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Design and Implementation of Smart Docking and Recharging System for Defense Robot

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Abstract:*In this paper, the wireless power transmission from the docking station to the defense surveillance robot is proposed. This power transmission is used to charge the battery of the robot through wireless charging and also more efficient due to shorter distance. The proposed system contains both way monitoring is done from the docking station to the destination and also from destination to the docking station. During this process the power in the battery of the camera will not be cut off for continuous monitoring purpose. For the position (latitude and longitude) purpose of the robot in the surveillance area a GPS detector is used. A continuous monitoring of the battery and the position in the robot is monitored from the control room. The transmission of this data between the robot and the control room are accomplished by the Radio Frequency transmission. Battery monitoring and control measurement are proposed by LABVIEW .Simulation result has been verified for battery monitoring and control measurement.*

Keywords: *wireless charging, battery monitoring, radio frequency, GPS detector, LABVIEW.*

I. Introduction

Nowadays, it is not easy to keep vigil of the country from external threats. For guarding always we cannot rely on soldiers alone. In some cases, soldiers will leave their areas for a short duration just to escape from inclement weather. Here we are designing a robot for defence surveillance. For continuous defence surveillance, automatic recharging has been done to the robot using wireless power transmission from docking section[1][2].For surveillance purpose, the path of the robot has to be fed initially. When the battery of the robot gets low it will automatically re-enter to the docking section for recharging purpose[3]. This system also contains multiple sensor modules with an embedded system[4]. Wireless Communications between robot and monitoring unit are accomplished through RF Transceiver[5]. This Robot will be ready to capture the image of any human who enters into robot surveillance region.

The presence of human can be determined by the camera and also ideal for real time video surveillance in defence area[6]. In order to cover the entire area, the robot module can be turned on various angles with automatic or manual control from the control room in remote area[7]. For the location of the robot GPS is used, this is widely spread and available at all the time for the remote user[8].For saving the human life's this robot is placed in the hazardous condition. The main purpose of this paper is to design the surveillance robot which are widely used for home and defence application. When its battery gets low it will automatically re-enters to its docking station for recharging purpose. This robot is usually capturing the images from remote areas and transmits the data to the control room.

II. Design Methodology Of Robot

A. Block Diagram

The design of the surveillance robot contains a Monitoring unit (fig.1), Robot unit (fig.2) and Camera unit (fig.3) which are as followed in this block diagram.

From the power transmitter the voltage and current will sends the power receiver for charging the robot. In robot unit the received powers are stored in the battery and it is monitored by the I/V monitoring unit. GPS receiver will tell the position (latitude and longitude) of the robot where it is located.This also show the location of docking system.

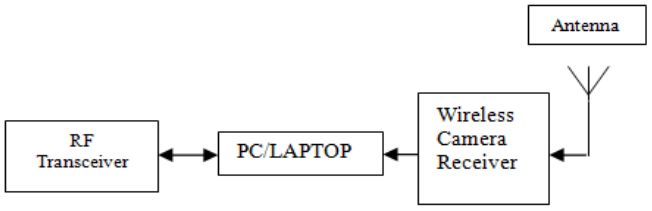

Fig.1 Monitoring Unit

Odometer is used to calculate the wheels rotation and also for navigation purpose. H-Bridge is used for bidirectional wheel rotation of the motor in the robot unit. These devices are controlled by the ARM microcontroller, here ARM microcontroller play a vital role to control all the major parts in the overall system; this is shown in figure 2.

The RF transceiverwill collect all the information from the ARM microcontroller and sent to monitoring unit. In this unit the RF transceiver is connected to the pc/laptop for monitoring purpose. At the same time from the camera unit a wireless camera receiver will send the images to the pc/laptop; this is shown in figure 1.

In this system there is a camera unit which contains a battery, regulator and a camera which is fixed to the robot; in this unit voltage regulator plays a vital role this is shown in figure 3.

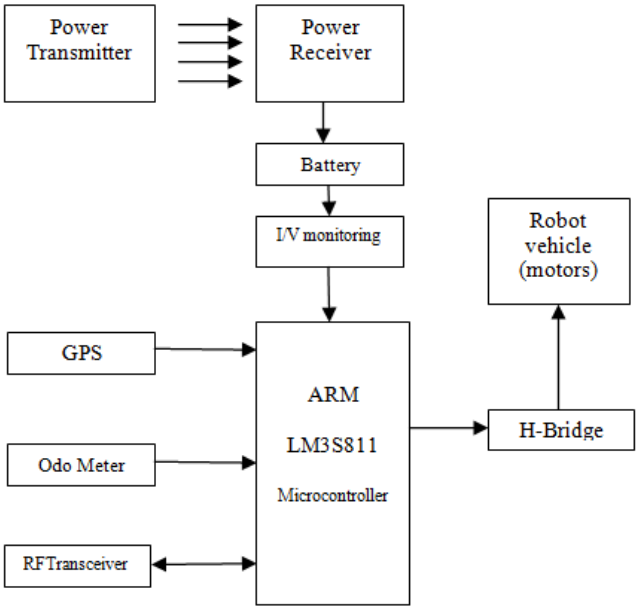

Fig.2 Robot Unit

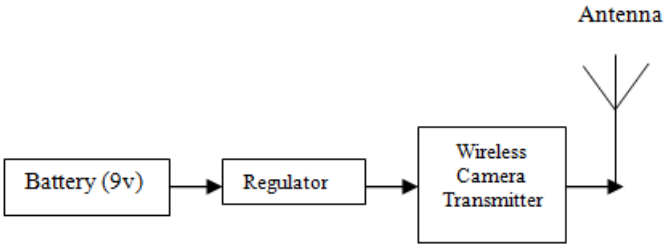

Fig.3 Camera Unit for Robot

III. Simulation Results

For the battery monitoring and the control measurements LABVIEW software is used for simulation purpose. This is one of virtual software which was developed by the National Instruments. The program language used here is Graphical language or also known as G-Code. To design a program in this is very easy and simple.

A before starting stage is also called as initial stage is made from the LABVIEW as shown in Figure 4. This will show the graph of the voltage and the current and also the motor with an indication of both Voltage warning and the running condition of motor.

A RPM (Speed of the motor) is shown during the motor is ON this will show the reading. This also shows the returning indication and ON/OFF Switch of the Robot, charging indication, constant charge current and full voltage. This will run only during the charging of robot. This is also called as initial stage.

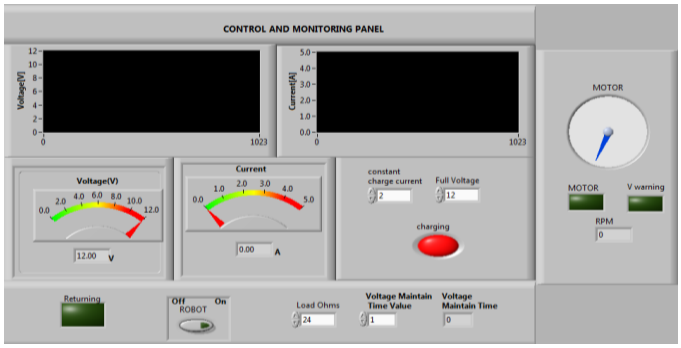

Fig.4 Before starting stage

When the Robot Switch is ON the motor will start rotating and the simultaneously the indication of the motor will blow and also in the graph the full voltage will goes down this indicates the battery is drying, as shown in the figure 5 (when the robot is started or switch is ON)

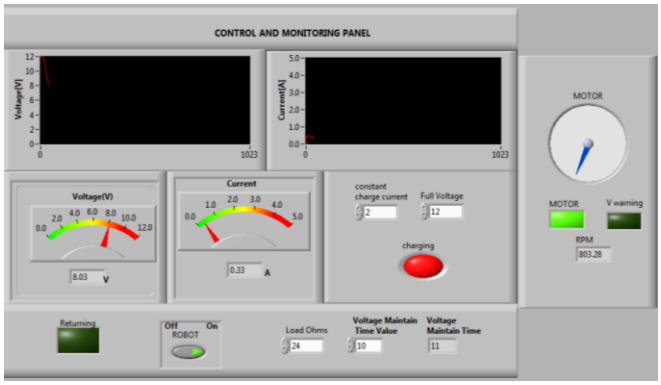

Fig.5 When the robot is started

During the discharge when the voltage reaches to a particular level, a voltage warning occurs for a certain period as shown in figure 6. After this particular time the returning indication occurs and the robot is returning to docking station for recharging purpose as shown in the figure 7.

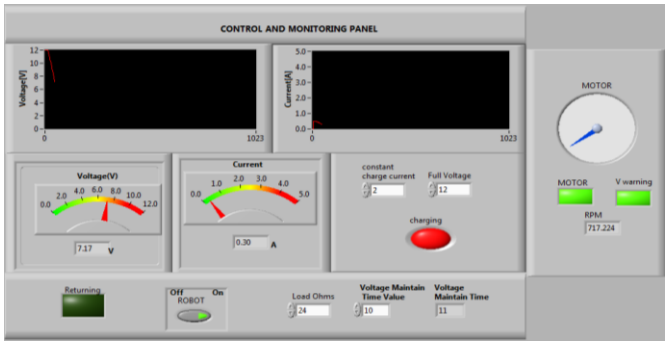

Fig. 6 Voltage warning

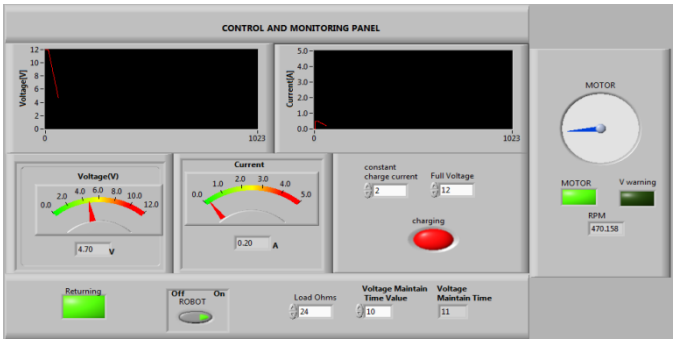

Fig. 7 Returning indication

Once the returning indication is OFF this means the robot is reached to the docking station. Now an automatic wireless charging is done to the robot. This is indicated by the charging indication; simultaneously in the graph the current and voltage is increased. This means the charging is done to the robot as shown in the figure 8.

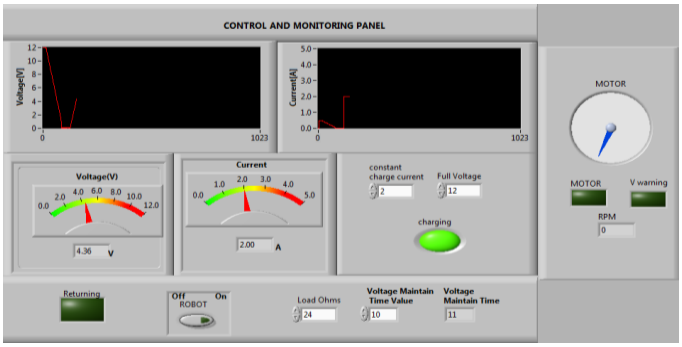

Fig. 8 Charging of Robot

After all this process the robot is ready for the next surveillances. This process is same and the initial stage. Here the simulation gives a clear view of measuring and monitoring of battery through LABVIEW software. In this case also gives a view of motor reading and indication, returning condition of the robot, voltage maintain time, voltage warning, charging during and after charging, and graph for both voltage and current.

IV. Conclusion

This paper discusses the development of surveillance robots using wireless charging. By this proposed model the wireless charging is done to the robot from the docking station with more accuracy and also a successful monitoring of battery level and location of robot using GPS detector from the control room is done. The simulation result shows successfully measured voltage and the current of the battery unit and it is displayed in the front panel of lab view software.

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