1. Visual Product Search

Focus area: Artificial Intelligence

Description:
It is necessary to develop a prototype of a mobile application that recognizes apparel items on a photo and provides a link to look-alike items at an online store. The application should help users find apparel items "just like those of my favorite blogger" on e-commerce sites. The greatest attention in the proposed solution must be paid to the development of a visual search-and-recognition technology.

2. Identification of Innovative Products

Focus area: Artificial Intelligence

Description:
It is necessary to come up with a solution that can identify innovative products in a database of products/services that contains a list of specifications and values for each product/service. “Innovative” in this case means having unique specifications or values.

Point-of-difference options:

- there is a specification/feature that is missing in similar products
- the value of a specification/feature or several of them differs from the values of similar products ("faster, higher, stronger")
- combinations of specifications/features and their values are not found in other products (for example, many manufacturers produce laptops with 12 cores and 32 GB of memory, as well as with 8 cores and 64 GB. However, there is only one model with 12 cores and 64 GB. Consequently, it has a unique combination of both features and therefore can be viewed as innovative).

3. Vulnerability Search

Focus area: Finance

Description:
It is necessary to perform a search for critical vulnerabilities and exploits, as well as to assess the security of a system by simulating an attack in a new digital payment service. The result should be a clear description of the sequence of actions that lead to the emergence of a specific vulnerability.

4. Application for Ground Public Transportation Real Time Monitoring

Focus area: Marketplaces

Description:
You need to design a solution that will enable local residents to track the location of above-ground public transportation vehicles (PTVs) in real time in order to forecast and optimize waiting times. The user of such a solution will be able to track the animated journey of a PTV on a map.

Input data:
Your team will receive a source of telemetric data coming from public transportation vehicles – buses, trolleys, and trams. The source is represented by the GTFS protocol. Each 20-50 seconds the source sends vehicle location data. Each data pack includes:

- GPS data (latitude, longitude, fixation time)
- Vehicle ID

Using a vehicle's ID and data directories (to be provided in the SQL format), you will need to determine the route along which the vehicle is traveling.

Each route can have one or more options. For example, Bus 24 has two route options:
1.from Krasnye Vorota to Aviamotornaya
2. from Aviamotornaya to Krasnye Vorota

In addition to these two, the route can have special options, for example, shortened and extended ones.

Assignment 1:
Using a PTV's trip history data, determine the exact route along which the PTV is traveling.

Assignment 2:
Visualize the PTV's animated journey on a map. The animation should be designed as an iOS or Android app.

- While working on the animation, bear in mind that the PTV location data is updated every 20-50 seconds. In between-the-updates time, the user should be able to see the PTV icon move on the map continuously.
- It is necessary to use the PTV's projected speed and distance. Projected speed is the speed that must be calculated by your algorithm. This speed must be based on the current speed according to the GPS data.
- Upon receiving new location data for a specific PTV, this vehicle's icon must not “jump” abruptly to a new position on the map, but smoothly travel to it along the PTV's route. You should design and implement a user-friendly scenario, when the PTV's projected new location is outside the projected distance range.
- If the projected distance includes public transportation stops, you should reflect this in your animation by calculating freeze time at the stop locations for passenger boarding and deboarding.
- To predict the PTV's speed at a particular section of its route, you should take the following factors into consideration:
    - the PTV's speed according to GPS
    - recent speeds of other vehicles at this section

5. IT Solutions Marketplace

Focus area: Marketplaces

Description:
We need a solution that connects software products to a cloud marketplace and covers their entire life cycle from the moment of entering the marketplace to the end of sales, including pricing, support and other accompanying processes. The proposed solution should be scalable and independent of the software product chosen for placement at the marketplace.
The marketplace will enable software developers to place products in the cloud (without having to think about the infrastructure, billing, etc.) and sell them to all users of the cloud in one click.

Assignment for the hackathon:
You need to create a functional marketplace prototype/simulator.

Important:

- To design a business architecture that will support several user interaction scenarios:
    a. A cloud product owner places his/her product on the marketplace.
    b. A marketplace owner.
    c. A user of services provided at the marketplace.
- To develop a detailed user journey for each scenario.
- To develop a metrics structure and an analytics system for each scenario.
- To develop a clickable prototype that reflects the above-mentioned business processes.
- It is important to consider non-standard scenarios and models for working with them.

6. Personalized Media Content Provision

Focus area: Smart City

Description:
It is necessary to develop a prototype that will provide mobile broadband access to the Internet during mass events attended by thousands of people, for example, music concerts or sports events (football matches or Formula 1 races).

Your prototype should include a sketch of a client application, a back-end platform prototype, and means of demonstrating the operation of this prototype under load.

Usage:
During mass events, people will use this new client application to watch live webcasts and buy premium video content from the operator (for example, they will be able to select video from specific cameras at a stadium or a concert venue, watch interviews with favorite athletes during intermissions, etc.), and also buy products and services form its partners.

The solution's platform is integrated into the operator's broadband access management network and provides personalized media content to the user. The platform is also open for integration with third-party commerce tools (first and foremost, for sales of physical goods).

Important:

- The proposed prototype should be able to handle a 5G network overload at events involving thousands of people and ensure the centralized distribution of network resources for content downloads without degradation in the quality of streaming while reducing the load on 5G network transport links and central control nodes.

- The prototype should demonstrate its load management capacities and be able to balance load between the platform's streaming servers and client queues. Upon reaching the peak load on open streaming sessions on the platform, the solution should not ignore new requests for establishing new streaming sessions, but inform users about the time left before the beginning of a video broadcast session.

- The platform must contain a component to onboard partners and enable them sell their services (physical goods) to consumers.

- You are required to demonstrate the performance of the platform under load and develop tools to create the expected load profile.

You should use the following assumptions:

1. the territory of the event is covered with 50 5G base stations;
2. each base station can support the maximum data speed of 15 Gbps;
3. the client device is capable of receiving data at 2 Gbps;
4. the client app requires 0.5 Gbps to maintain the highest quality of a live streaming video broadcast;
5. the client app's settings enable the app to be authorized on the operator's 5G network, with 80% of the base stations' bandwidth capacity allocated for media content transfer;
6. the platform can enable up to 1,200 video sessions simultaneously, while one streaming server can support up to 400 sessions.

You can also assume that when you open a video broadcast session for the next client application, the platform can access the locally hosted distributed core of the 5G network and identify the base station that the client application is currently using.

In order to demonstrate the operability of the platform prototype under peak load, it is possible to proportionally linearly reduce the load profile and the corresponding peak capacity of the platform prototype, in accordance with the computing resources provided to the hackathon participants.

7. Optimizing Street Maintenance Costs

Focus area: Smart City

Description:
The city needs to optimize its street maintenance operations. The required solution should help increase their efficiency and reduce associated costs.

Assignment:
You need to develop an algorithm for optimizing the workload and cleaning attachments distribution for street maintenance vehicles. Your solution should be able to:

1. optimize the distribution of cleaning attachments among vehicles;
2. minimize the amount of time and number of vehicles required to perform technological operations.

Details:

Participants will be provided with the following input data:

- Types of vehicles;
- Types of cleaning attachments for street maintenance vehicles;
- Descriptions of organizations responsible for street maintenance operations in the city (maintenance territories, available vehicles and appliances);
- A list of technological operations pertaining to street and yard cleaning (including the time each operation takes and appropriate appliance/vehicle combinations)

8. Budgeting Process Visualization

Focus area: Finance

Description:
You are required to design visualization tools (a working prototype) that reflect the budget formulation and execution processes based on data from Moscow's state information systems. The prototype should enable managers and their subordinates identify and track the execution status of measures required by law in connection with budget planning and spending operations.

Assignment:
You are required to develop a functional prototype of a budgeting process visualization solution.

Important:

1. Visualization:
    a. Tens of thousands of people will be using this solution. Therefore, it must have a user-friendly interface appropriate for entry-level users and a system of screen tips.
    b. Teams will provided with methodology support by the owner of the task.
2. Tool:
    a. Must contain a nested hierarchy of objects
    b. Must support user role-based access
    c. Must be a web-based solution.
3. Service:
    a. The budget process consists of several stages. Your solution must reflect their structure. The user should be able to access the structure at any time, for example, in order to see the list of documents required at a particular stage.

9. Digital Urban Space Modeling

Focus area: Management Systems

Description:
Proposed solutions should enable the overlaying of visual data on a 3D model of Moscow. These data will be transmitted from surveillance cameras installed on public transportation fleet as well as from mobile devices. Another important requirement is the ability to analyze changes in the 3D model in order

to identify violations. Contestants are advised to foresee an opportunity for the joint use of lidars and surveillance cameras to enable simultaneous model generation and visual data (textures) overlaying.

For the purposes of the hackathon, contestants are required to digitize and analyze a scaled-down mock urban layout.

Assignment:
Teams must implement a maximally simple algorithm consisting of the following control stages (can be adjusted by teams in order to optimize the algorithms):

1. The making of a digital model of a mock urban layout

The expected outcome at this stage is a digital 3D model generated with the help of existing software.
The main criterion is maximum accuracy.

2. Applying textures to the 3D model

Teams will need to digitally photograph the mockup and execute an algorithm for applying textures to the 3D model. The expected outcome at this stage is a digital 3D model with textures automatically superimposed on it by means of existing (or created during the hackathon) software.The main objective is to achieve maximum accuracy.

3. 3D model structuring

Teams will need to implement an algorithm to automatically detect specific objects on the model – buildings, trash bins, lampposts, traffic signs, sidewalks, roadways, advertising constructions (including those mounted on a building), etc.
The expected outcome at this stage is an automated algorithm for finding objects and calculating their boundaries, as well as for separating these objects from the solid 3D model and positioning them. Another expected outcome is an automatically generated table with information on the objects (specific data per object: a building, a trash bin, a bench, etc.)
The main objective is to ensure automatic performance.

4. Geopositioning on the 3D model

Teams need to attach objects to a coordinate grid that simulates geolocation.
The expected outcomes at this stage are the automatic linkage of a 3D element to a virtual coordinate grid; a table with with information on the objects (specific data per object: a building, a trash bin, a bench, etc.) automatically complemented with geospatial data.
The main objective is to ensure automatic performance.

5. The monitoring of changes in the 3D model

The mockup will contain “staged” violations and damages: a street light will be tilted to the side; road signs will be covered with graffiti; there will be a dent on the roadway, etc. Teams will need to scan and photograph the mockup again and identify specific violations in each object.
The expected outcome at this stage is an automatically generated table with data on the modified objects identified at stages 4 and 5.
The main objectives are to ensure automatic performance and detect as many changes as possible.

6. The training of the 3D model's analysis system

Teams must provide a solution for the implementation of the operator’s interface, which will “train” the analytical core of the system to identify specific objects (benches, trash bins, road signs, children's swings, etc.). The use of neural network technologies seems reasonable at this stage.

The expected outcomes at this stage are:

- a mockup interface for training the analytical subsystem or a complete (existing) technical solution;

- a technical description of the mathematical logic used to teach the analysis system to identify the following types of changes: the deformation/destruction of an object or damage to an object;
- a table with data on the modified objects identified at stages 4 and 5 complemented with two specific types of changes (property deformation/destruction or damage).

The main objectives are to ensure automatic performance and correctly detect as many violations as possible.

10. Developing an Integrated Approach to the Detection of Cross-Product Cyber Threats

Focus area: Management Systems

Description:

There are various types of products protecting various types of assets: Endpoint Security Suite (Anti-virus, EDR), Network (Firewall, IDS, IPS, UTM), Mail (Mail gateway), Web (Proxy, Web gateway), Cloud server protection (AV, EDR for virtual infrastructures, including VMware, Hyper-V, containers, and VDI).

Each of these solutions contains detection technologies (AV, IDS rules, web filtering…) and can independently identify suspicious activities and threats to specific types of assets. These solutions are also capable of sending raw telemetric data from respective assets, and this data needs to be collected and processed in one place.

Examples of telemetric data:

- An endpoint process with detailed information about it (who launched this process, what specific file on the disk is responsible for the process...)
- Traffic data: URL, IP, PCAP
- Email: headers, attachments, DCIM, SPF
- Detects from all solutions
- Asset inventory data: a list of installed apps, their versions, OS versions, LDAP/AD data

Requirements:

- To offer threat detection scenarios for threats that none of single solutions were able to spot, but which can be identified via a correlation of cross-product data (data coming from various infrastructure levels);
- To propose ways of reducing False Positive rates among the detects generated by products – by additionally checking these detects at other telemetric levels;
- To propose ways of correlating these data to identify threats;
- To offer automatic threat classification options for identified threats based on industry standards, such as MITRE, kill chain;
- To propose a UI for the presentation of correlation outcomes.