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Solar Energy Powered Robot

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ABSTRACT: This paper presents a development of solar powered robot at remote and border areas using multifunctional robot based on HTTP protocol. The robotic vehicle works in automatic mode with the help of sensors and in manual mode via instructions from webpage. The medium of communication used for this purpose is internet. This robotics used to detect metals in its path. We are using ESP32 embedded board coded with python programming. Using this system one can monitor and control the robot from anywhere in the world using IOT. This system is enhanced with the use of renewable resource of energy by equipping with solar panel. Manual operation is controlled by the direction keys in the webpage. In war field areas, robot is usually miniature in size so that they are capable enough to enter into tunnels, mines and small holes.

I. INTRODUCTION

The robot is basically a machine which can be programmed by a computer to carry out a series of complex operations automatically. With the development in technology, scientists come up with new ideas and inventions. Robots are now becoming an essential part of human life. The robotic technology can be used in various areas like hospital, industries and factory. Besides these areas, this technology is also used in Defense forces, Security systems and much dangerous mission execution. Robots could become assistant to human, and, they would become co-workers. Man would gradually be released from the shackles of time and space with the help of omnipresent applications and technological solutions. The man-machine relationship would become more and more integrated and interactive as smart machines come to the help of man in the most diverse contexts at work and in the free time. Changes in the social, cultural and economic sphere would occur.

Multifunctional robot is one of the technologies used in order to substitute the solider at border areas. The robot operates in an automated mode using ultrasonic sensors fitted on the robot for navigation. It can sense the obstacles in the path it moves. The robot can also senses harmful gases, metals etc, during manual mode the robot is operated via a webpage. The direction keys in the webpage are used for the control the path of the robot. All the above operations are on the whole controlled by a ESP32 which is powered by a solar panel.

II. LITERATURE SURVEY

A robots and intelligent machines advantage over human are that it can play a variety of movements and thinking tirelessly and endlessly. A robot can be a good partner in work and play. However, we can also identify a long-lasting phenomenon that advanced technologies, digitalization, robotics and the philosophy of lean production, management and government will finally result in the production model of more and more goods while involving less and less people (Brynjolfsson, 2001).

In the work by (Lever et al, 2006,2008) presents a four wheeled driven solar powered rover. Robot presented high efficiency, good mobility and long-term deployment even under harsh condition. (Runge et al., 2007) presented in his work the concept of unmanned aerial vehicles which can work for long endurance and high altitude (Lever, 2006). It can be of great application in polar regions. (Andrea, 2008) presents a design and initial result for power supply for an autonomous robot. Because of different layers of robot power flow, the energization of robot with maximum efficiency remain a concern.

1. Existing System
- Existing robots were operated within a limited range.
- Most of the robots used battery as a source of power supply which reduces the usage of the robot for a longer period.
- Previously, the robots were used to sense only one or two physical entities.

- Operates within a limited range.

    Proposed System

Proposed system is a multifunctional robot which is loaded with sensors to perform multitask, important feature is it operates using solar energy and communicates via wi-fi , it can be controlled using blynk app from remote place. 3.2.1 Advantages of proposed system

- No distance limitation.
- Using the solar energy for moving the robot.
- No other hardware is required because board has built-in wifi module.

4.   System Design and Architecture

1.   Hardware used in design of the system

A.   ESP32 Development Board
B.   Solar Cells
C.   Metal detection sensor
D.   BO motors, Wheels, Chassis
E.   L293D Driver module
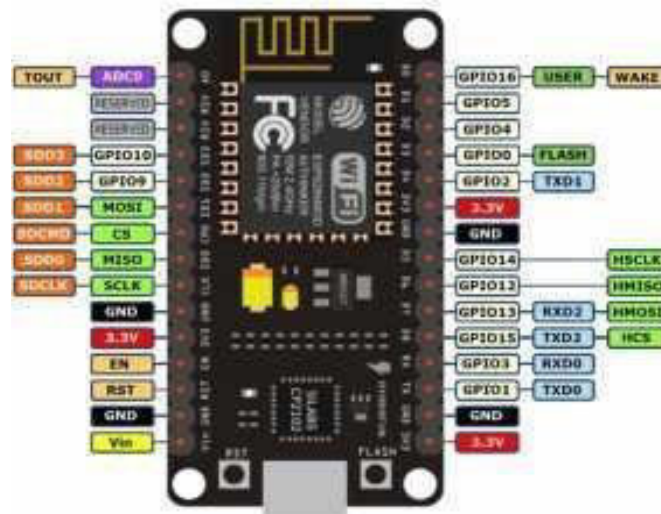F.   Bread board
G.   Jumper wires

A.ESP32 Board:

Fig 1:ESP32 Development Board

ESP32 is one of the microcontroller 802.11b/g/n integrated with802.11b/g/n Wi-Fi and dual mode Bluetooth its means it supports both Bluetooth 4.0 (BLE) and Bluetooth Classic (BT). It is a low- cost, low-power system so it has more advantages to implement the projects. ESP Ressif Systems and Shanghai-based Chinese company created/invented and developed this ESP32 microcontroller and it is manufactured by TSMC with the help of their 40 nm process. Sometimes it connects the network of its own. It provides power supply is of about 5V through USB. The ESP32 is good option for peer-to-peer connection without the need of an access point supports wi-fi Direct as well.

Features:

- Wi-Fi feature.
- Bluetooth feature.
- Security.

- Advanced pheripheral features.
- Clocks and timers.
- CPU and Memory.

B. Solar Panel:

Fig 2:Solar cells

Solar panel is device which absorbs the sun's rays and convert them into electrical energy. These panels are generally made ofphotovoltaic cells which are arranged in a grid-like pattern on the surface of solar panel. These cells are made up of semiconductor material, usually silicon. The silicon cell is covered with a grid of metals which directs these electrons in a path to create electricity. Amount of electrons released from the panel depends upon the intensity of sunlight incident on it. This produced electricity then can be guided through a wire to the load or to the battery for further application..
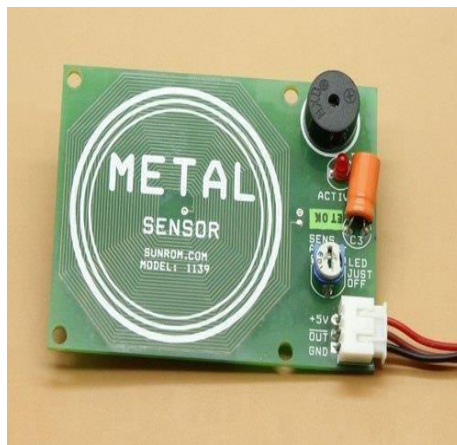
C. Metal Sensor:

Fig 3: Metal Sensor

Use metal detection sensor which detects the presence of metal in the path of robot and alerts the user.

D. BO Motars, Wheels,Chasis:

Fig 4 : BO motors

Fig shows the images of BO motors, these are the DC motors with 100 RPM, these helps to move the ROBOT model in the required directions.They can operate at voltage ranging from
3.3 to 9v;by changing the polarity direction of the motors could be controlled.

 BO motors wheels, these are fixed to BO motors, as motor rotates it keeps wheels moving, motor and wheels are attached to wood chassis of the model, wheels and motor together responsible for the movement of the whole system.

E. L293D Driver Modul

Fig 5:Driver Circuit

control the direction of motors, it receives control signals from esp32 board,esp32 board receives commands or instructions from blynk app. It has pins to receive input from battery and control unit and output pins to which motors are connected.

Features:
1.   Vcc pin 2.Gnd pin 3.A1 pin 4.A2 pin 5.B1 pin 6.B2 pin
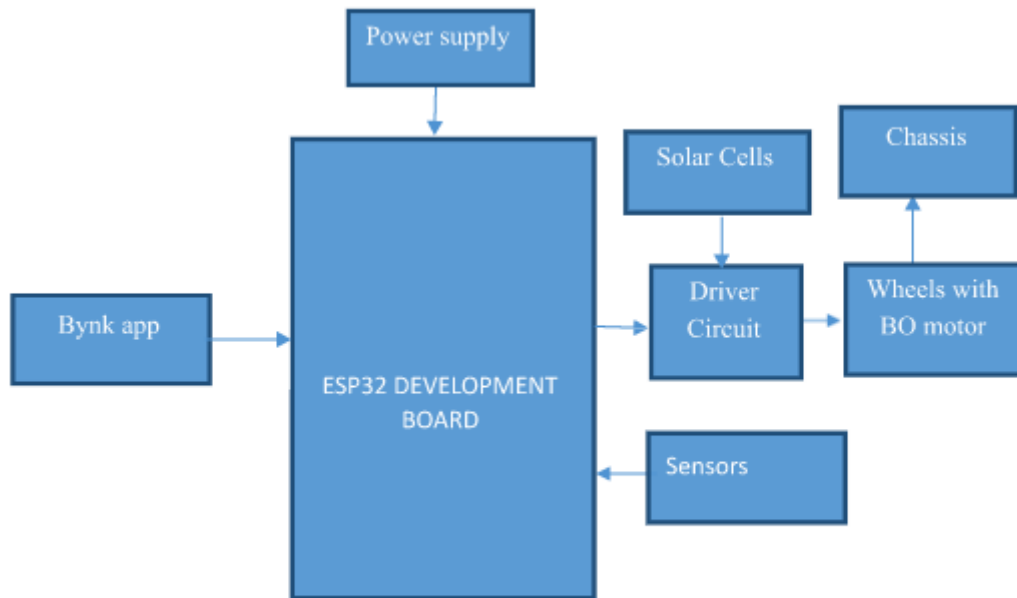
III. WORKING METHODOLOGY

Fig 6:Block diagram

The robot structure basically consists of the robot body as shown in the Figure 7 that includes solar panel, driver circuit,ESP32 board,dashboard, BO motar and sensor. One of the most interesting aspects of robot in general is its behavior, which requires a form of intelligence. Solar panel converts sun light in to electrical energy, this energy get saved in the battery through adapter which is further used to drive the motors. Driver circuit controls the direction of the motors and also supplies energy from battery to motors, it can take a voltage of up to 12 v, it receives control signal from ESP32 board.

Blynk app: Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets.

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things. The process that occurs when someone presses the Button in the Blynk application is that the data will move to Blynk Cloud, where data magically finds its way to the hardware that has been installed. One can control the moments of the robot by passing the commands to move in any directions. Based on the input commands the robot will move as follows.

- Move forward
- Move backward
- Move left ,right
- Stop
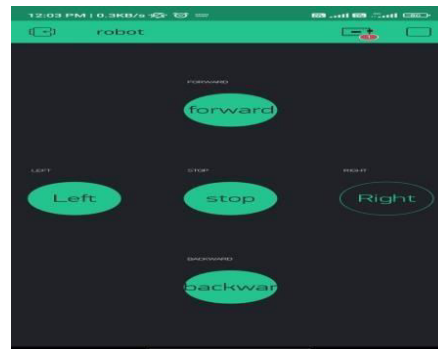
This robot uses Solar panel for power supply. As the solar panel provides continuous power to robot, a rechargeable battery is used to provide consistent power to the robot which is connected to solar panel through relay circuit. A relay circuit is operated by a relatively small electric current that can turn on the second battery when the first battery charge drains.

IV. FUTURE SCOPE

In addition to this, improvisation can be done by taking the pictures of surrounding area by using image processing with the help of camera and can also be used in industries and war field for surveillance. Without the help of user control robot can be made to work on its own by using artificial intelligence.

V. CONCLUSION

This paper illustrates that designing a solar robot which will meet our demands under different circumstances. Making a self-sustainable human independent robotic system develops two main ideas. The first one is creating a robot that can work on some projects without any human help. The second one is using a renewable power source as main energy supplier. Combining these two concepts, very powerful robotic systems can be assembled contributing to the whole aspect of the life in future. Using this machine, one can monitor the real time information of the surrounding; the proposed system is practically used to monitor the war field and risky areas, to detect metallic objects and alert the users as and when detected.

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