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DLD ENTERPRISES

‘LAST MAN’ I.S.A.W.

Increased Situational Awareness Widget

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Abstract

The sixth semester of Engineering Design serves many purposes to third year students. It exposes students to various aspects of designing and creating their own projects. Students learn how to develop their own project ideas and how to function in a group dynamic. The group decided to research the idea of creating a heat sensor that can be worn by soldier's who are currently deployed in dangerous locations. The heat sensor would be worn by soldiers while they are on special operational missions. The heat sensor would detect heat traces, and then the microcontroller would determine if they are within the minimal standards to then signal to the soldier through a wireless earpiece.

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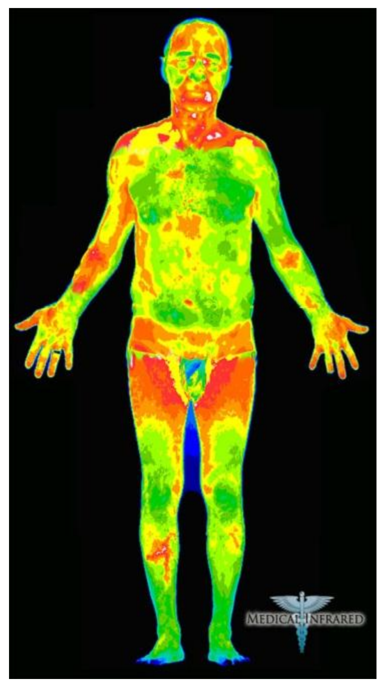
Introduction

With the advancements in technology, the idea of warfare is shifting drastically to deploy remote controlled devices along with other electronic instrumentation into a soldier's everyday life. GPS technology, predator missiles, satellite images, and electromagnetic pulse generators are just a few technical pieces that are implemented by the US military to make the jobs of the men and women serving the country easier and safer. However, there is not much that the soldier has on himself that is state of the art technology which can help them greatly in their everyday lifestyle.

Whenever soldiers are on road marches or are clearing rooms there is always a person denoted as "the last solider." The task that is given to this soldier is very important to the group that he or she is working with, for it is their job to look possible threats to the group behind them. Every few minutes this soldier must stop, turn around, and scan the area for incoming threats. It is their responsibility to notify the entire group and ensure that everyone is safe. Having to stop and scan the area behind him can become very time consuming and could ultimately pose a threat for the soldier may not see everything, or the soldier could be more focused on where the group is traveling and what is ahead of him. With the advancements in technology in infrared sensing devices and such image processing, a device can be designed to aid in the responsibilities of this soldier.



This device will be a fully automated product that can scan the entire environment behind the soldier for any infrared sources that may be approaching. Being that all humans are infrared heat sources, as seen on the right, it is impossible for this to be hidden from a sensor. However, it is possible for a human to disguise themselves with the environment to the naked eye, which makes the implementation of such a device appealing. Such a device will be able to see more than the human eye can see and ultimately be able to detect threats without the soldier needing to look back behind his shoulder.

This project will consist of three major parts. These parts consist of thermal sensing devices, a microcontroller, and a notification device to the soldier. Each of these elements to the project will be integrated together to allow for the product to determine human targets without any reliance on human direction. The system will be able to gather information, process the images, and notify the soldier of any threat while the soldier goes about its normal routine. This device does not need to eliminate the responsibility of the soldier and the need for him to turn around, but it will aid in the detection technique, ultimately keeping the group safer and well prepared.

In this design, the heat sensor would be attached to the back of the soldier's helmet and would scan the area of responsibility for anything that gives off a heat reading within the range of the device. The information will then be processed to determine if there is a possible threat, and the soldier will be notified accordingly.

This device would greatly help soldiers when they are executing a mission and are required to use road march formations or stacks for clearing rooms or buildings. The heat sensor would add to a soldiers and units safety which is the most important thing during times of conflict. Ensuring the safety of soldiers and providing them with the best devices to protect themselves during conflict is one the most important priorities for the United States military.

Discussion

Background Information

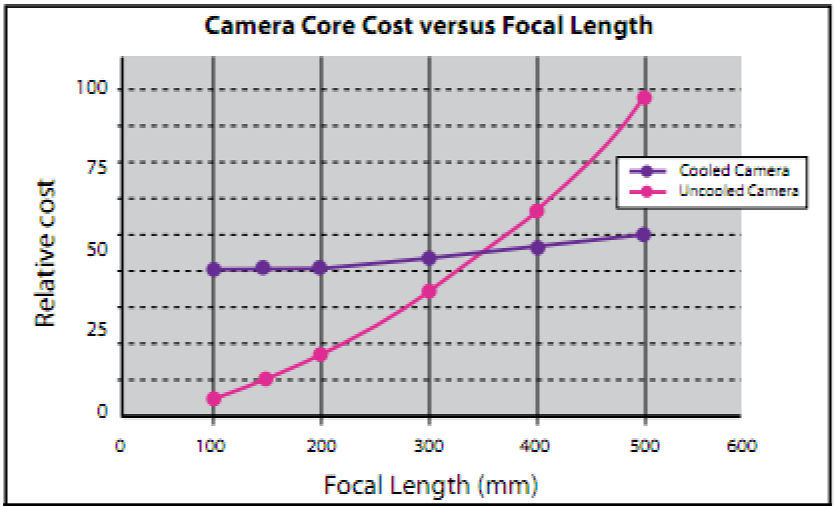
The overall design of the project consists of three major elements. There needs to be information on how to sense the environment around the soldier in a reliable way, compute the information being sense, and notify the soldier of any threats. With that being said, there are many different directions in which these tasks can be completed. Understanding the correct principles that should be applied for the project is key, and thus research was done to ensure that.

When developing the project each group member was responsible for researching various types of components that could be used to compile the overall device. Below can be found the initial research conducted by each team member.

The project at hand is meant to detect a human body from a distance away. The way this is done through sensors is with infrared heat sources. Being that there are various different categories of infrared light (near-infrared, mid-infrared, and long-infrared also known as thermal-infrared) we must hone in on one of these categories. The key difference between these types of infrared light, excluding the wavelengths, is that thermal-IR is emitted by an object instead of reflected off it as in the other two types of infrared light. Thermal-infrared is emitted because of activity on the atomic level, which is why inanimate objects emit little to no thermal-infrared light. Our project thus must hone in on the thermal infrared light sources. In order to detect such a light source, there must be a sensor that can measure specific wavelengths accurately. Knowing the type of infrared light we are trying to measure determines that our sensor must measure wavelengths measuring from 3 microns to over 30 microns [*Infrared Temperature Measurement Theory and Application, Page 1*]. The sensor to be chosen must be used to create the thermal imaging device which will help to notify the soldier.

There are two different types of thermal-imaging devices, un-cooled and cryogenically cooled. The cryogenically cooled devices are rather expensive and more prone to damage. These types of systems have the elements sealed inside a container that cools them to below 32 F. These types of devices are very accurate and have incredible resolution and sensitivity. A cryogenically cooled device has the ability to detect as small as 0.2 F temperature changes from over 1,000 feet away [*How Thermal Imaging Works, Page 2*]. The other types of thermal imaging devices are un-cooled. These are most common due to their inexpensive and rather durable nature. This unit operates at room temperature and has a battery that is built into the unit. The type of imaging we would want to use is different from the 'night vision' that most people think. Pending on the distance in which our project plans on being accurate, we must choose between these two different devices.

Our project is primarily focused on targeting individuals who may be trying to flank a moving unit. This would require a unit with a focal length of 350mm or greater. As seen in the chart to the right (*Camera Core Cost versus Focal Length*), economically it is more expensive to create an un-cooled device with a focal length above 350mm. This poses a problem in the design scheme for our project. As mentioned above, a cooled thermal imaging device is more prone to damage and is not as durable as the uncooled device. This puts the group in a sticky situation to decide which type of device we would want to go with. The cooled device would be less expensive, however would not be durable whereas the uncooled device would be much more durable, yet less accurate. Choosing which type of device we must go with involve a numerous amount of conditions and the feasibility to implement into a soldier's combat gear.



Reference: *Cooled vs Uncooled Devices, Page 2*

Seeing the various conditions that soldiers combat in, extreme weather temperatures and all different types of precipitation it makes sense to go with the uncooled system. This poses a problem when the system is in freezing conditions, because the uncooled system would fail. These complications pose various different things we must counter to obtain a working product. The information that is gathered through the thermal imaging device must be sent through a microprocessor to process the signal and send alerts to the soldier.

The main computing force of this project should be a microcontroller. In the recent years microcontrollers have become more prevalent in hobbyist projects. This has resulted in a drop in costs as well as the development of open source microcontrollers. A look at any hobby and do-it-yourself website will show that microcontrollers are being used to perform tasks that once required complex circuitry. Most importantly these devices are used in the collection and analysis of data obtained by sensors, which is appropriate for our application.

It would be possible to program a microcontroller using languages we are already familiar with such as C or C++. Although we have learned how to program a microcontroller in assembly language the ability to use higher languages makes programming simpler and more accessible. Writing C code is also much less time consuming compared to assembly language which requires the programmer to write out every single instruction. The use of compilers such as GCC or CodeVisionAVR allows for the compiling of C code for an AVR microcontroller. (T. Fryza).

If, however, the use of assembly language is required in a certain application it is possible to write a small segment of code in assembly. The compilers mentioned allow for such a combination of code by using special functions. Should there be a need for very specific instructions to be written to the microcontroller using only assembly then it is possible using these instructions.

Microcontrollers are available in large quantities and for very low prices. AVR is currently one of the major providers of microcontrollers for hobby use, the most famous one being the arduino. Programmers can be purchased and a compiler can be found for free. This being an open source microcontroller there are multiple sources of documentation available for the construction of such a device. One primary source is the hobbyist publication Makezine which had a whole issue dedicated to the arduino. It is a very flexible platform and is often used to read sensor data. This device proves to be simple to use and manufacture which should be useful in its application for this project. Multiple versions are available depending on the memory usage required. If we are to reduce the number of components that deal with the data coming from the sensors and leading to the output of this device then an AVR chip with greater memory can be used along with a code that should handle every task necessary. If we are to reduce the amount of computing power needed, reducing time between instruction sets then a lower memory device can be employed with more external components sorting the information before it even reaches the microcontroller.

The purpose of the output device is to notify the solider that the heat sensor has detected something behind him and that he should proceed with additional caution. There are three different options for an output device that are currently being considered. A small LED light that can easily be attached to the soldier's uniform and would light up when the heat sensor detects something. A small vibrating motor is an additional option; it could be clipped onto the solider uniform in the neck area which is a sensitive area so the soldier would not miss the signal. An additional output device being considered is an ear piece. It would make a particular noise when the heat sensor detected an object.

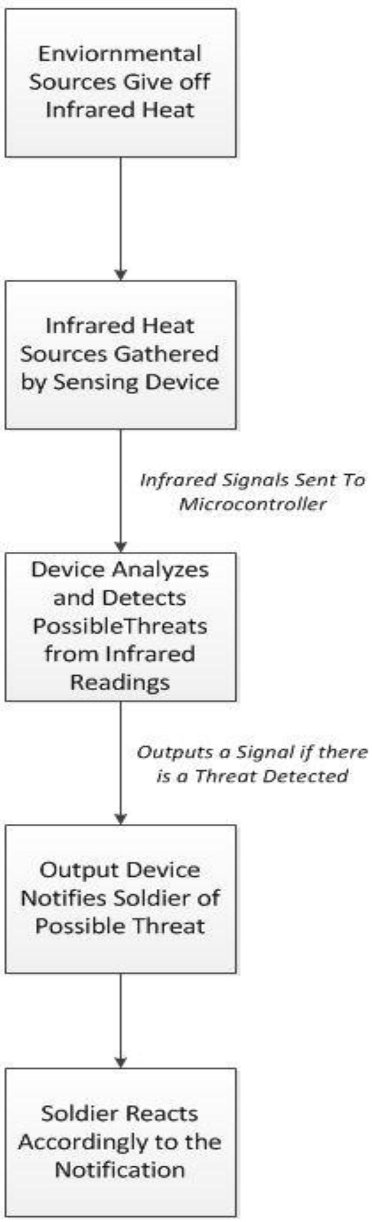
A small LED that operates off a remote signal would a very useful output device because it would be wireless and not produce any noise. A negative aspect of a wireless LED would be it would require a signal that could be picked up by the enemy therefore, exposing a soldier and his unit's location and at night a small light would be very obvious in the dark.

Another output device that could be utilized is a vibrating motor that would alert the soldier to potential danger when the heat sensor picked up on something. Similar to how cellular phones vibrate when a signal is being sent to the device is how this output device would work. The heat sensor would pick up a heat trace and if it was high enough the microprocessor would then send a signal to the small vibrating motor. A negative aspect of this output device is that the soldier may not feel the vibrations due to the adrenalin rush he maybe experience from being out and in harm's way.

An additional output device that could be used is an ear piece that would make a beeping noise or give off some type of tone when the heat sensor detected something behind the soldier. The ear piece would be similar to a blue tooth device. The heat sensor will send a signal when it has detected something to the ear piece which will then notify the solider. A negative aspect of using this is the sound the ear piece gives off could potentially be picked up by the enemy, therefore putting the soldier and his unit in harms way.

Functionality of the Design and its Components

The device will consist of three main components which are the thermal sensor, the microprocessor and the output device. Various types of thermal sensors, microprocessors and output devices were considered for this project but ultimately the group found the combination of the best three components that would work most effectively together. The thermal sensor that will be used is PICO460 LWIR, a AVR ATMega microprocessor will be used along with the FreeLinc FreeMotion 200 Wireless headset. In the diagram to the right you can see the functionality for the device.

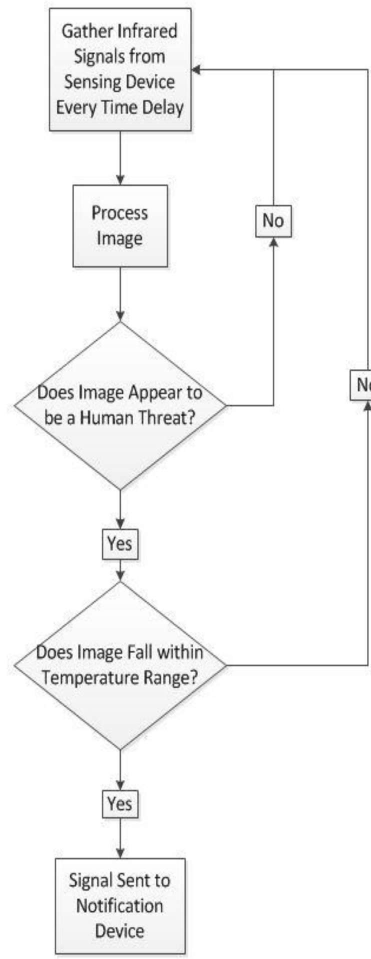


The top block in the diagram above indicates the sensing function. In this process, a sensor will be used to gather information from the environment. This information will be infrared readings from various sources behind the soldier. This will help to indicate if there is threat approaching the soldier, being that all humans give off infrared heat sources. The information that is gathered about the environment behind the soldier will be sent to the next device, in which another process will decipher the information.

The second major function is the processing of the information gathered. Being that the sensor will output an array of data to the controlling device, it must be processed. From the information gathered, this step is focused on determining whether or not there is a threat behind the soldier. The information must be analyzed through a coding scheme discussed in the subsequent section. If in this function it is determined that there is no threat to the soldier, nothing should be done. However, if it is determined that there is a threat to the soldier in this functional step, it will output a signal to the next device.

In the third function, there is a notification device. This function is focused on notifying the soldier of an incoming threat. After receiving a signal from the controlling device, this device will make a signal to alert the soldier via sound alert, vibration indicating, or a visual display. This will complete the overall functions of the project, and the soldier will be able to react accordingly to the threat.

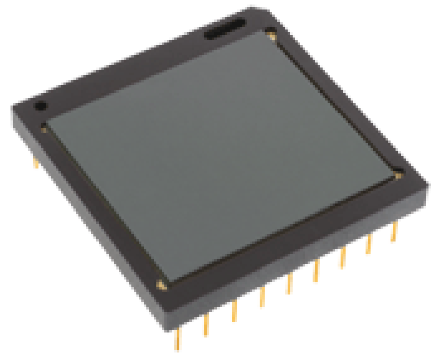
In the second step of the functional diagram, a device will read the signal coming from the sensing device. Being that this signal will be an array of infrared readings, it will have to be processed to be able to determine whether or not there is a threat to the soldier. The signal from the sensors will be converted into a format which can be read by this controlling device. The software encoded into the controller will read the signal at periodically at some predetermined amount of time. With every signal gathered, the program will proceed to analyze the infrared images using a combination of image processing techniques. This will provide an image of a person or other possible threat. As seen in the software flow chart, if this image falls within the specified parameters the controller will trigger the output device. In order for the device to react the image will have to have a rough outline of a person while showing a specified temperature range. This range should allow for the variations in human body temperature due to varying conditions such as activity or the local environment. Once these conditions have been met the controller will send a signal to the notification device. This will ultimately generate a signal, alerting the soldier to the presence of a possible threat behind them.



Technical Description of the Design and its Components

Infrared Sensing Scheme

In order to gather the information of the environment around the soldier, a special device must be used. This device would be the long wave infrared sensor (LWIR), with the possible use of a short wave infrared sensor to enhance the capabilities of the sensing device. This device is most vital in sensing the infrared light sources at a distance. The device will be placed between eye and neck level, and mounted on the back of the helmet. The infrared sensor that will be chosen is the PICO640 LWIR detector. This sensor is seen below on the right, and is very effective in the project we are implementing. The features of this device include:



PICO640LWIR

- *640x480 resolution*
- *Uncooled operating atmosphere*
- *25µm pixel pitch*
- *High-reliability, long life packaging featuring a re-fireable vacuum getter and long-wave infrared window*
- *An advanced read-out integrated circuit (ROIC) and signal processing architecture that combine to eliminate the need for temperature stabilization*
- *The ability to employ conventional signal processing through an optional thermoelectric cooler*
- *Availability in either round Type 1 (T1) or new Type 3 (T3) package*
- *Capabilities like these make the UD640-25 ideal for both military and commercial applications, including thermal weapon sights, driver's vision enhancers, and systems for border security and homeland defense.*

This device would also work in congruence with another sensor to enhance the operational specifications of the project. The next type of sensing device that would be used would be the SU1024LDM, which is seen below on the left. This is a new line-scan camera that has a 1024-pixel imager and is very compact (76 mm x 74 mm x 61 mm). The features of this sensing device include:

- *High quantum efficiency and dynamic range*
- *Integrate-while-read snapshot acquisition*
- *45,956 lps for 1024 pixels over a 25 mm width*
- *Wavelength response over 0.8 µm to 1.7 µm*
- *25 µm pixel pitch with the aperture height of*
- *25 µm sharply defined by a photomask*
- *14-bit base Camera Link® compatible output and control*
- *Operating temperature range of -10 to +50°C*
- *Mounts easily to spectrometers due to 5.7 mm image plane depth and O-ring light seal*
- *Mounts easily to optics benches or MV systems with tripod, front or side fastener hole patterns -*

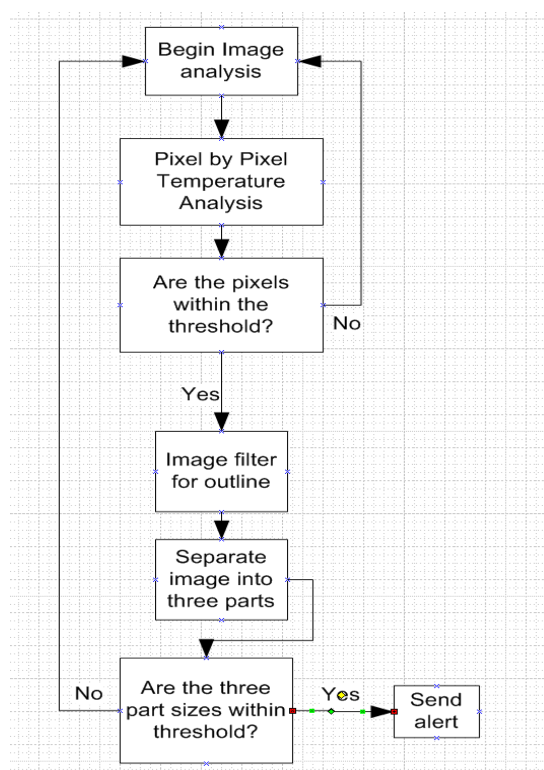
Optional adapters for F-mount or C-mount, lenses (C-mount lenses may not fully illuminate the full width of the 25.6 mm wide arrays)

The design of our project plans to integrate both the SWIR and LWIR sensing units into the system. When used in conjunction with each other these two units allow the user to be able to allow thermal imaging during a troublesome phenomenon called thermal crossover. Thermal crossovers typically occur during the sunrise and sunset, and this can cause thermal imaging devices to be rendered useless. This occurs when a thermal sight encounters a condition where some inactive targets without an internal heat source will warm up or cool off to the same temperature as the background. If this temperature is not big enough to be detected, the thermal imaging device is useless.

The sensing devices will interface with the microcontroller, through analog video connections. This video signal will need to be processed by the microcontroller in order to notify the soldier on incoming dangers. Analog video cables will connect the sensing devices into the microcontroller; the two cables will be joined together and will transmit sensing information to overlap each other. The short wave infrared sensor will enhance the long range infrared sensing device. Details as to how the image will be processed are discussed in the proceeding section, which displays a basic software flow. Once the microcontroller identifies a plausible target, a signal is sent to the output device. Details will further be discussed in later sections as to how the data will be processed.

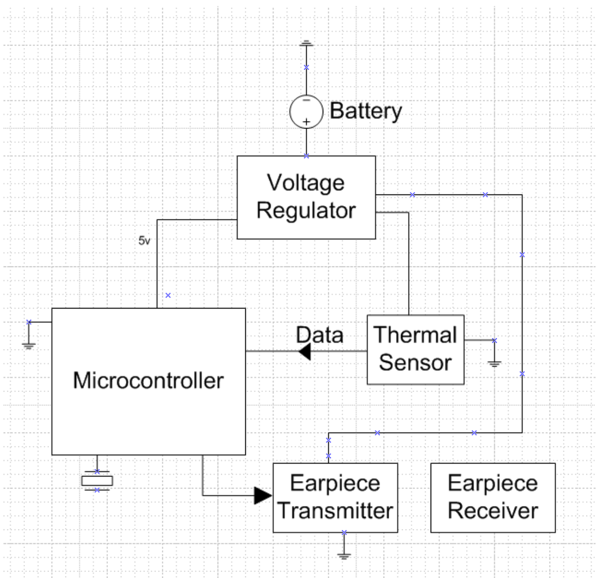
Microprocessor

The camera will send a signal via analog cable to the microcontroller. An onboard analog to digital converter will be able to alter the signal so that it can be used by the microcontroller's programming.



The programming will perform a search of the input image for a possible "threat". A threat is defined by a combination of temperature readings as well as image processing. A snapshot from the camera will be sent to the microcontroller. The microcontroller will read the temperature information of the image pixel by pixel. The temperature information will be compared to a predetermined value. A temperature reading between 80°F and 90°F should indicate the presence of a person. To make sure that the reading does in fact indicate the presence of an individual the device would have to process the captured image in order to find an outline. A filter program would detect the edges of the captured image. The filter image would then be further processed; it would be split into three sections, top, middle and bottom. These three sections would correspond to the head, midsection and legs of a person. The width of each of these sections will be measured by the software, if the measurements are within a threshold, that remains to be determined, then it will be confirmed that the image is that of a person. Once there is confirmation the controller will send a signal to the wireless headphone transmitter to inform the soldier that someone is behind him or her.

There are possible issues that will have to be worked out with the final product. The first issue is that of hardware, there will be a great deal of processing that will be involved, the microcontroller will have to be able to execute the program fast enough in order to provide up to date information to the soldier. A slight lag can prove fatal in the situations for which this device is designed. This should be a minor problem, the AVR Mega series can operate at clock rates of up to 16Mhz, which should be ample for the needs of this project. Another issue is that of accuracy, the skin temperature of a human being varies depending on a large variety of factors. Anything from personal health to the local environment can affect the temperature given off by a person. Furthermore clothing can mask the temperature of the human body. This could very likely result in inaccurate readings. To prevent such an issue this device will have to go through extensive field tests to determine what thresholds of temperature will have to be used to determine if a person is in fact standing in behind the soldier.



Ear Piece

The best choice for an ear piece is the FreeLinc FreeMotion 200 Wireless headset. The device is a wireless ear piece that can easily be worn by the soldier. The device creates a secure communication area around the solider which would block interception and/or interference from the potential enemy. The secure area around the soldier cannot be hacked either. The ability for no interception and/or interference along with the inability for the secure area to be hacked is because the device utilizes the Near Field Magnetic Induction which uses “a non-propagating, quasistic magnetic field technique to achieve wireless connectivity between two devices". NFMC does not depend upon using an electromagnetic field but instead uses a magnetic field localized around the transmitting device.

FreeLinc the creator of the FreeMotion 200 Wireless headset partnered with Aura Communications Technology, Inc. to produce the LibertyLink. LibertyLink uses the concept of Near Field Magnetic Induction. LibertyLink's magnetic communication creates a "bubble" that surrounds the user and it is private and secure. The "bubble" is only useful for area approximately 5 feet around the device. The ability to create this "bubble" allows for a low-costing and lower-operating (requires less power) device.

Principles Embedded in the Project

There are a number of approaches to detecting human shapes in video. New algorithms and methods are constantly being produced that can find human shapes whether they are blending into a crowd or if they are just standing alone. Our concern is with using heat sensors as well as image processing techniques to isolate a human shape in the input image.

The first portion of detection will require the measurement of ambient temperature. This is because the device will measure skin temperature and not internal body temperature. Since skin temperature can vary with the ambient temperature it is important to have this value stored in memory. The ambient temperature is measured by taking the mode of the last thirty temperatures measured by the detector.

The temperature of skin varies based on the ambient temperature using the following expression: $T_s = c_2T_a + c_1T_a + c_0$. Where c_2=1.555, c_2=-0.019799, c_0=6.037 and T_a is the last measured ambient temperature. The values of T_s and T_a can then be used in an expression that finds the difference between expected skin temperature and average background temperature and compares that to the difference between measured temperature and average background temperature.

$T(t) = \frac{T(k)-T_b(t)}{T_s(t)-T_b(t)}$ Where t refers to the time the measurement was taken, $T_{\mathbf{b}}$ is the background temperature based on an average of measurements, and T_s is the skin temperature as determined by the previous expression.

The value of T is going to be compared to a threshold value, when T exceeds the threshold than it is most likely that a human has walked into the field of vision of the detector. The threshold will have to be experimentally determined for our device, but according to one published project it can be 0.2. This value should give fewer false positives.

Performance Expectations/Objectives

The purpose of the project is to design a device that can be utilized by soldiers while they are deployed performing special operations. The device is composed of parts that have already been created; a thermal image sensor, a microprocessor and a wireless headset. The challenge the group faces is combining these three devices into one component that scans the area behind a soldier quickly and accurately. The device needs to be able to react quickly and accurately to a potential threat in order to notify the soldier so that he can react before it is too late. If the device cannot perform this basic function then it will fail to be successful. The device also needs to be able to react quickly and accurately because it cannot create a false positive. If a false positive is given to the soldier then the soldier will no longer trust the device when it gives off the tone that a potential threat is behind them. As previously stated the group believes they can create this device since all three major components of the device are already created, it is just a matter of scaling them down into this compact size without sacrificing the accuracy or quality of each component.

Critical Evaluation of the Project

There are various parts of the project that are considered to be very safe, from a practical design standpoint. One major baseline element to our project would be the overall flow of the project. It is determined that there is a strong aspect of what needs to be done in three distinctive steps. The way in which we get these functional steps done are subject to the discretion of group, however it is clear what needs to be done. In the first step, a device must sense the environment around the soldier for heat sources, and be able to determine them from various ranges. In the second step the signals from the sensing devices clearly need to be altered to be able to determine if there is a human target approaching. The final step to notify the soldier is simple as well. Having this outline of steps in the project is a very good start. This enables the project team to be able to work in three groups simultaneously to get the project completed on time. Once each of the three parts are completed, the project could then be integrated together soundly, being that each step it is known what is coming into the system, and what needs to go out of the system. This overall understanding of the major steps to the project is great steps to be considered as baseline elements of the overall development of the Last Man Heat Sensor Project

The second major baseline elements of our design are the devices considered to get the projects tasks done. Each of the devices were chosen for their capabilities and their performance in order to meet the project needs. The sensing devices chosen are very accurate and can read a various amount of data from different ranges. These devices are very durable, and applicable in all the different weather environments that a soldier would be placed in. The devices are top of the line, and output an analog video signal. In research, other projects have used these two devices in conjunction with each other. This proves that the devices are compatible with one another and appear to be very sound. The microcontroller is also another device that is very safe to use in the project. From all the information that we gathered, it appears as if this microcontroller that was chosen should be able to process the analog video signals from the sensors. The microprocessor should also be able to accept an array of coding formats, which allows for versatility for the project software element. For the software coding that we need to write, there is plenty of memory on the microcontroller as well. There is also sufficient memory on the device to enable the processing of the images that will be sent from the sensing devices. The microcontroller is also fully capable of outputting a signal to the wireless module. The third and final device chosen is the wireless headset. This device is very reliable and applicable to the design of the project. This module will be able to notify the soldier through a distinctive sound directly by the ear of the soldier. This ensures that the soldier can hear the device when it goes off, despite whatever sounds may be going off in the environment around the soldier. Along with the notification being very appealing, this device can be integrated directly into soldier's helmets, this makes the overall product very adaptable into the military. There would not be a need to change major parts of the soldier's equipment, rather there would just need to be a slight alteration by incorporating a headset to the helmet. The attributes to the overall design of the system make the project very safe a worthy of implementation. The elements chosen for the project should be considered as major baseline elements. They are all both sound and compatible together, which makes the overall system appealing to the customer.

As with all projects, although there is great planning, there are always elements which seem to be scary or difficult to implement. This project is no exception to this idea. There are two main areas in which the group is expecting to encounter problems with the completion of the project, which stem from lack of experience with such tasks trying to be completed. These major problems come in the development and implementation of software into the system. Being that there is no visual aspect to this project that the soldier can see, there is a heavy reliance on proper coding to ensure the success of the project. Without much prior software coding experience, developing this code could pose major threats to the overall project.

The first major problem with the software part of the project, is being able to successfully convert the analog signals into digital signals that can be analyzed by the microcontroller accurately. The thermal imagining sensor will send an analog signal to the microprocessor periodically based on the environment behind the soldier. The microprocessor needs to convert this signal into a digital format to allow for image processing to occur. As with any analog to digital conversion there is always a threat with a digital result that may not contain all the information. In the conversion, some of the information could be lost or skewed in a way which will become very inaccurate. If the data from the sensing devices is skewed too much from the original detection, the overall project could be deemed useless due to inaccurate readings. The main focus of the project is for the soldier to be notified of incoming human threats. If the soldier is falsely notified of a threat, it is not a major deal being that the soldier simply needs to look over his shoulder and check. However if the soldier is relying on the device and the device does not notify the soldier, then there is a major problem. The overall inaccuracy of the conversion is a very scary part of the project, and help from professionals along with large amounts of testing will be needed to complete this part of the project.

The second major part of the software that poses a major threat to success is the image processing of the digital signals. The proper technique must be chosen to be able to determine if there is a threat or not. The group assumes that edge detection will be a sound technique to use, however, it is unsure as to the accuracy that this technique has at various ranges. The microprocessor will need to compare images to what is typically determined to be a human threat. However, there are many different ways in which a human can be approaching the soldier. These images include standing, walking, running, crouching, etc. which all are different images that the microcontroller will need to be able to detect. The infrared image of a human also is reliant upon the distance at which the target is from the sensing device. A person standing at 10 meters away from a sensing device will appear completely different from a human standing 100 meters away from the same device. By taking into account all of these different variables, the group is uneasy about which technique of image processing must be used to complete the project, and make it accurate. As mentioned before misreadings are not a major threat, but a failed reading could be a major problem and ultimately life threatening. The lack of experience in the group dealing with image processing and its capabilities make this aspect of our design a major threat.

Considering the software element of the project, it is evident that inaccuracy is a major threat. The software is the most important part of the project, and if the project is not extremely accurate, the chances of it being implemented in the future are slim. The main focus on this project is to be successful, and in order to be successful the device needs to sell. Products that sell are extremely accurate at what they seek to accomplish, which is why the major threats to this project are the inaccuracies that are incorporated into the overall design through the software coding.

The group is very passionate about this project because of the promise it holds to provide the United States military with additional safety. Knowing that the group will create a device that could provide additional safety to soldiers who are currently deployed in dangerous locations is a great feeling. Besides the emotional factors of this project that will drive and motivate us to successfully create this device the challenges the project also creates is a driving factor.

As in any project there will be challenges and the group is motivated by these challenges. The ability to overcome the challenges previously stated and create a unique device that will provide additional safety to the United States military is another driving force that will help the group accomplishes this project.

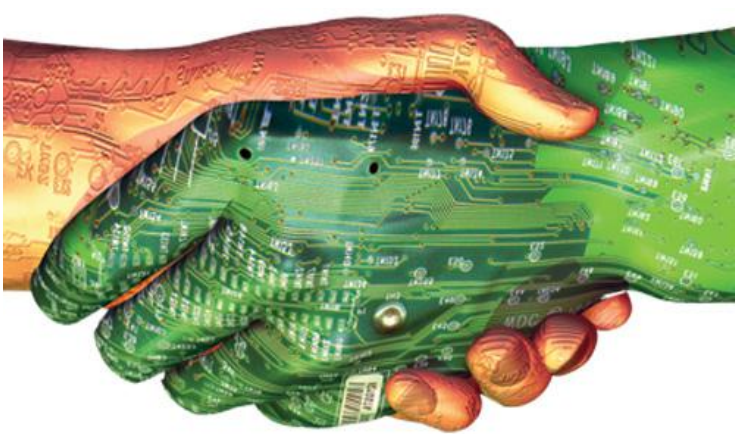
As the creators of the device we would promote this product as adding additional safety to soldiers that are deployed defending our nation. Safety of the soldier is a very important factor in this product because if the product fails we are endangering the lives of a service member which is something we do not want to do. This device will have to routine updates and test to ensure that it cannot be hacked or detected by the enemy. Also we would have to make sure the soldier understands that this device is for added safety but they still should not let their guard down and become reliant on this device. Soldiers must still ensure the safety of their area of responsibility while they are on a mission.

Like any project funding is a major obstacle that must be overcome in order to even begin. There are various ways the project can be financed. Financing can be through Stevens Institute of Technology, petitioning through private investors, the United States government and out of pocket funding. As students of Stevens, the school would want to have its name linked to this project in order to boost its status in academic and research communities. Stevens Institute of Technology would be the first potential source that the group would contact about receiving funding for this project. The group would also consider petitioning through private investors in order to fund the project. The private investors would receive rights to the project in order to entice the investor to fund the project. The most ideal source of funding would be through the United States government because this device is meant to directly benefit soldiers. Another funding source would be to fund the project with the group's personal money. This would be the least desirable option but the group is passionate enough about the project that if all other options were not available personal funds would be utilized. The group has also considered receiving funding from various combinations of these sources as well.

Summary

The planning set forth in this project prove to be rather promising to be a successful product. The ISAW, Increased Situational Awareness Widget, has a strong sense of what needs to be done to meet the demands of the target customers to the product. With the use of such sensing devices as the PICO640 LWIR and the SU1024LDM, seeks to be both compact and durable. These devices are top of the line in performance, and show great potential for the field they are being applied to. The AVR Mega microcontroller family chosen is also another aspect of the design that proves to be promising. Though the image processing that needs to be done is rather intense and lengthy, the microcontroller unit chosen should be able to get the task done. The ear piece that was chosen is both reliable and efficient. The FreeLinc FreeMotion 200 Wireless headset is a device that can easily be integrated into the helmet of a soldier. This allows for smooth incorporation of the device into the soldiers routine duties, as well as provides the soldier with a clear reliable alert of any incoming threat. This design is minimalistic in size and alterations to the uniform of a soldier, however it does not sacrifice accuracy and durability to do so. Though the design is rather flexible with which devices can be chosen, these seem to be the best devices on the market which will be able to get the job done.

The overall design of the ISAW is intended to greatly help the soldiers. This device will both help save the lives of soldiers and innocent bystanders in conditions of warfare. The way in which this will be achieved is through the use of simple technology implemented into everyday life. By using sensing devices, the soldier is able to see more than he normally can, being that infrared heat sources cannot be seen by the human eye. Through the design process, it is felt that the 'last man' soldier can benefit greatly from the device, which ultimately helps out the entire group he is working with. Whether it be clearing out buildings in an urban environment to sweeping for mines and bombs in the dessert, the ISAW will be able to detect possible incoming threats to the soldiers. A simple introduction of technology such as this has the potential to be lifesaving and alter the scope of warfare to the technological age of present day.



As the world advances more and more into technology, the need for soldiers to be directly in the line of battle will decrease. This is through the implementation of many different technologically advanced machines and devices that can be used autonomously or wirelessly controlled. These implementations will take the place of soldier's jobs ultimately keeping them safe from battle, and aware of the environment they are dealing with. The ISAW is not the start of this trend towards technologically advanced devices in warfare; rather it is another step to keep more soldiers in the vehicles deployed to send them back to home.

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Biography of Team Members

David Dewan – Electrical Engineering major who is currently a 2 out of 4 year undergraduate student. He was responsible for all research pertaining to the thermal imaging sensor.

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Daniil Zolotarev – Electrical Engineer major who is currently a 3 out 4 year undergraduate student. He was responsible for all research pertaining to the microprocessor.