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THE ROBUST IOT BASED GPS CONTROLLED ENVIRONMENT MONITORING ROBOTIC SYSTEM USING ON ARM

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Abstract: Environmental monitoring systems are often designed to measure and log the current status of an environment or to establish trends in environmental parameters. In this paper, We proposed an autonomous robotic system that is designed and implemented to monitor environmental parameters such as temperature, humidity, air quality, and harmful gas concentration. The robot has GPS coordinates, and it can store data on the Thing Speak IoT platform. The mobile robot is controlled by a smart phone which runs an app built on the Android platform. The whole system is realized using a cost-effective ARM-based embedded system lpc2148 which communicates through a wireless network to the IoT platform, where data are stored, processed and can be accessed using a computer or any smart device from anywhere. The system can update sensor data to IoT server every 15 seconds. 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. A proof-of-concept prototype has been developed to illustrate the effectiveness of the proposed system.

Keywords: ARM7 controller, SO2, MQ135 Sensor, , GPS, Robo.

1.INTRODUCTION

Environment monitoring is the collection of data and information on environmental parameters. Monitoring and evaluating the health of our natural resources is also essential for effective environmental planning, policymaking and solving environmental pollution. For the extremely polluted region, it carries the health risk for monitoring manually. To avoid these risks, remote monitoring techniques along with a robotic system that has intelligent data acquisition, communication and processing are crucial in revolutionizing monitoring and protection. 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 [1]. Robots are also being designed to explore areas with harmful gases, monitor climatic conditions, and to study about a remote place that is quite risky for the human [2]. Keeping the above statement in the forefront, 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 (Acorn RISC Machine) which presents a high-cost performance, code density, excellent period interrupt response and low

electricity consuming with a small piece of a silicon chip. Specifically, the ARM is an ideal option for the embedded system that might assume additional significant functions while other simple SCM (Single Chip Micyoco) cannot, as an instance, The Raspberry Pi 3 model B includes Broadcom BCM2837 64-bit ARMv8 Quad-Core Processor powered Single Board and ARM&. It also has enough pins for GPIO and serial communication pin that can be connected to the number of sensors. All those benefits make ARM the most effective selection for completing the system [3]. In order to deploy a scalable and remote monitoring system, an efficient platform that enables users to monitor their daily exposure to air pollutants by giving air quality information provided by various sensing infrastructure is proposed. The sensors periodically monitor air quality. The data can be monitored and accessed from anywhere using mobile phones or PC with Internet access. The implementation has sensors for air quality, CO, CO2, and temperature and humidity to monitor the environment around. The Raspberry Pi has been used to interact with the IoT platform and sensors. The ARM& Mega microcontroller is used for control and navigation of the robot. The system has been developed by python and embedded C programming language. The robotic system with GPS controlled feature enables to move according to user's instruction autonomously and collects sensor data from targeted locations. An Android app has been developed for the user friendly interface. All collected data is sent to the Thing Speak [4] IoT platform in order to be accessed by the user from a wireless connection. Real-time cloud graphical visualization is performed to analyze the collected data. This multipurpose robotic system is capable of remote monitoring without any human intervention and keeping away environmental hazard risks.

2.LITERATURE SURVEY:

In this environmental monitoring systems discussed, we use environmental sensors, robotic systems, IoT are been discussed in order to get overall description about the work.With recent advances in wireless sensor technology, low power single-board computers, and short-range communication technologies, remote sensing applications have improved towards solutions that encompass ubiquitous computing. A Cyber Physical device was once proposed for environmental monitoring of ambient stipulations in indoor spaces [4]. Shete R. and Agrawal S. presents the framework for monitoring the metropolis environment. Low-cost Raspberry Pi used for implanting the system. However, no emphasis has given on particulate matter which left the environment monitoring system incomplete[5].Biao Jiang and Christian F. Huacón developed a Cloud-based Environment Monitoring Smart Device (CEMSD) 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[6]. The data related to temperature, humidity, light intensity, gas leakage, sea level and rain intensity are captured, and then the data is sent wireless to Thing Speak using ARM& UNO. This work is focused significantly on the MATLAB visualization and

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analysis of the environmental data [7].© IJEDR 2019 | Volume 7, Issue 4 | ISSN: 2321-9939IJEDR1904071 International Journal of Engineering Development and Research (www.ijedr.org) 402The authors present an IoT based real-time weather monitoring system using Raspberry Pi which is intricate compared to ARM& due to the programming language used and the Raspier operating system [8]. The designed and developed a wireless network of sensors for environmental monitoring using Raspberry Pi and ARM&. They employed Wi-Fi module to instrument the IEEE 802.15.4 standard for data collection from multiple sensor nodes at a base station (Raspberry Pi). This system can be extended to ensemble large scale applications, however in the present form, the system lacks cloud connectivity [9].In order to deploy a scalable and remote monitoring system, an efficient platform that enables users to monitor their daily exposure to air pollutants by giving air quality information provided by various sensing infrastructure is proposed. The sensors periodically monitor air quality. The data can be monitored and accessed from anywhere using mobile phones or PC with Internet access. The implementation has sensors for air quality, CO, CO2, and temperature and humidity to monitor the environment around. The Raspberry Pi has been used to interact with the IoT platform and sensors. The ARM& Mega microcontroller is used for control and navigation of the robot. The system has been developed by python and embedded C programming language. The robotic system with GPS controlled feature enables to move according to user's instruction autonomously and collects sensor data from targeted locations. An Android app has been developed for the user- friendly interface [10].

3.BLOCK DIAGRAM:

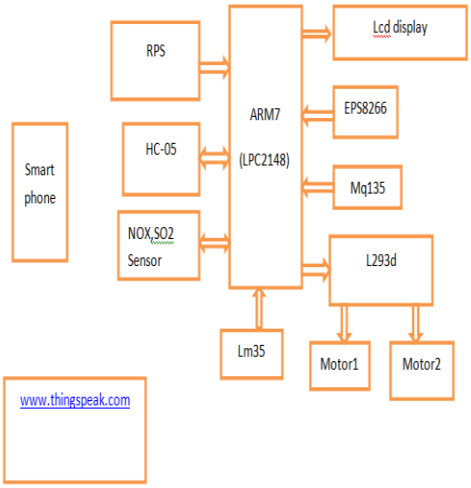

Fig: 3 Block Diagram

4.IMPLEMENTATION

4.1) Power Supply: This section is meant for supplying Power to all the sections mentioned above. It basically consists of a Transformer to step down the 230V ac to 9V ac followed by diodes. Here diodes are used to rectify the ac to dc. After rectification the obtained rippled dc is filtered using a capacitor Filter. A positive voltage regulator is used to regulate the obtained dc voltage.

4.2) ARM7: ARM is the abbreviation of Advanced RISC Machines, it is the name of a class of processors, and is the name of a kind technology too. The RISC instruction set, and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs

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Fig:4.1 ARM7 controller

4.3) Temperature sensor: Thermistors are a temperature sensing devise. It is used to sense the temperature. In this project by depends on the value of temperature the exhaust fan will run.

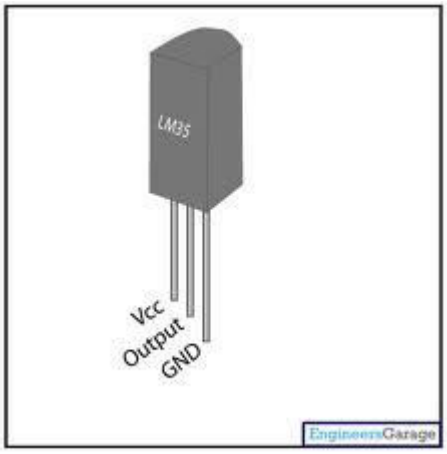

Fig:4.2 LM35 Sensor

4.4) so2 sensor: This electrochemical sensor is a high quality, cost effective electrochemical cell for the detection of Sulphur Dioxide in air. The 3-electrode robust design is ideal for fixed applications in industrial and environmental monitoring. This version is available for 0-20ppm SO2 measurement.

Fig 4.3: so2 sensor

4.5) No2 Sensor: Low-cost electrochemical nitrogen dioxide (NO2) sensors offer exciting new opportunities for fast and distributed outdoor air pollution measurements. The sensors are stable, long lasting, require very little power and are capable of measurement resolutions in the parts per billion (ppb) range. However, electrochemical NO2 sensors are susceptible to temperature (T), relative humidity (RH) and interfering gases, which can all impact the measurement.

4.6) HC-O5/Bluetooth: Communication device:-over project is based on wireless communication between micro controller and mobile phone. But alone micro controller is not able to communicate directly to the android mobile phone. Bluetooth Serial module's operation doesn't need drive, and can communicate with the other Bluetooth device that has the serial.

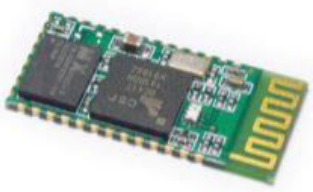

Fig. 4.4 HC-05 Bluetooth

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4.7) DC Motors: A DC motor with gear box attached to the shaft, which is mechanically commutated electric motor powered from direct current (DC). Generally used in DIY projects, Battery operated toys, Radio controlled vehicles, Robotic projects etc.

5.RESULT

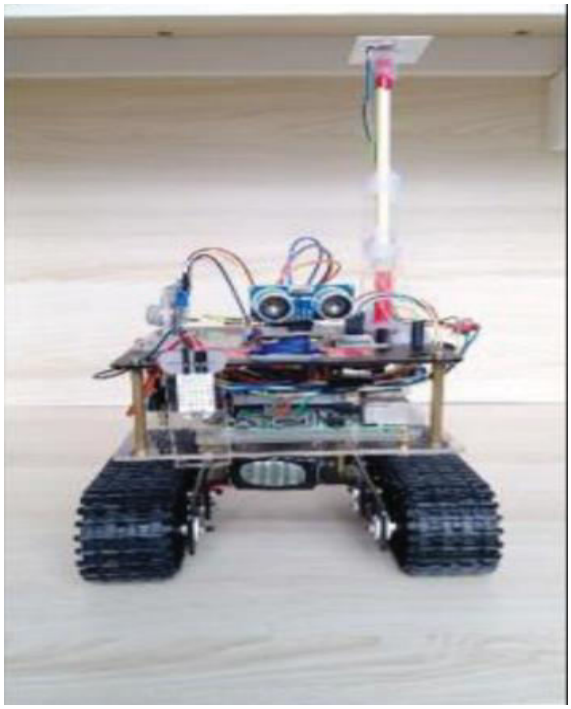

Fig:5 Hardware Implementation

6.CONCLUSION:

In this present work, design, and implementation of a GPS controlled robot for environmental parameters monitoring based on IoT and ARM have been accomplished. The developed ARM-based embedded system with the IoT 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 IoT server as well as displays it on the web for a high-level data analysis and processing. Graphical visualization evidence shows that the robotic system works efficiently. Moreover, the key advantages of the system are The intuitive user interfaces in the App and Autonomous movement after getting instruction from the user. Also, the system is cost-effective, and the costs are less than 80 USD. It updates sensor data to IoT server in every 15 seconds. Secured data in IoT platform and can be accessed from anywhere of the world. Future work 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.

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