Real Time Wireless Electrocardiogram (ECG) Monitoring System
Project proposal

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Introduction

The real time ECG monitoring system is a system designed to capture the electrocardiogram of a user, modulate and transmit it to a receiver and demodulator, which will then sense the hearth rate and sound a beep for each pulse. There is an alarm that sounds in case the hearth beat is too low.

There are several uses for this system, from just knowing your heart beat while exercising, to keeping track when a doctor should be contacted if the users' heart rate gets too low.

The system is primarily composed of seven modules, each of which will be independently implemented and tested.

Two 9V batteries will be used to power the transmitter in order to make the system portable and safe, assuring that it is isolated from the power line. The receiver will be powered from the +-15V from an existing power supply.

System Modules:

Modulator

The modulator is the circuit responsible for modulating the ECG signal captured from the ECG acquiring circuitry, using amplitude modulation (AM) with a carrier frequency of 455kHz. It utilizes a current mirror and an amplifier to modulate the signal over a carrier frequency.

The modulator receives a single input, the ECG signal, and outputs a radio frequency through its antenna. AM transmission usually uses a large antenna, however a small antenna must be chosen due to the intrinsically portable nature of this project.

Demodulator

The demodulator module will receive the electromagnetic waves emitted from the modulator, it'll then filter the carrier wave, leaving only the modulated signal, and regenerate the ECG signal.

The input of this module is the radio frequency transmitted from the modulator, and the output is, ideally, the same signal that the ECG capture device produced.

Heartbeat detector

The heart beat detector will ignore the entire portion of the ECG signal that is below a certain threshold, identifying only the peaks that correspond to one beat of the heart. The output of the first part of this module is a pulse for each heartbeat, which will be fed into the second part, that is responsible for identifying if the frequency is below a

predefined value. In case the heartbeat frequency is too low, this module is going to output a signal to the next part of the circuit, which fires an alarm.

Sound amplifier

The sound amplifier module amplifies the pulse received from the detector module and outputs that signal to a speaker, so the user can listen to a sound for each heartbeat.

Low heart rate detector

The low heart rate detector determines if the pulse rate is too low. This low value can be adjusted and in case the received heart rate is lower than this lower threshold, a signal is sent to the emergency signal reset module.

Emergency signal reset

The emergency signal reset is a module that receives the signal from the low heart rate detector and if the signal is low, the module sounds an alarm that is maintained on for a predefined period of time or until the responsible user turns the alarm off by means of a button. This emergency alarm tells the user if the user's heart rate is below a predefined value, and so warns people around or the user itself that medical action may be required. The alarm will also sound if the ECG monitor has been taken off.

ECG capture module

The ECG capture module is the one designed in Lab. 5, and has already been assembled. The leads are connected to the body using electrodes, and the outputs are connected directly to the heartbeat detector.

Testing

Each module will be tested and its features will be working independently before any integration between modules is made. This allows each module to be designed and debugged separately making it easier to get a functional design at the end and is expected to save a lot of debugging time.

Functional block diagram

The next figure illustrates a simplified version of the whole system as it is expected to be at the end of this project.

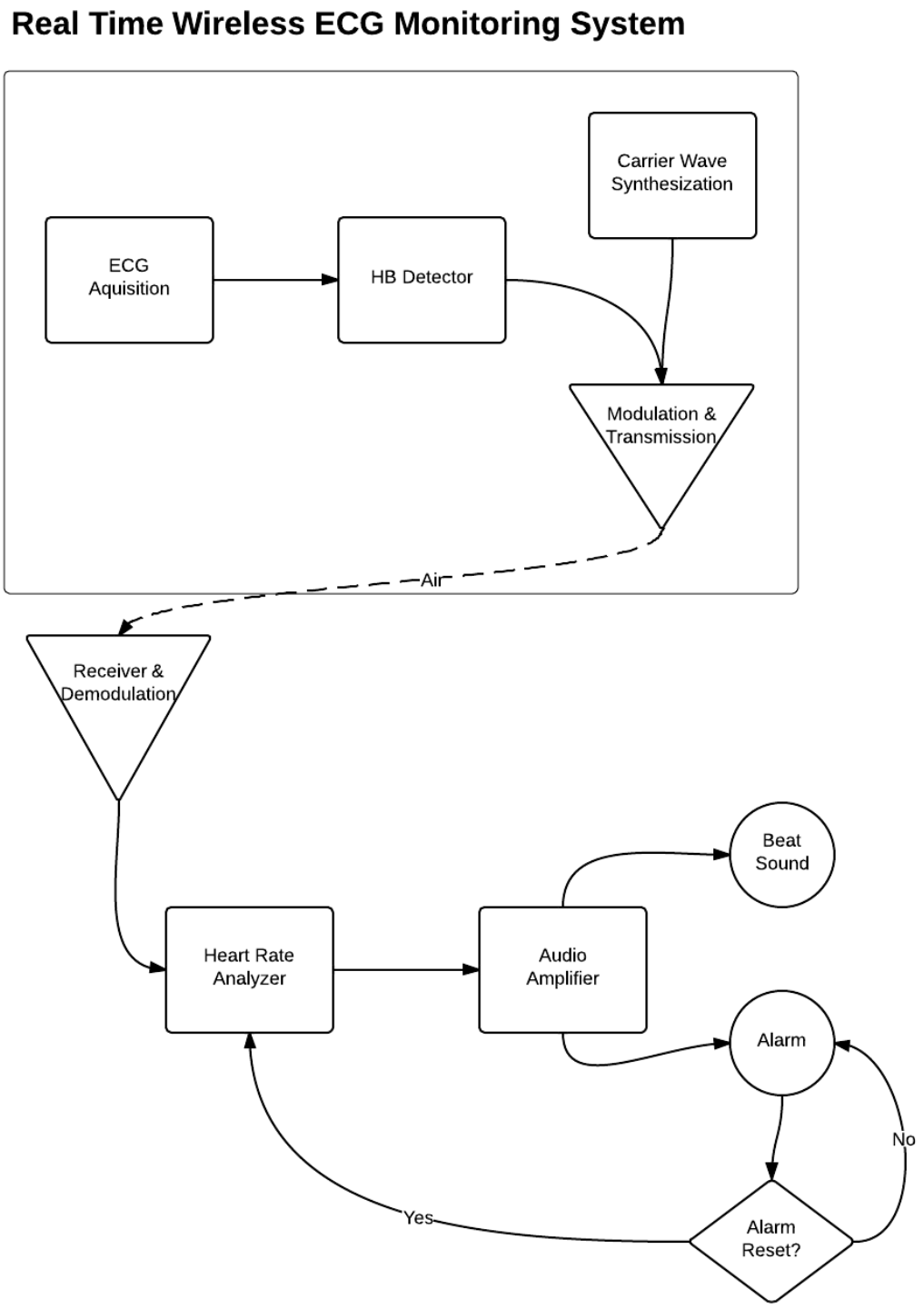

Figure 1 – Functional diagram of the designed system