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ISUC: IoT-Based Services for the User's Comfort

Rizwan Abbas [1], Gehad Abdullah Amran [2], Syed Agha Hassnain Mohsan [3], Mohammed H. Alsharif [4,*], Abu Jahid [5,*], Mohamed Marey [6] and Hala Mostafa [7]

1 College of Software Engineering, Northeastern University, Shenyang 110169, China
2 Department of Management Science Engineering, Dalian University of Technology, Dalian 116024, China
3 Ocean College, Zhejiang University, Zheda Road 1, Zhoushan 316021, China
4 Department of Electrical Engineering, College of Electronics and Information Engineering, Sejong University, Seoul 05006, Korea
5 School of Electrical Engineering and Computer Science, University of Ottawa, Ottawa, ON K1N 6N5, Canada
6 Smart Systems Engineering Laboratory, College of Engineering, Prince Sultan University, P.O. Box 66833, Riyadh 11586, Saudi Arabia
7 Department of Information Technology, College of Computer and Information Sciences, Princess Nourah bint Abdulrahman University, P.O. Box 84428, Riyadh 11671, Saudi Arabia
* Correspondence: malsharif@sejong.ac.kr (M.H.A.); ajahi011@uottawa.ca (A.J.)

Abstract: Emotions are alluded to as characteristic intuitive perspectives from certain conditions or temperaments. IoT applications can help in routine tasks and businesses. Most advances have not been taken advantage of regarding emotions. Emotions could be detected via the data gathered through IoT. Our investigation of related works revealed an absence of strategic methodologies in planning IoT frameworks according to feelings and shrewd alteration rules; thus, we present a philosophy that can rapidly assist in planning an IoT framework in this situation, where the identification of users is significant. We applied the proposed phases to test an IoT recommender framework named ISUC. The framework involves anticipating a user's future emotions by utilizing boundaries gathered from IoT gadgets. It suggests new exercises for the user to obtain the 'last' state. Experimental results confirm our recommended framework has achieved over 85% exactness in anticipating users' emotions in the future. The examination results presumed that an IoT-based framework could be created to detect positive emotions (e.g., peace, concretism, patience, enjoyment, and comfort) and negative emotions (e.g., irritation, abstraction, impatience, displeasure, and discomfort) to incite good emotions.

Keywords: internet of things; emotions; user's comfort; emotion detection

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1. Introduction

In psychology, emotions are characterized as complex feelings that result in physical and mental changes that impact one's thoughts and behaviors [1]. They tend to be viewed as mental responses that people encounter on a daily basis. Every day, an individual will encounter various types of emotions. These emotions can range from bliss to outrage, bitterness to energy, etc. Emotions can be characterized as singular responses to physical and mental changes encompassing a person. An individual's emotions are confounded to the degree that various factors can 'decide' his/her emotions. A situation (e.g., sky jumping) could generate energy in one individual and dread in another. The range of emotions in people has led to a 'moving case' to connect emotions (starting with one individual, appropriately, and then onto the next, with high exactness). This has driven numerous scientists to search for techniques to screen emotions and perceive what various situations mean for a person's emotional state. A broad examination has been conducted on this subject.

In our day-to-day experiences, while performing different routines, we share large amounts of data concerning our routines, way of living, conduct in various circumstances, and feelings. Researchers have classified feelings according to their tendencies: love, bliss, shock, outrage, bitterness, and dread. Paul Ekman's six basic classes of feelings (satisfaction, outrage, disdain, dread, misery, shock) are generally well-known and are the focal points of many analysts. Our feelings are significant parts of our routines. Our activities rely on our feelings. Research shows that feelings are valuable for 'tolerant disclosures'. Feelings do not concentrate profoundly on the Internet of Things (IoT). Acknowledgment and fine-grained examinations of feelings and opinions in the IoT climate are significant (i.e., pertaining to better IoT administration). Assuming an individual's perceived feelings show that he/she will likely be self-destructive, then, at that point, we could initiate social administrations, illuminate his/her partner, and suggest recreation-type exercises (to prevent the individual's expectations).

The Internet of Things (IoT) upholds individuals in their regular routines and conditions, e.g., via smart homes, smart urban communities, and smart wearables. Research has shown that it is essential to refine collaboration with innovation to perceive, decipher, process, and mimic an individual's feelings. Progress in innovation empowers the making of wellness applications in the IoT [2], concerning activity, way of life, solid eating routines, and new correspondence conditions that have enormous repercussions for businesses and social connections, work associations, culture, schooling, and showcasing. The potential advantages of Internet of Things have not been completely taken advantage of regarding feeling discernment.

A good illustration of emotions can be dissected is the work market [3]. For this situation, the significance of inspiring laborers or dynamic users is fundamental. Emotions are connected to work issues, for example, (a) efficiency, (b) social connections, (c) leaves due to stress or misery, (d) recreation exercises, and (e) expanded deals. Likewise, children who are able to appreciate people on deeper levels, and comprehend what and how they feel, are significant in instructive settings.

Emotions, such as deterred inclinations, strain, and irritation, may occur during different events and conditions. Assuming such emotions continue, one might end up with mental health issues [4]. Legitimate sentiments show positive emotional health. The uncooperative methodology exhibits emotional health issues. If the understudies are judiciously strong, they will answer learning situations with good inclinations, regardless of the event. If the understudies have issues, they might answer in a reverse way. Energetic guidance, a significant fragment of value preparation, is a primary method for creating positive emotions in students [5].

In this situation, we present six phases expected to foster an IoT framework in light of the user's feelings and implement them, fostering a suggested framework called ISUC. This framework presents smart calculations that can foresee users' emotions (because of past emotions) and examine unique circumstances, considering ordinary and distinction existing conditions as well as user heterogeneity. Our responsibilities are the following:

- Predict the user's emotions.
- Change exercises progressively to create pleasant feelings in the user.
- Adapt the ecological circumstances to change the user's setting.
- Reach the user's ideal state.

The remainder of this paper is organized as follows: Section 2 reviews the IoT frameworks. Section 3 presents the procedure proposed for ISUC: IoT-Based Services for the User's Comfort. Section 4 presents the trial results. Finally, Section 5 describes the conclusion and future work.

2. Related Work

The Internet of Things is an organization of interconnected gadgets that incorporates sensors, programming, and system administrations to gather and trade information. It incorporates all "things" that can be utilized as creation hardware, which gives valuable data to perform various investigations. These data can be recorded and broken down to work on gadget activity.

An instructor can give information to the student with his/her expertise [6]. Direct oversight encourages students to learn within the course targets (because of the correspondence with the instructor, at whatever point is required). Less correspondence brings about student disappointment [7]. Data moving through e-learning offers many benefits over conventional training [8]. It was found that the information gathered from eye signals exhibits an individual's level/place of his/her combination of thoughts [9], stress, essential thinking, and fatigue. Ismail and Mohamed [10] focused on courses that mirrored student ideas, stress, essential thinking, and exhaustion. Reference [11] focused on the 6G network (connecting to vehicles).

Specific instances of utilizing IoT gadgets include smart urban communities and smart homes [12]. In this work, 5G IoV [13] architecture based on SDN and fog–cloud computing is presented. Many peripherals sent in a metropolitan region create various types of data being communicated through suitable correspondence advancements to a control place (where information is put away and handled). We can study [14] a robust light field semantic segmentation network combining contextual and geometric features. A smart emotional framework can gather data from sensors or information sources and coordinate them into emotional gadgets outfitted with remote connection points. In this work [15], we look at generalized lifelong spectral clustering through dual memory. Each emotion has an organization of remote sensors, and the information identified by every gadget is communicated to an emotional center [16].

Liu et al. [17] reviewed multi-source heterogeneous unaided space transformation by means of fluffy connection brain organizations. Mealha et al. analyzed information portrayal methods for data in different settings (e.g., TV news and PC video games) [18]. The authors reported an association between the eyes, the eye sanctuaries, and the mouth [19]. Pushpaja V. Saudagare and D.S Chaudhari developed a strategy to recognize explanations from sentiments through brain frameworks. They reviewed the various methods of explanation, and distinguishing proof using MATLAB [20]. Zheng et al. [21] worked on visual reasoning through semantic representation.

Electroencephalography (EEG) is becoming more normal in examinations for emotion identification. EEG quality and progression have led to testing expansions in clinical preliminaries. EEG signals have been utilized before in distinguishing emotions. In a new report, the data were estimated to have precisions of 70–90% for dread, trouble, outrage, and happiness [22]. Soleymani and his group directed emotion recognition utilizing EEG flags and presumed that the EEG signals created promising outcomes. Different purposes for EEG emotion identification range from acknowledging hilter kilter spatial patterns [23], constant bliss location systems [24], and self-organizing emotion acknowledgment maps [25]. Zheng et al.'s [26] sentence-denoted algorithm was based on a multi-Layer semantic network.

Sui et al.'s [27] multi-sensor state assessment over lossy channels utilized coded estimations. Muid Mufti and Assia Khanam 'broke down' a rule because of emotions in e-learning [28]. Visible presentations can give information on students that can be utilized to assess an individual's contemplation and perspective [29]. Facial parts, such as the temples, eyes, nose, mouth, etc., are utilized in frameworks [30]. AI computations are further used for facial affirmation to develop accuracy and identification [31].

Currently, numerous IoT frameworks adjust or modify to users or their requirements. The power utilization of these smart gadgets are variables to consider. The creators have diminished the amount of time a smart band needs to quantify one's heart rate, decreasing high potential utilization without influencing the device's handiness. Zheng et al.'s [32] information-based diagram focused on installing a module plan for visual inquiries (addressing modeling).

On the subject of feelings of discovery, critical advances have been encountered. Many examinations have alluded to COVID-19, and feelings are vital to see the connections between feelings recorded (and the results achieved with the pandemic). Considering the consequences of a few examinations, we broaden what has been concentrated on in the writing, such as identifying feelings through IoT gadgets and utilizing profound learning for their discovery and order.

IoT-based emotion recognition (ER) frameworks are expanding requests in numerous spaces, such as dynamic and assisted living (AAL), medical services, and industry. Consolidating the inclination and settings in a 'brought-together' framework could upgrade the human help scope. Yet, this is a 'provoking' errand because of the absence of a specific connection point that is competent to give such a mix. In this sense, we target an innovative methodology [33] in light of the displaying language that can be utilized (even via guardians or non-specialists) to show human feelings, regarding settings for human help administrations. The proposed demonstrating approach depends on domain-specific modeling language (DSML), which assists with coordinating different IoT information sources in the AAL climate. Thus, it offers a conscious help-level connected with the ongoing profound conditions of the noticed subject. For the assessment, we show the evaluation of the all-around approved system usability score (SUS) to demonstrate that the proposed displaying language accomplishes elite execution (regarding convenience and learn-capacity measurements). Moreover, we assessed the exhibition at the run-time of the model launch by estimating the execution time (utilizing notable IoT administrations). K. Cao et al. [34] improved the physical layer security for IoT with non-orthogonal multiple-access assisted semi-grant-free transmission.

Cerebrum IoT is at the forefront of ongoing EEG information estimation. EEG has built up forward momentum in IoT because of its uniqueness, security, and universality [35]. Another EEG utilizes the range from the pressure location to the patient (distinguishing proof to 'incalculable' others). Cerebrum IoT is a developing field in research studies; it gives a robust technique for correspondence by moving information estimated for PC software. One strategy for handling the information of emotions through cerebrum frequencies is through EEG and brain IoT.

A survey (of the connection works) demonstrated that even though IoT presents different arrangements, systemic ways to deal with IoT administrations fixated on foreseeing users' emotions are deficient. The proposed arrangement utilizes caught sensor information to foresee the user's feelings and provides a valuable chance to adjust the user's communication. Subsequently, we can give a custom-made encounter that meets the user's ongoing necessities and assumptions and adjusts after a while to develop the user's comfort and upgrade the framework's capacities. The expected utilization of the person's set of experiences, in association with the framework to anticipate the user's ongoing profound state (and give a versatile reaction), is an excellent possibility for the eventual fate of IoT.

3. ISUC: IoT-Based Services for the User's Comfort

We recommend six phases in fostering an IoT framework and apply them to our IoT-based services for the user's comfort (ISUC) calculation, which utilizes IoT gadgets to catch (as well as breakdown) the user's information while the user completes a few exercises. In particular, we evaluated users' feelings while 'cooperating' with a cell phone, offering diversion exercises. The framework breaks down the ongoing user conditions and predicts future feelings to suggest the accompanying exercises. The philosophy introduced is a variety of that introduced by the authors in [36].

3.1. The Foundation of Data Preferences and System Requirements

In the primary phase, we wanted to decide where the framework would be utilized, laying out the user's attributes, exercises to be dissected, recurrences, and areas. When the setting was laid out, we decided the emotional boundaries that the framework would recognize throughout the examination. Information was gathered in two ways: 1—IoT information (information gathered naturally from IoT gadgets, for instance, physiological boundaries), and 2—information for the user's guide (from the user's self-revealed information).

In the plan period of our recommender framework, we decided on a "perky" setting where users performed various puzzles in two distinct settings (sitting and strolling). The puzzle arrangement was accomplished by considering the accompanying qualities: 1—thinking, for video games where rationale should be utilized to settle, 2—recall, for video games in which the players were required to recall phrases and examples, 3—word, for video games that utilized phrases and digits to add jargon 4—versatility, for puzzled in which the player should genuinely push. Data to be procured in the method were gender, period, recurrence of cell phone use, and recurrence of game. The measure used to gather the information was a two-stage Likert measure: 1—inconsistently, 2—often. We applied that characterization; two unique video games were chosen (one with every classification) and played by members for eight minutes.

User feelings were enrolled (multiple instances in every game), i.e., prior to playing, while playing, and upon completion. To enroll the player's inclination stage, we utilized Russell's affect grid, planned as a speedy method for deciding love, joy, disappointment, and excitement–drowsiness aspects on a 1–9 scale, and significantly affecting the social brain science of estimating emotions. As per the writing, the affect grid is reasonable for concentrating on connections with emotions. Physiological information was likewise enrolled. We used the between-beat stretch (IBI) (to work out the heart rate variability), electrodermal activity (EDA), temperature, and HR.

As a fundamental necessity, our framework should permit users to determine a 'last-wanted' profound expression that will be reached with smart calculations. These calculations will breakdown the user's conditions and suggest exercises or modifications to accomplish the user's last objective.

3.2. Gadget Demand Study

In this phase, we decide the sensors/gadgets to be utilized to gather the information recognized in Phase 1. Prerequisites, such as expenses, detecting recurrences, convenience, openness, or transmission capacity, are broken down. A few instances of IoT gadgets available are smart groups, smart fridges, smart watches, clinical sensors, wellness trackers, and so forth. We also consider user attributes and the course of user framework communication. For our framework, in the wake of concentrating on the IoT sensors/gadgets available, we chose a smart wristband that assisted with accomplishing the members' more noteworthy solaces. We utilized the E4 wristband–armband that incorporated 1—an infrared thermopile, 2—an electrodermal activity, 3—a three-pivot accelerometer, and 4—a PPG sensor.

3.3. Data Forecast

In that phase, we wanted to conclude what prescient methods to utilize (e.g., PyTorch, scikit-figure, Keras, or TensorFlow) and how to breakdown the connections between the framework's particular execution and customer information. The information investigated was acquired from the past phase (emotions, exercises, or other user information). As we made sense of in the past phase, our framework divided the information that we gathered through IoT. Along these lines, we stored considerably less information, improving information handling and time to make forecasts. For our situation, to plan and prepare the brain organization, we picked scikit-get the hang of (learning and model assessment phases), which utilizes order calculations (decides which classification of an item has a place), relapse (partners steady worth credits to articles), and gathering (bunches similar articles into sets). To foresee future user emotions, we utilized an AI work process. This work process was separated into four phases: information readiness, portrayal, acquisition, and assessment of the pre-owned model.

Our method assesses the likelihood that comparative information units in various examples will show a particular presentation. The model surveys which information is connected to foresee choices, including the user's upcoming exercises. The more prominent the exactness of the method, the more prominent the significance of the Internet of Things recommender framework.

If users realize that their gadgets are making them despondent while they utilize them, could this effectively change how they feel?

New doors being opened in AI boil down to influencing user conduct. As of now, Amazon, Google, and Facebook, among others, send a lot of research to keep us clicking and looking things over, essentially drawing us in with their promotional channels. Moreover, there are entire governmental issues of impact, which raises a fascinating turn of events—similar AI devices that are accessible to these bigger organizations can reach out to any individual (for the organization's own utilization). Applications and web engineers can now utilize these, yet the most significant applications exist with IoT gadgets. The effects occur because we are more impacted by haptics, colors, sounds, scents, intensity, and development. These cannot be recreated in applications.

While one could evoke some out-of-control AI (utilizing these to control humankind to do its offering), on the off chance that we are straightforward with users, we might possibly urge them toward their expressed objectives utilizing our gadgets and AI.

3.4. Data Investigation

In this phase, the gathered information was examined to lay out what associations with video games meant for the users' emotions. We planned explicit calculations for the information investigation. Forecasts were made in the following phase. The calculation examined what information brought about adjustments in emotions and the range of activities that caused these changes.

ISUC gathers information when the player is playing a video game (examining and handling this information). A shrewd calculation directs the determination of the information that portrays the player's condition and foresees the upcoming feelings. The estimation of feelings is arranged into two measures, measure 1 and measure 2, with the help of the affect grid. We partitioned measure 1 into "high", and "low" feeling classifications. We added another emotion class called "impartial" for measure 2. We utilized the classes for excitement and power, from the upper left to the base right, providing three regions in the matrix for measure 1 and eight regions for measure 2. We partitioned the information into two sections for E4 wristband boundaries, because of the time when they gathered 1—esteem 1 (minutes 0 to 3) and 2—esteem 2 (minutes 4 to 6) for heart rate variability and electrodermal activity, matching the information to the assortment of feeling-related information that happened previously, and after the player communicated with the framework. Thus, we diminished the number of contributions to the expectation framework because of the large measure of data gathered by the Internet of Things for heart rate variability and electrodermal activity.

We likewise broke down users' data: gender, age, kind of video game (thinking, language, versatility, memory), and information for the connection cycle of players with the video game information (peace, concretism, patience, enjoyment, and comfort).

3.5. IoT System Structure Design and Logic

Phase three included the plan of sensible cycles as well as the design of the IoT framework. Whereas different creators incorporated compositional components (appropriation of actuators, switches, sensors, and doors), in this plan, we remember the theoretical portrayal of information streams, information, results, and conduct. Figure 1 shows our IoT emotions framework design. This engineering is an intermediary due to the "things" and the cloud.

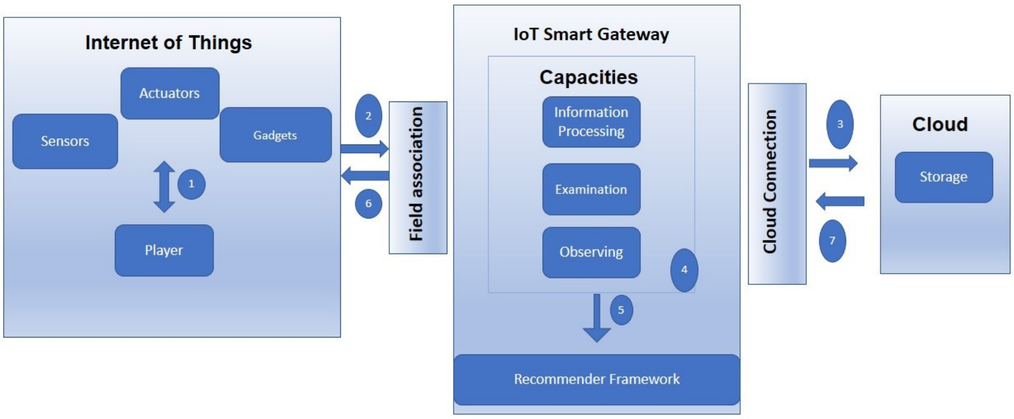

Figure 1. IoT Architecture.

The moves toward performances are as below: 1—the user cooperates with the "things" as much as the framework runs; 2—until the sensors, actuators, and gadgets are at the edge, they require speaking with the smart passage. Wi-Fi, Zigbee, near-field communication, and Bluetooth low-energy are the most well-known correspondence conventions utilized; 3—the smart entryway has information put away from the cloud if necessary; 4—the information from the sensors is handled; 5—the Internet of Things framework accepts information from the shrewd passage and the cloud and plays out the handling; 6—the framework obtains the consequences of the delivered examination; 7—if vital, information is put away in the cloud (utilizing the proper condemnation convention). We utilized Bluetooth LE (shrewd) for our smart gadgets to speak with the proposed framework, gathering information from user reviews. Likewise, the framework puts away user information from the data set through HTTP. In our suggested IoT framework, as mentioned in Figure 2, we attempt to accomplish short dormancy in the information handling, maintaining the handling nearer to the application used by the end user and gadget. Along these lines, the IoT shrewd passage screens information handling, dispensing many calls to the cloud. This plan helps settle the endless choices, further developing the user experience.

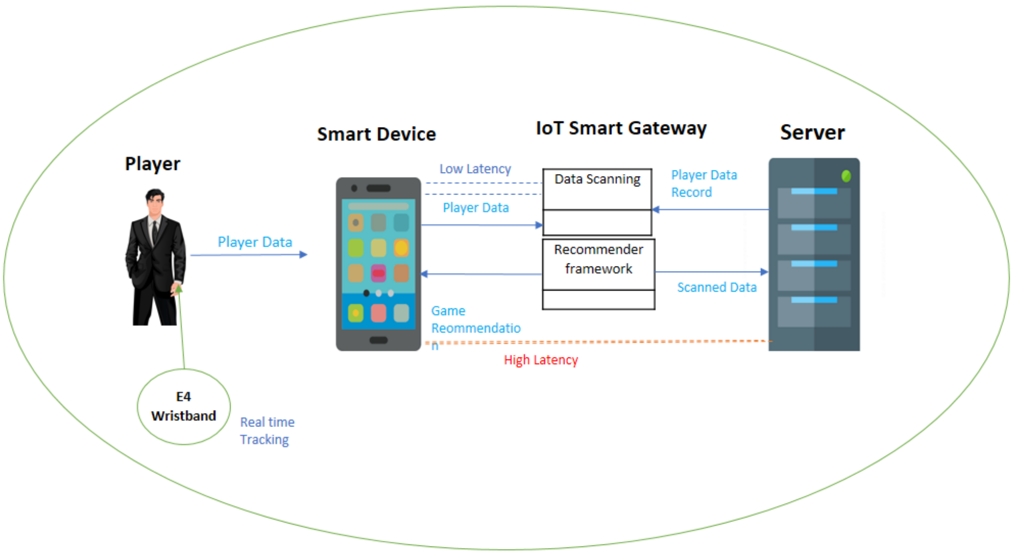

Figure 2. IoT Framework.

The moves toward performances are considered: 1—The player connects with the "things" right after the framework runs. 2—Since the actuators, switches, and sensors are at the boundary, they have to speak with the smart passage. Wi-Fi, Zigbee, near0field communication, and Bluetooth low-energy are the most well-known correspondence conventions utilized. 3—The smart passage has information put away from the cloud if necessary. 4—The information from the sensors is handled. 5—The Internet of Things framework takes information from the smart door and the cloud and plays out the handling. 6—The framework obtains the effects of the completed investigation. 7—If fundamental, information is put away in the cloud utilizing the relevant correspondence convention. We utilize smart Bluetooth LE for our shrewd gadgets to speak with our framework, gathering information from player studies. Moreover, the framework puts away user information from the data set through HTTP. In the designed IoT framework in Figure 2, we attempt to accomplish low idleness in the information handling, keeping the handling nearer to the player's application and gadget. Along these lines, the IoT smart entryway screens information handling, wiping out many calls to the cloud. This plan helps with endless choices, further developing the user's experience.

ISUC gathers the user's information (self-revealed information and Internet of Things) and the player's feelings. This information will be utilized to prescribe video games 'to perform'. Members must answer a poll that gathers the users' information, their perspectives regarding video games, and their feelings while playing. Player's response—five inquiries regarding video games (the player's 'down information') toward the completion of every video game. Via this information, we understand their thought processes and sentiments about the video games. Inquiries were chosen with the game experience questionnaire overview. IoT gadgets additionally gathered information from users. These data were utilized in the following phase to examine the connection between the two information links: user responses and information gathered by IoT gadgets.

The objective of the suggested plan is to create adaptable and versatile IoT frameworks because of feelings.

3.6. Internet of Things Framework

In the final phase, we wanted to plan the calculation that permitted the IoT framework to suggest or adjust (rethink exercises or IoT activities) to accomplish user objectives. For our situation, the framework suggests another game if the "emotions stream" does not meet the last wanted feelings. Another game proposition is laid out until the past forecast results are surveyed. Along these lines, the game with the most elevated likelihood of accomplishing the last wanted state is chosen. When the new movement is proposed, the user will start another connection cycle with the recently chosen game.

Before the arrival of the recommender framework, an evaluation is conducted to guarantee a decent degree of precision. If the framework does not accomplish sensible exactness, upgrading the proposed algorithm will be essential. An iterative cycle for all phases should be executed until the expected precision is accomplished. To begin with, we devised a few tests and utilized the boundaries of the framework that added them to the calculation.

- Test 1 (gameplay forecast): The framework will want to foresee what game to choose to accomplish a player's last inclination because of the accompanying information: 1—age, 2—gender, 3—player's underlying inclination, and 4—last wanted feeling.
- Test 2 (final excitement forecast): The framework will want to foresee the last 'excitement' a player will accomplish in light of the accompanying information: 1—beginning inclination, 2—language, 3—thinking, 4—memory, 5—versatility.
- Test 3 (game point expectation): The framework will want to forecast the 'esteem' in a player's "emotional game win" for the accompanying boundaries: 1—peace, 2—concretism, 3—patience, 4—enjoyment, and the last 5—comfort.

Figure 3 shows our proposed suggestion calculation. At first, ISUC obtains information, including the excitement needed to accomplish and, afterward, the constant excitement state. Then, the framework will suggest another game toward the start of the collaboration. 'Explore 1' acquires information from the data set and the player, and then utilizes the present and authentic information to suggest that game.

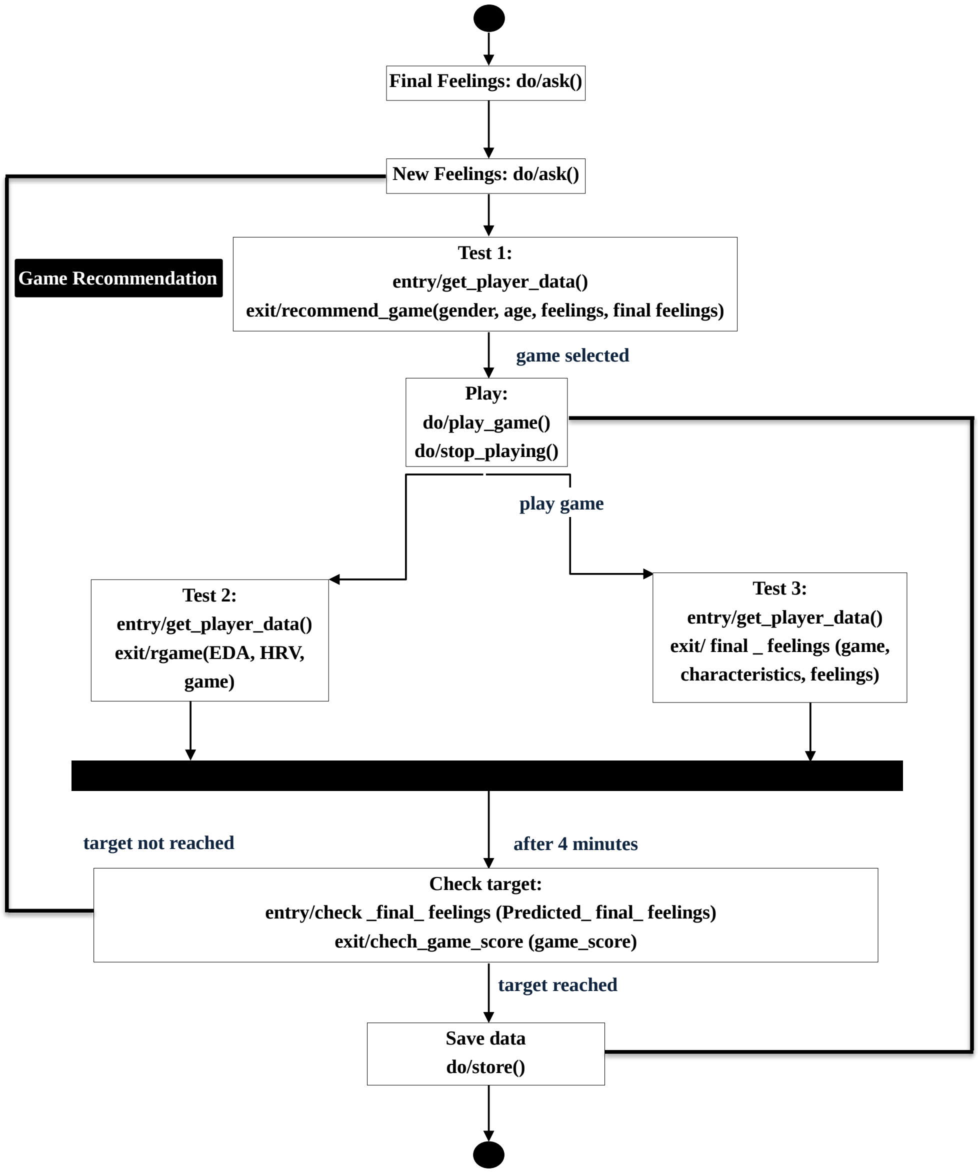

Figure 3. Algorithm for the recommendation framework.

From that point, whereas ISUC keeps recording information from the Internet of Things gadget, the player plays the suggested game. The framework accomplishes two tests (2 and 3), which create forecasts because of the information gathered throughout the cycle so the player plays the game. In explore 2, we gather the information from the smart band (heart rate variability and electrodermal activity) and game trademark information from the game the player is playing. With this information, we ascertain an "emotional score", that characterizes the various feelings by computing the player's condition, by thinking about the accompanying standards: fatigue, deliberation, disappointment, delight, and the work the user should give. With try 3, we can gauge a user's ongoing inclination and future last inclination utilizing verifiable information per game qualities.

With try 3, we can appraise the user's last inclination utilizing factual information, as indicated by the user's ongoing inclination and the game element information. Along these lines, by joining the two test outcomes, we can contrast it and the ideal last inclination. We store the information and conclude the framework if the expected outcome is given. If the outcome is not agreeable, we restore the information to work on the upcoming expectation of the game and tell (once more) how the player realizes at that point (to rehash the entire cycle).

The further information we gather for 'explore 1', the further the outcome will be changed and the more suitable it will become, as 'it' will win again in the long haul. This cycle will be rehashed since the player arrives at the ideal last inclination or chooses to stop the game and quit playing, e.g., because of exhaustion.

In the accompanying, we suggest the connection points of the models planned. At first, the framework obtains some information regarding his/her ongoing profound condition and the feeling he/she needs to accomplish. The framework will suggest a game because of the information recently gathered by different users, permitting the user to pause (e.g., due to fatigue, sluggishness, around others). Moreover, the user can begin the game unless arriving at the ideal last inclination, or the framework modifies the game. The framework will gather information from the user who cooperates with the game. The gathered boundaries are put away in a data set in which the suggestion calculation will attempt to prescribe fresh games to users. With this information, we ascertain a "profound score of the game", grouping the various feelings of the players through their advancements in two tomahawks: fiery (connected with the player's energy) and sound (regarding the player's demeanor). This point will inform us whether the player is advancing accurately and approaching the ideal last condition. When the season of the momentum game is finished, the framework gives the user the option to proceed or alter the game in light of the assessed last mindset. When the player arrives at the last express, the player will obtain some information regarding his/her present status, so this information can be appended to more readily appraise the suggested games for upcoming users.

4. Experiments

We conducted experiments by gathering 20 individuals of various genders and ages. Two video games were chosen to play out the trials: (a) Bejeweled and (b) Pikmin Bloom expedition.

4.1. E4 Wristband Data

We 'enrolled' Internet of Things information, the user's information, the typical heart rate variability, and electrodermal activities of all members; we took note of the information from the two video games that the players played with similar time limits. We utilized the information designs in the recommender framework to anticipate the last feelings of the players. In this way, we presumed that heart rate variability (HRV) and electrodermal activity (EDA) were types of information we could utilize in the recommender framework, as well as the information that presented the changeability in the players while playing various video games. Consequently, this information could improve the outcomes, anticipating the video games for the suggested framework.

4.2. Feelings Data

We executed characterizations related to the excitement and power of the feelings given by the players. We 'presented' the players—in every excitement/power in each place of the lattice—for the past and the last steps while they played the video games. We noticed the development of users' feelings expanding from the very outset to the furthest limit of the video game. For instance, on the off chance that we 'took a gander' at the lattices from 6–6 to 7–7, when the players began playing, there were 9 players with these feelings; keeping in mind that the players were playing, they expanded to 18 players. At last, 17 players remained in the high scope of feelings (from 6–6 to 7–7). The fervor and power of the 9 players rose, and eventually, 8 stayed.

4.3. Baselines

We have selected these three recommendation frameworks to examine the designed method's performance.

- **SVC:** SVC is a nonparametric grouping calculation that makes no presumption on the number or state of the data bunches. As far as we can tell, this turns out best for low-layered information, so if one's information is high-layered, a preprocessing step, for example utilizing head-part examination, is generally required.
- **KNN:** The K-nearest neighbor calculation, otherwise called KNN or K-NN, is a non-parametric directed learning classifier that utilizes nearness to make characterizations or forecasts about the data of interest.
- **Tree:** A tree is a progressive information structure characterized by nodes. Nodes address worth and are associated with edges. The tree has one node called a root. The tree begins from this and, consequently, it has no parent.

4.4. Evaluation Metrics—Positive Feelings

This surveys the user's comfort in different ways. We portray the five most positive feelings involved in estimating the significance evaluation:

- **Peace.** 1: The opportunity or a time of independence from public unsettling influence (or war). 2: A peaceful and quiet perspective. 3: Arrangement and concordance among individuals. 4: Consent to end a conflict.
- **Concretism:** A kind of thought or feeling that relies on prompt actual sensations and shows practically no limit with respect to reflection. In a few customary social orders, such reasoning might show itself in fetishism and confidence in enchantment. Concerning Jung's analytic psychology, this is a sort of thought or feeling dependent upon unmistakable faculties, showing a nearly positive side, if any, and comprehension of the theoretical idea. In a few exemplary societies, this thought process could transform into fetishism and confidence in legendary things.
- **Patience:** The nature of being patient, as the heading of incitement, inconvenience, disaster, torment, without protest, loss of one's temper, aggravation, or something similar. It is the capacity or readiness to smother fretfulness or disturbance when defied with delay or to have persistence with a sluggish student.
- **Enjoyment:** The sensation of delight and fulfillment that people when encountering something that they like.
- **Comfort:** A condition of actual simplicity and independence from torment or requirement.

4.5. Experimental Results for the Predicted Accuracies of Positive Feelings

After investigating the information gathered by the E4 wristband, our calculation inferred that temperature and heart rate variability (HRV) did not provide significant data to the ISUC. Interestingly, heart rate variability (HRV) and electrodermal activity (EDA) empowered ISUC to distinguish user feelings and profound swapping. We saw that heart rate variability (HRV) had critical inconstancy, while electrodermal activity (EDA) was more steady, besides the Pikmin Bloom expeditions. Table 1 shows the experimental outcomes for positive feelings. When the members played Pikmin Bloom expeditions, we observed that the heart rate variability (HRV) estimations had more factors than electrodermal activity (EDA).

Table 1. Shows the experimental outcomes for positive feelings.

Methods	Peace	Concretism	Patience	Enjoyment	Comfort
TREE	1.343	2.534	1.245	1.945	2.845
KNN	1.853	3.156	1.754	3.643	4.643
SVC	4.644	5.654	3.654	6.654	5.654
ISUC	**7.434**	**6.543**	**6.434**	**8.434**	**8.876**

Reconnaissance could be characterized as "the nearby perception of conduct and exercises". In a few cases, individuals embraced observations regarding 'influence', 'make due', or 'secure'. Sensors, cameras, and other hardware are significant for checking and administration processes. With such advances, perception is conceivable (from a long way off) through electronic gadgets or by gaining admittance to data that might contain plain or social innovation methods. The utilization of “Video Surveillance” (VS) is the use of VS over “Remote Sensor Networks” (WSNs). This has been utilized in practically all digital frameworks, including in the breakdown of traffic, providing security to the general population, and observing climate and medical care. Common issues in data transmission are obtained from ‘unwired’ hub association offices in WSNs.

We played out the two trials in Phase 6 and assessed the information indexes utilizing unique order strategies: K-nearest neighbor (KNN), support vector machine (SVC), and choice tree. The framework was prepared and approved with the gathered information utilizing cross-approval from the investigation and was coordinated into the proposal calculation. In the choice tree, we utilized six profundity values to stay away from information commotion or different oddities. Figure 4 shows the effects of these tests with the results; we could see the accuracy of positive feelings.

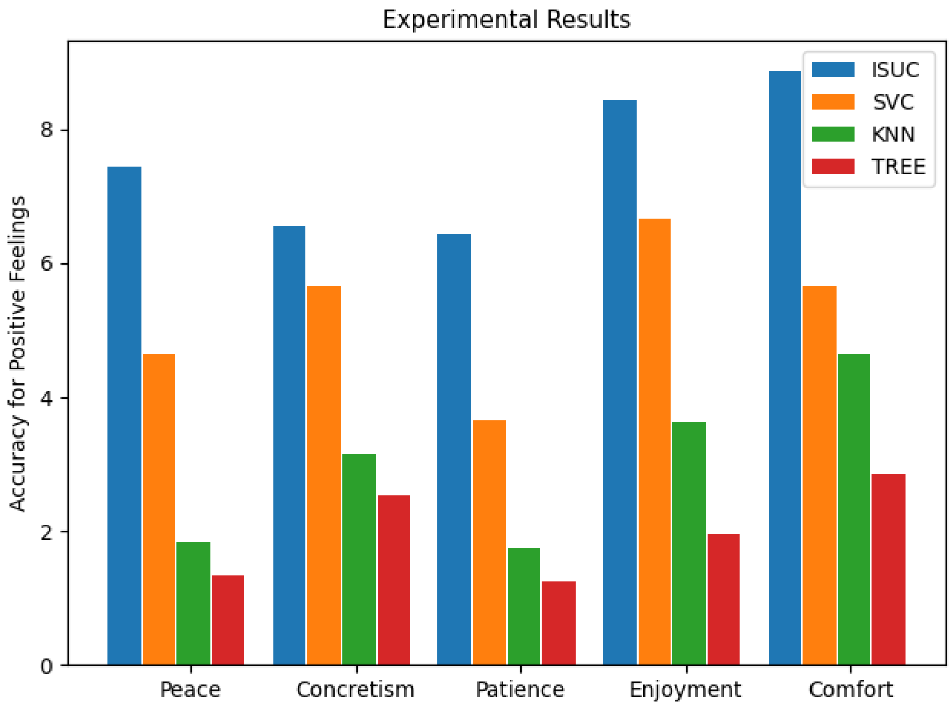

Figure 4. Shows the experimental outcomes for positive feelings.

Hence, for VS applications, the handling and transmission of large measures of video data at remote hubs need to be tested. Media transmission organizations could be utilized by reconnaissance innovation since they send recordings or data created by observation gadgets. For the data to be communicated, a gadget should be associated with the organization. The geological area of a cell phone can be characterized much simpler, regardless of whether the telephone is in backup mode, with the utilization of a strategy known as multilateration. In all, a latent gadget can be followed by working out the distinctions in the time required for a sign to go from wireless to any cell tower near the proprietor of the telephone.

With these outcomes, we found that the K-nearest neighbor (KNN), support vector machine (SVC) order calculations had higher ‘exactness’ than tree calculations for positive feelings, mainly when we needed to anticipate peace, concretism, patience, enjoyment, and comfort.

As demonstrated by the results, ISUC can work fundamentally higher from all baselines when evaluated with positive feelings of peace, concretism, patience, enjoyment, and comfort. It is recommended that ISUC is definitive to achieve the user’s comfort.

4.6. Evaluation Metrics—Negative Feelings

This surveys everything about the user's comfort in different ways. We portray the five most negative feelings involved in the estimations (for evaluating significance):

- **Irritation:** The condition of feeling irritated, eager, or somewhat irate. A response to an aggravating substance causes irritation or distress in a body part.
- **Abstraction:** The development of general thoughts or ideas by removing similitudes from specific occurrences. The exact mental cycles by which this happens are examined. Mental abstraction involves data decrease. More elevated levels of mental abstraction are related to an expanded point of view, while lower levels of mental abstraction are related to a restricted viewpoint.
- **Impatience:** The inclination to be fretful, peevish, or anxious. The lack of capacity or readiness to smother fretfulness or disturbance when defied with delay, or to have persistence with a sluggish student.
- **Displeasure:** Displeasure is a sensation of misery or irritation. The sensation of unfulfillment that one has when encountering something that one does not like.
- **Discomfort:** Discomfort is a difficult inclination in 'a piece' of one's body when one has been harmed or has been awkward for quite a while.

4.7. Experimental Results for the Predicted Accuracies of Negative Feelings

After investigating the information gathered by the E4 wristband, our calculation inferred that temperature and heart rate variability (HRV) did not provide significant data to the ISUC. Interestingly, heart rate variability (HRV) and electrodermal activity (EDA) empowered ISUC to distinguish user feelings and profound swapping. We saw that heart rate variability (HRV) had critical inconstancy, while electrodermal activity (EDA) was more steady (besides the Pikmin Bloom expeditions). Table 2 shows the experimental outcomes for negative feelings. When the members played Pikmin Bloom expeditions, we observed that the heart rate variability (HRV) estimations had more factors than electrodermal activity (EDA).

Another innovation in the broadcast communications field is called the "Internet of Things" (IoT). All items furnished with detecting gadgets that are available to an organization make up the IoT, giving these items the ability to gather and exchange data. IoT innovation is the impending significance stage that obtains colossal changes in business usefulness. In upcoming years, an assortment of associated gadgets, such as 'put' applications, and the tasks they carry out, will be usual.

The gathered information will be utilized to improve execution, distinguish specific necessities, and accommodate explicit prerequisites. To exploit the advances referenced above, it is necessary to consolidate them for the streamlining of administration innovation through the IoT.

Moreover, wearable gadgets can be incorporated into medical care systems since they offer creative capacities and various ways to deal with various social and clinical rules. The application, in addition to expanding the arrangements of clinical benefits and the nature of individuals' lives (e.g., people who are constantly sick and impeded), it appears to have a monetary advantage, as it saves medical service costs by limiting hospitalization or forestalling the illness early by helping to provide adequate assets to 'free-living'. To forestall the sickness, early monetary thoughts are critical. Many individuals experience the ill effects of grave clinical issues, similar to diabetes, asthma, and heart sicknesses, which are liable for the more significant parts of medical care costs.

Table 2. Shows the experimental outcomes of negative feelings.

Methods	Peace	Concretism	Patience	Enjoyment	Comfort
TREE	5.454	7.754	5.556	9.453	7.234
KNN	2.343	3.564	2.565	2.455	3.565
SVC	1.944	2.454	2.343	2.183	2.343
ISUC	**1.453**	**2.033**	**1.544**	**1.344**	**2.021**

We played out the two trials in Phase 6 and assessed the informational indexes utilizing unique order strategies: K-nearest neighbor (KNN), support vector machine (SVC),and choice tree. The framework was prepared and approved with the gathered information utilizing cross-approval from the investigation and was coordinated into the proposal calculation. In the choice tree, we utilized six profundity values to stay away from information commotion or different oddities. Figure 5 shows the effects of these tests with the results, looking at their accuracies for negative feelings. The information showed that every subject's pulse diminished when the prompted feeling was not happiness; the subject's pulse expanded when feelings of fear or anger were introduced. During positive feelings, the pulse value did not differ much from the underlying readings. The mean pulse values for the preliminaries for positive feelings are displayed in Figure 4; the mean pulse values for the preliminaries for negative feelings are displayed in Figure 5.

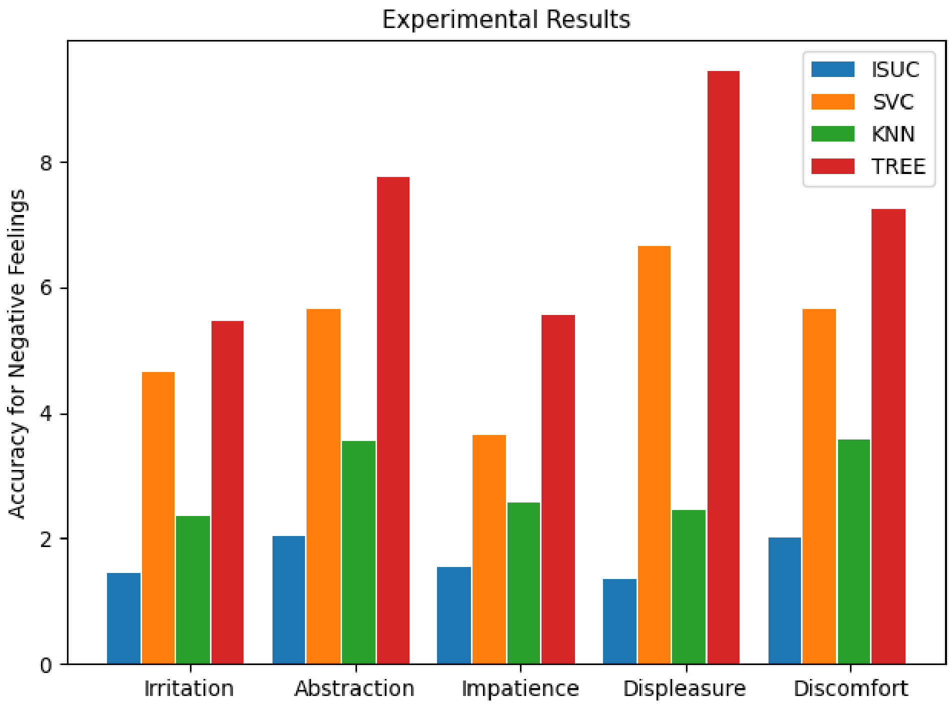

Figure 5. Shows the experimental outcomes for negative feelings.

The skin conductivity readings diminished because of negative feelings and continued as before for positive feelings. The outcomes show the recurrence designs on each graph introduced for every estimation.

With these outcomes, we found that the K-nearest neighbor (KNN) and support vector machine (SVC) order calculations had lower 'exactness' than the tree calculations for negative feelings, mainly when we needed to anticipate irritation, abstraction, impatience, displeasure, and discomfort.

As demonstrated by the results, ISUC fundamentally had lower exactness from the baselines when evaluated with negative feelings of irritation, abstraction, impatience, displeasure, and discomfort. It is recommended that ISUC is definitive to achieve the user's comfort.

5. Conclusions

This research introduces an IoT proposal framework related to user emotions. The proposition lays out the essential prerequisites that should be examined along with the improvements of the working processes of IoT devices (while thinking about feelings), considering IoT data for examinations, gadgets, physiological behaviors, and influence lattice measure. From there, the sky is the limit. Calculations were planned and expected to assess proficiency, precision, and required objectives. In this research, we introduce an IoT suggestion framework that follows six phases to 'breakdown' feelings and the user's conditions. One critical discovery of the research involved forecasting feelings; this assisted with tracking down better IoT frameworks to work on a user's 'prosperity'. Changing emotions is conceivable. The recommender framework is remembered by different devices to propose 'swapping' for a superior user experience (i.e., connected with the user's ideal feelings). Moreover, we attempted our ISUC framework to change the user's feelings (in relation to video games). If necessary, this framework prescribes movement changes to arrive at the user's last emotion. ISUC utilizes both the information from the IoT climate and information physically presented by the user. Subsequently, the framework accomplishes more than 85% precision in anticipating emotions while proposing new activities.

In future examinations, we intend to chip away at different situations to foster explicit frameworks for smart urban communities. For instance, we want to foster frameworks that tend to the prosperity of senior residents. Remaining 'solid' can assist elderly individuals in fighting off the gloom and other medical problems that accompany aging. Moreover, to support their profound well-being, they need to pursue sound judgment and decision-making. The recommender framework will breakdown the profound conditions of elderly individuals in their regular routines. By expecting future feelings, we aim to propose the right decisions for their exercises. Perceiving their feelings, understanding sentiments, and marking them accurately will assist in directing them to change their feelings and reasoning (alone and with others). An application focused on understanding individuals on a profound level will assist individuals in obtaining a 'charge' out of working on their psychological well-being.

This framework can likewise help young people in their work executions and in further developing their authoritative abilities (associated with individual encounters and compassion). The capacity to understand people deeper is connected to higher work fulfillment, execution, and self-viability. These frameworks will assist in taking care of pressure, sources of uneasiness, and different indications of low profound states, and assisting in further developing workplaces, work processes, and joint social efforts.

Our framework could likewise be applied to direct the feelings of kids. A young person's ability to control his/her feelings will influence his/her family, friends, scholarly execution, long-haul emotional well-being, and capacity to flourish in the world. Young people figuring out how to control their feelings is a critical achievement, the groundwork of which is laid in the earliest stretches of life. Young people who can restrain their motivations (frequently determined by feelings) and avoid interruptions can participate in additional supportive ways to achieve their objectives. These kinds of frameworks, subsequently, could be vital in managing kids' feelings.

Another model where the framework could be valuable is in instructive conditions. Profound encounters, dissatisfaction, uneasiness, commitment, or other feelings are essential in educational settings. Our proposition could assist in planning successful school systems that deliver the best climates for learning in "virtual" or "live" situations. The framework could propose transformations in exercises, work-outs, schoolwork, cut-off times, assessments, or equal breaks and rewards, relying upon a user's current and "future" feelings. Different profound states are related to (geographically particular and socially general) body sensations and might be connected to emotional issues. These elements could likewise be examined in the designed framework.

In the field of well-being—the framework could be utilized to gauge which feelings produce specific agonies or illnesses. Moreover, we could examine what nourishment means for well-being, temperament, exhaustion, and energy, or what poor well-being means for an invulnerable framework, diet, or occupation execution. The recommender framework could be utilized to propose new approaches to acting.

In all, our proposition can be applied in many fields and every aspect of smart urban communities where feelings influence users.

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