KUSAMA

Proposal: Robots Waiting for Kusama

Proponent: HqnKDzYBnFpGH5jXYZmUFXFnz76ynKN6nTh3De3oRxA9gYu
Date: 19.10.2020
Requested allocation: 4270 KSM
Short description: demonstration of web3 tools that will help to connect academic robotics to Kusama by the video examples of integrating 50 robotic devices from world universities to test network.

1. **Proposal summary:**

- launching of up to 50 robots of universities from Russia, Europe, Japan and China;
- requested amount of funds — 4270 KSM = 4000 KSM for robots (80 KSM ≈ 2500$ per robot) + 250 KSM for operational costs + 20 KSM for final video montage;
- deliverables: video of each robot, final montage, open repositories, blog publications, possible scientific papers.
- time to completion: 62 weeks.

2. **Context of the proposal**:

I am Ivan Berman and currently I am a PhD student at ITMO University (St. Petersburg, Russia). Since 2016, I have collaborated with the Robonomics Network to help them spread distributed ledger technology to academia. Together we have written several well-accepted scientific publications on the work of cyber-physical systems in the Robonomics infrastructure. Since Robonomics joined Polkadot projects, they began to actively recommend new Web3 tools of the ecosystem for robotics technicians, which drew my attention to the Kusama project.

A few words about my background. I earned at ITMO University my bachelor's (2012) and master's (2018) degrees in Intelligent Technologies in Robotics. Since 2015, I have been working as an engineer at the Faculty of Control Systems and Robotics of ITMO University. Here, I am engaged in R&D projects related to the control of mobile cyber-physical systems via Robot Operating System in various applications. For example, the wildfire security monitoring fires using an unmanned aerial vehicle and the monitoring of water pollution using autonomous water vehicles. The entire list of my publications is available on Google Scholar (h-index = 4).

Besides me, several people will participate from ITMO University: Vadim Manaenko — also a Phd student at ITMO University and an engineer at Robonomics Network, Alexander Kapitonov — my scientific advisor and one of the founders of Robonomics, Maria Sigutina — representative of ITMO University in Europe for communication with partner universities, and couple of colleagues from my faculty. Besides ITMO University: Fabio Bonsignorio, professor from Scuola Superiore Sant'Anna (Italy) as a scientific advisor. Also, each new robot adds two people from partner universities.

3. **Problem statement:**

   The experience of Robonomics has shown that the decentralized web is a very attractive technology in terms of security and organization for tasks where many heterogeneous robotic devices appear. However, for researchers in the field of robotics, the technology is still terra incognita. The idea behind it, and to a greater extent the tools for how to use it, still need to be conveyed to academia.

4. **Why is it important?**

   Web3 technologies help to clear the way for the Robot-as-a-Service business model, in which robots can be leased or hired to perform your tasks. What are the pitfalls of the RaaS model? Because there are potentially many devices, there is an increase in transaction and security costs. Right now, the only solution for RaaS is large cloud services, but trusting a giant center to control for a multitude of drones or sensors is too insecure and transaction fees of clouds are too high. This is where a niche for Web3 technologies appears. They not only better bypass the pitfalls of RaaS, but also significantly facilitate the exchange of technical and economic information between humans / robots and between different robots.

   This will open the way for projects such as: drones that perform flight mission orders; automatic production control using feedback from market analysis; water vessels that record water quality in a blockchain; robot artist which sells its work at auction.

5. **Proposal Objective:**

   The purpose of the proposal is to demonstrate current capabilities of Kusama network for robotics technicians working or studying at universities by presentation of already available web3 tools (Substrate, Cumulus and Robonomics).

   We want to conduct a large-scale demonstration with colleagues from partner universities in which various robots will function, being integrated in a test environment using the Robonomics parachain. The positioning of the demo will be as follows: “We are

waiting for the launch of Kusama. But while we are waiting, we want to demonstrate what open source web3 tools can be used to connect many different robotic devices directly to such a network".

The result should be a large amount of video material for each participating robot and a final joint demonstration (inspiration — ROS 10 Year Montage). In addition, the results of the demonstration will be disseminated on university blogs and news websites, and can also be used for presentation in scientific publications and conferences.

Among the alleged robots for the demonstration:

- mobile robotic platforms (such as PR2);
- ground robotic vehicles;
- industrial robots (primarily manipulators);
- drones;
- unmanned water vessels;
- sets of sensors;
- smart devices (such as robot vacuum cleaners and smart door locks).

Through this active promotion:

- For universities: it will be possible to conduct truly large-scale experiments to integrate multiple devices into a decentralized network.
- For Kusama: the project will receive academic publicity and the community will be replenished with highly qualified robotics specialists.
- For Robonomics: many new devices will connect to the network.

6. Why Kusama?

In my opinion, positioning Kusama as a wild ground for the experimentation with Web3 technologies fits perfectly into the academic community of experimenters, who prefer to try new concepts and mix different technologies. Also, the fact that the Robonomics parachain plans to launch on Kusama and has the capacity to fulfill this proposal plays a role.

7. If you have seen similar proposals before: why is yours different?

As far as I know, there have not been such proposals yet.

8. Payment conditions

Milestones:

Milestones 1-5. The first five milestones are directly devoted to communication with universities and work with robots:

- the milestones do not differ in the scope of work;
- as a result of each milestone, 10 ready robots are prepared (50 in total);
- each milestone takes approximately 12 weeks (60 weeks in total).

First, we negotiate with the universities about which robots they want to demonstrate. It is assumed that each robot demo will be performed by two people from universities (senior master's students or Phd students). Usually it takes from several weeks to several months to prepare a robot, so a reward of around $2500 looks suitable.

Then, participating colleagues need to walk through the sub-milestones for each robot, which include tasks for configuring, launching and preparation of results:

1. **Analysis of the ROS-module of the device, correcting the module if necessary, testing the module**. Since the Robonomics is an implementation of the Robot Operating System framework as a Substrate chain, in order to connect the robot to the network, it is needed a robot’s module for ROS. Writing a module from scratch is too time-consuming, but luckily many ready-made modules have been written for ROS over the ten years. However, the state of repositories with modules is not the best or even outdated, and the code has to be partially rewritten.
2. **Robot activation**. This requires planning what kind of activity the robot will demonstrate (cargo transfer, trajectory repetition, data collection, etc).
3. **Collection and sending of telemetry data**. During the execution of tasks, the robot should publish event data, debug information and work results to the network.
4. **Preparation of results**. This includes filming and editing videos, documenting an open repository with the robot's code, posting a small report to blogs (e.g. on Medium).

Thus, guaranteed deliverables of these milestones will be:

- videos with demonstration,
- open repositories,
- Internet publications.

Also, colleagues will most likely prefer to publish results in scientific papers, but due to the complexity and duration of the review process the publication can take a long time.

Milestones 6. The last task will be devoted to montage of the final video with all the robots, as well as summing up the results in blogs. Deliverables: the final montage, the final Internet publication (2 weeks to complete).

Funds allocation

Expenses (in KSM) per milestone (1-5):

	1 robot	10 robots
Operating costs of researchers to launch	60	600
External costs (to buy sensors, rent cloud, etc.)*	10	100
Total for researchers teams	**70**	**700**
Coordination and Negotiation**		150
Technical support costs from Robonomics team***		0
TOTAL		850

* The main equipment will be from university labs, but we want to give researchers about $300 for external costs

** The main coordinator — Ivan; Finding people in universities and corresponding / negotiating with them — Maria and Ivan; Helping teams during the preparation of robots — Ivan; Checking the results (good condition of repositories and text / video materials, adequate experiments) — Ivan and Fabio

*** Technical support is the standard responsibility of Robonomics team members, therefore it is not included in costs.

For the last milestone 6 — 20 KSM.

1 KSM = 31,09 $ at the rate on Coingecko.com, 19.10.2020.

Address of the fund recipient:

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