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Gps Controlled Environment Monitoring Robotic System

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ABSTRACT-- An environmental monitoring system involves the collection of one or more measurements that are used to assess the status of an environment and also to record the data. There is a need to monitor temperature or gases as they can be costly and deadly. Remote controlling of the devices offers many advantages to senior citizens and people with disabilities which helps them in being more autonomous and increasing quality of life. In this project, We propose a robotic system that is designed and implemented to monitor environmental parameters such as temperature, humidity, air quality, and harmful gas concentration autonomously. The robot has GPS coordinates. The mobile robot is controlled by a smartphone which runs an app built on the Android platform. The whole system is realized using a cost-effective ARM-based embedded system Raspberry Pi which communicates through a wireless network to the Android platform, where data are stored, processed and can be accessed using a computer or any smart device from anywhere. The stored data can be used for further analysis of the reduction of pollution, save energy and provide an overall living environment enhancement. The robotic system has designed for cost effective remote monitoring environmental parameters without any human intervention to avoid health risk efficiently.

Keywords—ARM and Embedded system, Raspberry pi, Air quality, GPS, Android App, Remote Monitoring.

I. INTRODUCTION

Air pollution kills an estimated seven million people worldwide every year. WHO data shows that 9 out of 10 people breathe air containing high levels of pollutants. WHO is working with countries to monitor air pollution and to improve the quality of air. From smog hanging over cities to smoke inside the home, air pollution poses a major threat to health and climate. The combined effects of ambient (outdoor) and household air pollution cause about seven million premature deaths every year, largely as a result of increased mortality from stroke, heart disease, chronic obstructive pulmonary disease, lung cancer and acute respiratory infections[6].

Monitoring and evaluating the health of our natural resources is essential for effective environmental planning and solving environmental pollution. For remote monitoring, developing a system will be an efficient solution so that the monitoring can be done without any human intervention. Recently, robotic systems are utilized as data-gathering tools by scientists for a greater understanding of environmental processes. The new trending wireless sensor and ARM-based embedded system technology are getting integrated on a single board, intended towards the advancement of this system. The core part of our designed system is based on the ARM which presents a code density, excellent period interrupt response and an accurate data to look into.

A. MOTIVATION

More than 80% of people living in urban areas that monitor air pollution are exposed to air quality levels that exceed WHO guideline limits, with low- and middle-income countries suffering from the highest exposures, both indoors and outdoors. To avoid the risks, remote monitoring techniques along with a robotic system that has intelligent data acquisition, communication and processing are crucial in revolutionizing, monitoring and protection. There are numerous options that have been proposed for remote monitoring of environmental conditions, mainly using wireless sensing methods, GPS, robotics, Iota-based technologies. However, most of these solutions only address data collection and data observation. In order to tackle the problem of remote environment monitoring with avoiding health risks, it is imperative that the system should collect data via a self-sufficient robotic system.

B. AIM OF THE PROPOSED SYSTEM

With the help of our project we aim to provide a self-working autonomous robotic system

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that records the data and sends it to the user without any human intervention. The robot is controlled and handled through GPS and it records the data of that environment continuously. So when the user wants to know the data he can access the data in his mobile or through any other device through an application.

II. LITERATURE SURVEY

Existing environmental monitoring systems discussed in this section are

1. Cyber-physical system for environmental monitoring

With recent advances in wireless sensor technology, single-board computers and short-range communication technologies, remote sensing applications have improved towards solutions that encompass ubiquitous computing. Cyber-Physical device was once proposed for environmental monitoring of ambient stipulations in indoor spaces [1].

2. Climate monitoring using Raspberry Pi

Shete R. and Agrawal S. present the framework for monitoring the metropolis environment. Raspberry Pi used for implanting the system. However, no emphasis has given on particulate matter which left the environment monitoring system incomplete[2].

3. Cloud-based smart device

Cloud-based Environment Monitoring Smart Device that monitors different environmental parameters such as air quality, noise, temperature, and humidity. The device collects and sends data from targeted measurement locations through a wireless network or cellular network to a cloud server [3].

4. Air quality monitoring system based on IOT using raspberry pi

The proposed method of this paper presents a real-time air quality monitoring system which includes various parameters: carbon monoxide, carbon dioxide, temperature, humidity and air pressure. Internet of Things converging with cloud computing offers a novel technique for better management of data coming from different sensors, collected and transmitted by low power, low cost ARM based microcontroller Raspberry pi 3[4]

III. METHODOLOGY

The figure shows the block diagram of our proposed system wherein all the devices are connected to the microcontroller i.e., Raspberry pi 3.With the help of motor driver, robot moves to the location, Sensors takes the input from the environment and sends it to the raspberry pi which than sends it to the android app, when asked.

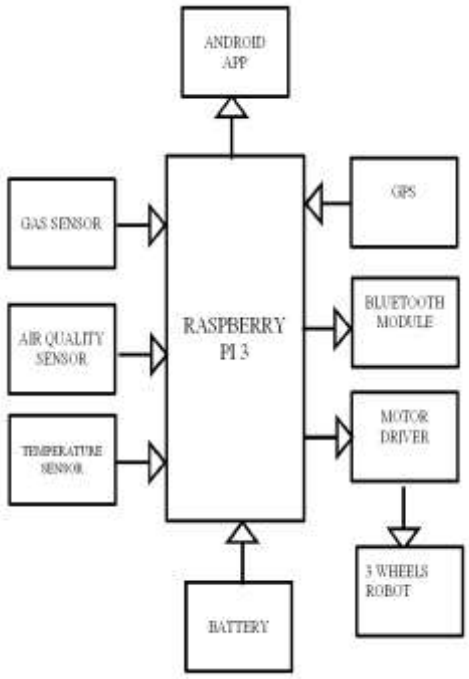

Fig 1: Block Diagram of Proposed Model

- The working of our project can be divided into two aspects Environment monitoring system, Navigation control system and a Core which handles the operation
- Environment monitoring system consists of the sensors namely gas sensors, air quality sensors, and temperature and humidity sensors.
- These sensors start to collect the data from the environment after reaching the specified location and give it to the core for further processing.
- Navigation system involves the GPS, Motor driver circuit and a Bluetooth module.
- This unit helps in movement of robot to the desired location with the help of GPS coordinates and movement is controlled by Bluetooth module /Internet through the user.
- The core used here is Raspberry pi 3 which governs the other two Systems. The data obtained from the sensing unit is processed and is given to the android application build for this project when the user wants the data and can access it from any part of the world.
- As the data is continuously updated, the supervisor or the user can check for any abnormality and can act accordingly.
- Thus the data is collected without human intervention which was the main objective of our project.

IV. RESULT ANALYSIS

The ARM based GPS controlled environment monitoring robot and Navigation and Control app. The prototype can work effectively in remote places to collect data, alone or in teams. The proposed system is quite cost-effective when compared with other existing methods that require more number of hardware accessories. The robot is capable of collecting and uploading environmental data to the Android App efficiently. The sensor data stored in the platform can be used for visualization and analysis of the environmental parameters. The gas sensors data in ppm, temperature sensor data in degree centigrade and humidity sensor data in percent relative humidity respectively.

V. FUTURE WORK

The future work is currently concentrated on developing operator free mobile robotic system. In this case the software processing data will be united with obstacles detection system and vehicle control system. The robotic system will be able to move through check points automatically and correct the path depending on the obstacles on the route. Another task considered for development is detecting coastal line with high resolution through laser scanners. It will allow moving the robot automatically near the water without check points.Future work also includes several features including solar power, advanced communication solutions for rural areas. The system can be modified to detect radiation and even other kinds of harmful gas autonomously to avoid human health risks. Also, the design method can also be applied in drone technology to make it even more dynamic.

VI. CONCLUSION

Here in this paper, GPS controlled robot for environmental parameters monitoring based on Android Platform and ARM have been accomplished. The developed ARM-based embedded system with the Android platform can monitor the environmental parameters, and the measurement of air quality is compact and cost-effective. The results obtained are found to be useful for monitoring real-time environmental conditions. The developed App allows the user to control and navigate the robot easily. The GPS controlled feature allows it to travel autonomously to the remote places and submits the collected data to the Raspberry pi which updates sensor data to Android app, and the Secured data in Android platform and can be accessed from anywhere of the world.

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