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IOT Based Real Time Monitoring Mobile Robot

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Abstract: ***The main objective of this paper is to create a fully controlled raspberry pi robot remotely through internet and to search and retrieve the information about the working environment like temperature, air quality. The mobile robot can be controlled wirelessly to avoid human interaction with dangerous places like chemical factories etc and to reduce human risk. It gives the user the comfort and ease for using home devices with minimal effort. The robot is controlled remotely from anywhere and at anytime through internet remotely. The user can give commands from a webpage to raspberry pi of robot. This mobile robot uses a camera that allows the live streaming of the surrounding environment in which robot exits (i.e, to search a particular area) to the webpage. It is also integrated with gas and temperature sensors to detect the internal condition of a working area. Database designed with server to store monitoring data and display in real time. Without being in the working area a user can know the condition and work with dangerous chemicals.***
Keywords: Raspberry pi 3, WebIOPi, Sensors, Webcam, Robot, Real time monitoring.

I. INTRODUCTION

A. Theoretical Background

Mobile robots have many applications including surveillance and security, delivery of material, household purposes, and etc. These robots use vision for detecting and avoiding obstacles .In this project, we present a network-based mobile robot designed with the goal of remote control and surveillance via the Internet using WebIOPi IoT framework. Remote control of robotic systems has been applied in manufacturing, storage rank inspection, nuclear power plant maintenance, space exploration, etc. Sensors can be used for real time monitoring of the environment and are recorded in the data base. These recorded sensor values will be read by the web application and will be display to the user through various devices like laptop, mobile etc.

To use a camera over the web, the user can watch and control the robot movements. With a robot, you have strong interaction. For instance, with a mobile robot equipped with an arm you can move along the floor and grasp objects. Raspberry pi 3 is to receive the commands from the web application and takes the data and controls the motors of the robot using the motor driver L293D. The robot can able to move forward, reverse, left and right directions. Mostly, available mobile robots using Bluetooth or zigbee technology as mode of communication which has limited the control distance.

B. Motivation

Without appearing in the working area the user can able to understand the condition of environment and work with explosive or dangerous chemicals.

C. Aim of the Proposed Work

Aim of the proposed work is to present a security surveillance integrated system based on WebIOPi IoT framework for remote monitoring and controlling of mobile robot.

D. Objectives of the Proposed Work

The objective of this project is low cost and reliable mobile robot that can be used remotely. Achieving wireless internet data transfer, reaching long distances and low latency between the operator and the robot .And to have a remote surveillance, monitoring and control system.

II. LITERATURE SURVEY

Work that has been done in the past related to present work has been outlined below

A. Survey of Existing Models/Work

In conventional methods, wireless controlled mobile robots use RF (Radio Frequency)circuits. These circuits are reliable over small ranges. These RF circuits consist of transmitter and receiver which are independent of one another. The advantages of RF circuits such as Ease of design, Low cost, low maintenance cost etc. At the same time it has a disadvantage like short Frequency Range,

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restricted working Range and limited control.

1) M. Selvam: In this smart phone based robotic control for surveillance applications where the robot is controlled through a smart phone android app which Bluetooth as a mode of communication. The drawbacks of system are Bluetooth is not reliable and range covered by it is 10m.And it does not have any sensors for monitoring real time environment [6].

T. Maria Jenifer, S. Raj Pandian , T. S. Vasumathi Priyadharshini & Raja Lavanya were proposed a robot system which can sense amd measure the environment temperature and send the value to a php server via Bluetooth android application [4].

III. OVERVIEW OF THE PROPOSED SYSTEM

A. Introduction and Related Concepts

The physical objects that are being connected will possess one or more sensors. Each sensor will monitor a specific condition such as location, vibration, motion and temperature. In IoT, these sensors will connect to each other and to systems that can understand or present information from the sensor's data feeds. These sensors will provide new information to a company's systems and to people. IoT data differs from traditional computing. The data can be small in size and frequent in transmission. The number of devices, or nodes, that are connecting to the network are also greater in IoT than in traditional PC computing.

IoT communicates information to people and systems, such as state and health of equipment (e.g.it's on or off, charged, full or empty) and data from sensors that can monitor a person's vital signs. In most cases, we didn't have access to this information before or it was collected manually and infrequently. It enables control and automation remotely. It is cost saving for both customers and companies.

This project uses WebIOPi IoT framework for controlling motor of the mobile robot. WebIOPi is an internet of things framework. WebIOPi is a good tool to control the GPIO over the local area network or web on the raspberry pi. It can Control, debug, and use raspberry Pi's GPIO, sensors and converters from a web browser or any app.

WebIOPi includes an HTTP server that provides both HTML resources and a REST API to control things. The browser will initially load a HTML file, that has an included Javascript which will perform asynchronous calls to the REST API to control and update the User Interface. Thi mehod is very efficient, because it does not need to refresh and download the whole page [7].

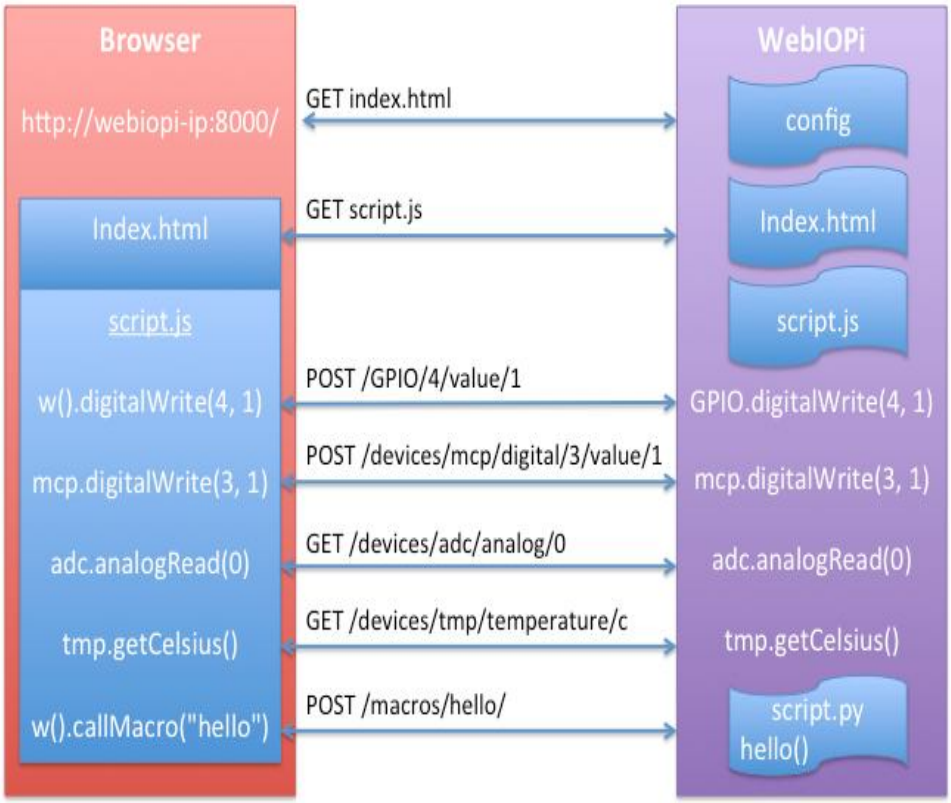


Fig. 1 WebIOPi basic working example

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B. Architecture/Design of Proposed System

To create a fully controlled IoT based Raspberry Pi Robot in which the commands are written in python script controlled through web page and the real time remote monitoring has been an important feature that can be used in the project. As a change in the status of the devices or sensor occurs, the user can be informed in real time. The user commands are transferred to a apache web server (i.e, raspberry pi in this project)which is usually done from a web interface through a web browser. The server processes the user commands using scripts written in python and sends them to the relevant units like motor of robot. This can also help control the buzzer, motion sensors etc. The WebIOPi framework is used to control the robot movements like forward, backward, left, right and halt. WebIOPi framework software runs on raspberry pi which runs with raspibian Jessie operating software. WebIOPi includes an HTTP server that provides both HTML resources and a REST API to control things. Browser will first load a HTML file, then the included JavaScript will make Asynchronous calls to the REST API to control and update the UI. The web browser first loads index.html file which is front end of the web application through GET request. This index html file loads javascript which has commands to call macros in python script.The anonymous Javascript function will passed to WebIOPi JS library with webiopi().ready().The python script file script.py will be loaded and executed by the WebIOPi server.

The web interface is developed using HTML and JavaScript. The raspberry pi has 3 modules running – the web server, database and main control program. The system makes use of a raspberry pi microprocessor for controlling robot movements, recording the measured sensor values. Measured sensor values are send to apache server using php script. The measured values are stored in mysql database. The hardware components include raspberry pi, temperature sensor, gas sensor, H bridge motor driver, geared dc motors. The relevant details are stored in Mysql database created. The user interface can be viewed or opened in devices like mobile, laptops, tablets. Raspberry pi internet access is through Wi-Fi module which is in-built for raspberry pi 3. The web browser can communicate with the raspberry pi through wlan in the same network. Motion server is a program that monitors the video signal from cameras. Using this motion software raspberry pi is made as webcam server with required configuration. This allows the live streaming to the webpage.

Weaved IoT kit is used to make raspberry Pi as an Internet of Things. The kit provides really simple tools for connecting the Pi to the cloud and turning Pi into an Internet of Things Kit. Using Web (HTTP) on port 80 service provided by weaved the web page Raspberry Pi serves up from anywhere.

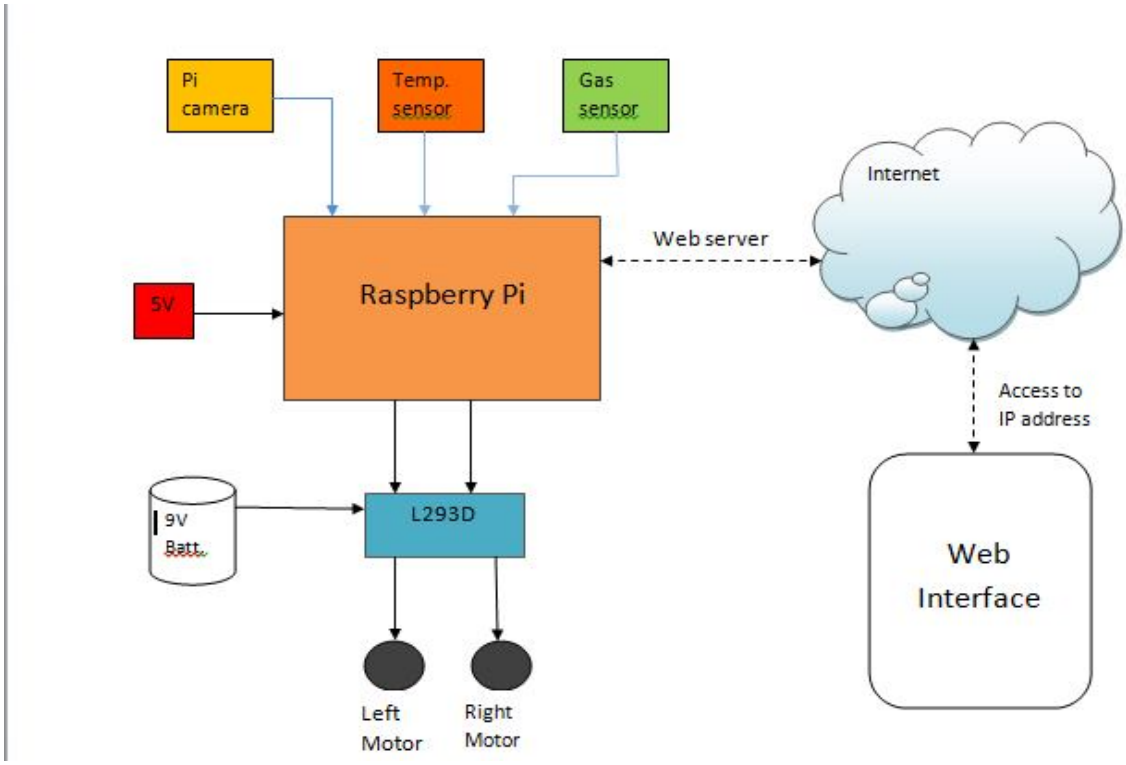


Fig.2 Block Diagram

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IV. RESULTS AND DISCUSSION

A. Performance Metrics

Performance of the system can be measured in terms of accuracy in the arrival of the data for every time frame.
It can be expressed as

Performance = (No. of events generated per second) / (No. of events that can be recorded in the database per second)

Where no of events that can be recorded in utilized cloud per second=3(to the maximum).

B. Results Obtained

In this paper, we have developed the IoT based mobile robot with a webcam live streaming technology which can be controlled through a webpage remotely. Fig. 4. shows the prototype of implemented IoT based mobile robot. The user can control the movement of the mobile robot like left, right, forward etc with the camera and the controls provided in webpage. The mobile robot is attached with sensors namely temperature and gas for monitoring the environment. As seen in Fig. 3 these sensor values will be updated and can be seen through web control page.

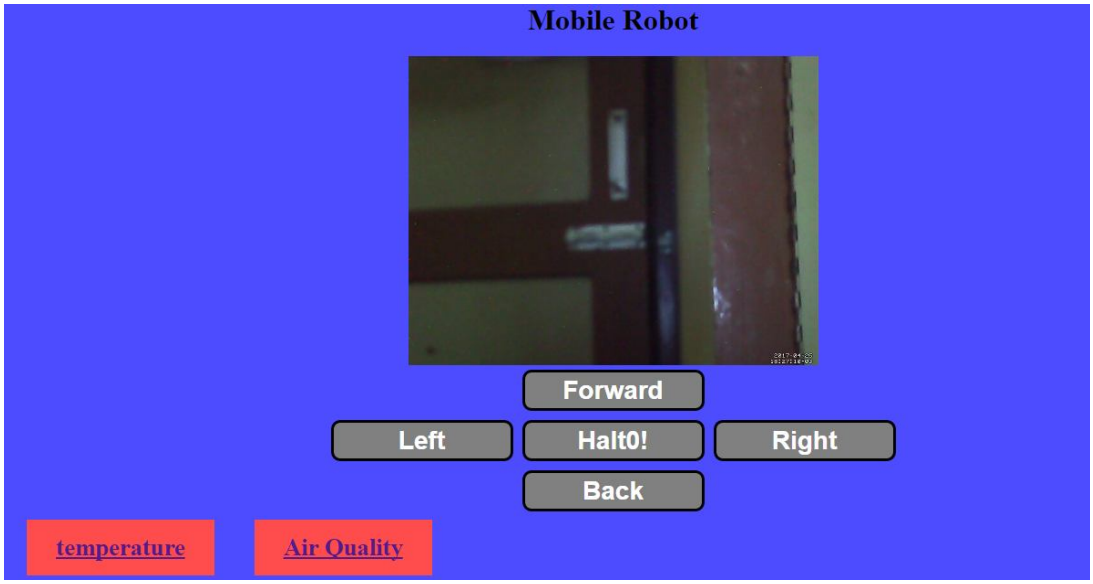


Fig.3 Web Application User Interface

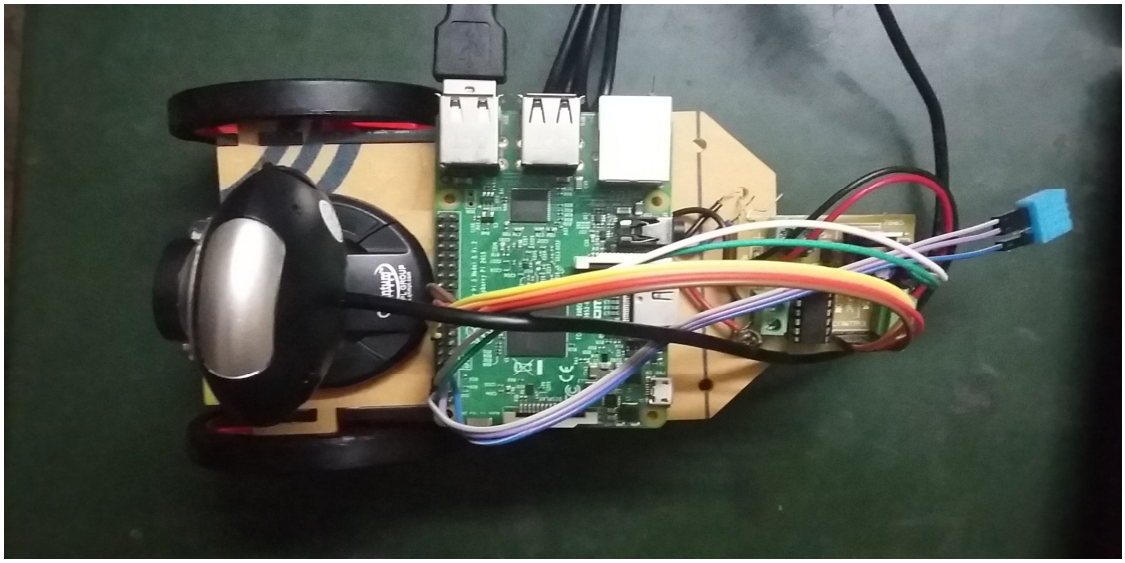


Fig.4 Prototype of the model

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The web application also monitor's the temperature and the gas readings in the environment where the camera surveillance is also monitored.

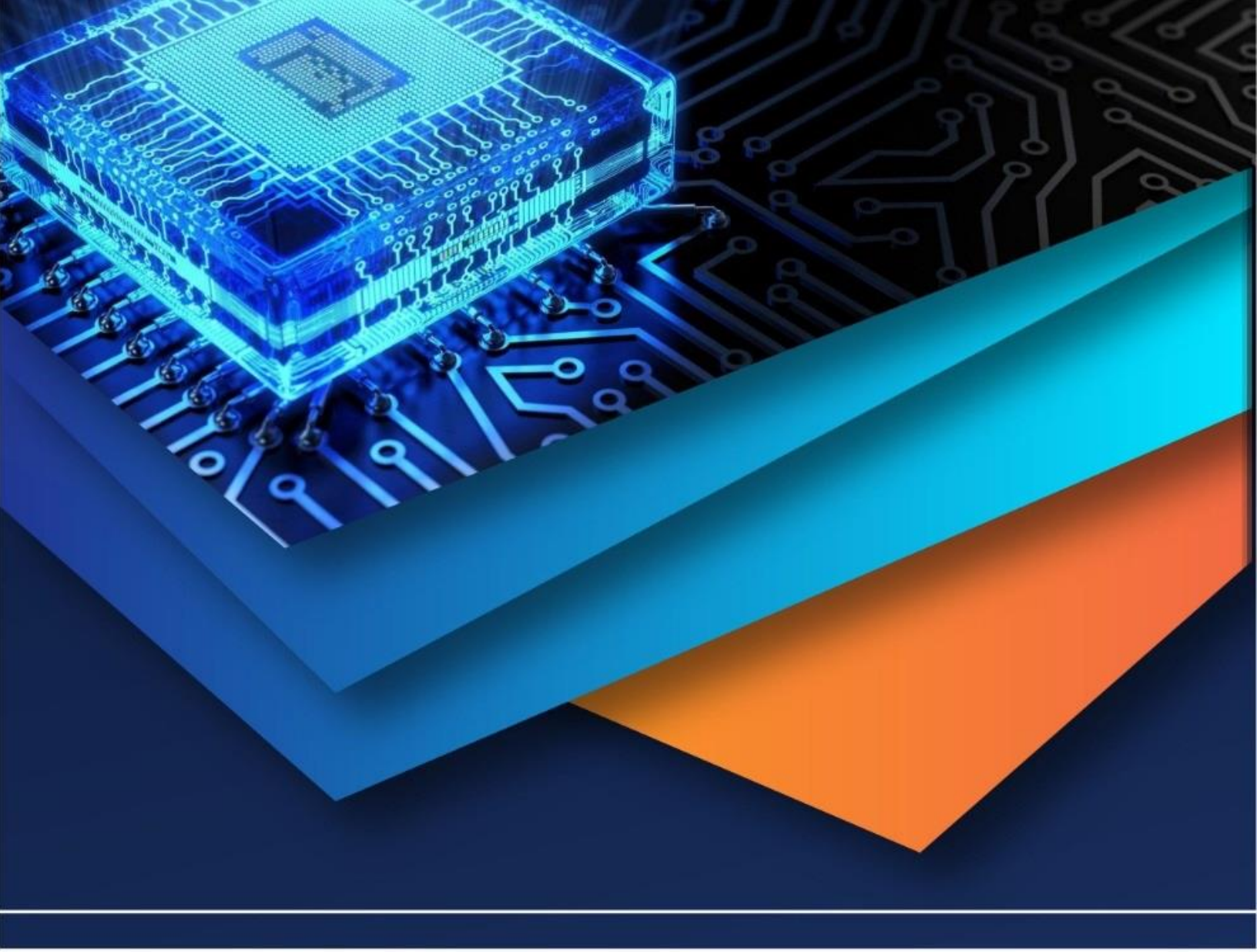
V. ACKNOWLEDGMENT

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