Smart Spy Surveillance Robotic System

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Abstract: **-This project presents the via internet through arduino uno board. The monitoring and controlling of robotic movements through wireless network by using a web browser and accessing a webpage. A camera is mounted on the robot to get better visibility of the objects. The PIR sensor detects a person or an object enters into a surveillance area and the smoke sensor detects the fire accidents by sensing the smoke level increasing in the atmosphere. Here we are using metal detector to detect the bomb because we know that any bomb contains some concentration or percentage of metal elements. This mobile robot can be operated from everywhere in the world by using internet of things.**

Keywords:-Arduino, PIR sensor, smoke sensor, metal detector, Motor driver, IOT

I. INTRODUCTION

Surveillance is the process of monitoring a situation, an area or a person. This generally occurs in a military scenario where surveillance of borderlines and enemy territory is essential to a country's safety. Human surveillance is achieved by deploying personnel near sensitive areas in order to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible. There are also added risks of losing personnel in the event of getting caught by the enemy. With advances in technology over the years, however, it is possibly to remotely monitor areas of importance by using robots in place of humans. Apart from the obvious advantage of not having to risk any personnel, terrestrial and aerial robots can also pick up details that are not obvious to humans. By equipping them with high resolution cameras and various sensors, it is possible to obtain information about the specific area remotely. Satellite communication makes it possible to communicate seamlessly with the robots and obtain real-time audio visual feedback. Thus, in recent times, surveillance technology has become an area of great research interest. However, building a small robot for testing and research purposes proves to be extremely expensive. Primarily because a security robot would require certain components such as a GPS module(Global Positioning System), High resolution cameras, radios for satellite connectivity, etc. Each of these components are quite expensive and piecing them together for the purpose of a robot is a very costly and time consuming affair. Moreover, a lot of time is wasted in writing driver code to interface all these components. The solution to this dilemma is quite simple. In the last few years, feature-rich smart phones have become popular. These phones come equipped with the required features such as a GPS module, a high resolution camera and internet connectivity. Due to the extremely efficient supply chains that go into manufacturing consumer electronic devices, these phones come quite cheap for the features that they provide. Also, the operating system on these smartphones provide Application Programmer Interfaces (APIs) for using the various sensors with ease. By using the APIs provided, we can easily write apps in a high-level language like Java, without the complication of writing driver code. In our system, we have used a smartphone running the Android Operating System which is one the most popular mobile operating systems today.

Thus, it is our aim to build a fully-featured surveillance robot using an easily available Android phone, which can be remotely controlled over the internet

II. PROPOSED METHOD

In the proposed system contain several parameters like PIR sensor, GPS sensor Metal Detector ,Smoke sensor ,RFID Reader ,spray motor give the sense to the ARDUINO microcontroller. The PIR (Passive Infra-Red) Sensor is a pyro electric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. Global Positioning System (GPS) is a global navigation satellite system that provides location and time information in all weather conditions. GPS satellites transmit signal information to earth. This signal information is received by the GPS receiver in order to measure the user's correct position. Metal detector using high-frequency oscillation to detect ferrous and non-ferrous metal objects and in capacitive models to detect non-metal objects. A smoke sensor is a device that senses smoke ,typically as an indicator of fire. A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag which is used to track individual objects .Radio waves are used to transfer data from the tag to a reader. Geared dc motors can be defined as an extension of dc motors. A geared DC Motor

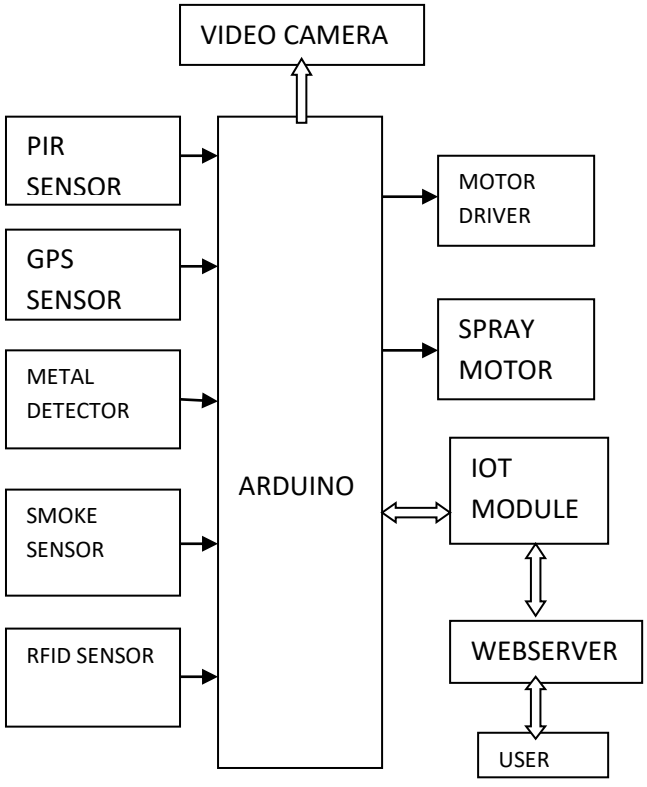

Fig 1. Operation of mobile robot

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 IOT has evolved from the convergence of wireless technologies, micro-electromechanical systems (MEMS) and the Internet. IOT module is a small electronic device embedded in objects, machines and things that connect to wireless networks and sends and receives data.

The spy robot can easily move, capture images and wirelessly transmit them, thus giving the soldiers an intimation about the dangers and situations in the war field. The robot will move depending on the motor direction based upon the input we give through transmitter (remote) section. IOT module signal share used as control signals. By using these signals encoding is done & signal is sent through the transmitter. At the receiver end, these decoded signal are given as input to drive the motor. The robot is used for short distance surveillance thus ensuring the security of the region. This helps the forces to view the things accurately that are currently happening in the surrounding area and to plan ahead accordingly. Thus we should be able to manipulate its path when necessary, to create the robot safely. To all that, a control unit is needed, where control units RF signal is used. By using these signals encoding is done & signal is sent through the transmitter. At the receiver end these decoded signal are given as input to drive the motor. Not for long range applications it can be used as a spy robot within short distances.

III.DESIGN AND IMPLEMENTATION

A. ARDUINO UNO R3 MICROCONTROLLER

The Arduino Uno R3 is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2(Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Revision 2 of the Uno board (A000046) has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

Fig. 2 Arduino UNO Board

2. Specification

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins:14(of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40mA
- DC Current for 3.3V Pin: 50mA
- Flash Memory: 32KB (ATmega328) of which 0.5 KB used by boot loader.
- SRAM: 2KB(ATmega328)
- EEPROM: 1KB(ATmega328)
- Clock Speed: 16MHz

Revision 3 of the board (A000066) has the following new features:

- ATmega16U2 instead 8U2 as USB-to-Serial converter
- 1.0 pin out: added SDA and SCL pins for TWI communication placed near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board and the second one is a not connected pin, that is reserved for future purposes.
- Stronger RESET circuit.

Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm centre-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

VIN:The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V: The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

3V3 : A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND: Ground pins.

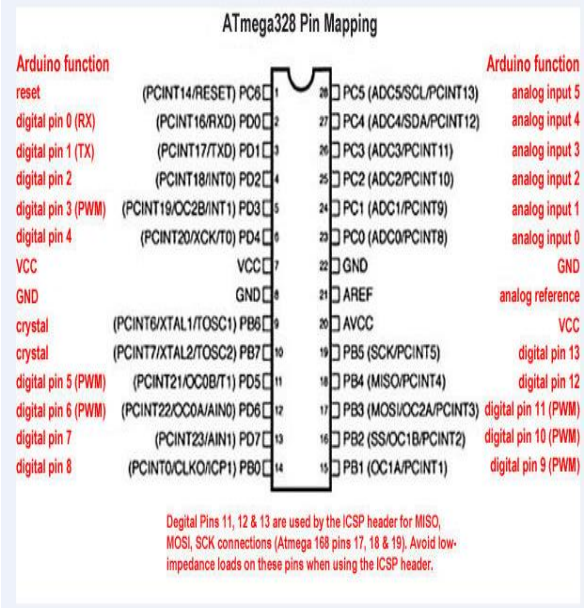

Fig 3. ATmega328 pin mapping

Input and output

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode(), digital Write(), and digital Read() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 m A and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms. In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX)

Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

External Interrupts: 2 and 3

These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt() function for details.

PWM: 3, 5, 6, 9, 10, and 11

Provide 8-bit PWM output with the analog Write() function.

SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK)

These pins support SPI communication using the SPI library.

LED: 13

There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. 3 | P a g e 3 Arduino Uno The Uno has 6 analog inputs, labelled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference() function. Additionally, some pins have specialized functionality:

I2C: 4 (SDA) and 5 (SCL).

Support I2C (TWI) communication using the Wire library.There are a couple of other pins on the board: AREF- Reference voltage for the analog inputs. Used with analog Reference(). Reset- Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

B. Passive Infrared Sensor (PIR):

The term PIR is the short form of the Passive Infra Red. The term “passive ”indicates that the sensor does not actively take part in the process, which means, it does not emit the referred IR signals itself, rather passively detects the infrared radiations coming from the human body in the surrounding area. The detected radiations are converted into an electrical charge, which is proportional to the detected level of the radiation. Then this charge is further improved by a built in FET and fed to the output pin of the device which becomes applicable to an external circuit for further triggering and amplification of the alarm stages.

Fig 4. PIR sensor

The Passive infrared sensors consist of three pins as indicated in the diagram shown above.

- Pin1 corresponds to the drain terminal of the device, which should be connected to the positive supply 5V DC.
- Pin2 corresponds to the source terminal of the device, which should be connected to the ground terminal via a 100K or 47K resistor. The Pin2 is the output pin of the sensor, and the detected IR signal is carried forward to an amplifier from the pin 2 of the sensor.
- Pin3 of the sensor is connected to the ground.

1. PIR Sensor’s Working Principle

The PIR sensors are more complicated than the other sensors as they consists of two slots. These slots are made of a special material which is sensitive to IR. The Fresnel lens is used to see that the two slots of the PIR can see out past some distance. When the sensor is inactive, then the two slots sense the same amount of IR. The ambient amount radiates from the outdoors, walls or room, etc. When a human body or any animal passes by, then it intercepts the first slot of the PIR sensor. This causes a positive differential change between the two bisects. When a human body leaves the sensing area, the sensor generates a negative differential change between the two bisects. The infrared sensor itself is housed in a hermetically sealed metal to improve humidity/temperature/noise/immunity. There is a window which is made of typically coated silicon material to protect the sensing element.

2.Specification:

- They are low power and low cost, pretty rugged, have a wide lens range, and are easy to interface .
- Supply voltage: DC3.3-12V
- Current drain :≤30uA
- Delay time: 2s-80mins,
- adjustable Blockade time:2.3S.
- Detecting distance: ≤8m Detecting angle: ≤120
- Voltage Output: 3.3V High/Low level signal or Open-Collector.
- Output Operation Temperature: -20℃-+55℃
- Infrared sensor: dual element, low noise, high sensitivity.

C.GPS module:.

Global Positioning System (GPS) is a global navigation satellite system that provides location and time information in all weather conditions. GPS satellites transmit signal information to earth. This signal information is received by the GPS receiver in order to measure the user’s correct position.

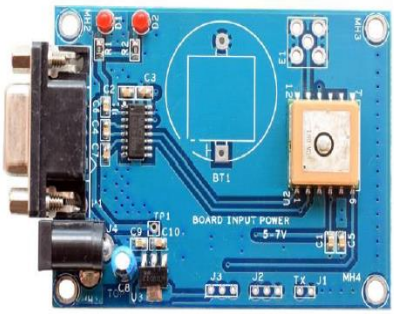

Fig 5. GPS module

1. Features
- Supply voltage: 12v DC
- Interface: UART RS232
- Optional T-TL UART also available
- Precision: 5 meters
- Automatic antenna switching function

D.Metal detector

Metal detector using high-frequency oscillation to detect ferrous and non-ferrous metal objects and in capacitive models to detect non metal objects.Models are available with environment resistance, heat resistance, resistance to chemicals,and resistance to water Proximity Sensors convert information on the movement or presence of an object into an electrical signal.

Fig 6. Metal detector

1. Features
Digital output is standard.
Analog output is available.
Operating voltage: 5VDC
Operating current: 300mA
Sensing range: 0.5mm to 70mm.

E. RFID Reader

An RFID system consists of tags, readers, communication protocol ls, computer networks, and databases. A typical RFID system being standardized by EPC global.The tag is a miniature chip containing product information with an affixed radio antenna. The tag is attached to an item or its packaging and contains a unique serial number called an electronic product code (EPC). The EPC is used to uniquely identify the pallet, case, or item. For low-cost tags, a reader transmits a radio signal to the tags to energize them so that the tag can transmit its EPC. A reader can be either stationary in a fixed state or handheld. There are communication protocols that define the exchange of messages from the tag to reader and reader to tag. The readers are connected to a computer network so that they can be queried by a management system. Then the management system can query a database determined by the EPC to find out more information about the item to which the tag is attached.

A tag contains information and a reader queries the tag for the information. A tag is sometimes called a transponder. The word transponder comes from the words transmitter and responder. It is an identifier affixed to a certain item or an object holding its identification information. The tag responds to a reader's request by transmitting the information. The tag consists of a microchip connected to an antenna and sometimes a battery. The chip has memory and today can store information up to 128 Kbytes. The tag's antenna is physically attached to the chip and is used to draw energy from the reader to energize the tag. Recent technology advances have made the size of a tag microchip smaller than a sand grain. However, its physical dimensions are determined by the size of antenna. A tag with a battery is known as an *active* tag and a tag without a battery is known as a *passive* tag. Active tags generate energy from its battery and passive tags receive energy from the reader that generates a radio frequency (RF) field.

A reader, also known as an *interrogator*, is a device used to query one or more tags within its range and communicate with them. It consists of one or more antennas that emit radio waves and receive signals from one or more tags. The reader sends a request as an interrogating signal for identification information to the tag. The tag wakes up and responds or broadcasts with the respective information by sending an encoded modified signal, which the reader decodes, forwarding it to the data processing device.

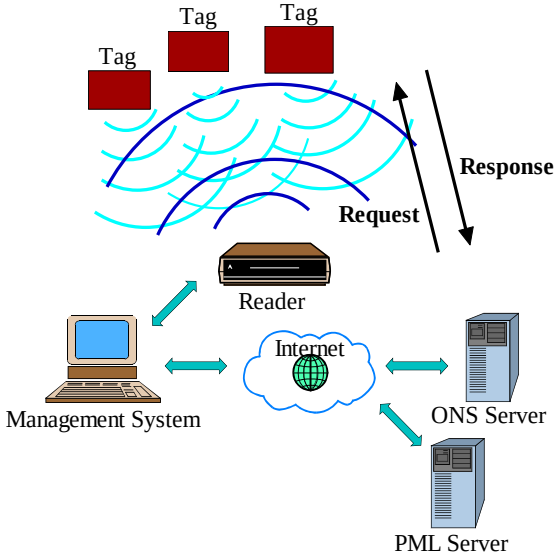

Fig 7. Electronic Product Code(EPC)global

1. Tags

There are two broad categories of RFID tags: active and passive. The characteristics of active and passive tags are summarized in Table 1. Each type will be described in separate sections.

Table 1. Comparison of passive and active tags

Characteristics	Passive RFID tag	Active RFID tag
Power Source	Provided by a reader	Inbuilt
Availability of power	Within the field of reader	Continuous
Signal Strength (Reader to Tag)	High	Low
Signal Strength	Low	High
Communication range	< 3meters	>100 meters
Tag reads	< 20 moving tags @ 3mph in few seconds	>1000 moving tags @ 100mph in 1 sec
Memory	128 bytes	128 Kbytes
Applicability in supply chain	Applicable where tagged items movement is constrained	Applicable where tagged items movement is variable and unconstrained
Expense	$0.05	$10.00-$50.00

Table 4.1 Comparison of passive and active tags

2. RFID Frequencies

RFID systems operate on different frequencies depending on the application. Ten such frequencies are defined and are shown Table 4.2. Four classes of frequencies used in RFID system are: Low Frequency (LF) with frequency range of 30 KHz to 300 KHz, High Frequency (HF) with frequency range of 3MHz to 30MHz, Ultra High Frequency (UHF), and Microwave Frequency above 1 GHz. These frequencies have specific ranges known as industrial-scientific–medical (ISM) or short-range device (SRD) frequency ranges. RFID systems operate on different frequencies so they will not interfere with existing radio frequency systems.

Frequency Band	Description
< 135 KHz	Low frequency (LF)
6.765 – 6.795 MHz	High frequency (HF)
7.4 – 8.8 MHz	High frequency (HF)
13.553 – 13.567 MHz	High frequency (HF)
26.957 – 27. 283 MHz	High frequency (HF)
433 MHz	Ultra-high frequency (UHF)
868 – 870 MHz	Ultra-high frequency (UHF)
902 – 928 MHz	Ultra-high frequency (UHF)
2.4 – 2.483 GHz	Super-high frequency (SHF)
5.725 – 5.875 GHz	Super-high frequency (SHF)

Table 4.2 Frequency band description

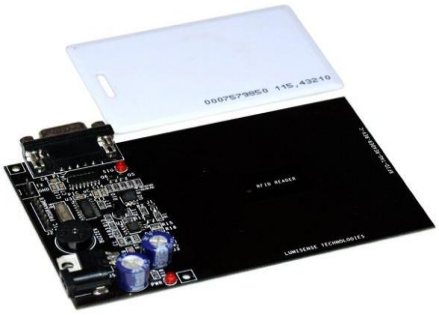

Fig 8.RFID Reader

3. Features

Supply voltage: 12v DC

Output: UART and TTL

In-built buzzer indicator

Signal LED is placed.

F. Smoke Sensor

A wide range of smoke sensor products for the detection of various gases, from explosive gases such as propane, toxic gases such as carbon monoxide, to air quality sensors for volatile organic compounds (VOCS) that are responsible for sick-house syndrome. Figaro offers a diverse portfolio of sensor technologies that can be matched to the unique requirements of each application. In the most extreme case where oxygen concentration is 0%, when metal oxide sensor material (typically tin dioxide [sno2-x]) is heated at high temperature such as 400˚C, free electrons flow through the conjoined parts (grain boundary) of tin dioxide crystals. In clean air (approx.. 21% O2), oxygen is adsorbed on the metal oxide surface. With its high electron affinity, adsorbed oxygen attracts free electrons inside the metal oxide, forming a potential barrier at the grain boundaries. This potential barrier prevents electron flow, causing high sensor resistance in clean air.

As a result, the density of adsorbed oxygen on the tin dioxide surface decreases, and the height of the potential barrier is reduced. Electrons easily flow through the potential barrier of reduced height, and the sensor resistance decreases. Gas concentration in air can be detected by measuring the resistance change of MOS-type gas sensors. The chemical reaction of gases and adsorbed oxygen on the tin dioxide surface varies depending on the reactivity of sensing materials and working temperature of the sensor.

Fig 9. Smoke sensor

1. Features

- Smake sensor detects the concentration of methane gas in the environmental air and output the reading as an analog voltage.
- The concentration sensing range of 300 ppm to 10,00
- high sensitivity to Methane, also to Propane and Butane0 ppm is suitable for leak detection.
- Analog and digital output
- High sensitivity to CH4, natural gas
- Small sensitivity to alcohol and smoke
- Fast response
- Stable and long life
- Operating voltage: 5VDC
- MQ-4 gas sensor detects the concentration of methane gas in the environmental air and output the reading as an analog voltage.
- The concentration sensing range of 300 ppm to 10,00
- high sensitivity to Methane, also to Propane and Butane0 ppm is suitable for leak detection.
- Analog and digital output
- High sensitivity to CH4, natural gas
- Small sensitivity to alcohol and smoke
- Fast response
- Stable and long life
- Operating voltage: 5VDC

G. Internet Protocol Camera

An Internet protocol camera, or IP camera, is a type of digital video camera commonly employed for surveillance, and which, unlike analog closed circuit television (CCTV) cameras, can send and receive data via a computer network and the Internet. Although most cameras that do this are webcams, the term IP camera or netcam is usually applied only to those used for surveillance that can be directly accessed over a network connection.

An IP camera is a networked digital video camera that transmits data over a Fast Ethernet link. IP cameras (also called "network cameras") are most often used for IP surveillance, a digitized and networked version of closed-circuit television (CCTV).

Benefits of IP camera over analog technology include:

- Remote administration from any location.
- Digital zoom.
- The ability to easily send images and video anywhere with an Internet connection.
- Progressive scanning, which enables better quality images extracted from the video, especially for moving targets.
- Adjustable frame rates and resolution to meet specific needs.
- Two-way communication.
- The ability to send alerts if suspicious activity is detected.
- Lower cabling requirements.
- Support for intelligent video.

H.Motor Driver (4 channel relay board)

This is an easy to use 4 channel relay board that works on 12V. Use it to control four 240V power appliances directly from microcontrollers or low voltage circuits. The board uses high quality relays, which can handle a maximum of 7A/240 V AC or 7A/24V DC. Each relay has all three connections - Common, Normally Open, Normally Closed brought out to 3 pin screw terminals which makes it easy to make and remove connections. The board has a power indication and a relay status LED to ease debugging. The board can accept inputs within a wide range of voltages from 4V to 12V.Power input and relay control signals are brought to header pins on the board.The power input for this board can also be provided through the onboard DC Barral Jack. Hence, our SMPS type power adapters can also be used to directly power this board.

1. Features

- Input supply 12 VDC @ 170 mA
- Output four SPDT relay
- Relay specification 5 A @ 230 VAC
- Trigger level 2 ~ 5 VDC
- Berg pins for connecting power and trigger voltage
- LED on each channel indicates relay status
- Power Battery Terminal (PBT) for easy relay output and aux power connection
- Four mounting holes of 3.2 mm each
- PCB dimensions 88 mm x 68 mm

2. Motor

30RPM Centre Shaft Economy Series DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside .Although motor gives 30 RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque. Tables below gives fairly good idea of the motor's performance in terms of RPM and no load current as a function of voltage and stall torque, stall current as a function of voltage.

For compatible wheels refer to Wheels and Accessories product category.

You can also mount this motor on the chassis using Motor Mount for Centre Shaft Economy Series DC Motor For adding Position Encoder, refer to Encoder Kit for Centre Shaft Economy Series DC Motor

3. Specifications

- DC supply: 4 to 12V
- RPM: 30 at 12V
- Total length: 46mm
- Motor diameter: 36mm
- Motor length: 25mm
- Brush type: Precious metal
- Gear head diameter: 37mm
- Gear head length: 21mm
- Output shaft: Centred
- Shaft diameter: 6mm
- Shaft length: 22mm
- Gear assembly: Spur
- Motor weight: 100gms

I. LCD

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs are used in a wide range of applications including computer monitors, televisions, instrument panels, aircraft cockpit displays, and signage. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they do not suffer image burn-in. LCDs are, however, susceptible to image persistence.

The LCD screen is more energy efficient and can be disposed of more safely than a CRT. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically modulated optical device made up of any number of segments filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome. Liquid crystals were first discovered in 1888. By 2008, worldwide sales of televisions with LCD screens exceeded annual sales of CRT units; the CRT became obsolete for most purposes.

Fig 10. LCD Display Module

1. Pin description:

Fig 11. LCD Pin details

PIN NO	FUNCTION	NAME
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7

Table 4.3 LCD Pin description

2. Advantages

- Very compact and light.
- Low power consumption. On average, 50-70% less energy is consumed than CRT monitors.
- No geometric distortion.
- The possible ability to have little or no flicker depending on backlight technology.
- Usually no refresh-rate flicker, as the LCD panel itself is usually refreshed at 200 Hz or more, regardless of the source refresh rate.
- Is very thin compared to a CRT monitor, which allows the monitor to be placed farther back from the user, reducing close-focusing related eye-strain.
- Razor sharp image with no bleeding/smearing when used at native resolution.
- Emits less electromagnetic radiation than a CRT monitor.
- Not affected by screen burn-in, though an identical but less severe phenomenon known as image persistence is possible.
- Can be made in almost any size or shape.
- No theoretical resolution limit.

3. Specification

Important factors to consider when evaluating an LCD:

i) Resolution versus range

Fundamentally resolution is the granularity (or number of levels) with which a performance feature of the display is divided. Resolution is often confused with range or the total end-to-end output of the display. Each of the major features of a display has both a resolution and a range that are tied to each other but very different. Frequently the range is an inherent limitation of the display while the resolution is a function of the electronics that make the display work.

ii)Spatial performance

LCDs come in only one size for a variety of applications and a variety of resolutions within each of those applications. LCD spatial performance is also sometimes described in terms of a "dot pitch". The size (or spatial range) of an LCD is always described in terms of the diagonal distance from one corner to its opposite. This is an historical remnant from the early days of CRT television when CRT screens were manufactured on the bottoms of glass bottles, a direct extension of cathode ray tubes used in oscilloscopes. The diameter of the bottle determined the size of the screen. Later, when televisions went to a squarer format, the square screens were measured diagonally to compare with the older round screens

Temporal/timing performance

Contrary to spatial

performance, temporal performance is a feature where smaller is better Specifically, the range is the pixel response time of an LCD, or how quickly a sub pixel's brightness changes from one level to another. For LCD monitors, this is measured in black to black gray to gray. These different types of measurements make comparison difficult Further, this number is almost never published in sales advertising.

Color performance:

There are many terms to describe colour performance of an LCD. They include color gamut which is the range of colors that can be displayed and color depth which is the color resolution or the resolution or fineness with which the color range is divided. Although color gamut can be expressed as three pairs of numbers, the XY coordinates within color space of the reddest red, greenest green, and bluest blue, it is usually expressed as a ratio of the total area within color space that a display can show relative to some standard such as saying that a display was "120% of NTSC". NTSC is the National Television Standards Committee, the old standard definition TV specification. Color gamut is a relatively straight forward feature. However with clever optical techniques that are based on the way humans see color, termed color stretch, colors can be shown that are outside of the nominal range of the display. In any case, color range is rarely discussed as a feature of the display as LCDs are designed to match the color ranges of the content that they are intended to show. Having a color range that exceeds the content is a useless feature.

Brightness and contrast ratio:

Contrast ratio is the ratio of the brightness of a full-on pixel to a full-off pixel and, as such, would be directly tied to brightness if not for the invention of the blinking backlight (or burst dimming). The LCD itself is only a light valve, it does not generate light; the light comes from a backlight that is either a fluorescent tube or a set of LEDs. The blinking backlight was developed to improve the motion performance of LCDs by turning the backlight off while the liquid crystals were in transition from one image to another. However, a side benefit of the blinking backlight was infinite contrast. The contrast reported on most LCDs is what the LCD is qualified at, not its actual performance. In any case, there are two large caveats to contrast ratio as a measure of LCD performance.

Color depth or color support

It is sometimes expressed in bits, either as the number of bits per sub-pixel or the number of bits per pixel. This can be ambiguous as an 8-bit color LCD can be 8 total bits spread between red, green, and blue or 8 bits each for each color in a different display. Further, LCDs sometimes use a technique called dithering which is time averaging colors to get intermediate

colors such as alternating between two different colors to get a color in between.Dithering is commonly used on computer displays where the images are mostly static and the temporal performance is unimportant.

When color depth is reported as color support, it is usually stated in terms of number of colors the LCD can show. The number of colors is the translation from the base 2-bit numbers into common base-10. For example, 8-bit color is 2 to the 8th power, which is 256 colors. 24-bit color is 2 to the 24th power, or 256 x 256 x 256, a total of 16,777,216 colors. The color resolution of the human eye depends on both the range of colors being sliced and the number of slices; but for most common displays the limit is about 28-bit color LCD TVs commonly display more than that as the digital processing can introduce color distortions and the additional levels of color are needed to ensure true color.

J. IOT (Internet of things)

To address Industrial Internet of Things (IOT) projects, Ethernet connectivity becomes the most reliable and stable technology. The IOT Ethernet Kit powered by AWS IOT uses an Ethernet LAN8740A driven by a 32-bit microcontroller with 2 MB of Flash (PIC32MZ EF) that provides plenty of memory space for your application. On the sensor side, hundreds of different sensors can be plugged into the Mikro Elektronka mikroBUS™ footprint allowing for prototyping a large variety of IOT proof-of-concepts. This IOT kit takes advantage of the AWS IOT service and provide a smooth user experience coming preloaded with the corresponding firmware. AWS IOT is a managed cloud platform that allows connected devices to interact easily and securely with cloud applications and other devices. Additionally, the firmware in the kit makes use of MPLAB® Harmony, FreeRTOS™, WolfMQTT and WolfSSL allowing you to quick-start your IOT design.

1. Description

- Developed as a reference for industrial Ethernet environments
- Complete development kit that includes IOT edge device and setup instructions for using AWS IOT
- Easy setup out of the box with your own AWS account
- JSON-based data payload
- MPLAB Harmony: integrated software framework
- Simple 32-bit microcontroller-based design
- Four input buttons, four output LEDs and one analog input potentiometer on edge device to show bidirectional control via AWS IOT
- mikroBUS header for expendability to build any IOT use case using available or custom sensors.

Fig 12. IOT Module

IV.CONCLUSION

The main motive of the war spying robot was to make it user friendly. The spy robot can easily move, capture images and wirelessly transmit them, thus giving the soldiers an intimation about the dangers and situations in the war field. The robot will move depending on the motor direction based upon the input we give through transmitter (remote) section. Iot module signal share used as control signals. By using these signals encoding is done & signal is sent through the transmitter. At the receiver end, these decoded signal are given as input to drive the motor. The robot is used for short distance surveillance thus ensuring the security of the region. This helps the forces to view the things accurately that are currently happening in the surrounding area and to plan ahead accordingly. Thus we should be able to manipulate its path when necessary, to create the robot safely. To all that, a control unit is needed, where control units RF signal is used. By using these signals encoding is done & signal is sent through the transmitter. At the receiver end these decoded signal are given as input to drive the motor. Not for long range applications it can be used as a spy robot within short distances.

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