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Opis infrastruktury dla transportu Hyperloop

-Description of the Infrastructure for the Hyperloop Transport System

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Glossary

1. **Hyperloop** – is an open-source transportation concept where the idea is to build a tube over or under the ground, in which the environment in the tube can safely transport people at high speeds but at a cheaper cost.

2. **Capsule** – refers to the transportation object that will be used to transport people and cars between stations. Can also be called a **pod**.

3. **Tube** – refers to the part of the hyperloop system that is responsible for housing the capsule. It is in the tube that a capsule travels.

4. **Pylon** – refers to the structural tower that will be used to hold and support tubes above the ground.

5. **Damper** – refers to a device that is placed between tubes and pylons to dissipate kinetic energy, so as to act as a shock absorber to wind as well as earthquakes.

6. **Route -** refers to the course taken in order to get from a starting point to the destination.

7. **Station -** refers to a stop along the route or the final destination of travel where a capsule can stop and load or unload passengers and cargo.

8. **Tunnel -** refers to the section along a route where tunneling has been utilized to avoid going over mountains in order to keep the route as straight as possible.

1. Introduction

The world of transportation has evolved so much ever since men started discovering new places. From riding the high seas using wind sails to crossing continents on fuel-powered ships. From slow propelled airplanes that could only fly short distances to commercial turbine jets that can cross the planet in half the time while carrying 500 plus passengers on average. However, as much as there has been advancement in transportation, the cost of using these services has been skyrocketing. In addition, the question of safety is still ever present and not forgetting of course, that there could be a better way to get from point A to B in a much cheaper, safer and faster way. These questions have given birth to a new open-source concept of transportation called the Hyperloop transport system. The Hyperloop transport systems aims to provide a much safer and faster way of travel compared to today's means of transportation while also making it a lot cheaper. The idea is to make traveling possible using capsules employing a tube that is situated from point A to B. Using the tube's pressure, capsules can travel from one destination to the next by simple propulsion mechanisms and pressure of the tube.

This project aims to create an IT Database Management System detailing the infrastructure of the Hyperloop system, focusing on its physical components and their characteristics.

1.1 Purpose

The system aims to help with the management of the infrastructure components that the Hyperloop could be using. For that purpose, it provides information about stations, tubes and mechanical components used by them.

1.2 Scope

As described above, the project aims to design an inventory management system for infrastructures used in the Hyperloop transport system. The system aims to have an up-to-date system that can be integrated into a holistic Hyperloop system that will be responsible for maintaining adequate infrastructure supplies as well as be used for spotting trends and potential problems. The system will be focused on the following key areas surrounding Hyperloop's Infrastructures as follows:

1. Infrastructure inventory management
2. Infrastructure Reporting and Analytics

2. System Features – Functional Requirements

Below is a list of the features that the Infrastructure Database system will have, a little description of what the feature will be expected to do and how important that specific feature is to the system.

No	Name	Description	Priority
1	Tube & tube-support infrastructure management feature	The feature keeps track of all components of the infrastructure of tube (Tube segments) and physical tube-support infrastructure (Pylons and Dampers). Manage the availability of all of these components and their type based on local terrain and the type of pods that are supposed to travel through the tube. Determine if any components are decommissioned/working/broken etc.	High
2	Vacuum pump management feature	System has to be able to manage all components of Vacuum pump system, the availability of these components. Their status included: decommissioned/maintaining/broken.	High
3	Energy Grid management feature	System has to be able to manage all components of Energy Grids including Batteries and Solar Panels, monitor their availability.	High
4	Route Sections management feature	The system has to manage the status of all Route Sections. Their status changes might be caused by the availability of the infrastructure upon which they function.	High
5	Stations infrastructure management feature	There has to be a capability of managing components of infrastructure of Stations consisting of Platforms and Airlocks. The availability of all these components (In planning/Working/Closed).	High
6	Linear Electric Motors management feature	There has to be a capability of managing all Linear Electric Motors. The capability of monitoring their status, determining if they are working well.	High
7	GUI	This function enables an easy way to search for specific data using GUI.	Medium

7	Generate reports feature	This function enables the generation of reports on the different entities and their statuses. For example, how many pylons are currently used and how many are available to be used for repair or replacement. Almost all components should have their status as "in production"/"working"/"broken"/"in repair" etc. This function will be using the Log table checking all needed information.	High
10	Describing components' properties.	The system contains information about the manufacturer and important attributes of all components.	High
11	Having location of each tube segment.	The database should store the location of each tube segment in use. Both geographical and as a chainage.	High
12	Automatic Log saving	Storing event logs created based on uploaded data.	High
13	Terrain control.	The database should be able to determine the type of terrain on which the pylons have been deployed.	High
14	Maintenance/Replace Alert Feature	1. This function will be responsible for sending automatic alerts by using triggers that keep track of maintenance or replacement dates and will alert monitoring staff prior to actual dates. Alerts will be sent a week early and then 2 days prior to the maintenance/replacement dates. 2. In addition, an automatic change in the infrastructure's "status" attribute is also changed as a result of the alert.	High
15	Add infrastructure	This feature allows new infrastructure elements, of existing types, to be added to the database.	High

3. Nonfunctional Requirements

Below is a table of Non-functional requirements which aim to determine how well the infrastructure of the system should ideally function.

No	Name	Description	Priority
1	System response time to changes.	The system should respond to changes in operating parameters within an acceptable time (firm real-time limit). 1. The response time of changing the component status should not be greater than 20 seconds. 2. The time required for saving in the Logs table should not be greater than 30 seconds. 3. The time required for reading from the Logs table taking into account queries only to it should not be greater than 25 seconds. 4. The time required for adding a new set of components into the database should not be greater than 2 minutes.	Medium
2	Work in a distributed environment.	Employees should be able to use the database from multiple places at the same time. Moreover, it should be possible to have the part of the database offline from the main servers and operate on them in different places. Later it should be possible to merge and validate data to the main server and between parts of the database.	High
3	Recoverability	1. The system should be able to endure sudden power outage. 2. After power restoration the system should be ready to operate in time not greater than 30 minutes with all data intact. 3. In case of memory loss, backup mechanism, creating timestamps every 10 minutes, should allow for reverting the database to its past state.	High

		4. The system should have the ability to validate the data with other servers and resolve incompatibilities with the help of men.	
4	Data security	1. The data between the servers should be sent through a secure tunnel via internet (not recommended option) or via private internet connection (recommended option). 2. The records data on the hard discs should be encrypted and have the same size as the original records. 3. There should be special, highly secured data disks that will store keys. 4. Hybrid encryption with a private and public key not less than 2048 bits and a symmetric key not less than 1024 bits is recommended. The symmetric key will be encrypted with the private key and stored in this form on the disk. When the need arises, the symmetric key will be decrypted and used to encrypt the data. It is possible to encrypt multiple symmetric keys with one private key. 5. There should be external anti-virus and anti-theft software. 6. User authentication should be implemented to avoid unauthorized access and modification for those without correct privileges. 7. Connections to the database should be done through a controlled firewall.	High
5	Data Copy Policy	The data should only be able to be copied into another disc only with physical interaction. It will help prevent the leak of information. Nonetheless it should be possible to copy a small portion of data, such as a small number of individual records to the external device.	Medium
6	Availability	Systems availability should be kept to at least 99% for all users.	Medium

7	Disk management	1. The system should use hard disks with vitality of at least 10 years. If the disk exceeds its expected lifetime, it should be replaced and the data copied. During this time, disk access to data within the specified time frame should still be provided. 2. The system should notify a user 6 months before a disk's life span is up so that backups may be done in advance.	High
8	Optimization using archives	The system should archive the Log table once in half a year. If the query to this table will require archived data, then it should be possible to get these records from archives (it will take longer).	Medium