Smart surveillance bot with low power MCU

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Abstract - *Our project is to design and build a wirelessly controlled surveillance robot. The main purpose of the robot is to be able to roam around in a given environment while transmitting back real time data (video) to the ground station. This real time data can then be used by the controller (human) to move the robot around. The robot must be compact and self contained with wireless transmission of data. The components for a robot are all housed on one intelligent machine that connects back to a server over a high-speed network. When deployed, a robot must be engineered to act autonomously. Any flaws in the programming lead to serious repercussions .The main objective is to build a cost effective and efficient robotic system, programmed to provide a platform for surveillance purpose, thus acting as a substitute for human in hazardous activities like mining, exploration, patrolling sensitive areas and for various applications that are at a safer distance and to monitor the movement of the robot through wireless mode of communication*

Key Words: **Surveillance, MSP430, CC3200, bot, iot, wifi Low power MCU**

1. INTRODUCTION

The main purpose of the robot we are making is to provide visual information of hard to access places, for example a building under a hostage situation. Hence the main feature of our robot is an onboard video camera. Also the robot must be compact and self contained in the sense it must have an onboard battery pack and wireless interface to the human controller. There are various surveillance systems such as camera ,CCTV etc..In these types of surveillance systems, the person who is stationary and is located in that particular area can only view what is happening in that place .Whereas, here ,even if the user is moving from one place to another ,he/she can keep track of what is happening in that particular place. Also another advantage is that it offers privacy on both sides since it is being viewed by only one person .The other major advantage is that it is a simple circuit .It can also find the number of persons located with the help of the Infrared sensor. Here we have used a low power MCU CC3200 SimpleLink WiFi which has its own inbuilt ARM Cortex M4 CPU designed by Texas Instruments.

The presently available methodical robots have hardware and controllers loaded onto them. This will make troubleshooting hectic. Clearly, new methods have to be devised to relieve the burden on human and to make the robots light weight for better locomotion.

This project, deals with a new optimized method of building an independent mobile robot with manual and automatic control techniques with wireless mode of control and monitoring.

1.1 Application and future scope

The following are the applications of this smart bot-

- Path finder applications areas inaccessible by humans like mines and damaged buildings.
- Dimensional tracking of the area under surveillance and patrolling.
- Self-guided vehicle for industrial material transportation system in large workspace such as hospitals, container ports etc**.**

The following points elaborates the future scope of this bot-

- ✓ In this world of technological advancement and the need to protect precious human lives, the concept of surveillance under supervision will always be 'THE NEED OF THE HOUR'. This robotic platform for surveillance purpose can be extended to many applications where human life would be at stake.

- ✓ The concept of surveillance can be extended to **'Land Mine' detection**, just by **incorporating a metal detector** and high resolution camera along with the robot chasis developed.

- ✓ In case of **fire accident or smoke detection**, the robot can be fitted with the respective sensor units, so that the information regarding the hazardous situation can be made available for the people.

- ✓ The efficiency of the robotic movement can further be enhanced by using **efficient intelligent control algorithms and servo motors**.
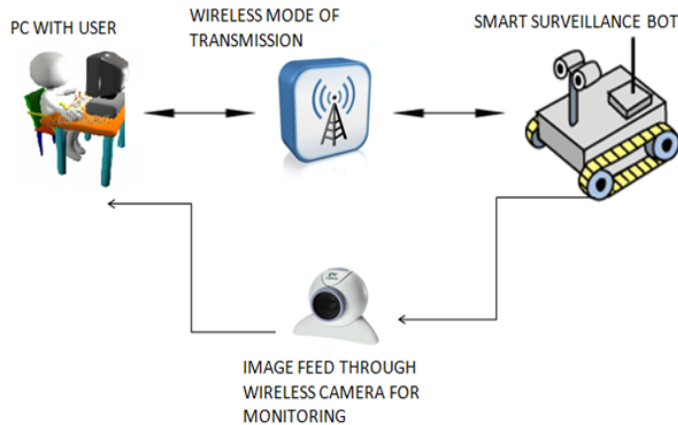
Thus the automation system being developed has the inherent advantages of flexibility, safety monitored control and easily reconfigurable to other robotic applications where human finds toxic environment such as oil refinery, nuclear reactor control, coalmining fields , dimension and path tracing etc.,.

Hence, the scope of this robotic system is always on the brighter side.

1.2 Software/language used

- Html,css,jscript(for webserver designing)
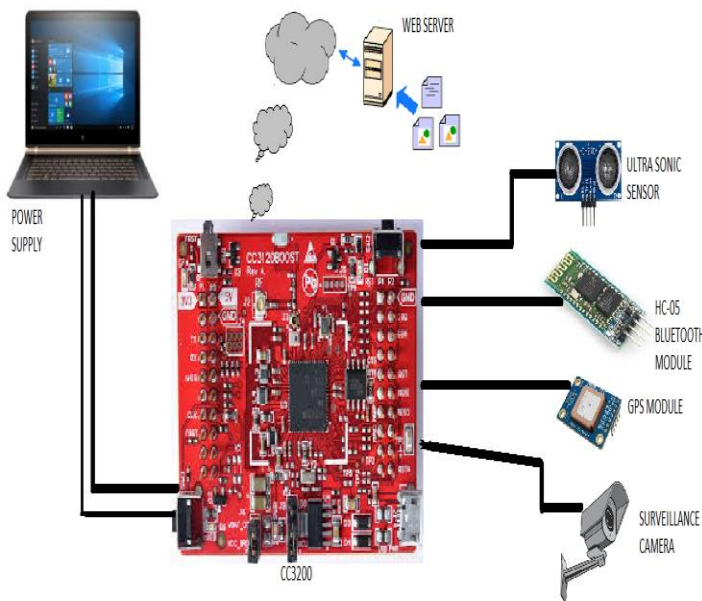- Energia IDE
- Embedded c

2. Schematics

Figure -1: overview of features to be incorporated in bot

3. Hardware/components description

1.CC3200

The CC3200 SimpleLink™ Wi-Fi®™ is the industry's first single-chip microcontroller (MCU) with built-in Wi-Fi connectivity, created for the Internet of Things (IoT). The CC3200 device is a wireless MCU that integrates a high-performance ARM Cortex-M4 MCU, allowing customers to develop an entire application with a single IC. This document introduces the user to the environment setup for the CC3200

SimpleLink Wi-Fi, along with programming examples from the software development kit (SDK).

The main features are as follows: →

- ✓ ARM Cortex M4 CPU (80 MHZ).
- ✓ Its 32 bit
- ✓ Has integrated TCP/IP stack
- ✓ TLS/SSL stack
- ✓ WiFi 802.11 b/g/n standards
- ✓ Can operate in three modes viz. Access point mode, smartconfig and WiFi direct roles.
- ✓ Has crypto engine with 256 bit encryption .
- ✓ Has 128MB external SPI flash support.
- ✓ 256kb RAM
- ✓ 16-bit PWM
- ✓ SDMMC
- ✓ I2C
- ✓ SPI
- ✓ UART

2.Ultrasonic sensor(HC SR04)

The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone). The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object**.**

Vcc- **Connects to 5V of positive voltage for power**
Trig- **A pulse is sent here for the sensor to go into ranging mode for object detection**
Echo- **The echo sends a signal back if an object has been detected or not. If a signal is returned, an object has been detected. If not, no object has been detected.**
GND- **Completes electrical pathway of the power.**

Figure-2:pin description of hc sr04 ultrasonic sensor

3.bluetooth module(HC05)

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate)3Mbps Modulation with complete 2.4GHz radio

transceiver and baseband. It uses CSR bluecore 04-External single chip bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).
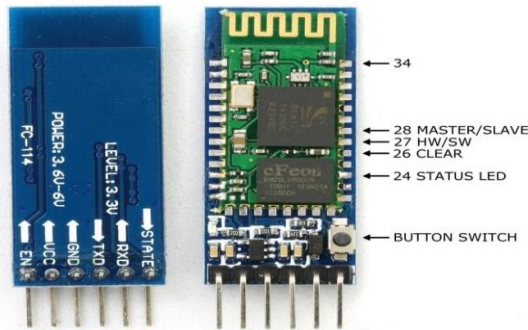

Figure-3:view of HC05 bluetooth module

4. Camera

In this project we have used TTL serial camera module with NTSC video output. These modules are a nice addition to a microcontroller project when you want to take a photo or control a video stream. The modules have a few features built in, such as the ability to change the brightness/saturation/hue of images, auto-contrast and auto-brightness adjustment, and motion detection.

The module was initially designed for surveillance purposes. Its meant to constantly stream TV-resolution video out of the Video pin (this is NTSC monochrome format) and also take commands from the serial port. The serial port commands can request that the module freeze the video and then download a JPEG color image. So for example, normally its just displaying video to a security monitor. When motion is detected, it would take a photo and save it to a disk for later analysis.

5. GPS

GPS stand for global positioning system and used to detect the Latitude and Longitude of any location on the Earth, with exact UTC time (Universal Time Coordinated). GPS module is the main component in our vehicle tracking system project. This device receives the coordinates from the satellite for each and every second, with time and date.

GPS module sends the data related to tracking position in real time, and it sends so many data in NMEA format (see the screenshot below). NMEA format consist several sentences, in which we only need one sentence. This sentence starts from $GPGGA and contains the coordinates, time and other useful information. This GPGGA is referred to Global Positioning System Fix Data.

3. CONCLUSIONS

In this project, an integrated system of Wi-Fi, IoT, GPS, Ultrasonic Sensor is introduced for efficient and economic surveillance applications by using a low power MCU developed and designed by Texas Instruments. We analyzed the solutions currently available for the implementation of IoT with low power consumption. By implementing this project we will step towards a new era of bots with upcoming high speed 5G and with it the introduction of IOT. It can automatically monitor the surveillance area & send the information to anyplace and anywhere. The technologies which are used in the proposed system are good enough to ensure the practical and perfect for monitoring and management for green environment.

REFERENCES

[1] http://www.cio.com/article/2463903/robotics/5-uses-for-the-surveillance-robot-of-tomorrow.html

[2] https://forums.ni.com/t5/Projects-Products/Smart-Surveillance-Robot-A-Novel-Platform-for-Surveillance/ta-p/3516695

[3] https://learn.adafruit.com/ttl-serial-camera

[4] http://energia.nu/pin-maps/guide_cc3200launchpad/