

# Smart Phones for Transcutaneous Pacing

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**Abstract :** This technology will enables us to monitor, analyse the heart rate of a patient using Smartphones. The smartphone will contain an application which will display the ECG graph. The application will also contain the patient's history, doctor's information and contact details. If the patient is about to experience arrhythmia it reports on the smartphone to the individual as well as the doctor. The doctor monitors the condition and gives the necessary amount of the of pulse required. The pulse is generated by using current driver circuit. The variation of this current can be controlled through smartphone application.

**IndexTerms – Arrhythmia, smartphone, application.**

## I. INTRODUCTION

During a medical emergency, when the patient is about to go in cardiac arrest temporary pacing of the patient's heart is done to stabilize the heart. The heart rate is brought to normal by this pacing. This type of pacing of the heart is called Transcutaneous pacing and sometimes it is also termed external pacing.

Transcutaneous pacing is done when the patient experiences a heart rate of less than 60 beats per minute (in adults). This condition in medical terms is called as Bradycardia

In recent biomedical advancement and researches, it has come into account that most of the patients who suffer *Bradycardia* that is Heart rate below 60bpm die due to late treatment.

The proper and timely treatment is not possible as there is no emergency equipment or portable equipment which monitors the heart and reports the individual as well as the doctor of the arrhythmia. This leads to no proper information of the heart disorder and hence leading to late treatment.

Therefore, this technology enables us to monitor the heart rate using Smartphones. And if there is arrhythmia it reports on the smartphone to the individual as well as the doctor. The doctor then gives the necessary amount of the of pulse required. The pulse is generated by using current driver circuit. The variation of this current can be controlled through smartphone.

## II. METHODOLOGY

Place 3 ECG leads on patient's chest. Connect ECG leads. These ECG leads are then connected to Arduino Uno via AD8232. The Arduino Uno will send the heart rate signal on Smartphone using Bluetooth. Monitor the heart rate on Smartphone using the application. If arrhythmia is detected, use Smartphone to control the current drivers and give a variable DC of specified mA. Place pads in AP (Antero-posterior) position (black on anterior chest, red on posterior chest) or place pads in AL (Antero-lateral) position. Start pacing and increase mA until pacing rate captured on the Smartphone. Provide the required pulse to stabilize the heart. Monitor the heart rate if arrhythmia is detected then repeat the above procedure. Monitor the heart rate if rhythm if stable the patient is out of danger for some time.

III. INTERFACING DIAGRAM

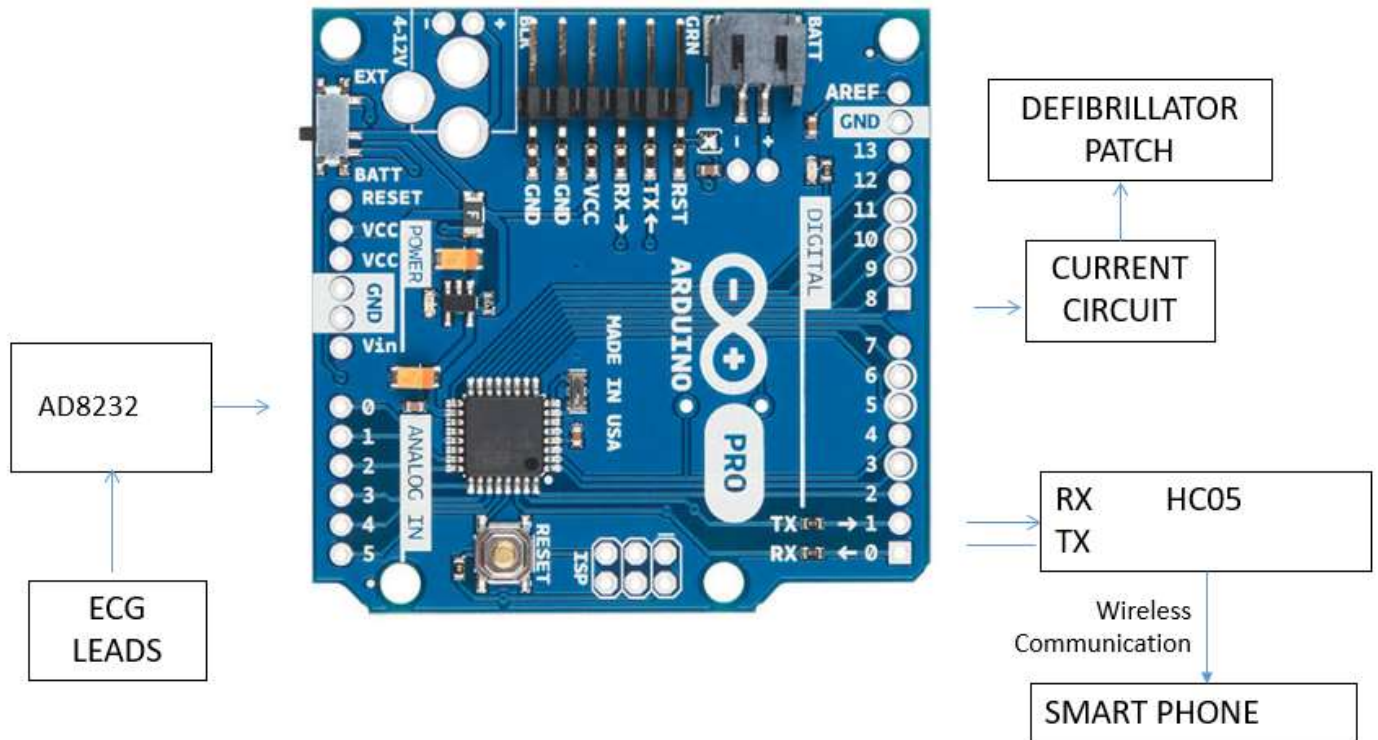


Figure1. Interfacing Diagram of Arduino Uno with Smartphones.

3.1 Arduino Uno

Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

3.2 ECG Leads

Use of 3 ECG leads placed AP (Antero-posterior) position (black on anterior chest, red on posterior chest) or place pads in AL (Antero-lateral) position.

3.3 AD8232

Fully integrated single-lead ECG front end. Low supply current: 170µA. Two or three electrode configurations. High signal gain with dc blocking capabilities. Single-supply operation 2.0V to 3.5V

### 3.4 HC-05

Its range is up to 10m. Uses UART for serial communication and is highly compatible device. Supports data communication link with all the phones.

### 3.5 Smartphone

Contains an Application which will monitor, analyse the heart and detect arrhythmia. Notification Alert when arrhythmia is detected. ECG details will be sent to doctor. Control current circuit. Store patient's history.

### 3.6 Current Driver Circuit

The Current driver circuit consists of two Operational Amplifiers. The 1<sup>st</sup> amplifier is used to amplify the voltage that we get from microcontroller. The 2<sup>nd</sup> Operational Amplifier with the MOSFET is the current circuit with generates the required amount of current. If a voltage of 100mV is provided by Arduino Uno then this circuit gives 10mA at its output. If 200mV is provided then the circuit gives 20mA at its output and so on.

### 3.7 Defibrillator Patch

Placed in such a manner that patients whole heart is covered. It is a patch through which the pulse is provided to the patient.

## IV. RESULTS AND DISCUSSION



Figure 2: Normal ECG



Figure3: Sinus Bradycardia

Smartphones detect, analyse and control the current drivers the pacing of heart and also monitor it at each instance. That is Smartphones acts as Transcutaneous pacers of the heart.

#### REFERENCES

- [1] Dalsey, William C. MD; Syverud, Scott A. MD; Hedges, Jerris R. MD, Facep; Clinical paper Emergency department use of transcutaneous pacing for cardiac arrests. Critical Care Medicine: May 1985.
- [2] Jonathan Sherbino; P. Richard Verbeek; Russell D.MacDonald; Bruce V.Sawadsky; Andrew C.McDonald.Laurie J.Morrison; Clinical paper Prehospital transcutaneous cardiac pacing for symptomatic Bradycardia or bradysystolic cardiac arrest: A systematic review. States that Advanced cardiac life support (ACLS) guidelines suggest transcutaneous cardiac pacing (TCP) for the treatment of symptomatic Bradycardia (SB) and bradysystolic cardiac arrest (BACA). Many EMS systems are extrapolating these guidelines and employing TCP in the Prehospital setting.
- [3] Dina Simuni; Slaven Tomac; Ivan Vrdoljale: Wireless ECG Monitoring System; 24<sup>th</sup> July 2009
- [4] K.A.Mamun; A.Sharma; A.S.M Hoque; T.Szeeci: Remote patient physical condition monitoring service module for iWARD hospital: 5<sup>th</sup> March 2015