NEW HORIZON
COLLEGE OF ENGINEERING

Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC Accredited by NAAC with 'A' Grade, Accredited by NBA

AUTOMATIC ON/OFF WATER PUMP

A MINI PROJECT REPORT

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In partial fulfillment for the award of the degree of

Bachelors of Engineering (BE)

In

Electrical & Electronics

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CERTIFICATE

Certified that the Mini Project work entitled **"AUTOMATIC ON/OFF PUMP OPERATOR"** carried out by **Nischal Dinesh(1NH18EE039), Prajwal(1NH18EE042), Sarthak Das(1NH18EE053)** are bonafide students of New Horizon College of Engineering submitted the report in completion of project at Department of Electrical and Electronics Engineering, New Horizon College of Engineering during the Academic Year 2019-20.

It is certified that all the corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for said Degree.

Project Guide

Name of the Guide

Mr. Inbaskaran

HoD-EEE

Dr. RamKumar S

ABSTRACT

The overall goal of this project is to automatically control the amount of water in the pump by preventing overflow with the help of relay and various other electrical components.

Water is the most important nature's gift to the mankind and to every creature present in this universe. There is no substitute for water, it is as important as oxygen. Now days it can be seen that water is not easily available everywhere and managing water in various big cities is not that simple. Automatic ON/OFF pump is one of the best name fit for this. The relay(9V) connected to the tank is supplied by 9V battery which is acting as a source. The entire circuit is controlled by a switch. The relay will automatically switch on the pump motor immediately when the overhead tank is full or at a particular maximum input given level, the pump motor will get switched off automatically, preventing overflow of the tank.

ACKNOWLEGMENT

We would like to thank everyone who supported us during this entire period of making of this project. It would not have been possible without the kind support and help of many individuals and professors. We would like to extend our sincere gratitude to every one of them. In performing this mini project, we had to take the help and guideline of some respected persons, who deserve our greatest gratitude. The completion of this project gives us much pleasure and satisfaction. We would like to show our gratitude to **Mr. Inbaskaran, Professor Dept. of Electrical Engineering** for giving us a good guideline and helping for project throughout numerous consultations. We would also like to thank **Dr. Ramkumar S, Head of the Dept. of Electrical Engineering** for helping us**.** I am thankful to other professors also for the valuable information provided by them in their respective fields. I am grateful for their cooperation during the period of our mini project. We would also like to expand our deepest gratitude to all those who have directly and indirectly guided us in preparing this report for this mini project.

Many people, especially our own classmates and team members itself, have made valuable comment suggestions on this proposal which gave us an inspiration and hope to improve and complete the mini project. We were very excited in doing this. We thank all the people for their help directly and indirectly to complete our project successfully.

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AIM

To automatically switch ON or OFF water pump based on different water levels in the overhead water tank.

OBJECTIVE

With the help of relay automatically turning of the pump without manually turning off the switch and find the value of I_B.

COMPONENTS REQUIRED

1. 9V battery
2. Connecting wires
3. Relay 9V
4. Cardboard
5. Plastic glasses
6. 3-6V mini water pump
7. Diode 1N4007
8. Transistor BC 547
9. Resistors
10. Switch

INTRODUCTION

Pump:

A pump is a mechanical device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be categorized into three types according to the method they use to move the fluid. Pumps are run off by some certain type mechanism and consume energy to perform mechanical work moving the fluid. Pumps work by many different kinds of energy sources, including manual and automatic operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps almost everywhere.

Mechanical pumps work on wide range of applications such as pumping water from wells, filtering aquarium, filtering pond and aeration, in the car industry for water-cooling and injection of fuel , in various energy industry for pumping oil and natural gas or for operating cooling towers and other components of heating, ventilation and air conditioning systems. In the medical field and industry, pumps are used in biochemical processes in medicines development and manufacturing , and as artificial replacements for various body parts, in particular the artificial heart and penile prosthesis and other processes also.

When a cover contains only one revolving impeller, it is called a single-stage pump. When a cover contains two or more revolving impellers, it is called a double- or multi-stage pump.

The pumping of water is a basic and practical technique, far more practical than pick it up with one's hands or lifting it in a hand-held bucket. This is very much true whether the water is drawn from a fresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an non hygenic and undesirable location. Regardless of the all outcomes, the energy required to pump water is an extremely demanding component of water consumption. All other different processes depend or benefit either from water descending from a higher elevation or some pressurized water plumbing system.

In day-to-day life, available water is often contaminated, unhealthy, or even naturally poisonous, so that it is necessary to pump potable water from lower levels to higher levels, where it can be of use. A fresh water source in a lower stream, river, pond, or lake is often pumped to higher ground for irrigation, livestock, cooking, cleaning or other uses by humans, who quite naturally need fresh water. This will purify mostly fresh water, and the treatment of largely contaminated water refer endlessly to pumping.

Relay:

A relay is a switch which is electrically operable. It consists of a combined deck two to three terminals for input as well as a set of operating contact terminals for outputs as well. The switch may have any number of contacts in multiple to make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit to delay by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations extensively.

Transistor BC547:

BC547 is a typical NPN type transistor therefore the collector and emitter will be left open (Reverse biased) when the base pin is held at ground and will be closed (Forward biased) when a signal is provided or passed through the base pin . BC547 has a gain value ranging from 110 to 800, this value determines the amplification capacity of the transistor. The highest amount of current that could flow through the pin of the collector is 100mA therefore we cannot connect loads that consume and use more than 100mA using this type of transistor. To bias a transistor we have to supply current to base pin, this current (IB) should be limited to 5mA not less than that.

When this transistor is completely biased then it can allow a maximum of 100mA to flow across the collector and emitter. Saturation Region belongs to this stage and the typical voltage allowed across the Collector-Emitter (V¬CE) or Base-Emitter (VBE) region could be 200 and 900 mV respectively. When base current is removed the transistor becomes completely off, this stage is called as the Cut-off Region and the Base Emitter voltage could be around 660 mV.

Diode 1N4007:

A diode is an electronic device which allows current flow through only one direction and prevents bidirectional flow. That is the current should always flow from the Anode to cathode and not vice-versa.

For 1N4007 Diode, the maximum current carrying capacity is 1A it with stand peaks up to 30A. Hence, we can use this in circuits that are designed for less than 1A. The reverse current is 5uA which is negligible. The power dissipation of this diode is 3W.

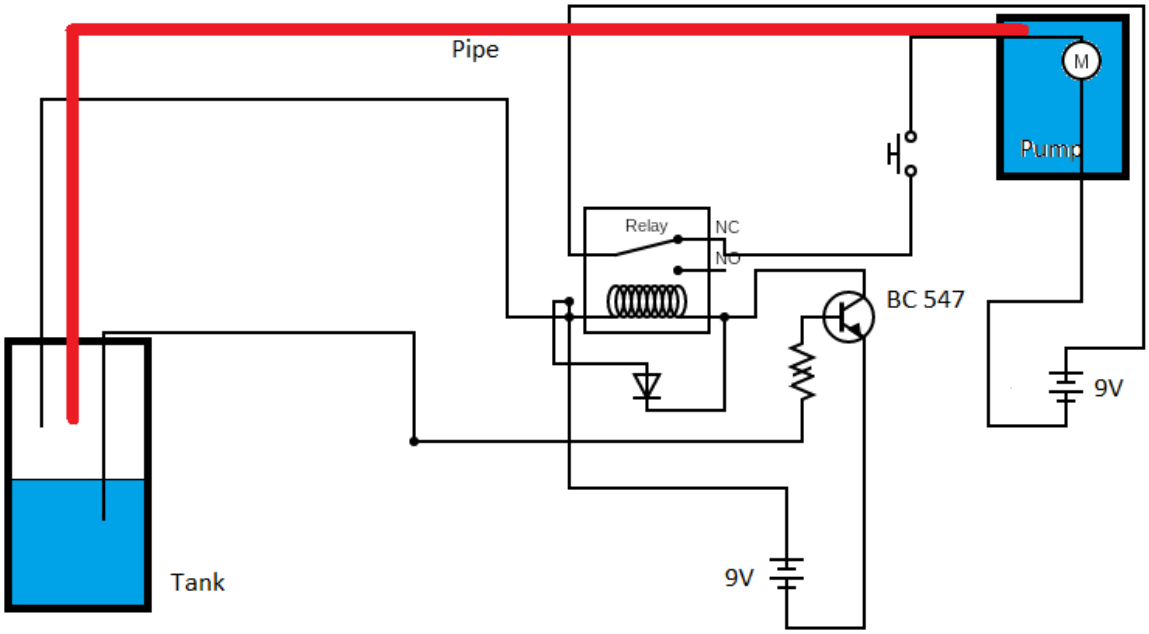
This section gives a pure view description and extent of everything included in this Project Report. The purpose of this report is to give the complete and detailed information about our mini

project. This document is primarily intended to anyone who wants to know about the automatic operation of switching on/off of the pump without manually switching it off.

PROBLEM STATEMENT

The problem which we encountered is most common in all water pumping applications is overflowing of water from the container which is only stopped when the switch is manually turned off. We solve this problem by the automatically turning off the pump when the tank is full or required amount of water is filled with the help of relay. In this way we are saving the water efficiently.

CONSTRUCTION



Above diagram shows the connection of the automatic on/off pump operator. A simple easy to use but very reliable and effective water level controller circuit diagram is shown here. Water is supplied to the tank through pipe. The pump is connected to a 9V supply which through the push switch is connected to the relay through the common terminal.

In transistor BC 547, the collector part is connected across one of the coil while the base is connected in series with a resistance and act as a lower probe of the tank. The emitter part of the transistor is connected to the negative terminal of 9V battery which in turn is connected to the other coil connection of the relay. Diode 1N4007 is connected across the relay. From the relay through the coil connection another wire is taken as the higher probe or the benchmark of the tank till where maximum water will be stored.

WORKING

The supply is given from the 9V batteries. As soon as the switch is turned on the entire circuit is closed, the switch is connected to the NC input of the relay, immediately current starts flowing and the motor starts pumping water to the tank. To avoid flowing of current in both directions the diode 1N4007 is used in the relay. To avoid burning of the transistor a resistor is connected in series with the base line. Initially the whole tank is empty and the transistor is also switched OFF. Let us consider the level of lower probe at quarter level of the tank while the level of upper probe at high level of the tank. The water level starts increasing and the tank starts to fill. When the water level reaches quarter level that is at the lower probe, the transistor gets switched ON. The resistor present limit the base current to that transistor. The relay is the main component which acts as a switch here for switching ON/OFF. The water level keeps on rising in the tank, when it reaches the upper probe, the transistor gets turned OFF. When the transistor gets turned "OFF", the current flowing through the relay coil decreases and the magnetic field collapses. However, the energy stored within the magnetic field has to go somewhere and a reverse voltage is developed across the coil as it tries to maintain the current in the relay coil. This type of action produces a high voltage spike across the relays coil that can damage the switching NPN transistor if allowed to build up. So, in order to prevent damage to the semiconductor transistor and other devices, a "flywheel diode", also known as a freewheeling diode, is connected across the relay coil.

Hence, we can automatically control the pump and prevent the overflow of water.

Mathematical Operation:

Vcc=9V

V_{BE}=0.7V

R_B=220

$I_B=(Vcc-V_{BE})/(R_B)$

$I_B=(9-0.7)/(220)$

$I_B=8.3/220 = 37.72mA$

RESULT

The water gets filled in the tank as long as it reaches the upper probe as the transistor is switched OFF automatically with the help of relay. Hence overflowing and wastage of water is prevented and energy is also used efficiently without any wastage. The value of I_B is 37.72mA.

APPLICATIONS

Pumps are used everywhere in the society for a variety of purposes. Earlier applications includes usage of the windmill or watermill to pump water to high level. Today, pumps are utilized for many purposes like irrigation, supplying water, gasoline supply, cooling and air conditioning systems, refrigeration (usually called a compressor), movement of chemicals, sewage treatment, controlling flood, marine services, etc.

Because of broad variety range of applications, pumps have an abundance of shapes and sizes: from very large to very small, from gas handling to liquid handling, from different pressures like higher to lower pressures, and from high to low volume.

- Buildings – used to pump the water supply including the curvaceous systems and also place where suction lift or high pressure is not required.
- Boost Application – a booster pump is used to increase pressure coming from the intake line.
- Wells – used in domestic and household water supply systems.
- Fire Protection – makes sure that uninterrupted water source is available.
- Circulation of hot water – used to move and supply water in a closed system where low head is required.
- Sump Pits – either horizontal or vertical water pump is used wherein it is operated by an automatic switch that is controlled by the float.
- Well Water Pump – a well water pump is used in home or business wherein it draws the water from the underground from very deep level to supply in a number of sinks and bathrooms.
- Pressure Tank Water Pump – a pressure pump is applied to regulate and stable the water pressure controlling the water flow that moves in places such as homes or businesses.
- Industrial & Fire Protection Industry - Heating and ventilation,feed boiler applications, air conditioning and cooling, increasing pressure , fire protection sprinkler systems.
- Waste Management, Agriculture & Manufacturing - Processing wastewater to plants, municipal industry, drainage system, processing gas, irrigation, and protection from flood
- Pharmaceutical, Medical, Chemical & Food Industries - paints, hydrocarbons, petrochemicals, cellulose, refining of sugar , production of food and beverage

LIST OF FIGURES

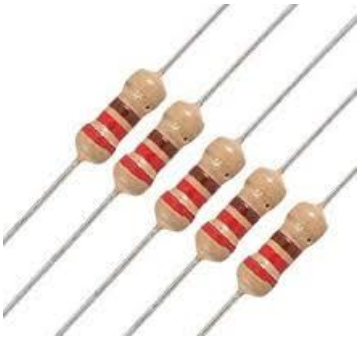
5. Plastic glasses

6. 3-6V mini water pump

7. Diode 1N4007

8. Transistor BC 547

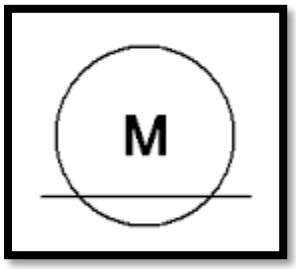
9. Resistors



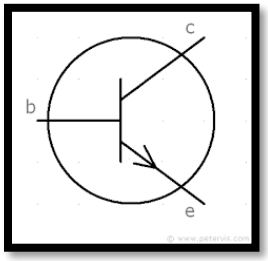
10. Switch

LIST OF SYMBOLS

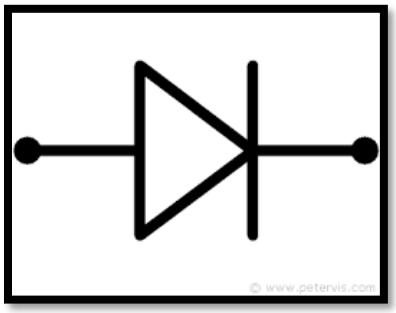
- Motor:



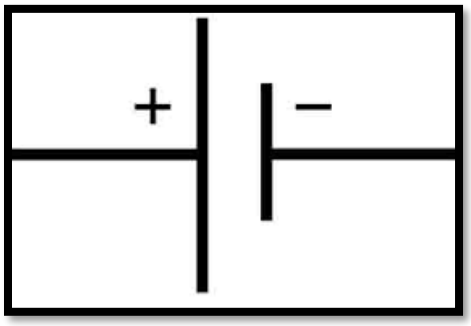
- Transistor:



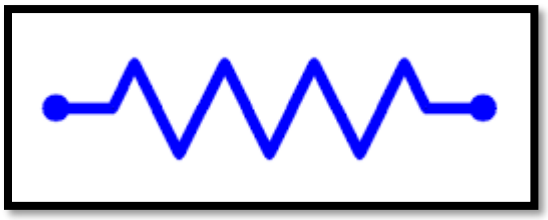
- Diode:



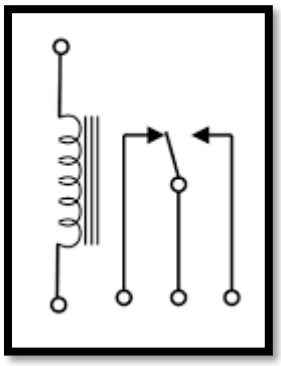
- Battery:



- Resistor:



- Relay:



REFERENCES

The following data for the project has been gathered from a number of sources. A list of few of the sources are:

1) Electronic For You magazine
2) Wikipedia.com
3) Google.com
4) Electrical textbooks
5) Circuittheory.com