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Research Article

ROBOT FOR SURVEILLANCE AND IMPLEMENTATION

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Abstract

The main objective of this work is to design and implement a remote sensing and monitoring system on a mobile robot with obstacle avoidance capability in unreachable area. A simple mobile robot prototype with onboard sensors is constructed for the surveillance of the surrounding environment. Tele-operation of such a mobile robot is a challenging task that requires an efficient interface and reliable real-time robot control to avoid obstacles. The proposed system enables the user to send commands to remote station and receive scanned data and images from the environment through the internet and mobile DTMF signal. The proposed system has hardware and software to obtain the suitable design parameters. Then, real experiments have been achieved to demonstrate the system performance including the tele-operation of mobile robot navigation, IR sensor to avoid obstacles, and real time sensing and monitoring in unreachable area.

Keywords: Robot, DTMF,Surviellance

I. Introduction

An Off-shore robot performs with a high degree of autonomy, which is particularly desirable in fields such as space exploration, cleaning floors, mowing lawns, surveillance purpose. Some modern robots are "off-shore" within the strict confines of their direct environment. It may not be that every degree of freedom exists in their surrounding environment, but the off-shore robot's workplace is challenging and can often contain chaotic, unpredicted variables. The exact orientation and position of the next object of work and even the type of object and the required task must be determined. An off-shore robot may also learn or gain new knowledge like adjusting for new methods of accomplishing its tasks or adapting to changing surroundings. Off-shore robots do not require regular maintenance, as other machines do.

II. Existing System

GPRS-Based Remote Sensing and Teleoperation of a Mobile Robot

This work was carried out by Kasim M. Al-Abidy, Mohammad M. Ali, Ahmad M. Derbis, and Abdullah W. Ak-Mutari. Their project was completely based on the features of obstacle avoidance and DTMF. The project executed using the IP cameras for a live relay which performs the live relay and controlling the movement of the robot using the DTMF signal. But obstacle avoidance is not achieved.

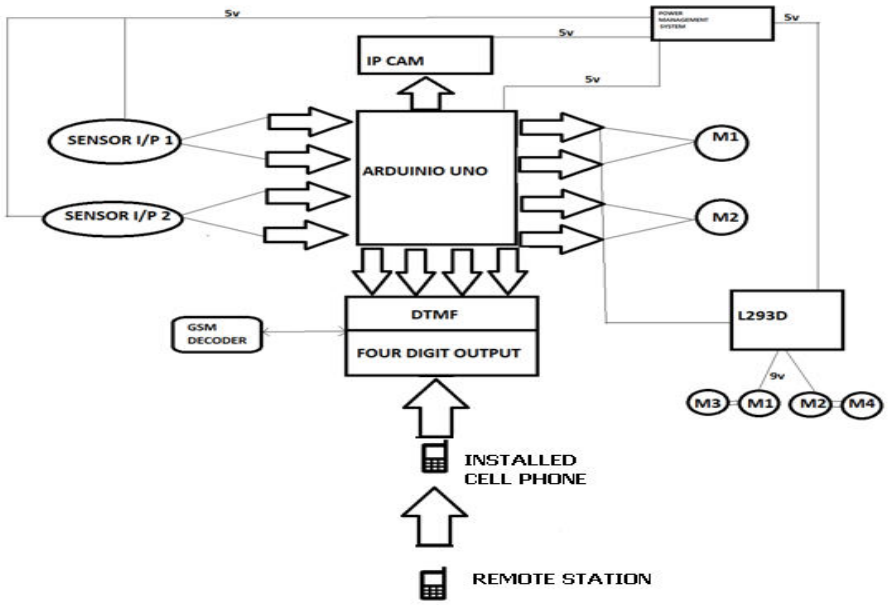
In the prevailing system the entire process would be controlled and sensed using the ultrasonic sensors and GPS separately which are very costly and are not preferable for a minimum level purpose. They used an ordinary microcontroller which performs very limited functions. They have performed the operations using the controller interfaced with the DTMF alone so that the obstacles are only detected they are not subjected to change their motion automatically.

The main objective of this work is to design a robot and implement it with features of live relay monitoring mounted a mobile robot controlled from a remote station. They used the tele-operation for which the DTMF signal is used for controlling the robot. The prevailing system consists of hardware and PROTUD development software to obtain the suitable parameters. The microcontroller is used only for the motion control of the mobile robot and separate connection for the IP camera. When there is a situation of smoke or improper vision the camera would go blind and the operation of live relay can become useless. One of the main feature of the mobile robot is obstacle avoidance is not achieved by the prevailing system.

III. Proposed System

The paper focuses on discussing a robot for survey and implementation purpose at off shore as well as common environment using mobile remote sensing. In our day to day surveillance and implementing is always been an essential thing. When emergency situation arises, sending human for surveying to a remote place which is dangerous task for human, a simple robot can be sent. The proposed system gives an idea of creating a robot especially for survey and implementation purpose at a bizarre situation. Making a costly robot for easily damageable environment is not a good productions idea. The mobile phone, IP camera, IR sensors are used for this purpose, so a cheap and effective robot which is completely user friendly is designed which do not require highly qualified technical to operate it. Moreover it

requires only a mobile phone and a PC or smart phone with internet connection. It helps the user to operate it from any part of the world with minimum care. It helps the human getting involved in a dangerous environment such as nuclear power plants, buildings under fire, terrorist spy cam, rigs, caves, canals, where humans are not allowed beyond some limits. The off shore industries would make use of these kind of robots in a very much useful areas, since humans are not preferred for surveillance purpose at a difficult environment like smoke, radiation, darkness, over heat, slippery parts, low level roof areas etc,.



1.1 Block Diagram Representation

III. Working

A call made from any part of the world to the mobile phone installed in the robot. The complete system starts to function once the call is received. The DTMF signal received through the specific numerical pads are received and the motor drivers are started to control.Arduino uno and Atmega microcontroller boards are used for IR sensor interfacing and IP camera, DTMF interfacing with driver modules. Once a call is made, the received DTMF signals controls the DC motors in the respective directions, The IP camera starts a live relay shown through the internet application viewed from smart phones and computers. The IR sensors are used to avoid obstacles even when there is a motion control command.

IV. Materials and Methods:

The microcontroller used here is Arduino UNO board which is specifically designed for robots. The UNO board is for interfacing the IR sensor for obstacle avoidance and also for interfacing them along with the DC motor for stopping and

turning the mobile robot without hitting the obstacle. It requires its own software coding to be installed via USB cable in it interfacing it with the PC.

IR Sensors works by using a specific light sensor to detect a particular wavelength of light in the Infra-Red (IR) spectrum. An LED is used to emit light with an intensity so as to receive the light by the sensor. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.

The IR sensors detect the obstacle at a range of 3 cm since it is a prototype. The IR sensors are installed at the front end of the mobile part of the robot. Both the sensors are switched ON when the robot is at ON state, so that it would automatically search of obstacle to get a clear way to precede its operation. The left IR sensor is in link with the two DC motors of the left wheel where as the right IR sensor is in link with the right side DC motors. So that the IR sensor would make the wheel stop and take a turn when there is any obstacle detected.

V. Working

There are two sensors fixed at the front of the robot base. AS thee DTMF signal is receivedthe DC motor moves in the instructed direction and axis. If an obstacle is detected at the Left sensor, it turns off the interface of that sensor alone with the driver module so that the DC motors enhancing this sensor alone would stop their function and Vice versa for the right side sensor. The IR sensor completely performs their action in logical function alone (1 and 0). Since the IR sensor is interfaced with the Arduino UNO microcontroller, all the commands received by the robot through DTMF is now made to be suppressed when the IR sensor detects an obstacle.

When it receives an obstacle detection signal the Arduino UNO would break the command existing and would perform the operation according to the program saved in it to take a turn and move further or to stop its movement.

IR sensors are the complete responsible for the obstacle avoidance feature of the robot. Because their other end of their sensors is connected with the MCB Atmega 32 which is also interfaced with the L293D required for motor driving purpose.

Once an obstacle is detected the connection with the motor drier of that particular sensor will be cut off. So that the wheels is in contact with that alone would stop its action where the other set of wheels and the IR sensor continues their work. If it is repeated once again the process would continue repeatedly until the DTMF function ends.

VI. IR-UNO Interfacing Steps

Step1- takes 2 IR transmitters and 2 IR receivers

Step2- connects their terminals in the breadboard where the 5v connection is made with them from the Arduino board.

Step3- makes sure the coding is done before after the connections are made perfectly.

Step4- now enter the coding and make them interfaced with the USB port from the system.

Step5- run the process

Step6- check for the output i.e., makes an obstacle within 20cm. The output will be the light turning off when an obstacle is detected

Step7- now remove them and wire them distinctly and make them fixed with the base of the robot and their terminals are connected to the Arduino UNO board.

Once their supplied with power from the lithium ion battery their functions would start to execute. No mean whatever the instruction given from the remote station. Their main function will become as avoiding obstacle.

But since they are also interfaced with the L293D they automatically become responsible for the driver module also. Because, the main objective of the project is to avoid obstacle and to continue their process ahead with the instruction given by the remote station.

VIII. Camera and Its Working

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 "net cam" is usually applied only to those used for surveillance. The first centralized IP camera was Axis Net eye 200, released in 1996 by Axis Communications.

The camera is mounted on a stand and then they are fixed on the base of the robot. The camera we use here is capable of only 5v=1.2A current to pass through it. Then they are connected with the power supply via IC 8870 so that when the operation starts the camera also starts its function along with them.

Steps to be followed for live relay

Step1- through Ethernet cable connects the camera with the router and makes the interfacing process.

Step2- now switches ON the wifi hot spot tethering in the phone we use here.

Step3- then the camera automatically gets connected with the tethered network

Step4- now used the D-link (the camera products name) site and signed up the camera with an ID and password.

Step5- now we can the environment where the robot it's placed can be viewed through PC, Smartphone, etc..

VIII. Voltage Regulator

The voltage regulator we use it here is 7805 for the purpose of regulating the 12 v supplied from each batteries to respective voltages for each components such as IP cam, Arduino UNO DC motors etc.

IX. Atmega 328

The ATmega328P provides the following features: 4K/8K bytes of In-System Programmable Flash with Read-While-Write capabilities, 256/512/512/1K bytes EEPROM, 512/1K/1K/2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning.

X. Algorithm Used

The Arduino UNO microcontroller used here has specific user defined functions according to the digital input and output pins we use here. Here pins are used with defined operations for each. The algorithm we use for the digital input and output.

Table-2.4: Pins and Connections.

PIN NO	CONNECTION
11	Motor 1
10	Motor 2
9	Motor 3
6	Motor 4
2	Q1(forward command)
3	Q2 (reverse command)
4	Q3 (left command)
5	Q4 (right command)
12	Sensor 1
13	Sensor 2

A separate algorithm is made to perform all the functions. The following explains clearly about the functions carried.

Straight command.

Pin 11-high-

Pin 10-low

Pin 9-high

Pin 8-low

Left command

Pin 11-high

Pin 10-low

Pin 9-low

Pin 8-low

Tilt left

Pin 11-low

Pin 10-low

Pin 9-high

Pin 8-low

XI. Results and Conclusions

Thus surveillance task is performed by the MOBOT with the control of remote sensing operation through DTMF signal and an obstacle avoidance using the IR sensor which is delivered at a live relay mode using the IP camera installed in it.The robot which is installed with an inbuilt cell phone with Wifi accessing facility, when receives a call it would start the process of surveillance. All these process happens when a remote station calls the private number located on the mobile part of the robot. The sounds produced by the key pads (DTMF) are used to control the robot. The IC decodes the tone and generates the signal given to the driver module ICL293D. The driver circuitry controls the rotation of the DC motors. The IR sensors fixed at the front side of the mobile part is interfaced with the Arduino UNO microcontroller which is specifically made to detect obstacle and also to avoid it. And now when the cell phone at the offshore which is installed with the robot receives a call, the auto answer mode will attend it. Then the universal key pads are used to

control the motion of the robot. The robot which moves according to the instruction will start its surveillance task. The area it makes it surveillance can be viewed at a live relay using an IP cam which is connected with the hot spot tethering option in the mobile installed on the robot.

When there is a bad vision due to smoke or damage to camera the obstacles can be avoided using the IR sensors fixed in the front side of the mobile part. Since the IR sensor is interfaced with the Arduino Uno microcontroller it performs the operation according to the program given to it. Thus the robot turns and takes reverse whenever it detects an obstacle.

Thus a surveillance robot with all the robotic functions are performed is constructed which can be implemented at off shore industries for surveillance at normal condition as well as emergency condition is constructed at a cheap cost and high efficiency.

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