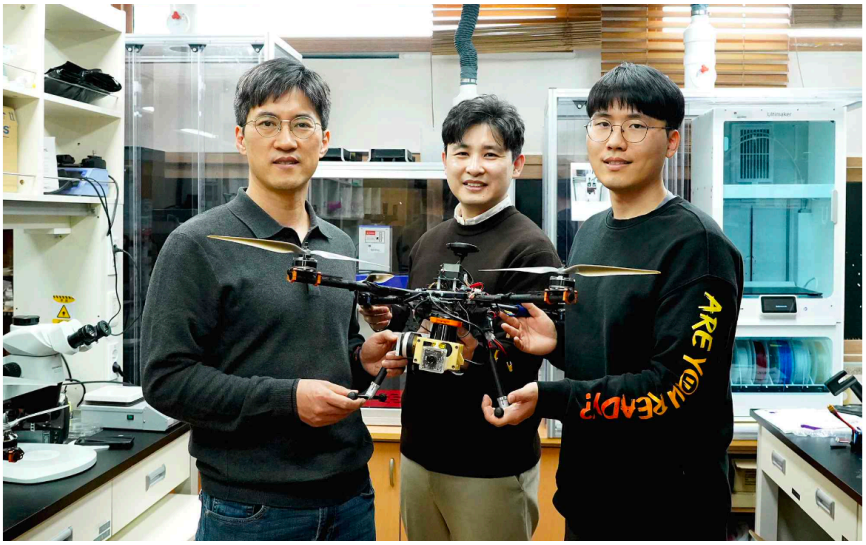
GIST develops AI drone technology that finds a safe place to avoid obstacles and lands on its own

- Obtains information about the landing site environment through camera sensors (visual information) and LiDAR sensors (distance measurement) and use deep learning technology to determine a safe landing site on its own
- Expected to be used in the unmanned aerial vehicle industry that requires landing in various places, such as drone delivery



▲ (From left) Professor Jongho Lee, Dr. Jeonggeun Lim, and student Hyungwook Yoo

Recently, in order to accelerate the commercialization of drones, the government is promoting the 'Drone Demonstration City Construction Project' and the 'Drone Commercialization Support Project' in which 17 local governments and 14 companies are participating, respectively, and domestic researchers have developed camera sensors* and lidar sensors*. It is expected that the convergence will revitalize the K-drone industry by creating a drone that recognizes the surrounding environment, finds a location on its own, and lands safely.

* camera sensor: A camera sensor usually refers to an internal image sensor. The image sensor accepts light and converts it into an electronic signal.

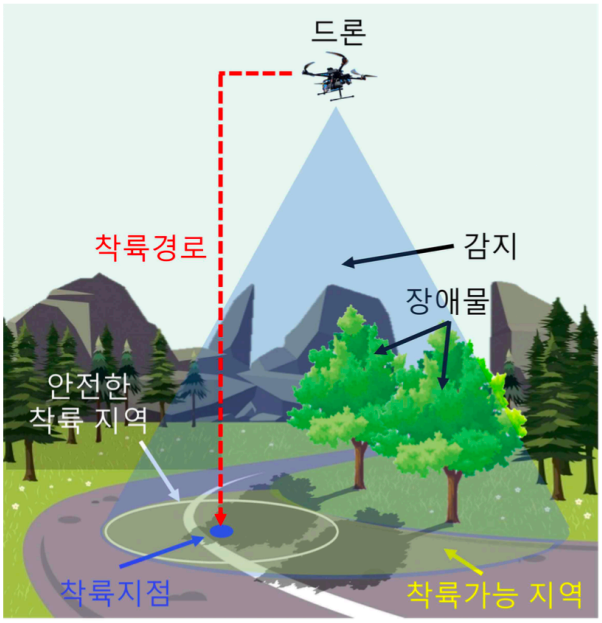
* LiDAR sensor (Light Detection and Ranging, LiDAR): A sensor that measures the location coordinates of a reflector by shooting a laser pulse and measuring the time it takes for it to reflect and return.

The Gwangju Institute of Science and Technology (GIST, President Kichul Lim) announced that Professor Jongho Lee's research team in the School of Mechanical Engineering developed drone technology that uses image information captured by a camera and distance information measured by a LiDAR sensor to allow the drone to find a safe location and land automatically.

The results of this research can be used in the future smart mobility unmanned aerial vehicle industry, including drone delivery that lands on its own in various places and environments. In particular, it is expected to overcome geographical limitations and enable missions in various environments, thereby reducing transportation costs and preventing safety accidents.

▲ A drone produced for research. By installing a lidar sensor that measures distance on the drone's two-axis gimbal, you can measure the height of the ground and calculate the slope of the ground based on this to find a flat surface that will not fall over when landing.

Previous research has generally focused on finding a landing point using one type of sensor, but the research team conducted a study to determine a safer landing point for the drone itself by using two sensors.



▲ Conceptual diagram of a drone equipped with a camera and LiDAR sensor using artificial intelligence and sensor fusion technology to recognize the surrounding environment and find a safe landing site. Drones can land safely by avoiding obstacles along their landing path.

By using sensors with different characteristics, such as a camera sensor that provides visual information and a LiDAR sensor that provides terrain information through distance measurement, this has the advantage of being able to obtain more diverse and highly reliable environmental information.

GPS (Global Positioning System), which is used for navigation route guidance, provides specific location information, but does not provide information about the surrounding environment (e.g. trees, water, hills, etc.). Therefore, in order to find a safe landing site, you must clearly know the landing site and the conditions of the surrounding environment.

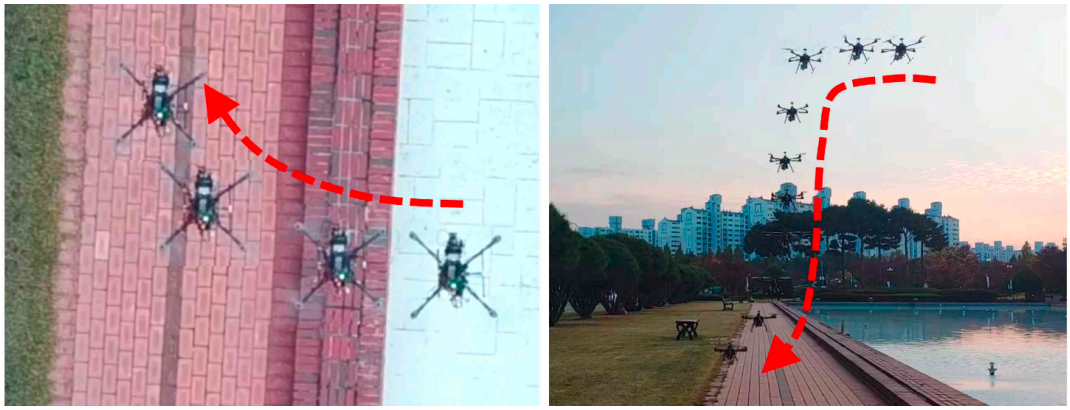
There are many studies in which drones land by recognizing markers installed in a designated location, but research on landing safely in a location that has not been identified in advance requires accurate recognition of the environment

surrounding the landing location. Compared to theoretical research, actual successful landing cases are lacking.

The research team developed a drone technology that allows the drone to find a safe location and land automatically by using image information captured by a camera and distance information measured by a LiDAR sensor.

Images captured by cameras are divided into areas where landings can be made and areas where landings cannot be made, such as roads, grass, and water, using deep learning technology. Because the drone may fall if it lands on a tilted ground, the research team installed a lidar sensor that measures the distance on the drone's two-axis gimbal. At this time, the drone can measure the height of the ground and calculate the slope of the ground based on this to find a flat surface that will not fall over when landing.

The research team studied not only natural environments with trees, grass, water, and hills, but also urban areas and various environments such as ▲ the rooftop of a building with obstacles ▲ bushes ▲ ponds and ▲ sloping places, and they confirmed that the drone could land safely on its own.



▲ A photo showing the vehicle automatically avoiding water and landing in a safe place near the pond in front of the GIST Administrative Building. (Left) Photo taken from above, (Right) Photo taken from the side

The first author, Dr. Jeonggeun Lim, said, "Drones are an essential technology for courier and delivery, and it took a lot of time and effort to produce the drone for research, implement the algorithm, and test it. I feel greatly rewarded for being able to contribute to the future smart mobility industry through artificial intelligence-based automatic landing technology."

Professor Jongho Lee said, "Using the results of this research, it is possible to safely land unmanned aerial vehicles such as drones without prior information about the surrounding environment. It is expected to be used in the future smart mobility unmanned aerial vehicle industry in various application fields such as drone delivery, national defense, and public safety."

This study, led by Professor Jongho Lee and conducted by Dr. Jeonggeun Lim as the first author, was conducted through GIST-MIT research cooperation and the Ministry of Culture, Sports and Tourism with support from the Korea Creative Content Agency's cultural technology research and development project, and was published online on March 13, 2024, in ‘IEEE/ASME Transactions on Mechatronics’, an excellent journal in the engineering and mechanical fields.