

# IoT Based Electricity Generation from Overwhelmed Water Tank

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**ABSTRACT:** The main goal of this project is to implement green technologies for society to reduce the fuel consumption costs. Green technology is an alternative energy but inexpensive, efficient and effective. This can slash fuel supplies, cost of capital and emissions. In addition, the aim of this project is to generate electricity by developing a pico-hydro-generation prototype system that produces low capacity to be used in rural communities. This project has primarily focused on the design and manufacture of a pico-hydro device that can be used for low capacity equipment such as motor and bulb. In addition, this project will evaluate the generator production based on turbine rotation. In the high-PVC tubing, water flow has the ability to move the turbine where it is attached to a generator to transform mechanical energy into electrical energy. Within this project the pulley system can be seen to improve the turbine's output. The turbine connecting to the pulley system needed lower speed compared to the turbine directly connecting to the generator.

**KEYWORDS:** Hydro electricity generation, Renewable energy, Internet of Things.

## I. INTRODUCTION

There are three types of hydropower facilities: impoundment, diversion, and pumped storage. Some hydropower plants use dams and some do not. The images below show both types of hydropower plants. Many dams were built for other purposes and hydropower was added later. There are about 80,000 dams in the United States, of which only 2,400 generate electricity. For recreation, stock / farm reservoirs, flood control, water storage, and irrigation, the other dams are. Hydroelectric power plants vary in scale from small home or village systems to massive projects generating electricity for utilities. An impoundment plant is the most common type of hydroelectric power plant. An impoundment project, usually a massive hydropower facility, uses a dam to hold water from the river in a tank. Water emitted from the reservoir flows via a turbine and spins it, which in effect stimulates a generator for electricity production. The water may be released either to meet changing electricity needs or to maintain a constant reservoir level. A micro hydropower plant has up to 100 kilowatt capacity. For a house, farm, ranch, or village, a small or micro-hydroelectric power system may generate enough electricity.

## II. EXISTING METHODS

The literature available in the preview of the goals of this study is reviewed in this chapter. Solar panels, biomass and hydro power are discovered as high potential sources of electricity. Nonetheless, among potential renewable energy options, Pico and micro hydro power systems are the most efficient ones. In springs, streams, creeks, waterfalls, tributaries and rivers, the complex power of natural water can be found. Pico hydroelectricity generation systems are capable of generating an output power of up to 5 KW, sufficient to supply a rural community village with low electricity usage.

### II.A.PICO HYDRO POWER GENERATION SYSTEM

Basar M.F.(2012) implements a well-suited pico hydro power generation network in remote areas where power transmission appears unlikely. The Pelton turbine is used to optimize the built idea, as it is especially suitable for high and low water flow levels in the Philippines. In addition, an IoT-based device which can easily track any unwanted issues. Compared to other electricity sources this pico-hydropower network is very economical.

## II.B. PICO HYDRO POWER AND THE STATUS OF IMPLEMENTATION

Hasim. N (2005) et.al introduces green energy, which consumes a small stream to generate electricity without relying on any non-renewable energy sources. The green scheme offers any alternative energy cheap, efficient, reliable, and cost-effective, so there is no need to worry about future scope, capital cost pollution, and life expectancy

## II.C. BOON FOR ELECTRICAL SPECIFICATION

Kapoor. M (2013) launched a Rural electrification to boost the wellbeing of individuals who are situated where centralized power grids are not reached. It's a well-known fact that India is very rich in water resources from which we can harness ample water for irrigation and massive amounts of electricity. Several major hydropower plants and irrigation schemes are under construction to harvest electricity. But India has several villages far from electrical grid link network reach. These villages have many natural water bodies such as rivulets, wetlands, natural rivers, and springs in challenging terrain and high altitude. Due to high altitude, life is difficult in most of these villages, but the same high altitude can prove to be a blessing if there is even a small source of water.

## III. PROPOSED SYSTEM

### III.A. EMBEDDED SYSTEM OVERVIEW

An Embedded System is a computer device conceived for different control functions within a larger system, often with computational constraints in real time. It is also integrated in a computer system, which includes hardware and mechanical components. A general-purpose computer such as a personal computer, on the other hand, is built to be versatile and satisfy a wide variety of end-user needs. It controls many devices in common use today.

Physically, the Embedded System range from portable devices such as digital watches and MP3 players, to large stationary installations like traffic lights and factory. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure.

Others also have efficiency requirements that must be met in real time, for reasons including health and usability. Others could have minimal to no performance requirements, which would simplify the device hardware to minimize costs.

### III.B. PROPOSED METHODOLOGY

Hydro power plants can be classified according to its capacity, head, purpose, facility types, hydrological radiation, and transmission system. Under the classification on capacity, the pico-hydro power generation system is appropriate and useful in local rural areas that needs only a little amount of electricity. Normally, pico-hydro power generation system can generate of under 5 kW. This system set-up is typically run-of-the-river, which uses pipes to divert the flow of water and can be found in rural areas.

The head and the flow are two important components needed in this particular system. The head component refers to the water pressure that determines the vertical fall of water. Also, this component develops an altitude for the water opening and turbine. The flow plays a vital part in harnessing the water power. It specifies the water quantity or the water flow rate. In a normal case, the maximum flow is calculated to be less than maximum stream flow. This proposed project will be implemented in the provinces of Fugato and Aurora in the Philippines because a continuous flow of water as a source is determined to power-up the Pelton turbine.

### Block Diagram

The entire system consists of an Arduino Uno, Power supply, Regulator, Battery, Water Turbine, LDR Sensor, Relay, Load, Water level indicator. The proposed system is based on the block diagram as shown in the figure.

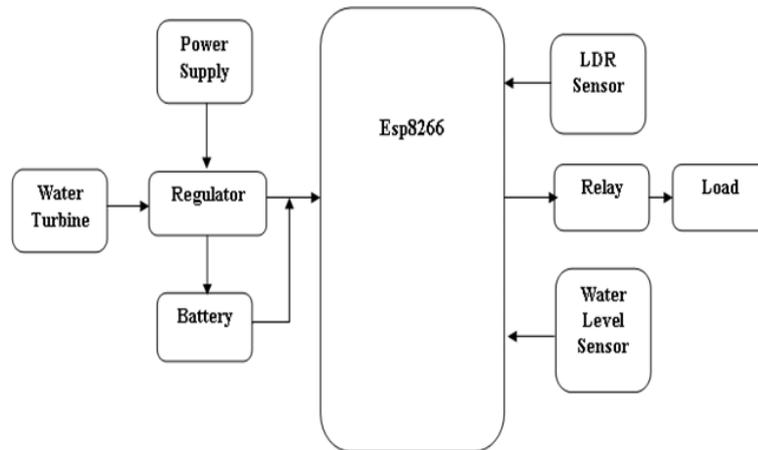


FIGURE 1. Block Diagram

#### IV. HARDWARE DESCRIPTION

##### Hardware Components

- Arduino UNO
- Relay
- Water Level Indicator
- LDR Sensor
- Water Turbine
- Power Supply

##### IV.A Arduino UNO

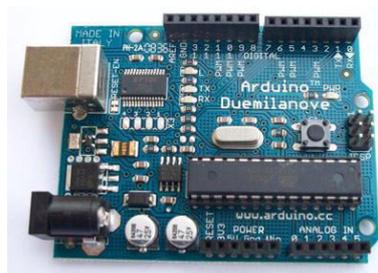


FIGURE 2. Arduino UNO

Arduino is an open source electronics platform accompanied with a hardware and software to design, develop and test complex electronics prototypes and products. The hardware consists of microcontroller with other electronic components which can be programmed using the software to do almost any task. The simplicity of the Arduino language makes it very easy for almost everyone who has an interest in electronics to write programs without the understanding of complex algorithms or codes.

Arduino is intended for an artist, tinker, designer or anyone, interested in playing with electronics without the knowhow of complex electronics and programming skills. Arduino is an excellent designed open source platform. It has specially designed boards which can be programmed using the Arduino Programming Language (APL).

The presence of Arduino is not only spreading between hobbyists, but it has also expanded its roots in industries and used by experts for making prototypes of commercial products. Arduino takes off the efforts required in complex coding and designing hardware.

The open source nature doesn't require any licenses to develop, use, redistribute or even sell the product. But the Arduino name is trade mark protected (Arduino™) i.e., you are free to sell the Arduino board under any other name however in order to sell it under the name "Arduino" you need to take permission from the founders and follow their quality terms.

The Software files which includes all the source code library are also open sourced. A user can modify them to make the project more versatile and improve its capabilities. This provides a strong online community support.

#### IV.B Relay

It can control high voltage electronic devices using relays. A Relay is actually a switch which is electrically operated by an electromagnet. The electromagnet is activated with a low voltage, for example 5 volts from a microcontroller and it pulls a contact to make or break a high voltage circuit.



FIGURE 3. Relay

We have those 2 sets of pins on the other side of the board. The first one has four pins, a ground and a VCC pin to control the module, and two In1 and In2 pins for input. The second set of pins has 3 pins between the JDVcc and the Vcc board, with a jumper. In such a configuration the relay's electromagnet is operated directly from the Arduino board, and if anything goes wrong with the relay the microcontroller may get hurt.

#### IV.C Water Level Indicator

Water sensor description: Water is first stored in an underground tank (UGT) in most buildings, and pumped from there to the overhead tank (OHT) on the roof. When their taps go dry, people usually switch on the pump and shut off the pump when the overhead tank begins to overflow. This results in the unnecessary wastage and sometimes non-availability of water in the case of emergency. Check out the Water level sensor circuit. The simple water level indicator circuit presented here makes this system automatic, i.e. it switches on the pump when the water level in the overhead tank goes low and switches it off as soon as the water level reaches a pre-determined level.

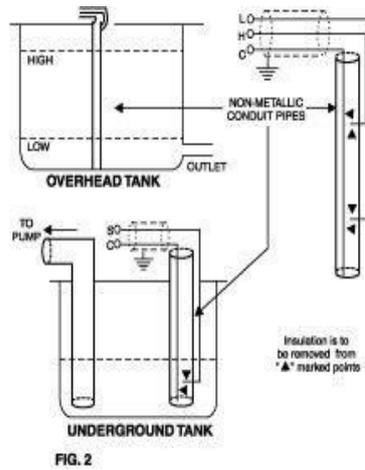


FIGURE 4. Water level indicator

IV.D LDR Sensor

A Light Dependent Resistor (also known as a photoconductor or photoresistor) is a device whose resistivity is a component of the electromagnetic radiation incident. Therefore, they are tools prone to light. They are often referred to as photoconductors, photoconductive cells or photocells.

These are made of high-resistance semi-conductor materials. There are several different symbols used to denote a photoresistor or LDR, the figure below shows one of the most widely used symbols. The arrow indicates light falling into it.

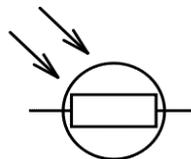


FIGURE 5. Pin Diagram

IV.E Water Turbine

Water wheels have been used for industrial control for hundreds of years. Their key shortcoming is scale, restricting the rate of flow and the head that can be harnessed. This took about a hundred years for the migration from water wheels to modern turbines. Progress took place during the Industrial Revolution, using the ideas and methods of science. They also made good use of the then emerging new materials and production methods.

The word turbine was introduced by the French engineer Claude Burdin in the early 19th century and is derived from the Greek word "τὺρβη" for "whirling" or a "vortex". The principal difference between early water turbines and water wheels is a water swirl part that transfers energy to a spinning rotor. The additional motion aspect allowed the turbine to be smaller than an equal-power water wheel. When spinning faster, they could handle more water, and mount even larger heads.

IV.F POWER SUPPLY

Power supply is a reference to an electric power source. A device or system that supplies an output charge or group of loads with electrical or other forms of energy is called a power supply unit or PSU. The term is most widely used for the supply of electrical energy, less often for mechanical equipment and seldom for others.

Electronic power supplies can be widely divided into linear and switching power supplies. Linear supply is a relatively simple design that becomes increasingly voluminous and heavy for high-current devices; poor efficiency can result in voltage control in a linear supply. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

#### IV. GLinear Power supply:

A linear power supply operated by AC typically uses a transformer to turn the voltage from the wall outlet (mains) into another, generally a lower voltage. When used to generate DC, a rectifier is used. The pulsating current from the rectifier is smoothed with a condenser. There will remain some slight, periodic deviations from smooth direct current, known as ripple. These pulsations occur at a frequency related to the AC power frequency (for example, a multiple of 50 or 60 Hz).

The voltage produced by an unregulated power supply can differ depending on the load and the variations in the voltage of the AC supply. A linear regulator will be used for Sensitive Electronics applications to control and adjust the voltage. This regulator would also substantially reduce the ripple and noise in direct current from the output. Also, linear regulators provide current limiting, shielding the power supply and the circuit connected from over-current. Adjustable linear power supplies are popular laboratory and service shop test equipment which allows a wide range of output voltages to be set. A bench power supply used by circuit designers for example can be adjustable up to 30 volts and up to 5 amperes output. For example, for applications needing a pulsed output, some can be powered by an external signal.

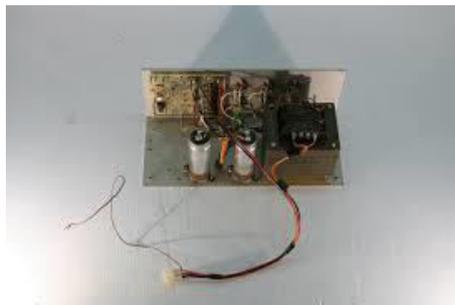


FIGURE 6. Linear Power Supply

#### IV.H Transformer

With no power loss, transformers convert AC electricity from one voltage to another. Transformers only operate with AC, and this is one of the reasons that power from the mains is AC. Step-up transformers raise voltage, and step-down transformers lower voltage. Most power supplies use a step-down transformer to lower to a safer low voltage the extremely high mains voltage (230V in UK). The input coil is called main, and secondary is the output coil.

#### IV.I Rectifier:

There are several ways that diodes can be connected to make a rectifier for converting AC to DC. The bridge rectifier is the most important one and it produces DC varying in full wave. If a centre-tap transformer is used, a full-wave rectifier may also be made from only two diodes, although this approach is seldom used now that diodes are cheaper. It is possible to use a single diode as a rectifier, but it only uses the positive(+) parts of the AC wave to generate half-wave DC.

## V. SOFTWARE REQUIRED

Arduino IDE

The Arduino Integrated Development Environment-or Arduino Software (IDE)-includes a text editor for code writing, a message area, a text screen, a toolbar with specific function buttons and a set of menus. It binds to and interacts with Arduino and Genuino Hardware to upload programs.

## VI. RESULTS AND DISCUSSION

Once the sensors exceed their threshold value then the LDR monitor shows the values. If the water level is high, the same mechanism is overhauled. The waste water flow can be exploited.

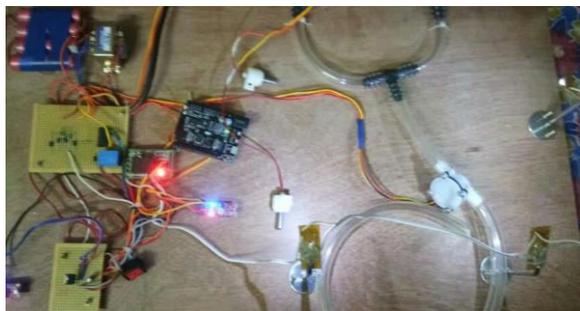


FIGURE 7. Implementation

## VII. ADVANTAGES

Clean Energy To generate energy regulate the flow of water through the turbines. Domestic energy source. Providing water and preventing flooding. Low maintenance costs, long service life and high reliability make them a very cost efficient and reliable source for generating electricity.

## VIII. CONCLUSION

A pico-hydro generation system shall be built as an alternative energy tool by collecting water from the residential buildings ' water tank. This could be a reliable and environmentally friendly source of energy which can be produced to establish hydrogenation of small scale. It is a very flexible power source that could be used even in remote areas across the globe to produce AC electricity.

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