ENERGY HARVESTING USING PIEZO-ELECTRIC AND VIBRATION TECHNIQUES

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ABSTRACT

the project deals with harvesting of the energy that is wasted during falling of water. The falling water energy is harvested by the use of piezoelectric transducer that is connected to the Arduino microcontroller. In this, the energy harvester consists of a piezoelectric film on an epoxy cantilever sandwiched between electrodes that are used to collect the generated power. The water falling on the structure creates and impulsive force that brings the internal lattice deformation, which causes the loss of symmetry and thus causes dipoles inside the material. This dipole in turn produces voltage on the electrodes. Mechanical vibrations follow the impact stress induced in the material, thus giving rise to the electrical force. This electrical source is stored in the battery for later use.

***Key Words*:** *Energy harvesting , Arduino, Piezoelectric, Dipoles, Battery.*

I. INTRODUCTION

Due to the over usage of the non-renewable energy, there might be a scenario where it will be completely depleted. Therefore now a day's people prefer clean and safe energy. This clean power is obtained by the use renewable energy sources like solar, wind, or hydroelectric energy. Another booming technology that is preferred these days is piezoelectric energy. This energy is obtained by inducing stress on a piezoelectric material which thereby converts it into electrical energy. This principle is called as piezoelectric principle.

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II. PROPOSED SYSTEM

The energy harvester consists of a piezoelectric film on an epoxy cantilever sandwiched between electrodes that are used to collect the generated power. A water drop falling on the structure creates an impulsive force that brings the internal lattice structure of the piezoelectric element to deform, causing the loss of symmetry, and therefore the generation of small dipoles, which global effect is an impulsive voltage on the electrodes. The generated electrical energy are viewed on the LCD. The produced DC energy is fed to the ultra-low power convertor. The ultra-low power capacitor reduces the discharging time; hence the battery time is longer. The stored DC energy is converted to AC voltage and used for home application.

III. EXISTING SYSTEM

The Existing System is Energy harvesting sources, including solar, wind and thermal each with a different optimal size. They either waste much available energy due to impedance mismatch, or they require active digital control that incurs overhead, or they work with only one specific type of source. Using solar energy can have a positive, indirect effect on the environment when solar energy replaces or reduces the use of other energy sources that have larger effects on the environment. However, some toxic materials and chemicals are used to make the photovoltaic (PV) cells that convert sunlight into electricity. Some solar thermal systems use potentially hazardous fluids to transfer heat.

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IV. SYSTEM ARCHITECTURE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

V. HARDWARE DESCRIPTION

Arduino UNO:

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

It is powered by USB and the inputs to the Arduino board are provided by the user through a personal computer or by using a laptop. The programming language that is used to code is C.

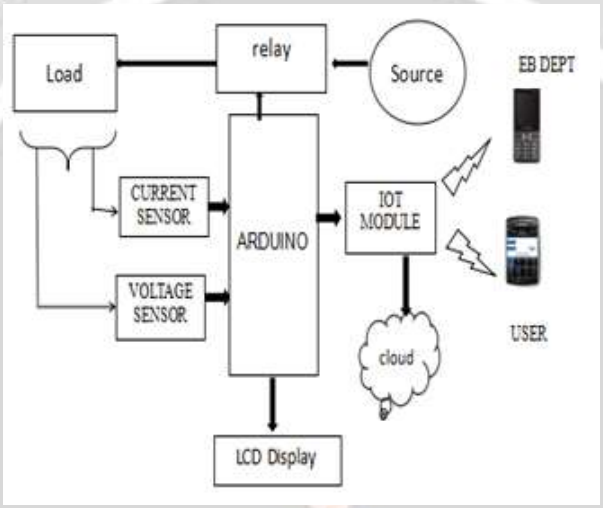

FIGURE.1. BLOCK DIAGRAM

VI. TECHNICAL DESCRIPTION

ATmega 328

The **ATmega328** is a single-chip microcontroller created by Atmel in the megaAVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core..

GPU (Graphics Processing Unit)

• Dual Core Video Core IV® Multimedia Co-Processor. Provides Open GL ES 2.0, hardware-accelerated Open VG, and 1080p30 H.264 high-profile decode.

• Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure

Memory

• 1GB LPDDR2

Operating System

• Boots from Micro SD card, running a version of the Linux operating system or Windows 10 IoT

Power

• Micro USB socket 5V1, 2.5A

Arduino

• Next Generation QUAD Core Broadcom BCM2837 64bit ARMv7 processor
• Processor speed has increased from 900MHz on Pi 2 to 1.25Ghz on the Arduino UNO
• BCM43143 Wi-Fi on board
• Bluetooth Low Energy (BLE) on board

• Upgraded switched power source up to 2.5 Amps (can now power even more powerful devices over USB ports)

Figure.2. Arduino UNO

SoC Built specifically for the new UNO, the Broadcom BCM2837 system-on-chip (SoC) includes four high-performance ARM Cortex-A53 processing cores running at 1.2GHz with 32kB Level 1 and 512kB Level 2 cache memory, a VideoCore IV graphics processor, and is linked to a 1GB LPDDR2 memory module on the rear of the board.

GPIO The 14 digital input/output pins can be used as input or output pins by using pinMode(), digitalRead() and digitalWrite() functions in Arduino programming. Each pin operate at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 KOhms which are disconnected by default.

USB chip The Arduino UNO shares the same SMSC LAN9514 chip as its predecessor, the Arduino, adding 10/100 Ethernet connectivity and four USB channels to the board.

As before, the SMSC chip connects to the SoC via a single USB channel, acting as a USB-to-Ethernet adaptor and USB hub.

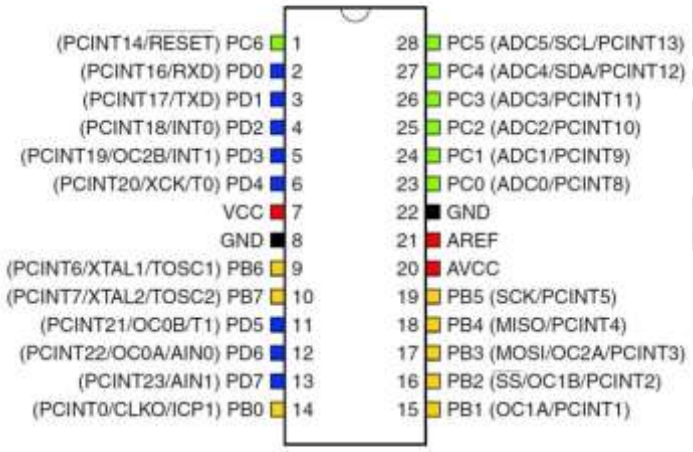

Figure.3. Pin Configuration

VII. SOFTWARE DESCRIPTION

Embedded C

Embedded C is a set of language extensions for the C Programming the C standards committee to address commonality issues that exist between C extensions for different embedded systems. Historically, embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed point arithmetic, multiple distinct memory banks and basic input output operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing. Embedded C use most of the syntax and semantics of standard C, e.g., main () function, variable definition, data type declaration, conditional statements (if, switch. case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, unions, etc.

VIII. WORKING MODULE

The water that falls on the piezoelectric material causes mechanical disturbances in the crystal. This disturbance causes disturbances in the dipole. This change in dipole causes and voltage signal. This change in voltage causes an electrical signal.

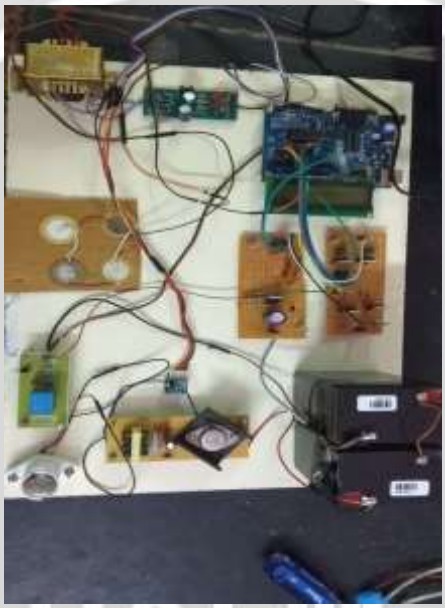

Figure.4. Hardware

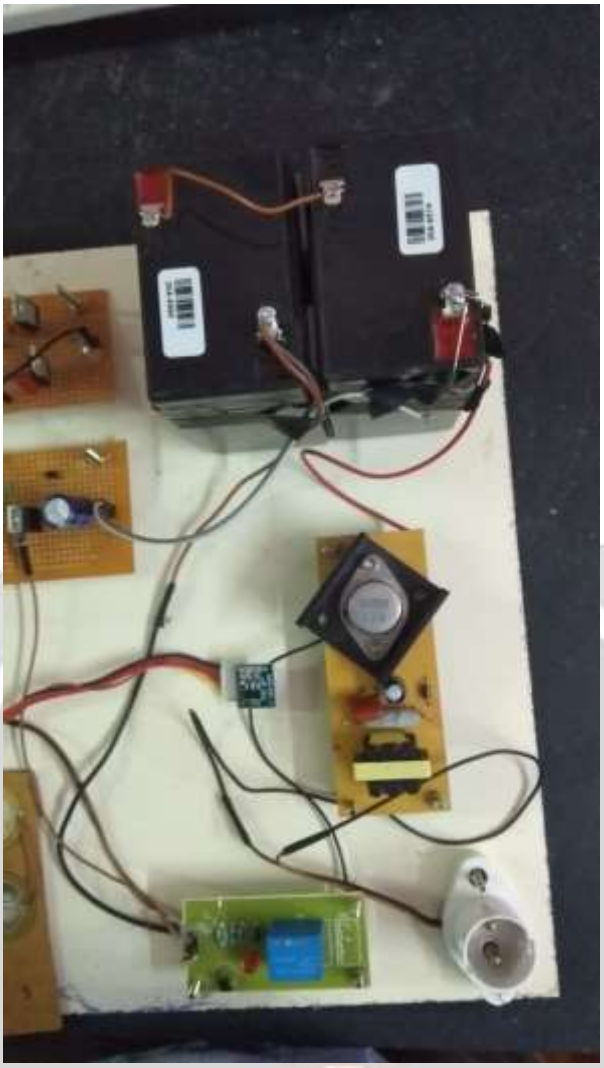

Figure.5. Image showing Unknown Interruption

IX. ADVANTAGES OF THE PROPOSED SYSTEM

- It offers reliability.
- Easy Energy Harvesting.
- Produce electricity

X. REFERENCE

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