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Smart Solar Powered Pesticide Sprayer for Agriculture

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ABSTRACT

In this project farmer friendly solar operated pesticidepump with devices such as DC mobile charger has been equipped. This pesticide pump is remotely use at various places such as farm, garden also in municipality to kill mosquitoes. In generalthe pesticide spraying tank is electrically charged and in case of natural disasters power supply is a questionable one hence the equipment is solar powered. The main safety precaution is that, the system works only when the operating person wears the safety mask. In future it can be enhanced to images processing where it recognizes the infected plant more accurately instead of manual monitoring.

INTRODUCTION

Here, the project is proposed for agricultural field in designing a pesticide device that can be used during the recovery period of natural calamities. This device can incorporated with smart features like process monitoring and providing with the safety provisions to operate the pesticide device. This device can be utilized commercially in personal and in public sector for the betterment of individual and society needs.[1-3].

LITERATURE REVIEW

The basic aim of solar pesticide sprayer is to reduce the work of farmers which is done manually. Solar Pesticide Sprayer is proved to be a useful machine which concentrates on ergonomics which is more efficient to workers, and the energy source used is nonconventional. Hence it possesses a great scope in near future. Solar pesticide sprayer consist of a solar panel,a battery ,motor pump and a container which consist of liquid pesticide. This will going to be more useful for Eco Smart farming. In the commonly available ones, the user needs to exert a lot of effort to push the lever up and down to create the pressure to spray. Sometimes when the pressure becomes uneven, the nozzle gets blocked and the farmer has to spend time to rectify it. The benefits obtained from this project is to minimize the pollution, optimize the power, more friendly to farmers usage,cost effective as well ergonomically efficient.[5].

PROPOSED METHODOLOGY

The solar pump system consist of solar panel, DC motor, Battery, pic16f877a control sensor, emergency LED, DC mobile charger, spray nozzle, pesticide tank etc. It uses solar energy to operate. First the solar panel collects solar radiation and converts it into electrical energy by photovoltaic conversion process. Battery uses this electricity to charge itself. The stored electricity used to run the

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motor and other portable devices. When the switch is turn ON the electricity is provided to motor to suck pesticide from tank and deliver it. But the ON and OFF state of motor is control by spray gun trigger. When trigger is pulled, the motor is made ON and pressure is maintained by micro control sensor. As trigger is released, the motor is made OFF. For portable devices, the adaptors are fixed on the body of tank. This adaptor provide plug-in and out connection for emergency LED, DC mobile charger.

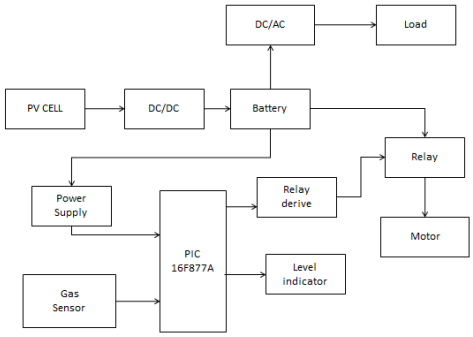
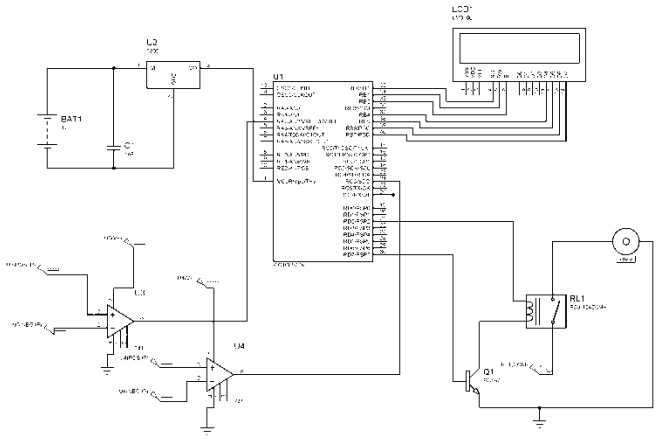


Fig: 1 Block Diagram

Sprayer is mechanical device that are specifically designed to spray liquid quickly and easily. They have number of different varieties. In this project we prepared solar operated spray pump and which can be used for many purposes. Our solar based pesticide spray pump is one of the most improved and modern version spray pump. It can be most often used at various locations such as farms, gardens although it can become more popular in rural areas as well. It is found more reliable to use. It uses solar power to run so it is maintenance free and pollution free pesticide pump as compare to two stroke engine pumps. The additional advantage of this model is that, it can be useful for appliances like emergency LED and unique DC mobile charger; also it can be used as home lighting system as its battery can be used at night too.[6-8].

CIRCUIT DIAGRAM



Port B Pins b0,b1,b2,b3,b4,b5,b6,b7 are connected to the LCD. Relay and Gas Sensor are Connected to the Port D d2,d7. Port A and Port C is connected to the Ultra sonic sensor.Vbb

WORKING PRINCIPLE

Solar radiation can be battery can be charged by Solar Panel available on the top of the Sprayers. A separate charging system using Solar Panels can also be used for charging the battery, converted directly into electricity using semiconductor devices, which are known as Photovoltaic (PV) cells. When Sunlight falls upon the Solar cell a part of the light is absorbed and it is converted into Electrical Energy. This Solar Panel is connected to 12V lead acid battery for storing the electrical energy. A 12V DC motor is connected to the lead acid battery to convert the electrical energy into mechanical energy. Charging can be done Using a solar panel. Battery can be charged continuously during discharge itself, by attaching the panel on the sprayers. Without panel on the sprayers, discharge can be done for a minimum period of 4 to 5 hours. By changing the battery, discharge can be continued for further more hours.During Rainy Season charging can be done by electrical devices.The main safety precaution is that, the system works only when the operating person wears the safety mask.[9-10]

HARDWARE DESCRIPTION

- Solar Panel
- DC-DC Converter
- 3.DC-AC
- Battery
- Gas Sensor
- Relay
- Power Supply
- Ultrasonic Sensor

SOLAR PANEL

solar panel collects solar radiation from sun and converts it into electrical energy by photovoltaic conversion process.In this project 10 watts solar panel is used. The 10 watts solar panel produce 6V. The electrical energy will send to the DC-DC converter.A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes an array of photovoltaic modules, an inverter, a battery pack for storage, interconnection wiring, and optionally a solar tracking mechanism.

DC-DC CONVERTER

A basic DC-DC converter takes the current and passes it through a switching element, which turns the DC signal into an AC square wave signal. This wave is, then passes through another filter which turns it back into a DC signal of required voltage. In this project it collect the electrical energy produced by solar panel and convert it to unregulated to regulated signal .in this it convert 12V unregulated signal into 12V regulated signal.DC to DC converter circuits also regulate theoutputvoltage. Some exceptions include high-efficiency LED power sources, which are a kind of DC to DC converter that regulates the current through the LEDs, and simple charge pumps which double or triple the output voltage.

DC-AC

A power inverter, or inverter, is an electronic device or circuitry that changes direct current (DC) to alternating current (AC). The input voltage, output voltage and frequency, and overall power handling depend on the design of the specific device or circuitry. In this it is used for application side. It is connected to a battery. The rating of DC-AC is 12V-230V.

BATTERY

Battery uses the electricity which is converted from solar panel to charge itself. The stored electricity used to run the motor and other portable devices. Battery is used for to run a motor, DC mobile charging. In this the 12V lead acid battery is used,it is 12amps battery. Full battery charge will be indicated by LED. It is capable to work 3-4 hours. The capability of the battery will vary with the load applied.

ULTRASONIC SENSOR

Ultrasonic sensors emit short, high-frequency sound pulses at regular intervals. These propagate in the air at the velocity of sound. If they strike anwater, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.

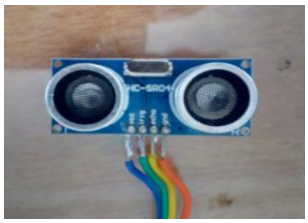


Fig: 2 Ultrasonic Sensor

Table: Power supply for components

Components	Supply voltage
1. Motor	**12V**
2. Relay	**12V**
3. Sensor	**5V**
4. Pic	**5V**
5. Level sensor	**5V**

GAS SENSOR

This is a simple-to-use liquefied petroleum gas (LPG) sensor, suitable for sensing LPG concentrations in the air. The MQ-6 can detect gas concentrations anywhere from 200 to 10000ppm. It is a high sensitivity sensor. It is connected to the microcontroller. It sense the exhaled air from human when the human wear the mask. Then the signal will be sent to the microcontroller Sensitive material of MQ-2 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist. The sensor's conductivity is more higher along with the gas concentration rising. Please use simple electrocircuit, Convertchange of conductivity to correspond output signal of gas concentration. MQ-2 gas sensor has high sensitivity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

Fig: 2 Gas Sensor

RELAY

A relay driver circuit is a circuit which can drive, or operate, a relay so that it can function appropriately in a circuit.The driven relay can then operate as a switch in the circuit which can open or close, according to the needs of the circuit and its operation.In this project, we will build a relay driver for both DC and AC relays. Since DC and AC voltages operate differently, to build relay drivers for them requires slightly different setup. We will also go over a generic relay driver which can operate from either AC or DC voltage and operate both AC and DC relays.Relays are switches that open and close circuits electromechanically or electronically. Relays

control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized. It is connected between the microcontroller and motor. In this it is used for switching purpose to switch the water motor ON and OFF .

POWER SUPPLY

All digital circuits work only with low DC voltage. A power supply unit is required to provide the appropriate voltage supply. This unit consists of transformer, rectifier, filter and a regulator. AC voltage typically of 230Vrms is connected to a

transformer which steps that AC voltage down to the desired AC voltage level. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filter to produce a DC voltage. This resulting DC voltage usually has some ripple or AC voltage variations. Regulator circuit can use this DC input to provide DC voltage that not only has much less ripple voltage but also remains in the same DC value, even when the DC voltage varies, or the load connected to the output DC voltage changes. The required DC supply is obtained from the available AC supply after rectification, filtration and regulationA power supply takes the AC from the wall outlet, converts it to unregulated DC, and reduces the voltage using an input power transformer, typically stepping it down to the voltage required by the load. For safety reasons, the transformer also separates the output power supply from the mains input. The power supply unit supply 5V to sensor ,12V for DC motor.

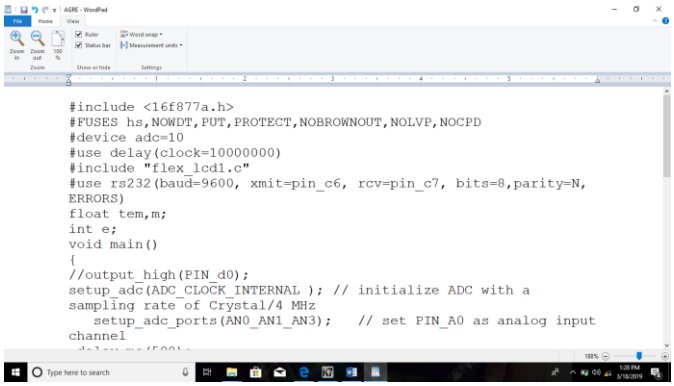
Pic 16F877A

The architectural decisions are directed at the maximization of speed-to-cost ratio. The PIC architecture was among the first scalar CPU designs, and is still among the simplest and cheapest. The Harvard architecture—in which instructions and data come from separate sources—simplifies timing and microcircuit design greatly, and this benefits clock speed, price, and power consumption.The PIC instruction set is suited to implementation of fast lookup tables in the program space. Such lookups take one instruction and two instruction cycles. Many functions can be modeled in this way. Optimization is facilitated by the relatively large program space of the PIC and by the design of the instruction set, which allows for embedded constants. For example, a branch instruction's target may be indexed by W, and execute a "RETLW" which does as it is named - return with literal in W.Interrupt latency is constant at three instruction cycles. External interrupts have to be synchronized with the fourclock instruction cycle, otherwise there can be a one instruction cycle jitter. Internal interrupts are already synchronized. The constant interrupt latency allows PICs to achieve interrupt driven low jitter timing sequences. An example of this is a video sync pulse generator. This is no longer true in the newest PIC models, ssbecause they have a synchronous interrupt latency of three or four cycles.

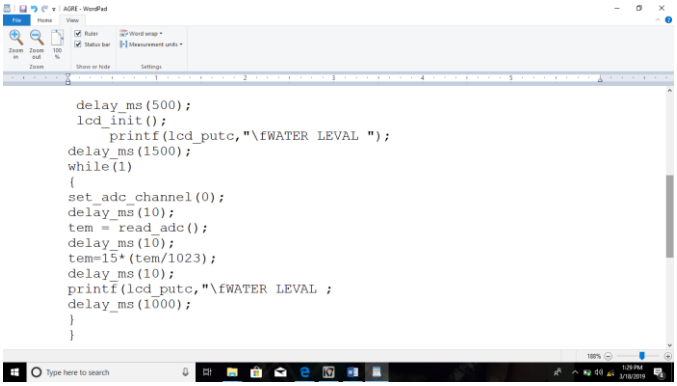
PORT CONNECTION

In this circuit diagram 16F877A PIC Microcontroller is used. In this PIC microcontroller 40 Pins are available. But mainly used as 12 pins . PIC Port Bis used for LCD and the pins are b0-b7. Port D is used for Relay and Gas sensor and the pins d0,d1.Port C is used for Ultra sonic sensor and the pins are c0,c1.

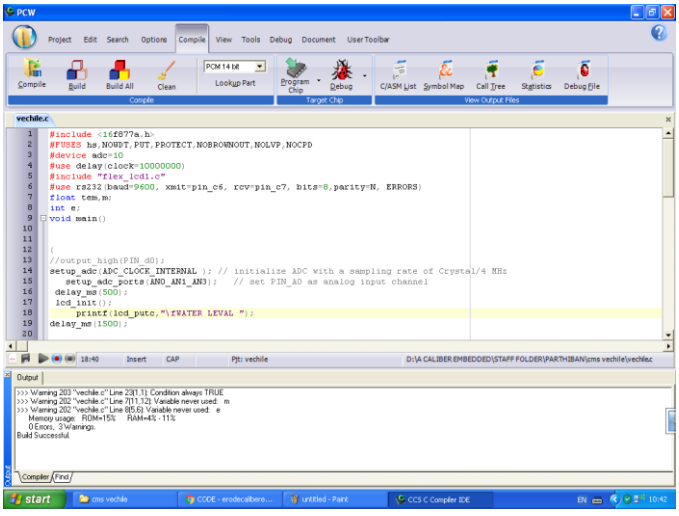
SOFTWARE DESCRIPTION



```
#include <16f877a.h>
#FUSES hs,NOWDT,PUT,PROTECT,NOBROWNOUT,NOLVP,NOCPD
#device adc=10
#use delay(clock=10000000)
#include "flex_lcd1.c"
#use rs232(baud=9600, xmit=pin_c6, rcv=pin_c7, bits=8,parity=N,
ERRORS)
float tem,m;
int e;
void main()
{
//output_high(PIN_d0);
setup_adc(ADC_CLOCK_INTERNAL ); // initialize ADC with a
sampling rate of Crystal/4 MHz
   setup_adc_ports(AN0_AN1_AN3);   // set PIN_A0 as analog input
channel
```



```
 delay_ms(500);
 lcd_init();
     printf(lcd_putc,"\fWATER LEVAL ");
delay_ms(1500);
while(1)
{
set_adc_channel(0);
delay_ms(10);
tem = read_adc();
delay_ms(10);
tem=15*(tem/1023);
delay_ms(10);
printf(lcd_putc,"\fWATER LEVAL ;
delay_ms(1000);
}
}
```



HARDWARE RESULT

CONCLUSION

Thus, solar operated spray pump will help the farmers of those remote areas of country where fuel is not available easily. They can perform their regular work as well as saves fuel up to large extent. At the same time they can do their pesticide spraying work with very less environment pollution. Thus, indirectly saving revenue of government and also most demanded fuel.

FUTURE SCOPE

- The overall weight of the tank can be minimized by molding techniques.
- The battery backup can be increased by adopting some new technology in electronic fields.
- In future it can be enhanced to images processing where it recognizes the infected plant more accurately instead of manual monitoring

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