Making Botball Even Better

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Abstract:

Botball is a well-established robotics organization whose primary mission is to excite students in science and technology all over the world. In any comprehensive program, however, there is always room for improvement. In our paper, we examine several elements of the Botball program like sensors, and the game field, drawn from our experience. We have participated in the program for the past few years. We believe the Botball game can be modified to introduce greater automation.

Introduction:

In the final days preceding regional competition, members frantically scrambled around the room to make last minute design changes and to program the Lego bots and iCreates. As the day of competition arrived, we realized the program we had made for our robots, with the exception of the "WaitforLight" function, relied solely on dead reckoning. The Botball program can minimize the amount teams rely on dead reckoning by introducing students to sensors with more sophistication and accuracy. When these up-graded sensors are included in the program with parts modifications, and certain elements on the game field are revised, the game can become an even greater challenge. The new challenge will require students to engage in problem-solving and to use a more productive team effort through collaboration.

Mission of the Botball Program

As mentioned on the Botball Educational Robotics Program's website, the mission is to "give students skills, experience, and opportunities to succeed as

they work in teams to **design, build and program a pair of autonomous robots** for regional and international competitions." The ever-growing organization has introduced students around the nation and the world into the fast-paced environment of science and technology. It has surpassed the standards by far. We believe, however, that the experience students take from Botball can be made even better, if the program was geared towards implementing sensors on robots to introduce a higher degree of automation.

Selection of Sensors

This year's inventory of sensors included a small and large touch sensor, an ET sensor, a light sensor, a top hat sensor, a camera, a sonar sensor, and a slot sensor. While they were undeniably fascinating to observe and experiment with, they often didn't have the features that would be advantageous to put them on our robots. For instance, after we ran several tests on the sonar, or ultrasonic distance sensor, we realized that the readings for distances 3-5 centimeters away were unreliable because the values overlapped with those of greater distances. This characteristic was corroborated as we analyzed the datasheet for the specific sensor given to us in the kit of parts. (Electronic Parts)

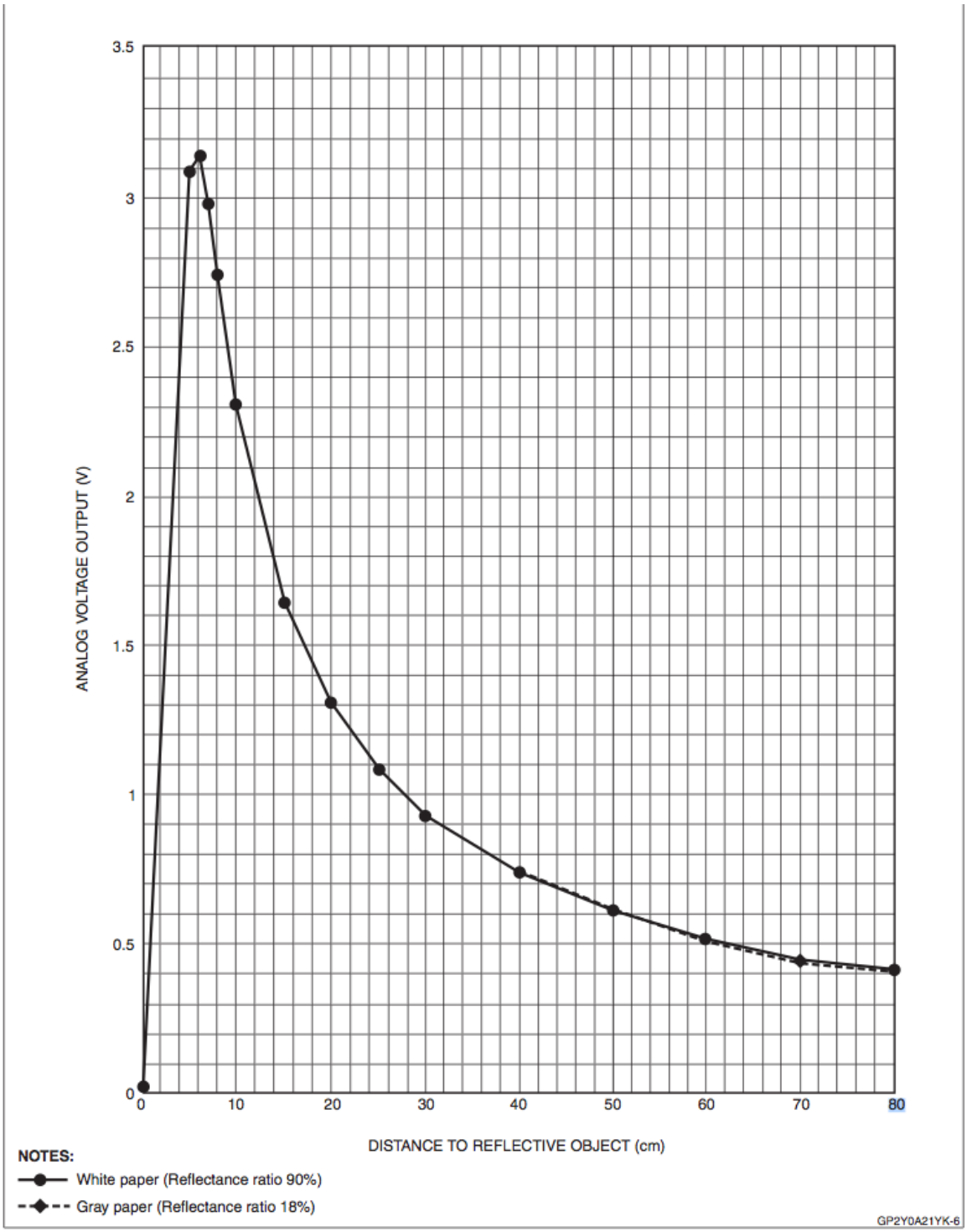

Figure 1 Datasheet for the Sharp 2Y0A2 Optical Sensor (http://document.sharpsma.com/files/GP2Y0A21YK-DATA-SHEET.PDF)

This graph explains the reason for the sensor's inability to reliably measure certain distances. If teams were given sensors with a broader range, it is likely that

students would be more willing to apply them to their robots. Furthermore, the difficulty in mounting the tactile sensors onto the robots serves as an additional hindrance towards greater automation. For instance, it would be very advantageous to use both the small and large touch sensors in this year's game.

Figure 2 The Large and Small Touch Sensors in the Kit of Parts (http://homebase.kipr.org/2010/file.php/7/2010_Workshop_Files/Documents/2010_Parts_Lists/2010_Electronic_Parts.pdf)

In the frenzy preceding competition, however, the lack of an effective way to mount such sensors played a large role in why our team did not integrate them into our design. If mounting devices already attached to the sensors were given, or even if the game rules were modified somehow to allow an innovative way to secure the sensors, this disadvantage could easily be overcome.

Modifications to the Game Field

Another way to minimize the use of dead reckoning and to promote the use of sensors would be to make slight modifications to the game field. If walls of foam or cardboard were to replace the PVC pipes, the optical distance sensors or even the tactile sensors, could be used to detect the robots position on the game board. Furthermore, colored tape that is easily distinguishable by the light sensors, would add another reason for students to use sensors. Likewise, if vertical poles were projected from the field and

were liable to fall over if they came in contact with the robot, the robots would be forced to rely on sensors to direct them in a path a safe distance from these vertical projections, thereby, promoting the use of sensors in the Botball game. The addition of the suggested features would encourage teams to have their robots rely more on sensors than on a pre-planned routine.

Conclusion:

Clearly, the growing participation in Botball within the nation and around the world indicates its success in promoting science and technology in the community. The Botball game could be even more sophisticated, however, if the game were to promote the use of sensors. In order to achieve such a daunting task, we encourage the replacement of some sensors, the addition of better mounting techniques or devices for the sensors, and alterations and additions to the game field.

Bibliography

Electronic Parts

http://homebase.kipr.org/2010/file.php/7/2010_Workshop_Files/Documents/2010_Parts_Lists/2010_Electronics_Parts.pdf

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http://ecb.omron.com.sg/pdf/photomicrosensors/non-amplified/EE-SX1042.pdf