A Low-Cost Sensor Based Autonomous And Semi-Autonomous Fire-Fighting Squad Robot

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Abstract- *The utilization of robots in circumstances that can be excessively hazardous for human mediations is developing. Developing sensor and mechanical advances, out threats individuals from danger of flame perils. This paper introduces an astute multi sensor based self-sufficient and semi-self-sufficient robot, which salvages from flame mischances in like manner everyday life. The proposed robot can be appeared monetarily, which constitutes six necessary modules which incorporates its structure, deterrent evasion and driver framework, control framework administered by a microcontroller, fire identification framework, remote managing framework, Global System for Mobile correspondence module. In self-ruling mode, when compared with a smoke finder, it takes lead as it can extinguish the fire at its origin than sitting tight for a protest seethe and make smoke. It willfully recognizes, explores itself and stifles fire with no human guide, accordingly sparing existences of numerous people. It likewise sends the crisis cautioning signal alarms to the security work force in the obligation and inside achieve fire station through the established GSM module. In semi-self-sufficient mode, this robot was intended to follow up on voice orders and also from a general UI created on the touch screen. This robot has included component of working in bunches by conveying between them.*

Keywords- autonomous and semi-autonomous robot; global system for mobile communication module; remote supervise system; man machine interface; general user

I. INTRODUCTION

As Robotic advances, have advanced and ended up being required, individuals have endeavored to substitute human work with new mechanical self-sufficiency propels, especially where individuals can put in chance while doing their activity. Creating sensor and mechanical advances, out threats individuals from danger of flame perils. This makes scope for robots to apply their abilities to substitute human's everyday exercises, enabling them to put their psyche on larger amount assignments. Regularly, people work in considerable or complex groups to determine troublesome situations outcome of some fiasco, be that as it may it would be more valuable in the event that we enable robots to keep from extreme fire risks, than to react after the event of flame calamity. The requirement for flame identification framework in a urban domain is obligatory and this robot is intended to coordinate those fundamental city condition needs.

The major and essential technique is to execute fire markers situated by assessing the scope of flame radiation. There are smoke identifiers and gas indicators which are ordinarily low in cost and formal answer for flame location. Late improvements incorporate the disseminated fiber optic temperature sensors which are extensively used to smother fire. By and by, these methods require pre-establishment of sensors making it too much costly and difficult to cover colossal zone. To cover vast regions and to screen them, diverse practices are required. One system is video preparing procedure utilizing shading video pictures. In any case, it can simply perceive the fire and fire. It can't recognize high temperature gas and hot material which are likewise the reasons for flame. In this way, another remote-controlled crisis dealing with firefighting robot is proposed, which can be utilized in down to business conditions, has been composed on the preface of minimal effort. It can uncommonly enhance the security in working spots and is extensive in keeping away from setbacks and diminishing property harms. It can battle both Class an and C fires which were exceptionally visit in libraries, schools, and organizations. Most importantly, it can be made up financially, producing minimal effort with one of a kind highlights.

Whatever is left of this article is sorted out in areas as, Section II clarifies the robot and its setup utilizing an auxiliary graph. Segment III shows the trial set up and delineates the equipment format. Area IV examines the Hardware of the robot, clarifying about the distinctive modules. Area V shows the product created to work the proposed robot. Conclusions and future extent of this paper are given in Section VI.

II. DESIGN

Proposed firefighting squad robot comprises of six basic parts viz., 1) structure 2) Obstacle shirking and Driver

framework, this robot stops consequently when there is any hindrance in its way and reroutes itself in the substitute conceivable briefest way, achieving its objective zone 3) Control framework, of this robot is administered by a microcontroller, which is utilized to send, get data to the robot and is likewise utilized to explore it to the assigned territories. 4) Fire identification framework, it recognizes fire in decided way, as well as has the capacity to distinguish fire in the field outside its characterized way. 5) Remote regulating framework, it can stream information remotely to the remote terminal. 6) Global System for Mobile (GSM) correspondence module, is utilized to send crisis caution signs to the security officer in the obligation and close-by flame station.

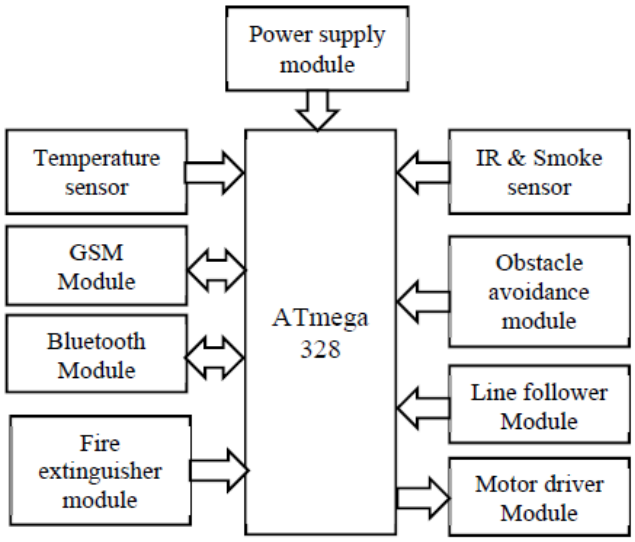

Fig. 1 Fire-fighting squad robot Structural Diagram

The utilitarian necessities are amassed and associated with control focus ATmega328 as delineated in square chart Fig. 1. The get together constitutes of temperature sensor, IR and smoke sensor, GSM module, impediment shirking module, Bluetooth module, line adherent module, fire quencher module and engine driver module. Couple of rechargeable Li-particle batteries of 3.7V/3000mAh are utilized to control the microcontroller and sensors in the robot.

III. EXPERIMENTAL SETUP

As demonstrated by the system and structure design, the work stream of robot is parceled into three phases. It gets motion from the smoke finders through the GSM module, at that point with no pre-decided way, it explores itself even within the sight of any obstructions. Consequently, examines for the fire through the sensors joined to it. If there should be an occurrence of flame peril, it sends alert flag to the fire fighters and to closest fire station through the GSM module and extinguishes fire. Fig. 2 plainly delineates the trial stage of this robot.

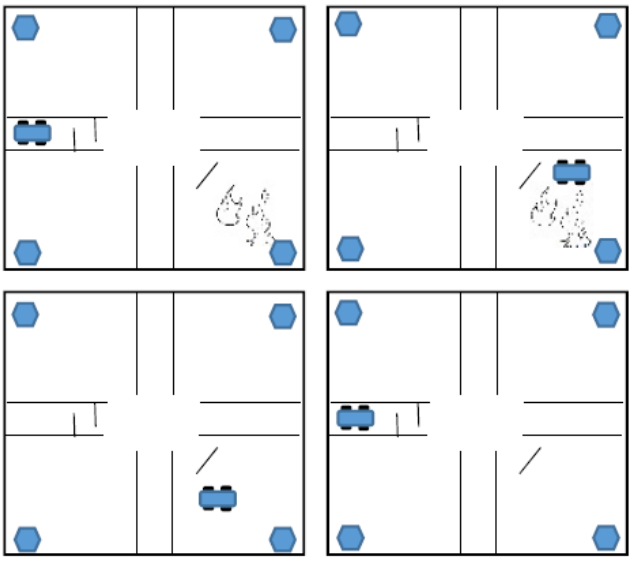

Fig. 2. Robot's Experimental Platform

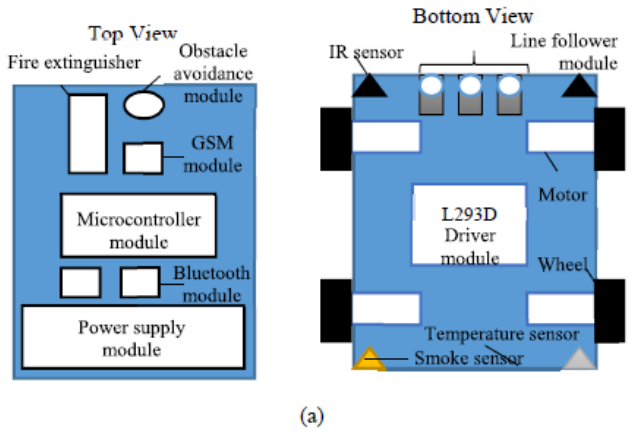

Fig. 3. Illustrative Hardware Layout (a) detailed image (b) practical implementation

The drive method of this robot is helpful and can be explored easily. To play out the framework limits well, the setup makes a sensible strategy in its equipment format as appeared in Fig. 3. From the best view, fire douser unit and Microcontroller can be seen nearby of GSM, Bluetooth and power supply modules. While in the base side, the required sensors with the driver module, the engine and driving wheels for controlling are attached.

IV. HARDWARE IMPLEMENTATION

The modules utilized as a part of the proposed robot are talked about in this segment.

A. Power Supply

Proposed firefighting squad robot has double power supply. One with rechargeable nickel cadmium battery of 7.2V/2000 mAh which supplies energy to LM7805 to deliver 5V for the engines. Second with a couple of rechargeable Li-particle batteries of 3.7V/3000mAh providing the microcontroller and all sensor in the robot. The purpose behind picking the double voltage sources is to stay away from the effect of high beginning streams of the dc engines on the dependability of the whole circuit.

The robot additionally has the ability to control from the supply mains. The air conditioner mains are advance around methods for a transformer and afterward amended to dc utilizing an uncontrolled diode rectifier. This is provided to LM7805 to give 5V for providing the entire circuit.

B. Obstacle avoidance modules

In computerization mode, the HC-SR04 ultrasonic sensor settled on the best edge front end as appeared in Fig. 3 is utilized. It creates the simple yield which is prepared by the microcontroller and is utilized to explore the robot towards the fire area.

C. Wireless Transmission & Photoelectric Sensors Modules

This assumes a noticeable part with two unique methods of activity. One to alarm the fire authorities and neighborhood individuals about the fire and second is to speak with kindred robots permitting to work in gatherings. SIM900A remote module was utilized to satisfy this task. It sends or gets the data according to the directions from the microcontroller. Photoelectric sensor module assumes the conspicuous part in the situations when the robots were expected to work in gatherings. The ace robot self-explores leaving the tracks for the slave robots through which they go as appeared if Fig. 4.

The slave robots are activated by the ace robot utilizing the remote module and afterward the photoelectric sensors were utilized to explore. To guarantee the unwavering quality and exactness of the slave robots, three units of photoelectric sensors are settled to the base casing as appeared in Fig. 3.

D. Infrared Flame & Smoke Sensor Module

This firefighting squad robot, naturally recognizes and puts off the fire in the zone with no particular course and bearings. The smoke sensors are settled in each room which at first recognizes the smoke and send flag to the robot through GSM module. Utilizing this flag, the robot explores either itself or physically towards the particular room.

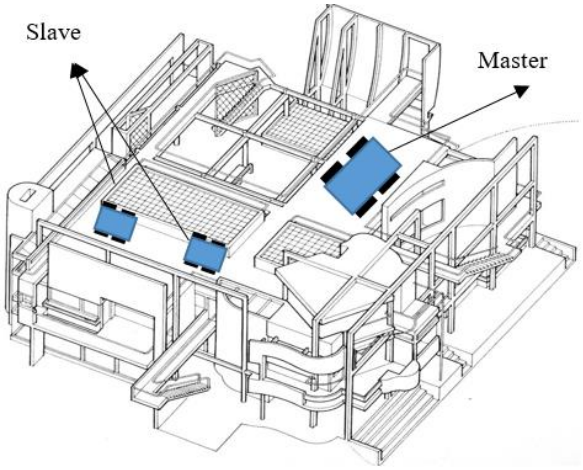

Fig. 4 Example of Robots working as a group.

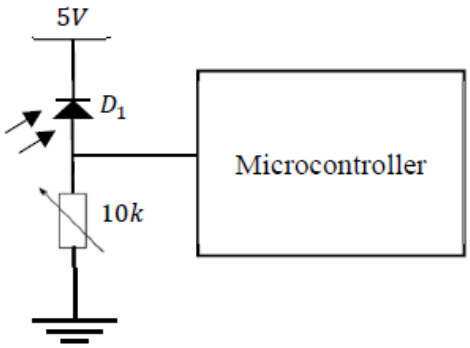

Fig. 5. Circuit for Infrared flame sensor

On achieving the region, the infrared fire sensors, appeared in Fig.5, settled on the base casing guarantees climate there is a fire around the room or not at first. On the off chance that yes, the GSM module cautions the neighborhood personals and fire warriors. At that point, the

robot explores either itself or physically towards the fire and stop at 8cm separation, at that point turns on the fire douser.

Five units are settled on different edges of the base of the robot as appeared in Fig. 3. As the power of fire builds, the simple yield from the IR sensor increments. At the point when the estimations of the sensor yields are bigger than the base limit esteem implies, there is fire around. Exploratory outcomes indicate discovery extend up to 200 cm with great precision.

The vital of infrared and self-route framework fills in as takes after. The four sensors put at all closures of the base casing explores the vehicle relying upon the fire force. The one set at the center alongside temperature sensor DS18b20 at the front identifies the fire and when the esteem is more prominent than the greatest edge esteem then robot quits moving and turns on the fire douser. The edge esteems setting guarantees the affectability of the fire discovery.

E. Rest of the System

Proposed firefighting squad robot, for semi-computerization mode the Bluetooth module, HC-06 was utilized. It gets summons either from the voice or from the touchscreen utilizing the android application created utilizing application creator programming. The driver module is driven by the L298, which works accepting orders from the microcontroller.

V. SOFTWARE IMPLEMENTATION

The framework programming was produced utilizing the installed C. This was exceptionally intricate and assumes the noticeable part in the entire robot task.

A. Main Program

The robot has for the most part two stages. To start with stage was committed to explore the robot towards the smoke sensor and second was devoted to explore towards the fire and quench it. The two stages have two methods of task, either computerized or semi-mechanized as appeared in the flowchart in Fig. 6. The robot was customized to work in robotized mode unless the administrator triggers the semi-computerized mode. The robot was left dynamic speaking with the smoke sensors in different rooms of the area, once it identifies the smoke, it either self-explores itself or physically explored towards the smoke sensor utilizing the flag it got from the sensor. On achieving the room, it enters the second stage, where the infrared sensors assume an unmistakable part of distinguishing the fire. In the event that there is fire, it re-alarms the fire authorities utilizing the remote module, and afterward again self-explores itself or physically explored towards the fire and once achieving the fire, it quits moving and begins the fire douser.

B. Squad Operation Program

This is a standout amongst the most vital component at this cost. The robots could work in bunches which is exceptionally unmistakable uncommonly when battling the fire remaining inside the area. The ace robot has the trigger to actuate the slave robots. It is likewise the one that makes the course and fix the area to work for slave robots. The slave robots have no self-knowledge to explore, they just utilize the line following framework to achieve the particular areas previously they begin the fire douser. The explanation behind picking this method of ace slave task is to spare the cost. Here for each 10 m one slave robot was named to work. The slave robots do have the semi-robotized method of activity simply like the mater robot. The stream outline for this squad task is appeared in Fig.7.

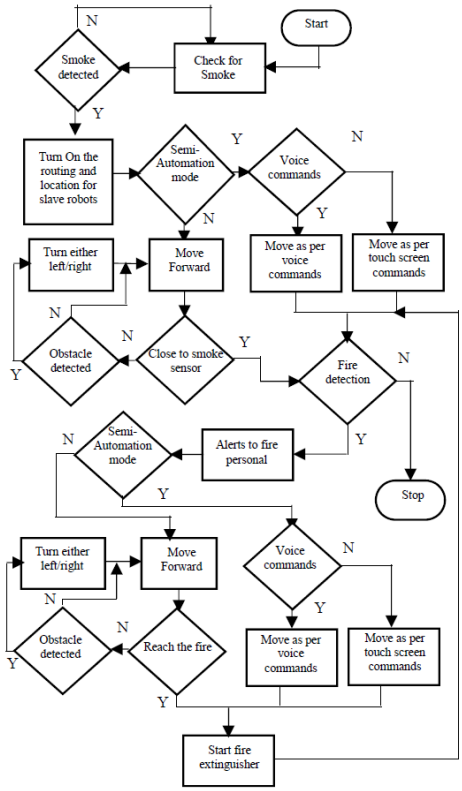

Fig. 6. Flow diagram of the main program for the firefighting squad robot

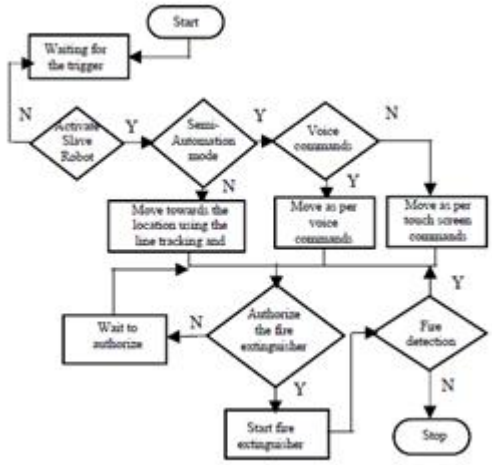

Fig. 7. Flow diagram of the program for the robot for operating in squad

VI. CONCLUSION

The design utilizing ATmega328 as control focus, with the exact engineering alongside the sensors, executes the programmed fire alert. In correlation with the current firefighting robots, proposed firefighting squad robot has the accompanying essential highlights; minimal effort extraordinary planned fire discovery sensors, through the including GSM module it can alarm fire office all the more exactly, along these lines upgrading the capacities of putting out flames. The robot has a more grounded limit of flexibility to find fire naturally. Robot has a more grounded capacity to put out of flame within the sight of obstructions. This robot has a particular component to work with a gathering of comparable robots. In particular, it can be made up budgetary well disposed, summing up negligible exertion with extraordinary segments. On the introduce of this setup, an ongoing position of the robot showed on the screens and other unique capacities can be included as expansions.

VII. FUTURE SCOPE

This thought has been roused by the want to outline a framework that can identify fires and mediation. In the current condition it can douse fire just in the way and not in every one of the rooms. It can be reached out to a genuine fire quencher by supplanting the fan by a carbon-di-oxide transporter and by making it to smother flames of all the room utilizing microprogramming. This gives us the chance to pass on to robots assignments that customarily people needed to do however were characteristically hazardous. Putting out fires is an undeniable possibility for such robotization. Given the quantity of lives lost routinely in firefighting, the framework we imagine is weeping for appropriation. Obviously, this thought has just touched the most superficial layer. As in the plan disentanglements and the execution imperatives in recommend, our undertaking is especially a proof-of-idea. Specifically, a viable independent putting out fires framework must incorporate a gathering of robots, imparting and coordinating in the mission; moreover, such a framework requires offices for experiencing impediments within the sight of flame, and capacity to get guidelines on-the-fly amid a task. Every single such concern were outside the extent of this undertaking. However, there has been examine on a large number of these pieces in various settings, e.g., coordination among portable operators, strategies for distinguishing and maintaining a strategic distance from deterrents, on-the-fly correspondence amongst people and versatile specialists, and so forth. It will be both intriguing and testing to assemble this into a useful, self-ruling putting out fires benefit.

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