MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of Higher Education
"South Ural State University (National Research University)"
School of Electrical Engineering and Computer Science
Department of Electronic Computing Machines

Ensuring the interaction of medical cyber-physical devices in IOT for remote areas and in emergency situations

For the master graduate qualification work of
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Introduction

This project involves the creation of an:

❖ The system of health assistance to the injured person in case of emergency for remote areas, based on the Internet of things.

❖ This system is characterized by saving time and effort for medical staff By receiving the patient's vital data from remote area in case of disasters, The system also works on low power.

Relevance

Development   a portable small medical device to use in case of emergency in remote areas where communication services are interrupted, it uses for purpose to rescue people's injured, the device consists of two parts:

1- sender device It contents medical sensors connected to the injured body that measure its temperature, electrical activity of the Heart Rate, blood oxygen saturation ,screen to display results Where it transmits medical Parameters wirelessly By Lora technology To receiver device on the emergency center or hospital .

2- receiver device

It contains a screen for displaying results it receives from sender device and same time sending data to cloud by Wi-Fi

Tasks necessary to achieve the goal

❖ Analyzing the market for existing device.

❖ Definition detail the set of requirements for the device;

❖ Design the system;

❖ Development Architecture and implementation

❖ Testing

Analyzing the market for existing device

Blue Spark Technologies

VitalConnect Sensor
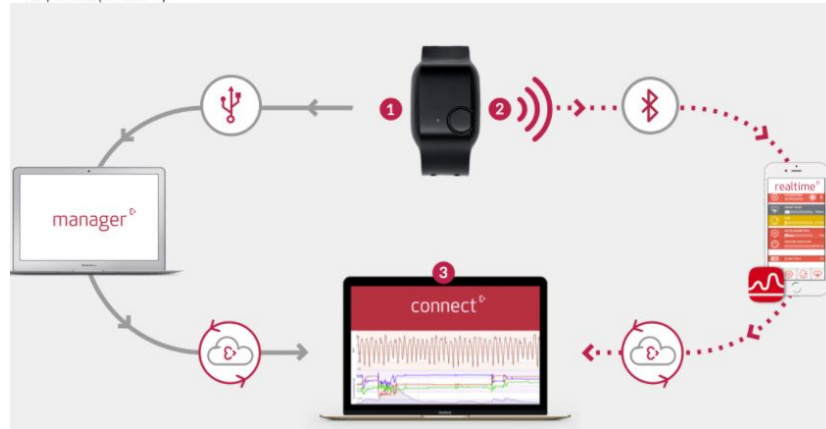
Empatica E4

Overview of analogues

Feature	Blue Spark	Empatica E4	VitalConnect
Transmits Data	Bluetooth	Bluetooth	Bluetooth
Connect to cloud service	Yes	Yes	yes
Battery life	72 H	24 H	168 H
Sensor	Temperature	Temperature, PPG, accelerometer, EDA	Temperature , heart rate, ECG, Respiratory Rate Body Posture, Fall Detection, Activity, Blood Pressure, Oxygen Saturation
Memory	No	Yes, recorded 48 H	Yes , recorded 10 H
wearable	patch it on the skin	wristband	patch it on the skin

Definition detail the set of requirements for the device

- **Functional requirements of the Device**

- ❖ Measurement of health parameters of the body and analysis display .
- ❖ Send health parameters to the long distance and with the low power.
- ❖ display health parameters received and send to publish on IOT platform.

Design the system architecture

- **The structure of the hardware part of the Device**
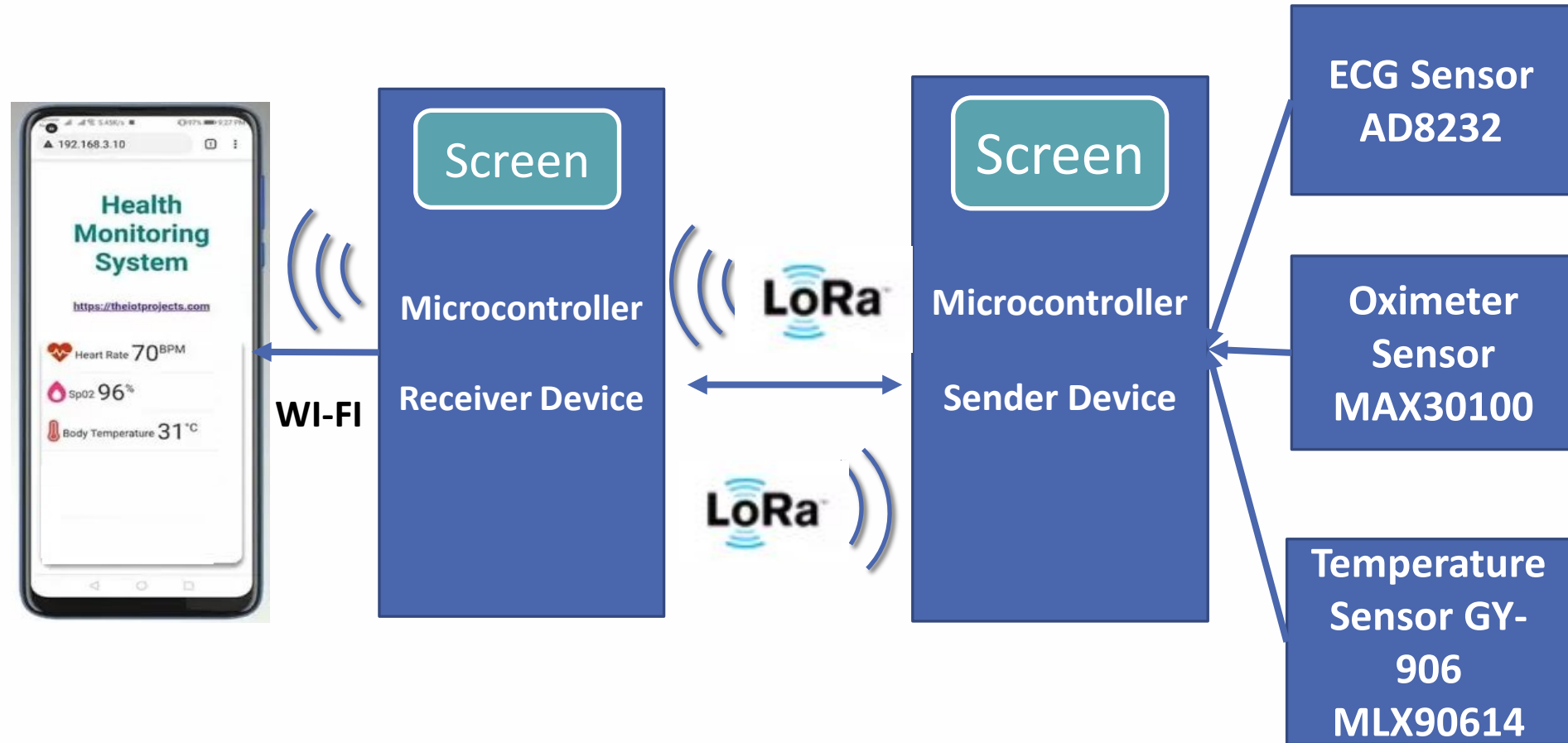
Sender Device

Structure of Block diagram
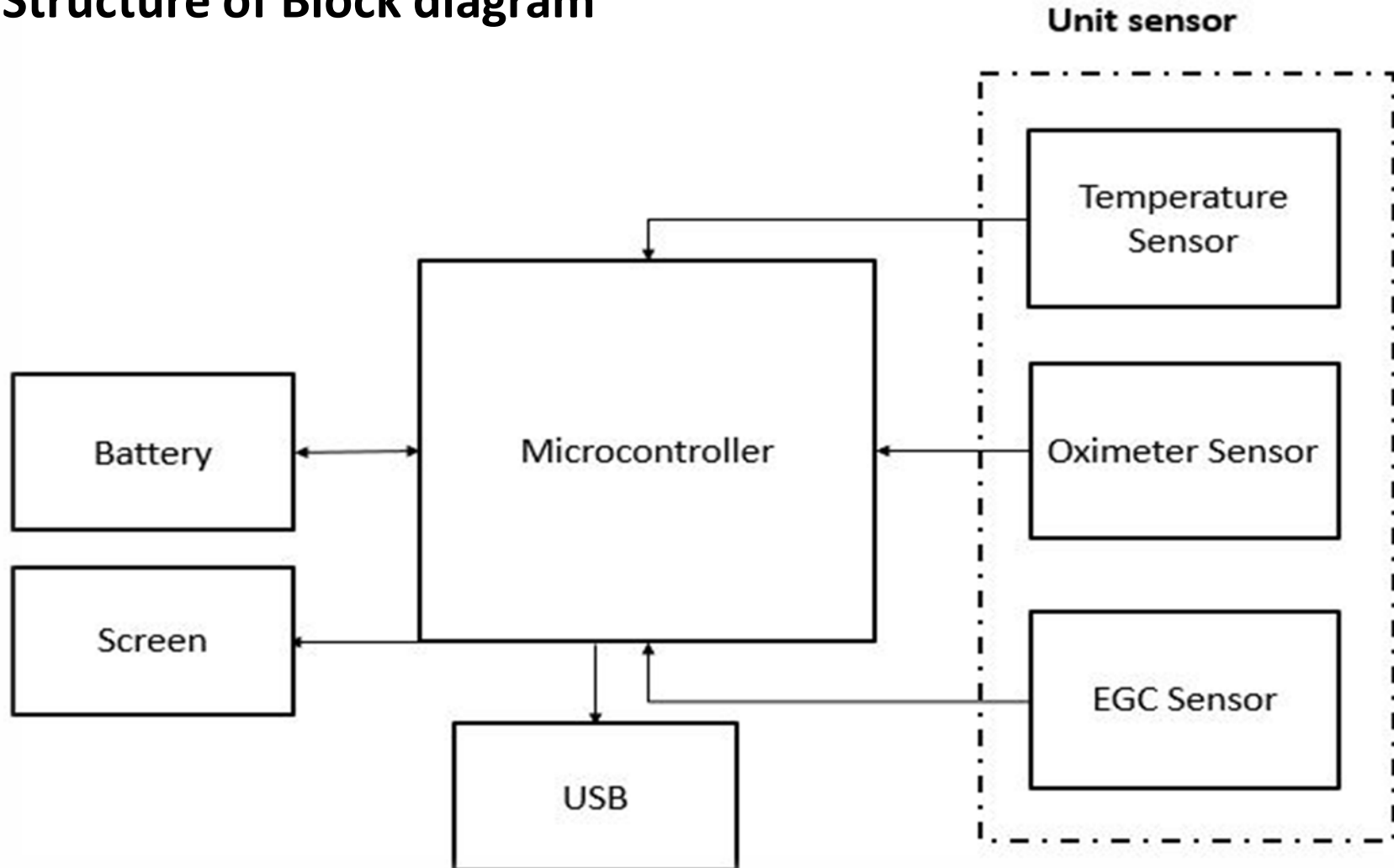
Receiver Device

Structure of Block diagram
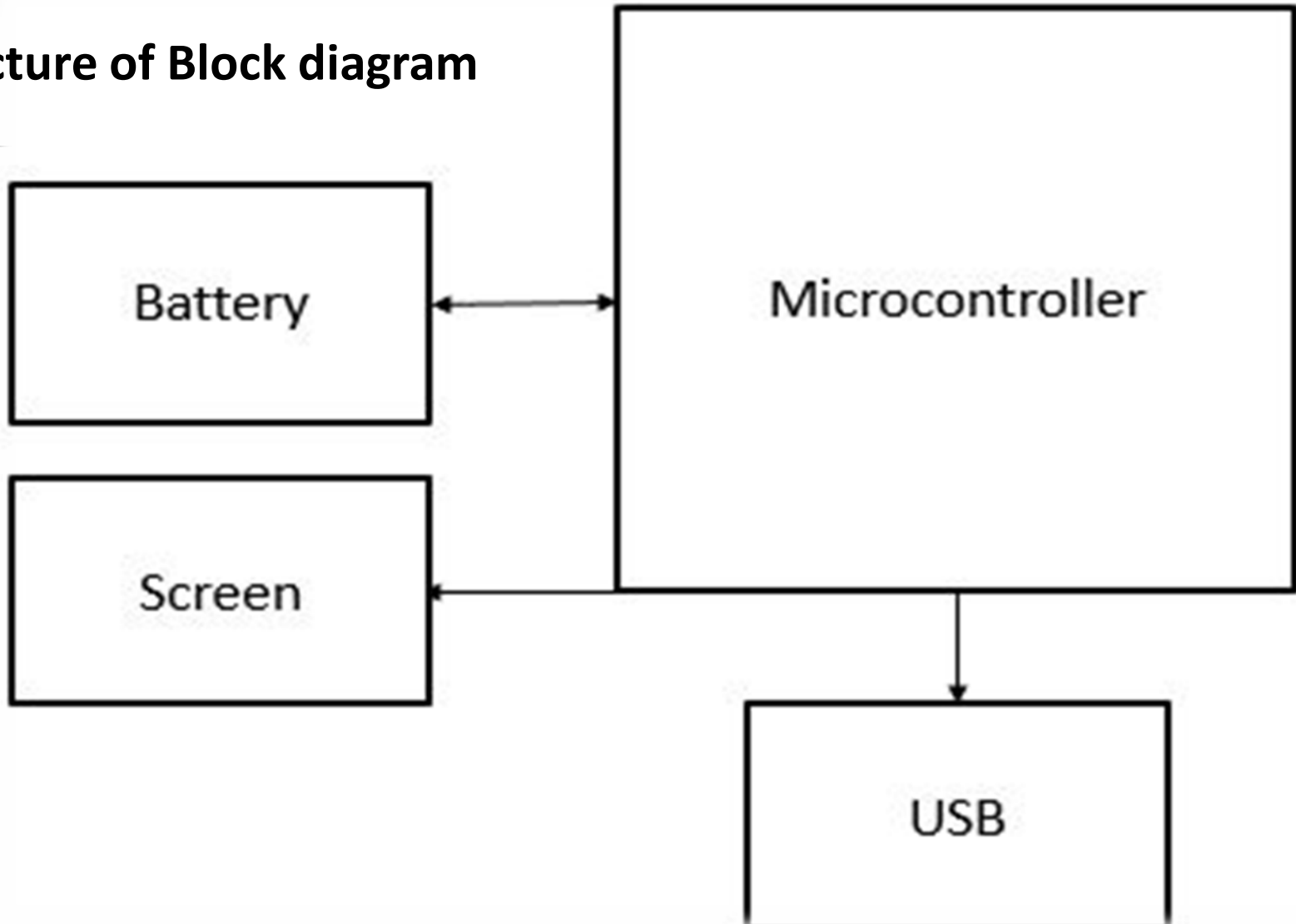
Device components

Sender Device

- **TTGO T-Beam ESP32.**

- **OLED**

- **AD8232 ECG Sensor**

- **MAX30100 Pulse Oximeter Sensor**

- **Temperature Sensor GY-906 MLX90614**

Receiver Device

- **TTGO T-Beam ESP32.**

- **OLED**

TTGO T-Beam ESP32

AD8232 ECG Sensor

- **MAX30100 Pulse Oximeter Sensor**
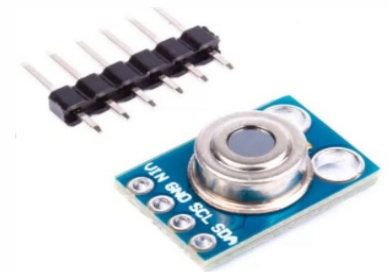
Temperature Sensor GY-906 MLX90614

Design cover

Sender Device

Battery

Screen

Antenna

TTGO Esp32

EGC Sensor

Temperature Sensor

Oximeter Sensor

Receiver Device

Battery

Screen

Antenna

TTGO Esp32
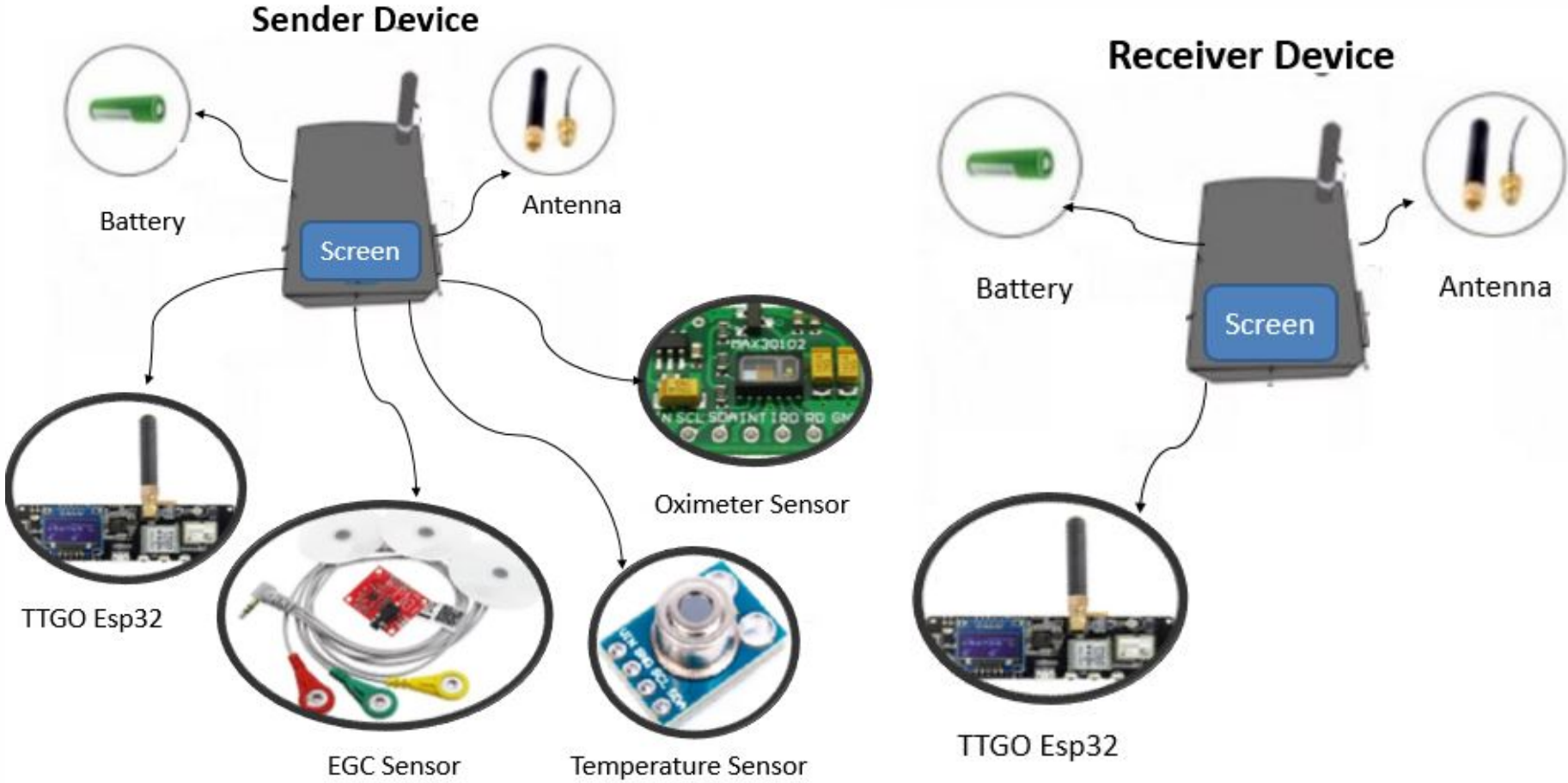
Sender Device
development Schematic diagram
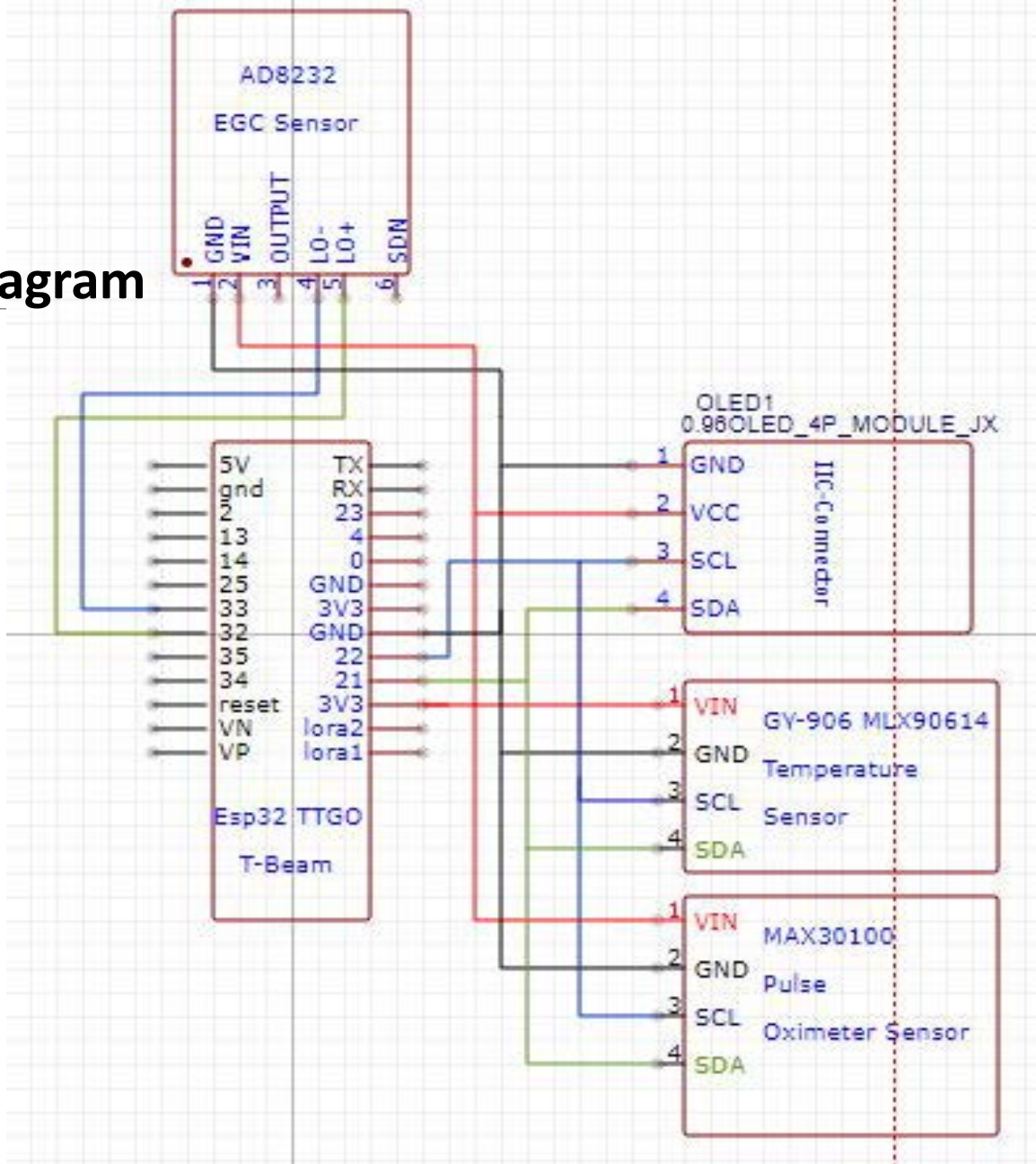
Receiver Device
development Schematic diagram
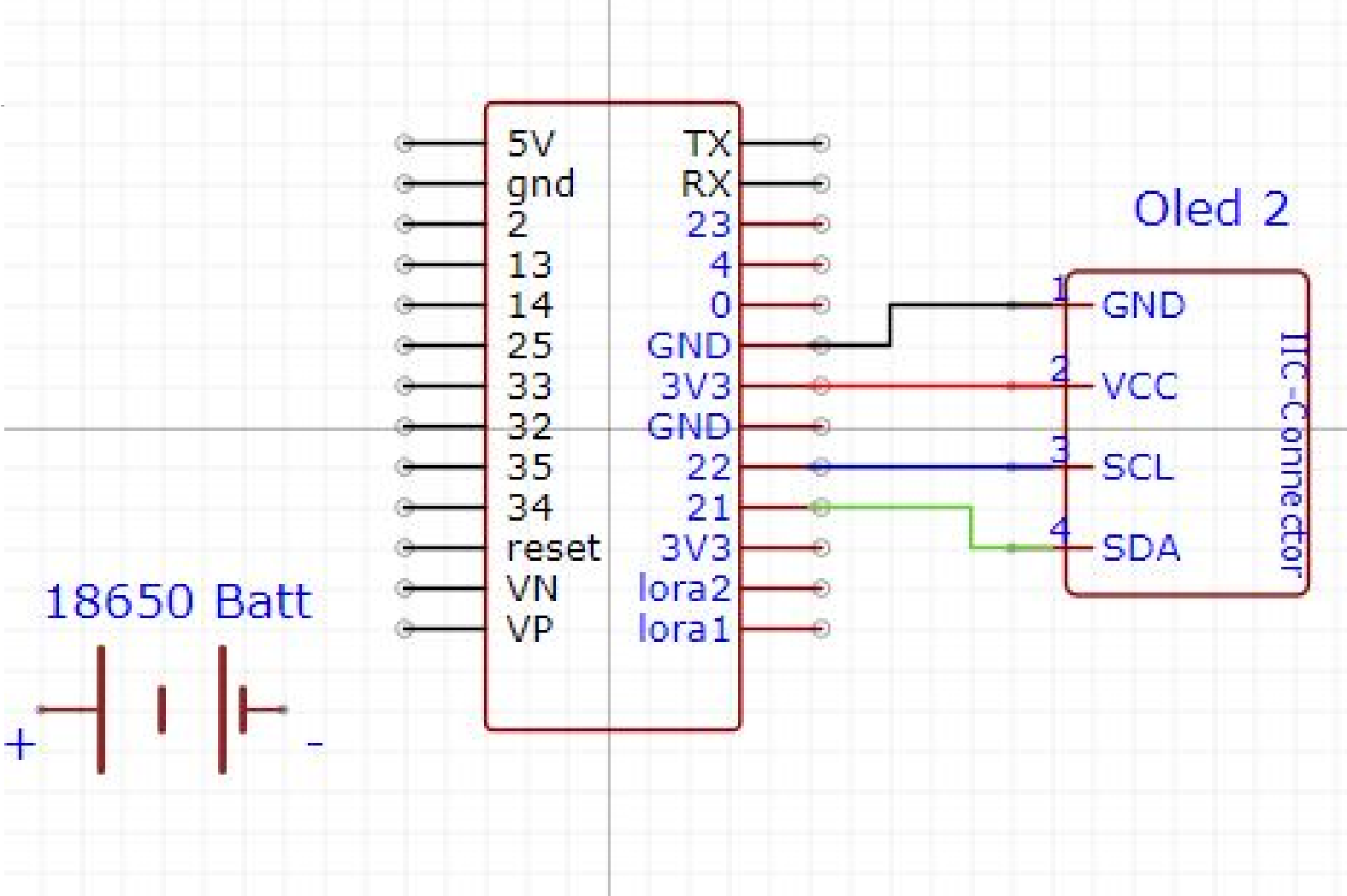
Test of the system

Sender Device

Temperature Result
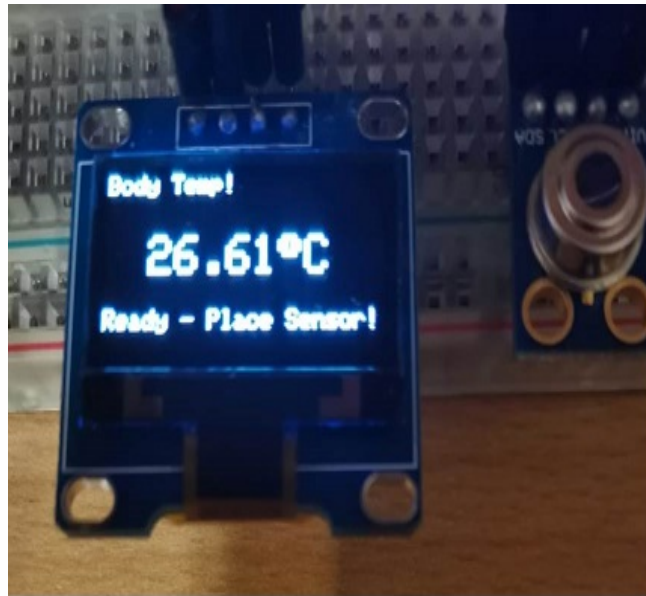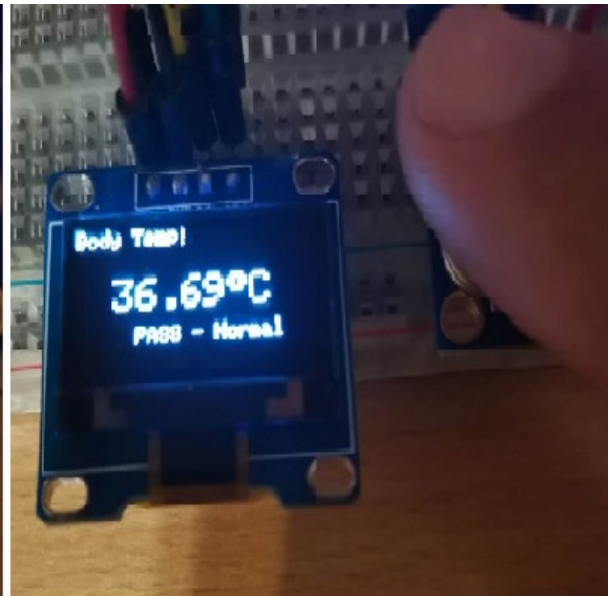
1   2   3

Test of the system

Sender Device

Saturation oxygen blood and Heart rate Result
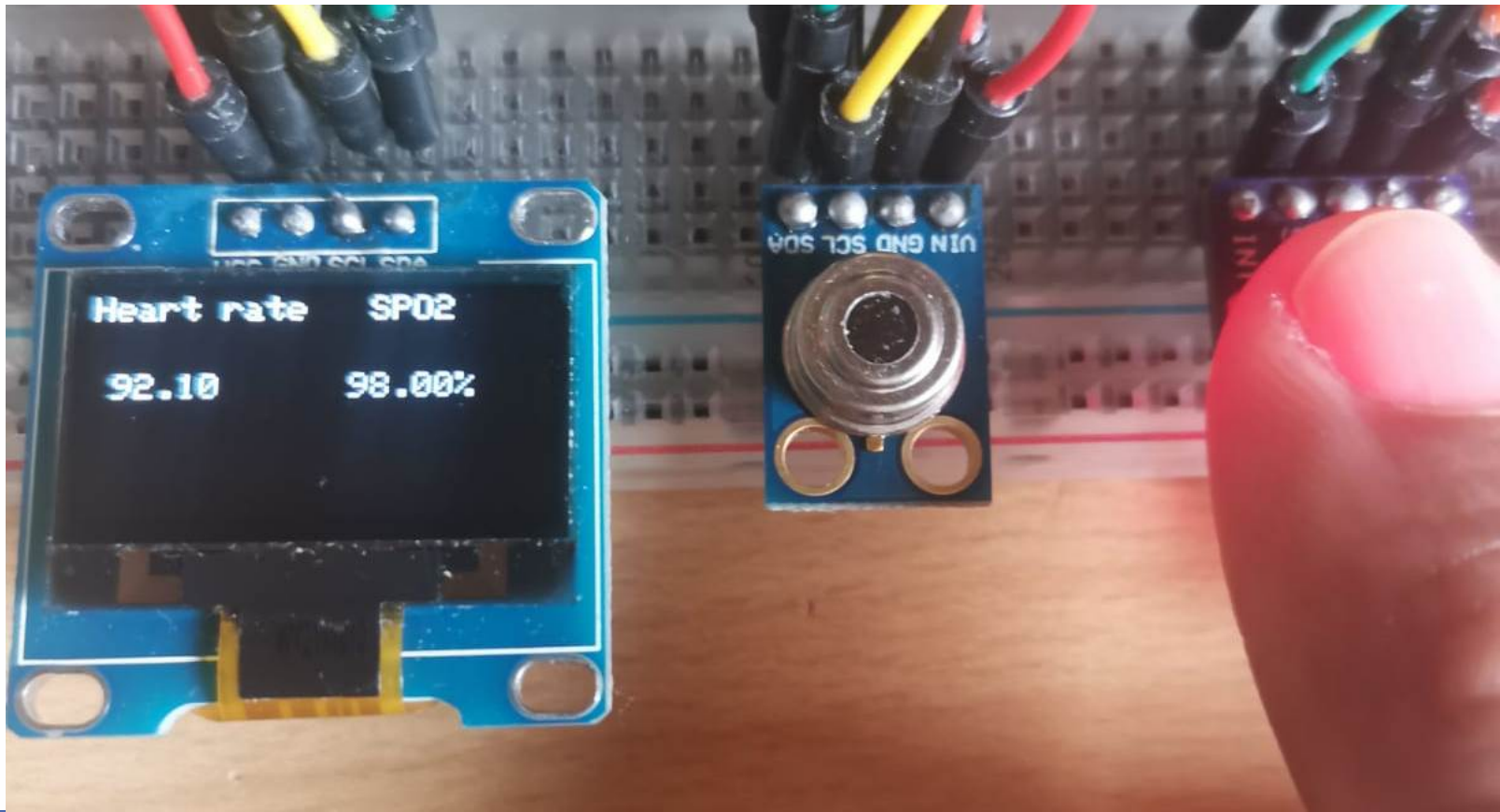
Test of the system

Check data sending & receiving

Sender Device

Receiver Device

Test of the system

Receiver Device

Temperature Result
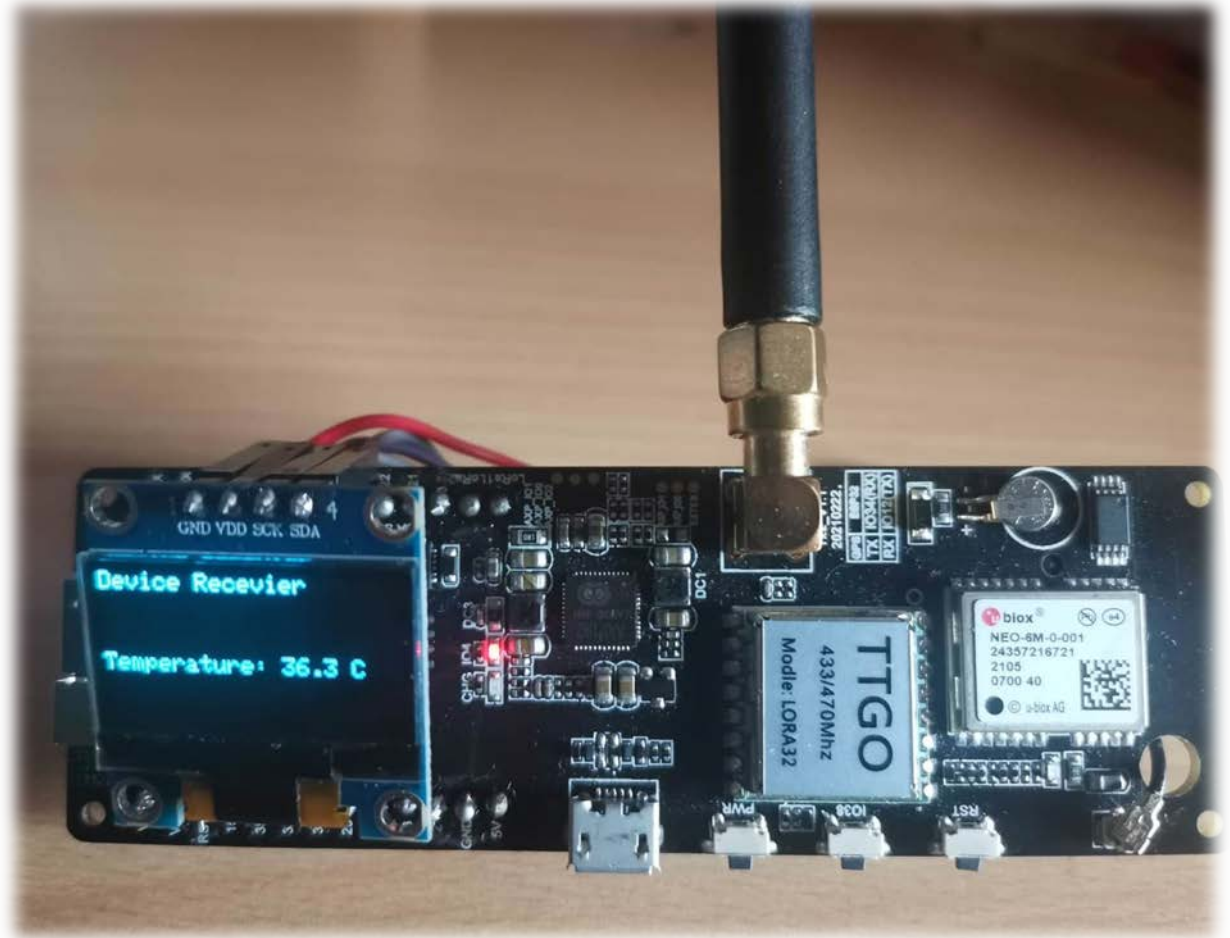
Test of the system

Receiver Device

Saturation

oxygen blood

and Heart rate
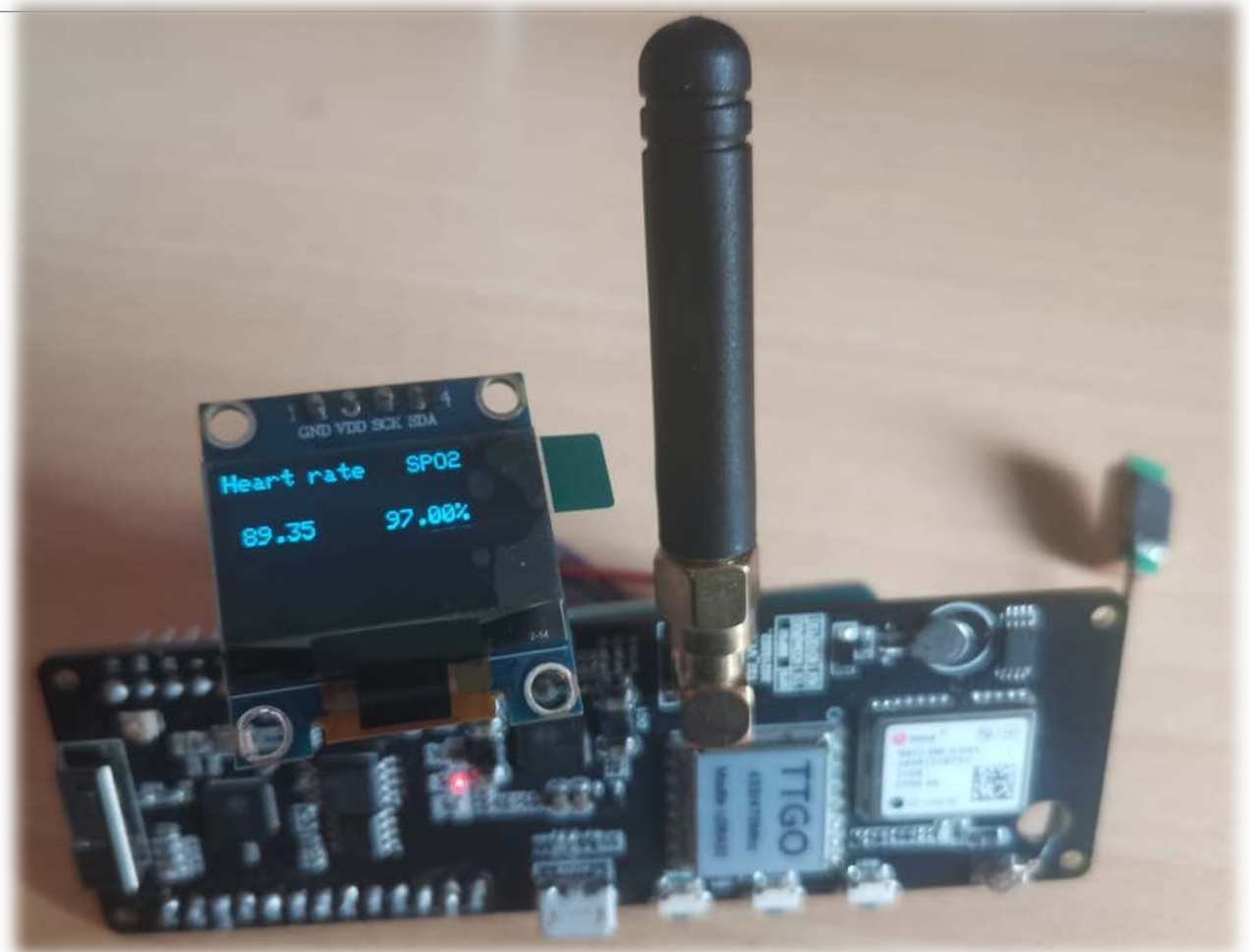
Result

Test of the system

Publish data on the cloud
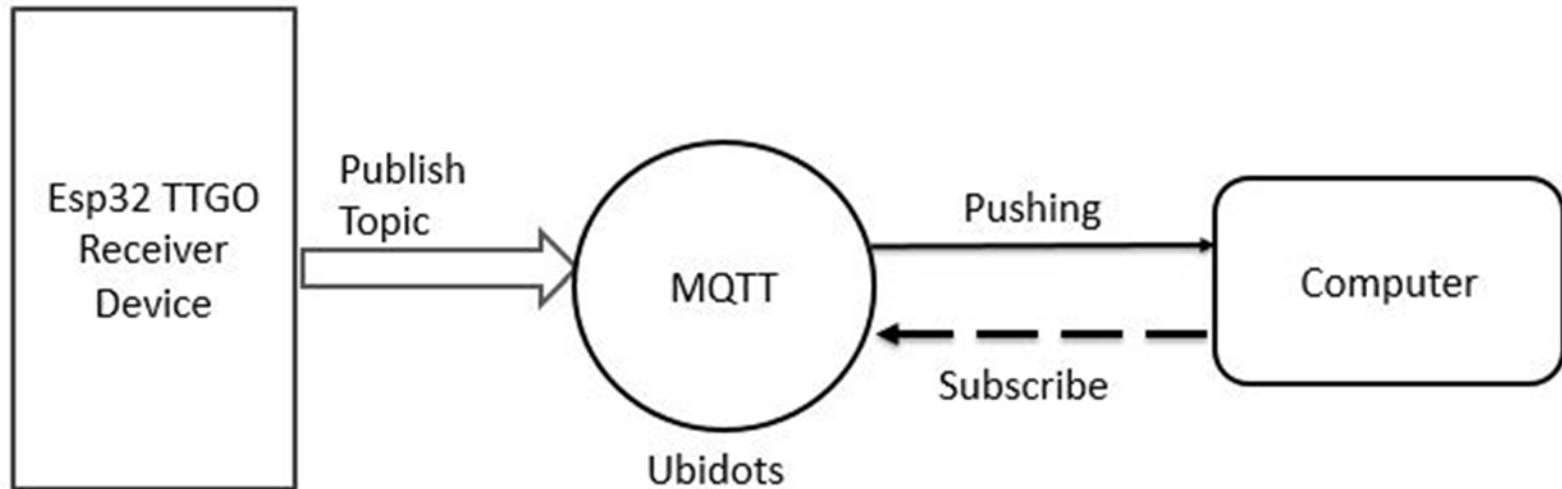
Test of the system

Display the received results on the platform interface
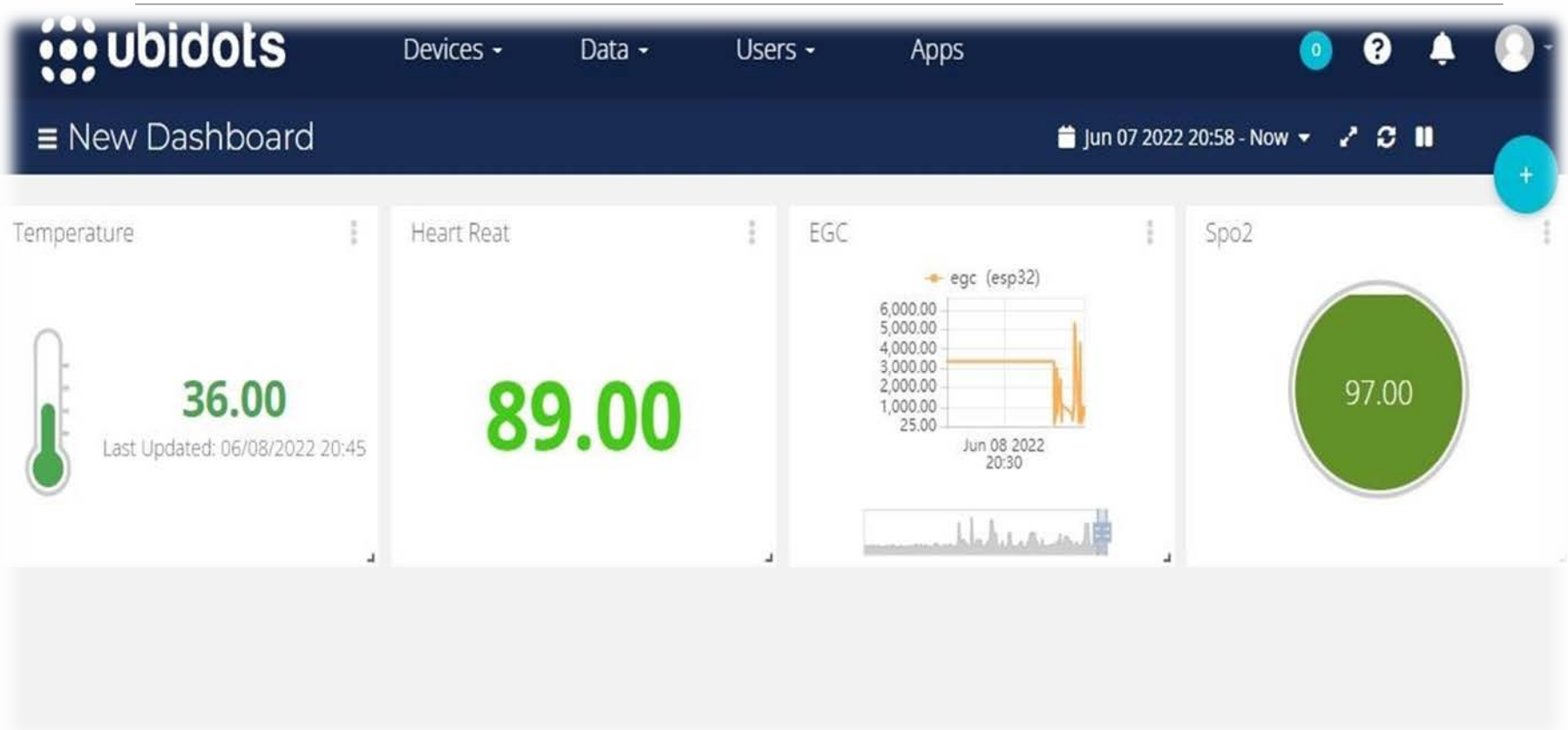
Test of the system

Results of temperature & SPO2 sensor cases
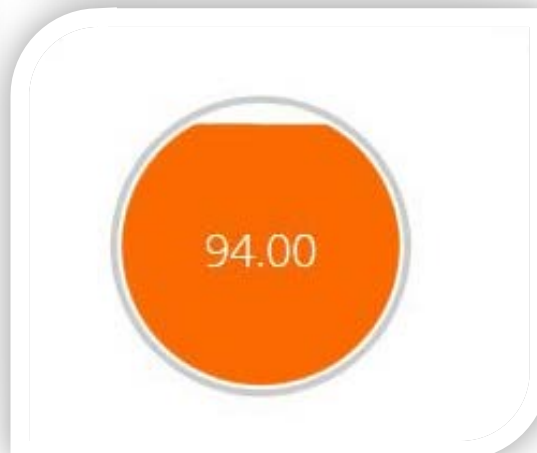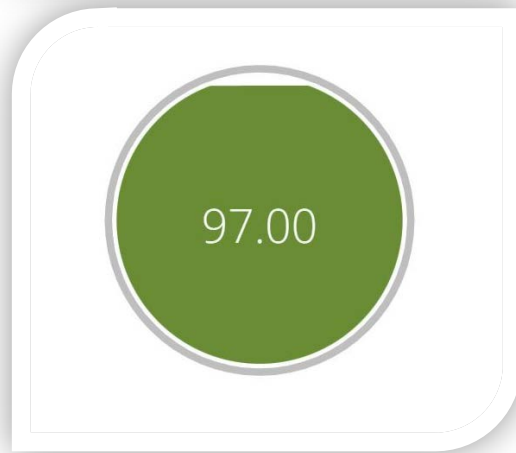
Test of the system

Results of EGC sensor case

Test of the system

Email Alert Test

Ensuring the interaction of medical cyber-physical devices in.pptx

Conclusions

- This system is developed to a Measurement of health parameters of the body and results analysis then display on locally screen.
- Sent health parameters to the long distance by Lora with the low power.
- Displayed were health parameters received and send to publish on IOT platform and received alerts For dangerous situations

Thank you