

MUHAMMAD AL-XORAZMIY
NOMIDAGI TATU FARG'ONA FILIALI
FERGANA BRANCH OF TUIT
NAMED AFTER MUHAMMAD AL-KHORAZMI

“AL-FARG‘ONIIY AVLODLARI”

ELEKTRON ILMIY JURNALI | ELECTRONIC SCIENTIFIC JOURNAL

TA'LIMDAGI ILMIY, OMMABOP VA ILMIY TADQIQOT ISHLARI



4-SON 1(8)
2024-YIL

TATU, FARG'ONA
O'ZBEKISTON



O'ZBEKISTON RESPUBLIKASI RAQAMLI TEXNOLOGIYALAR VAZIRLIGI

MUHAMMAD AL-XORAZMIY NOMIDAGI
TOSHKENT AXBOROT TEXNOLOGIYALARI UNIVERSITETI
FARG'ONA FILIALI

Muassis: Muhammad al-Xorazmiy nomidagi Toshkent axborot texnologiyalari universiteti Farg'ona filiali.

Chop etish tili: O'zbek, ingliz, rus. Jurnal texnika fanlariga ixtisoslashgan bo'lib, barcha shu sohadagi matematika, fizika, axborot texnologiyalari yo'nalishida maqolalar chop etib boradi.

Учредитель: Ферганский филиал Ташкентского университета информационных технологий имени Мухаммада ал-Хоразми.

Язык издания: узбекский, английский, русский. Журнал специализируется на технических науках и публикует статьи в области математики, физики и информационных технологий.

Founder: Fergana branch of the Tashkent University of Information Technologies named after Muhammad al-Khorazmi.

Language of publication: Uzbek, English, Russian. The magazine specializes in technical sciences and publishes articles in the field of mathematics, physics, and information technology.

2024 yil, Tom 1, №4
Vol.1, Iss.4, 2024 y

ELEKTRON ILMIY JURNALI

ELECTRONIC SCIENTIFIC JOURNAL

«Al-Farg'oniyl avlodlari» («The descendants of al-Fargani», «Potomki al-Fargani») O'zbekiston Respublikasi Prezidenti administratsiyasi huzuridagi Axborot va ommaviy kommunikatsiyalar agentligida 2022-yil 21 dekabrda 054493-son bilan ro'yxatdan o'tgan.

Jurnal OAK Rayosatining 2023-yil 30 sentabrdagi 343-sonli qarori bilan Texnika fanlari yo'nalishida milliy nashrlar ro'yxatiga kiritilgan.

Tahririyat manzili:
151100, Farg'ona sh.,
Aeroport ko'chasi 17-uy,
202A-xona
Tel: (+99899) 998-01-42
e-mail: info@al-fargoniy.uz

Qo'lyozmalar taqrizlanmaydi va qaytarilmaydi.

FARG'ONA - 2024 YIL

TAHRIR HAY'ATI

Maxkamov Baxtiyor Shuxratovich,

Muhammad al-Xorazmiy nomidagi Toshkent axborot texnologiyalari universiteti rektori, iqtisodiyot fanlari doktori, professor

Muxtarov Farrux Muhammadovich,

Muhammad al-Xorazmiy nomidagi Toshkent axborot texnologiyalari universiteti Farg'ona filiali direktori, texnika fanlari doktori

Arjannikov Andrey Vasilevich,

Rossiya Federatsiyasi Sibir davlat universiteti professori, fizika-matematika fanlari doktori

Satibayev Abdugani Djunosovich,

Qirg'iziston Respublikasi, Osh texnologiyalari universiteti, fizika-matematika fanlari doktori, professor

Rasulov Akbarali Maxamatovich,

Muhammad al-Xorazmiy nomidagi TATU Farg'ona filiali Axborot texnologiyalari kafedrasida professori, fizika-matematika fanlari doktori

Yakubov Maksadxon Sultaniyazovich,

Muhammad al-Xorazmiy nomidagi TATU «Axborot texnologiyalari» kafedrasida professori, t.f.d., professor, xalqaro axborotlashtirish fanlari Akademiyasi akademigi

G'ulomov Sherzod Rajaboyevich,

Muhammad al-Xorazmiy nomidagi TATU Kiberxavfsizlik fakulteti dekani, Ph.D., dotsent

G'aniyev Abduxalil Abdjalioviich,

Muhammad al-Xorazmiy nomidagi TATU Kiberxavfsizlik fakulteti, Axborot xavfsizligi kafedrasida t.f.n., dotsent

Zaynidinov Hakimjon Nasritdinovich,

Muhammad al-Xorazmiy nomidagi TATU Kompyuter injiniringi fakulteti, Sun'iy intellekt kafedrasida texnika fanlari doktori, professor

Abdullayev Abdujabbor,

Andijon mashinosozlik instituti, Iqtisod fanlari doktori, professor

Qo'ldashev Obbozjon Hakimovich,

O'zbekiston milliy universiteti huzuridagi Yarimo'tkazgichlar fizikasi va mikroelektronika ilmiy-tadqiqot instituti, texnika fanlari doktori, professor

Ergashev Sirojiddin Fayazovich,

Farg'ona politexnika instituti, elektronika va asbobsozlik kafedrasida professori, texnika fanlari doktori, professor

Polvonov Baxtiyor Zaylobiddinovich,

Muhammad al-Xorazmiy nomidagi TATU Farg'ona filiali Ilmiy ishlar va innovatsiyalar bo'yicha direktor o'rinbosari

Zulunov Ravshanbek Mamatovich,

Muhammad al-Xorazmiy nomidagi TATU Farg'ona filiali Dasturiy injiniring kafedrasida dotsenti, fizika-matematika fanlari nomzodi

Abdullaev Temurbek Marufovich,

Muhammad al-Xorazmiy nomidagi TATU Axborot texnologiyalari kafedra mudiri, texnika fanlar bo'yicha falsafa doktori

Zokirov Sanjar Ikromjon o'g'li,

Muhammad al-Xorazmiy nomidagi TATU Farg'ona filiali Ilmiy tadqiqotlar, innovatsiyalar va ilmiy-pedagogik kadrlar tayyorlash bo'limi boshlig'i, fizika-matematika fanlari bo'yicha falsafa doktori

Jurnal quyidagi bazalarda indekslanadi:



Eslatma! Jurnal materiallari to'plamiga kiritilgan ilmiy maqolalardagi raqamlar, ma'lumotlar haqqoniyligiga va keltirilgan iqtiboslar to'g'riligiga mualliflar shaxsan javobgardirlar.

MUNDARIJA | ОГЛАВЛЕНИЕ | TABLE OF CONTENTS

Rasulov Akbarali Maxamatovich, Ibroximov Nodirbek Ikromjonovich, To'xtasinov Azamat G'ofurovich, NOYOB MIS METALL KLASTERLARINING GEOMETRIK TUZILISHINI KOMPYUTER EKSPERIMENTI ORQALI TADQIQ ETISH	7-11
Далиев Бахтиёр Сирожидинович, Решение уравнения Абеля методом оптимальных квадратурных формул	12-15
Saidov Mansurjon Inomjonovich, Tartiblangan statistikalarda baholarni topish usullari	16-21
Kayumov Ahror Muminjonovich, TRIKOTAJ TO'QIMASI TARKIBIDAGI IP XUSUSIYATLARI VA DEFORMATSIYAGA TA'SIRI	22-27
Muradov Farrux Abdukaxarovich, Kucharov Olimjon Ruzimurotovich, Narzullayeva Nigora Ulugbekovna, Eshboyeva Nodira Faxriddinovna, GAZLI ARALASHMALAR VA ZARARLI MODDALARNING ATMOSFERADA TARQALISHI MASALASINI YUQORI TARTIBLI APPROKSIMATSIYANI QO'LLAGAN HOLDA UNI SONLI YECHISH ALGORITMI	28-37
Maniyozov Oybek Azatboyevich, NAVIER-STOKES TENGLAMASINI KLASSIK HAMDA KLASSIK BO'LMAGAN YECHIMLARINI VA UNING O'ZIGA XOSLIGI	38-44
Tillavoldiyev Azizbek Otobek o'g'li, Tibbiy tasvirlarda reprezentativ psevdoobyektlarni segmentatsiyalash algoritmi	45-51
Fayziev Shavkat Ismatovich, Karimov Sherzod Sobirjonovich, Muxtarov Alisher Muxtorovich, DDoS hujumlarni aniqlashda neyron tarmoqlarga asoslangan gibrid modellarni ishlab chiqish	52-58
Rasulmuxamedov Maxamadaziz Maxamadaminovich, Shukurova Shohsanam Bahridin qizi, Mirzaeva Zamira Maxamadazizovna, MURAKKAB SHAKLLI, HAJMLI JISMLARNING ELASTOPLASTIK DEFORMATSIYASINING MATEMATIK MODELLARINI QURISH	59-63
Uzakov B.M., Melikuziyev M.R., TARELKALI TURDAGI REKTIFIKATSIYA KOLONNANING HARORAT KO'RSATKICHLARINI MOSLASHUVCHAN BOSHQARISH	64-72
Порубай Оксана Витальевна, Эволюционные алгоритмы в задачах оптимизации режимов работы региональных энергосистем	73-77
Musayev Xurshid Sharifjonovich, TRIKOTAJ TO'QIMA TASVIRLARINI ANIQLASH VA RAQAMLI ISHLOV BERISH USULLARI	78-81
Нурдинова Разияхон Абдихаликовна, ПОЛУПРОВОДНИКИ КАК МАТЕРИАЛЫ ДЛЯ ИЗГОТОВЛЕНИЯ ТЕРМОГЕНЕРАТОРОВ В МЕДИЦИНЕ	82-85
Мовлонов Пахловон Ибрагимович, ДЕГРАДАЦИЯ СЭ ПОД ДЕЙСТВИЕМ ИЗЛУЧЕНИЯ ВИДИМОЙ ОБЛАСТИ СПЕКТРА И ИОНИЗИРУЮЩЕЙ РАДИАЦИИ	86-90
Севинов Жасур Усманович, Темербекова Барнохон Маратовна, Мамазаров Улугбек Бахтиёр угли, Бекимбетов Баходир Маратович, Синтез методов цифровой регистрации в системах сбора и обработки измерительной информации для обеспечения достоверности в информационно-управляющих системах	91-96
O.S.Rayimdjonova, ISSIQLIK VA OPTOELEKTRON O'ZGARTIRGICHLARNING ASOSIY TAVSIFLARI VA UMUMIY MASALALARI	97-100
Muradov Farrux Abdukaxarovich, Narzullayeva Nigora Ulugbekovna, Kucharov Olimjon Ruzimurotovich, Eshboyeva Nodira Faxriddinovna, ATMOSFERANING CHEGARAVIY QATLAMIDA GAZLI ARALASHMALAR VA ZARARLI MODDALARNING TARQALISHI MASALASINI O'ZGARUVCHILARNI ALMASHTIRISH USULI YORDAMIDA IFODALASH VA UNING SONLI YECHISH ALGORITMI	101-107
Акбаров Давлатали Егиталиевич, Акбаров Умматали Йигиталиевич, Кучкоров Мавзуржон Хурсанбоевич, Умаров Шухратжон Азизжонович, РАЗРАБОТКА АЛГОРИТМА СИММЕТРИЧНОГО БЛОЧНОГО ШИФРОВАНИЯ НА ОСНОВЕ СЕТИ ФЕЙСТЕЛЯ ПО КРИПТОСТОЙКИМИ БАЗОВЫМИ ТАБЛИЧНЫМ ПРЕОБРАЗОВАНИЯМИ	108-113
Xolmatov Abrorjon Alisher o'g'li, Xoshimov Baxodirjon Muminjonovich, MAZUTNI REKTIFIKATSIYALASH QURILMALARINING VAKUUM YARATISH TIZIMINI TAKOMILLASHTIRISH	114-125
Goipova Xumora Qobiljon qizi, Dasturiy ta'minotdagi xatolarni avtomatik topish va tuzatish uchun o'qitiladigan algoritmlar	126-129
Xudoykulov Z.T., Xudoynazarov U.U., YETARLI GOMOMORFIK SHIFRLASH ALGORITMLARI YORDAMIDA AXBOROTNI KRIPTOGRAFIK HIMOYALASH	130-135
Калашников Виталий Алексеевич, ОБОСНОВАНИЕ НЕОБХОДИМОСТИ СОЗДАНИЯ СПЕЦИАЛЬНОГО АГРЕГАТА ДЛЯ ПОСЕВА СЕМЯН ПШЕНИЦЫ В МЕЖДУРЯДЬЯ ХЛОПЧАТНИКА И ОПРЕДЕЛЕНИЕ ОСНОВНЫХ ПАРАМЕТРОВ ШАРНИРНО-ПОЛОЗОВИДНОГО СОШНИКА	136-143
Ermatova Zarina Qaxramonovna, To'qimachilik sanoatida Linter qurilmalarining ahamiyatini o'rganish va kuzatish	144-146
Tolipov Nodirjon Isaqovich, Madibragimova Iroda Mukhamedovna, ON A NON-CORRECT PROBLEM FOR A BIHARMONIC EQUATION IN A SEMICIRCLE	147-151
Xudoykulov Zarif Turakulovich, Qozoqova To'xtajon Qaxramon qizi, PRESENT YENGIL VAZNLI KRIPTOGRAFIK ALGORITMINING TAHLILI	152-157
D.S.Yaxshibayev, A.H.Usmonov, Yer osti sizot suvlari sathi o'zgarishini matematik modellashtirish va sonli tadbiq qilish	158-162

MUNDARIJA | ОГЛАВЛЕНИЕ | TABLE OF CONTENTS

Tojimatov Dostonbek Xomidjon o'g'li, KIBERRAZVEDKA AMALIYOTIDA IOC, LOG VA DARK WEB MONITORING MA'LUMOTLARINING INTELLEKTUAL INTEGRATSIYASIGA ASOSLANGAN KIBERTAHDIDLARNI ERTA ANIQLASH MODELI	163-167
Mirzayev Jamshid Boymurodovich, MATNLI MA'LUMOTLARNI YASHIRIN UZATISHDA STEGANOGRAFIK USULLARDAN FOYDALANISH	168-172
Kabildjanov Aleksandr Sabitovich, Pulatov G'iyos Gofurjonovich, Pulatova Gulxayo Azamjon qizi, LSTM MODELIDA ASOSIDA OB-HAVO SHAROITLARINING YURAK-QON BOSIMI KASALLIKLARIGA TA'SIRINI BASHORATLASH	173-177
Erejevov Keulimjay Kaymatdinovich, SHAXSNI OVOZI ORQALI IDENTIFIKATSIYALASH ALGORITMLARI	178-183
Muxtarov Ya., Obilov H., OPERATOR USULI YORDAMIDA O'ZGARMAS KOEFFITSIENTLI CHIZIQLI DIFFERENSIAL TENGLAMALAR SISTEMASINI INTEGRALLASH	184-188
Tillaboev Muxiddinjon, PILLANI NAMLIGINI O'LCHISHNING OPTOELEKTRON QURILMASI	189-192
Atajonova Saidakhon Boratalievna, Khasanova Makhinur Yuldashbayevna, INTEGRATION OF HYBRID SYSTEM ANALYSIS METHODS TO IMPROVE DECISION-MAKING EFFICIENCY	193-196
Зулунув Равшанбек Мамагович, ТЕХНОЛОГИИ ROBOTIC PROCESS AUTOMATION В МЕДИЦИНЕ	197-200
Aliyev Ibratjon Xatamovich, Bilolov Inomjon Uktamovich, CREATING A MODEL OF THE FALL OF SOLAR ENERGY IN CERTAIN COORDINATES	201-204
Akbarov Xatam Ulmasaliyevich, Ergashev Dilshodbek Mamasidiqovich, RDB TOKARLIK DASTGOHIDA ISHLOV BERISH JARAYONINING MATEMATIK MODELINI YARATISH	205-209
Абдуллаев Темурбек Маруфжонович, Козлов Александр Павлович, Разработка интеллектуальной системы управления освещением на основе IoT - технологий	210-219
O'rinboevyev Johongir Kalbay o'g'li, Nugmanova Mavluda Avaz qizi, KLASSTERLASH USULLARI YORDAMIDA NUTQNI AVTOMATIK SEGMENTATSIYALASH	220-225
Dalibekov Lochinbek Rustambekovich, 5G TARMOQLARIDA MASSIVE MIMO TEXNOLOGIYASINI JORIY ETISHNING TAHLILI	226-232
Bozarov Baxromjon Ilxomovich, Fure almashtirishlarini taqribiy hisoblash uchun optimal kvadratur formulalar	233-235
Xusanova Moxira Qurbonaliyevna, TARMOQ QURILMALARIDA DEMILITARIZATSIYALANGAN ZONA (DMZ) NI SOZLASH ORQALI XAVFSIZLIKNI TA'MINLASH	236-239
Ravshan Indiaminov, Sulton Khakberdiyev, INTERACTION BETWEEN MAGNETIC FIELDS AND THIN SHELLS	240-244
Muradov Muhammad Murod o'g'li, Mobil aloqa tayanch stansiyalarini qayta tiklanuvchan energiya ta'minot manbalaridan foydalangan holda energiya bilan ta'minlash xususiyatlari	245-250
Kabildjanov Aleksandr Sabitovich, Pulatov G'iyos Gofurjonovich, Pulatova Gulxayo Azamjon qizi, OB-HAVO SHAROITLARINING YURAK QON BOSIMI KASALLIKLARIGA TA'SIRINI MLP MODELIDA OPTIMALLASHTIRISH	251-255
Okhunov Dilshod Mamatjonovich, Okhunov Mamatjon Xamidovich, Azizov IskandarAbdusalim ugli, Ismoilzhonov Abdullokh Farrukhbk ugli, THE USE OF BIG DATA IN THE DIGITAL ECONOMY	256-260
Abduraimov Dostonbek Egamnazar o'g'li, ELASTIKLIK NAZARIYASI MASALASIGA LIBMAN TIPIDAGI ITERATSION USULNI QO'LLASHNING MATEMATIK MODELIDA	261-266
Мамадалиев Фозилжон Абдуллаевич, Новый подход составления математической модели для определения параметров торможения автомобиля в экстремальных условиях эксплуатации	267-269
Nasriddinov Otadavlat Usubjonovich, FIZIK MASALALARNI MATEMATIK PAKETLAR YORDAMIDA MODELASHTIRISH	270-272
Jo'rayev Mansurbek Mirkomilovich, Ro'zaliyev Abdumalikjon Vahobjon o'g'li, AVTOMATLASHTIRILGAN MONITORING TIZIMI SIMSIZ SENSOR TARMOG'IDA MA'LUMOTLARNI UZATISH	273-278
Shamsiyeva Xabiba Gafurovna, VIDEO MA'LUMOTLARGA ISHLOV BERISH VA KOMPYUTERLI KO'RISH ALGORITMLARINING APPARAT DASTURIY MAJMUI	279-284
Atajonov Muhiddin Odiljonovich, AVTONOM FOTOELEKTRIK MODULNI MODELASHTIRISH	285-288
J.M. Kurbanov, S.S.Sabirov, J.J.Kurbonov, NANOKATALIZATOR OLIH TEXNOLOGIYASIDA "NAVBAHOR" BENTONITINI QURITISH VA KUYDIRISH JARAYONLARINING TERMOGRAVIMETRIK TAHLILI	289-293
Umarov Shukhratjon, Rakhmonov Ozodbek, ASSESSMENT OF THE LEVEL OF SECURITY AVAILABLE IN 4G AND 5G MOBILE COMMUNICATION NETWORKS	294-297
Soliyev Bahromjon Nabijonovich, Elektron tijorat savdolarini dasturiy yondashuvi tahlilida metodlar, matematik model va amaliy ko'rsatkichlar	298-302
Asrayev Muhammadmullo Abdullajon o'g'li, SINFLAR ORASIDAGI MASOFA, QAROR QABUL QILISH QOIDASI VA AJRATISH FUNKSIYASI	303-305

MUNDARIJA | ОГЛАВЛЕНИЕ | TABLE OF CONTENTS

Polvonov Baxtiyor Zaylobidinovich, Khudoyberdieva Muxayyoxon Zoirjon qizi, Abdubannabov Mo'ydinjon Iqboljon o'g'li, Ergasheva Gulruksor Qobiljon qizi, Tohirjonova Zahro Shovkatjon qizi, Mamasodiqov Shohjahon, CHARACTERIZATION OF PHOTOLUMINESCENCE SPECTRUM OF CHALCOGENIDE CADMIUM-BASED SEMICONDUCTOR POLYCRYSTALLINE FILMS	306-315
Sharibayev Nosirjon Yusupjanovich, Musayev Xurshid Sharifjonovich, TRIKOTAJ TO'QIMALARINI REAL VAQT REJIMIDA ANIQLANGAN NUQSONLARNI TAHLIL QILISH	316-320
Эргашев Отабек Мирзапулатович, Асомиддинов Бекзод, СОЗДАНИЕ ПРОГРАММНЫХ МОДУЛЕЙ ДЛЯ РЕШЕНИЯ ФУНКЦИОНАЛЬНЫХ ЗАДАЧ ИНФОРМАЦИОННЫХ СИСТЕМ	321-326
Djurayev Sherzod Sobirjonovich, Ermatova Zarina Qaxramonovna, YANGI KONSTRUKSIYADAGI MULTISIKLON QURILMASINING ENERGIYA SAMARADORLIGINI TAHLIL QILISH	327-331
J.M. Kurbanov, S.S.Sabirov, J.J.Kurbonov, "NAVBAHOR" BENTONITINING MODIFIKATSIYALANGAN NAMUNASINI O'YUCH EMMda QIZDIRISH HARORATIGA QARAB TEKSTURA XUSUSIYATLARINING O'ZGARISHI	332-337
Sharibayev Nosirjon Yusubjanovich, Kayumov Ahror Muminjonovich, SINOV YORDAMIDA TRIKOTAJ MAXSULOTLARINI SHAKL SAQLASH VA DEFORMATSIYALANISH JARAYONLARINI MONITORINGI	338-343
Muminov Kamolkhon Ziyodjon o'g'li, Artificial Intelligence in Cybersecurity, Revolutionizing Threat Detection and Response Systems	344-347
Тажибаев Илхом Бахтиёрович, ОБРАБОТКА МНОГОКАНАЛЬНЫХ СИГНАЛОВ В РАДИОЧАСТОТНЫХ И ОПТИЧЕСКИХ СИСТЕМАХ	348-351
Karimov Sardor Ilhom ugli, Sotvoldiyeva Dildora Botirjon qizi, Karimova Barnokhon Ibrahimjon qizi, COMPARISON OF MULTISERVICE REMOTE SENSING DATA FOR VEGETATION INDEX ANALYSIS	352-354
Abdurasulova Dilnoza Botirali kizi, PNEUMATIC AND HYDRAULIC TECHNICAL TOOLS OF AUTOMATION	355-359
Абдукадиров Бахтиёр Абдувахитович, СПОСОБЫ НАСТРОЙКИ ВЕСОВ ДЛЯ СНИЖЕНИЯ ПОТЕРЬ ПРИ ОБУЧЕНИИ ДАННЫХ В НЕЙРОННЫХ СЕТЯХ	360-365
Turakulov Otabek Xolmirzayevich, Mamaraufov Odil Abdixamitovich, IJTIMOYI TARMOQLARDA ELEKTRON MATNLI MA'LUMOTLARNI TASNIFLASHNING NEYRON-NORAVSHAN ALGORITMI	366-370
Asrayev Muhammadmullo Abdullajon og'li, Muxtoriddinov Muhammadyusuf Temirxon o'g'li, REGIONS APPLICATIONS SYSTEMS RECOGNITION	371-373
Raximov Baxtiyor Nematovich, Yo'ldosheva Dilfuza Shokir qizi, Majmuaviy markazlashtirilgan tizimlarning arxitekturasi va funksiyalari	374-378
Нурилло Мамадалиев Азизиллоевич, Моделирование конфликтных ситуаций телевизионных изображений в процессе обработки видеoinформации	379-381
A.A. Otaxonov, ОБНАРУЖЕНИЕ И ОЦЕНКА ФИШИНГОВЫХ URL-АДРЕСОВ С ИСПОЛЬЗОВАНИЕМ АЛГОРИТМОВ МАШИННОГО ОБУЧЕНИЯ	382-390
Akbarov Xatam Ulmasaliyevich, Ergashev Dilshodbek Mamasodiqovich, X12M MARKALI PO'LAT UCHUN TERMOSIKLLI ISHLOV BERISHNI AMALGA OSHIRISH PARAMETRLARI	391-396
Abdukodirov Abduvaxit Gapirovich, Abdukadirov Baxtiyor Abduvaxitovich, YUZ TASVIRLARINI GEOMETRIK NORMALLASHTIRISH ALGORITMINI ISHLAB CHIQISH	397-401
D.B.Abdurasulova, T.U.Abduhafizov, RAQAMLI IQTISODIYOTNING O'SISHI VA UNING TADBIRKORLIK FAOLIYATIGA TA'SIRI	402-405
Ibragimov Navro'zbek Kimsanbayevich, Hududiy oliy ta'lim muassasalarida raqobat ustunligini ta'minlashning diagnostik tahlil qilish uchun dasturiy ta'minot	406-413
Melikuziyev Azimjon Latifjon ugli, USING COMPUTER-SIMULATOR PROGRAMS IN TEACHING PARALINGUISTIC UNITS	414-417
Soliev B.N., Ismoilova M.R., ELEKTRON TIJORATDA QAYTARILISHLARNI OPTIMALLASHTIRISH VA ULARNING NATIJALARI	418-421
Ergashev Otabek Mirzapulatovich, FUZZY RULE BASE DESIGN FOR NUMERICAL DATA ANALYSIS	422-428
Abdukadirova Gulbahor Xomidjon qizi, Abduqodirova Mohizoda Ilxomidin qizi, YUZ TASVIRLARIGA DASTLABKI ISHLOV BERISHDA NEYRON TARMOQ ALGORITMLARINI QO'LLASH SAMARADORLIGI	429-436
Садикова Мунира Алишеровна, ТРАНСФОРМАЦИЯ УПРАВЛЕНИЯ В ЦИФРОВУЮ ЭПОХУ	437-444
Pulatov Sherzod Utkurovich, Djumaniyazov Otabek Baxtiyarovich, THE ROLE OF IoT TECHNOLOGIES IN MONITORING THE ENVIRONMENTAL IMPACT OF INDUSTRIAL ENTERPRISES IN THE KHOREZM REGION	445-448
Mukhammadyunus Norinov, RESEARCH ON INCREASING THE BRIGHTNESS OF TELEVISION IMAGES	449-455
Arabboyev Alisher Avazbek o'g'li, DIFFIE-HELLMAN ALGORITMI VA XAVFSIZ KALIT ALMASHISH PROTOKOLLARI	456-458
Raximov Baxtiyor Nematovich, G'oiyova Xumora Qobiljon qizi, Ovoz tovushlari intellektual taxlili asosida videokuzatuz tizimini boshqarish	459-462

THE ROLE OF IoT TECHNOLOGIES IN MONITORING THE ENVIRONMENTAL IMPACT OF INDUSTRIAL ENTERPRISES IN THE KHOREZM REGION

Pulatov Sherzod Utkurovich,

Candidate of Technical Sciences, Associate Professor
Tashkent University of Information Technologies
named after Muhammad al-Khwarizmi
e-mail: shpulatov@mail.ru

Djumaniyazov Otabek Baxtiyarovich,

doctoral student
Tashkent University of Information Technologies
named after Muhammad al-Khwarizmi
e-mail: djumaniyazovotabek558@gmail.com

Abstract. In this article, we examined the use of wireless sensors and IoT (Internet of Things) technologies to monitor various industrial enterprises that emit harmful substances into the atmosphere and ambient air in the Khorezm region. Many industrial enterprises are located far from urban areas, and their negative impact on the environment in rural areas was studied.

Keywords: sensor, IoT, air, control

Introduction. Among the increasingly modern developing countries of the world, controlling harmful substances and various pollutants emitted into the atmosphere and ambient air is one of the problematic situations facing each country. Currently, improving the weather on Earth and maintaining it in one mode is considered very difficult. Because in developed countries, the contribution of industrial enterprises to the prosperity of the state is very high. Therefore, the economy of developed countries depends on many large industrial enterprises, and the construction of large industrial enterprises is rapidly underway. As a result, the ecological threat to the population and the biosphere of the whole world is increasing. Controlling this growing ecological threat, preventing it or reducing the level of danger is one of the urgent problems. In our article, a number of proposals have been developed to control the harmful substances emitted into the atmosphere and environment by industrial enterprises located in rural areas, using the Internet of Things and wireless sensors mentioned above, which have a negative impact on the ecology, atmosphere and ambient air. Several scientific studies are being conducted by world scientists in this regard. Because this is one of the problems that needs to be

seriously considered today. Most of the pollutants emitted into the atmosphere and environment by industrial enterprises in the Khorezm region are dust generated by oil and oil plants, flour factories, automobile factories, cotton factories, brick factories and construction processes. The types of substances emitted from them are as follows. SO₂, NO₂, O₂, PM_{2.5}, PM₁₀, PM_{1.0}, CO and CO₂. These harmful substances are the main harmful substances polluting the air on Earth. Some of these pollutants can persist for many years and migrate across large areas of soil before reaching water resources, where they can pose ecological or human health threats [1].

Literature review and methodology. Many developed countries have developed a number of measures to significantly reduce the levels of harmful substances and air pollution in the environment, atmosphere and ambient air, and as a result, many positive results have been achieved. In the USA [2], Europe [3] and China [4-6], due to a number of regulations related to ambient air, improvements in modern technologies and the transition to cleaner fuels, some reductions in the impact of some particulate matter on air quality have been achieved. For example, significant reductions in SO₂ emissions have been



observed. SO₂ concentrations were very low in large parts of Europe [7]. Some underdeveloped regions of Kazakhstan continue to suffer from high levels of air pollution due to weak environmental regulations for the metallurgical industry and coal-fired power plants. Modern emission control technologies that require and provide local application methods are not available. [8] Over the past decade, the Chinese central government has made several changes and amendments to prevent frequent manipulation of data. [9] At the same time, several national reforms have been implemented in the field of environmental air monitoring and monitoring [10]. However, in recent years, many cases of falsification of data by environmental air monitoring stations have been exposed. [11]. In Khorezm region, environmental, atmospheric and environmental pollutants are emitted into the air by vehicles in urban centers, as well as by factories and enterprises located in rural areas. If we implement these controls with the widespread use of wireless sensors and IoT technologies, we can gain a number of advantages. We will present the permissible limit values of air pollutants emitted into the atmosphere and ambient air based on literature data. The permissible limit values of harmful substances in the air, mg/m³, are listed in Table 1. The indicators shown in this table limit the amount of waste emissions from industrial enterprises so that the amount of harmful substances in populated areas does not exceed the RECHM. Its procedure and rules are set in GOST-17.2.3.03-78 and are calculated taking into account such data as air pollution from other sources, the height of exhaust stacks, wind direction and the speed of their mixing in the air, and the amount of harmful deposits deposited from it during the day. [12].

Construction work is developing rapidly in various parts of the world. Today, construction work is also increasing significantly in our country. However, the negative impact on ecology and the environment is also high. Pollution from various types of recyclable and non-recyclable household waste generated during the construction process is mainly related to construction materials and construction waste, improper management of the construction site,

improper disposal of waste, land damage and soil erosion, etc. The problems of atmospheric and ambient air pollution during the construction process mainly include dust. [13].

Results. Work has begun on the identification of various harmful substances emitted using devices consisting of wireless sensors in the ecology of the Khorezm region and the detection of harmful substances in the ambient air, and results have been obtained on some of them. The information on these results is given based on the characteristics of the wireless sensors used. For example, the measurement range: O₂-0 to 25 ppm, CO-0 to 10,000 ppm, CO₂-0 to 50 vol.%, NO-0 to 4,000 ppm, NO₂-0 to 500 ppm, SO₂-0 to 5,000 ppm. The program determines the values on the LCD screen and stores them in the memory block. The program code was written for the Arduino microcontroller to display the values on the LCD screen and store them in the memory block. If the limit is exceeded, it will inform about the name and value of the gas separately for each gas and the words "The specified limit has been exceeded!" If it is within the limit, it will display only the name and value of the gas on the LCD screen. The algorithm for this is shown in Figure 1.

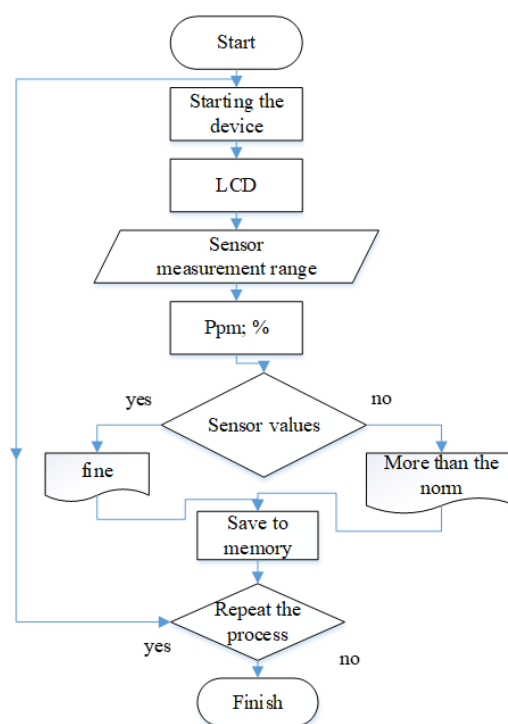


Figure 1. Algorithm for sensor detection range.



If we focus on the general structure of wireless sensors in our research work, we can divide the wireless sensor into 4 main parts. They are the sensing system, the digital output circuit, the wireless communication system, and the power supply system. Each part performs its own function. The first part, the sensing part, performs the functions of sensors that detect various harmful gases, adjusts analog signals, and converts analog and digital signals. The digital output system transmits the signals from the sensing system and the wireless communication system to both devices in the form of digital signals according to their characteristics. The wireless communication system serves to establish communication with the second device and transmit the received data. The power supply system serves to provide the aforementioned systems with electricity. These can be local electricity, various types of storage batteries, and solar panels. Figure 2.

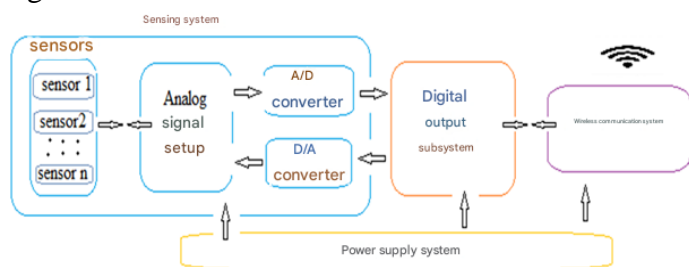


Figure 2. General structure of a wireless sensor.

In recent years, wireless sensors have continued to innovate and improve their performance. This includes the detection of various gases, smart lighting, a number of smart sensors used in smart homes, waste identification and management, etc. [14]. In our scientific research, it was observed that mobile communication base stations also release harmful substances into the atmosphere. The reason for this is that when local electricity is disconnected from the base station, diesel generators located at the station start up and carbon dioxide gas is released. [15-18].

Conclusion. Based on the above-analyzed articles and our scientific research, it can be said that preserving and protecting ecologically clean areas in all regions of the world is a huge task facing every society and humanity. To solve these urgent problems,

it is necessary to find solutions using modern information technologies. Because, nowadays, there are many wireless smart sensors and data transmission technologies based on the Internet of Things, and scientists around the world are widely using them in life. There are several achievements in monitoring ambient air. This creates opportunities for monitoring human health and air quality in the biosphere, including monitoring atmospheric air in various conditions.

References.

1. Djumaniyazov O.B, “Avtotransport vositalari va sanoat korxonalarining atmosferaga ta’siri”, Avtomatlashtirish tizimlari va yashil energetika muammolari: ishlab chiqarishda, fan va ta’limda respublika ilmiy -amaliy anjumani, Qarshi-2024. 313-bet.
2. United States Environmental Protection Agency. Air Pollutant Emissions Trends Data. Available online: <https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data>
3. European Environment Agency Sulphur Dioxide (SO₂) Emissions — European Environment Agency. Available online: <https://www.eea.europa.eu/data-and-maps/indicators/eea-32-sulphur-dioxide-so2-emissions-1>
4. Wang, Z.; Zheng, F.; Zhang, W.; Wang, S. Analysis of China-based changes in SO₂ pollution in the Beijing-Tianjin-Hebei region. OMI observations from 2006 to 2017. Adv. Meteorol. 2018, 2018, 8746068Chjao, P.; Tuygun, GT; Li, B.; Liu, J.; Yuan, L.; Luo, Y.; Syao, X.; Zhou, Y.
5. Impact of environmental regulations on air quality: Analysis of long-term trend of SO₂ and NO₂ in the largest urban agglomeration in southwest China. Atmos. Pollution. Res. 2019, 10, 2030–2039.
6. Lin, W.; Xu, X.; Ma, Z.; Zhao, X.; Liu, X.; Wang, Y. Characteristics and recent trends of sulfur dioxide in urban, rural and background areas in North China: effectiveness of control measures. J. Environ. Sci. 2012, 24, 34–49
7. Guerreiro, C.B.B.; Foltescu, V.; de Leeuw, F. State and trends of air quality in Europe. Atmos. Environ. 2014, 98, 376–384.
8. Daulet Assanov, Valeryi Zapasniy, Aiyngul Kerimray. Air Quality and Industrial Emissions in the Cities of Kazakhstan, Atmosphere 2021, 28 February



- 2021, 12(3), 314;
<https://doi.org/10.3390/atmos12030314>
9. Brombal, D. Accuracy of environmental monitoring in China: Exploring the influence of institutional, political and ideological factors. *Sustainability* 2017, 9, 324
10. Lo, K. How Authoritarian Is the Environmental Governance of China? *Environ. Sci. Policy* 2015, 54, 152–159.
11. Duan, H.; Yue, W.; Li, W. Reliability Assessment of PM_{2.5} Concentration Monitoring Data: A Case Study of China. *Atmosphere* 2024, 15, 1303. <https://doi.org/10.3390/atmos15111303>
12. Komiljonov K, Zarifov H, Aslonova M "SANOATLASHGAN HUDUDLARDAGI KORXONALARNING ATROF MUHITGA KO'RSATADIGAN ZARARLI TA'SIRLARINI TAHLIL QILISH" *Vetenariya Tibbiyoti Va Chorvachilik Blyuteni* 2022 yil. 58-63 b.
13. Wenkui Sun, Research on strategies of air pollution prevention and control in civil Engineering projects *Journal of Physics Conference Series* July 2024 2798(1):012008 DOI:10.1088/1742-6596/2798/1/012008
14. Rao, P. R.; Srinivas, S.; Ramesh, E. A report on the design of wireless sensor networks for IoT applications. *Int. J. Eng. Adv. Technol.* 2019, 8, 2005–2009.
15. Karimovich, M. O., MM, K. M., & Djumaniyozov, O. B. (2022). XORAZM VILOYATI MISOLIDA MOBIL ALOQA TAYANCH STANSIYALARI BARQAROR ENERGIYA MANBALARINING TAHLILI. *Komputer texnologiyalari*, 1(10).
16. U. K. Matyokubov, M. M. Muradov and O. B. Djumaniyozov, "Analysis of Sustainable Energy Sources of Mobile Communication Base Stations in the Case of Khorazm Region," 2022 International Conference on Information Science and Communications Technologies (ICISCT), Tashkent, Uzbekistan, 2022, pp. 1-4, doi: 10.1109/ICISCT55600.2022.10146885.
17. Ismailov Sh.K, Djumaniyozov O.B, Nurtolada optik yo'qotish mexanizmlari // Hozirgi sharoitda yuqori malakali kadrlarni tayyorlashda o'qitishning zamonaviy tizimlari va texnologiyalarini qo'llash masalalari respublika ilmiy-amaliy anjumani Urganch-2021. 18-20 b.
18. Collier-Oxandale, A., Casey, JG, Piedrahita, R., Ortega, J., Halliday, H., Johnston, J., & Hannigan, MP (2018). Menilai system quantifikasi sensor methane berbiaya rendah untuk untuk di lingkungan di lingkungan rural dan urban yang complex. *Teknik Pengukuran Atmosphere*, 11 (6), 3569–3594. <https://doi.org/10.5194/amt-11-3569-2018>.

