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Design of LASER Guided Digital Flood Gauge

Pranav Navathe[1], Sayanna G[2], Sushma yanampally[3]

U.G Student, Department of Mechanical Engineering, KCEA, Nizamabad, India [1]

Associate professor, Department of Mechanical Engineering, KCEA, Nizamabad, India[2]

U.G Student, Department of Civil Engineering, KCEA, Nizamabad, India[3]

Abstract: It works on the principle of time of flight, when a laser beam is subjected to an object it used to find the range of an object by sending a laser pulse in a narrow beam towards the object and measuring the time taken by the pulse to be reflected off the target and returned to the sender, The returned pulse is calculated in terms of measuring signals. The project laser guided digital flood gauge is a device which used to find water level or flood level in the dam by fixing sliding floater in a dam water parallel to laser range finding sensor at a certain distance and measuring values are calibrated in microcontroller basing on normal water level of dam, so that raise and fall of water level in dam is measured in the form laser pulse signals later which is sent to the microcontroller then signals are converted into measuring values and will be indicated on a digital indicating display.

Keywords: Time of flight, Sliding floater, Laser range finding sensor, Digital indicating display.

I. INTRODUCTION

Flood stage is the level at which a body of water's surface has risen to a sufficient level to cause sufficient inundation of areas that are not normally covered by water, causing an inconvenience or a threat to life and/or property. When a body of water rises to this level, it is considered a flood event. Thus to measure this flood event an instrument is used which is named as flood gauge. By using flood gauge in dams the water level is manually noted by observer with the help of scale readings.

Fig.1.1: Flood Gauge

II. A. PROBLEM IDENTIFICATION

- To avoid manual scale reading operation.
- To increase rate of measuring accuracy.
- To digitize operation.

B. SOLUTION TO THE PROBLEM

- In this laser guided digital flood gauge the rate of measuring accuracy is high.
- Independent of environmental conditions.
- Automated and digitalized in operation.

III. PROJECT EXPLANATION

A. What is time of flight?

Time of flight (TOF) is a property of an object, particle or acoustic, electromagnetic or other wave. It is the time that such an object needs to travel a distance through a medium. The measurement of this time (i.e. the time of flight) can be used for a time standard (such as an atomic fountain), as a way to measure velocity or path length through a given medium, or as a way to learn about the particle or medium (such as composition or flow rate). The travelling object may be detected directly (e.g., ion detector in mass spectrometry) or indirectly (e.g., light scattered from an object in laser Doppler velocimetry).

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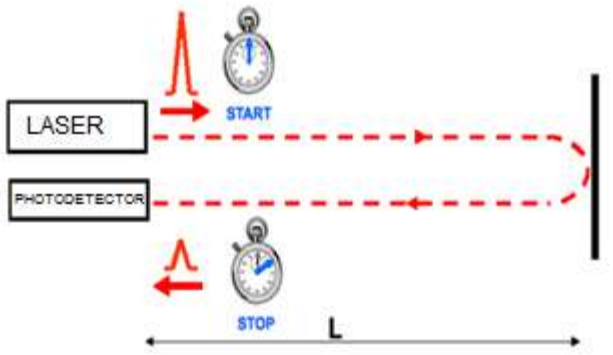

Fig: 3.1: Time of Flight (TOF)

In electronics, the TOF method is used to estimate the electron mobility. Originally, it was designed for measurement of low-conductive thin films, later adjusted for common semiconductors. This experimental technique is used for metal-dielectric-metal structures as well as organic field-effect transistors. The excess charges are generated by application of the laser or voltage pulse. In time-of-flight mass spectrometry, ions are accelerated by an electrical field to the same kinetic energy with the velocity of the ion depending on the mass-to-charge ratio. Thus the time-of-flight is used to measure velocity, from which the mass-to-charge ratio can be determined by that velocity of electron is measured.

B. What is LASER?

A laser is a coherent and focused beam of photons (coherent, in this context, means that it is all one wavelength, unlike ordinary light which showers on us in many wavelengths),The term "laser" originated as an acronym for "light amplification by stimulated emission of radiation".

Lasers are distinguished from other light sources by their coherence. Spatial coherence is typically expressed through the output being a narrow beam, which is diffraction-limited. Laser beams can be focused to very tiny spots, achieving a very high irradiance, or they can have very low divergence in order to concentrate their power at a great distance. Temporal (or longitudinal) coherence implies a polarized wave at a single frequency whose phase is correlated over a relatively great distance (the coherence length) along the beam. A beam produced by a thermal or other incoherent light source has an instantaneous amplitude and phase that vary randomly with respect to time and position.

C. General review of LASER guided digital flood gauge

The innovation related to digital flood gauge as particular application of measurement of water level in a dam, this gauge consists of laser guided range finder which is used to find the distance between sliding floater in a dam and fixed range sensor at certain height, as the level of water in a dam varies the distance between floater and range sensor increase or decreases then the rate of TOF of laser decreases or increases such that pulses varies with respect to time this pulse is sent to microcontroller which are calibrated into measuring values and displayed LCD display.

D. The parts used in LASER guided digital flood gauge

1. LASER range finding sensor
2. Sliding floater
3. Arduino UNO (Microcontroller Unit)
4. Digital indicator(LCD Display)

E. Description of parts:

1) LASER range finding sensor-

A laser range finding sensor is a rangefinder which uses a laser beam to determine the distance to an object. The most common form of laser rangefinder operates on the time of flight principle by sending a laser pulse in a narrow beam towards the object and measuring the time taken by the pulse to be reflected off the target and returned to the sender. The precision of the instrument is determined by the rise or fall time of the laser pulse and the speed of the receiver. One that uses very sharp laser pulses and has a very fast detector can range an object to within a few millimetres

Fig.3.2: SF11-C range finder

SF11-C is an ideal laser altimeter for UAVs, such as the ELEV-8 v3 Quad copter Kit. It can also serve as a highly effective rangefinder in a variety of applications. Its time-of-flight system makes accurate distance measurements that are not affected by speed, wind, changes in barometric pressure, noise, ambient light, or air temperature.

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2) Sliding floater-

Sliding Floater is plastic matter that can float on the surface of water on the principle of Archimedes buoyancy. This principle states that buoyant force what keeps the body float is equal to the weight of water that is displaced when the body enters into the water. If the weight of displaced water is at least equal to the weight of the body, the body will float.

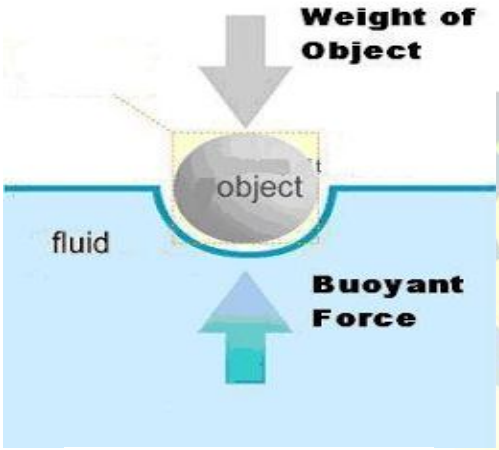

Fig.3.3: Archimedes' buoyancy principle

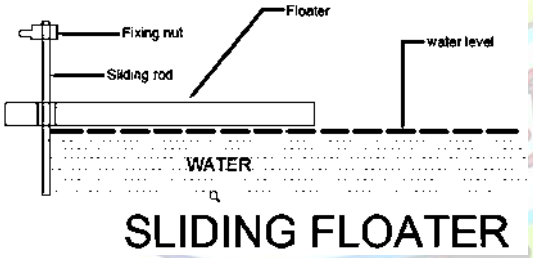

Fig.3.4: Sliding floater

Sliding floater consists of sliding rod and floating plastic body as increasing or decreasing of water level floater slides up and down.

3) Arduino UNO(Microcontroller unit)-

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply by connecting it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

By using Arduino UNO (microcontroller unit) the returned laser pulse basing on frequency is calibrated into measuring digital values by microcontroller depending upon programmed instructions.

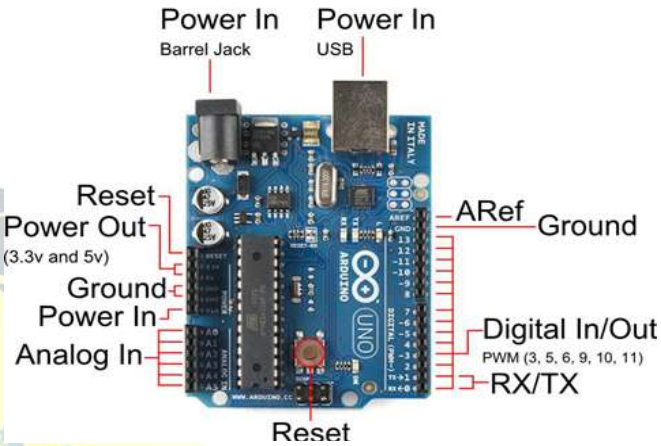

Fig.3.5: Arduino UNO

4) Digital indicator(LCD Display)-

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals.

Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and seven segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

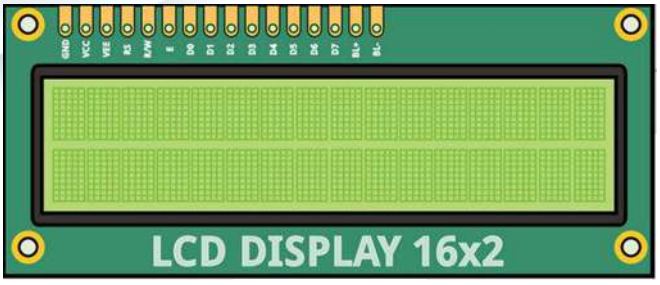

Fig.3.6: LCD Display

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The calibrated digital values which is obtained from microcontroller is displayed in LCD Display 16*2. Such observer can note readings accurately.

F. Block diagram of LASER guided digital flood gauge

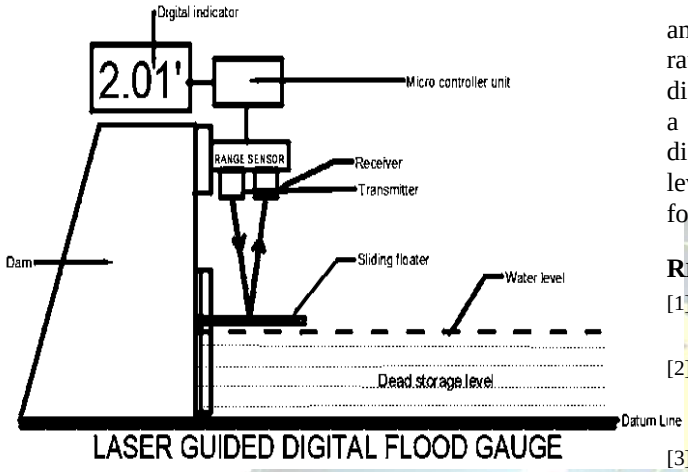

Fig.3.7: LASER guided digital flood gauge

G. Advantages-

a) Operation is automated.

b) Not effected to environment.

c) Rate of time response is high

d) Measuring accuracy is high.

H. Disadvantages-

a) Initial cost is high.

b) Need electricity for operation.

IV. FUTURE DEVELOPMENTS

i. By using laser guide digital flood gauge we can develop flood warning system (whenever increases in flood event or water level of dam by setting alarm automated).

ii. Flood measurement is done by using IOT (Internet of things), we can view water level in dam from anywhere in the world with the help of internet in smart phone or pc by entering into referral site.

iii. We can develop NEON CODE reading system with help of mobile application by scanning attached NEON CODE near dam with mobile it is easily get to know about water level in the dam.

iv. By using wireless radio signals operator in control cabin can easily monitor water level in dam.

V. CONCLUSION.

In this fast growing world every operation is digitalized and automated, so there is a need of increasing accuracy and rate of response to adopted technology. Thus LASER guided digital flood gauge is a device which measures water level in a dam accurately and rate of time response is very high, digitized in operation such that it is easy to register flood level in dam and helps to save time which is more precious for a flood controller.

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BIOGRAPHY

First Author
Pranav Navathe
U.G student
Email: pranavnavathe@gmail.com

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Department of Mechanical Engineering
Kshatriya college of engg, Armoor, Telangana, India.

Second Author
G.sayanna
Associate professor
Department of Mechanical Engineering
Kshatriya college of engg, Armoor, Telangana, India.

Third Author
Sushma yanampally
U.G student
Department of Civil Engineering
Kshatriya college of engg, Armoor, Telangana, India.