

The Design and Implementation of GPS Controlled Environment Monitoring Robotic System based on IoT and Raspberry pi

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Abstract:

Smart environments and Ambient Intelligence (AmI) advances are characterizing the future society where energy improvement is the fundamental for a practical development. Versatile mechanical technology is likewise making a significant commitment to this development with the integration of sensors and insightful handling calculations. This paper presents the utilization of an Assistant Personal Robot (APR) as a self-sufficient operator for temperature, stickiness, and luminance management in human-frequented regions. The robot multiagent capacities permit gathering sensor data while investigating or performing explicit undertakings and afterward checking human agreeableness levels. The proposed strategy makes data maps with the appropriation of temperature, mugginess, and luminance and deciphers such data as far as solace and cautions about restorative activations whenever required.

1. Introduction:

Human health and comfort are typically identified with the surrounding conditions where an individual invests extensive stretches of energy during the day. Advances on Ambient Intelligence (AmI) have encouraged the execution of shrewd conditions that can recognize and respond to human presence. The idea of brilliant conditions is normally centered around energy advancement, particularly on high-requesting structures and offices. One of the goals of AmI is to keep up a productive utilization of the energy assets by progressively changing the conduct of various actuators that control the ecological conditions through the location and transformation to human presence. The engineering of such frameworks is typically

founded on sensor networks meeting into a particular computational unit that plays out a continuous examination of the assembled information, changing the conduct of the various actuators situated inside the structure to coordinate the ideal qualities for every particular circumstance. The paper [1] introduced a contextual analysis of energy the executives in a savvy building dependent on the joining of Wireless Sensor Networks (WSN). In this line, having a proficient administration of the lighting control arrangement of structures is fundamental for energy improvement and it has just been tended to in the writing [2]. Likewise, it has been demonstrated that the utilization of WSN for minimal effort energy enhancement of green structure lighting frameworks is a suitable choice to consider

[3]. The support of air quality and warm conditions in structures is likewise a significant aspect of the energy devoured because of the powerful interest of ventilation and cooling units (HVAC). The paper [4] proposed the execution of a neurofuzzy regulator for warm solace guideline in a place of business in which an indicator model is utilized so as to keep consistent solace regardless of the warm variation time needed by HVAC frameworks. Moreover, the usage of sensor network innovations is additionally considered on metropolitan situations to, for instance, screen the air quality at various metropolitan areas [5] and traffic checking [6].

The unpredictability and size of fixed organization sensors are on the ascent [7]; this has advanced/empowered the exploration for new specialized philosophies with an end goal to make a typical calculated space among various heterogeneous gadgets, for example, sensors, actuators, handling units, stockpiling units, and terminals. The Internet of Things (IoT) idea was conceived from this need and has permitted a simple coordination of numerous/different gadgets cooperating inside a typical clever climate [8]. Since the advancement of the AmI advances, those gadgets are frequently utilized in family unit spaces so as to empower a brilliant administration of solace, medical care, security, and energy sparing. The subsequent execution of this strategy is prominently known as shrewd home [9]. The worldwide market really offers

straightforward shrewd home answers for nonexpert clients with an end goal to arrive at the overall population, empowering the improvement of new simple to-introduce proposition [10]. The majority of such executions are centered around giving medical services answers for old individuals or for individuals with maladies [11]. These methodologies on medical services savvy conditions are explicitly intended to give a few and various preferences pointed toward expanding independence and personal satisfaction of their clients.

The mix of versatile robots in savvy conditions is a difficult subject that has as principle objective the augmentation of the idea "shrewd climate" by methods for the mix of physical portable stages equipped for associating with clients, conditions, and different gadgets. The paper introduced a savvy home which screens and examines the ecological conditions to produce and convey sets of arrangements that are utilized to control a help robot working inside the home. The utilization of administration robots for performing medical care schedules is likewise regularly proposed in the logical writing. For instance, in a robot utilizes its PC vision framework for fall recognition. In a similar line, other help robots were proposed for its incorporation in a savvy climate like the Hobbit robot which has different actualized assistive administrations and powerful independent abilities. Furthermore, robot-assistive administrations for shopping conveyance and trash assortment are additionally tended to and examined in [6] in which a few old

individuals were welcome to take an interest in the trials. As the surrounding conditions can shift through various areas inside a similar room, one of the primary disadvantages of fixed-position sensor networks is building up the suitable number of estimating gadgets, just as their dispersion inside a typical space. Inserting sensors locally available versatile robots which are equipped for exploring around a predefined working territory is a viable answer for the adaptability and repetition issues of static organization sensors. Since the route strategies of the robot expects it to have the option to distinguish its situation inside the investigated territory, this data can be additionally recorded alongside the deliberate qualities, permitting it to make a connection between the talks and their situation inside the guide. This procedure gives adaptability when gaining data about the climate that can be helpful in certain applications. For instance, in a cloud-based help is proposed for ecological checking of server farms by methods for performing investigations with independent robots. In a portable robot was proposed as a canny firefighting humanoid robot fit for recognizing fire sources, smoke, and warm reflections by methods for preparing pictures from a warm infrared camera. In addition, reconnaissance and keen control of open air genuine conditions are tended to in by utilizing numerous sensor-prepared versatile robot operators powerfully intended for land watching.

This paper proposes the improvement of an encompassing oversight application as an

integral usefulness of an Assistant Personal Robot (APR), a humanoid-formed assistive robot. Assistive robots are frequently imagined as polyvalent stages equipped for performing various types of assistive schedules that can be progressively modified on request by utilizing its accessible and installed devices. This integral application is centered around keeping the robot mindful of its surrounding conditions: temperature, mugginess, and luminance when performing traditional errands. The fundamental goal of the proposed strategy is to furnish precise guides with the encompassing data acquired by the portable robot while playing out any undertaking so as to caution about awkward conditions. Later on, the APR will utilize this data so as to change the surrounding conditions by performing remedial activities.

2. Literature Survey:

Smart Environmental Sensing Robotic Vehicle for the Internet of Things Framework

Environmental observing utilizing sensors structure the base for a large portion of the ongoing day research. The key boundaries estimated are temperature, dampness, pressure, light illuminance and gas fixation. A few savvy arrangements were oposed to screen these boundaries inside the system of Internet of Things (IoT). To get to the mind boggling area where regular sensor arrangement is restricted, arrangements dependent on Robotic Vehicle (RV) ends up being promising innovation. Despite the fact that few exploration articles are accessible

on RV, it is as yet testing to control the vehicle over the lost separation. Subsequently, we propose an ecological detecting automated vehicle here dependent on 3G GSM network coordinated to the IoT structure giving significant distance route control and natural information assortment. The proposed framework is additionally furnished with shrewd energy reaper utilizing financially accessible sun oriented cells to encourage consistent controlling at the point when the vehicle is sent for basic assignments.

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Environmental checking frameworks are frequently intended to gauge and log the current status of an climate or to build up patterns in natural boundaries. In this paper, We proposed a self-ruling mechanical framework that is planned and actualized to screen natural boundaries, for example, temperature, stickiness, air quality, and destructive gas focus. The robot has GPS directions, and it can store information on the ThingSpeak IoT stage. The portable robot is constrained by a cell phone which runs an application based on the Android stage. The entirety framework is acknowledged utilizing a financially savvy ARM-based implanted framework called Arduino and Raspberry Pi which imparts through a remote organization to the IoT stage, where information are put away, handled and can be gotten to utilizing a PC or any brilliant gadget from anyplace. The

framework can refresh sensor information to IoT worker at regular intervals. The put away information can be utilized for additional examination of the decrease of contamination, spare energy and give a general living climate improvement. The automated framework has intended for cost-successful far off observing ecological boundaries without any human mediation to maintain a strategic distance from wellbeing hazard proficiently. A evidence of-idea model has been created to outline the viability of the proposed framework.

Ambient Intelligence Application Based on Environmental Measurements Performed with an Assistant Mobile Robot

This paper proposes the utilization of a self-ruling right hand portable robot so as to screen the ecological states of a huge indoor region and build up a surrounding knowledge application. The versatile robot utilizes single elite inserted sensors so as to gather and geo-reference natural data, for example, encompassing temperature, air speed and direction and gas focus. The information gathered with the associate portable robot is examined so as to identify uncommon estimations or errors and create centered remedial encompassing activities. This paper shows a case of the estimations acted in an exploration office which have empowered the discovery and area of an awkward temperature profile inside an office of the examination office. The encompassing shrewd application has been created by playing out some limited surrounding estimations that have been

examined so as to propose some encompassing incitations to address the awkward temperature profile.

3. Related Work

The GPS module continuously produces a set of data regarding the position of the earth surface where it is situated which includes the current position with respect to the equator of the earth in terms of Latitude and Longitude. This data can be decoded and printed into the readable format with the help of a microcontroller only. In this project the data regarding the geographical coordinate is extracted from the GPS output with the help of the Arduino. The Arduino can be used as a stand-alone board of which the output or inputs can be taken from the boards or given to the board. They can communicate using standard communication ports like USART, TWI, SPI 52

etc. which enables them to be connected with various kinds of devices. The Arduino board is designed for easy prototyping and the IDE used for coding is very simple and provides so many libraries for interfacing with common external devices.

GPS, or Global Positioning System, is also sometimes called Navistar. GPS is a satellite based global navigation satellite system, GNSS that is used to provide accurate location and time information anywhere on or near the Earth. GPS is run and maintained by the US government, although access to it has been opened up so that it is freely available worldwide when used with

suitable GPS receivers. Typically, GPS is able to provide position information to within a few meters, allowing accurate positioning to be made. It is also possible to extract timing information that enables frequencies and time to be very accurately maintained. Frequency stability performance figures of systems using GPS timing are far in better than crystal or many other accurate frequency sources. The performance and ease of use of GPS has meant that it is now an integral part of everyday life, with many portable or car-based "satnav" systems being used, as well as many mobile phones incorporating them to enable them to provide location information superimposed on the maps from the phone or satnav.

4. Methodology

The applied methodology for the proposed AmI application depends on the production of dynamic guides that give a visual portrayal of the encompassing data estimated by installed versatile robot sensors along the investigated region. The APR-02 executes a self-sufficient route strategy that recognizes its area inside the guide that speaks to the territory of activity; furthermore, this system likewise figures the direction that the robot must follow to arrive at its objective. During the investigations, the robot records the talks of the ideal sensors just as the area at which each talk was acquired, permitting the making of circulation maps for each checked boundary.

Navigation

One of the most significant highlights of the APR-02 is its ability to perform complex independent errands. The vast majority of

such assignments require data about the physical design around the robot, just as a consistent admittance to its present area. The initial step to accomplish a self-sufficient route framework is to fabricate a virtual guide of the territory of activity; when the guide is constructed, the robot will naturally store it as a source of perspective, permitting it to be stacked each time the robot needs to work in that particular zone. The system utilized for the planning strategies depends on the Simultaneous Localization and Mapping (SLAM) strategy which measures laser range information gave by the 2D LIDAR gadget installed the robot so as to figure the general situation of the robot while making a two-dimensional model of the investigated region with a goal of 1 mm. The SLAM strategy utilized in this paper depends on the FastSLAM approach [3] with a tweaked Iterative Closest Point (ICP)

calculation for laser test arrangement [4].

The route cycle is another equal cycle running on the control framework. This cycle inquires the current situation of the robot acquired through the SLAM cycle and afterward registers the way to the current objective in the guide. The way arranging is performed by methods for running an educated inquiry calculation (calculation [5] with a Manhattan heuristic) on a hub discretized variant of the virtual guide. Figure 2 shows a case of virtual guide made by the APR in a first investigation. The shaded region in this guide portrays the traversable hubs alongside their related loads. The loads of the hubs are allocated according to its safeness; for this, hubs situated close to snags are punished with an extra expense. This strategy guarantees that the way arranging calculation will organize wellbeing over separation, keeping up the

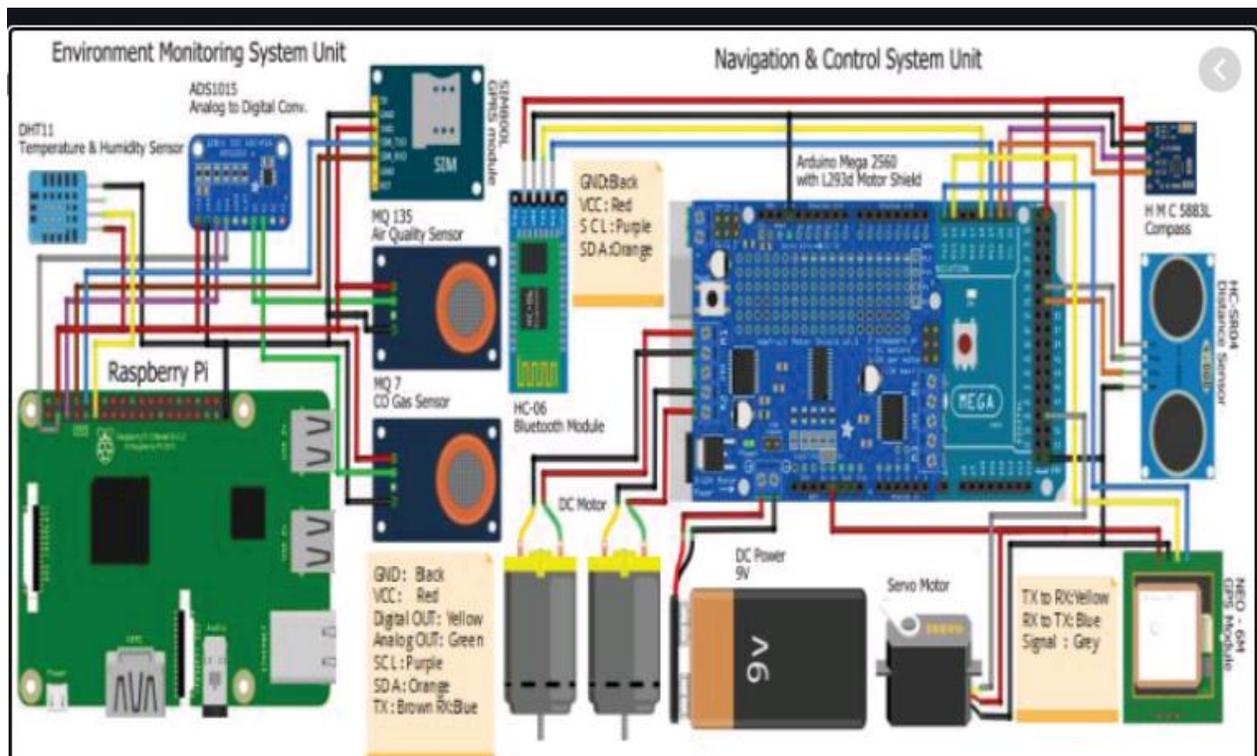


Figure 1 Architecture

robot quite far from dividers and different hindrances if conceivable. Moreover, the route cycle knows about unforeseen hindrances identified by the laser range sensor so as to dodge potential impacts.

Virtual guide made by the robot and the weighted safe zone.

Information Maps

This paper proposes the creation and utilization of data maps for encompassing management. The proposed system depends on the work introduced in [6] which was centered around the location of gas spillages. For this situation, the data maps are processed from crude sensor information accumulated at 1 Hz continually by the robot while performing other assistive assignments or during explicit encompassing

management investigations. Figure shows an image of the ARM-based implanted sensor board planned as a module to draw in interchanges with the APR and to give data of the temperature, moistness, and luminance. This implanted sensor framework has been planned as an adaptable USB adornment sensor framework that can be connected various areas of the versatile robot as per the ecological necessities. This sensor framework is likewise planned so as to give repetitive or correlative surrounding data, for instance, from the front or from the rear of the portable robot.

Installed ARM-based sensor framework equipped for examining temperature, stickiness, and luminance.

The information acquired by the installed sensors are prepared and furthermore put away in a custom structure which contains the crude talk from every sensor alongside the current robot organizes and the

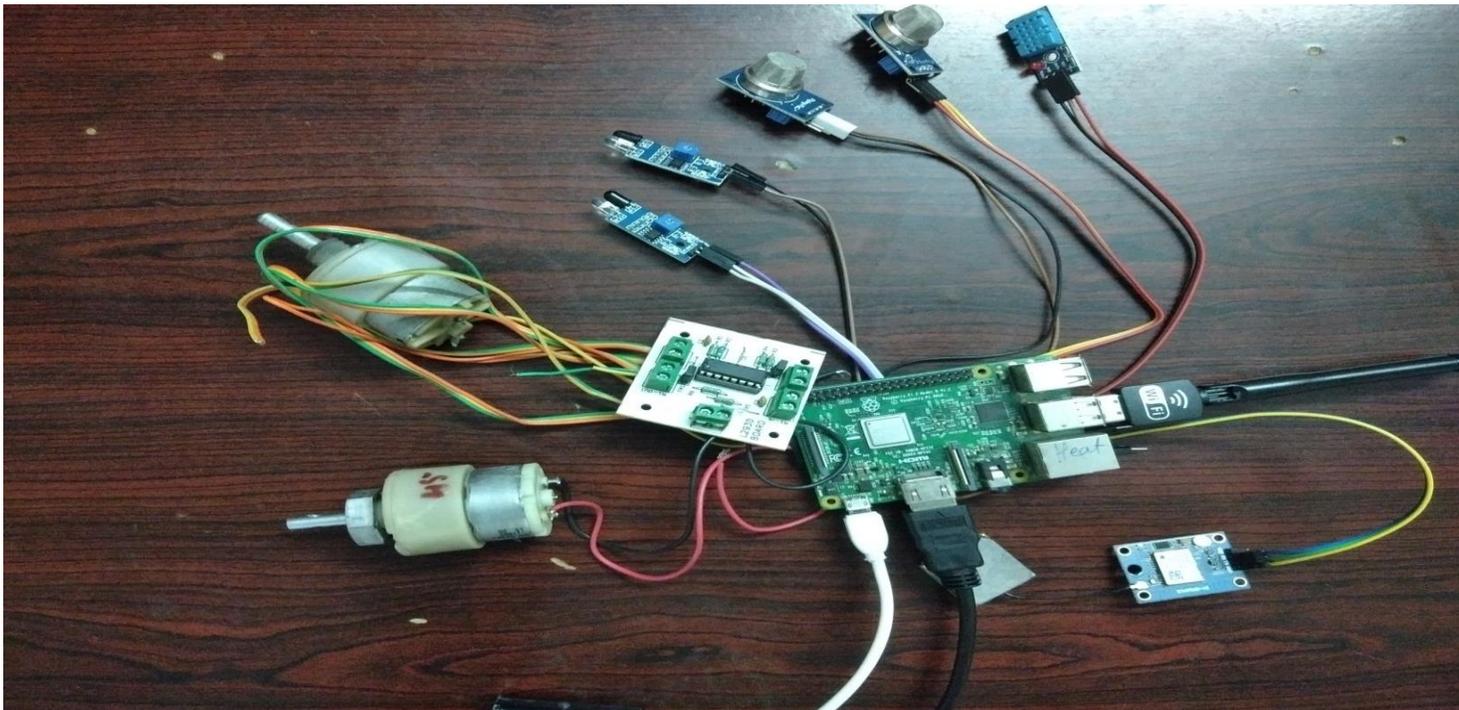


Figure 2 Connection

timestamp that recognizes the time at which the talk was gotten. The data maps are produced from a mix of the confined sensor tests and the virtual region map worked by the SLAM system. The sensor tests are incorporated into the virtual guide as per its relative two-dimensional directions with a goal of 1 mm. Now, the examples are introduced by utilizing the biharmonic spline strategy so as to fill the virtual guide limits. Subsequently, these data maps present the surrounding data in a powerful way that can be outwardly introduced or naturally handled so as to characterize contributions for additional restorative activations. The precision of this system basically relies upon the quantity of tests assembled by the robot inside the directed zone. By the by, this application doesn't need a soaked watching so as to get gainful outcomes. In this paper, the portrayal of the surrounding conditions has been assessed by essentially going once through a hall. Moreover, the data maps are fragmented in various zones (passageway, corridor, office, bathroom, and so on) with the distinctive human agreeableness levels characterized. It is intriguing to take note of that agreeableness ranges are not fixed and may fluctuate via season.

4. Result

The below shown figure represents proposed architecture of the project.

DHT11 sensor is connected to 7th GPIO pin of Raspberrypi3. Both temperature and humidity of environment is measured, will be sent to RPI in digital nature. MQ135 sensor is connected to 12th GPIO pin of Raspberrypi3. It will measure dangerous

gases in environment and forwarded to RPI in digital format. MQ7 sensor is connected to 13th GPIO pin of Raspberrypi3. It will measure dangerous gases in environment and forwarded to RPI in digital format. IR sensor is connected to 11th GPIO pin of Raspberrypi3. It will detect obstacles in-front of robot and forward signal 1 to RPI, if any obstacle exists. 0 will be sent to RPI, if no obstacle is presented in-front of robot. FIRE sensor is connected to 15 GPIO pin of Raspberrypi3. It will detect fire in-front of robot and forward signal 1 to RPI, if any fire exists. 0 will be sent to RPI, if no fire is presented in-front of robot. DC motors are connected to 12,13,16,19 GPIO pins of the RPI through L293D IC. GPS is connected to the Receiver pin of the RPI3. Directly both latitude and longitude will be sent to RPI in digital manner.

5. Conclusion

We adopts AmI application based on the use of a Personal Robot for the supervision of the temperature, humidity, and luminance conditions. This works as a complementary function for an intelligent assistant mobile robot capable of developing autonomous tasks in indoor environments. Intelligent robots provide high computational capabilities and enough resources to enable a multiagent control system capable of setting up different robot processes simultaneously. This methodology allows the robot to work on its main assistive tasks while executing an ambient supervision routine which is constantly gathering and processing additional sensor data.

6. References

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