



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Special Issue 2, April 2023

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

9940 572 462

6381 907 438

[ijirset@gmail.com](mailto:ijirset@gmail.com)

[www.ijirset.com](http://www.ijirset.com)

# Detection of Mental Health Tracker System using Machine Learning Algorithm

Sanmukapriya KT<sup>1</sup>, Mahalakshmi G<sup>2</sup>, Brundha R<sup>3</sup>, Dhakshunaamoorthiy<sup>4</sup>

U.G. Student, Department of Computer Engineering, Velammal Engineering College, Chennai, Tamil Nadu, India<sup>1,2,3</sup>

Assistant Professor, Department of Computer Engineering, Velammal Engineering College, Chennai,

Tamil Nadu, India<sup>4</sup>

**ABSTRACT:** Depression is a mental disorder characterized by persistent sadness, loss of interest, and a set of behavioral changes. The high prevalence of depression imposes a significant burden on the world population, demanding methods capable of monitoring and treating this mental disorder. Currently, a large number of mobile applications have been designed to provide support to depressive people. This paper aims to identify, analyze and characterize the current state of mobile applications focused on depression. The systems are designed to be user-friendly and customizable to meet the individual's needs. It also provides an integrative dashboard that summarizes the mental health of a patient. To do so, we conducted a systematic review of applications for depression assistance. The two most popular mobile app stores (Google Play Store and Apple App Store) have been explored to find the most relevant apps. After applying the inclusion and exclusion criteria and performing the quality assessment of the results, 216 applications were selected for the data extraction phase, where we summarized their benefits and limitations and identified gaps and trends. The results of this review evidenced that there is a growth in the diversity of apps' purposes such as chatbot, online therapy, educational tools, mood tracker, testing, and self-help. Index Terms—Health, Mobile Mental Health, Depression, Mobile Applications.

**KEYWORDS:** Natural Language Processing, Statistical analysis, Facebook site, Depression screening, User Generated Content (UGC).

## I. INTRODUCTION

According to the World Health Organization (WHO) [1], mental health is a well-being state in which an individual is able to use his/her abilities, recover himself/herself from the daily routine stress, be productive, and contribute with the community. The term Mental Disorder is normally used to designate problems related to the mental health. Some examples of mental disorders are: humour disorders (e.g., depression), excessive anxiety and stress, disorders caused by drug and alcohol use (i.e., drugs addiction), personality disorders (e.g., bipolar), and delusional disorders. These mental disorders are interlaced and do not happen alone, that is, a problem normally happens associated with the presence of another one. For example, depression can come with excessive anxious and/or suicide thinking (a type of delusional disorder). Some numbers about depression are worrisome [2]: depression already affects more than 300 million people in the world (from 2005 to 2015 that number grew 18,4%), and close to 800 thousand people die due to suicide every year, which is the second leading cause of death in people aged between 15 and 29 years. Therefore, mental health problems have significantly reached a huge portion of the world population. Traditionally, the model to assist individuals who have a mental disorder is performed through face-to-face meetings with specialized health professionals, usually psychologists and psychiatrists, in a frequency that can diversify according to the evaluation of the case, habitually from once a month to 3 times a week. However, as there is continued growth in the number of people with some type of mental disorder, it is essential to face the challenge of reducing or, at least, decelerating the growth of that number. One of the proposed solutions is the use of different patient assistance methods provided via mobile devices and applications. There is a growing amount of health mobile applications available to download in app stores. For this reason, researchers have systematically reviewed them. However, to the best of our knowledge, there is no recent deep review of mobile applications focused specifically on depression assistance. For this reason, our work is

intended to provide, in a systematic review, a characterization of the current mobile applications for depression assistance. We performed a review in relevant mobile app stores, identified and compared applications considering important features such as intended audience, purposes, and provided functionalities. Additionally, we summarized their benefits and limitations and we identified gaps and trends, which are useful for researchers to conduct further investigation. That summarized information is also relevant for developers (both software engineers and programmers) who dedicate efforts in developing mental health mobile applications since, usually, there is an absence of specialized health professionals involved in the software development process.

THE REST OF THE PAPER IS ORGANIZED AS FOLLOWS. SECTION II DESCRIBES THE METHODS USED TO CONDUCT OUR REVIEW. IN SECTION III, THE RESULTS OBTAINED FROM THE REVIEW ARE SHOWN. FROM THE RESULTS, IN SECTION IV WE CONCLUDE THE PAPER.

## II. METHODOLOGY

This study was conducted based/inspired on the guidelines of software engineering systematic literature review proposed by Kitchenham and Charters [24], [25]. We adapted those procedures proposed for literature systematic reviews to our mobile applications review in order to rigorously perform it. Our review was performed according to three main phases: Planning the Review, Conducting the Review, and Reporting the Review. In this section, we describe how the review was planned and conducted.

### a. Goal and Research Questions

The goal of this review was to identify the mobile mental health applications for depression assistance. To achieve this goal, we defined the following research questions:

- (RQ1): What are the purposes of the current mental health mobile applications focused on depression?
- (RQ2): What are the functionalities provided by them?
- (RQ3): What audiences those applications are intended for?
- (RQ4): What is the satisfaction level of the users?
- (RQ5): What are the gaps and trends in those applications?

### b. Search Strategy

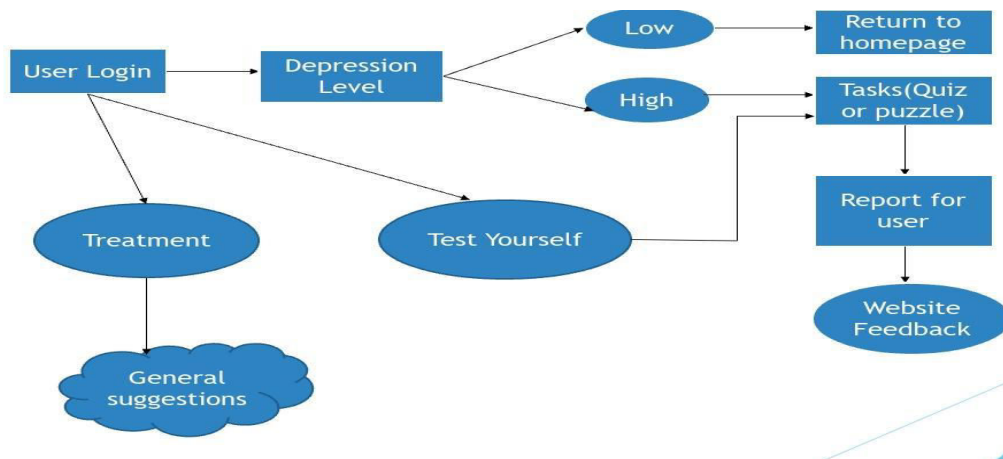
The definition of the search string was based on the PICO criteria [24], [25]: (P) Population: People presenting a depressive disorder were defined as the population of interest; (I) Intervention: The intervention was considered as mobile applications that provide psychoeducation, self-monitoring, self-help, among other methods that support the depression assistance; (C) Comparison: The comparison aspect was disregarded; and (O) Outcome: The results were defined as the entire set of existing mobile applications that support people suffering from depression. To maximize the results of this research, the search strings were determined according to the research goal and PICO criteria, resulting in the following terms: “depression”, “depressive disorder”, and “major depressive disorder”, which were also translated into Spanish and Portuguese for identifying applications in these languages.

### c. Selection Criteria and Quality Assessment

Once the search strings were applied to the search engines of the app stores, a large number of mobile applications were returned. The goal when applying the process of selection criteria was to identify the most relevant apps. Apps' information was retrieved by the two researchers, which evaluated their name, language, description, and last app's update. The inclusion (IC) and exclusion criteria (EC) used to select relevant apps are shown in Table I. Selection criteria basically considered apps in three languages focused on any content related to depression (i.e., apps intended for mental health professionals, depressive people, their family and caregivers, or the general public concerned about depression). The UpToDate Ness of an app indicates if it is continued, for this reason and because the last related review has been made in 2015 [15], we added the third selection criteria.

d. Extraction and Summarizing of Data

The data extraction strategy is an essential step in a systematic literature review, as it provides a means of synthesizing the results found, facilitating the understanding of the domain by other researchers [28]. We collected data from the store information about the apps and only downloaded and examined the websites of those apps that had no clear store descriptions or did not provide useful screenshots. In this way, the following data was extracted and documented from the eligible applications: name, platform, category, description, cost, user 5-star rating, number of ratings, number of downloads (available only in Google Play Store), and type of developer. In addition, we also identified if there were versions of the apps for wearable devices (e.g., smartwatches). The following information was obtained from the description, screenshots, or even from the application downloaded: intended audience, provided features, and types of multimedia content provided. In cases where the two researchers performed conflicting identifications, a discussion process was initiated to reach a common consensus. Even though, in situations where the conflict persisted, the analysis was delegated to the judge and the psychologist by deciding which identification was most appropriate.



III. EXPERIMENTAL RESULTS

A. Apps Selection

The simplified flow of this study with results from the selection stages is shown in Figure 1. A total of 553 apps were found by performing the search strategy, of which 405 from the Google Play Store, 127 Apple App Store, and 21 identified as duplicated apps across both stores. The main apps’ information was retrieved and evaluated by the two reviewers, in which the selection criteria and quality assessment were applied. After that, in applying the Cohens Kappa, it was found that the level of agreement regarding selection criteria and quality assessment between the reviewers was acceptable:  $\approx 0.81$ , which is considered an almost perfect agreement [29]. Next, to have all disagreements resolved, 45 apps with different assessments made by reviewers were discussed with the judge (software engineer) and the psychologist. In the end, 216 apps were screened to be analysed.

B. Categorization

Figure 2 presents the categories of the evaluated apps as defined by their developers in the stores. This information varies depending on the store, which had the following categories: Medical/Medicine, Health and Fitness, Lifestyle, Books and Reference, Education, Personalisation, Social, News and Magazines, Parenting, Game, and Utilities. The last four ones had only 1 app categorized as such. In some cases, developers of the duplicated apps categorized their apps differently for both stores. For this reason, we counted duplicated apps twice, even when they had the same category.

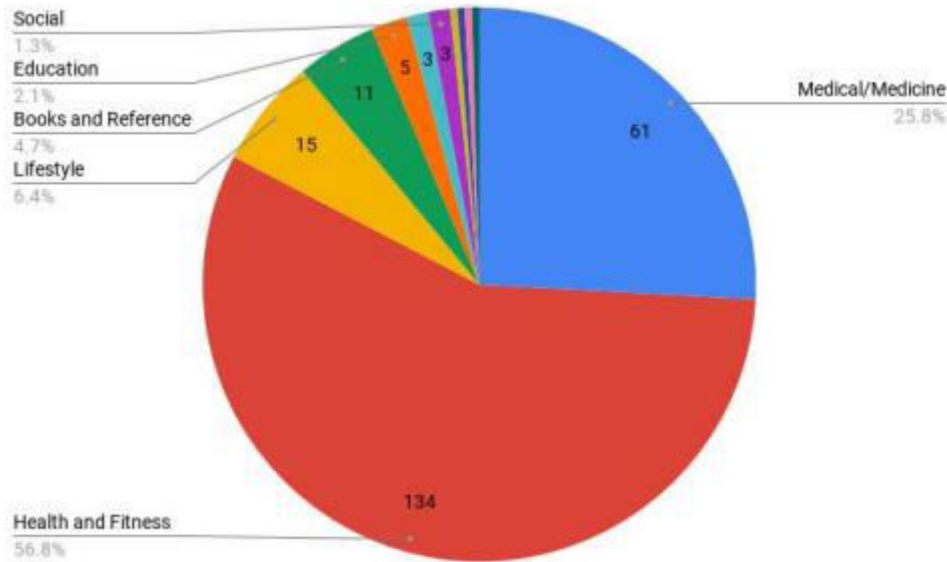


Fig. 2. Categories of Evaluated Apps.

To understand more about the purposes of the current mental health apps focused on depression and their provided functionalities, we individually analysed and categorized the apps according to their objectives in:

- Test: apps that provide digital and mobile versions of famous mental health questionnaires and scales such as Patient Health Questionnaire-9 (PHQ-9), Hospital Anxiety and Depression Scale (HADS), and Geriatric Depression Scale-15 (GDS-15);
- Educational: apps with content about depression, its symptoms, treatment, and recommendations for users to seek help from specialized professionals;
- Mood Tracker: Ecological Momentary Assessment (EMA) [30] apps that ask the user for self-assessments in order to capture the life as it is lived, registering experiences and behaviours, and monitoring the mood over time;
- Decision Support: Ecological Momentary Intervention (EMI) [6] apps in which the professional can perform interventions based on pieces of evidence provided by self-assessments of patients;
- Game: apps that explore gamification techniques or are educational games about depression;
- Chatbot: apps that use artificial intelligence techniques to provide conversations like humans, simulating a friend/buddy;
- Self-help (aka self-improvement): apps with a set of tips and guidance to deal with and overcome depression;
- Online Counselling: apps for online therapy that provide remote communication with certified and experienced mental health professionals, usually psychologists, but also marriage and family therapists, licensed counsellors, and clinical social workers;
- Alternative Methods: apps that propose methods such as yoga, hypnosis, massage, meditation, and diet for depression;

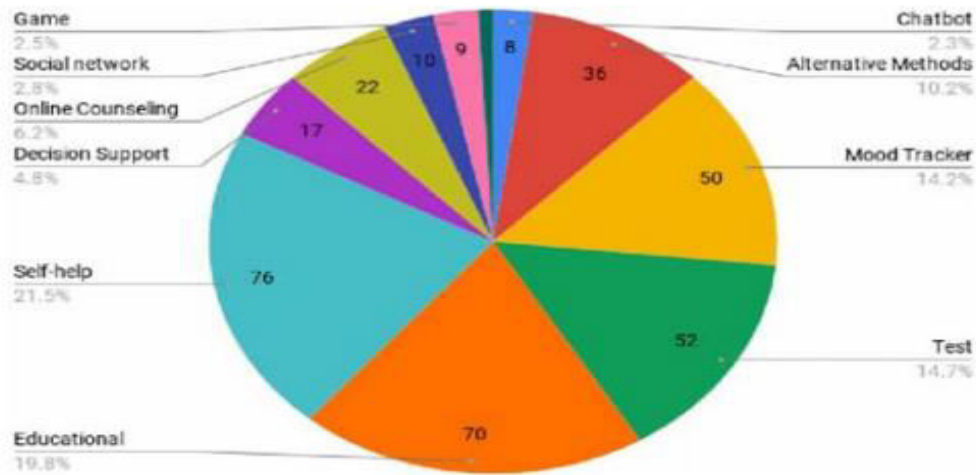
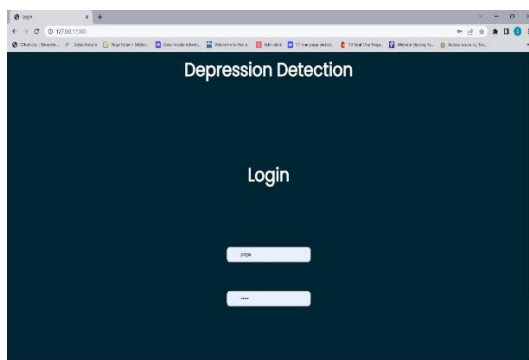


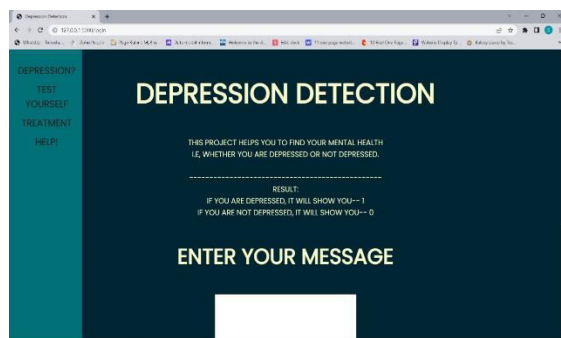
Fig. 3. Proposed Categorization for the Apps.

C. Qualification

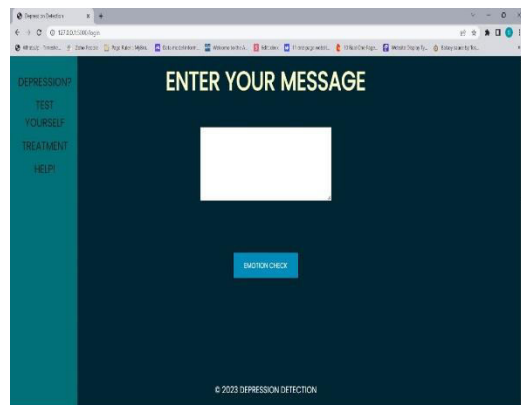
Figures 1,2,3 and 4 shows the results of depression analysis from a real user by using logistic regression model and Naive Bayes algorithm. Fig. (1) shows the login page with credentials to access the application. (2) is the homepage that displays four tabs with the app description. (3) has the text box for the user to enter text and submit button. (4) displays the result of the analysis.



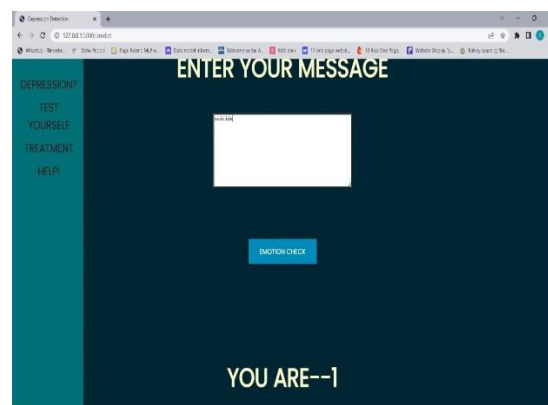
(1)



(2)



(3)



(4)

#### IV. CONCLUSION

In recent years, mobile devices have been used in the mental health domain as part of the medical, psychological, and general health services to help the mental disorders treatment and monitoring. Mobile technologies not only allow the continued monitoring of the individual's physiological state, but also contribute to building a lifetime record of psychological, mental, and social health. Hence, the use of those technologies in health assessments and interventions can be used to reduce healthcare costs, while improving the access to health services. In this paper, we described a systematic review on what and how 216 current mobile applications are providing resources for depression assistance. We decided to apply guidelines of software engineering systematic literature review to define a unique and adequate process for conducting the applications review. In this investigation, the main goal was to provide a characterization of those apps, identifying and discussing them by considering important features. Main findings highlight growth in the apps' purposes and functionalities, suggesting that apps are seeking to achieve users' requirements, but not always taking into account the need for face-to-face meetings with mental health professionals. As a result, the findings of this study can be an opportunity to propose solutions considering and encouraging the presence of qualified professionals in the process of treatment and monitoring. Further research efforts are needed to explore new possibilities to identify potential users who demand mental health services and to keep them in touch with the right professionals.

#### REFERENCES

- [1] "Mental health action plan 2013-2020," [http://www.who.int/mental\\_health/publications/action\\_plan/en/](http://www.who.int/mental_health/publications/action_plan/en/), World Health Organization, WHO Document Production Services, Tech. Rep., 2013, online; Accessed: Jan 11, 2019.
- [2] "Depression - key facts," <https://www.who.int/news-room/factsheets/detail/depression>, online; Accessed: Jan 11, 2019.
- [3] A. Rocha, M. R. Henriques, J. C. Lopes, R. Camacho, M. Klein, G. Modena, P. V. de Ven, E. McGovern, E. Tousset, T. Gauthier, and L. Warmerdam, "Ict4depression: Service oriented architecture applied to the treatment of depression," in 2012 25th IEEE International Symposium on Computer-Based Medical Systems (CBMS), June 2012, pp. 1–6.
- [4] A. S. Teles, A. Rocha, F. J. Silva, J. C. Lopes, D. OSullivan, P. V. d. Ven, and M. Endler, "Towards situation-aware mobile applications in mental health," in 2016 IEEE 29th International Symposium on ComputerBased Medical Systems (CBMS), 2016, pp. 349–354.
- [5] A. Soares Teles, A. Rocha, F. Jos da Silva e Silva, J. Correia Lopes, D. OSullivan, P. Van de Ven, and M. Endler, "Enriching mental health mobile assessment and intervention with situation awareness," *Sensors*, vol. 17, no. 1 – 127, 2017.
- [6] K. E. Heron and J. M. Smyth, "Ecological momentary interventions: Incorporating mobile technology into psychosocial and health behaviour treatments," *British Journal of Health Psychology*, vol. 15, no. 1, pp. 1– 39, 2010.
- [7] A. Teles, D. Pinheiro, J. Goncalves, R. Batista, F. Silva, V. Pinheiro, E. Haeusler, and M. Endler, "Mobilehealthnet: A middleware for mobile social networks in m-health," in Proceedings of the 3rd International Conference on Wireless Mobile Communication and Healthcare, ser. *MobiHealth '12*, 2012.
- [8] S. Kumar, W. Nilsen, M. Pavel, and M. Srivastava, "Mobile health: Revolutionizing healthcare through transdisciplinary research," *Computer*, vol. 46, no. 1, pp. 28–35, 2013.
- [9] P. P. Brzan, E. Rotman, M. Pajnkihar, and P. Klanjsek, "Mobile applications for control and self management of diabetes: A systematic review," *Journal of Medical Systems*, vol. 40, no. 9, 2016.
- [10] K. M. J. Azar, L. I. Lesser, B. Y. Laing, J. Stephens, M. S. Aurora, L. E. Burke, and L. P. Palaniappan, "Mobile applications for weight management: Theory-based content analysis," *American Journal of Preventive Medicine*, vol. 45, no. 5, pp. 583–589, 2013.
- [11] J. L. Bender, R. Y. K. Yue, M. J. To, L. Deacken, and A. R. Jadad, "A lot of action, but not in the right direction: Systematic review and content analysis of smartphone applications for the prevention, detection, and management of cancer," *Journal of Medical Internet Research*, vol. 15, no. 12, 2013.
- [12] K. E. Muessig, E. C. Pike, S. LeGrand, and L. B. Hightow-Weidman, "Mobile phone applications for the care and prevention of hiv and other sexually transmitted diseases: A review," *Journal of Medical Internet Research*, vol. 15, no. 1, 2013.
- [13] G. Giunti, E. Guisado-Fernandez, and B. Caulfield, "Connected health in multiple sclerosis: A mobile applications review," in 2017 IEEE 30th International Symposium on Computer-Based Medical Systems (CBMS), June 2017, pp. 660–665.



- [14] F. Gravenhorst, A. Muaremi, J. Bardram, A. Grunerbl, O. Mayora, " G. Wurzer, M. Frost, V. Osmani, B. Arnrich, P. Lukowicz, and G. Troster, " "Mobile phones as medical devices in mental disorder treatment: An overview," Personal Ubiquitous Computing, vol. 19, no. 2, pp. 335–353, 2015.
- [15] A. Huguet, S. Rao, P. J. McGrath, L. Wozney, M. Wheaton, J. Conrod, and S. Rozario, "A systematic review of cognitive behavioral therapy and behavioral activation apps for depression," PLOS ONE, vol. 11, pp. 1–19, 2016.





**SJIF: 8.423**



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INTERNATIONAL CENTRE



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details