Ubiquitous Computing: An Assistive Surveillance on In and Out Patients with Mental Illness via RFID

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Original Research Article

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Abstract

Ubiquitous Computing enable users to utilise computer software and hardware to perform tasks anytime anywhere without visualising them. In other words, software and hardware are embedded in the environment making them invisible while they are effectively in use. Over the last decayed, the use of ubiquitous computing has been exploited in the healthcare sector via Radio Frequency Identification for security purposes. However, it has not been gainfully applied in mental Healthcare wards or homes for observation of patients with mental illness as one of their routine treatment. This paper present the possibility of using Ubiquitous Computing aided RFID system to enhance observation treatment on patients with mental illness in mental wards. Chronological Scientific Research Methodology, which comprise of five stages was used to actualise the research goal under study. Problems and challenges posed by existing observation treatment techniques were discussed in detail such as patient with schizophrenia are most likely to abscond from the mental hospital premises and a bridge of patient's freedom of privacy e t c. A feasible system solution was formulated called "Real Time RFID Monitoring Middleware System" that would resolve the flaws or challenges of the existing observation treatment techniques. Also, comparative analysis was carried out between the feasible system formulated and the existing system in other to determine the validity and reliability of the feasible system solution. Recommendations were sighted persuading mental healthcare practitioners and government agencies to

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invest in the development of the proposed system due to its great and exciting features and end with a conclusion.

1 Introduction

Ubiquitous computing is the method of enhancing computer use by making many computers available throughout the physical environment, but making them effectively invisible to the user [1]. In Addition, users can effectively make use of computer generated features on real time basis without visualising the physical hardware and software components. There is numerous research works that has been done on ubiquitous computer system and its impact on the society at large over the last decade. Businesses such as retail and Currier Service Companies as well as in the health sector have modestly utilized this emerging technology with the use of Radio Frequency Identification (RFID).

Radio Frequency Identification system enables the tracking of goods and products and services in both retail and curriers firms, as well as assets and legacy facilities in hospitals. For instance, the Royal Wolverhampton National Health Service (NHS) Trust based in the United Kingdom, uses RFID surveillance system for "tracking the movements of patients and staff members, managing the locations of tagged assets, and ensuring hand-hygiene compliance" [2].

In this research work, the research methodology was discussed on how the research goal under study will be actualise. A detailed literature review was presented on Ubiquitous Computing and RFID technology impact in the healthcare sector. A brief discussion on the existing techniques used for the treatment of patients with mental illness as well as their challenges. In Addition, a feasible system solution called "Real Time RFID Monitoring Middleware System" was projected to resolve the possible challenges and enhance the performance of the existing techniques used for the treatment of patients with mental illness. Comparative analysis was done between the existing system techniques and that of the feasible system and then ends with recommendation and conclusion.

2 Research Methodology

Research methodology is essentially, the procedure by which researchers go about their work of describing, explaining and predicting phenomena [3]. In addition, it involves a sequential order of activities that must be implemented in other to resolve a problem. In other words, it comprises of sub activities to be completed systematically in other to actualise a research goal. The research methodology called "Chronological Scientific Research Methodology" was formulated and adopted by the researcher in other to actualize the research goal. It is made up of five different stages to be completed one at a time in descending order for the realisation of the research goal. These stages include Literature review, Description of the existing techniques, challenges of the existing techniques, feasible system solution and comparative analysis. See diagram below for more illustration.

An in-depth literature review will be carried out on ubiquitous computing and its relationship with RFID, use of RFID in hospital as well as brief information on mental illness. Source of information will be collected from academic journals and other related articles from the internet. The current technique use for the treatment of mental illness will be discussed briefly, followed by the challenges or problems posed by the current techniques. After which, the feasible system solution will be analyzed. The System solution is further breakdown into sub task which include formulation of the system architectural design, Sequence diagram to illustrate how the system would work after implementation and algorithm of the system solution. Comparative analysis will be done between the existing system technique and that of the feasible system solution, to determine the validity of the system solution.
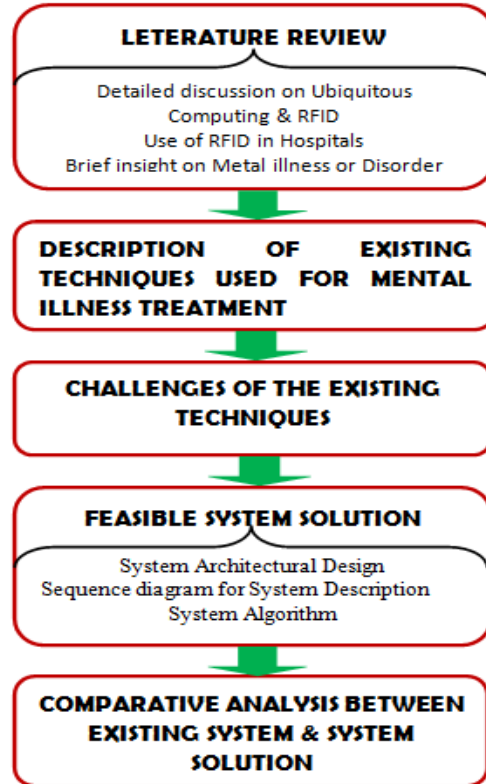
Fig. 1.1. Chronological scientific research methodology

3 Literature Review

Ubiquitous computing is an emerging technology that tends to revolutionise the use of computer hardware and software systems. [4], Defined Ubiquitous computing as the concept of integrating computer components into the physical environment, rather than having computers which are discrete objects. This means embedding computer hardware and software in other equipment and objects (such as walls, fridges and vehicles e t c) for use on a daily basis. That will enable prospective users to interact more naturally than they do presently, irrespective of their geographical location. In other words, "Ubiquitous computing is an advanced computing concept where computing is made to appear everywhere and anywhere" [5]. In ubiquitous computing, the hardware components are meant to be pervasive to users as they "become helpful but invisible force, assisting the users in meeting their needs without getting in the way" [6].

According to [7], Ubiquitous Computing is normally associated with a large number of small electronic devices which have computation and communication abilities such as smart mobile phones, contactless smart cards and handheld terminals etc. These small computers are set up with actuators and sensors, enabling them to communicate with the environment. The purpose of communication is to allow the dissemination of data or information within the environment and electronic devices. There are two main characteristics of ubiquitous computing which includes physical integration and spontaneous interoperation. Spontaneous interoperation is describe as a component that spontaneously interacts with a set of communicating components, that can adapt to changes both identity and functionality over a period of time as its status change [8]. For instance, a customer walks into a clothing shop that has a Smart Visual Display Unit (SVDU) mounted on the wall, which interacts with prospective customers. The system began to communicate with the customer by welcoming him or her for coming into the shop. The System (SVDU) is

capable to detect if the customer is an existing or a new customer. If it's an existing customer the system will address the customer by his or her name, interacting with the customer by informing him or her about his previous visit to the shop, the items he or she both and inquires from the customer what he or she intends to purchase at present. If the customer demand to know the price of a certain clothing outfit, the system (SVDU) will respond by telling the customer the price and other features of the outfit and convincing the customer to purchase it etc. Likewise if he or she a new customer, the system also interact with the customer by informing him or her about the various types of clothing outfits and model that are available, their prices as well as inquire from them what they intends to buy etc.

Physical integration in ubiquitous computing involves embedding computing infrastructure in building infrastructure; a smart space brings together two worlds that have been disjoint until now [9]. Smart space in this context, can be classified as a meeting room, hotel rooms and corridors etc. for example, a client checked into an hotel room, on opening the door, the lightings in the room were automatically turned on as well as the television set etc. [10]. Attest to the fact that "ubiquitous computing is considered an advanced technology to integrate real space and cyberspace, among existing things". In other words, a space or an environment consisting of Humans, interacting with networks of invisible computers for exchange and sharing of information anytime anywhere.

Ubiquitous computing has yet to be exploited to its full potential and benefits to mankind. However, technologies such as mobile phones, RFIDs, sensors, actuators and the web, have been utilise significantly to exploits its potentials since inception. An example of ubiquitous mobile application is the M-Payment software system. The software allows mobile phone owners to make direct payment for products purchased either in shopping mall or restaurants just like the conventional ATM cards. Ubiquitous web application is "designed taking into consideration that its contents must run as in a variety of platforms such as mobile phones, Personal Digital Assistants (PDAs) and desktop computers etc" [11]. Sensor devices are mainly embedded into various kinds of existing objects. They are specifically use for detecting the "movement of an object present state and distinguish between activity levels or even recognize special conditions or situations" [12]. For instance, a cup of tea fuses with sensor device to enable its user to detect its present state and to determine if the tea has gone cold or still hot for drinking.

Ubiquitous computing tends to possess numerous benefits in every facets of life. It has the ability for monitoring call logs, credit card records as well as observing or monitoring people in a specific geographical location for security purposes. It also gives "people the power to control the dissemination and spread of information about themselves" [13]. In addition, it provides mobile computing applications the enablement to know the physical location of things so that they can record them and report them to us [14]. For instance, an individual finds his or herself in an unfamiliar town and dare need of cash; mobile phone software can help the individual to locate the nearest ATM machine within the shortest possible time. It has the potential to enhance the productivity as well as limiting the costs in the healthcare sector. Assisting elderly and/or chronically ill people in their home environment, deployed to improve the quality of life and enrich everyday life in old age [15].

Radio Frequency Identification technology is one of the key components that has driven the use of ubiquitous computing in the last decayed. Radio frequency Identification is a generic term that is used to describe a system that transmit the identity of an in-animate and animate object wirelessly using radio waves [16]. Example of in-animate objects includes food items and other lifeless object while animate objects include living things such as humans and animals. The identity is a serial number that is uniquely allocated to an object. A unique number is used to identify an object from a distance without the assistance of any visible or sighting aid. In other words, "RFID is a technique use for the collection of data about a certain object without the need of touching or seeing the data carrier, through the use of inductive coupling or electromagnetic waves" [17].

Radio Frequency Identification (RFID) system is comprised of a Reader, Antenna and Tag as well as software. The tag can be either active or passive depending on the powering methods. Active tag uses an internal power source (battery) within the tag to power it frequently and its radio frequency (RF)

communication circuitry [18]. Passive tag depends on the power source from electromagnetic field of the reader because they do not have battery power source. In other words, they rely heavily on the energy source transferred from the readers' electromagnetic field to the tag. Radio frequency identification reader scans the tag and sends the tag information to the back-end database system that filters, analyzes, and stores the data [19]. In addition, the data or information is dispatched to other networked systems applications for more processing. Readers can be mounted in different locations within a community, transmitting information via wired or wireless system networks. The RFID antenna is a small coil either attached to either the reader or tag. In Addition, the antenna is sub divided into two namely reader antenna and tag antenna. The tag antenna is responsible for transmitting the signal containing the information stored on the tag. It also obtains signal or wave from the reader in other to supply power for passive tag. The reader antenna transmits the electromagnetic energy to activate the tag, recognizes the data transfer and forward the instructions to the tag [20]. In other words, the reader antenna is responsible for receiving information from the tag via a medium (wired or wireless).

RFID technology has impacted positively in the healthcare sector has it create active relationships between patients, healthcare practitioners (e g, doctors and nurses etc) and devices connected to the patients. According to [21], the connection allows speedy processing and delivery of vital information to the point-of-care through a variety of hand-held devices, while simultaneously delivering information to clinical data repositories such as the patient medical record. An example of vital information could vary from the patient's wellbeing, safety and security. In other words, RFID enable healthcare practitioner to ensure the safety and security for mainly patients that are at risk such as toddlers, patients with mental disorder and the elderly. Radio Frequency Identification technology provide healthcare facilities with the ability to identify, locate, track, and monitor patients, visitors, staff, assets, and equipment [22]. It is also used for tracking surgical instruments and treatment in hospitals. For instance, disposable surgical sponges are left unaware inside a patient after it has been stitched. This could result to fatal damages on the patients or lead to death. A Device called ClearCount consisting of RFID based tags and a special RFID disposal container used for the collection of discarded sponges, as well as a hand-held RFID reader to the body before stitching the patient [23]. The device also has software that assists nurses through the stitching process ensuring no sponge is left behind.

RFID technologies are used to support healthcare managements to locate and identify employees and patients in real time [24]. In addition, it simplifies the process of managing the care and discharge of patients, especially those who still needs constant observations and communication. RFID also provides a simple tracking solution of medical supplies from the factory to storage shelves, enabling efficient inventory management [25]. Also, RFID Systems are use for tracking of historical and modern medical facilities that are expensive. For instance, "Medical equipment that has historically been forgotten in storage is now tagged with RFID and easily found when needed" [26]. Despite the increase use of RFID systems in health sector, its potentials as not been fully explored in the aspect of improving the treatment of patients with mental illness. According to [27], mental Illness refers to conditions that affect cognition, emotion, and behaviour (e g, schizophrenia, depression and autism). These health problems are also identified as mental disorder. In addition, "Mental illness is a mental problem that significantly affects how a person feels, thinks, behaves, and interacts with other people" [28]. An individual is said to have Mental illnesses after the confirmation of a clinical diagnostic result on him.

According to [29], mental health disorders are medical conditions that disrupt a person's thinking, feeling, mood, ability to relate to others and daily functioning. There are different types of mental illnesses which includes "mood disorder (such as depression, anxiety and bipolar), psychotic disorder (such as schizophrenia), eating disorders and personality disorder" [30]. Bipolar is a mental illness that was previously referred to someone being agitated or overexcited without any reason. It affects the normal functioning of the brain so that the person experiences extreme mood of depression [31]. Psychotic disorder is when there is alteration in the chemical setting in the human brain. An example of psychotic disorder is schizophrenia. Schizophrenia negatively influences the usual performance of the brain. The symptoms of schizophrenia include hallucinations, Delusions, disorganised speech and behaviour. Hallucination is a false perception of objects or events and is sensory in nature [32]. In other words, it is a misrepresentation of the

senses that are real to the person. The affected person assume to hear, see feel and smell things that are not real. Delusion refers to a strongly held belief despite evidence that the belief is false [33]. People with delusion often have the feeling that there exist external forces that control their thoughts. Eating disorder occurs when an individual intentionally starving his/her self, resulting to excessive Wight loss called anorexia. That of personality disorder is when the behaviour of an individual deviates from the expectations of the society, leading to distress or impairment [34]. In other words, it is an unusual behaviour exhibited by an individual that is not acceptable in the society. The major courses of mental illnesses are mainly stressful circumstances, chemical in-balance in the brain, over dependence on alcohol and hard drugs such as cocaine etc.

4 Description of the Existing Techniques Used for Mental Illness Treatment

There are mainly three types of mental illness treatments used depending on the severity of the symptom. These include community mental health services, medication, Psychological treatments and Hospitalisation. Community mental health treatment is of three methods namely Acute Community Intervention (ACI) and Community Support (CS). ACI is when a team of mental health practitioners "who review and support people who are severely affected by mental illness, by visiting them in their homes or arrange for admission to mental home if needed" [35]. Community support is when a team of mental healthcare workers provides supports for a mentally ill person over a long period of time in their home.

Psychological treatment is of three methods namely Cognitive Behaviour Therapy (CBT), Interpersonal Psychotherapy and Dialectical Behaviour Therapy (DBT). Cognitive behavioural therapy (CBT) is talking therapy that can help you manage your problems by changing the way you think and behave [36]. It is mainly used to treat people with the symptoms of depression and anxiety. Interpersonal therapy is a "psychotherapy in which the focus is on a patient's relationships with peers and family members and the way they see themselves" [37]. It is often used for the treatment of depression. Dialectical Behaviour Therapy (DBT) was initially developed for the treatment of individuals that has chronic suicidal ideas. However, DBT has "evolved into a treatment for multi-disordered individuals with borderline personality disorder (BPD)" [38].

Hospitalisation or mental home treatment is used for treating persons who are acutely ill and needs thorough treatment for a short or long term [39]. Short-term period often takes between one to three months while long-term takes three to six month; depends on the severity of the Mental Illness, especially those with psychotic symptoms such as schizophrenia. Mental hospitals or homes are often run by the government and private practitioners. Most government mental homes are located in hospital environment while that of private homes are often located outskirt or countryside of a major city. Speaking from experience, some mental homes comprise of various rooms having toilet and bathrooms a single lounge room, garden, Staff offices and kitchen as well as fitness lounge. Patients are allowed to go for a walk or sight viewing in the garden. The garden is always located within the premises of the mental home for security purpose. Mental home management staff cannot afford to admit patients beyond the capacity of the number of rooms or bed space available in the home. For instance, if there are just twenty rooms in the home it means Management staff can only admit only twenty mental ill patients at a time. Other mental illness treatment is Antidepressant and Antipsychotic medications, Electroconvulsive and Involuntary treatment etc.

5 Challenges of the Existing Techniques

There are different strategy and method used for the treatment of mental disorder patients admitted into hospital words or homes. Especially, when the illness is severe to the extents the patient becomes vulnerable to itself and the general public. For instance, when the patient poses the risk of committing suicide, use of sharp object to cut their body part (e g. wrist) leading to excessive bleeding, being irrational by harassing anyone that come close to them such as spiting etc. Patients that exhibit such traits due to mental illness are

placed on a special type of treatment called One-to-One observation. The observation may be close or at a distant range depending on the severity of the patient vulnerability. A member of staff (usually Mental Healthcare Assistant or Mental healthcare nurse) is mandated to observe the patient. The observation process may last for days, weeks or even months depending on the patient's responsiveness to treatment.

Patients under one-to-one observation are allowed to take a walk to the garden within the hospital premises for sight viewing and other sporting activities Accompanied by a member of staff. Also, they are allowed to go out from the hospital ward for shopping, cinema under the supervision of a member of staff. Speaking from experience, most of these patients seize the opportunity to abscond despite being accompanied by member of staff. When such incidence happens, the job of the mental health management team on duty is at stake. The management team must search for the patient and make sure he or she returns back to the mental ward. In most cases the police are called upon, to search for the patient, which may cost the mental health management team or government lots of money. Some of these patients placed under observation, verbally or physically assault staff members deliberately who are observing them. They also do not like the idea of been placed under constant observation or being followed by member of staff at all times. They feel that their privacy have been snatched away from them. This could lead to some of them become more agitated and loss of self confident.

Community treatments also have some challenges. For instance, a patient with mental illness receiving treatment at his own apartment has been instructed not to go to the pub for a drink or night club, due to the nature of his illness (such as patient who had just undergo Detoxification). He or she may ignore such instruction, and do otherwise because he knows that he is not under the watchful eye of any mental healthcare worker. Definitely, his health will drastically deteriorate more than ever.

6 Feasible System Solution

The researcher as propose a system solution called "Real time RFID (in built Sensor) Monitoring Middleware System" that will drastically reduce the challenges posed by the existing observation treatment technique, used for the treatment of patient with mental health disorder. The proposed system solution will assist the management of mental healthcare and their staff members perform their observation duty effectively and efficiently with modest human intervention.

The system is made up of an active tag, antenna, reader, middleware software, track & trace application software, work stations, switch and saver. The active tag is comprised of a responder, memory, sensor chip, and a frequency transmission of 433 MHz. An Active tag with transponder wait until it receives signal from the reader before the responder will send a signal back with the relevant information about the patients hereabout. This makes the active tag to be efficient and effectively, due to the fact that tags with transponders conserve battery life when the tag is not within the range of the reader. The inbuilt sensor chip detects and transmits vital information about the patient mental state. The information could be checking if the patient is running temperature or is agitated, drunk, under the influence of hard drug etc. The memory stores the patient personal information such as the identification number, name of the patient and the type of illness symptom he/she is suffering from at present. In addition, each tag as its own unique number use for identifying patients in the mental home.

The type of the antenna suggested by the researcher is that of circular polarized antenna with a high rate of 35 foot coaxial cable (LMR-400 Series). This antenna receives and transmits radio signals at a high frequency between the ranges of 865 to 965 MHz. It was chosen because of dynamic nature of the tags. In other words, patients to be tag are not based in the same place as they move from one place to another. An integrated RFID reader with an ultra high frequency (UHF) rate of 865 to 868 MHz is used and connected to the Antenna. It combines the functions of both antenna and reader in a single device, enhancing the performance of the external antenna. The RFID reads and write information to the RFID tags via the antennas.

The middleware enables the interconnection of the hardware components and the software program (Track and Trace application program). It will allow mental health practitioners to obtain and manage real time information concerning patients, as well as sharing information throughout the entire system effectively and efficiently. The Track & Trace application software enables member of staff to visibly observe the location of any patients irrespective of their locations on real time. Member of staff may access this information by logging onto the computer system that is connected to the network system. See the Architectural design of the proposed system solution below for more insight.
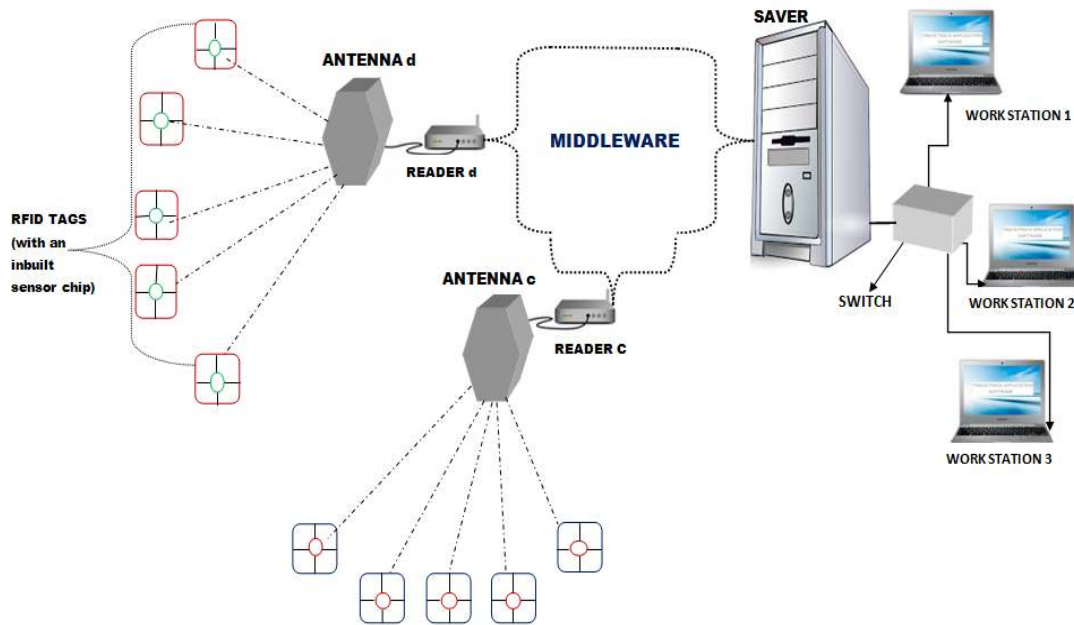

Fig. 1.2. Real time RFID monitoring middleware system

7 How the System Works in Real Time

The RFID tag is of wearable wrist band to be worn by all mental patients residing in the mental ward or home. Each tag uniquely identifies a patient, whose memory stores the Information (such as the patient identification number, name and the type of mental illness) relating to the patients. The memory of the tag also stores information (Such as the patient's level of temperature, agitation and drunken etc) or data from sensor feedback at any point in time. The Reader(s) transmit a message to the tag via the antenna, requesting for information about the whereabouts or location of every patients in the mental home or ward. The tags will then respond enabling the readers to receive or obtain the information via the antenna. The information obtained can only be accessed by the middleware from the various RFID tags via the reader(s). In Addition, the middleware enables staff member to have access to these information (such as the identity of the patient, his/her health status and location) via application software called "Track & Trace". Below is a sequence diagram for more insight on how the proposed system works.

From the sequence diagram above, it shows that the middleware plays the most important role in the entire system components. It controls the networking aspect of the RFID Reader(s) and the Track & Trace application software, providing an easy way to update the performance of different models of Reader(s) connected to the network. The primary function of the middleware is to obtain and integrate data from different Reader(s) simultaneously, processed these data into useful information. During Data procesing, data obtained from different sources (RFID Readers) are filtered and sorted in other to provide the users

(Staff of Mental Care Homes or Hospitals) with significant information, based on events that happened on real time. The filtering process enables superflous or repetitive data recieved from different tags via Reader(s) to be eliminated, so as to obtiain precise and accurate data (e g. the locations patients, their temperature level and detection of the related mental illness symptom on real time). The Filtering process also speedup the network transmission process and prevent the database (Server) to full up qiuckly.
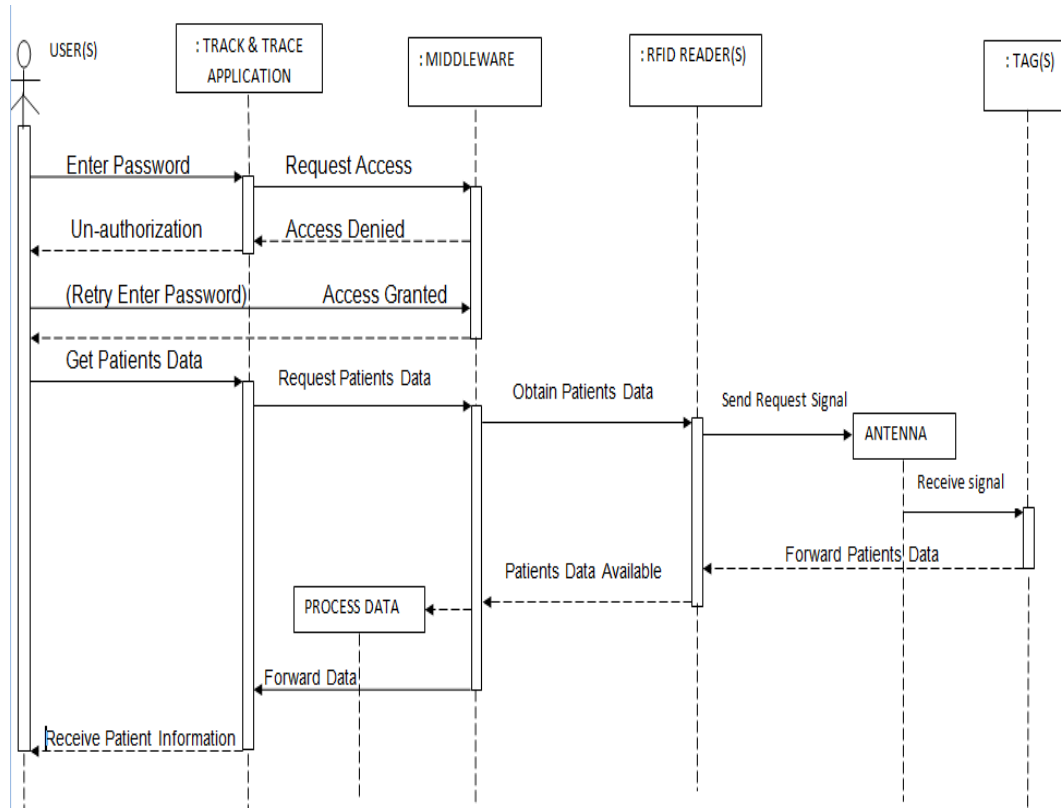

Fig. 1.3. Sequence diagram illustrating how the propose system works

The middleware also determines the destination (workstation residing on the network that requested for the informtion) to forward the information and when, on request by users. It has the ability to monitor and assign tag identification numbers to pateints. In other words, it can determine the tag Identification numbers that have been used as well as the patients that have already been assigned tags. In Addition, the middleware make sure that information is readily available for users to access via the Track & Trace Application Software. The Track & Trace application software gives users (as long as their PCs are connected to the network) the privellage to input informtion such as from which locations to read from, how to filter the information and the method to present findings or result information. It also allow users to receive reports or messages whenever an event occurs such as the wherabout of a pateints that abscorned from the hospital or mental home premises. The algorithm of the middleware in dipicted below for more insight.

7.1 Middleware algorithm (Pseudo-code)

In line 2 to 4, the performance of Reader(s) and Tag(s) are checked peradventure anyone has a problem; request is made to either add new tag/reader or resolve the problem of the existing one and start afresh. In line 5, it proceeds if Readers/Tags are working perfectly by Storing and allocating tags to patients. In line 6, patients personal information () Stored on tags (already assigned to patients) can be obtained. In line 9 up to

12, Data is requested from tags via reader(s) about the locations of the patients. These data are then processed by eliminating duplication of data thereafter converted into useful information pertaining the whereabouts and the health condition (such as the level of temperature, any feeling agitated, drunk or on illicit substance with the help of an inbuilt senor chip in tags) of each patients assigned a tag on real time. All these information are dispatched to the destination server (Database). Mental Health Staff Members can then access information from the server via the Track & Trace application software regarding the present location of all patients that are wearing the tag. See snippet of algorithm below for more insight.
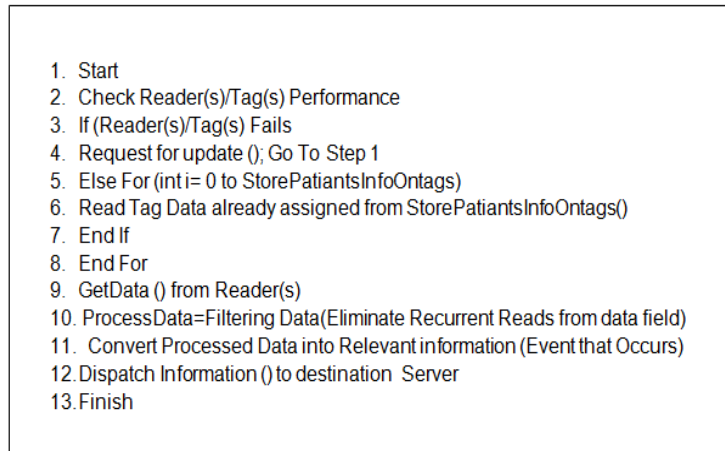
```
1.  Start
2.  Check Reader(s)/Tag(s) Performance
3.  If (Reader(s)/Tag(s) Fails
4.  Request for update (); Go To Step 1
5.  Else For (int i= 0 to StorePatiantsInfoOntags)
6.  Read Tag Data already assigned from StorePatiantsInfoOntags()
7.  End If
8.  End For
9.  GetData () from Reader(s)
10. ProcessData=Filtering Data(Eliminate Recurrent Reads from data field)
11. Convert Processed Data into Relevant information (Event that Occurs)
12. Dispatch Information () to destination  Server
13. Finish
```

Fig. 1.4. Algorithm for the middleware

Upon implementation of the proposed system, mental healthcare managements would be able to get real information regarding the locations and wellbeing of their patients kept under their custody. In a situation whereby a patient absconded from the ward or hospital premises, it can easily be tracked down facilitating the process of bringing him/her back to the ward or hospital. Also, it will enable the management to have real information about the present health status of the patients on real time. Symptoms such as patients running temperature, feeling agitated and drunk as well as under the influence of illicit drugs (e g. Cocaine and Marijuana etc) can easily be detected on real time via the inbuilt sensor on tag. With this handy information, it will enable management to administer treatment to the patient efficiently and effectively.

8 Comparative Analysis between Existing Surveillance System and the Feasible System Solution

Over the last decade to date, Close Circuits Television (CCTV) Camera System has been deployed for monitoring patients with mental disorder in mental health hospital wards. It has been estimated that thirty-four National Health Service (NHS) Trusts admitted to use of CCTV cameras to monitor patients in their mental wards [40]. This sum to one hundred and fifty-seven wards located in approximately eighty-three mental health hospitals in both England and Wales. The use of CCTV Cameras on mental wards is not only limited to the United Kingdom as study has shown that its use is also increasing in the United States and Canada. Management in most mental homes have attested to the fact that they mount CCTV cameras in patient's rooms and rest room as well as within and around the mental health hospital building complex.

The intention for using CCTV surveillance is acceptable due to the fact that they make hospital surroundings safe and secure for patients with mental disorder, visitors and mental health management staff. Research studies have shown that "the presence of cameras in the ward environment is more likely to incite a violent response because the cameras heighten levels of paranoia that are associated with their delusions and mental

health problem" [41]. Especially patients suffering from schizophrenia and other related psychotic symptoms are likely to be violently unpredictable when they are under CCTV surveillance.

Most in-patients are of the notion that the installation of CCTV cameras in their rooms and within as well as the hospital environment is interfering with their privacy and rights. This complains do not always go down well with the management staff of mental health care hospitals. Common sense will help us to know that patients suffering from chronic anxiety and delusional symptoms are likely to be agitated and isolate themselves from both inmates and staff members due to the presence of CCTV cameras. This can pose difficulty to member of staff in assessing the wellbeing of such patients, because they are more likely to find solace in themselves by not expressing their feelings to staff members.

Real time RFID Monitoring Middleware System which is the propose system solution has the capability to resolve the above challenges that the CCTV poses, as RFIDs Tags are only warn on the wrist by patients, the issue of privacy and rights is drastically reduced to the barest minimum. Also, the issue of patients resorting to violence due to the presence of CCTV cameras will be of the thing of the past. Because the proposed system as the function to monitor patients without displaying the physical appearances of patients. Another important feature of the Propose system is that it has an in-built sensor chip located in the RFID Tag that automatically detect the temperature level, possible agitation and anger symptom that may lead to unpredicted violence from the patient. With this information on hand, staff management can effectively and efficiently administer the right treatment to patients.

CCTV cameras do not have the ability to monitor or determine the whereabouts of patient whenever they absconded from the hospital premises into the society. However, the proposed Real Time RFID Monitoring Middleware System Network if implemented can detect and inform hospital management staff about the actual location the absconded patients on a real time within the society. This will enable the facilitation of the absconded patients to be apprehended and brought back to the hospital mental words within a limited period of time. Also, with the aid of RFID tags, staff management can easily monitor the wellbeing of out-patients in their respective homes that are still under treatment. Unlike the CCTV that possesses only the ability to monitor patients within and around the hospital premises.

9 Recommendation

The researcher strongly recommends that the mental health hospital management should considering investing into the proposed system upon its implantation. Because of its effective features (Discussed above) which it possesses compared to the CCTV cameras. In addition, management staff may even obtain the proposed system to compliment their existing CCTV camera Surveillance System for optimum security and safety of both patients and staff. That is, if they have the resources to maintain both system in a long term. Also, mental health stake holders around the world should look into the possibility of enhancing the function of the present surveillance system (CCTV) or do away with it at rightly, by investigating about the propose system features. On, how it could be implemented and be made available at a low cost to all mental health hospitals or homes, both in the developing and developed countries. As it will go a long way to enhance treatments and the Wellbeing of both in and out patients with mental illness. It will also reduce the incidents of violence posses by patients in the mental wards or homes.

10 Conclusion

In conclusion, the research topic under study has addresses the challenges the existing systems used for the treatment of patients with mental illness. It also proposed a workable Real time RFID Monitoring Middleware System (RRMS) that would drastically resolve these challenges upon implementation. The features of the proposed system were extensively discussed and how they can actually be of great assistance to mental healthcare management. For instance, in-patients will have the mindset that their privacy is secured to a reasonable extents, patients absconded from the mental homes or hospital ward can easily be

detected and traced his/her whereabouts thereby bring him/her back to the mental home, vital information regarding the wellbeing (level of temperature, agitation and blood pressure) of the patients can be obtain efficiently via the inbuilt sensor in the tag and out-patients who are still under care and minor treatment can be observed or monitored in other to checkmate their wellbeing in their respective individual residence etc. Comparative analysis was done, between the existing system used for monitoring patients with mental illness and the proposed system, in other to checkmate the validity of the proposed system solution. In the future, the researcher intends to implement and develop robust real time RFID middleware system software. That will capture the graphical image of patients. So that patients need not to be admitted into hospital mental wards for treatment but can obtain treatment from their respective homes conveniently. In other words, it will improve community mental health services and gives patients the option to be treated at home or be admitted into a mental hospital ward.

Competing Interests

Author has declared that no competing interests exist.

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