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(54) **ONE BUTTON MULTIFUNCION KEY FOB FOR CONTROLLING A SECURITY SYSTEM**

(75) Inventor: **Fred Katz**, Hauppauge, NY (US)

Correspondence Address:
HONEYWELL INTERNATIONAL INC.
101 COLUMBIA ROAD
P O BOX 2245
MORRISTOWN, NJ 07962-2245 (US)

(73) Assignee: **Honeywell International Inc.**

(57) **ABSTRACT**

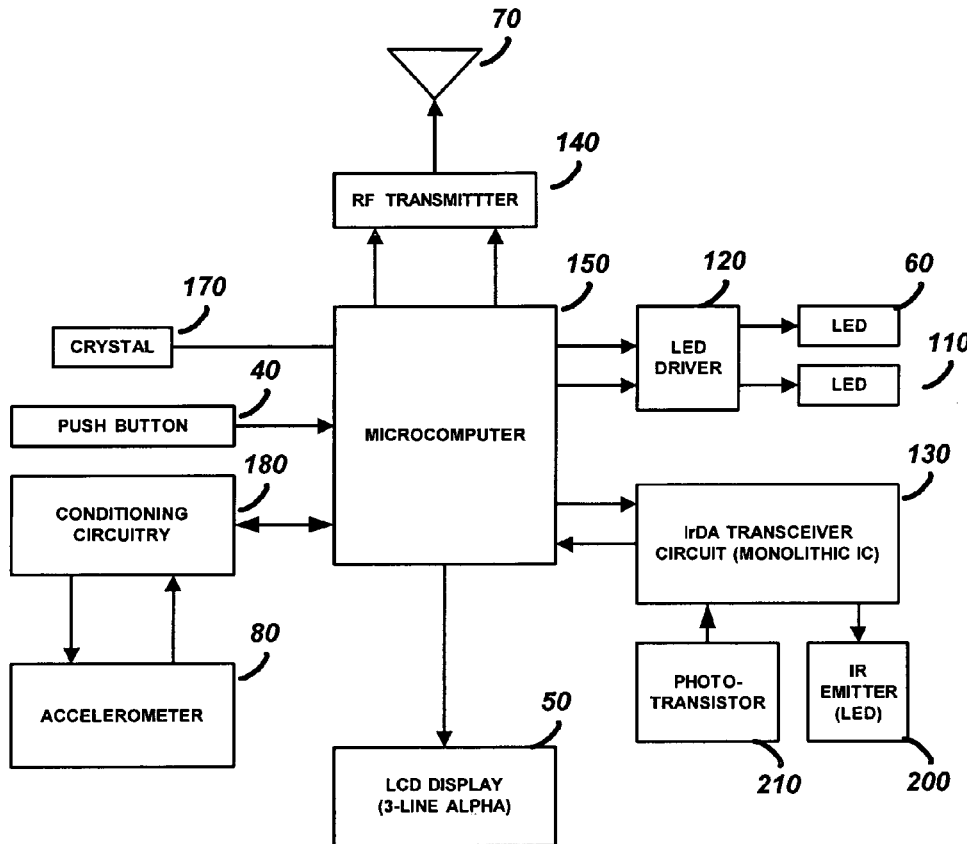A security device which is a hand held portable remote device such as a key fob that allows a user to interact with a security system using a single button. The security system functions such as arming, disarming, panic, garage door open, lamp on/off, and lamp dimming control will be displayed by the security device as control options and will be selected by a user using a forward, backward, left or right tilting motion and depressing the power on/select button. Once a control option has been selected, the security device will transmit the control option to the security system. The security device has a portable housing, a wireless communication port for interface with a security system, a display panel, an accelerometer device, and processing circuitry. The accelerometer device is used to determine the tilt of the security device and provide a control signal related to the tilt. The security device also has an infrared communication port for downloading control options, and single push button, for turning the security device on and for initiating the transmission of the output signal.
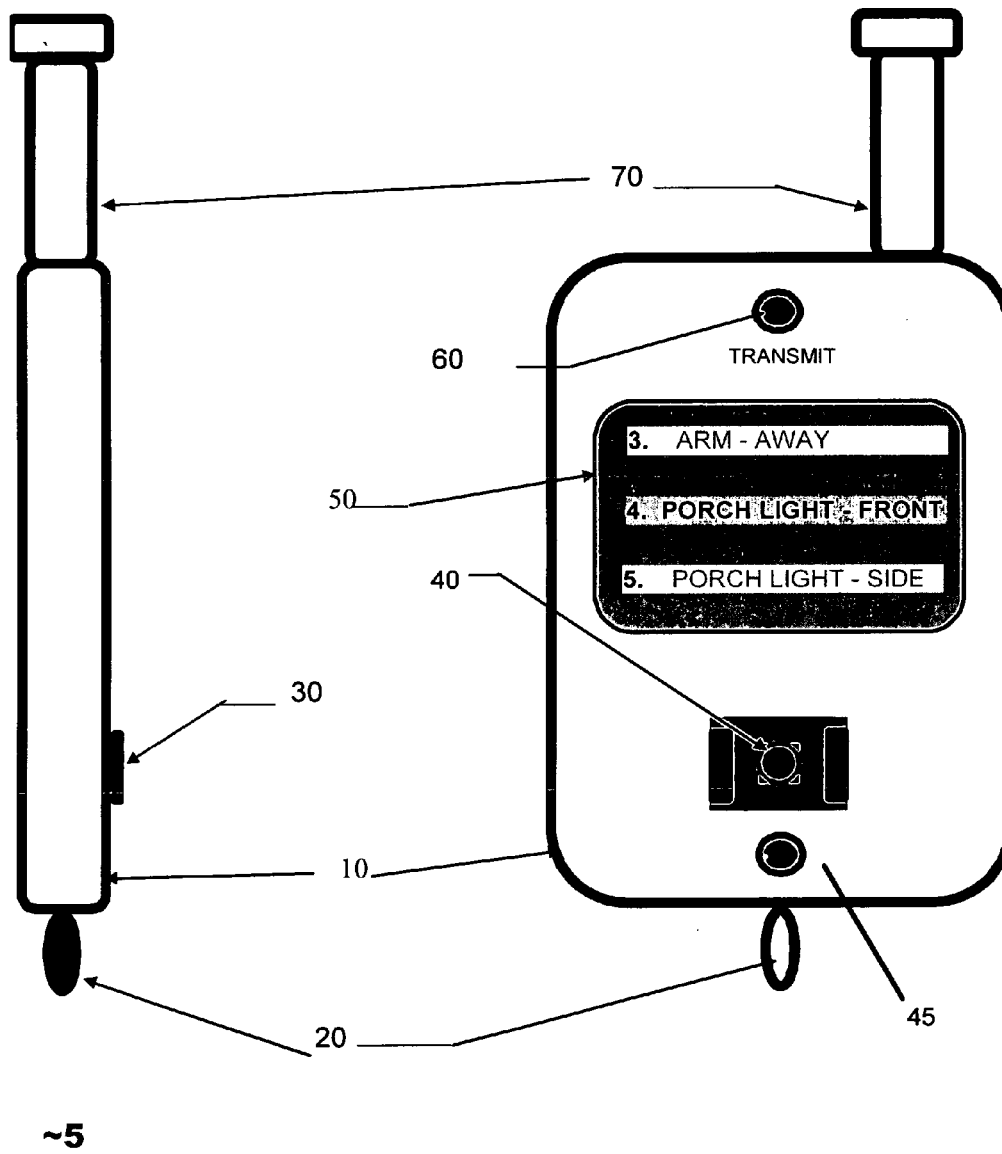
70

60

TRANSMIT

50

3. ARM - AWAY

4. PORCH LIGHT - FRONT

5. PORCH LIGHT - SIDE

40

30

10

20

45

~5

FIGURE 1

70

140

RF TRANSMITTER

170

CRYSTAL

40

PUSH BUTTON

180

CONDITIONING
CIRCUITRY

150

MICROCOMPUTER

120

LED
DRIVER

60

LED

110

LED

130

IrDA TRANSCEIVER
CIRCUIT (MONOLITHIC IC)

80

ACCELEROMETER

50

LCD DISPLAY
(3-LINE ALPHA)

PHOTO-
TRANSISTOR

IR
EMITTER
(LED)

210

200

FIGURE 2

USER PUSH
POWER ON/
SELECT
BUTTON

INPUT FROM
IrDa TRANSCEIVER
CIRCUIT?

Y

READ
INPUT
DATA
FROM
IrDa

PROGRAM
CONTROL
OPTIONS

N

DISPLAY
CONTROL
OPTIONS ON
LCD DISPLAY

TURN
BACKLIGHT
LED ON

INPUT FROM
SELECT
BUTTON ?

Y

GENERATE
TRANSMISSION
MESSAGE

N

TIME
OUT?

N

INPUT FROM
ACCELEROMETER
CHANGED ?

N

TRANSMIT
MESSAGE

SLEEP MODE

Y

Y

SCROLL UP

Y

FORWARD
TILT ?

N

TURN ON
TRANSMIT LED

SCROLL
DOWN

Y

BACKWARD
TILT ?

N

DISPLAY NEW
CONTROL
OPTIONS

ON MODE

Y

LEFT TILT?

N

TURN OFF
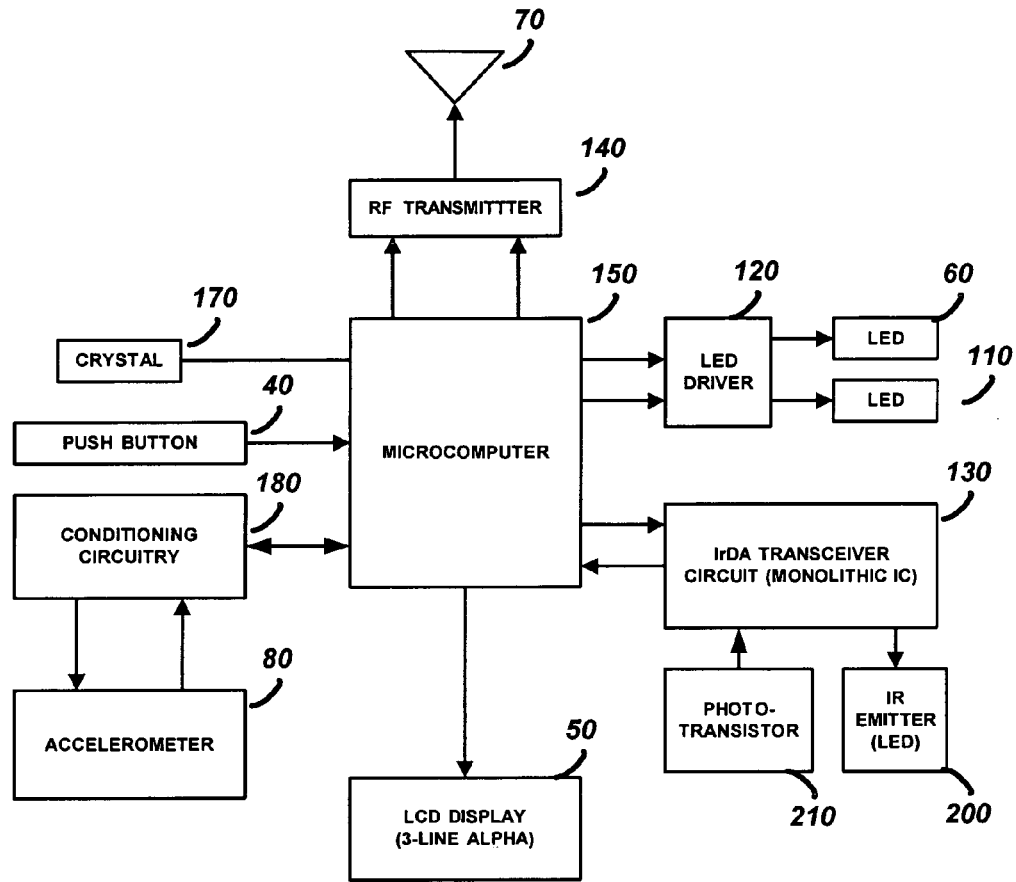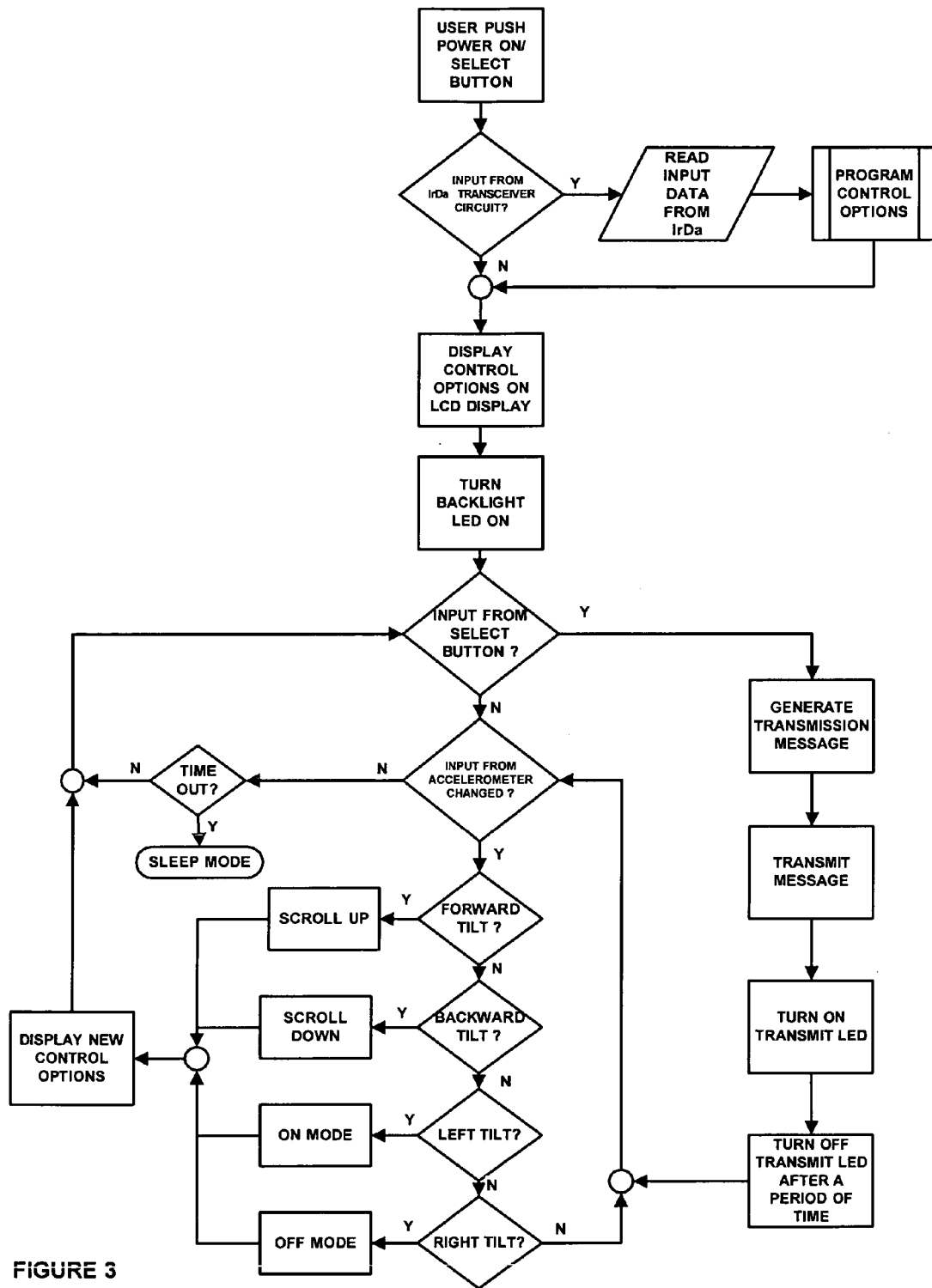TRANSMIT LED
AFTER A
PERIOD OF
TIME

OFF MODE

Y

RIGHT TILT?

N

FIGURE 3

ONE BUTTON MULTIFUNCION KEY FOB FOR CONTROLLING A SECURITY SYSTEM

TECHNICAL FIELD

[0001] This invention relates to security systems, and in particular to a control device that uses an accelerometer and a single button to control a security system.

BACKGROUND ART

[0002] Nearly all security systems of today utilize sophisticated control devices to perform the functions of programming the security system, arming or disarming the security system, providing a panic alert, controlling lighting, and controlling garage doors, etc. Many security systems employ multiple control devices to allow a user more flexibility in controlling the security system. The control devices may be wired or wireless wall-mounted control panels located at different entrances to the protected area or wireless portable handheld devices that can control the security system from outside the protected area.

[0003] A convenient embodiment of a wireless handheld device is a key fob that is small enough to be placed on a key chain. Key fobs are customarily used for locking and unlocking automobiles. They have room for only a few buttons to allow convenient placement of the device on a key chain which can be held in a pants pocket. The small number of buttons is a problem for security system control devices because it limits the amount of controllable functions the device can perform. It is therefore desirable for a homeowner to have a control device that performs the multiple functions of a wall mounted control panel while having the size and convenience of a key fob.

[0004] The convenient size of a key fob causes the necessity of smaller user interface components. These components may consist of buttons for selecting options, a screen for reading information, labeling of buttons, LED's for providing information to the user, and connectors for interfacing the key fob to other electronics. There is a direct relationship between the number of component and the size of the components. Larger components are easier for the user to see, but a smaller key fob with greater functionality is more desirable by the user. In addition, use of more buttons for greater functionality requires more labels for distinguishing the buttons and these labels sometimes are worn off the key fob after time causing the user to possibly push the wrong select button at times. Even if the labels are not worn off the user my accidentally select the wrong button. It is therefore desirable to limit the number of buttons on the key fob to as few as necessary while increasing the functionality of the key fob.

[0005] It is therefore an object of the present invention to provide a small portable handheld control device that can control the many functions of a security system.

[0006] It is a further object of the present invention to provide a control device with a display of the security system function which is to be selected.

[0007] It is a further object of the present invention to provide a control device with a single button for power on and for selecting security system functions.

[0008] It is a further object of the present invention to provide a control device with feedback to the user of the security device's transmissions to the security system.

[0009] Finally it is a further object of the present invention to provide a control device that is easily programmed by an installer to control a security system.

DISCLOSURE OF THE INVENTION

[0010] The present invention is a security device that is able to remotely control functions of a security system. The security device is generally a hand held portable remote device such as a key fob that allows a user to interact with the security system using a single button. The security system functions such as arming, disarming, panic, garage door open, lamp on/off, and lamp dimming control will be displayed by the security device as control options and will be selected by a user using a forward, backward, left or right tilting motion and depressing the power on/select button. Once a control option has been selected, the security device will transmit the control option to the security system. The security system procedures for performing the security system functions are well known to one skilled in the art and will not be described.

[0011] The security device comprises a portable housing, a wireless communication port for interfacing with a security system, a display panel, a motion or tilt sensing device such as an accelerometer device, and processing circuitry. The display panel is an LCD display panel and is used for displaying the control options to the user. The accelerometer device is used to determine the tilt of the security device and provide a control signal related to the tilt. The processing circuitry accepts the control signal, selects one of the control options based on the control signal, and generates an output signal based on the selected control option. The output signal is transmitted by the wireless communication port to the security system.

[0012] The security device also has a communications port such as an infrared port for receiving, during installation, the control options to be programmed into the security device. The security device further has a single user input, such as a push button, for turning the security device on and for initiating the transmission of the output signal, and an LED indicator for indicating that the transmission of the output signal has taken place.

[0013] The method of the present invention includes the steps of displaying control options to a user, tilting the security device (as explained below) to select one of the control options, measuring the tilting with an accelerometer to determine the selected control option, generating an output signal based on the selected control option, and transmitting the output signal to the security system using a wireless communication port. The method further includes the steps of turning on the security device to view the control options on the display panel, depressing a button or other user input to transmit the output signal to the security system, and illuminating an LED when the output signal is transmitted.

[0014] Since the accelerometer device in the preferred embodiment can measure the tilt in four different directions, the tilt in each direction can signify a different input. The security device is held in the user's palm as it is turned on by depressing a button. After the security device is powered on from its hibernation mode, the display reveals three control options. The control option in the center is the selected control option. The user may tilt the security device

forward to scroll the control options up or tilt the security device backward to scroll the control options down. A left tilt enables the selected control option, such as arming the security system, and a right tilt disables the selected control option, such as disarming the security system. Once the user has selected the control option, the user depresses the button again to transmit the control option.

BRIEF DESCRIPTION OF THE DRAWING

[0015] FIG. **1** is a diagram of the security device of the present invention.

[0016] FIG. **2** is a circuit diagram of the present invention.

[0017] FIG. **3** is a mode of operation flowchart of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0018] The preferred embodiments of the present invention will now be described with respect to the Figures. FIG. **1** illustrates the security device **5** as a key fob. Shown are front and side views of the key fob housing **10**. The key fob housing **10** has an antenna **70** and a keychain loop **20** attached to it. The antenna **70** provides a large transmission range, while the keychain loop **20** allows the security device **5** to be easily attached to a keychain. The antenna **70** may be extendable, fully retractable, or built-in (totally internal). The key fob housing **10** contains a recessed power on/select button **40** with guard **30**, an LCD display **50**, and an LED **60**. The power button is pushed to turn the security device **5** on. If it is turned on accidentally, it will turn itself off after a short time of inactivity. Once the security device **5** is turned on, the LCD display **50** will be lit by the backlight LED **110** (shown in FIG. **2**) and three control options will be displayed. For example, the LCD display **50** presently shows the control options "3. ARM-AWAY", "4. PORCH LIGHT_FRONT", and "5. PORCH LIGHT_SIDE". A predefined number of control options will be available in a list form, and the user will either select the control option currently in the center of the display (i.e. the option having the focus) or scroll through the list until a desired control option is in the center of the display and has the focus. Once the user reads the control options, he uses the power on/select button **40** to select the center control option or tilts the security device **5** forward or backward to scroll to a different control option. The LED **60** provides feedback to the user that the control option has been transmitted by the security device **5**.

[0019] FIG. **2** shows a circuit diagram of the security device **5**. The security device's processor is a single chip microcomputer **150** with a clock input from crystal **170**. The microcomputer **150** is normally in a sleep mode or hibernation state, drawing very little battery power. When the power on/select button **40** is pushed, the microcomputer **150** wakes up and places the control options on the LCD display **50**. The microcomputer **150** contains a built in LCD driver that directly controls the LCD display **50**. The microcomputer **150** also sends a signal to the LED driver **120** that causes the backlight LED **110** to be lit behind the LCD display **50**, which allows the user to see the control options.

[0020] The microcomputer **150** receives input data from the power on/select button **40** and the accelerometer **80** to determine the control option to be transmitted by the RF

transmitter **140**. Once the power on/select button **40** powers on the microcomputer **150**, it functions as a selection input that causes the middle control option (the option with the focus) displayed on the LCD display **50** to be transmitted. The input data from the accelerometer **80** informs the microcomputer **150** as to when and how to change the control options displayed by the LCD display **50**. When the user tilts the security device forward, backward, left, or right, the accelerometer **80** provides a measure of the acceleration in the X direction and the Y direction. The conditioning circuitry **180** determines the direction of the tilt from the accelerometer **80** output and the microcomputer **150** uses this information to scroll the displayed control options up or down, or cause the center control option to be turned on or off, respectively. The accelerometer **80** is a Motorola MMA6200 integrated circuit. It consists of a capacitive sensing cell (g-cell) and a signal conditioning ASIC. The g-cell is a mechanical structure formed from three semiconductor plates with two capacitors between the three plates. As the center plate moves with acceleration, the distance between the plates changes and each capacitor's value will change. The ASIC uses switched capacitor techniques to measure the g-cell capacitors and extract the acceleration data from the difference between the two capacitors. The acceleration sensing determines the tilt of the key fob by sensing the direction and magnitude of the acceleration of gravity in order to define in space the positional aspect (tilt) of the keyfob.

[0021] Once the user has tilted the security device **5** to display the desired control option, and/or has selected the on/off mode of the control option, and has depressed the power on/select button **40**, the microcomputer transmits the appropriate message data to the RF transmitter **140**. The RF transmitter **140** accepts the message data from the microcomputer **150** and when commanded by the microcomputer **150** converts the data to an RF message and transmits it to the security system through antenna **70**. The microcomputer **150** sends a signal to the LED driver **120** that causes the LED **60** to be illuminated indicating to the user that a command has been transmitted. The message structure and the transmit protocols are compatible with home security control panels as known in the art. The signals transmitted may also be compatible with receiver devices that interface with X-10 type Line Voltage control modules, equivalent AC power control devices, or wireless control units, all also well known in the art.

[0022] The control options displayed on the LCD display **50** are programmed into the microcomputer through the IRDA transceiver circuit **130** at installation. A communications link is established using the phototransistor **210** and the IR emitter **200**. The aperture of the IrDA port is a dark red optical window **45** fabricated out of an infrared-transmissive plastic lens that shields external non-infrared light from coming in, but permits infrared light from coming in and going out. This is located for example purposes, below the single button as shown on FIG. **1**.

[0023] The installer uses a laptop computer or the like to program the control option list and transmits the control option list to the security device **5** using the established phototransistor **210** link.

[0024] FIG. **3** shows a top level flow diagram of the microcomputer **150** operation. When the power on/select button **40** is pushed the microcomputer **150** checks for an input from the IrDa transceiver and if there is an input a connection is made to the transmitting computer and data is

read over the connection. The data will be programmed as the control options stored in the microcomputer's **150** memory. The data transmission over an IrDa port and the programming of the microcomputer **150** memory are well known processes to one skilled in the art. After the control options are stored or if there is no input from the IrDa, the control options are displayed on the LCD **50** and the backlight LED **110** is lit. The microcomputer **150** checks for an input from the power on/select button **40**. If there is none, the microcomputer **150** checks for an input from the accelerometer conditioning circuitry **180**. If there is no change in tilt, the microcomputer checks the time to determine if enough time has passed to go into a sleep mode. If enough time has not passed, the microcomputer **150** continues to check for an input from the select button **40** and from the accelerometer conditioning circuitry **180** until the time has expired. When an input from the select button has been received, the microcomputer **150** generates a transmission message containing the control option that is in the center of the LCD display **50**. The message is transmitted to RF transmitter **140** and the transmit LED **60** is turned on and after a few seconds turned off. Once a message has been transmitted, the microcomputer **150** continues to look for inputs from the accelerometer conditioning circuitry **180** and for an input from the power on/select button **140** until time has run out, which may be typically on the order of 20 seconds, and it goes into a sleep mode. When the microcomputer **150** receives an input from the accelerometer conditioning circuitry **180** it determines if the tilt was a forward, backward, left or right tilt. If it is a forward tilt, the displayed control options are changed so that the center control option is the top control option displayed, the bottom control option is the center control option, and a new control option is displayed in the bottom spot. If it is a backward tilt, the displayed control options are changed so that a new control option is display in the top spot, the top control option is displayed in the center spot, and the center control option is displayed in the bottom spot. If it is a left tilt, the control option in the center spot is turned on, and if it is a right tilt, the control option in the center spot is turned off. Next the LCD display **50** is updated with the new information, and the microcomputer continues to wait for an input from the select button **40** or from the accelerometer conditioning circuitry **180** until time has run out.

[0025]   It will be apparent to those skilled in the art that modifications to the specific embodiment described herein may be made while still being within the spirit and scope of the present invention. For example, the programming of the microcomputer **150** may be different, the LCD display **50** may display more or less control options. The power on/select button **40** may not perform both functions of power on and select (i.e. they may be performed by different buttons).

What is claimed is:

1. A security device for use with a security system comprising:

a. a housing,

b. a wireless communication port for interfacing with said security system,

c. a display panel for displaying control options to a

user,

d. an accelerometer device for determining a tilt of the security device and providing a control signal related to the tilt, and

e. processing circuitry for:

i. accepting said control signal,

ii. selecting one of said control options based on said control signal,

iii. generating an output signal based on the selected control option, said output signal to be transmitted by said wireless communication port to said security system.

2. The security device of claim 1 wherein the housing is portable.

3. The security device of claim 1 wherein the display panel is an LCD display panel.

4. The security device of claim 1 further comprising an infrared communication port and wherein the control options are programmed using data received through said infrared communication port.

5. The security device of claim 1 wherein said tilt of said security device causes said display to display different control options.

6. The security device of claim 1 further comprising a user input for initiating the transmission of said output signal.

7. The security device of claim 1 further comprising an LED indicator for indicating the transmission of said output signal.

8. A method of accepting a user input into a security device and controlling a security system comprising the steps of:

a. displaying control options to a user,

b. tilting said security device to select one of said control options,

c. measuring said tilting with said to determine said selected control option,

d. generating an output signal based on the selected control option, and

e. transmitting said output signal to said security system using a wireless communication port.

9. The method of claim 8 further comprising the step of turning on said security device to view the display panel with a user input.

10. The method of claim 8 further comprising the step of tilting said security device to display different control options.

11. The method of claim 10 wherein the step of tilting said security device to display different control options is a forward tilt that scrolls control options up.

12. The method of claim 10 wherein the step of tilting said security device to display different control options is a backward tilt that scrolls control options down.

13. The method of claim 8 wherein the step of tilting said security device to select one of said control options is a left tilt that enables the control option.

14. The method of claim 8 wherein the step of tilting said security device to select one of said control options is a right tilt that disables the control option.

15. The method of claim 8 further comprising the step of programming the control options into the security device.

16. The method of claim 15 further comprises the step of transmitting the control options to the security device using an infrared port.

17. The method of claim 8 further comprising the step of requiring a user input to transmit the output signal to said security system.

18. The method of claim 8 further comprising the step of indicating the transmission of the output signal by illuminating an LED.

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