Introduction

As complexities in work are reduced everyone got habituated to travel in cars, buses, some or the other ways rather than spending their energy by walking. Hence workload has been reduced and in all sector, people got habituated to sit and work all the day. Due to this reason, cardiovascular disease is one of the main causes of death in the many countries. The delay between the first symptom of any cardiac ailment and the call for medical assistance has a large variation among different patients and can have fatal consequences. One critical inference drawn from epidemiological data is that deployment of resources for early detection and treatment of heart disease has a higher potential of reducing fatality associated with cardiac disease than improved care after hospitalization. The other parameter is that the extra calories that are stored as fat are causing severe health problems. Moreover due to excess fat content in body, people are facing many obese problems. So by monitoring their energy consumption per day or hour they can balance their weight against food intake. Thus by tracking user activity using Tilt sensor we can get useful information about energy expenditure (calories burnt) using the number of steps walked (step count). Hence new strategies are needed to continuously monitor the patient’s health parameters.

There are few existing health bands which have been mentioned below:

Hyonyoung Han et.al proposed a paper in which a real-time, wearable and motion artefact reduced health monitoring device is represented. A finger band, wearable health monitoring device, consists of photoplethysmography (PPG) sensor, 3-axis accelerometer, microprocessor and wireless module. The PPG sensor acquires distorted heart beat signal due to motion artefact. The finger movements are detected using the accelerometer, and major motion directions caused due to the noise are researched by comparing each directional motion signals and distorted PPG signal. Two directional motions are significantly related to noise, therefore, these two directional active noise cancellation algorithms was applied to reconstruct the noise added heart beat signal.
Young Sung Kim et.al with Wide interest in wearable technology has brought progresses in wrist-worn, nonintrusive bio-signal measurement techniques. However, previous wrist-worn devices have rigid form-factors, causing them to be vulnerable to motion artefacts. In this paper, he has proposed a wrist-worn, nonintrusive heart rate sensing module which has an array of sensors mounted on a flexible band. Its flexibility allows it to fit users with various wrist diameters and improves robustness to motion artefacts. We adopted wire bonding techniques which allowed the resulting module to be small and thin like a wrist watch.

These heart rate measuring tools and environments are expensive and do not follow ergonomics (easy to use). Our prototype of Health Band is economical and user friendly and uses optical technology to detect the flow of blood through index finger. Three phases are used to detect pulses on the fingertip that include pulse detection, signal extraction, and pulse amplification. Qualitative and quantitative performance evaluation of the prototype on real signals shows accuracy in heart rate estimation, even under intense of physical activity. They compared the performance of our prototype with manual pulse measurement of heartbeat of 10 human subjects of different ages. The results showed that the error rate of the device is negligible.

**Objectives:**

The main objective of our Health Band module is to continuously monitor physiological and health parameters for critical patients who need frequent updates.

- To give a precise Heart Rate.
- To calculate the Calories Burnt through the count obtained from number of steps walked.
- To provide greater accuracy.
- To make cost effective when compared to present bands.
- To transfer the data to doctors for continuous monitoring of health parameters of an individual

Our Health band module will overcome issues caused due to good old methods of health checkups like:

* Long waits in queues in hospitals are avoided.
* Delayed registrations as a result of need to treat urgently are avoided.
* To avoided limited information that may be available when the patient arrives.
Methodology:

Method: photoplethysmography
Required Components:
1. Heart Rate Sensor-Resistors, Capacitors, TCRT1000, LM358.
2. Tilt Sensor
3. Oscillator-4MHz
4. Regulated DC Power Supply-5V
5. Microcontroller-P89V51RD2,P16F877a
6. GSM Module
7. LCD

Block diagram for measuring Heart Rate

Transmitter:

Receiver:

Signal Conditioning Circuit:
The sensor used in our project is TCRT1000, which is a reflective optical sensor with both the infrared light emitter and phototransistor placed side by side and are enclosed inside a leaded package so that there is minimum effect of surrounding visible light. Pulling the Enable pin high will turn the IR emitter LED on and activate the sensor. A fingertip placed over the sensor will act as a reflector of the incident light. The amount of light reflected back from the fingertip is monitored by the phototransistor. The output (VSENSOR) from the sensor is a periodic physiological waveform attributed to small variations in the reflected IR light which is caused by the pulsate tissue blood volume inside the finger. The waveform is, therefore, synchronous with the heart beat.

The first stage of the signal conditioning which will suppress the large DC component and boost the weak pulsate AC component, which carries the required information.

The output from the first signal conditioning stage goes to a similar second signal conditioning stage for further filtering and amplification. So, the total voltage gain achieved from the two cascaded stages is 101*101 = 10201. The two stages of filtering and amplification converts the input PPG signals to near TTL pulses and they are synchronous with the heart beat. The frequency (f) of these pulses is related to the heart rate (BPM) as, Beats per minute (BPM) = 60*f.

Block diagram for counting number of steps walked

Tilt Sensor Circuit:
Tilt sensors work by having a free moving mass, usually a rolling ball, in them with a conductive plate beneath. When the device gets power and is in its upright position, then the rolling ball settle at the bottom of the sensor to form an electrical connection between the two end terminals of the sensor. Next the circuit becomes short circuit and the LED gets sufficient current. If the circuit gets tilted so that the rolling ball doesn’t settle at the bottom of the sensor with the electrical conduction path, then the circuit becomes open. An accelerometer needs a microcontroller to interpret its X and Y-axis readings to see how tilted it is. But a tilt sensor acts more like a switch. It’s either open or closed and will either close or open electrical connection in a circuit. It's a simpler version that gives switch-like results but not a poor version because at times this simplicity is wanted rather than the more advanced data that an accelerometer will give.

**Results:**

1. To measure the Heart Rate and send the message saying whether it is normal, low or high Heart Rate to registered doctor’s mobile number through GSM.

![Image of heart rate measuring device]

2. Count the number of steps walked

![Image of step counting device]

3. Calculating the calories burnt using the number of steps walked through an application in mobile.

![Image of calorie calculation application]
Conclusion

The purpose of this Project is to determine the heart rate. The results showed that the heart rate varies from person to person, age and many other parameters. This variation is going from 60 bpm for walking up to 110 bpm, so the data did support the hypothesis. Some errors may have occurred during the conduction of test. Since heart rate is taken by counting for 60 seconds in the open environment, there is an error of +/- 4 bpm built in to the procedure.

The pedometer (use to measure the steps) performed well beyond our expectation. The module did not affect the visible results to the user, who sees a continuous update of steps and calories burned. The method of calculating distance by performing approximate integrals was proved to be accurate within reason and was very consistent over countless trials. In addition to accuracy, our project is compliant with regulations for transmitting wireless signals.

Future Scope

This project was done as a proof-of-concept, but it is conceivable that with some additional work, this could be turned into a commercial product. The project can be extended by integrating both the module (Heart Rate and Steps Count module) into a single module. Instead of using GSM modem which accounts for a traditional method, a Bluetooth technology may be used to transfer data obtained from the module and one can check health parameters in mobile with appropriate mobile application.

The sleep patterns can also be identified based on the motion of the body, heart rate as you sleep overnight. The device can be synchronised with mobile phone where one can learn about his sleep patterns from the night before like how long he slept, how fast he fell asleep, how much time he spent in light vs. restful sleep, how many times he woke up, and average heart rate during sleep.