

Research Proposal for R&E 2016

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| Research Title | Korean | |
| | English | Visible Laser Light as a Mode of Data and Energy Transmission in Operating a Robotic Device |
| Field | Field | Engineering (/) Math () Physics () Chemistry () Biology () Earth Science () Computer Science () |
| | Sub-field | Physics |
| Period | 2016. 3. 1. ~ 12. 31. (10 months) | |

I confirmed that the R&E research proposal is reviewed by me.

2015. 11. 30.

Name of Teacher Si Ishikaev (Sign)

Office of Planning & Research Affairs

Korea Science Academy

[Research Proposal]

| Guideline |
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| <ul style="list-style-type: none">○ Write in 3~4 pages of A4 size paper.○ Use 한글 2007 program or MS Word.○ Deadline: 2015. 11. 30.(Mon) 17:00○ Submit to: (file) rne.ksa@kaist.ac.kr / (paper) main building 1207 |
| Research keyword |
| <ul style="list-style-type: none">○ laser-powered, visible light, frequency, robotic device <p>※ maximum 5</p> |
| Research abstract |
| <p>○</p> <p>This research is focused on the construction of a robotic device powered and controlled through the use of visible laser. The laser, after being beamed at the robotic device's receiver, would have its energy converted into electrical energy that can be utilized by the robot. The laser would serve as an alternative to conventional sources of power such as batteries and would eliminate the use of wires to transfer electrical energy to the device. The laser system would also act as an information transmitter, wherein the robot's functions would be dependent on the frequencies emitted by the laser. The robot's processing system would serve to interpret the data received from the laser's frequencies, performing the corresponding functions afterwards.</p> <p>After exploration of the technology with an initial structurally simple robot has been done, we intend to make further improvements on the construction of the robot, such as the inclusion of sensors that would aid the robot in maneuvering itself through obstacles. This more advanced</p> |

robot would also be constructed to be of miniscule size, making it a representative model of devices that would not be able to function well if they were to bear batteries. This would make its usage appropriate in fields in which locations that are unreachable by humans are involved.

Research proposal

○ Purpose and Motive

This research aims to construct a robot powered and controlled by a visible laser system. Until now, traditional power sources (batteries and electrical outlets) are being used to operate robots; however, disadvantages and inconveniences such as short shelf lives and costliness tend to limit their functionality and lessen the appeal of their usage. Thus, through the application of the technology involved with the visible laser system's wireless energy transfer, there would be a less chance of encountering the problems associated with traditional power sources.

And so, the investigation of this technology would be made possible by the robot we aim to construct, which is specifically suited for the demonstration of our objectives. In the initial stages of our research, we only aim to make a simple robot that would aid in developing the fundamentals of the said technology that we intend to investigate. After the essentials of our technological system have been settled and our research has gone through enough refinement, we would then raise our goal in terms of our robotic device's construction and attempt to make a more miniscule and advanced robot that would act upon more complex functions in coordination with the visible laser's frequencies.

Moreover, the chances of the occurrence of malfunctions due to limitations associated with

conventional controlling mechanisms would be minimized in our robotic device due to our technological system's feature of data transfer through visible lasers.

○ Background and Objective

There are certain devices in which batteries are not convenient to use. Such devices could be those that are miniscule in size, since fitting a battery inside them could prove to be arduous. Miniature robots may also not be able to carry the weight of the batteries, thus hindering their ability to operate. Likewise, connecting such robots with wires to a power source can also limit their movements.

In the case of remote controlled devices, when the remote used to control them gets damaged, there would be no other means to control the device. In other words, the device would become useless. Making another remote control that is specifically suited for the device would require a lot of effort.

In an effort to provide an alternate solution to the aforementioned problems, our group aims on using a visible laser in order to transfer energy to a robotic device, thus disposing of the need for batteries and wires.

Furthermore, we also intend to use the visible laser as a mode of information transmission, so we would no longer need a remote control for our device. Modulating the frequency the laser emits would make the robot perform the corresponding functions assigned to the chosen frequencies. Therefore, the laser itself would be used to control the device. In this way, if ever the

laser system, the primary means of controlling our device, fails to work, simply replacing the laser with another one can make the robotic device work again.

Additionally, an essential objective of our research is to construct an actual robot that would demonstrate the mentioned intentions of our research. For this, we would just initially make a simple robot that could perform basic functions through interpreting the information sent by the laser system. After refining the technology of our energy and data transmission, we would then aim to make a more complex robot that could perform more complicated operations tuned in to the laser system to further develop our research.

○ Contents and method of research

In our research, the visible laser light would serve as a medium for information and energy transmission. Therefore, neither batteries nor a remote control would be needed for the operation of the robot. The range of frequencies the robot would be able to receive interpret would be limited to the visible spectrum.

After exploring the feasibility and capabilities of the usage of visible light to control the initial structurally simple robot we plan to make, we intend to assemble a somewhat more advanced robot that is as small as is appropriately possible, permitting it to probe and traverse small and unreachable locations. Its miniature size would justify its need for the visible light as a means of energy transfer, since it would not be capable of carrying batteries, or carrying batteries would limit its performance. This robot would then serve as a representative model in illustrating some of the problems our research group aims to solve, thus providing solutions for it. Once the robot

functions as expected, we would begin working on some modifications such as adding sensors so that it would be capable of avoiding obstacles, minimize the frequency range of the light so that it would still operate well under certain conditions, and many more.

○ Research Plan

For the robotic device we aim to construct, we plan on using visible laser light as a medium to control and maneuver it. Our group intends to manipulate the robot's size in such a way that would allow it to fit in narrow spaces, making it miniscule in size. We would just initially make a robot that could perform simple tasks, gradually improving it later on by making it perform more operations calibrated to the visible laser's frequencies as our research gets more developed. Seeing as we intend to assign specific frequencies to certain robotic functions, the range of light frequencies the robot would act upon would be limited to the visible spectrum due to our usage of visible light.

○ Reference

"How to Make a Robot". (August 4, 2010). <<http://www.robotshop.com/blog/en/how-to-make-a-robot-lesson-1-3707>>.

"BEGINNERS: How to Build Your First Robot Tutorial". <http://www.societyofrobots.com/robot_tutorial>.

"Wireless Electricity". <<https://sites.google.com/site/wirelesselectricityzb/research-paper>>.