*(100°C/V).The voltage from LM 35 is converted to digital format using ADC of ARM controller. This digital value is used to send via SMS after proper conversion.
3) *Coma patient recovery:* A sensor called Accelerometer that would help to detect any slight movement of an object and the object being in our case is the coma patient who is on bed for a longer duration without any movement. And they are monitored continuously using accelerometer for every time period to detect any tilt made by the patients. Here the transmitter end is fixed

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on the toe whose movement is received by the receiver end automatically and if there is any movement, this report is sent immediately to the doctor.

```
public class SensorActivity extends Activity, implements SensorEventListener
{
private final SensorManager mSensorManager;
private final Sensor mAccelerometer;
public SensorActivity ()
{
MSensorManager= (SensorManager) getSystemService (SENSOR_SERVICE);
mAccelerometer =
mSenorManager.getDefaultSensor (Sensor._TYPE_ACCELEROMETER);
}
```

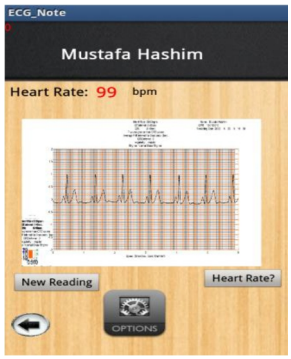
FIG-2: Shows the java code for accelerometer.

4) ECG: The system consists of the following subsystems:

a) Patient unit subsystem: This includes electrodes that sense the electrical activity going through the heart, signal amplification circuit, conditioning circuit, data acquisition circuit and home gateway. The circuit takes a reading every 30 minutes and sends it to home gateway PC.

b) Database subsystem: To store the patient ECG signal data, detect any abnormality in the ECG signal and publish the results that can be accessed only by authorized people.

c) Android unit subsystem: Android based application that enables doctors to access the patient details using android mobile.



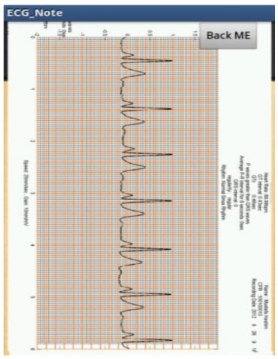


FIG-3: Patient's ECG in android mobile. FIG-4: Maximized ECG screen.

The ECG signals have Electrode contact noise such as loose contacts, motion artifacts, and baseline drift due to respiration. They also pick electro-magnetic interference caused by other electronic devices surrounding the ECG device and electrodes. Knowing that the standard ECG signal bandwidth ranges between 0.05 Hz and 100 Hz with average amplitude of 1mV only, we need to filter the signal with a Low Pass, Band Pass, and a Notch filters. Finally, the resulted signal must be amplified. Next the ECG signals need to be exported to the home gateway. In this project, USB DrDAQ data logger is acquiring the ECG data. It connects to the PC on a USB 2.0 port and to the ECG circuit's output using a probe through the scope channel of the DAQ. The home gateway could be any PC, laptop, iPad, PDA or any other device that can be connected to the Internet. The Home gateway will receive the ECG signal from the data logger and sends it to the healthcare server.

5) Saline Level Monitoring: For a patients on bed, there needs someone to monitor the saline level in the bottle else it tends to some risk factors. So here I propose a system that incorporates the LDR that works based on the intensity of light. When the saline water in the bottle is empty it alerts the guide at first and in turn, if he does not notice it, it itself closes the flow with the help of DC motor.

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6) *Glucometer:* Glucometers use test strips containing glucose oxidase, an enzyme that reacts to glucose in the blood droplet, and an interface to an electrode inside the meter. When the strip is inserted into the meter, the flux of the glucose reaction generates an electrical signal. The glucometer is calibrated so the number appearing in its digital readout corresponds to the strength of the electrical current: The more glucose in the sample, the higher the number which is sent via the blue tooth module to the android mobile which can then be sent to the doctor if the condition is critical.

B. System software

Hyper Next Android Creator (HAC) is a software development system aimed at beginner programmers that can help them create their own Android apps without knowing Java and the Android SDK. It is based on HyperCard that treated software as a stack of cards with only one card being visible at any one time and so is well suited to mobile phone applications that have only one window visible at a time. Hyper Next Android Creator's main programming language is simply called Hyper Next and is loosely based on Hyper card's Hyper Talk language. Hyper Next is an interpreted English-like language and has many features that allow creation of Android applications. It supports a growing subset of the Android SDK including its own versions of the GUI control types and automatically runs its own.

V. TESTING RESULTS



FIG- 5: Shows the patient details

SMS sending and SMS receiving programs are working properly are checked on Eclipse software by using AVD manager. The hardware is successfully implemented for remote health monitoring.

VI. CONCLUSION

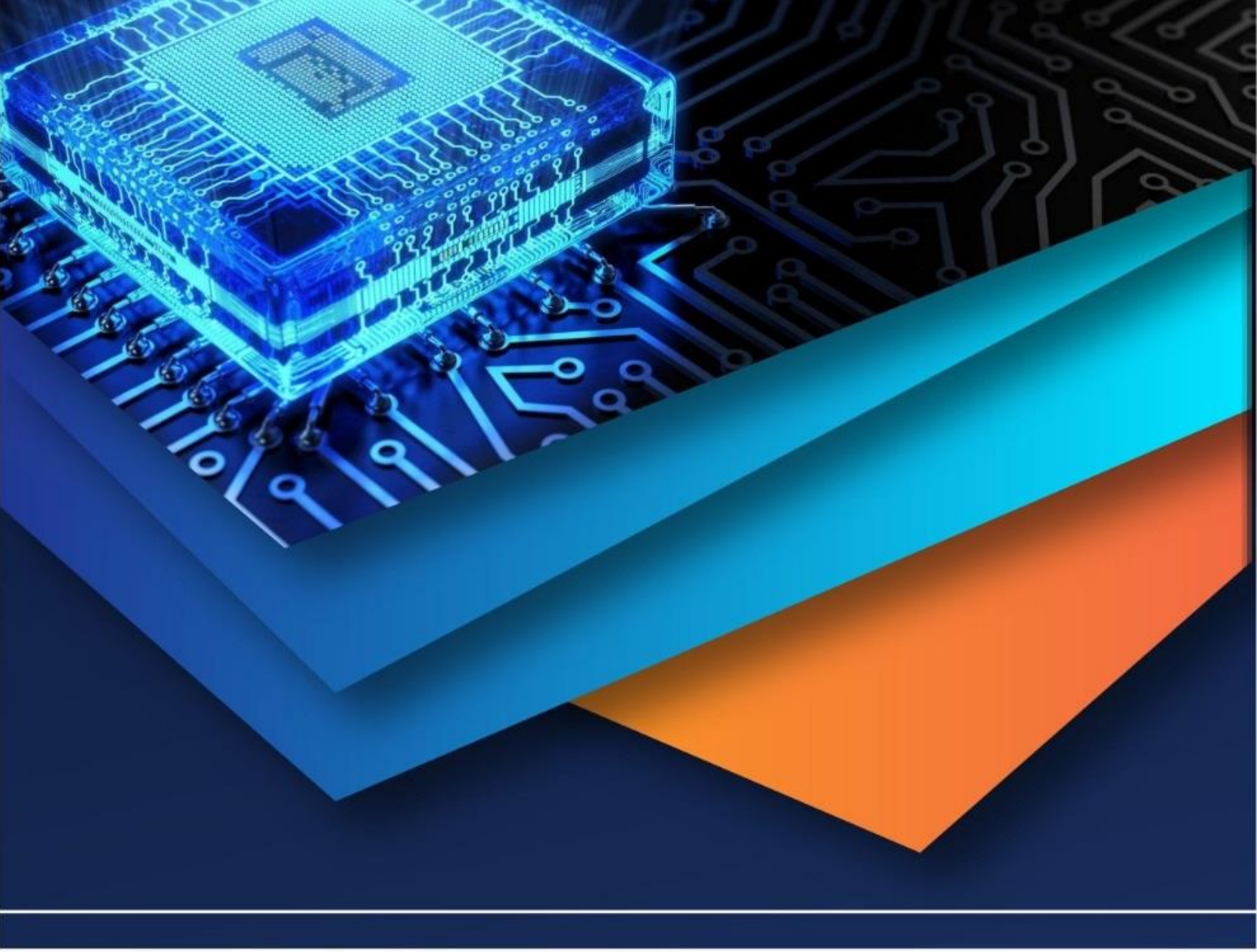
In this paper a real-time low cost patient monitoring system is introduced. The developed system produces live parameters that show the analysis of the readings for the abnormalities. If the system detects any of the abnormalities, it will alert the doctor and hospital by sending email and SMS message. The system also implements an application based on Android platform for doctors and for patients. The doctor application provide online information about the patient status, patient history and provides new reading every 30 minutes. This system provides some sort of freedom to both doctor and patient since the results are shown at real-time and the doctor will be alerted on his/her Android device in case of abnormality detection. This system founds to be more helpful at the time of natural calamities where there are numerous patients needing ICU. As a future work, the system can be enhanced more using normal mobiles instead of using android mobiles.

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