Embodied Speech and Facial Expression Avatar
Course Debriefing

Written by
Dan Harbin – Brent Sicking – Jaclyn Tech – Evan Zoss

Table of Contents

Group Management

Group Management Style

The combined skills and efforts of the team members are what made this project as successful as it was. Each team member had a certain part of the project to manage based on that person's area of expertise.

Management Overview and Skills Assessment:

- Brent – GUI layer manager. Knows Visual Studio, C++, and .NET.
- Jaclyn – Software and API manager. Psychology expert. Developed algorithms for controlling the motors, and generating facial expressions.
- Evan – Motor control circuits. Enable and disable the motors, and change their directions.
- Dan – Serial port interface and communication. Provided a hardware/software interface for controlling the hardware.

We held at least one weekly meeting to discuss issues and to ensure interoperability between components. These weekly meetings were open to Tuesdays at 6:00 PM and/or Wednesdays at 4:10 PM.

Throughout the project, each group member held to his or her responsibilities. All team members worked together to hack apart Yano. Jaclyn, Dan, and Evan tested the SV203 using HyperTerminal and a logic analyzer while Brent developed a framework for our software. All team members then helped put together a simple circuit hooking up one motor to an h-bridge and the SV203. Next, all of us helped test the control of Yano's motors one at a time. Evan then began to develop circuitry to connect all three of Yano's motors to the h-bridges and SV203. Dan created circuitry to handle sensor input on the SV203. Jaclyn and Brent continued to modify and debug software to accommodate for unexpected behavior of the h-bridges control of direction with the SV203.

As we progressed to the second half of the project, we split into different areas. Dan and Brent began to work on the sound analysis algorithm and corresponding user interface, Evan was in charge of figuring out the inner workings of the eye motor and perfecting our I/O circuitry, and Jaclyn researched the psychology of facial expressions and was in charge of developing and implementing the user interface for this control.

Upon completion of our individual responsibilities, we worked together on merging all aspects of the project. We each helped build and solder our final circuit board as well as put Yano back together.

Schedule of Tasks

In addition to our weekly group meetings mentioned above, each week we set apart time to meet with our instructors, Dr. Gutierrez-Osuna and Steve Ortiz.

- Monday, 4:10 – 4:25 PM – Meeting with Dr. Gutierrez-Osuna
- Monday, 5:00 – 6:00 PM – Meeting with Steve Ortiz

Below is a Gantt chart showing the duration and completion time of each of our major tasks.

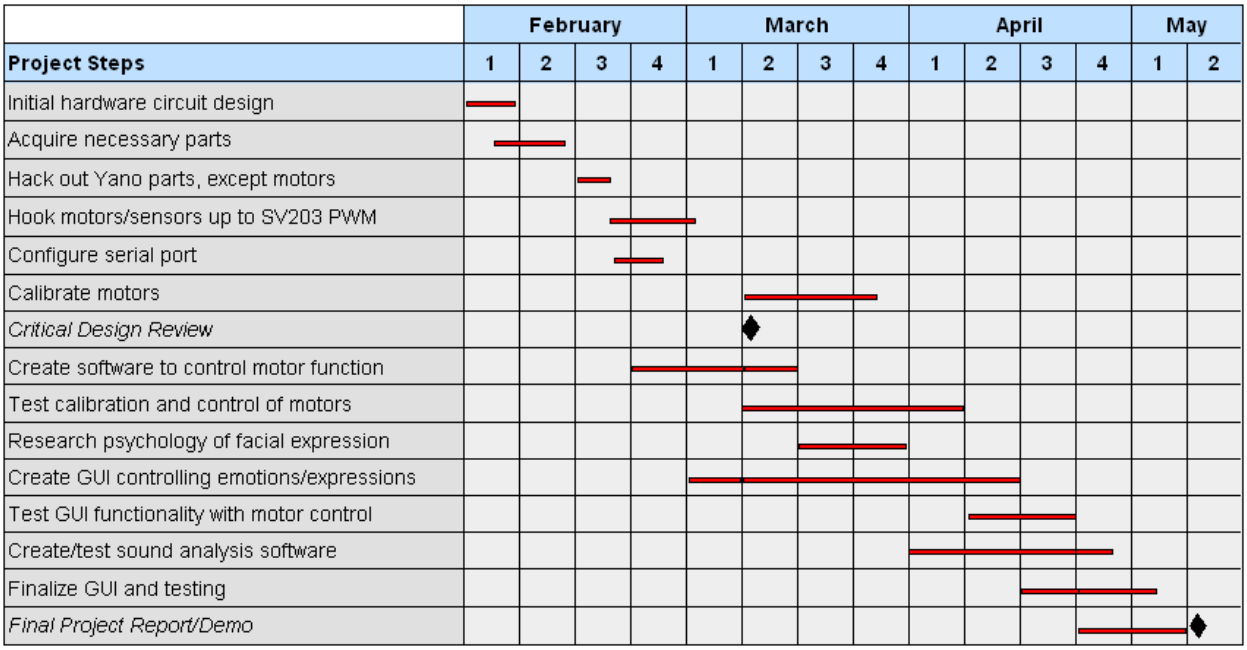

Figure 1: Gantt chart

Assessment of Group Management Style

Overall, our group management style (as described above) worked very well. We each upheld our own personal responsibilities and worked well together. If we were to do the project again, we believe it would be important for us to keep up with our schedule and weekly meetings as we did this semester. Creating reasonable goals for each week definitely helped us stay on track and not fall behind.

One thing we would do differently if we were to do the project over again is to divide the hardware responsibilities up more. As it turned out, building and maintaining our circuit to control Yano was a bigger task than expected. Evan put in a lot of extra effort and hard work to build our circuit, and it may have been completed sooner if some of the other team members took more hardware responsibilities along with their software responsibilities.

Another thing we would improve on if we could do the project again is the upkeep of our personal design journals. Some of us didn't always keep up with our journal from week to week, and it occasionally made it difficult if we wanted to refer to an idea or previous design of a certain aspect from several weeks back. Keeping up with our journals would have allowed us to be more organized and keep track of our design changes better.

Safety and Ethical Concerns

To ensure a safe project, all of the circuitry must be safely enclosed in the chest cavity of the Yano. We created slots in Yano's back to fit the power and serial connectors so that none of the circuitry is visible from the outside. All wires are also properly covered within Yano's body. Assuming that Yano was originally designed with safety in mind, this should protect users from hurting themselves or damaging the toy. We feel we have taken all the necessary steps in creating a safe product.

A major ethical concern of our project is the reliability and accuracy of our project. Yano's gear for the eye motor is design in such a way that it takes more power to move across certain parts of the track than others. This causes the eye motor to occasionally get out of sync after calibration if moved a certain direction on a certain point in the track. We worked very hard to ensure than Yano's eyes stay in sync as much as possible. However, there is still a small chance that we did not discover every possibility where his eyes move out of sync. This may affect the accuracy of some of the facial expressions.

Similarly, the software timing methods we used turned out to not be the most robust. As computer speeds increase over the years, our software in its current state may not be able to keep up and cause our product to become unreliable at times. If we could do the project over again, we would use a different software timing method to avoid this problem.

Validation and Testing Procedures

Our product works as defined by our goals and objectives. We successfully created a robotic face capable of displaying human emotion accompanied with speech. The tests we used to validate the design are:

- Calibration Test
- Expression Test
- Speech Test

The calibration test performs a routine calibration on all the motors. After calibration, each motor is driven to both endpoints and the end switches should be triggered. If the end switches are not triggered at both endpoints, then there is a flaw in the design. The test was performed 20 times in succession to make sure the motors did not need recalibration.

The expression test moves the face to all of the different pre-defined expressions. If each expression is generated independent from the previous motor positions, then the facial expression algorithm aspect of the design works. In order for the expression test to work, the calibration test needed to pass. In addition to ensuring that the algorithm works properly, we must ensure the believability and readability of each facial expression. To validate this aspect, we compared Yano's expressions to online examples and asked the opinions of several different people. If we had more time, or were able to do this project again, we would like to include a survey given out to about 25 to 30 people that asks the user to select between a few choices of what face they believe Yano is trying to convey. This would help validate the believability and readability for each face more.

The speech test takes a recorded utterance with many distinct sounds which Yano will mimic speaking. One less measurable aspect of this test will be "realism." If the mouth movement looks realistic, then it can be considered working. Another aspect of this test is consistency. Each time this recording is played, the mouth motions should be about the same. Loud sounds

should consistently produce a wide open mouth, and quieter sounds should consistently produce a more closed mouth.