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Virtual Sober Companion-Mood Analysis.

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Abstract: *The rehabilitation of drug addicts involves a phase of sober companionship where a person who has had a history with the drug but has maintained abstinence for more than three years is asked to accompany the recovering addict during all chores and tasks. The aim is to provide a cheaper alternative to human sober companions by introducing a virtual counterpart. Of the many facets to this application building and patient recovery project, Mood Analysis is the main module that is to be well understood and studied before any step towards making the application. The paper provides a review of all available works related to this domain.*
Keywords: *Smartphone, Operational logs, mood detection, mood enhancement, FitBit, CPS, BCI, POI.*

I.   Introduction

There are over 3 million people in India alone hooked on to drugs. Cannabis, heroin, opium and brown sugar hash are the most commonly used drugs in India. However, some evidence indicates that there is an increasing prevalence of meth as well. Drug addiction is a major problem for many families, communities and law enforcement agencies. Massive numbers of addicts are left to be treated by the families as financial costs, available services and lack of appropriate care challenge the country. This is not only the case for drug addicts.

There are over 110 million people in India who smoke cigarettes. Smoking causes lung cancer, pregnancy related problems, pulmonary heart disease and other heart and blood related ailments.

The de-addiction process involves relieving the addict from the urge to pursue the addiction besides detoxification and psychiatric help to cope with the damage done by some drugs. The last phase of the de addiction process involves the addict having a sober companion at all times.

A sober companion or sober coach provides one-on-one assistance to newly recovering drug addicts and alcoholics. The goal is to help the client maintain total abstinence from alcohol and drugs, and to establish healthy routines outside of a residential treatment facility. Sober companion treatment usually lasts for 30 days – often, much longer. The time required to effect a meaningful change varies greatly depending upon the client, his co-occurring disorders, and the family life at home.

Sober Companions are generally hired by celebrities, ex-military and retired sportsmen who resort to drugs besides all the glamour, struggle, pressure and other stresses of life.

In India, majority of the drug addicts are BPL or belong to the middle class and hence cannot afford a paid sober companion. A virtual sober companion who does exactly what the human counter-part does is the solution to the problem.

The major part of work in this domain and the eventual development of the application is the identification of the mood or mental consciousness or state of mind of the user, hence the research papers and approach to research is of finding optimal solutions to mood identification and analysis. An efficient virtual sober companion would also bring about a change in the detected mood and improve the condition of the user.

II.   Previous Works in the field
MoodSense Technology: Can Your Smartphone Infer Your Mood? [1]

MoodSense[1] is a smartphone service which aims at inferring the mood of the user based on data that already exists in the smartphone.

An experiment was conducted to identify the usability of the service and make a miniature prototype of the service.

The environment of the said experiment included:

(1) Subjects aged between 20 and 29.
(2) 8 of them were female and 17 were male.
(3) 17 of the users were students but the rest covered a diverse set of occupations including two software engineers, one web editor, one salesman and one teacher.
(4) LiveLab iPhone Logger was used to capture user behaviour using daemons operating in the background. The data was archived nightly to a server over a cell data or Wi-Fi connection.
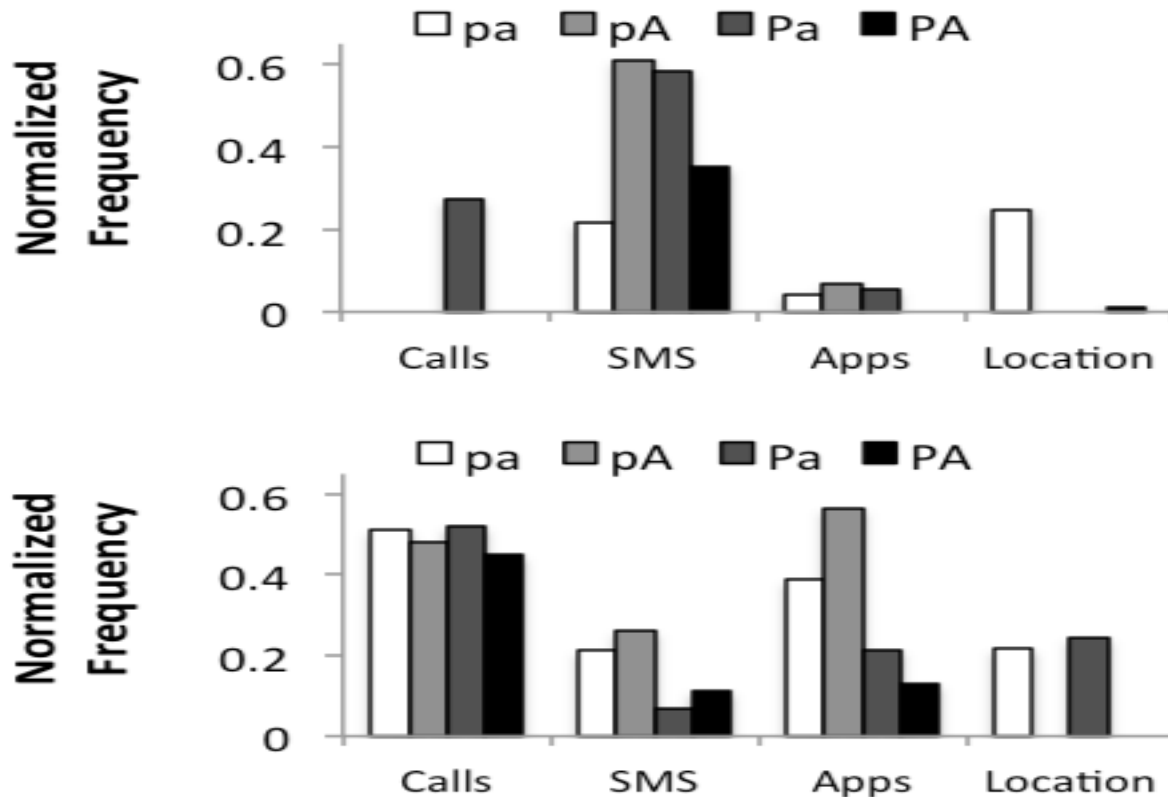

Figure 1: Normalised Frequency of Most Frequent Feature in each category for Two Users.

MoodSense could be essentially built on a model that predicted mood using smartphone usage statistics. The analysis of data collected in the experiment suggested that the model was indeed feasible but flouts various security and privacy norms.Summary, Key points and notes of different sections of the research paper are discussed below.

Gradually, mobile phone sensing has reached beyond the recognition of physically observable human behaviour or environmental context. The activities of an individual can be identified and studied to establish an accurate decision about his or her mood and mental standpoint.This is the basis of the research and it is legitimate as a huge load of data that runs in an individual's smartphone is adequate to analyse and infer mood.

Techniques that allow devices to infer the internal mental state of users are being developed and are opening exciting new opportunities for mobile applications. This is done by various methods. The research work over MoodSense [1] contributed to this new direction as the first demonstration of automatic mood inference using routinely collected phone data (e.g., browser, call, SMS, location history etc.).

A time-series of location estimates for the user is clustered using the DBSCAN clustering algorithm, which allows them to then count user-visits to each location cluster.This technique indicates the dependencies of each parameter which is being calculated.

User mood is represented by the following states: PA – above median pleasure and above median activeness; pA – below median pleasure and above median activeness;Pa–above median pleasure and below median activeness; and finally, pa – below median pleasure and below median activeness.

This application flouts various security norms, privacy norms and patient doctor privileged information.

A new treatment for substance addiction defies the recovery movement.[2]

The medical aspect of drug addiction rehabilitation is of utmost importance and the mental state identification of the user is necessary.An experiment is conducted to identify the moods and mental states of an addict at different times of the day.

The environment of the said experiment is (1)Participants in this study must be heavy addicts.(2)For male alcoholics,the threshold translated to 35 or more standard drinks a week—5 ounces of wine, 12 ounces of beer, or 1.5 shots of hard liquor. For women it was 28 or more drinks a week.

A medical approach was chosen where the brain and its working is mapped using medical equipment and the analysis was studied.

A set of pointers are established to maintain the sanity and mental conditioning of the recovering addict. These pointers are formulated by a panel of renowned psychiatrists.

"Depression does not cause drinking; drinking causes depression."

Also known as drug dependence, drug addiction the disease is not a subjective diagnosis.

It is defined by a set of symptoms: a strong need, or urge, to consume; not being able to stop consumption once started consuming; drug withdrawal symptoms such as nausea, sweating, shakiness, and anxiety; and the need to consume greater amounts of the drug to experience its effects, a phenomenon known in addiction parlance as tolerance.

Pharmaceutical giants like to keep their contributions low-key or steer clear of these applications altogether.

Addiction is common in people with mental health problems. But although substance abuse and mental health disorders like depression and anxiety are closely linked, one does not directly cause the other.

Alcohol or drugs are often used to self-medicate the symptoms of depression or anxiety. Unfortunately, substance abuse causes side effects and in the long run worsens the very symptoms they initially numbed or relieved.

Alcohol and drug abuse can increase underlying risk for mental disorders.Mental disorders are caused by a complex interplay of genetics, the environment, and other outside factors. If you are at risk for a mental disorder, drug or alcohol abuse may push a person over the edge.

Alcohol and drug abuse can make symptoms of a mental health problem worse. Substance abuse may sharply increase symptoms of mental illness or trigger new symptoms. Alcohol and drug abuse also interact with medications such as antidepressants, anti-anxiety pills, and mood stabilisers, making them less effective.

When consumptions is heavy and frequent, the body becomes physically dependent on the drug and goes through withdrawal if consumption is stopped suddenly. The symptoms of drug withdrawal range from mild to severe.

A timely intervention reminding the addict about his current state of mind and his decision of quitting the vice for the well-being of himself and his near and dear. This could be done by a utility pager.

According to reports published in the *Journal of the American Medical Association*: [5]

Roughly 50 percent of individuals with severe mental disorders are affected by substance abuse.

37 percent of alcohol abusers and 53 percent of drug abusers also have at least one serious mental illness.

Of all people diagnosed as mentally ill, 29 percent abuse either alcohol or drugs.

Five steps to a sober lifestyle suggested at the end of the experiment were:

Take care of self. To prevent mood swings and combat cravings, concentrate on eating right and getting plenty of sleep. Exercise is also key: it releases endorphins, relieves stress, and promotes emotional well-being.

Build support network. Positive influences and people who make one feel good about themselves should be in proximity. The more one is invested in other people and the community, the more they have to lose—which will help them stay motivated and on the recovery track.

Develop new activities and interests.Find new hobbies, volunteer activities, or work that gives a sense of meaning and purpose. When doing things which are fulfilling, eventually one will feel better about them self and drug or substance consumption will hold less appeal.

Continue treatment. Chances of staying sober improve if the addict is participating in a support group like Alcoholics Anonymous, have a sponsor, or are involved in therapy or an outpatient treatment program.

Deal with stress in a healthy way. Alcohol abuse is often a misguided attempt to manage stress. Find healthier ways to keep stress level in check, such as exercising, meditating, or practicing breathing exercises or other relaxation techniques.

Happy Hour - Improving Mood With An Emotionally Aware Application.[3]

The aim was to enable a mood enhancing mobile service which not only identified the mood but also brought abut a positive change to it .The factors leading to the development of such an application and the main reasons why it was possible are:

1) On a single device, it is possible to enumerate not only several wireless connectivity interfaces (4G/LTE, Wi-Fi, NFC, Bluetooth) but also various sensors (GPS, accelerometer, gyroscope, proximity/ambient light).

2)CPSs are known as Human-in-the loop Cyber-Physical Systems (HiTLCPSs), where the human becomes an integral part of the control-loop and his nature directly affect the system's actions.

3) Behaviour Change Intervention (BCI) system to improve human physical and mental well-being.
BCIs are therapeutic systems that focus on providing advice, support and relevant information to patients, in order to motivate the correction of prejudicial behaviours.

4)The BCIs suggest a suitable exercise routine to bring about a change in the user's mood.

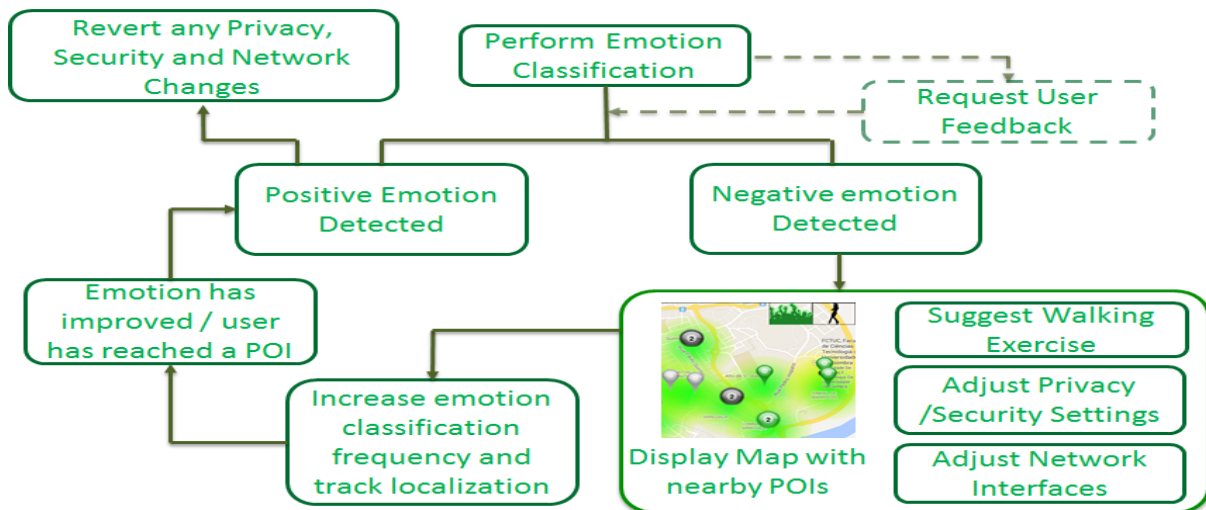5)A POI (point of interest) manager is hard-coded into the system where the decisions are to be made.

Figure 2: HappyHour application flow .[3]

An experiment was conducted to identify the moods and
The environment of the said experiment is**:**
(1) user mobile phone with the pre installed HAPPY HOUR mobile application.
(2) APK to identify input (pre installed system software in smartphones)

The user is asked to enter his or her emotion and this emotion is then analysed by a set of predefined functions stored in the database of the application. The CPSs suggest a physical exercise to the user which will aid the change of the mood of the user. This physical exertion is suggested to the user to change his or her mood according to a positive hierarchical order pre set by the database and ordered preferences of the application.
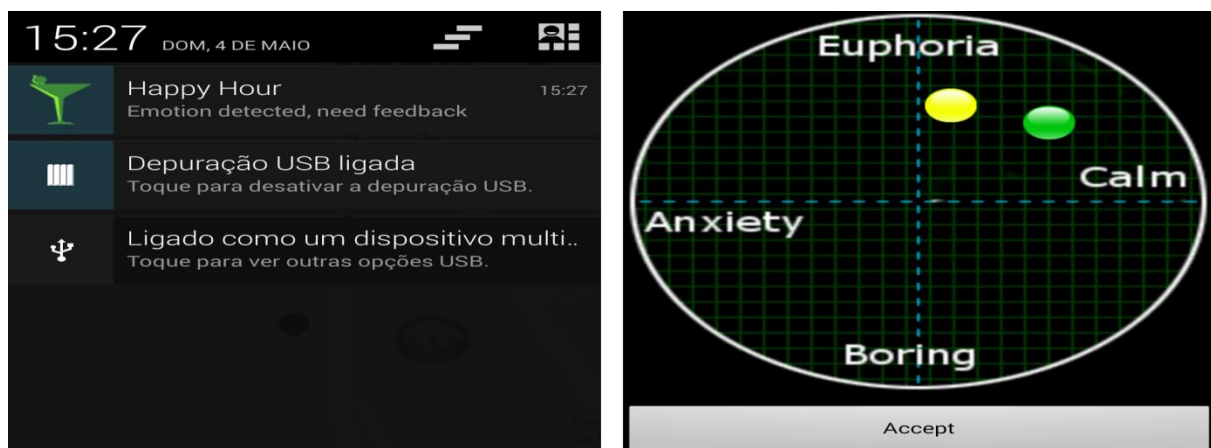

Figure 3: HappyHour Emotional Feedback . [3]

The BCI system plays an important role in identifying the mood and bringing about a positive change in it. It is aimed at improving physical and mental well being.BCIs are therapeutic systems that focus on providing advice, support and relevant information to patients, in order to motivate the correction of prejudicial behaviours. The human in the loop CPSs help in identification of an appropriate user feedback mechanism.

POI manager is a hard coded module which is a major decision making module without which the entire application would be of no use and completely un operational. This is an apt counterpart to the artificial intelligence of some advanced systems.

The POI manager also monitors data and privacy settings from other social networking applications present on the users' phone. This data is monitored and is kept to suitable settings so as to enable accurate collection of data and effective mood analysis.

The various phases of the running of the application are:

1)MONITORING HUMAN EMOTIONS

The core of the emotion-awareness lies in the ability to process different forms of sensing. From the beginning, the objective was not to propose robust methods for emotion detection, but instead, to provide a practical proof-of-concept that shows how emotional information can benefit HiTLCPSs.

2)EMOTIONALLY AWARE RULE SYSTEM

Depending on the emotion classification result and the user's feedback, the HiTL control assumes different decisions. These measures are the responsibility of the "emotionally aware rule system", which is implemented based on sets of actions. Users specify profiles for each emotional state, and actions associated with each profile. These profiles allow the application to automate and specify privacy and networking configurations in accordance to a HiTL paradigm. In particular, if a negative emotional state is detected (e.g. high anxiety or boredom), the default behaviour takes direct measures to improve the user's mood.

3)POINT OF INTEREST INFORMATION

The information provided by the application allows users to identify the best place in a local area to visit. Since every person has their own music tastes and emotional responses, providing detailed information about the environment of each POI might have impact on decision-making process. For in- stance, a person could choose a crowded bar with music if they want to dance, or decide to go visit a more quiet nature park for a relaxing walk, instead. Tracking and aggregating users' emotions and their activity allows HappyHour tocategorise points of interest. The android application allows users to select a destination for their walk through a map.

Figure 4: Happy Hour heat maps. [3]

Smartphone-Based Recognition of States and State Changes in Bipolar Disorder Patients.[4]

The study is based on the assumption that a consistent pattern of bad mood cycles can be a symptom to a major mental disorder. The treatment of the mental disorder would lead to the betterment of the mood cycles hence curing the user of any mental illness simultaneously.

The rehab patients, who constitute a major portion of my target audience have mood swings quite in relation to the bipolar behaviour which is a pertinent illness of recovering addicts.

So the basis of the research is the detection of any mental illness by identification of symptoms and treating the mental illness and coaxially ridding the patient of mood swings and other mental disorders. This not only helps in accurate mood detection but also does the work of an efficient mood enhancer by following medically correct procedure of treatment.

Some of the salient features of the technology implemented here are:

1) Self-Assessment of Mental Disorder Symptoms Using Mobile Phones-The mood swing patterns and instance mood readings of the user are matched with a set of pre defined readings and parametric data which are medically recognised.

2) Objective Monitoring of Symptoms of Mental Disorders-The acquired inputs of the user are segregated and compared with a database where it is then combined and related ailments with similar symptoms are identified and recognised.

3) Wearable Technology in Health Care-It refers to its compatibility with FitBit, iWatch, moto-watch and other wearable tech that help in health detection specifically motion , heart rate and gyroscope.

4) Automatic Recognition of Mental State- The data from the phones inbuilt sensors like the speedometer, GPS, gyroscope, photo sensor etc and that of the wearable technology the data is compared with the predefined set of moods and behaviours and the instant mood of the user is established.

Considering the usability of the envisioned system, some important aspects should be highlighted here:

1) The recognition results of a system as outlined here are not meant to automatically trigger medication. There is no danger that a false recognition would trigger potentially dangerous wrong medication.

2) Required reaction times are on a time scale of a few days rather than a single day. In fact, radical change seldom happens from one day to the next.

Initial experiments and several discussions with the medical personnel gave an insight into the relative relevance of different behavioural aspects:

1)Social interaction

2) Physical motion

3)Travel patterns

The mobile usage is used to track the users state of mind by monitoring texts, social networking activity and call logs. The data from these operational parameters are identified and analysed to predict the mood of the user. The mood analysis leads to cross checking of the prescribed mood with a set or symptoms of mental disorders . This makes the diagnosis of any mental disorder easier and the treatment of any psychological disorder or disfigured mood cycle easier and accurate .

Precision and recall graphs are made to analyse the user moods and are an attempt to quantify the users state of mind. The precision and recall graphs are used and constructed for sound and phone modalities.

Precision or *positive predictive value* is the fraction of retrieved instances to that of the instances that are relevant, while *recall* or *sensitivity* is the fraction of relevant instances to that of all that have been retrieved.

Phone modalities are the user logs and operational parameters. The sound modalities are basically the external input t the user in the form of sound example video, music or any other source which can affect the users mood as sound being the medium.

A density based clustering is also done to identify the readings of the phone sound and fusion modalities. Their uniqueness is a key to the precision of this experiment.

(av. # instances)	**Recall** (std)	**Precision** (std)	**total** (std)
PHONE (43)	54.4% (11.4)	37.3% (29)	64.2% (13)
SOUND (43)	61.3% (7.3)	24.2% (31)	69.8% (4.5)
FUSION P + S (43)	**58.4%** (3.2)	**59.0%** (11.3)	**69.3%** (3.5)
ACC (48)	62.9% (7.9)	64.8% (7.8)	71.7% (3.8)
LOC (33)	72.3% (14.5)	76.5% (13.7)	81.7% (6,5)
FUSION A + L (49)	**66.3%** (11.0)	**57.9%** (16.6)	**75.6%** (6.2)
all-in FUSION (49)	**65.8%** (8.8)	**72.0%** (12.2)	**76.4%** (4.1)

Figure 5: Accuracy in% (# of total instances)and Recall Precision for Phone,Sound and Fusion [4]

Patients	PHONE	Rec/Prec	SOUND	Rec/Prec	Fusion	Rec/Prec
p0102	75(46)	64.4/70.1	66(46)	51.2/40.4	73(46)	58.5/68.0
p0201	62(38)	52.5/53.2	68(32)	60.8/62.0	71(38)	58.7/66.4
p0302	71(60)	62.0/63.6	74(60)	64.5/52.0	71(60)	60.7/65.3
p0602	36(35)	33.9/35.0	76(35)	68.5/78.7	65(35)	57.0/48.0
p0902	68(41)	63.7/65.3	71(41)	68.5/68.5	68(41)	62.3/65.5
p1002	65(37)	78.7/69.4	65(37)	54.0/40.8	65(40)	53.3/41.4
Average	**66%**	**61/58**	**70%**	**60/59**	**69%**	**52/55**

Figure 6: Comparison of recognition of different modalities and fusion of all modalities and of all-in fusion [4]

III.Inferences

The MoodSense service application[1] cannot be used since it flouts various security and privacy norms. An alternative method has to be searched for and another method has to be found and decided upon.It was learnt that the MoodSense technology if not for its legality problems would be the ideal application to be used to identify the users' mood and provide effective relief.

An option would be to wait for the privacy norms to be made lenient by google and other norm deciding bodies so that the technology can be implemented and can help various mood detecting applications function effectively.

The mindset of the user and the crests and troughs of addict behaviour was identified by A new treatment for substance addiction defies the recovery movement.[2]. A fruitful set of pointers that would aid in design of a mood enhancing service application was found. The variations that the mental state of a recovering addict goes through during the usage of the application were learned. The mental conditioning to be provided by the application was identified and was helpful in deciding the services that should be provided by the application.

The mood of the user is specifically kept towards a positive gradient in the Happy Hour Application[3]. This is helped and aided by the POI manager where a decision is made to monitor the data flowing in from the other social networking applications. This also suggests any mild physical exertion which will bring about a positive change in the users' mood. The important feature of this application is the user feedback mechanism where the users mood is input and is then analysed rather than being presumed on device usage and history/logs etc which would be inaccurate and inefficient.

The use of the operational data, social interactions and physical motion are parameters whose study provides us with true study of the users mood by Smartphone-Based Recognition of States and State Changes in Bipolar Disorder Patients [4]. The treatment and diagnosis of mental disorders are an accurate method of finding out untapped mod disorders and untapped state of mind which may actually need conditioning and treatment and may prove to be a pivot in the overall treatment of the user.

IV. Conclusion

After a comparative analysis of the previous works in the field of mood inference by smartphones it was concluded that the accurate mood detection could be done by analysing data received by operational logs and related health data from gyroscope, photo sensor and GPS.

The accuracy of this data was established by a number of experiments mentioned above. The integral step towards efficient mood detection would be quantifying the input to a form acceptable for quick processing and swift comparison. The standardisation of the data to enable compact databases and their efficient comparison is also to be taken into consideration during design of the application.

Steps to enhance a detected mood should be verified by medical personnel and then implemented. Each step which detects a state of mind or induces a change to the mood should be certified by a qualified physician or psychiatrist.

V. Acknowledgements

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