

JOURNAL OF TRANSPORT



ISSUE 2, 2025 vol. 2

E-ISSN: 2181-2438

ISSN: 3060-5164



RESEARCH, INNOVATION, RESULTS



**TOSHKENT DAVLAT
TRANSPORT UNIVERSITETI**

Tashkent state
transport university



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E-ISSN: 2181-2438

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VOLUME 2, ISSUE 2

JUNE, 2025



jot.tstu.uz

TASHKENT STATE TRANSPORT UNIVERSITY

JOURNAL OF TRANSPORT

SCIENTIFIC-TECHNICAL AND SCIENTIFIC INNOVATION JOURNAL

VOLUME 2, ISSUE 2 JUNE, 2025

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Articles are published in Uzbek, Russian, and English, ensuring a wide-reaching audience and fostering cross-cultural academic exchange. As a beacon of academic excellence, the "Journal of Transport" continues to serve as a vital conduit for knowledge dissemination, collaboration, and innovation in the transport sector and related fields.

Experimental program and methods for developing and improving systems and tools to forecast and monitor emergency situations in railway infrastructure

Kh.K. Zukhridinov¹^a

¹Tashkent state transport university, Tashkent, Uzbekistan

Abstract: This article examines the experimental program and methods for developing and improving systems and tools for predicting and monitoring emergencies in railway structures. Based on the content and essence of the research objectives, an experimental research program was developed. Experimental studies were conducted to confirm the technical effectiveness of the theoretical research results, including the system for forecasting and monitoring the impact of emergencies on railway structures, and the physical and mathematical model for warning about emergency impact indicators.

Keywords: experimental research program, improvement, software, physical and mathematical model, Angren-Pop 2, ShNQ

Temir yo‘l inshootlarida favqulodda vaziyatlarni bashorat va monitoring qilish tizimlari va vositalarini ishlab chiqish va takomillashtirish bo‘yicha tajriba dasturi hamda usullari

Zuxridinov X.Q.¹^a

¹Toshkent davlat transport universiteti, Toshkent, O‘zbekiston

Annotatsiya: Ushbu maqolada temir yo‘l inshootlarida favqulodda vaziyatlarni bashorat va monitoring qilish tizimlari va vositalarini ishlab chiqish va takomillashtirish bo‘yicha tajriba dasturi hamda usullari ko‘rib chiqilgan. Tadqiqot vazifalarining mazmuni va mohiyatidan kelib chiqqan holda temir yo‘l inshootlariga favqulodda vaziyatlar ta‘siridan bashorat va monitoring qilish tizimini, favqulodda vaziyatlarning ta‘siri etish ko‘rsatkichlaridan ogohlatirishning fizik va matematik modelining nazariy tadqiqotlar natijalari texnik samaradorligini tajribada tasdiqlash yuzasidan tajriba tadqiqotlari o‘tkazilib tajriba tadqiqotlar dasturi ishlab chiqilgan.

Kalit so‘zlar: tajriba tadqiqotlar dasturi, takomillashtirish, dasturiy ta‘minot, fizik va matematik model, Angren-Pop 2, ShNQ

1. Kirish

Jahondagi temir yo‘l transporti sohasi mamlakatlarning iqtisodiyotini asosiy transport tizimi tarmog‘i bo‘lib hisoblanadi. Oxirgi yillarga kelib iqtisodiy o‘sish darajasini davlatlararo tovarlarning ayirboshlash ko‘lami temir yo‘l transportiga bo‘lgan ehtiyoj va talabning yanada o‘sib borishiga olib kelmoqda. Temir yo‘l transportida tashish jarayonini tashkil etish va poyezdlar harakati xavfsizligini ta‘minlashda temir yo‘lning obyektlari va inshootlaridagi doimiy ya‘ni mahalliy monitoring qilish tizimlari dolzarb bo‘lib qolmoqda. Shuning uchun favqulodda vaziyatlarni bashoratlash va monitoring tizimlaridan foydalanib harakatlanuvchi tarkib xavfsizligini ta‘minlash, tog‘li hududlarda joylashgan temir yo‘l inshootlarida favqulodda vaziyatlarni bashorat qilish va monitoring tizimlarini ishlab chiqish bo‘yicha turli davrlarda, mamlakatlarda ko‘pgina olimlar, mutaxassislar tomonidan, temir yo‘l inshootlarini texnik holatini mahalliy monitoring va prognoz qilish, favqulodda vaziyatlar tufayli yuzaga kelishi mumkin

bo‘lgan “zaiflik nuqtalari”ni oldindan bashorat qilish va aniqlash maqsadida, temir yo‘l transporti obyektlarini texnik holatini monitoring va diagnostika qilishni ko‘pgina tizimlari va texnik qurilmalari yaratilgan hamda amaliyotga joriy etilgan.

Dunyoda temir yo‘l transportida favqulodda vaziyatlar oqibatlarini bartaraf etish, xalq xo‘jaligi va temir yo‘l inshootlariga tahdidini oldini olish, yuklar, yo‘lovchi harakatlanuvchi tarkib, temir yo‘l inshootlarining xavfsizligini ta‘minlash qaratilgan ilmiy tadqiqot ishlari olib borilmoqda. Bu borada, jumladan, temir yo‘l transporti infratuzilmasining tog‘ va tog‘oldi hududlarida joylashgan obyektlarida tabiiy tusdagi favquloddagi vaziyatlarning ta‘sirida yuzaga keladigan xavflar ko‘lamini tadqiq etish, risklar ehtimolini baholashning xavfsizlik tahlili tuzilmasi parametrlariga bog‘liqligi bo‘yicha tadqiqotlar ustuvor hisoblanmoqda [2].

Mavzuning dolzarbligi. Tadqiqot vazifalarining mazmuni va mohiyatidan kelib chiqqan holda temir yo‘l inshootlariga favqulodda vaziyatlar ta‘siridan bashorat va monitoring qilish tizimini, favqulodda vaziyatlarning ta‘siri etish ko‘rsatkichlaridan ogohlatirishning fizik va matematik

^a <https://orcid.org/0000-0003-1044-7546>



modelining nazariy tadqiqotlar natijalari texnik samaradorligini tajribada tasdiqlash yuzasidan tajriba tadqiqotlari o'tkazildi [1]. Tajriba tadqiqotlar dasturiga quyidagilar kiritildi:

- temir yo'l inshootlarida favqulodda vaziyatlarni bashorat va monitoring qilish tizimini ishlab chiqishga oid ilmiy tadqiqotlar, ishlanmalar natijalarini tahlilini o'rganish;
- Angren-Pop 2 temir yo'l liniyasi inshootlarining geografik joylashuvlarini o'rganish;
- temir yo'l ko'priklari va viaduk (galereya)larini loyiha qurilish parametrlarini o'rganish (ShNQ 1.04.01-23, ShNQ 2.05.01-23, ShNQ 2.05.03-22, ShNQ 2.05.05-24, ShNQ 2.05.03-12);
- Angren-Pop 2 temir yo'l liniyasi infratuzilmasi obyektlari texnik holatini uzluksiz nazorat qilinishiga oid ekspert baholash (anketa-so'rov) usulini o'tkazish;
- temir yo'l inshootlarida yuzaga keladigan favqulodda vaziyatlarning zarar yetkazish ko'rsatkichlari sabab sodir bo'lish mumkin bo'lgan avariylarni o'rganish;
- temir yo'l inshootlarida yuzaga keladigan favqulodda vaziyatlarning zarar yetkazish ko'rsatkichlari sabab sodir bo'lish mumkin bo'lgan halokatlarini o'rganish;
- temir yo'l inshootlarida favqulodda vaziyatlardan ogohlantirish mahalliy monitoring tizimini fizik modelini ishlab chiqish;
- temir yo'l inshootlarida favqulodda vaziyatlardan ogohlantirish mahalliy monitoring tizimini matematik modelini ishlab chiqish;
- temir yo'l inshootlarida favqulodda vaziyatlardan ogohlantirish mahalliy monitoring tizimini fizik hamda matematik modelini ishlab chiqish va nazariy baholash;
- favqulodda vaziyatlarda bashorat va monitoring qilish tizimining prinsipial sxemasini ishlab chiqish;
- temir yo'l inshootlarida favqulodda vaziyatlardan ogohlantirish mahalliy monitoring qilish tizimini ishlab chiqish;
- amalda foydalaniladigan bashorat va monitoring qilish tizimini namunasini tayyorlash;
- eksperimental bashorat va monitoring qilish tizimini maketi namunasiga ta'sir qiladigan tashqi omillarni o'rganish;
- Angren-Pop 2 temir yo'l liniyasidagi favqulodda vaziyatlarni bashorat qilish tizimining mahalliy monitoring qilish dasturi algoritmning bajarilish ketma-ketligini ishlab chiqish;
- Angren-Pop 2 temir yo'l liniyasidagi favqulodda vaziyatlarni bashorat qilish tizimining mahalliy monitoring qilish dasturining Python 3.9.0 tilida dastur kodini tuzish;
- temir yo'l inshootlariga favqulodda vaziyatlar ta'siridan bashorat va monitoring qilish vositalarini o'rganish;
- taklif etilayotgan bashorat va monitoring qilish texnik qurilmasi samaradorligini baholash natijalari tahlilini o'rganish;
- eksperiment natijalariga ishlov berish.

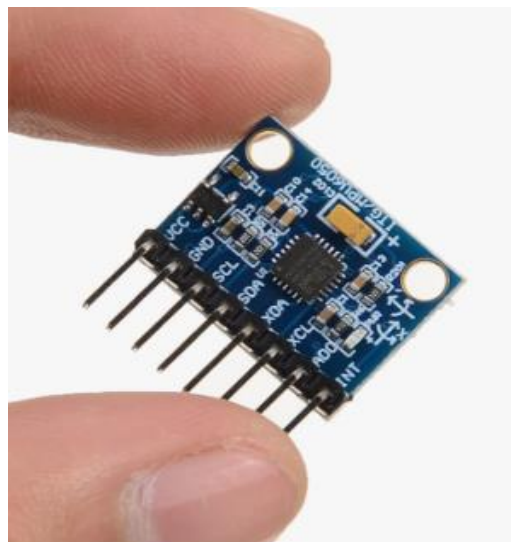
2. Tadqiqot metodologiyasi

Materiallar tahlili

Tajriba tadqiqotlarini o'tkazish usullari va vositalari. Temir yo'l transportiga bo'lgan xavfsizlikni yanada oshirish uchun temir yo'l inshootlarida favqulodda vaziyatlarni o'z vaqtida aniqlash va oldini olishda muhim chora tadbirlarini ko'rish kerak [3]. Buning uchun

favqulodda vaziyatlarni bashorat va monitoring qilish tizimining modelini yaratish juda muhim hisoblanadi. Temir yo'l inshootlarida favqulodda vaziyatlarni bashorat va monitoring qilish tizimining tajriba tadqiqotlarini o'tkazish vositalarini ko'rib chiqadigan bo'lsak bular quyidagi qurilmalardan tashkil topgan (1-jadvalga qarang):

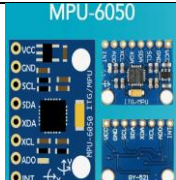
MPU 6050 tipidagi sensorli qurilma uch o'lchovli [4] harakatlarni hisoblaydigan sensor bo'lib bu arzon narxlardagi qurilma hisoblanadi. Bu qurilma smartfonlar, planshetlar, dronlarda va robototexnika sohalarida foydalaniladi [7]. Bu qurilma bir vaqtning o'zida X, Y va Z o'qlaridagi harakatlarni aniqlaydi (1-rasmga qarang).



1-rasm. MPU 6050 uch o'qli sensorning ko'rinishi

Temir yo'l inshootlarida favqulodda vaziyatlarni bashorat qilishda takomillashtirilgan monitoring nazorat qilish vositalari

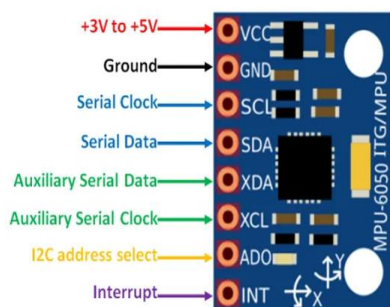
1-jadval

№	Qurilmalar nomi	Qurilmalarni ko'rinishi	Qurilmalarning vazifasi
1	MPU 6050 sensorli datchik		X, Y va Z o'qlaridagi harakatlarni aniqlaydi
2	SIM800L		Mobil telefonga ma'lumotlarni uzatadi
3	NRF24L01 + PA+LNA modul		Taklif etilayotgan texnik qurilmaning ma'lumot uzatish va qabul qilish radio moduli

4	Arduino UNO		Arduino dasturi bilan ulanish uchun Arduino mikrosxemasini
5	USB kabel		Arduino dasturi bilan Arduino mikrosxemasini bog'lovchi USB kabel
6	Ikki tomonlama montaj platasi (5x7)		Qurilmalarni bir-biri bilan ulash uchun montaj platasi
7	Tebranish va zarbani pezoelektrik aniqlash sensori moduli		Harakatni sezuvchi pezoelektrik aniqlash sensori moduli
8	Dupont ulash simlari		Qurilmalarni bir-biri bilan ulash uchun montaj simi
9	4,2 V 10000 mAh 18650 akumulyator batareykasi		Monitoring qilish qurilmasini elektr energiya bilan ta'minlovchi manba

MPU 6050 sensori ulash modul taxtasida (platasida) joylashtiriladi va bu sensorli qurilmaning ishlashi, pinouti, protokoli [6], Arduino platasi bilan ulanish xarakteristikasi quyida ko'rib chiqilgan (2-rasmga qarang).

MPU6050 Module Pinouts



2-rasm. Temir yo'l inshootlarida favqulodda vaziyatlarni bashorat qilishda foydalaniladigan MPU 6050 sensorli qurilmasining kirish va chiqish portlari

3. Xulosa

Maqolaning maqsad va vazifalari mazmun-mohiyatiga oid nazariy tahlil natijalarining aniqligini, taxminlarning ilmiy asoslangan ekanligini va nazariy ma'lumotlarning ishonchliligini tasdiqlash bo'yicha amalga oshiriladigan tajribalar dasturi ishlab chiqildi.

Tajribalar dasturiga kiritilgan tadqiqotlarni o'tkazish usullari va favqulodda vaziyatlarning ta'siri etish ko'rsatkichlaridan ogohlantiruvchi asboblari hamda uskunalarini tanlab olindi, ularning aniqlik darajasi belgilangan meyorlarda bo'lishi ta'minlandi.

Tajriba tadqiqotlari natijalarini yig'ish, saqlash, qayta ishlash va tahlil qilish uchun zarur ko'rinishda jamlash va taqdim etishning kompyuter amaliy dasturlari va elektron ilovalari tanlab olindi hamda ulardan foydalanish orqali tajriba tadqiqotlari ma'lumotlariga ishlov berildi.

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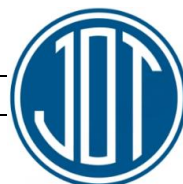
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Mualliflar to'g'risida ma'lumot/ Information about the authors

Zuxridinov
Xayotbek
Kaxramonjon
o'g'li /
Zukhriddinov
Khayotbek

Toshkent davlat transport universiteti
tayanch doktoranti
E-mail: hayotbek6868@mail.ru
Tel.: +998909008141
<https://orcid.org/0000-0003-1044-7546>



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