UTH-CAR RoboCup 2014
Humanoid Standard Platform League Team Description Paper

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Abstract. The team *UTH-CAM* is a new team, shaped for two institutions the firs Huejotzingo Technological University and the second Autonomous University of Campeche. In previous years participated in other category RoboCup and on this year our interest is participate in the category in the humanoid robots Standar Platform League.

1. – Introduction.

The Institutions offers students the opportunity to learn and develop humanoids robots with the capacity of walking, dancing and even playing a soccer match in an autonomous way. This is possible because the Institution has commercial humanoid robots such as NAO and Darwin-OP.

Due to the successful participation in several national and Latin Americans, for example: Mexican Tournaments of Robotic and Latin American Tournaments of Robotic, we decided to participate in this important event RoboCup.

2. - Vision and Localization Systems.

One of the challenges that we had to face was that our vision system converted video from RGB to HSV to segment the color afterwards. This algorithm had disadvantages since it used many processing resources. This was even more evident when applying the Hough transform to detect lines and circles. This problem was solved due to the incorporation of a more efficient algorithm in this edition of the RoboCup. In this algorithm, we get video in YUV model and we applied the segmentation of the color directly which is very efficient for the computer of the NAO robot, these algorithms are designed with the library Open CV. In order to make it function with our robots, we linked the framework Naoqui of the NAO with Open CV.

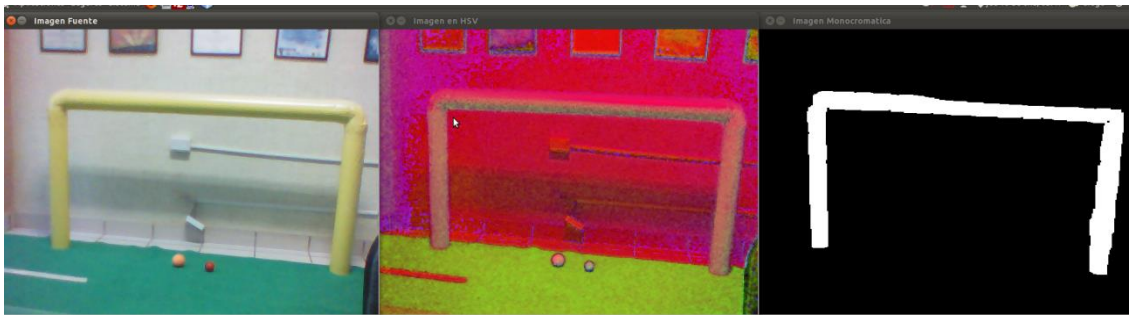

Fig.1. - Binarizacion of colors.

Our new vision system segments and binarizes the colors orange, white, green and yellow perfectly. Currently, we are working on detecting the lines of the field by using the Hough transform which will also be useful to locate the robots.

Fig. 2. - Hough transform and color filtering.

We are also working on the implementation of location through the Monte Carlo method and Kalman filters which is mainly based on a probabilistic state of the positions and route of each robot. While implementing this last method, we are working carefully on reducing the type of combinations in order to avoid the saturation of the pc of the robot.

In this edition, we are currently using the Game Controller which was not used in Robocup 2011. In addition, we are working on the development of algorithms of cooperation between agents. We are using a method of centralized control where

the robot goalie can indicate the other robots the position of the goal box mainly and we sometimes indicate the position of the ball in the field so that they can find it easily.

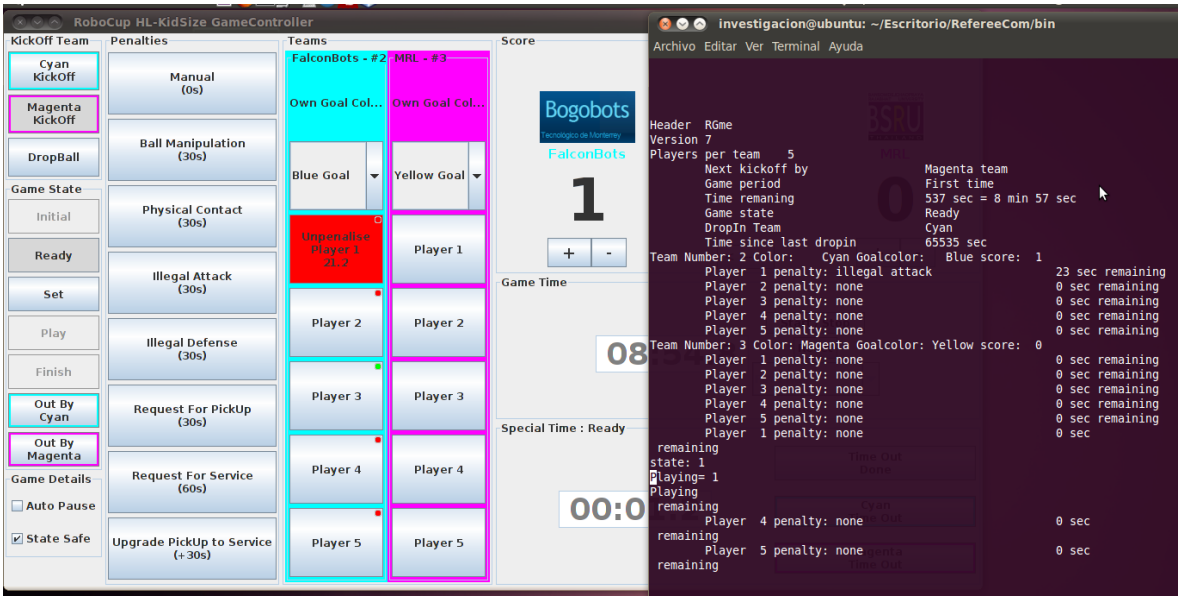

Fig 3. - Communication witch Game controller.

For getting information about the deepness of the ball, which is mainly based on a process of triangulation from two or more images (see figure 4). The camera height h, the angle? That is formed because of the lens and the ball position are known. This angle is formed because of the inclination degree of the servo tilt. These values help us to determine the precise distance of the ball.

$$\frac{h}{\sin \propto} = \frac{d}{\sin(90- \propto)}$$

$$d = h\frac{\sin(90- \propto)}{\sin \propto} \sin\left(\frac{\pi}{2} - \propto = \cos \propto\right)$$

$$= h\frac{\cos \propto}{\sin \propto} = \frac{h}{\tan \propto}$$

$$d = \frac{h}{\tan}$$

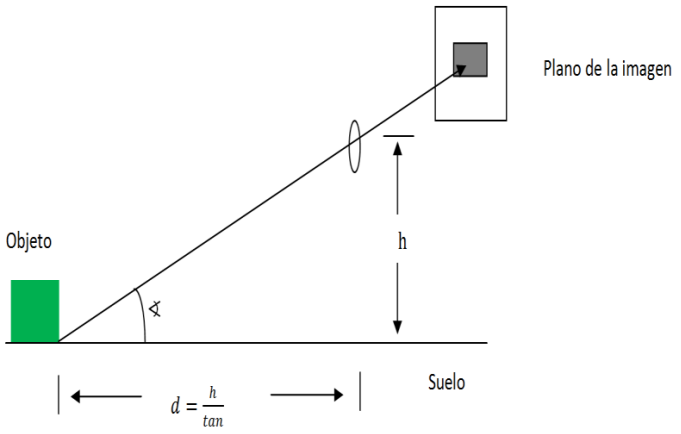

Fig. 4. - Determination of the distance between the robot and the ball.

3. - Localization

We propose a conformal model for 3D visual perception. In our model, the two views are fused in an extended 3D horopter model. For visual simultaneous localization and mapping (SLAM), an extended Kalman filter (EKF) technique is used for 3D reconstruction and determination of the robot head pose. In addition, the Viola and Jones machine-learning technique is applied to improve the robot relocalization. The 3D horopter, the EKF-based SLAM, and the Viola and Jones machine-learning technique are key elements for building a strong real-time perception system for robot humanoids. A variety of interesting experiments show the efficiency of our system for humanoid robot vision

4. - Artificial Intelligence.

This section describes the robot's intelligence, which is based on a finite-states machine. This consists of a robot model of behavior. This model consists of a finite quantity of possible states. In addition, the system can change of state when a specification is performed. This kind of change is known as transition. Therefore, the condition of transition has to be performed so that there can be a change of state. Likewise, the action of the current state has also to be performed.

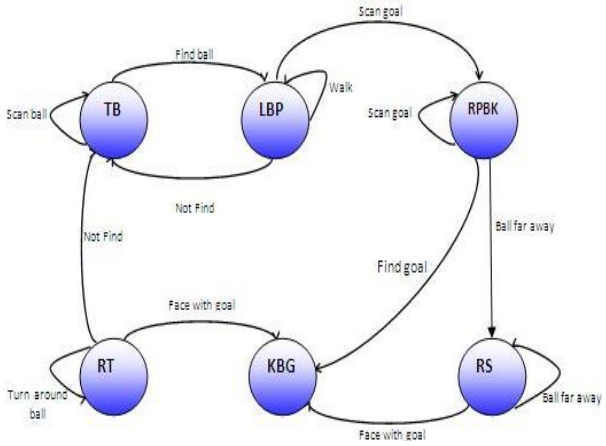

Fig. 5. - Finite-State machine.

List of the states

1. Track Ball (TB).
2. Localization of Ball Position(LBP)
3. Robot Turn (RT).
4. Robot Positioning at the Ball for Kicking (RPBK).
5. Robot Slide(RS)
6. Kicking the Ball towards the Goal(KBG)

5. - Conclusions and further research.

It is planned to create a library that can function in any architecture of humanoid robots. We are currently working in the creation of a new humanoid robot to participate in the category AdultZise which will function with the library that we intend to create. Even though we are a young team, we are glad and eager to participate in RoboCup every year. Our goal is to continue contributing to the development of

research in the field of humanoid robots to achieve the RoboCup's objective which is to make robots play against humans in 2050.

6. - Information of the TEAM

Team Name: UTH-CAM
Team leader Diego Mauricio Reyes Hernández
Mail: dreyes99@hotmail.com
Name Institution: Universidad Tecnologica de Huejotzingo
Number of robots: 5 NAO H25

7. - Publications and references

1.- Alberto Petrilli-Barceló, Heriberto Casarrubias-Vargas, Miguel Bernal-Marin, Eduardo Bayro-Corrochano,Rüdiger Dillmann:
Geometric Techniques for Humanoid Perception.
In International Journal of Humanoid Robotics 7(3): 429-450 (2010).

2. - Efraín Hernández, Roberto Carlos Ramírez, Jonathan Alcántar, Alberto Petrilli, Andrea Santillana, Antonio Salvador Gómez: VATIO UP
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3.- Efraín Hernández, Roberto Carlos Ramírez, Jonathan Alcántar, Alberto Petrilli, Andrea Santillana, Antonio Salvador Gómez: VATIO UP
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4. - Heriberto Casarrubias-Vargas, Alberto Petrilli-Barceló, Eduardo Bayro-Corrochano: EKF-SLAM and Machine Learning Techniques for Visual Robot Navigation.
In 20th International Conference on Pattern Recognition 2010: 396-399.

5. - Luis F Lupian, Alberto Romay, Andres Espinola, Diego Marquez and Diego M Reyes: Cyberlords+Falconbots RoboCup 2012 Humanoid KidSize team descrip-tion Paper: In RoboCup World championship, Mexico City, RoboCup Federation (June 2012)

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November 27th, 2013

Standard Platform League Technical Committee,

I hereby express the full commitment of team *UTH-CAM*, which I formally represent, to participate in the 2014 edition of the *RoboCup World Championship* to take place in *João Pessoa, Brazil* on July 19th – 25th 2014.

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