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Emergency Assisting Autonomous Robot Using GPS

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Abstract- **Robotics is the branch of engineering that deals with the design, construction, operation, and application of robots as well as computer systems for their control, sensory feedback, and information processing. This project aims to develop an autonomous intelligent robot which could assist humans in rescue operations during times of fire hazards. It is a fully autonomous robot which does not need any human interventions. The model is basically a 4 wheeled robotic vehicle. The robot uses global positioning system (GPS) and an array of sensors for navigation. This robot can be implemented in industries or big institutions to automatically extinguish accidental fires.**

***Index Terms*—GPS-Global Positioning System, UART-Universal Asynchronous Receiver Transmitter**

I. INTRODUCTION

In our lives, situations can occur when humans need to see more and beyond. Some places are hidden to human vision, are too dangerous or too far away. There is a need to equip the user with some devices which increase human perspective. For such enhancements the only technology that humans can depend on is robotics. It is one of the most developed branches of engineering, and is now being implemented for different application on different parts of the world. Disaster management is one of such fields in which robotics is applied. The main feature of robotics is that it is a combination of various engineering technologies including mechanical, electrical, electronics and computer science. So the potential of such an integrated technology is way beyond any expectations. A team of mobile robots can quickly set up a network of mobile sensors and actuators for rapid action. Applications which have human risks such as handling of nuclear waste, identification of location of explosives, etc., show the potential of use of mobile robots functioning as a group. Mobile robots have been used in search and rescue operation of World Trade Centre terrorist attack and Hanshin-Awaji earthquake. In such situations mobile robots can enter voids too small or deep for a person, and can begin surveying larger voids that people are not permitted to enter until a fire has been put out or the structure has been reinforced. Robots can carry cameras, thermal imagers, hazardous material detectors, and medical payloads into the interior of a rubble pile and set up communication link with human operator using the ad-hoc network set-up by these robots. Each robot equipped with accelerometer, gyroscope and magnetic compass as sensor devices, can plan its navigational path with reference to each other and can get the sensor network dynamically relocated. Team of mobile robots equipped with appropriate sensors and distributed and cooperative planning algorithms can also autonomously generate maps for oil spill or radiation leaks.

II. MODEL AND DESCRIPTION

The model proposed here is an autonomous robotic vehicle that assists humans during fire hazards in industries or institutions. The robot automatically detects fire with the help of flame sensors located at different zones on the industry. Then with the help of a GPS the robot navigate to the location and extinguishes the fire with the help of a water tank and pump arrangement.

This complete arrangement has 3 sections. First is a zone controller sections. Flame sensors are located at different locations. These locations are classified as zones. All flame sensors are connected to an AVR microcontroller. The location details (latitude and longitude) of the zones are preset in the controller. When one of the flame sensors is activated the controller sends the location details of that particular zone through an RF transmitter to the robot.

The robot receives the data and tracks to that particular coordinate with the help of GPS. The robot has a central AVR microcontroller which controls and coordinates all the activities of the robot, and a dedicated 8051 micro controller for the GPS control. Once the robot reaches the zone, using the flame sensor provided in the robot, it detects the flame and using a dc pump it pumps a jet of water to the flame until it is completely extinguished.

III. BLOCK DIAGRAM AND DESCRIPTION

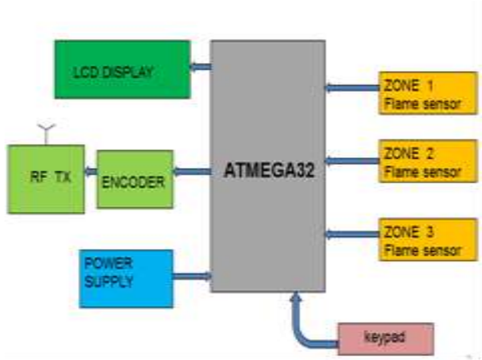

Fig 1 Zone control block

The sensors located at different zones are controlled by an AVR microcontroller. At the time on installing the sensors the latitude and longitude of the location is found out using a GPS and is feed to the AVR micro controller using a matrix key pad to address each zones. When any one of the sensors are activated the AVR controller sends its coordinates to the robot using an RF transmitter.

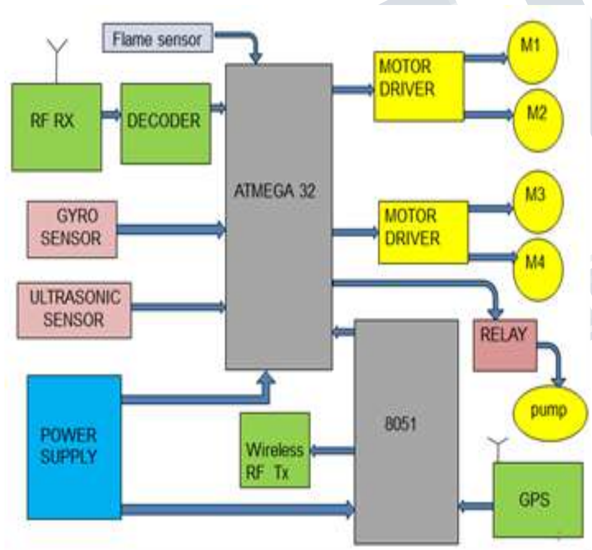

Fig 2 Robotic control section

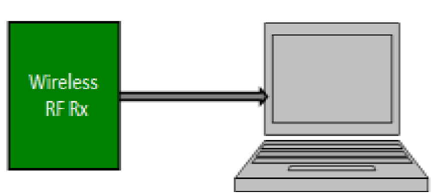

Fig 3.UART system connection

The robot is controlled by a central AVR microcontroller. There are ultrasonic sensors provided for obstacle sensing. A gyroscope sensor is used for sensing the direction of robot. Two motor drivers are provided for controlling the motors used for locomotion and the robotic arm. There is a relay used for operating the DC pump. A flame sensor is also provided in the robot for sensing the fire. All above components are controlled by the AVR micro controller. There is an RF receiver module provided for fetching the information from the zone controller. There is a dedicated 8051 microcontroller for receiving the GPS data. This secondary controller also sends the GPS information regarding the location to a system using a wireless UART module.

IV. WORKING

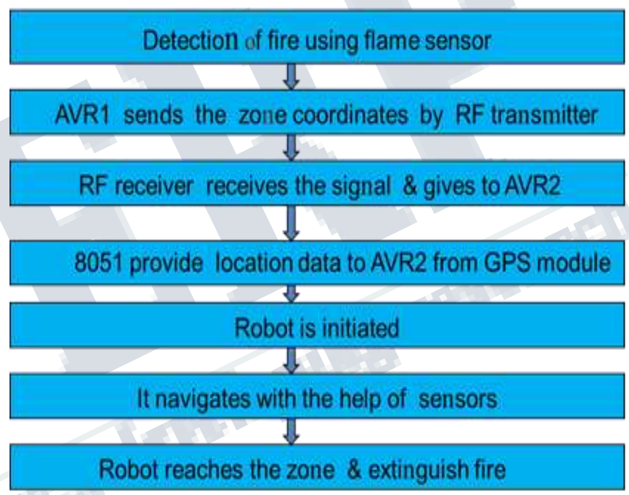

Fig 4. Overall working flowchart

The flame sensors located at different zones are controlled by an AVR microcontroller (1). Each zone location is feed to the AVR controller at the time of sensor installation. So when one of the flame sensor detects a fire it gives a signal to the AVR (1). The AVR (1) sends the location information unique to that zone to the robot using an RF encoder and transmitter.

This signal is received by the robot using an RF decoder and receiver. Then it is given to the main AVR controller 2. Now using the GPS data received from the GPS module and using the data from the gyro and ultrasonic obstacle sensors the robot tracks itself to the zone location. Once it reaches the location. The robot has an inbuilt flame sensor for locating the fire. Using this sensor the robot detects the fire and once the fire is conformed using a robotic arm arrangement the robot pumps water to extinguish it. The pump is operated using a relay which is triggered by the main controller.

V. COMPONENTS USED

Si.No	COMPONENTS
1	12V battery
2	Geared motors 100 rpm.
3	ATmega32
4	AT89S51
5	GPS Module and antenna
6	Flame sensors
7	Ultrasonic sensors
8	Gyro sensor
9	L298 motor driver IC
10	DC pump
11	HT12E & HT12D RF communicators
12	Wireless UART communicators

1. ULTRASONIC SENSORS

Fig 5.Ultrasonic Sensor

Ultrasonic sensors can be used to solve even the most complex tasks involving object detection or level measurement with millimeter precision, because their measuring method works reliably under almost all conditions. In industrial applications, ultrasonic sensors are characterized by their reliability and outstanding versatility. It has excellent directivity and sensitivity. Detection Range is about 12m. Nominal frequency of operation is 40kHz and operating temperature is -30oC to +85oC A single ultrasonic transducer is used as both emitter and receiver and is typically contained in the same housing. It's ideal for use in alarm systems and object detection.

2. GYROSCOPE SENSOR

Fig 6.Gyroscope Sensor

Gyro sensors are also known as angular rate sensors or angular velocity sensors, that sense angular velocity. It can also sense rotational motion and changes in orientation and therefore augment motion. Vibration gyro sensors can sense angular velocity due to the Coriolis force which is applied to a vibrating element. This motion produces a potential difference from which angular velocity is sensed. The angular velocity is converted into an electrical signal output.

3. L298MOTOR DRIVER

Fig 7.L298Motor Driver

L298 46V, 2A Dual DC Motor Driver module can drive two DC motors at the same time. Each L298 has two H-Bridges. Each H-Bridge can supply 2Amp. current. L298 has heat sink for better heat dissipation and fly back diodes for protection from back EMF. For higher current rating these H-Bridges can be connected in parallel. It has operating voltage in the range of 8V to 46V. The applications are in Stepper motor / DC motor drives, Factory automation robots, Numerically controlled machinery, Computer printers and plotters.

4. GEARED MOTOR

Fig 8.Geared Motor

100 RPM Side Shaft 37mm Diameter High Performance DC Gear Motor is suitable for small robots / automation systems. It has sturdy construction with gear box built to handle stall torque produced by the motor. Drive shaft is

supported from both sides with metal bushes. Motor runs smoothly from 4V to 12V and gives 30 RPM at 12V. Motor has 6mm diameter, 18mm length drive shaft with D shape for excellent coupling.

5. *WIRELESS UART*

Fig 9.Wireless UART Connector

Wireless UART Connector is a four pin IC-RXD,TXD,VCC,GRND .RXD receive serial data of 3 to 5V logic level, Usually connected to TXD pin of microcontrollers. TXD transmit Output serial data of 3V logic level, Usually connected to RXD pin of microcontrollers. VCC is regulated 5V supply input .GND is Ground level of power supply. Must be common ground with microcontroller. Working voltage 4.5 to 9V. Frequency of operation is 2.4 Ghz

6. *HT12E & HT12D*

Fig 10. Encoder and Decoder

The HT12E Encoder ICs are series of CMOS LSIs for Remote Control system applications. They are capable of Encoding 12 bit of information which consists of N address bits and 12-N data bits. Each address/data input is externally trinary programmable if bonded out.
The HT 12D ICs are series of CMOS LSIs for remote control system applications. This ICs are paired with each other. For proper operation a pair of encoder/decoder with the same number of address and data format should be selected. The Decoder receive the serial address and data from its corresponding decoder, transmitted by a carrier using an RF transmission medium and gives output to the output pins after processing the data.

7. *MICROCONTROLLERS*

ATMEGA 32

Fig 11.ATMEGA32 microcontroller

ATmega 32 is manufactured by ATMEL. It has 32Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 1024bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundaryscan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes. The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running

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while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

AT89S51

Fig 12. AT89S51 Microcontroller

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In-System Programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with In-System Programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

GPS SECTION

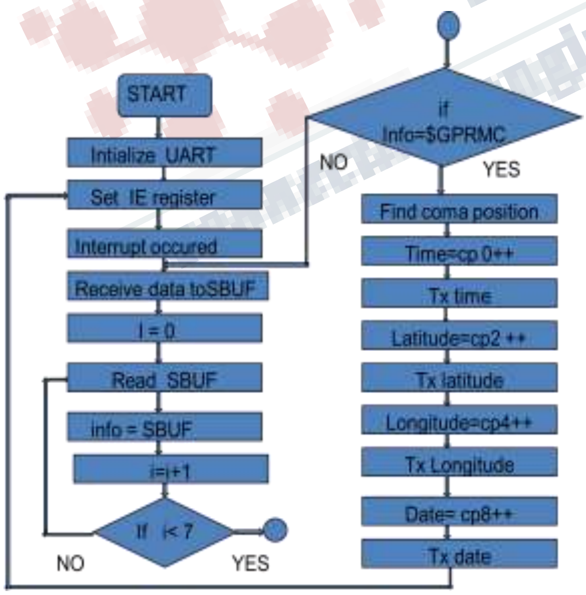

Fig 13.GPS working flowchart

This is the flow chart of GPS system used in robot. GPS means global positioning system, it is an ideal navigation system, used to collect information about the location from the satellite irrespective of weather conditions. It is used for various applications like construction, survey, environment, communication, intelligent vehicles, and agriculture and air planes. Here GPS system serves for obtaining the details of flame generated zone and provides an accurate navigation for locating the zone to the robot. GPS receivers receive almanac data from the satellite and also calculate their position by calculating its distance from then visible satellites and then by using triangulation method to calculate its position. GPS receivers also work on these NMEA Standards. After the data has been received and position has been calculated, the data is configured according to standards set up by NMEA (National Marine Electronics Association) and is serially transmitted at a baud rate of 9600 bps. The National Marine Electronics Association (NMEA) has developed standards that describe the interface between various marine electronic equipment's. The data given by the GPS receiver includes many information like position (latitude and longitude), altitude, speed, time etc. In its standards, NMEA has specified to send a series of data in a sentence. A particular sentence is totally self-reliant and is independent from other sentences. There are standard sentences for particular type of data and for various categories of devices. NMEA has also provided the functionality for individual companies to write their own sentences.

Fig 14.GPS section

All standard devices have a two letter prefix that defines the device for which it is being used, for GPS receivers the prefix is GP. The two letter prefix is then followed by three letters which represent the content of the sentence. The proprietor sentences allowed by the NMEA always start with P and are followed by a three letter sequence identifying manufacturer code and additional characters to define sentence type. For example a Garmin sentence would start with PGRM and Sony would begin with PSNY. Every sentence begins with a '$' sign, has about 80 characters and ends up with a carriage return/line feed sequence. Sentences are mostly framed in single lines (may run over to multiple lines sometimes) and the data items in each sentence are separated by commas. The data received is just ASCII text and varies in precision. A sentence ends with checksum which consists of a '*' and two hexadecimal digits. The checksum digits represent an 8 bit exclusive OR of all the characters between, but not including, the $ and *.

The GPS programming is carried out through a 8051 microcontroller unit .GPS is provided with serial communication. So first initiate the UART, .if any interrupt is occurring, the data receives starts. So enable the interrupt pin. The received data is stored in the sbuff register. The data is received in string form. GPS is inbuilt with different codes. The actual code needed is $GPRMC after which necessary latitude, longitude etc. are placed. So first of all check whether the code is $GPRMC .If it is true, then remaining data are collected step by step and comparing process is done. Here data is separated by commas. So storing the commas positions in a separate register is also activated. Finding the comma position, then reading the data required like time, date, longitude, latitude and that are transmitting to the base vehicle.

VI. CONCLUSION

The robot proposed in this project has high significance in the present life. Every people are busy and they do not get enough time to deal with safety. The proposed robot is a dedicated intelligent device which continuously surveys for any faults. And when fault is detected it automatically tracks itself to the fault location and resolves the problem.

REFERENCES

[1] GPS and sonar based area mapping and navigation by mobile robots**,** Ray, A.K. ; Dept. of Electrical. Eng., Indian Inst. of Technol., Kanpur, India. Industrial Informatics, 2009. INDIN 2009. 7th IEEE International Conference on June 2009

[2] Robert I. Egbert and Joseph E. King *The Gps Handbook: A Guide for the Outdoors*, 2003 :Burford Books

[3] Lawrence Letham Gps Made Easy: Using Global Positioning Systems in the Outdoors, 2003 :Mountaineers Books

[4] Irving M. Gottlieb Electric Motors and Control Techniques, 1994 :McGraw-Hill/TAB Electronics

[5] MykePredko and MykePredko Programming Robot Controllers, 2002 :McGraw-Hill/TAB Electronics