# Remote Healthcare System based on IoT for monitoring and Computer-aided diagnosis of Heart Diseases

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Introduction

- Cardiovascular Diseases (CVD) are the leading causes of death globally
- The electrocardiogram (ECG) is the most used exam to diagnose them
- People with CVD report fear of presenting to a Hospital because of COVID-19
- Remote monitoring emerges as an efficient tool of patient's triages and diagnoses
- People with mobility disabilities and living in remote locations can be benefited
- Machine Learning (ML) Techniques can identify CVDs based on ECG images
- Computer-aided diagnosis help the doctors and improves the quality of results
- Generation of digital reports with high traceability
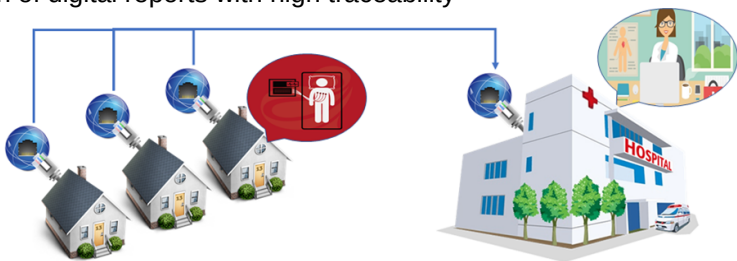
Objectives

- Project and construct a PCB for acquisition of ECG signals (Front-end)
- Codify a firmware for an embedded system that process these signals
- Create a graphical user interface (GUI) for ECG waveform local viewing and backup
- Design a Machine Learning (ML) technioque for identification of events related to CVDs
- Send the signals for a Cloud server for later medical diagnosis
- Develop a cloud server to support multiple ECG devices connectivity
- Provide webservices in cloud server for processing, filtering and storing ECG data
- Develop Progressive Web Apps (PWA) to allow ECG visualization and medical reports
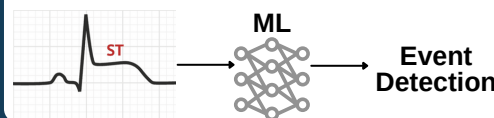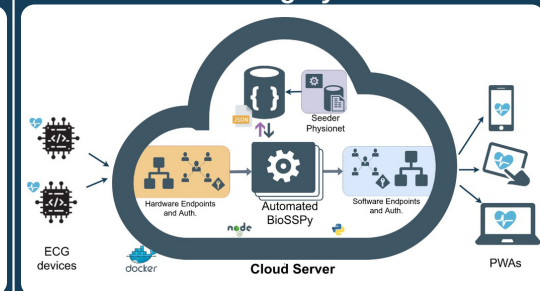
Proposed System
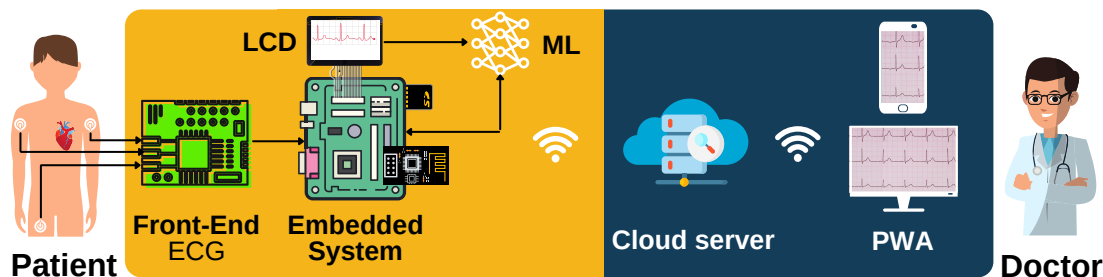
Methods

Computer-Aided Diagnosis

- Acute Myocardial Infarction (e.g.)
- Affects the normal ECG morphology
- Generates a ST-segment elevation
- ML detects the event based on ECG
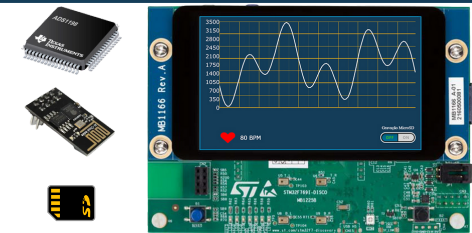- Send this information with ECG data

IoT based Monitoring System

Hardware Resources

- 12-lead ECG based on ADS1198
- Discovery kit with STM32F769NI MCU
  - MCU ARM®Cortex®-M7 core
  - Three 12-bit ADCs
  - ESP-8266 daughterboard connector
  - Connector for MicroSD card (backup)
  - 4" capacitive touch LCD display

Software and Firmware Resources

Software	Firmware
- Cloud Server running in PaaS - PWA prototype - PWA source code - Cloud server source code	- MCU source code - Neural Network - GUI design - Transmission of ECG signals

Ongoing and Future work

- Fabric the PCB of analog front-end
- Implement the GUI in embedded system
- Explore alternative PaaS for the Cloud Server
- Develop PWA interface to medical professionals
- Develop ECG exams management
- Include AI to detect events in Cloud Server
- Support for other biosignals data
- Protect cloud server from Security issues