

InformID

An RFID technology for life!

Thesis Proposal

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Brief Description:

InformID 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. InformID 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 embedded technology.

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. 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's 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 a 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. The set of conceptual designs that I am proposing 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 the 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 to 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 for this individual.”

A similar system may be easily incorporated into many hospitals and emergency rooms. This system would include an easily readable LCD, transponder and 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 and 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.

Other Potential Applications:

The InformID system is not just limited to carrying medical data nor is it limited to the medical field. With the capabilities of capturing real-time user data such as pulse, heart rate, body heat and perspiration information, the InformID system could be used in a variety of situations.

Athletics and Sports

Athletes and coaches are constantly monitoring vital statistics. This system would vastly improve both an individual's target physical rate and potentially improve an athletic team's overall performance. With multiple players on a sports team who are wearing an InformID tag, an overall performance rating of each player can be established in real time. If a player's statistics drop below certain levels (ie. heart rate is too high) the coaching staff could sideline the player for medical attention or rest.

For the casual home fitness user, InformID gives individual users the ability to track personal fitness information in a variety of ways. Those who are lifting weights in the gym could use their own personal system to keep track of repetitions and weight information. Interfacing a transponder unit with gym equipment would allow for machines to automatically set themselves to certain weight requirements based on tag readings from patrons using the equipment.

Video Games

A variety of video game titles for both computers and consoles require players to create a character or profile within the game. This process can be quite time consuming and redundant, especially when a game player switches to a different gaming station. With InformID, the ability to store that profiling information once and retrieve it again later for use on a different system is now possible. For example, many sports games require you to input player data such as height, weight and other physical attributes. All of this information already exists on an InformID tag, so why not use it? The ability to transfer all of this information just by picking up a game controller is very quick and efficient.

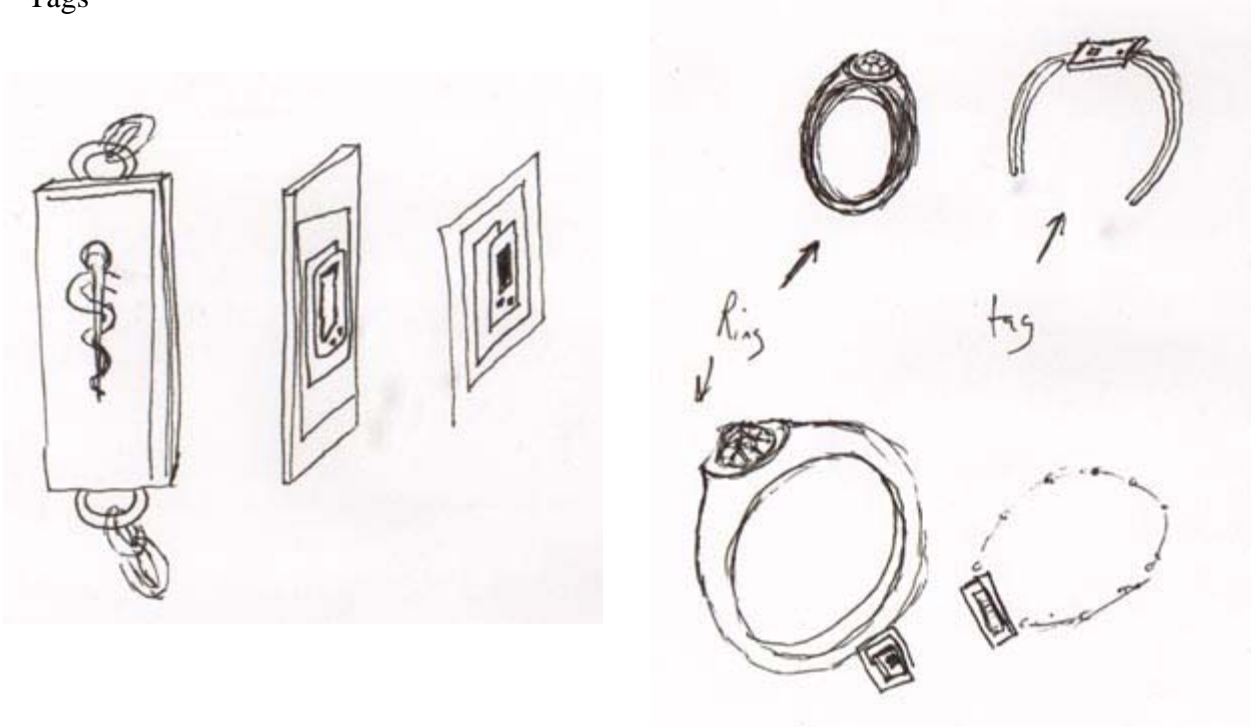
Home Automation

There are many ways in which an average individual must unlock or open up their homes on a daily basis. Opening the garage door, unlocking the front door and even turning on

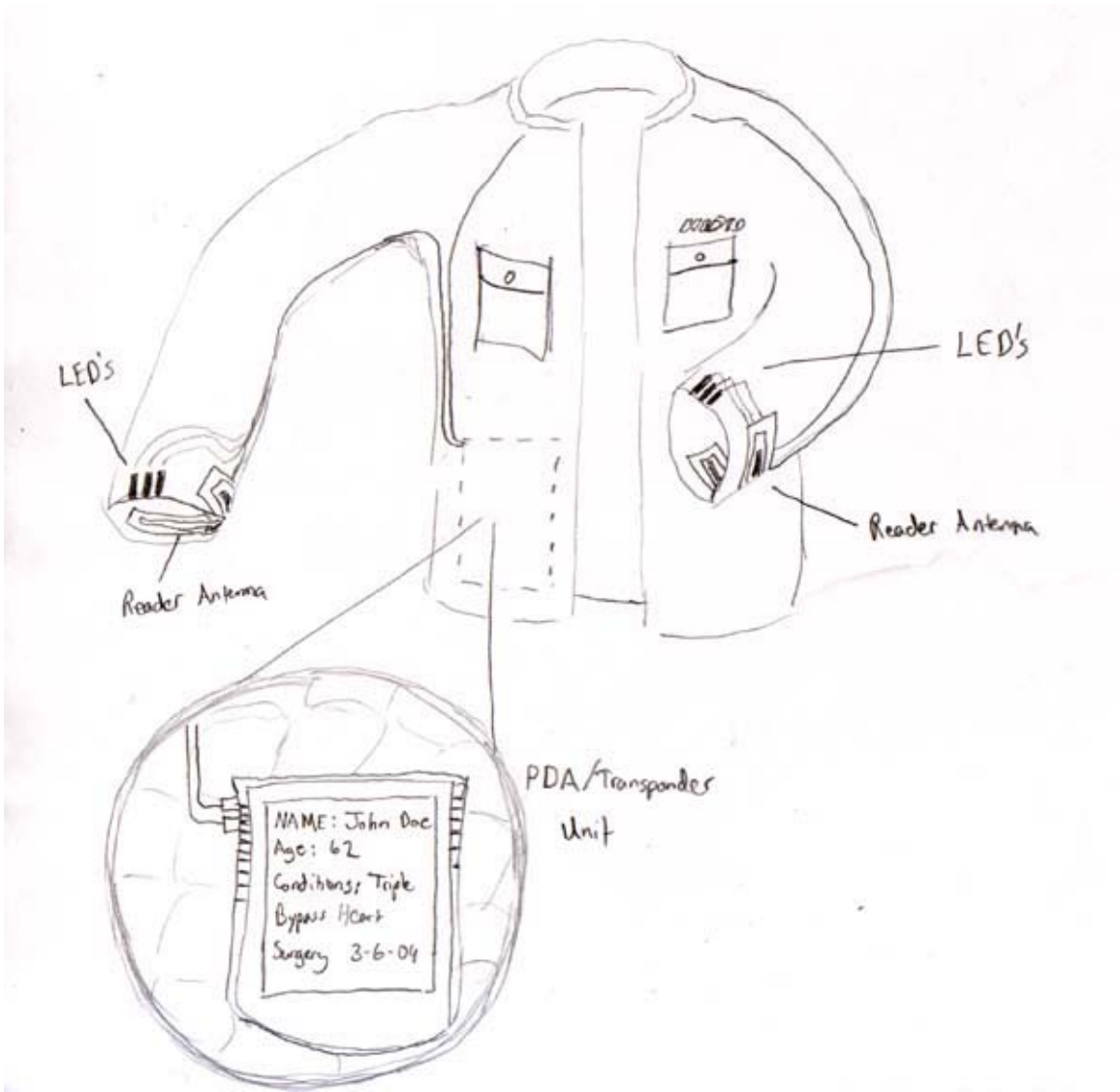
the light switch could be automated with InformID. This system of identification is personalized and encrypted so you never have to worry about identity theft. The automated home is not a new idea, but the feasibility is just becoming reachable with cheap identification hardware and easy interfacing with real world devices.

Reference Images:

Tags



Reader Jacket (paramedic)



Timeline and Budget:

Mike Brinker Thesis Budget/Schedule

<i>Team</i>	<i>Start date</i>	<i>Target completion date</i>	<i>\$/hr</i>	<i>Total \$</i>
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
Misc.				\$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 InformID. 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. InformID would fit very well here.

CEDIA Expo – www.cedia.net – More geared to custom home electronics, InformID 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.rfidjournal.com/article/articleview/901/1/1/>
http://www.alientechnology.com/02_products_p03.html

Nokia, a popular cell phone manufacturer, has just incorporated a version of RFID into their new 5140 cell phone. This article prominently places RFID in a very positive light, using the power of a reader unit in a phone to mark or trace back the last tag read in a

security route. It also shows a popular way for workers to verify attendance. This system is also proximity based but on a much smaller scale. Users of the cell phones would have to physically touch their phones to tags in order to get a reading. More information can be found here.

<http://www.nokia.com/nokia/0,,55738,00.html>

The Federal Highway Administration has decided to use RFID on a mass scale in order to better protect drivers and automate more toll booths. This system is in its early planning stages and can be found here.

<http://www.rfidjournal.com/article/articleview/866/1/1/>

The Mäkitalo Research Centre in Luleå has wired up hockey players for statistical analysis and broadcasting video and statistics to audience members via a PDA. Another great link that shows the possibilities for InformID.

<http://www.dh.umu.se/default.asp?sida=269>