Healthy Living – Performance Technology Installation

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ABSTRACT

Healthy Living is an Arduino based art installation designed to the represent the health levels of virtual people over their respective lifetimes. Each light bulb represents the life cycle of a person from birth to death, with the light intensity degrading in correlation with their stage of life. The piece visualises the effects of healthy living versus an apathetic lifestyle. Each person has a lifespan of 30 minutes. The bulb begins at full brightness, and as time passes it gradually fades to symbolise their waning life. Additional factors, such as weather and exercise will affect the outcomes of their life's duration. Healthy choices increases the vibrancy of life, while unhealthy choices are detrimental. One Arduino is assigned to each virtual person, with one separately being assigned to be a Master controller.

PROCESS OF DEVELOPMENT

Development for this installation began on the 17th of November 2016. It had the simple aim of collecting live weather data to control the daily transportation method of four virtual entities, and artistically represent its effect on human lifecycles. This changed and developed slightly over time to include real-world scenarios such stress, the low probability of a node dying from SADS and dying from an accident involved with their transport choice. Each of the nodes were allowed a lifecycle of 30 minutes, which approximated to 20 seconds per 'year'.

Prior to beginning however, we took the time to research statistics based around the health benefits to cycling, and probabilities surround road death and cycling based accidents [1].

We also took the liberty to research similar projects, and heavily based the inspiration of using pulsating lightbulbs from the Pulse Room piece by Rafael Lozano-Hemmer [2]. Inspiration for the Chinese Lanterns came from the Space Invaders 2008 piece. This showed to us the effectiveness of using such lanterns to enhance a smaller light source [3].

It was initially decided that alongside the generic template coded to each node, they would also be assigned three to five unique characteristics related to their general outlook on life.

The largest part of the installation was the work and overall success of the Master Arduino. It was decided from the inception of the initial concept, that an XML based Weather reader would be coded within Processing 3.0, with particular group members having previous experience in the same concept. Fluid communication then had to occur between Processing and the Master Arduino. Throughout this process, we were forced to alter our initial idea of collecting the previous 30 days of precipitation percentages, to collecting general forecasts from 3 hour intervals across a 5-day period. This was as a result of the restrictions surrounding the free Weather API used. Regardless it resulted in 40 unique data points for the XML decoder to access.

With each section of the project divided into individuals, we focused on the development of the overall product. Rather than build around a Master/Slave template code from the ground up, we spent more time coding the personalities of each node. Along with the large task of having the Master Node simply seamlessly output corresponding 1's and 0's based on Rain or Sun respectively. We kept the I2C (Arduino-to-Arduino Communication) in mind throughout this whole process by creating an input variable in each node running random 1's and 0's to simulate the Master input without requiring the Master Node being connected. This meant a more efficient workload, as we could work on individual nodes outside of any contact hours set by the group. With that variable set, it was simply down to inserting an I2C Send/Receive code snippet, generic to all of the nodes, and replace the random number generator with the input signal from the Master Arduino.

With the data being processed within each Node, the next phase of the installation was its visual aspect. Being a light based art piece, the most important part was coding the bulbs to interact correctly with the individual node codes. This took some time to finalise a flawless fade as the life force of the node depreciated. Further from that, we also had small bugs whereby the light would 'come back to life' occasionally, depending on the weather. Once each node's bulb worked seamlessly, it was assembled onto a bread-board and left to run in its full cycle continuously. This allowed us to test to see if there were any patterns forming in the timing and order of which the nodes died. To begin with, we discovered that *Luca,* was always dying last, upon further investigating we found a small mistype in his rate of

life depreciation. In general, however, the two Nodes who were coded to be healthy would live longer, and those who exercised less lived for a shorter length of time.

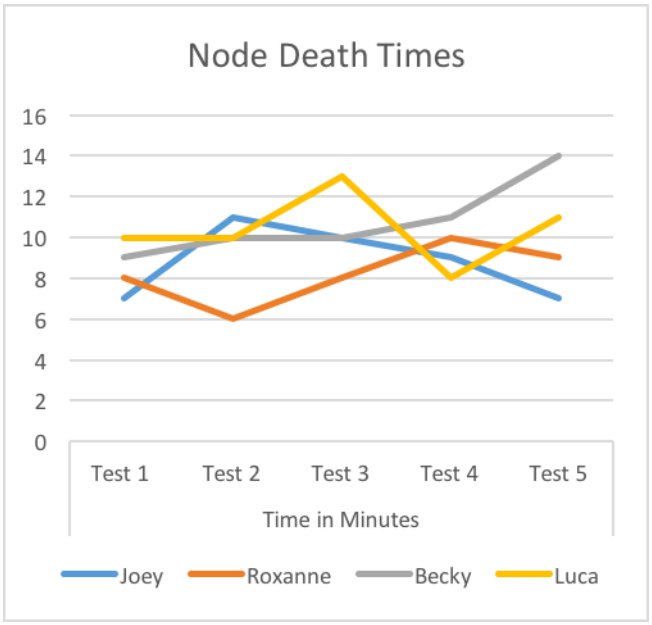

Figure 1. Node Death Time Test Data

Once a controlled testing had been successful, we moved onto the fabrication stage. Our original plan intended for the lightbulbs to be large, element based bulbs. The intention being an artistically raw and visually pleasing display, achieved by a simple design. Due to complications however, we switched to LED Bulbs. The switch to different bulb type impacted the original design aspect, due to the overall size of the LED being much smaller than intended. In order to combat this, we opted to insert them into a lampshade type fixture. It was ultimately decided from there that they would be Chinese Lanterns, allowing for a more perceivable glow from the smaller bulb, and also a compliment to the visual aesthetic of the piece.

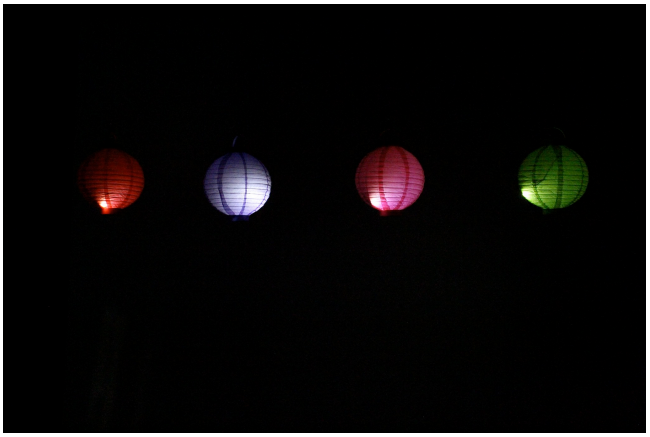

Figure 2. The installation suspended in full display

The fabrication and circuit design consisted of a few minor setbacks, but overall took the shortest amount of time. This was primarily down to the simplicity of the physical part of the installation. Initially, our focus on having individual node circuit units taking up the least amount of physical space backfired on us, and inevitably forced us to begin again. However, once we allowed ourselves the bigger chipboards, the production of the node circuit units took very little time, with a TIP Transistor being used on each unit to appropriately power the LED.

Once we had finished assembling, we found continuous issues in the storage of the piece, prior to its installation. We were forced to re-solder parts regularly, however once deduced that it was as a result of the chipboards being overheated while soldering, the issue was quickly remedied.

CODE WALKTHROUGH

The breakdown of the running of this installation's code is as follows;

Master Arduino

Data is called to the Processing sketch from an OpenWeather API using an XML based function. A simple if statement then determines if the XML line contains the words 'rain' or 'sun'. When the line contains rain, it will return a '0' to the Master Arduino, and a '1' if it determines it to be sunny. The API collects a weather data sample from every three hours of the last five-day period, allowing for forty independent weather samples. This information is then set to pulse every twenty seconds to the master Arduino via the USB Serial Port.

The Master Arduino source code simply collects these pulses of 0's and 1's to send to each node via I2C communication of the A4 and A5 pins.

Generic Node Source Code

A generic code was designed for each Node, and then built upon for their individual lifestyles and personalities. The generic code runs as follows;

Each node is assigned a starting life force of '100' at the beginning of each 30-minute cycle. Once a pulse of '0' or '1' is received to inform the node of the weather, the lifeChoice function runs. A probability based formula is ran to determine their chances of walking or driving based on the weather. The output of this function is to assign the choice variable an independent '0' for choice to walk or cycle, and a '1' if they wish to drive. A score is also then kept to count the amount of times they drive collectively and assigned to the score variable.

As per the pre-determined lifecycle length, the lifeDepletion function exists to continuously deplete the lifeForce by 3.33 for each time the millis function reaches twenty seconds, signifying another virtual year passing. There is also a condition in this function to fix a bug whereby if the last value prior to zero was less than 3.33,

the node would be brought into negative values continuously.

The heartbeat function coincides with the brightness and heartrate values. These determine the brightness of the LED blinks, and also the speed between pulses.

An activity based function also exists, which changes between the nodes, and awards or deducts from their life cycles based on stress levels, exercise frequency and if they drive or not.

Finally, in the loop function, there is a simple 'if statement' to reset the 'life' of the Arduino once it has reached the end of the determined life-cycle length. This is regardless of whether or not the node has died, as all nodes reset consecutively every thirty minutes.

Individual Node Characteristics

Joey
Joey is described as being a lazy node. He will be more than likely to drive than walk or cycle if it is raining, with a predefined 65% likelihood to drive. He also factors in increases in stress levels, should virtual scenarios occur such as his car breaking down and missing the bus. Joey also has the condition to add an extra year to his life if he should cycle for more than five days consecutively.

Roxanne
Roxanne uses a slightly different probability method to determine her transportation method. Her nature makes her choose her transport choice based on what she did previously. For example, when initiated, she is given a random number between one and ten. When she is more active a counter will increase by one. If it reaches five, Roxanne will walk or cycle without fail, and the counter will reset to zero allowing the cycle to begin again.

Becky
Becky is the first of the more active nodes. She has the condition of walking unless she has walked in the rain for the previous three loop cycles. When the lifeChoice function runs, and if Becky has decided to walk, yet it is also raining, a counter begins. This counter increases each time this scenario occurs, and once it reaches '3', she will drive the next time it rains. The counter then resets to '0' once a sun value is pulsed.

Luca
Luca is the final node, and the second node to be more active in their lifestyle choice. Luca is 70% likely to walk or cycle no matter the weather. However, he is set to have a 30% chance of choosing an alternative due to various predetermined reasons depending on a predefined array. This predefined array includes the probability of Luca being offered a lift, receiving an injury, and even the 0.02% of dying randomly.

MY CONTRIBUTION TO THE INSTALLATION

Overseeing

From the early stages of the planning for the installation, the group assigned me to co-ordinate the process. For my own definition, this meant making sure that we had a strict timeline ahead of us and setting deadlines to have certain phases of the installation completed. At times, there were different sub-groups working on different parts of the installation, whether it be two working on the LED Heartbeat Code, while others worked on the Master, and others worked on the nodes. With this in mind, I made sure to co-ordinate each subgroup, and make sure we didn't deviate from our original purpose of the installation. Along with that, I had to make sure to have a clear vision of the outcome of the installation, so that each decision or change made over the course of the developing stages still coincided with the outcome.

Developing Code

Aside from the above, my active role within the group was coding the initial template for each node. It was important for this to be completed and established in the early stages, so that other individuals in the group could use the code to further develop the other nodes.

Once Aidan had completed the LED Code, we both worked on implementing this into the Generic Node Template, and having it successfully complete lifecycles of different lengths and conditions.

In addition to this, once Kevin, Martin and Robert had completed their Master Arduino Weather Receiver, I worked with Kevin to establish the I2C Connection, firstly between the Master and one Slave, and later to all four. The latter part took some time, due to unpredictable error in communications between a Rev2 Arduino Uno and a Rev3. This was remedied by sourcing more Rev3 Arduinos.

Fabrication & Design

I was involved also in the various stages of the fabrication process of the installation. I worked with Tara on the initial schematic of the Node Transistor Units, and we began creating the units. We rotated this however between different group members, so as for one member to not be soldering for the whole duration of the fabrication phase and risk making mistakes. Inevitably though, mistakes were made, causing us to have to completely revisit this stage, to which we made the decision to let those in the group with more soldering experience to remedy the mistakes.

From there, I resumed the slightly 'hands-off' position, it was important at the final design phase for an objective view to be taken with different aspects of the installation. I split the group into three parts, one sub-group soldered, the second worked on the visual design and aesthetics of the installation, and the third group worked on consolidating and commenting the individual node code. To that extent, my contribution was to keep check on each subgroup, and

make sure that we were moving towards the end result as the deadline drew closer. I acted as a second pair of eyes for the coding group, double checked the electronics design, and helped the visual design sub-group in forming a design for the installation which would suit our initial aims and objectives.

Following the installation deadline, we were required to film a short ninety second video, artistically displaying the piece. I organised the space to use, as well as installing the piece on the set of this short video.

REFERENCES

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