**◦ Analysis overview**

This project focused on reducing traffic accidents between vehicles and pedestrians in Gangseo-gu. We first downloaded the traffic accident data from the Taas site.

**◦ Details of analysis results**

Graphical user interface, application

Description automatically generated[Figure 1] Object Recognition Flowchart

As shown in [Figure 1. Object Recognition Flowchart], image frames are sequentially extracted as images, and one frame is extracted each time the while statement is repeated once. In the process, we change the color image to black and white, select the section where we want to detect a moving object, and do not detect other areas. From then on, MOG2 is used in order to remove the static background to black, extract the moving object to white, and draw the outline based on the extracted white part through the closing technique, opening technique, and dilation 2 times, and the outline is set by us. From the moment it touches the red line, it is set to be a word on the Warning outline. When the word is actually implemented, a warning light is turned on to warn when a car, motorcycle, or person suddenly appears at a crossroad or three-way intersection in an alley. Here, why techniques such as Closing, Opening, and Dilation should be included in the middle will be explained in detail later in the report.

*Among the real-time background removal methods, an effective and frequently used method will be the Gaussian Mixture Model (GMM) or the Mixture of Gaussians (MOG). MOG can handle slow lighting changes, periodic background movement, slow-moving objects, long-term scene changes, and camera noise through variables based on pixel values ​​of past images. MOG has been widely applied to the development of effective applications with excellent computational efficiency and excellent performance for various situations through numerical control. [Source 1]*

We selected the MOG2 background estimation algorithm, a Gaussian mixture-based background/foreground segmentation algorithm implemented based on two papers by Zivkovic, to remove the static background and track the object by referring to the [Source 1] paper above. . Compared to MOG, which is the same Gaussian mixture-based background/foreground segmentation algorithm, MOG2 algorithm with a different method of taking Gaussian distribution was chosen, and MOG2 with high adaptability in various environments due to lighting changes was selected. Through the MOG2 model, compared to the previous frames, we extract only the changed parts, excluding the static parts, and express them in white. And by using the outline of the part expressed in white, we increased the recognition rate through various techniques and calculations.

In the early development stage, we used the createBackgroundSubtractorMOG2 algorithm's history (the number of past frames to use as a background), varThershold (threshold value for the square of the Mahalanobis distance between the pixel and the model), and detectShadows (shadow detection) to detect false detection. wanted to reduce. Among them, by increasing the varThreshold value from the default value of 16 to 80, the recognition rate was slightly lowered, but the initial stage was optimized by solving the false detecting error in other surroundings. After that, the image was driven in black and white to increase the stability of the model and reduce the delay of the image. In order to accurately track an object, it was inevitable for accurate recognition to increase the recognition rate by highlighting a moving object while removing noise. For this purpose, Closing, Opening, and Dilation of the shape transformation mentioned above were applied, and it can be easily understood by looking at the figure below.

Graphical user interface

Description automatically generated with low confidenceGraphical user interface

Description automatically generated with medium confidence

[Figure 2] Erosion [Figure 3] Dilation

Through [Figure 2] above, we can remove the surrounding noise by gradually reducing the object area through erosion, and through the expansion of [Figure 3], we can increase the recognition rate of the object by filling the holes inside the object. Through this, the closing technique and the opening technique can be well explained.

Graphical user interface

Description automatically generated

[Figure 4] Closing [Figure 5] Opening

A. Closing

In the case of the closing technique, it undergoes an erosion process after expansion. That is, after expanding the object, it is possible to fill in the holes of the object without further increasing the noise through erosion. As can be seen in [Figure 4] above, the green colored object is emphasized, and the red colored noise is not greatly increased.

B. Opening

In contrast to the closing technique, the opening technique expands after the erosion process. Therefore, while removing the noise, the loss of the object is minimized. As shown in [Figure 5], it can be seen that the object is protected as much as possible, and the noise indicated in red is removed.

By sequentially applying these closing and opening techniques, the object to be recognized can be highlighted and the surrounding noise can be removed. After that, Dilation was applied two more times to increase the recognition of distant objects. When setting the outline, we designed the object to have an outline when the recognized object is larger than a certain size. However, this hinders the creation of outlines on distant objects. Therefore, it was improved by adding the Dilation operation twice. Through this, the pain point could be improved by increasing the recognition rate by expanding the object.

**◦ Interpretation of results and implications**

In the end, tracking of moving objects using OpenCV will reduce the false detection of reflectors, improve the detection of distant objects, and compromise on whether to keep the model performance stable. It was continuous, and we compromised by finding an appropriate line, and decided to increase the recognition rate of distant objects by acknowledging false detection of reflectors to some extent, and made the model performance stable by limiting the object recognition section to roads. As a result, it is much more stable than the existing model and the recognition rate can be greatly increased.

**◦ Utilization plan and expected effect**

The sector where the project can be utilized is very wide if it is an alley where vehicles, motorcycles, bicycles, kickboards, etc. In particular, it is expected that many accidents can be reduced in places where visibility is difficult, such as an alley at an intersection or a three-way intersection. For example, in an alley that intersects, it is difficult for drivers and pedestrians to recognize the situation on either side of the road, so an accident may be caused by a sudden vehicle or pedestrian. Therefore, if the location of vehicles or pedestrians coming from either side is difficult to secure by using CCTV at the intersection of the relevant intersection or three-way intersection, and installing warning lights, the vehicle or pedestrians coming from both sides are close by stopping the accident. can prevent This is expected to significantly reduce accidents occurring in the alleyways.

**◦ Sources of utilization data and references, etc.**

1. **[Source 1] SFMOG: Super Fast MOG Based Background Subtraction Algorithm Seokbin Song, Jinheon Kim**
2. **[Reference Book] Computer Vision and Machine Learning with OpenCV4 (Gilbot, 2019)**
3. **[Figure 2], [Figure 3] Source https://blog.naver.com/aplusb/222650398927**