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Solar Powered Floating Trash Collector with Water Purifier

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ABSTRACT

Water is essential for our life, and there is no life without water on earth. It is important to maintain its cleanliness as it is the basic need for all living organisms on Earth. Water gets polluted due to many reasons such as waste from industry, garbage waste, sewage waste etc. This makes water unfit for drinking and other human activities. All urban water bodies in India are enduring a direct result of contamination and this results in scarcity of clean water. We have to incorporate technology such that cleaning work is done efficiently and effectively. This project helps in reducing pollution of water bodies thereby serves as a helping hand in removing scarcity of clean water. The main aim of our project is to collect trashes from water bodies together with purification of water. The system is made as a floating apparatus, when powered, it starts to float through water body and collect trashes. Along with trash collection a considerable amount of water is purified using filters. To make the boat self-sustainable, two solar panel are used which would charge the battery. When the Microcontroller is powered, it will drive the DC motors; motor for conveyer belt mechanism and motor for purification. Ardupilot, an open-source unmanned vehicle Autopilot software suite is used for autonomous vehicle control. Finally, a Wi-Fi module is used for visualising the status of microcontroller working. Thus, by incorporating this technology water scarcity and water purification can be overcome.

Keywords— *Trash collector, Floating mechanism, Purifier, Solar Energy, Remote controlled.*

1. INTRODUCTION

Water is the basic need for all living organisms and is the most essential resource, yet water pollution is one of the most serious environmental threats that we face today. More than70% of the fresh water in liquid form of our country is converted into being unfit for consumption. So that it is important to maintain the cleanliness of water. Almost every river system in India is now polluted to a considerable extent. As assessed by the scientists of the National Environmental Engineering Research Institute (NEERI) Nagpur, nearly 70% of water in India is polluted. This project helps to get rid of pollution of water bodies thereby reduces scarcity of clean water. Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from water. The goal is to produce water fit for specific purposes. Several methods are used for this; which include physical processes such as filtration, sedimentation, and distillation; biological processes such as slow sand filters or biologically active carbon; chemical processes such as flocculation and chlorination; and the use of electromagnetic radiation such as ultraviolet light.

The innovative system that we propose, offers a unique way to tackle water pollution by collecting the waste accumulated on the surface of water bodies along with purification of a considerable amount of water using filters. This system is made autonomous using ArduPilot which is programmed using mission planner and is also remote-operated which is controlled by an RC remote. DC pumps are attached to the microcontroller for the trash collection and purification. To make the boat self-sustainable we have implemented two Solar panels which would charge the battery.

Also, the project has the potential to become great socio-economic advantage if it is used wisely. This project is conducted to help clean the environment, specifically swimming pools, rivers, lakes, etc using renewable energy. This system does not require any external supply of energy so it is economic in energy usage

2. LITERATURE SURVEY

When the idea of such device came into our mind, we searched for the counter measures that can be implemented to limit the water pollution due to floating waste. As the issue is related to the environment and pollution has been responsible for very drastic changes in the environment, we started searching for various environment related journals to find any relevant information.

2.1. Trash Collection

Mr. Abhijeet. Mr. Ballade, Mr. Vishal S. Garde, Mr. Akash S. Lahane and Mr. Pranav V. Boob: India is holy country & during lots of festival like Ganesh Visarjan, Navratri Durga puja & mainly Siahnsth Kumbha mela there is lots of water pollution of Godavari River at Nashik. The water pollution is very important problem in rivers, ponds and water bodies near Godavari River at Nashik. Due to increase in water pollution in the form to waste debris; it is hampering the life of aquatic animal and make their life in danger. So that to reduce the water pollution we are trying to make river clean-up machine. “River clean-up machine" a machine which involves the removing the waste debris from water surface and safely dispose from the water body. The river clean-up machine works on hydropower to extract waste water debris, plastics & garbage from Godavari River at Nashik.

Mr. P. M. Sirsat, Dr. I. A. Khan, Mr. P. V. Jadhav, Mr. P.T. Date This paper emphasis on design and fabrication details of the river waste cleaning machine. The work has done looking at the current situation of our national rivers which are dump with crore litres of sewage and loaded with pollutants, toxic materials, debris etc. The government of India has taken charge to clean rivers and invest huge capital in many river cleanings projects like “Namami Gange”, ‘’Narmada Bachao’’ and many major and medium projects in various cities like Ahmadabad, Varanasi etc. By taking this into consideration, this machine has designed to clean river water surface. Conventional methods used for collection of floating waste are manual basis or by means of boat, thrash skimmers etc. and deposited near the shore of rivers. These methods are risky, costly and time consuming.

Osiany Nurlansa, Dewi Anisa Istiqomah, and Mahendra Astu Sanggha Pawitra
Nowadays, the environment problems arise in many towns in Indonesia. These problems come along by developing activities such as construction of houses, offices, and other business areas. The Environment issue which comes up from year to year and still cannot be solved is about garbage and waste from various places dispose into rivers. Those garbage’s can clog water flow, induce the water become dirty, smelly, and often overflow so then give effect floods. This research aims to design and make AGATOR (Automatic Garbage Collector), a rotor robot model as automatic garbage collector to counter accumulation of garbage in the river which has no flow effectively and efficiently.

2.2 Water Purification

Sharma and Bhatele carried out solar distillation with different feeds: The modes of feed were fresh water from the main supply and hot-water from the natural convection-solar water heater under withdrawal and non-withdrawal conditions. According to them, the temperatures of the humid air/ vapour in the solar still, drastically increased from the water level. It dropped at glass surface. With fresh water feed, the efficiency after first three hours was 13 -14 percent. It increased to 65.57 % and 64.87 % when there was extra withdrawal and the feed was hot water from solar water heater.

Suneesh and Jayaprakash carried out work on experimental validation of double slope solar distillation: They analysed the parameters like productivity, efficiency, internal heat transfer. The overall efficiency was observed to be 28 percent. According to their studies, still design was good enough to reduce convective and radiative heat loss and thus ensured maximum evaporation.

3. IMPLEMENTATION

3.1 Hardware

We used ATmega328as the core element of our project because it is a high performance yet low power consumption 8-bit AVR Microcontroller. It can commonly be found as a processor in Arduino boards. A NRF transceiver module is designed to operate in 2.4 GHz worldwide ISM frequency band and uses GFSK modulation for data transmission. The data transfer rate can be one of 250 Kbps, 1Mbps and 2 Mbps. The operating voltage of the module is from 1.9 to 3.6V, it consumes 26microA in standby mode and 900Na at power down mode. For the autonomous vehicle movement, we have used Ardupilot, an Open Source, Unmanned Vehicle Autopilot Software Suite. We also used a 2 Relay Module to switch higher voltage and current loads. A Propeller and a Conveyer belt are used for establishing vehicle movement. Finally, for the filtering we have used a normal filter along with sediment and carbon filters.

3.2 Motor Speed and Direction Control

Inorder to control the speed of boat, Potentiometer, Stepper motor, ESC are the components used. Library file for server motor is used, and initialise the values for ESC (pin number and max-min values of PWM). It is necessary to initialise the required variables like potentiometer. The readings from the potentiometer vary from 518 to 1023. The required input for the ESC is between 0 to 180, so that we need to map the values from the potentiometer to 0 to 180 (which means maximum phase width (0) and minimum phase width (180)). Maximum phase width, which the motor can run in full speed and for minimum phase width, which runs in low speed. In this system we have used two Propeller, so that by varying the speed of motors, the vehicle can be directed to left or right and at the same time gives forward movement.


```
#include <Servo.h>

#define R_SW 3
#define L_SW 5

Servo M1;
Servo M2;

int potValue,potValue_2;

void setup() {
 pinMode(R_SW,INPUT_PULLUP);
 pinMode(L_SW,INPUT_PULLUP);

 Serial.begin(9600);
 M1.attach(9,1000,2000);
 M1.attach(10,1000,2000);
}
void loop()
{
  potValue = analogRead(A0);
  potValue = map(potValue, 519, 1023, 0, 180);

  if(digital Read (L_SW)){
  M1.write(potValue);
 }
 else{
   M1.write(potValue);
   M2.write(potValue);
 }

 if(digital Read (R_SW)){
  M2.write(potValue);
 }
 else{
   M1.write(potValue);
   M2.write(potValue);
 }
```

Fig. 1: Program for controlling the speed of vehicle3.3 RC Remote Control

RC remote is programmed to control the working of propeller, conveyor belt, vehicle movement and speed and pumping mechanisms in water purifier. Here 4 sets of ESCs are used,2 for movement of vehicle, 1 for conveyer belt, 1 for propeller and the other for pumping and purification. Initially, the values and pin numbers for each component is set with the help of library files. The analog value from the Potentiometer is connected to the analog pin of the Microcontroller and data gets transmitted through NRF module. In the receiver section, the received potentiometer values are mapped to the required range of values by varying the PWM signal. The variation in pulses helps in controlling the speed of motors. This is the same concept that is used in Conveyer belt, Propeller and in the Pumping and Purification process.

3.3.1 Transmitting section

```
/*  A basic 4 channel transmitter using the nRF24L01 module.*/

#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>

const uint64_t pipeOut = 0xE8E8F0F0E1LL;

RF24 radio(9, 10);

// The sizeof this struct should not exceed 32 bytes
struct MyData {
  byte throttle;
  byte yaw;
  byte pitch;
  byte roll;
};

MyData data;

void resetData()
{
  data.throttle = 0;
  data.yaw = 127;
  data.pitch = 127;
  data.roll = 127;
}

void setup()
{
  radio.begin();
  radio.setAutoAck(false);
  radio.setDataRate(RF24_250KBPS);

  radio.openWritingPipe(pipeOut);
  resetData();
}
```



```
// Returns a corrected value for a joystick position that takes into account
// the values of the outer extents and the middle of the joystick range.
int mapJoystickValues(int val, int lower, int middle, int upper, bool reverse)
{
  val = constrain(val, lower, upper);
  if ( val < middle )
    val = map(val, lower, middle, 0, 128);
  else
    val = map(val, middle, upper, 128, 255);
  return ( reverse ? 255 - val : val );
}

void loop()
{
 // The calibration numbers used here should be measured
 // for your joysticks using the TestJoysticks sketch.
 data.throttle = mapJoystickValues( analogRead(0), 13, 524, 1015, true );
 data.yaw      = mapJoystickValues( analogRead(1),  1, 505, 1020, true );
 data.pitch    = mapJoystickValues( analogRead(2), 12, 544, 1021, true );
 data.roll     = mapJoystickValues( analogRead(3), 34, 522, 1020, true );

 radio.write(&data, sizeof(MyData));
}
```

Fig. 2: Program for Transmitter Section

3.3.2 Receiver Section

```
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>
#include <SPI.h>
#include <Wire.h>

#include <Servo.h>

const uint64_t pipeIn =  0xE8E8F0F0E1LL; // match this on both sides!

RF24 radio(9, 10);

 // The size of this struct should not exceed 32 bytes
struct MyData {
  byte throttle;
  byte yaw;
  byte pitch;
  byte roll;
 };

MyData data;

unsigned long packetsRead = 0;
unsigned long lastUpdate = 0;
int packetsSec = 0;
unsigned long lastRecvTime = 0;
unsigned long drops = 0;
```



```
void setup()
{
   radio.begin();
   radio.setDataRate(RF24_250KBPS); // Both endpoints must have this set the same
   radio.setAutoAck(false); // Both endpoints must have this set the same
   radio.openReadingPipe(1,pipeIn);
   radio.startListening();

   display.begin(SSD1306_SWITCHCAPVCC, 0x3C);  // initialize with the I2C addr 0x3D (for the 128x64)
   display.setTextSize(1);
   display.setTextColor(WHITE);
   display.clearDisplay();

   memset(&data, 0, sizeof(MyData));
esc1.attach(2);
esc2.attach(2);
esc3.attach(2);
esc4.attach(2);
esc1.writeMicroseconds(1000);
esc2.writeMicroseconds(1000);
esc3.writeMicroseconds(1000);
esc4.writeMicroseconds(1000);
}
```

```
void recvData()
{
   while ( radio.available() ) {
       radio.read(&data, sizeof(MyData));
       packetsRead++;
       lastRecvTime = millis();
    }

   unsigned long now = millis();
   if ( now - lastRecvTime > 1000 ) {
   drops++;
    }
 }

 void loop()
{
   recvData();
   updateScreen();

   i=map(i,0,255,1000,2000);
  esc1.writeMicroseconds(i);
   j=map(j,0,255,1000,2000);
  esc2.writeMicroseconds(j);
   k=map(k,0,255,1000,2000);
  esc3.writeMicroseconds(k);
   l=map(l,0,255,1000,2000);
  esc4.writeMicroseconds(l);
}
```

Fig. 3: Program for Receiver Section

4. BLOCK DIAGRAM

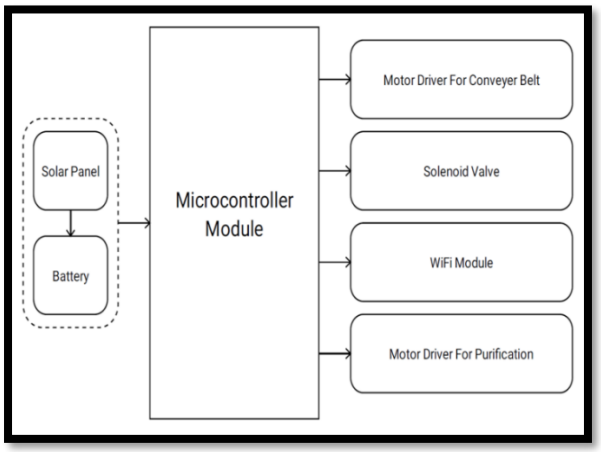

Fig. 4: Water purification and Trash collection

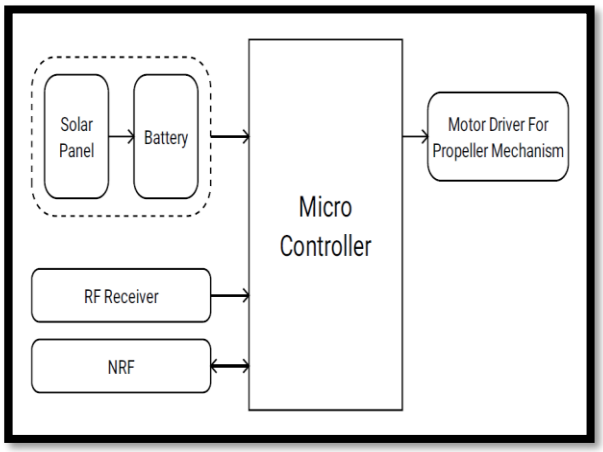

Fig. 5: Autonomous Vehicle Movement

In this project we are designing a floating trash collector with water purifier that operates on solar energy. ATmega328 is the microcontroller used for purification and trash collection. When power is given to the MC module, it drives the motor for conveyer belt and motor for purification module. Motor driver for conveyer belt is attached to a tray for collecting trashes from water. Solenoid valve is used to control the flow of water. The status of the MC working can be viewed using Wi-Fi module. A motor driver is attached for propeller mechanism. The entire system is controlled using a remote, an NRF transceiver is used for remote control mechanism. When water enters the valve along with the trash, the trashes will be collected at the trash collecting tray and the water is taken for purification by the filters. To ensure better purification of water, sediment filter and carbon filters are also used in addition to normal water purifier.

5. FUTURE SCOPE

This project tries to overcome water pollution and scarcity of clean water by collecting trashes from water bodies followed by its purification. The system can be made autonomous by using Ardupilot and mission planner. Ardupilot is a versatile, trusted, open source Ardupilot software for drones and other autonomous system. Mission planner is a full featured ground station application for the open source ardupilot system. It is a ground station for plane, copter and rover. It can be used as a configuration utility or as a dynamic control supplement for autonomous vehicle. We use components which are locally sourced and delivering at a nominal price, while performance cannot be compromised. The project does not require any electricity and mechanical power source since it is fully dependent on solar energy. This system can be used in all climatic conditions. Also it is easy to handle & use and in addition socio-culturally acceptable so that the product finds widespread dissemination. Our project has less environmental impact so that it can reduce water pollution to a great extent hence pollution of rivers like Ganga, Yamuna, etc can be reduced.

6. CONCLUSION

As solar energy is the main source of power, it can be even used in places where electricity is not available. This project is used to collect waste that gets accumulated on the surface of water bodies thereby purifying the water hence it helps in decreasing water pollution. After collecting the trashes, it will purify the polluted water. DC pumps are attached to the microcontroller for the purification and trash collection. To make the boat self-sustainable we have implemented two Solar panels which would charge the battery.

Insufficiency of pure drinking water leads thousands of people to danger every day. This product is expected to mitigate drinking water crisis both in urban and rural areas. In rural areas, it can be done in large scale for better feasibility Also, this project has the potential to become great security advantage if it is used wisely. The system works completely on solar power, which is free of cost. This floating system does not require any external supply hence it is economical. This project has only capital cost and almost no running cost. Hence, it will prove to be useful in the near future.

7. REFERENCES

[1] Sirichaiwatanasophon and sarineeonitrakul," Garbage collection robot on the beach using wireless communication", international conference on informatics, environment, energy & application IPCBEE.

[2] "Apoorva S. Chaithanya, Rukuma S. Prabhu, Saiswaroop B. Shetty, Denita D'Souza, "Autonomous Garbage Collector Robot", Department of Electrical & Electronics Engineering, St Joseph Engineering College, Mangalore, India.

[3] M. Gowtham, K. Richard Neiel, V. Nagarajan, P. Christhu Dass, and A. Thimothy, Integrated Performance Analysis of Latent Heat Storage and Finned Type Solar Distiller IACSIT International Journal of Engineering and Technology, Vol. 4, No. 5, October 2012.

[4] Ozuomba J.O.1, Edebeatu C.C.1, Opara M.F.2, Udoye M.C.3 and Okonkwo N.A.1 The Performance of a Solar Water Distillation Kit fabricated from Local materials Research Journal of Chemical Sciences ISSN 2231-606X Vol. 2(3), 64-67, March (2012).

[5] Nimal, R.J.G.R., Hussain, J.H., Effect of deep cryogenic treatment on EN24 steel, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP113-116, 2017

[6] Parameswari, D., Khanaa, V., Deploying lamport clocks and linked lists, International Journal of Pharmacy and Technology, V-8, I-3, PP-17039-17044, 2016.

