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Android Application based Wi-Fi Controlled Robot Car

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Abstract: ***In IoT things can be considered as real world object which can be given an IP address. To raise the ease of use of the real world things and improving the efficiency of its usage, merging of real world things by removing gap from real and virtual world objects with Wi-Fi and Bluetooth is done. Implementation done till now doesn't display values for acceleration, steering, rake on mobile screen so, In this paper Io T is implemented using Wi-Fi technology and Wi-Fi will be used to control electric vehicle for parameters like acceleration, brake, steering and display its current value on screen this application also provide GPS co-ordinates for updated position of vehicle after interval of every 5000 milliseconds and display images and live stream of video. Implementation of user friendly UI is accomplished.***

Keywords: RC car, Android Phone, Wi-Fi controlled car, IoT Application, live streaming, GPS coordinates

1. Introduction

The term Internet of Things referred to has embedded with electronics, software, sensors which is exchanging data via internet. "Thing" can be called as natural or manmade things which can be assigned an IP address and provided with the ability to transfer data within the existing Internet infrastructure. The benefit is that IoT devices and services can interact with each other and create greater efficiency and improve ease of use, lead to economy of scale and potentially lower unit cost. The benefit is that IoT devices and services can interact with each other and create greater efficiencies, improve ease of use, provide better capability, greater choice, lead to economies of scale and potentially lower unit cost. To increase usage of technology in real life and for contribution in digitalized India concept of IoT comes into picture IoT comes under industry 4.0 Architecture of IoT can be given as:

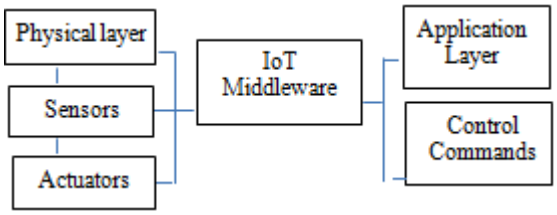

Figure 1.1: Basic architecture of IOT

The internet of things allows connection with the different entities (i.e., human beings, wireless sensors, mobile robots, etc.), using different but interoperable protocols and makes heterogeneous network. In this infrastructure entities have ability to transmit the information over the internet. It is difficult to estimate evolution of IoT as the things at a distance of billion or trillion are expected to get connected. Robots must have unique identity. In the IoT this robot can connect as a thing. Establish connection with the other things over the internet. Sometimes being an information consumer robot gain access to the important information achieve certain tasks. IoT is basically used to enhance human-robot collaboration. In either active or passive mode you can connect IoT to robot. In a passive mode, robot is not connected to internet but uniquely identified with the help of RFID. In an active mode robot is connected to internet and can transmit the information within robots connected in network. To achieve connection within robot and IoT: Things peak. With the help of robot it will maintain database for real time data and can make chart, embed graphs of the data on websites, and send real-time alerts to other devices, such as a cell phone. Also, we take into account. The integration of robot with IoT made technology so vast that researchers getting opportunities in research field

2. Literature Survey

Yuxin Jing, Letian Zhang et-al implemented "An android Remote Control Car Unit for search missions "It is used in mean to be in a search for natural disasters. It has accomplished with the autonomous development to avoid obstacles if they are not visible by driver. Requirements for it's implementation are Camera, Ultrasonic sensor, Bluetooth Servo Motor, Arduino UNO board, Wi-Fi router, Android studio. This application can make search operation more easier.[1]

AyanMaity et-al implemented "Android application based Bluetooth controlled robotic car" Robot is controlled with the help of Bluetooth it is useful in moving vehicle forward, backward, left, right are Arduino UNO (ATMEGA 32), Bluetooth module (HC-05), Smart phone, Motor driver (I293D).Main purpose of this robot is to detect hidden mines [2]

Rahul Kumar et-al implemented "Android Phone Controlled Bluetooth Robot" This paper dealswith design and control of vehicle capture live streams and videos at required location. Requirements for its implementation are Arduino Uno Board, DC Motors, Uart, L293D Motor Driver IC, Power adapter. [3]

MehmetcanGule, Murat, Orthun et-al implemented "Android Based Wi-Fi Controlled robot using Raspberrpi" In this paper implementation is done for robot forward, backward, left, right and to display live stream of video using USB camera and raspberry pi board. Most inventive application is implemented to make people lives easier [4]

Jan Nadvornik, Pavel, Smutny et –al studied "Remote Control Robot Using Android Mobile Device". The application allow robot to control interaction with display or voice when we use graphical user interface we can monitor current distance of obstacle from vehicle. Ultrasonic sensors are used to find distance of obstacle from vehicle [5]

Rahul Kumar, Ushapreethi, Pravin R. Kubade, Hrishikesh Kulkarni et-al studied "Android Phone controlled Bluetooth Robot" Robot is a reprogrammable, multifunctional device which is primarily designed to do work like human such as pick and place, loading and unloading, surveillance, health care, industrial, aerospace application. Robots are useful to perform dangerous and accurate work to improve productivity as they can work 24 hours without rest

Aim of this project was to control motion and speed of robot using Bluetooth of android device [6]

Jayesh George et-al implemented "Android controlled smart car In this application they are generating commands for acceleration, brake, clutch and transmitting it to Microcontroller with the help of Bluetooth. Requirements for its implementation are microcontroller, Bluetooth HC-05, DC geared motor, motor driver, Smart phone, Mikro C programming software, Pickit II Programmer, Tina Industrial Simulator, and Android Studio Android application helped in reducing difficulties in parking [7]

Saurabh Khoje, Devendra Urad, Monika Shirke, Anita Shinde et-al implemented "Robotic Control using Android Application " android smart phone to control robot and other system provide great advantage to industries with the help of this system current status of all respective machines can be maintained from the feedback from PID so with this errors will be removed from the system.

This paper by providing the design architecture for creating a robotic system which can be controlled very easily and can be implemented in various parts of daily life. Main objective of this paper is providing robotic architecture which can be controlled by smart phone with Bluetooth technology. [8]

Benjir Ahmed et-al implemented "Android Apps Controlled ROBO Car by Microcontroller using Bluetooth" In this project they have developed a Robot named "ROBO car" controlled by Android apps from Smart phone through Bluetooth communication interfacing the microcontroller. According to the commands received from android phone, the direction, speed, sound and light of the car can be controlled. Requirements for its implementation are as follows Arduino UNO, Bluetooth module, Ultrasonic Distance Sensor, DC gear motor, Motor Driver, Boost Converter, Temperature Sensor, Android studio. The implemented Android apps controlled ROBO car worked successfully. It is easily controlled using Bluetooth communication between smart phone and microcontroller. It was observed that direction, speed, light, sound of the car will be controlled properly [9]

Chan Chung Hung et-al studied "Wi-Fi remote control car via mobile device" goal of this project was to build Wi-Fi remote control car via mobile device. Mobile device screen is consist of buttons to plan distance, direction, mode of system but system has no accelerometer to show the reading for acceleration [10]

Raj Kumar Mistri et-al implemented "Wi-Fi controlled robot using node MCU" This is an embedded system. Aim of this project was controlling a robot from remote location of more than 1000 miles away. For its implementation are Power Supply, Node MCU, Motor and Motor Driver L293D, ESP2866 Wi-Fi module, wired interface. Controlling of the robot is tested successfully over the miles and application found efficient [11]

3. System Overview

3.1 Problem Statement

To design a system which will control vehicle remotely, display updated GPS co-ordinates after every 5 sec. and will display pictures and live video streaming using IP based camera

3.2 Objective

- To enable vehicle to be controlled by capturing instructions sent through Wi-Fi connection mobile device containing Android OS.
- To Implement GUI which will display updated GPS co-ordinates (Longitude, Latitude) of vehicle after every 5 sec.
- To display (Google map) showing shortest track to reach to destination
- To display video and for showing live video stream and pictures

4. Implementation Constraints

4.1 Communication Protocol

Wi-Fi P2P allows your application to quickly find and internet with nearby devices, at a range beyond the capabilities of Bluetooth. Wi-Fi is faster than Bluetooth. With the help of Wi-Fi you will be able to get connected with the nearby devices without needing to connect to a network or hotspot. If Application is designed to be a part of a secure, near-range network, Wi-Fi direct is suitable option for networking for the following reasons Wi-Fi uses WPA2 encryption and makes sure that privacy of the data will be maintained. Broadcasting of the services will be done to identify suitable peer. To determine which device is of which group power management of the Wi-Fi devices will be checked, UI, and service capabilities can be easily handled by server more effectively.[18]

4.2 Proprietary protocol

Proprietary: Proprietary protocols for communicating with a GPS receiver. These protocols send additional data that isn't included in the NMEA (National Marine Engineering Association) standard: for example, altitude and latitude.

NMEA this is a standard for getting talk to a computer. [15]

4.3 HTTP (Hypertext Transmission Protocol):

HTTP defines how messages are formatted and transmitted over worldwide communication, and actions Web servers and browsers should take response with respect to various commands. HTTP is called stateless protocol because each command is executed independently.[14]

4.4 Real Time Streaming Protocol

The Real Time Streaming Protocol (RTSP) is a network control protocol designed for use in entertainment and communications systems to control streaming media servers. The transmission of streaming data itself is not a task of RTSP. Real Time Protocol is used by most of the RTSP in conjunction with Real-time Control Protocol (RTCP) for media stream delivery. However, some vendors implement proprietary transport protocols. The RTSP server software from Real Networks [16]

4.5 Message Queuing Telemetry Transport (MQTT)

MQTT is used for machine to machine communication. It was designed as extremely lightweight communication protocol. It is useful for communication at remote location. It is also ideal for the mobile application size, low power usage, minimized data packets, and efficient distribution of information to one or many receiver [13]

4.6 Multithreading for live streaming

Multithreading is a Java feature that allows concurrent execution of two or more parts of a program for maximum utilization of CPU. Each part of such program is called a thread. So, threads are light-weight processes within a process.

Threads can be created by using two mechanisms:
1) Extending the Thread class
2) Implementing the Runnable Interface

We create a class that extends the **java.lang.Thread** class. This class overrides the run() method available in the Thread class. A thread begins its life inside run() method. We create an object of our new class and call start() method to start the execution of a thread. Start() invokes the run() method on the Thread object.

1) If we extend the Thread class, our class cannot extend any other class because Java doesn't support multiple inheritance. But, if we implement the Runnable interface, our class can still extend other classes.
2) We can achieve basic functionality of a thread by extending Thread class because it provides some inbuilt methods like yield(), interrupt() etc. that are not available in Runnable interface.

5. System Architecture

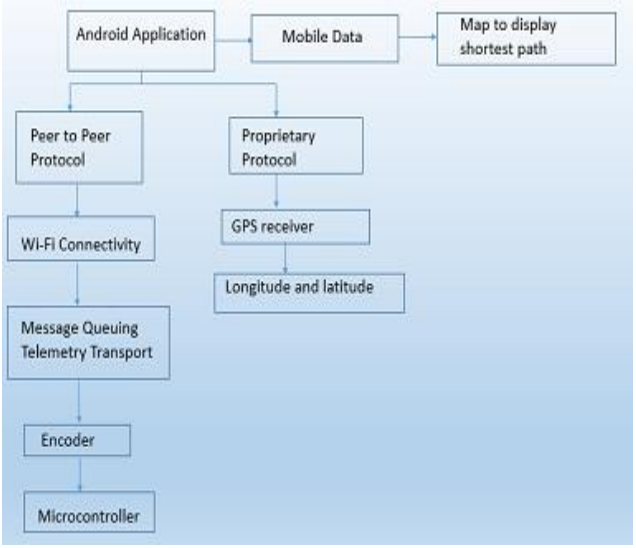

Figure 5.1: System Architecture

Detail description of fig 5.1 is given in chapter 6 of this paper.

6. Detail Description

Android application consist of five Activities first is it provides module to generate signals for Acceleration, Steering, Brake and pass it to microcontroller usage of Wi-Fi media will be done for the transmission of the signals. Second activity is to display Google map showing shortest path from source to destination, Application will need access to internet to display map. to display shortest path using map for it we need internet connection for it by using functions and Web View in android studio we will achieve goal Web View in Android turns the application into a web application. It comes from android.webkit.Web view. Here the web view class is an extension of android view class which is used to show webpages. A web view is a browser bundled inside mobile application producing hybrid app. using web view we can create app for the websites designed but still package it as app and put it on app store. Third target is to display updated GPS co-ordinates (Longitude, Latitude) after every 5 sec. Fourth target is to display video for live captures using IP based Camera. Fifth target is to display pictures of live captures. It has various attributes like Adaptability-This IOT based android application will easily adopt the view for 5 inches to 10 inches screen. Availability-If Wi-Fi enabled microcontroller is not available in range of 50 m application will not be able to send signals for acceleration, steering, brake. Correctness - as this is real time software correctness will be tested from live performance of vehicle as we will send steering angle from -720 to 720 degree, acceleration value from 0 to 120, retardation value decrement in acceleration at every on click by 10 for hard brake and soft brake. Flexibility-Android application provides flexibility to operate vehicle within defined range 50 m of Wi-Fi enabled micro-controller. Interoperability-Android application is connected to Wi-Fi enabled program of microcontroller which will be connected to encoder which is connected to motor Usability-application is easy to use and user friendly as all the controls

given on UI easily understandable. It will provide fast access to all activity screen. For live streaming as IP based camera is expected to be used so conversion of USB based camera to IP based camera is done following steps are expected to be followed Step1: Open any web browser and type www.download.com in address bar of web browser. Step 2: Click on "downloads "at the top of downloads.com home page Step 3: Type "Webcam Monitor" in the search bar.Step 4: Find "Webcam Monitor it will be your first search result on the list Step 5: Click on Download Now button at the right side of the search result Step 6:Click on save file button after "Opening wcm.exe"pop ups Step 7: Plug in your USB camera in to USB port Step 8: Locate the destination of saved program and double click on it. Step 9: Read the installation guide and follow the further instructions. Step 10: After opening the Wizard you will see popup Step 11: you have to click on next button and then you will select camera from the dropdown list Step 12: Click on "Finish" button.

ZoneMinder is also used to display output of IP based camera by converting it to web based camera.ZoneMinder from any internet-accessible device. ZoneMinder allows you to use any analog or IP based camera Infrastructure of protocol for IoT application:

6.1 IPv6 – It is "Internet Layer Protocol" used in largest networking over globe. [14]

6.2 6LoWPAN –This protocol is similar to IPv6 and it operates at a frequency of 2.4 GHz.[14]

6.3UDP (User Datagram Protocol) –This is OSI transport layer protocol similar to TCP and it is use in real time applications [14]

6.4DTLS (Datagram Transport Layer) –This provide privacy over client/server communication. [13]

6.5Content-Centric Networking (CCN) –Many of the challenges for Scalability, Security, and Mobility are achieved and there will be gain of efficient performance of network. [13]

6.6Time Synchronized Mesh Protocol (TSMP) The communication protocol in which transaction is happening in a particular given timeslots and activities will be synchronized so that there will not be any overlapping in wireless communication between client/server. [13]

6.7 CoAP (Constrained Application Protocol) "CoAP is an application layer protocol that is intended. This protocol is intended in minimizing mapping of HTTP whenever request is sent by user http perform mapping for that request and generates intended response [12]

6.8 XMPP (Extensible Messaging and Presence Protocol) this is open technology for real time communication. It is used for video calls, acknowledgements in real time communication [13]

6.9 AMQP (Advanced Message Queuing Protocol) This is standard application layer protocol. All the features such as routing, security, reliability, queuing comes under AMQP [13]

6.10 JMS (Java Message Service) - A Java Message Oriented Middleware (MOM) API for sending messages between two or more clients. SOAP (Simple Object Access Protocol), this protocol is used for communication and uses JSON, Web Sockets to achieve communication [13] Wi-Fi Sockets are used to achieve communication. A socket is an endpoint of a two-way communication link between two programs running on the network. Socket is bound to a port number.

7. User Interface

Figure 7.1: Driving signals

This fig 7.1 will display current values for acceleration; brake and value for steering angle this screen also provide display for shortest path

Figure 7.2: Video and images capture

This fig. 7.2 will display live streaming of video and captured images that is videos and images captured by IP based camera.

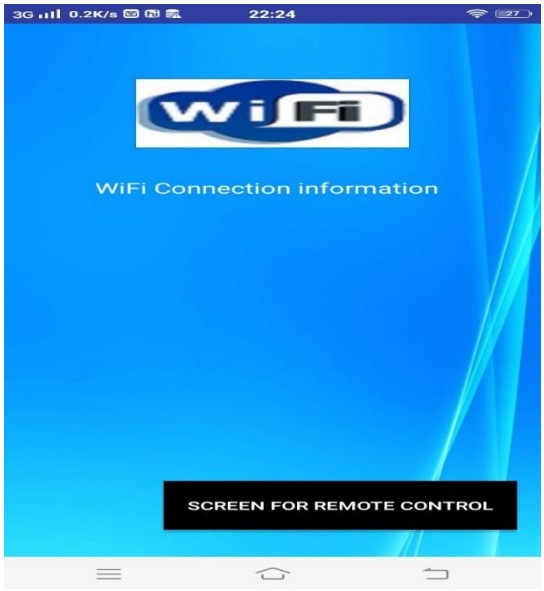

Figure 7.3: Wi-Fi connectivity

Fig 7.3 this screen will display name of microcontroller to which signals for acceleration, steering, brake will be send

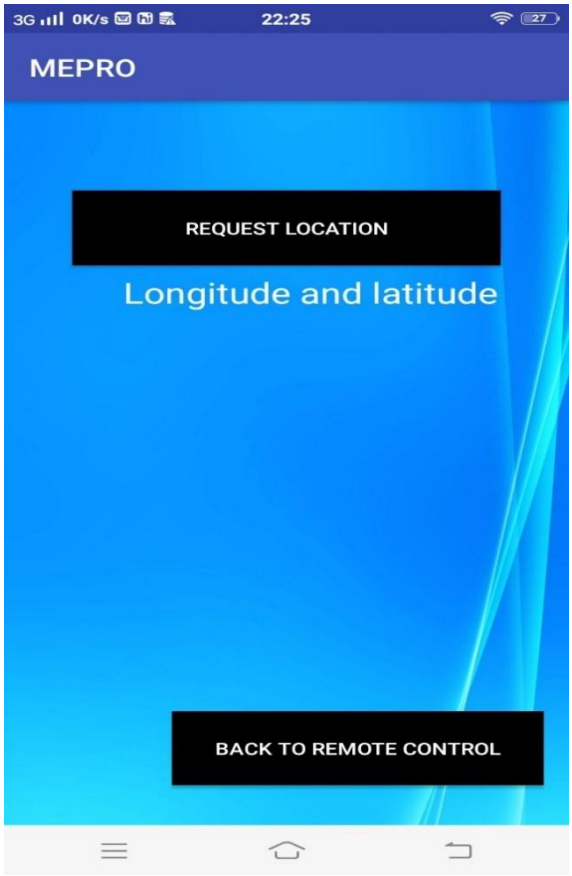

Figure 7.4: GPS co-ordinates

Fig 7.4 this screen will display updated GPS co-ordinates i.e. longitude and latitude for vehicle after every 5 sec.

8. Conclusion

The Internet of Things (IoT) is consisting of physical devices which can be given an IP address and can be uniquely identified. It can be defined on the basis of three types. In this paper IoT is used to control electric vehicle for parameters like acceleration, brake, steering and also for this Wi-Fi enabled microcontroller is used provide GPS co-ordinates for updated position of vehicle after interval of every 5000 milliseconds and display images and live stream of video.

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References

[1] Yuxin, Jing, LetinZhang, IrwinArce, AydinFarajidavar "AndroRC:An Android Remote Control Car Unit for Search Missions" :Integrated Medical System Laboratory Dept. of Electrical and Computer Engineering America, United States.2015, PP.1-5
[2] AyanMaity, Avijit Paul, PriyankaGoswami, Ankan Bhattacharya "Android Application Based Bluetooth Controlled Robotic Car"International Journal of Intelligent Information systems, Department of Electronics and Communication Engineering, Department of Computer Science and Engineering India, Nov 29, 2017, ISSN: 2328-7675, pp.62-66
[3] Kena Patel, Bhavna K. Pancholi "A Novel fire extinguishing vehicle controlled by androidapplication" Deparment of Electrical University of Baroda India IEEE International Conference on Smart Technologies and Management for Computing, ISSN 2231-4903, Vol.08, Issue 01, January-2018, PP.417-422
[4] MehmetcanGule, Murat, Orthun "Android Based Wi-Fi Controlled robot using Raspberrypi"Computer Engineering Department Turkey 2017 IEEEInternational Conference of Computer Science and Engineering, ISSN -4799-3528, PP.978-982
[5] Jan Nadvornik, Pavel, Smutny "Remote Control Robot Using Android Mobile Device" Department of Computer System and Instrumentation 2016, ISSN : 2319 - 8753, PP. 373-378
[6] Rahul Kumar, Ushapreethi, PravinR.Kubade, Hrishikesh Kulkarni "Android Phone controlled Bluetooth Robot"International Research Journal of Engineering and Technology 2016", -ISSN: 2395 - 0056, PP-104-114
[7] Jayesh George, Adithyasreyaj, DanielJoseph, Sajeer P "Android Controlled Smart Car"International Journal of

Computer Engineering in Research trendVolume2, Issue 12, December-2015, pp.1087-1090 ISSN (O): 2349-7084
[8] ISSNSaurabhKhoje, DevendraUrad, MonikaShirke, AnitaShinde "Robotic Control using Android Application "vol 7, 2017, ISSN 0975-9646, pp.773-776
[9] J Anitha, Y Thoyajakshi, A. Ramaya, V.Sravani, Prashant Kumar "Intelligent Parking System using Android Application"Vignan's Institute of Information and Technoogy 2017, ISSN-5090-2889, PP.165-174
[10] Chan Chung Hung Faculty of Computer Networks "Wi-Fi remote control car via mobile device"2013, PP. 1-14
[11] Raj Kumar Mistri et-al implemented"Wi-Fi controlled robot using node MCU" at Dept. of ECE, RTC Institute of Technology, Ranchi 2018, | Volume 6, ISSN: 2321-9939, PP. 325-328
[12] https://www.eclipse.org/community/eclipse_newsletter/2014/february/article2.php
[13] https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/
[14] https://www.postscapes.com/internet-of-things-protocols/
[15] https://www.tutorialspoint.com/http/
[16] https://www.thefreedictionary.com/proprietary+protocol
[17] https://www.techopedia.com/definition/31747/real-time-data-streaming
[18] https://www.techopedia.com/definition/25705/communication-protocol