# Cardiac Rhythm Monitoring with ChatGPT Integration

**Jovan Đurković**
MECOnet d.o.o.
Podgorica, Montenegro
jovan@meconet.me

**Mihailo Vukmirović**
Clinical Centar of Montenegro
Podgorica, Montenegro
mihailov@ucg.ac.me

**Andrej Skraba**
*University of Maribor*
Kranj, Slovenia
andrej.skraba@um.si

**Radovan Stojanović**
*Faculty of Electrical Engineering & MECOnet*
*University of Montenegro*
Podgorica, Montenegro
stox@ucg.ac.me

**Blagoje Babić**
Clinical Centar of Montenegro
Podgorica, Montenegro
blagoje.b@ucg.ac.me

**Vesna Miranović**
*Faculty of Medicine*
*University of Montenegro*
Podgorica, Montenegro
vesnami@ucg.ac.me

# Content

- Problem definition
- State of the art
- Methodology/Solution
- Results
- Conclusion

# Problem definition

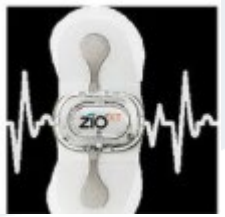
- **Proof of Concept for using existing AI systems for diagnosis in heart rhythm disorders?**
- Can we use it?
- If we can, how to do it in the most efficient way by applying embedded and IoT technologies?
- What are the advantages/disadvanteges of such a system?

# State of the art

- Cardiovascular diseases (CVDs) remain the leading global cause of death.
- Electrocardiography (ECG), remain most common used non-invasive to assess cardiac functions in term of rhythm based disorders as arrhythmia, bradycardia, tachycardia, pre-infraction and pre-strokes states.
- Cardio wearables are transforming personal and preventive heart health care, and the trend is accelerating fast. There are plenthy of such devices and holters, loop recorders, hand held monitors and watches are commonly used.





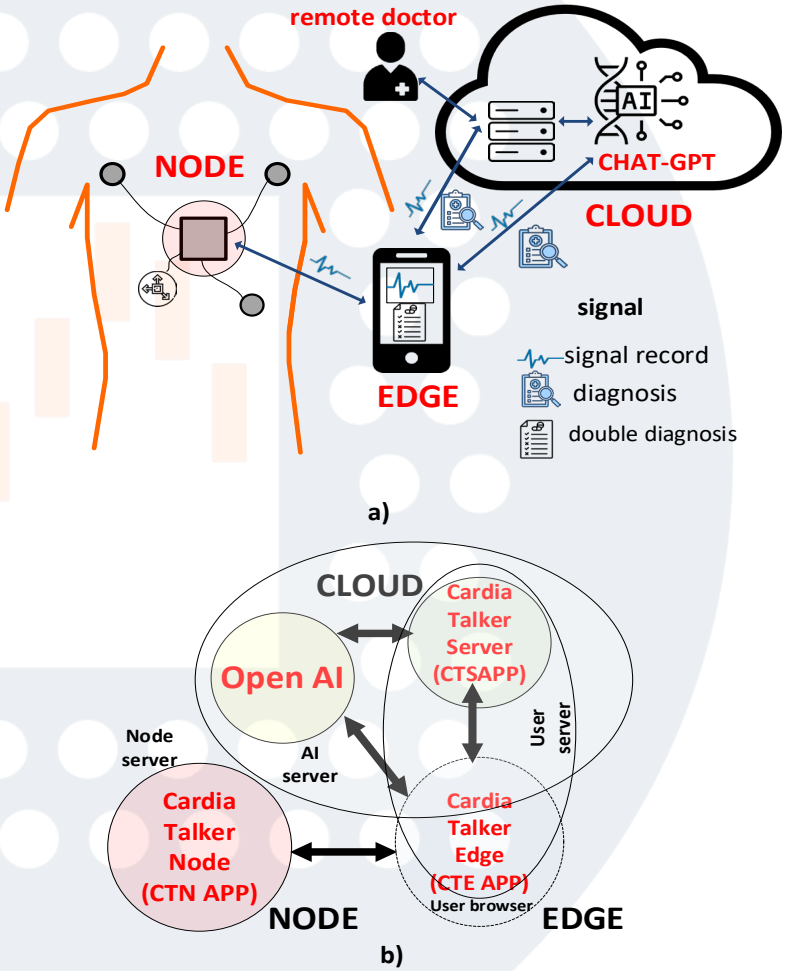
https://www.ccjm.org/content/86/7/483

# State of the art

- AI become applied in such systems from the begining
  - on spot and
  - PC based levels

# Methodology

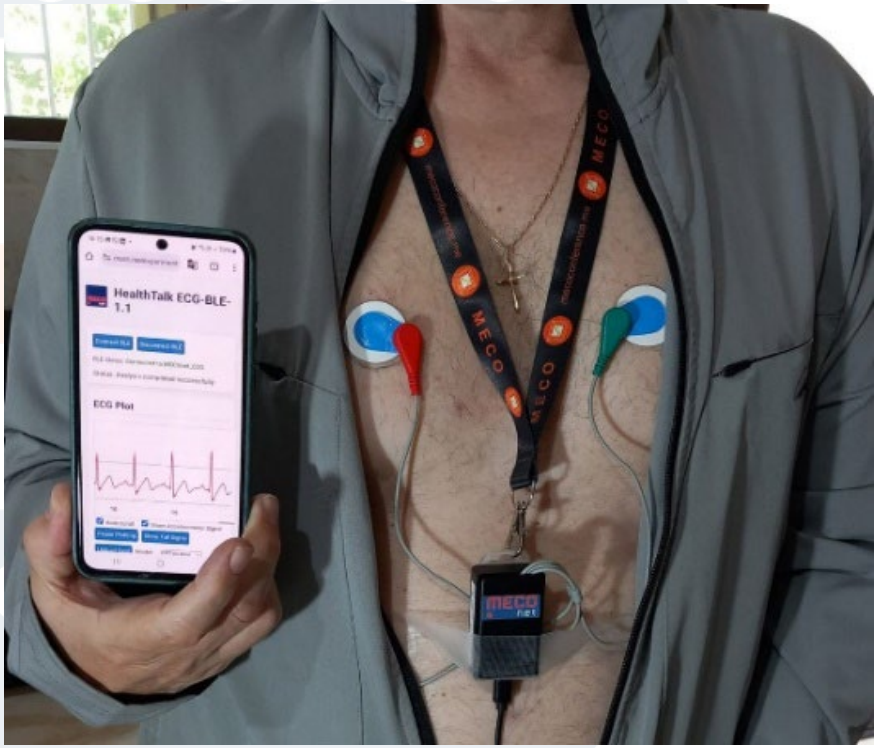
- Feasible AI supported system for cardia disorders monitoring
- With current state of the art in IoT and AI can be easy implemented.
- MECOnet developed CardiaTalker concept




The system architecture of CardiaTalker, a) overall system components, b) application layer architecture.

# Methodology

- CardiaTalker is attached to the patient's body, records the ECG signal and communicates with the mobile phone application and further to the cloud.
- Provide double diagnosis from ChatGPT and remote doctor.
- Has hardware and 3 layers software, firmware, Edge, Cloud



# Results

| Parameter | Specification / Result |
|---|---|
| Microcontroller Unit (MCU) | ESP32 (dual-core, Wi-Fi + BLE, low-power operation) |
| ECG Module | AD8232 (analog front-end for biopotential measurement) |
| Accelerometer (ACC) | Integrated DXL335 3-axis accelerometer |
| Power Source | 5000 mAh Li-ion power bank |
| Battery Life | >60 hours of continuous operation |
| ADC Resolution / Sampling Rate | 12-bit resolution, 200 Hz sampling frequency |
| Average Power Consumption | ~75 mA |
| Edge Communication Protocol | BLE (Bluetooth Low Energy) |
| Cloud Communication Protocol | Wi-Fi (HTTP POST to REST API) |
| Edge Communication Range | ~10 meters indoor with >98% packet reception rate |
| Cloud Upload Time (30s ECG) | ~2 seconds from CET App to CST App |
| OpenAI Response Time (60s ECG, gpt-4o-mini model) | ~40 seconds (includes upload, processing, and return) |
| OpenAI Response Time (60s ECG, gpt-4-turbo) | ~19 seconds (includes upload, processing, and return) |

# Results

## *AI Interpretation Quality*

- ChatGPT consistently provided coherent interpretations for well-formatted ECG prompts, identifying conditions like “normal rhythm” or “possible irregularity”
- Still it is not reliable in determining amplitude and time characteristics of typical segments of ECG signal as P-amp[mV], PR-dur[s], R-amp[mV], QT-dur[s], Q-amp[mV], ST-dur[s], T-amp[mV], QRS-dur[mV], S-amp[mV], RR-dur-av[s]. It does not even dare to determine the HR from the data available, for known selection frequency.
- Evaluations with ST segment elevation should be taken with a reserve, because it still does not have a mathematical model for the global evaluation of the ECG signal, not to mention the evaluation in the vicinity of the point.
- Assessment of arrhythmias can be done at the level of assessment of rhythm regularity, without going into the type of arrhythmias. In some testing it can not detect tachycardia between 120-150 bps as well as brachicardia of 30 bps. Irregular rhythm on basis of ectopic beat can be detected.
- Although slower gpt-4o-mini shown better accuracy than gpt-4-turbo.
- It is very important to well define input ECG record, recommended time and mVs stamps as well as better description of the input parameters.

# Conclusions

- This study presented a modular, cost-effective ECG monitoring pipeline that bridges wearable IoT devices and conversational AI to provide accessible cardiac health insights.
- By leveraging an ESP32-based sensor node and integrating with ChatGPT via a node–edge–cloud architecture, the system enables real-time ECG acquisition, wireless transmission, and AI-assisted interpretation suitable for both personal and remote healthcare settings.
- Experimental results confirmed stable signal acquisition, robust wireless performance, and user-friendly interaction through a mobile interface. ChatGPT provided understandable interpretations in most cases, making cardiac insights more accessible to non-experts.
- However, its limitations in analyzing precise ECG segment metrics and diagnosing complex conditions underscore the need for careful prompt design, improved signal preprocessing, and possibly hybrid AI models.
- Device, called CardiaTalker serves as a proof-of-concept that wearable AI-integrated systems can democratize heart health monitoring.

# Demo links

- Demo, Link for CT ChatGPT

# ACKNOWLEDGMENT

This Project is supported by
**Innovation Fund of Montenegro**
**under Grant POC-028-24**
for whose support the authors are very grateful.

# Thank you, Q&A?