RFID: IN THE WORLD OF HEALTH CARE

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ABSTRACT: The RFID (Radio Frequency Identification) is a decade old wireless technology based on radio frequencies and is a member of automatic identification and data capture (AIDC) family. Its first application was seen around in the year 1945 and in recent years numerous of applications have been evolved and is practically implemented in approximately each and every field. The motive of this work is to survey the different applications in present scenario in the field of healthcare.

Keywords: RFID, AID

INTRODUCTION: Radio Frequency Identification (RFID) is based on storing and remotely retrieving information or data as it consists of RFID tag, RFID reader and back-end Database 1. RFID uses the electromagnetic field for the transfer of data with the purpose of automatically identifying and tracking products onto which the tags are installed. The basic working phenomenon of RFID is shown in Fig. 1. This is a wireless technology and is better than other AID devices such as barcode etc as in this technology object can be tracked without any line-of-sight. RFID is an epic technology as it was used in the World War II as an IFF transponder to identify whether the aircraft is of a friend or a foe and is still used to this day. RFID has evolved to be the most drastically growing technology of this era or it may also be referred as the technology of 21st century.

RFID is continuing to become popular because it increases efficiency and provides better service to stakeholders 2. Applications of RFID are present everywhere which accelerates the job and also make things easily accessible. Its application can be explored by simply placing tags to the objects and the tags can be attached to any physical object, including medicine containers, hospital room equipment, vehicles, medical devices, envelopes, packages and even animals and humans 7. RFID
has found its firm applications in field of inventory, logistic controls, tracking, transportation, security, military, education, hospitals, health care etc. Fig.2 shows the long range and short range application of RFID.

Beside, numerous of the advantage and application of RFID there still exist major privacy problem. Many researchers have addressed issues that are related to RFID reliability and capability. RFID acts as a catalyst in performance of various applications yet has to prove its capability.

Research Framework:
In this framework, the existing literature has been categorized into various sections. Where,

Section 1 gives the brief introduction to RFID its working phenomenon, its applications etc. Section 2 deals with the framework of the research work.

Section 3 describes the application of RFID in health care i.e. in medicines, treatment, clinic, hospitals etc.

Section 4 consists of conclusion and discussion.

The focus of this work was to identify potential and role of RFID in mankind i.e. health care and also the future world of healthcare under the RFID technology.

Applications of RFID in Health Care:
Today's health care system has a sparkling opportunity for increasing the use of RFID, a wireless technology to improve the patient care. From a physician's office to an operating room, wireless technology provides great potential for such services as medical device alarm notifications, surgical instrument and hospital equipment tracking, and e-prescription writing. RFID technology is emerging within the health care arena to improve patient care and efficiency of the hospital.

In health care the use of passive tags are done which operate at frequencies 128 KHz, 13.6 MHz, 915 MHz, 2.5GHz and are applicable for both large area and small area e.g. logistic control of hospital, and movement of patients in hospital respectively and the role of small range application are more in health care. The application of RFID in health care can be classified into sub-headings as-

1. Asset management and tracking
2. Patient tracking and identification
3. Reducing drug and blood administration errors
4. Nutritional assistance
5. Health management for aged group

Asset management and tracking:
In hospitals the main motive is to provide comfort and proper care to the patients. Therefore, to attain the best response it is needed to manage the asset of all sorts whether be medicines or various equipment like scissors, wheelchairs etc. without any human errors. The RFID technology is resulting into an ease of access to objects without any line-of-sight and thus making things smarter and better. The asset management in health care with RFID are used are as elaborated below-

Smart Cabinet: RFID installed in a medicine hall keeps the record of the stock of medicines by
placing the tags on each medicines, syringes etc. as shown in Fig. 4.

The use of RFID as smart cabinets (smart shelves 20) has made the medicine hall more accurate and smart as it can detect the expired medicine so that it cannot become harmful to any patient by keeping healthcare its priority and also remind on the shortage of medicines. The process of operating smart cabinet is that firstly the users (staff/ nurses) identify themselves with a personal key card to open the door. Then they remove any item from the shelf. It’s obvious that all items in the Smart Cabinet have RFID tags attached to them and thus the information is captured in real-time so managers always have knowledge of what they have in stock.

**Smart Equipment:**
The real-time location service 8 is also provided by RFID which can be used by all medical staff in search of medical asset. RFID tags are installed on each and every equipment whether be small or large (wheel chairs, IV pumps, instruments, beds, patient’s file, high-value equipment etc.) it is basically done to track the location of the equipment in the hospital 5 and get it easily when required. The RFID tags are installed on wheelchairs so that it can be easily accessed by the staff of the hospitals as shown in Fig. 5. Same is the task with other equipment and devices to check whether its free or engaged by making it easily accessible and accelerating the procedures so that it can be used as early as possible to secure the patient’s health.

The “Beth Israel Deaconess Medical Centre” in Boston is an example which uses such services of the RFID to keep track of their medical equipment 4.

**Smart Cards:** Staff is the biggest asset of the hospital so its flow and management is very necessary.

With the help of RFID based smart cards the record of staff can be kept such as name, currier history, reporting time, whether present/absent and many more information as per requirement of hospital. The use of smart card in an organization also helps in locating the doctors/nurses so that patients can be examined on time.

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The nurse scans the bar code on the medication package and RFID tags on both the patient's wristband and the nurse's identification badge. Updates or changes to a patient's medication order are available in real-time, providing the nurse instant access to those changes, and the system also automatically charts each medication administration into the patient's Electronic Medical Record (EMR), saving data entry time and reducing the opportunity for human error. RFID technology is used on the patient's wristband and the caregiver's ID badge as it does not require direct contact or line-of-sight. This technology helps giving correct medications to the patient on time and also maintains the proper prescription electronically by reducing the chance of destruction and misplacement.

RFID sensors have been used to monitor through wireless communication the heart-rates of cardiac patients, to identify patients for surgery, to help locate embedded devices (pervasive healthcare) and to monitor the life of dental retainers.

Reducing drug and blood administration errors: Smart Surgery Tray:

Hospitals are getting smarter by the use of wireless technologies. The use of RFID in surgery tray has reduced the error more efficiently, this may be proved by the statement given by Adrianne Shepards on, manager of Maryland’s Central Pharmacy Services- “A RFID scanner now does the work. A tray is placed in the machine and seconds later a monitor lists what’s missing or dated which reduces delay”. Such technology is very helpful in trauma centers and emergency cases. The figure8 shows the smart surgical tray.

Tracking blood bags:

Occurrence of error in transfusion of blood is the major problem faced by hospitals which has become unacceptably frequent and severe.

Mis-transfusion of blood is the incorrect type of blood given to the patient due to the lack of identification which may result into serious health problems and even death. According to [Sun05], mis-transfusions typically result from an error made during the bedside check just prior to transfusion. Studies have documented [Saz90] that such errors are most likely to occur among surgical patients.

Implantation of RFID tags in the blood bags may decrease the error rate by tracking every bags of blood and by checking that the blood is given to correct patients. This is done by matching the information fed in the tag of blood bag and the information in the wrist band of the patient.

With the evolution of RFID technology in healthcare the overall process of managing blood bags is eased and is also time-saving. Most importantly, the risk of patients receiving the wrong type of blood is minimized.

Anti-counterfeiting of drug:

Drug counterfeiting is very harmful and also effects

- Reduces the safety of patient.
- Pharmaceuticals face loss of millions per year due to counterfeiting supply of drugs.

This problem is being taken seriously and in February 2004 the U.S. Food and Drug Administration (FDA) published a report encouraging the use of RFID to combat it and urging the drug industry to adopt the technology.
The use of RFID technology (i.e. tag, readers, antennas, and appropriate information systems) in making world of anti-counterfeiting drug is possible by the unique ID of each tag which are recorded or traced by every transactions made. This technology keeps the transparency in all stages from manufacturing to delivery i.e. the whole supply chain is monitored resulting into the diminishing of drug counterfeiting and even thefts related to drugs.

**Nutritional Assistance:**
The worldwide healthcare sector also includes the nutritional assistance according to the public base on their dietary requirement, food choices and diseases.

The RFID based plate coaster can give the report of whether the patients are consuming right food or not on the basis of nutritional value of food to be consumed and it even checks the expiry date of food items in the plate.

The RFID tags are utilized to access nutrition information for each kind of food in delivery to patients in the hospital, in old age home, residents, etc as shown in Fig.9.

![FIG.9: RFID BASED SMART PLATE](image)

The technology is taken under use by placing food plate on a coaster with an RFID reader and built-in scale. The in-built miniature scale measures the weight of the food placed on the RFID based coaster. In addition, the nutritional information regarding food is read by the RFID reader from the tag in the serving bin of the hospital canteen. With the nutritional information of each item of food and the amount of particular item of food that is added to the plate, the nutritional intake of a patient can be calculated. After this process the total nutritional information including the amount of vitamins, calories, sugars, carbohydrates, and grams (g) of consumed fat in the meal can be obtained and tracked.

**Health management for aged group:**
The health management in older age is very necessary as the patients’ needs routine check up and well equipped room so that in case of emergency any situation can be handled effortlessly. Chronic diseases are the greatest health threat faced by the elderly in an aging society. Health monitoring using RFID technology is predicted as the next stage in home care due to its great potential as a low-cost and high patient-safety medical service.

The use of RFID in health care has made easy to access the patient far from hospital/clinic, it performs following functions-

- Provides the real-time monitoring of the patients’ health,
- Keep on analyzing the vital signs at early age and also predict the life-threatening diseases,
- Check whether they are following their prescribed treatment, including taking their prescribed medicine on time.

![FIG.10: BLOOD PRESSURE MANAGEMENT OF PATIENT AT HOME FROM HOSPITAL](image)

Fig.10 shows the setup for the RFID based BPMS (blood-pressure management system) of the patient of old age. This setup requires the use of internet, smart phone, touchpad, PC (personal computer), tag attached to the body of patient, reader.

**DISCUSSION AND CONCLUSION:** RFID has been hailed as one of twenty-first century’s greatest contributions. It has turned to be a technology
providing new capabilities and efficient methods for several applications for example, in healthcare, access control, railways, sports, farms, agriculture and food etc. However from the above discussions it can be concluded that RFID has proved its evidence and efficiency in health care as it has become the reliable source for reduction in human errors in stock keeping (medicines, equipment etc.), surgeries (to detect the sponge or cotton left inside the body of patient during operation), medication, nutrition, billing etc.

RFID facilitates the adaption of location tracing technology in health care and shows the importance of real-time access. The use of RFID in biometrics, telemedicine, radiology, infection control, injection safety, etc. will be inherited by pharmaceuticals and hospitals in future. RFID has resulted into the fruitful technology and in coming years it will be adapted by many organizations to keep easy access over all objects.

ACKNOWLEDGEMENT: I would like to thank organizers of national conference entitled ‘Novel Tools and Treatment Approaches in Health Care System’ for selecting my paper for poster presentation, organized at Faculty of Pharmacy, Integral University, Lucknow on 3rd March 2015

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