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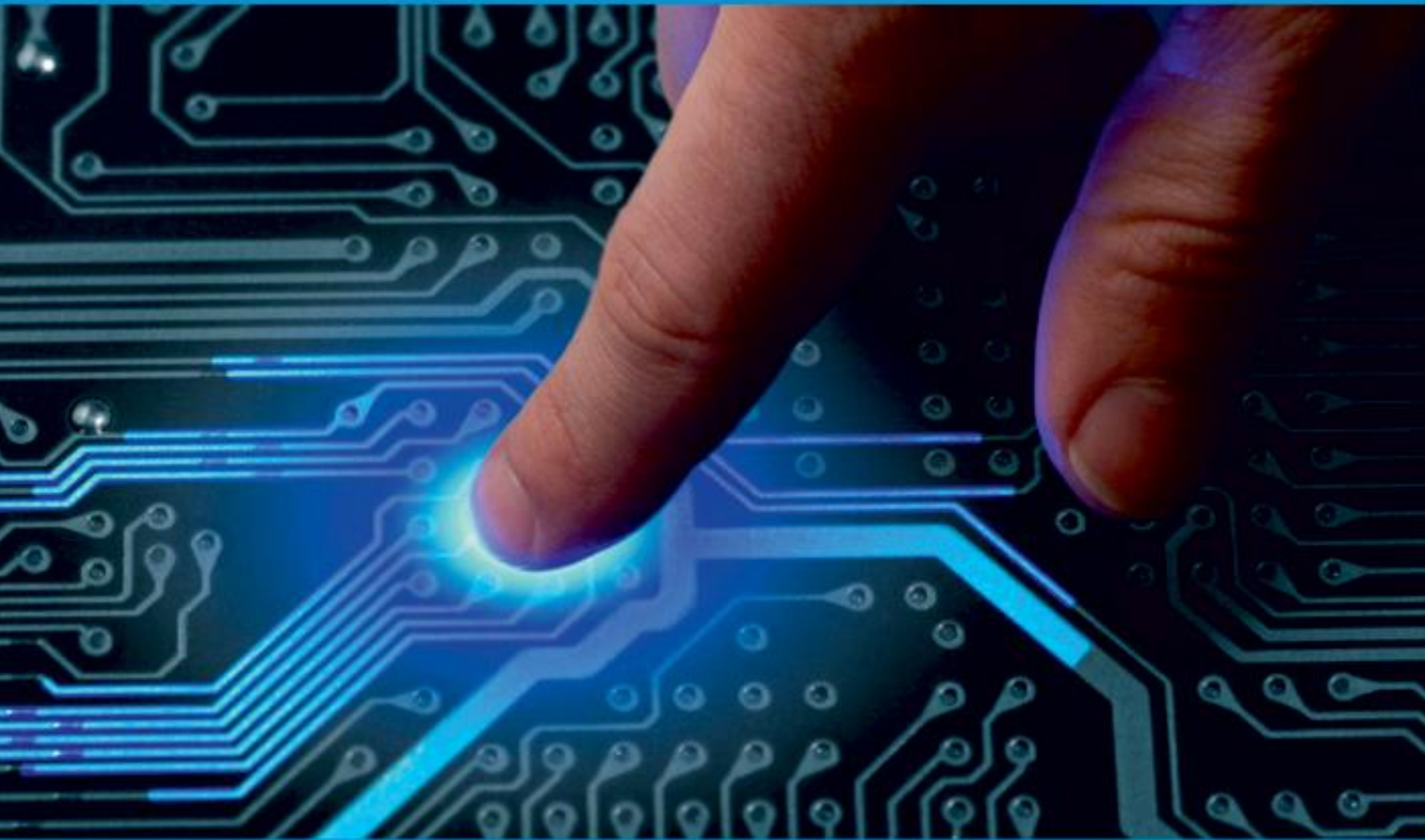

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Smart Solar Monitoring System

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ABSTRACT: The creation of a Solar Monitoring System, which would increase the effectiveness of panels, is detailed in this project's methodical process flow chart. Together, the technology and software of this hybrid prototype automatically orient solar panels toward the sun for maximum power generation. This method entails creating a device that follows the sun in order to maintain the panel at the ideal angle to the sun's rays. The system is made up of an Arduino UNO, a servo motor, and a Light Dependent Resistor (LDR) sensor. The main element for system control is the Arduino UNO. The solar system will follow the sun's position to maintain the solar panel perpendicular to the sun and optimum power output. The sun tracking prototype has been reserved for further tasks. This project outlines a methodical procedure for creating a Solar Monitoring System, which would enhance the efficiency of solar panels. This hybrid prototype's hardware and software work togetherto automatically position solar panels towards the sun for optimal production (electricity). In order to keep the panel at a proper angle to the sun's beams, this technique involves building a gadget that tracks the sun. Light Dependent Resistor (LDR) sensor, servo motor, and Arduino UNO compose the system. Arduino UNO is the key component for controlling the system. To make sure the solar panel is constantly perpendicular to the sun and maximize power output, the solar system will track the sun's location.The Sun, Wind, Waves and geothermal heat are renewable energy sources that will never run out. They are perpetual or self renewing. The rate of consumption does not exceed rate ofrenewability. The cost of generating electricity from wind and solar power has decreased by 90%over the past 20 years. It can be achieved by rotating the solar tracker along with the sun throughout the day. Sun's position is determined by its Azimuth and Elevation angles. Nowadays the world is moving towards a new era called the Internet of Things and everything can be found on the internet. These angle data can be also found on the Internet, which makes this solar tracker precise, cheap, andaccurate for tracking. It also makes monitoring the solar tracker position from anywhere at any time.

KEYWORDS: Solar tracking system with LDR, servo motor, and solar panel that transforms solar energy into electrical energy.

I.INTRODUCTION

Our greatest problem is climate change, which is brought on by our over dependence on fossil fuels. Only renewable energy can address this problem. A type of energy known as renewable energy is one that derives from the natural world without endangering the environment. Solar energy is one of the most widely used kind of renewable energy. Solar panels collect solar energy and transform it into electrical energy. The solar panel's ability to create electrical energy depends on how much sunshine it receives. Traditional solar panels are stationary, therefore they often don't capture the full amount of energy when the sun crosses the horizontal plane. To maximize the solar panel's output. The biggest challenge we face is climate change, which is being caused by our over reliance on fossil fuels.Renewable energy is the only solution to this issue. One of the most popular sources of renewable energy is solar energy.

In this project, we'll construct a sunlight tracking device to help us get the most electricity possible from the solar panels. Today, 70% of the population in India rural areas experience a dramatic situation where the electric supply is very low and irregular, and in some cases, completely absent from 80,000 villages in the country. The country suffers from unequal energy distribution, with power cuts of 2 to 3 hours in major cities, and in rural areas from 6 to 10 hours during the hot season (May to June). Up to 50% of households in India have no access to modern lighting and the electric grid did not reach remote places of the countryside, with some provinces lacking electricity in the 95% of the region [1]. There are some solutions like solar electricity from solar panels. Although many assume that renewable energy is too expensive for the poor but if it is combined withaffordable financing mechanisms, it can be fully implemented and makes this type of clean electricity (and many others like portable rechargeable lamps) a viable option for millions in India. Both renewable and non renewable resources are being used for production of electricity to meet the needs. But non renewable resources are under the stage of extinction so it is better to choose the renewable resources.

II. RELATED WORKS

The control circuit for the solar tracker is based on an ATMega16 microcontroller. This is programmed to detect the sunlight through the LDRs and then actuate the stepper motor to position the solar panel where it can receive maximum sunlight. Compared with any other type of motor, the stepper motor is more controllable, more energy efficient, more steady and has high tracking accuracy and suffers little environmental effect. The major components those are used in the prototype are given below:- Photo resistor, Microcontroller , Stepper motor. [1].The design of a single axis solar tracker system that automatically searches the optimum PV panel position with respect to the sun by means of a DC motor controlled by an intelligent drive unit that receives input signals from a light intensity sensor. The major components are PV Panel, DC Motor, LDR. [2].Photo Voltic module is one of the efficient sources of harnessing solar energy in the form of electricity .The output of PV module varies with the solar insolation, the cell temperature and output voltage of PV module . The components are used in this protype are microcontroller, PV panel , photo diodes. [3].Single-axis trackers have one degree of freedom that acts as an axis of rotation. The axis of rotation of single-axis trackers is typically aligned along a true North meridian. It is possible to align them in any cardinal direction with advanced tracking algorithms. The orientation of the module with respect to the tracker axis is important when modeling performance. [4].The proposed automatic tracking system controls elevation and orientation angles of solar panels such that the panels always maintain perpendicular to the sun light. The measured variables of our automatic solar tracking system were compared with those of a fixed- angle PV system. Components are PV panel , PLC .[5].The proposed drive system delivers precise control with the smallest possible step angle. A model of the permanent magnet stepper motor is simulated using MATLAB Simulink simulation software. The software and the hardware circuits of the stepper motor drive is designed and tested for different types of movements of the stepper motor. The proposed circuitry consists of the design of power supply circuit, microcontroller, buffer and a driver circuit. [6].An integrated development toolbox having a distributed nature and real-time requirements was developed. It is useful for Rapid Control Prototyping and for Hardware-in-the- Loop Simulations. The full functionality of MATLAB/Simulink can be used for parameter's visualization without interrupting or impeding the real time control process of the embedded microcontroller. The field-oriented for a two-phase PM stepper motor application is presented in order to demonstrate the effectiveness for this real time embedded controller. [7].Renewable energy based generations are connected at sub transmission and distribution levels and are normally dispersed throughout the network. This causes a number of benefits and challenges for power system operators. The voltage and small signal stability issues for a distribution network and provides a number of case studies. [8]

The capability of photovoltaic (PV) panel to generate energy approximately follows the intensity of the sunlight on the panel. The proposed automatic tracking system controls elevation and orientation angles of solar panels such that the panels always maintain perpendicular to the sunlight. The measured variables of our automatic solar tracking system were compared with those of a fixed- angle PV system. [9].The system can be used to supply constant stepped up voltage to dc loads. Here there are two modes of operations are done based on weather condition. They are direct and indirect modes. In direct mode tracker uses LDR sensors to move the solar panel and in indirect mode it uses RTC to move the solar panel. Arduino UNO controller is used to control the motor rotation through motor driver IC based on the information coming from RTC and LDR. The major components are used Photo Voltaic System, Boost Converter, LDR, RTC,555 Timer. [10]

III. EXISTING METHOD

The power is produced by fixed solar panels, which are installed on a roof, any agricultural purpose, ground mount, or tracker system. Electrical energy has been created from solar energy. Normally fixed at due south (or north in the southern hemisphere), they can be manually adjusted a predetermined number of times during the year (for example, every two or three months) to maintain alignment with the sun's shifting course. Traditional solar panels are stationary, therefore they often don't capture the full amount of energy when the sun crosses the horizontal plane. Fixed solar panels serve as stationary installations, securely mounted on various surfaces such as rooftops, agricultural structures, ground mounts, or specialized tracker systems. These panels function by harnessing solar rays and converting them into electrical energy. Traditionally, they are positioned facing due south (north in the southern hemisphere) to optimize sun exposure. However, homeowners have the option to manually adjust them periodically, typically every two to three months, to ensure they remain aligned with the changing path of the sun. While fixed panels are a reliable and cost-effective option, solar trackers offer an innovative solution to address this limitation. Solar trackers are equipped with mechanisms that actively follow the sun's trajectory throughout the day. By continuously adjusting their orientation, they maintain an optimal angle relative to the sun, ensuring maximum energycapture.

IV. PROPOSED SYSTEM

This framework allows for sophisticated mobile tracking and battery monitoring. Furthermore, it benefits the client. The frameworks will monitor the battery level, relay the final cloud information, and move the sun-oriented board in response to the sun's location. Additionally, those consumers may be included to the app's rundown of household appliances when registering for the app. By obtaining access to the cloud data, the app will provide the client with the whole information on those battery states. Solar monitoring systems work on the premise that solar panels should be oriented towards the sun to maximize energy harvesting.A significant development in the technology of solar energy generation is represented by solar monitoring systems. These systems maximize energy production, efficiency, and overall sustainability by dynamically aligning solar panels with the position of the sun. During seasons of greatest demand, which frequently coincide with periodsof high electricity use, this system produces more electricity.

Table: 1 Captured Panel voltage with propose tracking system

S.NO	TIME	PANEL VOLTAGE (IN VOLTS)
1	8:00 AM (initial)	8.6
2	9:00 AM	11.5
3	10:00 AM (1st tilt)	14
4	11:00 AM	16.5
5	12:00 PM (2nd tilt)	17.5
6	1:00 PM	17.8
7	2:00 PM (3rd tilt)	15.5
8	3:00 PM	15.2
9	4:00 PM (4th tilt)	13.8
10	5:00 PM	12.3
11	6:00 PM (reverse)	4.5

Table: 2 Captured panel voltages without proposed tracking system

S.NO	TIME	PANEL VOLTAGE (IN VOLTS)
1	8:00 AM	7.5
2	9:00 AM	9.5
3	10:00 AM	11.5
4	11:00 AM	12.1
5	12:00 PM	13.5
6	1:00 PM	13.8
7	2:00 PM	12.1
8	3:00 PM	11.3
9	4:00 PM	8.2
10	5:00 PM	6.3
11	6:00 PM	1.5

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V. BLOCK DIAGRAM

This module will use a camera to record live streaming video, and the video input is regarded as an input source for text recognition. In this module, live streaming video is recorded and converted from 24 frames per second to 1 frame per second in order to extract images as frames. After segmenting the images from the converted video that was extracted from the input image, this module allows for the removal of background noise. The OCR object recognition method can be used to process the extracted images in the text recognition module in order to identify text characters and numeric characters. The text is transformed into voice after it has been identified. This module allows you to convert text to audio. For blind people to understand easily, voice alert is employed. The system had been tested and the results show very significant impact on the mechanical design, controlling algorithm and also the cost of the development. The light intensity that has been recorded when the light rays fall on the solar panel is measured in LUX Luminous intensity. The minimum and maximum amount of temperature will be obtained with respect to the light rays. The temperature is measured in degree Celsius while the voltage is measured in volts.

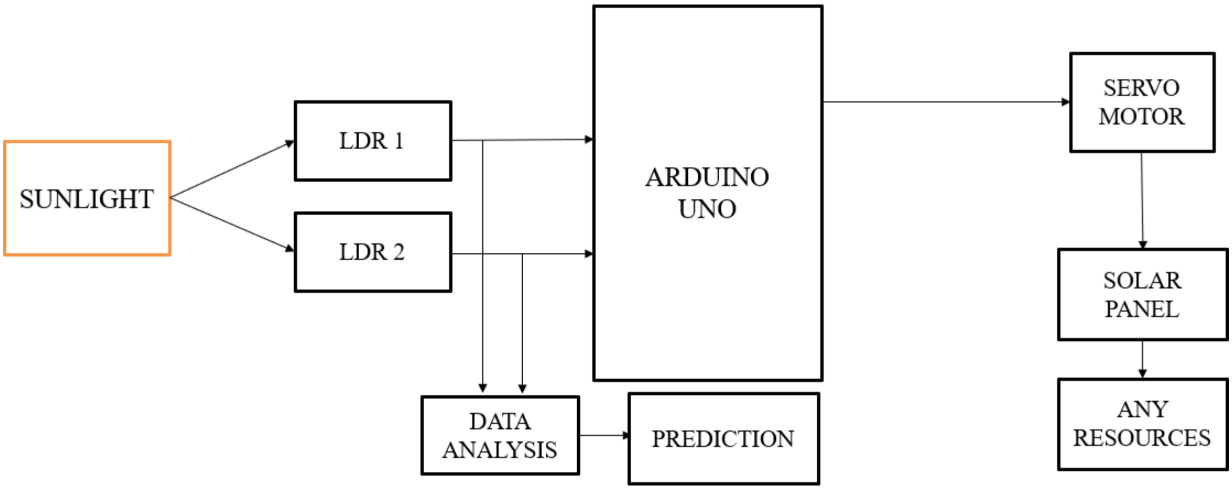

Figure: Block diagram of proposed system

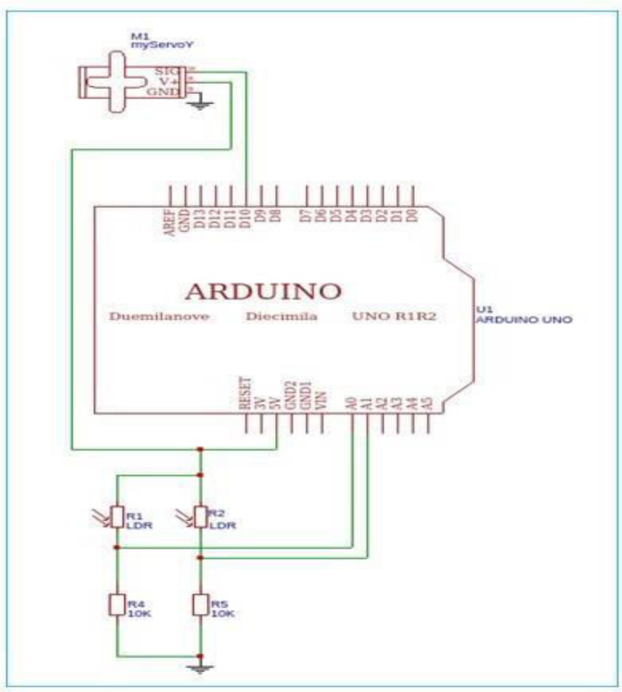

Figure: Circuit diagram of proposed system

VI. EXPERIMENTAL RESULTS

An upgraded version of solar panels is what we're proposing with our solar monitoring system. By tracking sunlight, this device allows us to efficiently access the sun from all angles.

Using a solar panel, servo motors, and LDR, this device tracks the light energy from sunlight and transforms it into electrical energy. We predict the data analyzing through light dependent resistor. The save energy will used for any resources.

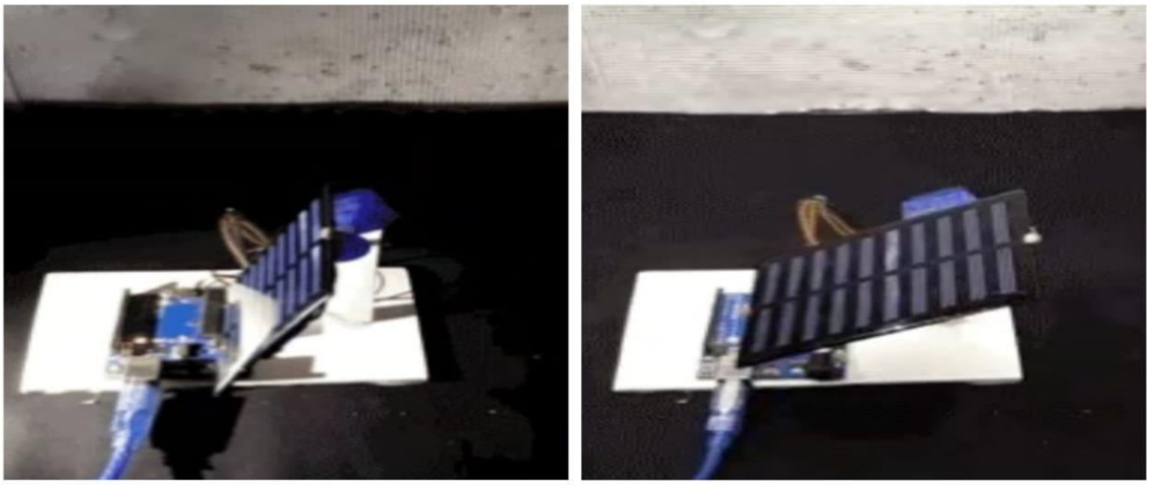

Figure: Smart solar monitoring system

VII. FUTURE SCOPE

The goals of this project were a purposely kept within what was believed to be attainable within theallotted timeline. As such, many advance improvements can be made up of initial design of solar tracker. It is felt this design represents a functioning scale model which could be replicated for amuch larger scale. following recommendation are provided as ideas for future expansion for thisproject. We can use wood and other locally available materials instead of Mild steel and thus reduce the cost further. A spring of appropriate stiffness could be designed to avoid sudden jerks. Provisions for safety of solar panels from rain. More accuracy can be achieved by providing measures again wind vibrations

VIII. CONCLUSION

The design of ARDUINO based on efficient solar tracking system with real time clock is developed and described. The proposed system provides a variable indication of their relative angle to the sun by comparing with pre defined measured readings. By using this method, the solar tracker was successfully maintained a solar array at a sufficiently perpendicular angle to the Sun. The power increase gained over a fixed horizontal array was in excess of 40%. The proposed design is achieved with low power consumption, high accuracy and low cost. This proposed solar tracker will be reliable and accurate throughout the operation and yields maximum output power when compared to the single-axis and static solar system. And the implementation of IoT can avoid human errors. It will be a good competitive solution for growing technology that uses solar energy for power. And itis expected to contest with other complex and expensive systems. As future work MPPT technique can be implemented for extracting maximum power from the photovoltaic module and high precisionsensors can be used to increase precision.

REFERENCES

[1] Solar Tracking System Using Stepper Motor Ankit Anuraj1 and Rahul Gandhi2 1 E-203, Shree Balaji Residency, Motera. Ahmedabad, Gujarat. 2 27Jayveer Society, Kalol,
Ahmedabad, Gujarat

[2] Design of a Solar Tracker System for PV Power Plants Tiberiu Tudorachel Liviu Kreindler1,
2 1 Electrical Engineering Faculty. University Politehnica of Bucharest, 313 Splaiul Independentei, Sect. 6, Bucharest, Romania, e-mail: tudorach@amotion.pub.ro 2 Technosoft, 266-268 Calea Rahovei, Sect. 5, Bucharest, Romania, e-mail:

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I_kreindler@tehnosoftmotion.com
[3] A review on an Automatic Solar Tracking System, Khyati Vyas, Mtech Scholar, Dr. Sudhir Jain, Professor, Dr. Sunil Joshi, Professor and Head, Department of REE, CTAE, College,MPUAT, Udaipur, http://arduino.cc/en/Main/arduinoBoard Uno ,India.
[4] WebSource:
http://en.wikipedia.org/wiki/Solar_tracker ,
http://www.societyofrobots.com/schematics_photoresistor.shtml .
[5] A Kaseem, M.Hameed "AMICROCONTROLLER BASED MULTI-FUNCTION SOLARTRACKING SYSTEM" Department of Electrical and computer and communications Engineering, Note Dame University. Louize Tsung-Yu Tsai, "Study the Difference of Solar Electricity Generation between the Fixed-Angle and Dual-Axis Tracker Systems," Master Thesis, Southern Taiwan University of Sc. and Tech., Tainan City, Taiwan, R.O.C., 2006.
[6] IEEE paper-: Stepper Motor Drives for Robotic Applications- Benetta Aranjo, Prashant Kumar Soori, and Puja Talukder.
[7] IEEE paper-:Model Based Design Controller for the Stepper Moto CalinRusu ,Iulian Bir
[8] 6th International Conference on Electrical and Computer Engineering ICECE 2010, 18-20 December 2010, Dhaka, Bangladesh
[9] Jong-Jinn Lay, "Development of a Sun Track Solar Energy System with Artificial Intelligence," Master Thesis, National Sun Yat-Sen University, Kaohsiung City, Taiwan,R.O.C., 2007.
[10] Ming-Huang Tsai, "Design and Implementation of a Wireless Monitoring/Control System forthe Dual-axis

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