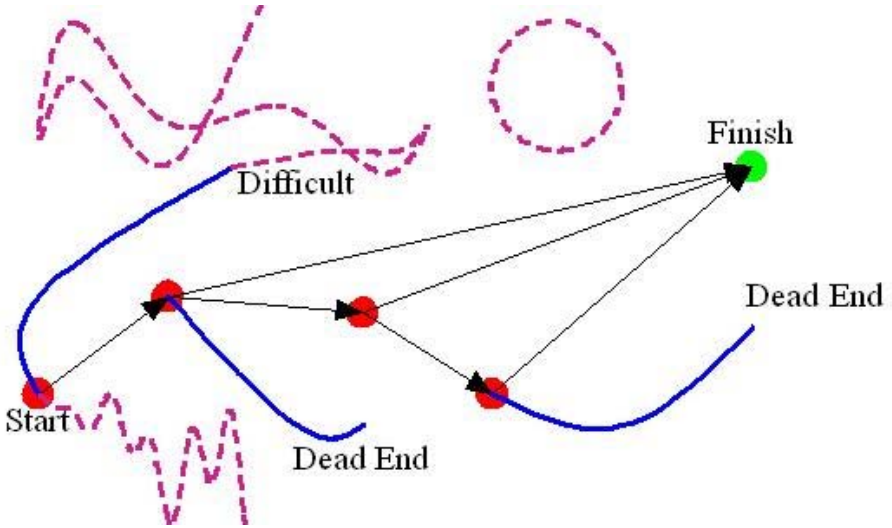
Solution Generation and Conceptual Design

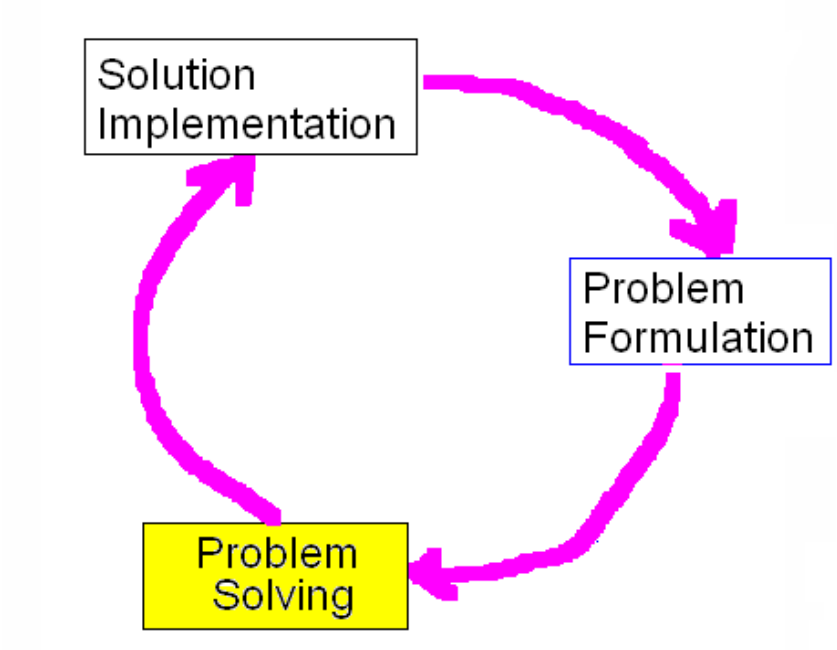


Electrical and Computer Engineering
Howard University

Instructor: Dr. Charles Kim

Class note webpage: www.mwftr.com/SD1415.html

Problem Solving → Solution Generation



- Objectives:
  - –Conceptual Design
  - –The steps of problem solving
  - –Strategies for generating, analyzing, and selecting alternatives

Where we are

- Problem was defined
- Current Status of Art investigated
- Design Requirements quantified (submitted today)
- So what's the next step?
  - Initial solution generation → Conceptual Design
  - Expansion of the solution space and generate alternative solution approaches
  - Select the top solution approaches
  - Team Conceptual Design for THE team solution which satisfies the design requirements
- Next week schedule (Oct 29)
  - Guest Speaker from NASA

How we did in the Current Status Investigation

Derrick McElwee
Dhuel Fisher
Isa Edwards-El
Jordan Monette
Senior Design

Research/ Search is done OK.

15/20

Advancements in Mobile Banking

Even as mobile banking continues to grow in popularity, many consumers are still extremely hesitant to adopt this new banking channel. They feel that mobile banking can expose their personal information and their banking accounts to hackers and prefer to stick with online banking as their main channel for bank transactions. However, what most consumers don't realize is that mobile banking is actually more robust security-wise than online banking.

This is NOT the summary!

How we did in the Current Status Investigation

15/20

Underwater Current Connector

Crepin A. Mahop (@02660097), Joshua Ajayi (@02646816), De'Shawnn Woods II (@02668528), Trey Morris, Kerri Chambers (@02667717), Akim Mahadiow (@02675762), Terinney Haley

October 15, 2014

First paragraph is not meant for Intro. only!

The current unmanned underwater vehicles (UUV) rely on advance technologies that use specific materials and systems to operate. In order for us to have a thorough understanding of the functionality and mechanism of those vehicles and later on incorporate solutions to solve or improve the current UUV, it is imperative to describe and define materials and systems that will play significant roles into this process. Our focus in this paper is to define and describe system such a radio frequency signal processing for UUV, compare different products such as dry-mate and wet-mate electrical connectors and the physical and chemical characteristic of materials such as niobium.

No summary is given here!

Status of Rele

RF Signal Pro

Radio f ed as a rate of oscillation in the range of 3 kHz to 300 GHz

Not significant research/search was done.

How we did in the Current Status Investigation

Research search is done ok. 15/20

Intruder

Jonnetta Bratcher (@02670878), Naja Green (@02665005), Justin Powell (@02662212), Jonathan Lopera (@02670079), Candace Ross (@02671771)

10/15/2014

(This is not the summary of the "Status". The 1st paragraph is not meant for Intro only.

Computing systems including personal computers, smart phones and medical devices are integrated into our daily lives, and they sometimes deliver critical functionalities. While we are heavily relaying on their performance, their security should be guaranteed to trust their execution. Therefore, security is main constituent of any computing machine. In practice, cryptographic algorithms are widely used to protect sensitive information from intentional leakage or modification. In this competition, our goal is to protect a sensitive medical device against possible attacks aimed to change its setting or expose stored personal information to unauthorized personals. We will setup a system consisting of one Intel Atom board and an infusion pump. The board has an Altera FPGA. We will implement several security measures on the FPGA against possible attacks on the infusion pump.

I. Status of Relevant Technology

Technology is rapidly growing and evolving, leading to a wider realm of implementation. As technology expands, particularly that of computers, the need for data security and protection magnifies as well. Information security is important in both software and hardware systems. In software realm, malicious attacks occur through various methods. One such method is malware, a general term for software that can be installed unintentionally on either personal or organizational computers to create damage. Examples of malware include computer viruses, worms, Trojans, spyware, adware,

How we did in the Current Status Investigation

20/20

Sign Language to Text (SLATE)

Renika Montogomery(@02710019); Yonathan Yilma(@02665148); Reginald Etienne; Claude Nzdami Kolloh (@02685957); Marcos Celestino Carvalho Junior(@02727654); Sarad Dhungel (@02669503)

October, 15, 2014

The core principle behind our project is to create a fast and efficient method of communication for the hearing impaired with others that do not know sign language. The theory of the technology is to have a device that is portable and inexpensive that has a camera to record sign language (American Sign Language) which is then translated into English. The output could be in text or voice form. One particular product, which we have just found out about in the past couple days, is really similar to project. The "MyVoice" device is a small, handheld gizmo which looks like the average smartphone that is composed of a built-in microphone, speaker, soundboard, video camera, and monitor. The camera records the hand motions of a person speaking ASL, processes the video, and then serves up a spoken translation via an electronic voice. It can also work in the other direction, converting spoken words into sign language that is then displayed on the monitor. We are forced into changing our direction to achieve our goal because the "MyVoice" product is almost identical to our proposed plan. The device only has prototypes and is only to translate one single phrase at the time. We have not decided in which ways to change our project as we have just discovered about this device late but one suggested ideas are to create a more efficient, cheaper model. Another suggestion is to be able to use a device with camera that customers already have such as phones and tablets. Using these devices we can provide software or an app that can help perform the task so that the customers would not have to buy or carry another device.

Very well done 1st para

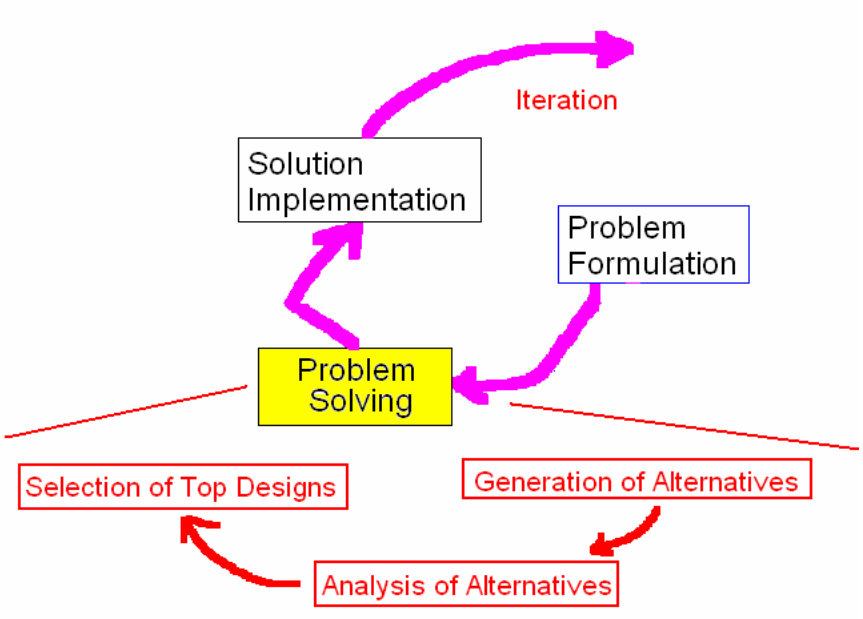
REDO for the Current Status Investigation

- **Remedy works required for the 3 teams**
  - More investigation (if required or desired)
  - Refined First Paragraph
  - Submission of the revised Current Status of Art → **Monday 11:59pm 10/27/2014 via email**

- **Submission (Late) is required for 1 team**
  - Penalty in score, but better than no submission
  - Is team dynamics problematic already?

Problem Solving Process

- Problem Solving Process
  - **Finding** design **solutionS** to a problem ---" 1 SolutionS Generation"
  - **Exploring and Analyzing** those solutionS, and ---"2 Analysis of Alternatives"
  - **Selecting** the most promising design for implementation --- "3 Top Design Selection"



Step 1: Generation of solutions (and Alternatives)

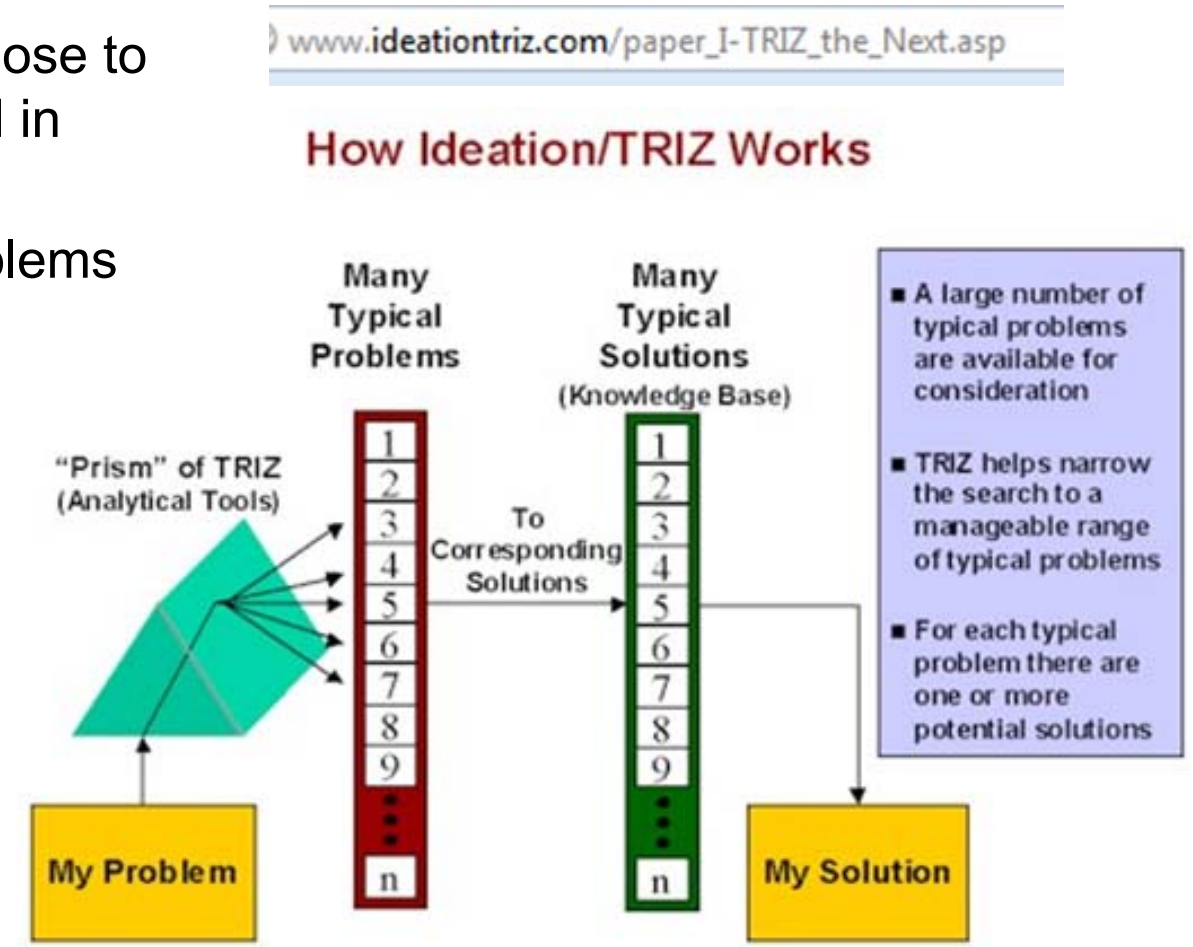
- The act of expansion - all possible solutions
- Overcome the temptation to adopt the first idea
- Building on the initial conceptual design and consider (or add) alternative ways of achieving the solution
- Wide design space but true to the problem (and functional requirements) → better approach, better efficiency, economical way, etc.

How do I/We generate solutions?

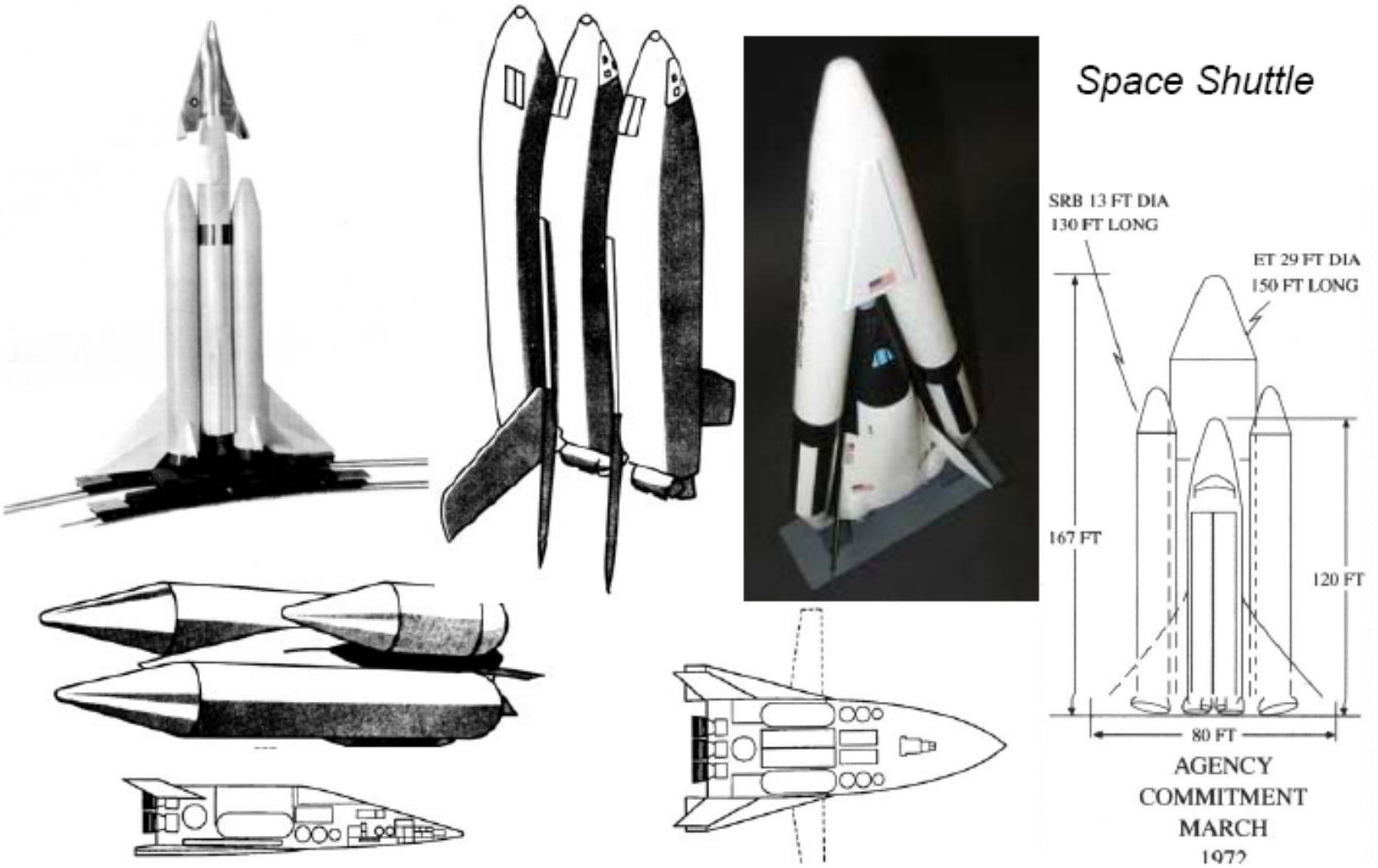
- Period of Ideation is a vulnerable period of ideas
- Use creativity – remember that you're more creative than your daily life shows
- More ideas can be generated if team members first develop ideas individually and then pool them together
- Setting the problem aside and then returning to it ("incubation") helps stimulate more idea generation
- **Team Idea Generation Strategy**
  - **1 Individually, think of the problem and generate ideas (day 1) – Individual Idea Generation**
  - **2 Set the problem aside (day 2) - Incubation**
  - **3 In the team meeting (day 3), present individually generated ideas, and build on them. – Determination of a Team Idea**
  - **If no satisfactory solution is achieved, do the steps of 2 and 3 again.**

How do I/We generate solutions?

- **Ask**, using the TRIZ approach:
  - How are problems close to the given one solved in other patents?
  - How are similar problems solved in leading industries?
  - How are opposite problems solved?
- **Do**, using the TRIZ approach
- Generate multiple alternative ideas



Remember the different designs of space shuttle?



We can use "Conceptual design" for **initial** & alternative solution approaches

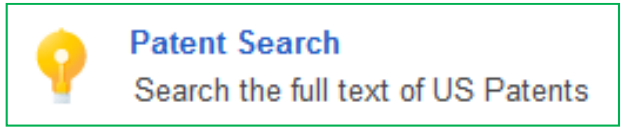
- **Conceptual Design**
  - Provides general or system level structures with schematics, block diagrams, flowcharts, etc, to reach at the desired solution which satisfies the design requirements
  - Provides a description of the desired system which satisfies the design requirements
  - Provides integrated ideas and concepts about how the desired system does, behaves, and responds.
  - Defines, in addition to functionality, aesthetics (looks).
  - Uses drawings and models and proto-type products
- **How do we make a conceptual design?**
  - Any good example or case to start from?

"Conceptual Design" Examples from Patents which are relevant to the project

- **A good conceptual design should:**
  - Provide a description of a desired system which satisfies the design requirements
  - Provide integrated ideas and concepts about how the desired system behaves [functionality] and looks [aesthetics]
  - Use drawings and/or models and/or proto-types
- **Learn from Patents for a good conceptual design**
  - Follow Patent Figures and their Descriptions using the Figures
  - How different figures (structure, logic diagram, flowchart, hardware, software, etc) are deployed to describe different (or ALL) aspects of the idea (conceptual design for solution)

"Conceptual Design" Examples from Patents Relevant to the Projects ----

- **Examples of Conceptual Designs**
  - Next slides (a lot of them) will show different ways **of drawing figures** (for different purposes and different elements such as structure, H/W, S/W, operation flow, network, etc) and **of describing the concept using the figures**.
  - I picked the patents that are relevant to the class projects.
  - You may want to read the **details of inventions** of your interest (Use Google Patent search with Patent Titles)

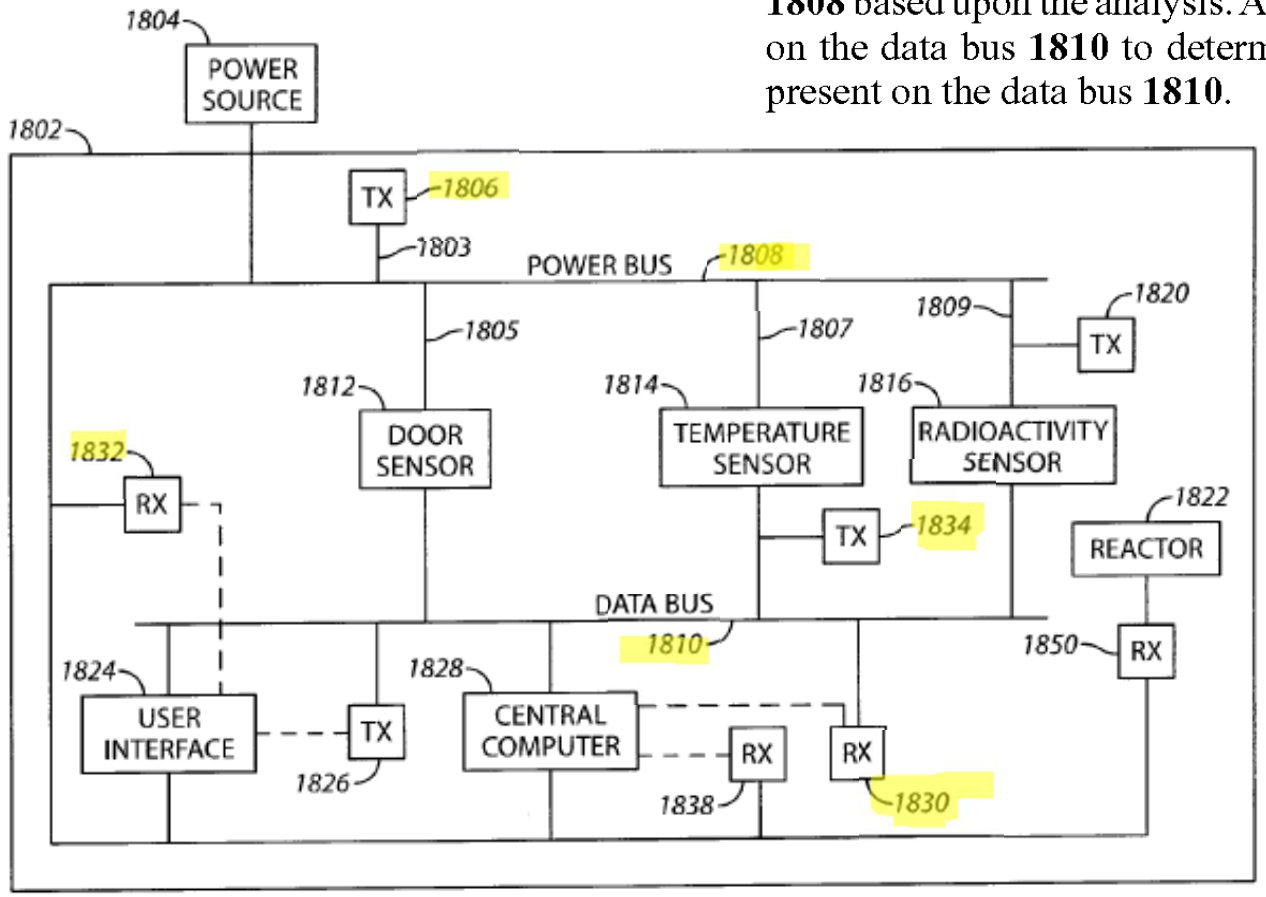


- **CAUTION 1**:
  - You do not have to follow the examples shown in the next slides; they are for illustrating that there are many different ways of drawing for different purposes.
- **CAUTION 2**:
  - Do not blindly follow the way the inventions are structured or the inventions themselves; You have your own way of solving your problem.
  - Design for your problem and your project

Conceptual Design - Examples

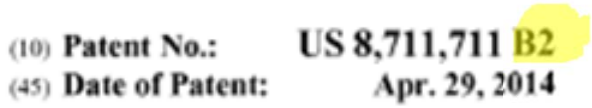
(10) **Patent No.:** **US 8,711,711 B2**
(45) **Date of Patent:** **Apr. 29, 2014**

In other aspects, a modulated signal is transmitted from the transmitter **1834** or **1806** and across the power bus **1808** that is coupled to the sensors **1812**, **1814**, or **1816**. The modulated signal is received at the receiver **1832**. The receiver **1832** analyzes the received modulated signal and determines whether an intermittent fault has occurred on the power bus **1808** based upon the analysis. A similar approach can be used on the data bus **1810** to determine if intermittent faults are present on the data bus **1810**.



Kind Codes of USPTO

- A letter and a number which follow the patent number
- WIPO Standard ST. 16 code: “Kind Code”
- Kind codes changed in January 2, 2001



Kind Code	Kind of Document
A1	Patent Application Publication
A2	Patent Application Re-publication
A9	Patent Application Corrected-publication
B1	Patent [No previously-published pre-grant publication]
B2	Patent [having previously-published pre-grant publication]
P1	Plant Patent Application Publication
P2	Plant Patent [No previously-published pre-grant publication]
P3	Plant Patent [Having previously-published pre-grant publication]
S	Design Patent

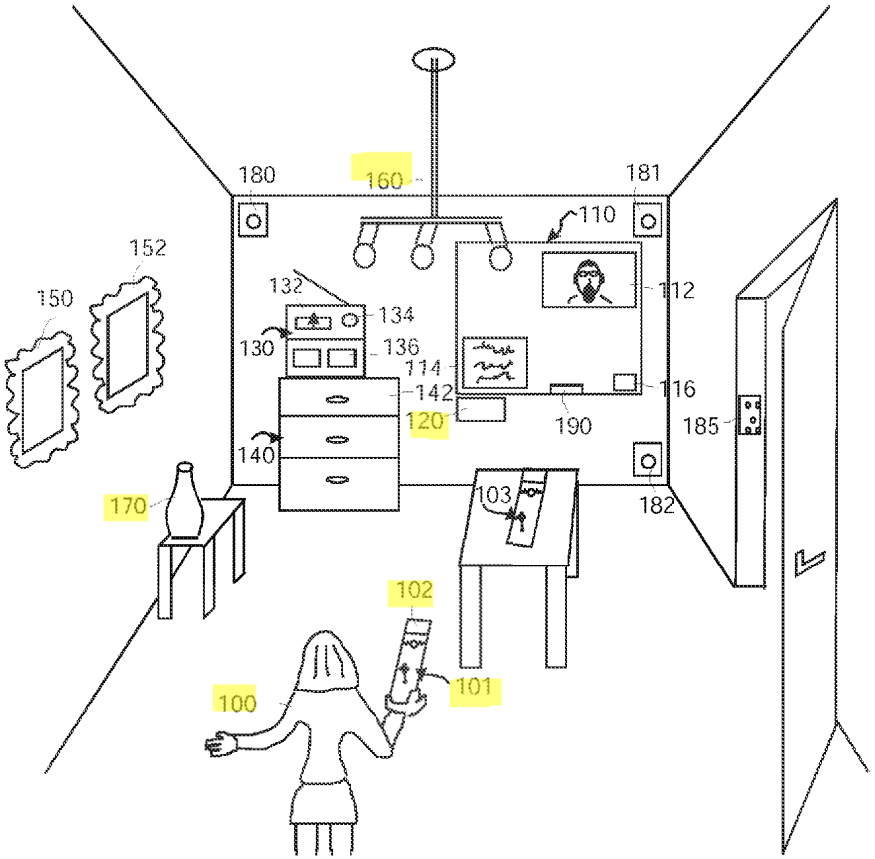
Conceptual Design - Examples

- User Interface System Based on Pointing Device

(10) **Pub. No.: US 2014/0062879 A1**
(43) **Pub. Date: Mar. 6, 2014**

[0049] According to the invention, the pointing device **101** contains a camera **102**, and can send pictures of regions of a room or objects in those regions to a digital signal processor (DSP) **120**, which can identify the regions or objects on the basis of one or more pictures imaged by the camera **102**. The camera is connected to the pointing device **101** in such a way, that it images well the region pointed to. E.g. it can typically reside at the far end of the pointing device **101**, but it could also be mounted on the side under an angle. The user **100** has the freedom to point to whatever object he wants, and in such a way a very user-friendly and powerful user interaction system can be realized.

[0051] The DSP **120** is designed to send user interface information I, e.g. apparatus control data ac, to an identified apparatus. E.g. user **100** can point the pointing device **101** to light **160** and push an on-button on the pointing device **101**, which results in the DSP **120** sending an on-command to the identified light **160**. The object identified needs not be the apparatus to be controlled itself. E.g. pointing at vase **170** may



Conceptual Design - Examples

- Evolving light patterns in the canvas of LEDs

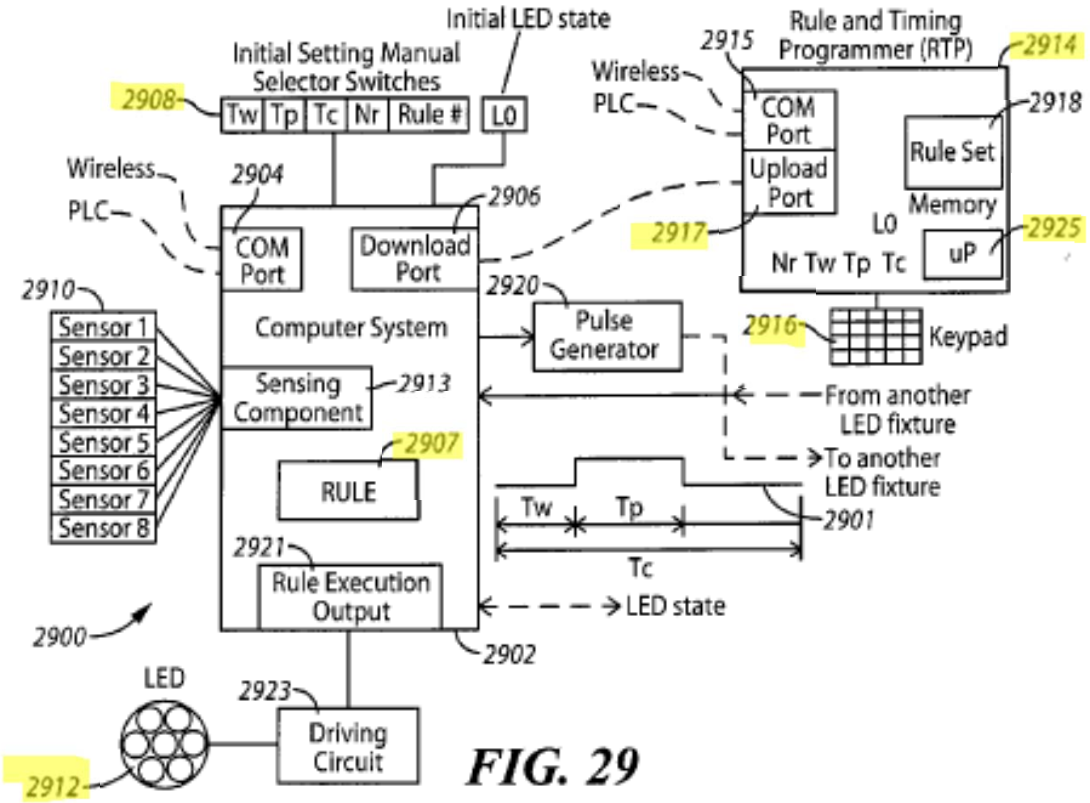


FIG. 29

The initial items can be either determined by the manual selector switches **2908** separately placed in the LED fixture or by downloaded from a Rule and Timing Programmer (RTP) **2914**, a separate system not installed in LED fixture. The RTP **2914** includes a processor **2925** and can be realized by a computer system which is capable of wired communication downloading and wireless or PLC communication of the items needed in the LED fixtures that can be typed in by a keypad **2916** attached to the RTP **2914** or available in a memory **2918** inside the RTP **2914**. The RTP **2914** includes a COM port (to receive wireless or PLC data) and an upload port **2917** (to upload information to the download port **2906**). A rule **2907** is downloaded via COM port **2904**. The information from the sensors is processed by sensing components **2913**. A rule execution output **2921** (with instructions as to how to drive the LED **2912**) drives a driving circuit **2923** that converts the instructions to electrical signals to control the LED **2912**.

Another approach for initializing the items mentioned above, whether via manual selector switches **2908** or by RTP **2914**, is to obtain the row number (Nr) and a table of the row number and the timing pulse information for the row number, which is stored inside the memory of the controller and retrievable to the computer system, instead of reading them all separately. This alternative approach is advantageous if the initial setting values are to be downloaded or communicated from the RTP **2914**.

Conceptual Design - Examples

- Power cutting tool with synchronized dust control device

Upon the magnetizing coil **66** of the relay **68** being energized, normally open contacts **70** of the relay are closed, thereby closing the partial circuit with connects the receptacle **36** to another receptacle **72**. It is important to note this continuity, which occurs simultaneously with connecting all power consuming components of the cutting tool electric motor **12** to power.

This in and of itself does not start the appliance electric motor **28**. The appliance electric motor **28** may be actually connected to operating power in either one of two ways. In one way, an extension cord **74** having a first plug and cord assembly **76** and a second plug and cord assembly **78** may be connected to the standard electrical receptacle (not shown) of the residential electrical system, provided that the selected electrical receptacle is not on the same circuit as that into which the plug and cord assembly **32** has been inserted. This connection scheme is not an absolute condition, but is an assurance that the protective device serving the selected electrical receptacles will not open the power circuit, as could occur should both the cutting tool electric motor **12** and the appliance electric motor **28** be connected to the same general purpose receptacle circuit.

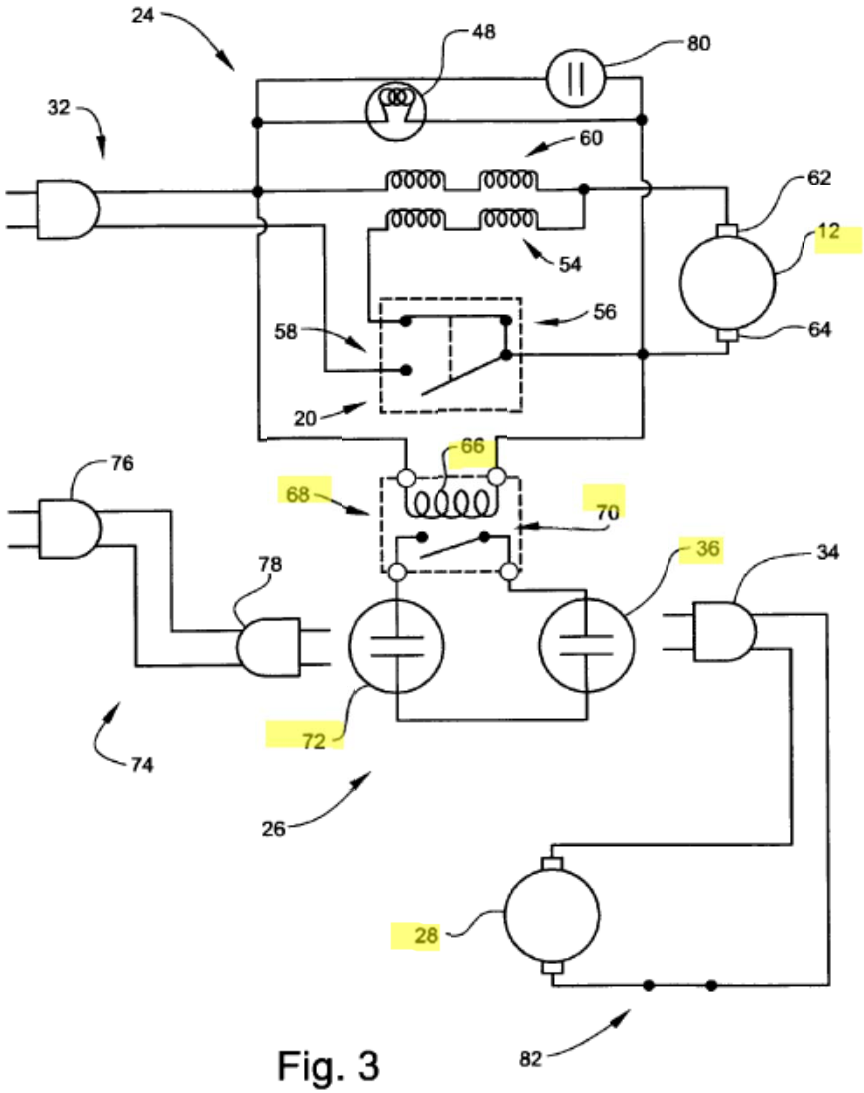


Fig. 3

Wet- and Dry-Mates

[54] **CONVERTIBLE DRY-MATE TO WET-MATE SUBMERSIBLE ELECTRICAL CONNECTOR SYSTEM**

As illustrated in FIG. **5**, a second connector that is wet-mateable with the distal end of adapter **100** comprises a generally cylindrical termination shell **29**, a plug shell **9**, and multiple electrical contact pins **11**. Pins **11** have conductive tips **21**, shafts **22** coated with an insulating material, and solder pots **25**. The second connector also comprises an end plate **13** made of a rigid dielectric material. End plate **13** has multiple bores **23** that retain pins **11**. End plate **13** provides a close-tolerance fit between bores **23** and insulated shafts **22**, maintaining pins **11** in position. An elastomeric gland seal **14** is retained in each bore **23** by an annular shoulder **24**. Gland seals **14** form fluid-tight seals between insulated shafts **22** and bores **23**. An O-ring **16** is retained in an annular groove in end plate **13** and forms a fluid-tight seal between shell **9** and end plate **13**. A snap ring **15**, which snaps into aligned shoulders in endcap **34** and shell **9**, captures end plate **13**.

Multiple insulated wires **27**, each comprising a center conductor and an insulating jacket, and each corresponding to a pin **11**, are soldered, crimp-fit, or otherwise electrically and mechanically connected to their corresponding pins **11**. A sleeve seal **71** seals the gap where the conductor of each insulated wire **27** exits from its jacket and enters solder pot **25**. Sleeve seal **71** extends over a portion of insulated shaft **22** and a portion of the insulting jacket of wire **27**. Sleeve seals **71** are encapsulated in a dielectric base **5**.

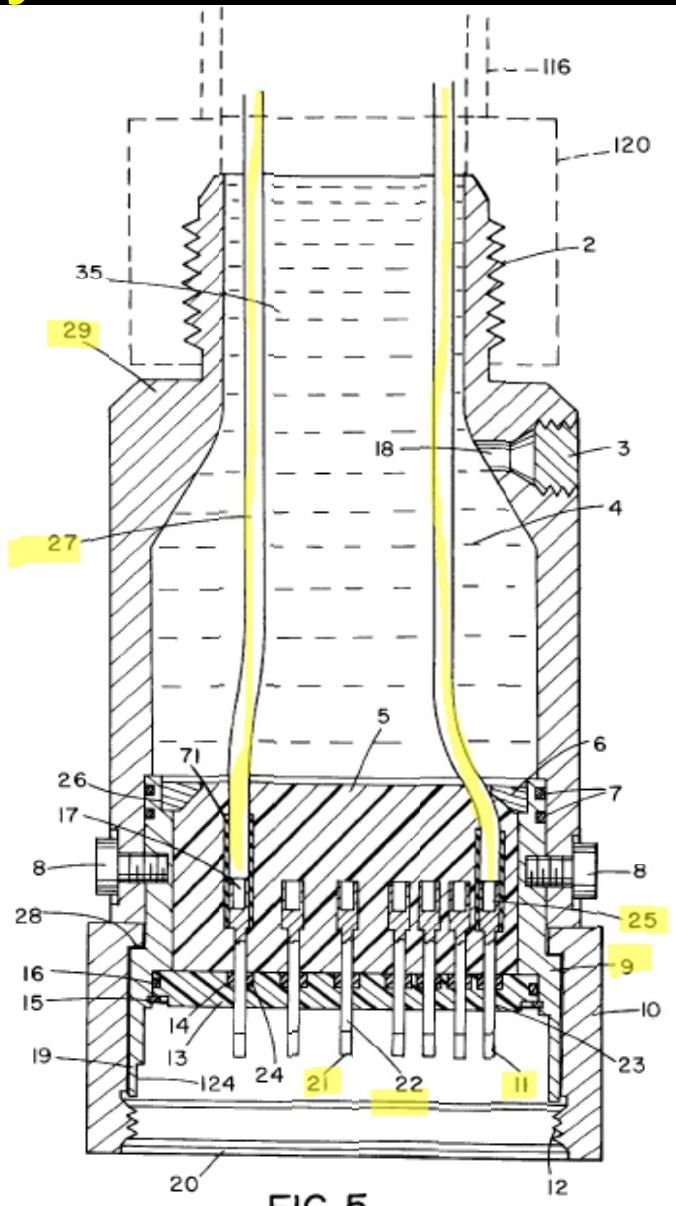


FIG. 5

Wet-Mate Connector

(54) **WET MATE CONNECTOR**

(10) **Patent No.: US 7,959,454 B2**

(45) **Date of Patent: Jun. 14, 2011**

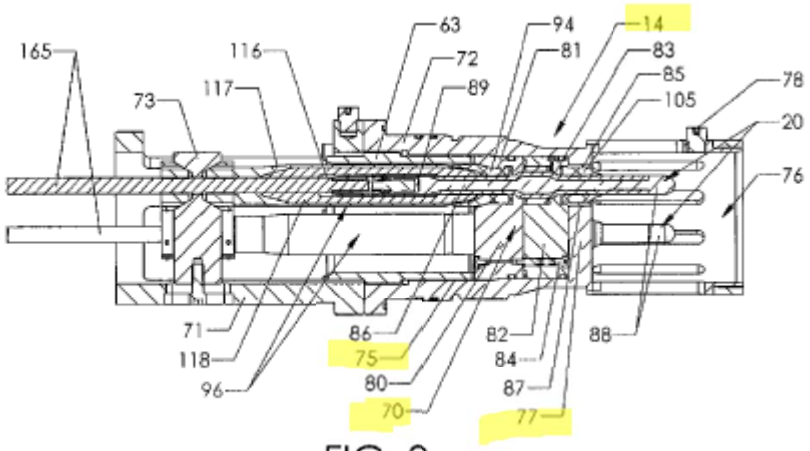


FIG. 9

Plug unit **14** is illustrated in FIGS. **9** and **10**, with FIG. **10** illustrating the plug module or penetrator subassembly **70** without the outer shell. As illustrated in FIG. **9**, plug unit **14** comprises an outer cylindrical shell **72** of rigid material having a bore **75**, a recessed front wall **77** having openings **87** aligned with the plug probes or pins **20** which extend through the wall, and an open forward end sleeve **76**. A conventional alignment key **78** projects radially outwardly from the shell **72**. When the plug and receptacle units are secured together, key **78** will engage in axial alignment keyway **79** in the receptacle (see FIG. **3**), as is known in the field. This provides proper alignment of the electrical pins and sockets in the plug and receptacle units as the units are mated together. FIG. **9** also illustrates a rear adapter or termination shell **71** containing cable support clamp **73** and surrounding the spliced rear ends of contact pins **20**.

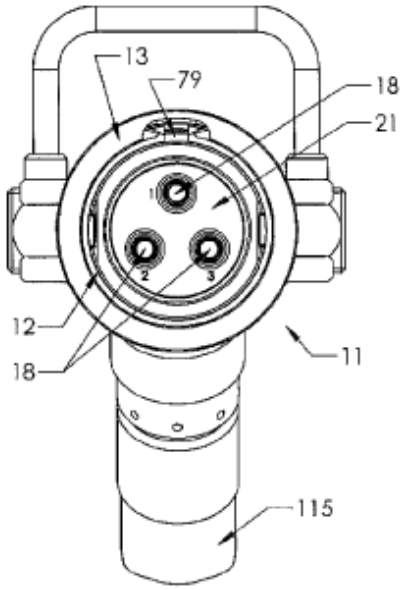


FIG. 3

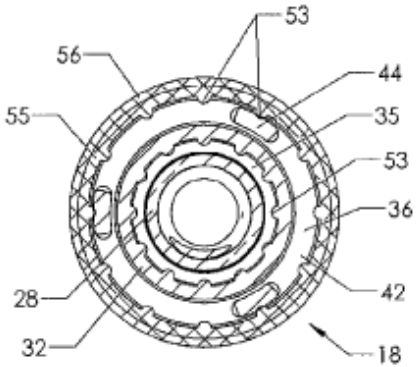


FIG. 5

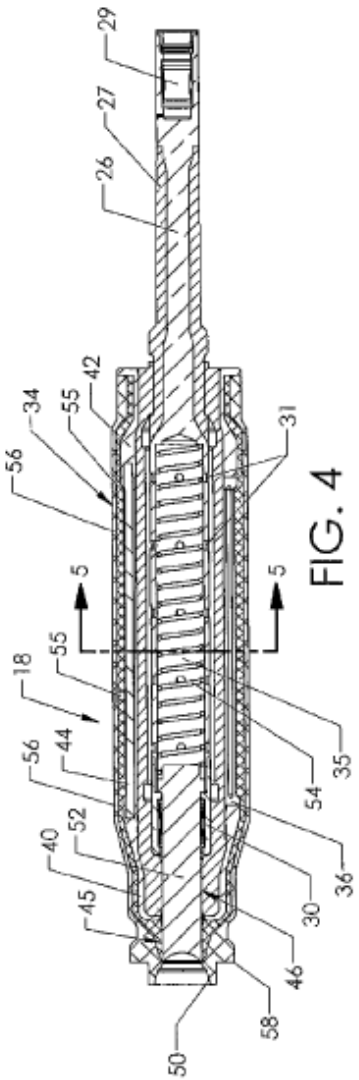


FIG. 4

Signal Coupler

[54] **SIGNAL COUPLING APPARATUS**

[11] **3,925,737**

[45] **Dec. 9, 1975**

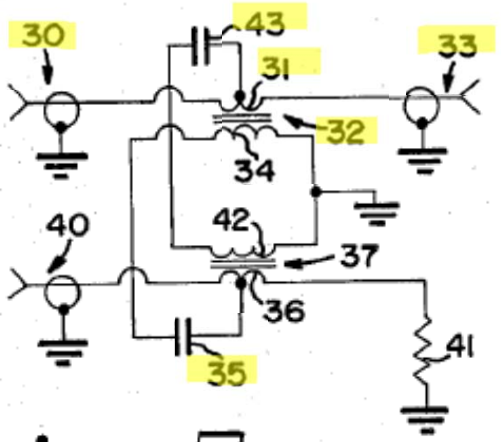


Fig. 2

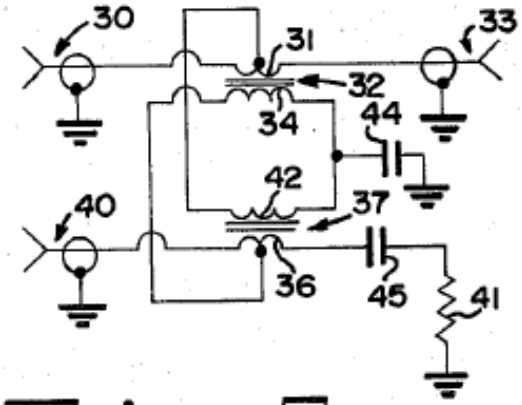


Fig. 3

In FIG. **2** a directional coupler in accordance with the invention is illustrated schematically. An input means or port **30** is illustrated as an RF coupler connected to a coaxial cable. The center conductor of the coaxial cable is connected via a primary winding **31** of a transformer **32** to an output means or port **33** also illustrated as an RF coupler connected to a coaxial cable. Input means **30** and output means **33** together with the center conductors of the coaxial cables define a pri-

FIG. **3** is a schematic illustration of a second embodiment of the invention wherein low frequency power is also coupled to the secondary transmission path. In FIG. **3** capacitors **35** and **43** are removed. Primary winding **42** of transformer **37** and secondary winding **34** of transformer **32** are connected to circuit ground through a blocking means illustrated as a capacitor **44** instead of being connected directly to circuit ground. A blocking means illustrated as a capacitor **45** is connected between secondary winding **36** of transformer **37** and idler resistor **41**.

RF Choke for Signal Coupling

[54] **RADIO FREQUENCY CHOKE AND TAP**

[11] **Patent Number:** **5,483,208**

[45] **Date of Patent:** **Jan. 9, 1996**

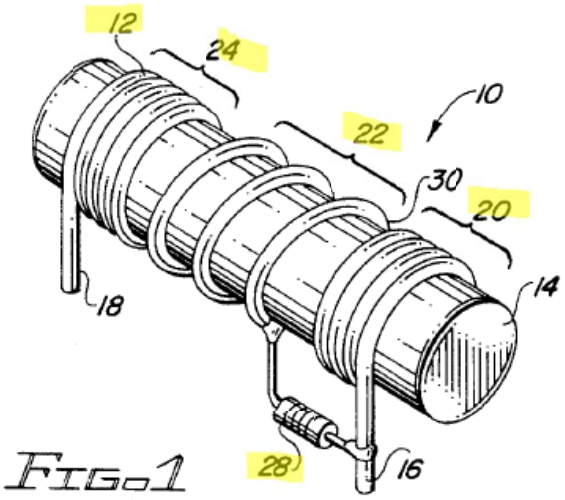


FIG. 1

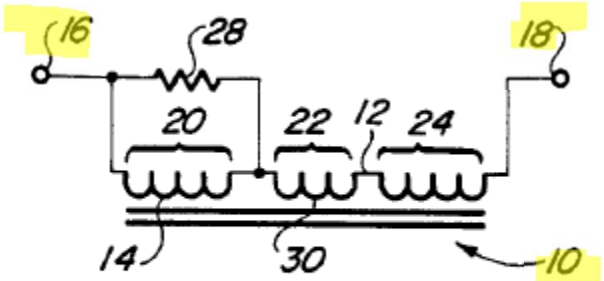


FIG. 4

The RF signals and the AC power signals are transmitted onto the input lead **16** and exit RF choke **10** at output lead **18**. The wire **12** is wound around the core a predetermined number of turns. Preferably the wire is wound eleven times to form a first winding group **20** of four abutting windings, then wound into a second winding group **22** of three spaced apart windings and a third winding group **24** of four abutting windings. It is critical that the first and third winding groups **20** and **24** have the same number of windings.

A resistor **28** having a preselected value is connected between the input lead **16** and a first turn **30** of the wire **12** in the second winding group **22**. Resistor **28** preferably ranges in value between 325 ohms and 1490 ohms, with the preferred resistor value being 620 ohms, plus or minus five percent, and has an ⅛ watt power rating.

As is shown, cable transmission and distribution systems vary in bandwidth of the RF signals and AC current carrying capacity. Such systems will affect the choke configuration. Thus, the following description is presented for completeness and is intended as an example and not as a limitation of the present invention.

Voice Encryption

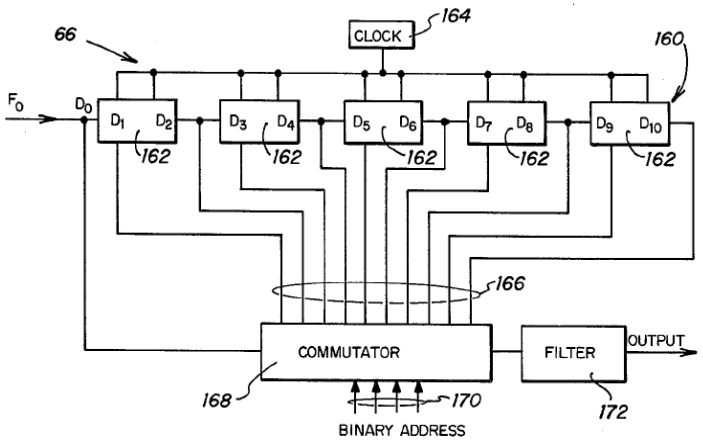


FIG. 5

[54] **DYNAMIC FREQUENCY AND TIME VOICE ENCRYPTION SYSTEM AND METHOD**

[11] **4,278,840**

[45] **Jul. 14, 1981**

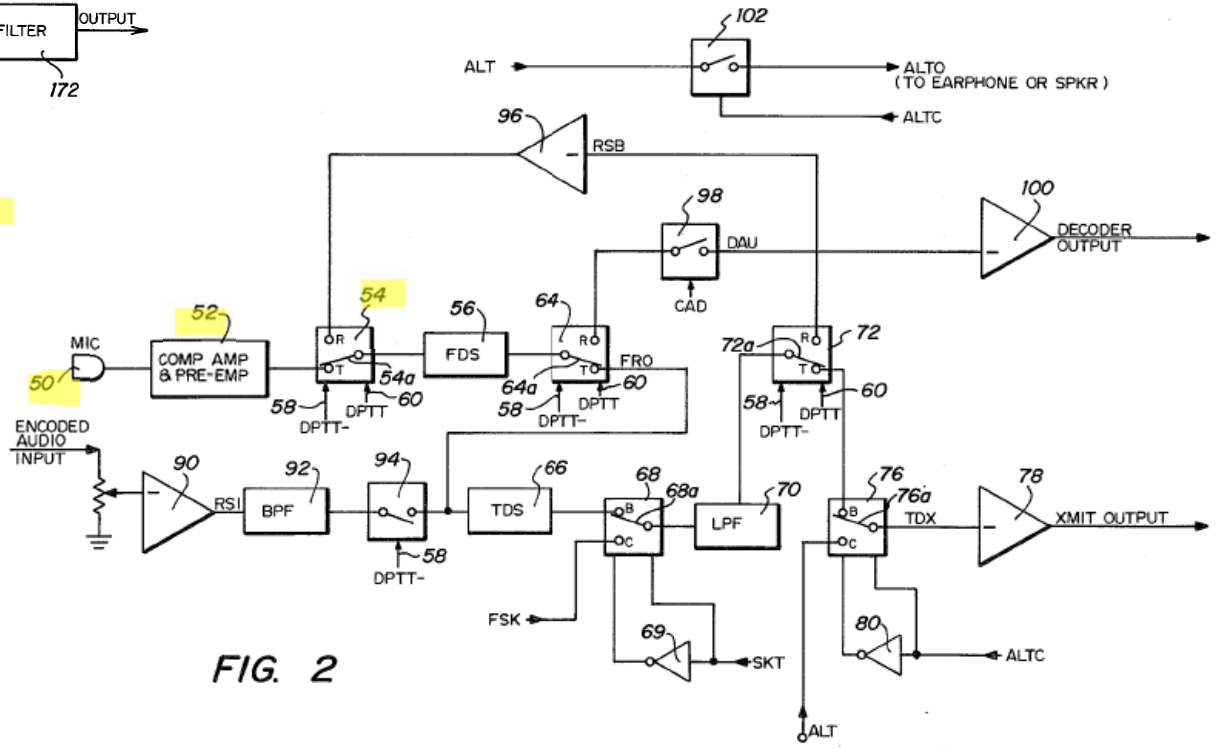


FIG. 2

FIG. 1 is a block diagram of the present voice scrambling system **10**. A microphone **50** is adapted to receive voice signals. The audio output of microphone **50** is applied to a compression amplifier and pre-emphasis network **52** and is routed through an electronic switch **54** to a frequency division section (FDS) **56**. The frequency division section **56** of voice scrambler system **10** will be subsequently described with reference to FIG. **3**. Electronic switch **54** includes a switch arm **54***a* movable between the R and T terminals. As shown in FIG. **2**, when switch arm **54***a* contacts the T terminal, voice scrambler system **10** is in the transmit mode. When switch arm **54***a* contacts the R terminal, voice scrambler system **10** is in the receive mode. The positioning of switch arm **54***a* is controlled by operation of Push-To-Talk switch **20** (FIG. **1**) which generates the Push-To-Talk signal represented by two signal lines, DPTT- and DPTT applied to electronic switch **54** by signal lines **58** and **60**. Electronic switch **54** is a solid state, single-pole, double-throw switch.

Voice Encryption

(54) **ONE VAULT VOICE ENCRYPTION**

(10) **Pub. No.: US 2011/0222688 A1**
(43) **Pub. Date: Sep. 15, 2011**

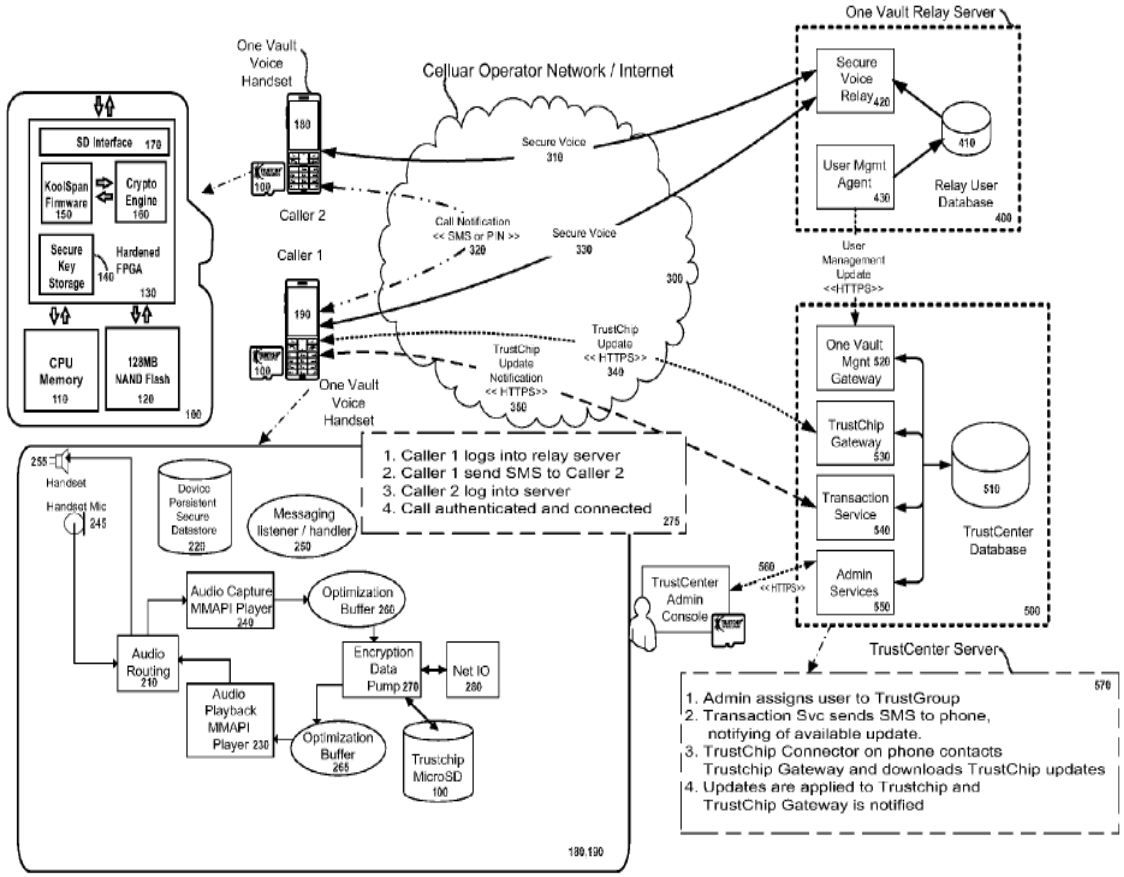


FIG. 1

[0034] FIG. **1** is a block diagram of the overall system of the present invention. Referring to FIG. **1**, there are several major components of the One Vault Voice system of the present invention, each of which will be described in more detail below. Encryption device **100** may comprise a KoolSpan TrustChip manufactured by KoolSpan, Inc. of Bethesda Md.

[0035] FIG. **7** is a diagram illustrating the major features of the trust chip solution. FIG. **8** is a diagram illustrating the major components of the trust chip. FIG. **9** is a diagram illustrating how keys may be stored in the trust chip. Referring to FIGS. **1** and **8**, encryption/decryption device **100** may comprise a TrustChip, which is a silicon-based design supporting KoolSpan's security architecture for wired and wireless networks. Easy to implement, there are no Public Key Infrastructure (PKI) certificate servers to deploy, configure or maintain. encryption/decryption device **100** may be provided with standard SD Card/USB interfaces **170** and is provided with a hardened, tamper-resistant, tamper-evident package **130**. Each Trust Chip **100** is provided with a unique, secret serial number stored in flash memory **120**. An internal 32-bit processor **110** generates and handles keys. The device supports multiple security associations, network connections and applications and is provided with bi-directional authentication. FIPS certified algorithms stored in firmware **150** are used to generate keys stored in secure memory area **140**. Customizable firmware **150** may be provided for specific OEM applications. Once keys are generated, crypto engine **160** may encrypt data received and sent through secure interface **170**.

Mobile Banking Payment Platform

(54) **MOBILE BANKING AND PAYMENT PLATFORM**

(10) **Pub. No.: US 2010/0191602 A1**
(43) **Pub. Date: Jul. 29, 2010**

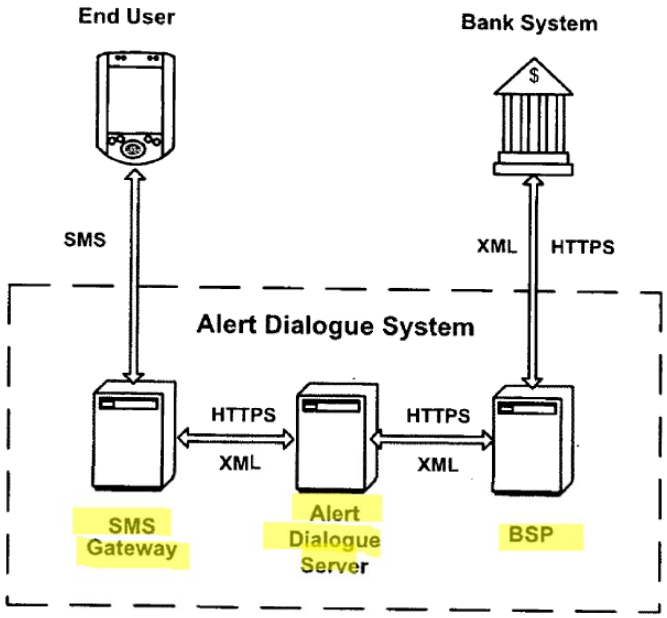
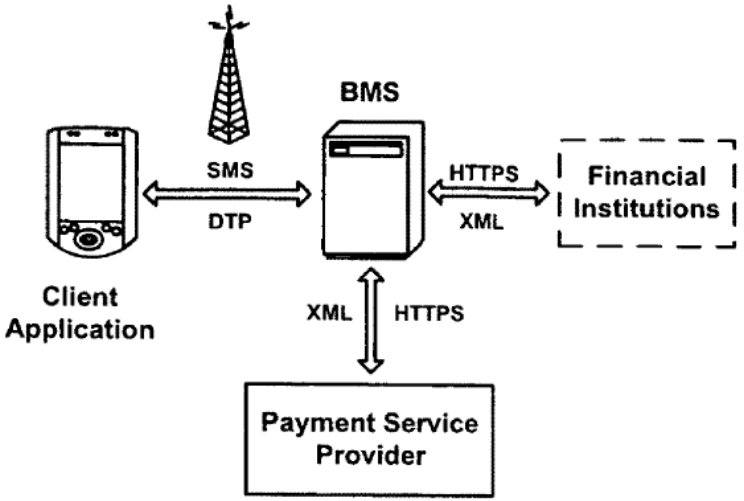


FIG. 7



[0061] Interactive Alert Dialogue System includes the following main components: the SMS Gateway (SMSG), a Bank Secure Platform (BSP) and an Alert Dialogue Server (ADS). In one preferred non-limiting embodiment, the general architecture of the System is illustrated at FIG. 7, the SMS Gateway connects to an SMS Center (SMSC) of a mobile services operator, supports several SMSC protocols conversion of HTTP-requests to binary text messages, conversion of binary text messages to HTTP-requests, retries on failures and logging of transactions. The Alert Dialogue Server allocates a dialogue ID and channel to a dialogue with session details, matches of reply with corresponding dialogue and forwards of an answer back to BSP. If sending of answer fails, it is handed over to the spooler framework. The Bank Secure Platform (BSP) provides authentication, protective guards, such as load control, dynamic reply—URL management, XML message checking, delivery of dialogue status, etc.

Mobile Banking Transactions

(54) **PERSONALIZED MOBILE BANKING TRANSACTIONS**

(10) **Patent No.:** **US 8,725,577 B2**
(45) **Date of Patent:** ***May 13, 2014**

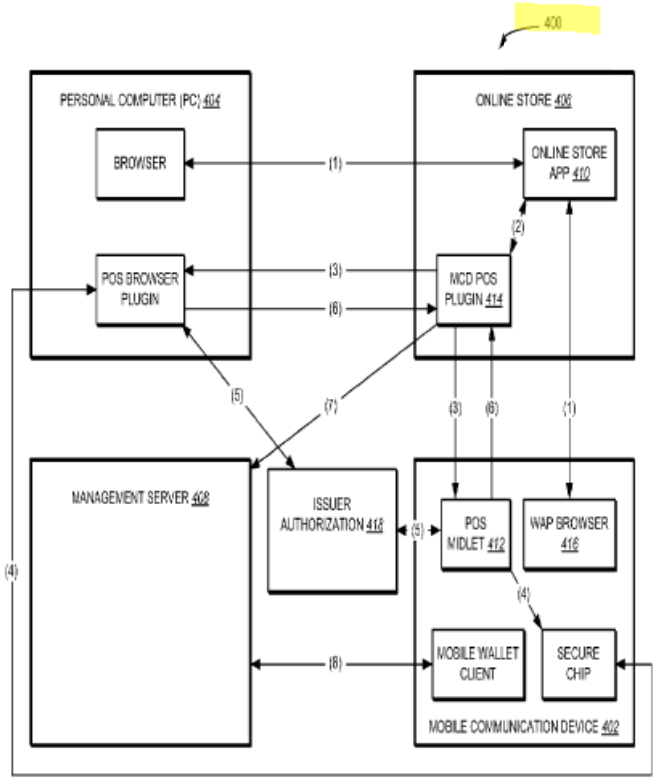


FIG. 4

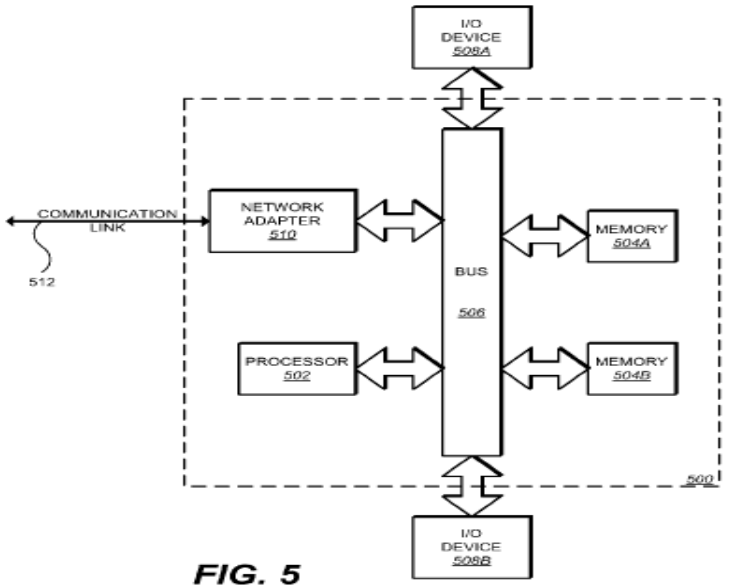


FIG. 5

FIG. **4** illustrates an example payment transaction being made in a communication system **400** in accordance with one implementation. The communication system **400** includes a mobile communication device **402**, a personal computer (PC) **404**, an online store **406**, and a core (or datastore) **408**. As indicated by interaction (1), a user (or customer), using a phone (e.g., mobile communication device **402** or personal computer **404**), browses an online store website (online store application **410**) and finds an item that the customer wishes to purchase. This could also be a purchase made through a midlet application (POS midlet **412**) residing on the mobile communication device **402**. The user then goes to, e.g., a checkout of the online store **406** make a purchase. If the user has coupons in their mobile wallet the user can either manually apply the coupon or have the coupon automatically

Hardware Trojan-Resistance

(54) **TROJAN-RESISTANT BUS ARCHITECTURE AND METHODS**

(10) **Patent No.: US 8,549,630 B2**
(45) **Date of Patent: Oct. 1, 2013**

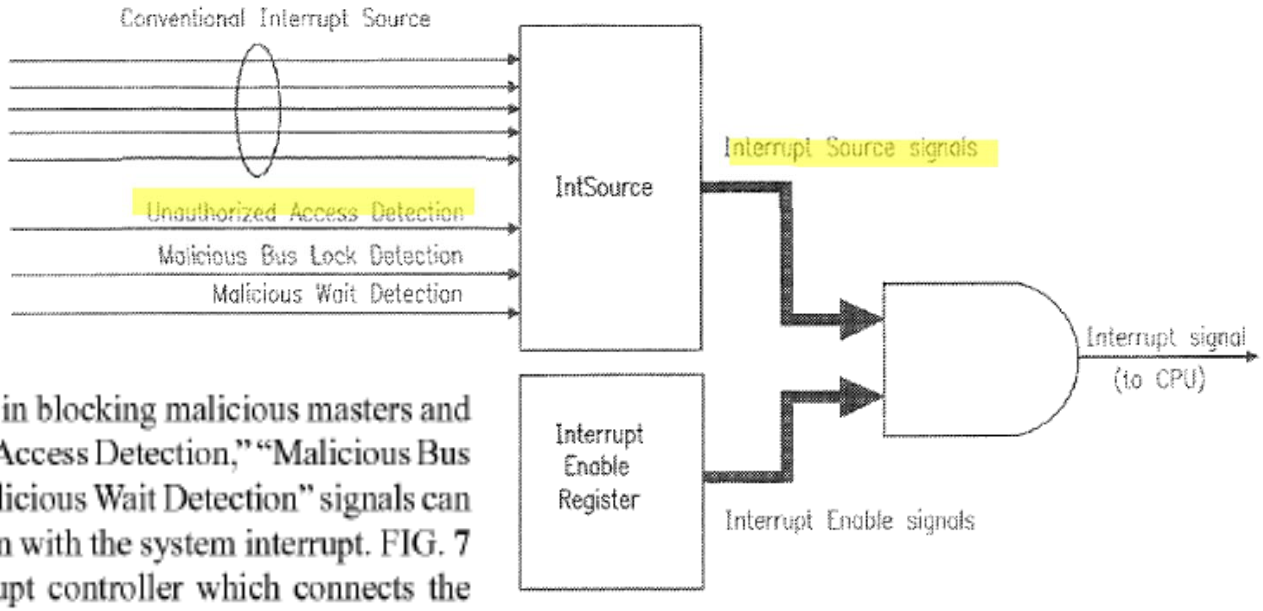


FIG. 7

In addition to their uses in blocking malicious masters and slaves, the "Unauthorized Access Detection," "Malicious Bus Lock Detection," and "Malicious Wait Detection" signals can also be used in conjunction with the system interrupt. FIG. 7 shows a simplified interrupt controller which connects the detection signals as interrupt sources. When a malicious behavior is detected in One of the proposed bus components, at first the behavior is temporarily blocked. The corresponding detection signal triggers a system interrupt, causing the CPU to jump to a vector address corresponding to an appropriate interrupt handler routine. In the interrupt handler routine, the CPU utilizes a specific interrupt service routine corresponding to the detection signal. Actions taken can include reporting malicious behaviors to users or host systems.

Network Security Protection

(54) **NETWORK SECURITY PROTECTION**

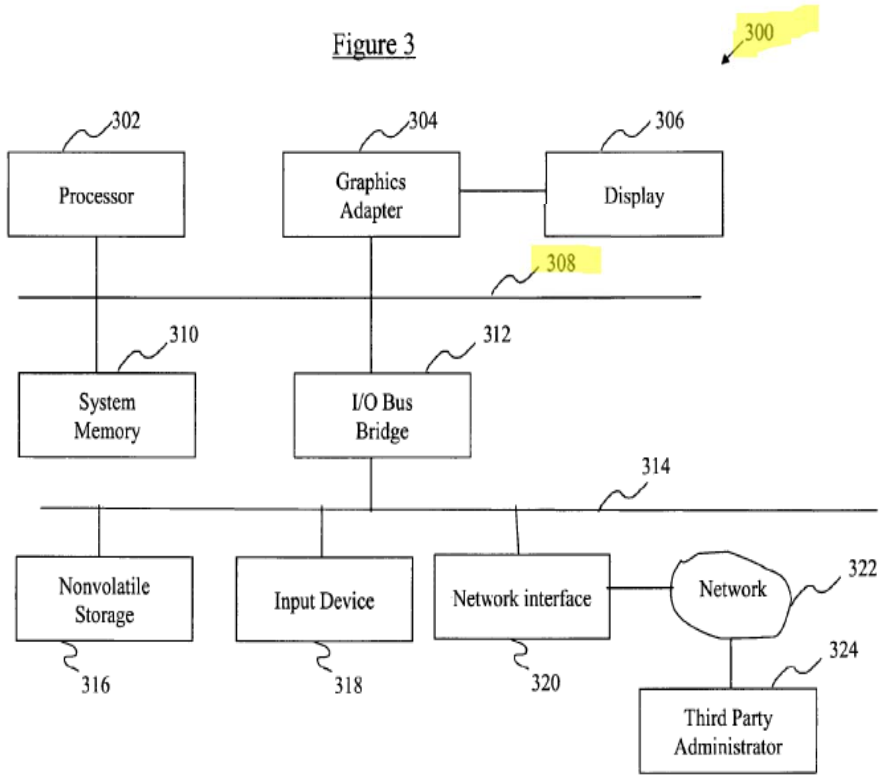
(10) **Patent No.: US 8,813,216 B2**
(45) **Date of Patent: Aug. 19, 2014**

With reference now to the FIG. **3**, there is depicted a block diagram of an exemplary data processing system that may be used by a server or client user in an NJE node in accordance with the present invention. Data processing system **300** may be, for example, one of the models of personal or server computers available from International Business Machines Corporation of Armonk, N.Y. Data processing system **300** includes a central processing unit (CPU) **302**, which is connected to a system bus **308**. In the exemplary embodiment, data processing system **300** includes a graphics adapter **304** also connected to system bus **308**, for providing user interface information to a display **306**.

Also connected to system bus **308** are a system memory **310** and an input/output (I/O) bus bridge **312**. I/O bus bridge **312** couples an I/O bus **314** to system bus **308**, relaying and/or transforming data transactions from one bus to the other. Peripheral devices such as nonvolatile storage **316**, which may be a hard disk drive, and input device **318**, which may include a conventional mouse, a trackball, or the like, is connected to I/O bus **314**.

Communication with processing system **300** is via a network interface **320**, which is preferably a Network Interface Card (NIC) or similar logic known to those skilled in the art of network communication. Network interface **320** couples to a network **322** (e.g., the Internet, an enterprise Wide Area Network WAN, et al.) to a third party administrator **324**. Third party administrator is a computer system operable by a third party, preferably for implementing the invention described below for a customer (enterprise, corporation, node, etc.)

Figure 3



Sign Language Interpreter

(54) **MACHINE BASED SIGN LANGUAGE INTERPRETER**

(10) **Patent No.: US 8,751,215 B2**

(45) **Date of Patent: Jun. 10, 2014**

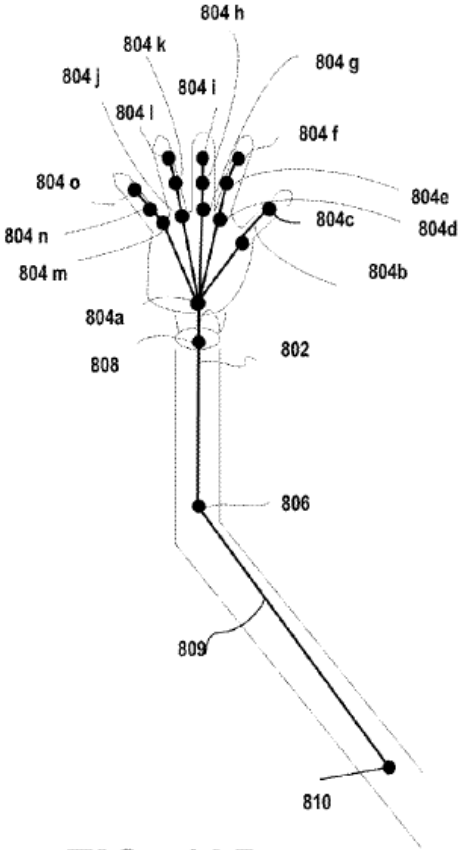
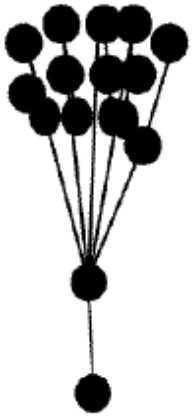


FIG. 10D



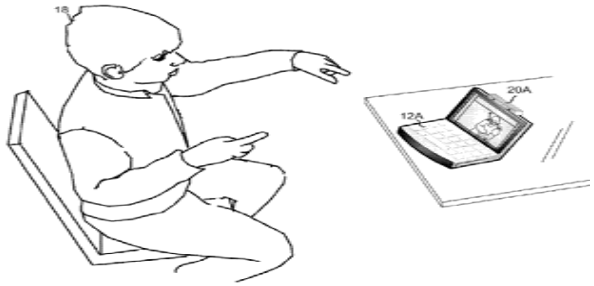


FIG. 1B

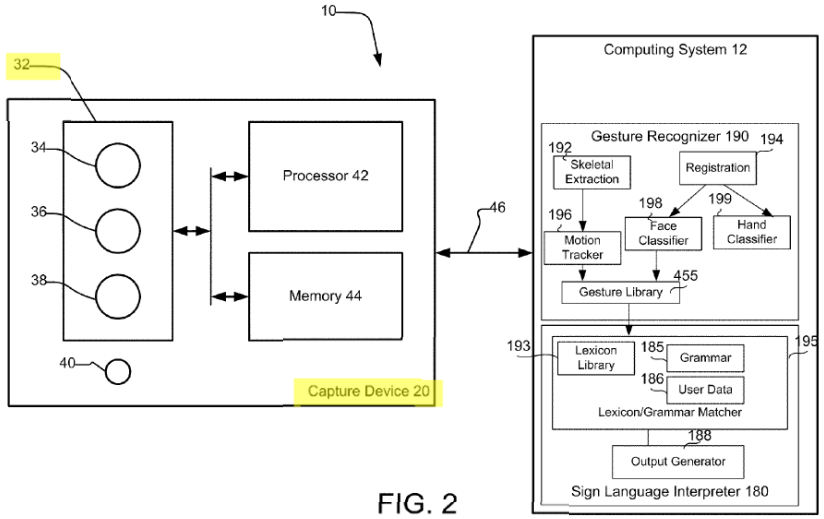


FIG. 2

As shown in FIG. **2**, the capture device **20** may include an image camera component **32**. According to an example embodiment, the image camera component **32** may be a depth camera that may capture the depth image of a scene. The depth image may include a two-dimensional (2-D) pixel area of the captured scene where each pixel in the 2-D pixel area may represent a depth value such as a length or distance in, for example, centimeters, millimeters, or the like of an object in the captured scene from the camera.

Sign Language Translator

(54) **SIGN LANGUAGE TRANSLATOR**

(10) **Patent No.: US 8,566,077 B2**

(45) **Date of Patent: Oct. 22, 2013**

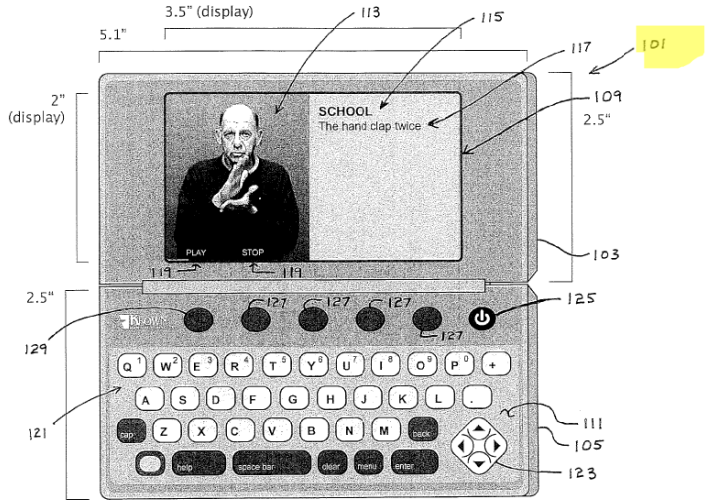


Fig. 1

Referring to FIG. **1** in the drawings, an alternative embodiment of a digital sign language translator **101** according to the present application is illustrated. In this embodiment, translator **101** is configured as a small hand-held electronic device, similar in size and shape to personal digital assistants (PDA's), cell phones, or personal organizer. As such, the functionalities of translator **101**, as disclosed herein, may be incorporated into a PDA device, such as a cell phone, smart phone, or other PDA type device. In the example of FIG. **1**,

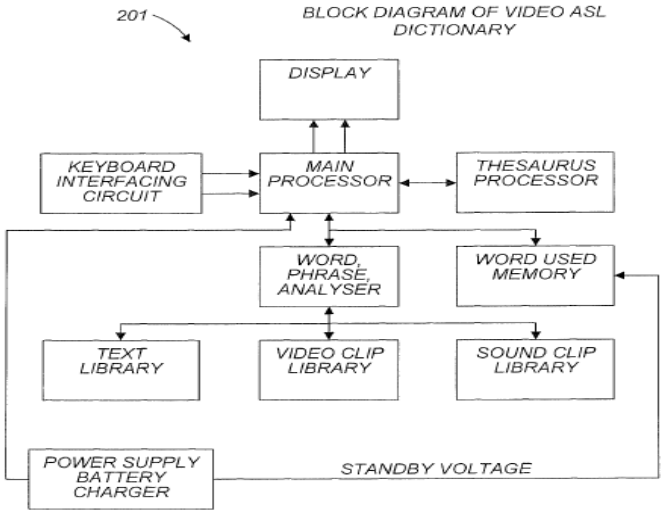


FIG. 2

Referring now also to FIGS. **2-4** in the drawings, a portion of the functionality of one embodiment of translator **101** is illustrated. FIG. **2** shows a high-level block diagram **201** of translator **101**, FIG. **3** shows a flowchart **301** of the dictionary feature of translator **101**, and FIG. **4** shows a flowchart **401** of the video clips of ASL feature of translator **101**.

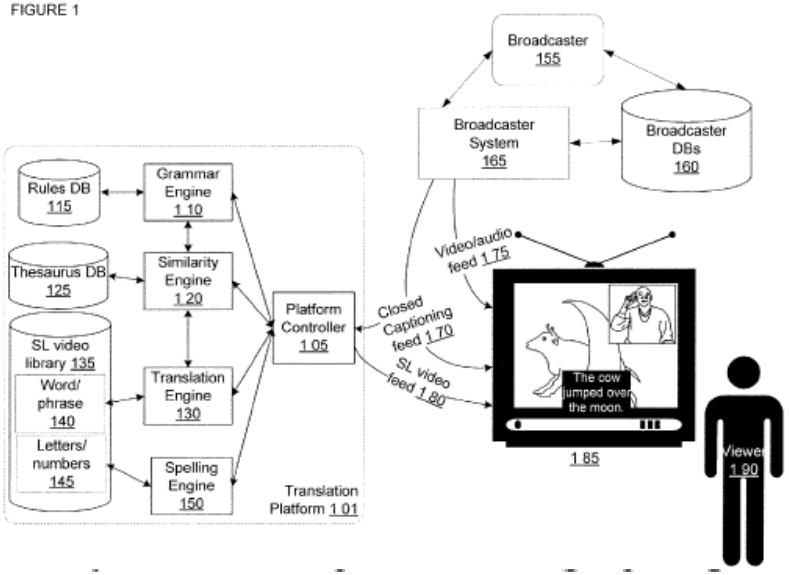
Text-to-Sign Language

(54) **APPARATUSES, METHODS AND SYSTEMS FOR A TEXT-TO-SIGN LANGUAGE TRANSLATION PLATFORM**

(10) **Patent No.: US 8,566,075 B1**

(45) **Date of Patent: Oct. 22, 2013**

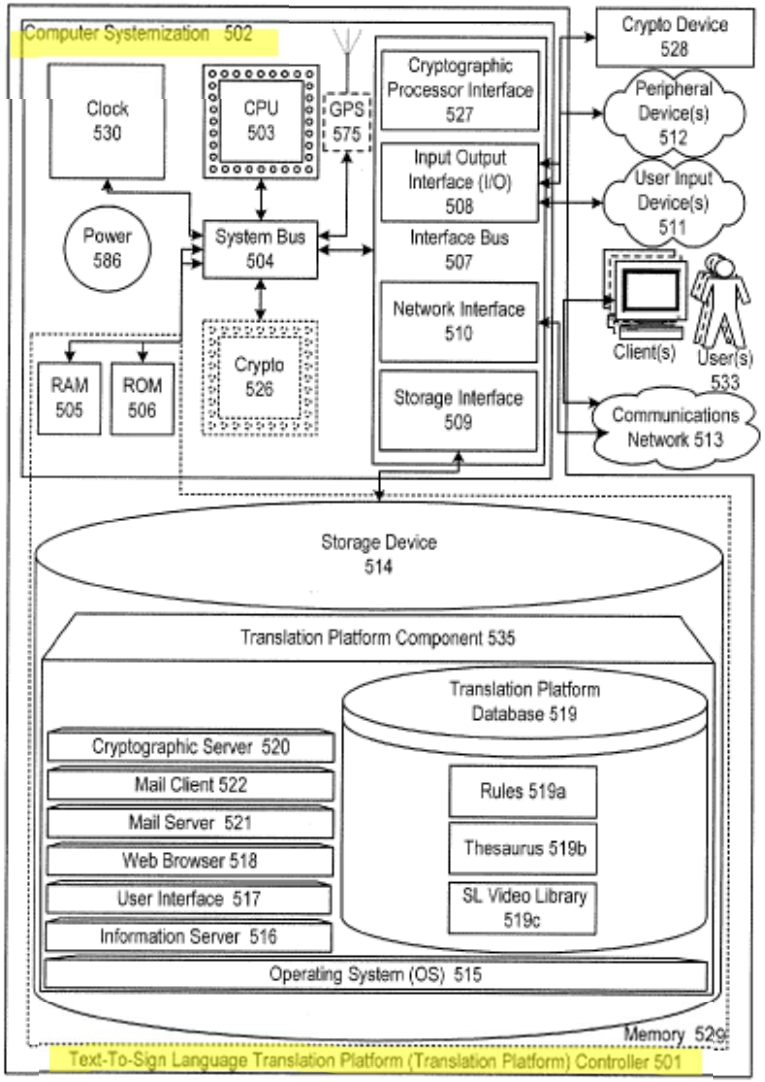
FIGURE 1



Text-to-Sign Language Translation Platform Controller

FIG. **5** of the present disclosure illustrates inventive aspects of a text-to-sign language translation platform controller **501** in a block diagram. In this embodiment, the text-to-sign language translation platform controller **501** may serve to aggregate, process, store, search, serve, identify, instruct, generate, match, and/or update databases, database elements, database element fields, and/or other related data.

FIGURE 5



Numbering Components and Using them in the description

- 1. Each component in a figure must have a number (marked by a number).
- 2. If the component is used in another figure, the component should keep the same number.
- 3. A process (instead of a component) is to be described alone, unless the detail of the process must be described. In this case, all components in the figure for the process must be numbered.
- 4**. In description**, whenever a numbered component is used, that the name of the component must be followed by the component number. For example, if a memory is numbered 2 and CPU 4 in Fig. 3, then do this way: "As illustrated in Fig. 3, the CPU 4 calculates and the results are stored in the memory 2**.**"
- 5. Description must be narrative - **not** a bulleted item. Complete sentences and paragraphs are to be used as in a technical paper or an essay.
- 6. For details and further clarification, please refer some of the figures and the accompanying descriptions in the patent examples.

Team Class Activity -- **"Individual Idea Generation"**

- **Individual work** – each team member works separately without discussion
  - Conceptual Design for the initial solution approach
  - Remember: The solution should satisfy the design requirements
  - Conceptual Design Process
    - Ideation
    - Concept Development
    - Concept Refinement
    - Description with Figures (following Patents)
  - **Individual Scores in grading**
- **Submission:**
  - the individual initial conceptual design for the solution of the team project (**Description with figures**)
  - Team Name + Individual name
  - **Thursday – Friday: Come to my office and pick up yours**

Team Assignment

- 0 Start from each individual idea generated today
- 1 Take an incubation period of 1 or 2 days

R1

- 2 Hold a team meeting for the initial conceptual designs of the team
  - Discuss on the individual ideas and develop into concepts
  - Generate multiple (2 or more) Conceptual Designs for solving the problem (i.e., meeting the requirements)
  - Describe with figures for each of the initial conceptual designs.
- 3 Take another incubation period of 1 or 2 days

R2

- 4 Hold another team meeting
  - Discuss on and refine the conceptual designs
  - Refine the (2 or more) Conceptual Designs
  - Describe with figures for each of the initial conceptual designs.

Suggestion for Timeline and Submission

Day and Date	Activities
W 10/22/2014	Individually generated idea
R 10/23/2014	Incubation period
F 10/24/2014	Team meeting • Discuss individual ideas and develop into concepts • Generate Multiple (2 or more) Conceptual Designs • Describe [type] with figures for each of the conceptual designs.
M-T 10/28/2014	Incubation period (with the conceptual designs)
W 10/29/2014	Team meeting • Discuss on the multiple conceptual designs • Refine the conceptual designs • Describe [type] with figures for each of the conceptual designs [1].
M 11/03/2014	Team meeting • Submission check – description texts and figures
W 11/05/2014	Submission of [1] -- hardcopy

R1

R2

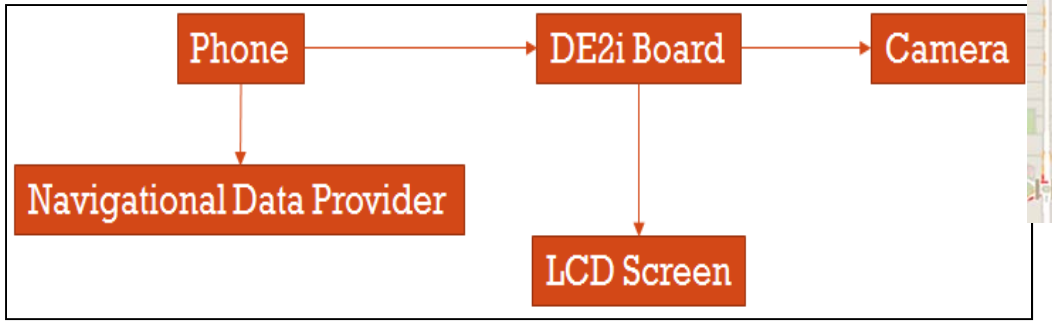
NOTE: Very high weight in grading

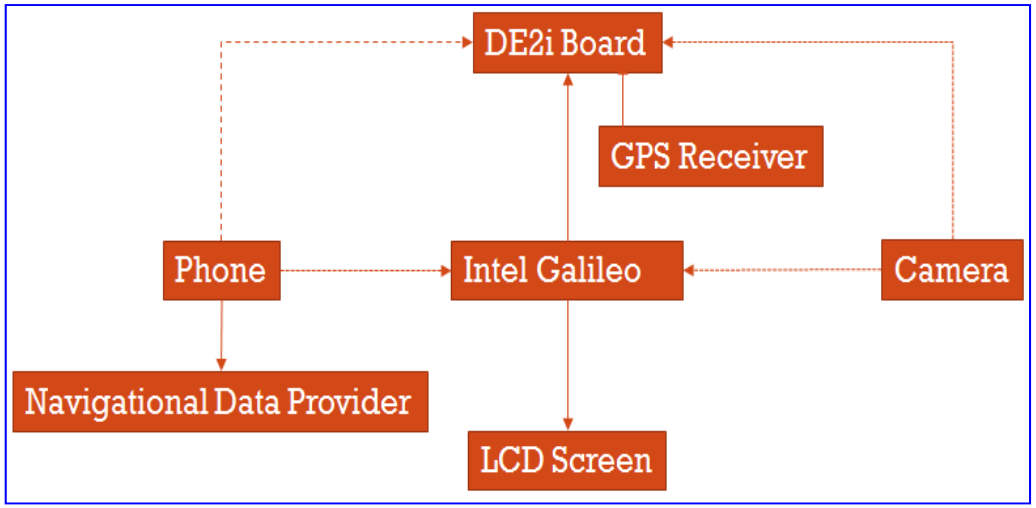
Step 2: Analysis of Alternatives (of Conceptual Designs)

- So, what do we have?
  - Multiple Conceptual Designs as to solve the problem
- Analysis of the Conceptual Designs
  - 1 Concept Screening
    - Remove those that do not meet the functional requirements ("concept screening")
  - 2 In-depth analysis of final candidates ("Proof of Concepts" "Evaluation of Conceptual Designs"): Choose based on the project characteristics
    - Modeling and simulation – Equations, Modeling and Simulation tools and Software
      - **What Software tool? Matlab, Pspice, COMSOL, etc, etc**
    - Experimentation (with prototype)
      - **What do we prototype? Entire system? A component?**
    - Qualitative Reasoning – Analytical Analysis and/or Expert Opinion
      - **What analytic methods? Who knows the best?**
    - Other Methods
      - **What? How?**

Last Examples of Alternative Conceptual Designs and Analysis Methods

- Eye View Navigation



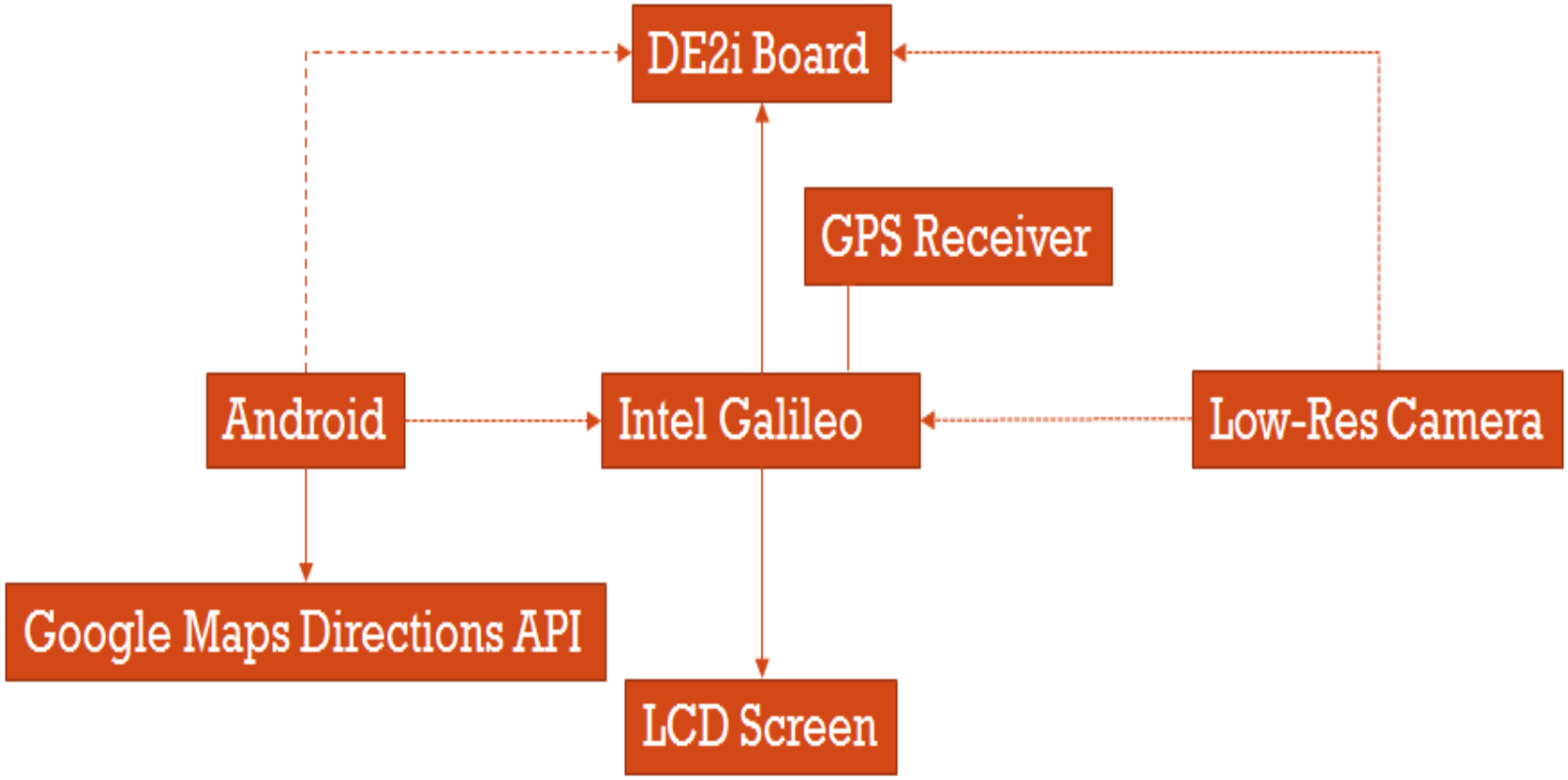


Analysis Methods

1. Experimentation with Coding
2. Datasheet for connectivity
3. Prototype

Last Examples of Alternative Conceptual Designs and Analysis Methods

- Eye View Navigation – Final Conceptual Design



Refined Final Design

5-7" LCD DISPLAY

VGA Connection

DE2i-150 INTEL/ALTERA BOARD

GPS Receiver on DE2i-150

40-pin ribbon connector cable to Altera Expansion ort

USB Connection to Intel Atom Side

Pairing between Phone and Galileo

ANDROID SMARTPHONE

Mobile Data (3G/4G/LTE connection) is required

Smaller tasks like parsing and initial processing of Navigation Data is done by the Galilieo

INTEL GALILEO BOARD

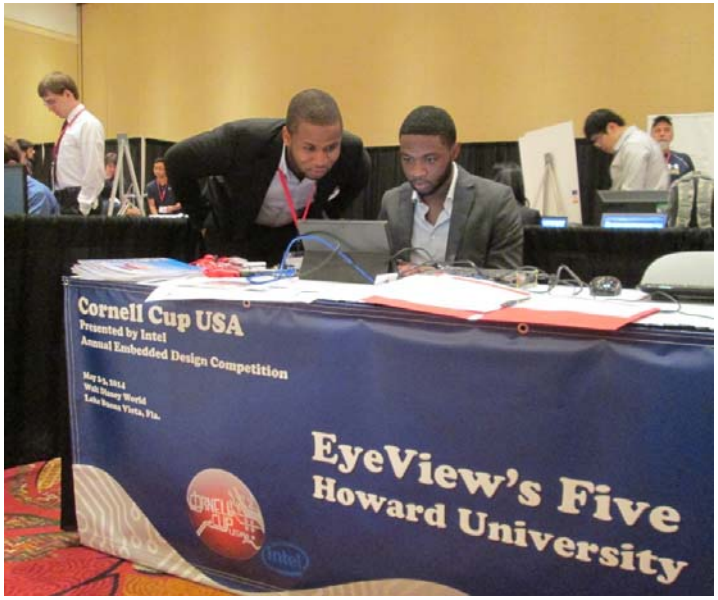
5 MEGA PIXEL DIGITAL CAMERA PACKAGE (Compatible with Altera Side)

Google Maps Direction Web API call is abstracted by the **EyeView App**

http://maps.googleapis.com/maps/api/directions/output?parameters

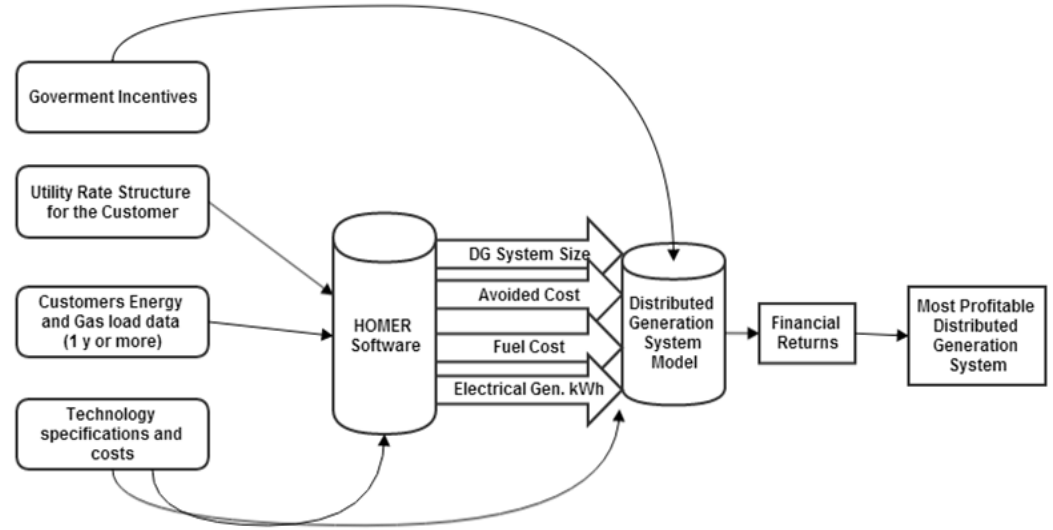
GOOGLE NAVIGATIONAL DATA PROVIDER

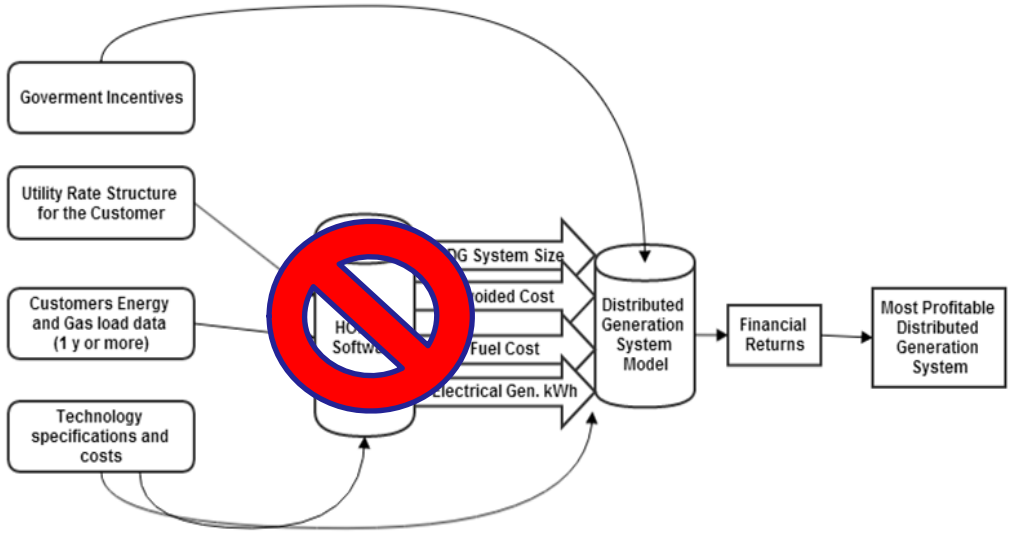
Intel-Cornell Cup 2014 Finalist

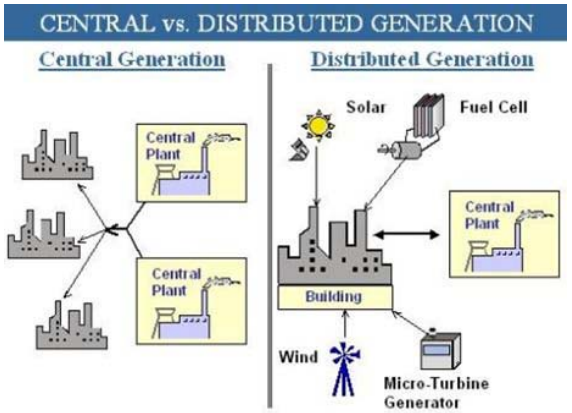


Last Examples of Alternative Conceptual Designs and Analysis Methods

- Distributed Generation – Configuration and Economical Analysis





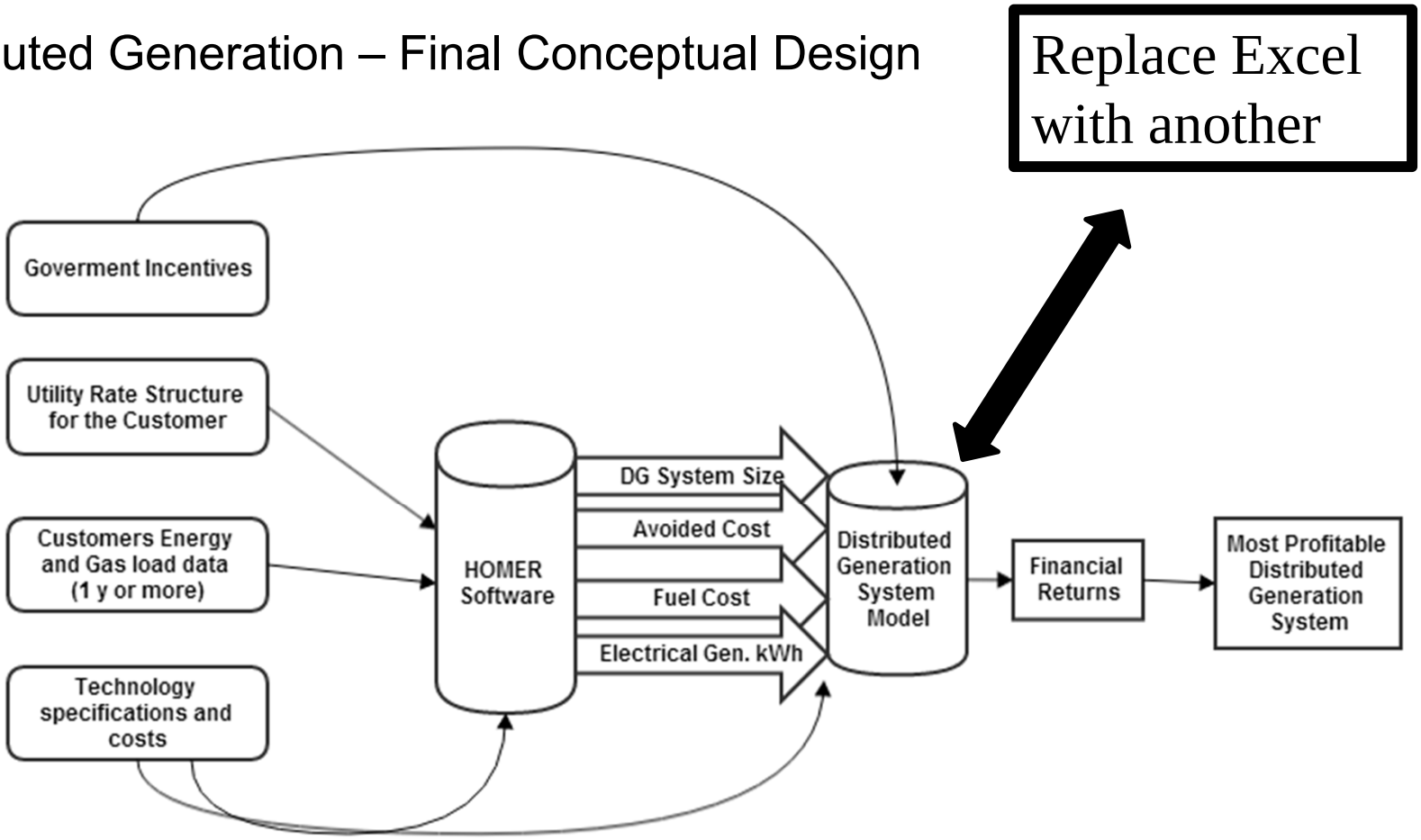


Analysis Methods

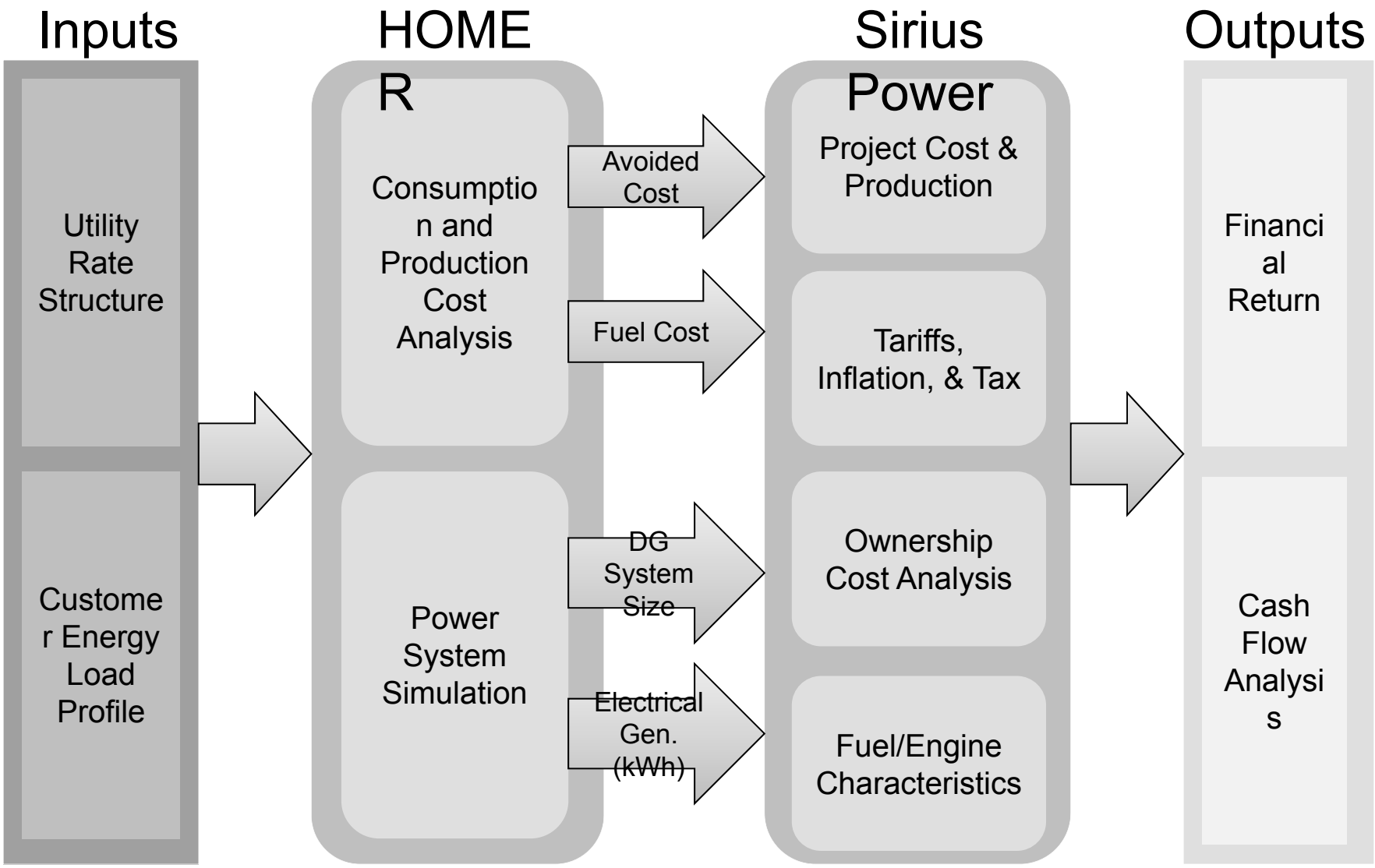
1. Experimentation - Interfacing and Connectivity
2. Qualitative Reasoning

Last Examples of Alternative Conceptual Designs and Analysis Methods

- Distributed Generation – Final Conceptual Design



Final Design Diagram



Which analysis approached to use? Example

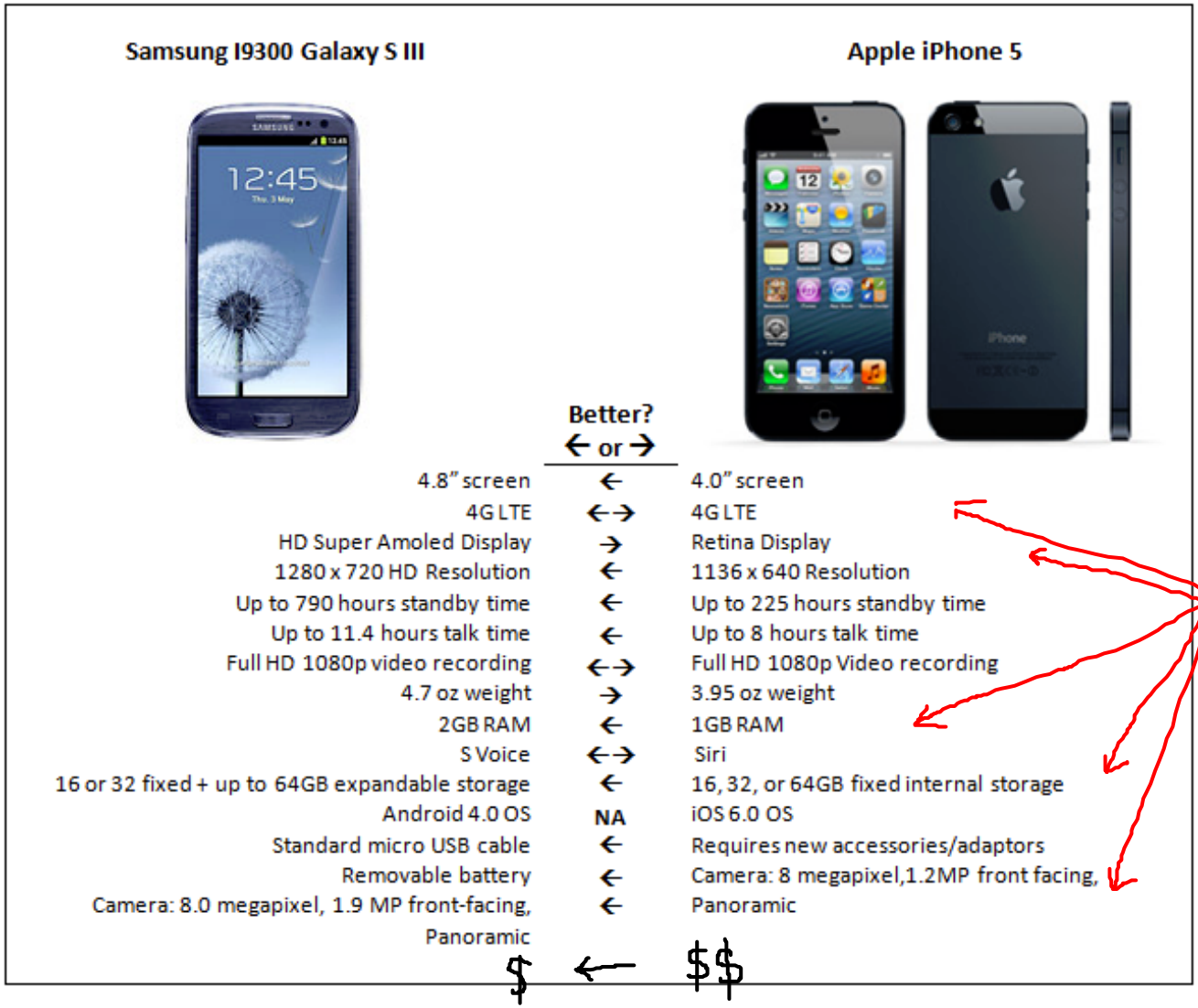
- 3 types of sensors on the table and need to choose 1
  - **Datasheet & Experimentation**
- Can a red LED be used as a light source for photo-diode based measurement in place of white LED?
  - **Experimentation**
- In handling numerous inputs and outputs, which one do I use? Do I need an additional microcontroller?
  - **Datasheet and Qualitative reasoning**
- Which motor is better, 1/2hp with 5lb weight or ¼ hp with 1 lb weight?
  - **Simulation and Qualitative Reasoning**
- Which method is better between an energy saving measure and increased energy efficiency measure for a building energy management? Or combination of two?
  - **Simulation and sensitivity analysis**

Step 3. Selection of Top Designs

- A step after thorough analyses (using the methods selected)
- To Design Selection is decision-making
- Decision-making involves making trade-offs → "Trade Study"
  - The results of the analyses
  - Requirements from customer → Attribute Selection Criteria
- Decision Tool
  - Decision Matrix

Step 3. Selection of Top Designs

- iPhone vs Android Phone --- Example



Samsung I9300 Galaxy S III	Better? ← or →	Apple iPhone 5
4.8" screen	←	4.0" screen
4G LTE	↔	4G LTE
HD Super Amoled Display	→	Retina Display
1280 x 720 HD Resolution	←	1136 x 640 Resolution
Up to 790 hours standby time	←	Up to 225 hours standby time
Up to 11.4 hours talk time	←	Up to 8 hours talk time
Full HD 1080p video recording	↔	Full HD 1080p Video recording
4.7 oz weight	→	3.95 oz weight
2GB RAM	←	1GB RAM
S Voice	↔	Siri
16 or 32 fixed + up to 64GB expandable storage	←	16, 32, or 64GB fixed internal storage
Android 4.0 OS	NA	iOS 6.0 OS
Standard micro USB cable	←	Requires new accessories/adaptors
Removable battery	←	Camera: 8 megapixel,1.2MP front facing,
Camera: 8.0 megapixel, 1.9 MP front-facing, Panoramic	←	Panoramic
$	←	$$

Attributes

Decision Matrix - Example

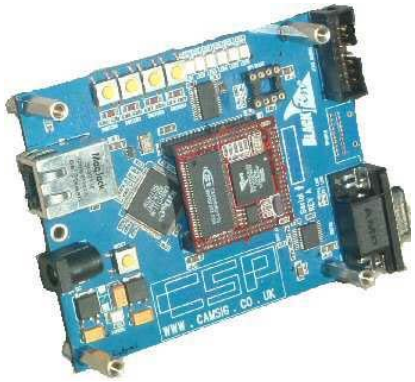
Purchase of a used car

CAR	COST	ODOMETER READING	MECHANIC'S RATING (1 - 10)	LOOKS (1 - 10)
RED	$2000	50,000	7	5
BLACK	$2500	40,000	5	6
BLUE	$3000	20,000	8	8

- Which car do you buy under the following two different weight scenarios (Choice of "Attributes")
  - You concerned about all four attributes equally.
  - You concerned about cost and fairly indifferent about looks. Mileage and the mechanic's ratings are equally important for you.

Using a Decision Matrix

- 1: Determine and Weight Attributes – True to the design requirements
- 2: Rate the Alternatives
- 3: Rank the Alternatives
- 4: Select the best Alternative
- 5: Resolve the decision by combining alternatives



		Bluetooth Development Boards							
		Teleca Comtec		Stonestreet One		GCT		Atmel	
Selection Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Price	40	4	1.6	3	1.2	1	0.4	1	0.4
Power	15	4	0.6	4	0.6	4	0.6	1	0.15
Software	35	2	0.7	4	1.4	3	1.05	2	0.7
Version	10	1	0.1	4	0.4	4	0.4	4	0.4
Total Score			3		3.6		2.45		1.65
	Rank		2		1		3		4

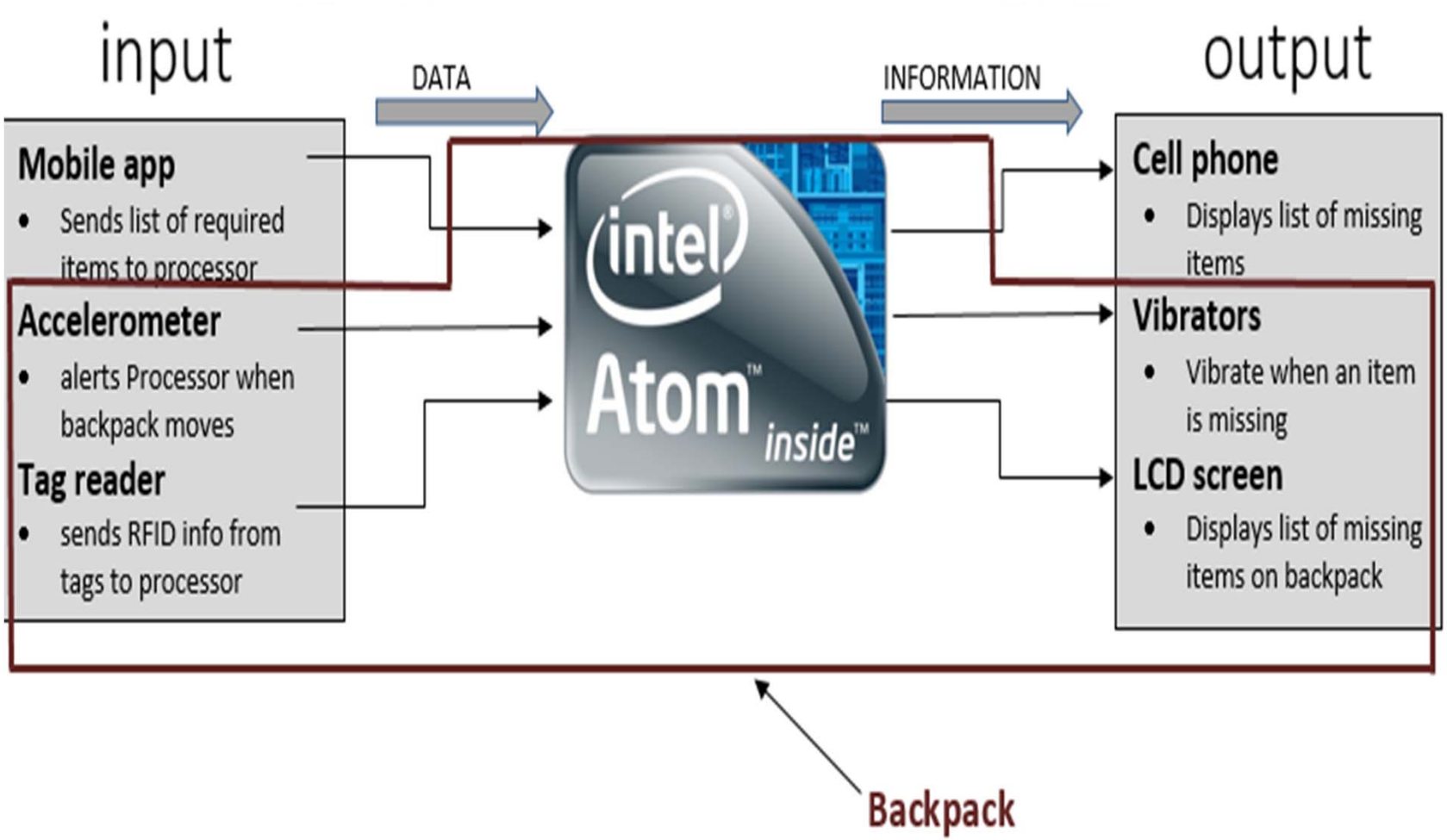
Alternative Conceptual Designs (Alternatives) and Decision Making

Examples

SMART BACKPACK

2013 Intel-Cornell Cup “Honorable Mention” & 2013 23rd ECE Day 1st Place

Conceptual Design

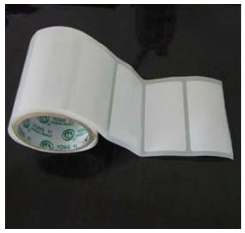


Design 1

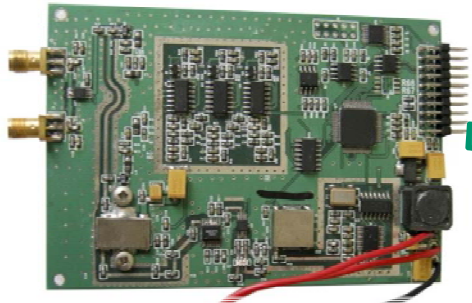
Smart Phone

Bluetooth

Sticker Tags



RFID Reader Module



Serial Connection

Vibrating Motor

Wired

Wired

Pins

Arduino with Bluetooth shield

Intel Board with built in accelerometer

LCD Screen

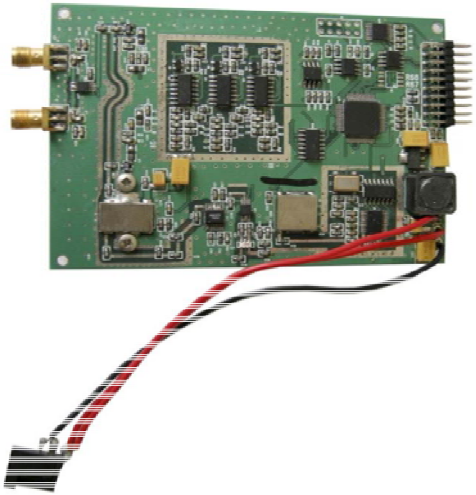
Design 1 Pros and Cons

Pros	Cons
Convenient view/edit of schedule through smartphone	Interference with surrounding Wi-Fi using UHF tags and reader
Wireless connectivity through Bluetooth	Bluetooth battery consumption on the smartphone
Built in accelerometer to detect movement	Limited programming choice for application
Easy input and output connectivity through the Arduino	
Multiple notification (Smartphone, Vibrating motor, and LCD screen)	

Design 2

RFID reader

RFID tags



Desktop/Laptop

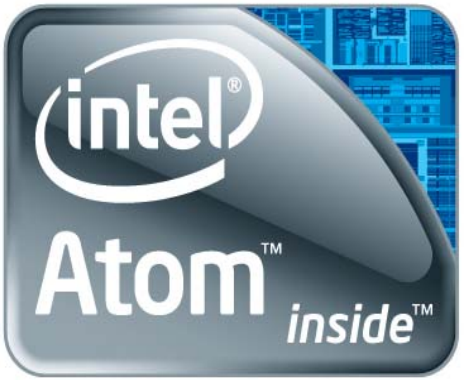
WiFi

Serial Connection

LCD

Wired

Wired



Intel Board with built in accelerometer

Actuator

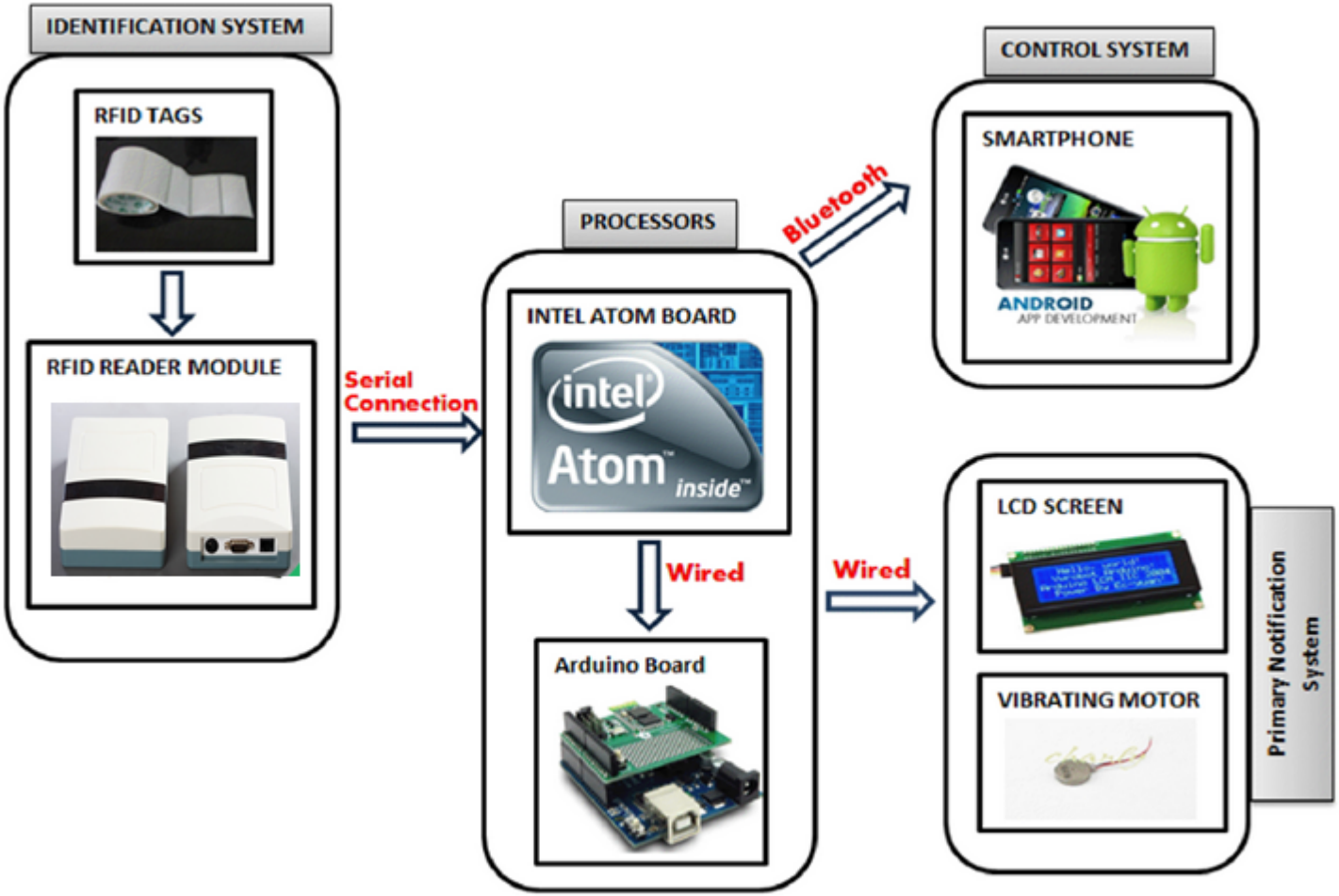
Design 2 Pros and Cons

Pros	Cons
More choices of programming languages for the application development	Since the user's schedule is pulled from a calendar on the desktop, changes cannot be made on the go.
Using the built-in accelerometer reduces cost.	Mode of communication between the backpack and the CPU is limited to Wi-Fi.
Desktop computers are less susceptible to theft than smartphones.	Standard ports on the Intel board (USB ports, VGA ports)

Design Decision Matrix

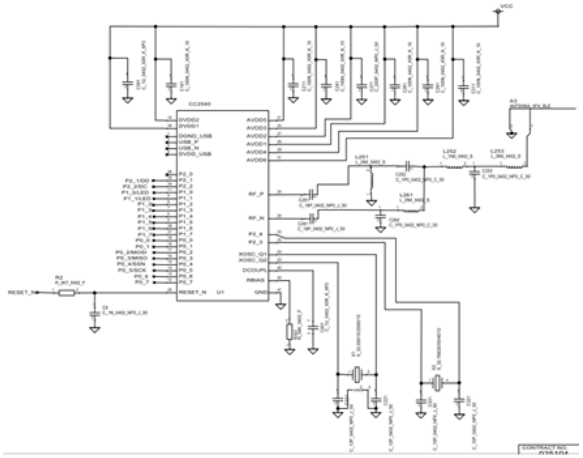
	Weight	Design 1	Score	Agg. Score	Design 2	Score	Agg. Score
Functionality	**5**	Smartphone Arduino Vibrating motor	**5**	**25**	Desktop Actuator	**3**	**15**
Connectivity	**2**	Bluetooth Wired Wi-Fi	**5**	**10**	Wired Wi-Fi	**3**	**6**
Weight	**3**	Approx. 940g	***4***	**12**	Approx. 890g	***5***	**15**
Power	**4**	More components to be powered	**3**	**12**	Fewer components to be powered	**5**	**20**
Convenience	**1**	On the go edit	**5**	**5**	At home edit	**3**	**3**
TOTAL				**64**			**59**

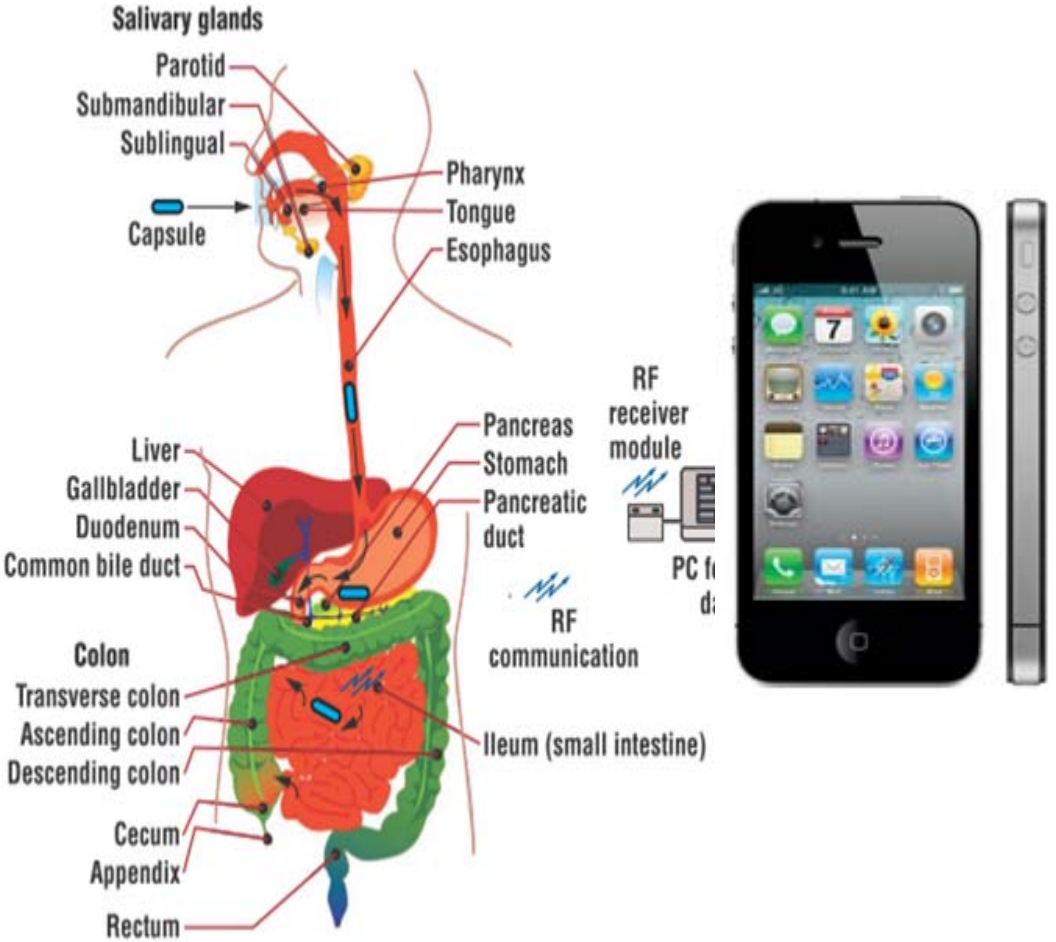
Final Design



Swallowable Capsule

- Capsule
- Receiver





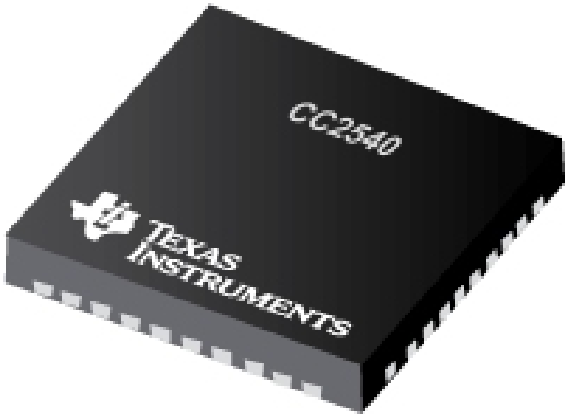
2012 ECE Day 2nd Place

Microprocessor 1: EM250

- **Manufacturer**: Ember
- **Size**: 7 x 7 mm
- **RF Protocol**: ZigBee 802.15.4
  - **Max. Data Rate**: 250 kbps
- Surface Mount Technology (SMT)
- Dev. Kit: $2,500

Microprocessor 2: CC2540

- **Manufacturer**: Texas Instruments
- **Size**: 6 x 6 mm
- **RF Protocol**: Bluetooth Low Energy (BLE)
  - **Max. Data Rate**: 1 Mbps
- Surface Mount Technology (SMT)
- Dev. Kit: $299



Microprocessor 3: nRF8001

- **Manufacturer**: Nordic Semiconductor
- **Size**: 5 x 5 mm
- **RF Protocol**: Bluetooth Low Energy (BLE)
  - **Max. Data Rate**: 1 Mbps
- Surface Mount Technology (SMT)
- Dev. Kit: $400

Microprocessor Comparison

Name	CC2540	nRF8001	EM250
Manufacturer	Texas Instruments	Nordic Semiconductor	Ember
Size	6x6 mm	5x5 mm	7x7 mm
Packaging	SMT	SMT	SMT
Memory	128/256kB Flash, 8kB RAM	-	128kB Flash, 5kB SRAM
Comm. Protocol	Bluetooth Low Energy	Bluetooth Low Energy	802.15.4 Zigbee
Max. Data Rate	1 MBps	1 MBps	250 kbps
Frequency	2.4 GHz	2.4 GHz	2.4 GHz
Software	BTool	nRF8001 SDK	xIDE
Vendor	Digikey	Mouser	Digikey
Chip Price	$6.15	$4.56	$6.16
Kit Price	$299.00	$400.00	$2,500.00
Receiver	Bluetooth 4.0 Compatible Device (iPhone 4S)		WiFi Compatible Device

Microprocessor Decision Matrix

Criteria	Weight	TI CC2540		Nordic nRF8001		Ember EM250	
Cost	35	4	1.4	3	1.05	2	0.7
Programming	30	3	0.9	3	0.9	3	0.9
Receiver	10	2	0.2	2	0.2	4	0.4
Data Rate	25	3	0.75	3	0.75	2	0.5
Weighted Total		**3.25**		**2.9**		**2.5**	
Rank		**1**		**2**		**3**	

Temperature Sensor Comparison

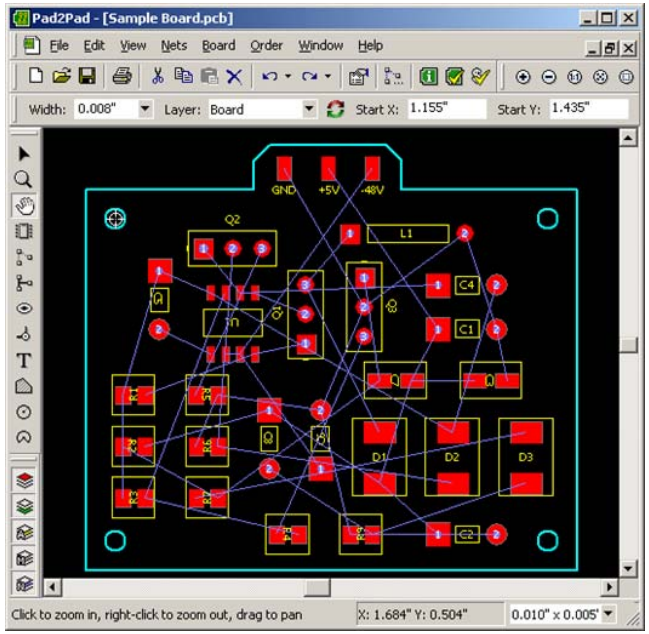
Name	Temperature Range	Accuracy	Supply Voltage	Operating Current	Output	Size	Cost
LM335	-40^{0}C to 100^{0}C	±1°C	5V	400 µA to 5 mA	Analog	5 x 6 mm	$1.36
TMP102	-40°C to 125°C	±0.5°C	1.4V to 3.6V	1 µA - 10µA	Digital	1.7 x 1.7mm	$1.80
TMP104	−55°C to +150°C	±0.5°C	1.4 V - 3.6V	3 µA at 0.25 HZ	Digital	0.8 × 1 mm	$1.94
LM74	−55°C to +150°C	±0.0625°C	3.0V or 2.65V - 5.5V	265µA	Digital	5 x 6.2 mm	$1.88
LM84	0 to 100^{0}C	±1°C	3.0V – 3.6V	1mA	Digital	5 x 6 mm	$4.11

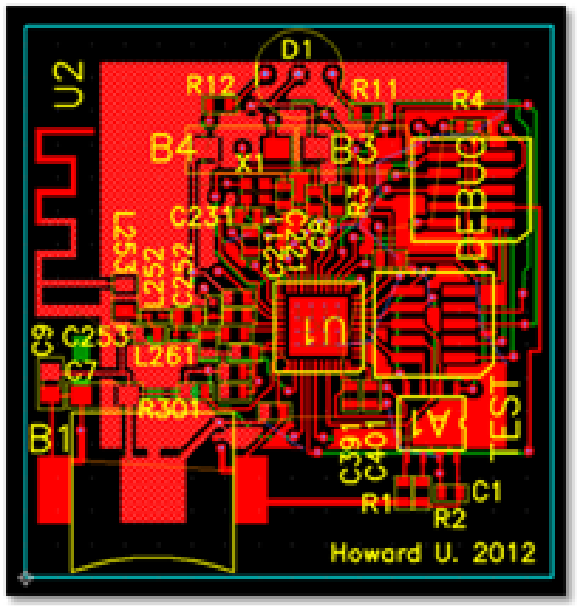
Temp. Sensor Decision Matrix

Criteria	Weight	LM335		TMP102		TMP104		LM74		LM84	
Size	40	4	1.6	5	2	5	2	4	1.6	4	1.6
Precision	20	3	0.6	4	0.8	4	0.8	2	0.4	5	1
Supply Voltage	10	2	0.2	4	0.4	4	0.4	4	0.4	4	0.4
Output Format	20	2	0.4	5	1	5	1	5	1	5	1
Cost	10	5	0.5	5	0.5	5	0.5	5	0.5	1	0.1
Weighted Total		**3.3**		**4.7**		**4.7**		**3.9**		**4.1**	
Rank		**5**		**1**		**1**		**4**		**3**	

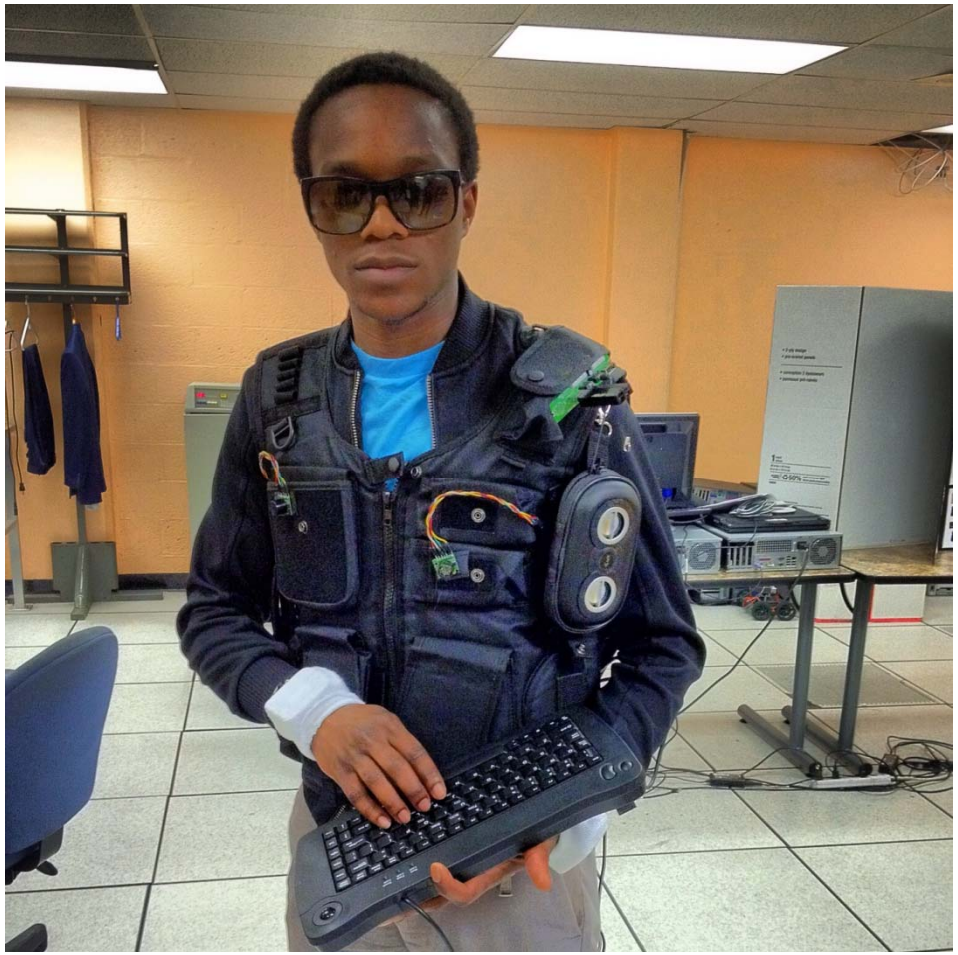
Final Design Components

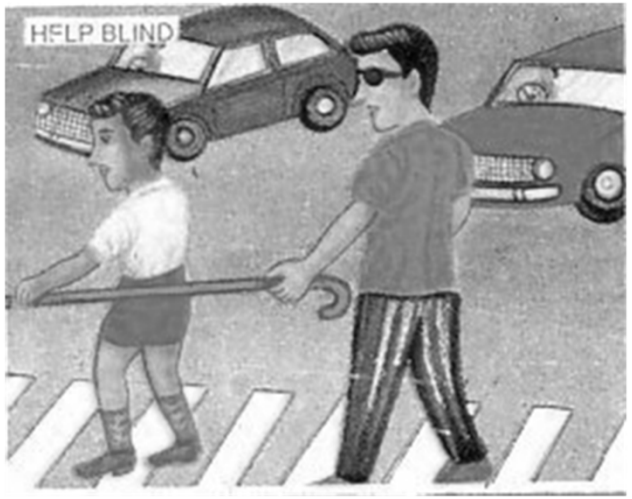
- **Microprocessor**: CC2540
- **Temperature Sensor**: TMP102
- **PCB Manufacturer**: Pad2Pad
- **Camera**: OV3642

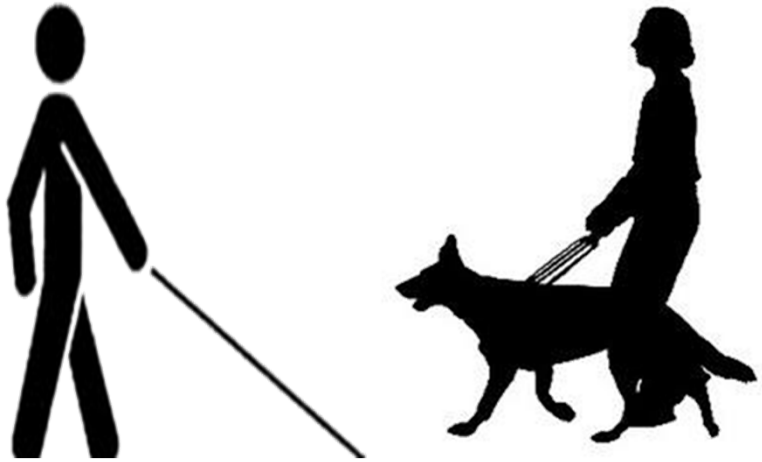




Blind Assistant

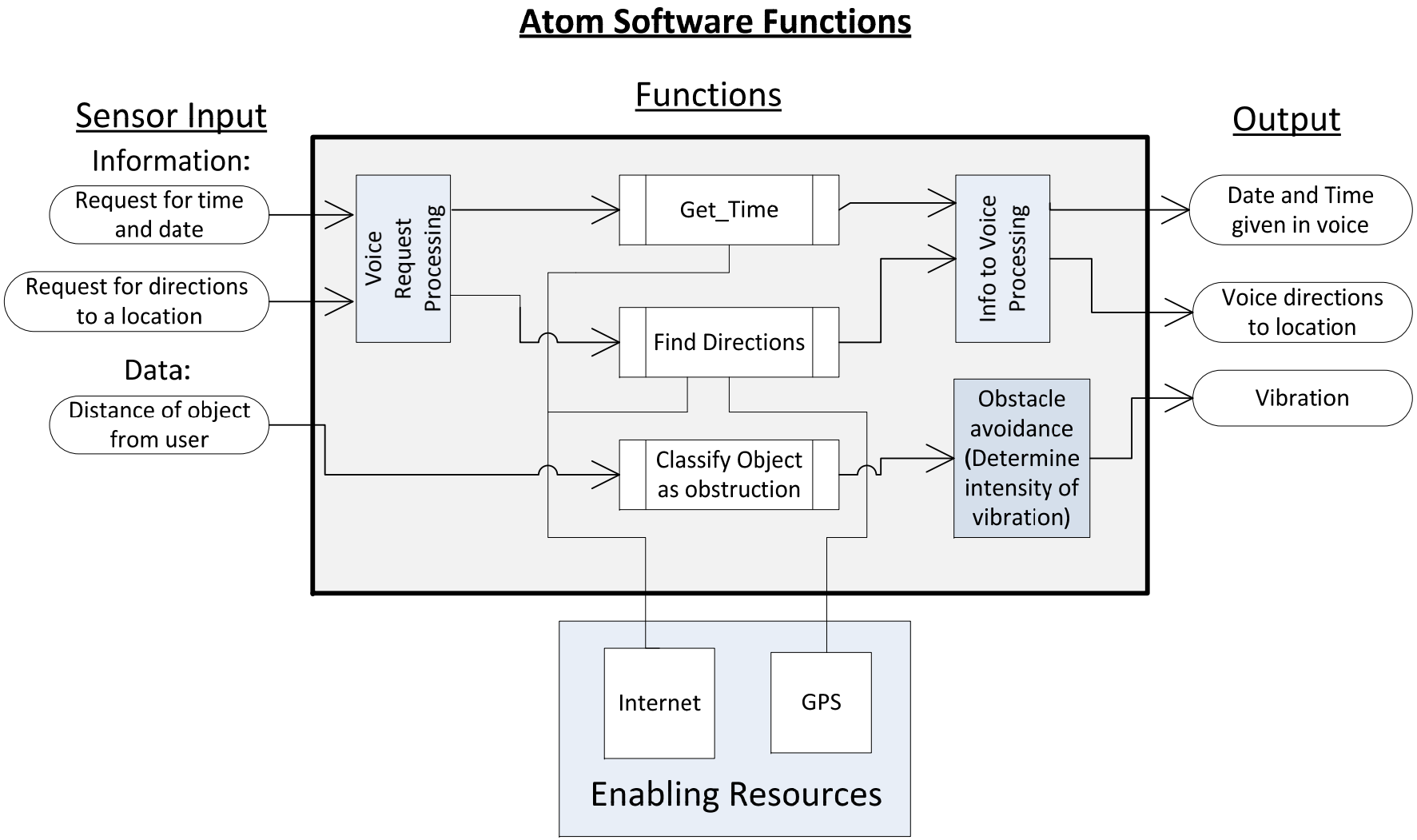






2012 Intel-Cornell Cup “Wild Card Winner” & 2012 ECE Day 1st Place

Conceptual Design



Analysis of Alternative components

OBSTACLE ALERT

- Vibration Modules
  - Availability of already designed modules
  - Ease of connection?
  - Wireless communication with module?
- Audible tones
  - Sounds are easy to make
  - Might be confusing while providing direction to locations (horrible user experience
  - Difficult to integrate with voice provided directions

Measure (Weight)	User Experience	Ease of Implementation	Total
Vibration Modules	9	6	**15**
Headset tones	5	8	**13**

Analysis of Alternative components

DISTANCE CALCULATION SENSOR

- Ultrasonic Sensor
  - Good widespread connection
  - Little interference based of weather (reliable)
- Infra red sensor
  - Easily affected by sunlight
  - More accurate but slim spectrum

Measure (Weight)	User Experience (0.7)	Ease of Implementation(0.9)	Accuracy (0.9)	Reliability (0.9)	Total
Ultrasonic Sensor	8	7	7	9	**26.3**
Infra red	6	8	9	6	**24.9**

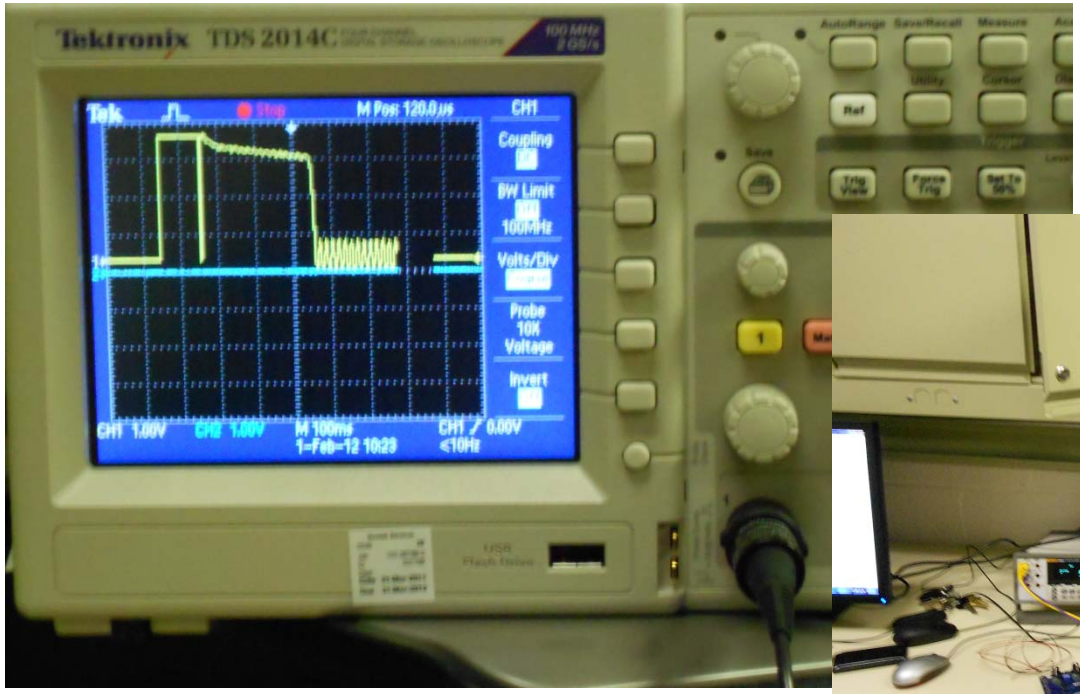
Analysis of Alternative components

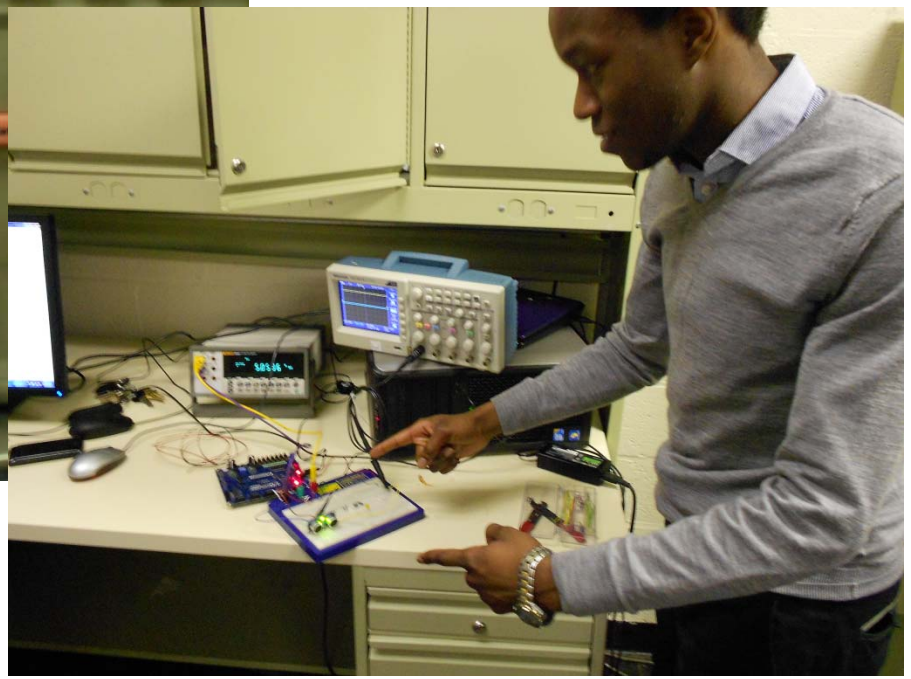
INPUTTING DESIRED ADDRESSES

- Braille Keyboard
  - Time to input address (poor user experience)
  - Easy to integrate with system
  - Allows for more accuracy
- Voice (voice synthesis)
  - Possible great user experience
  - Implementation requirements (we have time constraints)
  - Low accuracy

Measure (Weight)	User Experience (0.9)	Ease of Implementation(0.8)	Reliability (0.8)	Total
Voice Operation	9	4	6	**16.1**
Braille Keyboard	4	8	8	**16.4**

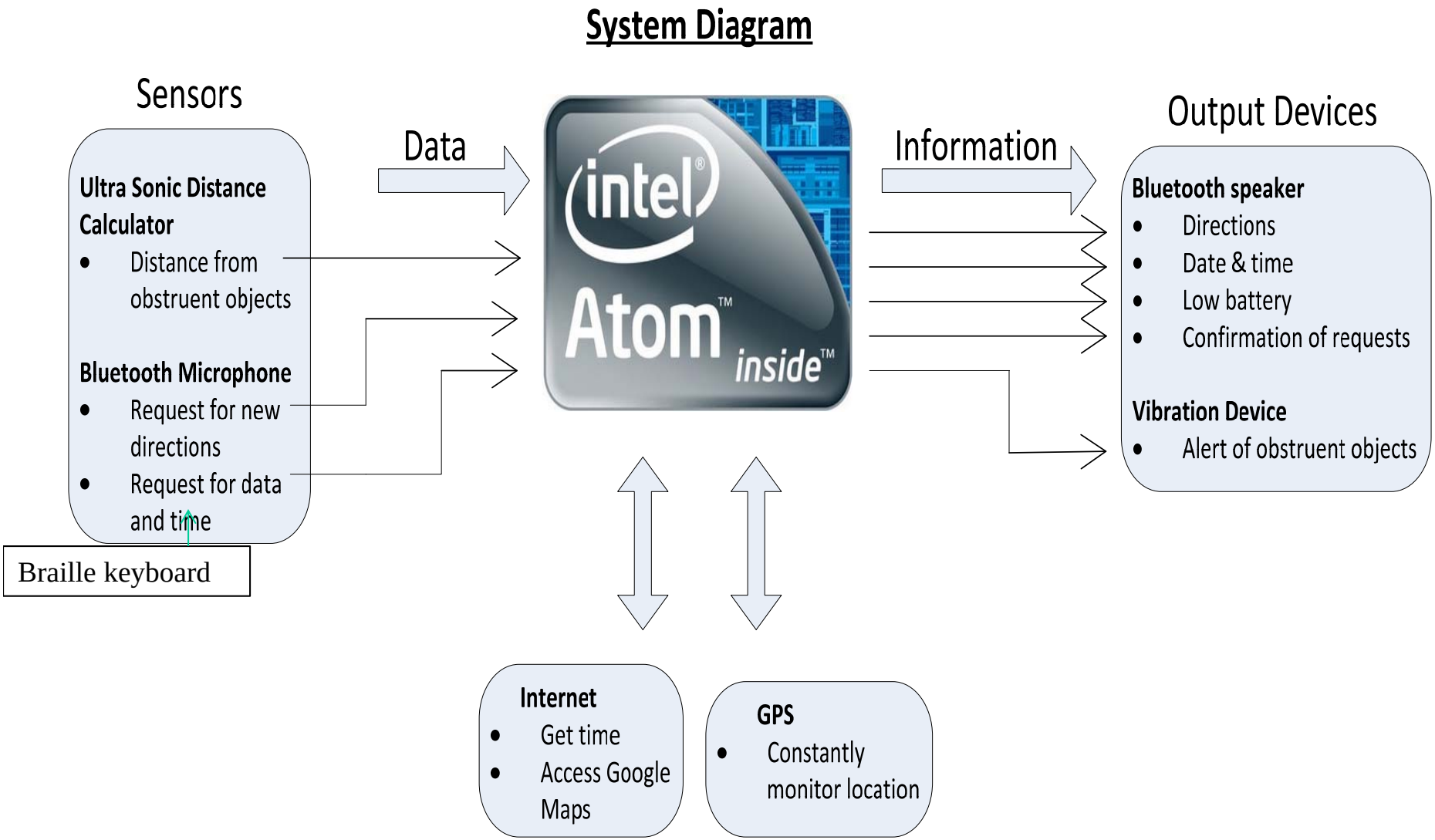
Experimentation for Sensors





I/O Controller and Ultrasonic sensor being tested on a PC

Final Design and Components



4 Step Activity for Final Conceptual Design Selection

- Step 1: Analysis Approaches for the Alternatives (i.e., multiple conceptual designs)
  - What are the alternatives in the conceptual design that need to be addressed for the final, good solution? What are the key items, values, parameters, etc that have to be analyzed? How to analyze? What analysis method to be adopted and employed?
- Step 2: Perform Analysis
  - Experimentation
  - Modeling and Simulation
  - Qualitative Reasoning
  - Other methods
- Step 3: Decision Making Matrix for final design selection & Report submission
- Step 4: Presentation for Conceptual Design – Public Event

Step 1 – Determination of Analysis Approaches

- What are the key items, values, parameters, etc, that have to be analyzed? How to analyze? What analysis method to be adopted and employed?
- **Submission: The list of alternatives and their key items to be analyzed for comparison, AND the corresponding analysis method(s) to apply to do the analysis**
- **Submission due: Today (Typed and printed) – can be email submitted**

Step 2: Perform Analysis

- Using the analysis method(s) decided in the Step 1, analyze the alternative designs approaches considering the functional requirements (speed, response time, weight, power, life, etc) and other pertinent criteria

- **Submission: Report on the analyses and the results**

- **Submission Due: Nov 12 (Typed and printed)**

Step 3: Decision Matrix for Top Design Selection

- Decision trade study – decision matrix
  - Selection of attributes which are relevant to meeting the design requirements
- Pick the top concept design and solution
- Refined the Final Solution Design with detailed description
- **Submission: Refine the Final Solution Design, and describe the final design with figures and description following the patent figures/description examples.**
  - **MS Word Format**
  - **Schematics and figures must drawn with graphic software (no hand sketches, please)**
  - **Software structure, architecture, flowchart**
- **Submission Due: Nov 19 (Typed and printed) Email submission permitted**

Step 4: Presentation of Conceptual Design

- Public Presentation of the project in comprehensive details
  - Background: Needs and demands
  - Problem Statement
  - Current Status of Arts
  - Design Requirements
  - Multiple Alternative Conceptual Designs
  - Determination of the items to be analyzed and the analysis methods
  - Analysis of Alternative Designs using the methods for the items
  - Selection of attributes relevant to the functional requirements
  - Decision Matrix
  - Final Conceptual design selection
- **Submission: PPT(X) File by (M) Dec 1 via email**
- **Rehearsal of presentation:** We will pick a date/time for each team **(T Dec 2)** --- Each team leader notifies the instructor of possible time slots.
- **Public Presentation: Dec 3 (Wed) -- Classroom**

Class Schedule of the Final Weeks

- Nov 12 (W)
  - Lecture on Project Implementation
  - Submission: **Step 2** - Alternative Analysis Results
- Nov 19 (W)
  - Lecture on Oral Presentation
  - Submission: **Step 3** - Final Design Description with Figures
- Nov 26 (W)
  - No Class.
- Dec 1 (M): Submission of Presentation File: **Step 4**
- Dec 2 (T): Team rehearsal with the instructor.
- Dec 3 (W)
  - Public Presentation on Conceptual Design
- Dec 4(R) – 5(F) – 8 (M):
  - Final Exam (We will pick a date and time)
- Dec 4(R) – 10 (W): Submission of
  - Project Folder
  - Individual Project Note
  - Peer Evaluation