or simply cost reduction at saw through increased feed speeds and blade life all contribute to the increasing difficulty of dicing wafers. This presentation provided an overview of the wafer dicing process and the available dicing technology options. More focused discussions were on mechanical saw and the key process parameters that need to be optimized in order to meet the growing process challenges.

The First CPMT Micromouse Best Packaging Award

Submitted by Allen M. Earman, CPMT-SCV Chapter Vice-Chair

It has been years since I witnessed an IEEE Micromouse contest – many years. The Micromouse competition has been around for decades. IEEE Spectrum Magazine first introduced the microprocessor-controlled, autonomous Micromouse in 1977 with the first competition held in June 1979. I was a graduating Senior at Virginia Tech in June 1979 and the *new* Micromouse competition was a much talked about topic in the EE department that year. Back then there were no "Tips & Tricks" webpages, or even articles on the subject. Still, more than 6000 teams across the United States submitted their entries to the IEEE competition that year.

Flash forward twenty-seven years to January 2006: As the Chapter Chair for the Santa Clara Valley chapter of CPMT, I was busy putting together my Chapter Goals for 2006. Along with the usual topics of "Improve Chapter Finances," and "Increase Chapter Membership," I was looking for something new to engage the IEEE student members at the local universities. Our chapter already was quite involved at the student level as we were in the final stages of establishing a CPMT Student Chapter at San Jose State University. In April of that year, the SJSU CPMT Student Chapter received its charter as only the sixth CPMT Student worldwide and only the third in the U.S. But,…What else could we do? More importantly, "What else could we do – within the range of our local chapter capabilities?" Enter the Micromouse. I don't recall precisely from where the idea came. Perhaps I was trying to remember what excited me all those years ago as an undergrad EE student – tempered with the hoary experience of 25 years in new product development. The idea gelled. What if the Micromouse was more than an apparatus for autonomous navigation of the maze? What if the Micromouse was a New Product? What would you need to consider if you were planning to engineer the device for introduction as a consumer product? How would you design and build it?

Being an active member of CPMT and involved in the packaging and reliability of new products in my work life, several things immediately sprang to mind: power consumption, thermal management, size/weight, RFI/EMC, and quality and reliability. This might work! The Santa Clara Valley Chapter could sponsor an Award for "Best Packaging" for a Micromouse Competition! Thus, began the idea that resulted in the first CPMT Micromouse Best Packaging Award presented at the Region 6 – Central Area Spring Meeting at California State University at Chico in April 2007.

As to be expected, something like this does not happen overnight. There were many steps of intermediate accomplishment on the way to the actual prize award. First, our local CPMT chapter agreed to our stated goals for 2006. Next, I needed the support of the Director and Student Activities Chair for Region 6. This process began as a series of e-mail messages describing the concept to the Region 6 officers. Some thought it an admirable concept, others thought it would detract from the primary Micromouse competition. After a few back-and-forth messages with ever increasing length and detail, it was suggested that I produce a Formal Proposal to Region 6 Executive Committee that could be reviewed and voted upon at the next ExCom meeting. The proposal was accepted with the conditions that I also provide a complete set of contest Guidelines, Entry Form, and that our CPMT chapter – as financial sponsor of the award – transfer the funds for the award to the Region 6 treasurer at the beginning of the 2007 fiscal year so they would be available for the competition in Spring 2007.

Since the first intra-school Micromouse competition is held at the Area-level – with the winner going on to compete at the Region-level, our chapter decided to sponsor the award for our Area, the Region 6-Central Area. The Best Packaging Award would, therefore, be an additional prize for the Area competition only. After all, we are only a local chapter. There are 23 universities in the Region 6-Central Area that have active IEEE Student Branch Chapters. And more than one team can compete from each school. So, the potential for a large field of entries was high. The next step was to *get-the-word-out* to the Central Area schools. Initially, the Region 6 officers said that our Contest Guidelines and Entry Form would be posted on the Region 6 Student Activities webpage.

Early March 2007: Eight weeks to the Central Area Spring Meeting. And no posting of the Best Packaging Award information on the Region 6 webpages. Panic starts to set in!

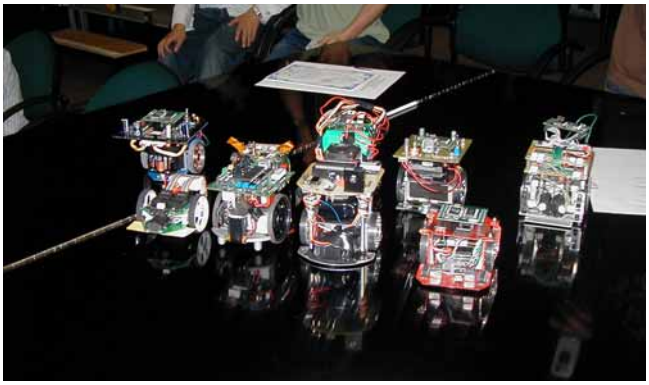
A few more e-mail messages later and I discover that Region 6 leaves these things up to the Area Chairs. A quick search for the Central Area webpage yields a single, short, unadorned page that simply notes the date and location for the Spring Area meeting. Well, at least now I know it will be held at Cal-State Chico! But, how do we get the word out for this new contest? To my rescue – and the rescue of the Best Packaging Award for 2007 – is the Region 6 Regional Student Representative, Lise Johnston. Lise led me through the learning curve for the IEEE e-Notice announcement tool and provided me with the full list Central Area Student Branch Chapters. With this new tool in hand, I quickly distributed the Best Packaging Award Guidelines and Entry Form to all of the Student Branch members in the Central Area of Region 6 – to 14,986 student members!

Mid-April 2007: Less than two weeks to go. Time to start thinking about the logistics of judging the competition. I had generated a Judges Form for scoring the contestants back in the Fall of 2006 along with the Contest Guidelines. And the Guidelines spelled out the evaluation criteria and scoring in detail. Power consumption would be derived from the Micromouse battery configuration – number of cells and rated capacity (Ampere-hours) per cell. Special Bonus points would be awarded for use of rechargeable and recyclable batteries. Thermal management would be evaluated by measuring the hot-spot temperature of the Micromouse with an infrared temperature probe. Initially, we would measure the Micromouse at both quiescent (on, but not running), and op-

erational (on, and running) conditions. However, at the actual competition we discovered that several of the Micromouse devices only functioned in the "run" mode – as soon as they were turned on, they would start moving and try to navigate the maze. So, we dropped the quiescent temperature measurement. Micromouse size and weight would be measured with tape-measure and scale.

The two more complex measurements would be RFI/EMC and audible noise level. These would require additional test equipment such as a digital oscilloscope and a sound level meter. Quality evaluation would be subjective by the judges based on workmanship of the assembled Micromouse – was it well layout, good assembly, etc. Finally, we included a Product Design category in which we would evaluate each Micromouse device on the aesthetic design appearance, creativity, markings (branding), and human-factors such as ease of use and location and accessibility of controls.

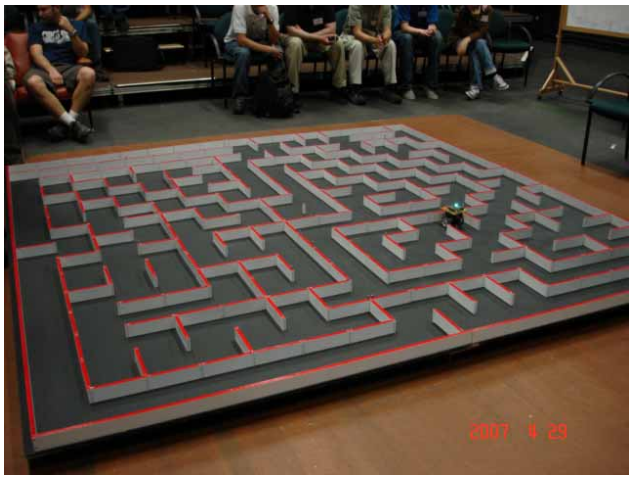
Our CPMT chapter decided to send two of us to be judges for the contest – an excellent idea as I will explain shortly. Luu Nguyen, CPMT Fellow and active member of our chapter, had been our *forward scout* and attended the Central Area meeting and Micromouse competition in 2006 at Cal-State Fresno. Luu brought back valuable information on the schedule of events and the modern Micromouse devices. Luu and I assembled our test equipment for the task: a Tektronix digital hand-held oscilloscope with RF antenna, hand-held infrared temperature probe with laser targeting, Extech hand-held digital sound meter with background rejection and peak-hold, notebook PC, digital camera, tape-measure, and bathroom scale (for Micromouse weight measurements). Since we were venturing into an unknown venue, we also included a workshop AC power strip and heavy-duty extension cable, a folding PC table and folding chair, small hand tool set, extra batteries, and a rolling, collapsible crate to carry all the gear. Almost all of which we used – we did not need the extra batteries after all. Also, I created an Excel spreadsheet for recording and tabulating the scores for the contestants that calculated the overall scoring results and gave us the winner as soon as we had entered the data form the last contestant.



Eight Micromouse Contestants sitting on the baby grand piano in the Performing Arts Hall

Competition Day, April 28, 2007, Chico California: Luu and I arrived at the Central Area meeting with our crate of equipment in tow. During the morning presentations I gave a brief presentation on the CPMT Best Packaging Award. There were nine Micromouse Teams from five universities: CSU-Chico, University of Hawaii-Honolulu, University of Hawaii-Manoa, UC-Davis, and San Francisco State University. Seven of the nine contestants also entered the Best Packaging Competition. Each of the Micromouse teams had given their Micromice clever names. The Chico State teams were Juanito 5 Jr., and Remington Plastic. The University of Hawaii fielded Ramrod, The Prodigy, and A.I. from Manoa. The SFSU entry was Gold Digger and the UC-Davis Micromouse was Rat-Zilla.

Following the morning presentations, the Micromouse teams were allowed to go to the competition hall where the maze was set up for some practice and last minute adjustments before lunch. During lunch the maze would be reconfigured for the actual competition that would start right after lunch. So, off the teams went across campus to the competition hall in the Performing Arts building, along with Luu and myself – and our crate of equipment. Once there, we had about one hour to set up our equipment and judge seven contestants on seven areas – while the teams tried out their Micromice in the practice maze and not a few people tried to figure out what Luu and I were doing with all this equipment. We struggled a bit with the first two contestants – such as discovering that the Micromouse would not just sit there once it was turned on – it would run toward the edge of the table, looking for the maze. We quickly found a few excess maze-wall segments to use as *blocks* to lift the Micromouse wheels off the table for the evaluations. We sadly discovered that our bathroom scale had a minimum weight that exceeded the typical weight of the Micromice – leaving us no means of weighing the contestants. We also discovered that the background rejection feature in our digital sound meter proved exceptionally useful as the crowd of curious onlookers kept the ambient sound level at a consistent 36 dBA.



A practice run through the Maze

By the third contestant Luu and I got the hang of the procedure: I would photograph the Micormouse and measure the dimensions while Luu checked on the battery configuration and rating. I would measure the frequency and amplitude of the RF emissions while Luu measured the hot-spots with the infrared probe and the Micromouse on blocks. I would measure the audible noise level and Luu would inspect the workmanship and product design aspects while I entered the data in the spreadsheet. As the teams were ushered out of the room promptly at noon so that the final maze configuration could be assembled, we had just completed the sixth Micromouse. We had to wait until the beginning of the Maze Competition after lunch to judge the seventh and final Micromouse.

All of our category scoring was relative. The measurements were rank ordered and the top three contestants received 5, 3, and 1 points – or, 3, 2, and 1 points, depending on the category weighting. The rest of the contestants received zero points. The final, overall scores ranged from 4 points to 18 points, with the top three finishers scoring 18, 14, and 13 points. We had clear Win, Place, and Show finishers. For the next couple of hours, we got to sit back and enjoy the Maze Competition.

The heat of competition

The meeting reconvened back in the original meeting room for the awarding of the prizes. The Maze winner was the UC-Davis team with Rat-Zilla – successfully navigating the maze in 38.9 seconds on it s first attempt! Interestingly, the same UC-Davis team won the Maze Competition in Fresno in 2006. Could this be the start of a dynasty? To the surprise of the attendees – and to the teams – Rat-Zilla also took the Best Packaging Prize with Juanito 5 Jr. and Ramrod taking second and third. Rat-Zilla excelled at having the smallest volumetric envelope, lowest RF emission, and the second-lowest audible noise level. Rat-Zilla was unique in its use of AC pancake motors (used in magnetic disk drives) for its main drive. These motors were exceptionally quiet and very fast. Many of the other contestants used noisy stepper motors to move the Micromouse from square-to-square in the Maze. Also, the UC-Davis were the only team to "brand" their Micromouse with the Rat-Zilla name and UC-Davis emblazoned on the unit – thus earning themselves sole points for Product Design Markings. With First Place in the Maze competition and the Best Packaging award, the UC-Davis team went home with an extra $1,000 for their student chapter.

The overall Winner of both Maze and Best Packaging, Rat-Zilla from UC-Davis

Following a few concluding remarks from the Central Area Chair, Ron Kane, Luu and I packed up our crate of equipment and headed off across the Central Valley back to the Bay Area and Santa Clara with a full list of successes & opportunities for next year's judges – and a lot of memories. After 16 months of development from initial idea to implementation and the first award, we were quite satisfied in the results. All of the student teams were very interested in our evaluation process, the methods and equipment we used, and the scoring criteria. Why were these particular measurements important? Do all new products go through this type of testing? For us, the real question was, "Did we succeed at our original goal – the engagement of IEEE students in the fundamentals of packaging design, design for manufacturing, design for reliability, and product design?" Undoubtedly, there was the spark of interest in the Micromouse teams. The design project criteria for the Micromouse just expanded from performance capability to product design and reliability – from circuits, software, and feedback loops to power consumption, heat dissipation, and RF and audible noise – to packaging, manufacturability, and reliability – to the CPMT Society.

Bill Allan and Michael Cheng from UC-Davis accepting the First CPMT Micromouse Best Packaging Award from Allen Earman from CPMT-Santa Clara Valley

IEEE CPMT Society Newsletter

Send inputs, suggestions, and articles by email to nsltr-input@cpmt.org

….. Editor

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