

An Explanation and Proposal on Multisensor Data Fusion

Sathish Kumar S V

UG Student - Department of Mechatronics,
(Kumaraguru College of Technology, Coimbatore - 641049.)

Abstract:- Multi-sensor fusion (or) multi-sensor information fusion is an emerging technology which is being applied in the field of robotics, image and signal processing and medical diagnosis. The main objective of this paper is to give an idea about the various sensor fusion performance and technical characteristic obtained from different techniques. It is based on the principle of integration of data from different sensors that could allow a better understanding of the data from different varieties of sources for achieving better performance in many of the individual sources like weather forecasting, statistical data analysis and estimation. In engineering system, the fusion methods are significant because the system could provide capability to systems with different sensors especially beyond that individual system of the sensors. Multi-sensor fusion of data allows integration of data from various sensors for improving the perceiving of environment and makes easier for decision making, planning, executing and control of automation. From this paper had proposed an idea about the smart home system with the help of various sensors which help to mentor the home which helps the people for mentoring the old persons in home.

Keywords:- Multi-sensor data fusion, image fusion, neural network image fusion, decision level fusion, integrating data, Smart Home.

I. INTRODUCTION

Multi-sensor fusion is like an animal which evaluate its surrounding with the help of the sounds (Signals) from the surrounding which helps it to find the its surrounding is fit for it or not. The multisensor data fusion is like the human brain which helps us to recognise the sense of different taste this is also like the animal sensing the sounds from the surrounding. Multi-sensor fusions also plays a major role in combining of sensor data from various sources for inferring the reliable and accurate results that is unfeasible from the individual sensor.

The process of sensor fusion integrates data's in such a way that it results with the best performance which could be attained if each information is used alone. From this proposal it will give an idea about the smart home from the multisensor process in homes. The smart home is based on the motion detections and it helps in theft protection which indicates the detection to the user. Some of the factors that improve the performance of the system.

- Improved System reliability.
- Extended coverage.
- Improved confidence.

- Shorter response time.
- Improved resolution.

Some of the key issues are

- Nature of the sensors types available with resolution.
- Ability of digitalization of sensors.
- Ability to implement the algorithm to the sensors and to the centre where it is controlled.

II. CONCEPT OF MULTI SENSOR FUSION

The multisensor fusion concept is simple which has the basic four level process as follows.

Information Source: This is source of information about the sensors and other database which helps in situating the sensors in the required place.

Source Preprocessing: This stage helps in data pre-screening and data allocation for the sensors which are going to be used. The helps the fusion process to checked before the time.

Level1 Processing (Object Refinement):

At this level the entities like position, velocity, identity is obtained which help for the military to target their enemies. This process involves four basic elements are data alignment (transformation of data to a consistent reference frame and units), association (using correlation methods), tracking actual and future positions of objects, and identification

Level2 Processing (Situation Refinement):

At this level it helps to analyse some prior information which should be mentored and want to immediately inform the user like objects, event and the context information's.

Level 3 Processing (Threat Refinement):

Based on a prior knowledge from the level 2 and predictions about the future situation helps in assessing the current situation of place. This is a quite difficult level of processing because it is not based on the figured database in the system rather the things happen other than that like strategies, environmental threats etc.

Level 4 Processing (Process Refinement):

This process is a meta-process concerned with other process. It helps in controlling the other system by monitoring the performance, its ability of working and identifying the information which is a feedback from the system which had to be improved. In this process it results in the objective of the multisensory data fusion which we are targeting.

Database Management:

This is act the brain for the process in which helps in storing all the data in the system. It helps in storing, retrieving, archiving, compressing, queries and protecting the data. This is complex because we can't predict the happening in the process, so it is a complex process.

Human Machine Interaction:

This process provides the interface between the system and the human by the input and the communication to the fusion results to the operator and user. This interaction helps the user to know about the information from the input and the incident which taken place. Some model for the human and user interaction are JDL, Waterfall Fusion Process Model, Boyd Model, The LAAS Architecture, The Omnibus Model.

III. INPUT OUTPUT MODES

If the input is given to the system, the output must be get from the system. So, the fusion process of input and output are done in six various modes.

- *Data In - Data Out:*

In this method the input and the output are in the form of data. This type of method is majorly used in the fusion process. This method used in the front end of the processing stream and it works basically in the signals and image processing systems.

- *Feature In – Feature Out:*

In this method it based on the features which is obtained from both input and output. It occurs in the middle of the processing stream. Here the information which are got as a raw measurement is then combined into a qualitative and quantitative.

- *Decision In – Decision Out:*

It is based on the decision for the input and the output. It mainly occurs at the end of the processing stream. It is the integrational process of the decisions from the different sensors and data may be raw or extracted from the feature. This method is adopted in the instance when the used sensors are compatible.

- *Data In – Feature Out:*

In this method the input is based on the raw data from the sensors or other input facilities and the output is as the feature format (visually representing it) with the surroundings or the phenomenon we consider.

- *Feature In – Decision Out:*

Here the input is accepted as the feature format and the generates the desired decision output. Here the input is get from the sensors and the output which is generated as the decision is displayed to the user. This type is mainly used in many pattern recognition tasks like object recognition.

- *Data In – Decision Out:*

In this method the input is given as the raw data from the sensors and the output is generated as the decision. This is like feature in – decision out mode.

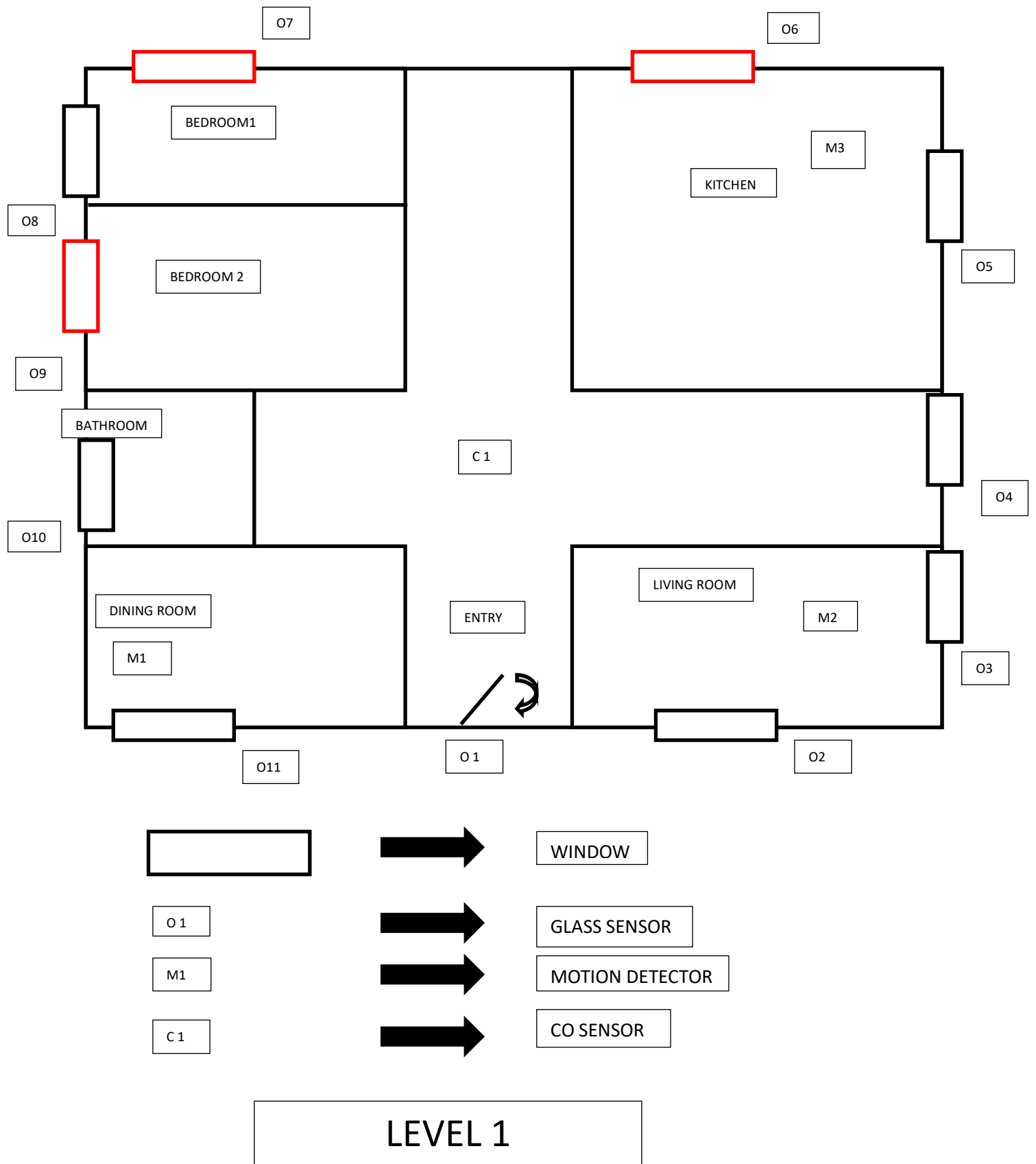
IV. HOME MONITORING SYSTEM

This is about the home security system, which helps the user to continuously have an coverage of his/her home. It is also used as the monitoring system for the elder people using the motion detectors like camera etc. Here some of the simple sensors are used and the multi sensor fusion is implemented using it's information which makes the user to have the information about their home when they are out. Here we are using some of the listed level 0 sensors:

- Open-Close sensor
- Motion detector
- CO detecting sensor
- Glass breaking sensor
- Smoke detector
- Thermal Camera for detection

These sensors are referring to the level 0 sensor these sensors are the basically used in the home monitoring system which helps in a good monitoring guide for the user. The thermal sensors are used because it helps in easily monitoring of the home also it helps the user to have a complete monitoring about the health of the elders.

In this level the sensors are positioned in the required position in the house which helps in observing the house by the user. Here my idea to use the thermal camera for the motion detection. These are basic sensors and idea for the simple home security or monitoring system.



LEVEL 2:

In this level the prior information about the location of the sensors are loaded into the system containing the database. In this level the complete details are provided about the perfect location of the sensors which make the user to understand the interfacing fusion process.

Let's consider this level from the proposal. We can see the living room of the house it contains the motion detection sensor (M2) and the glass break and the forward and backward motion sensors helps in window for opening and closing (O3 & O2) and the sensor for motion detection (M3) and the window sensors (O6 & O5) are in the Kitchen. Also, the motion is detected it helps for the user to look for the illness of the old. Thus, like this we are adding the context about the sensor's absolute position in the home.

LEVEL 3:

This level is completely based upon the level 1 and level 2 information what we had considered which means the current situation and the future prediction that makes the user to identify the issues in it. This level is completely based upon the incidents which can be able to analyse the incidents which had happened earlier and then now.

Assuming the situation that the windows had been broken. Let's consider the window (O9) is first broke and then the window (O6) after some months and then the window (O7) after some days of the second window broke. This had been stored in database of the system which helps the in predicting the future incidents when it may happen and the reason for the breakage that helps the user for the clear solution about the problem which he/she faces. Here in some instance the old age people who are is also noted by their abnormal motion in the home and this helps the user to call for emergency.

LEVEL 4:

This which act like the feedback loop system which makes the user more comfortable for the incidents that happens in the home which will help in giving the solution to the user for the problem. From the diagram the dotted redlines marks the privacy region of the house which indicated that it is the higher risk region from the front door and the windows facing the street.

From the assumption lets finalise that the sensors O11, O1, O2 are at lower risk and it must have a slight importance than the other. The other sensors from O3 to O10 are under the privacy region which makes the user to have a continuous view on and mainly the sensors which have been broke previously O7, O6, O9 which are at higher risk which must be continuously notes. In these cases, the fusion process helps in for the better process and guide the user for the better updates.

V. CONCLUSION

Advancement in technology and software are the major reason for the emerging of new technologies in the real life. These technologies which doesn't follow the traditional concepts (1's & 0's) it is based on the fuzzy logic and the neural network. The best example for the multi sensor fusion is autonomous vehicles braking system it follows the fuzzy logic

which gradually applies brake based on the distance of the obstacle before it but in traditional logic it's like sudden braking system when the obstacle is there. From this proposal a person can be able to understand the multi sensor data fusion process with the proposal about the home monitoring system.

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