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Telemetry Monitoring of An Environment Using Robot

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ABSTRACT

In many places, higher officials will patrol every area to keep an eye on how things are working and functioning. It could be challenging for the higher officials to finish all the locations in a day due to the broad geographical coverage. To create a proxy for this, we have made "Telemetry Monitoring of an Environment using Robot" as a stand-in for the higher officials. The Google assistant, which is wirelessly connected to Node MicroController Unit (Node MCU), receives voice commands for our robot. It will obey the user's command to arrive at the desired location. The robot will also use an ultrasonic sensor for obstacle avoidance. This enables the robot to avoid potential roadblocks. The surroundings are observed as it is being streamed live using a Wi-Fi camera and two-way communication. This system provides a platform to monitor any location in a workplace for the user from anywhere.

Keywords: *Telemetry monitoring, voice commands, obstacle avoidance, streamed live, two-way communication*

INTRODUCTION

In many places, the higher officials or superiors will need to walk the entire working area at places like schools, colleges, and businesses to oversee the workspace. Both the labour force and the time of superiors will be needed for this. We are aware that CCTV cameras are available for security purposes, however there are some situations where all-day security is not required. Yet, they require a surveillance camera to keep an eye on every inch of their workspace. In this situation, they can deploy a mobile robot to conveniently accomplish the same thing. This is also in demand because it is both effective and economical. Smaller businesses and people may be able to afford it since it makes the best use of current technological breakthroughs' potential.

In the present day, we require a system's propensity to harness the power of advanced technologies to deliver higher security solutions quickly and easily. As the internet is so prevalent in all fields, it is convenient to use it to complete tasks quickly and effectively. In the reference, a voice-controlled autonomous vehicle that utilizes IoT technology is introduced in [1]. The evolution of IoT in smart vehicles is also discussed in [2]. an Arduino-based voice-controlled

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robot with human interaction capability is presented in [3], while the system in a robot is implemented in [4]. a speech recognition system for a voice-controlled robot that includes real-time obstacle detection and avoidance is described in [5]. the development of a voice recognition robot with real-time surveillance and automation is discussed in [6]. an IoT framework that incorporates trigger condition-aware flexible polling intervals for real-time applications is introduced in [7]. Additionally, a semantic web approach to simplify trigger-action programming for end-user applications with IoT applications using IFTTT is proposed in [8]. The paper analyzes IFTTT recipes is to study how humans use IoT devices is discussed in [9]. an IoT-based RFID attendance monitoring system for students in a specific area using Arduino ESP8266 and Adafruit.io is proposed in [10]. the design of patient health monitoring using ESP8266 and Adafruit IO Dashboard is described in [11]. a low-cost implementation of MQTT using ESP8266 is proposed in [12]. an autonomous robot application that includes human pose detection for elder monitoring. Lastly is introduced in [13], an RDF-based semantic for condition monitoring of an autonomous mobile robot is proposed in [14], while an autonomous exploring map and navigation for an agricultural robot is proposed in [15]. The system known as "Telemetry monitoring of an environment utilizing Robots" was created by fusing these elements together. It encourages users to work more intelligently.

It combines the Internet of things (IoT) and embedded technology in which If This Then That (IFTTT) was used to help Adafruit IO to supply the necessary instructions. This causes the Node MCU microcontroller and Google Assistant to communicate. Moreover, the same microcontroller is connected to the required hardware parts. When a user uses the Google Assistant and gives a voice command, the Google Assistant will forward the command to the microcontroller, which will then cause the robot to move in response to the output. A two-way communication camera mounted on the robot will enable live tracking of its progress.

Problem Definition

Every industry, including schools, colleges, and businesses, needs to be completely secure, but it can be difficult to keep track of everything. People's time and job are major concerns today. They therefore always preferred their needs to be more precise. Also, in this period, everyone needs to complete their tasks in a clever and efficient way. So, the technique used for this should be far more accurate and priced.

To meet the security objectives for the industries that just demand a few needs of surveillance to monitor their workspace by limiting the power, time, and expenditures spent on security instrumentality and staff a system is required.

Conceptual Definition

Embedded System

An embedded system is a combination of both hardware and software created for a specific purpose. It would also be works in larger systems. For this, it is programmed in such a way that it does only one specific task. Nowadays, the application of the embedded system can be seen in many places like in agriculture, industrial equipment's, cameras, digital watches, household appliances, etc.

Even though they are computing systems, they can have simple Graphical User Interfaces (GUIs), like those seen in mobile devices, or they can have no User Interface (UI), like those found on devices made to execute a specific task. Button, Light Emitting Diode (LED), and touchscreen sensing are examples of user interfaces. Some systems also employ remote user interfaces.

After few years, the Numerous well-known technology companies like Apple, IBM, Intel, and Texas are among the major chip producers for embedded systems. So, the expected rise of these companies can be seen due to the regular investment in Artificial Intelligence (AI) and mobile computing will be needed for chip manufacturing for high-level processing.

Characteristics of Embedded System: The following are the qualities which are exists in it:

- Generally, it contains hardware, software, and firmware.

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- It is task-specific since it is placed inside the for that particular purpose alone.
- It can be seen in various forms like microprocessor, microcontroller, or integrated circuit to provide the system to compute the power of the system.
- They are frequently used in real-time applications that uses internet-connected and non-interactive Internet of Things (IoT) devices.
- It can vary in its function and complexity, software, firmware, and hardware based upon the application.
- They frequently need to fulfil their role within a time limit to maintain the functionality of the larger system.

Structure of an Embedded System: Although embedded systems complexity varies, they typically have three key components:

- Hardware: Microprocessors and microcontrollers are the foundation of embedded systems' hardware. Like microcontrollers, a microprocessor is a Central Processing Unit (CPU) which incorporates with other computing elements like Digital Signal Processor (DSP) and memory chips. These parts will then housed on an individual chip.
- Software and firmware: Complexity for software of an embedded system might vary. Yet, the embedded IoT systems and industrial-grade microcontrollers typically run straight forward software that only consumes truly few memory space.
- Real time Operating System: Especially in small scale systems, they are not present in embedded systems. By controlling the software and guidelines for program execution, RTOSes will be specify how the system operates.

Hardware Components of an Embedded System: The fundamental embedded systems would have the following hardware components:

- Data from physical senses will converted into an electrical signal by sensors.
- An analog electrical signal will transformed to a digital signal using an analog-to-digital converter (ADC).
- Digital signals are processed by processors and stored in memory.
- Digital data obtained from the processor will transformed into analog data by using digital-to-analog converters (DAC).
- Actuators select the appropriate output by comparing it to memory-stored output.
- The processor converts the information from the processor's readable input, which the sensor reads from external sources, into a purposeful output of the embedded system as shown in Figure 1.

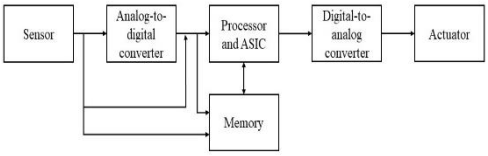

FIG 1: Flow of Information in Embedded Systems

Internet of Things

Internet of Things (IoT) could be a platform that has been living for a protracted time, the thought goes as back as around 1926 once it absolutely was mentioned by Nikola Tesla himself in associate in nursing interview, however the term itself was devised within the recent past, in 1999 by Kevin Ashton. But it came into the market, a decade before in 2010-2011. As per the fundamental definition, Internet of Things is a set of radars, sensors, activators/triggers etc. that are deep-rooted into physical entities and are joined wirelessly or through wired medium to speak among themselves. It may be thought of as a network for multiple embedded systems or assortment of networks of multiple embedded systems to speak and perform tasks as needed. These systems may be programmed in many alternative ways to perform one or many tasks.

This network is additionally safe because it is ever gift on the net that the possibility of failure is low, and even the info that holds on stays on-line therefore it may be accessed quickly. The most important objective of a network is permitting someone to access a bunch of devices that then can be controlled by the user to perform desired tasks. Within the last 2 to 3 years this idea has been enforced and has semiconductor diode to terribly winning ends up in the shape of merchandise among various fields. One such

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example is Google's home automation scheme manager known as Google Home that could be a hand-held sensible speaker integrated with home automation capabilities. It not only permits straight forward voice commands to manage basic operations like playing/switching songs, read image galleries, offer news and updates etc. it can also act with any sensible devices placed in any corner of your home.

This can be achieved by the utilization of Google Assistant, the sensible Artificial Intelligence (Sensible AI) virtual assistant created by Google that is often connected to the servers around the world that permits language process at a way quicker rate once that the commands are taken to require acceptable actions and trigger the specified device to figure. There are more upcoming sensible speakers like Alexa by Amazon, Apple's Home kit and currently even automobile corporations like BMW, MG Motor and even Tesla are attempting to enter the sensible speaker unit inside their cars. However, besides home utility automation and Automobile, IoT has conjointly helped many alternative industries, one amongst them being the play trade. With the discharge of Sony's PlayStation three, a replacement feature known as Remote Play was introduced that was later carried on to successive generation PlayStation four. It instantly became very hype within the play community as currently you will play all your console games in your laptops and computers whereas sitting in another corner of the globe, this allowed users to attach their systems via the net with the console creating the laptop as a screen then it may be controlled and any of the games might be controlled remotely from any place within the world.

This made the console system movable while it does not require anyone to hold it everywhere. IoT is not restricted solely the advanced technological trade; its reach is on the far side that, it is currently conjointly proving to be vastly helpful in primary industries like Agriculture. Its application allows far more economical use of accessible tools and work force by decreasing the quantity of overall labor place within the entire method, most of the observance of close setting is finished by the setup established round the farms. The idea of sensible Farming is on the increase currently and has been evidenced to be a major game changer within the means the whole agricultural method is meted out. A large quantity of knowledge is associated with climate conditions, soil quality and health etc.

Existing System

The current systems are focused on the design and implementation of an obstacle-avoiding spy robot. These robots can be either controlled manually by the operator using a remote control that is packed with numerous buttons, or it can be autonomous in its movements and move intelligently by detecting obstacles in front of it with the aid of an obstacle detectable circuit. Since the robot can be controlled manually by the user via a remote control, or it can be autonomous and move around obstacles on its own by utilizing an obstacle detector circuit. However, the primary source for these operations can only be used through the Bluetooth interface along with some limitations.

As a result, it can only be used while the user is nearby, they are focusing on keypad input-based system to RF transmitter that will take more time, using LiDAR sensor for object detection, its sensitivity and accuracy can be effective but will not be affordable. However, it only does one job at a time.

Proposed System

As we see, most of the systems would become obsolete. Because technology is advancing at a rapid pace. Like the systems mentioned above, there may be a solution that is both a little bit wiser and much smarter. But, in this case, we have developed a system that will do multitasks at a time by putting up the pieces shown in Figure 2 together to work in a well-organized way. This will lead to accomplishing a system which will work more efficiently and intelligently while still being trendy in the modern period.

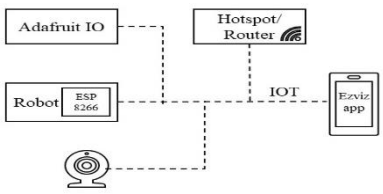

FIG 2: Proposed System

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This system begins by turning on the robot's switch, which triggers an automatic connection to the user's hotspot from the microprocessor (Node MCU). This results in giving the user control over how it moves in response to their commands. The Ezviz Application (App) would then allow users to view the live stream. By employing merely, the user's voice command, this makes it simple to conduct surveillance in any location. For the vast area coverage, the user can use the router for the same. Moreover, the user does not need to be present close to the area where the robot is located. As we are employing internet connectivity for user-robot interaction, it has become even simpler.

METHODOLOGY

The system's implementation includes both hardware and software in accordance with the system requirements depicted in Figure 3.

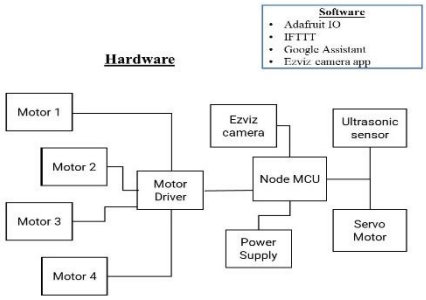

FIG 3: Block Diagram of the System

The robot prototype is entirely constructed of hardware, while the software will contain all the interfaces and programs needed for the system. As a result, the IoT and embedded systems will be necessary for the entire system to function.

Software Implementation

The Node MCU must be able to connect to the user's internet for the system to function. We chose the microcontroller device model as ESP8266 which has a built-in Wi-Fi connectivity and a cloud service platform Adafruit IO to help in interaction with the robot. Then, as shown in Figure 4, the button labels are fed by using Adafruit IO according to the specifications for the robot to function.

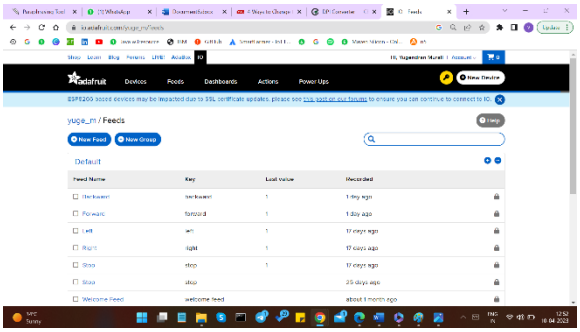

FIG 4: Creation of Feeds in Adafruit IO

To make things more reliable, here we use Google Assistant as an input device with the microcontroller that we are currently utilizing. To do this, we constructed applets using IFTTT, a digital automation platform which provides visual interfaces between the robot and the user. It is connected via Adafruit IO. Here, as Figure 5 illustrates, we have built a few commands that the Google Assistant will recognize as input commands. This is what we refer to as applet creation. By configuring it in this way, only the user's voice commands received via the Google Assistant may be processed and returned as the robot's output is flawless.

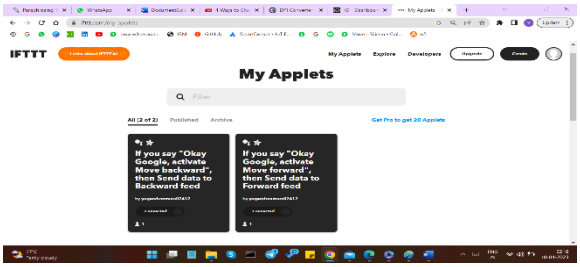

FIG 5: Creation of Applets using IFTTT

When those voice commands are given to the Google Assistant, it will automatically respond to it in the robot's movement. This is done using Google home, which helps to control the devices connected with it. The following steps in Figure 6 show the process of interfacing the Google Assistant with IFTTT.

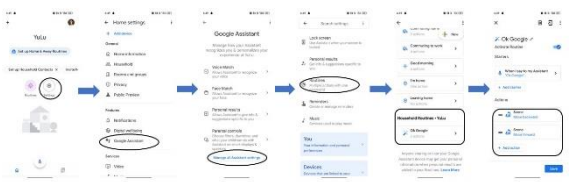

FIG 6: Google Home Setting

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Hardware Implementation

The hardware implementation for this system represents the hardware components which altogether form the robot. It incorporates the above-given software parts to make the system work. This robot consists of so many components like ultrasonic sensor, motor driver, motors, wheels, Node MCU (Microcontroller), Battery. To design the robot, all these components were settled upon a metal piece with a Wi-Fi camera fitted on it.

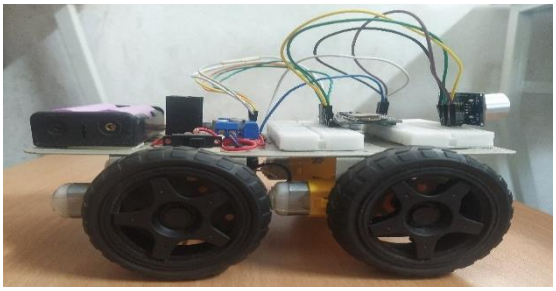

FIG 7: Side View of the Robot

As shown in Figure 7, the base of the robot is coupled with four motors and wheels. Then these motors are connected to the motor driver which is placed on the top of the robot by using the wire connections.

After this, a Node MCU and ultrasonic sensor is placed on to it along with a bread board so that it will be convenient for making the wires connections with the microcontroller.

Then a pair of batteries were also placed on the robot to provide the power supply to it. After this, these components were now connected to each other using jumper wires as shown in Figure 8.

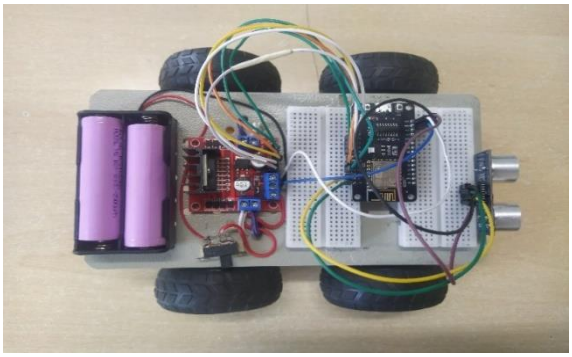

FIG 8: Top View of the Robot

It then has an Ezviz camera which is fixed on top of the robot as shown in Figure 9. It will stream the live video throughout the path and is 360 degrees rotatable. It will also provide two-way communication between the user and the customer. These live videos can also be recorded and saved in a cloud server to the user's account in case of reference in future use.

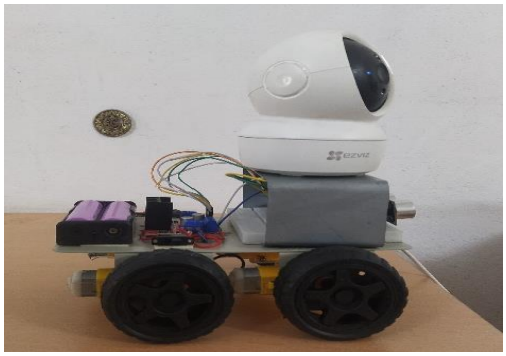

FIG 9: Side View of the Robot with Camera

RESULT AND DISCUSSION

By using the above-mentioned hardware components and software tools, we designed the robot shown in Figure 10.

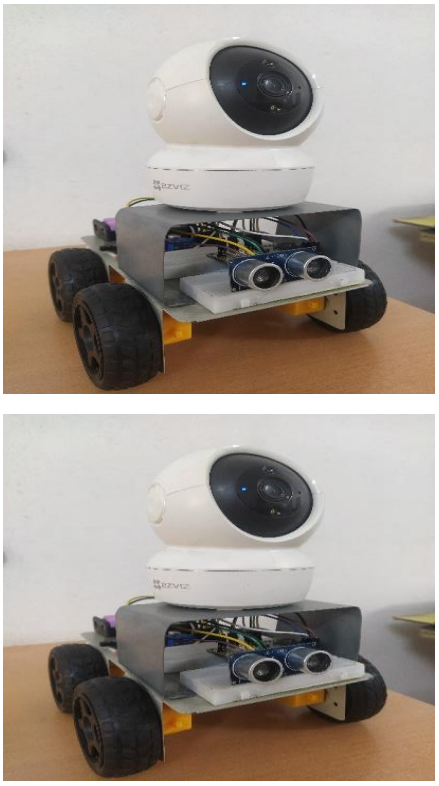

FIG 10: Front view of the Robot

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This system's objective is to use the internet to track a location in relation to a user's voice command. The user will be given instructions on which direction to go, and the robot will be moved accordingly. As a result, we are employing the Ezviz camera to complete these jobs more effectively and intelligently. The Ezviz app is used to view its live broadcast, as shown in Figure 11.

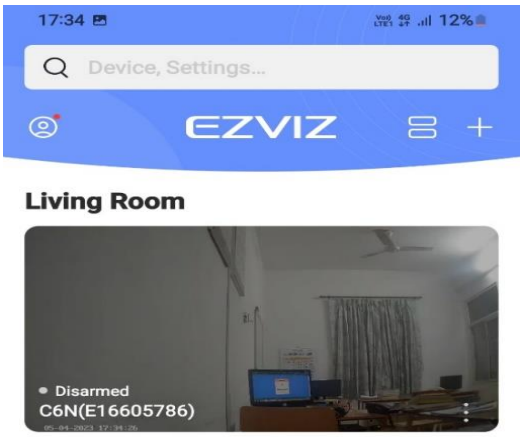

FIG 11: Ezviz Camera App

Together with this, we also have a ton of other choices, including 360-degree rotation, communication, recording, and user-friendly. As seen in Figure 12, the app offers the user four buttons to alter the camera view.

FIG 12: Live Stream of the Camera in Ezviz App

This system can be used in various fields like schools, colleges, Hospitals, Secured places, Industries, Home, Defense sector etc.

The potential uses of IOT are endless. The demand in Artificial Intelligence (AI), networks, and the ability to establish, automate, administer, and defend a variety of use cases at large scale will be expite the development of the industrial-Internet.

By obtaining a geographical perspective of the area that must be monitored, the route for travelling to the desired location can be identified. Because of this, it can be automatically driven in a wiser method by plotting that specific location.

CONCLUSION

IOT (Internet of things) platform provides a simple environment to connect the hardware devices through the user. This low-cost system can be useful in the place where we need to monitor the workspace. It reduces the physical work and time consumption of the human being from doing the monitoring duty of any place from anywhere.

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