IMPLEMENTATION OF INTELLECTUAL TRANSPORT SYSTEMS IN UZBEKISTAN

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Abstract: The development of ITT in Uzbekistan has accelerated in recent years within the framework of "Safe City" and digital transport projects. According to the Ministry of Transport, only on the section of the A-373 highway from Tashkent to Andijan, the Road Safety Department has warned drivers in advance about 182 accidents that could lead to an accident over the past two years. At the same time, accident commissioners received real-time accident information from "smart" roads. On October 20, 2025, separate lanes for buses between roads were launched on the roads of Tashkent city under the BRT (Bus Rapid Transit) system. As a result, the speed of buses has doubled.

Keywords: Intelligent transport system, Artificial Intelligence (AI), Internet of Things (IoT), traffic light, RFID (Radio Frequency Identification) communication, feedback loop, ERGS (Route Guidance System) electronic system, ETC (Electronic Toll Collection) electronic toll collection, BRT (Bus Rapid Transit) system.

In our country, in recent years, extensive organizational and practical work has been carried out to improve the road safety system. In particular, by Resolution No. 717 of the Cabinet of Ministers of the Republic of Uzbekistan dated November 29, 2021, a “Special Regime” was introduced to support artificial intelligence (AI) technologies . Its purpose is to test innovative projects in the field of AI (regulatory sandbox), stimulate experimental research and attract investments in this area [1] .

Based on the presidential decree, the implementation of SI technologies in the transport sector is stipulated within the framework of the "Digital Uzbekistan - 2030" strategy. According to it , the Ministry of Innovative Development is entrusted with the task of supporting scientific and technical research and innovations in SI [2].

According to the Ministry of Transport, by 2025 , it is planned to install ITTs at all regulated intersections across the republic and introduce a unified digital management system. This project is aimed at effective traffic management and traffic optimization.

and the Internet of Things (IoT) today , includes several key stages [3] :

1. Early controls (late 19th century - mid -20th century):

The foundation of ITT was laid with automated methods of traffic regulation. The gas traffic light, installed in 1868, is considered one of the first attempts at an "Intelligent System" in the history of IoT . This device, created by John Knight, was designed to reduce the human factor and regulate street traffic. Although it was not connected to the Internet, it used a special mechanism to control an external object (traffic) . Its red and green lights (using gas lamps at night) provided a visual signal to drivers. This was the simplest, visual manifestation of the "data transfer" function in today's IoT systems .

Unfortunately, a month later, a gas leak caused the traffic light to explode. This historic event shows how old the issue of security and reliability , which is still paramount for today's IoT devices, is.

in 1920 by Detroit police officer William Potts, is the foundation of today's Smart City concept. Its significance from an IoT perspective:

• Complicated logic: The transition from a two-color (stop and go only) system to a three-color system was to add a "warning" (yellow light) function to the device. This is similar to the logic of current sensors that signal "danger is approaching."

• The beginning of synchronization: Detroit was the first city to link traffic lights at multiple intersections and control them from a single control panel. This was the first example of devices working as a system .

• Reduced human intervention: Initially operated manually by police officers, these systems were soon switched to automatic timers. This was a period of transition from the "thing" to operating independently according to a set algorithm, without human command.

into IoT traffic lights , which were controlled by computers in the 1950s and today analyze traffic through sensors .

The 1940s and 1950s are considered the birth of one of the most important technologies in the history of IoT - RFID (Radio Frequency Identification) . Without this technology, it is impossible to imagine today's "smart" warehouses, payment cards or product tracking systems in stores .

The "ancestor" of RFID is a spy-related listening device called "The Thing" installed in the US embassy by Soviet inventor Leon Theremin in 1945.

In 1948, the late Harry Stockman, in his paper "Communication by Means of Reflected Power," theoretically proved that it was possible to receive information from devices by sending wireless signals to them.

This foundation, laid in the 1950s, later led to the term "Internet of Things" being coined by Kevin Ashton in 1999, specifically in connection with RFID technology.

In the 1950s , computerized detection systems called pressure plates were first used to control traffic lights. This introduction of computerized control through pressure plates is a practical demonstration of the concept of "feedback loop" in the history of IoT .

The role of this system in the development of IoT is as follows:

• The Age of Sensors: While traffic lights in the 1920s relied solely on time (timers), pressure plates in the 1950s gained the ability to "sense ." A sensor embedded under the pavement detected the weight of a car - the simplest mechanical ancestor of today's "smart" sensors;

• Data-driven decision: When a computer (relay system) receives a signal from a sensor, it decides, "The intersection is busy, the light needs to be changed." This process creates a chain of data collection -> analysis -> action . This is the basis of today's IoT algorithms.

• Industrial automation: It was during this period that control systems began to be connected not only to mechanics, but also to logical electronics (initially simple computers);

Although these systems were effective, they were expensive and difficult to maintain (because the plates were prone to breakage). This led to the development of inductive loops. and paved the way for optical sensors .

2. The period of formation of the system (1960s–1980s):

During this period, technologies for remote control and monitoring of traffic flow developed:

• ERGS (Route Guidance System): In the late 1960s, experiments were conducted in the US on electronic systems that provided directions to drivers;

• Telematics: In 1978, the term "telematics" appeared, which meant the integration of telecommunications and informatics;

• On-board computers: The first electronic systems and diagnostic tools began to be installed in cars.

3. Period of institutional development and standardization (1990–2010):

At this stage, ITT was recognized as a separate scientific and technical field:

- 1991: The term "Intelligent Transportation Systems" (ITS) was officially adopted in the United States. In the same year, ERTICO (European ITS Organization) was formed in Europe.
- 1994: The first World ITS Congress was held in Paris.
- ETC (Electronic Toll Collection): Electronic toll collection and traffic information systems (e.g. VICS in Japan) have been widely implemented.

4. Modern stage - the era of "smart" and connected transport (2010 to the present):

Currently, ITT relies on the following technologies:

- V2X (Vehicle-to-Everything): The exchange of information between vehicles and the road infrastructure.
- Autonomous driving: Driverless vehicles driven by artificial intelligence.
- Big Data and AI: Big data analytics for traffic flow prediction and real-time traffic optimization.

The development of ICT in Uzbekistan in recent years has been "Safe City" and accelerated within the framework of digital transport projects. ITT is a set of systems that integrate information and communication technologies (ICT) between road infrastructure, vehicles and users in order to manage the transport network more efficiently, safely and conveniently.

The main goal of ITT is to optimize traffic flow by collecting and distributing data using computers, electronics, wireless communications , and navigation systems (e.g., GPS). It solves the following tasks:

- Traffic safety: Real-time detection and reporting of accidents and emergencies;
- Efficiency: Reducing traffic congestion and increasing road capacity;
- Ecology: Reducing fuel consumption and harmful gases emitted into the environment.

According to the Ministry of Transport , on the A-373 highway from Tashkent to Andijan alone, the Road Safety Department warned drivers of 182 incidents that could lead to accidents in two years. At the same time, accident commissioners received information about accidents in real time from “smart” roads. Timely closure of the lane in places where traffic accidents occurred also helped to prevent secondary accidents [4].

is equipped with thousands of video cameras capable of recording panoramic photos and videos, hundreds of dynamic information boards. Weather conditions are monitored day and night by dozens of meteorological stations.

Also, driving safety is significantly improved with the MONTRANS DVR, which monitors the driver's condition. The device monitors the level of fatigue and signs of distraction, which allows you to timely warn about the need to take a break.

On October 20, 2025 , the President of our Republic , President Shavkat Mirziyoyev, noted that if separate lanes for buses are increased between roads under the BRT (Bus Rapid Transit) system on the roads of Tashkent, people will abandon the use of personal cars on weekdays. [5] .

BRT (Bus Rapid Transit) is a public transport system that combines the speed and reliability of rail with the speed and efficiency of buses. It is based on separated lanes (usually in the middle of the carriageway) , priority at intersections, paid stops and short travel times (Figure 2).



Figure 1. Sh.Rusraveli Street in Tashkent

"If we build roads like this, if we put these buses in, people will only drive their cars on Saturdays and Sundays. Shota said that the BRT system on Rustaveli Street will be an example for other streets."

In this, the edge of the road was allocated for bicycle and pedestrian paths, which were separated. 14 thousand trees were planted. The entire drainage system was closed. The bus only runs in the middle. The speed of buses has doubled [6].

BRT is a globally proven model, operating in over 200 cities around the world. In megacities such as Bogota, Istanbul, Beijing, Guangzhou, and Mexico City, BRT has reduced traffic congestion and provided millions of citizens with fast and affordable transportation. BRT is an indicator of a city's progress .

A dedicated bus lane in the middle of the street based on the BRT system was first introduced in Tashkent on a nearly 7-kilometer section of Shota Rustaveli Street from Mirabad Street to Choshtepa Street. The road, divided into 10 carriageways , will accommodate cars in 6 lanes and buses in 2 specially designated directions. The remaining 2 lanes are intended for parking cars [7].

, the total cost of which is $19.2 million, 21 new bus stops and 463 "smart" traffic lights were installed. An intelligent transport system was introduced.

It is planned to create separate lanes for buses covering 10 more routes in the city , covering a length of about 51 km. That is, buses will be able to move freely on other streets , as on Shota Rustaveli Street. According to the project submitted to the President , by 2030 this system will also be introduced on streets such as Shakhrisabz, Amir Temur, Yangi Sergeli, Makhtumkuli, Nurafshon [8].

The project is expected to cost $126 million. After its implementation, the average speed of buses in the city will increase from 18 km/h to 23 km/h, and the intervals will be reduced from 20 minutes to 8-10 minutes [9].

The issue of introducing intelligent transport infrastructure into the road sector is a topical and widely discussed issue in the world, since such projects are characterized by a quick payback period rather than attracting a large number of investors . Currently, conferences discussing this issue are regularly held in our country, and intelligent road control technologies are actively developing and improving.

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