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GPS Controlled Robotic Vehicle for Environmental Impact Analysis

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ABSTRACT : Environmental monitoring is indeed a review of the processes and activities required to track the environmental baseline. IoT sensors are able to offer correct real-time information on the surrounding to assist us to understand how we tend to have an effect on the environment and take actions to enhance quality of life. We proposed an automated vehicle that used for monitoring temperature, humidity, pressure, light luminescence and concentration of gases. Visualization of environment can be obtained by camera through IoT gateway. The proposed robotic vehicle is controlled by an individual via android application. Latitude and longitude coordinates are obtained by Global Position System mounted on the robotic vehicle. The robotic system is accomplished using a cost-efficient Arduino that communicates through a wireless network to the Internet of things platform, where data are stored, processed and can be accessed using a smart device. The system can update the data to the application for every 8 seconds. Data stored can be used to further explore pollution reduction, energy savings and improve the overall living environment. It focuses primarily on Internet connected monitoring system that streams live camera imagery and other environmental information through Internet of things. The system can be linked with satellite for effective communication.

KEYWORDS :GPS, Sensor, Robotic Vehicle, IoT Platform, Arduino.

I. INTRODUCTION

Environmental monitoring involves assessing environmental quality to controlling risk. It is developed as the basis for environmental impact assessment production. This knowledge is used to research natural changes and measure current environmental condition and used in the preparation of environmental impact assessments, as well as in various circumstances in which human activities threaten the natural environment with harmful effects. The main aim of this system is to track the Environmental Parameters without any human intervention. C.Nagarajan *et al.* proposed environmental observation stations are very sensitive to changes in temperature and humidness amongst other factors [3]. The architecture is sorted into environmental monitoring, navigation system and IoT platform. Internet of things is all about connecting electronic devices together and exchanging data. Scientists use robotic systems as a method for data collection for a better understanding of environmental processes [8]. For areas with dangerous air, climatic conditions are regulated and environments that are hazardous for humans such as remote robots are used. In IoT gateway data is transmitted from sensors, and they are often stored and analyzed by diverse IoT platforms like Blynk, Thingier.io, and Thingspeak [4]. C.Nagarajan *et al.*[12] proposed the robotic vehicle can be seen in an android application via the Internet. System provides new opportunities that arise large scale environmental monitoring.

II. RELATED WORK

In this environmental observation system, we tend to use environmental sensors, robotic systems, IoT square measures are discussed in order to get the overall description about the work.

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Cloud-based surroundings observance

Biao Jiang and Christian F. Huacon engineered up a Cloud-based surroundings observance good Device (CEMSD) that screens numerous natural parameters, as an example, air quality, clamor, temperature, and viscosity. The contraption gathers and sends data from centered estimation areas through a distant system or cell system to a cloud server. The knowledge known with temperature, humidity, lightweight power, gas spillage, and ocean level and rain force area unit caught, and after the knowledge are shipped remotely to Thing Speak utilizing Arduino UNO. This work is targeted all together round the MATLAB perception and examination of the natural data [5].

Environmental pollution monitoring

Omar Otoniel Flores-Cortez and Ronny Adalberto Cortez propose a low value internet of thing system for environmental pollution observation in developing countries. The design and development of designing telemetry station for watching contamination by particulate matter (PM) within the surrounding atmosphere [6]. An Esp32 controller as the electronic equipment and Google Suite as IoT stage were utilized. The result is an IoT model for the activity of contamination by PM2.5 and PM10 pollutants, that data are accessible from any device with web access through an internet site.

Cyber-physical system for environmental monitoring

With recent advances in wireless device technology, low power single-board computers, and short-range Communication technologies, remote sensing applications have improved towards solutions that include present Computing. A Cyber-Physical device was once projected for Environmental observation of ambient stipulations in indoor areas [7].

III. SYSTEM ARCHITECTURE

The proposed framework has established fusing the embedded hardware, IoT segments, and software. The methodological development of this research was based on IoT System. This paper aims to apply IoT techniques, embedded system and electronic sensors in the design and implementation of a low-cost robotics to monitoring the condition in the environment. The robotic system is constructed by using mechanical and electrical components. It is of the wheeled type for autonomous movement. Our proposed system is wireless and therefore the increasing internet technology like Wi-Fi, cloud network, wireless system are often used from everywhere and anytime. The controlling vehicles for the environment monitoring in system is an Arduino. The data send using mobile app is received by IoT module connected to Arduino. Then, it reads the data and decides the output of electrical devices connected to it through Internet. The system can update data to IoT server for every 8 seconds. LM35, MQ-2, HumiditySensor, digital air pressure sensor, LDR and Radiation sensor are the sensors used for environment monitoring. HC-05 is the Bluetooth module used in the robotic system. It can be used for both master and slave configuration. Blynk is an open source android application acts as an interface between the smart phone and hardware which is accountable for the communication. Systems can also use Blynk cloud or compile our private Blynk server. A power supply of 5V is given to the electronic circuit from the Battery. Camera is connected to the circuit in order to obtain the environmental visualization. The robotic vehicle navigation is monitored by GPS module.

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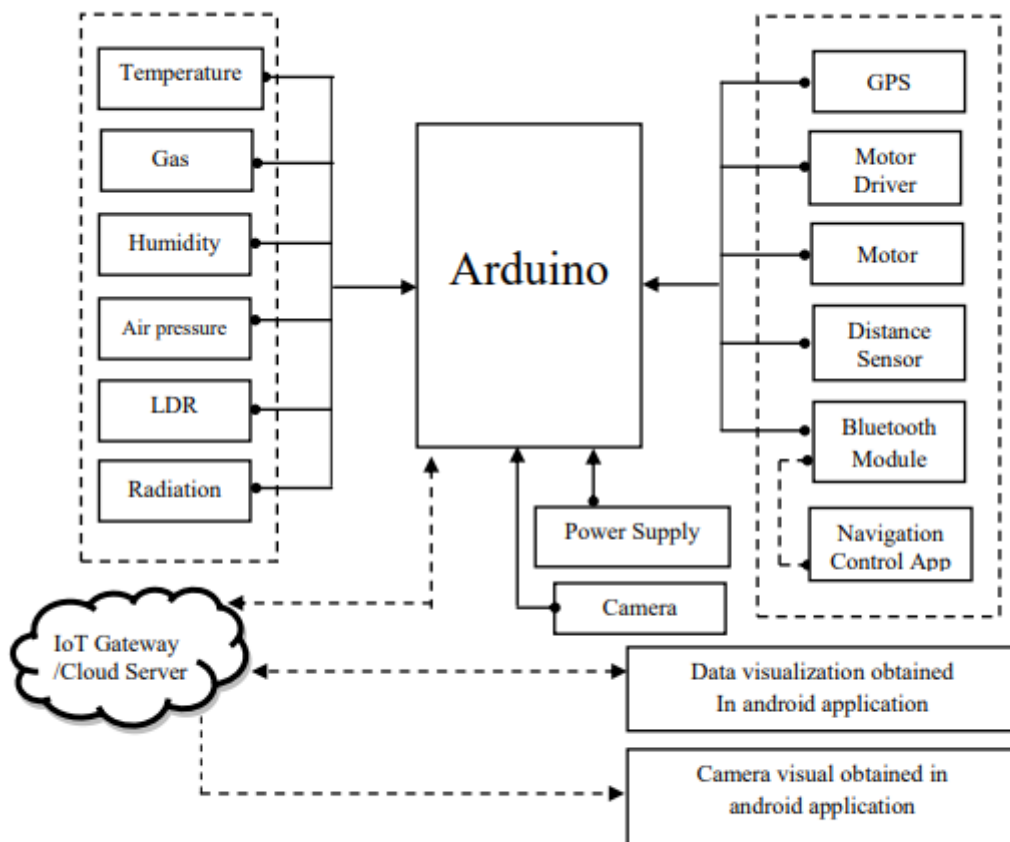


Figure .1 Block Diagram of Proposed System

IV. SYSTEM COMPONENTS

Arduino mega

Arduino is an open source microcontroller that will be simply programmed, erased and reprogrammed at any instant of time. Main advantages are speedy processing and easy interface. The Arduino software system is easy-to-use for beginners, nevertheless flexible enough for advanced users [8]. The Arduino Mega is a microcontroller board based on the ATmega2560 containing 54 digital input/output pins, 16 analog inputs, 4 UARTs (hardware serial ports). ATmega2560 is our choice as it is an easy option for use in prototyping with ease in robotics.

Environmental monitoring

Sensors

The robotic monitoring system uses sensors such as a temperature sensor (LM35), Gas and smoke sensor (MQ-2), Photo resistor (LDR), Humidity sensor (DHT11), Atmospheric Pressure sensor (Digital air pressure sensor).

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LM35 is a temperature measuring system having associate analog output voltage proportional to the temperature [9]. It provides output voltage in Centigrade (Celsius). The sensitivity of LM35 is ten degree Celsius. As temperature increases, output voltage conjointly will increase. The MQ-2 Smoke LPG Butane Hydrogen Gas Sensor Locator Module is valuable for gas spillage identification. Due to its high sensitivity and speedy reaction time, measurement can be taken as quickly as possible. It is reasonable for recognizing H₂, LPG, CH₄, CO, Liquor, Smoke or Propane. The affectability of the sensor can be balanced by the potentiometer. A photo resistor may be a resistor whose resistance decreases with increasing incident lightweight intensity. It exhibits electrical conduction. The DHT11 is a humidity sensor. It uses an electrical phenomenon humidity device and a semiconductor unit to measure the surrounding air and spits out a digital signal on the information pin. The amount of vapour in air will have an effect on human comfort as well as manufacturing producing process in industries.

Environmental visualization

Environmental visualization is obtained through smart camera system. With the use of camera in sensing element network one can produce vital applications like video surveillance which typically helps in environmental monitoring. IoT Smart camera captures the video visuals from the surroundings and IoT gateway which is connected to Internet that transmits the data to the cloud server using wireless communication. The data from the cloud is then transferred to the mobile application. Transferring video signal consumes less time when compared to other application. Obtained visual data can be used to analyse the environmental condition, human surveillance, and security aspects [10].



Figure.2 Environmental Visualization Obtained Through Camera

Navigation and control hardware

For navigation and control the system requires GPS module and compass with Arduino mega. Global Positioning System (GPS) is a satellite navigation system used to verify the ground position of associate object. Global Positioning System is a satellite-based navigation system that provides vital positioning capabilities to the robotic vehicle. It has two links uplink and down link. Motor driver is a microcircuit chip that is usually used to control motors in robots. L293D motor driver IC is used to control the autonomous movement. It is capable of controlling two DC motor simultaneously. It allows DC motor to drive on any direction. Motor driver is capable of rotating the motor in clockwise or anticlockwise direction. The H-Bridge concept allows the voltage to change its direction.

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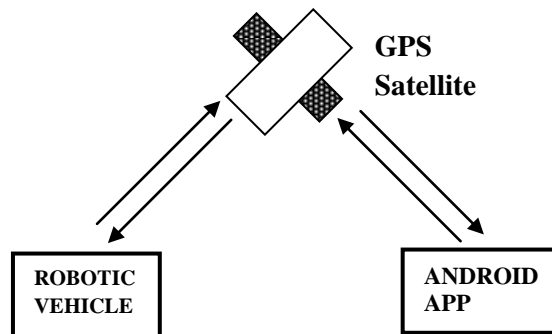


Figure .3 GPS module

V. PROPOSED SYSTEM

The robotic system is designed in a way to provide autonomous movement. The autonomous movement can be controlled by the mobile application. The intuitive user interfaces within the App and Autonomous movement after getting instruction from the user. Environmental visualization is transmitted to android application through IoT gateway which is obtained by the camera mounted on the robotic vehicle. Robotic system monitors environmental parameters like temperature, humidity, air quality, air pressure, light intensity and radiation. Latitude and longitude coordinates are obtained by Global Position System mounted on the robotic vehicle. The robotic system is accomplished using a cost-efficient Arduino that communicates through a wireless network to the Internet of things platform, where data are stored, processed and can be accessed using a smart device. The proposed system updates the data to IoT platform for every 8 second. Data are collected and transmitted to phone through IoT. The stored data will be used for further analysis of the reduction of pollution, save energy and provide an overall living environment enhancement.

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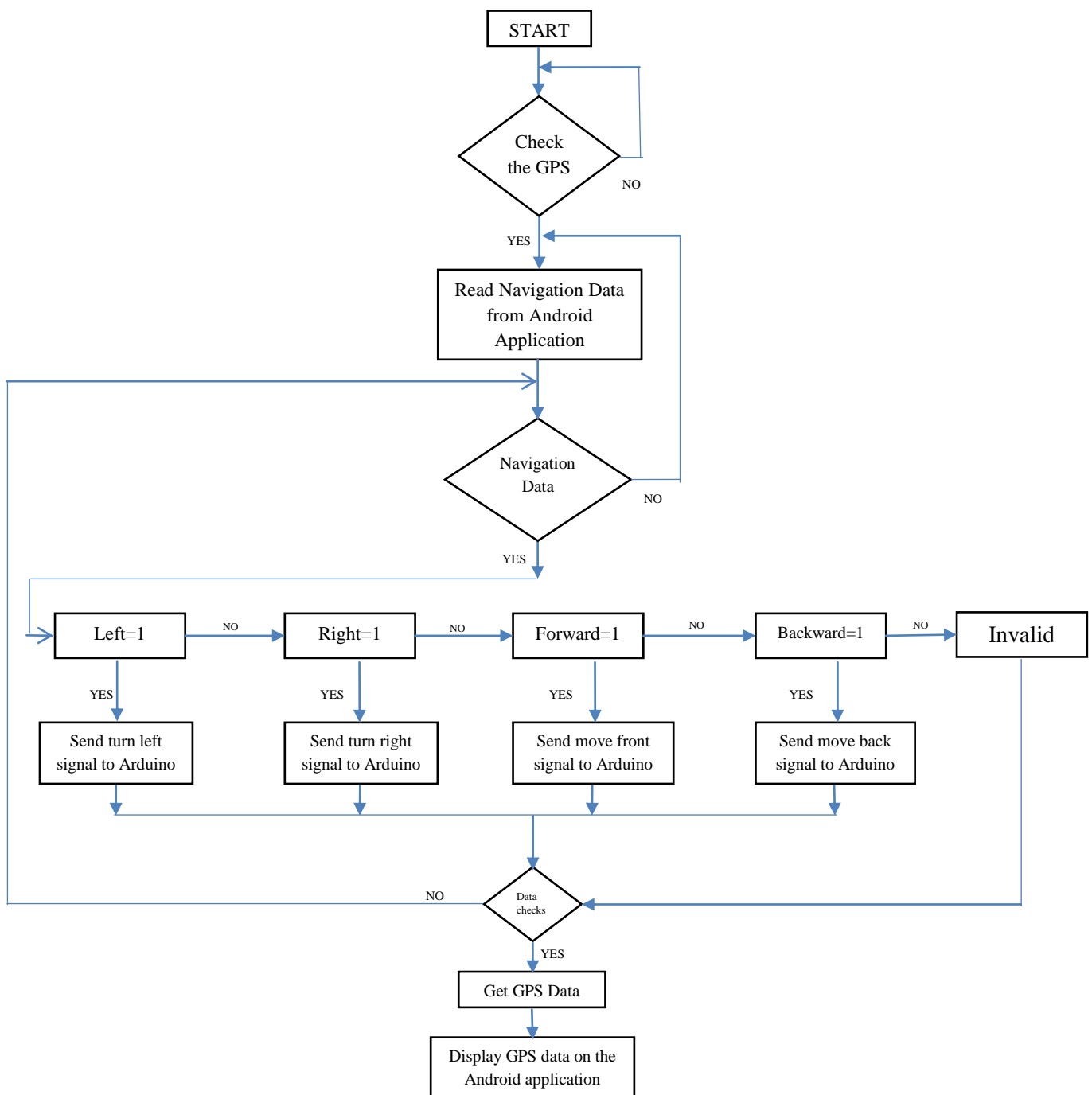


Figure. 4 Flow Chart for environment sensing

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VI. CONCLUSION

This paper proposes a GPS controlled robotic vehicle for monitoring the environmental conditions such as temperature, humidity, air quality, air pressure, light intensity, and radiation. Sensors sense the data from the environment and transmit it to the cloud server using wireless communication. Then the data are updated to android application for every eight seconds. The key benefits of the system are the user interfaces within the App and Autonomous movement after obtaining instruction from the user. The proposed robotic vehicle work effectively in remote places to collect data and it is easy to implement. The environmental visualization can be monitored in android application which is obtained through the camera in the system. Data obtained through the internet of things platform can be used for future prediction.

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