جامعة الإمام عبد الرحمن بن فيصل
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Senior Design Project Summary

Project Title: Wireless Periodic Diagnosis of Some Vital Signs For Chronic Patients Using HARRE Drone System	**Date:** 20th December 2017

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Abstract

Chronic diseases need a periodic examination so, the patient needs to go to the hospital regularly for diagnosis. With time, these visits become tiring to the patients. Therefore, HARRE system has been designed to find a faster and easier way for periodic examination of chronic disease patients. HARRE system is a wireless periodic diagnosis system which will be built inside a box attached to the bottom of a drone. This system is used as a communication bridge between chronic disease patients and doctors. It consists of three main parts: wireless periodic monitoring circuit, drone, and a medical phone application.

Design Problem Statement

Generally, chronic illnesses cannot be preceded by vaccinations or cured by medication, nor do they just disappear. So, patients with these diseases need to visit the doctors regularly (i.e. every two or three months) to check their health and renew their drugs. Therefore, these visits become with time so annoying to some patients. On the other hand, some patients can easily forget about the dates of these visits. To solve such problems, we decided to build a system called HARRE drone system to check the health states of those patients and make their lives more easier.

ARRE
BME

Project Constraints

✧ The ECG can measure only Lead I, Lead II and Lead III because it has only 3 electrodes.

✧ The temperature measured in an axillary position from 35°- 45°.

✧ The Arduino can only withstand a voltage of 3.3V.

✧ The Wi-Fi board can work at 2.4 GHz frequency range.

✧ Power Supply can only withstand output voltage 3.3V / 5V.

✧ The maximum voltage that the drone can handle is 11V.

✧ The maximum weight that the drone can lift is 3208 g including its own components.

✧ Drone's flight time is only 6 min.

✧ Receiver, transmitter, and WiFi work at same frequency which is 2.4 GHz.

✧ HARRE done cane be controlled by using the transmitter and receiver within 1609 m range, depending on the noise and obstacles.

Project Description

HARRE system is composed of three main parts as illustrated in figure 1. The first one is the wireless periodic monitoring circuit that will measure some physiological parameters which include: ECG, temperature, SpO2 and heart rate by using some sensors. The sensors are controlled and programmed by Arduino 101. The communication between the patient and the doctor through the application can be achieved by connecting the ESP8266 Wi-Fi module to Arduino 101. The medical application allows the doctor to add or edit the patient information, while the patient can edit only his address, and view his information and appointments. Also, it will have some good features like the automatically set up alarm, which will give an alert in the patient's cell phone few hours before his appointment. Finally, the drone which is an integrated system that is capable of carrying the wireless periodic monitoring circuit to the patient's house location.
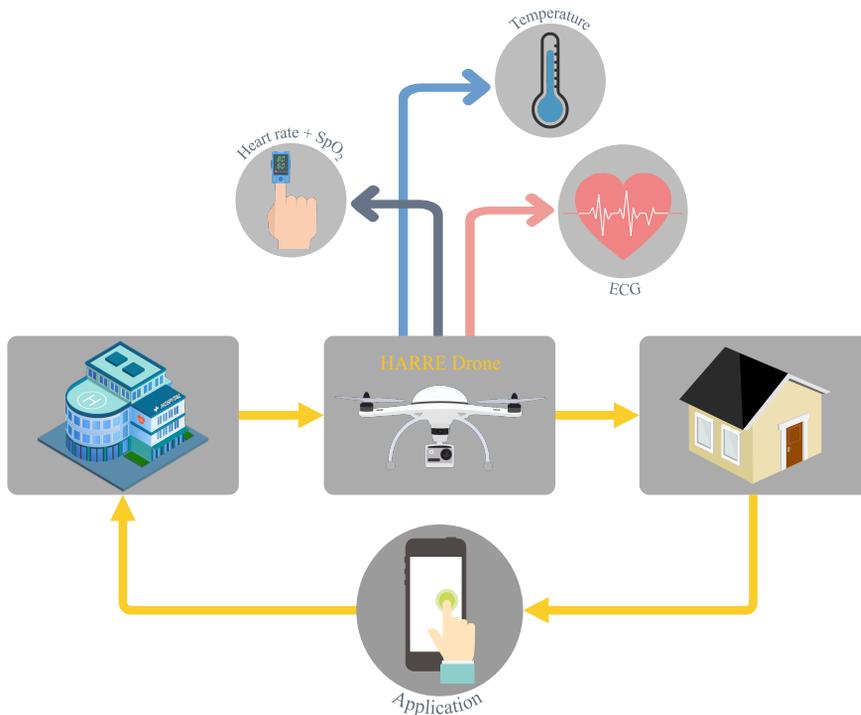
Figure 1: HARRE drone system summary.

Engineering Standards and Ethics Consideration

Any device in contact with the human body should have some standards in order to protect the human's life and to make sure that this device will provide him with the maximum benefit. Many organizations such as FDA, AAMI, ISO and more put these standards.

For example, an ECG device and heart rate monitor should follow ANSI/AAMI EC13:2002 standard(details provided here http://www.pauljbennett.com/pbennett/work/ec13/ec13.pdf). Pulse oximeters should follow ISO 9919:2005. The temperature sensors must follow ISO 80601-2-56:2009(details provided in https://www.iso.org/standard/44106.html). Pulse oximeters should follow ISO 80601-2-61:2011(details provided here https://www.iso.org/standard/51847.html). IEEE 802.11 standard is used for communication here.

Timeline

Table 1 illustrates the timeline that will be maintained throughout the project. The literature survey which is the first step in our project will take five weeks to complete. After that, the project formulation step will take two weeks to complete.

Then, materials and components selection step follows and it will need four weeks to complete. Next step is the prototype design, which is considered as the core of the project, will take four weeks to complete. Build prototype and programming is the next step and it will take eight weeks to complete. Testing the programming codes results will take two weeks to complete. Designing phone medical application is the following step which will take 12 weeks to complete. Finally, a full review for the whole project will be done and it will take four weeks to complete. Writing the final report will take the whole period of the two semesters which is 32 weeks.

Table 1: Timeline of the project work.

Months	September				October				November				December				January				February				March				April			
Weeks	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Literature Survey	■	■	■	■																												
Project Formulation					■																											
Material and Component Selection						■	■	■																								
Prototype Design									■	■	■																					
Build Prototype + programming																	■	■	■	■	■	■	■	■								
Testing																									■	■						
Design Phone Medical Application																	■	■	■	■	■	■	■	■	■	■	■	■				
Final Review																													■	■	■	■
Final Report	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■