ID8- A REAL TIME SEAFLOOR SEISMOMETER

M. Carbonell[167], I. Massana[165], J.A. Prat[166] and E. Trullols[164] , Joaquín del Río[156]

Abstract - In this paper we present a new compact design of marine seismometer in the frame of INTMARSIS project. The design pretends to be an alternative to OBS (Ocean Bottom Seismometers) in shallow waters (depth < 500m) to be deployed near de coast. In contrast to OBS, a physical connection between the seafloor unit and the surface buoy allows real time data processing, satellite communication and intranet publishing.
Even though an umbilical cable seems to be the more obvious alternative, the low energetic consumption of the seafloor unit and the recent improvements in inductive communications open a very interesting new possibility, the connection with steel cables. Steel cables are cheaper and not so heavy as the umbilical ones, and the bandwidth inductive communications supports at least 3 channels 100Hz sampling in real time.
Mechanical structure and deployment procedure are also discussed.

Keywords – marine technology, marine sensors, OBS, seismometers

ID9- AUTOMATIC TURBOT FISH CUTTING USING MACHINE VISION

Fernando Martín-Rodríguez[73, 195], Mónica Barral-Martínez[196]

Abstract - This paper is about the design of an automated machine to cut turbot fish specimens. Machine vision is a key part of this project as it is used to compute a cutting curve for specimen's head. This task is impossible to be carried out by mechanical means. Machine vision is used to detect head boundary and a robot is used to cut the head. Afterwards mechanical systems are used to slice fish to get an easy presentation for end consumer (as fish fillets than can be easily marketed and consumed.

Keywords: turbot fish, food industry, machine vision, mathematical morphology, Hough transform.

I. INTRODUCTION

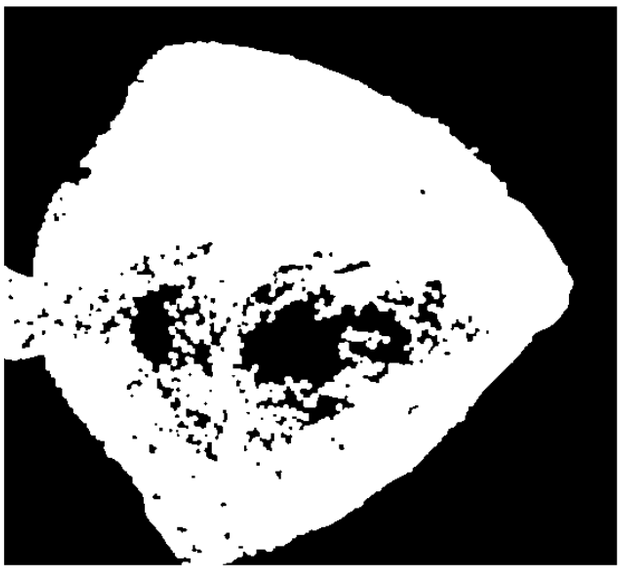
There is some interest in food industry to be able to automatically slice turbot fishes to get a new commercial presentation, very attractive to customers as they will be fillets with no fish bones, very easy to cook and to eat.
Turbots are flat fishes of very delicate flavor and high commercial interest. Nowadays, they are farmed in numerous places. Its special shape makes difficult to create an automatic cutter. The main problem is cutting the fish head, as it is necessary to develop a curve cutting that will depend on specimen size. Formerly this cutting was made by specialized personnel but it is an unpleasant and dangerous activity because specimens are very slippery and can cause that workers hurt themselves with their own knives.
That's the reason for using computer vision as a means of automatically detecting the necessary cutting curve and instructing a robot for cutting the head away. Afterwards mechanical systems are used to slice fish to get an easy presentation for end consumer.

Turbot test image, got at a processing plant.

So definite system is equipped with a computer vision camera [1] and an appropriate lighting system that obtains a digital high quality image of the specimens. An industrial computer will process this image to get a cutting curve that will be transferred to a robot [2] that used an electric saw to cut out the head.

II IMAGE PREPROCESSING

At the first processing stages, we use the fact that turbot body is darker than its background to segment it. Classic algorithm from Otsu is used [3].
Afterwards, mathematical morphology [4] is used to get the fish silhouette.



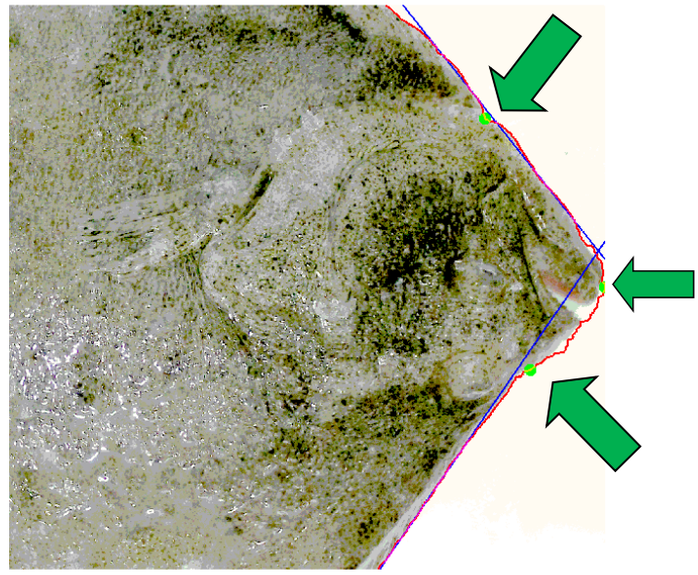
Fish silhouette.

III. CUTTING CURVE COMPUTATION

Fish silhouette is then modeled using two straight lines that are computed through Hough transform [5] (blue lines in the figure below). The error (distance) between the real contour and both lines is computed. That computation allows determining three important points:

- Peak: rightmost point of silhouette. Really we do not need blue lines for locating this point.
- Head starting: local maximum in distance function, the maximum that is nearest to peak.
- Head ending (by the eye): local minimum in distance function, the first minimum on the other side of the peak.

Finally, we compute a cutting curve as a parabola from starting to ending point. Besides curve axis is equidistant from both extreme points. And putting the coordinate origin at the peak point: let x be the mean x-coordinate of extreme point; then, 3x will be the x-coordinate of the vertex. These two conditions will define vertex and so we will have three equations to determine the parabola.
Curve points are passed as coordinates (in millimeters) to the cutting robot in a XML file (peak point is the coordinate origin).



Key points.

Cutting curve.

IV. REFERENCES

[1] http://www.jai.com
[2] http://www.kuka.com
[3] N. Otsu, "A Threshold Selection Method for Gray-Level Histograms", IEEE Transactions on System, Man and Cybernetics, vol. 9, N.1 (1979).
[4] R.C. González, R.E. Woods, "Digital image processing using MATLAB", Steven L. Eddins, Upper Saddle River: Gatesmark Publishing, cop. 2009.
[5] R.O. Duda, P. E. Hart, "Use of the Hough Transformation to Detect Lines and Curves in Pictures," Comm. ACM, Vol. 15, pp. 11–15 (January, 1972),