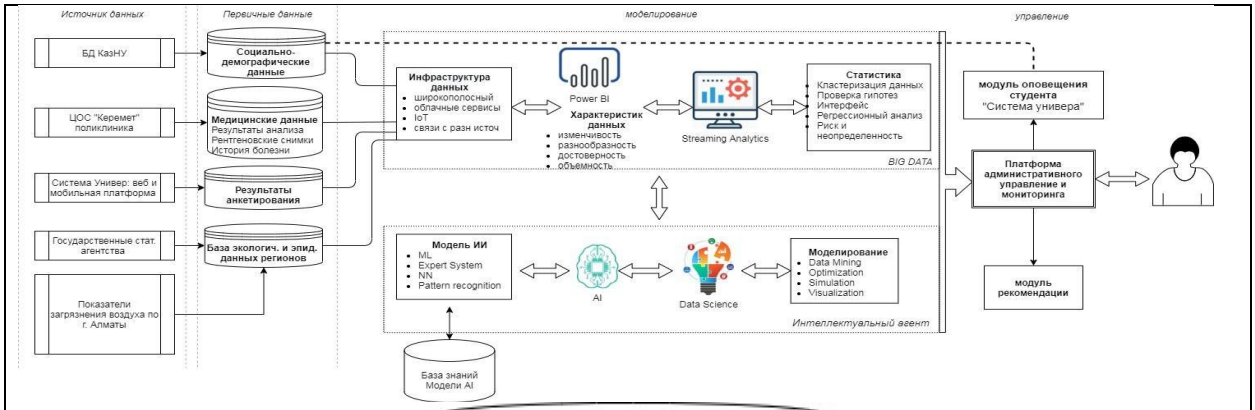
Brief information about the project

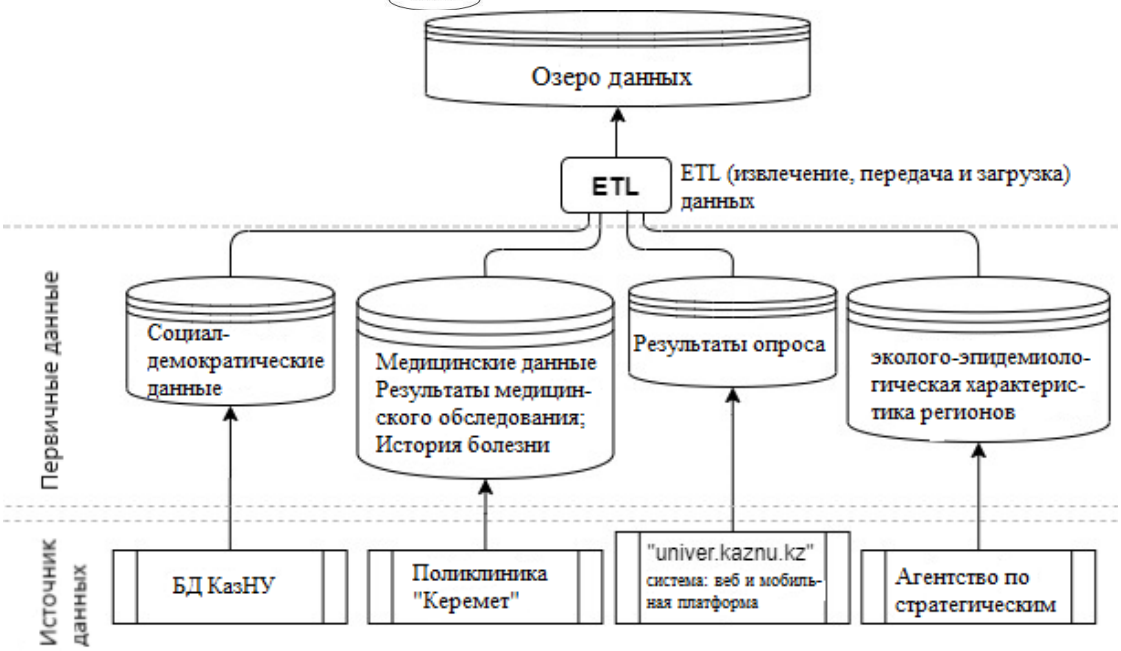
Name of the project	AP09260767 "Development of an intelligent information and analytical system for assessing the health status of students in Kazakhstan" (0223RK00642)
Relevance	The implementation of the tasks of this project will make it possible to develop an up-to-date, but currently missing, system that collects and analyzes information on the health status of students on a regular and continuous basis, which is of great importance from the point of view of sustainable national development.
Purpose	Development and implementation of an information and analytical system for assessing the health of students to form a set of measures to prevent diseases and improve the quality of life of young people using artificial intelligence algorithms.
Objectives	1. Development of the architecture of an intelligent information and analytical system for assessing the health status of students. 2. Research of health indicators and indicators related to the health of students based on a survey and a medical examination. 3. Development of a module for the collection, storage and preprocessing of data on health indicators and indicators related to the health of students obtained as a result of surveys and medical examinations. 4. Design and development of a student's digital health profile as a module of the educational process automation system using cloud technologies. 5. Development of machine learning algorithms for multifactorial analysis of a complex of health indicators and indicators related to the health of students and identification of the influence of biological, social, psychological, geochemical factors on the health and quality of life of students. 6. Design and development of a student's digital health passport based on the processing and consolidated analysis and classification of data, taking into account the threshold values of health indicators and health-related indicators. 7. Development of recommendation functionality for the prevention and rehabilitation of students.
Expected and achieved results	– The architecture of an intelligent information and analytical system for assessing the health status of students has been developed; – Health indicators and indicators related to the health of students based on a survey and a medical examination are investigated; – A module has been developed for the collection, storage and preprocessing of data on health indicators and

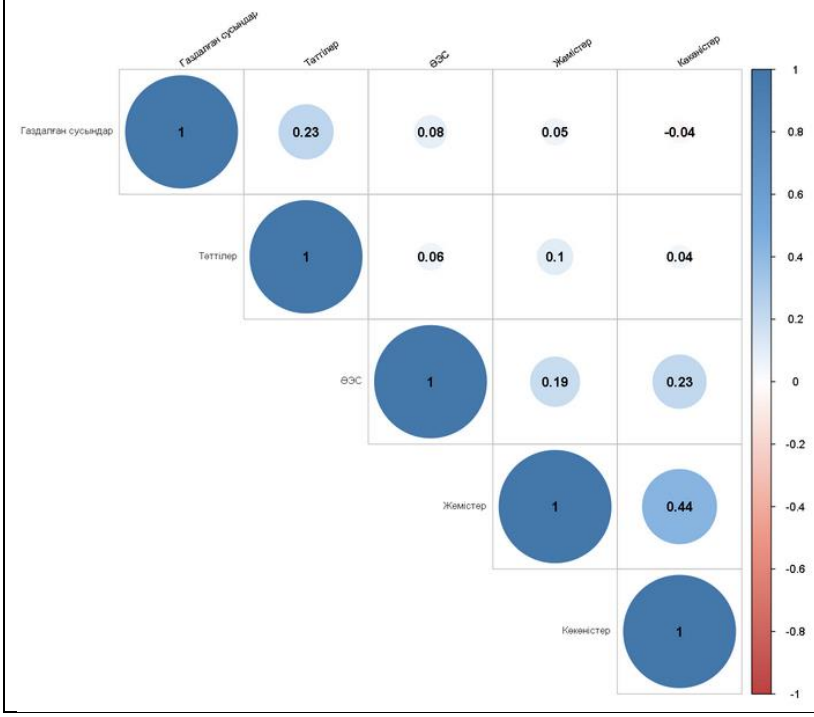
	indicators related to the health of students obtained as a result of surveys and medical examinations; – A student's digital health passport has been designed and developed based on the processing and consolidated analysis and classification of data, taking into account the threshold values of health indicators and health-related indicators; – A recommendation functionality for the prevention and rehabilitation of students has been developed;
Research team members with their identifiers (Scopus Author ID, Researcher ID, ORCID, if available) and links to relevant profiles	1. Tyulepberdinova Gulnur, Scopus Author ID: 57194439539, ORCID ID: 0000-0002-4322-8983 2. Mansurova Madina Scopus Author ID: 56617164900, ORCID ID: 0000-0002-9680-2758 3. Amirkhanova Gulshat, Scopus author ID: 57192719131, ORCID ID: 0000-0003-3933-5476 4. Sarsembayeva Talshyn Scopus Author ID: 57224454827, ORCID ID: 0000-0001-7668-2640 5. Tasmurzaev Nurdaulet Scopus Author ID: 57238311800, ORCID ID: 0000-0003-3039-6715 6. Aangeldy Bibars Scopus Author ID: 57239012100, ORCID ID: 0000-0002-4089-6337 7. Isaeva Raukhan Scopus Author ID: 57190182243, ORCID ID: 0000-0001-7370-025X 8. Tursynova Azhar Scopus Author ID: 57222725276, ORCID ID: 0000-0002-1918-065X 9. Sambetbaeva Aigerim Daniyarkyzy 10. Sarsenova Lazzat Scopus Author ID: 57218488329, ORCID ID: 0000-0001-8643-0703
List of publications with links to them	**For 2021 year** 1. Mansurova M., Zubairova M., Kadyrbek N., Tyulepberdinova G., Sarsembayeva T. Data Analysis for The Student Health Digital Profile // 16th International Conference on Electronics Computer and Computation (ICECCO), 2021. – P. 54-61. 2. Mansurova M., Sarsenova L., Kadyrbek N., Sarsembayeva T., Tyulepberdinova G., Sailau B. Design and Development of Student Digital Health Profile // 2021 IEEE 15th International Conference on Application of Information and Communication Technologies (AICT), 2021. - P. 1-5. 3.M. E. Mansurova, V. B. Barakhnin, G. A. Tyulepberdinova, F. R. Gusmanova, A. A. Nurakhanova. Comparative analysis of the classification of health status by methods of artificial intelligence // bulletin of Abai Kaznpu, Series "physical and Mathematical Sciences". – 2021. -№3(75). – P. 129-137. **For 2022 year** 1. Gulnur Tyulepberdinova, Madina Mansurova, Gulshat Amirkhanova, Olzhas Suleimen. Using Machine Learning Algorithms to Analyze a Set of Student Health Indicators

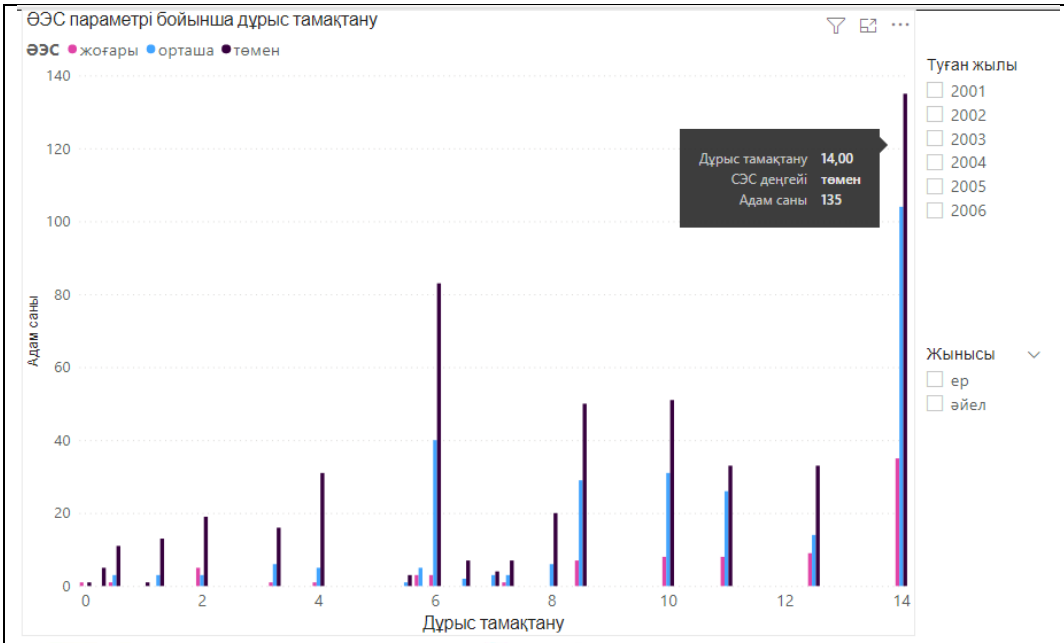
	// 7th International Conference on Computer Science and Engineering, Diyarbakir, Turkey, 2022. – P. 550-553. 2. Talshyn Sarsembayeva, Madina Mansurova, Adai Shomanov, Magzhan Sarsembayev, Symbat Sagyzbayeva, Gassyrbek Rakhimzhanov Metadata of the chapter that will be visualized in SpringerLink: Pre-processing of CT Images of the Lungs. //ACIIDS, LNAI, 2022. – P. 1–8. 3. Sarsembayeva T., Shomanov A., Sarsembayev M., Mansurova M., Zhumasheva A., Zhunussova A., Rakhimzhanov G. UNet Model for Segmentation of COPD Lung Lesions on Computed Tomography Images // CEUR Workshop Proceedings, 2022. – P. 33-42. 4. Sarsembayeva T., Zholdas N., Mansurova M., Sarsembayev M., Urykkaliyev A. Study of Non-Invasive Methods of Measuring Glucose for Patients with Diabetes Mellitus // SIST 2022 - 2022 International Conference on Smart Information Systems and Technologies, Proceedings, 2022. – P. 945-952. 5. Zholdas N., Mansurova M., Sarsembayev M., Postolache O., Shomanov A., Sarsembayeva T. Application of mHealth Technologies to Improve Self-Control of Children and Adolescents with Type 1 Diabetes // 2022 IEEE International Symposium on Medical Measurements and Applications, MeMeA, 2022. – P. 475-485. 6. Tasmurzayev N., Amangeldy B., Baigarayeva Z., Mansurova M., Resnik B., Amirkhanova G. Improvement of HVAC System Using the Intelligent Control System // ENERGYCON 2022 - 2022 IEEE 7th International Energy Conference, 2022. – P.375-387. 7. Tyulepberdinova G.A., Mansurova M.E., Sarsembayeva T.S., Sarsenova L.K., Amirkhanova G.A. Chapter of the monograph: Intelligent information and analytical system "Digital profile of student's health". – Almaty: Kazakh University, 2022. – 63 p. Security documents: 8. Copyright certificate No. 27384. Amirkhanova G. A., Khasenov J.D., Tyulepberdinova G.A., Sarsembayeva T.S. / Client module of the software complex for storing and processing biomedical data; publ. 06/22/2022 9. Copyright certificate No. 27461. Tyulepberdinova G.A., Suleimenov O.D. / Program for predicting the disease by symptoms. published on 06/24/2022 **For 2023 year** 1. Amangeldy B., Tasmurzayev N., Mansurova M., Imanbek B., Sarsembayeva T. Design and Development of IoT Based Medical Cleanroom // Communications in Computer and Information Science. – 2023. – P. 459-469. 2. G.A. Tyulepberdinova1, T.S. Sarsembayeva, S.A. Adilzhanova, S.N. Issabayeva Information and analytical system for assessing the health status of students // JMMCS. - №2(118). – 2023. – P. 89-99.

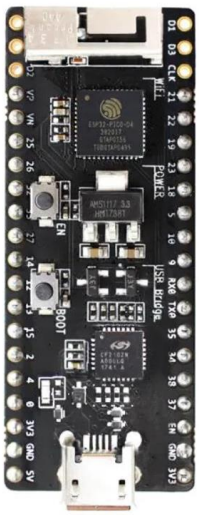
	3. Murat Kunelbayev, Madina Mansurova, Gulnur Tyulepberdinova, Talshyn Sarsembayeva, Sulu Issabayeva, Darazha Issabayeva. Comparison of parameters of a flat solar collector with a tubular collector to ensure energy flexibility in smart buildings, International Journal of Innovative Research and Scientific Studies (IJIRSS), 2023, статья принята, в печати. (Percentile 66) 4. Gulnur Tyulepberdinova, Murat Kunelbayev, and Madina Mansurova, Gulshat Amirkhanova, Zhanar Oralbekova. Development and Research of a Remote Patient Monitoring System, International Journal of Innovative Research and Scientific Studies (IJIRSS), 2023, статья принята, в печати. (Percentile 66) 5. Gulnur Tyulepberdinova, Madina Mansurova, Talshyn Sarsembayeva, Sulu Issabayeva, Darazha Issabayeva. Machine learning in student health evaluation: The physical, social, and mental conditions Journal of Technical Education and Training. 2023, статья принята, в печати. (Percentile 53) 6. Yerlan Zaitin, Madina Mansurova, Murat Kunelbayev, Gulnur Tyulepberdinova, Adai Shomanov. Development of a patient health monitoring system based on the Internet of Things with a module for predicting vital signs, Indonesian Journal of Electrical Engineering and Computer Science,), 2023, статья принята, в печати. (Percentile 61) **Security documents:** 1. Copyright certificate No. 35363. Studentin densaulygy turaly malimetterdi zhinau, Aktau zhane ondeu/Tulepberdinova Gulnur Alpyzy, Kilybayeva Ainur Kilybaykyzy, Sarsembayeva Talshyn Sagdatbekkyzy, Amirkhanova Gulshat Amanzholovna; publ.30.09. 2023. 2. Copyright certificate No.34783. Studentterdin sandyk densaulyk profili / Zhenis Medina, Tulepberdinova Gulnur Alpykyzy; publ.18.04. 2023. 3. Copyright certificate No. 35191. Bultty technologiyany koldana otyryp, derakterdi taldaudykshogyrlandyrylgan modulin zhasau / Tyulepberdinova Gulnur Alpyskyzy, Tynyshtykov Alibi Asylbekuly, Toiganbayeva Nazgul Abenovna, Gaziz Gulnur Gazizkyzy; publ.26.04.2023.
Patents	Utility model patent No. 8142. Architecture of the patient monitoring system / Tyulepberdinova G.A., Kunelbaev M.M., Mansurova M.E.; - No. 03-86-2, application 12.04.23; publ. 09.06.2023. – 1 p.


Источник данных
Первичные данные
моделирование
управление
БД КазНУ
ЦОС "Керемет" поликлиника
Система Универ: веб и мобильная платформа
Государственные стат. агентства
Показатели загрязнения воздуха по г. Алматы
Социально-демографические данные
Медицинские данные
Результаты анализа
Рентгеновские снимки
История болезни
Результаты анкетирования
База экологич. и эпид. данных регионов
Инфраструктура данных
широкополосный
облачные сервисы
IoT
связи с разн источ
Power BI
Характеристик данных
изменчивость
разнообразность
достоверность
объемность
Streaming Analytics
Статистика
Кластеризация данных
Проверка гипотез
Интерфейс
Регрессионный анализ
Риск и неопределенность
BIG DATA
модуль оповещения студента
"Система универа"
Платформа административного управление и мониторинга
модуль рекомендации
Модель ИИ
ML
Expert System
NN
Pattern recognition
AI
Data Science
Моделирование
Data Mining
Optimization
Simulation
Visualization
Интеллектуальный ивент
База знаний Модели AI

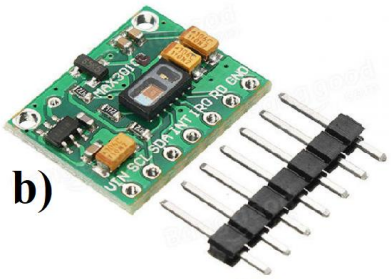

Озеро данных
ETL
ETL (извлечение, передача и загрузка) данных
Первичные данные
Социал-демократические данные
Медицинские данные Результаты медицин-ского обследования; История болезни
Результаты опроса
эколого-эпидемиоло-гическая характерис-тика регионов
Источник данных
БД КазНУ
Поликлиника "Керемет"
"univer.kaznu.kz" система: веб и мобиль-ная платформа
Агентство по стратегическим


Газдалған сусындар
Тәттілер
ӨЭС
Жемістер
Көкөністер
1
0.23
0.08
0.05
-0.04
0.06
0.1
0.04
0.19
0.23
0.44
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1

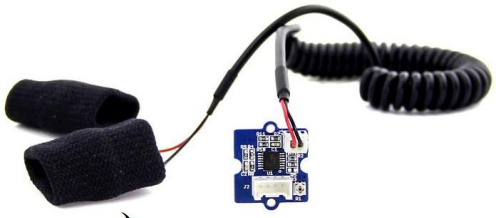

ӘЭС параметрі бойынша дұрыс тамақтану
ӘЭС жоғары орташа төмен
Адам саны
Дұрыс тамақтану
Дұрыс тамақтану 14,00
СЭС деңгейі төмен
Адам саны 135
Туған жылы
2001
2002
2003
2004
2005
2006
Жынысы
ер
әйел



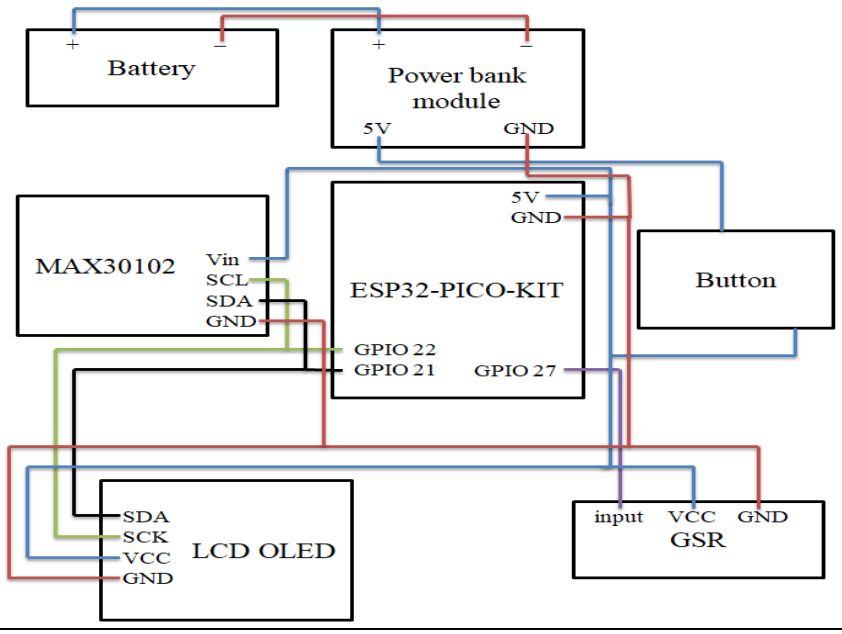
a)

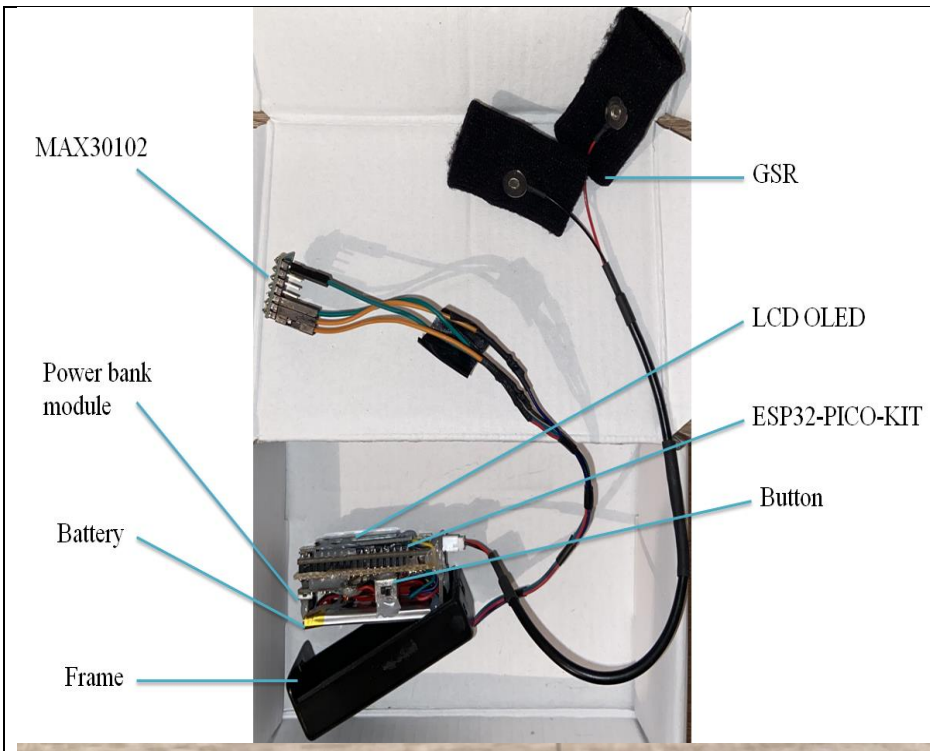


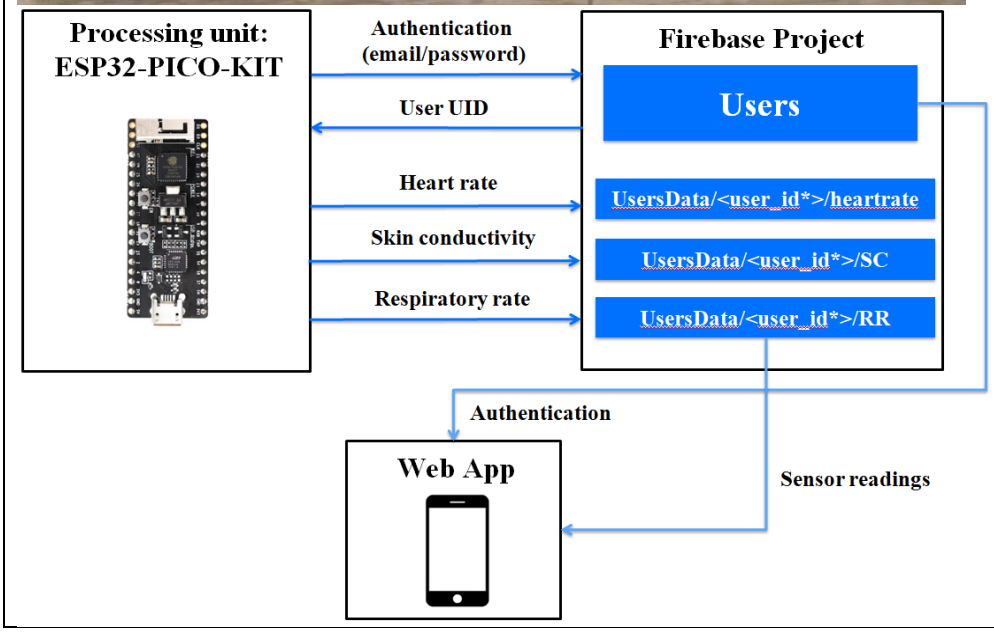
b)

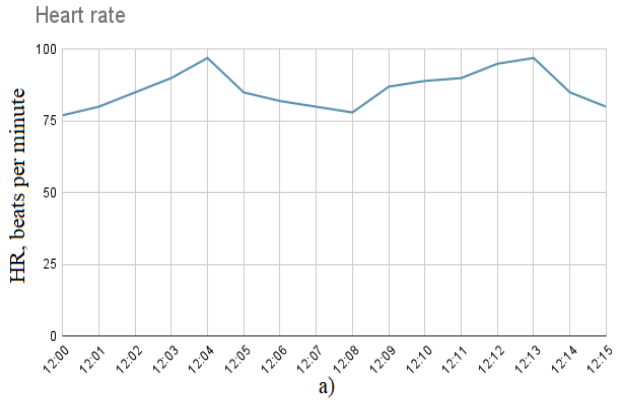


c)

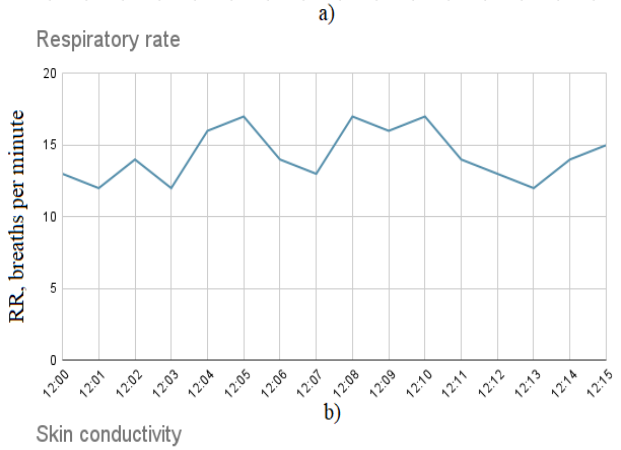

Battery
Power bank module
5V
GND
MAX30102
Vin
SCL
SDA
GND
ESP32-PICO-KIT
5V
GND
GPIO 22
GPIO 21
GPIO 27
Button
SDA
SCK
VCC
GND
LCD OLED
input
VCC
GND
GSR


MAX30102
GSR
LCD OLED
Power bank module
ESP32-PICO-KIT
Button
Battery
Frame

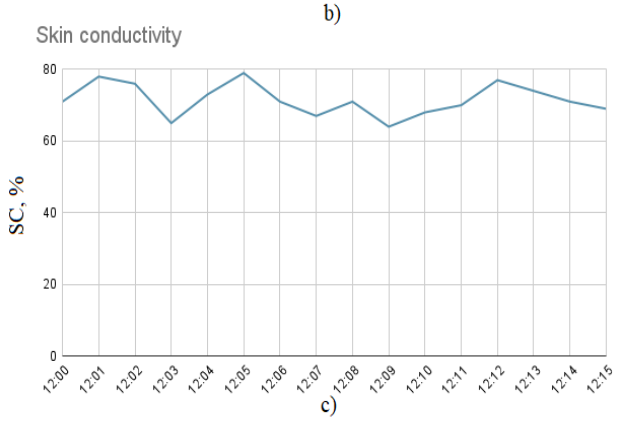

Processing unit: ESP32-PICO-KIT
Authentication (email/password)
User UID
Heart rate
Skin conductivity
Respiratory rate
Firebase Project
Users
UsersData/<user_id*>/heartrate
UsersData/<user_id*>/SC
UsersData/<user_id*>/RR
Authentication
Web App
Sensor readings


Heart rate
HR, beats per minute
100
75
50
25
0
12:00
12:01
12:02
12:03
12:04
12:05
12:06
12:07
12:08
12:09
12:10
12:11
12:12
12:13
12:14
12:15

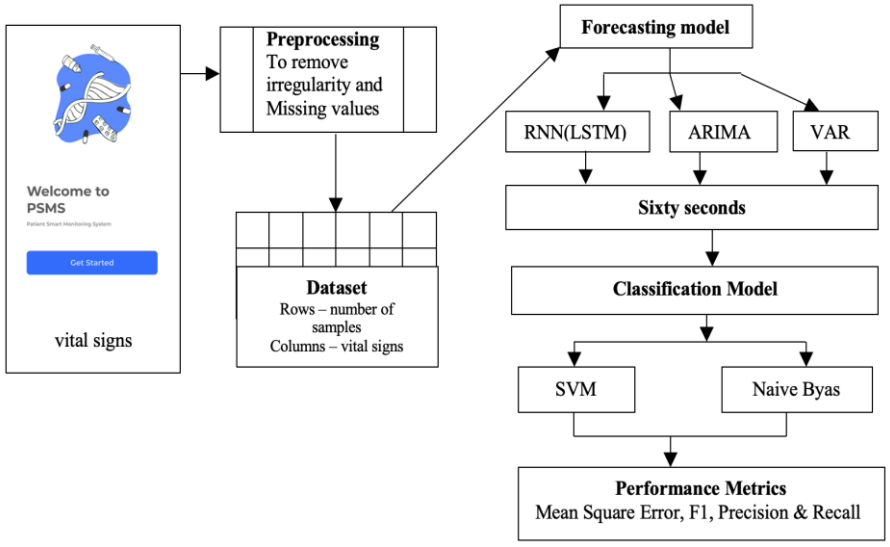
a)

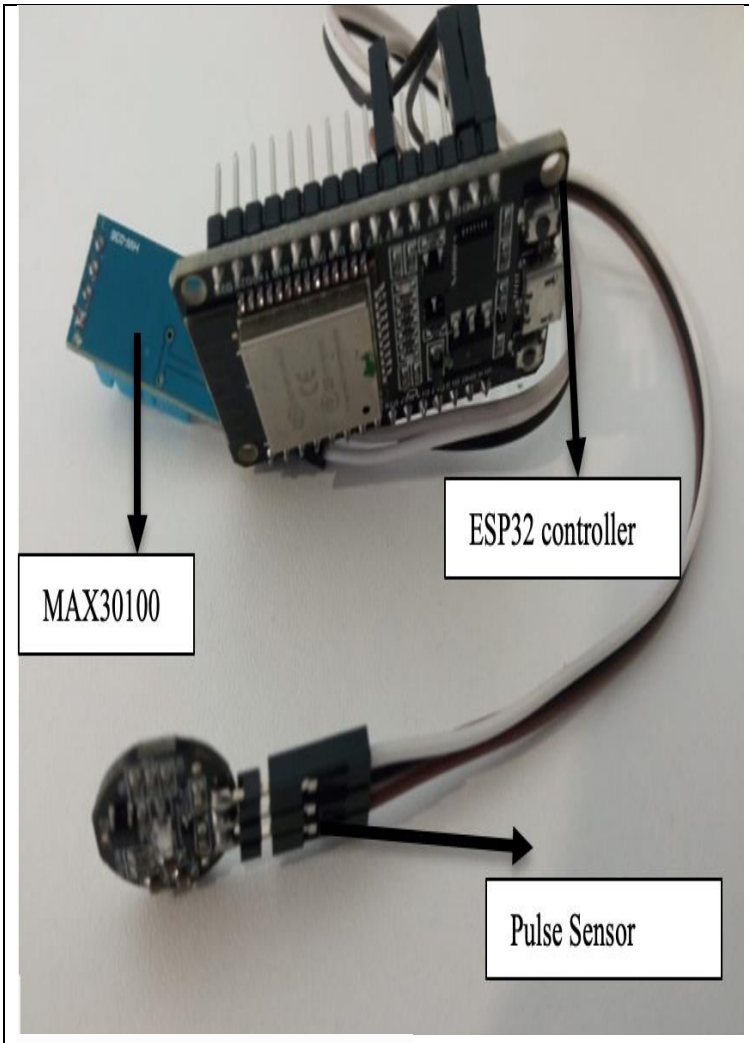

Respiratory rate
RR, breaths per minute
20
15
10
5
0
12:00
12:01
12:02
12:03
12:04
12:05
12:06
12:07
12:08
12:09
12:10
12:11
12:12
12:13
12:14
12:15

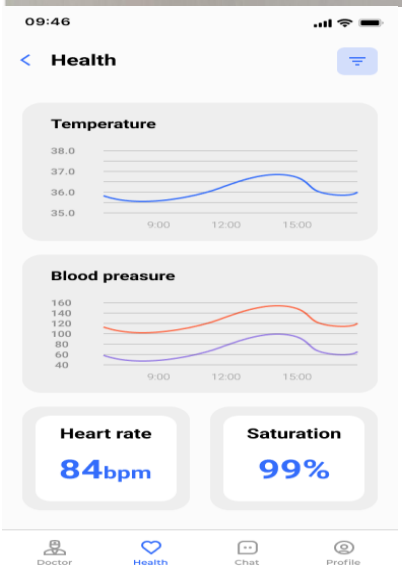
b)

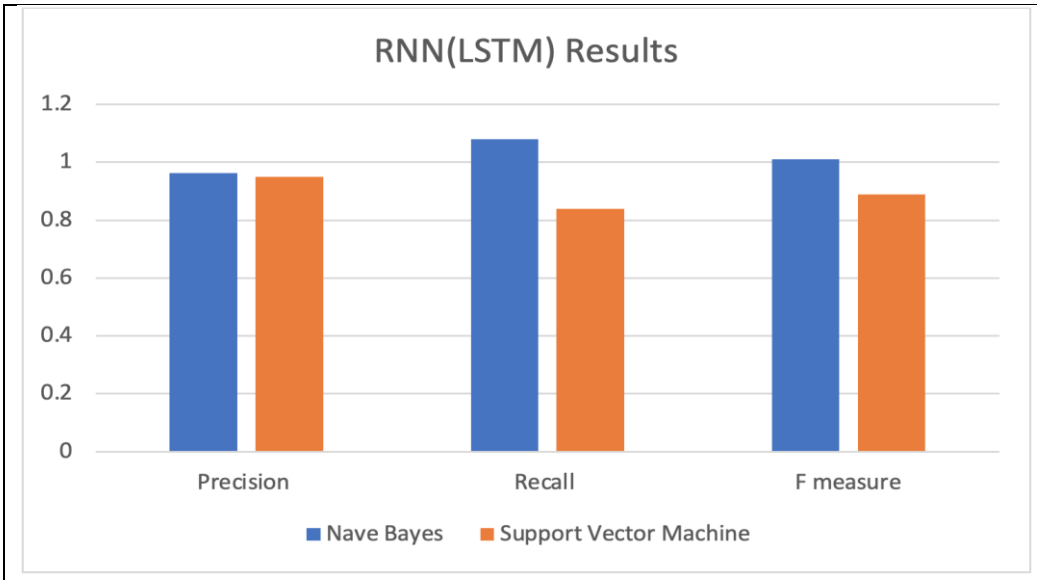

Skin conductivity
SC, %
80
60
40
20
0
12:00
12:01
12:02
12:03
12:04
12:05
12:06
12:07
12:08
12:09
12:10
12:11
12:12
12:13
12:14
12:15

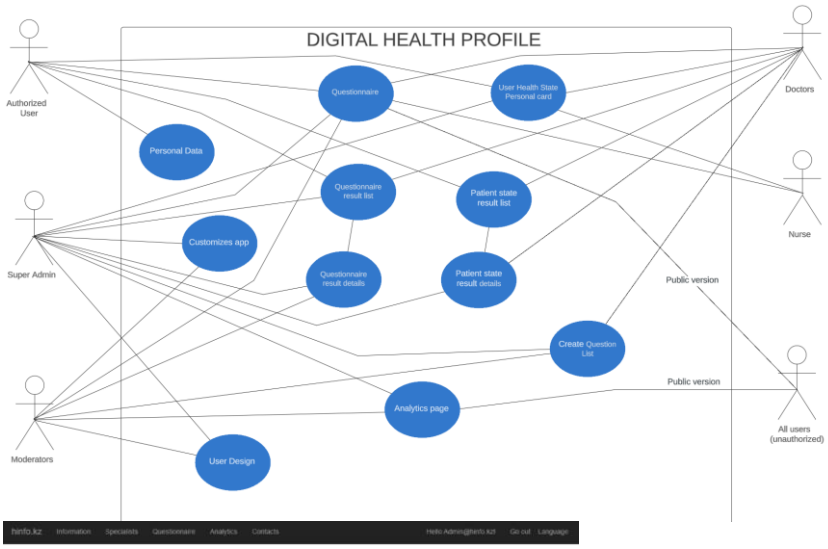
c)

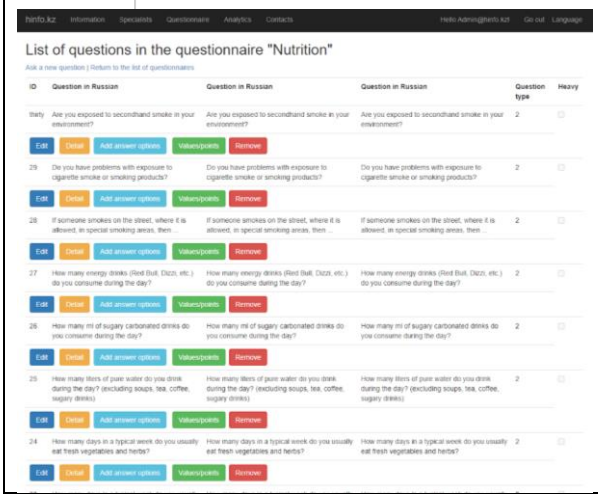

Welcome to PSMS
Get Started
vital signs
Preprocessing
To remove irregularity and Missing values
Dataset
Rows – number of samples
Columns – vital signs
Forecasting model
RNN(LSTM)
ARIMA
VAR
Sixty seconds
Classification Model
SVM
Naive Byas
Performance Metrics
Mean Square Error, F1, Precision & Recall

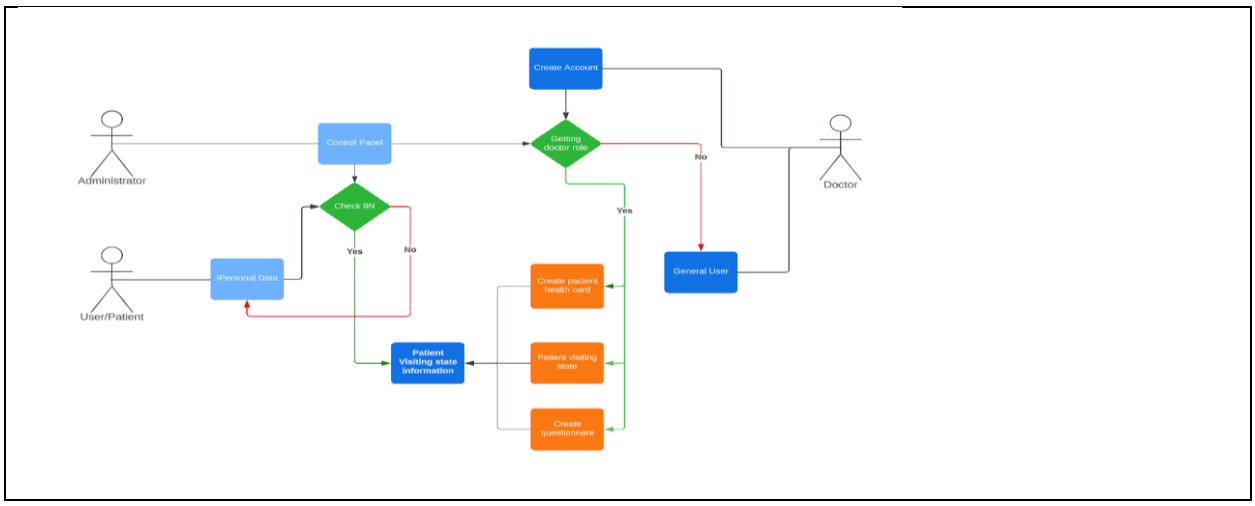

ESP32 controller
MAX30100
Pulse Sensor


09:46
Health
Temperature
38.0
37.0
36.0
35.0
9:00
12:00
15:00
Blood preasure
160
140
120
100
80
60
40
9:00
12:00
15:00
Heart rate
84bpm
Saturation
99%
Doctor
Health
Chat
Profile


RNN(LSTM) Results
1.2
1
0.8
0.6
0.4
0.2
0
Precision
Recall
F measure
Nave Bayes
Support Vector Machine


DIGITAL HEALTH PROFILE
Authorized User
Questionnaire
User Health State Personal card
Doctors
Personal Data
Questionnaire result list
Patient state result list
Nurse
Super Admin
Customizes app
Questionnaire result details
Patient state result details
Public version
Create Question List
Public version
Analytics page
All users (unauthorized)
Moderators
User Design


List of questions in the questionnaire "Nutrition"
Ask a new question | Return to the list of questionnaires
ID
Question in Russian
Question in Russian
Question in Russian
Question type
Heavy
Edit
Detail
Add answer options
Values/points
Remove


Create Account
Administrator
Control Panel
Getting doctor role
No
Doctor
Check IIN
Yes
No
Yes
User/Patient
IPersonal Data
General User
Create pacient health card
Patient Visiting state Information
Patient visiting state
Create questionnare