Capstone Project Report
Buddy with buddy

https://vsawado.wixsite.com/birdingwithbuddy

Course section IT4983/W02

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Executive summary: In this research paper, we will cover the process of how we build Birding with Buddy. Birding with Buddy is an educational and entertaining immersive virtual 3D low-poly bird-watching experience for visitors. Buddy the Beaver guides the user through different terrain types to identify diverse bird species with sounds.

The player will be placed within a spot on a circular map that has pre-set biomes/locations. These biomes will each contain a certain number of bird species that naturally inhabit those biomes and the player will have the chance to identify them as they are navigating through the biome on the trail. The biomes and trail will bleed into other biomes ensuring that the player has a chance to spot all of the different bird species in the game.

Integrate a bird identification system where players click on sound waves to switch to a binocular view. In this view, players can choose to Identify the correct bird from multiple choices, Hear the Call Again, Consult a Field Guide, or close out the UI to complete it later. It will also feature flippable pages, called the guide, with images and notable markings of different bird species, allowing players to consult the guide for additional information. Once choosing the correct bird, the user will be presented with a congratulations message and be able to continue on their hike with Buddy to identify more birds along the trail.

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Background

Business and project background

The project is sponsored by Carters Lake Nature Center, which is located in Murray County, Georgia(*Mobile District*). We report directly to the head park ranger George who has been in charge of the interpretive program for the past 6 years, whose main goal is education. In the past 2 to 3 years, they have been reformatting their nature center to a visitor center, which is a place to come learn and explore before a visitor goes outdoors. George wants to implement technologies to engage the kids and as well teach them. The general goal of this capstone project is for us to create a game that enables the kids to interact with birds in a way that they can't do so by reading a poster or a book or with a lack of technology.

Project scope, objectives, and deliverables

The scope of the project is to create a game that will engage the kids in the hobby of birding. The concept of the game is an open-world, low-poly, semi-realistic, with a 3rd person camera view of Buddy while he walks around the environment. Buddy the Beaver is the core mascot of Carters Lake Visitor Center, which has to be created as a 3D model. As Buddy is exploring, he will hear different audible bird calls near each bird habitat, once he hears a call, he will be able to click the binocular buttons that will zoom in to the view of the bird at which point they will have to identify the bird. Each bird will need to have their own specialized 3D model or 3D model with identifying characteristics. There will also be a field guide that will contain real pictures of the different birds so that they can identify the birds in the environments. Since it will be an open world, it will have multiple biomes/environments that correlate to the bird habitat.

Technical backgrounds

Before we started, we had to research what platforms and technologies would help us reach our objectives and goals. We decided to use Unity as our game engine and Blender as software to create our 3D models. Unity was a wide choice because of its capability of cloud collaboration, small disk size, and helpful documentation. We use Unity assets to obtain 3D objects and scenery to help us build our environment.

Project outcomes and achievements summary

Assessment of project outcomes

Project Management Planning

- Project Planning
- Risk Management Planning
- Project Plan Review/Revision

Preliminary Research

- Technology Stack Research
- Buddy/Bird Species Research
- Software Research

3D Modeling

- Bird Models
- Buddy the Beaver Model

Game Development

- Open World Environment Development
- Asset Integration
- Character Controller Mechanics Development
- Bird Identification Mechanism Implementation
- Field Guide Design and Implementation
- User Interface Design
- Game Polish

Testing

- Testing Methodology Research
- Game Mechanics Testing
- Bug Reporting and Tracking
- User Experience Testing and Feedback
- Performance Testing

Technical summary of the solutions

The approach to creating the Buddy the Beaver model firstly was going to be a re-skin or re-design utilizing a pre-existing Blender asset(Technologies, Unity). Early on it was found there was not one suitable enough so a new model was going to need to be created from scratch. A prototype model was created within Blender ensuring his physical proportions were similar as well as his key physical features such as his orange vest and green baseball cap. The model will be rigged,

weighted, and imported into the game environment to see it operate within the game engine and further development will be taken from the feedback of this trial process.

Project planning and management summary

Overview

The project was primarily planned and managed by creating a Microsoft Project file. In the project file, we created a work breakdown structure (WBS) to organize the team's work into smaller segments. This allowed us to plan out and account for every part of the project from beginning to end. Each segment has a corresponding timeline, completion percentage, predecessor tasks, and responsible team member(s).

Our WBS was divided into the following subsections: Project Management Planning (18 days), Preliminary Research (10 days), 3D Modeling (16 days), Game Development (51 days), and Testing (4 days). Each subsection is further broken down into smaller segments.

Throughout the semester, we have consistently updated the file when additional tasks needed to be added or existing tasks could be removed. Using the Predecessor column, we set up task sequencing. When all tasks were added and organized, we enabled MS Project's auto-scheduling feature, which automatically scheduled all our tasks based on factors including resources (team members), predecessor tasks, and deadline constraints.

With the WBS, MS Project generates a Gantt chart, which is a visual representation of the project schedule in a bar graph format. The timeline of the project is displayed in one view with all tasks and dependencies included. With these tools, we were able to effectively monitor the progress of each task, each project segment, and the project in its entirety.

MS Project also tracks the remaining work hours assigned to each group member, which can be seen from the Resource Overview report. With this information, we adjusted the workloads to apply load leveling. The work hours for each team

member were then assigned in a more equal distribution. Overall, MS Project has been a great help in managing our project and keeping on top of upcoming tasks.

Going forward, we will now have all team members available to focus on game development. There will be 2-3 members working on each game design component. Each team member will be responsible for tracking their progress by updating the Gantt chart daily.

Project process

Beginning work on the project it became apparent early on in development that game design and model design were going to be enormous time-consuming factors. These aspects of the development process were entirely new to most of the team and solid foundational understandings of both the game environment and model designing software, Unity and Blender, were going to be fundamental as the project moved forward. Quick and responsive feedback for the environment ensured that the aesthetic and scope of the map could be set early on and helped cut down on unnecessary efforts over developing in later milestones.

To account for these realizations, we adjusted the schedule to allow more time for preliminary research for Unity and Blender. The creation of the bird models was going to be a time-consuming process that we did not have enough time to complete, so we decided to purchase bird model assets. For the same reason, the game map and character controller were downloaded and imported into our Unity project.

So far, we have completed the project planning phase and are close to completing the 3D model creation phase. We've integrated a fully functional game map(Studio, Polytope), a third-person character controller(Technologies, Unity), and the bird models that were purchased(Studio, Omabuarts). Our project has been set up with Unity Cloud to collaborate on the project in real time. By the end of milestone 1, we were able to complete the 3D model of Buddy the Beaver and set up most of the map, including pathways, trees, and structures.

By the end of milestone 2, we were able to complete the binocular feature, guidebook feature, bird identification feature, and Buddy model fully functional and playable. By the end of milestone 3, we were able to complete 3D bird sounds, Test the game and UI on a touchscreen, implement a menu(w/ password exit, how-to, credits, timeout reset), and fix minor issues. (more details within Weekly Log)

Team contribution summary

Troy Sorrells: In charge of the creation of the Buddy the Beaver 3D model for the in-game character model as well as assisting in any other 3D modeling

aspects for the game environment. Assist in group research and in areas where project help is needed.

Lazare V. Sawadogo(Team Leader): Technical Writing, game developing, ui developing, meeting note taker/recorder, creating and maintaining the team site. I also help to facilitate group progress by scheduling and running the team meetings, creating outlines for presentations, and being available as much as possible to help clarify any issues or questions regarding the project and its expectations. I also act as the liaison between the Project Sponsor/Professor and the team.

Blake Graham: Help to research and implement them in accordance with the various tasks that need to be done in order to successfully complete this project. In charge of the 3D bird models for the project.

Ikhelowa Adeji (Eric) (Co-leader): Help the primary leader with tasks to ensure everything is up to date and assist in group research. In charge of Project Change Management, Quality Assurance Plan, and Risk Management Plan.

Zach Alpine: Oversee 3D game development and assist in group research when needed. In charge of the RACI Gantt Chart schedule and WBS.

Workload summary

From the Resource Usage view in MS Project, we can calculate the man-hour subtotals by milestone 1. MS Project assumes each work day is 8 man-hours, so to make the numbers into more reasonable estimates of actual man-hours, we assumed each work day is 2 man-hours. The man-hour subtotals for milestone 1 were as follows: Lazare (102), Eric (82), Troy (111), Blake (78), Zach (94).

Project Management Planning was mostly a group effort. Report and presentation outlining was done by Lazare and Eric. 3D Modeling was mainly handled by Troy and Blake. And most of the game development so far was handled by Lazare, Zach, and Blake.

Team reflection on project experience

Project success factors
The most contributing factor to the project's success has been the frequent communication between the team members as well as concise communication between the team leader, the project organizer, and the sponsor. This has ensured firstly that nothing has been missed between the team in terms of deadlines, project sponsor requests, or overall quality of the project. Communication has been the cohesive glue that has made the team a unit of five rather than five individuals working alone.

Team collaboration and communication experiences
As a team, it was understood that team communication was going to be the key factor in ensuring the project went according to plan, and any problems found could be dealt with in an efficient, timely manner. Firstly a group Microsoft Teams channel was set up by the team leader and each of the members was added. This chat served as the core communication hub for the team to collaborate in and send any updates, group files, or have team meetings. Also within this channel, each of the members posted their personal communication details such as SMS phone numbers and personal email addresses so team members could be reached if they were not available through Microsoft Teams.

Utilizing this team channel daily for all updates to current team milestone projects as well as planning ideas for future portions of the project became vital to the success of the group. Consistent communication with each other as well as communication with the project sponsor and organizer kept the group’s focus clear and concise to accurately develop the perfect game that the project sponsor was looking for.

Some of the useful chat features within Microsoft Teams such as chat read receipts, personal user availability displays, and reaction emojis increased group morale and enhanced the team aspect of this project. Another useful feature was the ease of video call communication which allowed for quick and easy calls between group members and the sponsors. Also, the in-app support of Microsoft software such as Microsoft Word, Microsoft Excel, and Microsoft PowerPoint made the transition seamless when working within the app.

Challenges

One of the more difficult challenges coming into the project was how to properly handle the development of the game given the high learning curve of becoming accustomed to new software such as Blender and Unity. One of the most time-consuming issues found early on was how to properly re-skin all of the birds which the project sponsor had given as a request to be within the game. This proved to be an ordeal given the amount of development time it would take to texture and color each individual bird model. A more streamlined approach was to search for resources of pre-made bird skins(Studio, Omabuarts) that resembled all the birds that were requested and install these into the game environment rather than hard re-skinning them by hand.

Areas to improve

An area the group can improve upon would be implementing a game development document to catalog all the changes the game goes through and keep track of major changes. This would be beneficial to keep track of some of the project sponsors specific requests to make sure they are not lost as development tracks into later milestones and the requests that are introduced early can be as accurate as possible. This would also prove beneficial at the end of the game's development life cycle to have as a record of the game's overall development process from concept to implementation.

Appendix

Project files list

Bird's Info(Sponsor):
https://kennesawedu.sharepoint.com/:x:/r/sites/Team-Sp24-BirdingwithBuddycapstone/_layouts/15/doc2.aspx?action=edit&sourcedoc=%7Bccfc882a-6de7-4ba8-9773-1580d1d218a6%7D&wdOrigin=TEAMS-WEB.teams.chiclet&wdExp=TEAMS-CONTROL&web=1
Our Bird Info:
https://docs.google.com/document/d/1eL7-6wUOee3cKlZJNaG6-qo5nPcp0YpnPY26jBohG_4/edit
Project Plan:
https://docs.google.com/document/d/1uObD0Hoo_jAgSFqXxCqce8YflvcbwZWVAAr843jYUf4/edit
Weekly Log:
https://docs.google.com/document/d/1W2O1PrqRW4RKObSlzryjxf6LRzd0tS2VKPk7r2wC04M/edit
Milestone 3:
https://docs.google.com/presentation/d/1Df1dFtPKVImsrCePlE1HU1IelQk0sEdn_dmY2Ffy8uQ/edit#slide=id.g2b89134d236_0_689
Resource Overview:
Birding_with_Buddy_Gantt_Chart_V3_Resource_Overview 2.pdf
Gantt Chart:
Birding_with_Buddy_Gantt_Chart_V3_pdf 2.pdf
Birding_with_Buddy_Gantt_Chart_V3_mpp 2.mpp

Progress reports list

Weekly Log: (shows our weekly progress on the project)
https://docs.google.com/document/d/1W2O1PrqRW4RKObSlzryjxf6LRzd0tS2VKPk7r2wC04M/edit

References

https://www.sam.usace.army.mil/Missions/Civil-Works/Recreation/Carters-Lake/

"Carters Lake." *Mobile District, U.S. Army Corps of Engineers*, www.sam.usace.army.mil/Missions/Civil-Works/Recreation/Carters-Lake/. Accessed 16 Feb. 2024.

https://assetstore.unity.com/packages/essentials/starter-assets-thirdperson-updates-in-new-charactercontroller-pa-196526

Technologies, Unity. "Starter Assets - Thirdperson: Updates in New Charactercontroller Package: Essentials." *Unity Asset Store*, assetstore.unity.com/packages/essentials/starter-assets-thirdperson-updates-in-new-charactercontroller-pa-196526. Accessed 16 Feb. 2024.

https://assetstore.unity.com/packages/3d/characters/animals/birds/quirky-series-birds-bundle-212504

Studio, Omabuarts. "Quirky Series - Birds Bundle: Characters." *Unity Asset Store*, assetstore.unity.com/packages/3d/characters/animals/birds/quirky-series-birds-bundle-212504. Accessed 16 Feb. 2024.

https://assetstore.unity.com/packages/3d/environments/lowpoly-environment-nature-free-medieval-fantasy-series-187052

Studio, Polytope. "Lowpoly Environment - Nature Free - Medieval Fantasy Series: 3D Environments." *Unity Asset Store*, assetstore.unity.com/packages/3d/environments/lowpoly-environment-nature-free-medieval-fantasy-series-187052. Accessed 16 Feb. 2024.

https://xeno-canto.org/

Foundation, Xeno-canto. "Canto." *Xeno*, xeno-canto.org/. Accessed 21 Mar. 2024.

https://assetstore.unity.com/packages/tools/animation/book-page-curl-55588

Aldandarawy, Abdullah. "Book - Page Curl: Animation Tools." *Unity Asset Store*, assetstore.unity.com/packages/tools/animation/book-page-curl-55588. Accessed 21 Mar. 2024.

Credit

Professor
Donald Privitera

Sponsor
Mr. George McBroom

Developers
Lazare Sawadogo, Blake Graham, Troy Sorrells, Ikhelowa Adeji, Zach Alpine

Advisers and organizers
Alla Kemelmakher, Nasiya Sharif

Guidebook
https://youtu.be/peJ22VmW7QQ?si=WpQjh_0nx3kq8wKB
https://assetstore.unity.com/packages/tools/animation/book-page-curl-55588

Character Rigging
https://youtu.be/lf1rgiD45YI?si=zo7AS1s42nMz1WtH
https://youtu.be/vzJ7454X46g?si=5pTB1v_1WkeuLVTw
https://youtu.be/_Er4eqhhDTo?si=mlor-pf_Lum58Vce

Binocular
https://youtu.be/9g2VqJvWnQI?si=TP2gCEcNuCU1k6nf
https://youtu.be/DAXgs7kTYQg?si=GflHvmYUJcYzbR1F
https://youtu.be/yApA2-SQnYw?si=bKVbZ5ILauOx4nVn

Optimizations
https://youtu.be/yuCFupLJ8kY?si=njIw98Do5sfmFruA
https://youtu.be/ysk7ATmIeOs?si=oDVQvjHU95_5iXWQ
https://youtu.be/v5_RN8o1b3g?si=aJZxgrqPfzO_tptw
https://youtu.be/Xd4UhJufTx4?si=jaKhnw7liK7d0WAh

Unity Basic
https://youtu.be/AmGSEH7QcDg?si=kt5i344Exum2sGls

Environments

https://youtu.be/Fhx7t0REfMI?si=b0KrAnJ60knJCybH
https://youtu.be/MWQv2Bagwgk?si=PEbMGGIbo-KYPuHs
https://youtu.be/2XdQkwSw-bA?si=0hEEx4zDkWU9giQy
https://assetstore.unity.com/packages/3d/environments/military-free-260358
https://assetstore.unity.com/packages/3d/vegetation/trees/low-poly-tree-pack-57866
https://assetstore.unity.com/packages/3d/environments/lowpoly-environment-nature-free-medieval-fantasy-series-187052

3D Birds

https://assetstore.unity.com/packages/3d/characters/animals/birds/quirky-series-birds-bundle-212504 (Modified by Blake Graham)

Bird Audio

Xeno-Canto.org; Patrick J. Blake, Russ Wigh, Mike Nelson, Anthony Gliozzo, Paul Marvin, Sander Pieterse, Stuart Fisher, Daniel Lane, Paul Driver, Tayler Brooks, Barry Edmonston, Aidan Place, Brian Hendrix, Phil Brown, Cristian Pinto.