International Journal of Academic Engineering Research (IJAER)
ISSN: 2643-9085
Vol. 10 Issue 2 February - 2026, Pages: 37-41

Intelligent Real Time Monitoring and Care Giver Support System for People with Mental Health Disorders

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Abstract: *Mental health disorders have become one of the most significant public health challenges of the twenty-first century, affecting individuals across all age groups and social categories. The impact of these disorders is multidimensional, touching not only the patient but also families, caregivers, workplaces, and national health systems[1]. In many low- and middle-income countries, the number of psychiatrists, psychologists, and mental health nurses is extremely small compared to the growing number of patients. As a result, the responsibility of daily supervision is shifted to family members who rarely possess professional skills or technological support. At the same time, the rapid development of Internet of Things technologies, wearable sensors, mobile communication, and artificial intelligence has introduced new possibilities for remote health monitoring[2]. These technologies can observe behavioral and physiological changes, recognize emergencies, and transmit alerts instantly to caregivers regardless of distance. This review paper examines in depth the concept of an intelligent real time monitoring and caregiver support system designed for people with mental health disorders[3]. The paper explores the background of mental health care, the difficulties faced by caregivers, and the technological opportunities available for addressing these challenges[4]. Existing approaches such as mobile health applications, GPS tracking, fall detection systems, and behavioral analytics are critically discussed. Furthermore, the review analyzes social, ethical, and practical considerations that must be respected when designing such systems, including privacy, consent, affordability, and cultural acceptance[5]. The review concludes that an integrated, locally adaptable monitoring system can play a transformative role by improving patient safety, reducing hospital readmissions, and strengthening the relationship between patients, families, and health professionals[6].*

Keywords: Mental health, real time monitoring, caregivers, IoT, wearable sensors, assistive technology, GSM communication.

INTRODUCTION

Mental health disorders constitute a broad range of conditions that affect thinking, mood, perception, and behavior. Disorders such as schizophrenia, bipolar disorder, major depression, and anxiet" not only disturb the internal psychological state of an individual but also influence social relationships, employment, education, and personal safety[7]. Unlike many physical illnesses where symptoms are visible and measurable, mental health symptoms are often hidden, subjective, and unpredictable[8]. A patient may appear calm and stable in one moment and become confused, aggressive, or suicidal in the next. This unpredictable nature makes continuous supervision a critical requirement[9].

In most developing countries, including Tanzania, mental health services are concentrated in a few urban hospitals. Community mental health programs are still developing, and professional home-based care is rare[10]. Consequently, families become the primary caregivers. Mothers, fathers, spouses, or even children take responsibility for supervising the patient, ensuring medication adherence, calming emotional crises, and protecting the patient from harm[11]. These responsibilities are heavy and emotionally exhausting, especially when caregivers must also work to support the family economically.

Traditional mental health care models rely on periodic clinic appointments, counseling sessions, and self-reporting by the patient. Such models assume that the patient is able to recognize their own symptoms and seek help when necessary[12]. In reality, many patients lack insight into their condition, forget appointments, or refuse medication. Crises often occur between hospital visits, leaving caregivers without guidance. Incidents such as wandering away from home, involvement in road accidents, self-neglect, or violent behavior are frequently reported[13].

The emergence of smart devices and wireless communication offers a new direction. Wearable sensors can collect information about movement, location, heart rate, and other indicators continuously[14]. Mobile networks can transmit this information in real time to caregivers or health professionals. An intelligent system can analyze the data and differentiate normal daily activity from risky situations[7]. This review therefore focuses on the potential of such technology to support caregivers and to create a safer living environment for people with mental health disorders[15].

BACKGROUND

The burden of mental health disorders is rising globally due to urbanization, economic stress, substance abuse, and social changes. The World Health Organization identifies mental illness as one of the leading causes of disability

worldwide. In Tanzania, like many African countries, mental health services receive limited budget allocation compared to other diseases such as malaria or HIV/AIDS[16]. Psychiatric hospitals are few, and most are located far from rural communities where the majority of the population lives.

Mental health symptoms often interfere with the basic abilities required for independent living. Patients may experience hallucinations that instruct them to leave home, delusions that make them distrust family members, or severe depression that removes motivation to eat or bathe. During manic episodes, a person may walk long distances without rest or engage in risky financial and sexual behavior. These conditions place the patient in constant danger[8].

Caregivers struggle with multiple challenges. First, there is the challenge of time. A caregiver cannot remain with the patient every minute, yet a single unsupervised hour may be enough for a crisis to occur. Second, there is lack of knowledge. Many caregivers do not understand early warning signs of relapse[17]. Third, there is emotional burden. Living with a mentally ill relative often leads to fear, shame, and social isolation. Communities sometimes stigmatize both the patient and the family.

Technology has begun to influence health care in other fields. Diabetic patients use glucometers at home; heart patients use portable ECG devices; pregnant women receive SMS reminders for clinic visits[8]. These successes inspire similar innovation in mental health. Wearable technology such as smart watches, fitness bands, and GPS trackers have become affordable and widely available. These devices can measure steps, body temperature, heart rate variability, and geographical position[15].

However, mental health presents unique challenges compared to physical health. Behavioral data are more complex than blood sugar levels. Privacy concerns are higher because monitoring thoughts and movements can be perceived as surveillance. Furthermore, many mental health patients have low income and limited education, which restricts the use of sophisticated smartphones or internet-based systems[18].

In Tanzania, GSM network coverage is widespread even in villages where internet is unstable. SMS remains the most reliable form of digital communication[19]. Therefore, a system that uses GSM alerts rather than internet notifications is more appropriate for the local context. A wearable device connected directly to GSM can operate independently of smartphones and can be used by elderly caregivers who own simple phones[19].

Another background aspect is medication management. Antipsychotic and antidepressant drugs must be taken regularly to maintain stability. Forgetting medication is a common cause of relapse. A monitoring system that includes reminders and confirmation messages can help both patient and caregiver to maintain the treatment schedule[20].

Social and ethical dimensions are equally important. Patients deserve dignity and autonomy. Monitoring should be designed as a supportive tool rather than a mechanism of control[21]. Consent, data protection, and respectful communication must be integrated into any technological solution. Considering these medical, technological, and social factors, the idea of an intelligent caregiver support system becomes highly relevant[22].

STATEMENT OF THE PROBLEM

Despite the heavy burden of mental illness, caregivers in Tanzania and similar settings continue to rely on manual and unreliable methods of supervision[23]. There is no accessible system that can continuously observe a patient's location and behavior and immediately inform caregivers when danger arises. Patients may disappear for hours before anyone notices. Falls, self-harm attempts, or violent episodes occur without early warning. Hospitals receive patients only after severe damage has already happened.

Existing commercial devices are expensive, depend on internet connectivity, and are designed mainly for elderly people in developed countries[24]. They do not address the realities of African households where electricity supply is unstable, smartphones are shared among family members, and literacy levels vary. The lack of a locally appropriate solution leads to: Increased accidents and loss of life, High emotional and financial stress to families,Frequent hospital readmissions,Social stigma and neglect of patients[25].

Thus due to this situation motivates the need for an intelligent, affordable, and culturally sensitive monitoring system that supports caregivers in real time and complements professional mental health services.

OBJECTIVES

Main Objective

To develop and critically review an intelligent real time monitoring and caregiver support system that enhances supervision, safety, and communication for people living with mental health disorders.

Specific Objectives

1. Designing a wearable device for real-time patient location tracking that continuously monitors and records the patient's movements throughout the day and night.
2. Monitoring body movement and detecting abnormal wandering using advanced built-in motion, activity, and position sensors to capture detailed movement patterns and unusual behavior.
3. Automatic SMS alerts to caregivers during emergencies with instant notifications, including critical details about the patient's status, location, and any detected abnormal activity.
4. Providing Medication reminder alerts for the patient through scheduled vibrations, sounds, on-screen notifications, and repeat reminders to ensure adherence to prescribed treatment routines consistently.

RELATED WORKS

Numerous researchers have attempted to integrate technology into mental health care with varying degrees of success. Mobile health applications such as mood diaries, cognitive behavioral therapy apps, and appointment reminders are widely available on digital platforms[26]. These applications help patients to reflect on their emotions and to maintain communication with therapists. However, they rely on the patient's willingness and cognitive ability to interact with the application, which is often absent during severe episodes[27].

Wearable devices have been explored as objective tools for monitoring. Studies have shown that heart rate variability and sleep patterns correlate with anxiety and depression levels. Accelerometers have been used to detect restlessness or reduced activity, which may signal relapse[20]. GPS trackers have been particularly useful in preventing wandering among dementia patients. Some projects developed systems that send alerts when a patient leaves a predefined geographical area[28].

Fall detection has received significant attention, mainly for elderly users. Algorithms analyze sudden changes in acceleration to identify falls and automatically call emergency contacts. Similar techniques can be applied to mental health patients who may fall during agitation or due to medication side effects, Machine learning and artificial intelligence have opened new possibilities. Researchers have trained models to recognize speech changes associated with mania or depression, to analyze social media posts for suicidal ideation, and to predict relapse from sensor data. While these approaches show promise, they often require large datasets, powerful smartphones, and stable internet connections[29].

A critical review of these works reveals several weaknesses. Most systems address a single function rather than providing a holistic caregiver platform[30]. Many are pilot projects conducted in controlled environments and not tested in real African households. Usability for illiterate or elderly caregivers is rarely considered. Moreover, ethical frameworks are often missing, raising concerns about misuse of personal data[31].Therefore, the literature indicates a strong need for a comprehensive, low-cost, GSM-based system designed specifically for mental health disorders in developing countries. Such a system should integrate location tracking, motion detection, emergency communication, and caregiver feedback into one simple device[22].

OBSERVATION

From the reviewed studies and practical community experiences, several important observations emerge. First, mental health behavior is non-linear and context dependent. The same patient may show different patterns on different days depending on stress, medication, or family interaction. Monitoring systems must therefore be adaptive and personalized[17].

Second, caregivers value reliability over sophistication. An alert that arrives late or falsely alarms too often will quickly be ignored. Systems must balance sensitivity with accuracy to maintain trust[32].

Third, privacy remains a major concern. Patients fear being watched continuously, and communities may misuse information. Transparent consent procedures and limited data collection are necessary to protect dignity[33].

Fourth, technical challenges such as battery life, device durability, and network failure directly affect effectiveness. A device that stops working during power cuts cannot be depended upon[34].

Fifth, social acceptance determines success. If family members do not understand the purpose of the device, they may resist using it. Education and involvement of caregivers from the design stage are essential[35].

These observations provide the basis for defining the Requirements of the proposed intelligent care giver support system.

CONCLUSION

This review has demonstrated that mental health disorders present complex and continuous care challenges that cannot be effectively managed through traditional hospital-centered approaches alone. The unpredictable nature of mental illness, combined with shortage of professionals and limited supervision at home, places patients at high risk of wandering, injury, medication non-adherence, and social neglect. Advances in Internet of Things, wearable sensors, and mobile communication provide a realistic opportunity to support caregivers through intelligent real time monitoring systems.

The analysis of existing studies shows that although various technologies such as GPS tracking, fall detection, and mobile health applications exist, most solutions remain fragmented, expensive, or unsuitable for low-resource environments. There is therefore a clear need for an integrated, affordable, and user-friendly caregiver support system specifically designed for people with mental health disorders. Such a system can enhance early detection of crises, enable rapid

caregiver response, improve medication management, and reduce emotional and financial burden on families.

In conclusion, the development of an intelligent real time monitoring and caregiver support system is both technically feasible and socially necessary. When implemented with respect for ethics, privacy, and cultural context, this technology can greatly improve safety, dignity, and quality of life for people living with mental health disorders and strengthen community-based mental health care.

RECOMMENDATION AND FUTURE WORKS

The findings of this review indicate that an intelligent real time monitoring and caregiver support system can significantly improve the safety and supervision of people with mental health disorders. However, for such a system to be effective and sustainable, several recommendations must be considered.

First, the system should be designed with affordability and simplicity as primary goals. Many caregivers in Tanzania and similar environments use basic mobile phones and have limited technical knowledge. Therefore, the communication between the wearable device and caregivers should rely mainly on GSM/SMS technology.

Second, future implementation must focus on user-centered design. Caregivers and patients should be involved from the early stages of development to ensure that the device is comfortable, culturally acceptable, and easy to operate.

Third, Future work should explore the use of intelligent algorithms to differentiate normal daily activities from dangerous behaviors such as extreme agitation, falls, or wandering. This will help to reduce false alarms, which can discourage caregivers from trusting the system.

Fourth, strong attention must be given to ethical and privacy issues. Future studies should develop clear guidelines on data protection, consent from patients, and responsible use of location information. Collaboration with mental health professionals, legal experts, and community leaders is necessary to ensure that the technology respects human dignity.

Fifth, future research should involve real-world pilot testing with selected families and health facilities. Such trials will help to evaluate battery life, network reliability, caregiver acceptance, and the actual impact on patient safety. Feedback from these trials should guide further improvement of both hardware and software components.

Lastly, integration with the existing health system is essential. In the future, the system could be connected with hospitals and community mental health workers so that alerts can be shared with
professionals when necessary. This will transform the device from a family tool into a national mental health support platform.

ACKNOWLEDGEMENT

We would like to express Our sincere gratitude to all individuals and institutions that contributed directly or indirectly to the preparation of this review paper. Special appreciation is extended to Our lecturer Abdallah Ali and academic supervisors for their valuable guidance, constructive criticism, and encouragement throughout the development of this work. We also acknowledge the efforts of researchers and authors in the field of mental health and assistive technology whose publications provided essential knowledge and insight that shaped this study.

Our heartfelt appreciation goes to caregivers and families of people living with mental health disorders, whose daily experiences inspired the idea of developing an intelligent monitoring and caregiver support system. Their commitment, patience, and compassion highlight the urgent need for technological solutions to support home-based mental health care.

Finally, We thank Our colleagues, friends, and family members for their moral support, motivation, and understanding during the preparation of this paper. Their encouragement gave us strength to complete this academic task successfully.

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