

# Intelligent Gaming Input Device for Tilt Recognition

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## Abstract

Farcana has developed a smart a gaming input device, that, apart from being a tool for the gamer to use in the process of gameplay, is also a suitable tool to collect biomedical information about the gamer, which after analysis by the artificial intelligence (AI) system allows informing the gamer about whether the individual is in a state of tilt. Tilt itself is a poor emotional state of the individual that appears due to the latter's inability to control one's emotions in the process of gameplay. The gamer can be either winning or losing, yet the fact that he/she can neither control nor even acknowledge the emotional state is tilt. The latter is an immense factor of impact on the overall success of the individual in the sphere of gaming and one's rating in cybersport. This paper has analyzed numerous studies and patents on the topic at hand. The available literature has provided the necessary insight on the topic of tilt and why it is important to help the gamer acknowledge one's state, especially given deteriorating results. Also, we have proposed a framework for the AI system for tilt recognition.

## Keywords

Tilt, Psychological State, Gaming, Cybersport, Progress

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## 1. Introduction

In recent years, esports have been deeply embedded in today's digital subculture among young people. The term “esports” refers to “a kind of sport in which the basic components of the sport are aided by electronic systems”, with “the input of players and teams, as well as the output of the system”, mediated via human-computer interfaces. Being a professional esports player requires a distinct set of talents and interests than casual gaming.

Esports are competitive to a certain extent. Players need to master not just their physical abilities, but also their ability to work together strategically and keep their emotions in check. Each game has an effect on a player's rank, which is a numerical score or tier that symbolizes a player's skill level. Gamers of all skill levels, from professionals to weekend warriors, take esports very seriously; some take it more seriously than other areas of their lives.

The competitive character of esports games, like that of conventional games and sports, is intended to pique the interest of players by fueling their intrinsic drive to succeed. Sometimes, the level of competitiveness is too high to be considered a fun pastime. Intense emotions are stirred up and social and emotional obstacles are faced as a result of vigorous play. Professional esports need a high level of strategic thinking, the ability to train and improve performance (both individually and as a team), and the ability to keep one's emotions under check.

The success of each game depends on many factors, and psychological state is one of them. Players, who are focused and are confident in their game plan try to stick to it and statistically are unlikely to make a gross mistake that could lead to ultimate failure [1]. Then, it will be much more difficult for the players, over whom emotions have prevailed, to tune in to the result. The condition when a gamer stops controlling himself due to constant failures is called tilt [2]. This paper delves into the issue of tilt from the perspective of psychology and provides a custom-designed gamer solution to the problem in the form of patented technology of a smart gaming input device.

### 1.1. Research Questions

- 1) What is tilt and how does it influence the individual in the process of gaming?
- 2) What methods can be applied to monitor the emotional state of the individual?
- 3) What factors must one focus on in the process of developing a device capable of monitoring the gamer's emotional state?

### 1.2. Method

To get a grasp of the topic, one is required to study the scope of literature that was available on the topic. Utilizing the information on Google Scholar and using the Keywords tilt in psychology and tilt in cybersport, one has received 115,000 and 17 responses consequentially all including patents. These have then been categorized and sifted out. The first one chose the time range for the past 5 years to have all studies up-to-date, which left us with 18,200 studies on tilt in psychology and 12 on tilt in cybersport (including patents). After focusing only on full-scope studies made available, we have noted 430 studies on tilt in psychology and 9 on tilt in cybersport (including patents). Additional factors for literature review have been direct relevance to the topic, which decreased the number of studies to 12 studies on tilt in psychology and 6 studies on tilt in cy-

bersport (including patents). These have been assessed with their consequential analysis of the topic at hand. Next, a design of a smart gaming input device is suggested that will help the gamer acknowledge one's state and therefore not harm the latter's gaming.

### 1.3. Summary

This paper has analyzed numerous studies and patents on the topic at hand. The available literature has provided the necessary insight on the topic of tilt and why it is important to help the gamer acknowledge one's state, especially given deteriorating results.

## 2. Literature Review

Among all the components that make up the complex structure of the professional competence of an e-sportsman, those professionally significant qualities (competencies) that are directly related to the functional parameters of the ego organism are of considerable importance, *i.e.*, have a psychophysiological nature [3].

In their materials, the authors point out that the professional activity of a cyber-athlete includes long-term training and sports competitions, in the process of which a certain restructuring of brain activity occurs in the cyber-gamer, and the psycho-functional state changes [4]. Neuromarketers recorded objective indicators of changes in the psychofunctional state of gamers with different levels of professional skill. At the same time, the electrical activity of the brain according to the EEG data and the movement of the eyeballs based on the application of the "eye tracking" technology were [5].

An analysis of the emotional state of e-athletes with different levels of professional skill, the intensity of intellectual stress occurring during the game, and the degree of player involvement in the process was carried out based on EEG data [6]. Based on objective consideration of psychophysiological parameters, it became possible to determine those significant qualities of a professional cyber-gamer, which are a necessary resource for the implementation of game tasks during a sports match and can be considered as professionally significant qualities of a cyber-athlete. Such qualities include the ability to allocate attention between gameplay elements that are important for the tactical management of the game [7]. For professional participation in e-sports, it is important to form stable patterns of distribution of attention when studying the screen, which provides the opportunity to pay attention to a greater number of game elements in less time. The ability to control and manage one's emotions, including the skill of self-regulation and management of pre-start stress, and the ability to achieve and maintain the necessary psycho-emotional state characteristic of eustress during competitive periods of a professional career [2].

Studies of the professionally significant qualities and characteristics of e-athletes have shown that at different stages of professional development, during the

competitive period, as well as in the course of everyday professional activities, e-athletes face stiff competition from rival teams or individual players, and also experience significant psychological stress and are exposed to various stress factors that prevent the realization of their potential opportunities [4] [8]. A comparative analysis of the psychological state of e-sportsmen and representatives of traditional sports during competitions and at the stage of preparation for them shows that psycho-emotional stress experienced by athletes (fear of failure, experiencing tension problems as a result of a misunderstanding, especially in team sports, etc.) similar characteristics and common psychological mechanisms of occurrence [9]. And in the absence of regulation skills, psycho-emotional stress harms the performance and professional efficiency of athletes in both groups. This condition is called tilt.

### 2.1. What Is Tilt and Why Does It Occur?

Tilting is a mental condition brought on by unfavorable events and/or emotions that negatively impacts in-game performance and decision-making. Being in a condition of tilt may lead to further tilting, since the negative repercussions induce additional unpleasant feelings. This concept encompasses the internal responses to experiences, the visible deterioration of gaming and decision-making, external and internal influences, and the fact that it is a state of mind.

Tilt is a concept that came to esports from poker. The very meaning is the emotional state of a person, which arises due to constant gaming failures and is expressed by actions that are uncharacteristic of the person performing them [2]. It is easy enough to notice that the player is in a state of tilt. Most likely, the latter will get angry, swear obscene words, pound fists on the keyboard and start provoking the opponents. Such a gamer can no longer control his emotions and actions should he/she choose to continue the game [10]. The game itself in this case becomes an irritating factor, as the gamer cannot succeed or enter the flux in the process of gaming [11]. Therefore, it is better to finish the game, because the probability of further success is extremely low.

In general, tilt is a normal phenomenon, and not a rare occurrence as one may think. No player can constantly demonstrate the same results while remaining unbeaten. Someone loses more often, someone less often, but defeats in games such as CS:GO or Dota are suffered even by experienced gamers. The player's character and one's psychological state are important here (Start, 2019). If one demonstrates a violent reaction to failure, then tilt is just around the corner, with the game ultimately losing its meaning. However, if the player is capable of learning from defeat and maintaining focus, then failures can be replaced by victories [12]. At the same time, players in the state of tilt become easy prey to provocation and various hoaxes on the part of their competition.

Tilt takes place as a result of various factors associated with failures during the game and the inability of the gamer to adequately perceive and respond to them (Garcia-Lanzo *et al.*, 2020). Consequential losses in a depressed psychological

state are the result of tilt. If one continues the game after the appearance of tilt, the gamer will make wrong decisions, commit reckless actions and blame teammates for his/her own mistakes (Garcia-Lanzo *et al.*, 2020). The result of such a game will be lost time and a bad mood. Thus, if a gamer feels that one has been overcome with tilt, it is best to just quit the game.

## 2.2. Types of Tilt

Tilt is expressed in several ways. Conventionally, the tilt state of the individual can be divided into two types, hidden and evident [13]. They depend on what caused the outburst of emotions and what the gamer's character is. Moreover, tilt can be caused not only by constant defeats but also by victories. A gamer who constantly loses gradually loses confidence in his/her abilities and starts to make uncharacteristic mistakes. Yet, with constant winnings, the opposite can occur [13]. The gamer gets an emotional lift and confidence in his/her victory, after which he/she acts more boldly. Yet, in practice, losses provoke tilt much more often than victories.

At first glance, it is difficult to notice the hidden tilt. It is characterized by a depressed inner state of the player. Hidden tilt accumulates due to unexpected losses and can stretch out for several days, weeks, and even months [13]. A gamer who is in a state of hidden tilt will play distractedly, in a completely uncharacteristic manner. Tilt will cause him/her to be confused and completely misunderstand the whole situation [14]. The player will notice the deterioration of the results but is unlikely that one will understand the reason for this, thereby starting to feel depressed. In this situation, it is best to forget about the game for a while and then return to it with renewed strength [14].

In the case of evident tilt, the gamer begins to openly make mistakes and suffers defeats more often. Short-tempered people manifest this via a stream of negative emotions directed at rivals or teammates [15]. If the gamer notices that one is in a state of tilt, one should close the game to avoid both defeat and loss of time.

## 2.3. Manifestation of Tilt

Tilt can occur at the most unexpected moment of the game. Gamers who, it would seem to be participating in their field of expertise, suddenly begin to lose. At this moment there is a surge of negative emotions [15]. The situation that was just under control is starting to get out of hand. The gamer loses focus and begins to suffer one defeat after another.

At this moment, emotional players begin to lose their nerve. They can bang their fists on the table or start to curse or swear. Calm gamers will show a more restrained reaction to tilt. As a rule, they try to keep their feelings to themselves, but their facial expressions still give away their state [4].

Also, characteristic signs of tilt are:

- the desire to splash out emotions on objects that fall within reach;

- loud insults at opponents and teammates;
- slaps and pounds with one's fists and hands, or even feet on the walls, table, and objects that are nearby;
- insulting opponents in-game chats;
- constant demands will pay off, which will not lead to anything;
- increased aggression during the game, which ends in stupid mistakes;
- dialogue with oneself;
- disgruntled grumbling under his breath.

All these factors negatively affect the gamer's focus and lead to painful injuries.

#### 2.4. The Psychological State of the Gamer

Any emotions affect every completed in-game action, which is why a strong player must keep his cool in order not to make mistakes that affect the outcome of the match [4]. When a person loses, enthusiasm is quickly replaced by anxious thoughts that you do not understand what you should do against this opponent, and your tactics do not work. You start to get nervous and it's even worse to play. But e-sports disciplines are too varied. At the same time, the dynamics of the game process also differ, which strongly affects the emotional state of the player [4]. With limited time to make decisions, a weak player can get lost in his actions and panic, which will negatively affect the outcome of the entire match.

Attitude is also very important. A strong player advises himself not to succumb to in-game provocation, the so-called "BM" (bad manners) [4]. Therefore, every e-sportsman has his variable action plan (game plan) for the game, depending on the given situation [8]. When a player starts to make mistakes and lose, he can also make unreasonable actions that lead to defeat. When you encounter unknown things and don't know the answer to them, you start to get nervous, and it shows. This is a state of body stress [8].

If the causes of rapid heartbeat lie in the pathology of the entire system, then tachycardia is considered serious. The increased work of the department, in this case, is caused by the increased load on this area. It is important to diagnose the disease in time so that the human condition does not become fatal [8]:

- Often the heart rate is observed accompanied by hypertension, as the pressure on the walls of blood vessels becomes excessive, the body will necessarily react to this process [2]. If the arteries are severely affected by atherosclerotic plaques, their flexibility is impaired, and a frequent pulse can lead to the development of a stroke or heart attack [2].
- The pulse represents the oscillation of blood in the vascular bed, which is caused by the process of contraction of the atria and ventricles. When the work of the organ is normal, the blood is ejected from the area of the ventricles and atria, passing into the arteries [2]. If the heartbeat is too active, then the whole rhythm of such blood pumping is disturbed, it stagnates in

the organ, which increases the risk of thrombosis. Bradycardia can also occur against the background of this pathological process [2].

When the gamer is in this state, the latter's self-esteem and moral condition do not allow him to show his/her true level of play: mistakes occur that a person would never make in a normal game.

### 2.5. Technological Means of Control

As has been made clear when the individual is in a state of stress, abruptly flowing into tilt, the latter's heart rate becomes elevated [2]. There are multiple gadgets from the world of consumer electronics that help people benefit from non-intrusive monitoring. However, these gadgets have never been fixed solely in the gaming industry [2]. Naturally, their primary focus is innovative healthcare [1]. The world has got to know about the Photo-Plethysmography (PPG) technique that is used to analyze peripheral blood volume changes via a near-IR light and a photodetector. The PPG allows receiving information about Heart Rate Variability (HRV) via Inter Beat Intervals (IBIs). The HRV can also help in understanding the user's emotional state [2]. The PPG sensing technology is now present in the form of wearable gadgets, contact-free gadgets, and ordinary devices. The most widespread are wearable sensors most often presented in the form of fitness trackers [1]. The latter are unobtrusive, although are most often used for measuring the heart rate and calories burnt [1].

### 3. Findings and Analysis

Having multiple smart sensors on the market, one believes that they are not used to their fullest. The potential for implementing the PPG technology in monitoring systems is much higher. Farcana has considered using several autonomic markers responsible for biological measurements of the individual's body. Naturally, from such sensors, one can receive info on the galvanic skin response (GSR), electroencephalogram (EEG), electromyogram, respiration, and electrocardiogram (ECG). Receiving this scope of information would allow us to tell much more about the state of the individual. Of course, these can also measure the skin temperature, and various multimodal data that the developer or gamer himself would like to be demonstrated on the screen for the individual to monitor his/her state. However, to have all these classifiers fulfilled, they must be compatible with the physical aspect of the devices made available. In terms of tilt, Farcana has focused on the heart rate monitoring that allows making the gamer aware of the situation with a further recommendation of action to avoid stress, and consequentially tilt (**Figure 1**). Also, among high-risk cardiac players those who can foresee upcoming tilt can have a chance of preventing cardiac risk/issues/accidents etc.

The available patents have not focused on utilizing the available technology and implementing them in the smart gaming input devices. Thus, the suggested Farcana technology is in no way an infringement of any patents or ownership



**Figure 1.** Farcana smart gaming input device.

rights of any individual or company (**Figure 1**). We present a device that provides more immersive gameplay combining data from sensors processed by a built-in microprocessor capable of obtaining the gamer's heart rate. This smart gaming input device is executed in the form of a computer pointing device built as a computer mouse with PPG and motion sensors (**Figure 1**). These sensors are attached to the device frame to have an accurate read of data and signals received from the players. In addition, all data are transferred to the cloud for processing and analysis. At the same time, the device system also includes an artificial intelligence system capable of analyzing all data received in real-time. This heart rate data is also used to identify problematic digital biomarkers for various diseases as HRV helps to pinpoint various humoral, neural, and neuro-visceral processes to identify various disorders of brain, body, and behavior.

### 3.1. The Framework

The framework (Wenlu, 2020) for the AI system has main two components: one component is the cloud and the other is the node. The cloud is responsible for storing data as new data is collected, and also to store the trained machine learning models for tilt recognition. Group-based models have been to show greater performance compared to user-specific models and general models, hence in this research we at Farcana Labs train a group-based machine learning model. This model will be updated in the cloud as new data is acquired. The second component of the framework is the node which consists of tilt recognition model, a data processing module and a supervisor for supervising the machine learning process. We also take feedback from the player to confirm the tilt recognition. The two main functionalities of the node are extracting features from the collected physiological signals and using the model trained on the cloud to recognize tilt. **Figure 2** shows a schematic of the proposed framework.

### 3.2. Training of Group-Based Model

#### 3.2.1. Clustering

If several users are sufficiently similar, a model built for one may be applied to all of them. For this reason, we compare how well each user's model does with the rest of the population and then classify them accordingly. Here's how it works: After creating user-specific models for each subject with the linear SVM algorithm, resulting in a total of  $n$  models, each subject's model is evaluated on



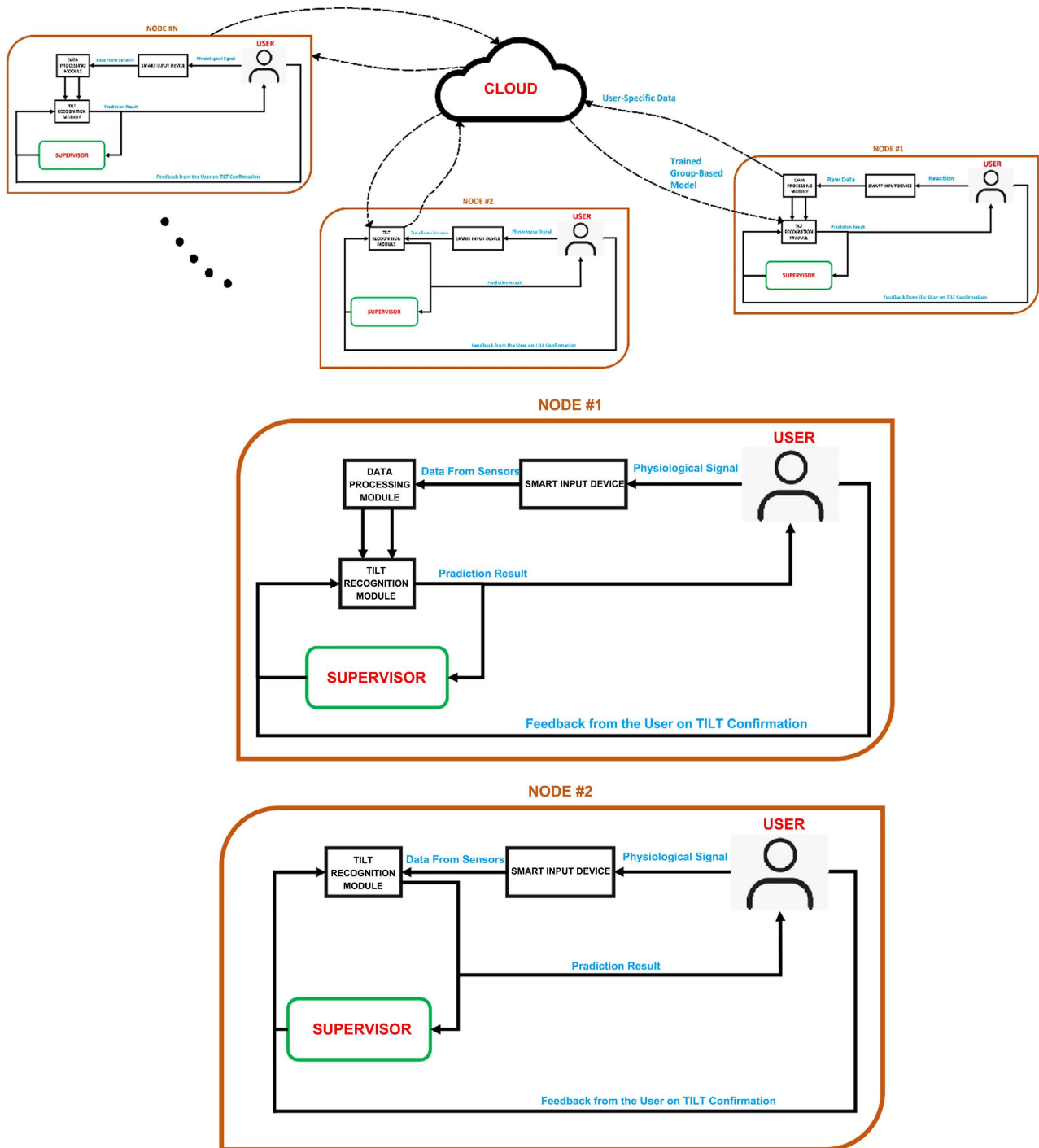


Figure 2. Proposed framework for the AI system.

the other subjects with the F1-score metric, resulting in a  $n \times n$  matrix, and hierarchical clustering is then used to classify the subjects into groups based on their F1-scores. The model performance matrix  $P$  for  $N$  subjects may be partitioned into  $K$  groups, with each partition holding a list of the subjects that falls into that partition. As a metric of clustering quality, inertia is defined as the sum of sample distances to their nearest cluster centroid.

### 3.2.2. Training Process

After applying the K clusters, the original data set is partitioned into K subsets, each of which will include all samples from the same topic. Each dataset is used for training the group-based model. The model's predictive capacity is its performance during training. It also indicates the maximum efficiency achievable by the collective model.

### 3.2.3. Assigning New User to a Relevant Group

For each new user, the optimal group-based model will be the one that can best learn from that user's training data.

### 3.2.4. Prediction for the New User

A new user's sample data can be predicted after the appropriate group-based model has been identified.

## 4. Conclusion

Tilt is a state of a player caused by strong emotions from winning or losing, in which the latter plays in a way that is not characteristic of the individual himself starting to make many mistakes in the game. Almost all gamers play to improve their rating, and everyone wants to climb as high as possible, with some succeeding, and others not. The main factor influencing an individual's success is tilt. It prevents the player from thinking about how to play better and because of this, the player stops growing. In many cases, the individual does not even acknowledge this and starts to behave irrationally. Utilizing the available technology of various medical sensors capable of gathering data on the state of the individual, Farcana has developed a smart gaming input device, which not only gathers raw data from the gamer but analyzes it and makes recommendations towards further actions. If the gamer is in a state of tilt, the latter is presented with this information, as well as proof in the form of the heart rate monitor, suggesting that the individual stops. This device is already patented by Farcana and provides the next step in immersive gameplay. We are currently building the proposed AI system, and in future study full details of the system with results of research conducted using this system will be presented.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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