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A Wireless Surveillance Robot with Motion Detection and Metal Sensors for Military purpose with Live Video Transmission

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ABSTRACT

A framework is presented in this paper for the control of a multisensory robot under several constraints. In this approach, the features coming from several sensors are treated as a single feature vector. In this paper, we are going to implement Dealing With Constraints In Sensor-Based Robot Control. The transmitter side has MEMS, metal sensor, robot and ZIGBEE. MEMS is used here for tracking the position of the robot and metal sensor detect the bomb if any metal found, buzzer will alarm and we can control the robot by PC. The control signal is transmitted through ZIGBEE which is a wireless protocol. Wireless camera is used to monitor the area in PC. Thus allowing live video monitoring.

Keywords: Micro Electro Mechanical Systems (MEMS), Personal computer (PC), Signal Section, ZIGBEE End Device (ZED), Microcontroller.

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INTRODUCTION

The main objective of this project is to create a wireless robot for military and surveillance purpose. Surveillance robot is to recognize and detect motion and path of a robot through the application and use of MEMS. It is the successful applications of the MEMS that plays the most important role in the development of this prototype. Since emphasis is put towards the military and surveillance purpose, it is very much important in such a case to have a backup support system available for a surveillance robot incase the video transmission gets affected due to uncertain reasons [1]. Here, MEMS is being used for deriving a detailed information about the path taken by the robot to reach the desired destination. With the help of sensors the prototype can be used for detection of metallic objects in its vicinity.

In proposed designs, one or more systems may not be activate due to sensing and tracking limitations. The actual field performance may be less effective. Limitations in the algorithms and sensors may cause difficulty in real world applications. Moreover, it may use more complex algorithms to determine metal detection and path tracking.

In this paper, we have described a design for manually controlling the directions of the surveillance robot so that the bot would be able to cross all the traffic junctions without time delay with proper video monitoring [3]. The software keeps a database for all the GPS coordinates for easy access using the MEMS. The sensors are embedded in the body of the moving bot that senses any metal or explosives when comes into contact and Micro Electro Mechanical Systems (MEMS) tracks the location of the surveillance robot.

With the advancement in the field of robotics it has almost become easy for human beings to complete their tasks easy or tough through the effective use of robots. With the help of this prototype project it shall be proved that technology has the solution for every task/obstacle set for a robot to complete in a given period of time taking the environmental conditions in the surroundings into consideration.

Therefore it may be said that with the help of this prototype it shall become easy to track the path taken by the robot during its course of motion. This is can be done by deriving the xyz plane details about the path taken by the prototype. With this details it becomes easy to detect the actual position of the prototype and hence with the successful application of global positioning system for the derived details it becomes easy to reach the position of the prototype. Hence it may be declared that the prototype build under this project can be efficiently developed and used for military operations.

RELATED WORK

Significant work has been done by the help of which a design for manually controlling the operation of a surveillance bot been described.

It provides support to Army especially for accomplishing the mission faster. It is more reliable. The system must be based on standards, fully automated, flexible, intelligent and low cost.

The availability of more pervasive and newer communication networks such as ZigBee is more reliable. The objective of the system is to fulfill the needs of an error free and efficient surveillance system. In case of finding an explosive in the war field such as mines, it can accurately and quickly give us the coordinates through which place and position can be tracked. It is made to reduce human errors, wrong data or treatment.

The solution to the surveillance and metal detection problem and an advanced algorithm have been described to find the correct path. To make sure, that the robot would arrive at the desired location, the live video transmission makes the work easy. But management of the prototype in case of loss of video signals is the main objective of this research work. The reliability of the system is discussed based on the data equipped by tracking the coordinates of the location obtained with the help of the MEMS [2]. Then a mathematical model is established. At last, a model example is shown. This model ensures that by proper application of mathematical model and real time values can provide a simple calculation so as to derive the exact location of the prototype based on coordinates derived by the robot on its course of travel from source to destination.

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SYSTEM MODEL

The multisensory robot is a peculiar kind of robot, which operates with human control, comes under embedded system. The robot is controlled by software. It is used to detect the metal and also used for surveillance pupose. It sends the information throughout its path through the zigbee transmitter, and a receiver is used to receiving the signals and it displayed on the monitor. It consists of a microcontroller based embedded system connected to various sensors that monitoring different situations [3][4].

This system also transfers live videos from mine to the ground station using zigbee. Once MEMS gets tilted, coordinates will be sent through using the zigbee transceiver with location.

Transmitting section

The Transmitting section consists of AT89S52 microcontoller, MEMS, metal detector, buzzer, LCD, PC (for ease of viewing the video transmission.

AT89S52 microcontroller :

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Indus-try-standard 80C51 instruction set and pin out.

Fig. 1: AT89S52 Atmel microcontroller

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Indus-try-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory pro-grammars. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

MEMS:

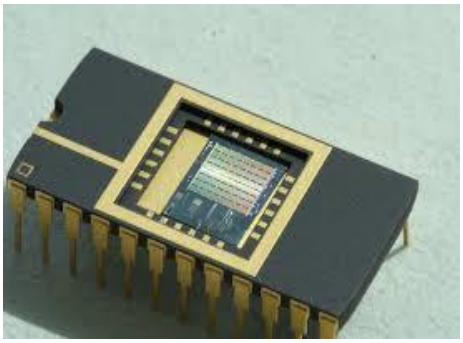

Fig. 2: Micro Electro Mechanical Systems

MEMS sensor used for this project is one of the most promising technologies for 21st century. It is an enabling technology for pressure and acceleration sensors. MEMS-based sensors provide an interface that can

sense and process. They are a class of devices which makes small mechanical and electrical components on a single chip [5]. They are crucial components in hard disk drives, automotive electronics, computer peripherals, wireless devices, medical equipment and smart mobile electronic devices such as PDAs and cell phones. The benefits of MEMS are high performance, miniaturization, integration, low power and low cost.

Metal detector:

Sensors used for detecting metal objects such as explosives and mines can be detected using a metal detector embedded into the body of the surveillance robot.

PC:

It eases the video transmission constraints. Different hardware can be used to connect the peripherals so as to ensure that correct details regarding the location of the prototype is achieved. In our case we are using a TV tuner card.

Receiving section

The Receiving Section consists of Zigbee and serial communication port i.e., MAX232A. ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for Low-Rate Wireless Personal Area Networks (LR-WPANs), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio needing low rates of data transfer.

ZigBee is a low-cost, low-power, wireless mesh networking standard [6]. First, the low cost allows the technology to be widely deployed in wireless control and monitoring applications. Second, the low power-usage allows longer life with smaller batteries. Third, the mesh networking provides high reliability and more extensive range.

Fig. 3: MRF24J40 Zigbee

ZigBee operates in the industrial, scientific and medical (ISM) radio bands; 868 MHz in Europe, 915 MHz in the USA and Australia, and 2.4 GHz in most jurisdictions worldwide. The technology is intended to be simpler and less expensive than other WPANs such as Bluetooth [7][8]. ZigBee chip vendors typically sell integrated radios and microcontrollers with between 60 KB and 256 KB flash memory. There are three different types of ZigBee devices:

ZigBee coordinator (ZC)

The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee coordinator in each network since it is the device that started the network originally. It is able to store information about the network, including acting as the Trust Center & repository for security keys.

ZigBee Router (ZR)

As well as running an application function, a router can act as an intermediate router, passing on data from other devices.

ZigBee End Device (ZED)

A ZED requires the least amount of memory, and therefore can be less expensive to manufacture than a ZR or ZC.

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits[9]. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. Wireless Small size camera for Surveillance and robotics. The tiny and low power operation makes it useful for mounting on wireless robots to transmit the videos to receiver. That signal can be directly seen into TV or in pc through TV Tuner or Video Capture Card. The camera module consists of a wireless camera and an AV receiver and an AV tuner card. The wireless camera is mounted on the robot and the video signal is transmitted to the AV receiver and it is tuned to get the original signal. The video is then transmitted to the PC by interfacing an AV tuner card. The camera module will transmit the video coverage of the paths and thus helping in easier mapping of the path.

CONCLUSION

With the help of embedded technology and amazing trends of electronic components a prototype has been designed to provide wireless video transmission and positional details of the prototype with the use of MEMS (Micro-Electro-Mechanical Systems).

The prototype model of the robot can successfully provide a live video transmission as well as its location details. Hence it may be concluded that a prototype has been successfully built keeping the constraints and tasks to be achieved into consideration in the given time period with desired output under the necessary guidelines.

For future use, the project can be remodeled into an intelligence robot using different types of sensors such as fire sensor, gas sensor and temperature sensor. All these sensors can be useful in determining various aspects such as alarm will buzz in case of a fire, will provide an indicator of how poisonous a gas is using the Gas sensor, etc.

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