**RFID Personnel Identification Proposal**



**Team 1**

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**Abstract:**

When firefighters are injured during a mass casualty event, triage personnel must assess injuries as well as access medical information during the triage process. Currently the process of gaining relevant medical history requires communication with the injured firefighter. While effective, it still takes valuable time to obtain required information. Also, if the injury resulted in lack of consciousness, obtaining relevant medical history may not be possible. To assist in the triage of injured firefighters, it is proposed to implement a radio frequency identification (RFID) system to identify injured firefighters. By integrating RFID technology into the triage process, triage personnel will be able to access pertinent medical information without directly communicating with the injured firefighter.

Each firefighter will be equipped with an RFID tag that contains a unique identification number. This identification number corresponds to information stored on a secure local database. This local database will be dispatched with the mobile care unit to the incident zone. Triage personnel will use an RFID scanner to retrieve the identification code from the injured firefighter’s RFID tag. The identification code will then allow triage personnel to access the information corresponding to the firefighter from the database.

**Scope:**

***The following are within the scope of the project:***

* Selection of RFID tags and RFID scanner that are compatible with one another
* Programming identification code on passive RFID tags
* Creation of database that holds medical information for 200 firefighters
* Encrypting medical information stored on local and master databases in accordance with
* Advanced Encryption Standard (AES) specifications [1]
* Synchronizing information on master database with local databases

***The following are not within the scope of the project:***

* A training course for usage of the RFID system
* The creation and distribution of training documentation for the RFID system
* The selection and design of the necklace the RFID tag will be secured to
* Gathering and inputting firefighter medical information

**Constraints:**

***The following are technical constraints of implementing the RFID system:***

* RFID device shall maintain full functionality in temperatures ranging from -20 degrees fahrenheit to 180 degrees fahrenheit
* RFID device shall have an Ingress Protection Rating (IP) of 55 [2]
* Operational range of RFID tag shall be a maximum of 1 meter
* RFID device shall be passive-energized by RFID scanner
* RFID device shall be maximum of 10 centimeters long, 10 centimeters wide, and 3 centimeters thick
* RFID device shall operate at frequency less than of 1 GHz
* RFID device shall have minimum of 24 bit memory capacity
* The database shall be able to manage over 200 personnel records

***The following are non-technical constraints of implementing the RFID system:***

* All aspects of the system shall conform to the Health Insurance Portability and Accountability Act (HIPAA) [3]
* The RFID tag and scanner shall conform to all Federal Communications Commission (FCC) radio spectrum allocation regulations for RFID devices [3]
* The scanner shall be fully operable by triage personnel wearing medical gloves
* The system shall employ commercial off the shelf components (COTS)
* All medical records shall be encrypted according to the AES specification [1]

**Approach:**

The proposed RFID system will be implemented using three components: passive RFID tags that will be securely equipped to necklaces worn by firefighters, a computer tablet equipped with an RFID scanner that can access firefighter’s medical records, and a master database stored in a server at the firehouse. Each firefighter will be equipped with a RFID tag that will store an identification number unique to each individual firefighter. The RFID scanner will then send a signal to supply power for the RFID tag to transmit the identification number. This identification number will then be used by the scanner to perform a lookup on the local database to retrieve and display medical records. The master database will allow firefighters to update and modify their existing medical information and will synchronize with the local database on the computer tablet.

**Feasibility:**

The three components of our proposed project are the passive RFID tag, the computer tablet equipped with an RFID scanner, and the master database stored in a server at the firehouse. Each of these individual components have examples that are implemented in the real world. The XTREME RFID Rivet Jr tag currently sold by Atlas RFID fits all technical constraints relating to the RFID tag set in this proposal [5]. Passive RFID technology is already implemented to identify lost animals. Common house pets, such as cats and dogs, are implanted with passive RFID tags the size of a grain of rice [6]. If a pet is found that has a tag, veterinary technicians are able to read the identification code using a RFID scanner that corresponds to an entry in a database [6]. This entry contains owner contact information so the lost pet can be reunited with it’s owner [6]. This method of acquiring RFID information and searching a database is similar to what is being proposed in this paper. The DT395BT Rugged Tablet is an example of a computer tablet capable of scanning RFID tags, storing a local database, and displaying medical information to its operator [7]. Finally, the master database could be stored on a fire department owned computer allowing authorized operators to login and make changes to medical records. These updated records can then be synchronized to the computer tablet utilizing the transmission protocol (TCP) to send data from the server application running on the firehouse computer to the client application running on the tablet.

**Resources:**

***Personnel:***

The RFID-1 team will do all research, planning, and analyzing of the system. This team includes Troy Caplinger, Robert Lang, Vincent Haenni, Anthony Inman, and Jonathan Carpenter. Other personnel that will assist the RFID-1 team in accomplishing tasks include instructors, teaching assistants, and industry professionals. The instructors are Dr. Fred Garber, Eric Buck, Brandy Foster. The teaching assistants are Ma Joelle Lingat and Saqeb Iftekhar. Firefighting and medical professionals such as Fire Chief Christopher Carpenter of the Riverside Ohio fire department.

***Facilities and Equipment:***

The facilities available to the RFID-1 team include the Fritz and Dolores Russ Engineering Center computer labs 152B and 152E, which include printers and computers with access to MATLAB, Mathematica, Solid Works, Microsoft Office, Microsoft Visual Studio, Netbeans, and Notepad++.

**Challenges/Mitigation:**

* Challenge: Medical personnel operating computer tablet with medical gloves, which may result in reduced functionality of the touch screen capabilities.
  + Mitigation: Equip user with a stylus or compatible gloves
* Challenge: Conforming to HIPAA privacy constraints
  + Mitigation: Encrypt medical information stored on the master and local databases

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**Works Cited**

[1] National Institute of Standards and Technology. (2016, January 29). *Advanced Encryption Standard Algorithm Validation List* [Online]. Available: http://csrc.nist.gov/groups/STM/cavp/documents/aes/aesval.html. [Accessed: 05-Feb-2016].

[2] DSM&T. (2016). *IP Rating Chart* [Online]. Available: http://www.dsmt.com/resources/ip-rating-chart/ [Accessed: 05-Feb-2016].

[3] Federal Communications Commission. (2016). *Radio Spectrum Allocation* [Online]. Available: https://www.fcc.gov/engineering-technology/policy-and-rules-division/general/radio-spectrum-allocation. [Accessed: 05-Feb-2016].

[4] U.S. Department of Health and Human Services. 2008. *Privacy* [Online]. Available: http://www.hhs.gov/hipaa/for-professionals/privacy/. [Accessed: 05-Feb-2016].

[5] AtlasRFIDstore. (2016). *XTREME RFID Rivet Jr Tag* [Online]. Available: http://www.atlasrfidstore.com/xtreme-rfid-rivet-jr-tag-pack-of-10/ [Accessed: 05-Feb-2016].

[6] Intervet Inc. (2016). *How Microchipping Works: How to Microchip Your Pet* [Online]. Available: http://public.homeagain.com/how-pet-microchipping-works.html [Accessed: 05-Feb-2016].

[7] Group Mobile Inc. (2016). *DT395BT Rugged Tablet* [Online]. Available: http://www.groupmobile.com/specs.asp/sku=7515/dept\_id=/mf\_id=83/DT395BT+Rugged+Tablet.html/ [Accessed: 05-Feb-2016].