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(54) **INDICATED POSITION DETECTING DEVICE AND INDICATED POSITION DETECTING METHOD**

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(57) **ABSTRACT**

Provided are an indicated position detecting device and an indicated position detecting method that can suppress a decrease in the accuracy of detecting a position indicated by an indicator. An indicated position detecting device for detecting a position indicated by an indicator includes a first transmission circuit and a second transmission circuit. The first transmission circuit transmits a first transmission signal related to first processing of detecting the position indicated by the indicator. The second transmission circuit transmits a second transmission signal related to second processing different from the first processing. A waveform of the first transmission signal and a waveform of the second transmission signal are orthogonal to each other in the same period.

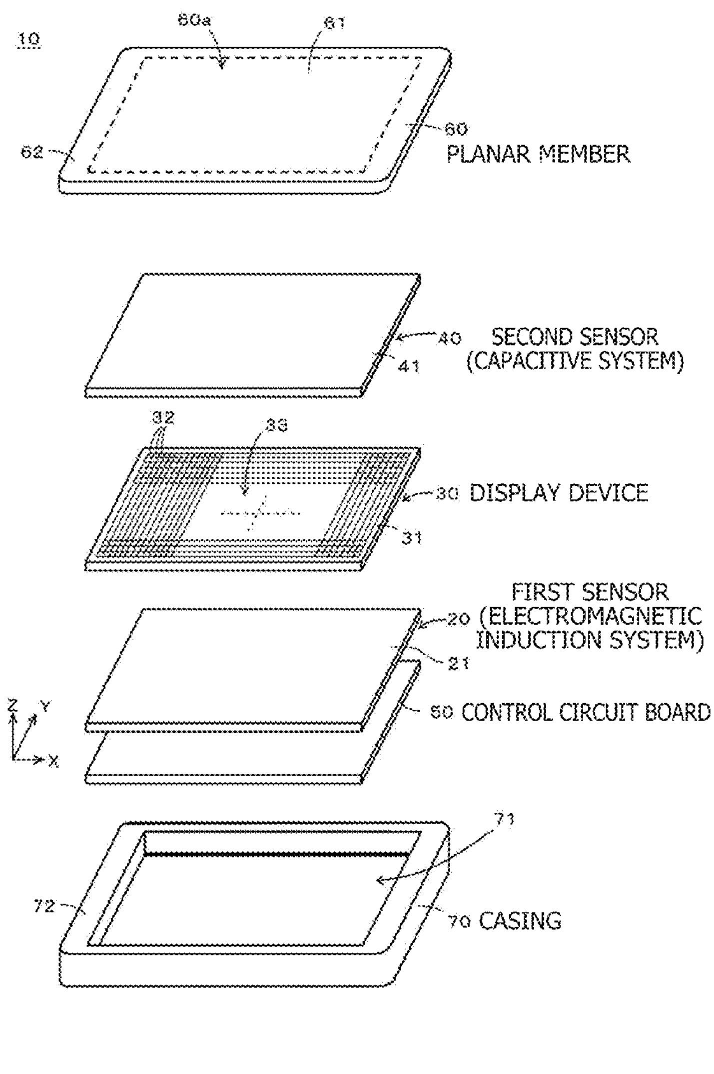


FIG. 1

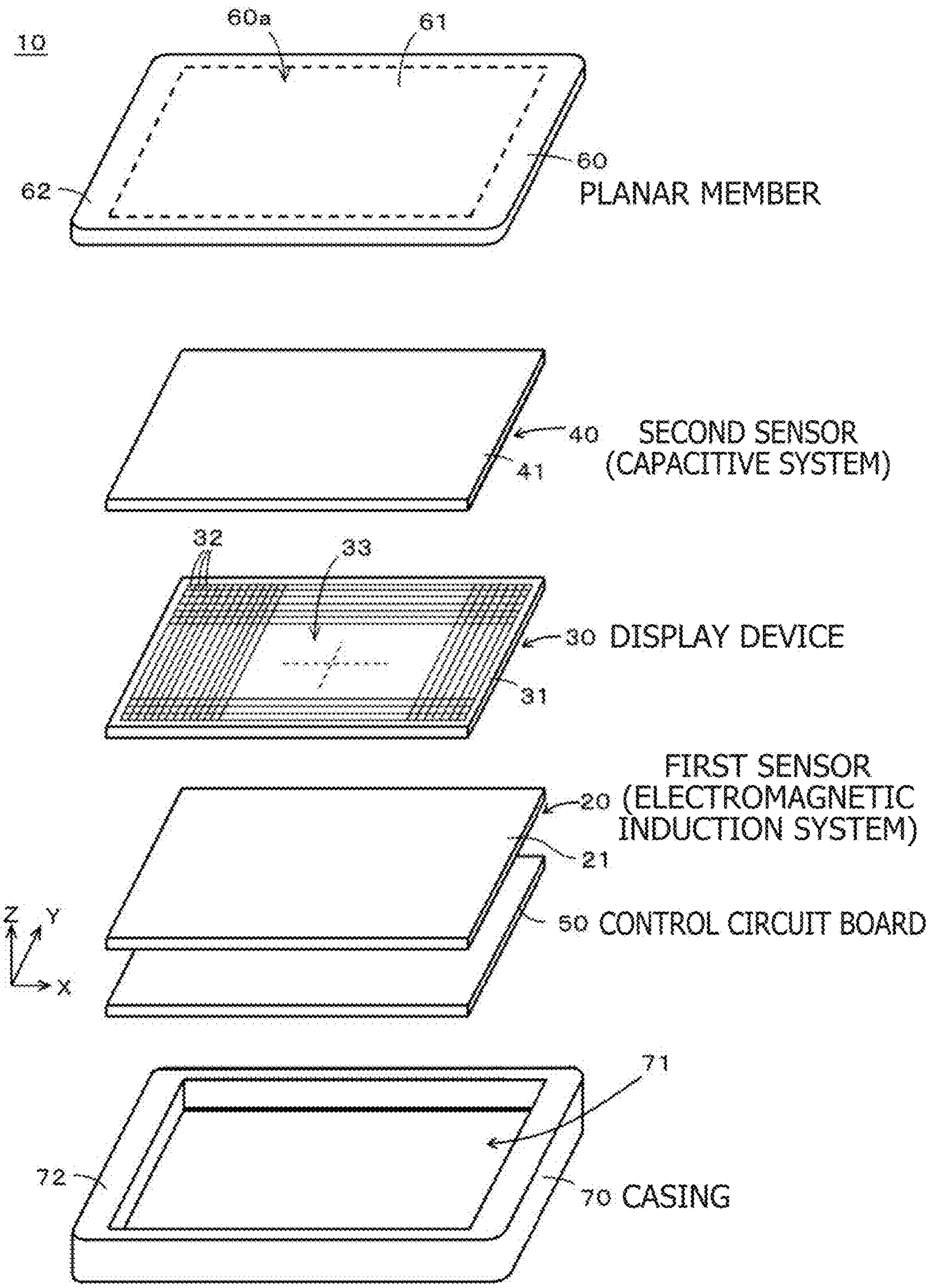

10
60a
61
60
PLANAR MEMBER
62
40
SECOND SENSOR
(CAPACITIVE SYSTEM)
41
32
33
30
DISPLAY DEVICE
31
FIRST SENSOR
(ELECTROMAGNETIC
INDUCTION SYSTEM)
20
21
50
CONTROL CIRCUIT BOARD
Z
Y
X
71
72
70
CASING

FIG. 2

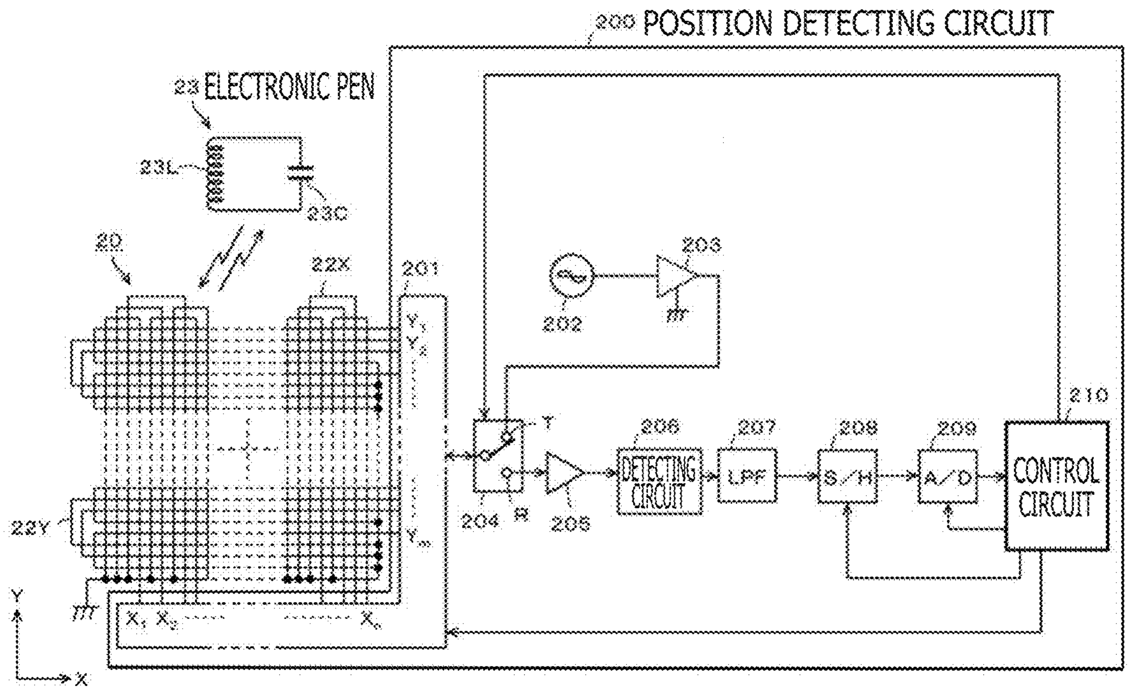

200 POSITION DETECTING CIRCUIT
23 ELECTRONIC PEN
23L
23C
20
22X
201
Y1
Y2
Ym
22Y
X1 X2
Xn
Y
X
202
203
T
204
R
205
206 DETECTING CIRCUIT
207 LPF
208 S/H
209 A/D
210 CONTROL CIRCUIT

FIG. 3

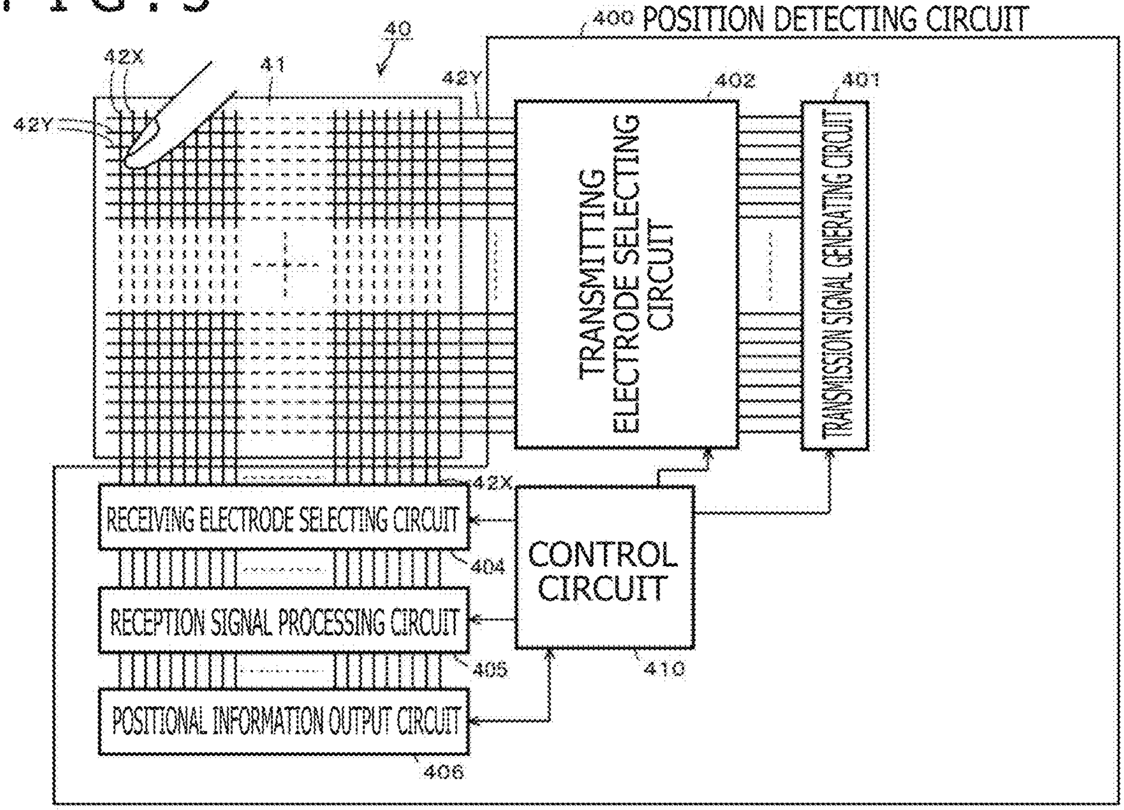

400 POSITION DETECTING CIRCUIT
40
41
42X
42Y
42Y
402
401
TRANSMITTING ELECTRODE SELECTING CIRCUIT
TRANSMISSION SIGNAL GENERATING CIRCUIT
42X
RECEIVING ELECTRODE SELECTING CIRCUIT
404
CONTROL CIRCUIT
RECEPTION SIGNAL PROCESSING CIRCUIT
405
410
POSITIONAL INFORMATION OUTPUT CIRCUIT
406

FIG. 4

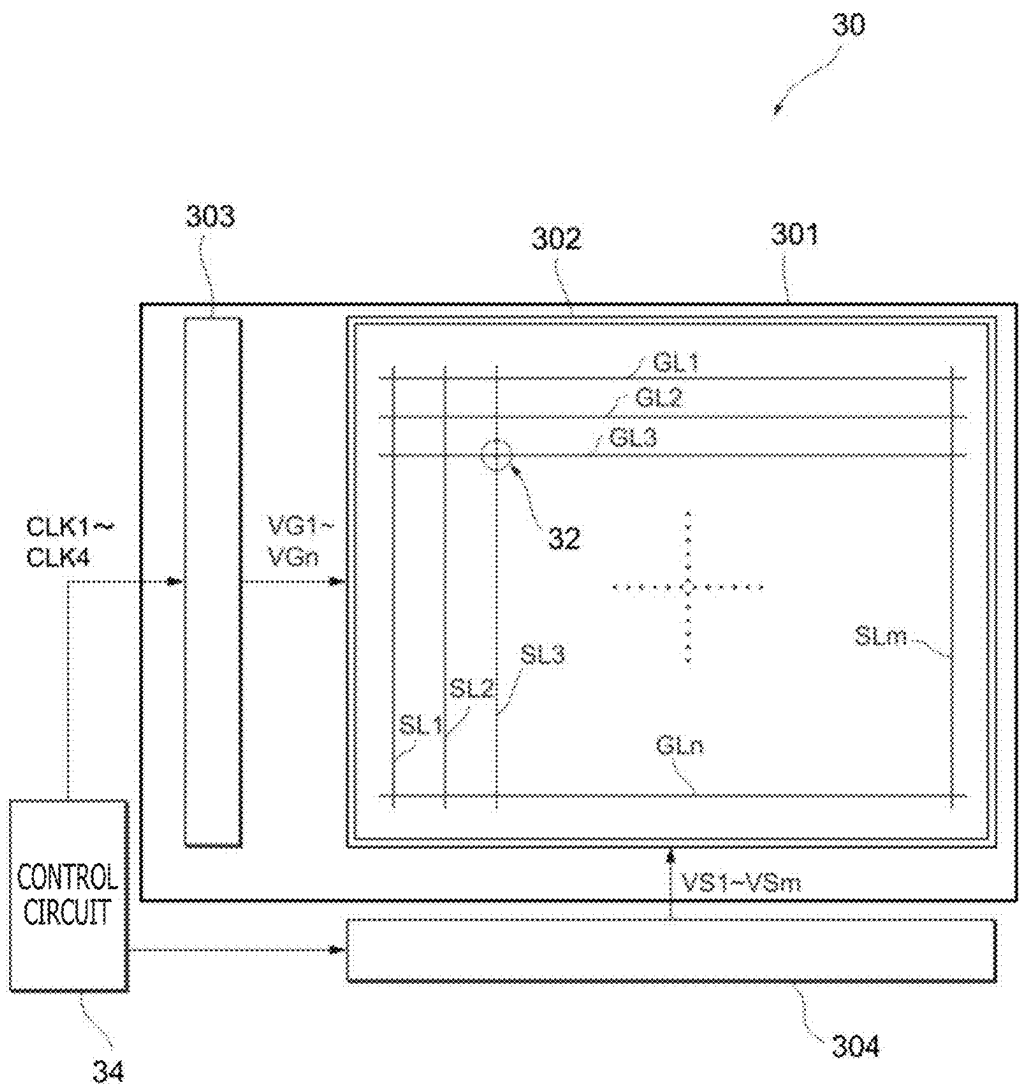

30
303
302
301
GL1
GL2
GL3
32
CLK1~
CLK4
VG1~
VGn
SLm
SL3
SL2
SL1
GLn
CONTROL
CIRCUIT
VS1~VSm
34
304

FIG. 5

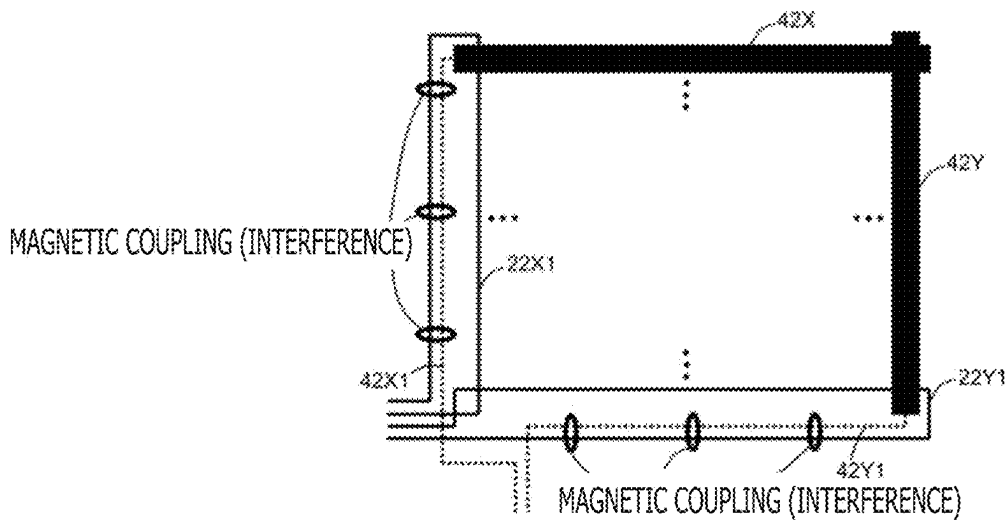

42X
42Y
MAGNETIC COUPLING (INTERFERENCE)
22X1
42X1
22Y1
42Y1
MAGNETIC COUPLING (INTERFERENCE)

FIG. 6

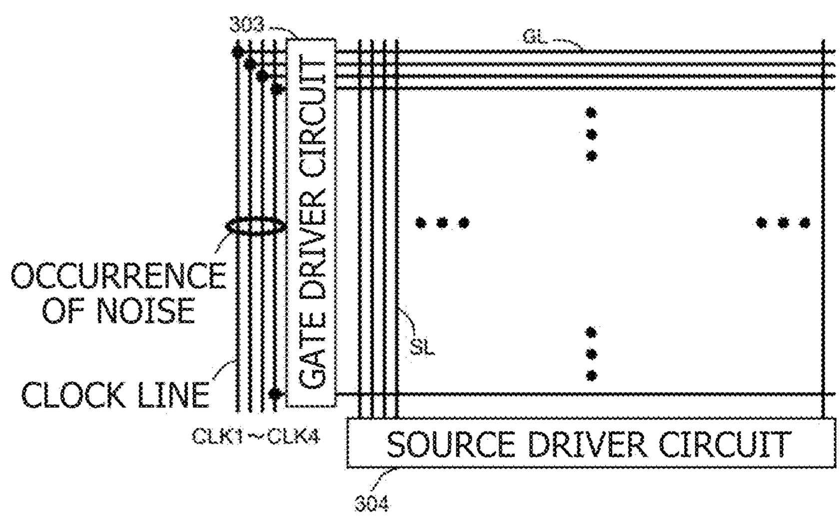

303
GL
GATE DRIVER CIRCUIT
OCCURRENCE OF NOISE
SL
CLOCK LINE
CLK1~CLK4
SOURCE DRIVER CIRCUIT
304

FIG. 7

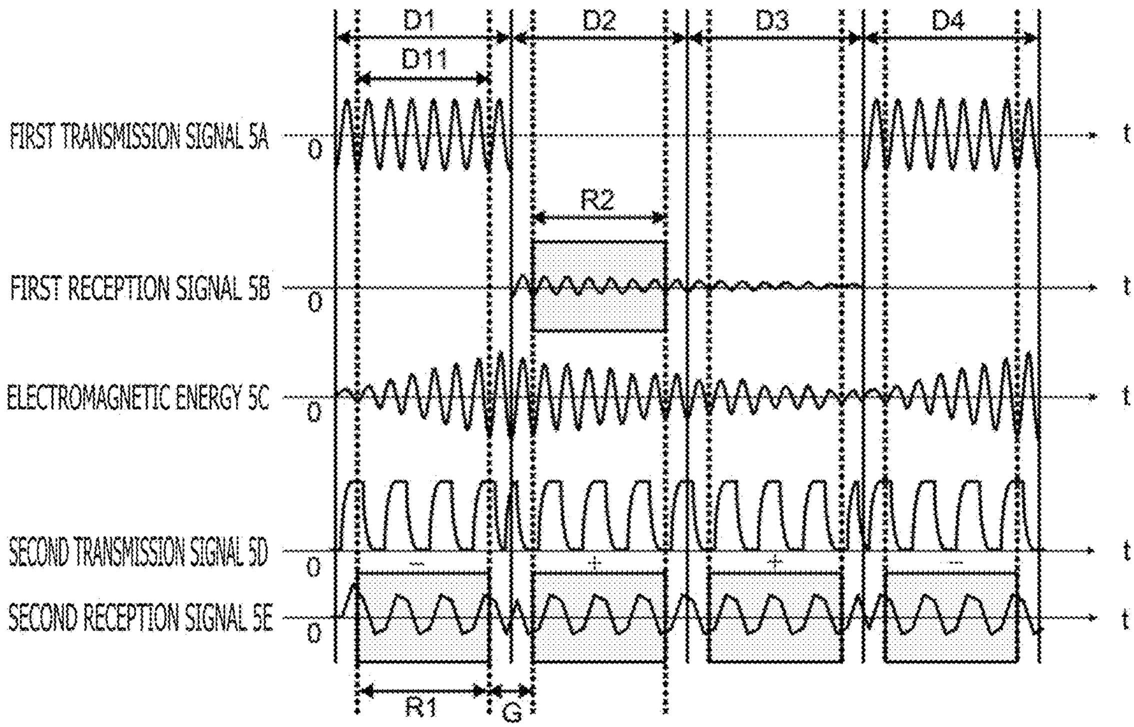

D1
D2
D3
D4
D11
FIRST TRANSMISSION SIGNAL 5A
0
t
R2
FIRST RECEPTION SIGNAL 5B
ELECTROMAGNETIC ENERGY 5C
SECOND TRANSMISSION SIGNAL 5D
SECOND RECEPTION SIGNAL 5E
R1
G

FIG. 8

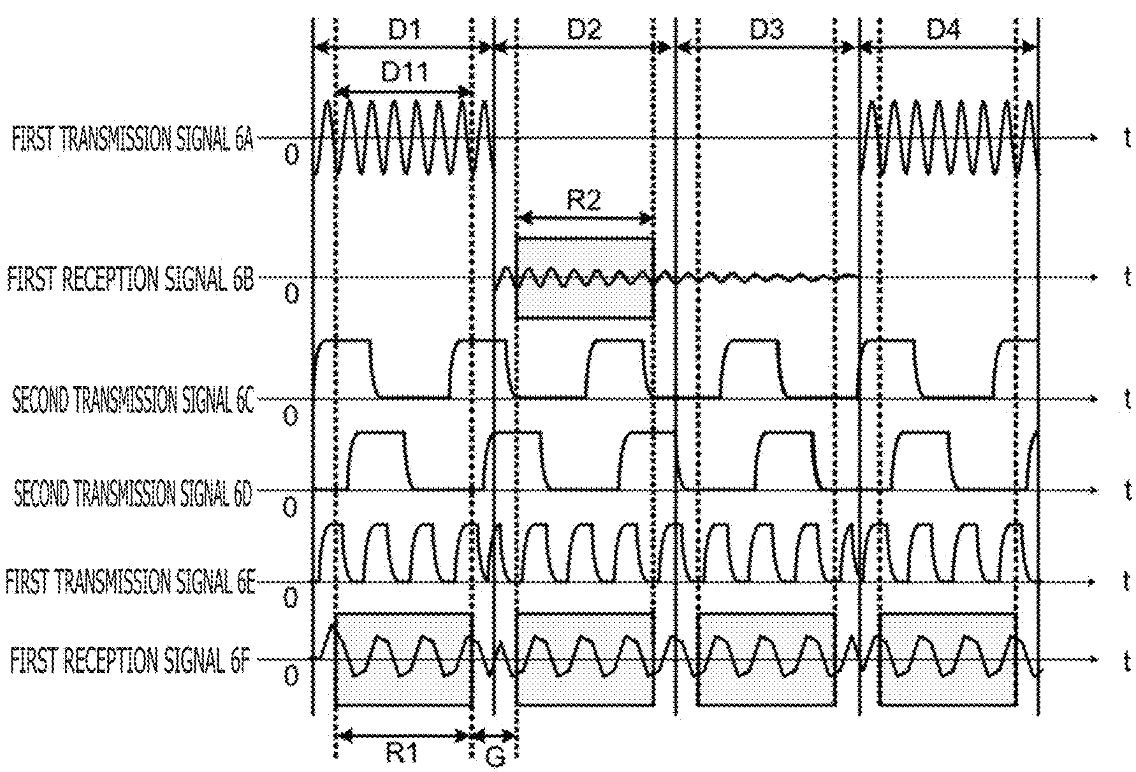
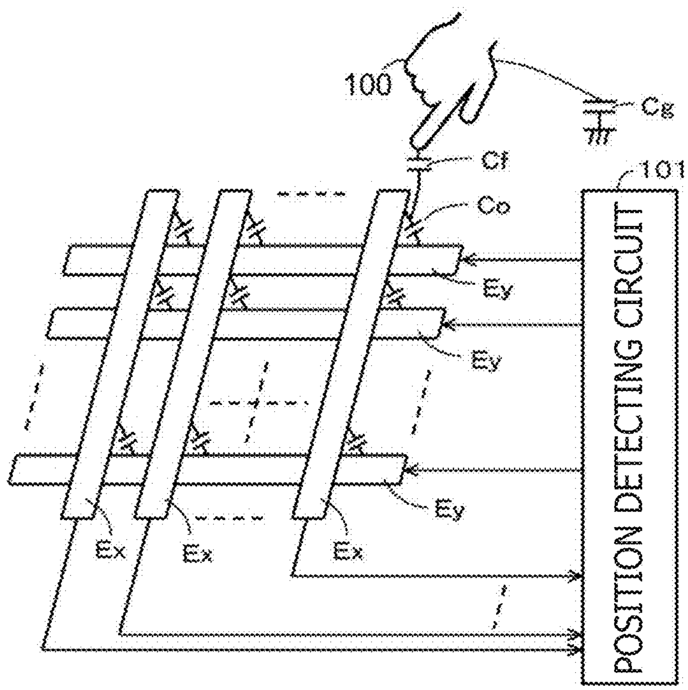

D1
D2
D3
D4
D11
FIRST TRANSMISSION SIGNAL 6A
0
t
R2
FIRST RECEPTION SIGNAL 6B
SECOND TRANSMISSION SIGNAL 6C
SECOND TRANSMISSION SIGNAL 6D
FIRST TRANSMISSION SIGNAL 6E
FIRST RECEPTION SIGNAL 6F
R1
G

FIG. 9



(PRIOR ART)

INDICATED POSITION DETECTING DEVICE AND INDICATED POSITION DETECTING METHOD

BACKGROUND

Technical Field

[0001] The present disclosure relates to an indicated position detecting device and an indicated position detecting method.

Description of the Related Art

[0002] An indicated position detecting device that detects a position indicated by an indicator such as a finger or a pen (indicated position) is included and widely used in electronic apparatuses such as tablet-type information terminals including a flat display (for example, a liquid crystal panel). As a position detecting system to be used in the indicated position detecting device, various systems are provided, such as a resistive film system, an electromagnetic induction system, and a capacitive system.

[0003] Of these, as disclosed in Patent Document 1, for example, an indicated position detecting device of the electromagnetic induction system includes a position detecting device including a sensor formed by arranging a large number of loop coils in an X-axis direction and a Y-axis direction of coordinate axes, and an electronic pen as a position indicator of a pen shape that has a resonance circuit including a coil as an example of an inductance element wound around a magnetic core, and a capacitor.

[0004] The position detecting device transmits a magnetic field to the electronic pen by supplying a transmission signal of a predetermined frequency to the loop coils of the sensor. The resonance circuit of the electronic pen is configured to have a resonance frequency corresponding to the frequency of the transmission signal. The resonance circuit stores magnetic energy on the basis of an electromagnetic induction action between the resonance circuit and the loop coils of the sensor. Then, the electronic pen feeds back a magnetic field based on the magnetic energy stored in the resonance circuit to the loop coils of the sensor of the position detecting device.

[0005] An induced voltage is generated in the loop coils of the sensor due to the magnetic field from the electronic pen. The position detecting device detects coordinate values in the X-axis direction and the Y-axis direction of a position indicated by the electronic pen on the sensor, on the basis of the value of the induced voltage generated in each of the loop coils.

[0006] The indicated position detecting device of the electromagnetic induction system enables the indicated position to be input by the electronic pen as an indicator with a relatively high definition, and is thus widely used.

[0007] In addition, as for an indicated position detecting device of the capacitive system, which is a system of detecting an indicated position of an indicator (such as a finger or a pen-type position indicator (capacitive pen)) used for a touch panel or the like, there are two kinds of systems, that is, a surface type (surface capacitive type) and a projected type (projected capacitive type). Both of the systems detect the indicated position of the indicator by detecting a change in a state of capacitive coupling between sensor electrodes and the indicator. An indicated position detecting device of a system referred to as a cross point capacitive coupling system, which is an extension of the projected-type capacitive system, has also spread (see Patent Document 2, for example).

[0008] FIG. **9** illustrates a configuration of an example of a sensor of the indicated position detecting device of the cross point capacitive system. As illustrated in FIG. **9**, the sensor of the indicated position detecting device of the cross point capacitive system is constituted by arranging, for example, a plurality of upper electrodes Ex in the Y-axis direction (vertical direction) of an indication input surface and a plurality of lower electrodes Ey in the X-axis direction (horizontal direction) thereof at respective predetermined intervals in the X-axis direction and the Y-axis direction and arranging the upper electrodes Ex and the lower electrodes Ey such that the upper electrodes Ex and the lower electrodes Ey are orthogonal to each other and spaced from each other with a slight gap. In this case, a predetermined capacitance Co (fixed capacitance) is formed at overlapping parts (cross points) between the upper electrodes Ex and the lower electrodes Ey.

[0009] Then, at a position where an indicator **100** such as the position indicator held by a user or a finger of the user is in proximity to or in contact with the indication input surface, a capacitance Cf is formed between the electrodes Ex and Ey at the position and the indicator. Moreover, the indicator **100** is connected to a ground via a predetermined capacitance Cg through a human body. As a result, due to the capacitances Cf and Cg, the capacitance between the upper electrode Ex and the lower electrode Ey changes at the position indicated by the indicator **100**. The position detecting device of the cross point capacitive system identifies the position indicated by the indicator **100** within the indication input surface, by detecting the change in this capacitance.

[0010] The change in this capacitance is detected by a position detecting circuit **101**. The position detecting circuit **101**, for example, sets the lower electrodes Ey as transmitting electrodes and supplies a predetermined transmission signal to the transmitting electrodes, and sets the upper electrodes Ex as receiving electrodes, receives a reception signal from the receiving electrodes, and detects a change in current of the reception signal. The position detecting circuit **101** thereby detects the change in the capacitance between the upper electrode Ex and the lower electrode Ey. The position detecting circuit **101** detects the position indicated by the indicator, by simultaneously supplying the transmission signal to all of the transmitting electrodes, and simultaneously performing processing of detecting the change in current of the reception signal from all of the receiving electrodes.

[0011] The indicator as a target whose indicated position is to be detected by the sensor for the indicated position detection of the electromagnetic induction system described above is the electronic pen of the electromagnetic induction system. On the other hand, the indicator as a target whose indicated position is to be detected by the sensor for the indicated position detection of the capacitive system is a finger or the capacitive pen. Thus, the targets to be detected are totally different. Accordingly, one indicated position detecting device may include the sensor for the indicated position detection of the electromagnetic induction system and the sensor for the indicated position detection of the capacitive system. This indicated position detecting device can simultaneously detect an indication of the position indicated by the electronic pen, by using the sensor for the indicated position detection of the electromagnetic induction system, while detecting an indication of the position indicated by a finger, for example, by using the sensor for the indicated position detection of the capacitive system.

PRIOR ART DOCUMENT

Patent Documents

[0012] Patent Document 1: Japanese Patent Laid-open No. 2009-86925

[0013] Patent Document 2: Japanese Patent Laid-open No. 2011-3035

BRIEF SUMMARY

Technical Problems

[0014] Now, an electronic apparatus such as a tablet-type information terminal including a display (for example, a liquid crystal panel) presents a challenge of making provision for frame narrowing, which makes the width of a rim (frame) enclosing the display panel narrower in order to realize miniaturization of the electronic apparatus while maintaining the size of the display panel. Moreover, in order to make provision for the frame narrowing, the electronic apparatus is desired to have a reduced arrangement space for the loop coils and signal lines used in the indicated position detecting device.

[0015] However, when an indicated position detecting device of the electromagnetic induction system and an indicated position detecting device of the capacitive system are mounted in one electronic apparatus, loop coils used in the indicated position detecting device of the electromagnetic induction system and signal lines used for the transmission of a transmission signal and the reception of a reception signal in the indicated position detecting device of the capacitive system may be arranged in proximity to each other. In this case, due to magnetic coupling (interference) between the loop coils and the signal lines, an electromagnetic noise is mixed into the loop coils from the signal lines used for the transmission of the transmission signal, and an electromagnetic noise is mixed into the signal lines used for the reception of the reception signal from the loop coils. When an electromagnetic noise is mixed into the loop coils from the signal lines used for the transmission of the transmission signal, the S/N ratio of a magnetic field transmitted from the electronic pen and received in the loop coils is decreased, and consequently, the accuracy of indicated position detection in the indicated position detecting device of the electromagnetic induction system is decreased. In addition, when an electromagnetic noise is mixed into the signal lines used for the reception of the reception signal from the loop coils, the S/N ratio of the reception signal is decreased, and consequently, the accuracy of indicated position detection in the indicated position detecting device of the capacitive system is decreased.

[0016] In addition, when the indicated position detecting device of the electromagnetic induction system and the indicated position detecting device of the capacitive system are mounted in one electronic apparatus, the loop coils used in the indicated position detecting device of the electromagnetic induction system, the signal lines used in the indicated position detecting device of the capacitive system, and signal lines (for example, clock lines) used for the transmission of driving signals (for example, clock signals) for driving the display panel may be arranged in proximity to each other. In this case, as a result of the mixing of an electromagnetic noise into the loop coils used in the indicated position detecting device of the electromagnetic induction system and the signal lines used for the reception of the reception signal in the indicated position detecting device of the capacitive system from the signal lines used for the transmission of the driving signals, the S/N ratio of the magnetic field transmitted from the electronic pen and received in the loop coils is decreased, thus decreasing the accuracy of position detection in the indicated position detecting device of the electromagnetic induction system, and the S/N ratio of the reception signal is decreased, thus decreasing the accuracy of position detection in the indicated position detecting device of the capacitive system.

[0017] Embodiments of the present disclosure provide an indicated position detecting device and an indicated position detecting method that can suppress a decrease in the accuracy of detecting a position indicated by an indicator.

Technical Solution

[0018] According to the present disclosure, an indicated position detecting device having the following configuration is provided.

[0019] [1] An indicated position detecting device for detecting a position indicated by an indicator includes a first transmission circuit, and a second transmission circuit, wherein the first transmission circuit, in operation, transmits a first transmission signal related to first processing of detecting the position indicated by the indicator, wherein the second transmission circuit, in operation, transmits a second transmission signal related to second processing different from the first processing, and wherein a waveform of the first transmission signal and a waveform of the second transmission signal are orthogonal to each other in the same period.

[0020] According to the present disclosure, the waveform of the first transmission signal and the waveform of the second transmission signal are orthogonal to each other in the same period, a noise mixed into a reception signal related to the first or second processing due to the first or second transmission signal is suppressed, and thereby a decrease in the position detection accuracy of the first or second processing related to the reception signal is suppressed.

[0021] In the following, various embodiments of the present disclosure will be illustrated. The embodiments illustrated in the following can be combined with each other.

[0022] [2] In the indicated position detecting device according to [1], a value obtained by subtracting a wave number of the second transmission signal from a wave number of the first transmission signal in the same period is a positive or negative integer.

[0023] [3] In the indicated position detecting device according to [1] or [2], the first processing is processing of detecting the position indicated by the indicator by an electromagnetic induction system, and the second processing is processing of detecting the position indicated by the indicator by a capacitive system.

[0024] [4] In the indicated position detecting device according to any one of [1] to [3], a transmission period of the first transmission signal at least partially overlaps a transmission period of the second transmission signal.

[0025] [5] In the indicated position detecting device according to [4], a start time point and an end time point of the transmission period of the first transmission signal are the same as a start time point and an end time point of the transmission period of the second transmission signal.

[0026] [6] The indicated position detecting device according to [1] further includes a display, in which the first processing is processing of detecting the position indicated by the indicator on the display by an electromagnetic induction system, and the second processing is processing of driving the display.

[0027] [7] The indicated position detecting device according to [1] further includes a display, in which the first processing is processing of detecting the position indicated by the indicator on the display by a capacitive system, and the second processing is processing of driving the display.

[0028] [8] An indicated position detecting device for detecting a position indicated by an indicator includes a first transmission circuit, a second transmission circuit, a first reception circuit, and a second reception circuit, wherein the first transmission circuit, in operation, transmits a first transmission signal related to first processing of detecting the position indicated by the indicator, wherein the second transmission circuit, in operation, transmits a second transmission signal related to second processing of detecting the position indicated by the indicator, wherein the first reception circuit, in operation, receives a first reception signal related to the first processing, wherein the second reception circuit, in operation, receives a second reception signal related to the second processing, and wherein a waveform of the first reception signal and a waveform of the second reception signal are orthogonal to each other in the same period.

[0029] [9] In the indicated position detecting device according to [8], a value obtained by subtracting a wave number of the second transmission signal from a wave number of the first transmission signal in the same period is a positive or negative integer.

[0030] [10] In the indicated position detecting device according to [8] or [9], the first reception circuit, in operation, receives the first reception signal in a transmission period of the second transmission signal.

[0031] [11] In the indicated position detecting device according to any one of [8] to [10], the second reception circuit, in operation, receives the second reception signal in a transmission period of the first transmission signal.

[0032] [12] In the indicated position detecting device according to any one of [8] to [11], a guard interval is provided between a reception period of the first reception signal and a reception period of the second reception signal.

[0033] [13] An indicated position detecting method for detecting a position indicated by an indicator includes transmitting a first transmission signal related to first processing of detecting the position indicated by the indicator, and transmitting a second transmission signal related to second processing different from the first processing, wherein a waveform of the first transmission signal and a waveform of the second transmission signal are orthogonal to each other in the same period.

[0034] [14] An indicated position detecting method for detecting a position indicated by an indicator includes transmitting a first transmission signal related to first processing of detecting the position indicated by the indicator, transmitting a second transmission signal related to second processing of detecting the position indicated by the indicator, receiving a first reception signal related to the first processing, and receiving a second reception signal related to the second processing, a waveform of the first reception signal and a waveform of the second reception signal being orthogonal to each other in the same period.

Advantageous Effect

[0035] According to the present disclosure, it is possible to suppress a decrease in the accuracy of detecting a position indicated by an indicator.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0036] FIG. **1** is an exploded perspective view illustrating an example of a configuration of an electronic apparatus in a present embodiment.

[0037] FIG. **2** is a diagram illustrating an example of a configuration of a first sensor and a position detecting circuit in the present embodiment.

[0038] FIG. **3** is a diagram illustrating an example of a configuration of a second sensor and a position detecting circuit in the present embodiment.

[0039] FIG. **4** is a diagram illustrating an example of a control configuration of a display device in the present embodiment.

[0040] FIG. **5** is a diagram of assistance in explaining problems to be solved in the present embodiment.

[0041] FIG. **6** is a diagram of assistance in explaining problems to be solved in the present embodiment.

[0042] FIG. **7** is a waveform chart related to processing of detecting positions indicated by indicators.

[0043] FIG. **8** is a waveform chart related to processing of detecting the positions indicated by the indicators.

[0044] FIG. **9** is a diagram illustrating a configuration of an example of a sensor of an indicated position detecting device of a cross point capacitive system.

DETAILED DESCRIPTION

[0045] An embodiment of the present disclosure will be described with reference to the accompanying drawings. Incidentally, in each figure, parts identified by the same reference numerals have the same or similar configuration.

Description of General Configuration

[0046] FIG. **1** is an exploded configuration view illustrating an example of a configuration of an electronic apparatus **10** (corresponding to an "indicated position detecting device" according to the present disclosure) in the present embodiment. The electronic apparatus **10** is a pad-type terminal that has a function of detecting a position indicated by an indicator for an electromagnetic induction system constituted by a position indicator such as an electronic pen (which will hereinafter be referred to as a "first indicator"), for example, by a sensor for indicated position detection of the electromagnetic induction system (which will hereinafter be referred to as a "first sensor") and has a function of detecting a position indicated by an indicator such as a finger or a position indicator (capacitive pen) (which will hereinafter be referred to as a "second indicator") on a display screen of a display device, by a sensor for indicated position detection of a capacitive system (which will hereinafter be referred to as a "second sensor"), and can thus detect the positions indicated by the first and second indicators simultaneously, by the two sensors.

[0047] The electronic apparatus **10** as an example of the pad-type terminal includes a first sensor **20** for the indicated position detection of the electromagnetic induction system, a display device **30**, a second sensor **40** for the position detection of the capacitive system, a control circuit board **50**, a planar member **60**, and a casing **70**.

[0048] The display device **30** is constituted by a flat display such as a liquid crystal display or an organic electroluminescent (EL) display. The display device **30** includes a display screen **33** in which a large number of display pixels **32** are arranged in an X-axis direction (horizontal direction) and a large number of display pixels **32** are arranged in a Y-axis direction (vertical direction) orthogonal to the X-axis direction on a display substrate **31**.

[0049] The first sensor **20** is disposed on the undersurface side of the display screen **33** of the display device **30** so as to be superposed on the display device **30**. In addition, the second sensor **40** is disposed on the top surface side of the display screen **33** of the display device **30** so as to be superposed on the display screen **33** of the display device **30**. Hence, the first sensor **20** and the second sensor **40** are also arranged in superposed relation to each other.

[0050] Moreover, a detection region of the first sensor **20** capable of detecting the position indicated by the first indicator, a detection region of the second sensor **40** capable of detecting the position indicated by the second indicator, and a display region of the display screen **33** of the display device **30** are formed in substantially equal size, and are arranged in superposed relation to each other.

[0051] Though not illustrated in FIG. **1**, a position detecting circuit of the electromagnetic induction system is connected to the first sensor **20**, and a position detecting circuit of the capacitive system is connected to the second sensor **40**. The first and second position detecting circuits are provided on the control circuit board **50**, and are connected to the first sensor **20** and the second sensor **40** by flexible cables, for example. The control circuit board **50** is mounted with a microcomputer for controlling the electronic apparatus **10**, a control circuit of the display device **30**, other electronic parts, and a copper foil wiring pattern. Incidentally, there may be a plurality of control circuit boards **50** in the electronic apparatus **10**. In addition, the first and second position detecting circuits may be provided on another control circuit board than the control circuit board **50**.

[0052] The planar member **60** is formed of a transparent material such as, for example, glass or resin. The side of one surface **60***a* of the planar member **60** is formed as an indication surface (operation surface) for indicating positions by the first indicator constituted by the electronic pen and the second indicator such as a finger or an indicating pen. Moreover, the second sensor **40** and the display device **30** are arranged on the side of a surface of the planar member **60** on an opposite side from the one surface **60***a* of the planar member **60**.

[0053] The planar member **60** has a shape slightly larger than the indicator detection regions of the first sensor **20** and the second sensor **40**. That is, in the planar member **60** in FIG. **1**, a region **61** indicated by being enclosed by a dotted line is a region corresponding to the indicator detection regions of the first sensor **20** and the second sensor **40**, and a frame region **62** is formed on the periphery of the region **61**. Though not illustrated in the figure, the planar member **60** may be formed such that the frame region **62** is set in an opaque state by subjecting the frame region **62** to, for example, silk screen printing or the like, and only the region **61** is maintained in a transparent state.

[0054] The casing **70** is formed by a synthetic resin, for example. The casing **70** has a recessed portion **71** formed therein to house the first sensor **20**, the display device **30**, the second sensor **40**, and the control circuit board **50**. After the first sensor **20**, the display device **30**, the second sensor **40**, and the control circuit board **50** are housed within the recessed portion **71**, the recessed portion **71** is closed by coupling the frame region **62** of the planar member **60** to a frame region **72** of the casing **70** by an adhesive, for example. The electronic apparatus **10** is thus assembled.

[0055] Incidentally, the first sensor **20** may be put into a chassis of the display device **30**, and the second sensor **40** may be disposed on the first sensor **20** and the display device **30**.

[0056] Next, referring to FIG. **2**, description will be made of an example of configuration of the first sensor **20** and a position detecting circuit **200** of the electromagnetic induction system. An electronic pen **23** as an example of the first indicator used in conjunction with the first sensor **20** in the present example includes a resonance circuit constituted by a coil **23**L and a capacitor **23**C connected in parallel with the coil **23**L.

[0057] The first sensor **20** is formed by arranging an X-axis direction loop coil group **22**X on one surface of a wiring board **21** (see FIG. **1**), and arranging a Y-axis direction loop coil group **22**Y on another surface of the wiring board **21**. The X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y are each formed by a plurality of rectangular loop coils. In the present embodiment, n loop coils are arranged in the X-axis direction, and m loop coils are arranged in the Y-axis direction. The respective loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y are arranged so as to be superposed on each other.

[0058] The loop coils constituting the X-axis direction loop coil group **22**X are arranged so as to be juxtaposed to each other at equal intervals and sequentially overlap each other in the horizontal direction (X-axis direction) of the detection region for detecting the position indicated by the electronic pen **23**. In addition, the loop coils constituting the Y-axis direction loop coil group **22**Y are arranged so as to be juxtaposed to each other at equal intervals and sequentially overlap each other in the vertical direction (Y-axis direction) of the detection region.

[0059] The position detecting circuit **200** is connected to the first sensor **20**. The position detecting circuit **200** includes a selecting circuit **201**, an oscillator **202**, a current driver **203** constituting a transmitting amplifier, a transmission and reception switching circuit **204**, a receiving amplifier **205**, a detecting circuit **206**, a low-pass filter **207**, a sample and hold circuit **208**, an analog to digital (A/D) converter circuit **209**, and a control circuit **210**.

[0060] The X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y are connected to the selecting circuit **201**. The selecting circuit **201** sequentially selects one loop coil of the two loop coil groups **22**X and **22**Y under control of the control circuit **210**.

[0061] The oscillator **202** generates an alternating-current signal of a frequency f0. This alternating-current signal is supplied to the current driver **203**, is converted therein into a current, and is then sent out to the transmission and reception switching circuit **204**. The transmission and reception switching circuit **204** switches a connection destination (a transmitting side terminal T or a receiving side terminal R) to which the loop coil selected by the selecting circuit **201** is connected in each predetermined time under control of the control circuit **210**. The current driver **203** is connected to the transmitting side terminal T. The receiving amplifier **205** is connected to the receiving side terminal R.

[0062] Hence, at a time of transmission, the alternating-current signal converted into a current in the current driver **203** is supplied to the loop coil selected by the selecting circuit **201** via the transmitting side terminal T of the transmission and reception switching circuit **204**. In addition, at a time of reception, an induced voltage generated in the loop coil selected by the selecting circuit **201** is supplied to the receiving amplifier **205** via the selecting circuit **201** and the receiving side terminal R of the transmission and reception switching circuit **204**, is amplified therein, and is then sent out to the detecting circuit **206**.

[0063] The induced voltage amplified in the receiving amplifier **205** is detected by the detecting circuit **206**, and is supplied to the A/D converter circuit **209** via the low-pass filter **207** and the sample and hold circuit **208**. The A/D converter circuit **209** converts the signal supplied thereto via the low-pass filter **207** and the sample and hold circuit **208** from an analog signal to a digital signal, and supplies the digital signal to the control circuit **210**.

[0064] The control circuit **210** performs control for detecting an indicated position. That is, the control circuit **210** controls the selection of a loop coil in the selecting circuit **201**, signal switching in the transmission and reception switching circuit **204**, timing of the sample and hold circuit **208**, and the like.

[0065] The control circuit **210** performs energization control of the loop coil selected by the selecting circuit **201** in the X-axis direction loop coil group **22**X or the Y-axis direction loop coil group **22**Y, by switching the transmission and reception switching circuit **204** so as to connect to the transmitting side terminal T. The control circuit **210** thereby makes a magnetic field sent out. The resonance circuit of the electronic pen **23** acts to receive the magnetic field sent out from the loop coil, store magnetic energy, and transmit a magnetic field based on the stored magnetic energy to the first sensor **20**.

[0066] Next, the control circuit **210** switches the transmission and reception switching circuit **204** so as to connect to the receiving side terminal R. Then, an induced voltage is generated in each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y due to the magnetic field transmitted from the electronic pen **23** as a position indicator.

[0067] The control circuit **210** calculates coordinate values of the indicated position in the X-axis direction and the Y-axis direction in the detection region of the first sensor **20** on the basis of the voltage value of the induced voltage generated in each of the loop coils. Then, the control circuit **210** detects the position indicated by the electronic pen **23** from the calculated coordinate values. Receiving a result of the detection from the control circuit **210**, an external host (personal computer (PC)) controls a screen displayed on the display device **30**.

[0068] In addition, the control circuit **210** is connected to a control circuit **410** of a position detecting circuit **400** of the second sensor **40**, and mutually exchanges synchronizing signals with the control circuit **410** to synchronize the operation of detecting the position indicated by the electronic pen with the operation of detecting the position indicated by a finger or the position indicator. For example, the control circuit **210** transmits, to the control circuit **410**, a start signal indicating a start of the operation of detecting the position indicated by the electronic pen. In addition, the control circuit **410** may transmit, to the control circuit **210**, a start signal indicating a start of the operation of detecting the position indicated by the finger or the position indicator. Separately from the control circuit **210** and the control circuit **410**, a control unit may be provided which synchronizes the operation of detecting the position indicated by the electronic pen and the operation of detecting the position indicated by the finger or the position indicator with each other between the control circuit **210** and the control circuit **410**.

[0069] Next, referring to FIG. **3**, description will be made of an example of configuration of the second sensor **40** and the position detecting circuit **400**. The second sensor **40** is configured as a sensor of a cross point capacitive system in order to realize multi-touch detection, which detects a plurality of fingers simultaneously.

[0070] The second sensor **40** is constituted by forming an electrode group including a plurality of electrodes having optical transparency, for example, on one surface of a transparent substrate **41** (surface on an opposite side from a surface facing the display screen **33** of the display device **30**). The transparent substrate **41** is formed by a glass substrate or a resin film substrate, for example.

[0071] The electrode group includes a plurality of first electrodes **42**X each formed in the Y-axis direction (vertical direction) and a plurality of second electrodes **42**Y each formed in the X-axis direction (horizontal direction) orthogonal to the Y-axis direction. The first electrodes **42**X are arranged so as to be separated from each other at predetermined intervals in the X-axis direction. In addition, the second electrodes **42**Y are arranged so as to be separated from each other at predetermined intervals in the Y-axis direction. The first electrode **42**X and the second electrode **42**Y are formed by an optically transparent conductive material, for example, a conductor formed of an indium tin oxide (ITO) film, or a metal mesh.

[0072] Moreover, the first electrodes **42**X and the second electrodes **42**Y are formed on the same one surface side of the transparent substrate **41**. Therefore, in cross point regions as intersections of the first electrodes **42**X and the second electrodes **42**Y orthogonal to each other, the first electrodes **42**X and the second electrodes **42**Y are electrically insulated from each other by disposing an insulating material between the first electrodes **42**X and the second electrodes **42**Y.

[0073] The position detecting circuit **400** is connected to the second sensor **40**. The position detecting circuit **400** includes a transmission signal generating circuit **401**, a transmitting electrode selecting circuit **402**, a receiving electrode selecting circuit **404**, a reception signal processing circuit **405**, a positional information output circuit **406**, and a control circuit **410**.

[0074] The position detecting circuit **400** discretely performs position detection processing at predetermined time intervals, for example, at intervals of 10 milliseconds under control of the control circuit **410**. The position detecting circuit **400** thereby individually detects a plurality of position indications by the second indicator on the second sensor **40**, and obtains respective position detection results.

[0075] The transmission signal generating circuit **401** and the transmitting electrode selecting circuit **402** constitute a transmission signal supply circuit. The receiving electrode selecting circuit **404** and the reception signal processing circuit **405** constitute a signal receiving circuit. Moreover, the first electrodes **42**X are set as receiving electrodes, and the second electrodes **42**Y are set as transmitting electrodes.

[0076] The transmission signal generating circuit **401** supplies a predetermined transmission signal to the transmitting electrode selecting circuit **402** in predetermined timing according to control of the control circuit **410**. An orthogonal spread code or the like, for example, can be used as the predetermined transmission signal (see Japanese Patent Laid-open No. 2021-99827, for example).

[0077] The transmitting electrode selecting circuit **402** selects predetermined second electrodes **42**Y (transmitting electrodes) according to selection control of the control circuit **410**. A plurality of ones (all, even-numbered ones, or odd-numbered ones) of the second electrodes **42**Y that are selected by the transmitting electrode selecting circuit **402** are simultaneously supplied with the transmission signal from the transmission signal generating circuit **401**. Incidentally, the transmission signal may be directly transmitted from the transmission signal generating circuit **401** to all of the second electrodes **42**Y without the provision of the transmitting electrode selecting circuit **402**.

[0078] The receiving electrode selecting circuit **404** selects a plurality of ones (all, even-numbered ones, or odd-numbered ones) of the first electrodes **42**X according to control of the control circuit **410**, and supplies reception signals received simultaneously from the selected first electrodes **42**X to the reception signal processing circuit **405**.

[0079] On the basis of control by the control circuit **410**, the reception signal processing circuit **405** detects, by a first electrode **42**X, a signal change in the reception signal caused by the indication of a position on the second sensor **40** by the second indicator such as a finger or the position indicator. The reception signal processing circuit **405** supplies a resulting detection output to the positional information output circuit **406**.

[0080] On the basis of control by the control circuit **410**, the positional information output circuit **406** generates an coordinate output as a position detection result, the coordinate output being an indicated position detection signal corresponding to the position indicated by the second indicator such as the finger or the position indicator, from the first electrode **42**X at which the signal change in the reception signal has occurred and a second electrode **42**Y supplied with the transmission signal at that time from the detection output of the reception signal processing circuit **405**. The positional information output circuit **406** outputs the position detection result to the control circuit **410**.

[0081] Receiving, from the control circuit **210**, the position detection result from the positional information output circuit **406**, the external host (PC) controls a screen displayed on the display device **30** according to the position detection result.

[0082] As described above, the position detecting device according to the present embodiment includes the first sensor **20** and the position detecting circuit **200** of the electromagnetic induction system and includes the second sensor **40** and the position detecting circuit **400** of the capacitive system, and is capable of simultaneously detecting position indications by the first indicator (for example, the electronic pen) and the second indicator (for example, the finger or the position indicator). The electronic apparatus **10** can perform processing such as performing changing control of a display image on the display device **30** according to a result of the detection of the first indicator and a result of the detection of the second indicator.

[0083] Next, referring to FIG. **4**, description will be made of an example of a control configuration of the display device **30**. The display device **30** includes a display module **301** (corresponding to a "display" in the present disclosure), a backlight module **302**, a gate driver circuit **303**, and a source driver circuit **304**. A control circuit **34** is mounted on the control circuit board **50** (see FIG. **1**). The gate driver circuit **303** and the control circuit **34** are connected to each other via four clock lines not illustrated in the figure.

[0084] The display module **301** includes row signal lines GL**1** to GLn arranged in the vertical direction, column signal lines SL**1** to SLm arranged in the horizontal direction, and display pixels **32** (image elements) arranged at respective points of intersection of the row signal lines GL**1** to GLn and the column signal lines SL**1** to SLm. The display module **301** drives a corresponding one of the row signal lines GL**1** to GLn according to a gate signal VG**1** to VGn transmitted from the gate driver circuit **303**, and drives the respective display pixels **32** corresponding to source signals VS**1** to VSm transmitted from the source driver circuit **304** at luminances indicated by the source signals VS**1** to VSm.

[0085] The row signal lines GL**1** to GLn are gate lines, for example, and n row signal lines GL**1** to GLn are arranged in the vertical direction in the display device **30**. The row signal lines GL**1** to GLn are driven by the corresponding gate signals VG**1** to VGn transmitted from the gate driver circuit **303**, and relay charge exchanges between gate electrodes of the display pixels **32** corresponding to the points of intersection of the row signal lines GL**1** to GLn and the column signal lines SL**1** to SLm and the gate driver circuit **303**.

[0086] The column signal lines SL**1** to SLm are source lines, for example, and m column signal lines SL**1** to SLm are arranged in the horizontal direction in the display device **30**. The column signal lines SL**1** to SLm are driven by the corresponding source signals VS**1** to VSm transmitted from the source driver circuit **304**, and relay charge exchanges between source electrodes of the display pixels **32** corresponding to the points of intersection of the column signal lines SL**1** to SLm and the row signal lines GL**1** to GLn and the source driver circuit **304**.

[0087] The display pixels **32** are liquid crystal image elements, for example, and a total of n×m display pixels **32** are arranged at the points of intersection of the row signal lines GL**1** to GLn and the column signal lines SL**1** to SLm in the display device **30**. One of the row signal lines GL**1** to GLn is connected to the gate electrode of a display pixel **32**, and one of the column signal lines SL**1** to SLm is connected to the source electrode of the display pixel **32**. When charges are supplied to the gate electrodes of the display pixels **32** via the row signal lines GL**1** to GLn connected to the gate electrodes, the display pixels **32** display a corresponding image at luminances according to potentials possessed by the column signal lines SL**1** to SLm connected to the source electrodes of the display pixels **32**.

[0088] The backlight module **302** is a light source disposed on the back side of the display module **301**. The backlight module **302** irradiates the display module **301** with light from the back side.

[0089] The gate driver circuit **303** is a circuit that drives the row signal lines GL**1** to GLn. The gate driver circuit **303** is disposed within the display module **301** when the display device **30** is viewed from the display screen **33** side. The gate driver circuit **303** drives the row signal lines GL**1** to GLn in order by outputting the gate signals VG**1** to VGn to the corresponding row signal lines GL**1** to GLn in timing according to clock signals CLK**1** to CLK**4** output from the control circuit **34**. In addition, the gate driver circuit **303** supplies and extracts charges to and from the gate electrodes of the corresponding display pixels **32** via the driven row signal lines GL**1** to GLn.

[0090] The source driver circuit **304** is a circuit that drives the column signal lines SL**1** to SLm. The source driver circuit **304** is disposed on the lower side of the display module **301** when the display device **30** is viewed from the display screen **33** side. The source driver circuit **304** outputs the source signals VS**1** to VSm having potentials set each time for the respective column signal lines SL**1** to SLm by the control circuit **34** to the corresponding column signal lines SL**1** to SLn in timing according to the control circuit **34**. The source driver circuit **304** supplies the source electrodes of the display pixels **32** corresponding to the points of intersection of the row signal lines GL**1** to GLn driven by the gate driver circuit **303** and the column signal lines SL**1** to SLm with potentials possessed by the source signals VS**1** to VSm corresponding to the display pixels **32**.

[0091] The control circuit **34** is a circuit for controlling the display device **30**. At a time of starting the driving of the row signal lines GL**1** to GLm by the gate driver circuit **303**, the control circuit **34** generates a start signal as a signal indicating the start of the driving, and outputs the start signal to the gate driver circuit **303**. In addition, the control circuit **34** generates the clock signals CLK**1** to CLK**4** for operating the gate driver circuit **303**, and outputs the clock signals CLK**1** to CLK**4** to the gate driver circuit **303** via the four clock lines.

[0092] Further, the control circuit **34** generates a clock signal for operating the source driver circuit **304**, and outputs the clock signal to the source driver circuit **304**. In addition, the control circuit **34** sets potentials to be supplied to the source electrodes of corresponding display pixels **32** via the column signal lines SL**1** to SLm, and outputs a signal having information regarding the set potentials to the source driver circuit **304**.

Description of Problems

[0093] The electronic apparatus **10** described above presents a challenge of making provision for frame narrowing, which makes the width of a rim (frame) enclosing the flat display (display module **301**) narrower in order to realize miniaturization of the electronic apparatus **10** while maintaining the size of the flat display (display module **301**). Moreover, in order to make provision for the frame narrowing, the electronic apparatus **10** is desired to have a reduced arrangement space for the loop coils and the signal lines used in the indicated position detecting device for detecting the positions indicated by indicators.

[0094] However, when both of an indicated position detecting device of the electromagnetic induction system and an indicated position detecting device of the capacitive system are mounted in one electronic apparatus **10**, loop coils used in the indicated position detecting device of the electromagnetic induction system and signal lines used for the transmission of a transmission signal and the reception of a reception signal in the indicated position detecting device of the capacitive system may be arranged in proximity to each other. In this case, due to magnetic coupling (interference) between the loop coils and the signal lines, an electromagnetic noise is mixed into the loop coils from the signal lines used for the transmission of the transmission signal, and an electromagnetic noise is mixed into the signal lines used for the reception of the reception signal from the loop coils. When an electromagnetic noise is mixed into the loop coils from the signal lines used for the transmission of the transmission signal, the S/N ratio of a magnetic field transmitted from the electronic pen **23** and received in the loop coils is decreased, and consequently, the accuracy of indicated position detection in the indicated position detecting device of the electromagnetic induction system is decreased. In addition, when an electromagnetic noise is mixed into the signal lines used for the reception of the reception signal from the loop coils, the S/N ratio of the reception signal is decreased, and consequently, the accuracy of indicated position detection in the indicated position detecting device of the capacitive system is decreased.

[0095] For example, as illustrated in FIG. **5**, loop coils **22X1** and **22Y1** used in the indicated position detecting device of the electromagnetic induction system, a signal line **42X1** used for the transmission of the transmission signal in the indicated position detecting device of the capacitive system, and a signal line **42Y 1** used for the reception of the reception signal may be arranged in proximity to each other. In this case, due to magnetic coupling (interference) between the loop coil **22X1** and the signal line **42X1**, an electromagnetic noise is mixed into the loop coil **22X1** from the signal line **42X1** used for the transmission of the transmission signal, and thereby the S/N ratio of a magnetic field transmitted from the electronic pen **23** and received in the loop coil **22X1** is decreased, thus decreasing the accuracy of indicated position detection in the indicated position detecting device of the electromagnetic induction system. In addition, due to magnetic coupling (interference) between the loop coil **22Y1** and the signal line **42Y1**, an electromagnetic noise is mixed into the signal line **42Y1** used for the reception of a reception signal from the loop coil **22Y1**, and thereby the S/N ratio of the reception signal is decreased, thus decreasing the accuracy of indicated position detection in the indicated position detecting device of the capacitive system.

[0096] In addition, when the indicated position detecting device of the electromagnetic induction system and the indicated position detecting device of the capacitive system are mounted in one electronic apparatus **10**, the loop coils used in the indicated position detecting device of the electromagnetic induction system, the signal lines used in the indicated position detecting device of the capacitive system, and signal lines (for example, clock lines) used for the transmission of driving signals (for example, clock signals) for driving the flat display (display module **301**) may be arranged in proximity to each other. In this case, as a result of the mixing of an electromagnetic noise into the loop coils used in the indicated position detecting device of the electromagnetic induction system and the signal lines used for the reception of the reception signal in the indicated position detecting device of the capacitive system from the signal lines used for the transmission of the driving signals, the S/N ratio of the magnetic field transmitted from the electronic pen **23** and received in the loop coils is decreased, thus decreasing the accuracy of position detection in the indicated position detecting device of the electromagnetic induction system, and the S/N ratio of the reception signal is decreased, thus decreasing the accuracy of position detection in the indicated position detecting device of the capacitive system.

[0097] For example, as illustrated in FIG. **6**, the loop coils (not illustrated) used in the indicated position detecting device of the electromagnetic induction system, the signal lines (not illustrated) used in the indicated position detecting device of the capacitive system, and the signal lines (clock lines) used for the transmission of the driving signals (clock signals CLK**1** to CLK**4**) for driving the flat display (display module **301**) may be arranged in proximity to each other. In this case, as a result of the mixing of an electromagnetic noise into the loop coils used in the indicated position detecting device of the electromagnetic induction system and the signal lines used for the reception of the reception signal in the indicated position detecting device of the capacitive system from the clock lines used for the transmission of the clock signals, the S/N ratio of the magnetic field transmitted from the electronic pen **23** and received in the loop coils is decreased, thus decreasing the accuracy of position detection in the indicated position detecting device of the electromagnetic induction system, and the S/N ratio of the reception signal is decreased, thus decreasing the accuracy of position detection in the indicated position detecting device of the capacitive system.

Description of Configuration for Solving Problems

[0098] In order to solve the above-described problems, the electronic apparatus **10** (indicated position detecting device) in the present embodiment includes a first transmission circuit (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) that transmits a first transmission signal (electromagnetic induction signal) related to first processing of detecting a position indicated by an indicator (electronic pen **23**) by the electromagnetic induction system, a second transmission circuit (transmission signal generating circuit **401**) that transmits a second transmission signal (transmission signal) related to second processing of detecting a position indicated by an indicator (a finger or the position indicator (capacitive pen)) by the capacitive system, and a first reception circuit (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) that receives a first reception signal (electromagnetic induction signal) related to the first processing in a transmission period of the second transmission signal. Moreover, in the same period, the waveform of the first transmission signal (electromagnetic induction signal) and the waveform of the second transmission signal (transmission signal) are orthogonal to each other. Here, on the basis of a principle of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system, the center frequency of the first transmission signal (electromagnetic induction signal) and the center frequency of the reception signal (electromagnetic induction signal) are the same in a frequency spectrum represented by the amplitude of a frequency component of each sine wave as a function of frequency. Hence, in a reception period of the first reception signal (electromagnetic induction signal), the waveform of the first reception signal (electromagnetic induction signal) and the waveform of the second transmission signal (transmission signal) are orthogonal to each other, that is, an inner product of the waveform of the first reception signal (electromagnetic induction signal) and the waveform of the second transmission signal (transmission signal) is 0. As a result, the first reception signal in which the mixing in of the electromagnetic noise due to the transmission of the second transmission signal is suppressed can be detected. In a case where the waveform of the first transmission signal (electromagnetic induction signal) and the waveform of the second transmission signal (transmission signal) are orthogonal to each other in the same period, a value obtained by subtracting the wave number of the second transmission signal from the wave number of the first transmission signal, for example, is a positive or negative integer. Incidentally, at the center frequency of the first reception signal (electromagnetic induction signal) in the frequency spectrum, the signal power of the second transmission signal (transmission signal) is 0.

[0099] In the present embodiment, the first transmission signal (electromagnetic induction signal) and the second transmission signal (transmission signal) orthogonal to each other are transmitted in the same period in advance in order to be able to demodulate the first reception signal (electromagnetic induction signal) correctly even when an electromagnetic noise is mixed into the loop coils used for the reception of the first reception signal (electromagnetic induction signal) from the signal lines used for the transmission of the second transmission signal (transmission signal) in the reception period of the first reception signal (electromagnetic induction signal). A concept of the two signal waveforms orthogonal to each other is based on orthogonal frequency division multiplexing (OFDM) commonly used in a wireless communication field of wireless local area networks (LANs), the Third Generation Partnership Project (3GPP) (registered trademark), and the like.

[0100] That is, by performing processing of obtaining a product of the first reception signal (electromagnetic induction signal) and an internal signal corresponding to the second transmission signal (transmission signal) and integrating the product for a predetermined period as processing at a time of the reception of the first reception signal, it becomes possible to extract the first reception signal in which the mixing in of the electromagnetic noise due to the transmission of the second transmission signal is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the first reception signal desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system. Here, the internal signal corresponding to the second transmission signal (transmission signal) is a spread code by which the second transmission signal can be recovered, a locally generated signal and data matching the frequency and pattern of the second transmission signal, and the like. Incidentally, in a case of performing digital demodulation processing, correlation operation processing or discrete Fourier transform (DFT) processing is performed. In addition, in a case of performing analog demodulation processing, orthogonal demodulation processing is performed. Incidentally, the inner product of the waveform of the first reception signal (electromagnetic induction signal) and the waveform of the second transmission signal (transmission signal) does not necessarily need to be 0, and may be equal to or less than a predetermined value to a degree that the first reception signal in which the mixing in of the electromagnetic noise due to the transmission of the second transmission signal is suppressed can be extracted.

[0101] In addition, in the present embodiment, the electronic apparatus **10** (indicated position detecting device) includes a first transmission circuit (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) that transmits a first transmission signal (electromagnetic induction signal) related to first processing of detecting a position indicated by an indicator (electronic pen **23**) by the electromagnetic induction system, a second transmission circuit (transmission signal generating circuit **401**) that transmits a second transmission signal (transmission signal) related to second processing of detecting a position indicated by an indicator (a finger or the position indicator (capacitive pen)) by the capacitive system, and a second reception circuit (receiving electrode selecting circuit **404**) that receives a second reception signal related to the second processing in a transmission period of the first transmission signal (electromagnetic induction signal). Moreover, in the same period, the waveform of the first transmission signal (electromagnetic induction signal) and the waveform of the second transmission signal (transmission signal) are orthogonal to each other. Here, on the basis of a principle of detecting the position indicated by the indicator (a finger or the position indicator (capacitive pen)) by the capacitive system, the center frequency of the second transmission signal (transmission signal) and the center frequency of the second reception signal are the same in the frequency spectrum. Hence, in a reception period of the second reception signal, the waveform of the first transmission signal (electromagnetic induction signal) and the waveform of the second reception signal are orthogonal to each other, that is, an inner product of the waveform of the first transmission signal (electromagnetic induction signal) and the waveform of the second reception signal is 0. As a result, the second reception signal in which the mixing in of an electromagnetic noise due to the transmission of the first transmission signal is suppressed can be detected. In a case where the waveform of the first transmission signal (electromagnetic induction signal) and the waveform of the second transmission signal (transmission signal) are orthogonal to each other in the same period, a value obtained by subtracting the wave number of the second transmission signal from the wave number of the first transmission signal, for example, is a positive or negative integer. Incidentally, at the center frequency of the second reception signal in the frequency spectrum, the signal power of the first transmission signal (electromagnetic induction signal) is 0.

[0102] In the present embodiment, the first transmission signal (electromagnetic induction signal) and the second transmission signal (transmission signal) orthogonal to each other are transmitted in the same period in advance in order to be able to demodulate the second reception signal correctly even when an electromagnetic noise is mixed into the signal lines used for the reception of the second reception signal from the loop coils (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) used for the transmission of the first transmission signal (electromagnetic induction signal) in the reception period of the second reception signal.

[0103] That is, by performing processing of obtaining a product of the second reception signal and an internal signal corresponding to the first transmission signal (electromagnetic induction signal) and integrating the product for a predetermined period as processing at a time of the reception of the second reception signal, it becomes possible to extract the second reception signal in which the mixing in of the electromagnetic noise due to the transmission of the first transmission signal (electromagnetic induction signal) is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the second reception signal desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (a finger or the position indicator (capacitive pen)) by the capacitive system. Here, the internal signal corresponding to the first transmission signal (electromagnetic induction signal) is a spread code by which the first transmission signal can be recovered, a locally generated signal and data matching the frequency and pattern of the first transmission signal, and the like. Incidentally, in a case of performing digital demodulation processing, correlation operation processing or DFT processing is performed. In addition, in a case of performing analog demodulation processing, orthogonal demodulation processing is performed. Incidentally, the inner product of the waveform of the first transmission signal (electromagnetic induction signal) and the waveform of the second reception signal does not necessarily need to be 0, and may be equal to or less than a predetermined value to a degree that the second reception signal in which the mixing in of the electromagnetic noise due to the transmission of the first transmission signal is suppressed can be extracted.

[0104] FIG. **7** is a waveform chart related to processing of detecting positions indicated by indicators. In FIG. **7**, a first transmission signal **5**A represents the waveform (temporal change) of a transmission signal (electromagnetic induction signal) related to processing of detecting the position indicated by an indicator (electronic pen **23**) by the electromagnetic induction system. A first reception signal **5**B represents the waveform (temporal change) of a reception signal (electromagnetic induction signal) related to the processing of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system. Electromagnetic energy **5**C represents the waveform (temporal change) of a current flowing through the resonance circuit of the electronic pen **23** or in turn a voltage in response to the sending out of the first transmission signal **5**A (electromagnetic induction signal). A second transmission signal **5**D represents the waveform (temporal change) of a transmission signal related to processing of detecting the position indicated by an indicator (a finger or the position indicator (capacitive pen)) by the capacitive system. A second reception signal **5**E represents the waveform (temporal change) of a reception signal related to the processing of detecting the position indicated by the indicator (a finger or the position indicator (capacitive pen)) by the capacitive system. For each of the first transmission signal **5**A, the first reception signal **5**B, the electromagnetic energy **5**C, the second transmission signal **5**D, and the second reception signal **5**E, an axis of abscissas indicates time (t), and an axis of ordinates indicates magnitude. Incidentally, as for the time on the axis of abscissas, all of the first transmission signal **5**A, the first reception signal **5**B, the electromagnetic energy **5**C, the second transmission signal **5**D, and the second reception signal **5**E are illustrated on the same time axis.

[0105] As indicated by the first transmission signal **5**A, in periods D**1** and D**4**, the control circuit **210** performs energization control of the loop coil selected by the selecting circuit **201** in the X-axis direction loop coil group **22**X or the Y-axis direction loop coil group **22**Y, by switching the transmission and reception switching circuit **204** so as to connect to the transmitting side terminal T. The control circuit **210** thereby makes a magnetic field sent out to the electronic pen **23**.

[0106] As indicated by the first reception signal **5**B, in a period D**2**, the control circuit **210** makes each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y receive a magnetic field transmitted from the electronic pen **23**, by switching the transmission and reception switching circuit **204** so as to connect to the receiving side terminal R. An induced voltage is generated in each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y due to the received first reception signal **5**B. The first reception signal **5**B received from the electronic pen **23** by each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y gradually decreases with the passage of time.

[0107] As indicated by the electromagnetic energy **5**C in the period D**1**, the magnetic energy stored in the resonance circuit of the electronic pen **23** gradually increases because a magnetic field is sent out from the energization-controlled loop coils to the electronic pen **23** by the transmission of the first transmission signal **5**A (electromagnetic induction signal). Then, in periods D**2** and D**3** in which the sending out of the magnetic field from the loop coils to the electronic pen **23** is stopped, the electromagnetic energy stored in the resonance circuit of the electronic pen **23** gradually decreases as the first reception signal **5**B (electromagnetic induction signal) is transmitted from the electronic pen **23** to each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y.

[0108] As indicated by the second transmission signal **5**D, in the periods D**1** to D**4**, the control circuit **410** controls the transmission signal generating circuit **401** to make the transmission signal generating circuit **401** transmit a transmission signal to the second electrodes **42**Y (transmitting electrodes) through the transmitting electrode selecting circuit **402**. The periods D**1** and D**4** in which the loop coils are energization-controlled by the transmission of the first transmission signal **5**A (electromagnetic induction signal) overlap at least a part of the transmission periods D**1** to D**4** of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes). Incidentally, a start time point and an end time point of the periods in which the loop coils are energization-controlled by the transmission of the first transmission signal **5**A (electromagnetic induction signal) may be the same as a start time point and an end time point of the transmission periods of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes).

[0109] As indicated by the second reception signal **5**E, in the periods D**1** to D**4**, the control circuit **410** controls the receiving electrode selecting circuit **404** to make the receiving electrode selecting circuit **404** receive the reception signal from the first electrodes **42**X.

[0110] In the present embodiment, in a period D**11** of the period D**1**, the waveform of the first transmission signal **5**A transmitted for performing energization control of the loop coils and the waveform of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) are orthogonal to each other. Here, on the basis of a principle of detecting the position indicated by the indicator (a finger or the position indicator (capacitive pen)) by the capacitive system, the center frequency of the second reception signal **5**E received from the first electrodes **42**X and the center frequency of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) are the same in the frequency spectrum. Hence, in a reception period R**1** of the second reception signal **5**E that is equal to the period D**11**, the waveform of the first transmission signal **5**A transmitted for performing energization control of the loop coils and the waveform of the second reception signal **5**E received from the first electrodes **42**X are orthogonal to each other. In the example illustrated in FIG. **7**, in the same period D**11**, a value obtained by subtracting the wave number (three waves) of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) from the wave number (six waves) of the first transmission signal **5**A transmitted for performing energization control of the loop coils is a positive integer (three waves). Incidentally, in the present embodiment, a steep change in the second transmission signal **5**D at a start time point and an end time point of the period D**11** is avoided by adjusting (for example, shifting by 90 degrees) the phase of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes). A decrease in orthogonality between the waveform of the first transmission signal **5**A transmitted for performing energization control of the loop coils and the waveform of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) is thereby suppressed when a shift in timing of the transmission of the second transmission signal **5**D has occurred.

[0111] In the present embodiment, the first transmission signal **5**A and the second transmission signal **5**D orthogonal to each other are transmitted in the same period D**11** in advance in order to be able to demodulate the second reception signal **5**E correctly even when an electromagnetic noise is mixed into the signal lines used for the reception of the second reception signal **5**E from the first electrodes **42**X from the loop coils (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) used in the energization control of the first transmission signal **5**A in the reception period R**1** of the second reception signal **5**E.

[0112] That is, by performing processing of obtaining a product of the second reception signal **5**E received in the reception period R**1** and an internal signal corresponding to the first transmission signal **5**A transmitted for performing energization control of the loop coils and integrating the product for a predetermined period as processing at a time of the reception of the second reception signal **5**E, it becomes possible to extract the second reception signal **5**E in which the mixing in of an electromagnetic noise due to the transmission of the first transmission signal **5**A is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the second reception signal **5**E desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (a finger or the capacitive pen) by the capacitive system.

[0113] In addition, on the basis of a principle of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system, the center frequency of the first transmission signal **5**A transmitted for performing energization control of the loop coils and the center frequency of the first reception signal **5**B (electromagnetic induction signal) received from the electronic pen **23** are the same in the frequency spectrum. Hence, in a reception period R**2** in which the first reception signal **5**B transmitted from the electronic pen **23** is received in the period D**2**, the waveform of the first reception signal **5**B, for example, the waveform of a resonance frequency in the resonance circuit of the electronic pen **23** (the resonance frequency may change according to a pen pressure of the electronic pen **23**) and the waveform of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) are orthogonal to each other, that is, an inner product of the waveform of the first reception signal **5**B and the waveform of the second transmission signal **5**D is 0.

[0114] Incidentally, in the reception period R**2** in which the first reception signal **5**B is received, the waveform of the first reception signal **5**B (electromagnetic induction signal) received from the electronic pen **23** and the waveform of the second reception signal **5**E received from the first electrodes **42**X are orthogonal to each other, that is, an inner product of the waveform of the first reception signal **5**B and the waveform of the second reception signal **5**E is 0. Moreover, in the same period R**2**, a value obtained by subtracting the wave number (three waves) of the second reception signal **5**E from the wave number (six waves) of the first reception signal **5**B is a positive integer (three waves).

[0115] In the present embodiment, the first transmission signal **5**A and the second transmission signal **5**D orthogonal to each other are transmitted in the same period D**11** in advance in order to be able to demodulate the first reception signal **5**B correctly even when an electromagnetic noise is mixed into the loop coils (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) used for the reception of the first reception signal **5**B from the electronic pen **23** from the signal lines used for the transmission of the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) in the reception period R**2** of the first reception signal **5**B.

[0116] That is, by performing processing of obtaining a product of the first reception signal **5**B received in the reception period R**2** and an internal signal corresponding to the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) and integrating the product for a predetermined period as processing at a time of the reception of the first reception signal **5**B, it becomes possible to extract the first reception signal **5**B in which the mixing in of an electromagnetic noise due to the transmission of the second transmission signal **5**D is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the first reception signal **5**B desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system.

[0117] Incidentally, a period G corresponding to a guard interval is provided between the reception period R**1** in which the second reception signal **5**E from the first electrodes **42**X is received and the reception period R**2** of the first reception signal **5**B (electromagnetic induction signal) received from the electronic pen **23**. It is thereby possible to obtain an effect of being able to mitigate an adverse effect (decrease in the accuracy of detection of the first reception signal **5**B and the second reception signal **5**E or in turn the accuracy of detection of the indicated positions) in a case of occurrence of a shift in timing of receiving the second reception signal **5**E from the first electrodes **42**X or a shift in timing of receiving the first reception signal **5**B from the electronic pen **23** and an effect of being able to secure a time until the waveform of the first reception signal **5**B received from the electronic pen **23** becomes stable after the first transmission signal **5**A is transmitted for performing energization control of the loop coils. In addition, in a case where the second transmission signal **5**D transmitted to the second electrodes **42**Y (transmitting electrodes) is a spread code, and the spread code is switched from a negative (−) to a positive (+), for example, between the reception period R**1** and the reception period R**2** (see FIG. **7**), it is also possible to prevent the accuracy of detection of the first reception signal **5**B received from the electronic pen **23** from being decreased by being affected by the switching.

[0118] In addition, in the present embodiment, the electronic apparatus **10** (indicated position detecting device) includes a first transmission circuit (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) that transmits a first transmission signal (electromagnetic induction signal) related to first processing of detecting a position indicated by an indicator (electronic pen **23**) by the electromagnetic induction system, a second transmission circuit (control circuit **34**) that transmits a second transmission signal (clock signal) related to second processing of driving a display (display module **301**), and a first reception circuit (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) that receives a first reception signal (electromagnetic induction signal) related to the first processing in a transmission period of the second transmission signal. Moreover, in the same period, the waveform of the first transmission signal and the waveform of the second transmission signal are orthogonal to each other. Here, on the basis of a principle of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system, the center frequency of the first reception signal and the center frequency of the first transmission signal are the same in the frequency spectrum. Hence, in a reception period of the first reception signal, the waveform of the first reception signal and the waveform of the second transmission signal are orthogonal to each other, that is, an inner product of the waveform of the first reception signal and the waveform of the second transmission signal is 0. As a result, the first reception signal in which the mixing in of an electromagnetic noise due to the transmission of the second transmission signal is suppressed can be detected. In a case where the waveform of the first transmission signal and the waveform of the second transmission signal are orthogonal to each other in the same period, a value obtained by subtracting the wave number of the second transmission signal from the wave number of the first transmission signal, for example, is a positive or negative integer. Incidentally, at the center frequency of the first reception signal in the frequency spectrum, the signal power density of the second transmission signal is 0.

[0119] In the present embodiment, the first transmission signal and the second transmission signal (clock signal) orthogonal to each other are transmitted in the same period in advance in order to be able to demodulate the first reception signal correctly even when an electromagnetic noise is mixed into the loop coils used for the reception of the first reception signal from the signal lines (clock lines) used for the transmission of the second transmission signal in the reception period of the first reception signal.

[0120] That is, by performing processing of obtaining a product of the first reception signal (electromagnetic induction signal) and an internal signal corresponding to the second transmission signal (clock signal) and integrating the product for a predetermined period as processing at a time of the reception of the first reception signal, it becomes possible to extract the first reception signal in which the mixing in of the electromagnetic noise due to the transmission of the second transmission signal is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the first reception signal desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system. Here, the internal signal corresponding to the second transmission signal (clock signal) is a spread code by which the second transmission signal can be recovered, a locally generated signal and data matching the frequency and pattern of the second transmission signal, and the like. Incidentally, in a case of performing digital demodulation processing, correlation operation processing or DFT processing is performed. In addition, in a case of performing analog demodulation processing, orthogonal demodulation processing is performed. Incidentally, the inner product of the waveform of the first reception signal (electromagnetic induction signal) and the waveform of the second transmission signal (clock signal) does not necessarily need to be 0, and may be equal to or less than a predetermined value to a degree that the first reception signal in which the mixing in of the electromagnetic noise due to the transmission of the second transmission signal is suppressed can be extracted.

[0121] In addition, in the present embodiment, the electronic apparatus **10** (indicated position detecting device) includes a first transmission circuit (transmission signal generating circuit **401**) that transmits a first transmission signal (transmission signal) related to first processing of detecting a position indicated by an indicator (a finger or the capacitive pen) by the capacitive system, a second transmission circuit (control circuit **34**) that transmits a second transmission signal (clock signal) related to second processing of driving a display (display module **301**), and a first reception circuit (receiving electrode selecting circuit **404**) that receives a first reception signal related to the first processing in a transmission period of the second transmission signal. Moreover, in the same period, the waveform of the first transmission signal (transmission signal) and the waveform of the second transmission signal (clock signal) are orthogonal to each other. Here, on the basis of a principle of detecting the position indicated by the indicator (a finger or the capacitive pen) by the capacitive system, the center frequency of the first reception signal and the center frequency of the first transmission signal are the same in the frequency spectrum. Hence, in a reception period of the first reception signal, the waveform of the first reception signal and the waveform of the second transmission signal (clock signal) are orthogonal to each other, that is, an inner product of the waveform of the first reception signal and the waveform of the second transmission signal is 0. As a result, the first reception signal in which the mixing in of an electromagnetic noise due to the transmission of the second transmission signal is suppressed can be detected. In a case where the waveform of the first transmission signal and the waveform of the second transmission signal are orthogonal to each other, a value obtained by subtracting the wave number of the second transmission signal from the wave number of the first transmission signal, for example, is a positive or negative integer. Incidentally, at the center frequency of the first reception signal in the frequency spectrum, the signal power of the second transmission signal (clock signal) is 0.

[0122] In the present embodiment, the first transmission signal and the second transmission signal orthogonal to each other are transmitted in the same period in advance in order to be able to demodulate the first reception signal correctly even when an electromagnetic noise is mixed into the signal lines used for the reception of the first reception signal from the signal lines (clock lines) used for the transmission of the second transmission signal (clock signal) in the reception period of the first reception signal.

[0123] That is, by performing processing of obtaining a product of the first reception signal and an internal signal corresponding to the second transmission signal (clock signal) and integrating the product for a predetermined period as processing at a time of the reception of the first reception signal, it becomes possible to extract the first reception signal in which the mixing in of the electromagnetic noise due to the transmission of the second transmission signal is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the first reception signal desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (a finger or the capacitive pen) by the capacitive system. Here, the internal signal corresponding to the second transmission signal is a spread code by which the second transmission signal can be recovered, a locally generated signal and data matching the frequency and pattern of the second transmission signal, and the like. Incidentally, in a case of performing digital demodulation processing, correlation operation processing or DFT processing is performed. In addition, in a case of performing analog demodulation processing, orthogonal demodulation processing is performed. Incidentally, the inner product of the waveform of the first reception signal and the waveform of the second transmission signal does not necessarily need to be 0, and may be equal to or less than a predetermined value to a degree that the first reception signal in which the mixing in of the electromagnetic noise due to the transmission of the second transmission signal is suppressed can be extracted.

[0124] FIG. **8** is a waveform chart related to processing of detecting positions indicated by indicators. In FIG. **8**, a first transmission signal **6**A represents the waveform (temporal change) of a transmission signal (electromagnetic induction signal) related to processing of detecting the position indicated by an indicator (electronic pen **23**) by the electromagnetic induction system. A first reception signal **6**B represents the waveform (temporal change) of a reception signal (electromagnetic induction signal) related to the processing of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system. A second transmission signal **6**C represents the waveform (temporal change) of the clock signal CLK**1** related to processing of driving the display (display module **301**). A second transmission signal **6**D represents the waveform (temporal change) of the clock signal CLK**2** related to the processing of driving the display (display module **301**). A first transmission signal **6**E represents the waveform (temporal change) of a transmission signal related to processing of detecting the position indicated by an indicator (a finger or the capacitive pen) by the capacitive system. A first reception signal **6**F represents the waveform (temporal change) of a first reception signal related to the processing of detecting the position indicated by the indicator (a finger or the capacitive pen) by the capacitive system. For each of the first transmission signal **6**A, the first reception signal **6**B, the second transmission signals **6**C and **6**D, the first transmission signal **6**E, and the first reception signal **6**F, an axis of abscissas indicates time (t), and an axis of ordinates indicates magnitude. Incidentally, as for the time on the axis of abscissas, all of the first transmission signal **6**A, the first reception signal **6**B, the second transmission signals **6**C and **6**D, the first transmission signal **6**E, and the first reception signal **6**F are illustrated on the same time axis.

[0125] As indicated by the first transmission signal **6**A, in periods D**1** and D**4**, the control circuit **210** performs energization control of the loop coil selected by the selecting circuit **201** in the X-axis direction loop coil group **22**X or the Y-axis direction loop coil group **22**Y, by switching the transmission and reception switching circuit **204** so as to connect to the transmitting side terminal T. The control circuit **210** thereby makes a magnetic field sent out to the electronic pen **23**.

[0126] As indicated by the first reception signal **6**B, in a period D**2**, the control circuit **210** makes each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y receive a magnetic field transmitted from the electronic pen **23**, by switching the transmission and reception switching circuit **204** so as to connect to the receiving side terminal R. An induced voltage is generated in each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y due to the received first reception signal **6**B. The first reception signal **6**B received from the electronic pen **23** by each of the loop coils of the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y gradually decreases with the passage of time.

[0127] As indicated by the second transmission signal **6**C, in periods D**1** to D**4**, the control circuit **34** generates the clock signal CLK**1** for operating the gate driver circuit **303**, and outputs the clock signal CLK**1** to the gate driver circuit **303** via the clock line.

[0128] As indicated by the second transmission signal **6**D, in the periods D**1** to D**4**, the control circuit **34** generates the clock signal CLK**2** for operating the gate driver circuit **303**, the clock signal CLK**2** being different in phase from the clock signal CLK**1**, and outputs the clock signal CLK**2** to the gate driver circuit **303** via the clock line.

[0129] As indicated by the first transmission signal **6**E, in the periods D**1** to D**4**, the control circuit **410** controls the transmission signal generating circuit **401** to make the transmission signal generating circuit **401** transmit a transmission signal to the second electrodes **42**Y (transmitting electrodes) through the transmitting electrode selecting circuit **402**.

[0130] As indicated by the first reception signal **6**F, in the periods D**1** to D**4**, the control circuit **410** controls the receiving electrode selecting circuit **404** to make the receiving electrode selecting circuit **404** receive the reception signal from the first electrodes **42**X.

[0131] In the present embodiment, in a period D**11** of the period D**1**, the waveform of the second transmission signal **6**D output from the control circuit **34** and the waveform of the first transmission signal **6**E transmitted to the second electrodes **42**Y (transmitting electrodes) are orthogonal to each other. Here, on the basis of a principle of detecting the position indicated by the indicator (a finger or the capacitive pen) by the capacitive system, the center frequency of the first reception signal **6**F received from the first electrodes **42**X and the center frequency of the first transmission signal **6**E transmitted to the second electrodes **42**Y (transmitting electrodes) are the same in the frequency spectrum. Hence, in a reception period R**1** of the first reception signal **6**F that is equal to the period D**11**, the waveform of the second transmission signal **6**D output from the control circuit **34** and the waveform of the first reception signal **6**F received from the first electrodes **42**X are orthogonal to each other. In the example illustrated in FIG. **8**, a value obtained by subtracting the wave number (one wave) of the second transmission signal **6**D output from the control circuit **34** from the wave number (three waves) of the first transmission signal **6**E transmitted to the second electrodes **42**Y (transmitting electrodes) is a positive integer (two waves).

[0132] In the present embodiment, the second transmission signal **6**D and the first transmission signal **6**E orthogonal to each other are transmitted in the same period D**11** in advance in order to be able to demodulate the first reception signal **6**F correctly even when an electromagnetic noise is mixed into the signal lines used for the reception of the first reception signal **6**F received from the first electrodes **42**X from the signal line (clock line) used for the transmission of the second transmission signal **6**D in the reception period R**1** of the first reception signal **6**F.

[0133] That is, by performing processing of obtaining a product of the first reception signal **6**F received in the reception period R**1** and an internal signal corresponding to the second transmission signal **6**D output from the control circuit **34** and integrating the product for a predetermined period as processing at a time of the reception of the first reception signal **6**F, it becomes possible to extract the first reception signal **6**F in which the mixing in of an electromagnetic noise due to the transmission of the second transmission signal **6**D is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the first reception signal **6**F desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (a finger or the capacitive pen) by the capacitive system.

[0134] In addition, in the period D**11** of the period D**1**, the waveform of the second transmission signal **6**C output from the control circuit **34** and the waveform of the first transmission signal **6**A transmitted for performing energization control of the loop coils are orthogonal to each other. Here, on the basis of a principle of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system, the center frequency of the first transmission signal **6**A transmitted for performing energization control of the loop coils and the center frequency of the first reception signal **6**B received from the electronic pen **23** are the same in the frequency spectrum. Hence, in a reception period R**2** of the first reception signal **6**B received from the electronic pen **23**, the waveform of the second transmission signal **6**C output from the control circuit **34** and the waveform of the first reception signal **6**B received from the electronic pen **23** are orthogonal to each other. In the example illustrated in FIG. **8**, in the same period D**11**, a value obtained by subtracting the wave number (one wave) of the second transmission signal **6**C output from the control circuit **34** from the wave number (six waves) of the first transmission signal **6**A transmitted for performing energization control of the loop coils is a positive integer (five waves).

[0135] In the present embodiment, the second transmission signal **6**C and the first transmission signal **6**A orthogonal to each other are transmitted in the same period D**11** in advance in order to be able to demodulate the first reception signal **6**B correctly even when an electromagnetic noise is mixed into the loop coils (the X-axis direction loop coil group **22**X and the Y-axis direction loop coil group **22**Y) used for the reception of the first reception signal **6**B from the electronic pen **23** from the signal line (clock line) used for the transmission of the second transmission signal **6**C in the reception period R**2** of the first reception signal **6**B.

[0136] That is, by performing processing of obtaining a product of the first reception signal **6**B received in the reception period R**2** and an internal signal corresponding to the second transmission signal **6**C output from the control circuit **34** and integrating the product for a predetermined period as processing at a time of the reception of the first reception signal **6**B, it becomes possible to extract the first reception signal **6**B in which the mixing in of an electromagnetic noise due to the transmission of the second transmission signal **6**C is suppressed (demodulation), or in other words, separate the noise unrelated to the characteristics of the first reception signal **6**B desired to be detected. It is consequently possible to suppress a decrease in the accuracy of detecting the position indicated by the indicator (electronic pen **23**) by the electromagnetic induction system.

Modifications

[0137] Incidentally, in the foregoing embodiment, description has been made of an example in which the value obtained by subtracting the wave number of the second transmission signal from the wave number of the first transmission signal is a positive or negative integer in a case where the waveform of the first transmission signal and the waveform of the second transmission signal are orthogonal to each other. However, the present disclosure is not limited to this. For example, in the case where the waveform of the first transmission signal and the waveform of the second transmission signal are orthogonal to each other, it suffices for the inner product of the waveform of the first transmission signal and the waveform of the second transmission signal to be 0, and the value obtained by subtracting the wave number of the second transmission signal from the wave number of the first transmission signal may be 0. In this case, a sine wave (for example, $\sin(2\pi mx)$), which is a sine wave, is cited as the first transmission signal, and a cosine wave (for example, $\cos(2\pi nx)$ where $m=n$), which is a sine wave, is cited as the second transmission signal. Incidentally, the phase of the signal transmitted by the pen of the electromagnetic induction system is not known on the side of the first reception circuit that receives the electromagnetic induction signal. Thus, in a case where the first transmission signal and the second transmission signal have waveforms having the same frequency and made different only in phase (example: a sine wave and a cosine wave), it may be difficult to distinguish the first transmission signal and the second transmission signal from each other. Therefore, in a case where the first processing is that of the electromagnetic induction system, the value obtained by subtracting the wave number of the second transmission signal from the wave number of the first transmission signal in the same period is preferably a positive or negative integer.

[0138] In addition, in the foregoing embodiment, the electronic apparatus **10** may adopt an in-cell system. The in-cell system is a system that uses the display device **30**, and uses the first electrodes **42**X or the second electrodes **42**Y in the second sensor **40** for the position detection of the capacitive system also as an electrode (for example, a common electrode of a liquid crystal display or a negative electrode of an organic EL display) supplied with a potential necessary to drive the display pixels **32** of the display device **30**.

[0139] In addition, the foregoing embodiments each merely represent an example of an embodiment in carrying out the present disclosure, and the technical scope of the present disclosure is not to be construed as being limited by these embodiments. That is, the present disclosure can be carried out in various forms without departing from the spirit or main features of the present disclosure.

DESCRIPTION OF REFERENCE SYMBOLS

[0140] **10**: Electronic apparatus
[0141] **20**: First sensor
[0142] **21**: Wiring board
[0143] **23**: Electronic pen
[0144] **23**L: Coil
[0145] **23**C: Capacitor
[0146] **22**X: X-axis direction loop coil group
[0147] **22**X**1**: Loop coil
[0148] **22**Y: Y-axis direction loop coil group
[0149] **22**Y**1**: Loop coil
[0150] **30**: Display device
[0151] **31**: Display substrate
[0152] **32**: Display pixel
[0153] **33**: Display screen
[0154] **34**: Control circuit
[0155] **40**: Second sensor
[0156] **41**: Transparent substrate
[0157] **42**X: First electrode
[0158] **42**X**1**: Signal line
[0159] **42**Y: Second electrode
[0160] **42**Y**1**: Signal line
[0161] **50**: Control circuit board
[0162] **60**: Planar member
[0163] **60***a*: Surface
[0164] **61**: Region
[0165] **62**: Frame region
[0166] **70**: Casing
[0167] **71**: Recessed portion
[0168] **72**: Frame region
[0169] **100**: Indicator
[0170] **101**: Position detecting circuit

[0171] **200**: Position detecting circuit
[0172] **201**: Selecting circuit
[0173] **202**: Oscillator
[0174] **203**: Current driver
[0175] **204**: Transmission and reception switching circuit
[0176] **205**: Receiving amplifier
[0177] **206**: Detecting circuit
[0178] **207**: Low-pass filter
[0179] **208**: Sample and hold circuit
[0180] **209**: A/D converter circuit
[0181] **210**: Control circuit
[0182] **301**: Display module
[0183] **302**: Backlight module
[0184] **303**: Gate driver circuit
[0185] **304**: Source driver circuit
[0186] **400**: Position detecting circuit
[0187] **401**: Transmission signal generating circuit
[0188] **402**: Transmitting electrode selecting circuit
[0189] **404**: Receiving electrode selecting circuit
[0190] **405**: Reception signal processing circuit
[0191] **406**: Positional information output circuit
[0192] **410**: Control circuit
[0193] **411**: Position indication condition determining circuit

[0194] The various embodiments described above can be combined to provide further embodiments. All of the U.S. patents, U.S. patent application publications, U.S. patent applications, foreign patents, foreign patent applications and non-patent publications referred to in this specification and/or listed in the Application Data Sheet are incorporated herein by reference, in their entirety. Aspects of the embodiments can be modified, if necessary to employ concepts of the various patents, applications and publications to provide yet further embodiments.

[0195] These and other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

1. An indicated position detecting device for detecting a position indicated by an indicator, the indicated position detecting device comprising:
a first transmission circuit; and
a second transmission circuit,
wherein the first transmission circuit, in operation, transmits a first transmission signal related to first processing of detecting the position indicated by the indicator,
wherein the second transmission circuit, in operation, transmits a second transmission signal related to second processing different from the first processing, and
wherein a waveform of the first transmission signal and a waveform of the second transmission signal are orthogonal to each other in a same period.

2. The indicated position detecting device according to claim **1**, wherein
a value obtained by subtracting a wave number of the second transmission signal from a wave number of the first transmission signal in the same period is a positive or negative integer.

3. The indicated position detecting device according to claim **1**, wherein
the first processing is processing of detecting the position indicated by the indicator by an electromagnetic induction system, and
the second processing is processing of detecting the position indicated by the indicator by a capacitive system.

4. The indicated position detecting device according to claim **1**, wherein
a transmission period of the first transmission signal at least partially overlaps a transmission period of the second transmission signal.

5. The indicated position detecting device according to claim **4**, wherein
a start time point and an end time point of the transmission period of the first transmission signal are same as a start time point and an end time point of the transmission period of the second transmission signal.

6. The indicated position detecting device according to claim **1**, further comprising:
a display, wherein:
the first processing is processing of detecting the position indicated by the indicator on the display by an electromagnetic induction system, and
the second processing is processing of driving the display.

7. The indicated position detecting device according to claim **1**, further comprising:
a display, wherein:
the first processing is processing of detecting the position indicated by the indicator on the display by a capacitive system, and
the second processing is processing of driving the display.

8. An indicated position detecting device for detecting a position indicated by an indicator, the indicated position detecting device comprising:
a first transmission circuit;
a second transmission circuit;
a first reception circuit; and
a second reception circuit,
wherein the first transmission circuit, in operation, transmits a first transmission signal related to first processing of detecting the position indicated by the indicator,
wherein the second transmission circuit, in operation, transmits a second transmission signal related to second processing of detecting the position indicated by the indicator,
wherein the first reception circuit, in operation, receives a first reception signal related to the first processing,
wherein the second reception circuit, in operation, receives a second reception signal related to the second processing, and
wherein a waveform of the first reception signal and a waveform of the second reception signal are orthogonal to each other in a same period.

9. The indicated position detecting device according to claim **8**, wherein
a value obtained by subtracting a wave number of the second reception signal from a wave number of the first reception signal in the same period is a positive or negative integer.

10. The indicated position detecting device according to claim **8**, wherein

the first reception circuit, in operation, receives the first reception signal in a transmission period of the second transmission signal.

11. The indicated position detecting device according to claim **8**, wherein

the second reception circuit, in operation, receives the second reception signal in a transmission period of the first transmission signal.

12. The indicated position detecting device according to claim **8**, wherein

a guard interval is provided between a reception period of the first reception signal and a reception period of the second reception signal.

13. An indicated position detecting method for detecting a position indicated by an indicator, the indicated position detecting method comprising:

transmitting a first transmission signal related to first processing of detecting the position indicated by the indicator; and

transmitting a second transmission signal related to second processing different from the first processing,

wherein a waveform of the first transmission signal and a waveform of the second transmission signal are orthogonal to each other in a same period.

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