BEHIND THE BITS

University of Advancing Technology
UAT
Learn. Experience. Innovate.

ISSUE 12

TEAM

Aubrey Dahl
Advertising Art

Contributions by:
Amanda Grose, Robotics & Embedded Systems
John Leddon, Advertising Art
Christopher Parness, Digital Video
Alexis Serpas, Network Security
Jonathon Sherwood, Game Design
Jaime Zamora, Virtual Reality

REACH MY RAINBOW
LEARNING ABOUT COLOR

Children are receptive to art, especially color. Being a visual medium, learning about color and color theory at a young age through gamification can be enriching, especially when many children lose their love for art early on.

Earlier this year, Aubrey Dahl (Advertising Art) was hired to host a painting-themed party for an eight-year-old girl and her friends. She prepared canvases with pictures for the girls to paint. During the activity, Aubrey asked the girls questions about the colors they were using and mixing.

Unsurprisingly, there were some aspects of the colors they didn't know, but were able to immediately understand after Aubrey explained basic color theory concepts to them. This made her wonder why they weren't familiar with this material in the first place and why it isn't taught to more of an extent.

While doing research, Aubrey discovered many educational games for math, science, reading, and foreign languages… but nothing extensive in the area of art and color. That's why Aubrey developed Reach My Rainbow Learning About Color.

Reach My Rainbow is an educational game about color and color theory geared towards children and intended to be used in elementary art classes. There are 10 levels that teach different aspects of art, structured with a lesson, activity, and reward. Each lesson teaches concepts, and the activity allows children to test the concepts they just learned. Each level ends with a coloring page as a reward, where children use what they've just learned to color their own picture.

The art design and visuals in the game are meant to be simple yet cute, appealing to children. The game has visual, auditory, and kinesthetic aspects to enhance learning and stimulate the senses.

As the project stands, Aubrey is excited to get it into classrooms by licensing it to elementary schools. In future iterations, Aubrey is interested in expanding to include middle and high school versions, allowing lessons to be more in-depth.
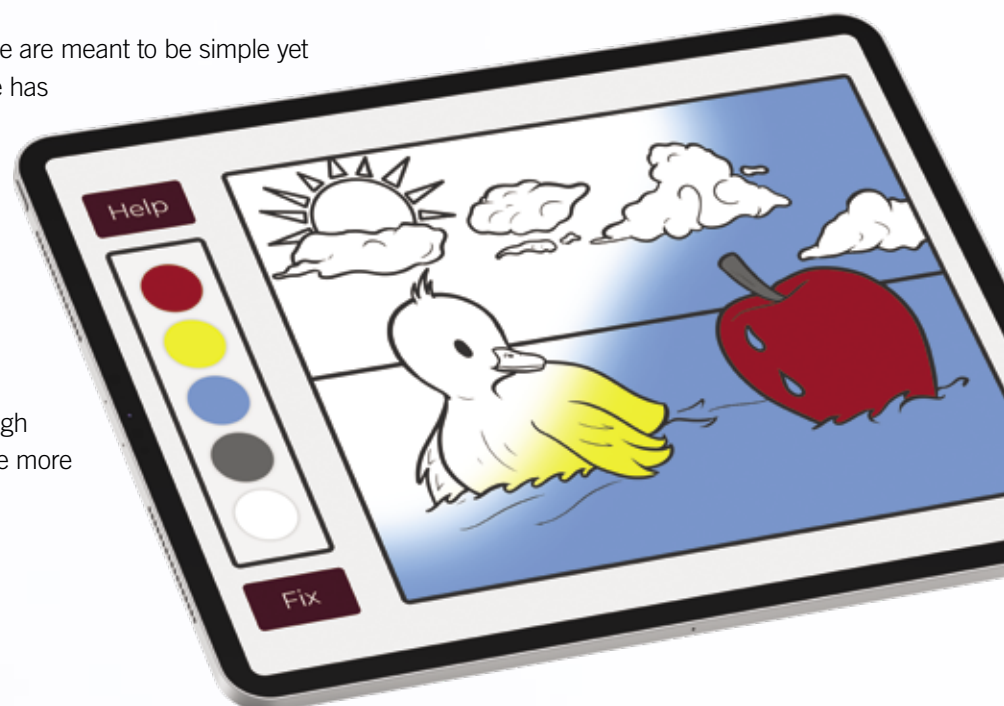
IN ART

Alessandra Caballero Sosa (Game Art and Animation) has always loved art and learning about art history. For her, this was mostly done through lectures, but since most people have different learning styles, Alessandra wanted to create a more immersive learning experience for art.

With this in mind, Alessandra developed an idea to recreate famous paintings in 3D environments where the user is able to move around the 3D model painting while gathering knowledge related to the artwork. To achieve this, everything needs to be recreated, from the layouts, lighting, and mood to matching the art style by imitating the technique through texturing.

For the prototype, Alessandra chose Impressionism. Specifically, Vincent van Gogh's Café Terrace at Night (1888), stating, "the portrait has a particular ambiance to it" that inspired her.

She began by conceptualizing a 3D environment out of the 2D painting. Alessandra used Google Maps to view the actual location to get a better idea of the physical layout. After drawing a couple of sketches, she started creating assets and arranging the scene in Maya. She also decided to create a base material that would simulate brush strokes and used this to texture the objects.

Getting the textures right was one of the trickiest aspects. Impressionism has thick, heavy brushstrokes that appear as if done quickly. Alessandra tried to recreate this in her material creation using Substance Painter and integrated it into the 3D environment following the layout she previously created. She also limited the environment by using blocking volumes and a plane with texture that matched the original painting. Realizing that material creation alone didn't emphasize the painted effect accurately, Alessandra researched and followed a tutorial on post-processing effects, which gave the environment an enhanced brushstroke look that mimicked the original painting.

Next, Alessandra worked on the learning aspect of the project. She chose to create text pop-ups that would appear as the user moves around the scene, showing information and interesting facts about the artist and the painting. For this, she created a blueprint to make the pop-ups. At first, text appeared in the game, but post-processing made it hard to read, so she moved the text to the user interface.

Finally, to have a more complete prototype, Alessandra created a menu to navigate start, options, and quit. Here, the user can choose different artists and paintings to view. She also created a start sequence to cinematically showcase the scene before the user walks around the scene.

There were many new skills Alessandra learned during the course of this project, including blueprints, user interface, menu functionality, and object interaction. The future ahead for this project and Alessandra is bright! This project can be used in K-12 schools, post-secondary education, and wherever art history is taught, such as museums.

Alessandra Caballero Sosa, Game Art & Animation
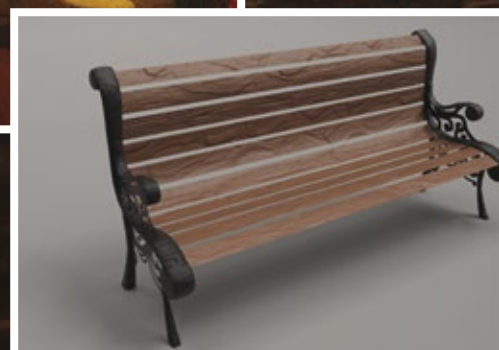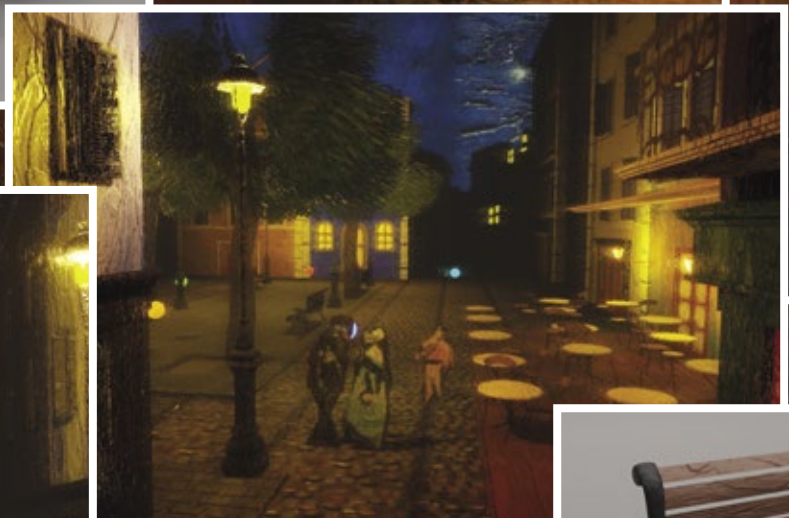
AME

ASTUTE MEDICAL ENVIRONMENT

When **Garren Koller** (Robotics & Embedded Systems, Digital Maker & Fabrication, A.S. Data Science, A.S. Artificial Intelligence, A.S. Advancing Computer Science) was younger, he had a condition that led to frequent seizures, which meant he was in the hospital — a lot. Eventually, a Cardiac Loop Recorder was inserted into his chest to collect his heart rate data.

Attending UAT, Garren quickly realized two things: first, he wants to help people using his tech experience, and second, he wants to update the technology used in hospitals, bringing them up to speed with current technology.

The idea for AME started when Garren was working on a project called the Refine Smart House. The goal of this project was to update UAT's Engineering Lab and Maker Lab with modern Internet of Things (IoT) technology. It was this idea, upgrading older systems and connecting them to the IoT, that inspired Garren to create AME.

AME stands for Astute Medical Environment, which enables medical devices to connect to a localized network (Intranet) making them IoT devices and displaying information on a computer matrix (patient's record). This allows for a faster and more comprehensive diagnosis controlled through a network gateway.

By giving the devices this functionality, it will enable doctors to activate devices and access device data in an easy-to-use interface. The true innovation claim here is creating an IoT ecosystem for the medical industry.

THE DEVICE

To prove his concept, Garren created a pulse oximeter that measures heart rate and oxygen levels in blood. Through an IR sensor, the device is able to detect when a finger is on the device.

Garren started by designing schematics and eventually a PCB for the pulse oximeter sensor and sensor board. This process included advanced digital logic design, signal processing, and high-speed digital systems to communicate sensor data with esp32.

Using trends in design principles, Garren modeled the housing component of the pulse oximeter with a PCB design using EasyEDA, and then applied that design to the form and function of a pulse oximeter device. He then 3D printed the housing, assembled all non-extended parts by JLC PCB, and soldered the extended component to the surface mount. The housing helps the sensor make more accurate readings.

THE NETWORK

The pulse oximeter is able to send data using the onboard microcontroller to a server, which then saves the reading and relays the data to a user interface. This user interface is only accessible on a local network by those who have the proper credentials. The device-to-server communication makes use of the iot.io library created by fellow UAT student Dylan Crockett (ACS, Artificial Intelligence), which is designed to make IoT development faster and simpler. Schematics show the inputs and outputs of the digital logic systems to allow for the MAX30105 module to work.

THE APPLICATION

After the data is collected from the pulse oximeter, it appears in an easy-to-use user interface where the values are displayed. All data collected goes to a CSV file.

The future for this project is exciting! Garren is currently in the process of securing a provisional patent.

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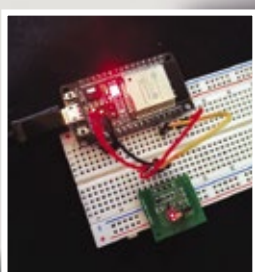
easy rearranging

Last semester, **Audra Jackson** (Advertising Art) was helping her boyfriend and his roommates rearrange their furniture using digital graphing — this sparked an idea. What if there was a service that allowed people to see their room rearranged without actually moving their furniture? Thus, Easy Rearranging was born.

BEFORE

AFTER

Audra Jackson
Advertising Art
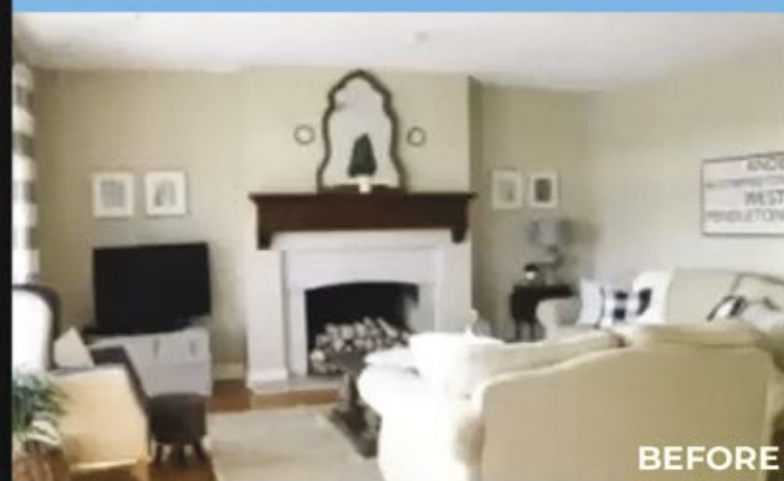
CREATORS OF THE DARK

For years, Michael Nicholson (Game Design, Game Art & Animation) has dreamed of games better connecting with the streaming industry, and through his Student Innovation Project (SIP), he saw the opportunity to create that bridge.

Creators of the Dark is a co-op horror game featuring live interactive features. Users on streaming platforms, such as Twitch or Mixer, can connect their game, allowing viewers to participate and play alongside the streamer. Each viewer has a role and ability based on their status and ranking within the streamer's chat.
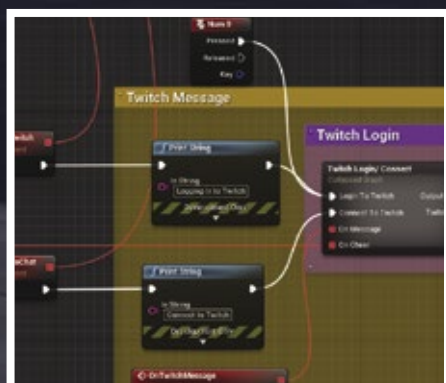
Where it All Started

Creators of the Dark started as a project geared towards helping partnered Mixer streamers earn more through Mixer's monetizable currency, Ember.

On June 22, 2020, Mixer abruptly shut down, forcing Michael to switch everything to Twitch, a different streaming platform. Twitch was more complicated to work with, but this didn't faze him. Mixer's functionality had everything built in as a party plugin, used within Unreal, but Twitch doesn't have the same functionality. Michael quickly jumped into learning about databases and plugins, integrating casting with blueprint actors, rewriting code from scratch, and redesigning aspects of the game.

Currently, there are only a few interactive games that support Twitch interactivity, but sadly, most of these games primarily rely on viewers voting and inspecting the results. From the start, Michael knew that he wanted viewers to participate rather than just spectating. This is where the founding design for Creators of the Dark came from.

Creators of the Dark is designed to be an interactive, four-player horror game where users try to escape a monster based on legends from around the world. Once streamers connect the game to their Twitch account, an array of options are unlocked for the viewers, allowing them to play alongside the streamer.

Easy Rearranging is an interior design company and app providing users with a way to rearrange their furniture in less time. The app is designed to allow users to send in the measurements of their room(s) and furniture. Using these measurements, Easy Rearranging will create digital layouts of arrangement possibilities for your home, at just a small cost.

Dedicated to providing the best options to fit users' needs, Easy Rearranging can create layouts that may include getting new furniture or getting rid of an old piece, and can also provide layouts that bring everything closer or even create a more inviting space for large family gatherings.

Inbox

Digital Layouts

Hi, I have attached two digital layouts for your living room per your request. Please let me know if you would like to see any ... Thanks!

Send

How it Works
When opening the Easy Rearranging app for the first time, users are prompted to sign in to their account with an email and password or through Facebook or Google. Once logged in, the homepage provides an example of furniture rearrangement after a remodel. The 'about' page provides a description of what Easy Rearranging is and the services provided with contact information included at the bottom of the page. The 'pricing' page details the cost of layouts provided based on the number of furniture items being moved.

The 'measurements' and 'info' pages enable users to fill out their personal information, reason for rearranging, and measurements of furniture, as well as the option to attach images. Once a user submits this, a form is sent to the team email and the user receives an automatic inquiry email letting them know their request was received.

Once the request is reviewed, the user will receive an estimate for the cost of digital layouts. After the payment is received, the user receives a confirmation email providing a timeframe for completion and delivery of the layouts. Finally, the user receives an email with the digital layouts attached. If they have any questions or concerns, they can respond to the email.
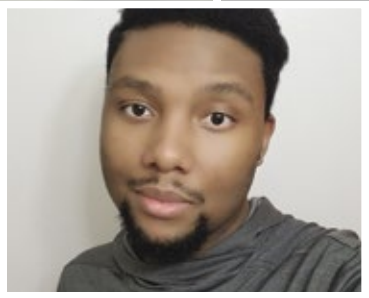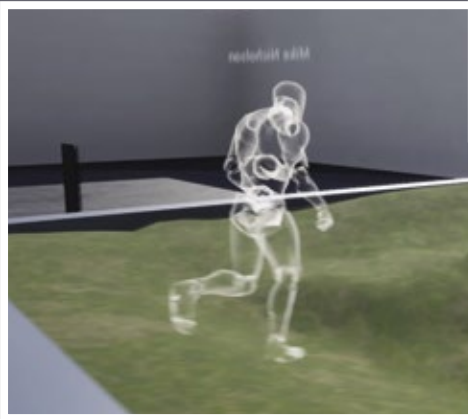
Pricing

...ranging we base our prices ...mber of furniture pieces you ...oking to have moved.

Moving 1 to 3 Pieces of Furniture

Moving 4 to 6

CreatorsRequiem: To give others a chance, please wait before activating another command creatorsrequiem

CreatorsRequiem: -cooldown

...orsRequiem:0

...ch grass

How Does the Game Work?
At the start of the game, users in each session are given a primary goal and two optional objectives to complete by using the stream chat to activate commands. These commands include abilities, AI prompts for each user, and participation in rituals, such as banishing the monster. The primary goal changes depending on the status of the match. Once an objective is completed, active participants will be notified of what their next objectives are.

The viewer also has a set amount of spare energy that depletes with each command activated and also uses bits, a paid digital currency on Twitch, to multiply the effects of abilities or temporarily boost player stats. Alternatively, viewers can sacrifice their spare energy to activate these effects. One user's action, or lack thereof, does not prevent another user's action.

...atorsrequiem 's remaining

...atorsRequiem's ghost has

...ch search area

CreatorsRequiem: @creatorsrequiem 's remaining
...y: 70

...quiem: @CreatorsRequiem's ghost has

...quiem: @CreatorsRequiem has found 1

Michael Nicholson
Game Design,
Game Art & Animation

...quiem: -help

CreatorsRequiem: Available Commands (Use -help <command name> for more information on the command): -test

H@XCORD

Do you care about security but aren't quite a Linux expert? Advancing Computer Science and Network Security dual-major student Bradley Chavis created a solution for just such users. H@xc0rd is a simple yet powerful Discord bot for the utilization of common tools prevalent to the network security field, all without the need to understand Linux. Tools range from exploit to recon, consisting of ones such as Hashcat, Hydra, Nmap, Shodan and many more. Each of these tools has its own custom-built help section to guide the user through understanding what the tool is, how to use it and how to use the results gained from it.

H@xc0rd was built off the node.js run time library, leveraging many libraries along the way, such as Discord.js and axios. The different commands are based on modules, enabling them to be loaded dynamically. This provides another advantage — being able to limit users to certain tools and commands. Since many tools within this project can be intrusive to the local network that it's hosted off of, the bot owner has the ability to adjust exactly who has access to what tool at any time, significantly reducing the chance for it to be abused.

"With only one command to start it, there's no reason not to love it," says Bradley. "No more struggling to set up a Linux machine, or trying to find all the tools compatible with Windows. It's just one command and you're done."

H@xc0rd is even simpler to use on the server this bot is hosted on — only a Discord account and a basic knowledge of the platform is needed. To utilize everything, simply tighten the specified prefix that can be found packaged sub. js on file and the command you want to run. Like a "!ping" command, which gives you latency to the bot.

Want to crack a password hash? Let java ripper do all the work and show off the results to everyone on the server. It's no longer necessary to export the results of the tool to a file and send that file to others, time and time again. Better yet, want to find information on how many times a certain password has been compromised, like password? Use the "!haveibeenpwed," which utilizes the haveibeenpwed guy to query and display the results.

Looking to find out information about a machine accessible to the public internet through "!shodan," and don't know where to start? H@xc0rd offers a simple solution. Just add the help argument after any command for a comprehensive description of the tool, arguments that can be used with the command and external resources to learn more about that specific tool.

Now you may ask, how do I know all the commands in the first place? Well, the command "!commands" of course, which lists out all the available commands. There are currently approximately 15 types of tools implemented into this project.

As time goes on, new tools come along and current ones slowly fall out of date by not getting updated. To accommodate this, Bradley and project partner David Austad (Network Security) will constantly update the tools within the project, removing and replacing them with new ones that provide similar results.

If there is a tool you really want to use, but hasn't been implemented yet, you have the freedom to add it yourself. Knowing that the bot couldn't satisfy everyone with just the tools Bradley and David were able to implement, H@xc0rd was built so that a new tool can be implemented in a matter of minutes.

During the building of this project, Bradley and David ran into a big issue— at first, the only way to run H@xc0rd was on Linux. Since this didn't comply with the final goal of use by everyone, a solution was needed. The solution came in the form of Docker, a virtualization platform that allows operating systems' environments, like Linux, to run on systems that generally wouldn't support that, such as Windows or Mac OS. Docker's implementation into this project allowed H@xc0rd to be hosted on nearly every operating system and can easily be tuned if one doesn't work perfectly through the provided install script.

Another big part of the project was making it as simple as possible for the user to set it up through install scripts. The entire set up process was automated through bash scripts to run natively on most Linux systems. And, saving the best part for last, it's free and open source. Bradley states, "You will never be limited with what you can do with this project, only by your imagination."

As time goes by, Bradley hopes others will contribute to it as well. Currently, H@xc0rd is only available via GitHub. Plans are in the works to host it through Docker as well, since you can compile it and host it there yourself.
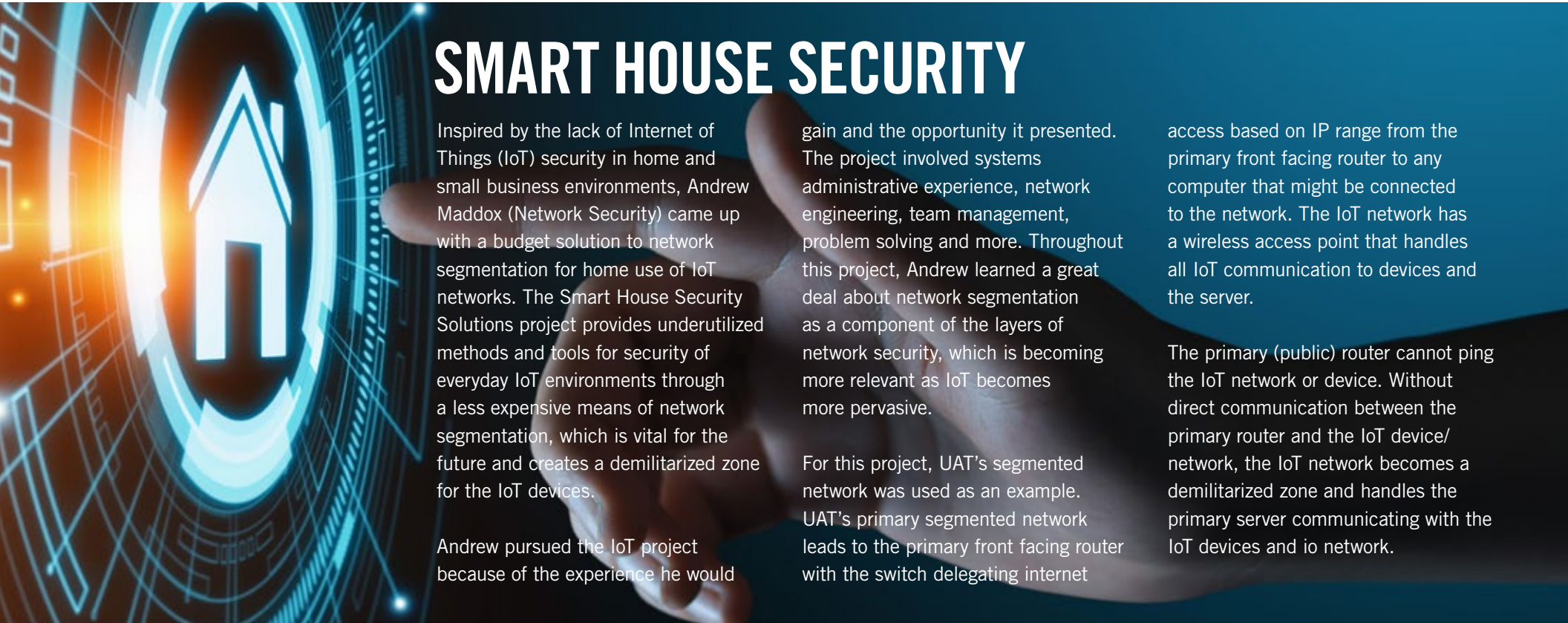
SMART HOUSE SECURITY

Inspired by the lack of Internet of Things (IoT) security in home and small business environments, Andrew Maddox (Network Security) came up with a budget solution to network segmentation for home use of IoT networks. The Smart House Security Solutions project provides underutilized methods and tools for security of everyday IoT environments through a less expensive means of network segmentation, which is vital for the future and creates a demilitarized zone for the IoT devices.

Andrew pursued the IoT project because of the experience he would gain and the opportunity it presented. The project involved systems administrative experience, network engineering, team management, problem solving and more. Throughout this project, Andrew learned a great deal about network segmentation as a component of the layers of network security, which is becoming more relevant as IoT becomes more pervasive.

For this project, UAT's segmented network was used as an example. UAT's primary segmented network leads to the primary front facing router with the switch delegating internet access based on IP range from the primary front facing router to any computer that might be connected to the network. The IoT network has a wireless access point that handles all IoT communication to devices and the server.

The primary (public) router cannot ping the IoT network or device. Without direct communication between the primary router and the IoT device/network, the IoT network becomes a demilitarized zone and handles the primary server communicating with the IoT devices and io network.
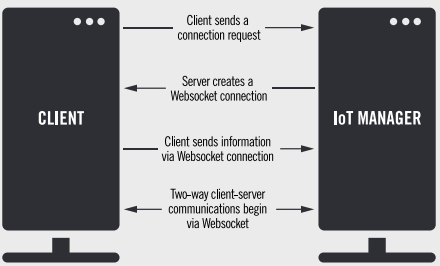
IOT.IO

IoT.io is an Internet of Things (IoT) device communication framework designed to make IoT development easier when designing IoT solutions and systems. Created by Dylan Crockett (Advancing Computer Science, Artificial Intelligence), this first of its kind IoT-focused ecosystem of management libraries is easy to implement without prior knowledge and allows developers to focus more on their devices and user experience, rather than on the nitty gritty communication details. IoT.io even allows hobbyist developers to get into IoT development without experience in networked device communications.

How Does it Work?
IoT.io uses new technologies, such as WebSocket, to make connecting and communicating with IoT devices easier. Through WebSocket, IoT.io increases the available range of hosting locations while also making it easier to host user interfaces and IoT devices' backend on the same platform, with very little overhead for the actual implementation.

Using WebSocket, IoT.io is able to provide two-way communication between the IoT device and the IoT manager, which is the server endpoint for the device. This allows for real-time two-way communication, which is a huge benefit as many other IoT frameworks don't offer this functionality. When the device connects, the manager will initiate a WebSocket connection to allow the client to pass information. Then, WebSocket uses a two-way communication protocol between the device and the server, allowing the user to pull information from the device after that point. IoT.io is intuitive and an easy-to-use event-style messaging system for sending and notifying the client and server to handle and react to specific actions as they happen.

CLIENT — Client sends a connection request → IoT MANAGER
Server creates a Websocket connection
Client sends information via Websocket connection
Two-way client-server communications begin via Websocket

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Mobile Game Programming
Students will design and develop a Role-Playing Game that provides players with multiple characters to select from, each of which have special attributes such as strength, power, weapons, casting spells, throwing projectiles, etc. Students will also learn how to create Heads-Up Displays (HUDs) for inventory and player health, mana and progress, all of which are tested by generating Artificial Intelligence (AI) characters.

History of Madness
In this course, students will explore madness and insanity throughout history. This course will explore questions, such as how has madness been defined in different periods and societies? Is madness a temporary or permanent affliction? Can it be cured, if so, how? Is madness a sign of genius or criminality? Who gets to define what madness is in the first place? Students will analyze how madness has been depicted culturally/artistically and look at how gender, race, social class, sexuality and religion shaped conceptions of insanity. Finally, students will use this study of the past to better grasp their current understanding of mental health.

Gamification
The game industry has developed a set of tools and practices for engaging player bases. This engagement has become part of the culture and expectations of interactive user experiences. The design psychology and philosophy behind gamification includes principles of engagement, interaction, motivation, socializing, competition, achievement and self-expression. This course leverages these design principles to create activities, solve problems and build interactions using game systems and mechanics.

Virtual Environments
Immersive digital environments provide students with simulated spaces they can explore and interact within. Students will learn the elements of effective virtual environments, along with how to construct them within the parameters of existing hardware to produce simulations that are realistic to users. Topics such as latency, feedback, geometry, multi-person interaction, physics engines and data integrations will be learned by students.

Open Source Intelligence
This course is focused on understanding how free-flowing data can be used to develop strategy and influence policy in response to modern digital threats. Students will develop the skills necessary to find, identify, investigate and report on cybercrimes. Students will also develop the skills necessary to contribute to modern intelligence analysis operations.

DEGREES

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> Notification of scholarship eligibility when you apply
> Select your spot in the dorms
> Better class choices
> Campus events
> Student news

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BEHIND THE BITS

PROJECT TRANSITION

Many horror games have a hair-raising environmental change effect. This effect has always mesmerized Josue Espinoza Beltran (Game Programming), as an avid horror game player, for its ability to spin a game's story and make the player question reality.

While playing, Josue was thinking about the possibility of changing a whole character model as players approached non-player characters (NPC). Specifically, Josue wanted to bring a mind-bending aspect to monsters — players can see monsters in the distance, but as they approach one, the NPC morphs into a human form.

With the concept decided upon, Josue started experimenting within Unity, which led him to use the Level of Detail (LOD) technique to accomplish the character model change.

The LOD technique allows the number of triangles rendered for a game object to be reduced, based on its distance from the camera. To use it, a game object must have a number of meshes with decreasing levels of detail in its geometry. These meshes are called LOD levels. The farther a game object is from the camera, the lower-detail LOD level is rendered. Game objects appear and disappear as the camera comes closer or moves away from the game object.

LOD is used with various game objects. Sometimes it's used for the scene, like when trees, mountains and other non-movable objects transition into the player's field of view, or used to update character models into better looking versions, as the camera focuses on the character, more detail appears.

Josue made use of Unity's LOD system to not only update the triangles, the traditional use, but also to transition the 3D characters to different models as the LOD levels change.

Polygons and the high level of detail required for character models are not easy to create, understand, and change for game programmers. Using the LOD system makes it easier and more efficient for game programmers to deal with changing character models in video games — and Josue proved it. Last summer, he tried the same transition with programming before innovating the use of the LOD system. The results? He's been more comfortable using the built-in LOD system — with three character model changes, the LOD system was time efficient and easier to maneuver.

In the future, Josue would like to implement his prototype into a game, work to deliver more polished transitions between character models, and make Project Transition available not only for character models, but for interactable objects as well.

TEAM

Josue Espinoza Beltran
Game Programming

Contributions by:

James Cortezano, Game
Art & Animation

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