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(54) **Title**: A2TOUCH (ASELSAN AIR TOUCH) VIRTUAL CONTROL SYSTEM

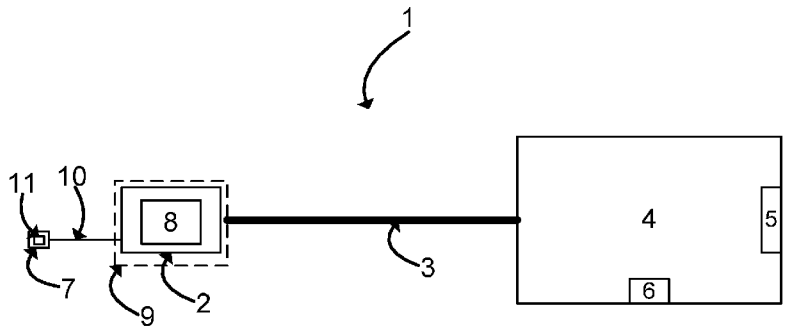

Figure 1

(57) **Abstract**: The present invention relates to system (1) to give pilots opportunity to control all the functions without any body movement, by just moving their hands (101). Another object of the invention is to ease combination of the control increase by only software upgrades. The invention is also an input device for HMD systems. Because of the shielding structure, the invention can be used at military platforms with EMI/EMC compatibility.

DESCRIPTION
A2TOUCH (ASELSAN AIR TOUCH)
VIRTUAL CONTROL SYSTEM

Field of the invention

This invention is related with a system that enables pilots to control avionic functions without any hard button press, only moving their hands in free air.

Background of the invention

Pilots should stoop to the display to control the MFDs or KDUs by pressing hard buttons. This body movement may decrease the situational awareness. Also, the possible combination of controls is limited by the number of the hard buttons. On the other hand, HMD systems have limited input control interfaces like push buttons. Because of this, their display modules can't be used for function control, instead they can only be used for viewing.

(Here and after MFD, KDU, HMD and other avionic systems will be named as master systems.)

The United States patent application numbered **US2013135240** discloses an apparatus for remotely operating a computer using a combination of voice commands and finger movements. The apparatus includes a microphone and a plurality of control elements in the form of touch-sensitive touchpads and/or motion-sensitive elements that are used to operate the computer and to move an on-screen cursor. The related invention can be a solution to remotely control the avionic functions. But pilots should wear glove and glove usage may create problems in touchpads and motion-sensitive elements.

The United States patent application numbered **US8373658** discloses a motion sensing system includes a hand-held device and a receiver device. The hand-held

device includes a microcontroller, a G-sensor (one 3-axis accelerometer), only one 2-axisgyroscope, and a wireless transmitter. The receiver device is preferably a dongle and includes a microcontroller and a wireless receiver. The related invention can be a solution to remotely control the avionic functions. But the environment that the pilots need to use the system has EMC/EMI constraints; good shielding is required for the sensors to be compatible to EMI. Also, wireless communication may be effected from the noises.

Objects of the invention

The object of the invention is to give pilots opportunity to control all the functions without any body movement, by just moving their hands.

Another object of the invention is to ease combination of the control increase by only software upgrades.

Another object of the invention is to provide interface to HMDs for function control.

Another object of the invention is to provide an EMI/EMC compatible sensing device.

Another object of the invention is to provide user friendly device in terms of use with glove.

Another object of the invention is to provide settings to ease the integration of the system to master systems.

Detailed description of the invention

A2Touch virtual control system in order to fulfill the objects of the present invention is illustrated in the attached figures, where:

Figure 1 is the schematic of the A2Touch virtual control system.

Figure 2 is the connection of the system to pilot's glove.

Elements shown in the figures are numbered as follows:

1. A2Touch Virtual Control System
2. Sensor Unit
3. Shielded Data & Power Cable
4. Control Unit
5. Communication Interface
6. Programming Interface
7. ON/OFF Button
8. Sensor unit connection Interface
9. Sensor Unit Shield Box
10. ON/OFF Button Cable
11. ON/OFF Button Connection Interface

101. User hand
102. Screen
103. Icon
104. Thumb
105. Axes

The inventive system for virtual control system (1) essentially comprises

- at least one sensor unit (2) which detects the hand motion,
- at least one shielded data and power cable (3)
  - which carries the power and the data between sensor unit (2) and control unit (4)
  - which is compatible for EMC/EMI.
- at least one control unit (4) which calculates the hand position according to the data coming from the sensor unit (2),
- at least one communication interface (5) to send the calculated data by the control unit (4) to master systems,
- at least one programming interface (6) to set the properties of the

communication interface (5) and calculations ,

- at least one ON/OFF button (7) to start and stop the A2Touch system (1)
- at least one sensor unit connection interface (8) to stick sensor unit (2) to pilot glove,
- at least one sensor unit shield box (9) to protect sensors on the sensor unit (2) from EMI.
- at least one ON/OFF button cable (10) to connect ON/OFF button to sensor unit (2),
- at least one ON/OFF button connection interface (11) to stick ON/OFF button (7) to pilot pointing finger.

In the preferred embodiment of the invention, the step A2Touch system ON operation comprises the sub-steps of

- pilot, pressing the ON/OFF button (7) with the thumb (104),
- A2Touch system, sending start command to master system by the control unit (4),
- master system, displaying an icon (103) on the screen (102),
- pilot, releasing the ON/OFF button.

In the preferred embodiment of the invention, while the A2Touch system is running, OFF operation comprises the sub-steps of

- pilot, pressing the ON/OFF button (7) with the thumb (104),
- A2Touch system, sending stop command to master systems by the control unit (4),
- Master system, removing the icon (103) from the screen (102),
- pilot, releasing the ON/OFF button.

In the preferred embodiment of the invention, the communication interface (5) supports the following standards

- full-duplex RS-485,
- RS-422

In the preferred embodiment of the invention, the programming interface (6) supports the following standard

- RS-232,

In the preferred embodiment of the invention, the step programming via programming interface (6) comprises the sub-steps of

- setting the preferred communication interface (5) standard,
- setting the baud rate of the communication interface (5),
- setting the selection distance in terms of millimeters,
- setting the resolution of the screen (102) that A2Touch system will be used in terms of pixel number,
- setting the sensitivity of the A2Touch system in terms of pixels/milimeters,
- setting the mode of the A2Touch system operation; automatic or manual,
- setting the refresh rate of the A2Touch system in automatic mode.

Selection distance is used to detect a selection command when the pilot moves his/her hand in downward direction trough z-axis (105) longer than or equal to selection distance.

A2Touch system sends the position data to master systems as pixel coordinates.

Resolution of the screen is used by the A2Touch system to know the screen borders.

Sensitivity is used to update the position in terms of pixels according to setting when the hand moves certain millimeters.

In manual mode, A2Touch system waits for position request command from the master system. After the request command, A2Touch system calculates the position at that time and sends the information.

In manual mode, selection information is only send by the A2Touch system when the

selection is done by the pilot.

In automatic mode, A2Touch calculates and sends the position data according to refresh rate.

In automatic mode, selection information is send always with the position data. In case of no selection, dummy information is sent.

In the preferred embodiment of the invention, the step communication via communication interface (5) comprises the sub-steps of

- sending start / stop command to master system,
- sending position data in terms of pixel coordinates,
- sending selection command when a selection occurs,
- receiving calculation request in manual mode,
- receiving platform position data to calculate relative position for the hand movements.

In the preferred embodiment of the invention, the step initialization comprises the sub-steps of

- waiting for ON/OFF button press,
- sending center pixel coordinates to master systems after start command,
- setting the related hand position as the center when the ON/OFF button press detected.

In the preferred embodiment of the invention, the sensor unit (2) is sticked to user glove and ON/OFF button (7) is sticked to pointing finger.

In the preferred embodiment of the invention, ON/OFF button cable (10) carries the electrical signal when the press action occurs. Also, this cable is strong enough to disconnect ON/OFF button from pointing finger when the sensor unit is pulled.

In the preferred embodiment of the invention, sensor unit shield box (9) protects the sensors on the sensor unit (2) from electromagnetic radiation.

In the preferred embodiment of the invention, shielded data & power cable (3) have four wires, two wires for power and two wires for data transfer. The wire pairs have their own shielding around which are ended at sensor unit shield box (9) and control unit (4).

In the preferred embodiment of the invention, A2Touch virtual control system (1) consists of a sensor unit (2), a shielded power and data cable (3), a control unit (4), a communication interface (5), a programming interface (6), an ON/OFF button (7), a sensor unit connection interface (8), a sensor unit shield box (9), an ON/OFF button cable (10) and an ON/OFF button connection interface (11).

In the preferred embodiment of the invention, the ON/OFF button (7) is sticked to pilot pointing finger by the connection interface (11). The pilot presses the ON/OFF button (7) by his/her thumb (104) to start the A2Touch system. Control unit (4) realizes the press action and sends a start command to master systems via communication interface (5). The master systems display an icon (103) on their screens (102). The pilot releases the button after seeing the icon.

In the preferred embodiment of the invention, the A2Touch virtual control system (1) uses three coordinate axes (x, y, z (105)). The user hand (101) movements are detected in these axes. These movements are detected by the sensor unit (2) which is stick on the user glove. The motion data is transferred via data cable (3). The movements on the x and y axes (105) will be result in position change. A movement through z axes is accepted as a selection.

In the preferred embodiment of the invention, the position information is sent as pixel coordinates by the control unit (4). With the position data, selection command is sent if the user makes a selection by moving his/her hand downward through z-axis.

To stop the A2Touch system pilot presses the ON/OFF button (7) and waits until the icon (103) disappears from the screen (102). Then pilot releases the button. It is possible to remove sensor unit (2) and ON/OFF button (7) from the glove by just pulling the sensor unit (2).

CLAIMS

1. The inventive A2Touch virtual control system (1) essentially **comprises**

- at least one sensor unit (2) which detects the hand motion,
- at least one shielded data and power cable (3)
  - which carries the power and the data between sensor unit (2) and control unit (4)
  - which is compatible for EMC/EMI.
- at least one control unit (4) which calculates the hand position according to the data coming from the sensor unit (2),
- at least one communication interface (5) to send the calculated data by the control unit (4) to master systems,
- at least one programming interface (6) to set the properties of the communication interface (5) and calculations ,
- at least one ON/OFF button (7) to start and stop the A2Touch system (1),
- at least one sensor unit (2) connection interface (8) to stick sensor unit (2) to pilot glove,
- at least one sensor unit shield box (9) to protect sensors on the sensor unit (2) from EMI,
- at least one ON/OFF button (7) cable (10) to connect ON/OFF button to sensor unit (2),
- at least one ON/OFF button (7) connection interface (11) to stick ON/OFF button (7) to pilot pointing finger.

2. In the preferred embodiment of the invention, the step A2Touch ON operation **comprises** the sub-steps of

- pilot, pressing the ON/OFF button (7) with the thumb (104),
- A2Touch system, sending start command to master systems by the control unit (4),
- master system, displaying an icon (103) on the screen (102),
- pilot, releasing the ON/OFF button.

3. In the preferred embodiment of the invention, while the A2Touch system is running, OFF operation **comprises** the sub-steps of
   - pilot, pressing the ON/OFF button (7) with the thumb (104),
   - A2Touch system, sending stop command to master systems by the control unit (4),
   - master system, removing the icon (103) from the screen (102),
   - pilot, releasing the ON/OFF button.

4. In the preferred embodiment of the invention, the step programming via programming interface (6) **comprises** the sub-steps of
   - setting the preferred communication interface (5) standard,
   - setting the baud rate of the communication interface (5),
   - setting the selection distance (105) in terms of millimeters,
   - setting the resolution of the screen (102) that A2Touch system will be used in terms of pixel number,
   - setting the sensitivity of the A2Touch system in terms of pixels/ millimeters,
   - setting the mode of the A2Touch system operation; automatic or manual,
   - setting the refresh rate of the A2Touch system in automatic mode.

5. The A2Touch virtual control system (1) according to claim 1 **characterized by** using the selection distance to detect a selection by hand movement downward through z axes (105).

6. The A2Touch virtual control system (1) according to claim 1 **characterized by** sending the position data as pixel coordinates.

7. The A2Touch virtual control system (1) according to claim 1 **characterized by** using the master system screen (102) resolution to know the screen borders.

8. The A2Touch virtual control system (1) according to claim 7 **characterized by** stopping to update hand position when the pilot's hand move outside the screen borders.

9. The A2Touch virtual control system (1) according to claim 1 **characterized by** using sensitivity information to update the position in terms of pixels when the hand moves certain millimeters.

10. The A2Touch virtual control system (1) according to claim 1 **characterized by** having operation modes; automatic or manual.

11. In manual mode, the A2Touch virtual control system (1) according to claim 10 **characterized by** waiting for position request command from the master system. After the request command, calculating the position at that time and sending the information.

12. In manual mode, the A2Touch virtual control system (1) according to claim 10 **characterized by** sending selection information when the selection is done

13. In automatic mode, the A2Touch virtual control system (1) according to claim 10 **characterized by** calculating and sending the position data according to refresh rate.

14. In automatic mode, the A2Touch virtual control system (1) according to claim 10 **characterized by**, sending selection information always with the position data. In case of no selection, sending dummy information.

15. In the preferred embodiment of the invention, the step communication via communication interface (5) **comprises** the sub-steps of

- sending start / stop command to master system,

- sending position data in terms of pixel coordinates,
- sending selection command when a selection occurs,
- receiving calculation request in manual mode,
- receiving platform position data to calculate relative position for the hand movements.

16. In the preferred embodiment of the invention, the step initialization **comprises** the sub-steps of
- waiting for ON/OFF button press,
- sending center pixel coordinates to master systems after start command,
- setting the related hand position as the center when the ON/OFF button press detected.

17. The A2Touch virtual control system (1) according to claim 1 **characterized by** sticking the sensor unit (2) is to user glove.

18. The A2Touch virtual control system (1) according to claim 1 **characterized by** sticking ON/OFF button (7) to pointing finger.

19. The A2Touch virtual control system (1) according to claim 1 **characterized by** having the ON/OFF button cable strong enough to disconnect ON/OFF button from pointing finger when the sensor unit is pulled.

20. The A2Touch virtual control system (1) according to claim 1 **characterized by** having sensor unit shield box (9) to protect the sensors on the sensor unit (2) from electromagnetic radiation.

21. The A2Touch virtual control system (1) according to claim 1 **characterized by** having shielded data & power cable (3) with four wires, two wires for power and two wires for data transfer. The wire pairs have their own shielding around which are ended at sensor unit shield box (9) and control unit (4).

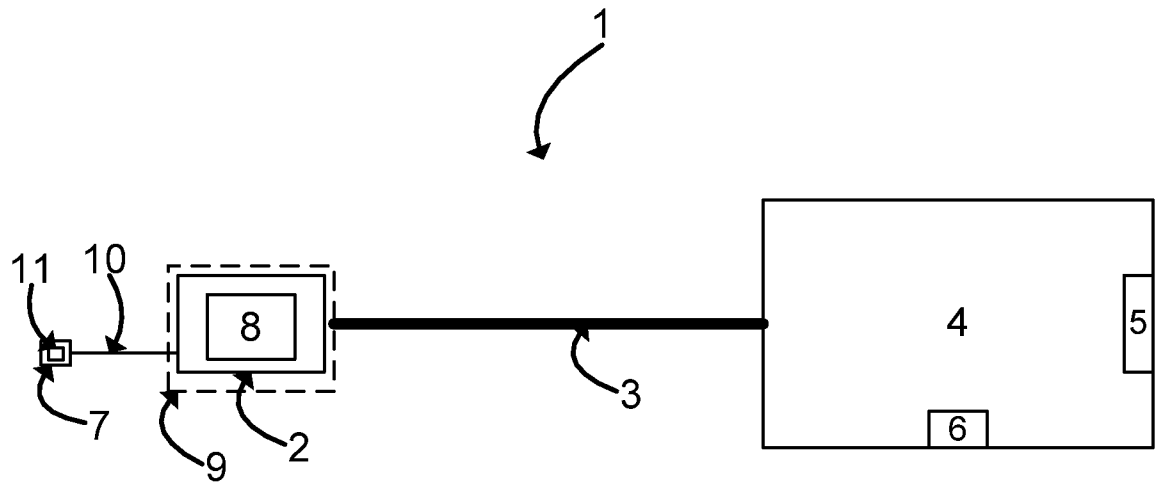

Figure 1

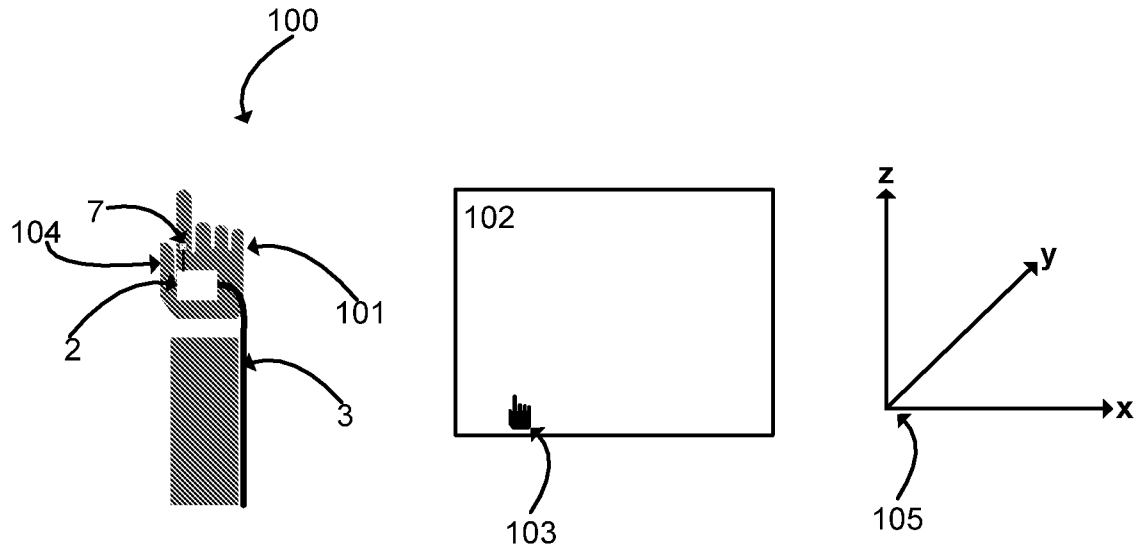

Figure 2

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/058221

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F3/01 G06F3/038 G06F3/0346
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 4 988 981 A (ZIMMERMAN THOMAS G [US] ET AL) 29 January 1991 (1991-01-29) abstract; figures 1,2	1-21
A	US 5 128 671 A (THOMAS JR WILLIAM A [US]) 7 July 1992 (1992-07-07) abstract; figures 1,2	1-21
A	US 2011/285623 A1 (YE ZHOU [US] ET AL) 24 November 2011 (2011-11-24) cited in the application abstract; figure 1	1-21

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
4 March 2014	11/03/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Schneider, Michael

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/058221

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006/125968 A1 (YOKOZAWA YUKIO [JP] ET AL) 15 June 2006 (2006-06-15) abstract; figure 1 paragraphs [0260], [0261] -----	1-21
A	US 6 025 831 A (GARDINER MARK S [US]) 15 February 2000 (2000-02-15) abstract column 4, line 58 - column 5, line 5; figure 5A -----	1-21
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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