SENSOR FUSION ALGORITHM

Sensor Fusion is the process of merging data from multiple sensors such that to reduce the amount of uncertainty that may be involved in a robot navigation motion or task performing. Sensors are used to collect data from disparate sources. The data is then computed to achieve the resulting information having has uncertainty than would be possible when these sources were used individually. The algorithm allows the passage of collected data to be passed through a series of computational steps to return a value which is representative of the correct raw data from the sensors. It also helps depict the sensors whose values are out of range or when they start working asynchronously.

The following structure diagram explains the working of the algorithm in a step wise manner:

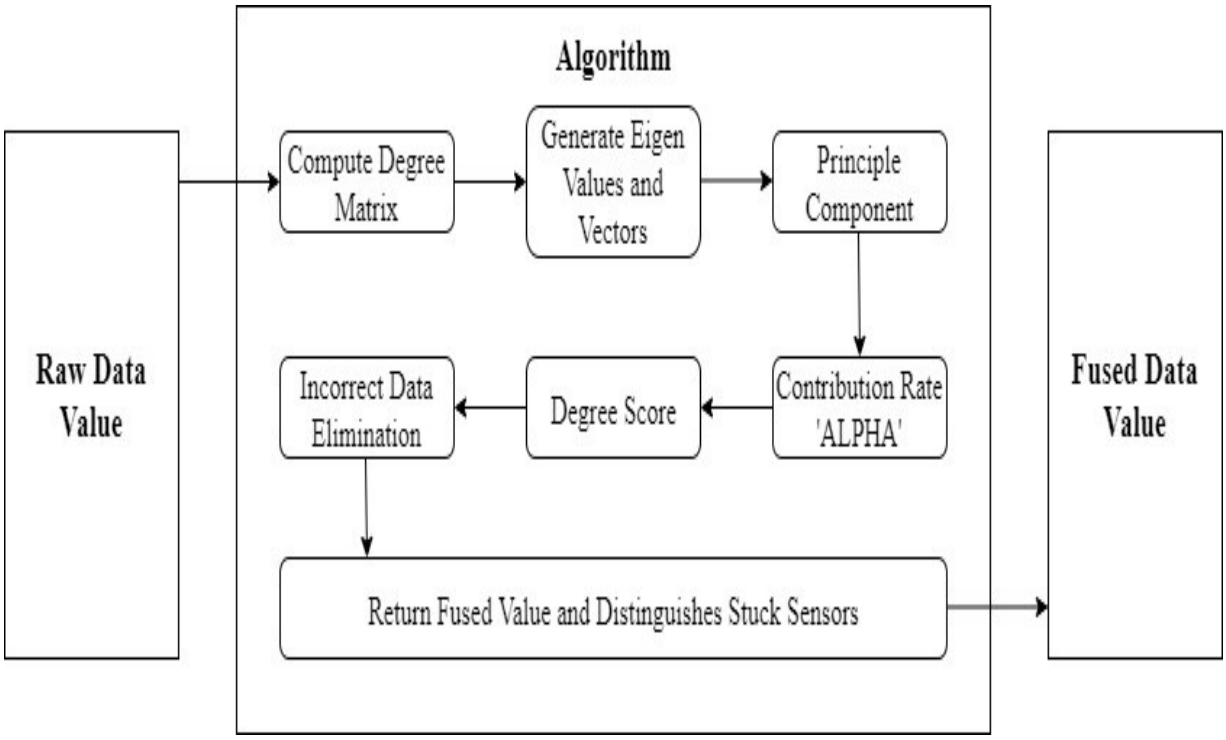

Fig. 1. Structure Diagram.

Specification:

The main purpose of the algorithm is to sense data using **n** number of sensors such that meaningful output value can be generated through computations. We start by collecting the raw data values from different sensors. The data goes through the algorithm phase that consists of various operations to assure correctness.

It is a 7-step process that starts by calculating the support degree matrix between sensors to acquire the information about the sensors. Afterwards, the eigen values and the corresponding eigen vectors for the support degree matrix are calculated to reduce the noise in data. They are used to capture the key information that is stored in a large matrix. We have used GSL as an external library to calculate such vectors. In third step, the principle components of the matrix are calculated to reduce a large set of variables to a small set that still contains most of the information in the large set. The complexity of the process is further reduced by calculating the contribution rate of the principle components. After integrating the support degree score for all the sensors, invalid sensor readings are observed and are thus eliminated by calculating the weighted coefficients for each sensor to discard the faulty sensor readings. In general, sensors show certain changes in the data received in response to a physical property, that is, the changing nature of the data readings is time dependent. It helps us indicate whether the sensors whose value does not change after a certain time period.

The fused data value is the output value returned by the algorithm.

Test Strategies:

We have used the “Black Box” testing method for each component. Test cases are created by adding different combinations of input values, run the algorithm and check whether the output is what we expected.