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SOLAR POWERED SURVEILLANCE CAMBOT

Mr. O.V.P.R SivaKumar, Professor, Dept. of Electronics and Communication Engineering, Geethanjali College of Engineering and Technology.
Yanala Praneetha, Bhumpalli Manichandan Reddy and Erukala Anitha, Students, Dept. of Electronics and Communication Engineering, Geethanjali College of Engineering and Technology

Abstract
Often cameras can be wireless and are intended to perform the activities for many applications. Most of the wireless video cameras can be used for a small radius to monitor the live video through smart phones and often these are fixed permanently at specific places. There may be blind spots which cannot be seen through this system.

The concept presented here is innovative because this camera will be arranged over a moving mechanism and can be controlled through a remote-control unit such that it can be transported where required. Most important part is the normal setup uses batteries as power supply but we are making use of Solar panels for power supply. This type of camera is considered of great help in monitoring students in schools and protection of big houses that are having open land surrounded by the home and surveillance purposes.

Keywords: Radio Frequency Communication, Solar panel, Microcontrollers, Wi-Fi camera, DC motors

I. Introduction

The main objective of this project work is to provide a robotic vehicle equipped with a wireless camera for remote monitoring/spying activities or purposes. For this purpose, a V380 wireless video camera is used and it is arranged over a moving mechanism. This system is to be useful in war fields, terrorism affected areas and sensitive areas. It can also be used to operate in jungles and other environments humans cannot possibly enter due to the hazardous environment [2]. The vehicle can be controlled remotely by an RF communication system using RF transmitter and RF receiver. The operation is quite simple, with the help of a remote control unit the vehicle can be controlled in all directions.

Spy robots are remotely controlled robots, equipped with a camera, transmitting video data through their mobile. Spy vehicles equipped with cameras are made small and compact enough to easily transport. The vehicle is made up of a wireless camera, an antenna, batteries and movable wheels [1]. The two different Atmel series of microcontroller chips are used to remotely control a wireless system and to control Spy robots.

Radio Frequency module signals are used in wireless remote control systems for transmitting and receiving wireless logic signals to control the motors of the Spy robot control system. Radio communication is the process of sending information from one place and receiving it in another place without using any connecting wires. It is also called a wireless communication system; the most important form of radio communication is radio broadcasting.

The solar panel used in the project work can deliver a maximum current of 0.8 amps under the bright Sun and this energy is used for charging the battery. For this purpose, a high power rechargeable battery is used as a back-up source; thereby the system can be used to drive the

camera along with its robotic vehicle. One way to utilize solar energy is to generate electricity directly from the sunlight by photovoltaic conversion.

Since photovoltaic modules have now become extensively available in the country. Solar energy has long been regarded as an ideal energy source but for the fact that we knew little to tap or use it to our advantage. The advancement in science and technology brought out by mankind has led to developments like the photovoltaic cell. Solar panels comprise a number of such P V Cells. The output of the Solar Panel is proportional to the intensity of incident radiation from the sun. The microcontroller 89C2051 used in the remote control unit and the main control circuit designed with the 89C52 controller chip used in the project work is playing a dominant role. The remote control unit and control unit both are constructed with Atmel series controller chips.

Microcontrollers are increasingly being used to implement control systems. It is therefore important to understand Microcontroller-controlled systems well. Today, microcontrollers have become an integral part of all control systems. Dedicated controllers that use microcontrollers, have certainly improved the functional, operational and performance based specifications.

II. COMPONENTS USED

2.1 L293D H Bridge IC

The L293D H-bridge IC can be used in a solar-powered surveillance camera system to control various motorized functions. By providing bidirectional control for DC motors or stepper motors, the L293D IC enables the camera to move and adjust its position remotely. This can allow the camera to follow motion, capture images from different angles, or optimize night vision capabilities. Both the enable pins (EN1 and EN2) of motor driver L293D are combined together and interfaced with 89C52 controller chip to access the command signals. Depending on the command signals issued by the decoder chip, the enable pins are activated to control all the four internal drivers of L293D respectively to drive two reduction geared DC motors. Here H Bridge is required, because the decoder output is not sufficient to drive the DC motors, so current drivers are required for motor rotation.

2.2 Wi-Fi Camera

V380 Wi-Fi camera is used to transmit the live video (broadcasting) to the concerned smart phone through wireless communication system. V380 cameras can work without the internet and the wireless video link can be established between the phone and camera through the v380 pro app. Wireless cameras are more flexible than wired cameras because they aren't tied by wires such that the vehicle that is equipped with this camera can move in the field freely. The camera is used to monitor the surroundings in the mobile phone and to identify the suspicious activities.

Figure 1: Wi-Fi Camera

2.3 DC Motor

A DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation. In this project DC motors are used to drive the vehicle.

2.4 Radio frequency communication [3]

An RF module (radio frequency module) is a small electronic device used to transmit and receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through radio frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communication incorporates a transmitter or receiver.

Transmitter module

The RF transmitter module is a small tiny device capable of transmitting a radio wave and modulating that wave to carry data. 433MHz Transmitter modules are usually implemented alongside a Microcontroller which will provide data to the module which can be transmitted.

Receiver module

The receiver module used here receives the signal from the transmitter through its antenna, demodulates the signal by which carrier will be eliminated and it is filtered to suppress the noise, with the help of a signal amplifier original signal will be strengthened and original code (Replica) will be generated.

2.5 89C2051 Microcontroller [4]

Features:

- 2K Bytes of Reprogrammable Flash Memory, Endurance:10,000 Write/Erase Cycles
- 2.7V to 6V Operating Range
- Fully Static Operation: 0 Hz to 24 MHz
- Two-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 15 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial UART Channel
- On-chip Analog Comparator

2.6 89C52 Microcontroller [5]

- Compatible with MCS-51 TM Products
- 8K Bytes of In-System Reprogrammable
- Flash Memory
- Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Programmable Serial Channel
- Low power Idle and Power-down Modes

2.7 µVision3 IDE

The µVision3 IDE from Keil Software combines project management; make facility, source code editing, program debugging, and complete simulation in one powerful environment. µVision3

helps you get programs working faster than ever while providing an easy-to-use development platform [6]. The editor and debugger are integrated into a single application and provide a seamless embedded project development environment.

III. DESIGN

3.1 Block Diagram

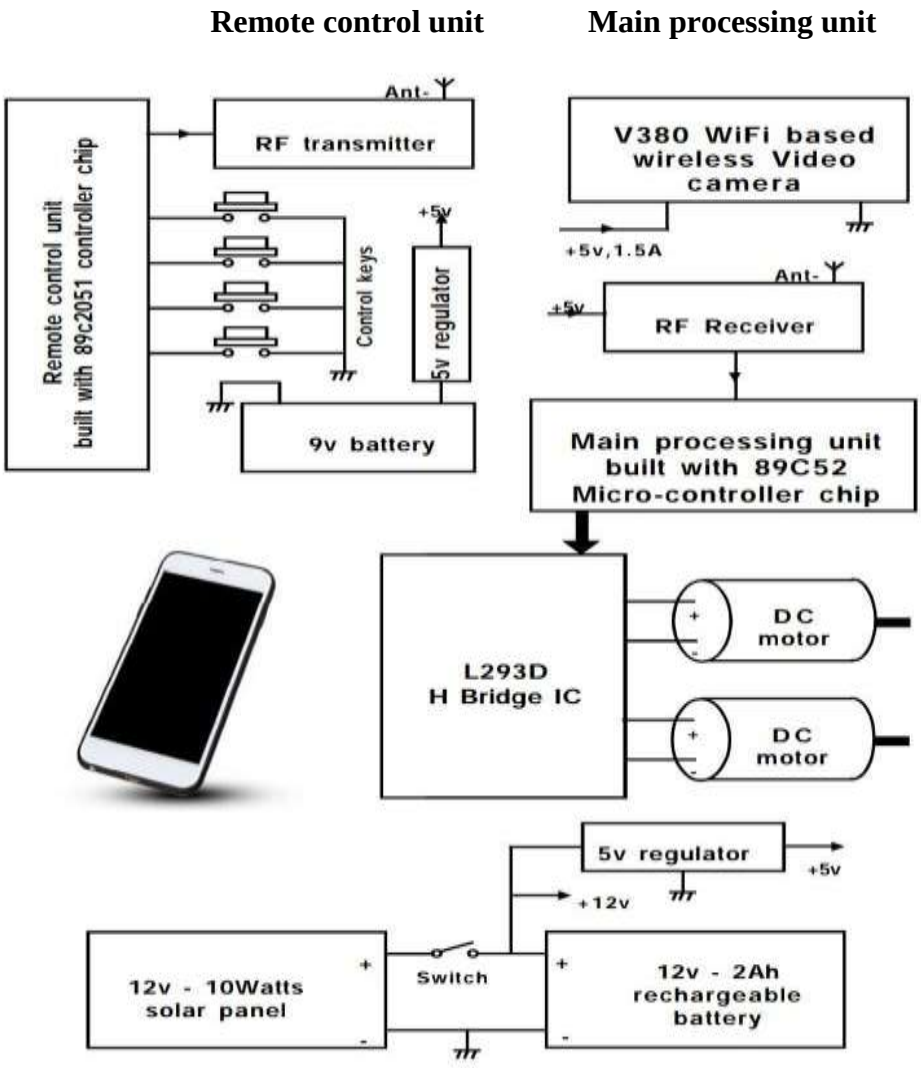

Figure 2: Block Diagram

The block diagram consists of three sections:
1. Main vehicle
2. Remote control unit
3. Power supply

3.2 Circuit diagram

The circuit diagram depicts the connections established between the components in the three different blocks of the system and the communication between the RF transmitter and receiver.

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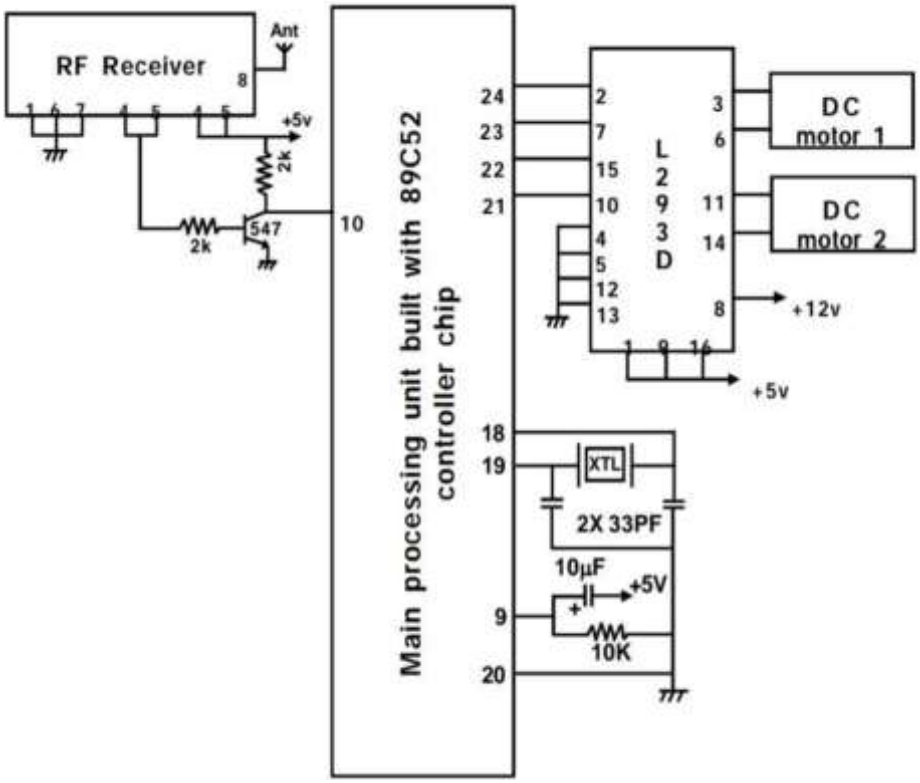

Figure 3: Circuit Diagram of Main vehicle

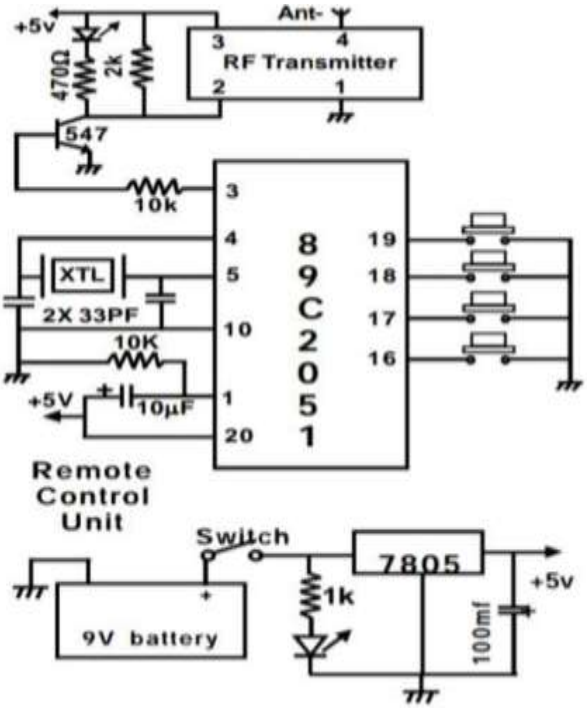

Figure 4: Circuit diagram of Remote control unit

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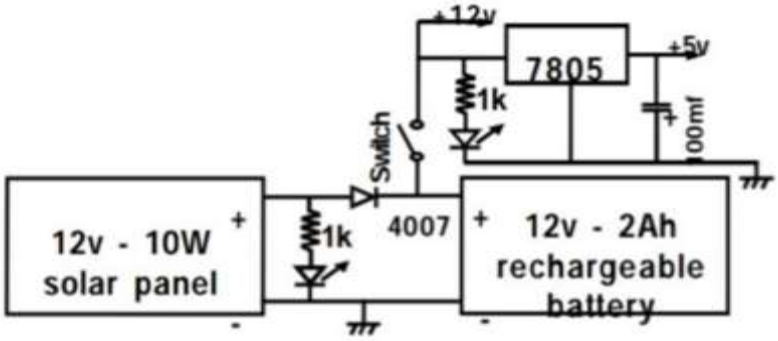

Figure 5: Circuit diagram of Power supply unit

3.3 Flowchart of Transmitter and Receiver

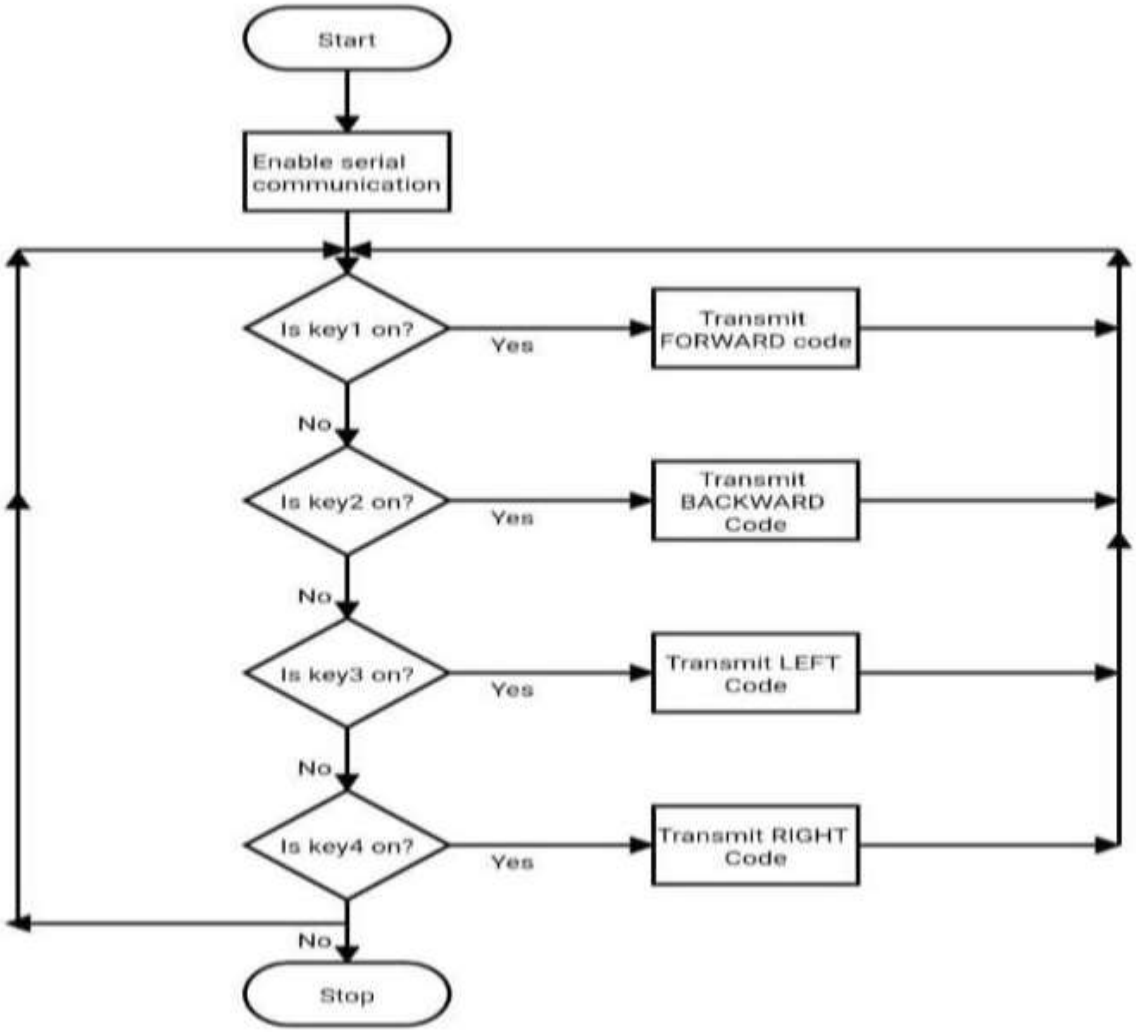

Figure 6: Flowchart of RF Transmitter

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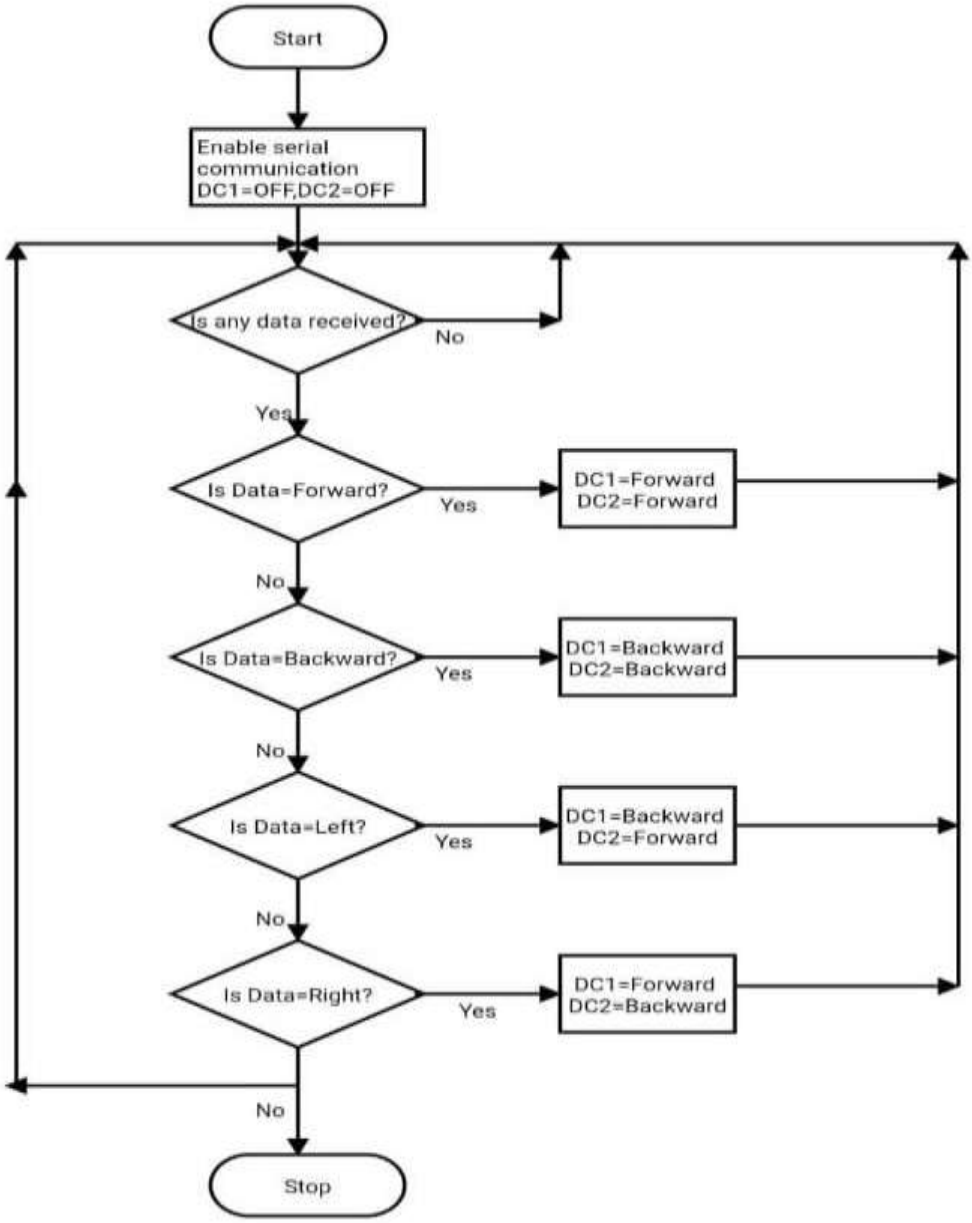

Figure 7: Flowchart of RF receiver

IV. WORKING

4.1 Remote control unit

This unit is designed with an 89C2051 Microcontroller which is an 8-bit controller and has 2KB memory. The program is prepared to generate four command codes for four control keys. The RF transmitter that is used here is intended to transmit the digital data, as the controller used here generates digital data in the form of 8 bits, this data will be transmitted. The message signal is digital. In a digital signal the digital data produced by an embedded system in the form of 8-bit data will be transmitted. Whenever any key is active, the corresponding code in the form of 8 bit digital data is transmitted which is modulated and processed through an analog carrier signal of 433MHz to the RF transmitter as an input.

4.2 Main Processing Unit

This unit is constructed with an 89C52 Microcontroller chip which is an 8 bit controller and has 8KB memory. In the receiving module, the received information will be demodulated, decoded, filtered and the robot will be controlled accordingly. This chip is programmed to decode the data received from the receiver and accordingly the vehicle motors will be controlled independently. Here, L293D H-Bridge IC is used to control two DC motors.

4.3 Camera Module

The V380 camera or security camera systems are becoming more and more high-tech, easier and convenient to monitor through any smartphone. We can establish a wireless video broadcasting link directly to the smartphone with the use of a mobile app. Connect a video camera to a phone by downloading the V380 pro. This camera is used to monitor the activities 360 degrees around in the mobile phone through the app.

4.4 Battery

The UV rays from the sun will be converted to Electric Energy. The panel used in the project can generate a maximum current of 0.7A under bright sun. This solar panel is connected to a Lead-acid rechargeable battery.
Battery rating=12V-2ah.
The video cam used consumes nearly 1.5A.
Control unit consumes 0.5A.
Total Consumption=2A
Battery backup time =Battery rating/Current consumption =1hr.
Charging time=Battery rating/Generated current=2/0.7=2.85 hrs.

V. APPLICATIONS

1. These types of cameras are considered of great help in monitoring students in schools and protection of big houses that are having open land surrounded by the home.
2. Remote controlled vehicles can be used in military applications where humans cannot travel into the caves and watch the live video.
3. This camera can be used for police patrolling where they can find out suspicious activities and help people from dangerous attacks.
4. They can be used in industries, military applications, in jungles, deserts, etc.

VI. RESULTS

The images of the hardware prototype and the pictures captured by the CAMBOT in real time are shown below:

Figure 8: Solar powered Surveillance Vehicle

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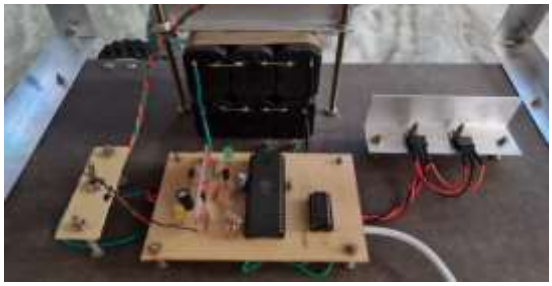

Figure 9: Main processing unit

Figure 10: Remote control unit

IMAGES OF A PARKING AREA CAPTURED BY CAMBOT

Figure 11: Front view

Figure 12: Top view

Figure 13: Front right view

Figure 14: Front left view

Figure 15: Rear view

Figure 16: Rear right view

VII. ADVANTAGES

- **Renewable Energy Source:** Solar powered CAMBOTs utilize solar energy, which is a clean and renewable energy source, reducing dependence on fossil fuels and contributing to environmental sustainability.
- **Off-Grid Operation:** These vehicles can operate independently without the need for a constant external power source, making them suitable for remote or off-grid locations where access to electricity may be limited or not available.
- **Cost-Effective:** Solar powered CAMBOTs can help reduce electricity costs as they rely on free solar energy for their power needs, resulting in potential cost savings over time after the initial installation.
- **Easy Installation:** They are relatively easy to install as they do not require complicated wiring or electrical connections, allowing for quick and hassle-free deployment in various locations.
- **Increased Security**: Solar-powered cam bots can enhance security by providing surveillance in areas where traditional power sources may not be available, improving situational awareness, and deterring potential intruders or criminals.

VIII. CONCLUSION

Surveillance is the monitoring of behavior, many activities, for the purpose of information gathering, influencing, managing or directing. This can include observation from a distance by means of electronic equipment, such as closed-circuit television (CCTV), or interception of electronically transmitted information like Internet traffic. It can also include simple technical methods, such as human intelligence gathering and postal interception. Since the applications of these robots are plentiful, they can be used in industries, military applications, in jungles, deserts, etc.

The vehicles equipped with wireless video cameras have the capability to move around in their environment and broadcast the live video to the concerned mobile phone. These kinds of robots can be used for many applications. A simple robot is designed to prove the basic concept practically in which a V380 type Wi-Fi camera is used to transmit the live video. Results are found to be satisfactory. The blind spots can be monitored effectively.

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