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Vision-Based Slam Algorithm For Quadcopter

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Abstract

This paper presents efficiently building a 3D map of the environment for real-time computation, to define the pose of the agent in real-world settings using a Vision-Based SLAM (Simultaneous Localization and Mapping) Algorithm. This algorithm uses images acquired from cameras and other image sensors. Visual SLAM can use simple cameras (such as wide-angle and spherical cameras), compound eye cameras (stereo and multi-cameras), and RGB-D cameras (depth and ToF cameras). This algorithm measures pictures and allows to fabricate a guide and confine the vehicle continuously. Visual SLAM algorithms also permit the vehicle to map out non-specified environments. This map data is used to bring out performance such as path planning and obstacle avoidance. Intensive testing of four different extractors- SIFT, SURF, SHI-TOMASI, and ORB-was undertaken, to determine the best use for indoor/outdoor environments. The results were verified and have concluded using ORB-SLAM because it is a good alternative to SIFT and SURF in terms of computation cost, matching performance, accuracy, and fast detection of keypoint.

Key words: SLAM, Localize, SIFT, SURF, SHI-TOMASI, ORB

Introduction

Water is one of the prime resources available by nature for the living organisms to sustain life on earth. Water has numerous applications in any human's life. Usable water or the potable water is one that is said as pure and can be used for drinking and any other purposes. Many civilizations around the world have originated on the banks of some of the rivers & water bodies. These civilizations started in the bank of water bodies as there was availability of fresh & clean water for the people to settle in the area. Rivers and water bodies are called as the "cradle of mankind". Rain is the source of water for any fresh water storing water body and are very critical for a region that is dependent on water resources. Rains have started to fail during recent times due to irregularities in seasons in almost major parts of the world due to global warming factor. Availability of fresh water in the world is rapidly depleting as the consumption rate to the population explosion rate is very high. The only available water resource on the earth in abundant is the sea water or the saltwater. The sea water is not usable water usually and it is not the pure form of water as it contains more proportion of concentrated salts and mineral contents so it not fit for use for any purpose directly. There are many methods available through which the sea water is converted into potable water[1]. One such method is using the solar still device. A solar still works on two scientific principles, one is the evaporation and other is the condensation. The salts, minerals and contaminants doesn't evaporate with the water. Most still are having black bottomed vessels filled with water and has clear glass covered on the top. Sunlight absorbed by the black vessel speeds up the rate of evaporation. The evaporation is then trapped on the glass surface and funnelled away.

Figure 1.1: Image of Single slope solar still

Working Principle

Solar still works on the principle of distillation using solar rays. It is similar to the principle of rain forming and falling. The water evaporates from the ocean due to sun radiation and these water vapours are taken towards land by the clouds and the rain fall occurs, the same working is carried out on the still. The still is made of aluminium tray and the water is poured inside this tray The tray wall & floor is covered with another wooden box on all sides except on top. The top side is covered with a see-through glass. The gap between the wooden box and the aluminium tray is provided to fill PCM and Nano Particles[2][3]. The lower tilted end of the still is connected to a PVC piping for collecting the water droplets formed in the inside surface of the glass roof. This water is guided out through the PVC pipe and collected in the storage can for usage.

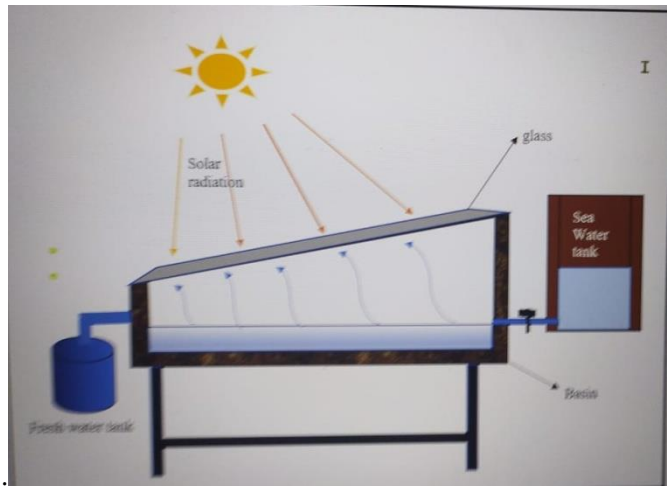
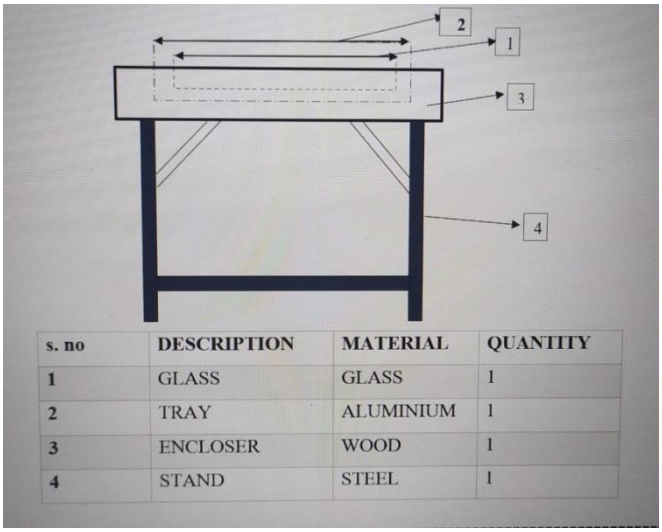


Figure 2.1 working of solar still

Construction

The solar still consists of tray , wooden enclosure for 5 sides of the aluminium tray, saltwater tank, fresh water collecting tank, clear glass for covering the top surface of the aluminium tray, stand for placing the solar still at height, PVC pipes and elbow fittings, rubber hose for collecting the fresh water. The aluminium tray is the storage vessel that is coated with black coloured paint. There are two holes given in the aluminium tray to keep PVC piping for water in and outlet. The wooden box is covered on all sides except the top and giving 2 inches gap surrounding the aluminium tray in which the PCM is filled[5]. The top surface is closed with a clear glass and the gaps are closed with sealants Thermometers for measuring water temperature, outside temperature and the PCM temperature are connected and mounted to the still. The lower tilted end PVC piping is connected to the rubber hose that is inserted into fresh water collecting tank. The solar still is placed on a height as such the shadows do not create a hindrance for the still process. The still is one side inclined and is

tilted to 10 degrees from top to bottom. This angle is maintained to help in the funnelling process of the water droplets to get collected in the PVC pipe and get drained out.



s. no	DESCRIPTION	MATERIAL	QUANTITY
1	GLASS	GLASS	1
2	TRAY	ALUMINIUM	1
3	ENCLOSER	WOOD	1
4	STAND	STEEL	1

Figure 3.1: Components of the set up

4. Results And Discussion

The readings for temperature of the water inside the still, readings of PCM temperature and the glass temperature are noted and the relevant water output during the process on hourly basis is measured and noted down. The output water is measured in the bottle by the level indication marking done on the can for every 5ml.The readings taken using the solar still is used for plotting a graph. The graphs plotted are temperature comparison chart and hourly water output chart. The temperature comparison were the temperature of glass with the temperature of water inside the solar still comparison on various times during a trial day. The hourly water output chart gives the output of water on different hours of a trial day. This chart shows the water collected inside the can in millilitres.

Trial readings taken/ were plotted as graph to show the water output on hourly basis and temperature differences in the solar still water and outside glass temperature and the PCM insulated with nanoparticles temperature.

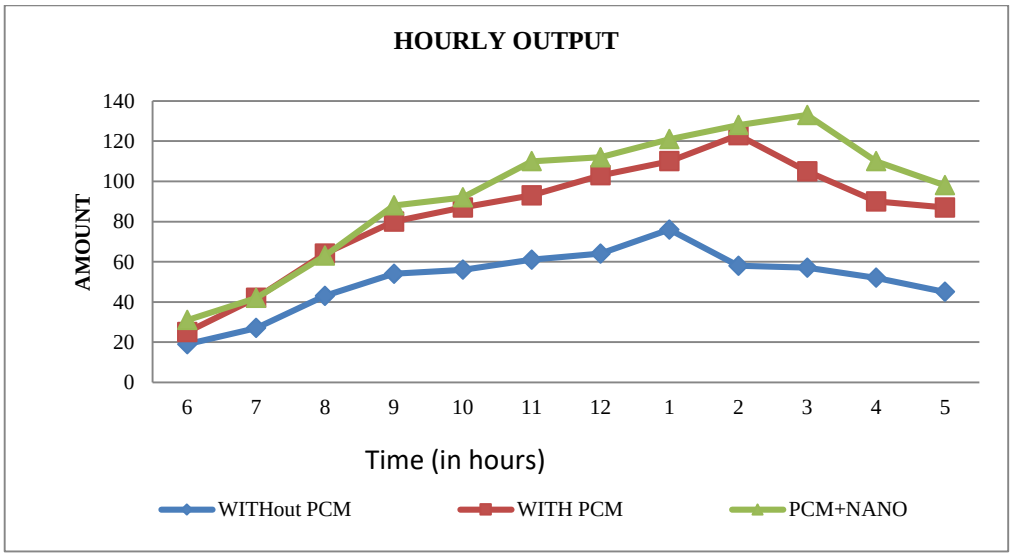


Figure 4.1: Amount vs. Time Graphs

The total amount of water we received is 7.35 litre after using 40 litre of sea water as an input. The water test report of the received output is favourable for drinking. Thus, a solar still is designed fabricated, installed and trials have been carried out on it for the required efficiency improvement and the values on normal still and PCM filled still is compared and an efficiency comparison chart is plotted to identify the improvement on the efficiency of the solar still.

The below chart shows the overall efficiency comparison of output water collected from the solar still with and without PCM:

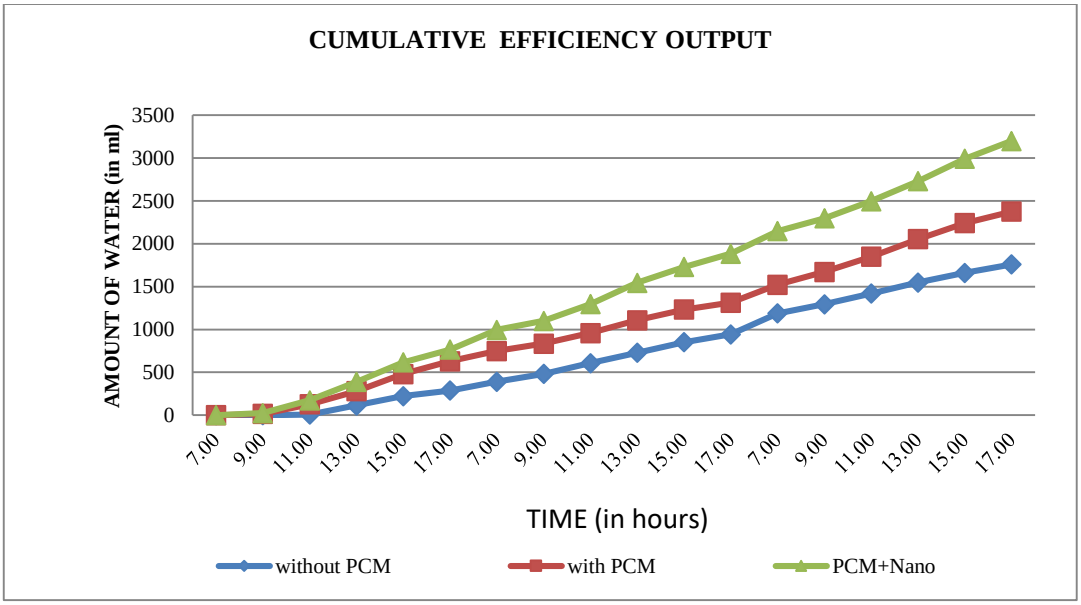


Figure 4.2- Cumulative output efficiency comparison chart

This is a new approach of compositing a PCM with coconut shell to make the solar still work more efficiently and the proved efficiency is 8 %, which is 3.6 % greater than the normal solar still (without PCM) of similar operating conditions and capacity.

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