

# Studienarbeit

*Zur Inbetriebnahme des KAT Walk mini S und der anschließenden Evaluierung der Nutzererfahrung*

Verfasser: Umberto Falkenhagen

Matrikelnummer: 260601

Studiengang: Medieninformatik (Bachelor), 7. Semester

Semester: Sommersemester 2022

Betreuer: Prof. Jirka Dell'Oro-Friedl

Abgabedatum: 11.07.2022

## Table of Contents

1.	Introduction .....	1
2.	Setting up hardware and system requirements .....	3
3.	Software components .....	5
3.1.	Consumer setup.....	5
3.2.	Producer setup .....	6
3.2.1.	Unity implementation.....	6
4.	Experience of usefulness in existing games .....	8
4.1.	Creation of my prototype .....	8
4.2.	General experience.....	10
4.3.	In-game experience .....	11
5.	Summary .....	13

## 1. Introduction

Virtual reality has been around for quite some time. The first head-mounted headset was created in 1968 and was called “The sword of Damocles” and it looked as intimidating as the name sounded. Since then, VR headsets have come a long way and evolved from a futuristic concept into a new approach to creating our realities. Especially in recent years more and more companies released their own devices giving people more variety to choose from, for example choosing between standalone headsets and PC-VR headsets.

Furthermore, the technological evolution in the past decades made it possible to create better graphics and more immersive experiences. However, as the capabilities of VR headsets grew, the available space that most people have in their flats for using them did not. While some games like “Beatsaber” where the player doesn’t physically move through their environment but instead stands in one place and only uses their arms and head are not affected by this problem, a large portion of modern VR games are.

The classic solution to that problem was using the VR controllers for locomotion, for example, pressing a joystick on the controller to move forward. However, this approach had some disadvantages and difficulties. First, many people struggle with motion sickness if their eyes tell them that they are moving but all other senses tell them otherwise. Second, using only parts of your body instead of all of it takes a lot away from the immersion of a game. And third, if people start physically walking around, they will often run into obstacles or at least a guardian system to protect them from harm.

With that problem of locomotion in mind, the VR treadmill was born. In general, a “VR treadmill is an Omnidirectional running area, which allows the user to move around physically in any direction (left, right, forward, backward, or diagonally) in a virtual environment. The user has a restricted gaming zone covered with a fence and waist belt,

linked to the treadmill with firm rods. VR treadmills systems can trace the movement of the body on the tread/walk using integral sensors. This information is assembled and transferred to the computer. After processing, this information gets converted into motion within a virtual environment.” (U)

In this paper I want to discuss one of these devices, namely the “Kat Walk mini S”, describe what needs to be done to make it work in already published games as well as implement it in a game engine, and evaluate its use cases.

## 2. Setting up hardware and system requirements

The device comes with a manual in which it is narrowly described how to assemble the Kat mini. Therefore, I won't spend the time explaining it again. In case you need help with the assembly please check out the [Kat website](https://www.kat-vr.com) and download the manual.



Figure 1: Advertisement banner for the Kat Walk mini S  
(Source: <https://www.kat-vr.com/products/kat-walk-mini-s>)

The device must be connected to two power outlets and one USB 2.0 port on your computer. Please note that a USB stick is delivered alongside the device. This USB must be connected to a separate USB port on your computer.

The Kat mini naturally comes with a few requirements for your computer, namely, they are:

- Operating system: Windows 7 SP1, Windows 8.1 or higher, Windows 10.
- USB port: 2x USB 2.0 or above
- Storage space: 100 MB of free hard disk space (for installing the software adapter)

If you also want to create your own applications for the KAT mini you have to buy an Authentication-Dongle to use the device for testing. Alternatively, you can also use a free Test-Runtime which simulates some of the input of the device.

However, a significant number of requirements are related to the chosen VR headset as well as the games that you play. I used an “HTC Vive” headset, so I will list the requirements for this series of headsets below:

Component	Recommended system requirements	Minimum system requirements
Processor	Intel Core i5-4590/AMD FX 8350 equivalent or better	Intel Core i5-4590/AMD FX 8350 equivalent or better
GPU	NVIDIA GeForce GTX 1060, AMD Radeon RX 480 equivalent or better	NVIDIA GeForce GTX 970, AMD Radeon R9 290 equivalent or better
Memory	4 GB RAM or more	4 GB RAM or more
Video output	HDMI 1.4, DisplayPort 1.2 or newer	HDMI 1.4, DisplayPort 1.2 or newer
USB port	1x USB 2.0 or newer	1x USB 2.0 or newer
Operating system	Windows 7 SP1, Windows 8.1 or later, Windows 10	Windows 7 SP1, Windows 8.1 or later, Windows 10

Figure 2: Vive system requirements (Source: [https://www.vive.com/eu/support/vive/category\\_howto/what-are-the-system-requirements.html](https://www.vive.com/eu/support/vive/category_howto/what-are-the-system-requirements.html))

### 3. Software components

There are two different use cases both of which depend on different software components. These are either just playing already existing games (consumer setup) or creating their own applications (producer setup).

Regardless of the use case, you will always need to install *Steam* as well as the *SteamVR* service provided for free in the *Steam Store*. Additionally, you will most likely also need drivers and software tools based on the HMD headset of your choice (e.g., *Viveport* for *HTC Vive* headsets).

#### 3.1. Consumer setup

If you want to play already existing games, you will first have to make sure whether it works with KAT devices. In general, this includes “all Steam VR games with support for Free Locomotion (unrestricted movement around the game environment)[...]”, as the developer state on their website. There you can also find a list of games they tested so far: <https://www.kat-vr.com/pages/all-gamelist>.

If your chosen game is compatible, you must install it via Steam. Besides that, you will now only need the KAT I/O Consumer Edition. Once that is set up you should find your installed game in the library tab within the KAT I/O software and run it from there.

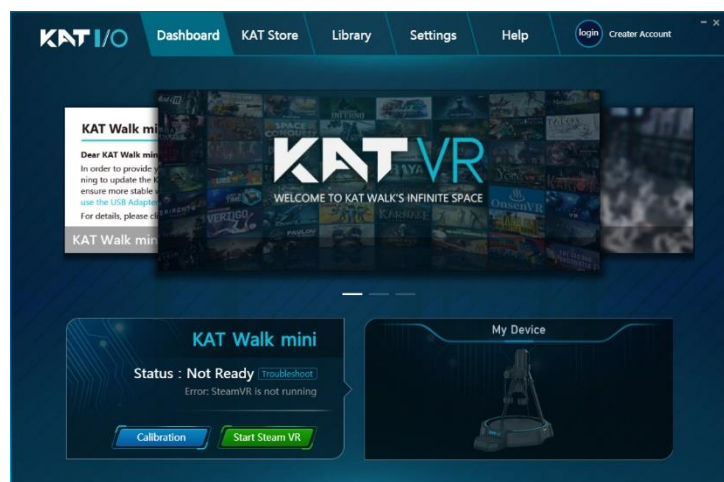


Figure 3: Kat I/O Consumer Edition (Screenshot)

### 3.2. Producer setup

If you want to create your own application using the KAT mini changes the requirements a bit. First, you will need the KAT Industry application which you usually receive along

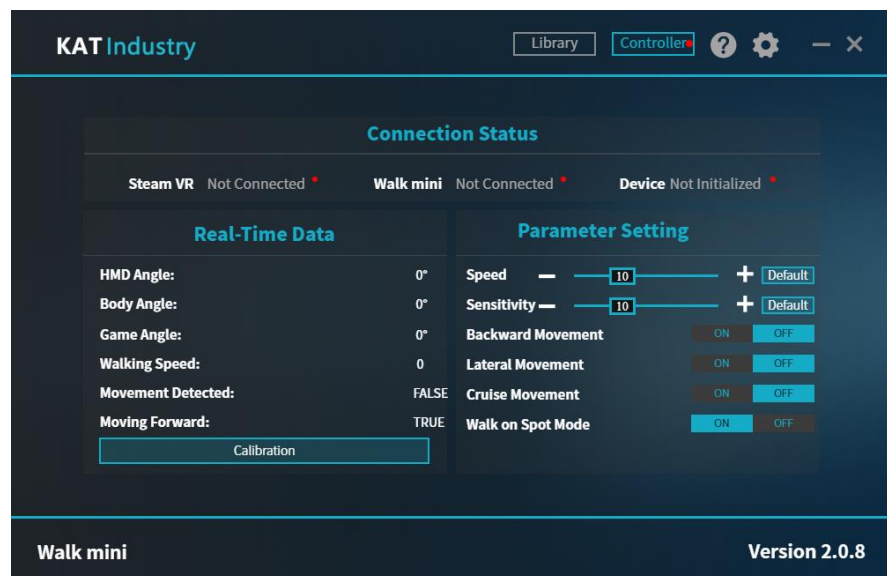


Figure 4: KAT Industry software (Screenshot) showing the different parameters which resemble the devices status)

when buying the Authentication-Dongle which I mentioned earlier. Once this is installed you will have to decide whether you want to use the Unity engine or the Unreal engine for development. However, both follow a similar approach. Alongside the Industry software, you will also receive an SDK which includes the test runtime to simulate the device input, one runtime to track inputs from the device, and a plugin for both development engines respectively. As I have used Unity, I will explain the detailed setup for this option. In case you are using Unreal please try to follow the basic steps of importing plugins as well as the manual provided in the SDK file.

#### 3.2.1. Unity implementation

When setting up a project you will first have to paste some DLL files that are included in the SDK package to the System32 folder on your computer. Following that, you will only need to import the delivered Unity package into your project. It includes all necessary prefabs as well as the SteamVR plugin for Unity, though you might have to update it using Unity's built-in package manager.



As easy as this sounds, I had some issues setting it up properly. On the one side, I received a package with an outdated SteamVR version. This meant that OpenVR (an XR management tool like OpenXR) on which SteamVR relies was not included in the import but had to be added to the project by first removing the SteamVR plugin completely from the project and then re-importing it through the package manager.

On the other side (and probably linked to the SteamVR/OpenVR problem), the delivered “KAT\_Walker” prefab (basically a ready-to-use player avatar prefab) did not work correctly. Firstly, the prefab was not working as some scripts were missing entirely. To fix it I had to edit the prefab by removing the Camera Rig, adding a new one, and linking it up properly to its remaining references in the prefab.

While it was now possible to use the prefab within a scene, walk around and properly use the input of the device to move around in general, the camera was not located in the right position. As can be seen in the xxx screenshot, the camera was not positioned at the player’s head position but instead snapped to one of the edges of the SteamVR camera rig box surrounding the player. While I could not find the cause of it, I am sure it is something inside the camera rig’s configuration and finally fixed it by setting the x and z scale of the box to 0.

Once these fixes were done, I was able to create my prototype without further issues. However, it should be noted that I did not implement any complex interactions within my prototype (e.g., clicking buttons, using teleporting instead of walking, moving objects, etc.) so I cannot say whether my work-around for fixing the camera position would have any downsides on that.

## 4. Experience of usefulness in existing games

While using the device for development I also spend a good amount of time trying out already existing games as well as my own prototype. I want to use this chapter to summarize some pros and cons that I noticed. To structure the feedback, I will split it into different sections. First, I will discuss the experience with the device in general, including the setup, software, and similar topics. After that, I will talk about the in-game experience.

### 4.1. Creation of my prototype

As mentioned, I also created a prototype for the “Kat Walk mini S”. I developed this for basically two reasons. The first reason, which was already laid out in detail in chapter 3 was to get familiar with the process of creating own applications for this device and to explore issues and problems when working with the provided plugins.

The second reason was that the device itself came with no playable tutorial to get used to the device and how to use it. Since one of my goals was to evaluate the usefulness of the device in different use cases. Since this also includes people with little to no experience in VR, I wanted to create a tutorial that focuses on the functionalities of the treadmill instead of having a game in which the user would have to learn many different controls simultaneously.

As can be seen in figure 3, the prototype consisted of two different stations, both of which were aimed to make the player switch between different kinds of walking. The player would spawn in an open area where they could walk around without any specified goal, allowing them to get used to the device and feeling first.

From there they could go to the different stations in front of which I placed a board each that served to give a short explanation for the respective stations.

Firstly, there was the “Chasing Block Station”. It consisted of a wide area with a small cube in its center. Once the player would come close to the block it would move somewhere else within the area, just to move once again if the player chases it. This would continue if the user continued chasing it. This station’s goal was to practice walking around, orientation and rotation.

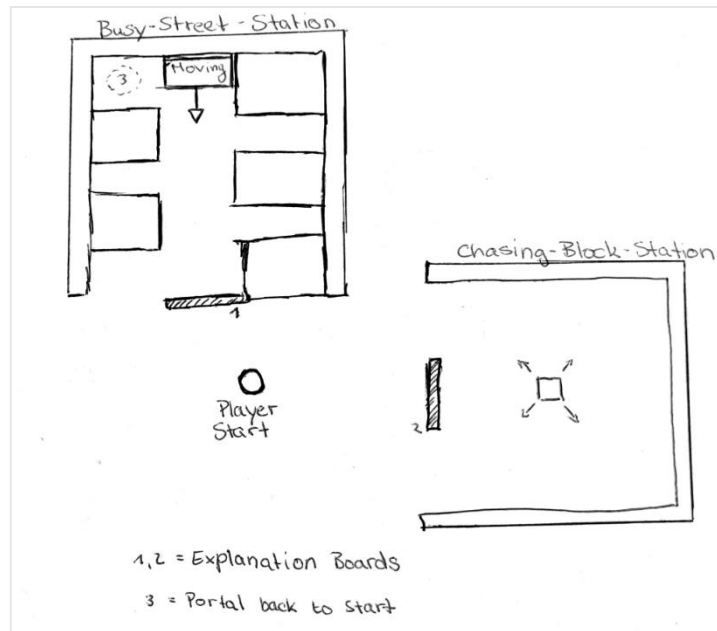


Figure 5: Tutorial prototype layout sketch

The second station was the “Busy Street Station” which relates to the real-life scenario in which the player would have to cross a street while dodging the cars on it. The goal of the player was to reach the portal at the end of the station while larger cubes would spawn at the end of the road and move towards the entrance. This aimed to put the player in a position where they would first assess the situation and then cross the street in Zick-Zack-lines up to the end, switching between walking and running.

I was able to present this prototype to about 10 different people and it helped a lot to gather feedback on the usefulness of this device. Though I did not perform extended user tests with in-depth documentation of the results, you will find the core learnings in the following chapters.

(Note: Sadly, the PC which I used for creating and testing the prototype stopped working after the “Digitaltage Freiburg” at which I presented it. Due to that, I could not get screenshots or save them to another drive. Hopefully, the tech department can fix it without deleting it. Nevertheless, I could at least find a picture of the event, where you can see me talking to one of the testers.)



Figure 6: Picture from Digitaltage Freiburg (Source: <https://twitter.com/digitalfreiburg/status/1539967745827262464>)

#### 4.2. General experience

Firstly, I cannot say much about the assembly of the device as that had already been done priorly to my work. However, I did re-assemble it occasionally and only partially when I had to move the device to different events. This always worked fine and without any issues. Furthermore, I can say that the treadmill gave me the impression of a high-quality product. All parts fit together well, and the device has a solid look and feel. Even in more extreme situations like a sprint or other fast movement, everything holds tight and gives a good amount of security. Though understandable, the weight of the device was a lot and made it hard to move it around alone and nearly impossible to move it to other locations without further help.

On the software side, most things also worked well. When playing existing games there was little more to do than to connect the device, install the games and then start them through the KAT IO app. The website of the developer also gives a good overview of

games that are already tested with the device and are guaranteed to work. Sadly, the games always must be started through the KAT IO app which makes it at least very hard to modify games like Skyrim, where mods are essential to make the game playable.

When developing my games, the experience was a little less positive. Firstly, I think it is unnecessary to charge an additional ~300\$ for the authentication dongle and the SDK. This demotivates developers to make experimental applications specified for this device as SteamVR is already for free and using KAT for movement is only optional.

Secondly, I was a little bit frustrated that the developers are not keeping the SDK properly updated. This led to some issues when setting up the project which I had to fix myself before I could even get started. When watching the tutorial provided with the SDK this made me even angrier as this video visualized that it could have been much easier if the SDK was on the same version as Unity.

However, I want to mention that the developers did their best to support me when I had questions. I was in constant contact with them and most of the time we could fix the issues at hand.

#### 4.3. In-game experience

Overall, I am quite satisfied with the device. Running away from a dragon, sneaking around some zombies, and just moving without the fear of running into a wall was a very nice experience. However, I also found myself as well as other testers to be exhausted quickly from the kind of walking and resorting to movement via the normal controller inputs. The movement is quite different from our natural style of walking as you slide with your feet on the ground instead of lifting them up one after another. This could be eased with the provided shoe covers (having less haptic than using the device with socks). However, these covers were quite uncomfortable and did only

fit certain shoe sizes properly. I hope that the developers will put some more thought into the shoe covers and improve them.

Furthermore, this walking style also made very precise movement quite hard. While you would not notice this in most situations like roaming the world of Tamriel, it was quite unpleasant when caution is required, for example when playing games like “The Walking Dead: Saints and Sinner” where you must sneak up on zombies. This was another situation where a lot of people started using the controller inputs instead of walking with the device.

Finally, I think that all these issues become less severe when players get more used to the device and the walking style. Sadly, I also think that these issues are especially prominent to people who want to try the device out and could scare them off. Additionally, I also think that these issues also take a heavy toll on the immersion of the VR experience, as players often complained about the weight and clunkiness of the device. This problem was also combined with the well-known cable issue of the used HMD, meaning that the cable of the HMD often got stuck on the device. While this can be fixed in multiple ways, like using a wireless headset or buying a cable stand, I think this problem could have been taken care of by the developers when selling a device at that price.

## 5. Summary

Overall, I can say that I am impressed by the device. Most components work fine, and it can be a lot of fun gameplaywise.

Nevertheless, I think that treadmills are still in their baby shoes and need a lot of improvements before being used in a wider market. While playing, one will often feel like being rather restricted by the device instead of being able to move freely in VR. Also taking the price of the treadmill into account, I would say that the device in its current state is only useful for developers who want to be ahead of most other current applications and people who have a great affinity for VR. As a developer, I must also say that there is little motivation now to develop specifically for this device, partially because of its current state of development but mostly because of the small number of people who have access to it or would be willing to make such a huge investment. Most games use it as an alternative input source, meaning that games are only made available for this platform instead of being designed for it. This is problematic as I think games are missing out on a great opportunity that only comes from taking this kind of input into account from the very beginning of designing a game.

Concluding on that the current device is more of a proof of concept, showing that it is possible to make an omnidirectional treadmill. I am confident that newer models as well as more competitors in the market will bring more innovations and further improvements to these devices. The growth in popularity is now based on several factors, e.g., more available games, lower prices, as well as a better user experience. We will see how they will change in the future, and I am keen to try out more things with such devices.

From a personal perspective, I can only advise you to try this device out when you get the chance. However, as an individual, I would not recommend buying it as it is a huge investment and still has some

downsides when playing. At least I did not feel that it helped my immersion into the games, while I still had a lot of fun running instead of using the controllers.