Wireless Video Surveillance Robot

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Abstract— *IoT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smart phones and tablets, to any range of traditionally dumb or non-internet-enabled physical devices and everyday objects. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled. With the arrival of driverless vehicles, a branch of IoT, i.e. the Internet of Vehicle starts to gain more attention. With the world developing in the sector of IoT (Internet of Things) there are many latest technological update which are based on that concept. The Wireless Video Surveillance Robot uses the similar concept in its implementation.*

The Raspberry Pi Foundation provides Raspbian, a Debian-based Linux distribution for download, as well as third-party Ubuntu, Windows 10 IoT Core, RISC OS, and specialized media center distributions. It promotes Python and Scratch as the main programming languages, with support for many other languages. The default firmware is closed source, while an unofficial open source is available. Many other operating systems can also run on the Raspberry Pi. Other third-party operating systems available via the official website include Ubuntu MATE, Windows 10 IoT Core, RISC OS and specialized distributions for the Kodi media center and classroom management.

The raspberry pi controller is the core component in the design and structure of robot. The robot has an infrared and photo diode mounted on its circuit for auto transmission and collision detection in case of collision. The light emitted by the infrared, when closer to an obstacle gets reflected back from obstacle and absorbed by photo diode which on absorption of light detects the path of object and diverts the robot to avoid collision.

The robot is controlled by controller through wireless network which has the radius of about 200m. The robot is mounted with high quality camera for real time transmission of data.

Index Terms—*IoT, Robot, Surveillance, Raspberry Pi, Wireless, Python*

I. INTRODUCTION

The IoT (Internet of Things) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators and connectivity which enables these things to connect, collect and exchange data.

IoT involves extending internet connectivity beyond standard devices, such as desktops, laptops, smartphones and tablets, to any range of traditionally dumb or non-internet-enabled physical devices and everyday object. Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled.

Wireless Video Surveillance Robot is actually an IoT based technology which makes the deployment of surveillance in even the remotely inaccessible area where it is almost impossible for human to reach. Even if the reach is possible some areas are way too risky to be camp by humans.

In such places it comes really handy to have some machine which can do the surveillance work instead of human. This is where Wireless Video Surveillance Robot comes into use. The Robot uses Wireless connection to transmit and receive data rather than any other form of rays (used for data communication by other robots).

The Wireless Video Surveillance Robot is built with the help of Raspberry pi and has the wireless range upto 200m. The Robot uses smart sensors to detect obstacle and divert its path while on the field if the human controlling is not able to do it in sufficient time. This factor helps robot to avoid any damage that can be caused to it due to collision while working on the field.

The robot is remotely controlled through an interface depending upon the module on which the robot is built. The data is send via the Internet connection. The circuitry designed for the construction of robot can determine the range to robot and the speed at which the data can be transmitted between the interface and the robot.

A. Problem Definition

Video Surveillance is the process of monitoring a situation, an area or a person. This generally occurs in a military scenario where surveillance of borderlines and enemy territory is essential to a country's safety. Human surveillance is achieved by deploying personnel near sensitive areas in order to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible.

There are also the added risks of losing personnel in the event of getting caught by the enemy. With advances in technology over the years, it is possible to remotely monitor areas of importance by using robots in place of humans. The deployment of robot is both risks effective and cost effective.

B. Literature Survey

The development & innovation in technological field is moving at the rocket speed. Every new day rises with some new innovation and the rate at which the technology is developing and has spread its wings wide it is almost near to impossible for a single person to keep the track of all the development been done till now.

With development of technology in modern world gaining pace it is about time that some importance should be given to the department of surveillance technology which is still working on age old technology to get its work done.

Consider an example of traffic signal. Since the establishment of embedded technology the prototype for traffic signal has remained same even though the technology surrounding it has been revised couple of times. The technology surrounding traffic signals is mostly vehicles which depend on it for its smooth functioning.

The earlier day's vehicles were just installed with simple machinery which is required for working of the four or two wheels which are installed on it and some lights surrounding the vehicles. But with the advancement of technology the changes are made and now we have reached to the point where we don't even need to drive our own cars!

This proves that how far we have moved with technology and how long the development in surveillance field is overdue. There are various work and researches carried on with the surveillance technology but none has been brought into real world; that too in abundance to be a noticeable change. Similarly various robotic technologies have been proposed and brought into implementation in the robotic field but none worked as fine as it should and has been rejected very soon than expected.

The Wireless Video Surveillance Robot is used to overcome all these technological lacking and unavailability in the technological field to bring about some overdue changes in this field.

II. DESIGN

A.Block Diagram

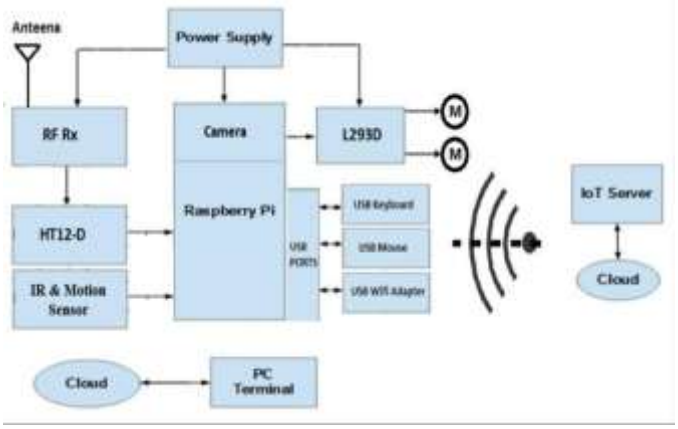

Fig: Block Diagram

The diagram represented above shows the different modules present in the circuit. It is represented with different blocks.

- The Brain of the circuit is Raspberry Pi.
- It is single board credit card size computer based on a 900 MHz quad-core ARM Cortex-A7 CPU with 1 GB RAM.
- It is also equipped with two IR obstacle sensors which allow it to see the obstacles that you can't because of we not being physically present there.
- It will detect an object and if the object detected, it will change its direction.
- As stated before, the robot has quite a few sensors on board.
- It also has a camera which can be used for video surveillance of human beings.
- We also have used a motion sensor to detect human movement.
- If a human is detected, the system will enable a camera module.
- It also has an L293 motor driver to allow sufficient current to power the motors via the Raspberry Pi GPIO.
- We have established IoT server which enables to control robot from a remote places.
- We have flash Raspbian OS in microSD card
- Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware.
- An operating system is the set of basic programs and utilities that make your Raspberry Pi run.

B. Circuit Diagram

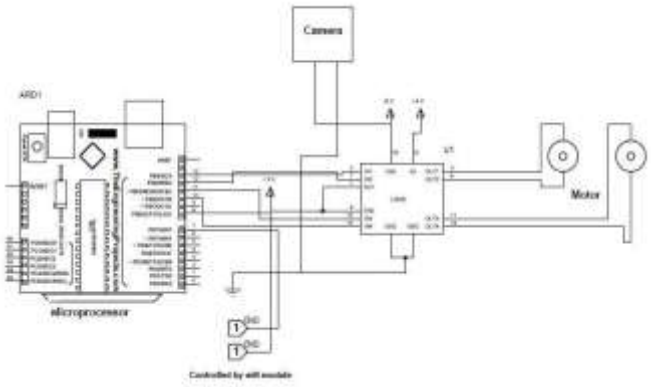

Fig: Circuit Diagram

The above given figure is the circuit diagram for the actual module to be constructed. The circuit functions in the following ways:

- The circuit has raspberry pi 3 microprocessor in which the actual program is embedded through which the circuit functions
- The input output is controlled through this controller and every component of the circuit is connected with it
- It has camera fitted on the top which is used for the surveillance purpose. The camera has rotation of 355º
- The L293D IC which helps to drive the DC motor in the circuit

- The L293D is a 16 pin IC which can control a set of two DC motors simultaneously in any direction

III. COMPONENTS

A. Raspberry Pi 3 Module

The Raspberry Pi is a series of small single board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries.

The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals and cases. However, some accessories have been included in several official and unofficial bundles.

Raspberry Pi 3 Model was released with a 64 bit quad core processor, on-board WiFi, Bluetooth and USB boot capabilities. It has two models one with 1.4 GHz processor and a three times faster network based on gigabit Ethernet or 2.4/5 GHz dual-band WiFi. Other options are Power over Ethernet (PoE), USB boot and network boot.

Fig: Raspberry Pi 3 Module

B. L293D Motor Driver IC

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor driver acts as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously. It means that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver Integrated Circuit (IC).

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anti-clockwise directions, respectively.

Fig: L293D Motor Driver IC

C.+9V Battery

The nine volt battery is a common size of battery that was introduced for the early transistor radios. It is constructed of six individual 1.5V LR61 cells enclosed in a wrapper. These cells are slightly smaller than LR8D425 AAAA cells and can be used in their place for some devices, even though they are 3.5 mm shorter. Carbon-Zinc types are made with six flat cells in a stack, enclosed in a moisture- resistant wrapper to prevent drying.

Fig: +9V Battery

D. DC Motor

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over wide range, using either a variable supply voltage or by changing the strength of current in its field windings.

The DC motor contains either permanent magnets or electromagnetic windings on the stator, which is on the outside of the motor. On the inside, the rotor or "armature" located. The rotor contains the coil windings that are powered by DC current. When powered by DC current a magnetic field is created around the rotor. Rotation is caused by the fact that one side of the rotor is attracted by the magnetic field in the stator and the other side is repelled.

Fig: DC Motor

E. +5V Battery

A medium-sized rechargeable battery pack used mainly for Raspberry Pi. The charging circuit will draw 1A from a 5V supply. How long the battery lasts within the circuit depends a bit on what you have connected. According to that it can last upto 4 hours to 7 hours.

Fig: +5V Battery

F. A2B Cable

The A2B Cable is used for Promira Serial Platform that provides the ability to passively monitor a system using Analog Devices. It is a two wire interface developed by Analog Devices with a single master and multiple downstream slaves.

Traditional implementations for high fidelity audio in automobiles required a large amount of expensive, heavy cabling. ADI set about it a better way – initially with the AD2410 and most recently with the AD242x family of enhanced A2B transceivers. All A2B transceivers are capable of distributing audio and control data together with clock and power over a single, unshielded, low cost twisted-pair wire.

Fig: A2B Cable

G. Data Cable

A data cable is any media that allows baseband transmissions from a transmitter to a receiver. Examples of various data cables are: Networking Media, Ethernet Cables, Token Ring Cables, and Coaxial Cable. Coaxial Cable is sometimes used as a baseband digital data cable.

Fig: Data Cable

H. 360º Symbol

The camera can be changed depending on the pixel required by the user. Here we are using 355º rotating camera to provide wide angle without having to move the whole robot.

Fig: 360º Camer

IV. CONCLUSIONS

IoT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smart phones and tablets, to any range of traditionally dumb or non-internet-enabled physical devices and everyday objects.

Embedded with technology, these devices can communicate and interact over the Internet, and they can be remotely monitored and controlled. With the arrival of driverless vehicles, a branch of IoT, i.e. the Internet of Vehicle starts to gain more attention.

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V. FUTURE SCOPE

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