by Daniel Ward II

VEX League play in the Hoosier State

New games and a unique all-night challenge

The State of Indiana is at it again. Fall 2010 saw the first two of five VEX robotics league tournaments to be held in the 2010-2011 school year in support of the Indiana Robotics Educators (IRE) grant project. The first event, with 80 teams and hundreds of spectators was held in Bloomington at Ivy Tech Community College. The second first of its kind event was held at Indian Creek High School in Trafalgar. As a new, unique and innovative competition concept, the author predicts the format and excitement generated by this event will be duplicated everywhere.

The Lock Tight event utilized three fields for play.

BLOOMINGTON ROBOTICS CLUB COMPETITION

Teams gathered from schools from all over the state of Indiana to play in this one-day, three-event competition at Ivy Tech. This event, sponsored by the Bloomington Robotics Club (BRC) for the past four years, has consistently been one of the largest one-day VEX robotics competitions in the world. The BRC and its industry partners have been very active in supporting educators through fundraising and helping their community by collecting donations for charity instead of entry fees for their sponsored events. The BRC also generously grants each rookie team a VEX kit to build their competition robot and take it back to their schools. All other registered teams receive a $250 credit with VisualEdge, Incorporated for VEX parts and accessories to be used to build their competition robot.

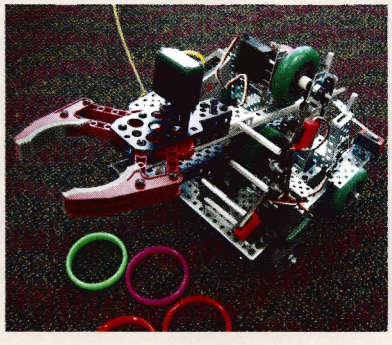
MILESTONES

A majority of the students competing are mentored by teachers that have been introduced to the field of robotics and competition through the Indiana Robotics Educators, IRE, summer workshop grant. Teachers have had the opportunity to

HOOPLA

This is the brainchild of the Design Technology Department at Ivy Tech Community College-Bloomington. Classes designed the game using CAD software, wrote the rules and constructed the field components. It is a two minute two-on-two game played on a carpeted 8x9ft. competition field. Robots must place standard ring toss rings (yes, there are standard ring toss rings) onto two sets horizontal T-shaped PVC goals on opposite sides of the field. Each team of two is declared either red or blue at the beginning of the match and must place their collected rings onto the pipes. The winner was the one that placed the most rings onto the goal with their color. All of the five different colored rings were worth one point except the red rings that were worth five. A little finesse was called for when collecting the red rings as all of the rings started out in the middle of the field in a pile. All teams competing in this part of the competition played seven seeding matches to determine their place in the playoffs. Four fields played at once during the seeding matches. Sixteen teams compete at a time and then quickly move to play again or repair and recharge.


Hoopla, this year's table game, resulted in 60 different robot solutions to the design problem.


Ring grabbing robot utilizing and extendable VEX Claw and lots of limit switches to keep the arm within preset operating envelope.

SEE THE VIDEO!

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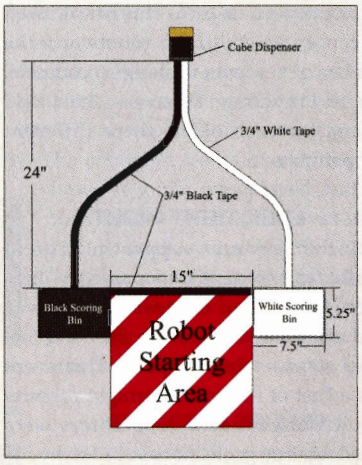
CUBE CONUNDRUM

This challenges the participants to design, build, and program a robot to retrieve colored cubes and deliver them to the proper scoring bin. Each robot was timed and evaluated on its sorting accuracy with the fastest time and highest score at the end of the day being declared the winner. The kicker is that the teams had no access to the field other than a rough drawing in the rules release. All teams were introduced to the field at the beginning of the competition and allowed to measure and explore the fields before writing their program. Almost all teams utilized easyC from intelitek to program their machines. It was played on a 3 x 4ft. plywood field which has been painted a medium shade of gray. Two 7.5 x 5.25 x 3in. black and white bins are located on one end of the playing field. The gap between the bins served as the 15 x 15in. starting zone. A cube dispenser made out of VEX metal was located 24 inches away from the starting zone and bins. This dispenser is elevated three inches above the playing field surface. The dispenser is 2.5 x 2.5 x 10.5in. and has a 2.25 inch tall opening on the front and sides to allow access to the 2 x 2in. wooden cube scoring objects.

A team works on a problem in the live programming challenge-Cube Conundrum

Black and white lines on the playing field create a path from the dispenser to the scoring bins. The procedure to solve the problem seems simple, but teams quickly found that the challenge was truly diabolical. Problem number one was to leave the starting zone and locate one of the colored lines using the VEX line tracking sensors. The sensors utilize an infrared emitter and register values back to the processor. Competitors used this value to locate and slowly turn their robot onto the line.

Problem number two was a little simpler. Most chose to use a limit switch in combination with a VEX Claw pre-adjusted to the correct height to simultaneously stop the robot's forward motion and cause the claw to close around the colored block.



Cube Conundrum V2.

Problem number three was the hardest. The color of the block had to be determined in order to take the block to the appropriate scoring box. The best way to accomplish this is to press a single VEX line tracker sensor tightly against the block and have the software take a look at the value returned from the sensor. Teams had to carefully adjust the range of values in their code so the software could determine if the block was black or white in order to return it to the proper scoring box. After determining the color, the robot had to reacquire a line or use dead reckoning to deliver the blocks to the scoring boxes. Some teams utilized an ultrasonic sensor to stop at the box and drop the block. The robots had three minutes to empty the dispenser.

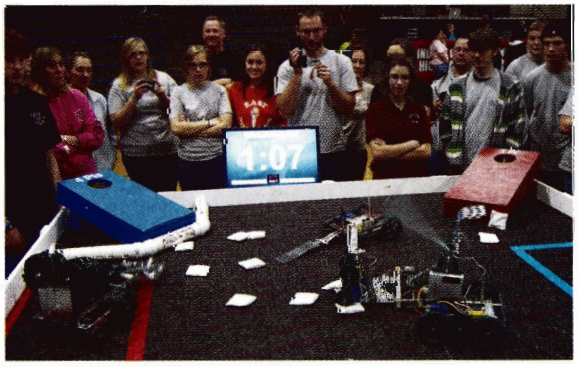
This new game met with some success, but the four-hour time limit allowed to write, test, debug, test, debug, calibrate, recalibrate, test, and scream proved to be too much for most of the teams (the room was 90 degrees by the end of the day). Many could get one or two of the functions to work, but only a couple managed to get a block back to the scoring boxes. Teams did learn a lesson from this competition—sensors require a lot of care and feeding. Everyone had a great time and vowed to return next year. Look for a version of this game from VisualEdge in 2011.

end up to three years of training and mpetition through the six-year-old ant project. The IRE grant project has ained over 1000 teachers throughout e state representing more than 420 iddle and high schools since 2005.

The partnership of the Indiana botics Educators, Indiana Department Workforce Development, Ivy Tech mmunity College, and the omington Robotics Club has been a emendous catalyst in getting school ministrators, teachers, students and rents to this event and ready to play. l teams involved with this competition very fortunate to have the support of e state, community college system, ong school systems, students and par- s. People from all of these entities are sent at the competition outnumbering competitors by a factor of three. The networking at these events is one of the greatest residual outcomes of the summer workshops and subsequent competitions. Parents, teachers and school administrators find that their problems are similar in this time of reduced budgets, and they can compare notes while their teams compete. Even though money is tight, these competitions keep getting more competitors every year. Bloomington has opted this year to hold the competition to only 80 teams due to space limitations. In the past, this competition has hosted over 100 teams every year-maxing out at 137 teams three years ago.

THE EVENTS!

The 80-team field would be playing in their choice of three events: *Hoopla*, the primary remote-controlled table game, *Cube Conundrum*, the live autonomous programming challenge and *Full Pull*, for the design challenge. Realizing that many schools field



Lock Tight's Cornhole scoring goals proved challenging for all teams.

multiple teams, each with their own talents, IRE in conjunction with BRC has been hosting this multi-game competition concept since 2006. This has allowed for more variety in the robots and the number of students wishing to compete. It is not uncommon to have a school field a team for each of the three different competitions.

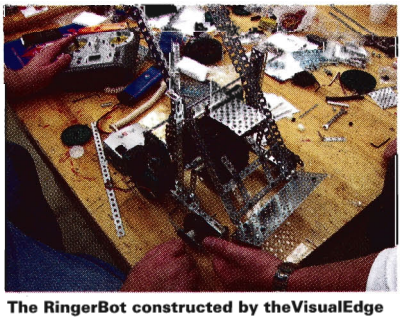
LOCK TIGHT NIGHT

With the help and support of a great number of student and parent volunteers, the second contest of 2010 was held at Indian Creek High School a few miles south of Indianapolis. This event was a first of its kind, overnight robotics event where student competitors were pitted against professionals in an on-site build and competition.

Some of the night's casualties... What time is it anyway?

This contest was totally unique as none of the teams registered had any clues about the game they were to play. The teams began filtering into the high school on Friday at around 7:00 pm for their 12-hour build session and to receive their kits or get the kits they brought with them inspected. All teams utilized identical VisualEdge competition kits for the contest with no extra parts allowed. The kits were purchased by the teams prior to the event as part of their entry fees or brought unopened to the event to speed the inspection process. By 8:00, all of the teams had arrived, and the doors were locked. They would reopen at 7:30 in the morning when the registered professional teams representing Cummins, Roll-Royce, Overton Carbide, and VisualEdge would arrive to get their first look at the game and familiarize themselves with the competition format. The professional teams also had to purchase their own kits which were waiting for them at assigned build tables, separate from, but accessible to, the student teams.

At 8:00 pm the particulars of the game were revealed. Students from Indian Creek's Computers and Design class presented an animation explaining the game rules they had spent several weeks developing. As the fields were revealed and the documentation for the game was distributed to the teams, students were already examining the playing field trying to figure out how to get their robot to play *Hack Attack*, a facsimile of the backyard game "Cornhole". Cornhole is played much like horseshoes except that, instead of shoes and stakes, the game is played with a sloping goal-usually made from a box with a hole cut into the middle of it-and beanbags that the players attempt to throw into the holes. Each alliance of two teams had two goals in which they could score. One goal was worth two points and could be approached from three sides. The other, worth four points, had a PVC barrier that held the machines some distance away and essentially prevented the machines from climbing the goal. They were going to have to push their beanbags, reach really far with an arm, or



The RingerBot constructed by theVisualEdge professional team.

DESIGN CHALLENGE: FULL PULL

The design challenge this year was the popular *Full Pull*, a Game-in-a-Box from VisualEdge, Inc. The game consists of a 55-inch track laid out on the carpeted floor with a simple "Start" and "Finish" line. The major component of the game was a sturdy, scaled-down tractor pull sled. The sled consists of a mobile ramp with wheels on one end and a skid on the other with a moving weight box on top. The weight box slides up the ramp as the robots pull it down the track moving the weight from the wheeled end to the skid generating end, which increases friction with the floor.

Full Pull from VisualEdge is always a crowd favorite. Robots exceeded last year's record pull by 6 pounds.

Each robot is required to complete a "Full Pull" in order to advance to the next pull. After each pull, the robot was disconnected from the sled and it was returned to the starting position for the next competitor. Each competitor got a dry run with the ten-pound sled with no additional weight in the box. Out of the 18 teams, only 3 made it to the last round where there was a tie for the win. This event is a true testament to the durability of the plastic parts in the VEX kit. No clutches or gears were lost to damage in this event.

This game is very popular with the robot designers. One must consider all of the aspects of the pull. Constantly changing friction, torque, battery power and traction make this game a legitimate challenge, and it gets more competitive every year. There were a total of seven pulling rounds with the last seeing 58.5 pounds in the weight box! Last year's final pull was 38.5 pounds in five pulling rounds. The new two-wire VEX motors and their added torque made the game very interesting and were strong enough to twist the frames of the machines as they advanced down the track.

simply throw the beanbags at the hole.

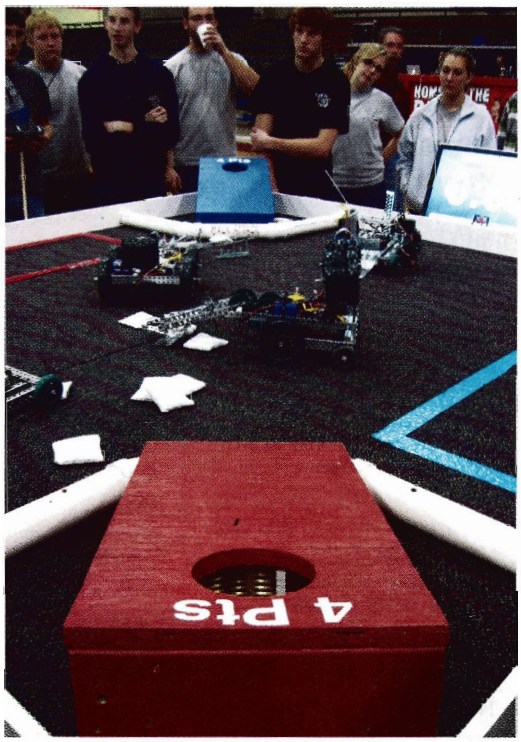
Several of the teams immediately began the task of building a sturdy drivebase for their machines. Many hoped for a robot that could drive up on top of the *Hack Attack* boards (allowed under the robotics rules). After spending four hours building this strategy, teams began to have serious second thoughts, knowing they only had eight more hours to develop a working robot worthy of competition. A couple of the teams opted even to completely dismantle their robot to explore other design options.

After six hours of construction and testing, students began dropping like flies. Like Thomas Edison in his laboratory, many catnapped at their worktables next to their partially-completed machines, hoping a short recharge would help them get through the night. Others gave out completely, crashing on the concrete floors between the bleacher seats in the gym or on the floors around their team's area. Some teams slept in shifts with a briefing on the build as groups awakened their replacements. The school also had the forethought to provide chaperoned sleeping rooms for boys, girls and teachers.

RUBBER BANDS TO THE RESCUE

Just as teams were reaching their breaking points with the extremely difficult task of building a robot that could consistently score, student and adult members of the Lock Tight Night staff came around with an early Christmas gift to help relieve some of the frustration that a few of the teams were experiencing. At first, several of the teams dismissed the gift of a bag of rubber bands as useless for the task. However, it was not long until the rubber bands began to appear on tires for traction and on long extension arms to help them retract back into place. Tension began to get more intense as the time grew closer for the professionals to arrive. By 7:20 am, they began to trickle in and examine what the students were already designing, building and testing. They wasted no time in walking around the pit areas and closely looking at the playing fields to get an idea of what concepts worked. At 8:00 they watched the game animation and began opening and organizing their kits on their workbenches.

The staff held off introducing the professional teams to the students to allow them time to familiarize themselves with the kit and the game. By 8:15 the professional teams were already underway working through the building process while student teams began their practice rounds. As the student teams entered the practice rounds, fatigue began to take over. The gym bleachers, once again, became concrete sleeping bags for some students who simply could not take anymore. Qualifying matches began around 10:00, and some of the teams who were ready to go home earlier in the morning began to show signs of scoring. Crowds gathered around the qualifying matches as teams started taking notice of which robots were working well. When lunch time arrived, many teams had gathered enough confidence in their work that they were willing to break and eat in the cafeteria. In contrast, the company teams made a dash for the cafeteria to gather up their lunch and ate quickly or immediately took their food back to their areas to finish their designs.



The bean bag scoring components proved difficult to handle.

The company teams not only worked through lunch, but one of the teams even worked all the way through the opening ceremonies, trying to perfect their design before having to compete against the student teams in the finals at 2:00 in the afternoon. When the finals began, all of the teams were still tweaking their concepts-trying maximize their scoring ability. The company teams quickly learned how the game was played and did their best to bring themselves up to speed with the student teams. Throughout the game, students used their previous experiences with the game pieces and the VEX machines to their advantage.

STUDENTS TRIUMPH

At the end of the game, the pros would only take home the experience. The trophies for Lock Tight Night, would belong to the students. Not to be outdone, the always gracious professional teams each selected a school team and gave them their kits to take home.

CONCLUSION

At the end of the very long night and day, the volunteers gathered around to compare notes. There were no catastrophic field failures, control problems or any intense arguments between competitors. It was a good day, and the best robots rose to the top. There were no winners or losers at this competition—only competitors and friends thinking about the next competition.

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—the editors

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