WiP Abstract: Noise Adaptive System using Abstract and Probabilistic Model

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I. INTRODUCTION

In order to design a resilient system with multiple sensors, one of the important things we should consider is the sensor fusion model. Two main classes of sensor models are usually considered: *probabilistic* [1] and *abstract* [2]. The difference between two models is the assumption of noise distribution. In the former, it assumes the pre-designed noise distributions (e.g., Gaussian). In the later, it less assumes noise distribution. In the typical environment, the sensor noise usually follows a certain noise distribution. However, the former model might not work well in practice under the certain environment as a large number of noise factors can easily affects the source of noise. Therefore, we propose a noise adaptive system which exploits the process of switching between the abstract and probabilistic model according to the measurement distributions.

II. PROPOSED SYSTEM

A. Noise Adaptive System

The proposed system exploits both the abstract and probabilistic models in accordance with the measurement distributions as shown in Figure 1. Since the noise distribution could be changed by external factor, we want to make a more resilient system by using both two models. In the proposed system, we design an abnormal analyzer as an analytical tool that determines whether the distribution of measured values follows Gaussian or not. If the estimated distribution is Gaussian, our system uses a probabilistic model and if not, an abstract model is used in order to generate the result of sensor fusion. For our experiment, the unmanned ground vehicle is used to measure sensor values (Encoder, IMU and GPS) as shown in Figure 2. It has the maximum speed of 2 m/s and the data can be gathered by driving it on straight lines.

III. CONCLUSION

In the sensor fusion model, the abstract and probabilistic model are generally used. However, each model could have the different performance in various environments (i.e., the distribution of values is not Gaussian). Therefore, we propose the system using the both models according to the distribution of values. In case of Gaussian distribution, the system uses the probabilistic model and if not, the abstract model is used instead. To determine whether the distribution is Gaussian or not, the statistical schemes can be applied for our system.

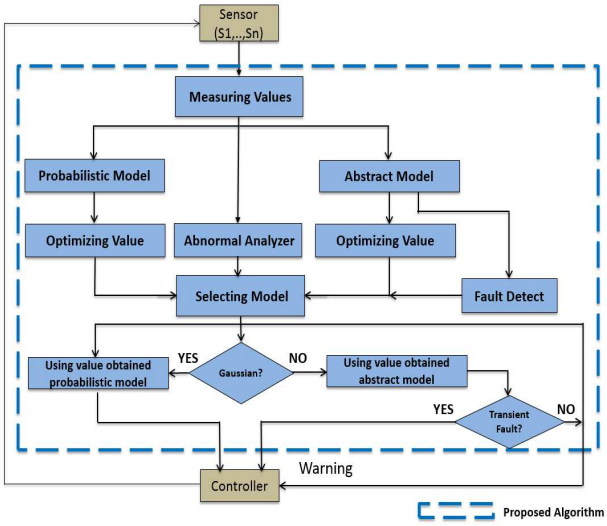

Figure 1. Structure of Noise Adaptive System.

We expect that the proposed system will provide the better accuracy and be more resilient against effects of changing environments than the system that uses a single model. It can be also used for the systems using multiple sensors to obtain the stable value in various environments.

Figure 2. Unmanned Ground Vehicle Called Jackal.

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