CSE1901 - Technical Answers to Real World Problems (TARP)

Project Report

SPARK

By

19BCE1420	Vaasu Bhatnagar
19BCE1422	Varan Gulati
19BCE1431	Rahul Garg
19BCE1518	Priyadarshini Pal

B. Tech Computer Science and Engineering

Submitted to

Dr Geetha S

School of Computer Science and Engineering

VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

April 2022

DECLARATION

I hereby declare that the report titled "**SPARK"** submitted by me to VIT Chennai is a record of bona-fide work undertaken by me under the supervision of **Dr Geetha S**, School of Computer Science and Engineering, Vellore Institute of Technology, Chennai.

Signature of the Candidate

Vaasu Bhatnagar
Varan Gulati
Rahul Garg
Priyadarshini Pal

19BCE1420
19BCE1422
19BCE1431
19BCE1518

CERTIFICATE

Certified that this project report entitled "**SPARK"** is a bonafide work of **Vaasu Bhatnagar (19BCE1420), Varan Gulati (19BCE1422), Rahul Garg (19BCE1431) , Priyadarshini Pal (19BCE1518)** and they carried out the Project work under my supervision and guidance for CSE1901 - Technical Answers to Real World Problems (TARP).

Dr Geetha S

SCOPE, VIT Chennai

ACKNOWLEDGEMENT

We wish to express our sincere thanks and deep sense of gratitude to our project guide, Dr Geetha S, for her consistent encouragement and valuable guidance offered to us in a pleasant manner throughout the course of the project work.

We are extremely grateful to the Dean of the SCOPE, VIT Chennai, for extending the facilities of the School towards our project and for the unstinting support. We also take this opportunity to thank all the faculty of the School for their support and their wisdom imparted to us throughout the course.

Vaasu Bhatnagar
Varan Gulati
Rahul Garg
Priyadarshini Pal

19BCE1420
19BCE1422
19BCE1431
19BCE1518

ABSTRACT

Parkinson's disease is a brain disorder that impairs a person's ability to balance and coordinate body movements. It causes tremors, stiffness, and other physical effects. This disease makes it difficult for people to walk and talk.

Parkinson's disease patients have difficulty controlling their movements. However, when visual cues are present to guide them, motor control improves. Patients even stated, "If you could just get me up a flight of stairs, I'd be fine." These issues result in a loss of independence and a lower quality of life because sufferers frequently avoid activities outside of the home, leading to isolation and depression.

CONTENTS

1. Introduction

1.1 Objective and goal of the project

Parkinson’s disease is a brain disorder which weakens the ability of a person to balance and coordinate movements of his body. It causes shaking, stiffness and other such physical affects. People suffering from this disease have difficulty walking and talking.

1.2 Problem Statement

Parkinson's patients have trouble controlling their movements. Yet, when visual cues are here to guide them, motor control is enhanced. Patients even said "If you get me up a flight of stairs I'd be up no problem at all.” These problems lead to loss of independence and reduced quality of life like they sufferers often avoid activities outside of the home, leading to isolation and depression.

1.3 Motivation

We are trying to empower people with Parkinson’s to feel more comfortable engaging with the world around them with our prototype model. By this model we can Build an 3D object visuals by their given commands using AR which helps us in presenting virtual objects and information in our field of vision.

1.2 Challenges

It is expensive to develop AR technology based projects and to maintain it. Moreover production of AR based devices is costly. We would try and keep the development and implementation cost of our project to the least amount possible. Lack of privacy is a concern in AR based applications. We could add a signup system with additional security features in the future. It usually requires basic learning to effectively use AR compliant devices. However we would like to make our user interface fairly simple, without a lot of depth and with very less navigation required to fully utilize the application.

2. Literature Survey

To simplify the life of Parkinson's patients, a tool named Dextrabot is being developed by 10thclass students. This tool works on arduino-nano principal which is going to control the sensor basically it's a sensor mechanism tool which helps the Parkinson's patient problems related to hand like hand tremors almost 39 % of Parkinson's have hand tremors. The device helps the patients to eat, brush, drink as overall helps to get the stability in hand as a spoon is attached to feed the patient, similarly for brushing, toothbrush can be attached. Overall this device comes as a very affordable and very convenient way to help many patients as there are a huge number of Parkinson's patients nowadays and it helps to make their life more independent.

[1] Poornima Nataraj [(publishes on 7 April 2022)]: Available Online: https://analyticsindiamag.com/class-10-students-develop-robotic-handle-to-help-parkinsons-patients/.

Since Parkinson's disease suffering people are huge in numbers and many people are living with this disability, their problem of neurodegenerative disorder which arises due to the issues in their motor function where it slows down their movement in walking like needing the support of a walker to walk on normal surface but they can walk on stairs normally without any support, they had hand tremors and issues in terms of balancing as due to disorder in their neurons. In Earlier 1960's one of its treatment for motor function is being declared named levodopa but it is stated that this Parkinson disease is not that simple disease it has much complications differing from people to people. Till now not much effective disease tempering therapies have been described.

[2]Sigurlaug Sveinbjornsdottir,"The clinical symptoms of Parkinson's disease",Journal of Neurochemistry, 11 July, 2016

As in this advanced technological world, everyone wants the whole world on their one scroll in their mobile phones as many web apps are launching their mobile app version as it get used more in numbers by the people as they find it very convenient in usage purpose. And to get the real visual of the things is another concern. To make theaugmented reality experience on our phones is way another major demand of the users. As now mobiles have features with particular sensors to process the technology of augmented reality. There are development tools along with methods

for proper designing and deploying the concept of augmented reality which helps teachers and students to better work on this area. The tool named VEDILS which is the authoring tool which provide the simplicity in spatial sector along with programming also on the preference for 2D over 3D overall for android apps it is a block-based programming. This includes major four steps, first to design along with development of components which are new, and then secondly we train them, and in third step we proceed with iteration for the design and last step is to give them assessment.

[3]José Miguel Motaa, Iván Ruiz-Rubea, Juan Manuel Doderoa, Inmaculada Arnedillo-Sánchez, ” Augmented reality mobile app development for all”, Computers & Electrical Engineering, vol. 65, January 2018,

Inability to take steps while walking or taking short steps while walking so they need support of walker for walking this we called a freezing of gait or FOG symptoms which mainly noticed in advanced Parkinson’s disease is one of the major disabling symptoms of Parkinson’s patients. To measure the movement in patient’s body, sensors which measure the accelerations on body are being used in the wearable device where components are being used by examining the frequency which detects the symptoms of FOG. The Parkinson’s patients restarts their walk with the generation of rhythmic auditory signal as when the FOG is being detected. Their wearable device performance with the sensors used the algorithms applied along with the style of walk is being performed by analyzing the ten Parkinson’s patients for around 8 hours and their data was being documented in which 8 experienced the fog while studying. And most of them declared this wearable device as helpful enough for their disorder.

[4] Marc Bachlin, Meir Plotnik, Daniel Roggen, Inbal Maidan, Jeffrey M. Hausdorff, Nir Giladi, Gerhard Troster, “Wearable Assistant for Parkinson’s Disease Patients With the Freezing of Gait Symptom”, IEEE Transactions on Information Technology in Biomedicine ., vol. 14, Issue: 2, March. 2010.

As in this evolving technological world to better our work along with our lifestyles we take the support of technology in almost every sector. Such one of the sector where technology is used in vast range for our better survival is in medical sectors. As there we need to be more precise and

accurate for our work like surgeries but manually or with some common technology we cannot obtain that accurate visualization of any organ for laparoscopic surgery as due to some of the limitations faced by the tech. So the advanced technique used for the visualization of an organ in surgery is augmented reality which gives the 3D illusion of our ultrasound or MRI with the real time camera images. By tracking the targeted organ or laparoscope, a geometric correct image is being formed. A surgeon gets the better understanding or visual of the structures by the images between the developed 3D images of an organ or the live laparoscopic image. For urology and surgeries completed with the technical success by the laparoscopic and with the assistance of robot. There are some limitations of the augmented reality technology is that its dynamic tracking of deformation and movement of an organ is infancy which can be improvised by the future technological development.

[5]Nakamoto, Masahiko,Ukimura, Osamu Faber, Kenneth, Gill, Inderbir S,"Current progress on augmented reality visualization in endoscopic surgery", Current Opinion in Urology, vol.22, pp. 121-126, March. 2012.

3 Requirements Specification

3.1 **Hardware Requirements**

- Windows: 7 SP1+, 8, 10, 64-bit versions only
- GPU: Graphics card with DX10 (shader model 4.0) capabilities
- Android: Android SDK and Java Development Kit (JDK)
- Eye tracking
- Accelerometer
- Gyroscope
- VR Glasses

3.2 **Software Requirements**

Software requirements for augmented reality include- AR software works in conjunction with devices such as tablets, phones, headsets, and more. These integrating devices contain sensors, digital projectors, and hence require:appropriate software that enables computer-generated objects to be projected into the real world , On-board operating system and user interface to support the software , web Browser , authoring to allow the user to use API links to other databases and websites to display information.

4 System Design

The system we propose revolves around the construction of an Augmented Reality app. We decided to use the popular UNITY engine to design our application. After installing some additional augmented reality libraries, we could import a 3d asset into the engine and build the application as an android package (apk), which we could then transfer to our mobile phones for testing.

The 3d assets we decided to create were made using Blender, and some were imported from the Unity Store. We created assets such as:-

1. Staircases,
2. Cross mark,
3. Horizontal parallel lines
4. Turning arrow.

After adding these 3D assets to our application, we constructed our application and could view a 3D model of the above mentioned objects through our phone cameras. The spawn point of the objects along with the orientation depends on the positioning of the mobile phone; hence it automatically adjusts with the change in position of the patient.

The phone shall be placed in an augmented reality headset which would allow hands free working of our application.

5 Implementation of System

We decided to make this painted staircase illusion, as well as other visual signals, available to everybody on the planet. So we set out to create an augmented reality solution that focused on two motion issues that people with Parkinson's experience: "freezing of gait," an ambulatory disturbance that results in slow, shuffled walking, and "dyskinesia," the impairment of voluntary movement, especially when there are no stimuli to trigger reflexes.

We started by prototyping the optimum staircase length and determining the walking motion signals with paper markers. The final solution incorporated five visual signals based on research and prototyping: a staircase for walking, curved lines for turning, parallel lines for crossing a doorway, and cross markings to indicate where to sit. We utilized this step to hammer out core usability concerns, such as what is a natural pace and direction of turning cues despite not being able to co-design the experience with people with Parkinson's. After that, we used the Unity Store and Blender to find and modify 3D assets and scripts for the various illusions, while simultaneously working on the AR to build the relevant scenes in unity engine and then testing the results on an AR app which we deployed on our phones

6. Results and Discussion

This AR app that was built using Vuforia and Unity was designed to help patients of Parkinson's disease. Modules were built for helping patients walk with ease, turn corners easily, walk through doorways, and interact with objects like chairs.
All the above mentioned objectives were met. The app was fully functional, with all the modules working as intended.

7. Conclusion and Future Work

The objective of our project was to create an AR application that would help patients of Parkinson's perform some movements with more efficiency than before, and we achieved our objective.

The staircase module helped patients walk more comfortably on straight paths. The cross mark module allowed patients to interact with objects such as chairs with a lot less effort. The horizontal parallel lines module allowed patients to walk through doorways faster and the turning arrow provided a path for them to follow when taking a turn.

For future work, some additional modules can be added to the project along with additional functionality. For example, the entire house of a Parkinson's patient can be mapped and specific functions like food, television etc. can be added that already contain predefined steps and methods. Using pre-existing sub-modules, the app can guide the patient to the desired location and reduce a lot of strain for the patient and other household members.

8. REFERENCES

[1] Dengfei Jie, Lijuan Xie, Xiuqin Rao, Yibin Ying “Using visible and near infrared diffuse transmittance technique to predict soluble solids content of watermelon in an on-line detection system” Postharvest Biology and Technology, vol. 90, April. 2014.

[2] S. Hutchinson, G. Hager and P. Corke, "A tutorial on visual servo control", IEEE Trans. Robot. Automat., vol. 12,Oct. 1996.

[3] R. Yosafat, C. Machbub and E. M. I. Hidayat, "Design and implementation of Pan-Tilt control for face tracking", IEEE International Conference on System Engineering and Technology (ICSET), 2017.

[4] Pang, Y., Yuan, Y., Li, X. and Pan, J. (2011). Efficient HOG human detection. Signal Processing, 91(4), pp.773–781.

[5] K, S. and S.S., M. (2018). Human Detection and Tracking using HOG for Action Recognition. Procedia Computer Science, 132(1877-0509), pp.1317–1326.

APPENDIX

Code:

```
public class MainActivity extends AppCompatActivity {
    private static final String TAG = MainActivity.class.getSimpleName();
    private static final double MIN_OPENGL_VERSION = 3.0;

    ArFragment arFragment;
    ModelRenderable lampPostRenderable;
    private Uri selectedObject;

    @Override
    @SuppressWarnings({"AndroidApiChecker", "FutureReturnValueIgnored"})
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        arFragment = (ArFragment) getSupportFragmentManager().findFragmentById(R.id.ux_fragment);

        initializeGallery();

        arFragment.setOnTapArPlaneListener(
                (HitResult hitresult, Plane plane, MotionEvent motionevent) -> {
                    if (plane.getType() != Plane.Type.HORIZONTAL_UPWARD_FACING)
                        return;

                    Anchor anchor = hitresult.createAnchor();
                    placeObject(arFragment, anchor, Uri.parse("chair.sfb"));
```

```
    private void placeObject(ArFragment arFragment, Anchor anchor, Uri uri) {
        ModelRenderable.builder()
                .setSource(arFragment.getContext(), uri)
                .build()
                .thenAccept(modelRenderable -> addNodeToScene(arFragment, anchor, modelRenderable))
                .exceptionally(throwable -> {
                            Toast.makeText(arFragment.getContext(), "Error:" + throwable.getMessage(), Toast.LENGTH_LONG).s
                            return null;
                        }

                );

    }

    private void addNodeToScene(ArFragment arFragment, Anchor anchor, Renderable renderable) {
        AnchorNode anchorNode = new AnchorNode(anchor);
        TransformableNode node = new TransformableNode(arFragment.getTransformationSystem());
        node.setRenderable(renderable);
        node.setParent(anchorNode);
        arFragment.getArSceneView().getScene().addChild(anchorNode);
        node.select();
    }
```

Screenshots of Live Demo