Wireless Surveillance Robot with Motion Detection and Live Video Transmission

A. Sivasoundari, S. Kalaimani, M. Balamurugan

Abstract-Automatic motion detection features are able to enhance surveillance efficiency and quality. The aim of this paper is to recognize and detect motion automatically around a robot's environment in order to equip a mobile robot for a surveillance task. The robot design has been partitioned into sensor, control, and planning subsystems. A robotic system has a drive chassis having a drive motor and a drive element to control both the robot movements and the rotation of wireless camera. Microcontroller PIC16F877 is designed to ensure that robot is always oriented towards desired position. The required information is based on the input obtained from a Charge Coupled Device (CCD) with battery of 12v. As the first step toward achieving the goal, it is necessary to have a mobile robot for the detection of motion of any-thing, any gas leakages and the presence of heat in that particular unstructured environment. REMOTEC is now commercializing the SURBOT technology on wheeled mobile robot for used in places such as nuclear power plants, atomic power plants and other hazardous environments.

Keywords: Sensors, PIC Microcontroller, stepper motor, CCTV.

I. INTRODUCTION

The word robot comes from the Czech word for forced labor, or serf. A robot is a reprogrammable, multifunctional manipulator designed to move materials, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks. Basically a robot consists of a mechanical structure, such as a wheeled platform, arm, or other construction, capable of interacting with its environment. Sensors to sense the environment and give useful feedback to the device. Systems to process sensory input in the context of the current situation and instruct the device to perform actions in response to the situation.

A. Characteristics of Robotics

Robots come in a tremendous variety of "sizes and flavors" such as Manipulator, Legged robot, wheeled robot, Autonomous underwater robot, unmanned aerial robot. The robot performs the Jobs that are dangerous, boring, stressful, or labor-intensive for humans. There are some essential characteristics that a robot must have and this might help us to decide what a robot is and what not a robot is. It will also help us to decide what features we need to build a machine before it can count as a robot.

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A robot has four essential characteristics:

Sensing: First of all, Robot would have to be able to sense its surroundings. A robot needs to move around its environment. Whether rolling on wheels, walking on legs.

Energy: A robot needs to be power itself. A robot might be solar powered, electrically powered, battery powered.

Intelligence: A robot needs some kind of "smarts." This is where programming enters the pictures. A programmer is the person who gives the robot its 'smarts.' The robot will have to have some way to receive the program so that it knows what it is to do.

Adaptability: Adaptability is where a certain robot can be used to carry out more than one task. A simple example is a robot being used to weld car bodies. If a different car body is to be manufactured, the program which controls the robot can be changed. The robot will then carry out a different series of movements to weld the new car body.

B. Laws of Robotics

Asimov proposed three "Laws of Robotics"

Law 1: A robot may not injure a human being or through inaction, allow a human being to come to harm.

Law 2: A robot must obey orders given to it by human beings, except where such orders would conflict with a higher order law.

Law 3: A robot must protect its own existence as long as such protection does not conflict with a higher order law.

C. Need for Robots

Often, robots are used to do jobs that could be done by humans. However, there are many reasons why robots are better than humans in performing certain tasks.

Speed: Robot may be used because they are FASTER than people at carrying out tasks. This is because a robot is really a mechanism which is controlled by a computer. Some robots actually MOVE more quickly than we can, so they can carry out a task such as picking up and inserting items, more quickly.

Hazardous (Dangerous Environments): Robots may be used because they can work in places where a human would be in danger. For example, robots can be designed to withstand greater amounts of Heat, Radiation, Chemical fumes, than humans could.

Repetitive Tasks: Sometimes robots are not really much faster than humans, but they are good at simply doing the same job over and over again. This is easy for a robot, because once the robot has been programmed to do a job once; the same program can be run many times to carry out a job many times. And the robot will not get bored as a human would.

Efficiency: Efficiency is all about carrying tasks without waste. This could mean not wasting time, not wasting materials, not wasting energy.

Accuracy: Accuracy is all about carrying out tasks very precisely. In a factory manufacturing items, each item has to be made identically. When items are being assembled, a robot can position parts within fractions of millimeter.

II. OPERATIONS INVOLVED IN SURVEILLANCE ROBOT

A. General Principles OF Surveillance Robot

Surveillance robot is to recognize and detect motion automatically around a robot's environment. The robot design has been partitioned into sensor, control, and planning subsystems. Robotic surveillance appliance is built on a moving platform designed for surveillance and security tasks. This robot can be operated in "remote eyes" or "automatic trip" modes. This means it can be steered remotely by a human watchman as a moving surveillance camera or it can drive autonomously along an undefined route, detecting all inconsistencies in the video input. Secret surveillance in tightly constrained spaces is demanded in many military and civilian activities, such as cave-in enemy raids and indoor hostage rescue missions.

These special applications require a kind of miniature mobile robot to function covertly in highly confined environments. In our approach, moving targets can be detected by the robot using motion detection sensor and wireless camera. To adapt to different lighting conditions, the target model is updated regularly based on an update mechanism.

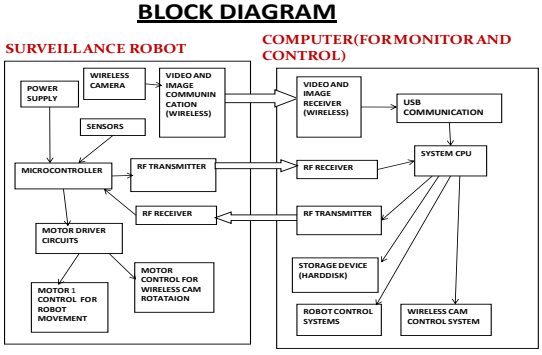
To ensure robust tracking, the robot detects abnormal human behavior by tracking the upper body of a person. To lower the false alarms by motion detection system, gas detector, fire sensor, metal detector directs the robot to the scene where events occur and the robot can employ its camera to further confirm the occurrence of the events.

B. General Block Diagram

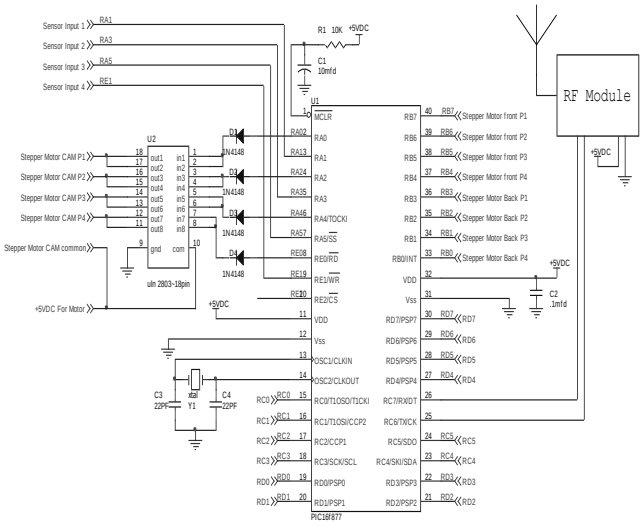
The robot structure consists basically of the robot body that includes arms and wheels. One of the most interesting aspects of robot in general is its behavior, which requires a form of intelligence.

The block diagram of our wireless surveillance robot consists of two parts

1. Robot block
2. Computer block



a. Block diagram



b. Circuit Diagram

C. Microcontroller PIC16F877

The 16F877 is one of the most popular PIC microcontrollers and it is easy to see why it comes in a 40 pin DIP pin-out and it has many internal peripherals. The 40 pins make it easier to use the peripherals as the functions are spread out over the pins. This makes it easier to decide what external devices to attach without worrying too much if there enough pins to the job. One of the main advantages is that each pin is only shared between two or three functions so it is easier to decide what the pin function

D. Sensors

A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. For accuracy, all sensors need to be calibrated against known standards.

A sensor is a device which receives and responds to a signal or stimulus. Here, the term "stimulus" means a property or a quantity that needs to be converted into electrical form.

Types of sensors used

1. Passive Infra Red sensor (Motion detector)
2. Gas sensor
3. Metal sensor
4. Fire sensor

1. Passive Infrared Sensor

A Passive Infra-Red sensor (PIR sensor) is an electronic device which measures infrared light radiating from objects in its field of view. Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall.

Design: Infrared radiation enters through the front of the sensor, known as the sensor face. At the core of a PIR is a solid state sensor or set of sensors, made from approximately 1/4 inches square of natural or artificial pyro electric materials, usually in the form of a thin film, out of gallium nitride (GaN), caesium nitrate (CsNO3), polyvinyl fluorides, derivatives of phenylpyrazine, and cobalt phthalocyanine. Lithium tantalate (LiTaO3) is a crystal exhibiting both piezoelectric and pyroelectric properties.

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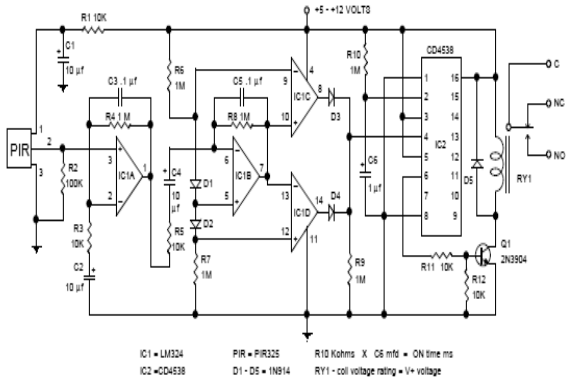
The sensor is often manufactured as part of an integrated circuit and may consist of one (1), two (2) or four (4) 'pixels' of equal areas of the pyro electric material. Pairs of the sensor pixels may be wired as opposite inputs to a differential amplifier.

In such a configuration, the PIR measurements cancel each other so that the average temperature of the field of view is removed from the electrical signal; an increase of IR energy across the entire sensor is self-cancelling and will not trigger the device. This allows the device to resist false indications of change in the event of being exposed to flashes of light or field-wide illumination. (Continuous bright light could still saturate the sensor materials and render the sensor unable to register further information.)

At the same time, this differential arrangement minimizes common-mode interference; this allows the device to resist triggering due to nearby electric fields. However, a differential pair of sensors cannot measure temperature in that configuration and therefore this configuration is specialized for motion detectors.



c. Motion sensor circuit

PIR-based motion detector: In a PIR-based motion detector, the PIR sensor is typically mounted on a printed circuit board which also contains the necessary electronics required to interpret the signals from the chip. The complete circuit is contained in a housing which is then mounted in a location where the sensor can view the area to be monitored. Infrared energy is able to reach the sensor through the window because the plastic used is transparent to infrared radiation (but only translucent to visible light). This plastic sheet prevents the introduction of dust and insects which could obscure the sensor's field of view.

A few mechanisms have been used to focus the distant infrared energy onto the sensor surface. The window may have Fresnel lenses molded into it. Alternatively, sometimes PIR sensors are used with plastic segmented parabolic mirrors to focus the infrared energy; when mirrors are used, the plastic window cover has no Fresnel lenses molded into it. A filtering window (or lens) may be used to limit the wavelengths to 8-14 micrometers which is most sensitive to human infrared radiation (9.4 micrometers being the strongest).

The PIR device can be thought of as a kind of infrared 'camera' which remembers the amount of infrared energy focused on its surface. Once power is applied to the PIR the electronics in the PIR shortly settle into a quiescent state and energize a small relay. This relay controls a set of electrical contacts which are usually connected to the detection input of an alarm control panel.

If the amount of infrared energy focused on the sensor changes within a configured time period, the device will switch the state of the alarm output relay. The alarm output relay is typically a "normally closed (NC)" relay, also known as a "Form B" relay.

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 was not 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 tries 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. Manufacturers recommend careful placement of their products to prevent false alarms. They suggest mounting the PIRs in such a way that the PIR cannot 'see' out of a window.

Although the wavelength of infrared radiation to which the chips are sensitive does not penetrate glass very well, a strong infrared source can overload the chip with enough infrared energy to fool the electronics and cause a false (non-intruder caused) alarm. A person moving on the other side of the glass however would not be 'seen' by the PIR.

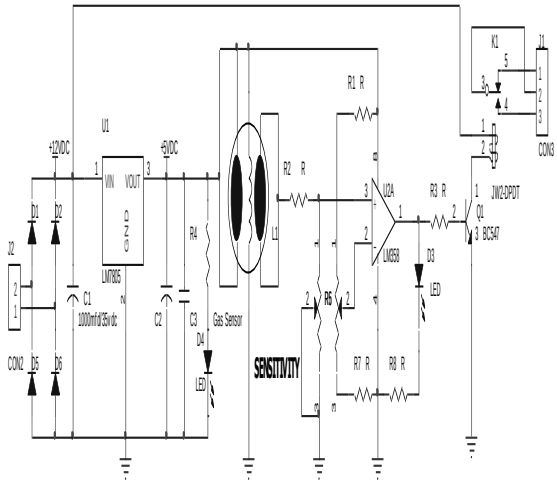
PIRs can have more than one internal sensing element so that, with the appropriate electronics and Fresnel lens, it can detect direction. Left to right, right to left, up or down and provide an appropriate output signal.

Features

- Detection range up to 20 feet away
- Single bit output
- Jumper selects single or continuous trigger output mode
- 3-pin SIP header ready for breadboard or through-hole projects
- Small size makes it easy to conceal

1. Gas Sensor

A gas sensor is a device which detects the presence of various gases within an area, usually as part of a system to warn about gases which might be harmful to humans or animals. Gas sensors can be used to detect combustible, toxic, and oxygen and CO_2 gases. A smoke detecting portion for detecting a smoke signal which changes in response to detect the smoke density to output it. Cryogenics such as liquid nitrogen (LN2), helium (He), and argon (Ar) can inert or deplete oxygen (02) in a confined space if a leak is present. A rapid decrease of oxygen can provide a very dangerous environment for employees, so it will also detect this type of oxygen. Ideal sensor for use to detect the presence of a dangerous gas leak in hazardous environment. This unit can be easily incorporated into the VB unit gives the visual indication of the poisonous gas concentration. The sensor has excellent sensitivity combined with a quick response time. The sensor can also sense iso-butane, propane, LNG and cigarette smoke



d. Gas sensor circuit

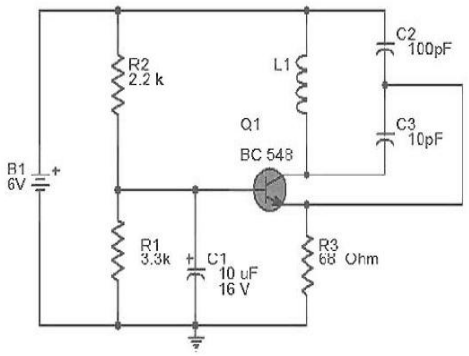
Features

Sensitivity : High
Detection Range : 100 - 10,000 ppm iso-butane propane
Fast Response Time : <10s
Heater Voltage : 5.0V
Dimensions : 18mm Diameter, 17mm High excluding pins,
Pins - 6mm high

2. Metal Sensor

Surveillance Robot allows for unprecedented target recognition at all hours to provide the ultimate protection from intrusion. This innovative technology consists of multiple integrated systems to make security more affordable than ever. In that ultimate task Metal detector play an important role. Metal-detector technology is a huge part of our lives, with a range of uses that spans from leisure to work to safety.

The metal detectors in airports, office buildings, schools, government agencies and prisons help ensure that no one is bringing a weapon onto the premises. Consumer-oriented metal detectors provide millions of people around the world with an opportunity to discover hidden treasures. A metal detector is a device which responds to metal that may not be readily apparent. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field.



e. Metal Sensor Circuit

If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces an alternating magnetic field of its own. If another coil is used to measure the magnetic field acting as a magnetometer, the change in the magnetic field due to the metallic object can be detected.

Modern top models are fully computerized, using integrated circuit technology to allow the user to set sensitivity, discrimination, track speed, threshold volume, notch filters, etc. and hole these parameters in memory for future use. These detectors are lighter, deeper- seeking, use less battery power and discriminate better.

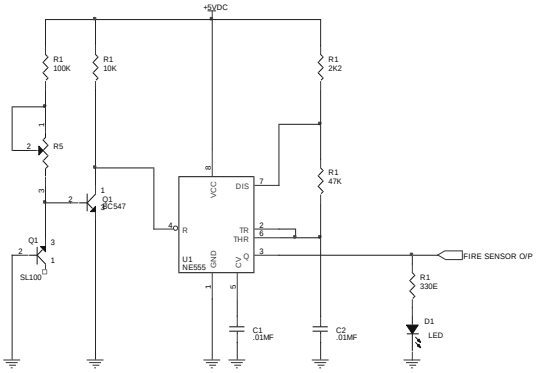
Features: Metal detector provides superior metal discrimination and detection. It automatically suppresses or eliminates electrical interference associated with x-ray devices, video monitors and communications equipment, helping to reduce the likelihood of nuisance alarms and ultimately improving traffic throughput.

The detector is highly portable and can be operated by remote console or a battery pack as needed. The Metal Detector has a unique coil design offering a multidimensional detection field with total uniformity both horizontally and vertically.

3. Fire Sensor

Fire sensor works at specific ranges, which uses optical sensors to record the incoming radiation at a particular wavelength. The energy radiated from the flame is electromagnetic radiation and it can be identified at various spectral ranges like UV, IR and VIS. Fire sensor has a cone of vision that defines the effective capability of sensing fire. It is inefficient for slow fires however it responds faster for rapidly developing fire like combustible gas and liquid.

A fire sensor comprising an internal temperature detecting portion for detecting an internal temperature of the sensor to output it. A fire sensor calculates temperature difference, which indicates a rate of temperature rise when the sensor receives heat generated by a fire, between the external temperature and a pseudo output.



f. Fire sensor circuit

In the fire detecting method using the temperature sensor, there is a method utilizing a differential element which can detect a rate of temperature rise relative to the time and then decide the fire based on the rapid temperature rise.

According to the fire detecting method utilizing the differential element, because the smoke detection sensitivity is decreased at the time of the slow temperature rise whereas the smoke detection sensitivity is increased at the time of the quick temperature rise, the fire can be detected without fail even if a smoke density is low. However, in the fire detecting method utilizing the differential element, if the hot air of the heating, etc.

blows directly against the fire sensor irrespective of the low room temperature, the smoke detection sensitivity is increased due to the rapid temperature rise. Therefore, the smoke generated by the causes other than the fire is judged as the fire, and hence it may be also a cause of the non-fire alarm.

Features

- Heat sensors are designed to detect a rapid rise in temperature.
- Minimum and maximum temperature memory
- Temperature trend indicator
- Humidity

E. Stepper Motor

A stepper motor is an electromechanical device that converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in proper sequence.

The motor rotation has several direct relationships to the applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shaft rotation is directly related to the frequency of the input pulses.

Stepper motors are either bipolar, requiring two power sources are a switchable polarity power source, or uni-polar requiring only one power source. They are powered by DC current sources and require digital circuitry to produce the coil energizing sequences for rotation of the motor. Feedback is not always required for control, but the use of an encoder or other position sensor can ensure accuracy when it is essential.

A stepper motor's shaft has permanent magnets attached to it, together called the rotor. Around the body of the motor is a series of coils that create a magnetic field that interacts with the permanent magnets.

Stepper motor, however, behave differently than standard DC motors. They cannot run freely by themselves. Stepper motors do as their name suggests, they "step "a little bit at a time.

Stepper motors also differ from DC motors in their torque-speed relationship. DC motors generally are not very good at producing high torque at low speeds, without the aid of a gearing mechanism.

Stepper motors, on the other hand, work in the opposite manner. They produce highest torque at low speeds. Stepper motors also have other characteristics, holding torque which is not present in DC motors.

Holding torque allows a stepper motor to hold its position firmly when not turning. This eliminates the need for a mechanical brake mechanism. When the coils are turned on and off the magnetic field cause the rotor to move. As the coils are turned on and off in a certain sequence the motor will rotate forward or reverse.

To make the stepper motor rotate, you must constantly turn on and off the coils. This ability to stay put at one position rigidly is often an advantage of stepper motor. The torque at standstill is called the holding torque.

Working Principle: The stepper motor we used for robot movement and wireless camera rotation is unipolar stepper motor. These have two center-tapped coils, which are treated as four coils. Six-wire motors bring out each center-tap separately.

The two center taps need to be connected externally to form one connected to a positive motor power supply. Unipolar motors may be connecting as bipolar ones by not using the positive wires.

This stepper motor is connected to the controller by two modes

1. Independent mode
2. Computer controlled mode.

We enhanced our robot movement and wireless camera rotation with computer controlled mode. In this computer controlled mode use two switch relay interfaced with MCLR and RA0 of PIC microcontroller this will act as set reset for the microcontroller, the necessary frequency to run stepper motor is provided by using crystal oscillator connected to OSC1/CLK1.

Connecting the motor with microcontroller is important because it cause any errors; use a multimeter to measure the resistance between pairs of wires and layouts. Connect the wires to terminal block and apply power. Make sure that the switches are in set condition with microcontroller. By properly executing this condition motor starts to rotate.

Technical Specifications

Working voltage : Positive 6-12v DC (for kit).
Motor voltage : 8-40v DC.
Maximum current: 100mA for circuit, Up to 6A for motor.

Features

Stepper motors are not just rated by voltage. The following are its feature

1. Voltage: Stepper motor usually has a voltage rating. Exceeding rated voltage is sometimes necessary to obtain the desired torque from a given motor, but doing by this may produce excessive heat and/or shorten the life of the motor.

2. Resistance: Resistance-per-winding is another characteristic of a stepper motor. This resistance will determine current drawn by the motor, as well as affect the motor's torque curve and maximum operating speed.

3. Degrees per step: This is often the most important factor in choosing a stepper motor for a given application. This specifies the number of degrees the shaft will rotate for each step.

Advantages

- low cost
- Ruggedness
- Simplicity in construction
- High reliability
- No maintenance
- Wide acceptance
- No feedback components are needed
- They work in just about my environment
- Inherently more failsafe than servo motors
- The rotation angle of motor is proportional to input pulse.
- The motor has full torque at standstill
- Precise positioning and repeatability of movement since good stepper motors have an accuracy of 3-5%of a step and this error is non-cumulative from one step to next.
- Excellent response to starting, stopping, reversing.

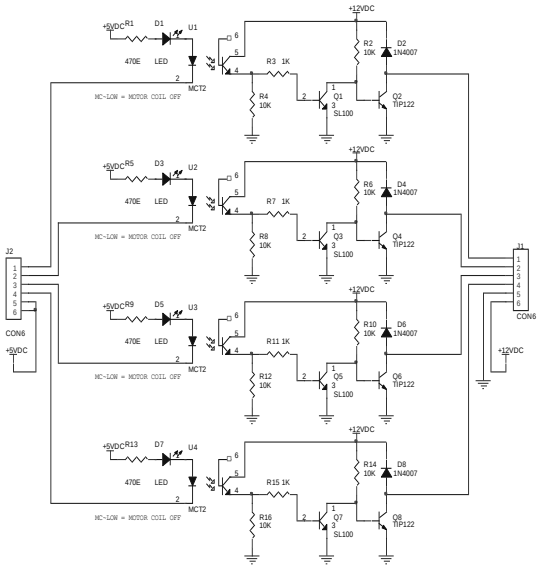
F. Driver Circuit

The driver circuit is the link between digital circuitry and mechanical action. The computer sends out binary commands, and high powered actuators do stuff.

Most often driver circuits are used to control rotational direction of DC motors. And unless you buy a potentially expensive motor-driver, we need the driver circuits to control any robot with a motor.

Driver Circuit for Robot Movement

There are several types of transistors, such as the SL100 , TIP122and optocouplers are used .The purpose of using optocoupler is to avoid the effects of back emf on microcontroller produced by stepper motor.



g. Driver circuit for robot movement

These are two control lines which we apply this logic voltage to. Since you have two pins, and only a binary control, there are four possible things that can happen.

J2=0 ; j1=0 : Nothing happens, the motor is turned off
J2=1 ; j1=0 : Motor rotates clockwise
J2=0 ; j1=1 : Motor rotates counterclockwise
J2=1 ; j1=1 : Circuit explodes into pretty sparks

This driver circuit supplies timing pulses to the stepper motor in a sequential order, guided by microcontroller. The frequency of these pulses controls the speed of the stepper motor. Here the output of TIP122 transistor has low on-resistance and can deliver up to 6A each without needing a heat sink.

Driver Circuit for Camera Rotation

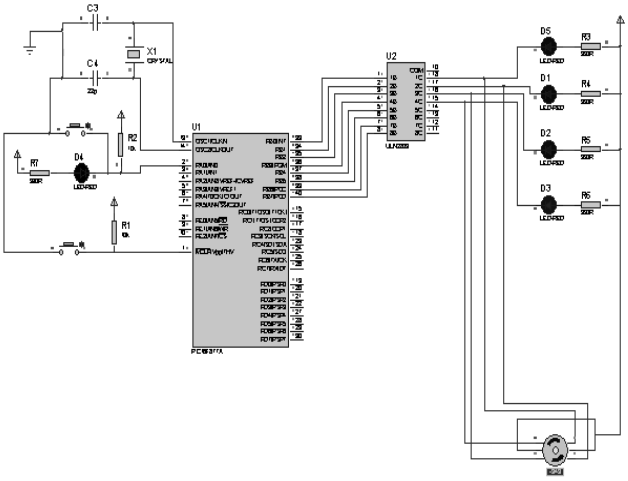
To control the speed of stepper motor which is used in wireless camera rotation we used ULN2803 IC as a driver circuit.

ULN2803 consists of eight NPN Darlington transistors in this family of arrays are ideally suited for interfacing between low logic level digital circuitry such as TTL, CMOS or PMOS/NMOS and the higher current/voltage requirements of lamps, relays, printer hammers or other similar loads for a broad range of computer, industrial, and consumer applications. All devices feature open–collector outputs and freewheeling clamp diodes for transient suppression.

The ULN2803 is designed to be compatible with standard TTL families while the ULN2804 is optimized for 6 to 15 volt high level CMOS or PMOS.

The ULN2803 is designed to be compatible with standard TTL families while the ULN2804 is optimized for 6 to 15 volt high level CMOS or PMOS.

The ULx2803A/LW and ULx2804A/LW are the standard Darlington arrays. The outputs are capable of sinking 500 mA and will withstand at least 50 V in the OFF state. Outputs may be paralleled for higher load current capability. The ULx2823A/LW will withstand 95 V in the OFF state.



h. Driver circuit for Camera rotation

Features

- TTL, DTL, PMOS, or CMOS Compatible Inputs
- Output Current to 500 mA
- Output Voltage to 95 V
- Transient-Protected Outputs

G. Video and Image Transmission

In our project, live video transmission is carried out by video capturing device -wireless camera, and with video perception device- TV tuner.

Wireless Video System: Wireless video systems are able to manage multiple devices throughout an unknown environment by sending or receiving information wirelessly. This reduces the clutter and installation associated with wires and cords. There are two main uses for these systems: entertainment and security.

Wireless video systems are particularly useful for surveillance systems because they also do not use wires to transmit information. Wireless video security systems often employ several different devices, including fire sensors, motion sensors, and more. But by far most useful device in a wireless video system is the cameras. These cameras can be equipped to capture images and then transmit them to a central device that will either store the information or burn it onto a DVD otherwise it will store it in appropriate memory spaces. These cameras can be equipped with infrared or night vision as well.

Closed-circuit television (CCTV) is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors. It differs from broadcast television, In that the signal is not openly transmitted, though it may employ point to point wireless links.

CCTV is often used for surveillance in areas that may need monitoring such as banks, casinos, airports, military installations, and convenience stores.

CCTV equipment may be used to observe parts of a process from a central control room; when, for example, the environment is not suitable for humans.

CCTV systems may operate continuously or only as required to monitor a particular event. A more advanced form of CCTV, utilizing Digital Video Recorders (DVRs), provides recording for possibly many years, with a variety of quality and performance options and extra features (such as motion-detection and email alerts).

Motion Detector Recording –recording only when something is happening. This allows you to record more on a smaller sized hard drive and eliminates the old-fashioned notion of searching through hours of footage to find a few minutes of action.

Video Perception Device: Video perception device is TV tuner for establishing communication between wireless camera and PC; it also consists of antenna to receive the signals from wireless camera. This process is done by using video capture cards.

Video Capture Cards: Video capture cards are a class of video capture devices designed to plug directly into expansion slots in personal computers and servers.

These cards typically include one or more software drivers to expose the cards' features, via various operating systems, to software applications that further process the video for specific purposes. As a class, the cards are used to capture baseband analog composite video, S-Video, and, in models equipped with tuners, RF modulated video. Some specialized cards support digital video via digital video delivery standards including Serial Digital Interface (SDI) and, more recently, the emerging HDMI standard. These models often support both standard definition (SD) and high definition (HD) variants.

While most PCI and PCI-Express capture devices are dedicated to that purpose, AGP capture devices are usually included with the graphics adapted on the board as an all-in-one package. Unlike video editing cards, these cards tend to not have dedicated hardware for processing video beyond the analog-to-digital conversion. Most, but not all, video capture cards also support one or more channels of audio.

There are many applications for video capture cards including converting a live analog source into some type of analog or digital media, (such as a VHS tape to a DVD), archiving, video editing, scheduled recording, television tuning, or video surveillance.

The cards may have significantly different designs to optimally support each of these functions. One of the most popular applications for video capture cards is to capture video and audio for live Internet video streaming. The live stream can also be simultaneously archived and formatted for video on demand. The capture cards used for this purpose are typically purchased, installed, and configured in host PC systems by hobbyists or systems integrators. Some care is required to select suitable host systems for video encoding.

H. RF Modem

Communication between robot and PC is bidirectional communication, which takes place by RF modem.We used RF Modem of 9600 bps Serial TTL Level can be used for applications that need two way wireless data transmission. It features high data rate of 9600 bps fixed and longer transmission distance 100m.

The communication protocol is self-controlled and completely transparent to user interface. The module can be embedded to your current design so that wireless communication can be set up easily.

Operation: Module works in half-duplex mode. Means it can either transmit or receive but not both at same time. Module has packet buffer of 128 bytes. When receiving 128 Bytes from the serial port, it will send data out at once. If the data package received is below 128 Bytes, the module will wait for about 30 ms and then send it. In order to send data immediately, 128 Bytes data per transmission is necessary.

After each transmission, module will be switched to receiver mode automatically. The switch time is about 5ms. The LED for TX and RX indicates whether module is currently receiving or transmitting data. The data sent is checked for CRC error if any, the transmitter sends out data up to 15 times till data is correctly received. RX-IN Receive Input serial data at 9600 bps of 3 to 5V logic level, usually connected to TXD pin of microcontrollers. TX-OUT Transmit Output serial data at 9600 bps of 3V logic level, usually connected to RXD pin of microcontrollers. GND Ground level of power supply. +5V Power Supply Regulated 5V supply input.

Features

- Automatic switching between transmitter and receiver mode.
- FSK technology and half duplex mode is robust to interference.
- 433 MHz band is used so there is no need to apply frequency usage license.
- Protocol translation is self controlled, easy to use.
- High sensitivity, long transmission range.
- Standard UART interface, TTL (3-5V) logic level.
- Very reliable, small size, easier mounting.
- No tuning required, PLL based self tuned.

Application

- Remote control
- Remote measurement system
- Weather stations
- Sensor Networks

I. USB Communication

USB communications device class (or USB CDC) is a composite Universal Serial Bus device class. It provides a single device class, but there may be more than one interface implemented such as a custom control interface, data interface, audio, or mass storage related interfaces. The communication device class is primarily used for modems. However it also supports ISDN and fax machines. It also supports plain telephony applications for performing regular voice calls.

Additionally this device supports computer networking to a network card, providing interfaces for transmitting Ethernet or ATM frames onto some physical media. This class is generally implemented in embedded systems like mobile phones to achieve more than one functionality from the device, so that a phone may be used as a modem, fax or network port. The data interfaces are generally used to perform bulk data transfer.

J. Applications of Surveillance Robot

- Used to detect motion and happenings that takes place in high jacked environment
- Used in nuclear power plants and other hazardous environments
- Automatic motion detection for underground coal mining.
- To detect and visualize the motions in mars, moon and widely used in space research.
- To detect the motion in Earthquake affected areas.

III. RESULTS

The motion detection in any unstructured environment, it means that the environment where man cannot adapt is done by motion detection sensor and for supporting purpose we had added gas sensor, fire sensor and metal detector because of these sensors, any poisonous gas, smoke in that environment must comes under the knowledge of user.

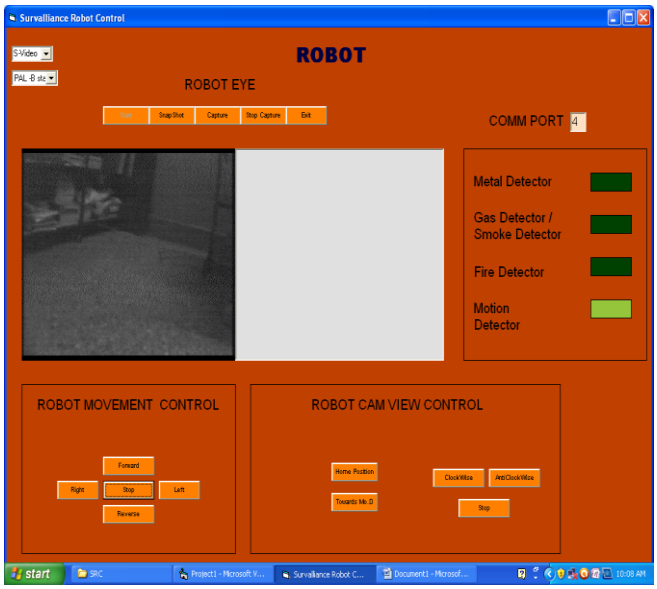
Fire which is the huge source of destruction can also be indicated in our Visual Basic screen, so user can take suitable measures for this type of problem.

In detecting any metal objects such as gun rocket launcher which is the equipment's of destroying human lives can also be detected and user can gain about the presence of these objects in the supposed areas.

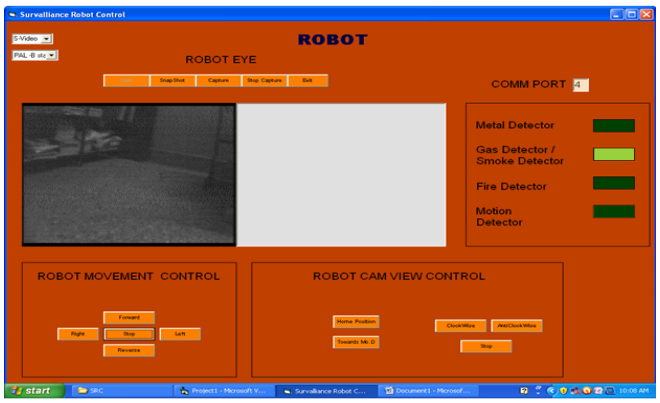
Because live video transmission carried out by video transmission device which is wireless cameras and video perception device, we can watch live happenings in that particular environment. And due to this arrangement only we can equip our robot in the area which is invisible to the user.

Thus the surveillance robot is perfectly adoptable with the high jacked Environment with all its above features.

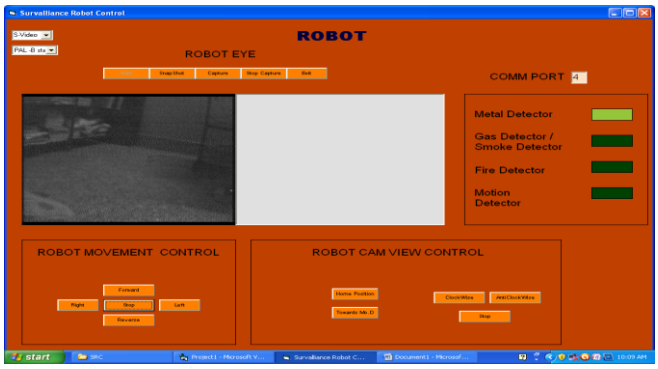
SNAP SHOT - MOTION DETECTION



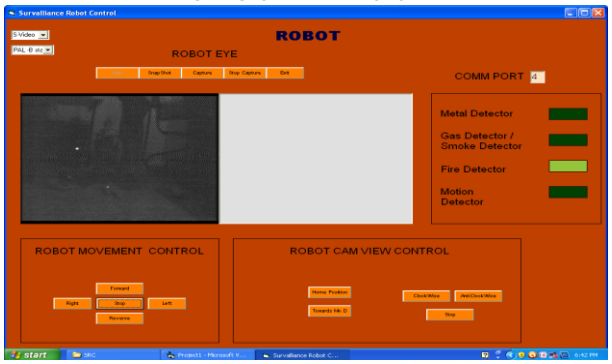
SNAP SHOT - GAS DETECTION



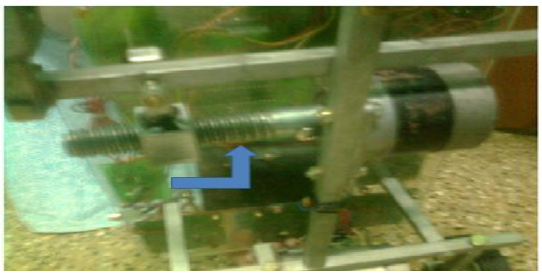
SNAP SHOT - METAL DETECTION



SNAP SHOT - FIRE DETECTION



FRONT WHEEL SETUP



RIGHT TURN

LEFT TURN

BACK WHEEL SETUP

IV. CONCLUSION

The PIC16F77 microcontroller not only controls all the hardware components of the system, it also communicates with Visual Basic interface through a RF communication using Profilic USB communication port. Sensors effectively identify the motion, gas, fire and metals promoting surveillance features. Also designing a Visual Basic interface is intuitive enough for the user to control the robot in an effective manner.

A. Future Scope

There are a number of improvement and modification that can be designed and increase real world application practically and functionally, they are:

By adopting the aeronautical mechanism in our surveillance robot, it can act as a flying robot. The robot uses RF communication for simpler task; tis should be changed by wireless communication using GSM technology. Further the communication between PC and the robot can be promoted by utilizing the principles of Wi-Fi.

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