

Embedded systems Project

Heart Monitor

Presented by:

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Agenda

Short introduction.

Components and tools.

How it works

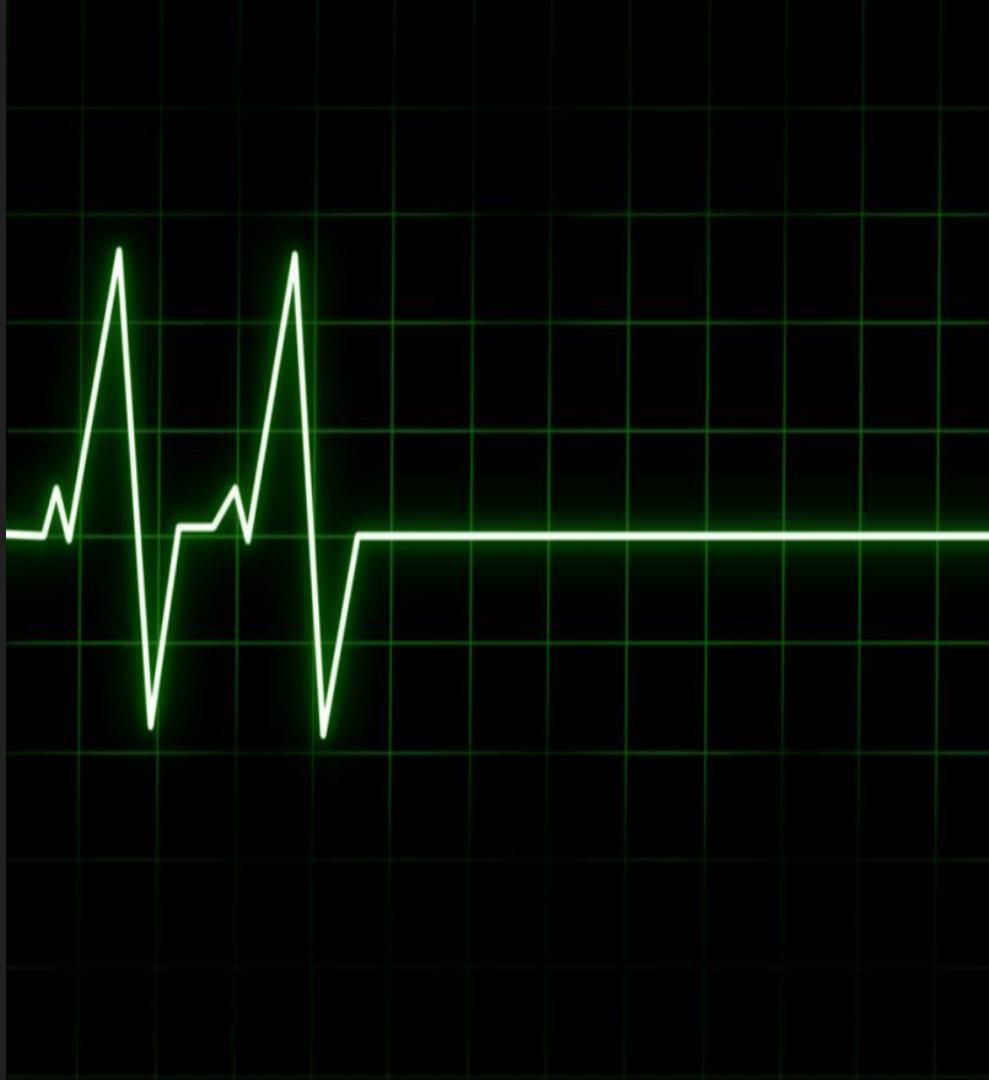
Diagrams to show design.

Programming Challenges.

Project timing.

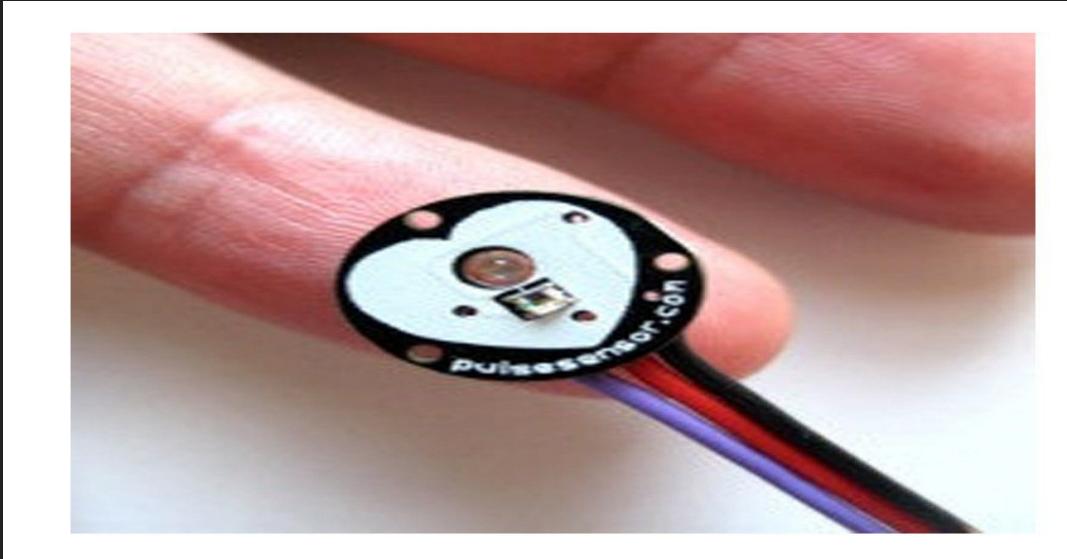
References.

Questions??



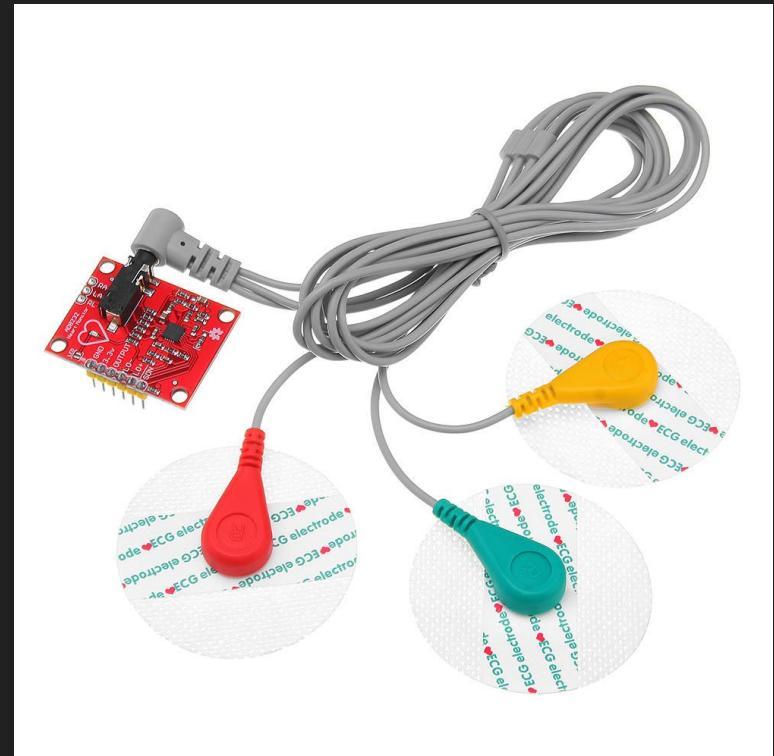
Short introduction

This app could be used to check on the patient and record his/her own heart activity over a period of time in a day and this will help to reduce the time the patient spends in the hospital and will create his/her reports always without a direct contact with the hospital.



Components and tools

- STM32L432KCU6 32 PINS
- AD8232 Heart Rate Monitor.
- Breadboard & Wires.
- LED to get some indication about the validity of the system.



Cycle diagram

ECG Sensor

Signal
conditioner

ADC

Universal serial bus



Understanding the problem:

00

The goal is just developing a USB Based ECG Portable system and displayed the acquired ECG signal and pass it to a PC using print screen to get the data in graph form and this is done by using an available microcontroller, an Analog circuit (ADC), Universal serial bus technology, an automated ECG Signal.

01

Got some final analysis like a report of an individual.

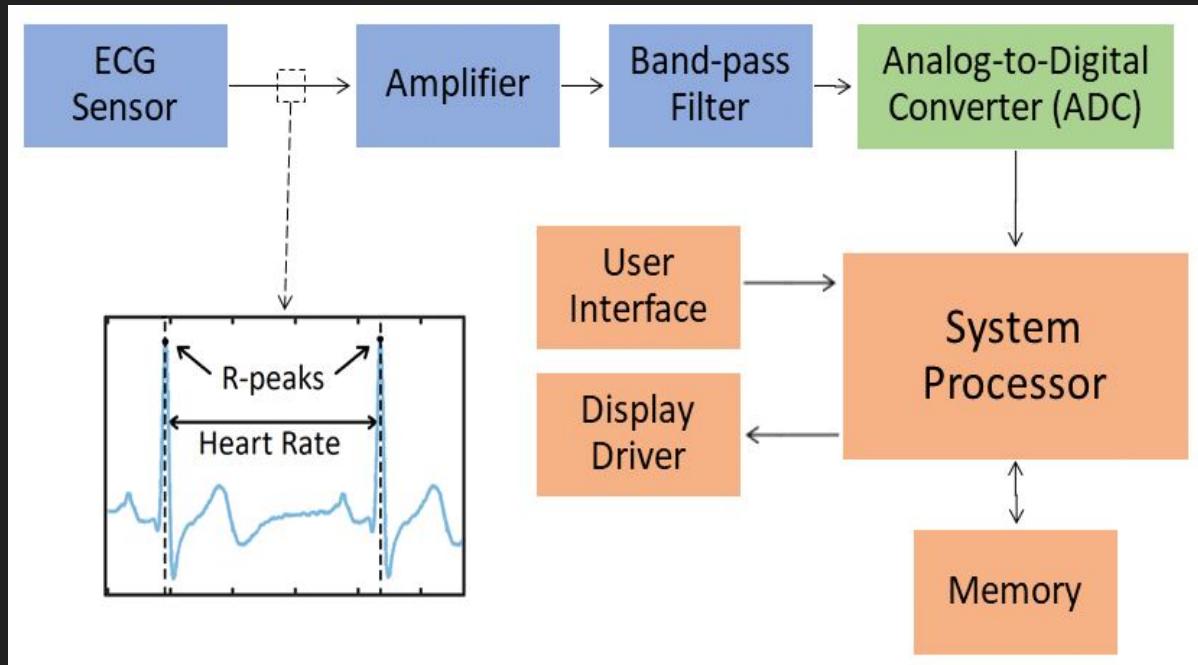
02

Discussing code wise.

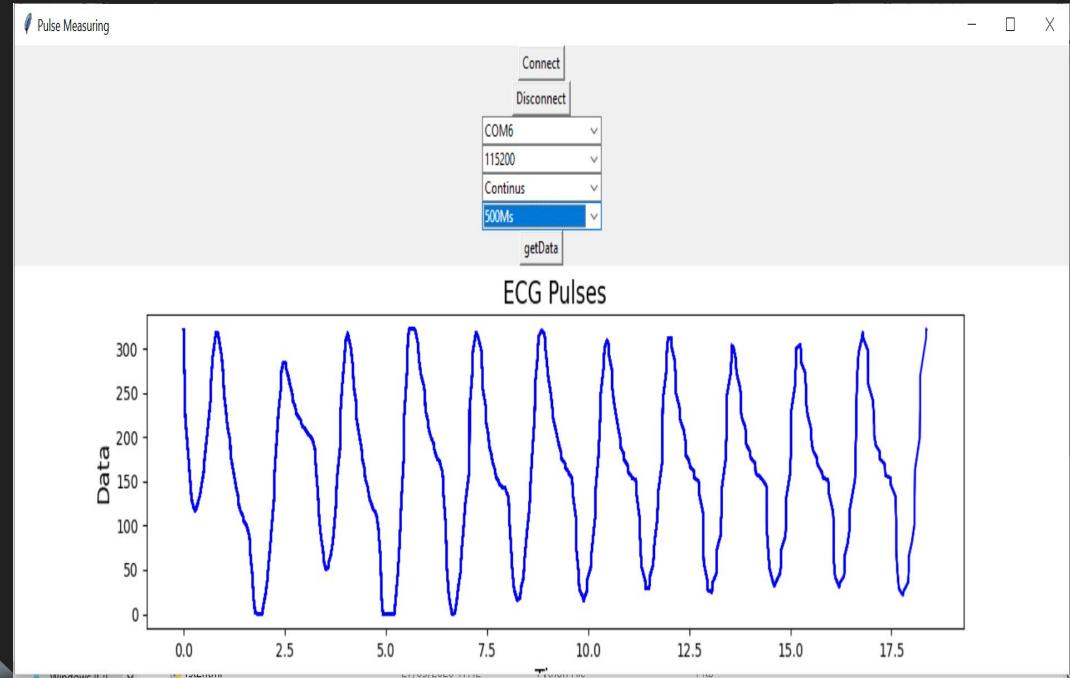
Architecture design

Short Note:

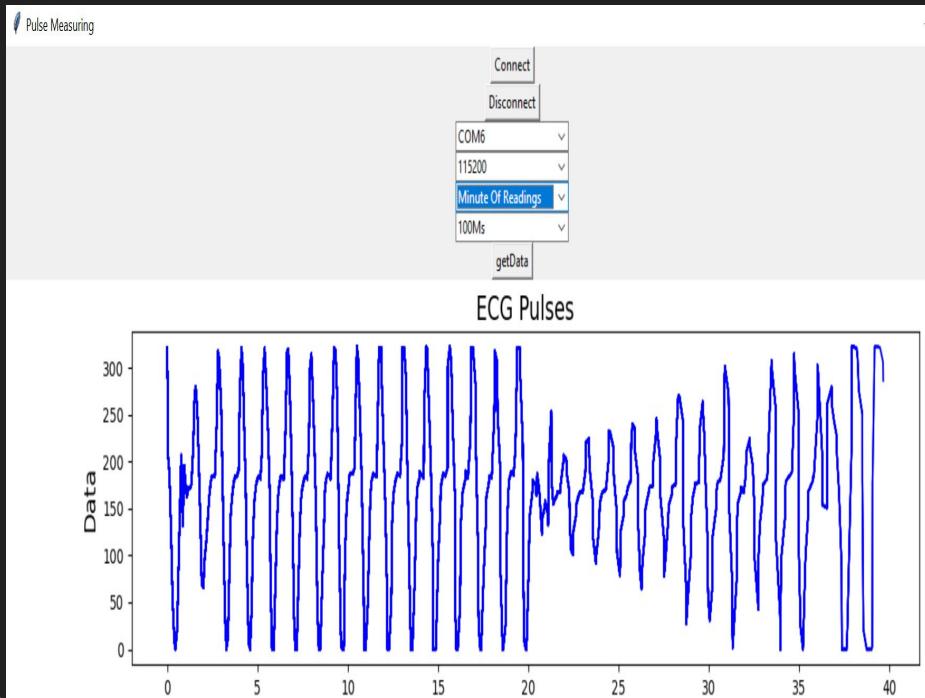
The parts about (Amplifier and Band-pass filter) are already handled on the used sensor as it works itself as a signal conditioner.



Project diagrams

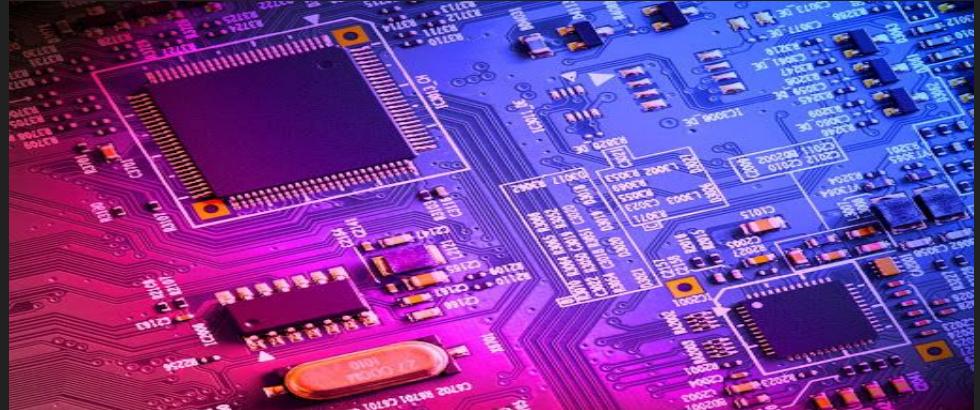


Project diagrams

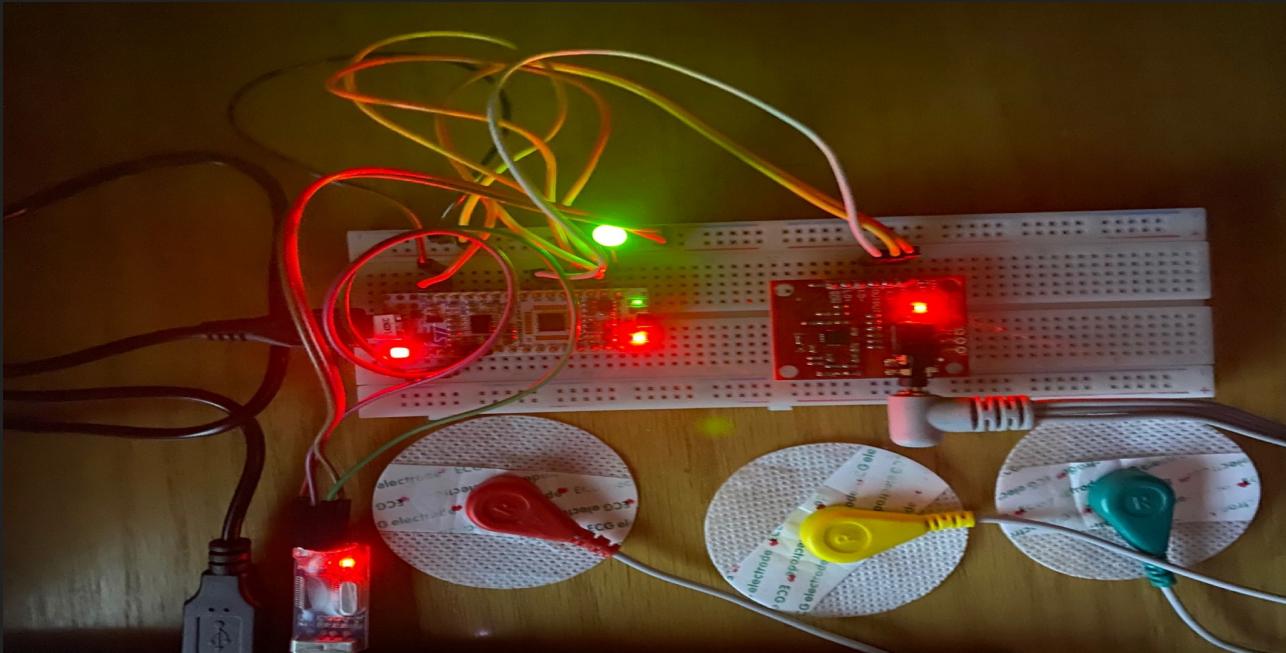


Hardware Design

The design consists of ECG sensor with electrodes, (amplifier and filtering which is the signal conditioner) and this is already done explicitly in this kind of sensor “AD8232“, (ADC analog to digital converter and this will be done in the microcontroller. PC is also used to analyze the data and draw the calculate data and sampling rates.



Real connections for the project

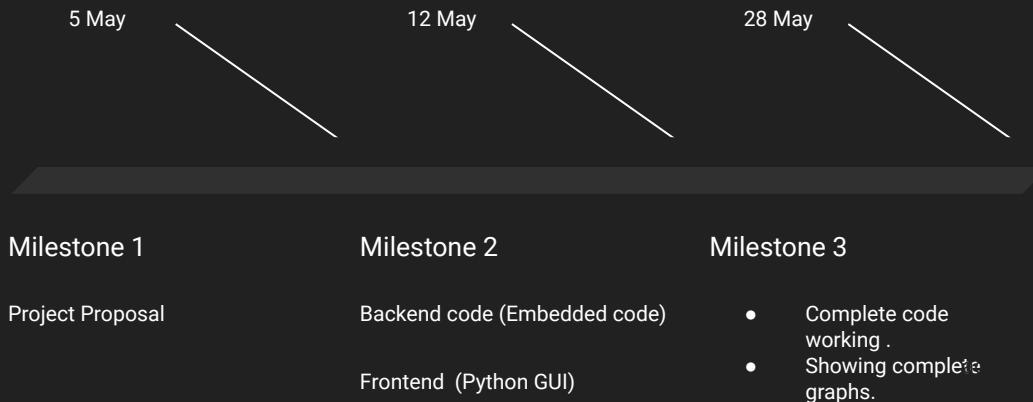


Parts of the embedded code to be discussed:

```
mainFile.c No Selection
819 while(*str)
820 {
821     usartPutChar(usartNr, *str++);
822 }
823 }
824
825
826
827 static const char hexTable[16]={‘0’,’1’,’2’,’3’,’4’,’5’,’6’,’7’,’8’,’9’,’A’,’B’,’C’,’D’,’E’,’F’};
828 static inline int encodeHex(int d)
829 {
830     return hexTable[d&0xF];
831 }
832
833 #define True 1
834 #define False 0
835
836 int64_t isOpen = True;
837
838 void sendString(char str[]){
839
840     usartPrint(DEV_USART1, str);
841     usartPutchar(DEV_USART1, ‘\n’);
842 }
843
844 static char *itoa_simple_helper(char *dest, int i) {
845     if (i <= -10) {
846         dest = itoa_simple_helper(dest, i/10);
847     }
848     *dest++ = ‘0’ - i%10;
849     return dest;
850 }
851
852 char *conv2Str(char *dest, int i) {
853     char *s = dest;
854     if (i < 0) {
855         *s++ = ‘-’;
856     } else {
857         i = -i;
858     }
859     *itoa_simple_helper(s, i) = ‘\0’;
860     return dest;
861 }
862
863
```

```
mainFile.c _main
913 //ADC Config/
914 //sendString("Load");
915
916 initADC();
917 int32_t mainTimerMs = sysTickGetCount() + 1000;
918 int32_t countTimerMinute = sysTickGetCount() + 1000;
919
920 int64_t mainDebugCounter = 0;
921
922 // loop forever
923 for(;;)
924 {
925
926     //int data = ADC1->DR;
927
928     const int32_t stc = sysTickGetCount();
929     const int32_t diff = stc - mainTimerMs;
930     const int32_t diffMinute = countTimerMinute - stc;
931     if ((diff)>=0)
932     {
933
934         mainTimerMs += sampleRate;
935
936
937         //Mode Continus
938         {
939             if(Mode == MODE_CONTINUES){
940
941                 if(isOpen == True){
942                     ledOn(GREEN_LED_PORT, GREEN_LED_PIN);
943                     isOpen = False;
944                 }else{
945                     ledOff(GREEN_LED_PORT, GREEN_LED_PIN);
946
947                     isOpen = True;
948                 }
949
950
951
952             Send_ADC_Value();
953         }
954     }
955
956
957 //Mode Minute
```

Project timeline



Future features:

- Turning it to a complete mobile application to be easy to use.
- Adding temperature sensor so the user can get more than one service in one app.
- Considering the low power features.

References:

<https://www.st.com/resource/en/datasheet/stm32l432kc.pdf>

[https://www.researchgate.net/figure/A-heart-monitor-block-diagram-composed-of-electrocardiogram-ECG-sensors-amplifiers fig6 327334051](https://www.researchgate.net/figure/A-heart-monitor-block-diagram-composed-of-electrocardiogram-ECG-sensors-amplifiers_fig6_327334051)

Design of Portable ECG Device Based on STM32.pdf

[https://www.researchgate.net/publication/311912500 An_EMBEDDED_System_for_Monitoring_Pulse_Rate_during_Indoor_Exercise](https://www.researchgate.net/publication/311912500_An_EMBEDDED_System_for_Monitoring_Pulse_Rate_during_Indoor_Exercise)

<https://www.hindawi.com/journals/wcmc/2018/9138578/>

Questions..

Thank you!

