

## **Design and Development of Multitasking Robot for Safety and Security Applications**

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### **ABSTRACT:**

A robot is “An autonomous device that performs functions normally ascribed to humans or a machine in the form human.” Generally, it is machine that functions in spite of a living person. Robots are used for special applications like handling hazardous situations and tasks that need high accuracy and speed. A danger event is normally happened by the negligence of humans. To implement real time inspection and surveillance of the border security, intelligent remote monitoring system is developed. The proposed work presents designing and development of a multipurpose intelligent robot using wireless camera detecting alive humans, metals, obstacles, at remote areas and send information to main location. The proposed system uses machine intelligence to provide immediate response from sensors. The robot system is equipped with sensors those can alert the user when some anomaly appears within the range while robot is working.

Any living thing which can move is detected by PIR sensor and immediately the information is transmitted to control section . If any metal is present nearby the robot it is detected by metal detector and information is passed to control section .Accelerometer measures accelerations (change of speed / tilt / motion) of the robot and sends the information to control. If the light intensity is reduced based on the sensor value the lighting system will be switched on condition. . A GPS receiver is used In order to know the location of the robot. Mobile jammer is used to prevent cellular phones from receiving signals from base stations. When used, the jammer effectively disables cellular phone . A ultrasonic sensor is used for automatic navigation of the robot and also it is used for obstacle detection. A Wireless camera is used for video monitoring in the control section.

### **Key Words:**

LPC2148, ZIGBEE, GPS, temperature sensor, metal detector, PIR sensor

### **Introduction:**

The main feature of this robot differentiating it from others multiple tasks and execution of versatile tasks in night and rough areas. This whole robot system works in two modes. Mode one is automatic mode and the other is user controllable mode. By default, robot works in automatic mode in which all sensors like human detecting sensor, temperature sensor, metal detecting sensor, obstacle detecting sensor, Ultrasonic sensor, wireless AV camera , GPS receiver are functional for automatic action. The movement of robot in automatic mode is controlled through obstacle detecting sensor. In user controllable mode, user sends the signal to robot using Zigbee module and controls it manually. User could watch the surroundings through wireless camera built in the robot and gives directions to change the path accordingly. In both modes, user could hear the talk of humans at the border areas with the help of microphone in wireless camera.

### **I.The Hardware System:**

**Micro controller:** This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

### **ARM7TDMI:**

ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs.

**Liquid-crystal display (LCD)** is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock.

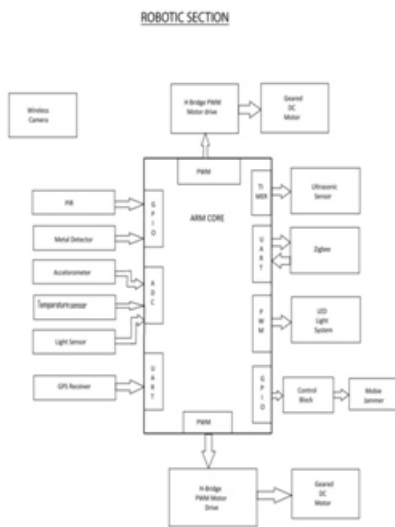


Fig: Robotic section

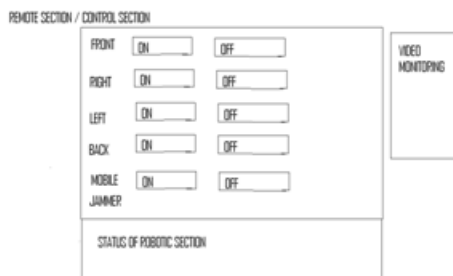


Fig: Remote section

## II. Board hardware resource features ZIGBEE:

Zigbee modules feature a UART interface, which allows any microcontroller or microprocessor to immediately use the services of the Zigbee protocol. All a Zigbee hardware designer has to do in this case is ensure that the host's serial port logic levels are compatible with the XBee's 2.8- to 3.4-V logic levels. The logic level conversion can be performed using either a standard RS-232 IC or logic level translators such as the 74LVTH125 when the host is directly connected to the XBee UART. The below table gives the pin description of transceiver. The X-Bee RF Modules interface to a host device through a logic-level asynchronous Serial port.

Through its serial port, the module can communicate with any logic and voltage Compatible UART; or through a level translator to any serial device. Data is presented to the X-Bee module through its DIN pin, and it must be in the asynchronous serial format, which consists of a start bit, 8 data bits, and a stop bit. Because the input data goes directly into the input of a UART within the X-Bee module, no bit inversions are necessary within the asynchronous serial data stream. All of the required timing and parity checking is automatically taken care of by the X-Bee's UART.

### GPS:

The Global Positioning System (GPS) is a satellite-based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides you with information. Using GPS technology, you can determine location, velocity, and time, 24 hours a day, in any weather conditions anywhere in the world—for free. GPS, formally known as the NAVSTAR (Navigation Satellite Timing and Ranging). GPS technology requires the following three segments. They are Space segment, Control segment, User segment .

### Space Segment:

At least 24 GPS satellites orbit the earth twice a day in a specific pattern. They travel at approximately 7,000 miles per hour about 12,000 miles above the earth's surface. These satellites are spaced so that a GPS receiver anywhere in the world can receive signals from at least four of them.

### Control segment:

The control segment is responsible for constantly monitoring satellite health, signal integrity, and orbital configuration from the ground control segment includes the following sections: Master control station, Monitor stations, Ground antennas.

### User Segment:

The GPS user segment consists of your GPS receiver. Your receiver collects and processes signals from the GPS satellites that are in view and then uses that information to determine and display your location, speed, time, and so forth.

Your GPS receiver does not transmit any information back to the satellites.

## PIR sensor:

A Passive Infra Red sensor (PIR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view. PIR sensors are often used in the construction of PIR-based motion detectors (see below). 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. All objects emit what is known as black body radiation. It is usually infrared radiation that is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The term passive in this instance means that the PIR device does not emit an infrared beam but merely passively accepts incoming infrared radiation. “Infra” meaning below our ability to detect it visually, and “Red” because this color represents the lowest energy level that our eyes can sense before it becomes invisible. Thus, infrared means below the energy level of the color red, and applies to many sources of invisible energy.



**Fig: PIR Sensor**

## Temperature sensor:

A thermistor is a type of resistor whose resistance is dependent on temperature. Thermistors are widely used as inrush current limiter, temperature sensors (NTC type typically), self-resetting overcurrent protectors, and self-regulating heating elements. The TMP103 is a digital output temperature sensor in a four-ball wafer chip-scale package (WCSP). The TMP103 is capable of reading temperatures to a resolution of 1°C.



**Fig: Temperature sensor**

## Accelerometer:

Micro-Electro-Mechanical Systems (MEMS) is the integration of mechanical elements, sensors, actuators, and electronics on a common silicon substrate through microfabrication technology. While the electronics are fabricated using integrated circuit (IC) process sequences (e.g., CMOS, Bipolar, or BICMOS processes), the micro-mechanical components are fabricated using compatible “micromachining” processes that selectively etch away parts of the silicon wafer or add new structural layers to form the mechanical and electromechanical devices. An accelerometer is an instrument for measuring acceleration, detecting and measuring vibrations, or for measuring acceleration due to gravity (inclination). Accelerometers can be used to measure vibration on vehicles, machines, buildings, process control systems and safety installations. They can also be used to measure seismic activity, inclination, machine vibration, dynamic distance and speed with or without the influence of gravity.

## MEMS ACCELEROMETER :

Another kind works with the capacitance and the changes initiated within it as a result of some accelerative force. This technology is used from automotive industry to agriculture industry and from NASA to military researches and operations.

## Metal detector:

A metal detector is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. Another common type are stationary “walk through” metal detectors used for security screening at access points in prisons, courthouses, and airports to detect concealed metal weapons on a person’s body. 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.

If a piece of electrically conductive metal is close to the coil, eddy currents will be induced in the metal, and this produces a 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.

## Light sensor:

The light sensor enables a robot to detect light. Robots can be programmed to have a specific reaction if a certain amount of light is detected. The light sensor uses a cadmium sulfoselenide (CdS) photoconductive photocell. The CdS photocell is a photo resistor, meaning that its resistance value changes based on the amount of incident light. The light sensor can give the robot vision and make it easier for it to operate autonomously. The light sensor allows the robot to follow a light source, such as a beam of light from a flash light or similar.



Fig: Light sensor

## Ultrasonic sensor:

The sensor is primarily intended to be used in security systems for detection of moving objects, but can be effectively involved in intelligent children's toys, automatic door opening devices, and sports training and contactless-speed measurement equipment. Infrared sensors are characterized by high sensitivity, low cost and are widely used. But, these sensors can generate false alarm signals if heating systems are active or temperature change speed exceeds some threshold level. Moreover, infrared sensors appreciably lose sensitivity if small insects penetrate the sensor lens. Ultrasound motion detection sensors are characterized by small power consumption, suitable cost and high sensitivity. That is why this kind of sensor is commonly used in home, office and car security systems. Existing ultrasound sensors consist of multiple passive and active components and are relatively complicated for production and testing. Sensors often times require a laborious tuning process.



Fig: Ultrasonic sensor

## Mobile jammer:

The Room Cell Phone Jammer is an instrument to prevent cellular phone receiving and transmitting signals from the base station. Specially for personal usage anywhere. These can prevent secret information leakage through your mobile phone. It only shields the signals of mobile phone and does not effect the normal operation of other electronic devices. These also helps in the prevention of noise pollution generated by mobile phones.



Fig: Mobile jammer

## DC Motor:

A DC motor relies on the fact that like magnet poles repel and unlike magnetic poles attract each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.

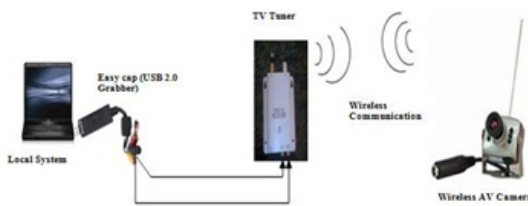


Fig: DC Motor

## Wireless AV Camera:

It is a small sized camera and having delicate appearance, good performance with high-quality picture and sound transmitting and receiving.

supports minimum of 100m transmission distance without block and can be used on TV, monitor, LCD, etc. including adaptive bracket and supports easy installation. Wireless video communications are shown in fig 12. The AV signal from the camera is sent to the TV tuner which is connected to the local system through the easy cap (USB 2.0 Grabber). The Audio-Video streaming is done at the local and also at the remote system.



**Fig: Wireless video communication**

### III.CONCLUSION:

The project “Design and development of multitasking robot for safety and security applications” has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC’s and with the help of growing technology the project has been successfully implemented.

### IV.FUTURE SCOPE :

Other wireless technologies like Wi-Fi or Bluetooth can be used as communication protocol instead of Zigbee technology. Touch screen/Voice based robot control can also be used in future to make the system sophisticated.

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