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LOBOT: Low-Cost Robotic Vehicle

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ABSTRACT: The objective of this paper is to implement and propose LOBOT, a low-cost, self-contained localization system for small-sized ground robotic vehicle. LOBOT does not require external reference facilities, expensive hardware, careful tuning or calibration and is capable of operating under various indoor and outdoor environments. It identifies the local relative movement through various inexpensive sensors and a correct location by GPS technology. The controlling becomes easy with wireless technology like Bluetooth and RFID. By graphical user interface is easy to find out various parameter and graph of some parameter. LOBOT keeps the positioning error well under an accepted threshold

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KEYWORDS: Localization, robot, sensor, GPS, RFID, Bluetooth

I. INTRODUCTION

The word 'Robot' was coined by the Czechoslovakian writer, Karel Capek, in 1920. He used it for the main characters of his play who were autonomous, similar in all ways to men. The robots could do any kind of job normally done by labours. The expression comes from the Czech word, "Robata", which means forced labour or serfdom. Unfortunately, robotics hasn't achieved this level of perfection. Still there has been a tremendous development in this field for the past 20 years or so. The emerging area of robots calls for different types of skills. Entering non-industrial areas, the first fledgling robots for domestic use are coming off the production lines. Robots are being used in hazardous places, such as outer space or under the sea. Technical advances are gradually endowing robots with properties that actually increase their similarity to humans Engineers are attempting to add sensors to the current breed of industrial robots, so that they can see, touch, and even hear. Machines with this extra power will obtain information about events in the outside world what engineers call feedback and the hardware will be able to react according to the changes in circumstances, instead of simply repeating a fixed routine of instructions. From military technology and space exploration to the health industry and commerce, the advantages of using robots have been realized to the point that they are becoming a part of our collective experience and every day lives. They function to relieve us from danger and tedium:

- **Safety:** Robotics have been developed to handle nuclear and radioactive chemicals for many different uses including nuclear weapons, power plants, environmental cleanup, and the processing of certain drugs.
- **Unpleasantness:** Robots perform many tasks that are tedious and unpleasant, but necessary, such as welding or janitorial work.
- **Repetition and precision:** Assembly line work has been one of the mainstays of the robotics industry. Robots are used extensively in manufacturing and, more glamorously, in space exploration, where minimum maintenance requirements are emphasized

Robot is defined as,

"A reprogrammable, multifunctional manipulator designed to move material, parts, tools or specialized devices through various programmed motions for the performance of a variety of tasks."

Small sized ground robotic vehicles have great potential to be deployed in situations that are either uncomfortable for humans or simply too tedious. For example, a robot may become part of industrial operations, or become part of a senior citizen's life, or become a tour guide for an exhibition centre. The robot is kept as small as possible to allow access through narrow passageways such as a tunnel [1][2]. To fulfil these missions, the robotic vehicle often has to obtain its accurate localization in real time. Considering the difficulty or impossibility in frequent calibration or the management of external facilities, it is desirable to have a self-contained positioning system for the robot: ideally, the localization system should be completely integrated onto the robot instead of requiring external facilities to obtain the

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position; the system should work indoors and outdoors without any human involvement such as manual calibration or management. Meanwhile, the cost is expected to be as low as possible. To resolve the problems we propose the LOBOT [3].

II. LITERATURE SURVEY

The first industrial modern robot was the unimates developed by George Devol and Joe Engelberger in the late 50's and early 60's. Engelberger formed unimation and was first to market robot and has been called the father of robotics. Modern industrial arm has increased in capability and performance through controller and language development, improved mechanisms, sensing, and drive systems. In the early to mid 80's the robot industry grew very fast.

Mine Rover- It was developed in 2005 abandoned mines-remnants of old west mining booms –closely guard their secrets in the forgotten corners of Arizona's backcountry. "What's inside? What's concealed just around that bend in the tunnel?" are the inevitable questions those hikers and others ask when they stumble across these slumbering relics. Those can be dangerous questions. Crumbling walls and ceilings that threaten to collapse at the slightest touch; hidden vertical shafts; poisonous gases; wildlife lurking inside are just some of the dangers that prevent the non suicidal from exploring. Still the question remains: what's inside? They've built an 18 inch long, radio controlled rover to do the looking for them .it's equipped with a power full search light to explore the mines dark recesses and a pan and tilt video camera to send images back to their laptop computer. Jessica Dooley and Keith Brock made the ground rover to tour a mine [4].

Vision-based mobile Robot learning and Navigation- It was developed in 2005. This research develops a vision-based learning mechanism for semi-autonomous mobile robot navigation. Laser-based localization, vision-based object detection and recognition, and route-based navigation techniques for a mobile robot have been integrated. Initially, the robot can localize itself in an indoor environment with its laser range finder. Then, a user can teleoperate the robot and point the objects of interest via a graphical user interface. In addition, the robot can automatically detect potential objects of interest. The objects are automatically recognized by the object recognition system using Neural Networks. If the robot cannot recognize an object, it asks the user to identify it. The user can ask the robot to navigate back autonomously to an object recognized or identified before. The human and robot can interact vocally via an integrated speech recognition and synthesis software component. The completed system has been successfully tested on a Pioneer 3-AT mobile robot [5].

Search and Rescue Robot- This was developed in 2006 the centre for robot assisted search and rescue has developed a search and rescue robot which can be controlled for rescue operations. it edges forward ,climbs over a mound of debris ,then stops. Suddenly the rubber threads shifts from horizontal to vertical, raising the lens into a better vantage point to transmit images .it seems to have a mind of its own, even though every move is guided by a man 10 yards away with a remote control and laptop

Hazardous Gas detecting method applied in coal mine detection robot- This was developed in 2011. As one of the largest coal production and consumption countries in the world, China is also one of the related accidents occurred frequently countries such as gas explosion, flood, breaking out of fire during the exploitation of coal mine. Coal Mine Detection Robot can be substituted or partial substituted for emergency workers to enter the mine shaft disaster site and detect hazardous gas and do some environmental exploration and surveying task. Coal Mine Detection Robot uses infra-red spectrum absorption way to detect methane, carbon monoxide and such gas simultaneously. The principle of gas survey meter of infra-red spectrum is according to the selectively absorption of infrared radiation by the mash gas, CO to achieve the detection of their concentration. The advantages of this kind of hazardous gas detecting are: simultaneously and rapidly detecting methane, CO and high sensitivity, good selectivity and fast response. Otherwise, it is easy to be taken by robot due to its simple and light structure, have a lager detection range and probe is not easy failure to be poisoning and aging [6].

The remote control of mobile robot based on embedded technology- This was developed in 2011 Along with the development of society, the remote control of mobile robot has broad prospect of application. With the continuous

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development of embedded system, the system provides excellent hardware platform for embedded mobile robot. With embedded WinCE5.0 operating system, This paper put forward a kind of remote control method of mobile robots. The experiments had proved then embedded mobile robot has low power consumption and strong real-time control. It also had proved the validity of this method [7].

III. PROPOSED METHODOLOGY AND DISCUSSION

The controller LPC2148 ARM7 used in the system is receiving different input signals from various sensors such as humidity sensor, gas sensor, temperature sensor, proximity sensor. Proximity sensor is used for detections of objects nearer to the robot. Humidity sensor is used to sense the humidity in the air, Temperature sensor is used to sense the temperature in the air, Gas sensor is used to detect the various gases in the air. For localization purpose the GPS module i.e. global positioning system is used to get the exact location of the robot it is self contained localization system. For the driving the robot there is the use of motor driver and motor for locomotion of the robot. RFID and Bluetooth module are used for wireless communication. From RFID we can set the details of robot to the pc and from the Bluetooth we can get the details on the android mobile. PC cannot be directly interface to controller so MAX232 is used which produces a bi-directional serial communication.LCD display is used to display the various parameters and the set point level of the system. For exceeding level of set point there is the use of alarm system. Fig.1. shows the block diagram of the system.

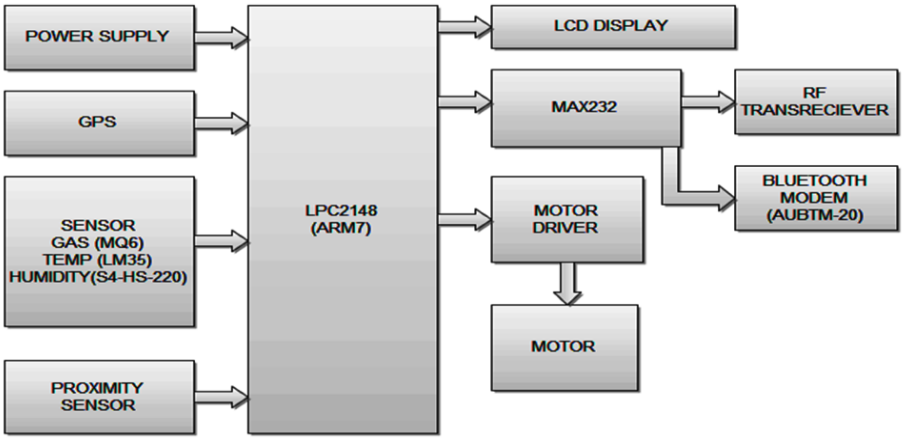

Fig.1. Block Diagram

In control section there is RFID and Bluetooth used so that from RFID we can control the robotic action by PC and from Bluetooth it can be control by android cell phone. There is a complete use of GUI for controlling section by PC and cell phone.

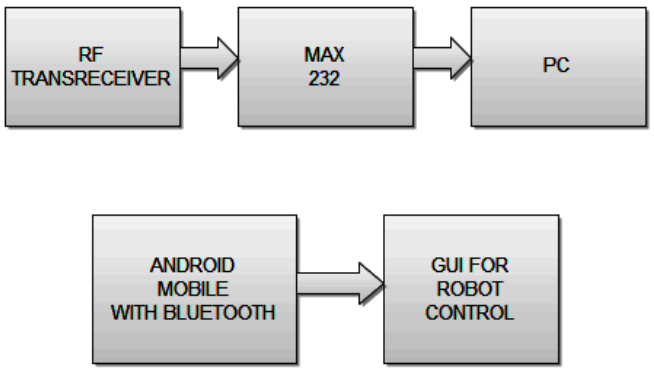

Fig.2. Control Section

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The Design of LOBOT-- LOBOT localizes a robotic vehicle with a hybrid approach consisting of absolute positioning through a GPS receiver and sensors. All the different sensors such as Gas sensor MQ6, Temperature sensor LM35, Humidity sensor S4-HS-220, Proximity sensor are installed on the robotic vehicle. The proximity sensor is to detect the nearer object to the robot and Thus infer the travel distance of the robot. An embedded microcontroller LPC2148 ARM7 inside the robot vehicle takes central control of these sensors and also is responsible for computing the current absolute position. LOBOT uses GPS to obtain an absolute position and utilizes the sensors to measures local relative movement since the last known absolute position through GPS. As a matter of fact, even if GPS is available, LOBOT may still only uses the local relative component over a short time period instead of GPS because GPS is known to have error. The infrequent use of GPS saves electric power. RFID and Bluetooth module are used for wireless communication. Due to RFID we can sent the details of robot to personal computer and can be controlled accordingly and by Bluetooth we can get details to are android mobile with SPP application and controlled through it. For exceeding level of set point there is the use of alarm. Graphic user interface GUI is used for displaying all parameters and graphs. And for GPS side by side Google maps can be shown for location. All data base can be seen which include parameters like date, time, and various readings. Range of RF is 30m and 2.4GHz. And Bluetooth range is 10-15m with 2.5ghz. GPS Is Ranging From 30-50m.

IV. RESULT

A software system in visual basic was developed to interact with the robot via a GUI. After localising itself, the robot continues to explore the environment. The user can watch the position of robot on the GUI or by Google map. Due to the parameters reading and graph we can get the information of the sensors rating. Due to the LOBOT's self-contained nature it can operate in indoor and outdoor environment. Due to its inexpensive set of sensors the LOBOT is cost effective and low cost.

V. CONCLUSION

We propose LOBOT a low-cost, self-contained, accurate localization system for small-sized ground robotic vehicle. it localizes a robotic vehicle with a hybrid approach consisting of infrequent absolute positioning through a GPS. by Bluetooth and RF transceiver it becomes easy for communication and controlling the robot. We can use Wi-Fi and implement LOBOT in future.

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BIOGRAPHY

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