

# A COLOUR - CODED BRACELET MODELLING SYSTEM

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**Abstract-** This paper presents a current invention for monitoring the athletes' health. In the sports field, the Bracelet is used to find the heart rate and also to find people who take drugs. The heart beat sensor in the bracelet is used to find the heart beat level, pressure sensor is to check the blood pressure level and drug detection sensor is to detect drug consumption and temperature sensor to sense temperature of the human body. The sensor output is processed by the controller and received by the receiver through GSM module. The range of GSM module is relatively high so we are going to use this module for long distance purpose. The processing software is a user friendly, and it provides data acquisition, monitoring and recording. And hence the software displays the heartbeat, pressure, body temperature and the intake of drug level. This will be very helpful for athletes and coaches to monitor the fitness level of athletes and regulate their exercise training regime in a more effective and safer manner.

**Keywords—**Analog to Digital converter, Blood Pressure, Electro Cardio Gram, Global System for Mobile Communication, Light Emitting Diode, Peripheral Interface Controller, Recommended Standard Number 232

## I. INTRODUCTION

In today's life, the use of a heart rate monitor is very common and not simply used at the hospitals as a monitoring system for patients. Generally, heart rate monitor was used by a person who has heart problem and who cares about their heart rate is normal or not. In the sport field, the heart rate monitor is needed to determine the range of heart rate. This range of heart rate should be compatible with the exercise done by an athlete to get an optimum exercise to prevent from serious injury. Such digital display of target heart rate did not provide for simple reading the display under the most conditions of use, particularly when the user is exercising smartly. This paper proposed an innovation to respond to this problem by providing a novel Wearable biomedical signal sensor device for monitoring heartbeat conditions at anywhere easily, which displays the heart rate by glowing of 3 different LED's and enabling a user to tell at a brief glance, whether they are exercising at a suitable intensity and the coach to identify the sports person who have in taken drug or alcohol. The proposed innovation will be programmed to automatically suggest the user about their health conditions. The work will be focused for sport training application. This Prototyping can monitor appropriate heart rate while performing an exercise by sending feedback to the user via the specific color (LED) and to the coach via the wireless protocol which is GSM module. The GSM module wireless protocol is chosen as a transmission medium because it provides a small volume, high expansion, low power consumption, stylization and two-way transmission compared to bluetooth and zigbee. In this research work, we developed a group of sensors for measuring heart beat rate, pressure level, temperature level and drug level with real-time monitoring system based on GSM module wireless network. We are using a special type of device in which both heart rate and blood pressure can be measured simultaneously. According to the range of heart beat rate three LED's glows. The green LED for low beat rate, yellow LED for medium beat rate and red LED for high beat rate. The heart beat data measured by the sensor is processed by the ADC in the micro controller that data was read every second and stored on pic controller. The data from pic controller unit was sent to base node via GSM module wireless network and stored. Pic controller hardware and GSM module are packed in suitable case and can be worn on the sports person's wrist. The physiological parameters that are monitored with the proposed wearable bracelet are electrocardiogram (ECG), heart rate (HR) derived from ECG signals by determining the body temperature, respiratory rate, and three axis movement of the subject measured using an accelerometer. In order to design and construct the signal acquisition circuits efficiently and simply, modular design concept is adopted in this paper. Four basic high quality and flexible modules for signal conditioning are designed and assembled together for satisfying each sensor. When the bracelet is wear on the hand of athlete all the four types of sensors start doing their work. If any one of the parameter range is low or high then message is displayed on coach's mobile number using GSM wireless network.

## II. METHADODOLOGY

### A. HARDWARE DESIGN

The heart rate monitoring bracelet model mainly consists of two subsystems: first, a wearable data acquisition hardware, where the sensors for acquiring the biomedical parameters are integrated and transmitted to the receiver through GSM, and secondly, a remote monitoring station placed separately. This system as a whole is used in sports application.

The hardware design mainly consists of four sensors namely: Drug detection Sensor, Heartbeat Sensor, Pressure Sensor & Temperature Sensor. These sensors are connected to the pic controller. This pic controller is further connected to three different colour LED's. The transmission medium used here is GSM.

1. Block diagram

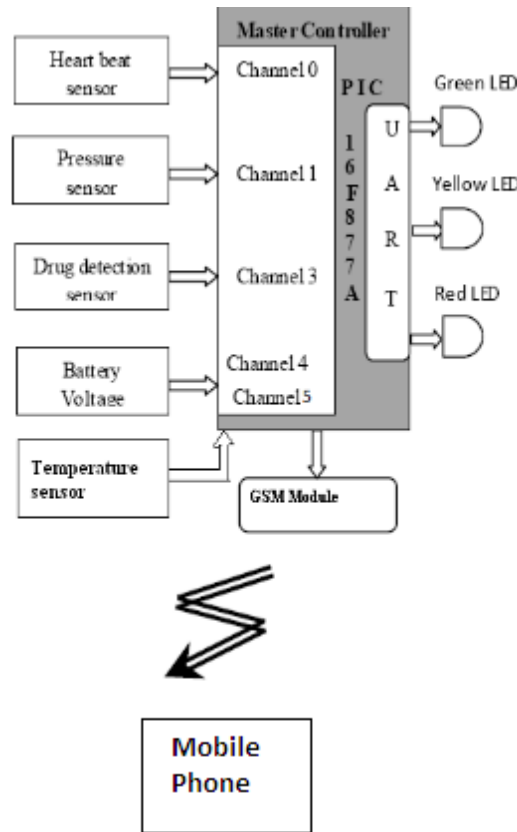


Fig.1 Block Diagram

a. Transmitter Module

i. Heart Beat & Pressure Sensor:

For this we are using a device which measures the both heart rate and blood pressure. It displays systolic, diastolic, pulse. It operates on serial data at 9600 baud rate. It is easy to operate, more accurate.

	Systolic(mmHg)	Diastolic(mmHg)
Hypotension	<90	<60
Desired	90-119	60-79
Prehypertension	120-139	80-89

Table .1

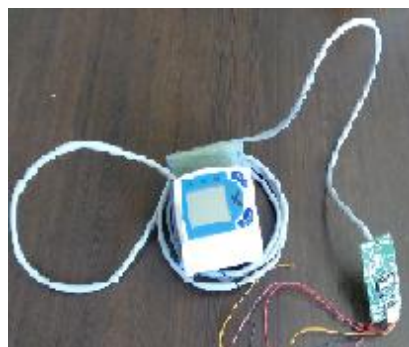


Fig.2 Blood pressure & heart beat sensor

ii. *Drug Detection Sensor*

Fig.3 Alcohol sensor

The drug detection sensor used here is Gas sensor MQ-303A. It is a tin di -oxide semiconductor gas sensor which has a high sensitivity to alcohol with quick response speed. This model is suitable for alcohol detection such as portable drug detection or breath alcohol checker.

iii. *Temperature Sensor*

The temperature sensor is used here is LM35 sensor. It is a precision IC temperature sensor with its output proportional to the temperature . The sensor circuitry is sealed. So it is not subjected to oxidation and other processes. Using LM35, temperature we can measure more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 oC temperature rise in air. The operating temperature range is from -55°C to 150°C.

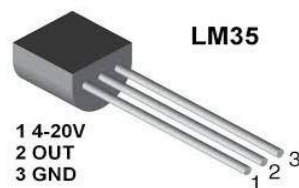


Fig.4 Temperature sensor

4. *GSM Module*

The SIM900 is completely quad band GSM solution in a SMT module. It can be embedded in customer application. The basic segregation of working of modem is as under voice calls, GSM data calls, SMS and GPRS. GSM module comes with serial interface through which the modem can be controlled using AT command interface. AT antenna and power adaptor are provided. The SIM900 needs only 3 wires ie. Tx, Rx and ground. Using GSM module we can send and read the messages and connect to the internet via GPRS.



Fig. 5 GSM Module

b. *DATA PROCESSING*

The pic controller used here is PIC18f4550 .It is a 40 pin pic controller with 5 I\O ports, 10 bit ADC up to 8 channels, three 16 bit timers and 2 comparators. Operat ing speed: DC 20 MHz clock input DC – 200 ns per instruction cycle. It has 8K x 14 words of Flash Program Memory, 368 x 8 bytes of Data Memory (RAM) and 256 x 8 bytes of EEPROM. 5 volt dc supply is given to the heart beat sensor, pressure sensor, drug detection sensor. firstly the heart beat sensor's output is given to the PIC18f4550 .This pic controller has built-in analogue to digital converter (ADC) and RS-232 serial communication interface. The flash program memory allows in-circuit reprogramming of the firmware. Although the ADC has a 10-bit These heart beat signals are in turn converted from analog to digital form in this built in ADC. Then this converted output is temporarily stored in RAM memory of PIC18f4550. After a small delay the pressure sensor output is given to the PIC18f4550 where these pressure signals are in turn converted from ADC form. Then this converted output is temporarily stored in RAM memory of PIC18f4550. Again After a small delay of 3ns drug detection sensor output is given to the PIC18f4550 where these signals are in turn converted to digital form. Then this converted output is temporarily stored in RAM memory of PIC18f4550.

The heart rate is calculated using the equation as followed

$$\text{BPM (Beats Per Minute)} = 60 \backslash \text{period (second)}$$

The formula used here is to calculate the HR max is presented in equation and respectively it is for male and female.

For Male: The value of HR max = 206.9 - (0.67 x age)

For Female: The value of HR max = 212.9 - (0.67 x age)

Then, the following equation is used to calculate the target heart rate (THR) zone.

$$\text{THR} = \text{HR max} \times \% \text{ intensity}$$

When this target heart rate value is found based on the Age Prediction formula and prediction equations then the heart rate and the pressure rate for each second of an individual is found. The calculated heart rate and the measured heart rate are compared. Then the heart rate for that second is found to be normal, low or high in the PIC18f4550 controller. If the heartbeat value is normal when compared to the target heart rate then the Yellow LED glows. And if the heartbeat value is low when compared to the target heart rate then the Green LED glows. And if the heartbeat value is high when compared to the target heart rate then the Red LED glows in the transmitter section, in the wearable bracelet. By this range of heart rate, it should be compatible with the exercise done by an athlete to get an optimum exercise to prevent from serious health issue.

### c. Receiver module

As a receiver module we are using a mobile phone. With the help of GSM module message is send to coach's number. Pic controller receives the sensors data. The data from every sensor are stored in the memory of pic controller and subsequently transferred to mobile phone. In SMS the sport persons heart rate,blood pressure level,drug level and body temperature range is displayed.

## B. SOFTWARE DESIGN

### Firmware Design

The program embedded on the PIC18f4550 is written in MPLAB. The program contains the following:

- i. Conversion of analogue signals such as heartbeat, pressure rate, drug level, temperature sensor to the digital signals.
- ii. In heartbeat detection the target Heart rate and Maximum Heart rate are calculated.
- iii. Analyze whether the Heartbeat rate is normal, low or high.
- iv. Indication of the respective LED's according to the Heartbeat rate at that instant.
- v. Packetize the collected data and the transmit them through the serial communication interface.
- vi. Recept, interpretate and then execute all the commands from the serial communication interface.

### Algorithm and flowchart

#### A. . Algorithm:

- I. Begin the process.
- ii. Read the data from heart beat sensor.
- iii. Perform analog to didgital conversion.
- iv. By analyzing the heart beat the data is given to the GSM module.
- v. If the heart beat rate is low then green LED will glow.
- vi. If the heart beat rate is normal then yellow LED will glow.
- vii. If the heartbeat rate is high then red LED will glow.
- viii. All this result will display on computer.
- ix. End the process.

B. Flowchart

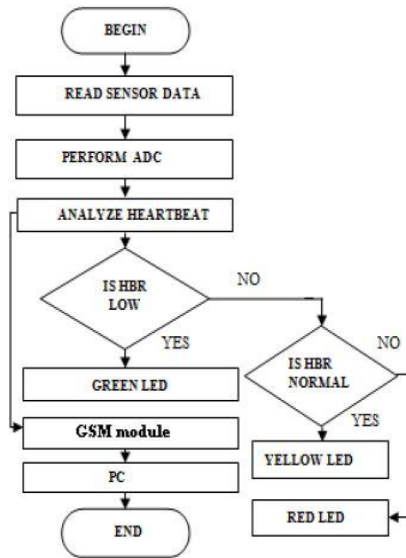


Fig.6 FLOWCHART

III. OBSERVATION AND RESULT ANALYSIS

A. Observation:

Led Color	Target zone	Training Recommended
Yellow	Normal(72 BPM)	Fit person, maintain the activity level.
Green	Low(60-70 BPM )	Unfit person, increase the activity level.
Red	High(>72 BPM)	Indicates the person is in abnormal state, recovery and cool down exercises should be done

Table.2

Different Color of LED Based On Heart Rate Zone

Led Color	Pressure level	systolic (mmHg)	diastolic (mmHg)
Yellow	Normal	90 - 130	60-80
Green	Low	< 90	< 60
Red	High	>140	>90

Table.3

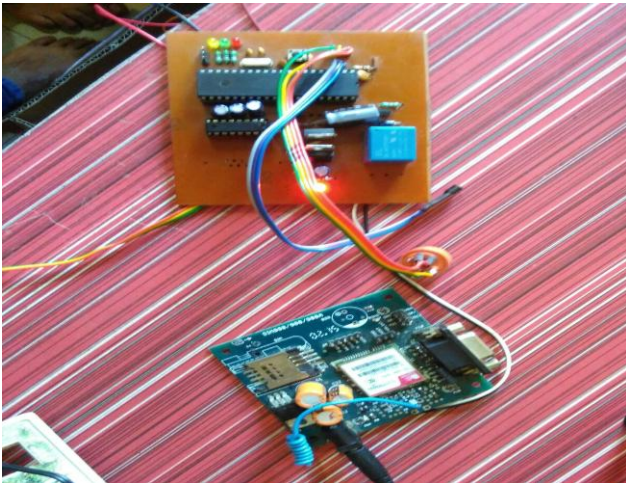
**B. Result Analysis:**

Fig.3 Model of Wearable Heart Rate Monitor with a Pulse Oximeter

**IV. CONCLUSION**

The portable colour coded bracelet modelling system is designed as a wearable bracelet. It is non invasive, easy to wear so that the athlete feel comfortable and will not impede their activities. In Future we will be focused on reducing the size of LED strips/bracelet to be worn as a wrist band and can be designed for low cost with less power consumption so can be comfortably used in daily life.

**V. FUTURE SCOPE**

Now a days different types of cell phones are used by people. So our device will be compatible with phones like iphone, android etc. Using GPS system we also track the location of athletes. We can use this device in hospitals and in military applications.

**VI. APPLICATIONS**

- I. This project is useful for the sport persons to measure his heart rate, blood pressure, temperature and drug level.
- II. The system is also used in hospitals to monitor the patient's health.
- III. In military applications.

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