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ULTRASONIC BASED TARGETTING DEVICE FOR MILITARY APPLICATIONS

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***Abstract*- The objective of the project is to sense the distance of any object using ultrasonic sensor and to target an object using PIR sensor. The targeting device consists of gear motor arrangement, PIR and ultrasonic sensor to which Peripheral Interface Controller is interfaced. The two sensors detect and target an object within the range of 400 cm. A program is fed into PIC for converting analog signals from sensors to digital value, so that the sensors and the motor will be controlled. When an object is interrupted, ultrasonic sensor sends an ultrasonic wave to the object and it returns the echo pulse. This echo pulse calculates the distance of object. Meanwhile the PIR sensor detects the motion of the object and targeted using laser pointer. The measured distance will be displayed in the LCD display. Finally, the laser mounted on the top plate along with the sensors points the direction and serves as a hypothetical gun.**

***Keywords*- Passive Infrared Sensor (PIR), Programmable Integrated Circuit (PIC).**

1.INTRODUCTION

A targeting device is a rotating weapon platform usually controlled manually or remotely. A sentry gun is a step up from that because it is computer controlled. It engages targets all by itself. It was science fiction before, but now it's really happening.

The targeting assembly consists of a base that gives the structural support. The tripod design used is minimalistic but practical as demonstrated by the model. The motor is attached accordingly. A miniature breadboard is pasted on top so that corresponding electronics can be mounted on the surface and adjusted or debugged with ease. These electronics include the Ultrasonic distance sensor facing forwards. On the base, is mounted the PIR Motion sensor along with the PIC and other related hardware. When the PIC is switched on, the PIR Motion Sensor is fed a voltage of 5V and will take two seconds to self-calibrate after which any disturbance in motion will cause it to return a HIGH output of 3.3V. The distance sensor uses ultrasonic waves to display the distance of an object from it. The HIGH output returned after time t is converted into distance by using the formula,

$$S=d*t$$

Where

s is the speed of sound.,d is less than 400 cm,

i.e. when the target is in range, the targeting stops and hypothetically opens fire.The gear motor set up is employed for the rotation of the whole assembly which houses the laser pointer and ultrasonic sensor

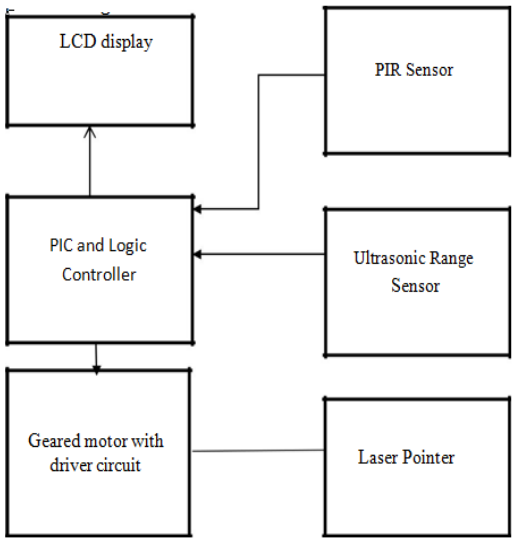

Fig.1.Pin configuration

and PIR sensor. The hardware is powered by an external supply of 12V as the PIC facilitates only 5V. The motion of the gear motor is stopped when the target is detected. With the help of driver circuit which is connected between the PIC and the gear motor. If the object has been detected, the relay circuit is then powered and the circuit becomes open, stopping the gear motor. The ultrasonic sensor now being powered and displays the distance, the PIR sensor detects the object. When the object is detected by the ultrasonic and PIR sensor, the motor gets stopped and then the laser appropriately targets the object.

DESCRIPTION

2. ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent range accuracy and stable readings in an easy-to-use package. It operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect).

An ultrasonic sensor consists of a transmitter and receiver which are available as separate units or embedded together as single unit. The above image shows the ultrasonic transmitter and receiver

2.1Features

- Easy to use 4-pin breakout.
- Range: 2cm-400cm non contact measurement function.
- Ranging accuracy: ±3cm (incremental towards maximum range).
- Measure angle: 15º.
- Operates on 40khz ultrasonic frequency range.
- Operating voltage of 4.8 V to 5.5 V (± 0.2V max).
- Operating Temperature Range: 0C to 60C

Connection headers with VCC,trig(T),echo(R), GND

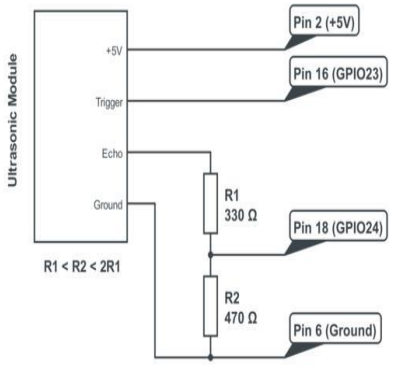

Fig.2.Pin configuration

2.2 Basic operating principle

IO port TRIG trigger ranging to at least 10us high level signal; the module automatically sends eight 40kh zsquare wave, automatically detects whether a signal return.

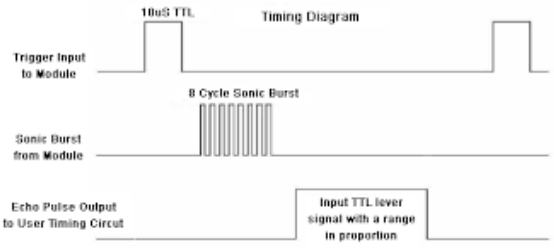

Fig.3.Timing diagram

A signal to return to a high output through the IO port ECHOES high duration of ultrasound wave from the transmitter to the time of the return. The reliable, high performance, high accuracy,blind area within 2cm.

Test distance = (high level time *sound velocity (340M / S)) / 2.

3. PASSIVE INFRARED SENSOR

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR)light radiating from objects in its field of view. They are referred to as PIR, "Passive Infrared", "Pyro electric", or "IR motion" sensors.

The pyro electric sensor is made of a crystalline material that generates a surface electric charge when exposed to heat in the form of infrared radiation. When the amount of radiation striking the crystal changes, the amount of charge also changes and can then be measured with a sensitive FET device built into the sensor.

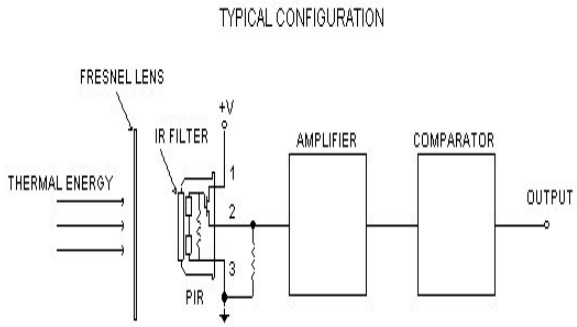

Fig.4.PIR Sensor

- Output: Digital pulse high (3V) when triggered (motion detected) digital low when idle(no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor.
- Power supply: 3.3V - 5V input

Every object that has a temperature above perfect zero emits thermal energy (heat) in form of radiation. Human beings, radiate at wavelength of 9-10micrometers all time of the day. The PIR sensors are tuned to detect this IR wavelength which only emanates when a human being arrives in their a(here, an electric signal of small amplitude). Since these sensors do not have an infrared source of their own, they are also termed as passive.

3.1 Working of PIR sensor

A person entering the monitored area is detected when the infrared energy emitted from the intruder's body is focused by a Fresnel lens or a mirror segment and overlaps a section on the chip which had previously been looking at some much cooler part of the protected area. That portion of the chip is now much warmer than when the intruder wasn't there. As the intruder moves, so does the hot spot on the surface of the chip. This moving hot spot causes the electronics connected to the chip to de-energize the relay, operating its contacts, thereby activating the detection input on the alarm control panel. Conversely, if an intruder were to try to defeat a PIR perhaps by holding some sort of thermal shield between himself and the PIR, a corresponding 'cold' spot moving across the face of the chip will also cause the relay to de-energize — unless the thermal shield has the same temperature as the objects behind it.

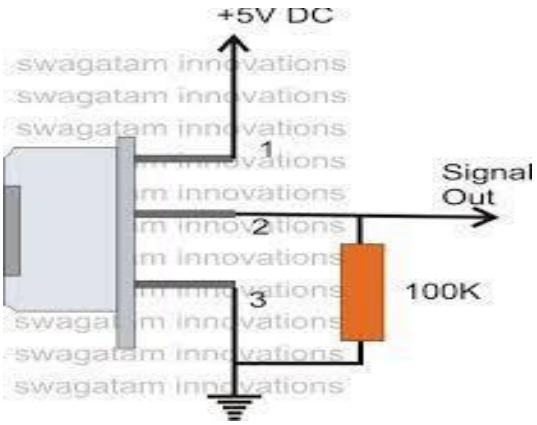

Fig.5.pin configuration

4. MICROCONTROLLER

PIC is the main part of the program. The PIC is an 8 bit microcontroller from Microchip Corporation It is used for control purposes. Currently they are one of the most popular microcontrollers, used in many commercial and industrial applications. The PIC microcontroller architecture is based on a modified Harvard RISC (Reduced Instruction Set Computer)

instruction set with dual-bus architecture, providing fast and flexible design with an easy migration path from only 6 pins to 80 pins and from 384 bytes to 128 Kbytes of program memory. The PIC is a 40 pin Integrate circuit. The basic assembler instruction set of PIC microcontrollers consists of only 33 instructions and most of the family members (except the newly developed devices) use the same instruction set

The PIC (16F877A) is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The core architecture is based on high performance RISC (CPU) with only 35 single word (14 bit) instructions. Since 16f877a takes RISC architecture most of its instructions take only one instruction cycle for execution expect that the instructions used for branching. The PIC employs pipeline technique to execute the instructions, i.e., when the execution of one instruction is going on, the next instruction to be executed of one instruction to be executed is fetched from the program memory.PIC is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

V. MOTOR CONTROL UNIT

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable Fig. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore the minor and major details that make the gear head and hence the working of geared DC motor.

5.1 External Structure

At the first sight, the external structure of a DC geared motor looks as a straight expansion over the simple DC ones. The outer body of the gear head is made of high density plastic but it is quite easy to open as only screws are used to attach the outer and the inner structure. The major reason behind this could be to lubricate gear head from time to time. The plastic body has a threading through which nut can be easily mounted and vice versa from the gear head.

5.2 Internal Structure

On opening the outer plastic casing of the gear head, gear assemblies on the top as well as on bottom part of the gear head are visible. These gear assemblies are highly lubricated with grease so as to avoid any sort of wear and tear due to frictional forces. Shown below is the top part of the gear head. It is connected to rotating shaft and has one gear that allows the rotation. strong circular imprint shows the presence of the gear that rotates the gear at the upper portion.

5.3 Working of the DC Geared Motor

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed.The DC motor works over a fair range of voltage. The higher the input voltage more is the RPM (rotations per minute) of the motor. For example, if the motor works in the range of 6-12V, it will have the least RPM at 6V and maximum at 12 V.

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The working of the gears is very interesting to know. It can be explained by the principle of conservation of angular momentum. The gear having smaller radius will cover more RPM than the one with larger radius. However, the larger gear will give more torque to the smaller gear than vice versa. The comparison of angular velocity between input gear (the one that transfers energy) to output gear gives the gear ratio. When multiple gears are connected together, conservation of energy is also followed. The direction in which the other gear rotates is always the opposite of the gear adjacent to it. In any DC motor, RPM and torque are inversely proportional. Hence the gear having more torque will provide a lesser RPM and converse. In a geared DC motor, the concept of pulse width modulation is applied. In a geared DC motor, the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate. The larger part of the gear further turns the smaller duplex part. The small duplex part receives the torque but not the speed from its predecessor which it transfers to larger part of other gear and so on. The third gear's duplex part has more teeth than others and hence it transfers more torque to the gear that is connected to the shaft.

6. EXPERIMENTAL SETUP

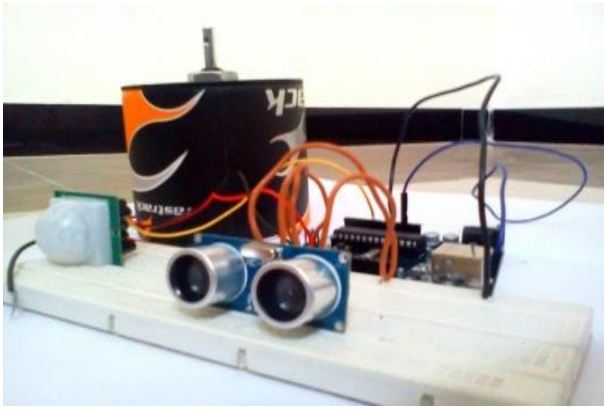

Fig.6.Experimental setup of targeting device

The targeting device consists of gear motor arrangement, PIR and ultrasonic sensor to which Peripheral Interface Controller is interfaced. The ultrasonic sensor is connected to the port C and port B pins.RC0 and RC4 of PIC is connected to trigger pin and echo pin of ultrasonic sensor respectively. The PIR sensor is connected to port RCO PIC microcontroller. The motor is connected to the RC5 and RC6 of PIC through driver circuit. The vcc and ground is connected to supply and ground.

7. CONCLUSION

This hardware setup for targeting device was assembled. It detects the target accurately. This setup can be used in military installations. Cheaper variants can be armed with tranquilizer darts that can take out predatory animals that may kill and eat livestock. A tranquilizer dart is a non-lethal gun used for capture via a special chemical. Tranquilizer guns shoot darts filled with tranquilizer that, when injected, temporarily sedates an animal or human, so that it may be handled safely. By implementing so, the domesticated animals can be tagged with friendly RFID tags that will cause the targeting to ignore them.

REFERENCES

[1] http://www.pic.cc/

[2] Peatman,J.B., Design with microcontroller, McGram-Hill,New York,1988.

[3] Hall,D.V.,Microprocessor and Interfacing: programming, and hardware,2nd ed., Tata McGraw-Hill,NewDelhi,1999.

[4] http://smartprj.com/catalog/index.php.

[5] http://in.mouser.com/atmel/?gclid=CLrMjITIgr4CFWjKtAodFkYAtg.

[6] Ultrasonic Transducers: Materials and Design for Sensors, Actuators and Medical Applications (Woodhead Publishing Series in Electronic and Optical Materials) by K Nakamura.

[7] "How Infrared motion detector components work". Non commercial research page. Global Corporation. Retrieved 2013-05-31.

[8] http://www.engineersgarage.com/insight/how-motion-pir-sensor-works.

[9] http://www.popularmechanics.com/technology/military/research/8-laser-weapon-systems-to-zap-planes-boats-and-people#slide-1

[10] http://www.businessinsider.in/The-Armys-8-Wheeled-Laser-Truck-Can-Burn-Mortars-Drones-Right-Out-Of-The-Sky/articleshow/27231804.cms

[11] http://www.digikey.com/us/en/techzone/sensors/resources/articles/sensing-motion-with-passive-infrared-sensors.html.