

Design and implementation of smart robot

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ABSTRACT

Robotic industry has been replaced human efforts gradually in performing rather difficult tasks. Here we are combining autonomous obstacle detection Robot, fire sensing robot, GSM controlled Robot and Bomb detecting Robot. This Robot can play a significant role in reducing human effort and saving a lot of time by smart sensing and navigation technique. It finds its usage in diverse number of fields. It can be used in areas such as military service, fire service, and even in homes too. This Robot can be used to accomplish the assigned missions in an unpredictable environment. In our task we are designing a single Robot which can perform all the above operations and hence control the delay in performing the task with appropriate programming. We are using multisensor integration technique to sense fire, obstacle, bomb using fire sensor, ultrasonic transducer and proximity sensor integrated with AT89S52 microcontroller. In this paper we have developed an embedded C program code to design our Robot.

KEYWORDS- Robotics, Ultrasonic transducer, fire sensor, proximity sensor, Embedded C.

I. INTRODUCTION

Robotics is the field concerned with the connection of perception into action. Robotic Technology has always been the keen area for the researchers in many applications like office automation, military, entertainment, industry automation, planetary automation etc...The robot has become very popular subject and has been used in many fields with a large scope but the problem is that they all exist separately. Many researches has been carried out in this field for solving out the drawbacks. In our project we are developing a robot which can perform multitasks such as fire detection, obstacle detection, bomb detection and can be controlled by GSM SMS.

This robot can play a significant role in reducing human effort and saving a lot of time by smart sensing and navigation techniques. It finds its usage in a number of diverse fields. It holds a lot of significance in the military sector where critical path sensing, bomb detecting is required so as to safely carry out the operations.

II. LITERATURE REVIEW

Meha Sharma et.al...[1] has proposed path finding technique by detecting obstacles using IR sensors and then follows its way by orienting itself in obstacle free environment.

Sougata Das et.al ...[2] has proposed an approach for designing this system is to implement a microcontroller-based control module that receives instruction and commands from a cellular phone over the GSM network interfaced with the main controller module.

Poona Son sale et.al...[3] has proposed an adaptive algorithm for fire detection, and uses a smoke sensor, flame sensor and temperature sensor to detect fire incident.

Noel Sharkey et.al...[4] has proposed an artificial intelligent system

Kiranma.K et.al...[5] has proposed supervision robot using GSM module along with fire detection is carried out by locating the exact location of the accident and hence springlers are used for extinguishing the fire.

A.R.Kohle et.al...[6] has a method for detecting the obstacles in implementing automation infrastructure projects and construction industry.

Daniel W. Watson et al. [7] has proposed the path planning robot for altruistically negotiating system using the Near-sighted Tarzan Algorithm.

Weijun Zang et al. [8] has proposed an automatic collision avoidance approach for remote control of redundant manipulator by dynamic trajectory planning algorithm.

Upendra Saharkar et al. [9] has proposed the remedies over the obstacles in implementing automation in Indian infrastructure projects.

Ehud Sharlin et al. [10] has proposed a three dimensional tangible user interface for controlling a robotic team.

III. ARCHITECTURAL DETAILS

The Smart Robot consists of following components as shown in following fig assembled on chassis. Here we are using AT89S52 Microcontroller, fire sensor, signal control unit ultrasonic distance sensor, interfacing control unit, bomb detector, LCD, GSM modem, drive, relay and two D.C motors are interconnected via 4 connecting wires.

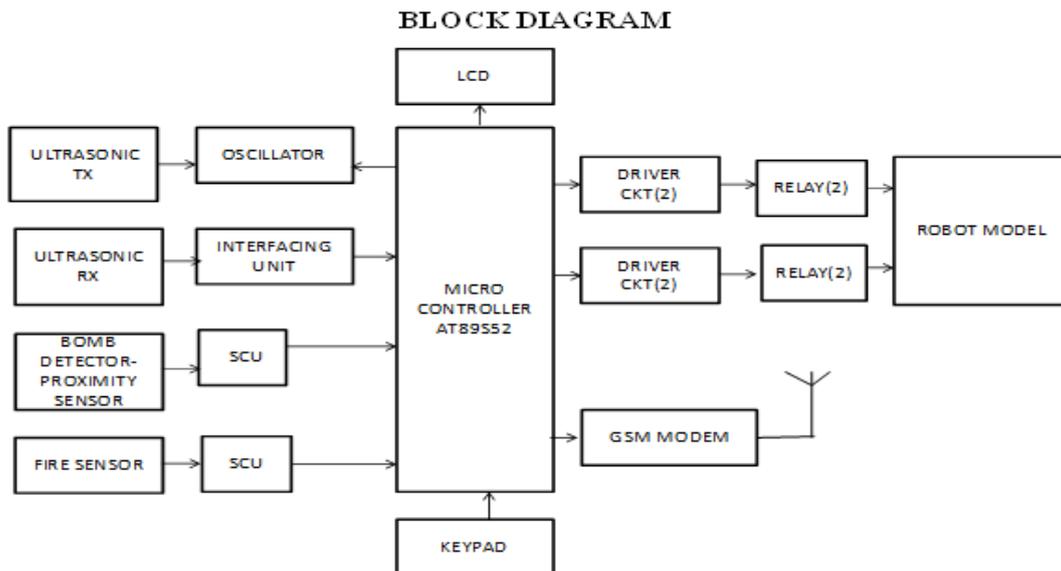
The components:

a. Flame sensor: A flame sensor is used to detect the flame occurrence. When sensor detects the fire, then it became short circuit. When there is no fire it will be open circuit. The flame sensor is like a small module and it is connected to resistor. This can form the voltage divider circuit which is connected with inverting input terminal of the comparator. A non inverted terminal is applied with the reference voltage. The comparator is constructed with inbuilt operational amplifier. When there is no fire, the fire sensor became open circuit. So the inverting terminal voltage is greater than non inverting input signal. Now comparator output is 0v. hence 0v is applied to MC. when there occurs a fire, the fire sensor became 5v. so the inverting input terminal voltage is less than non inverting input terminal. Now comparator output is 5v. Hence 5v voltage is given to MC.

b. Ultrasonic Distance Sensor: Ultrasonic transducer also known as transceivers work on the principle similar to radar and sonar which evaluates the attributes of a target by interpreting the echoes from radio or sound waves. It is a device which converts energy into ultrasound or sound waves above the range of human hearing. The parallax ultrasonic distance sensor provides precise, non contact distance from above 2cm (0.8 inches) to 3 meters (3.3yards). Its very easy to connect. The sensor works by transmitting an ultrasonic burst and providing an output pulse that corresponds to the time required, for the burst echo to return to the sensor. The distance of the target is calculated in accordance with the echo pulse width. The location at which a transducer focuses the sound can be determined by the active transducer area and shape, the ultrasound frequency and the sound velocity of the propagation medium. Ultrasonic sensors are widely used to detect movements of targets and to measure the distance to targets in many automation applications. Ultrasonics is a great solution for clear object detection, clear label detection. Target colour and or reflectivity do not affect ultrasonic sensors which can operate at high glare environments. The ultrasonic sensor is a pair sensors has a receiver and a transmitter sensor. The presence of the obstacle can be indicated by the ultrasonic waves from the transmitter and hence the receiver checks the transmitted signal. If any obstacle is detected the directions of the robot is automatically changed.

c. LCD: A 16X2 LCD is used here. A 16X2 LCD it can display 16 characters per line and there are two such lines. Each character in this LCD is displayed in the form of 5X7 pixel matrix. The command and data are the two such registers in LCD. The command instructions given to the LCD are stored in the command register. The predefined tasks like initializing, clearing its screen, setting the cursor position, controlling display etc..., can be done by the command instructions given to the LCD. The data to be displayed on the LCD is stored in the data register. The data is in ASCII value of the character to be displayed on the LCD.

d. Proximity Sensor: Inductive proximity sensors are widely used in various applications to detect the metal devices. They are used in various environment high reliability. Inductive proximity sensors, generates an EMF and detect the eddy current losses induced. When the field is disturbed by metal target, the coil generates a field, wrapped round, a ferrite coil, which is used by a transistorized circuit to produce oscillations. The target, while entering the EMF produced by the coil, while decrease the oscillations due to eddy current developed in the target. If the target approaches the sensor, within so called sensor range, the oscillations cannot be produced anymore. The detector circuit generates an output signal controlling a relay or switch.



e. signal control unit: The control unit is a circuitry that controls the flow of data through the processor and coordinates the activities of the other units within it, and it controls what happens inside the processor. The control unit receives external instructions or commands which it converts to a sequence of control signals that the control unit applies to the data path to implement a sequence of register-transfer level operations. SCU prevents the overlapping of information.

f. GSM Modem: We have used general packet radio service (GPRS) modem SIM900 from SIMCON Ltd. The SIM900 is a complete Quad Band GSM/GPRS solution in a SMT module which can be embedded into the customer application. Featuring an industry-standard interface the SIM900 delivers GPRS/GSM 900/1800/1900 MHz performances for voice, SMS, data and fax in a small form factor and with low power consumption. With a tiny configuration of 24mmX24mmX3mm, SIM900 can fit almost all the space requirements, especially for user demand of design.

g. Microcontroller-AT89S52: The AT 89S52 is a low power, high performance CMOS 8 bit MC With 8K bytes of in-system programmable flash memory. The on-chip flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8 bit CPU within system programmable flash on a monolithic chip, the AT8952 is a powerful MC which provides a high flexible and cost effective system to many embedded controlled applications. The idle mode helps in stopping the CPU. The power down mode saves the RAM contents but freeze the oscillator, disabling all other chip function until the next interrupt or hardware reset.

IV. OPERATION:

When power is given to the circuit through 6V battery, microcontroller will be turned on and as per the logic it sends signals to the components connected to it. The robot will start moving if START command is given through SMS. The processing and decision process of AT89S52 is based on embedded C coding. It facilitates the microcontroller to take a left turn on facing an obstacle on the pure right of the axis aligned along its path. Similarly it takes a right turn on facing an obstacle on the pure left of the axis aligned at its path. For an obstacle in forward direction along its path axis, it takes a right turn. For an object between forward and left direction, it introduces a delay and then turns right and viceversa implementation of an object between forward and right direction. If all the three directions are blocked after a certain delay it moves back. It is based on the working of ultrasonic distance sensor. In the absence of all of the above mentioned scenarios, the robot will move forward. The comparator compares the reference voltage with the obtained output voltage of the sensor. The fire sensor is used to detect the flame occurrence. On the basis open or short circuit we can detect the presence of fire. In case of bomb detection, here we are using induction proximity sensor which is based on the induction principle, where the sensor acts as a primary coil and if any bomb detected it will act as a secondary coil, then it produces some flux lines between the sensor and bomb and it sends the information to microcontroller. The voltage can be controlled with the help of regulators such as 7812 and 7815. Our robot is designed in such a way that it can perform multiple operations and hence saves time and human efforts. Our robot can easily implement in military sectors.

V. CONCLUSION

We have implemented this SMART ROBOT, a self-thinking one which skillfully makes its way through unknown environment by planning its path using programmed brain without human supervision. We are using AT89S52 instead of pic microcontroller since it avoids the requirement of any peripheral memory devices, occupying less memory space and easy programming thus overcoming the limitations of a microcontroller. We have typically selected proximity sensors, ultrasonic transducer and fire sensor as they use narrow beamwidth and are unaffected by sound absorbing materials. The components used for this is cost effective, thus making it accessible.

Our robot is an intelligent multisensory based system which can perform each operations simultaneously and in an iterative way. We are expecting a further boom in our project in the areas of military, industry, factory and buildings.

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