MINISTRY OF EDUCATION AND TRAINING SOCIALIST REPUBLIC OF VIETNAM

**VIETNAMESE GERMAN UNIVERSITY Independence – Freedom - Happiness**

**APPLICATION FORM**

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| Project Title: Real-time traffic density estimation by UAV |
| Code: |

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1. **SUMMARY**

Traffic jam has always been a major concern and distress for many citizens in crowded city like HCM and Hanoi. Several solutions have been carried out, including: Allocating extra police resources to conduct the traffic flow; asking voluntary drivers to provide the traffic status at that road segment, which will then be updated and publicly informed on the radio channel, etc. However, these approaches are very costly, inefficient, using mainly human labor, serving as short-term solutions. To partly solve this problem, we propose the use of UAV (drone) to film traffic footage video, transmit them back to the station and calculate the traffic density in real-time, from which we can use for many applications such as analyzing the traffic habit of drivers or estimating the capacity of a certain road segment. Our project will make use of a hot-trend and state-of-the-art approach – Deep learning, applied with fundamental techniques in image processing and computer vision.

Our project includes eight stages:

1. Performing academic literature research on deep learning, computer vision and traffic monitoring;
2. Developing and evaluating an object detection convolutional neural network (CNN) model on computer and testing it with available online traffic dataset;
3. Building the drone and practicing the flying mechanism;
4. Flying the drone to capture realistic images of the exterior environment and enhance the training dataset. Also, we will re-train the detection network with this newly-updated dataset;
5. Building the transmission system between the drone and the station;
6. Testing the transmission system outdoors;
7. Validating the network’s capability in terms of processing the transmitted video and estimating the valid traffic density in real-time. In addition, we need to carry out experiments under various different traffic conditions for final assessment;
8. Writing report.

At the first stage, we need to do some research on previously published related papers on neural network, deep learning and traffic monitoring to find the best approach for the problem. So far, we have decided to adopt the image segmentation to estimate the traffic density.

At the second stage, we need to use deep learning technique, namely the convolutional neural network, to teach the computer to segment the image’s pixels belonging to road with the ones belonging to vehicle and pedestrians. From this data, we can easily calculate the traffic density. All the training of the model will be based on online available large dataset of traffic on the internet, which might not fit with the real traffic scenarios of Vietnam.

At the third stage, we will rebuild our drone from scratch to fit with our purpose. We also have to train ourselves to be capable of controlling and flying the drone, which is the most challenging task, before applying the autonomous flying mode.

At the fourth step, we need to fly the drone to outside environment to enrich our training image dataset because the most of the dataset on online database are captured at side view of traffic, not from aerial view (top view), which is the view of the drone. From this dataset improvement, we can make our detection model much more accurate.

At the fifth stage, we will use the Wi-Fi communication model to build the transmission system between the drone and the station so that the recorded video can be transmitted back and processed in real-time. The transmission system must ensure that the recorded video quality is not affected and the delay time is insignificant.

At the sixth stage, we will test the transmission in exterior environment by flying the drone outside again and transmit back some video to check for the practicality.

At the seventh stage, we will run the model on our computer to segment the transmitted video and output the traffic density in real-time. Also, the validating experiments must be carried out in different road segment and for a long time to test for the reliability and stability of the traffic estimation.

At the last stage, we will write the report to summary all the progress and achievement of the project.

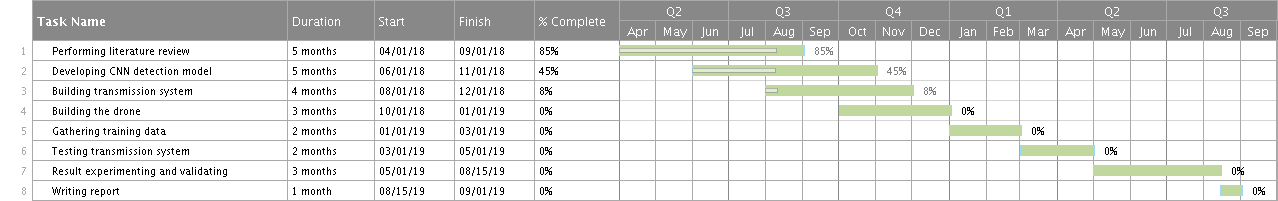
To conclude, this project not only has many economic and practical benefits, it also opens the doors to many other interesting applications in the fields of deep learning, computer vision and image processing. This project is a good initial platform for us to further develop the project in the future to process the video in real-time on the drone rather than transmitting the video back to the station. This will reduce the delay time as well as improve the estimation accuracy.

*Keywords*: UAV, drone, Deep learning, Convolutional Neural Network, Raspberry Pi, Computer vision, Traffic density

1. **TIMELINE**

Please provide a general timeline for your research project, including the start date, the completion date, and the current status of your project

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| --- |
| Start Date: 1st September, 2018 |
| Completion Date: 1st September, 2019 |
| 1st April 2018 – 1st September 2018: Performing literature review  1st June 2018 – 1st November 2018: Developing CNN object detection model  1st August 2018 – 1st December 2018: Building transmission system  1st October 2018 – 1st January 2019: Building the drone  1st January 2019 – 1st March 2019: Gathering training data  1st March 2019 – 1st May 2019: Testing transmission system  1st May 2019 – 1st August 2019: Experimenting and validating result  1st August 2019 – 1st September 2019: Writing report |

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1. **BUDGET**

Please complete the following form by listing the itemized projected expenses for your research project. When expenses are not known, make a conservative estimate. Remember that receipts will be required for reimbursement of all expenses from VGU. Items which you expect to fund from sources other than the anticipated grant should be included in the ‘total estimated cost’ line, but excluded from the ‘total requested funding’ line.

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Estimated cost** | **Requested funding** | **Note** |
| Motor | 2,200,000 VND | 2,200,000 VND | x4 |
| Flight controller | 4,400,000 VND | 4,400,000 VND | x4 |
| ESC | 1,100,000 VND | 1,100,000 VND |  |
| Receiver | 700,000 VND | 700,000 VND |  |
| Frame | 2,000,000VND | 2,000,000VND |  |
| Lipo battery | 2,200,000 VND | 2,200,000 VND | x2 |
| Gimbal | 3,300,000 VND | 3,300,000 VND |  |
| Raspberry Pi 3 | 2,000,000 VND | 2,000,000 VND |  |
| Camera | 1,100,000 VND | 1,100,000 VND |  |
| Wi-Fi module | 1,000,000 VND | 1,000,000 VND |  |
| **TOTAL:** | 20,000,000 VND | 20,000,000 VND |  |

1. **ACADEMIC SUPERVISOR**

I have reviewed this project description and projected budget, and I support this undergraduate research grant request.

*Supervisor’s signature date*

1. **ACADEMIC RESEARCH**

The proposed undergraduate research project is supported by the following research grants solely or jointly administered by me (*leave blank if not applicable)*:

*Supervisor’s signature*

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| --- |
| Grant title: |
| Principal Investigator: |
| Project number: |
| Source of funding: |

**DO NOT WRITE BELOW THIS LINE**

(This part is filled in by the Chair of the Evaluation Committee)

*Comments:*

*Decision*:

*Funded amount:*

*Date:*

*Signature:*

*Name:*