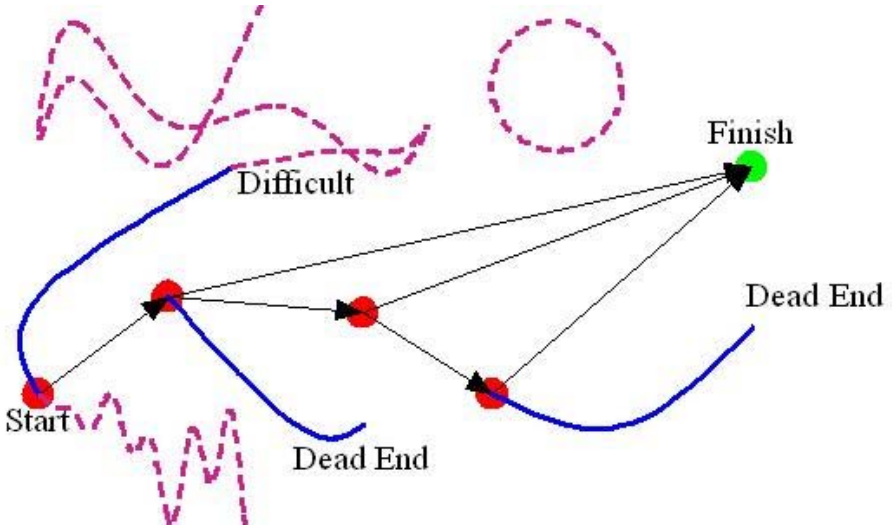
Solution Generation and Conceptual Design



Electrical and Computer Engineering
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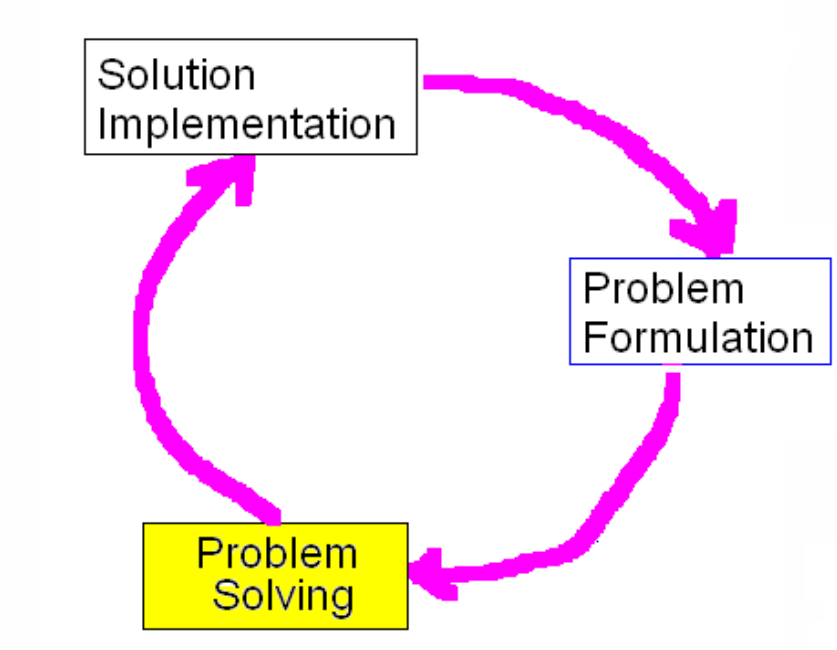
www.mwftr.com/SD1516.html

Problem Solving → Solution Generation



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

Where we are

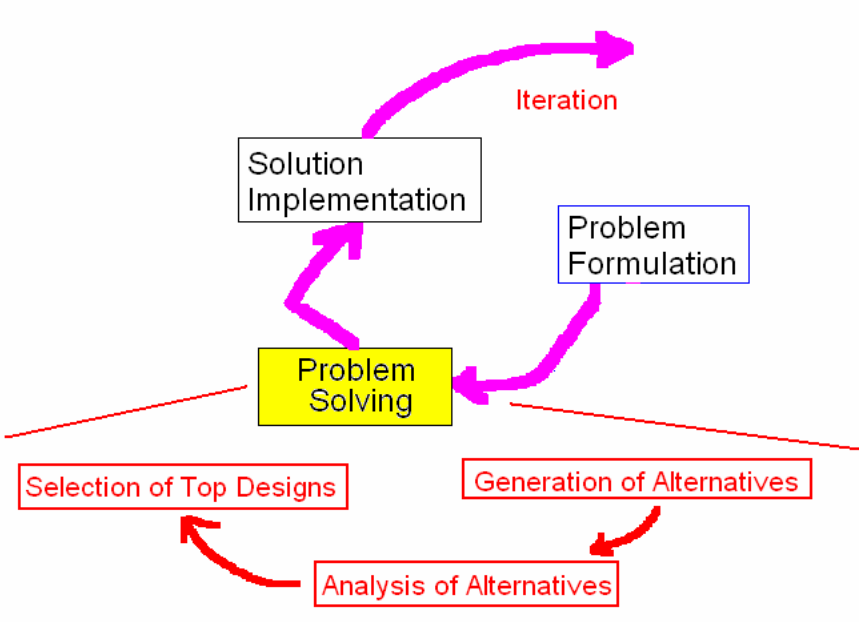
- Problem Statement was defined
- Design Requirements --- Undergoing in VIP teams (should be finished by this week's team meeting)
- Submission Due/List for each VIP team
  - **W 10/28/2015 (Today):**
    1. Problem Statement
    2. Team Contract
  - **W 11/4/2015 (Next Week)**
    1. Design Requirement
    2. Parts/Components List (if applicable)
  - ~~**W 11/11/2015**~~ → **R 11/12/2015**
    1. Conceptual Design [Subject of Today's Class]
       - Individual Idea Generation
       - Team Conceptual Design

The Next Step → Solution

- 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

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)

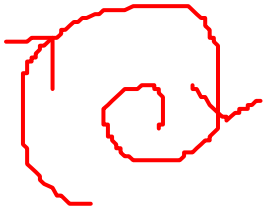
- The act of expansion - all possible solutions
- Overcome the temptation to adopt the first idea
- Building on the initial conceptual design and consider (or add) alternative ways of achieving the solution
- Wide design space but true to the problem (and functional requirements) → better approach, better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

How do I/We generate solutions?

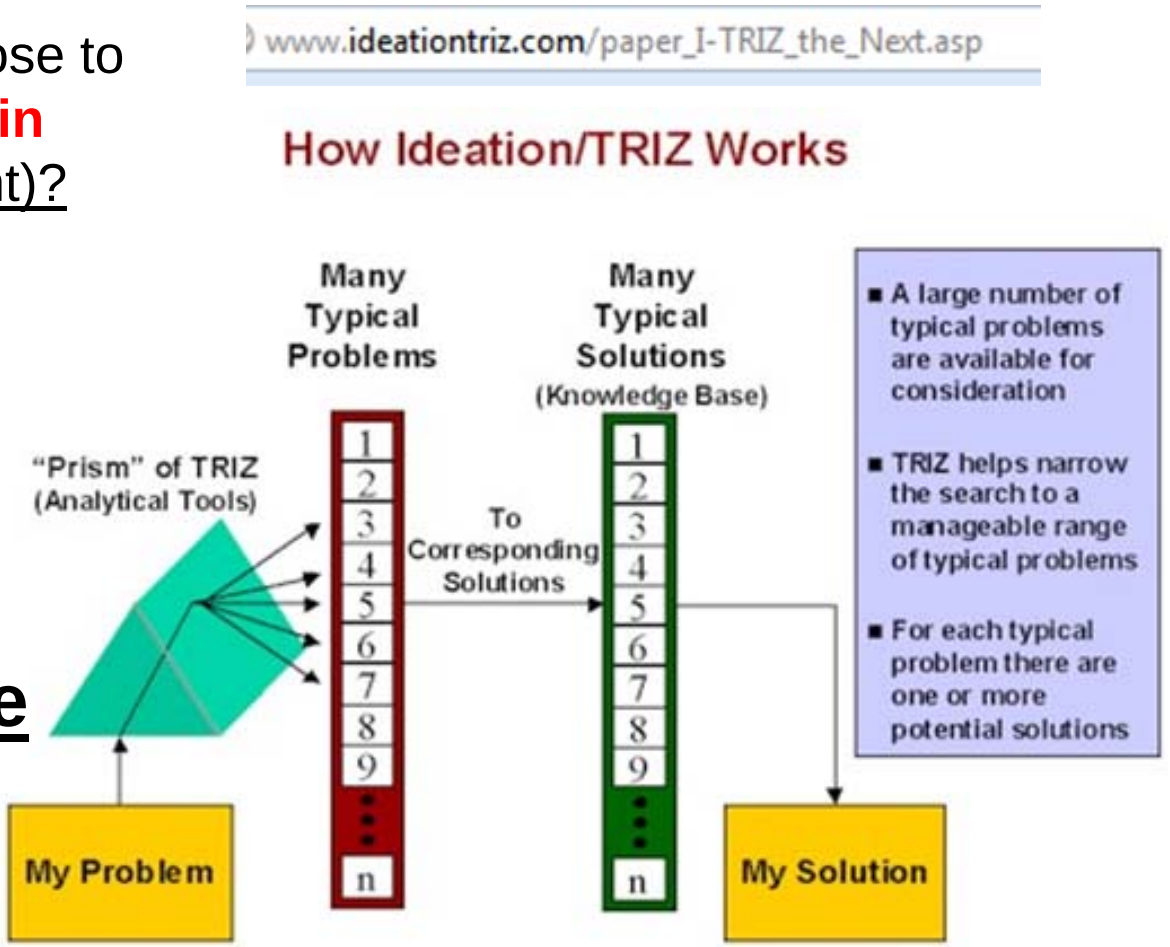
- **Team Idea Generation Strategy**
  1. **Individually, think of the problem and generate ideas (day 1) – Individual Idea Generation**
  2. **Set the problem aside (day 2) - Incubation**
  3. **In the team meeting (day 3), present individually generated ideas, and build on them. – Determination of a Team Idea**
  4. **If no satisfactory solution is achieved, do the steps of 2 and 3 again.**



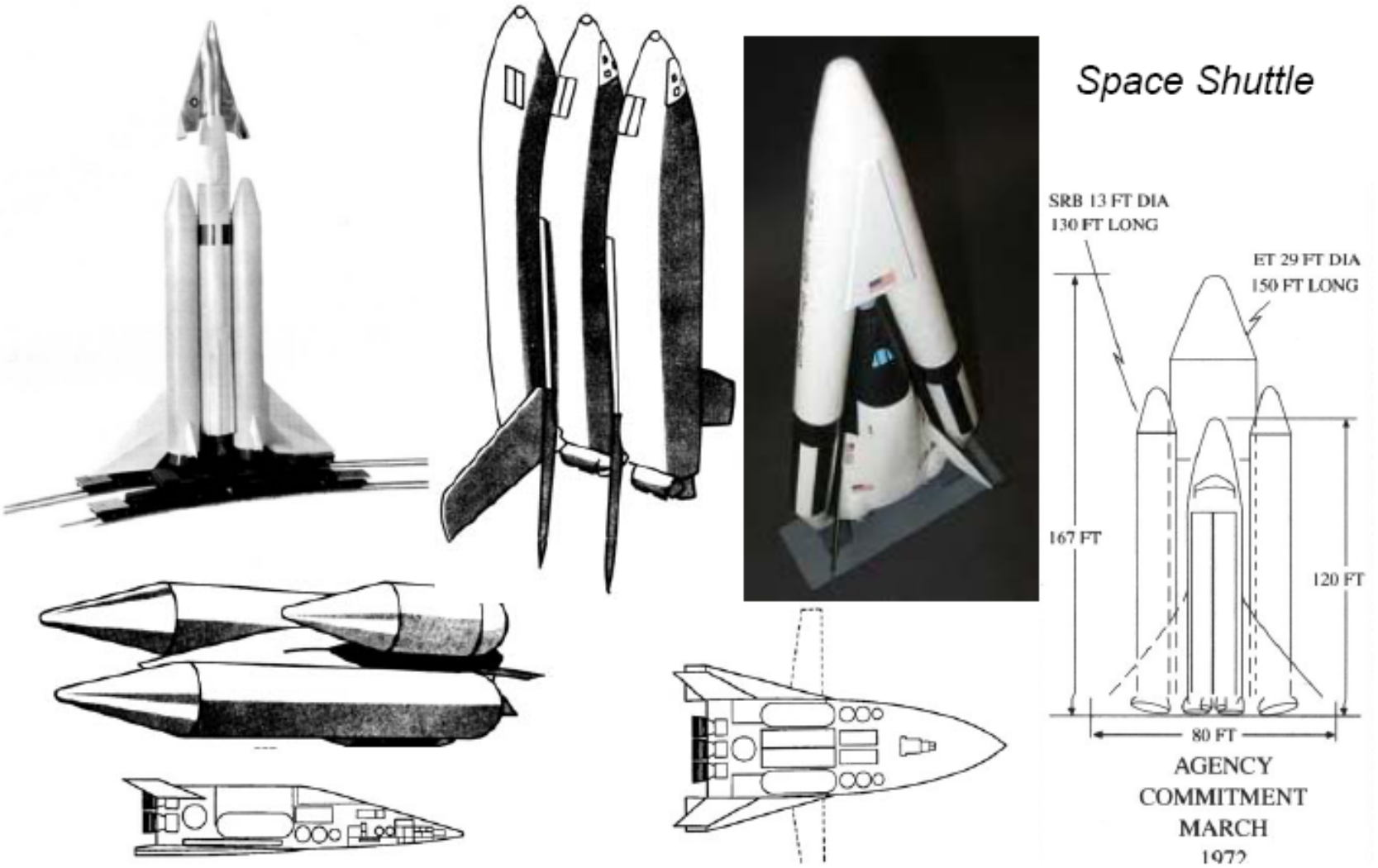
How do I/We generate solutions?

- **Ask**, using the TRIZ approach:
  - How are problems close to the given one solved **in other fields** (of patent)?
  - How are **similar problems** solved in leading industries?
  - How are **opposite problems** solved?

- Generate **multiple alternative** ideas



Remember the different designs of space shuttle?



We can use "Conceptual design" for solution generation

- **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, apperance (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 employed to describe different (or ALL) aspects of the idea

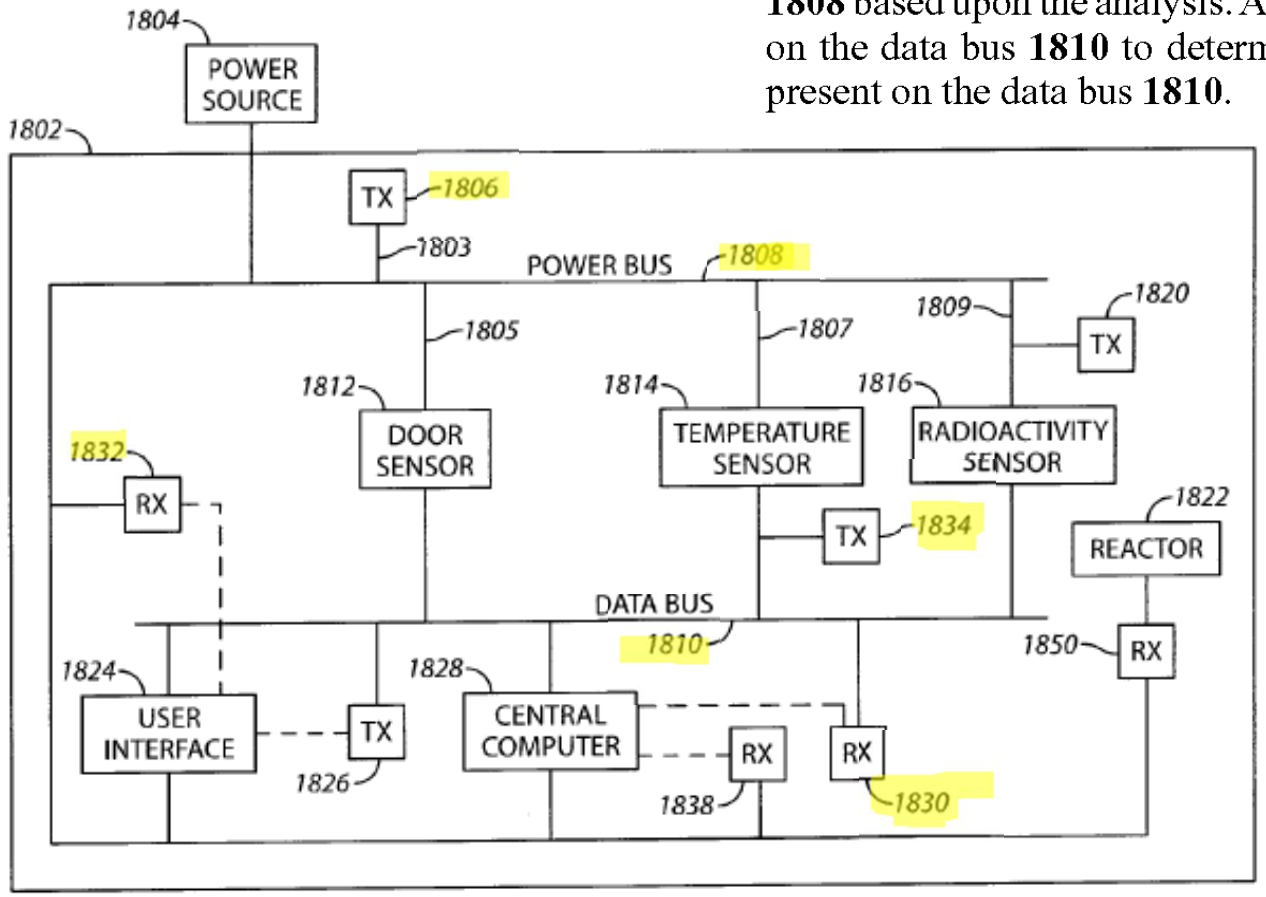
"Conceptual Design" Examples from Patents Relevant to the Projects ----

- **Examples of Conceptual Designs**
  - Next slides (a lot of them) will show different ways **of (1) drawing figures** (for different purposes and different elements such as structure, H/W, S/W, operation flow, network, etc) and **of (2) describing the concept using the figures**.
- **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.

Conceptual Design - Examples

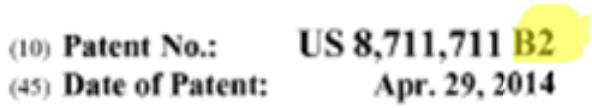
(10) **Patent No.:** **US 8,711,711 B2**
(45) **Date of Patent:** **Apr. 29, 2014**

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

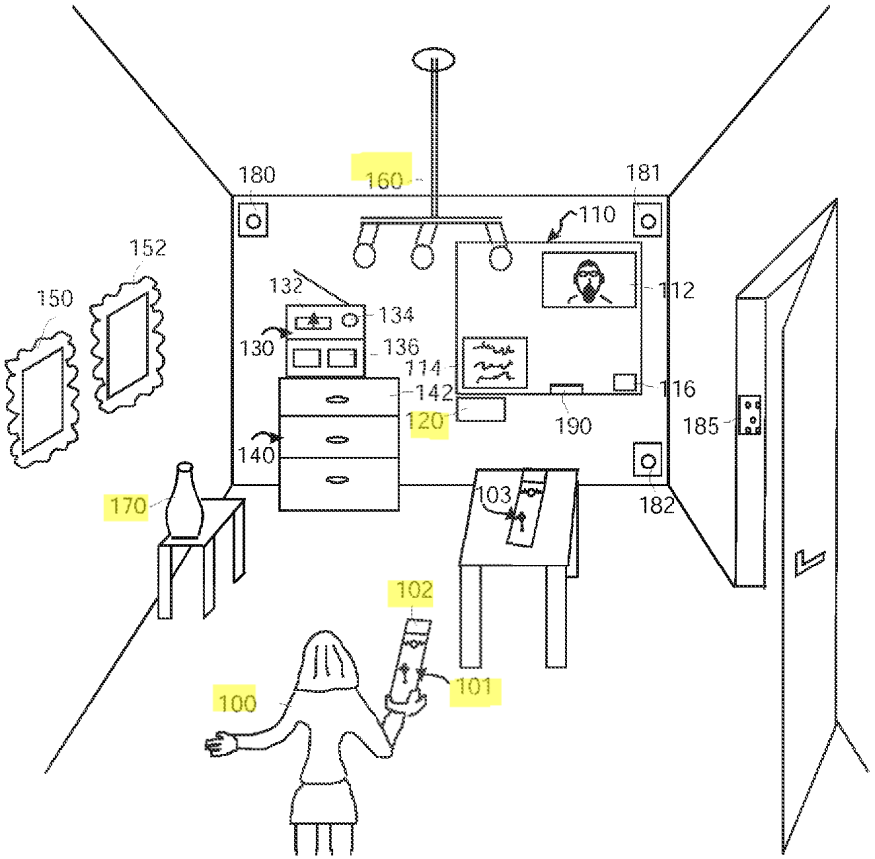
Conceptual Design - Examples

- 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

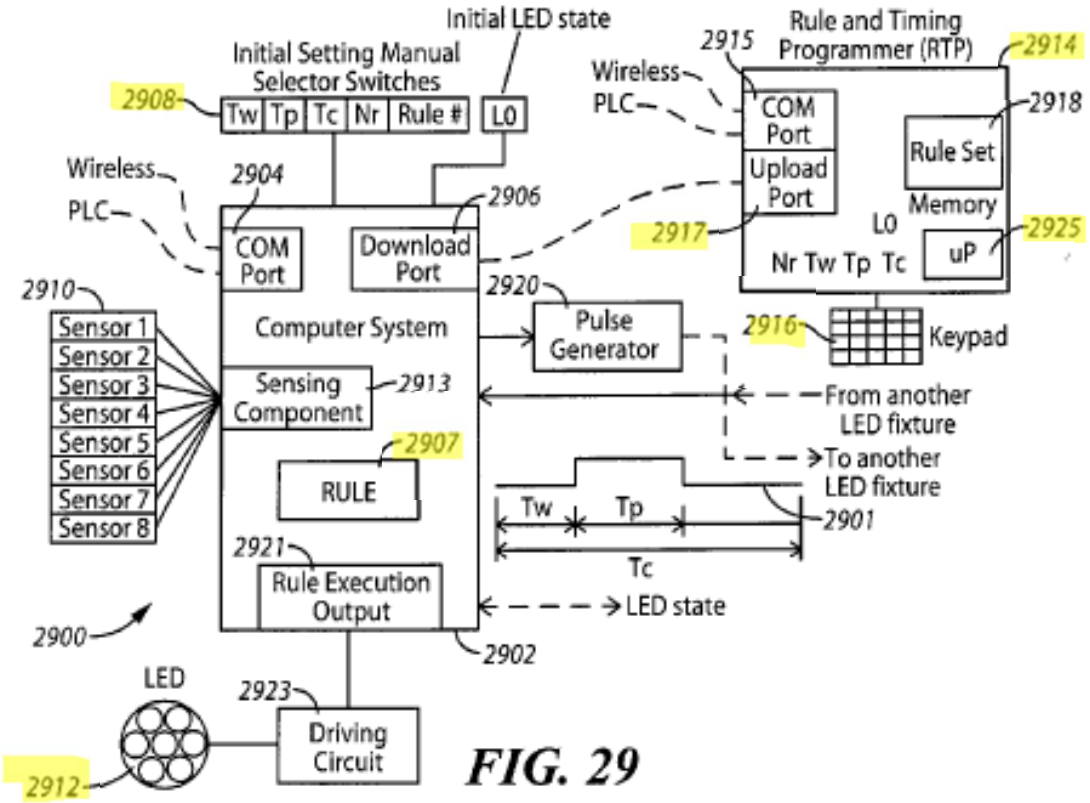


FIG. 29

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.

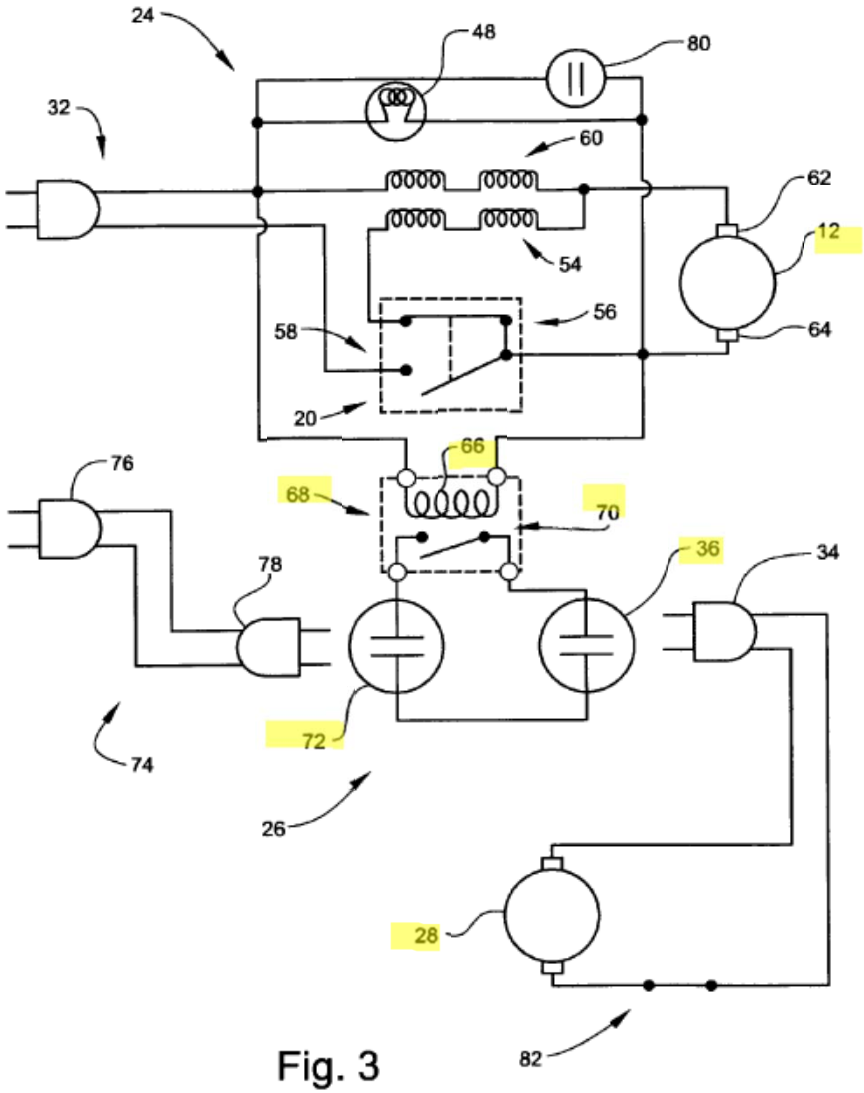


Fig. 3

Wet-Mate Connector

(54) **WET MATE CONNECTOR**

(10) **Patent No.: US 7,959,454 B2**
(45) **Date of Patent: Jun. 14, 2011**

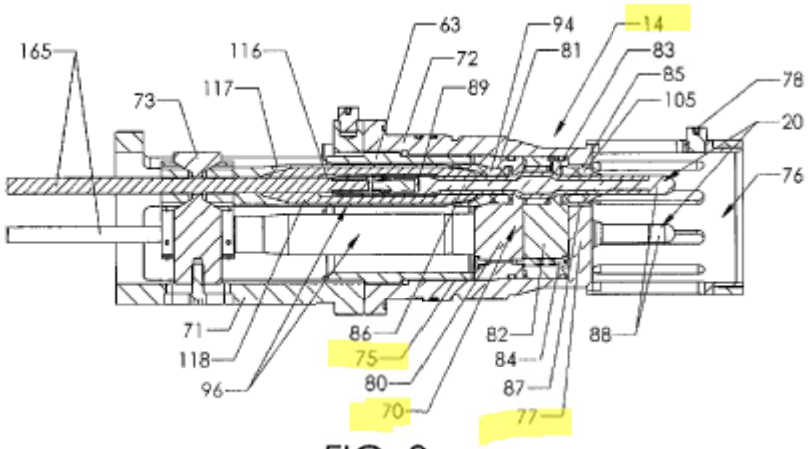


FIG. 9

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**.

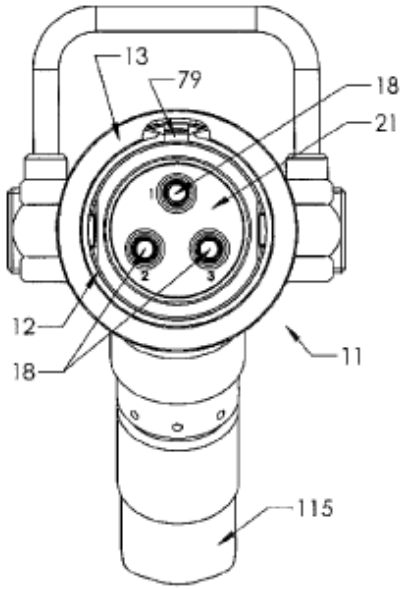


FIG. 3

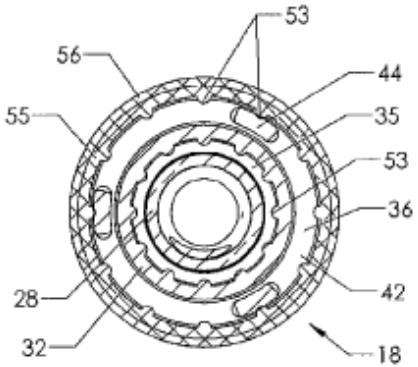


FIG. 5

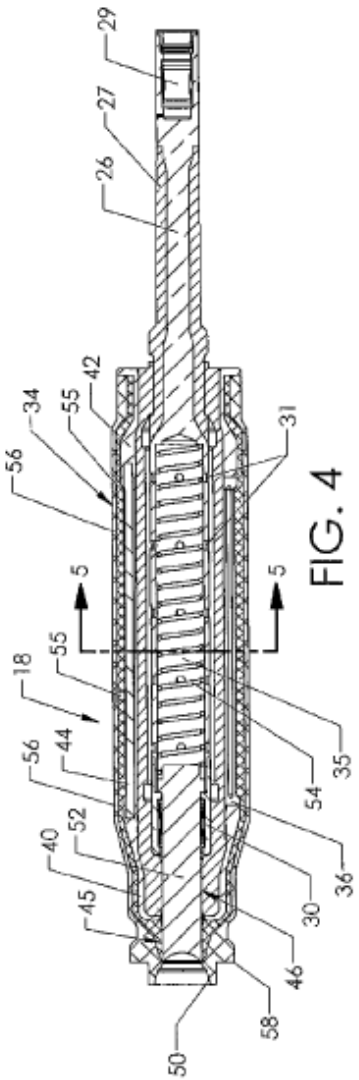


FIG. 4

RF Choke for Signal Coupling

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

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

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

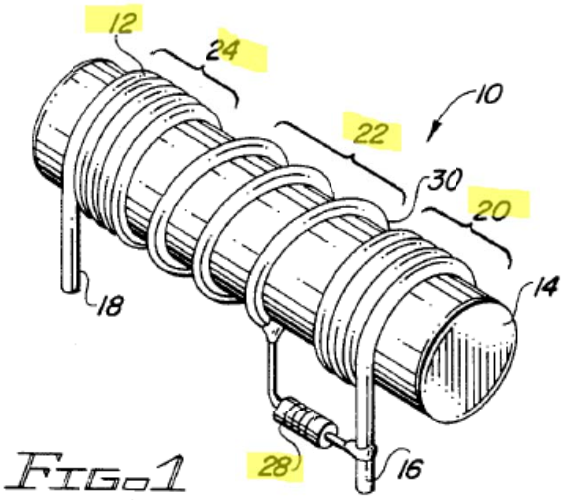


FIG. 1

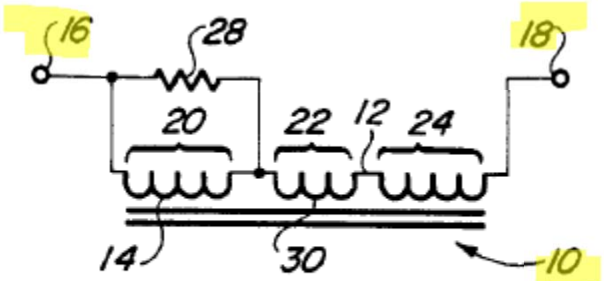


FIG. 4

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

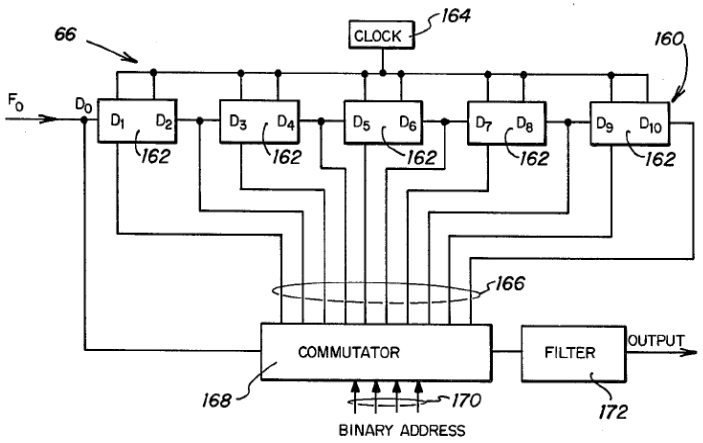


FIG. 5

FIG. 2 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.

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

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

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

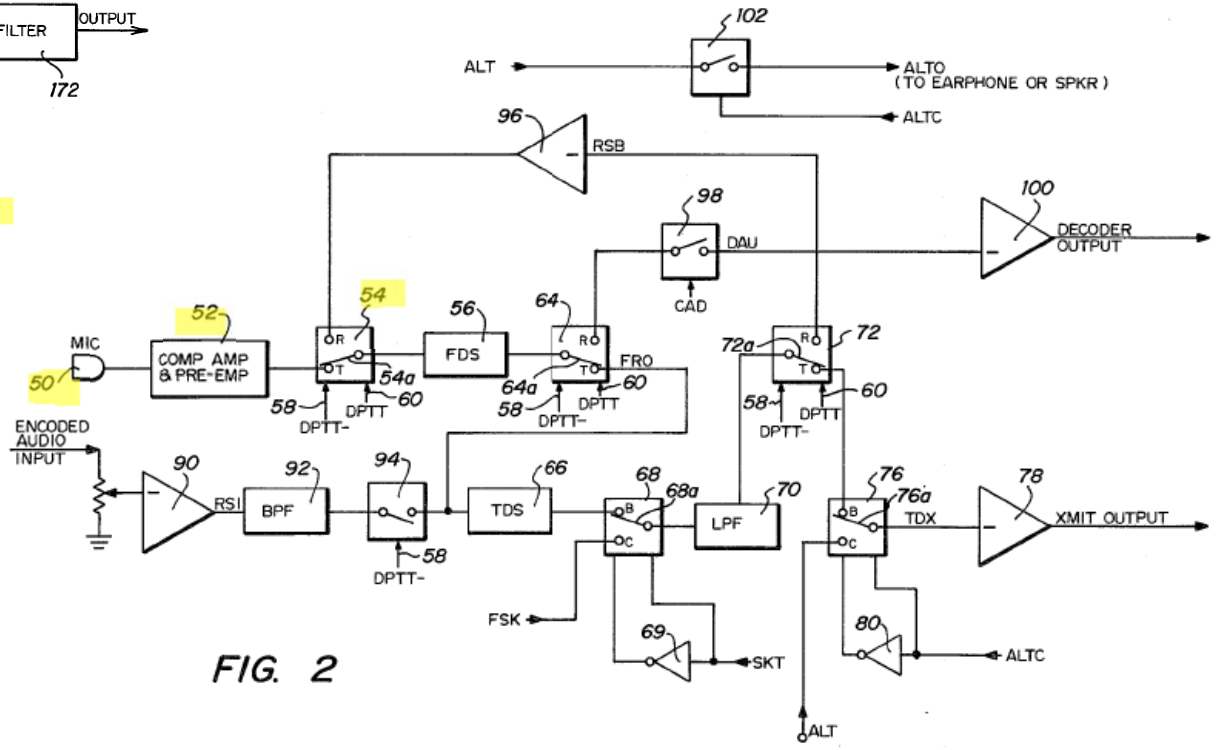


FIG. 2

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**

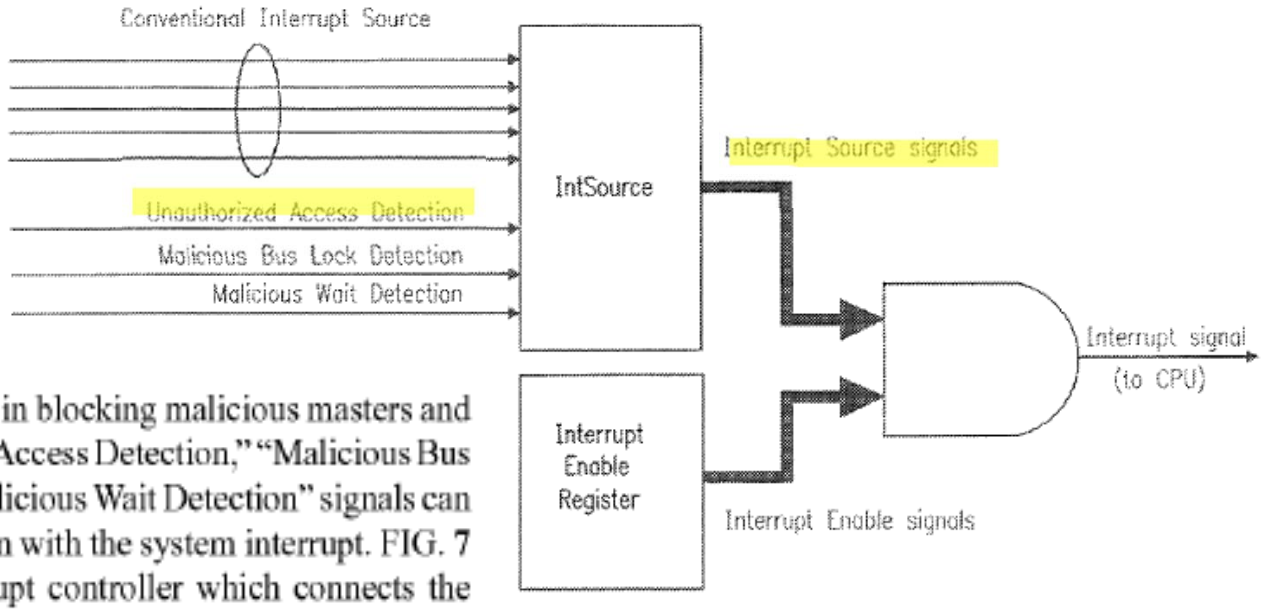


FIG. 7

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.

Sign Language Interpreter

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

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

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

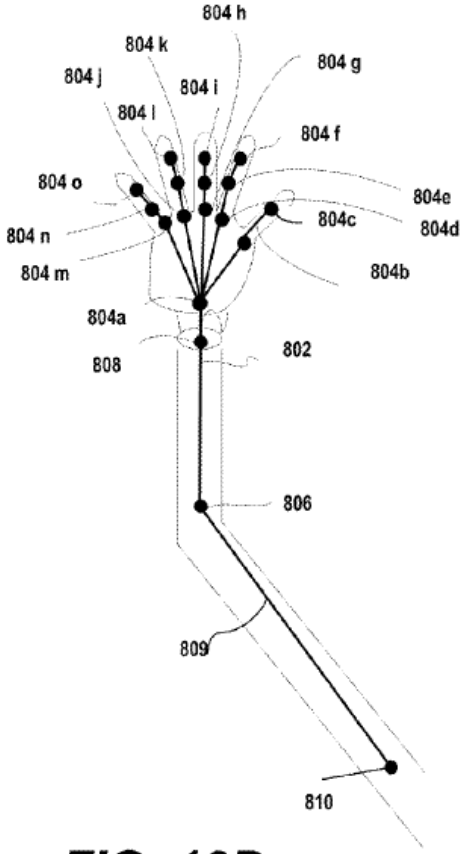
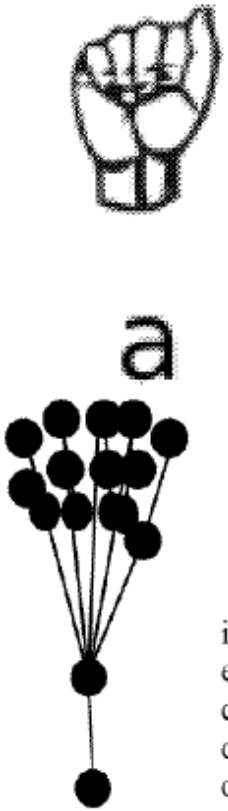


FIG. 10D



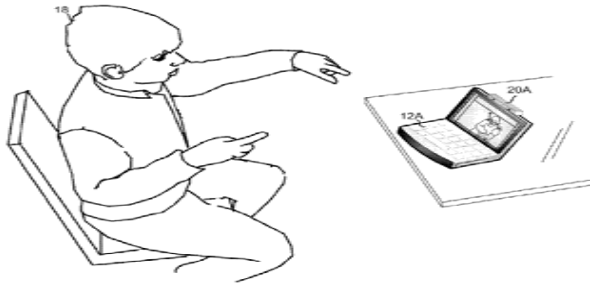


FIG. 1B

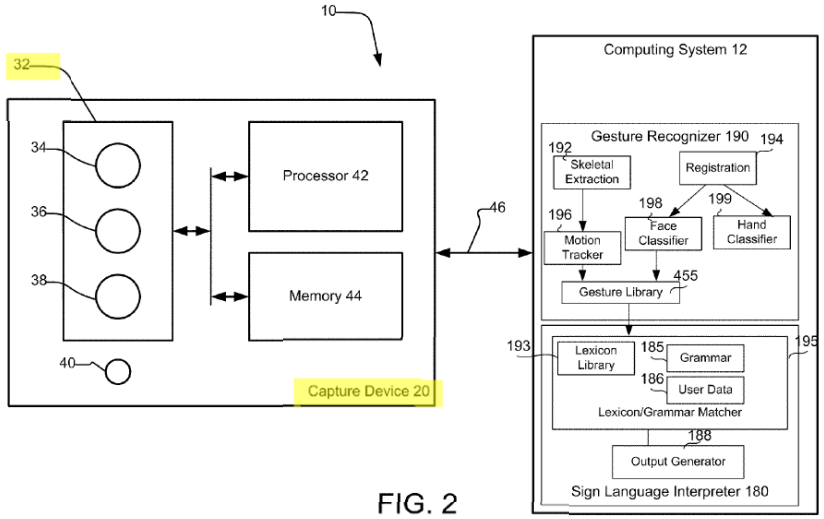


FIG. 2

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**

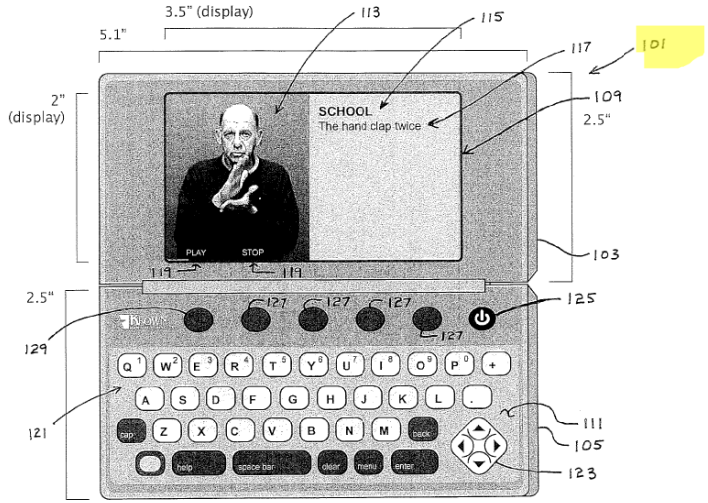


Fig. 1

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**,

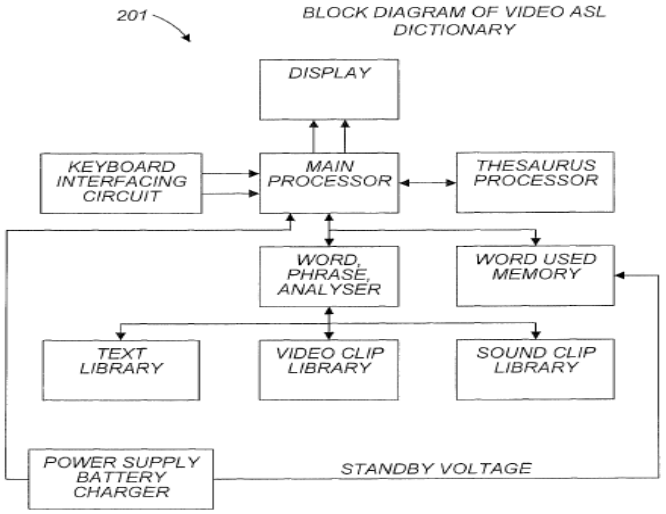


FIG. 2

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**.

Describing Concepts Using Figures

- 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.

Team Activity -- **"Team Conceptual Design Generation"**

- **STEP 1: Give assignment to each team member to bring up Individual Concept Design** – each team member works separately without discussion
  - – If needed, refer this class note to team members to study to learn about conceptual design
  - – Conceptual Design for the initial solution approach
    - Figures and Descriptions
  - – Remember: The solution should satisfy the design requirements
  - – Bring the individual work to the next team meeting [Incubation]

Team Activity -- **"Team Conceptual Design Generation"**

- **Step 2:** Hold a team meeting to produce the initial team conceptual design
  - Discuss on the individual designs and develop into a team concept
  - Generate the combined Conceptual Design for solving the problem (i.e., meeting the requirements)
  - Describe with figures the initial team conceptual design.
- Step 3: Submission
  - Collect and submit the **individual designs** (from all team members)
  - Submit the **team initial conceptual design**

Suggested Timeline

Date	Activities
W 10/28/2015	Give assignment to Individually generate a conceptual design. Give the link to this class note on “Solution Generation” process
	Incubation period
F 10/30/2014 Or First week of November	Team meeting • Discuss individual ideas and develop into concepts • Generate the Team Conceptual Design • Describe [type] with figures the conceptual design.
W 11/4/2015	• Reminder: • Submission of Design Requirements
R 11/12/2015	Submission* of (1) Collected Individual Designs and (2) Team Initial Conceptual Design

***NOTE**: Very high weight in grading