Image source: blog.pinmicro.com

REMOTE HEALTH CARE USING INTERNET OF THINGS

PRESENTATION OVERVIEW

OUTLINE OF TOPICS

- Objective
- Problems
- Literature Review
- Proposed Solution
- Tools and Technologies used
- Hardware Implementation
- Results
- Analysis
- Further Work
- Conclusion

OBJECTIVE

To create a system where the patient can send their health related data (here, ECG data is used) from sensor to a doctor for checkup over the internet for remote health care.

PROBLEMS

Doctor to population ratio in rural areas of Nepal = 1:150000

Difficult for disabled and elderly people to visit hospital regularly.

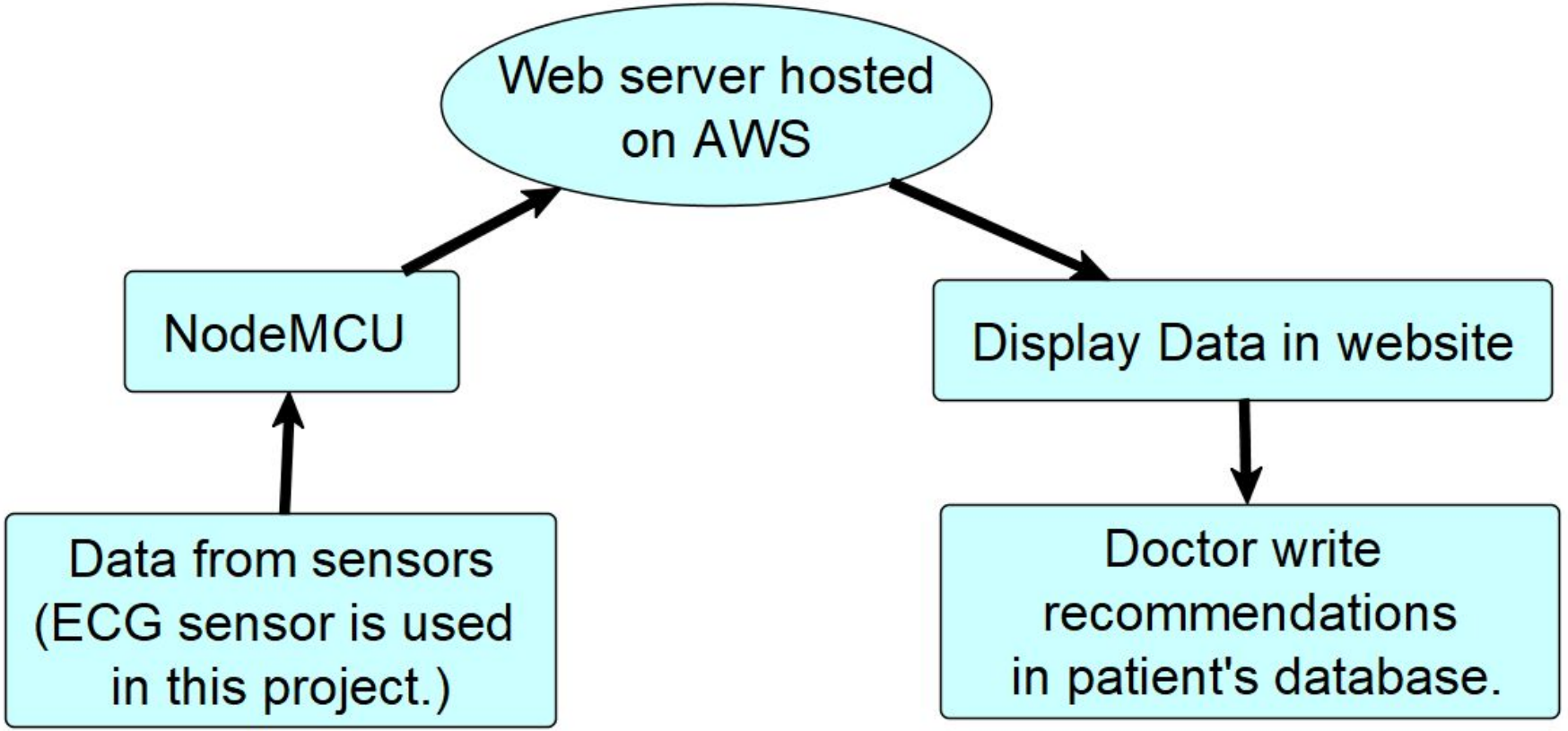
People do not have spare time to visit hospital for their regular health check-up.

Carrying all the previous medical records for health check-up is tedious for a person.

LITERATURE REVIEW

- Pilot program was launched in Gulmi District of Nepal where health workers were provided with a free phone number to call three General Practitioner Doctors in the District Hospital.
- In some district hospitals of Nepal, an Internet connection, computer and camera is provided so that they can request a hospital in Kathmandu for consultations on medical problems.

PROPOSED SOLUTION



TOOLS AND TECHNOLOGIES USED

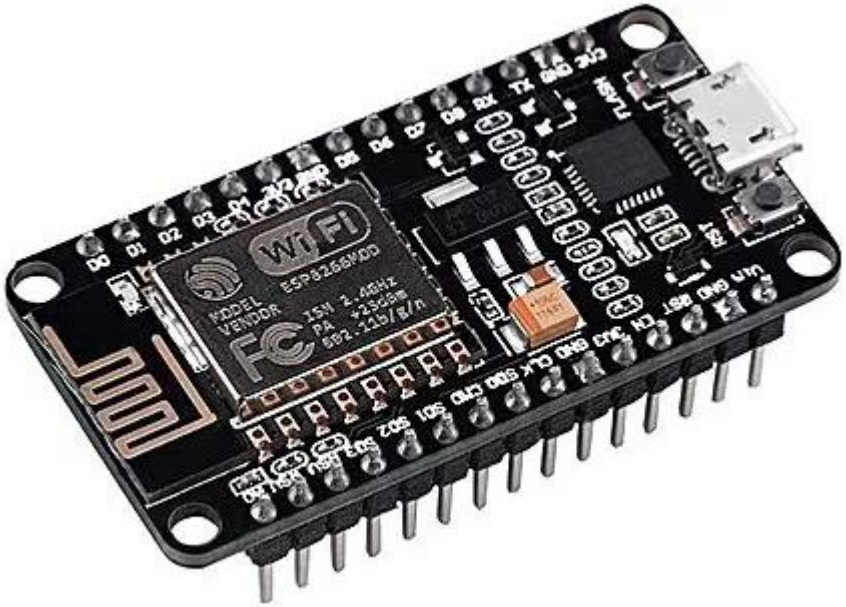


Image source: www.amazon.in

NodeMCU

- Microcontroller with built-in wifi-module.
- Programming can be done in Arduino IDE.
- It is used to send ECG data to web server in this project.

TOOLS AND TECHNOLOGIES USED

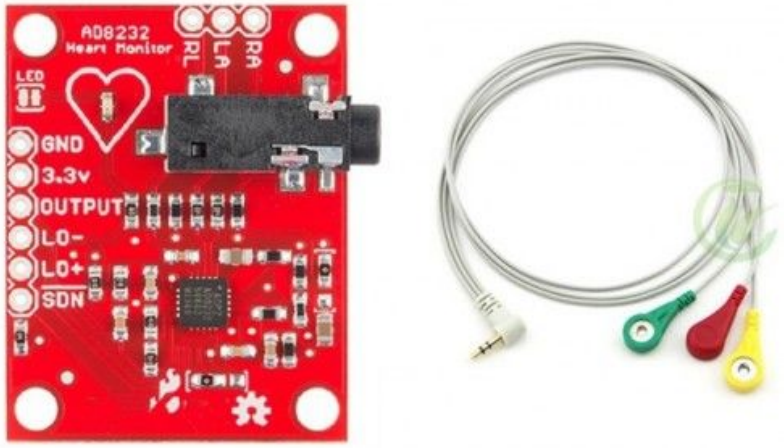


Image source: www.embededstudio.com

ECG sensor (AD8232)

- It measures electrical activity of the heart.
- Data obtained from it can be used to plot ECG graph.
- Patient’s data obtained from this sensor is sent to NodeMCU.

TOOLS AND TECHNOLOGIES USED

SOFTWARE

Django
- ❏ Python based web framework
- ❏ Used for backend development

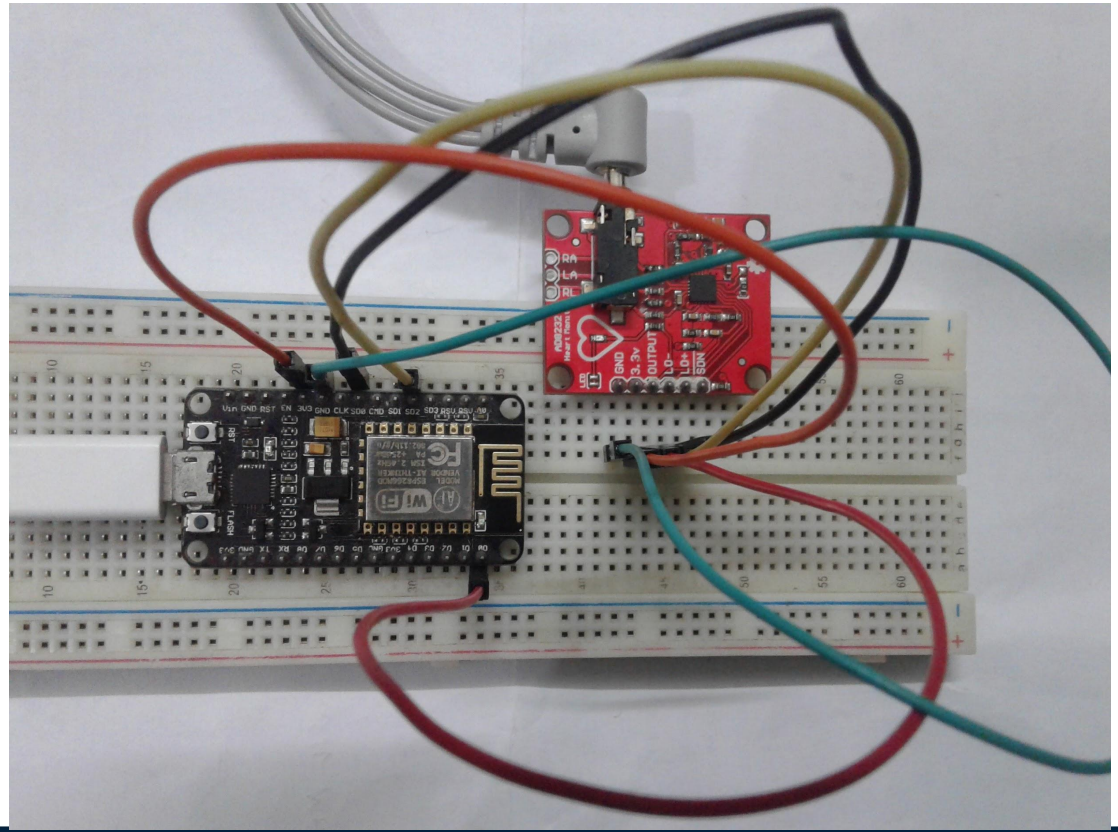
HTML, CSS, Javascript and Bootstrap
- ❏ Used for frontend development

MySQL
- ❏ Used for database management

Amazon Web Services (AWS)
- ❏ Used for hosting website

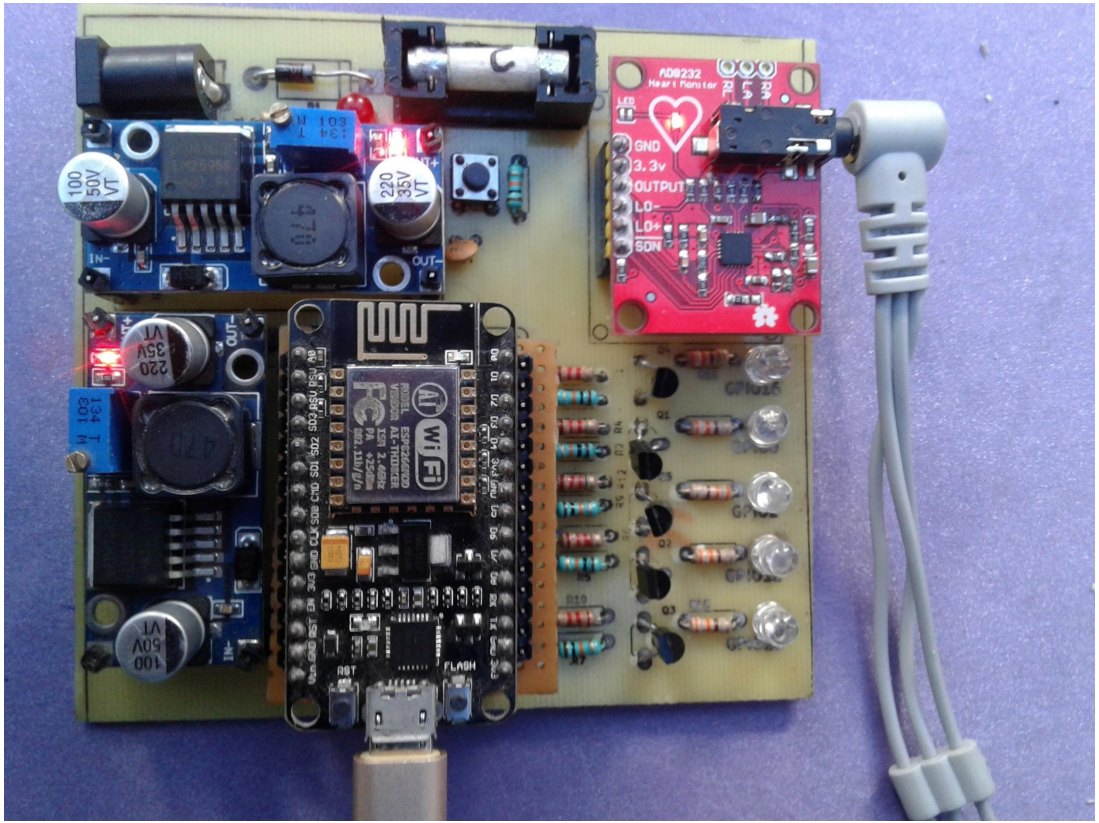
Arduino IDE
- ❏ Used for programming NodeMCU

HARDWARE IMPLEMENTATION



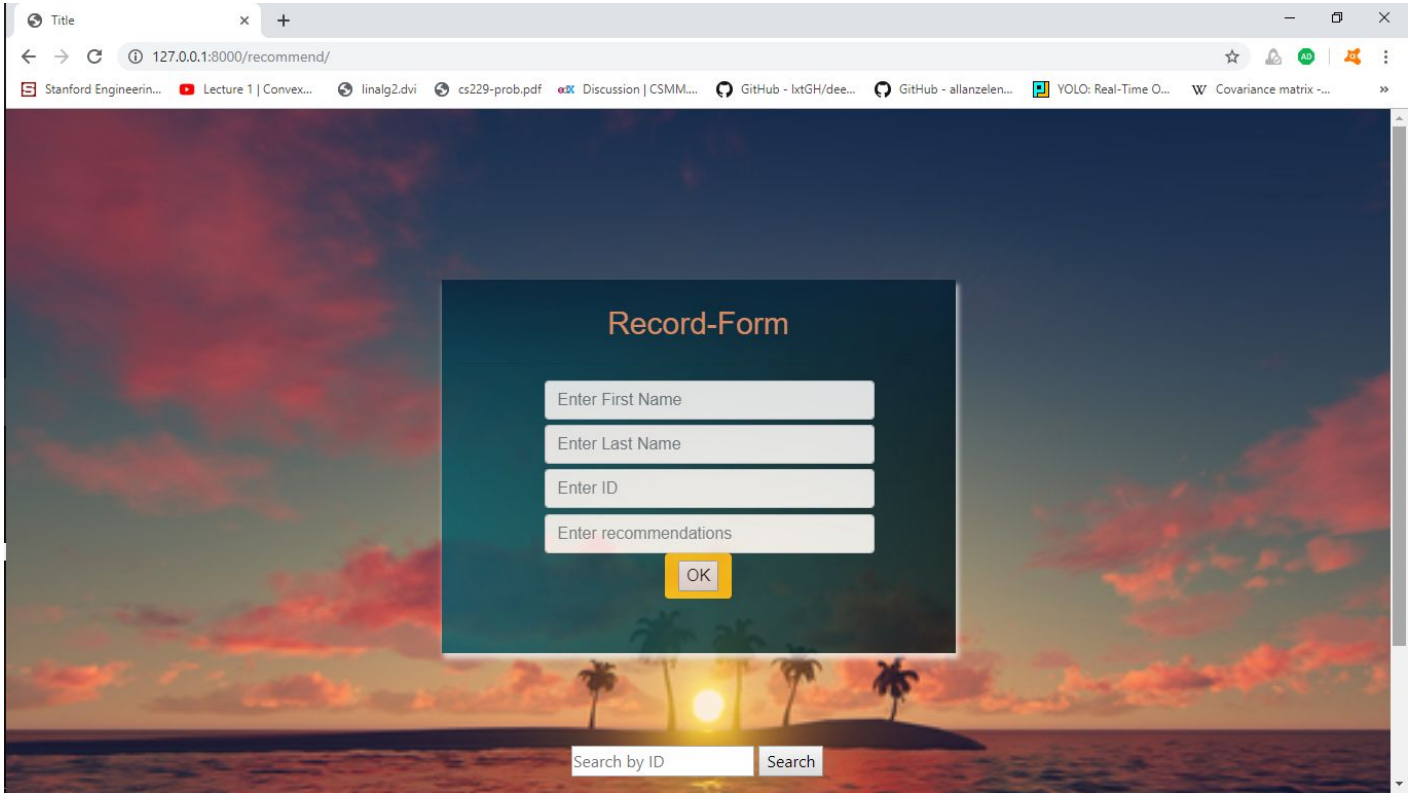
Prototyping circuit for ECG sensor on a breadboard.

RESULTS



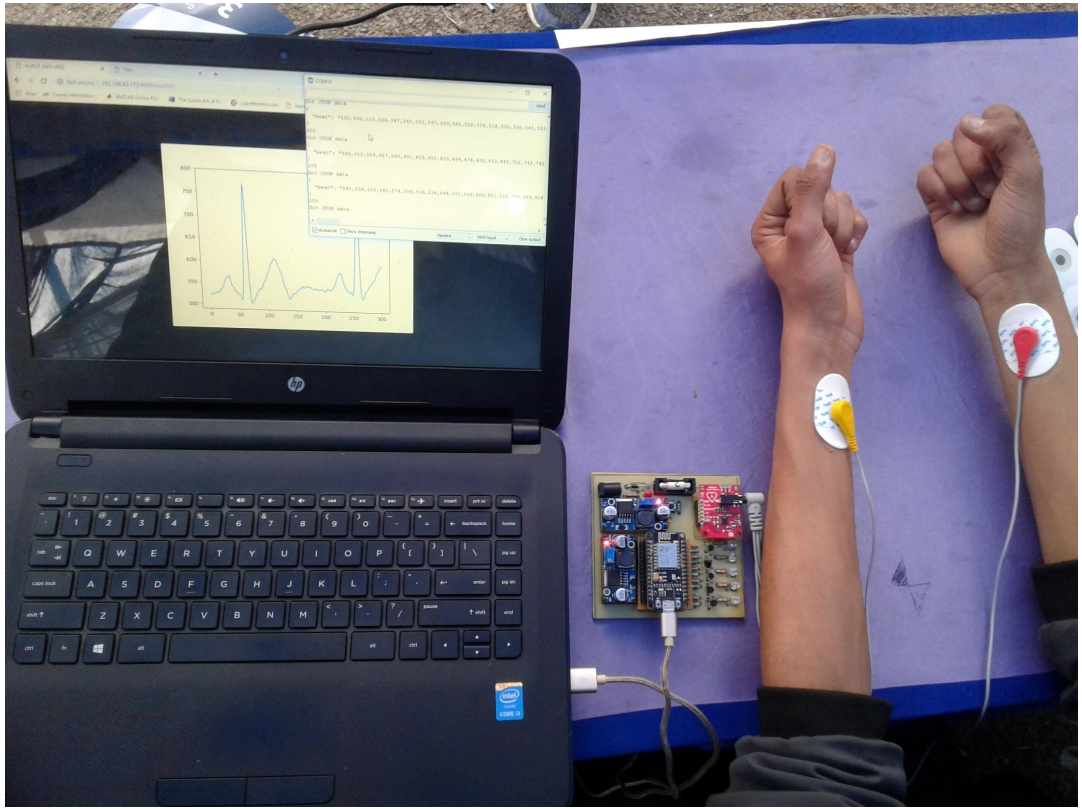
Assemble all the components on a PCB for final product.

RESULTS



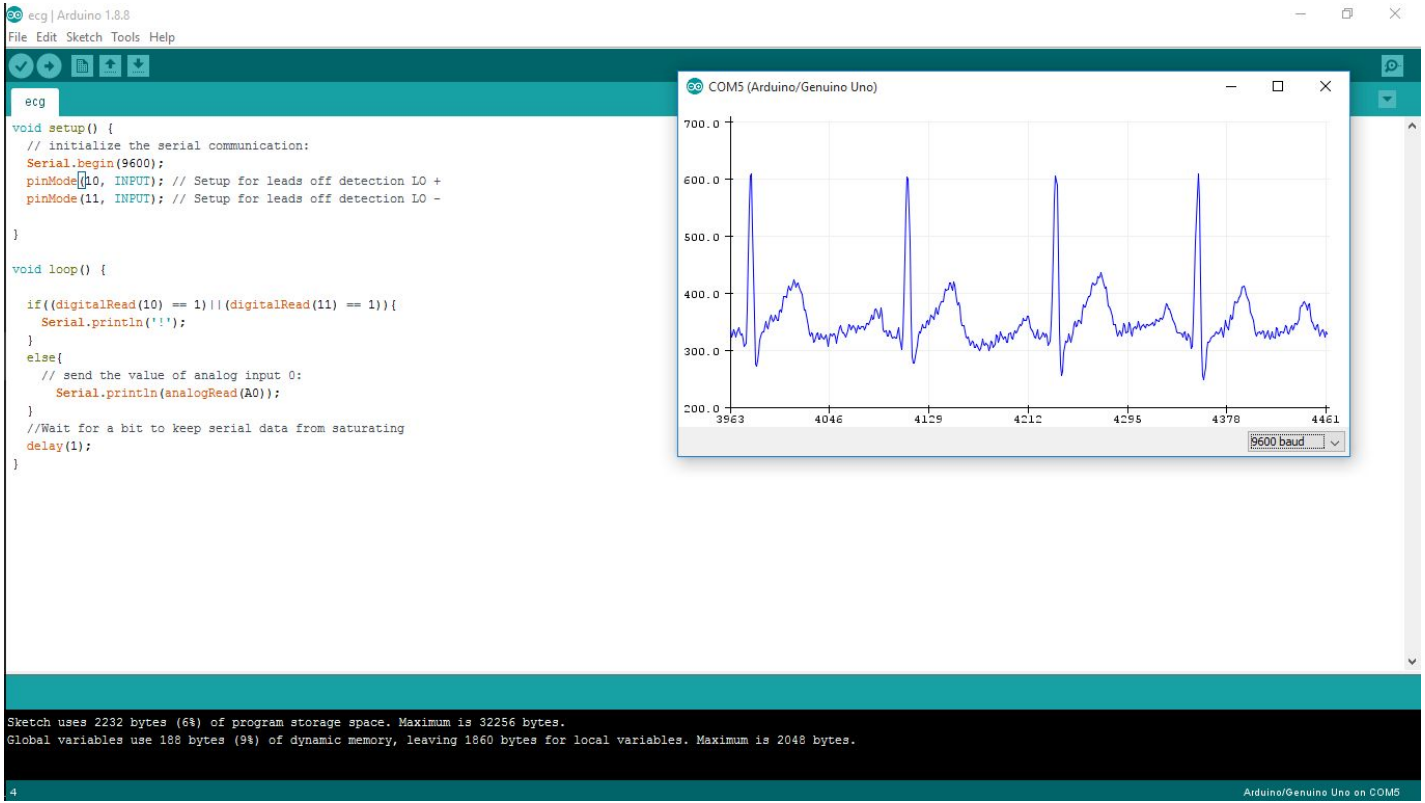
Website to provide recommend-ations to the patient by the doctor.

RESULTS



Demonstration of the project in a national technological festival.

ANALYSIS

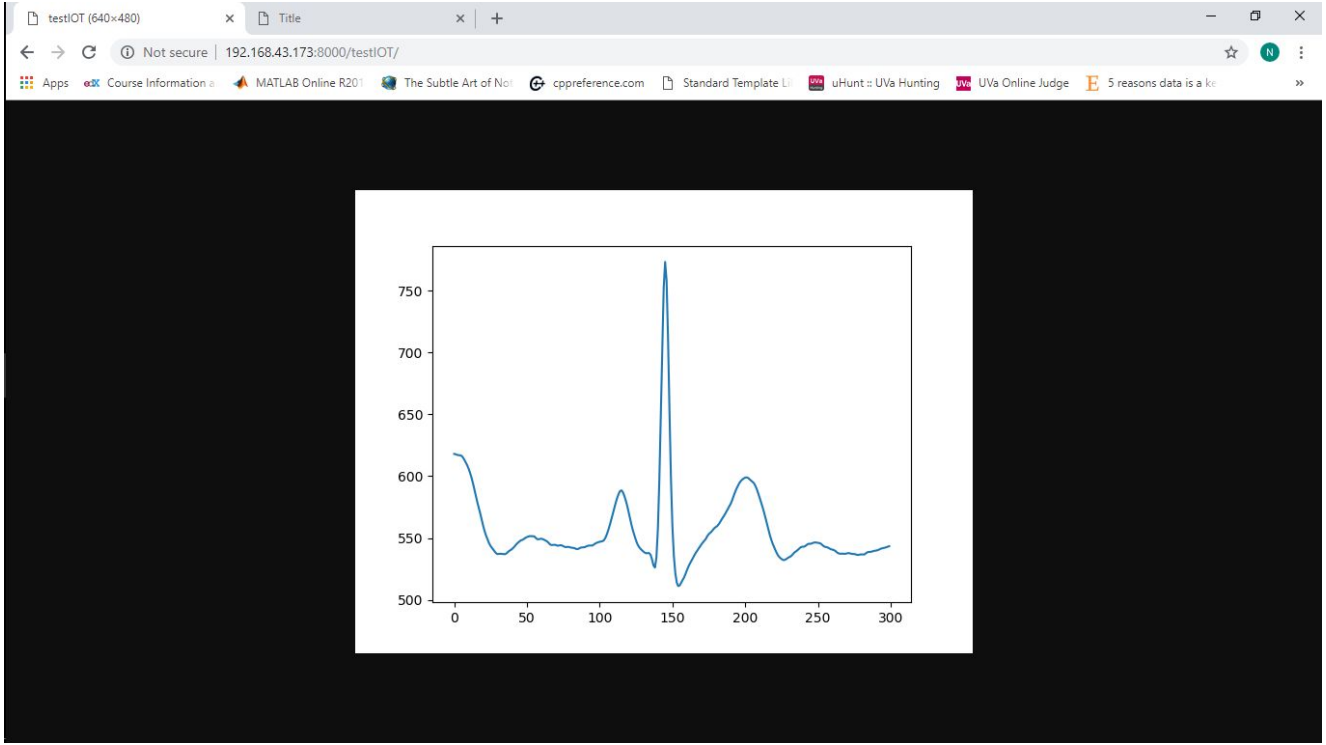


Output of ECG sensor on Arduino IDE.

ANALYSIS

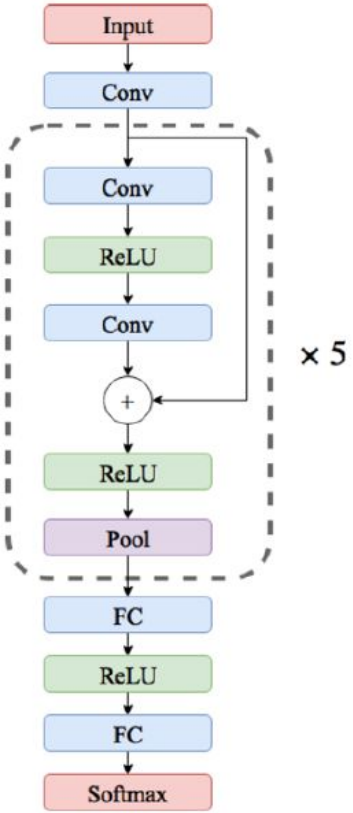
ECG graph displayed on a webpage from the data received from NodeMCU.

ANALYSIS



- ECG graph after using exponential smoothing in the data.
- Parameters of exponential smoothing were tuned manually.

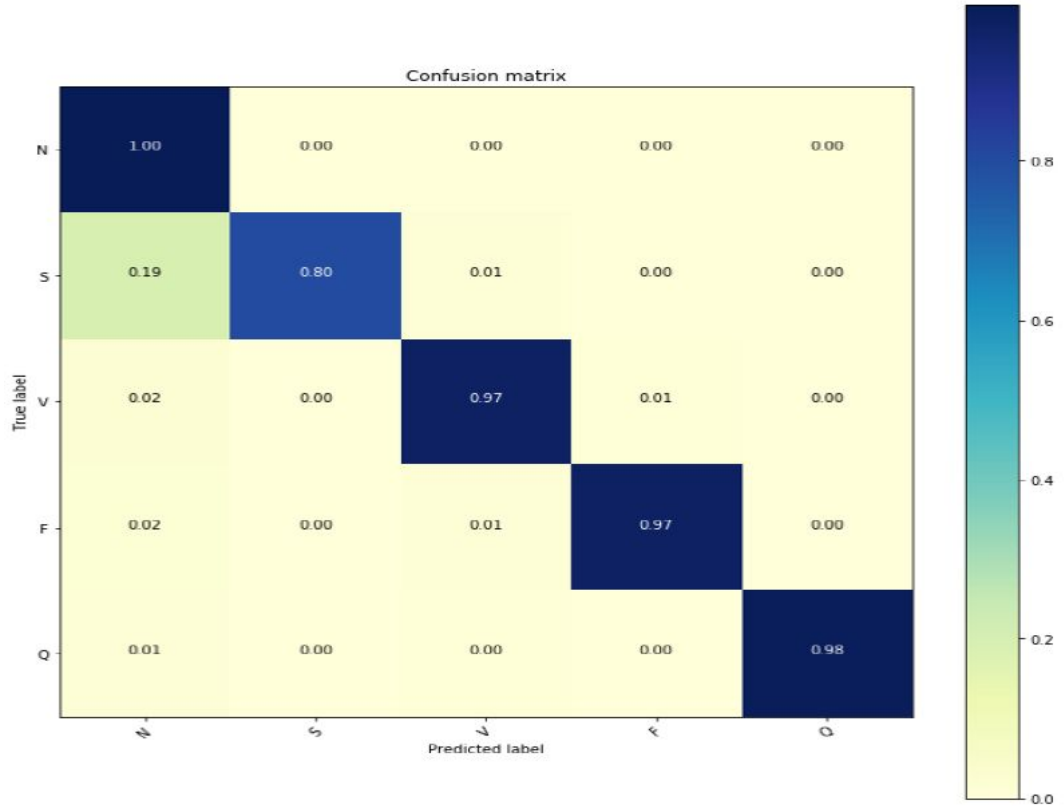
FURTHER WORK



- Later, we tried to use a deep convolutional neural network to classify heartbeats obtained from ECG sensor data.
- The model architecture was taken from a research paper and trained on our dataset.
- It was able to classify five different classes of arrhythmias (irregular heartbeat).

Reference: M. Kachuee, S. Fazeli and M. Sarrafzadeh "ECG Heartbeat Classification: A Deep Transferable Representation," University of California, Los Angeles, 2018.

FURTHER WORK



Confusion matrix showing the classification result of above convolutional neural network in our dataset.

CONCLUSION

We were successful in building a system that can transfer ECG data coming from sensor over the internet for remote health care. Later, we also trained a convolutional neural network to classify five different classes of arrhythmia.

THANK YOU