**FLYCYCLE PROJECT PROPOSAL**



**University of Maryland**

# **Team:** MRE (Medical Robotics and Equipment) Lab

**Team Lead:** Assistant Professor Dr. Axel Krieger

**Team Members:**

**Graduate Student:** Anirudh Topiwala

## 1 Goal and Objectives

We propose to setup and modify the Flycycle robot, donated by ATR Corporation to the Maryland Robotics Center. This robot is a Virtual Reality exercise machine that provides a complete as well as an entertaining workout for the upper and the lower body. The idea here is to combine the lower body workout of riding a cycle with the upper body workout of hand gliding. Using the feedback from the sensors, the user is completely immersed into the virtual reality game which is controlled by his body movements. The full exercise entails activities like climbing, diving, banking and pedaling. The short-term objective is to modernize the Flycycle whereas the long-term goal includes improvising on the modified Flycycle. The scope here is vast, ranging from adding a VR headset to get a complete immersive fitness experience to using the Flycycle for rehabilitation purposes.

**(a) Modernizing the Flycycle**

The first set of objectives would be to modify the Flycycle. This would include validating the integrity of the sensors and if necessary replace any damaged parts. Secondly, a study will be carried out on what parts can by updated to make the robot compliable with the recently developed games and software’s as the robot was designed a long time back. An example here would be changing the operating system on board. Finally, the Flycycle will be fully integrated with an Android or an IOS game to give an immersed Virtual Reality Fitness gaming experience.

**(b) Improvements on the Flycycle**

Once the robot is up and running, further improvements on the robot can be carried out, such as extending the gaming experience to a VR headset. Another area of improvement is using the Flycycle for rehabilitation purposes.

**To summarize, the project consists of the following four objectives:**

1. **Assemble the Robot once it arrives at the Robotics Realization Lab.**
2. **Identify and order replacements to Modify the Robot and its interface.**
3. **Integrate a Virtual Reality game with the Flycycle sensors to get an immersive Fitness experience.**
4. **Look for improvements on integrating a Virtual Reality Headset with the Flycycle or How the Flycycle can be used for rehabilitation purposes.**

**At the end of this summer project, we will execute all the above objectives to build a first of its kind Flycycle used for exercising with a Virtual Reality experience.**

## 2) Project Plan and Milestones

For this project, we will be using the Flycycle robot donated by the ATR corporation to the Maryland Robotics Center. The project is divided and executed into four objectives. 1) Assemble the Robot once it arrives at the Robotics Realization Lab. 2) Identify and order replacements to Modify the Robot and its interface. 3) Integrate a Virtual Reality game with the Flycycle sensors to get an immersive Fitness experience. 4) Look for improvements on integrating a Virtual Reality Headset with the Flycycle or How the Flycycle can be used for rehabilitation purposes.

In objective one, with the help of the technical lead from the ATR corporation, we will assemble and set up the Flycycle robot in the Robotics Realization Lab. This will include, making sure that all parts are attached properly and understanding the basic instructions and guidelines on handling the robot.

For objective two, a through analysis of the existing sensors will be made. Also, a study will be carried out on what parts can by updated to make the robot compliable with the recently developed games and software’s as the robot was designed a long time back. Once this is done, the new sensors and parts will be integrated with the Flycycle and a basic demo of the Flycycle will be carried out. Here, the outputs from different sensors will be studied and checked if the integration was successful.

For objective three, a game will be developed so that the Flycycle can interact with the game and give a virtual reality experience. The game would be either be developed in Android or in IOS. The theme of the games would be on similar grounds as flight simulators or car racing games, so that the acceleration can be controlled by the pedaling speed of the Flycycle and the steering of the vehicle will be controlled by the user’s body (using the potentiometers mounted on the top two arms of the Flycycle). The level of effort required can then be used to set different levels in the game. Although, the difficulty level of the game would not be able to be changed significantly because of the passive degrees of freedom. Once the game is operational, we should have a fully functional Flycycle robot set up.

The final objective for the summer is to improve upon the features and applications of the Flycycle Robot. The first improvement here could be integrating a Virtual Reality headset to get a completely immersive experience of the game. This is in comparisons with the latest developments made in the field of VR Fitness. Companies like ICAROS and Black Box VR have already started working on combining physical fitness with Virtual Reality games to give a fun and interesting workout.

Another application for Flycycle is in Rehabilitation Robotics. As the Flycycle aims as working out the entire body, it can help patients build muscle strength. Also, if we integrate active degrees of freedom into the robot, then we can vary the stress incurred on the muscles and tone the muscle as required.

The first objective, should not take a lot of time. It will be completed in the first week of the robot’s arrival. Achieving the second objective might be a little bit time consuming as the conditions of the existing parts is not known. Also, integrating the new sensors might take some time. Although, it should be completed by the end of June. The third objective again, should not take a lot of time. As there as already a lot of preexisting games available in the market. The Flycycle should be up and running by the end of July.

The final objective of carrying out a study on future goals would be the last part of the summer project. It should be completed by the end of summer or towards the end of August.

## 3. Budget for the Summer

|  |  |
| --- | --- |
| Items | Cost |
| Computer Screen | 150-250 |
| Industrial Grade Joystick Potentiometers | 50X4=200 |
| Oculus Rift with Accessories | 1200 |
| Oculus PC | 2000 |
| Sensors and Miscellaneous Electronics | 4000 |
| Additional Hardware and Replacements | 2500 |
| 3D Prints | 500 |
| Graduate Research Assistant:  Anirudh Topiwala (40 hrs./week @$15/hr.) | 7800 |
| Total Cost | 18000 $ |