MedID

A lifesaving RFID technology

Thesis Proposal
Mike Brinker
4/12/04

Table of Contents

Brief Description:

MedID is an out of sight, out of mind medical technology that can save lives. This device consists of two parts. The first is a small tag that is easily concealed on an individual and carries crucial medical information. The second is a reading device that, in the case of an emergency, a paramedic or doctor could use in a hands free way to access this important information. This protected medical information would then allow doctors and paramedics to quickly and easily diagnose and identify medical conditions and emergencies on a patient to patient basis. MedID is a truly unique medical system because it is powerless and wire free!

Project Overview:

Radio Frequency ID is starting to see mainstream use in many large scale consumer product outlets. This active barcode technology allows for quick and easy product tracking at every stage of the marketing and development process of a variety of store bought products. With such a scaleable technology and potentially cheap hardware to produce, RFID is quickly moving into the human interface world and will see some exciting uses involving ubiquitous computing.

The ability to track and quickly identify any goods on store shelves gives many retailers a broader sense of their inventories and allows them to better manage large scale shipments and replacements of said goods as they pass in and out of their stores. Medical applications for RFID are quickly becoming accepted as a safe and effective means in which to track Alzheimer's patients in hospitals and to easily keep track of pets and children. Once this technology gains mass appeal, what other potential venues are available for using such a cheap, simple and effective identification technology?

Such technology has yet to be used effectively as preventative measures for medical complications of an average live at home individual. Many devices have come and gone that claim to help or aid the elderly in medical situations. Such brand names are easily recognizable (Life Touch) but are deplorable in concept and highly ineffective at both preventing and solving medical crisis' in a time effective manner.

To better understand the intention of this project and the underlying problem, below is a sample scenario that I feel is worth potentially solving with the current state of RFID technology.

> *"An individual at their personal residence needs medical assistance and dials 9-1-1 but does not remain conscious for long. As paramedics arrive on scene, they are faced with many questions. Who is the individual in need of assistance and what is the nature of their problem? Does the medical emergency require medical assistance elsewhere or immediate resuscitation on the scene? What are the victim's vital signs? Is there an important medicinal history that could be vital to solving the medical problem?"*

The above situation is quite often the brunt of any paramedics work during an average day. The time taken to answer those questions can ultimately determine the victims' chances of survival. It is my goal to aid a paramedics decision making process by potentially answering some of these questions using RFID technology. The key to potentially uncovering a viable solution to the problem lies mainly with the transparency of the technology involved, and a system that is totally passive that can be referenced only if the paramedic has the time or needs the information.

Radio Frequency Identification (RFID) is a system of transmitting a unique encrypted number wirelessly between a tag and transponder (reader). The number is 96 bits long and has enough unique combinations to potentially label every atom in the universe. RFID is both interesting and unique for a variety of reasons. The system of reading embedded tags does not need line of site transmission like a barcode reader. Instead, multiple tags may be read simultaneously just by being within a few feet of them. RFID tags are unique in that they come in two flavors, passive and active. Active tags are usually powered by a battery of some sort, allowing the tag to be read at long ranges. A passive tag, much like the one used in my proposed system, does not require a power source at all! Instead, the range in which the tag can be read is very limited (sometimes less than six inches). RFID is safe and effective for maintaining privacy. Each tag is encrypted to allow a specific reader or set of readers to access their information.

In order to better facilitate the storage of medical information and vital signs, a unique version of RFID must be developed that can store more information and be easily concealed on an individual. These are two very large technical hurdles that have already been achieved by a company called Alien Technology. These concept designs however have not been applied to the medical field as of yet.

A system that is both transparent and passive for the user and paramedic is imperative. For the individual wearing their unique tag, it should be easily concealed in a piece of jewelry or medical alert band. Many diabetics wear a unique bracelet that identifies the nature of their medical condition. Such a bracelet, when combined with this system, can easily conceal and hold an RFID tag. This tag would then store that individual's medical information and personal medical history. As the individual's medical conditions change, the tag information will become outdated. The information on each tag is also easily changed by placing it under a unique writing transponder. With the adoption of this system, any participating pharmacy, doctors office and hospital will have a writing unit that can update an individuals tag wirelessly just by placing the tag within a few feet of the unit. This allows for a simple control method over the information being processed and written to the tag. Only physician and pharmaceutical information that has been processed by a licensed professional can pass through the system to these unique writing stations, and then written to the individuals tag with little to no hassle.

The opposite end of the system would be used by medical professionals both in the field and in medical centers. The system used by paramedics incorporates two pieces of technology in a wearable unit. This unit stretches from cuff of the paramedics shirt to the inside lapel or jacket pocket. The cuff contains a tri-colored LED and an RFID reading

antenna. The LED and antenna are then hooked into a Personal Digital Assistant that is sewn into the inside of the paramedic's coat. The PDA serves as an LCD readout of the information obtained by the antenna from the tags of people in need of medical assistance. The tri-colored LED serves as an alert and lets them know what information is available, if any. An example of the signifiers would be as follows.

Blue:	No information available, user has no tag.
Amber:	User has a tag containing medical information.
Green:	User has a tag containing unique medical conditions.

These options are better defined as easily glance-able readouts that can give quick and accurate information. Seconds are lives! Using a multicolored LED lets a paramedic continue with their work if no time is available. If time is available and questions can be answered using the device, the paramedic may refer to the PDA containing a read out of all the information pulled from the RFID tag on the individual in question.

The essential difference between an Amber colored LED and a Green one is that it is an easily distinguishable difference that signifies if someone has a special medical condition worth noting immediately. Such examples include extreme allergies, specific heart conditions and recent medicinal/dietary changes. Having a display that indicates an abnormality in a person's health can also help distinguish the proper care needed in a given emergency. An average person who wears a tag with no medical conditions may or may not present any useful information to a paramedic through the tag. It is then useful to the paramedic to be able to ignore an amber light and continue intensive care without referring to the device. A real world example of this is as follows.

> *"A team of paramedics is called onto the scene of a terrible car accident. The passenger in a two door sedan has been thrown clear of the vehicle and is suffering from multiple lacerations to several vital areas of the body. Extreme blood loss is evident. Upon arrival, the paramedic immediately begins prep the victim for evacuation to the nearest hospital. Upon working on the individual, the paramedic realizes that he has an amber light on the cuff of his shirt. Due to the extreme amount of blood loss, and that the individual needs to be transported immediately, he ignores the amber light and makes sure to pass on to the hospital that vital signs and personal information are available on this individual through the MedID system."*

A similar system may be easily incorporated into many hospitals and emergency rooms. This system would include an easily readable LCD and transponder to read tags, but would lack the LED system for obvious reasons. The LCD and reader could be mounted in a variety of places including but not limited to emergency rooms, hospital beds,

Much of this technology and practice is already starting to become realized and implemented. An emergency medical center in Memphis has already successfully tested a system that tracks trauma patients on their journey through the emergency ward of the

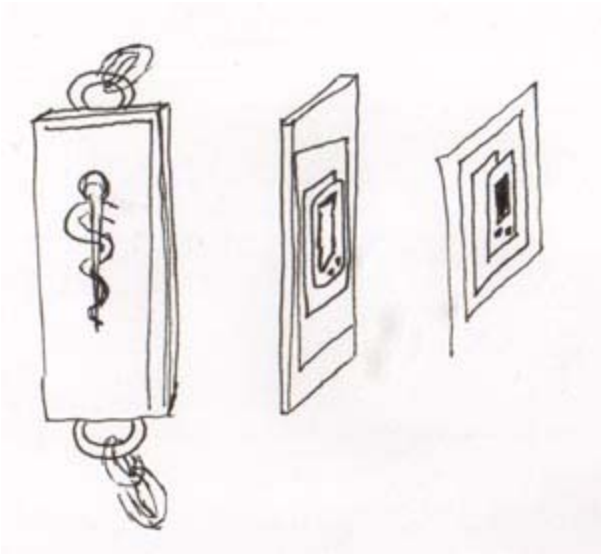
hospital. Other medical studies that have been done involve RFID as an actual embedded device within a human's sub dermal tissue layer.

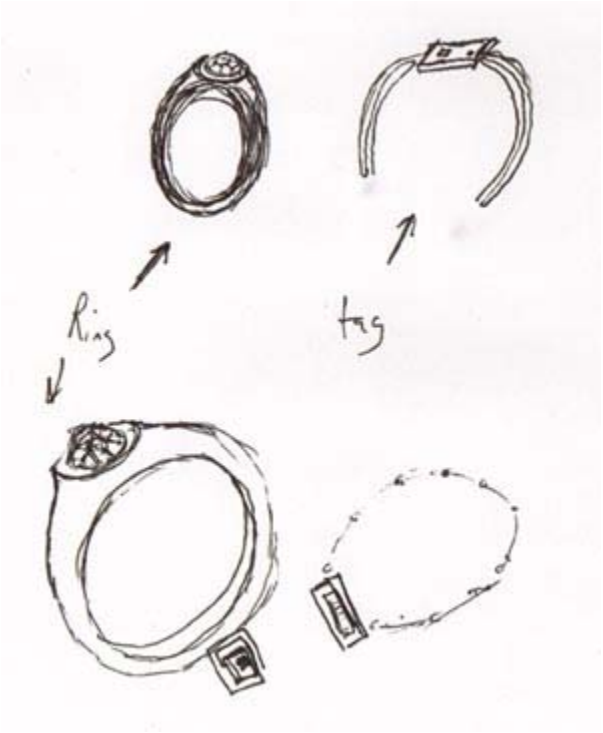
With many applications for RFID still on the horizon, it is likely that the technology will continue to evolve into smaller, more powerful units capable of storing more data with little space. What this will mean is an increase in a variety of units and types of units available. It is imperative that a standard be set now in order to make these tags backwards compatible and to coexist with one another. This project could help set that standard by driving the demand for special medical tags and create a potential precedent that will solidify RFID as the technology of choice for this particular medical application.

Saving lives and making our world an easier place to live in is a tough challenge. Through this system, current medical information can travel much faster and potentially reach a level of instantly

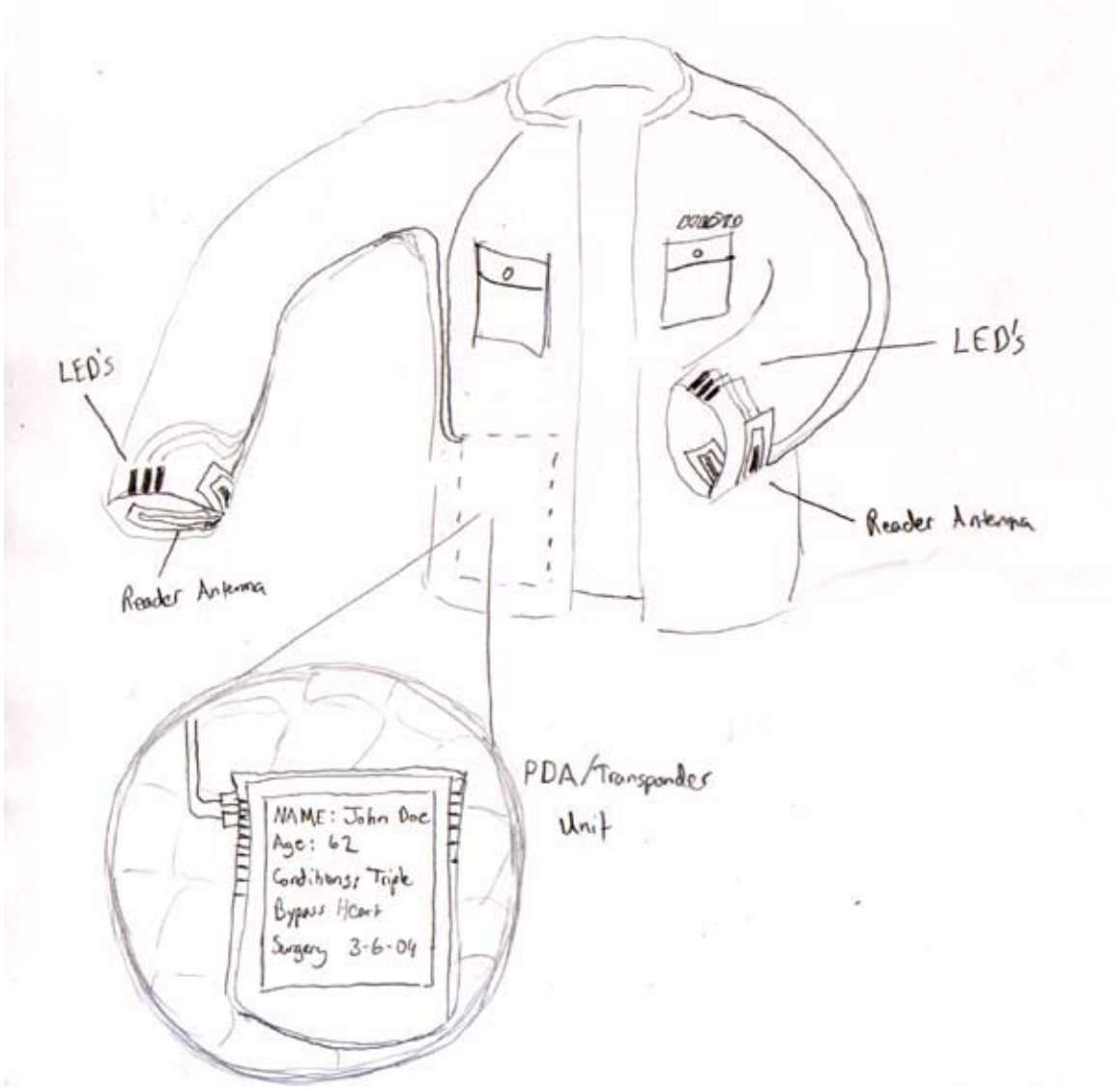
Reference Images:

Tags





Reader Jacket (paramedic)



Timeline and Budget:

Mike Brinker
Thesis Budget/Schedule

Team	*Start date*	*Target completion date*	*$/hr*	*Total $*
Thesis Advisory Team				
Peggy Weil	8/16/2004	5/3/2004	N/A	
Scott Fisher	8/16/2004	5/3/2004	N/A	
Non-IM Faculty Member ?	8/16/2004	5/3/2004	N/A	
Production Team				
Mike Brinker	8/16/2004	5/3/2004	$25.00	$0.00
Perry Hoberman	11/4/2004	2/10/2005	$25.00	$0.00
Preston Defrancis (Engineer)	10/4/2004	2/10/2005	$12.00	$6,000.00
Engineering Student #2	10/4/2004	2/10/2005	$6.00	$3,000.00
Interactive Student #1	8/23/2004	9/27/2004	$6.00	$3,000.00
Computer Science Student #1	11/4/2004	12/2/2004	$6.00	$3,000.00
Financial Funding/Backer				
Pre-Production Research				
Technology research	8/23/2004	8/30/2004	N/A	$0.00
Existing Application research	8/30/2004	9/6/2004	N/A	$0.00
Medical research	9/6/2004	9/13/2004	N/A	$0.00
Design Document / Video	9/13/2004	9/27/2004		$300.00
Development Budget				
Proto-type Wearable Reader	10/4/2004	11/4/2004		$2,000.00
Proto-type Writer	11/4/2004	12/2/2004		$4,000.00
Proto-type /RW Tag	1/10/2005	2/10/2005		$2,000.00
Hardware				$8,000.00
Wiggle Room				$2,000.00
Field/User Testing				
Paramedics	2/10/2005	2/20/2005		$0.00
Doctors Offices	2/20/2005	2/30/2005		$0.00
Elderly/Assisted Living	2/30/2005	3/10/2005		$0.00
Special Medical Cases	3/10/2005	3/15/2005		$0.00
Final Documentation		4/29/2005		
Grand Total				**$33,300.00**

Potential Venues:

Medical

Assistive Technology Expo – www.pat.org – If and when they have them, a definite place to begin showing the potential for MedID. Held in North Carolina on a not so yearly basis.

RFID Journal Live! – www.rfidjournallive.com – Focused on RFID mostly in supply chains, but also includes vertical markets such as the medical field. Very worth going to and is hosted in Chicago.

Abilities Expo – www.abilitiesexpo.com – might prove to be a valuable resource as well as outlet. Provides people with disabilities new options for improving their lives. Hosted here in California, New York and Chicago.

Tech related

Tech Expo – www.techexpo.ca – A good overall technological conference geared to every industry, including medical and science related fields. MedID would fit very well here.

CEDIA Expo – www.cedia.net – More geared to custom home electronics, MedID might have a place as a tech demo rather than a medical one.

Pack Expo – www.packexpo.com – A great place to show where RFID itself is headed, but still not much of a medical venue.

Potential References:

January 2004 Scientific American article entitled, "RFID, A Key to Automating Everything" by Roy Want. This article outlines a lot of the important issues involving RFID, especially those that concern what RFID really is, and what it can and cannot do. Projections for the future are of course focused on compatibility and low cost materials.

Backscatter RFID developed by Alien Technologies has both the large memory capacity (4 kb) and range needed to fulfill the technology gap that is crucial in developing my thesis project hardware. They were responsible for developing the tags used in the trauma patient tracking exercise in Memphis.
http://www.alientechnology.com/02_products_p03.html