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IoT based GPS Controlled Environment Monitoring Robotic System

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ABSTRACT:

Due to the innovative advancements, the ability to collect explicit environment releases haveincreased in urbansocieties. The main aim of this paper is tocreate cloud-based framework known as Cloud-based Smart Device Environment Monitoring (CEMSD). This is able to track all kind of natural parameters like quality of air, stickiness content and temperaturelevel.

In order to create CEMSD, components like Raspberry Pi 3 (RPi 3) of Model B, DHT11 temperature sensor along with microchip, a gas sensor,COZIR wide range 100% carbon dioxide (CO2) sensor, MQ131- Ozone (O3) gas sensor, PPD42NS particulate issue (PM) woods dust sensorare used. The function of CEMSD is to gather the information and sendto cloud with the help of remote/cellassociation. Here, the information will be collected, monitored, and made accessible with the help of a PC or through a savvy device.

Keywords: PYTHON ARM, Internet of Things, Raspberry Pi, GPS.

INTRODUCTION

Observing and monitoring the environmental parameters have become essential to know the condition of environment. Also, measuring the sustainability of our health has become important for the purpose ofcapableecologicalpositioning, for strategycreation and pollution-control. This shows the well-beinghazard of physical observationin the case ofextremely polluted area. In this case, designing adeviceis useful for remote monitoring so that scrutinizing the polluted areacan be done with no human intervention. Many researchers utilizeddifferent frameworks to collect information using instruments that are more likely to realize natural cycles [1]. The tracking of all kind of climatic circumstanceshave become an efficient method and remote monitoring framework have been performed using remote sensor. These sensors could control and monitor quality of air. The collected information will be accessed through mobile phones or by PC in remote areas also. In order to scrutinize the

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environment condition, the execution involvesCO & CO2, air quality, and temperature, dampness sensors [2].

LITERATURE REVIEW

Furthermost, a detailed study on wireless type of technologies prove to create a framework of remote sensors.Thisstudy led to advancements in the field of wireless technology both in the aspects of technological as well as economical. Here, the main issue is the choice of the communication. The gathered information could be transferred using IP address to any place i.e., using web platform. Next is choosing a right micro-controller. In [1], a Cloud-based Smart System for Environment Control" proposed by Biao Jiang and Christian F.Huacon illustrates thatthe natural pollutionhas become uncontrollablein all the metropolitan-urban zonesdue to advancements in modernizationas well as faster economic progress. This has led todevelopment of cloud-based smart deviceknown as CEMSD i.e., Cloud-based Environment Monitoring Smart Device. This is used to detect all-naturalmargins such as noise level, humidity, level of temperature, and the quality of air [3]-[5].

In the paper titled "**Mobile Robots Navigation in Indoor Environments Using Kinect Sensor**" by Diogo Santos Ortiz Correa, Diego Fernando Sciotti, Marcos Gomes Prado, Daniel Oliva Sales, DenisFernando Wolf, Fernando Santos Osório- a new kind of surveilling system is demonstrated for monitoring indoor environments. The system is divided into two parts. In the first part, it consists of navigation system involved with Kinect sensor to detect obstacles. The second part involves ANN i.e., artificial neural network in order to identify various configurations. The main limitation of this paper is it is limited to indoor applications [11].

In the paper titled"**Collaborative Multi-Robot Search and Rescue: Planning, Coordination, Perception, and Active Vision**" by Jorge Peña Queralta, Jussi Taipalmaa, Bilge Can Pullinen, Victor Kathan Sarker, Tuan Nguyen Gia, Hannu Tenhunen, Moncef Gabbouj, Jenni Raitoharju And Tomi Westerlund, it represents multi-robot systems which supportSAR (Search and Rescue) type of operations. These operations could help to establish a communication link, search for the victim, monitoring, surveilling the situation etc. Techniques such as active perception are applied to SAR which helps to understand and analyze the SAR personnel actions [13].

In the paper titled **"Design of Wireless Mobile Environment Monitoring System Based on Spherical Amphibious Robots"** by Shuxiang Guo, Xujie Yang, Jian Guo, Chunying Li, it represents an environment monitoring system which monitors data of aquaculture. To display the obtained data, controlling interface is designed using LabVIEW. The communication between robot and the PC is established using XBee module. The robot is embedded with pressure sensors, temperature and humidity sensors and HD cameras to capture the data. In this, a PID controller is used to detect and monitor the fish in various depths [3].

In the paper titled **"Autonomous Environmental Monitoring by Self-powered Biohybrid Robot"** by Kan Shoji, Keisuke Morishima, Yoshitake Akiyama, Nobuhumi Nakamura and Hiroyuki Ohno, a self-powered monitoring system for tracking the

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environmental conditions is introduced. These are the bio-hybrid robots used for generating electric power from their body fluid. This can be used to observe the environment by the backpacked insect. To make this happen, the imBFC (insect-mountable Biofuel Cell) and a wireless sensor module will be mounted on the insect. This insect will monitor and track the environmental conditions [8].

METHODOLOGY

This section illustrates the overallmethodology of the proposed. This section shows the block diagram of the existing as well as proposed system in order to compare the results.

The present environmental checkup structuresdiscussed in this section are to simplify the ideology with a focus on remote sensors, IoTmechanized frameworks. In cyber-physical monitoring structure including remote-sensing detecting kind of applications, advances in short-path communication, innovations in remote sensor applications, single-board PCs consuming low-power etc., have been enhancedproviding global processing [6], [7]. This framework was intended for the indoor observation of environment [10]. In order to check the quality of air, Raspberry Pi included framework is proposed [12].

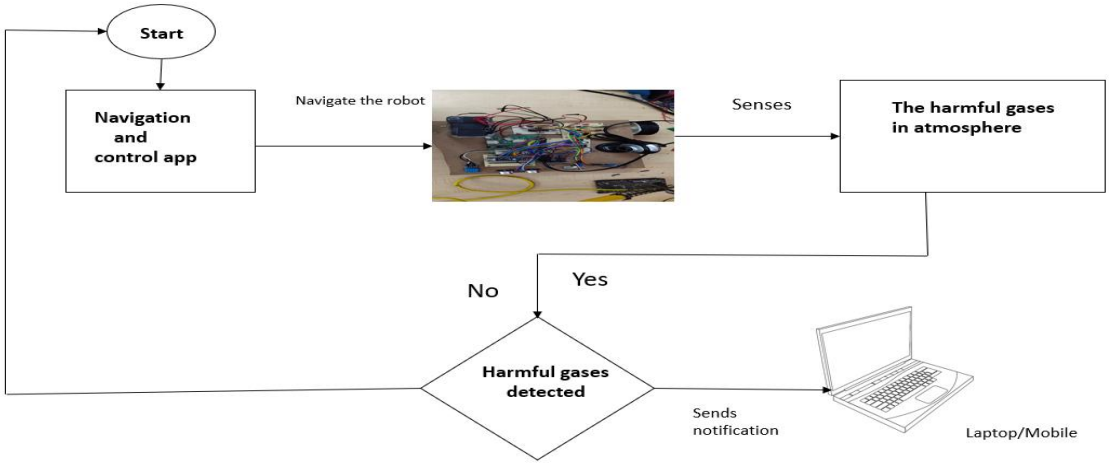

FIGURE 1: Implementation of proposed system

The above FIGURE 1 shows the implementation of the proposed system. The entire methodology starts with the navigation and control app. This is used to assist directions to the robot i.e., navigate the robot to the destination place. This senses the harmful gases available in the atmosphere. The levels of atmospheric parameters are then detected and sent to mobile application i.e., blynk application via internet. These parameters are then carefully monitored in the app.

BLOCK DIAGRAM

The proposed robotic smart device was proposed to synchronize the implanted components, IoT modules and programming segments. FIGURE 2 shows the IoT and ARM based automated device. This framework is divided into two sections:

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1. **Environment Monitoring System**: This structure is responsible for gathering information from the sensor and sending it to the IoT phase.

2.Navigation and Control System: This structure is responsiblefor controlling the automated design through application.

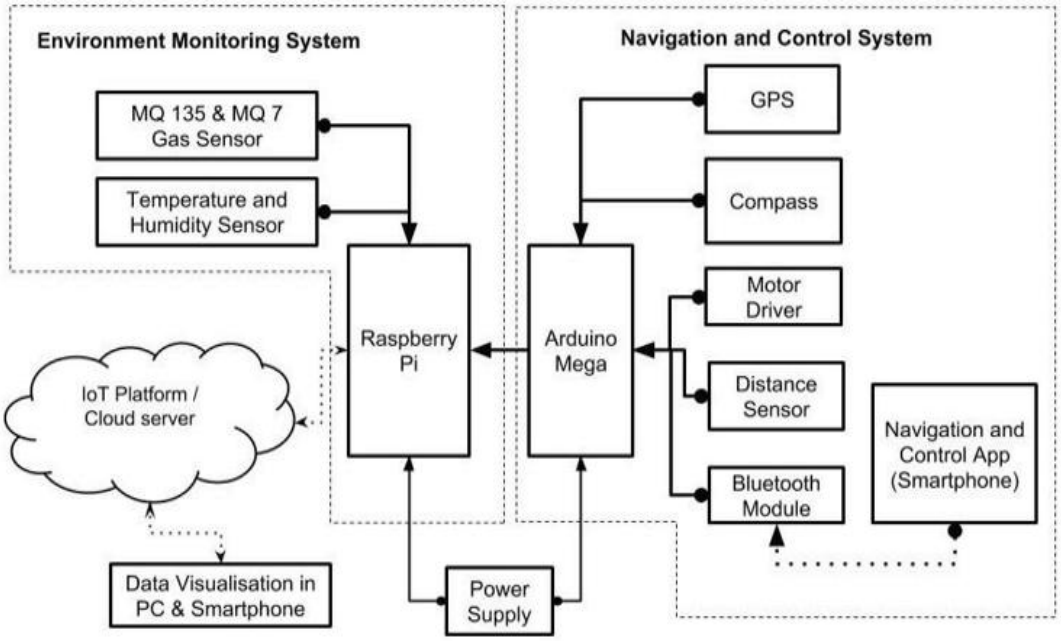

FIGURE 2: Existing block diagram

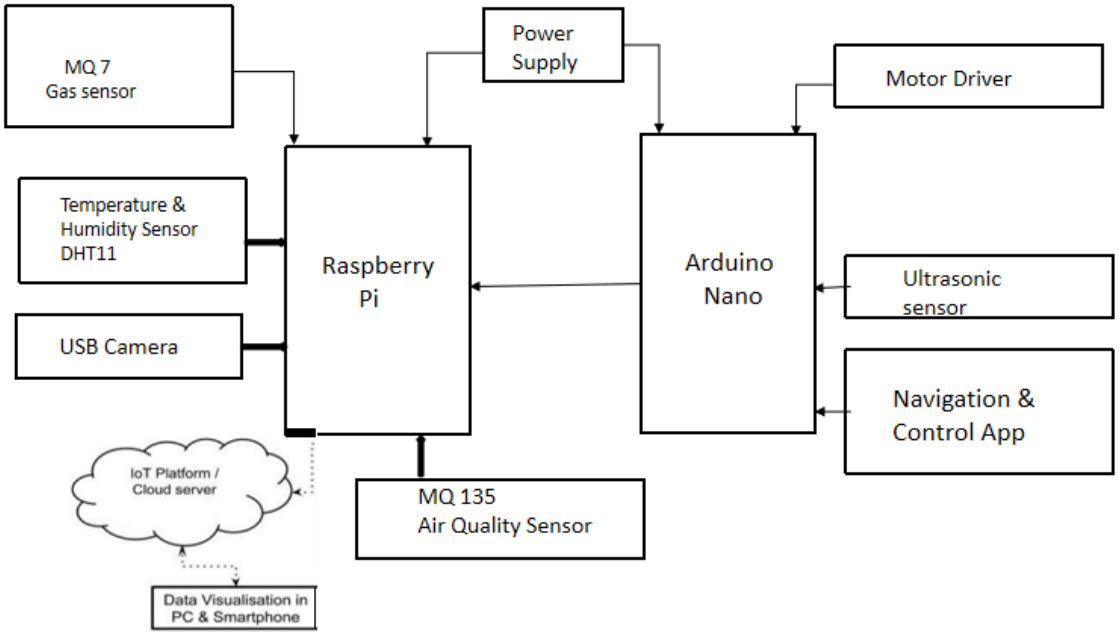

FIGURE 3: Block diagram of proposed system design

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In this, a Raspberry Pi is used in the framework is designed to interface the three sensors such as DHT11, MQ135 sensor, and the MQ7 gas sensor. Raspberry Pi functionality is to gather the information from the sensor and send to IoT network. Here, the robot is essential as there is a need for availability of network through GPRS module.This will make the sensors to accommodate the necessary information of natural margins. Hence, there will be no human intervention. The block diagram comprises of a micro-controller- Arduino mega, GPS module, a robot skeleton consisting of robot-route and a design of control framework, compass, DC engine, and an Arduino engine shield comprising of a L293D engine driver. This controls DC engine with Arduino. A robot-route design structure makes use of Arduino which is used to speak through GPS. And, compass is used to discoverthe location and reach the destination. An ultra-sonic sensor is placed to give the exact route location. Finally, an application is needed to assist directions with the help of Bluetooth.

The block diagram of proposed system is shown in FIGURE 3. In this, all the components/ devices get interfaced to Raspberry pi 3 and Arduino micro-controller. The robot will be able to travel from one place to another through motor driver.The sensors will gather the information and transfers to raspberry pi. This in-turn sends to an android application- Blynk IoT. The basic Navigation system consists of a GPS module, a Bluetooth and compass moduleleading to design complexity.

To avoid these limitations, an android application known as Blynk-Iot is chosen. In this, it allows live-tracking of information.

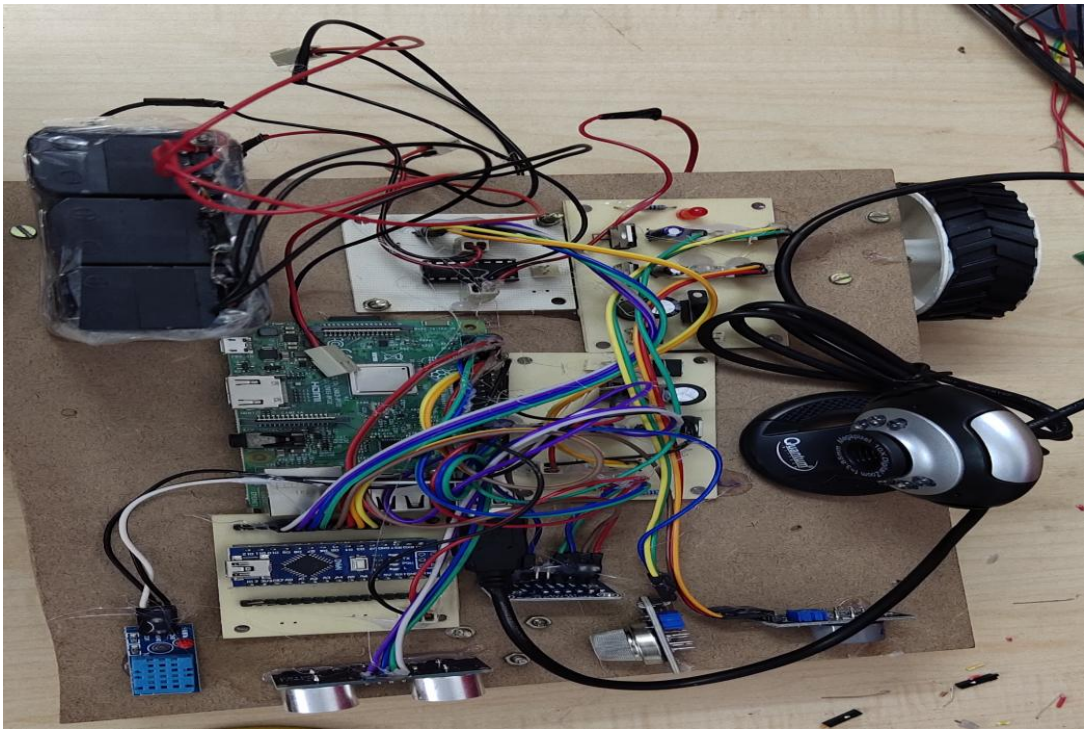

FIGURE 4: Overall circuit of the proposed system

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HARDWARE COMPONENTS

Raspberry Pi 3B:

It is an ARM-based credit card sized board. This is a single board computer. The processor runs at 1.2 GHz and consists of 1 GB of RAM memory. It consists of 40 GPIO pins meant for general purpose. Additional features include Bluetooth connectivity as well as wireless LAN.

Arduino Nano:

It is based on ATmega328P microcontroller. It consists of 14 digital I/O pins, analog inputs of 8, flash memory of 32KB. The clock speed is 16 MHz This series of microcontroller is chosen because of its easy prototyping in the area of robotics.

Environment monitoring system:

This block consists of sensors such as MQ-7, MQ135, Humidity sensor and DHT11 temperature sensor. The MQ-7 sensor is a carbon-monoxide gas detector which detects the level of carbon monoxide present in air. MQ135 sensor will detect the toxic or harmful gases available in air. DHT11 is a temperature sensor as well as humidity sensor.

Navigation and control system:

Blynk application

This is an easy-to-use interface which allows creation of a dashboard, organize buttons, widgets easily on screen. It also allows to interact with digital as well as analog pins. Sending and receiving the information from the hardware is so simple in this application. It could control the hardware remotely, it can display, store, visualize the sensor data. The FIGURE 5 shows the architecture of Blynk.

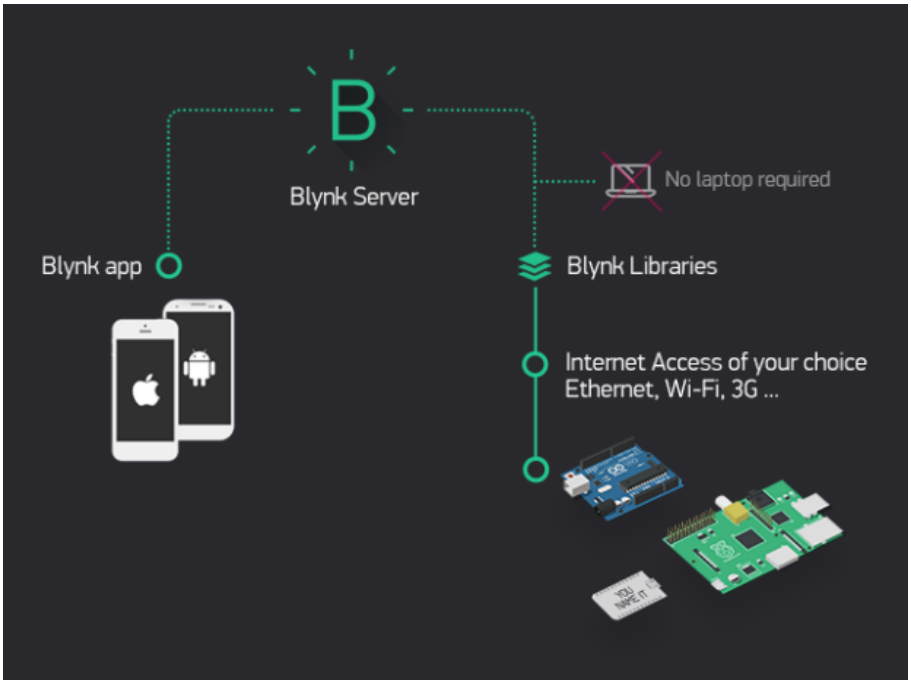

FIGURE 5: Blynk Architecture

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RESULTS

FIGURE 6: Output graph showing when robot is turned off

The above FIGURE 6 shows the output graph when robot is turned off. Here the graph is nil as there is no sensors activated when robot is off. These results are shown in Blynk application.

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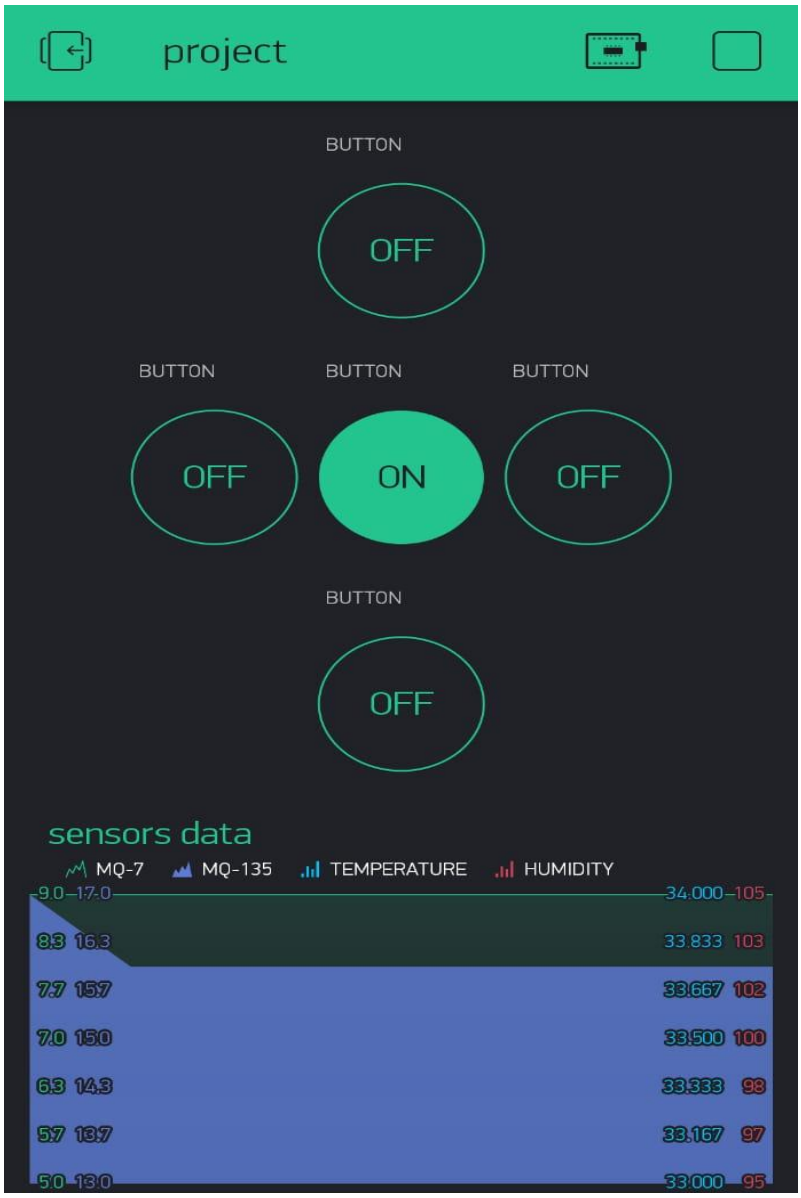

FIGURE 7: Output graph showing when robot is turned on and MQ-7 sensor senses the data

The above FIGURE 7 shows the output graph when robot is turned on. Here, MQ-7 sensor captures the data like temperature level, humidity level. From this figure, blue color indicates temperature level and red color indicates humidity level.

CONCLUSION

A detailed study underwent on structure which allows to detect environmental margins/ parameters. In this, a framework is designed in order to monitor the environmental parameters and the developed framework could consume lowpower. This smart device is suitable for both indoor as well as outdoor monitoring. The environmental conditions sensed by the sensors are efficiently balanced. A GPS and ARM based robot is proposed to observe theenvironmental

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parameters effectively. This smart device could track the environmental boundaries and helps to estimate the quality of air efficiently. The results prove that it is useful in tracking the environment conditions gradually andthe app enhances the smooth usage thereby ensuring easy controlling of the robot.

FUTURE SCOPE

In future, this system can be extended to many devices by connecting together. A IoT application could be designed by modifyingthe code. The sensed data could be gathered in broker. This could be accessed to whoever needs for it i.e., an android device is able to support various inbuilt values from sensor like humidity, temperature, pressure, and light intensity. These values can be easily gathered in broker. These can be accessed whenever required by the users. Sensors can also be externally interfacedto the device. This could also be accessed and retrieved when needed. All the devices can be interfaced together and communication among those devicescould be established through a secured Wi-Fi connection.

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