HEART RATE MONITORING DEVICE

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ABSTRACT: An estimated 17.9 million people died from cardiovascular diseases (CVDs) in 2019, representing 32% of all global deaths. This can be prevented if the threat of cardiovascular diseases is diagnosed as early as possible and to do so very important and basic device is used is a Heart rate monitoring device The device senses the heart rate from the tip of the finger using the IR reflection method and displays it on a three-digit seven-segment with the help of intel 8051 microcontroller.

Keywords:-Photoplethysmography, Microcontroller 8051,LTH 1550-01 (IR diode n phototransistor pair),Seven segment displays, LM324 OpaAm

INTRODUCTION:

The device senses the heart rate from the tip of the finger using the IR reflection method and displays it on a three-digit seven segment display in beats per minute this device is built using an intel 8051 microcontrollers with an accuracy of 4 beats per minute This device makes use of Photoplethysmography the process of optically estimating the volumetric measurement of an organWhen the heart expands (diastole) the volume of blood inside the fingertip increases and when the heart contracts (systole) the volume of blood inside the fingertip decreases. The resultant pulsing of blood volume inside the fingertip is directly proportional to the heart rate and the device counts the number of pulses in one minute, that's the heart rate in beats per minute (bpm).

COMPONENTS USED:

A) INTEL 8051 MICROCONTROLLER :

It is an 8-bit microcontroller. It is built with 40 pins DIP (dual inline package), 4kb of ROM storage and 128 bytes of RAM storage, 2 16-bit timers. It consists of are four parallel 8-bit bidirectional ports, which are programmable as well as addressable as per the requirement. An on-chip crystal oscillator is integrated into the microcontroller having a crystal frequency of 12 MHz
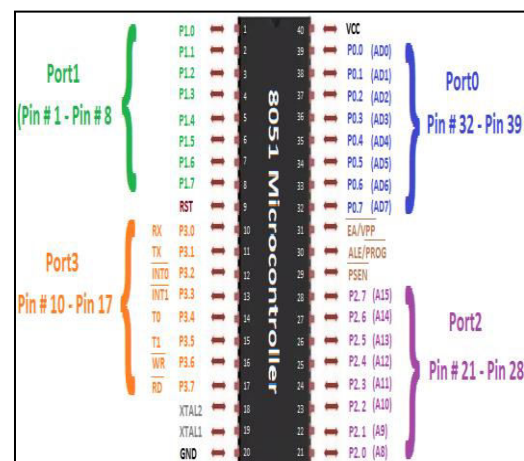
some features 8051: -

- 4 KB on-chip ROM (Program memory).
- 128 bytes on-chip RAM (Data memory).
- 8-bit data bus (bidirectional).
- 16-bit address bus (unidirectional).
- Two 16-bit timers.

B) LTH 1550-01 (IR diode n phototransistor pair)

LTH1550-01 photo-interrupter is made up of an IR diode and NPN silicon phototransistor in a single package. When IR is led inside the reflective sensor is forward biased, the sensor transmits IR rays. These rays get reflected when it hits on an obstacle. The phototransistor is aligned in such a way that it collects the reflected ray. When light falls on the phototransistor, the transistor starts to conduct. Hence the collector current increases and collector voltage decrease.
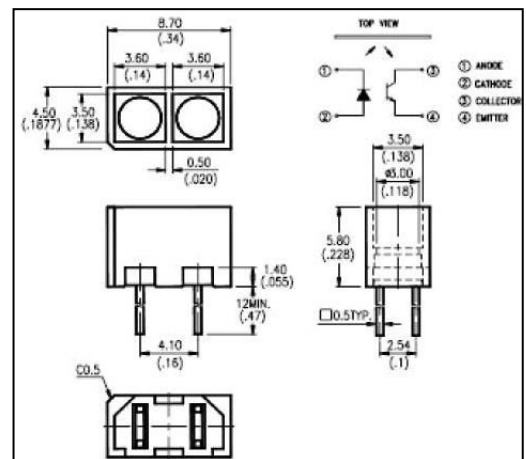

C)LED

LED, in full light-emitting diode, in electronics, a semiconductor device that emits infrared or visible light when charged with an electric device

The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the bandgap of the semiconductor.[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device
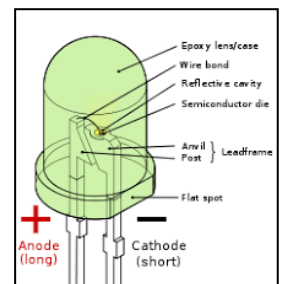
D)2N2222 transistor

The 2N2222 is a common NPN Bipolar junction transistor (BJT) used for general-purpose low-power amplifying or switching applications. It is designed for low to medium current, low power, medium voltage and can operate at moderately high speeds
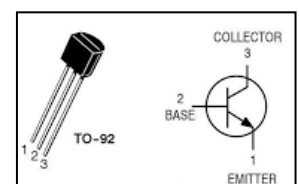
E) Seven segment displays

Seven section shows are the result show gadget that gives a method for showing data as picture or text or decimal numbers which is an option in contrast to the more complicated dab lattice shows. It is generally utilized in advanced timekeepers, essential mini-computers, electronic meters, and other electronic gadgets that show mathematical data. It consists of seven segments of light-emitting diodes (LEDs) which are assembled like numerical 8.
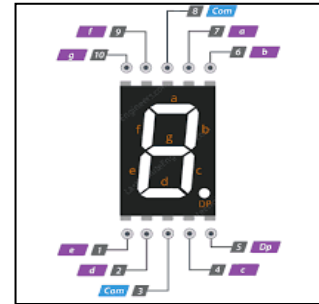
F) LM324 Opamp

The LM324 series are low−cost, quad functional intensifiers with genuine differential information sources. They enjoy a few unmistakable upper hands over standard functional enhancer types in single stock applications. The quad intensifier can work at supply voltages as low as 3.0 V or as high as 32 V with peaceful flows around one−fifth of those related with the MC1741 (on a for every speaker premise). The familiar mode input range incorporates the negative stock, accordingly dispensing with the need for outer biasing parts in numerous applications. The output voltage range also includes the negative power supply voltage.
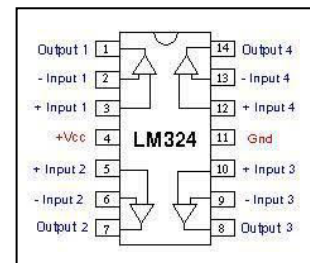
Working:

LTH1550-01 photo-interrupter forms the photoplethysmography sensor here. LTH1550-01 is simply an IR diode – phototransistor pair in a single package. When the fingertip is placed over the sensor the volumetric pulsing of the blood volume inside the fingertip due to the heartbeat varies the intensity of the reflected beam and this variation in intensity is according to the heartbeat.

At the point when less light falls on the phototransistor it leads less, its gatherer current reductions as its authority voltage diminishes.

This variety in the gatherer voltage will be corresponding to the pulse.This variation in the collector voltage will be proportional to the heart rate. The microcontrollercalculatesthis variation and display it to a seven-segment display

Circuit Diagram:

Flowchart:

```mermaid
flowchart TD
    Start((Start)) --> A1[Move starting address of LUT → DPTR]
    A1 --> A2[Set P1 as O/P port]
    A2 --> A3[Set P0 as O/P port]
    A3 --> A4[Load register R6 → 2330D]
    A4 --> A5[Set P3.5 as I/P port]
    A5 --> A6[Set timer 1 as mode 2 counter]
    A6 --> A7[Set timer 0 as mode 1 counter]
    A7 --> A8[Load TL1 with initial value]
    A8 --> A9[Load TH1 with initial value]
    A9 --> A10[Start timer 1 (counter)]
    A10 --> A11[Load initial value of TH0]
    A11 --> B1[Load initial value of TL0]
    B1 --> B2[Start timer 0]
    B2 --> B3[Check for timer 0]
    B3 --> B4[Stop timer 0]
    B4 --> B5[Clear timer flag 0]
    B5 --> D1{IS R6=0?}
    D1 -- No --> A11
    D1 -- Yes --> B6[Clear timer flag 0]
    B6 --> B7[Clear timer flag 0]
    B7 --> B8[Clear timer flag 0]
    B8 --> C1[Stop timer 1 (counter)]
    C1 --> C2[Clear timer flag 0]
    C2 --> C3[Clear timer flag 1]
    C3 --> C4[Call for subroutine Dloop]
    C4 --> C5[Displaying count]
    C5 --> C6[Short jump & move 252D to R5]
    C6 --> C7[Load the current count to accumulator]
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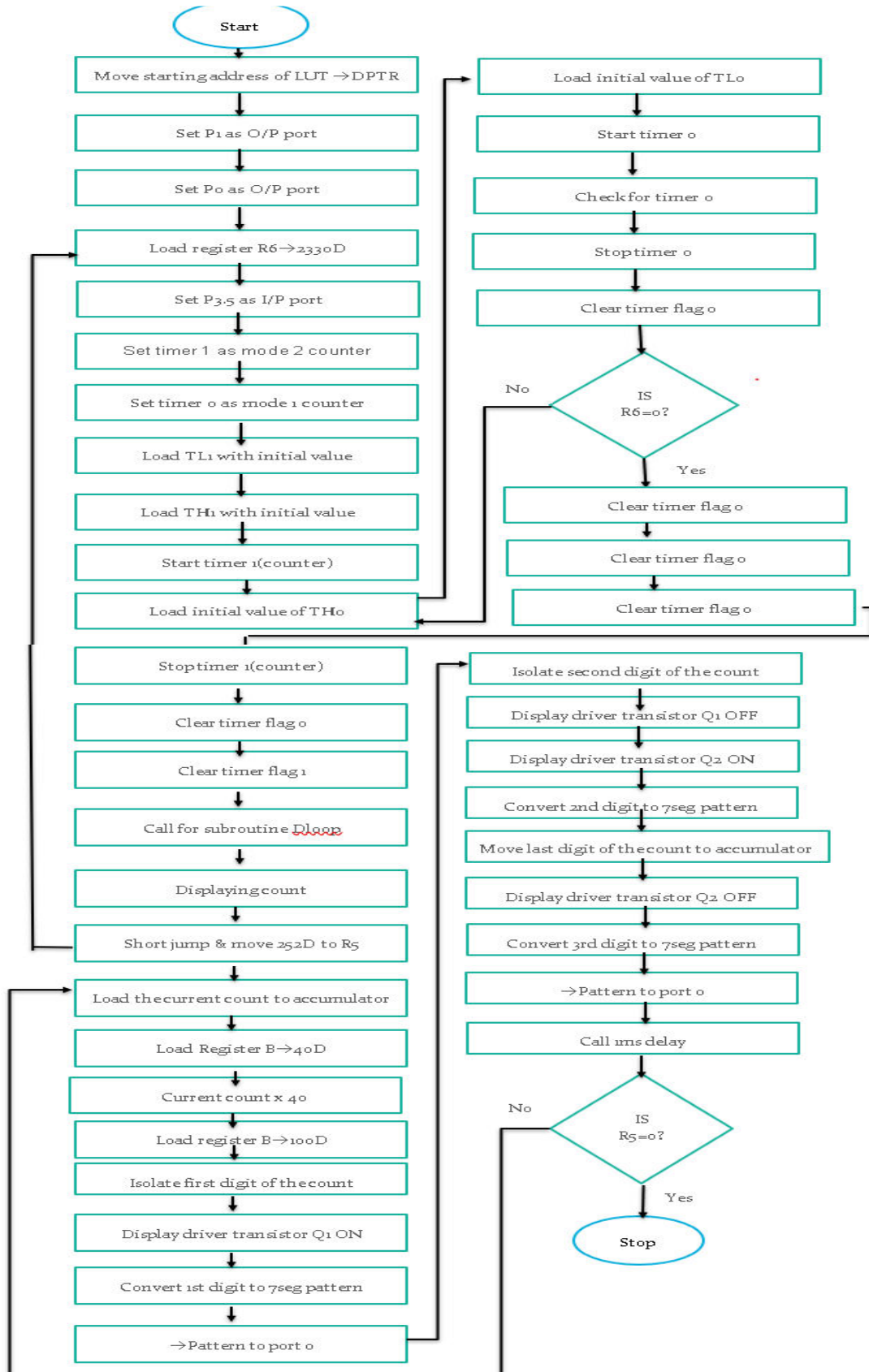
Boxes (left column, continued):
- Load the current count to accumulator
- Load Register B → 40D
- Current count x 40
- Load register B → 100D
- Isolate first digit of the count
- Display driver transistor Q1 ON
- Convert 1st digit to 7seg pattern
- → Pattern to port 0

Boxes (right column):
- Isolate second digit of the count
- Display driver transistor Q1 OFF
- Display driver transistor Q2 ON
- Convert 2nd digit to 7seg pattern
- Move last digit of the count to accumulator
- Display driver transistor Q2 OFF
- Convert 3rd digit to 7seg pattern
- → Pattern to port 0
- Call 1ms delay
- IS R5=0? → No (loop back) / Yes → Stop

REFERNCE: -

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