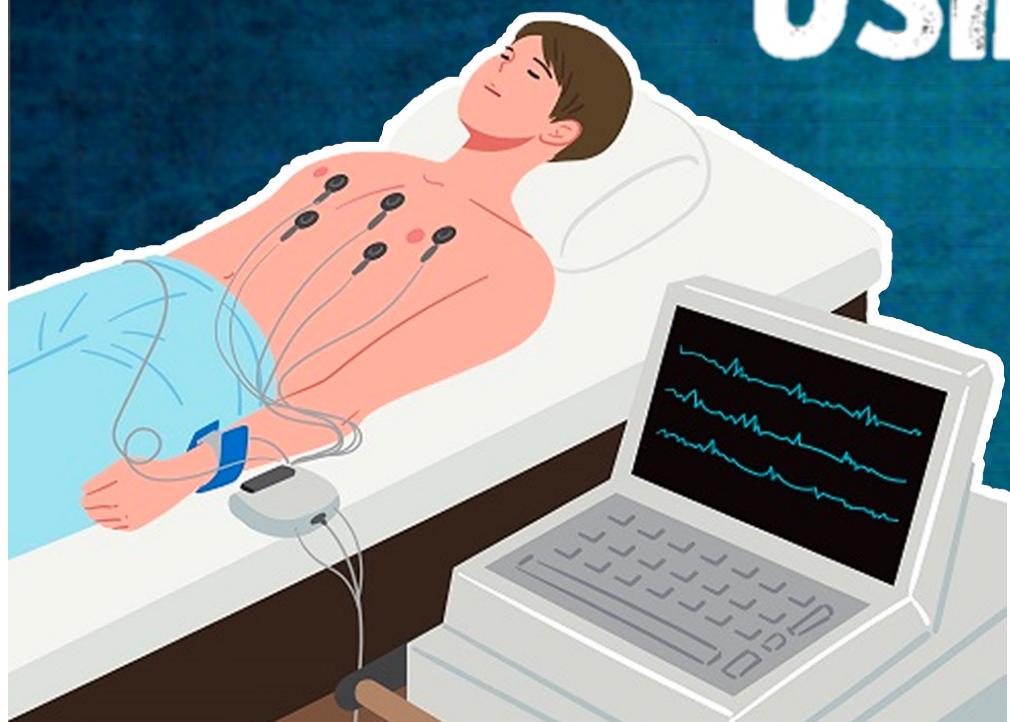


# ELECTROCARDIOGRAM USING ARDUINO



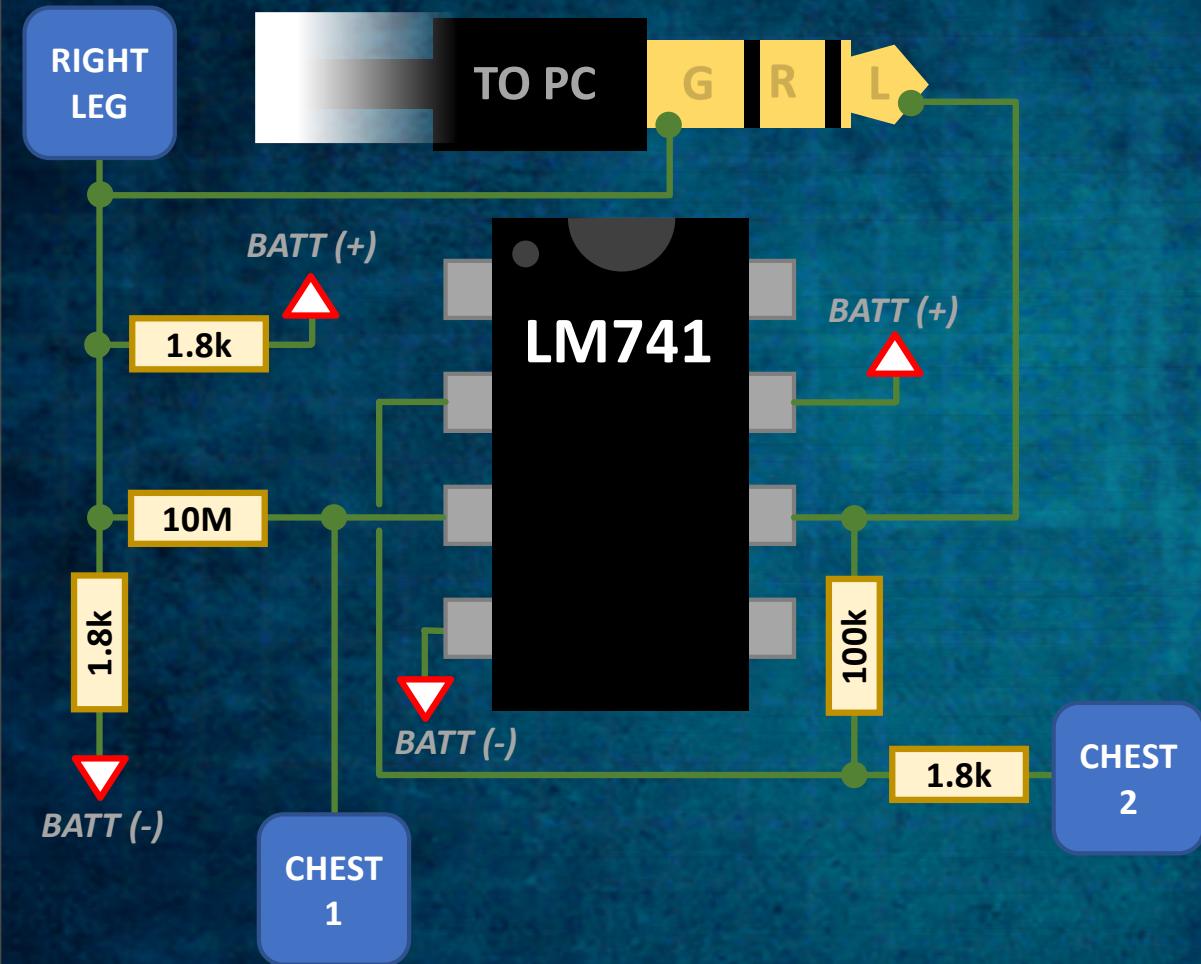
**HARDWARE PROJECT  
+ Software PROJECT**

Presented By :-  
R Radhika (2K20/EC/152)

**ECG**  
**SINGLE OP-AMP**  
**VERSION**

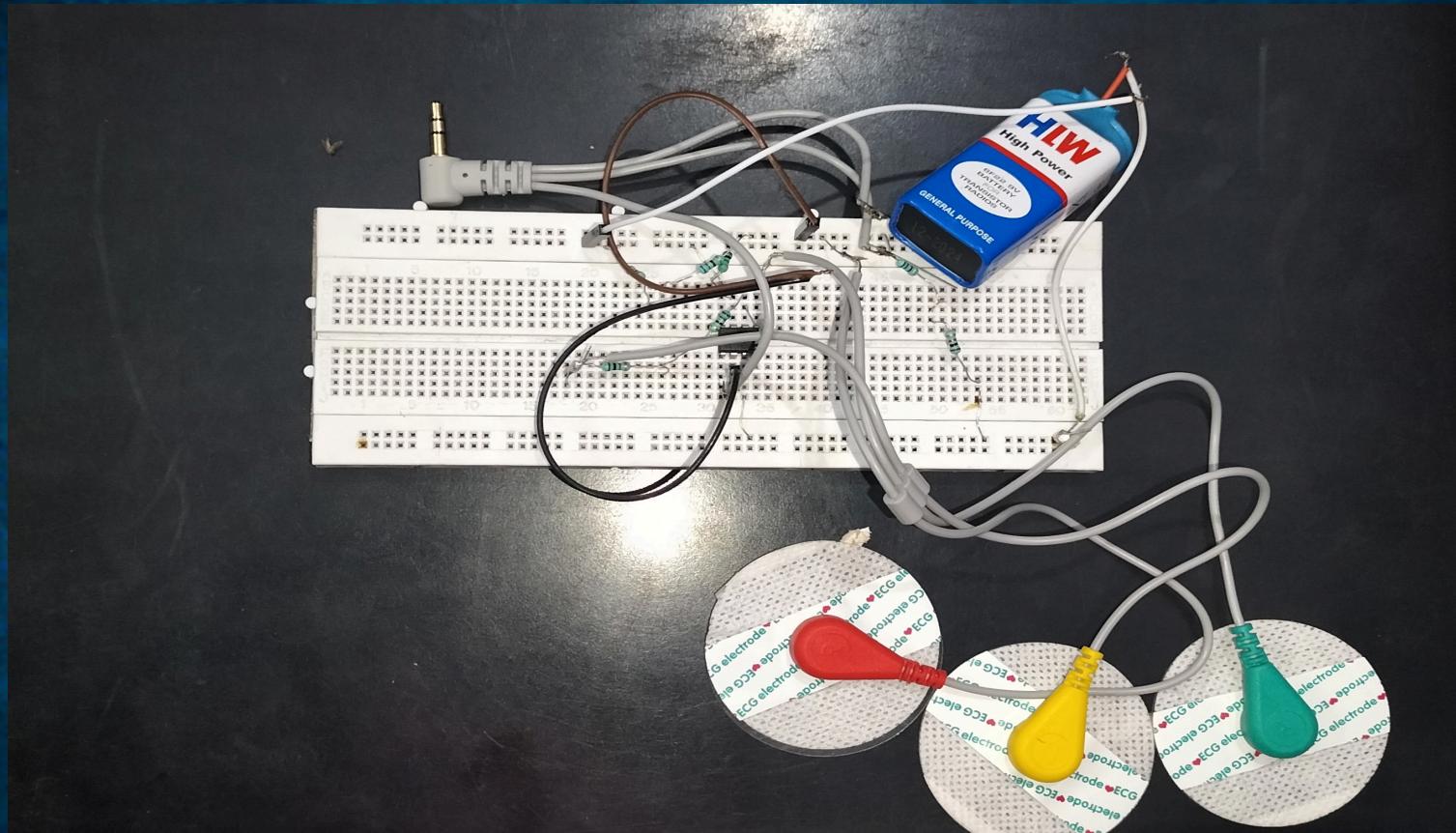


# CIRCUIT DIAGRAM

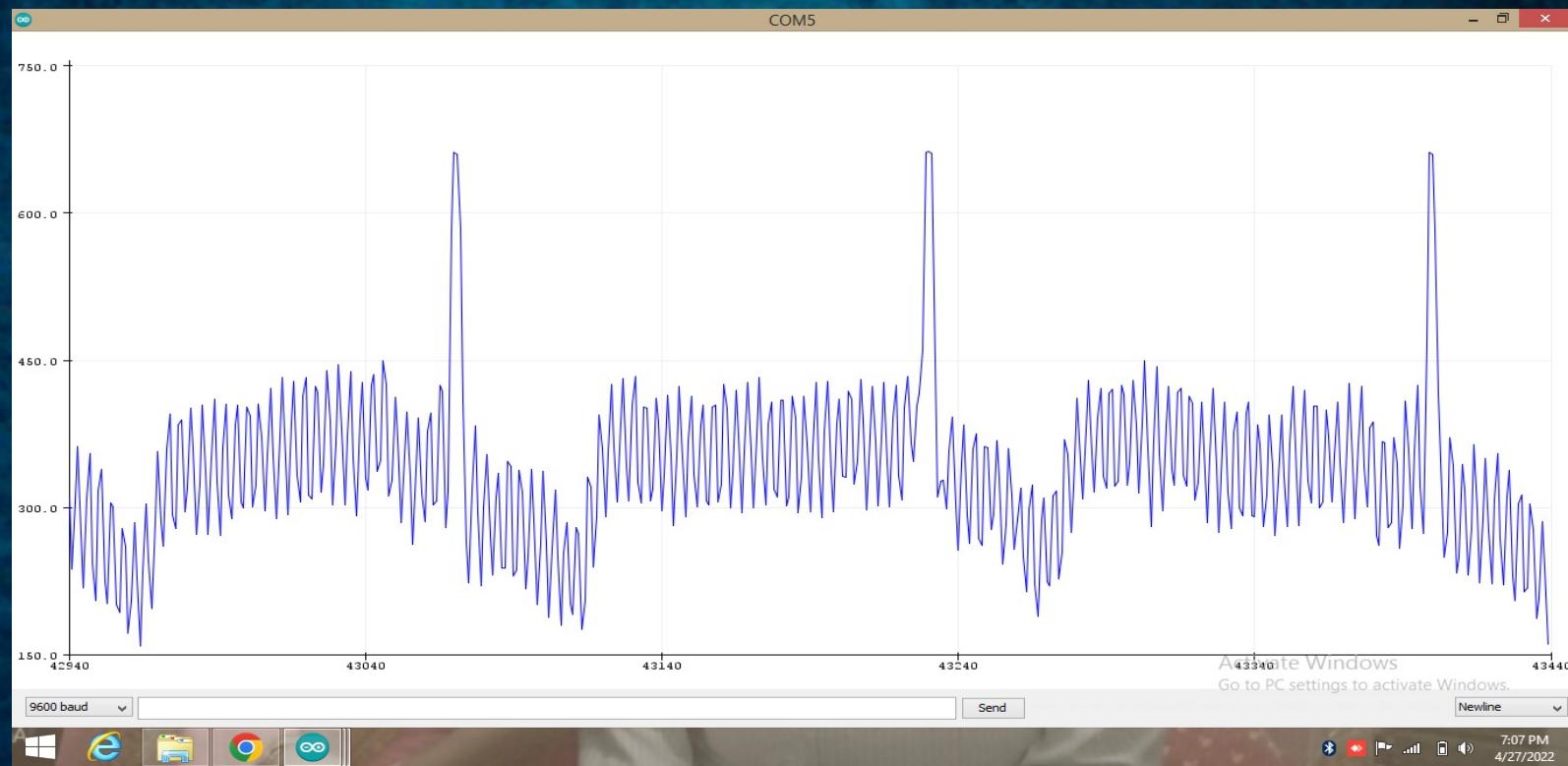


- Core of the circuit is an operational amplifier.
- Voltage divider with respect to ground is made and the values are 100k and 1.8k ohm.
- Node is connected to the computer and its with respect to ground.
- There are three electrodes :
  - One is connected to the **LEG** which is grounded.
  - Second electrode is placed in the **Chest 1** from which the signal is amplified.
  - Third electrode is placed in the **Chest 2** is replaced with the ground.
- It is powered with a 9V battery.
- Output is rich in 60Hz noise, but when sharply low-pass filtered to around 45Hz the ECG becomes very clear.

# CIRCUIT



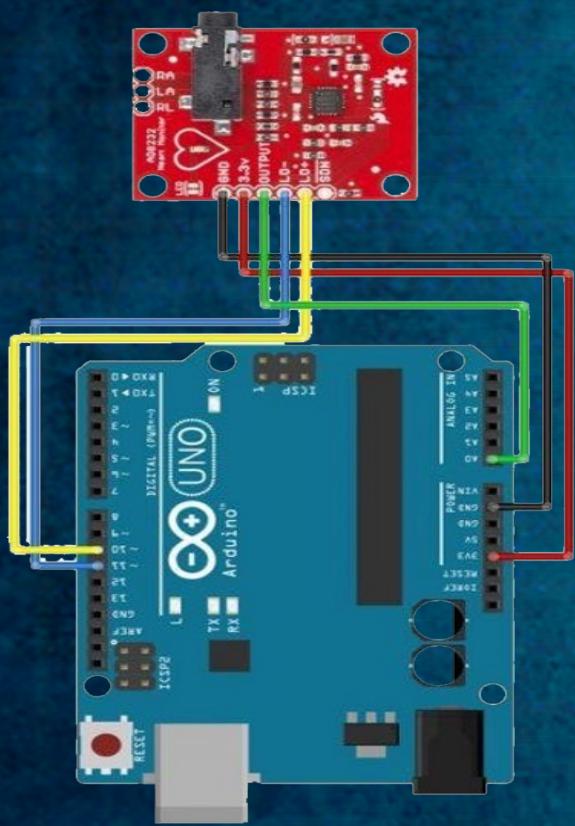
# OUTPUT GRAPH





**ECG USING  
ARDUINO  
&  
ECG SENSOR**

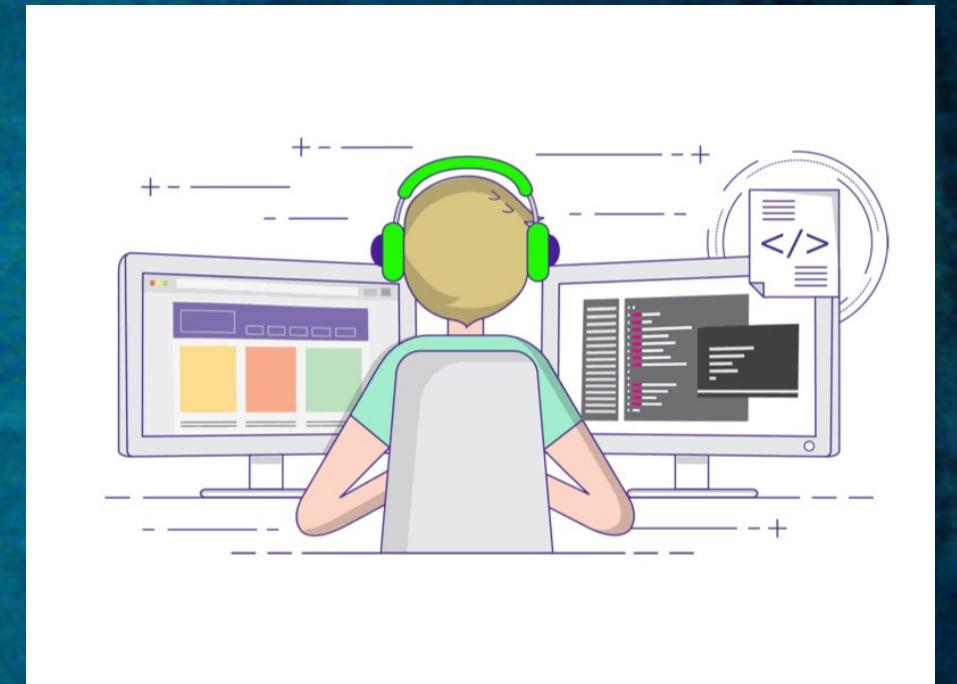
# CIRCUIT DIAGRAM



Board Label	Arduino Connection
GND (Ground)	GND
3.3V (Power supply)	3.3V
Output (Output signal)	A0
LO- (Leads-off Detect -)	11
LO+ (Leads-off Detect +)	10
SDN (Shutdown)	Not used

# Code

```
void setup() {  
  // initialize the serial communication:  
  Serial.begin(9600);  
  
  pinMode(10, INPUT); // Setup for leads off detection LO +  
  pinMode(11, INPUT); // Setup for leads off detection LO -  
}  
  
void loop() {  
  if((digitalRead(10) == 1) || (digitalRead(11) == 1)){  
    Serial.println('!');  
  }  
  else{  
    // send the value of analog input 0:  
    Serial.println(analogRead(A0));  
  }  
  //Wait for a bit to keep serial data from saturating  
  delay(1);  
}
```



**DRAWBACK  
&  
ITS  
SOLUTION**



Use of bread board should be eliminated to avoid noise. The holes in the bread board acts as a passage for electromagnetic radiation to interrupt the signal.

#### **Noise Can be Eliminated to some instant by**

- Improving the Construction technique.
- Improve the circuit as these are a lot of work that we could do with multiple operational amplitron that would improve the quality of a signal.

But our approach is to keep the circuit as simple as possible and get the ECG waveform on the output. Taking about the software section use took the signal from the ECG and connected it to the frequency domain with a function called **FFT**.

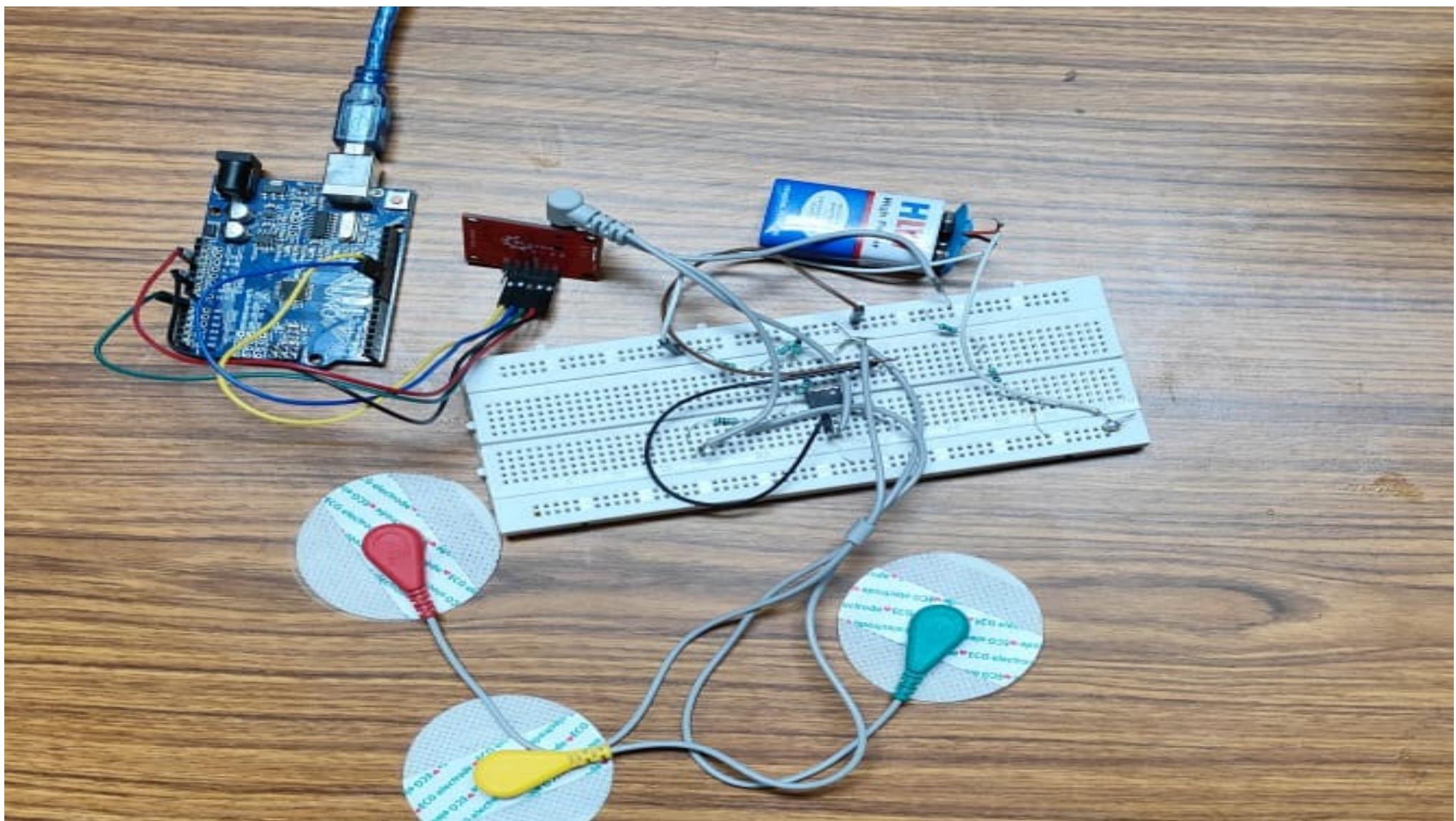
Then we eliminated the high frequency component and convert its back to the time domain and by doing so we could adjust a cut off frequency or a low pass frequency.

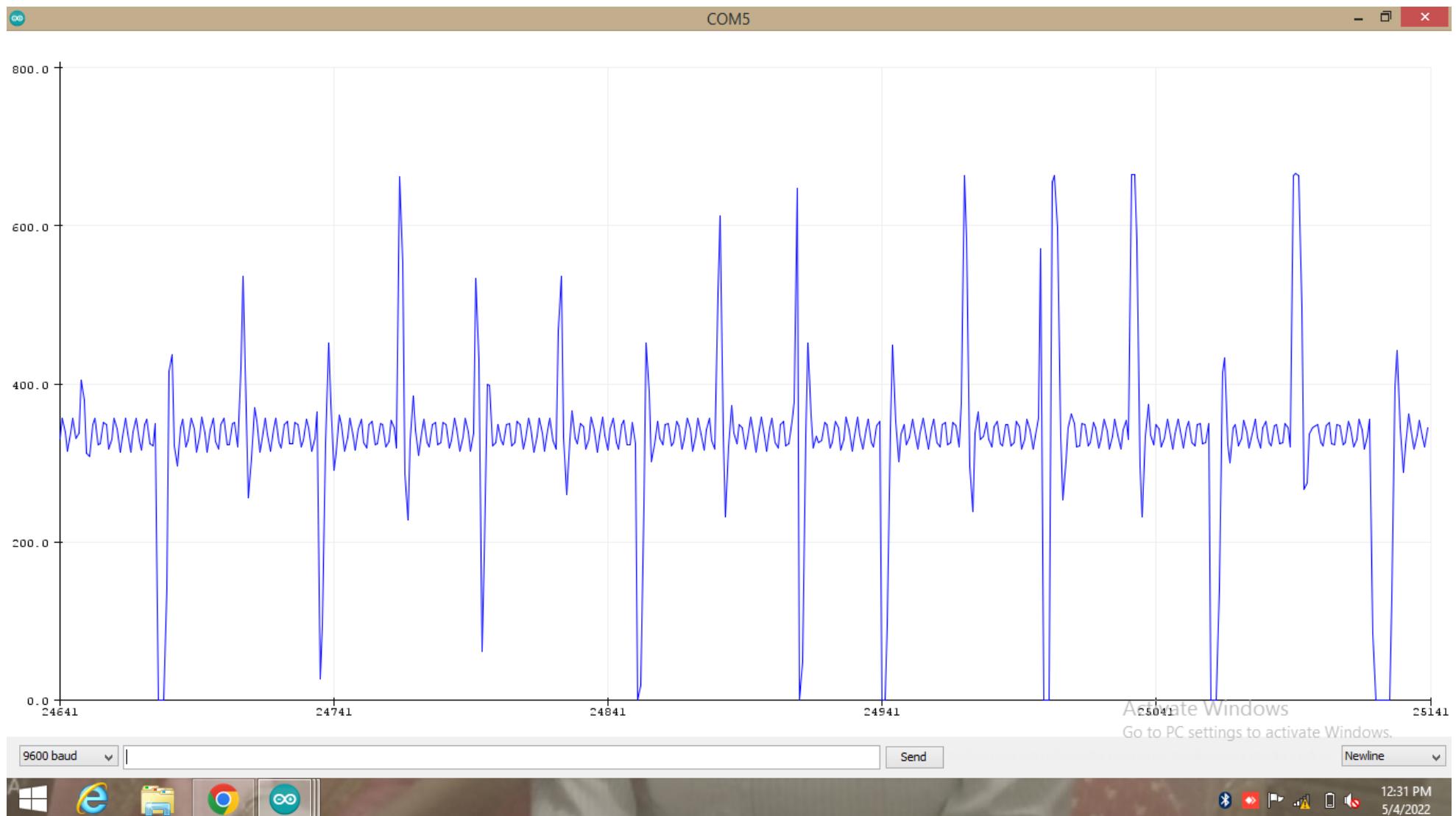
So, a signal with noise of (say 70Hz) can be low pass filtered to 45Hz and by that the 70Hz noise is getting eliminated and the ECG comes through.

# ECG

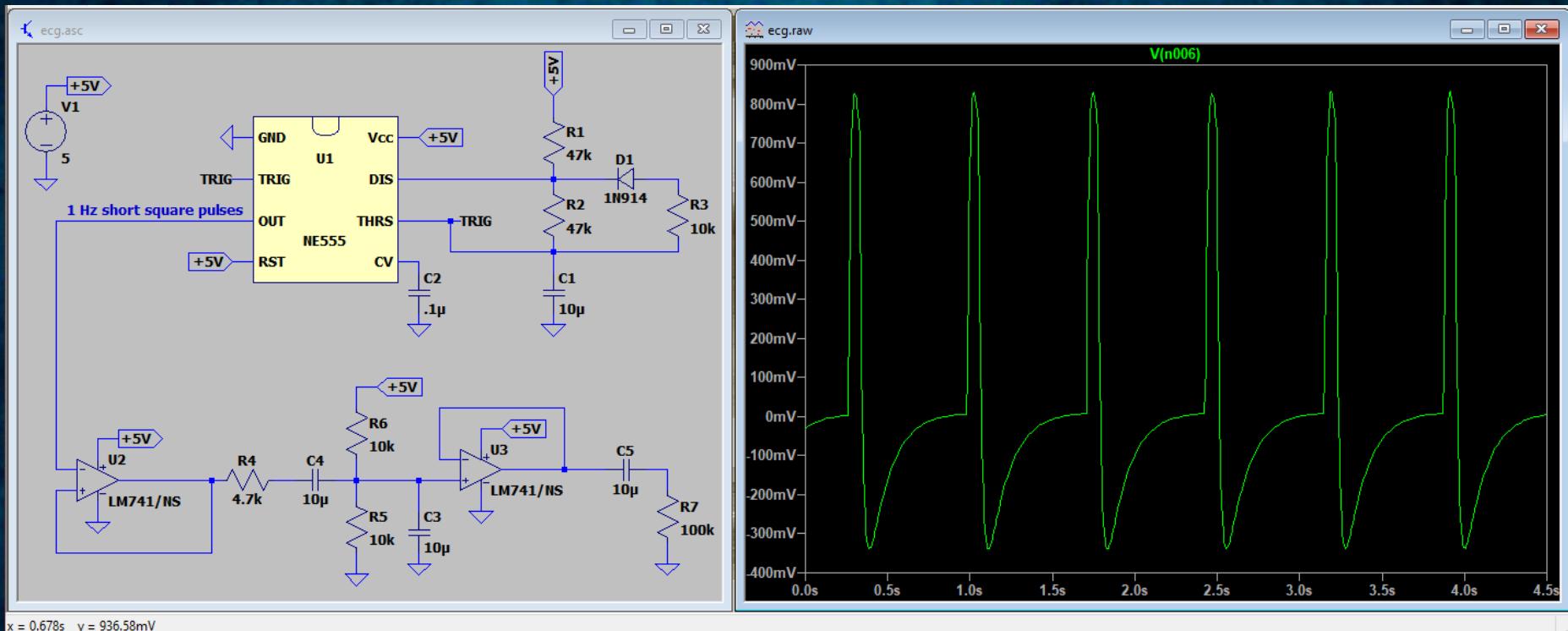
New and improved  
circuit +  
(Future research)







# CIRCUIT DIAGRAM and GRAPH





# CONCLUSION

## THE EXPECTED RESULTS ARE AS FOLLOWS

If the test is normal, it should show that your heart is beating at an even rate of 60 to 100 beats per minute. Many different heart conditions can show up on an ECG, including a fast, slow, or abnormal heart rhythm, a heart defect, coronary artery disease, heart valve disease, or an enlarged heart.



## INNOVATION

The innovation in this project is that we're linking biological device with electronics by using Arduino UNO and few other minimal components purely related to electronics. This project has contained three completely different and basic to advanced versions of ECG has been presented.

# Research Papers for Reference

- Recognizing Real Time ECG Anomalies Using Arduino, AD8232 and Java
- ECG measurement system based on ARDUINO and android devices
- To be implemented
- A wireless patient monitoring system using integrated ecg module, pulse oximeter, blood pressure and temperature sensor

**THANK  
YOU**