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IoT Based Dual-ARM Tele Robotic System

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Abstract - *The proposed robotic unit is designed to develop a pick and place dual arm tele robotic vehicle with online video surveillance in remote places with wifi as a medium. A soft catching gripper is designed to avoid extra pressure on the suspected object (for eg. Bombs) for safety reasons. The robotic vehicle is controlled by the Blynk application used in android cellphones. At the transmitting end commands are sent to the receiver to control the movement of the robot either to move forward, backward, left, right, stop by the android application. Arduino serve the purpose of microprocessor as well as server for the system. The Blynk software acts as a remote control that has the advantage of adequate range, while the receiver end ESP8266 Wi-Fi device is connected to the processor to drive DC motor through motor driver IC for required operation. Robotic movement is contolled by the user by seeing the live video streaming. This module works on the concept of IoT which is Internet of Things, where the digital system are connected to all the physical devices. The proposed unit can be used in military applications.*

Key Words: **Arduino, Wi-Fi, Surveillance, IoT, tele-robot, Blynk**

1. INTRODUCTION

The advancement of technology and rapid growth of industry has resulted in reduction of human efforts, the main reason for which being machines!! Machines play an important role in our life. A machine might be anything, be it a bike or laptop or even a robot. Application of Robots in our life have being increased in a wide range. Robots use in defence has increased by the day. Our paper includes of how a robot can be of use to human race in general. Previously robots were not controlled by electronic circuitry or computer programs. After then they were built using principle of mechanics by improving over time with the coming of electronic age. In today's world, robots find use in various places be it in robotic components used in children's toys, in industrial applications or even be it to detonate buried bombs. Depending on how difficult the robots task are the complexity of computer software depends. In this project we use IoT to establish communication between the user and a robotic vehicle. This is a reliable communication as a continuous video feedback is available to control the robotic vehicle. Due to the IoT, there is no limitation on range or distance between the user and the robotic vehicle. Internet of Things robotics has opened up a completely new range of real-world applications namely tele-surgery, tele-training, tele-manufacturing, disaster rescue, health care, traffic control, , space exploration, etc., and the list is supposed to increase further in the coming years.

An embedded web server creates an easy way for controlling & monitoring any device which is at remote place. For designing the system we require a cell phone along with the internet facility at the remote locations. If we don't have internet connectivity still we can use the unit using Wi-Fi modem. We implement a system which is low cost, portable, & having less maintenance. The reporting of this real-time data corresponding to the process plants is therefore of great use. Robots are becoming more and more advanced as technology increments in the areas of memories, CPU speed, sensors, etc. With the rapid growth of the Internet, highly advanced devices or sensors have been embedded into it for performance. The proposed system consist of two units mainly a robotic module and a remotely control unit. The robotic unit is consisting of the pick and place gripper, webcam, Wi-Fi dongle, and the heart of the project arduino along with the PCB containing motor driven IC and voltage regulator circuitry.

1.1 PROBLEM STATEMENT:

The pick and place robot being implemented to ease the process of moving heavy materials, process of sorting etc. Usually the transfer process of the heavy materials is being carried out, using man power and if the transfer process is repeated for a period of time, it can cause injuries to the operator. By using this particular robot the operator, will no longer have to bent and lift up heavy loads thus increasing the efficiency of the work and preventing injuries. Human beings can make mistakes. In the industrial world, the industry cannot afford to take any kind of mistakes. As every mistake is costly whether interns of time, money and material. Online video streaming can be implemented using IP camera for the security purpose.

1.2 OBJECTIVE:

1. The robot is used in multipurpose military application so it must work in real time.
2. If there is any obstacle in the route, it must be able to move it aside so pick and place application can be implemented.
3. For the security purpose video streaming can be implemented using IP camera.
4. The robot should fully be based on IOT.
5. To avoid the obstacles ultrasonic distance sensor should be implemented.
6. To implement the GPS system to trace the location of Robot.

2. SYSTEM OVERVIEW

The Internet of Things (IoT) is a technology rapidly spreading in modern wireless Telecommunications. The basic idea of IoT is connectivity of variety of things or objects – such as Radio-Frequency Identifications (RFID) tags, sensors, actuators, mobile phones, etc.

In this project, here one can control the robot from remote end say laptop or mobile with the use of Wi-Fi as well as Internet and we can get the live streaming of video from the robot for the purpose of surveillance, this video is obtained on web browser of the remote device from where we are operating the device also we are able to control the robotic movement. DC motors are used for the movement of robotic wheels. Arduino is used for video processing and sending the processed video to user PC with the help of Wi-Fi as well as internet.

The Arduino is a minicomputer, computer which can be used in electronic applications or projects, and for many of the things that your desktop PC does, like browsing, text editing and games. It also plays high-definition video and it has a built in Ethernet Connection so one get easy connectivity, at least for the most common boards. And we can easily add Wi-Fi connectivity by plug in a Wi-Fi dongle on one of the USB port.

The robotic unit consists of Wi-Fi dongle, a USB web cam, a PCB consisting motor driven IC and voltage regulator circuitry. The User unit consists of a PC or laptop within the Wi-Fi range. The live video streaming of the environment can be seen.

3. METHODOLOGY:

Arduino is used to control and monitor the robotic unit. A webcam is connected to one of its USB ports. A Wi-Fi dongle is provided so as arduino can communicate over Wi-Fi. Internet can be provided to the arduino through this. The webcam will capture live data with regards to its surroundings and then send it to a desired device through internet. The user will be observing this data on the monitor at the user end. According to the desired movement, the user will control the robotic vehicle and the robotic arm through the webpage or keyboard available at the user end. The input given through the webpage or the keyboard is then sent through the internet and the desired movement occurs at the robot end.

4. BLOCK DIAGRAM:

4.1 Proposed block diagram:

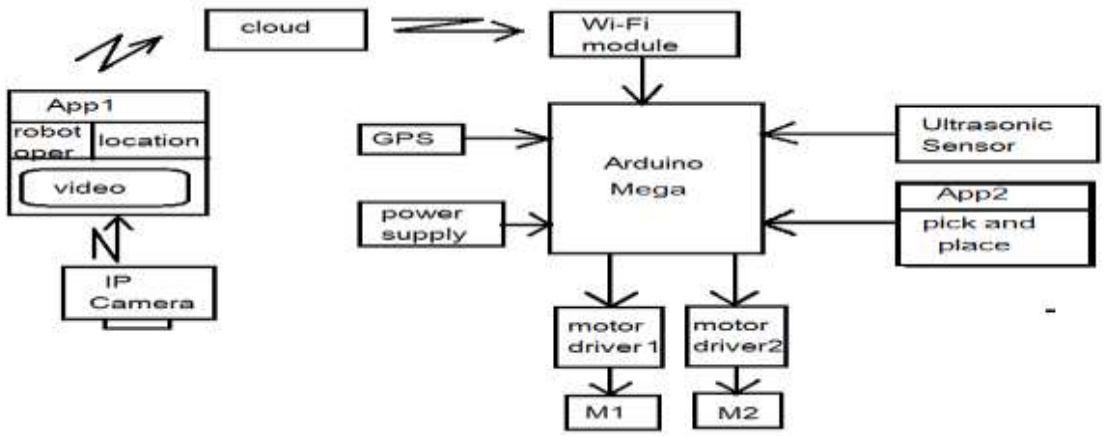

Fig 1: BLOCK DIAGRAM OF PROPOSED SYSTEM

4.2. Components:

- Arduino
- L298N motor driver
- DC motors
- ESP8266
- IP Camera
- Ultrasonic Sensor
- Robotic Arm
- GPS

➢ **Arduino:**

Fig 2: Arduino

Arduino is an open-source computer software and hardware company, user community and work that designs and manufactures kits for building interactive objects and digital devices that can sense and control the physical world. These systems provide sets of digital and analog I/O pins that can be interfaced to various extension board stand other circuits. The boards feature USB on same board, including serial communications interfaces, for loading programs from personal computers. For programming the ICs the microcontrollers, the Arduino platform provides an integrated development environment(IDE) based on the Processing work, which includes support for C++ and C programming languages.

➢ **L298N MOTOR DRIVER:**

Fig 3: L293D Motor Driver

We are using motor driver L298N for interfacing the motors to the Arduino. With L298N driver we can control two motors with single driver. It requires 5V of power supply for operations. We can use adaptors of 5V which are available in market. Its output voltage ranges from 9V up to 32V. So we can also control motors which require very high voltages. For handling such voltages the driver package has very good heat sink which keeps temperature of IC very low for the better performance.

- **DC MOTORS:**

DC motors with built in gearing Arrangement is used in this work. It is because it is simple to control and have higher torque compared to servomotors. The motor driver IC is needed to use DC motor. To drive the motor simply connect the one wire to one of the driver terminals and the other to other terminal.

- **ESP 8266**:

Fig 4: ESP8266

The ESP8266 is a low cost and very user friendly device to provide internet connectivity to your projects. The module can work both as a station (can connect to Wi-Fi) and a Access point (can create hotspot), hence it can easily upload and fetch data, making Internet of Things as easy as possible. It can fetch data from internet using Acess Point Interface hence your project could access any information that is available in the internet, thus making it smarter. It can be programmed using the Arduino IDE is the another exciting feature of this module which makes it a lot more user friendly.

- **IP CAMERA:**

An IP camera is also called a surveillance camera is a digital video camera as it is almost employed for surveillance, and which is unlike analog closed-circuit television (CCTV) camera which can send and receive data via the internet or a computer network. The term netcam or Internet Protocol camera is usually applied only to those used for surveillance that can be directly accessed over a network connection, although the most cameras that do this are webcams.

- **ULTRASONIC SENSOR :**

Fig 5: Ultrasonic sensor

HC-SR04 is a ultrasonic distance measurement sensor. It is a type of Acoustic sensor. It provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy up to 3mm. Each HC-SR04 module includes an ultrasonic receiver, a transmitter and a control circuit. There are only four pins on the HC-SR04: VCC (Power), GND (Ground), Echo (Receive), and Trig (Trigger).

- **ROBOTIC ARM**

The robotic arm is an excellent robotic gripper for development of any robotic arm project without spending a lot of money. It can be used for other robotic and IoT projects, it is best suitable for pick and place type robots. Its operating voltage range is 5-12V. It is well suited for object size up-to 11 cm. It has high torque and low power consumption.

- **GPS:**

A **GPS tracking unit** is a navigation device that uses the Global Positioning System (GPS) to determine its location and track the device's movements. It is normally carried by a moving person or vehicle. The recorded data of location can either be transmitted to an Internet connected device using the cellular (GPRS or SMS) , satellite modem or radio embedded in the unit or stored within the tracking unit. This allows the asset's location to be displayed on a map when analysing the track later map backdrop or either in real time, using GPS tracking software.

5. RESULT AND CONCLUSION:

Fig 6: Dual Arm Tele-Robotic System Hardware

In this paper an efficient IoT based dual arm tele-robotic system is implemented. The memory load of the system is reduced due to the use of cloud service. The control commands are successfully transmitted via Wi-Fi and on reception the desired operations successfully take place. Such systems can be brought into use at places such as military, defense, industry and research purposes, etc.

6. FUTURE SCOPE:

6.1 As we place robot instead of human soldier it is necessary that the robot will defence himself and protect our nation from the enemy. To make robot self defence it can be implemented with a laser gun. The laser gun with the help of IP camera will detect the enemy and shoot according to mode of operation i.e. automatic and manual mode. It will be a good application of surveillance robot to protect the nation from enemy.

6.2 This security robot also need an Artificial Intelligence that would allow it to recognize the world around it and be able to detect the intruders and alert the human operator.

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