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PROBLEM DETECTED ARTIFICAL SAFETY LANDING MEDICAL TRANSPORT SOLAR UNMANNED AERIAL VEHICLE

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Abstract- The harnessing of solar energy during the operation of an unmanned aerial vehicle (UAV) provides a potential solution to combat the energy constraints. This thesis examines the practicality of a mini solar-assisted UAV and provides experimental validation in regards to energy maximization through solar-electric power management and flight path optimization. A solar-assisted UAV is constructed and shows an increase in flight time. In addition, through the application of power management techniques, an increase in net energy for the solar-assisted UAV is observed. A simulation environment is also developed providing a model for the UAV and estimations for the energy collected and consumed during flight. The simulation results are consistent with real-time measurements during flight tests. Finally, an energy-optimal flight path increasing the net energy is obtained and successfully demonstrated during flight tests. This project deals with UAV using solar energy as their only source of energy for more than 24 hours' flight. Using solar panels, it collects the energy during the day for immediate use but also store the remaining part for the night flight. The objective is to identify, design and analyze such a reusable solar power unmanned aerial vehicle for high altitude long endurance application with successful implementation of higher energy density batteries such as Li-Po. A detail analysis has been performed to compare similar airplanes to study their successes and failure. An aircraft with similar wingspan as NASA Helios and remarkably less weight, nearly 1135lb, than it is been design. A weight analysis and power sensitivity analysis were researched, and it was shown that this aircraft would generate 75kw of power that is greater than the power available to fly.

Index Terms – **Unmanned Aerial Vehicle; Solar cells; Power consumption; Problem Detected Artificial Safety Landing.**

I. INTRODUCTION

1. The use of solar power as an energy resource allows small scale UAVs to carry heavier, more powerful sensor payloads, and can extend flight times to over 24 hours, thereby achieving multi-day flight. This work focuses on recent developments by the Center for Distributed Robotics on a four meter wingspan solar UAV designed for low altitude aerial sensing applications. Highlighted in this paper are aspects of airframe, propulsion, and electronics hardware design as well as experiments that quantify the solar power system and airframe performance. Having an exciting array of applications, the scope of unmanned aerial vehicle (UAV) application could be far wider one if its flight endurance can be prolonged. Solar-powered UAV, promising notable prolongation in flight endurance, is drawing increasing attention in the industries' recent research and development. This work arose from a Bachelor's degree capstone project at Hong Kong Polytechnic University. The project aims to modify a 2-metre wingspan remote-controlled (RC) UAV available in the consumer market to be powered by a combination of solar and battery-stored power.

2. The major objective is to greatly increase the flight endurance of the UAV by the power generated from the solar panels. The power system is first designed by selecting the suitable system architecture and then by selecting suitable components related to solar power. The flight control system is configured to conduct flight tests and validate the power system performance. Under fair experimental conditions with desirable weather conditions, the solar power system on the aircraft results in 22.5% savings in the use of battery-stored capacity. The decrease rate of battery voltage during the stable level flight of the solar-powered UAV built is also much slower than the same configuration without a solar-power system.

3. Also nowadays price of petrol and other fuels are going to be higher, because of scarcity of those fuels. So there is great demand of use of non-exhaustible unlimited source of energy like solar energy. Solar aircraft is one of the ways to utilize solar energy. Solar aircraft uses solar panel to collect the solar radiation for immediate use but it also store the remaining part for the night flight. This paper intended to stimulate research on renewable energy sources for aviation. In future solar powered airplanes could be used for different types of aerial monitoring and unmanned flights. This review paper briefly shows history, application and use of solar aircraft. We are focusing on design and fabrication of solar aircraft which is unmanned prototype. This project deals with UAV using solar energy as their only source of energy for more than 24 hours flight. Using solar panels, it collects the energy during the day for immediate use but also store the remaining part for the night flight.

Fig1. Overview of Drone

II. SYSTEM OVERVIEW - 1

1. After designing the airplane with the data of weight and placement of solar cells, power consumption of the airplane and produced power of the solar cells should be calculated. Solar cells totally produce a maximum nominal power of 17.7 watts. Therefore calculation over the power consumption of the airplane in different phases of the flight is inevitable. If the power consumption is less than the produced power of the solar cells, then it can be resulted that the airplane is capable of flying without batteries. But there is a critical fact about solar cell behavior; while under a shadow of a cloud or a different angle of radiation the produced power of the solar cell will significantly reduce. So, using a backup battery will help us preventing crashes while flying with only solar cells as our main power source. But, before deciding of using solar cells as our main power source, we need to know if it can produce that.

2. Many have already come out with state of the art design and the prototypes are remarkable. However, based on current technology, utilizing green energy as power source in such energy consuming drones are still under research. There is design like an airplane-like solar powered UAV but not yet in helicopter shape. Based on current technology on the flying model designs, some has come out with the design of an airplane. Many has come out with the helicopter design, but with 4 rotor blades design for balancing & controlling purposes. After years of research & development, even a mini quad copter with a size as small as the palm of our hand is already available at consumer end [11, 12]. But the problem with these designs is the considerably large power consumption of aerial vehicles. For instance, a RC helicopter with size as large as a reference book consumes 6 AA heavy duty batteries with less than an hour of flight. Such large amount of energy consumption is not environment friendly and of course cost ineffective. On the other hand, solar powered vehicle has come out with so many innovative designs and can be made as simple as with a small-scale PV cell panel, electric motor, 4 tires with a thin wooden block which is able to move a toy car under a sunny day. On the aerial vehicle side, research has to be done to realize the dream of making something fly with solar energy. There are few researches & studies, which simulate a virtual flight system, or make an airplane-like model to fly it with solar energy [12]. Still there is no recognized research which has been making a hovering aerial vehicle such as helicopter to be powered by solar energy. Since it is possible to make solar powered car, it is also possible to make a solar powered aerial vehicle, more specifically, solar powered heli/quad copter [13-15]. During design or modification of a drone, there are few things that need to be considered such as electric rechargeable battery, aerodynamics of the drone and so on [6].Generally, a flying robot needs a rechargeable battery to supply power to the system. Currently, Lithium ion and Lithium Polymer rechargeable batteries are commonly used in the market. The battery is normally made to encase by a hard metal to keep the electrodes wound up tight by the separator sheet. This makes the lithium ion battery heavier and limited its possible shapes. The aerodynamics of the drone that is required to consider in the design and modification is the ground effect and dynamic rollover [6]. The ground effect favors the lifting force and thus making the system of flying robot require less power to hover in the air. Dynamic Rollover occurs when the hovering flying robot becomes light on its skids.

Fig2. Inter Circuit System

II. SYSTEM OVERVIEW – 2

The process flow of designing solar powered mini quad copter is shown in Figure 3.

AutoCAD and the realization of the designed structure was carried then. Next, the design of the circuitry of solar boost converter and charge controller was carried out. All sources from the website and electronic societies were taken as reference. Simulation software such as TINA was used to run the simulation test for the circuitry designed to make sure the circuitry was fully functional before going to the practical stage. Then, the designed solar system was ready in this step and implemented on the body of the mini drone which was then tested in the final stage. Adjustment and modification were done in the final stage to make solar power system fully functional enabling the mini drone to perform flight operation.

III. LITERATURE REVIEW

1. TITLE— SOLAR POWERED UAV: DESIGN AND EXPERIMENTS
AUTHOR— Scott Morton, Nikolas
YEAR— 2015

Unmanned solar powered aircraft offer a unique set of advanced capabilities and have set general aviation records for longest continuous flight and greatest sustained altitude. However, the application of solar powered flight to small scale solar powered unmanned aerial vehicles (UAVs) has seen sparse research activity and is only partially explored. The use of solar power as an energy resource allows small scale UAVs to carry heavier, more powerful sensor payloads, and can extend flight times to over 24 hours, thereby achieving multi-day flight. This work focuses on recent developments by the Center for Distributed Robotics on a four meter wingspan solar UAV designed for low altitude aerial sensing applications. Highlighted in this paper are aspects of airframe, propulsion, and electronics hardware design as well as experiments that quantify the solar power system and airframe performance.

2. TITLE— RF CONTROLLED SOLAR BASED ROBOTIC DRONE
AUTHOR— SUNIL KUMAR CHAUDHARY, ARCHANA YADAV
YEAR— 2021

In this paper, we present the recent research in the development of AL drones by using an algorithm of deep learning (A subset of machine learning algorithms) and computer vision (CV) based on a drone camera, the study explores the potential use of drones not only in searching the victim person, animals, important properties during natural calamities like flood, volcanoes eruption, forest fire, cyclones, and earthquake, etc. but also it insights into much useful information to collect to ensure the future safety by using a machine learning algorithm. Preparing for and responding to disasters is a major logistical challenge. "Actionable Data" is the next powerful approach and reliable to the Al drones. As we know that drones often generate a huge amount of data - sometimes it produces a large amount of data that we can't handle at a time. Unmanned Aerial Vehicles (UAVs) are the only possible approach that can add value to our AI-based drone without putting any additional efforts to make UAVs more frequent automation. During search and rescue operations, UAVs played a crucial role over humans. As we know that UAVs can be sent to any desired location without any prior knowledge about the exact conditions in the target area. In this paper, we worked to reduce the number of factors that cause hindrance to the effective deployment of UAVs and increasing the duration of flight duration for the rescue operation. We also use the first Indian microprocessor Shakti class c which is installed in the board.

IV. STRUCTURAL MODIFICATION OF MINI QUADCOPTER

The design and modification of the structure of mini quad copter is shown in Figure 2. The black shape on top represented the solar panel. The placement of the solar panel was located at the best position in body to get most radiation energy from the sunlight without affecting the aerodynamics of the quad copter since it was located at the center of the body. The blue frame which covers around each motor was the typical frame work provided by mini drone in the market for outdoor protection.

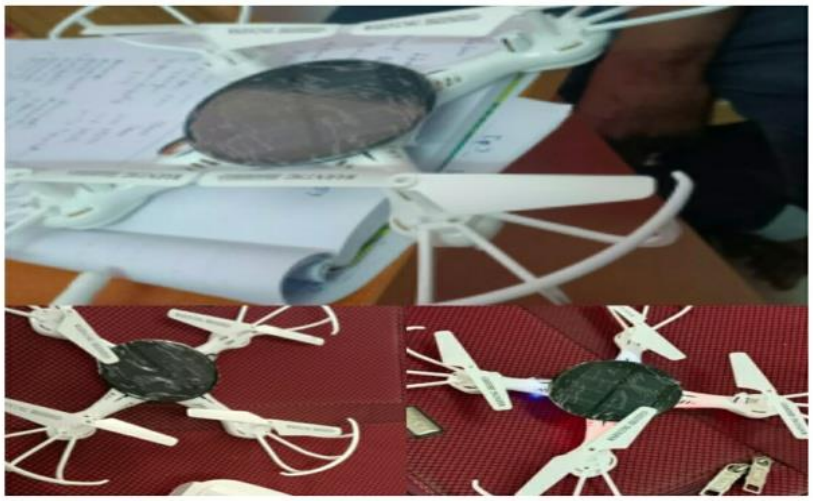
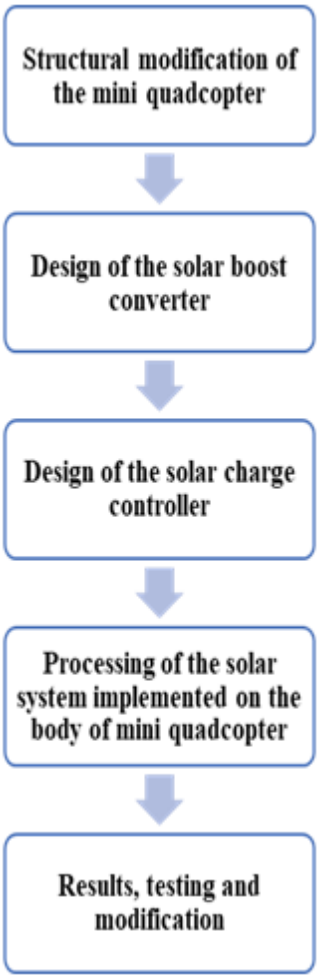


Fig3. Outer Look of Finished Drone



AIRCRAFT WEIGHT ESTIMATES

Components Weight (in lb.)	Components Weight (in lb.)
Batteries	150g
Solar Cells	200g
Airframe	50g
Payload	500g
TOTAL	900g

V. EXPERIMENTAL RESULTS

The board consists of a microcontroller which can measure the output voltage and amperage of the batteries and send the data to the ground station while flight test. Batteries used in the airplane are three series of Lithium-Polymer each of which has a nominal voltage of 3.7v, causing an overall voltage of 11.1v. This voltage will change during the flight and should be probed by analog to digital convertor (ADC) of the micro controller. But the maximum voltage that can be probed by the micro Controller is 5 volts. So, two resistors in series are put in the board between two poles of the batteries. One is 56kΩ and the other is 39kΩ. The voltage between pins of the second resistor is probed by the ADC pin of the micro controller. The maximum probed voltage is 4.55 v . For probing the current we should use a high power resistor with low resistance. As a result, a 0.1Ω resistor is used in the Circuit. The amount of voltage between two pins of the resistor will show 0.1 of the current. The order of the current is about 4 amps at maximum so the probed voltage is 0.4 volts. Reading this amount directly by the ADC will cause inaccuracy in current probing. Therefore, we need to use an O-Amp to multiply the ADC reading data by approximately 10. So it can be read by the ADC as a scale of 0 to 4 volts.

VI. DESIGN OF THE SOLAR BOOST CONVERTER CIRCUIT

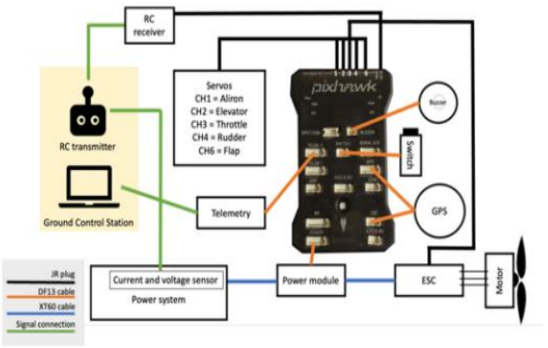


Fig4. Working of Circuit board

A solar boost converter boosts low input voltage to higher output voltage. The current will surely be stepped down in the process of stepping up the voltage input. To design the solar boost converter for mini quad copter, the circuit must be as simple as possible so that the circuit board is light weight and can be easily installed to the body of the mini quad copter. The solar boost converter needs to be designed and added into the whole system so that the potential difference produced by the solar panel can be boosted to a higher voltage. The solar panel used in this development has a size of (5.5cm X 4.5cm).

Although water is an irreplaceable resource for the survival of human species, the contamination of water bodies resulting from daily human activities has led to a depletion in the available sources of potable water. Although, finding more reliable and sustainable methods of waste water treatment and garbage disposal is instrumental in combating water pollution in the long run, cleaning up water bodies is a far more pressing issue.The major issues with cleaning Lakes and Pools are

- Finding/hiring motorized boats each time for cleaning
- 2 People team – 1 for driving other for collecting trash
- Not being able to clean regularly due to manual process
- Higher salary and motor boat costs involved of cleaning

Using two powerful electric motors for propulsion, this RC Lake cleaner Drone has been designed to skim and clean the surface of open water bodies such as lakes, ponds, rivers, canals etc.This system consists of a wire mesh that collects garbage floating on the surface of water bodies as it sails through. Along with helping clean up water bodies, this boat is equipped with Ph and Turbidity sensors that help to map and detect the level of pollution in a water body. This boat is completely rudderless and steers itself by varying the thrust on either of its motors. Thereby, improving reliability by reducing the number of moving parts.

1. The six solar panels mounted on its top help to increase the life of its battery and enable it to run for longer hours.
2. The RC cleaner drone utilizes 2x High torque motors, RC Controller, Solar Panels, 2x Sensors, wireless camera, collector mesh and an At mega microcontroller to achieve this task. The dual drive rudderless motor system is used to provide drive to the rc boat using dual propulsion system. This allows for an easy rudderless movement control.
3. The collector mesh is enclosed inside the rc boat frame to capture surface garbage floating on water. This allows the drone to swallow all the garbage coming in its path and take it ahead. Any sea creatures caught along with the garbage may easily swim out of the mesh through front opening if caught, thus it doesn't harm any sea life.
4. The RC controller is used to send movement controls to the drone controller unit via RF signals. These signals are received and decoded by the controller unit and then processed by microcontroller to operate drive motors. The drone uses 2x sensors (Ph and turbidity) to sense and ph and turbidity level of water pollution which are constantly stored in the memory card for late reference. The top mounted solar panels are used to draw solar power and constantly charge the battery as the drone operates. Even if the drone shuts down in the middle of the lake. Half an hour of sunlight can again make the robot operational again. Also a top mounted strobe light is used to find the drone in darkness or misty conditions.
5. This allows for a remotely operated long range lake pool cleaner drone. the nodes in their final positions, a radio network is set up. Now measurement data from the last node xn is sent to BS through nodes xn−1, xn−2… x2, x1 respectively. If any node xk is damaged or not responding, the network chain is broken. As a result, the data from nodes xk+1 to xn do not reach BS. In order to bridge the gap and restore the network relaying chain, the drones have to be able to change their positions on demand. The scenario considered at this stage of the project assumes that the nodes from xn to xk+1 are moving according to the algorithm presented in Figure 2 until the network chain is restored.
6. A system working under the described circumstances requires a relevant communication architecture and a routing protocol. In order to satisfy these requirements, a flying ad hoc network (FANET) with a proper architecture are considered. It is a kind of network that consists of a group of small UAVs connected in an ad-hoc manner, cooperating as a team to achieve high-level goals. The idea of FANETs confirms that all of the UAVs communicate with each other and with the BS at the same time, without having pre-defined fixed communications paths. But according to FANETs design, only a subset of UAVs can interconnect with the ground station, which perfectly satisfies the system's idea. Following the project assumptions and the currently realized phase, a simple UAVs ad-hoc network has been chosen.

VII. FEATURE ENHANCEMENT

A light weight solar powered flying quad copter has been developed for environmental monitoring purpose. The structural construction of the flying model is accomplished in such way that the solar panel gets the best position to gain optimum solar energy together with additional crash protection frame structure. The designed circuitry of solar charge controller and boost converter focuses on light weight aspect to make flying possible with added weight for various environmental sensors mounted for constant monitoring purposes.

VIII. CONCLUSION

Nowadays, there are more and more robots replace human being's job. In recent years, the researches accelerate the technology development of multi rotor drone and make it become the flying robot that can self-stabilize and fly according to the waypoints setting by ground station. Therefore, this project designs a system to detect the efficacy of solar panel by UAV integrated with thermal sensors. Firstly, UAV flies above solar panel, takes picture by thermal sensors and transmits to website automatically. Secondly, the system cuts out the area that out of the panel, examine every pixel of the picture and calculates the ratio of red pixels that present the area of overheat. Finally, the system reports the efficacy of solar panel by program that judges from the ratio of overheat, weather condition, etc. By this way, we can save a lot of time and detect the solar panel safely

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