WATER BOTTLE FOR KIDS

INNOVATIVE AND CREATIVE PROJECT REPORT

Submitted by

S. RAJADURAI	**19BEC034**
N. DHINESH	**19BEC042**
V. SELVARAJ	**19BEC064**

in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

Dr. MAHALINGAM COLLEGE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution

Affiliated to ANNA UNIVERSITY

CHENNAI - 600 025

JUNE 2022

Dr. MAHALINGAM COLLEGE OF ENGINEERING AND TECHNOLOGY, POLLACHI -642 003

(An Autonomous Institution Affiliated to Anna University, Chennai - 600 025)

BONAFIDE CERTIFICATE

Certified that this project report titled **"water bottle for kids"** is

the bonafide work of

S. RAJADURAI	**19BEC034**
N. DHINESH	**19BEC042**
V. SELVARAJ	**19BEC064**

who carried out the project work under my supervision.

Dr. R. SUDHAKAR M.E., Ph.D.,

PROFESSOR AND HEAD
Department of ECE
Dr. Mahalingam college of
Engineering and Technology
Pollachi- 642003

K.R GOKUL ANAND M.E.,

SUPERVISOR
Assistant Professor
Department of ECE
Dr. Mahalingam college of
Engineering and Technology
Pollachi- 642003

Submitted for the Autonomous End Semester Innovative and Creative project Viva-Voce Examination held on ___________________

INTERNAL EXAMINER -I **INTERNAL EXAMINER -II**

ABSTRACT

Right amount of water is needed for every human to live a healthy life. Adults consume the water their body needs but incase of kids its essential for kids to be remainded. Water is an essential nutrient for human health. However, individuals may ignore drinking enough water due to the rush of everyday life. Although these facts are known to many, recent studies indicate that we tend to ignore drinking enough water required for our body. Our system will be helpful in intimating the kids to drink water at right interval of time and indicates the level of water present inside it without opening the bottle. This will increase the consumption of water.

ACKNOWLEDGEMENT

We wish to express our sincere thanks to all who have contributed to do this project through their support, encouragement and guidance.

We extend our gratitude to our management for having provided us with all facilities to build my project successfully. We express our sincere thanks to our honourable Secretary, **Dr.C.Ramaswamy, M.E., Ph.D., F.I.V**., for providing the required amenities.

We take this opportunity to express our deepest gratitude to our principal **Dr.A.Rathinavelu, M.Tech., Ph.D.,** who provide suitable environment to carry out the project.

We express our extreme gratefulness to **Dr.R.Sudhakar, M.E., Ph.D.,** Professor and Head of the department of Electronics and Communication Engineering, for his constant support and encouragement.

We wish to express our deep sense of gratitude and thankfulness to my project guide **K.R.Gokul Anand,** for the valuable suggestion and guidance offered during the course of the project.

Finally, we are committed to place our heartfelt thanks to all those who had contributed directly and indirectly towards the success of the completion of this project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

PWM	PULSE WIDTH MODULATION
SPI	SERIAL PERIPHERAL INTERFACE
TWI	TWO WIRE INTERFACE
AREF	ANALOG REFERENCE
CHF	CONGESTIVE HEART FAILURE
IDE	INTEGRATED DEVELOPMENT ENVIRONMENT
GND	GROUND
SDA	SERIAL DATA
SCL	SERIAL CLOCK PIN
INT	INTERRUPT

CHAPTER 1

1.1 INTRODUCTION

Exponential growth of the number of physical objects connected to the Internet, also known as Internet of Things or IoT, is expected to reach 50 billion devices by 2020. New applications include smart homes, transportation, healthcare, and industrial automation. Smart objects in our environment can provide context awareness that is often missing during monitoring of activities of daily living. Smart objects equipped with physiological and activity sensors, that we call SmartStuff provide new opportunities for unobtrusive physiological monitoring. Integration of SmartStuff with wearable body sensor networks is facilitated with smartphones and smartwatches. New generations of smartwatches, such as Basis Peak or Apple Watch, feature continuous measurement of physiological parameters, such as heart rate, galvanic skin resistance (GSR), and temperature. Smartwatches can also receive messages and notifications that are very important for ubiquitous health monitoring applications. Smart sensors and smart environments facilitate one of the main trends in big data science – the quantified self (QS). The QS community is engaged in self tracking or group tracking of physiological, behavioral, and environmental information. New sensors and systems enable seamless collection of records and integration in databases that can facilitate data mining and new insights. This trend is further supported by establishment of the standard toolsets, such as Apple HealthBook, Google Fit, Samsung S.A.M.I, and Microsoft Healthvault. Big Data analytics can support personalized health monitoring and interventions. One of the most important factors for health and wellbeing is proper hydration. Water makes up 60% of our body, 75% of our brain, and 83% of our blood. An intelligent hydration monitoring and management platform can provide automatic, accurate, and reliable monitoring of fluid consumption and provide configurable advice for optimum personalized hydration management. A smart water bottle can satisfy the needs of a variety of groups, including athletes that want to enhance performance, dieters that want to achieve their weight goals, as well as elderly in group homes or living alone that often suffer from dehydration. While most users who seek to improve their wellness have insufficient liquid intake, some medical applications require limiting of water intake. Typical examples include kidney disease and congestive heart failure (CHF) patients that need to comply with recommended water intake protocols and limit the total amount of liquid taken during the day while still taking liquids regularly throughout the day. An integrated hydration management platform enables users to receive alerts and reminders of when to drink, set goals for how much to drink, show current and previous consumption levels, and where they are vis-à-vis their individual hydration goals at any moment in time. The first intelligent water bottle on the market was Hydra Coach. The bottle features a display that presents hydration information, but no wireless connectivity. The new generation of bottles, such as HydrateMe and Trago feature Bluetooth wireless interfaces and custom smartphone and smartwatch applications. This paper presents preliminary results of the sensor enabled smart water bottle for kids. We present system architecture, possible applications, and preliminary performance analysis of the implemented prototype. Water is a vital nutrient for our mental and physical health. Dehydration, i.e., not having enough water, can cause symptoms such as headache, fatigue, disorder in blood pressure, urinary infections, muscle and skin problems. Although these facts are known to many, recent studies indicate that we tend to ignore drinking enough water required for our body. For example, the results of two surveys conducted in the US showed that more than 30 percent of adults and almost 50 percent of children and adolescents are inadequately dehydrated. Thus, it is key to remind people to drink water regularly to prevent the negative effects of dehydration. This situation provides a great opportunity for changing user behavior through technology. Addressing this, we first designed a smart bottle concept which indicate us to intake water daily and gives positive feedback to motivate drinking water regularly.

CHAPTER 2

2.1 HARDWARE COMPONENTS

2.1.1 ARDUINO UNO:

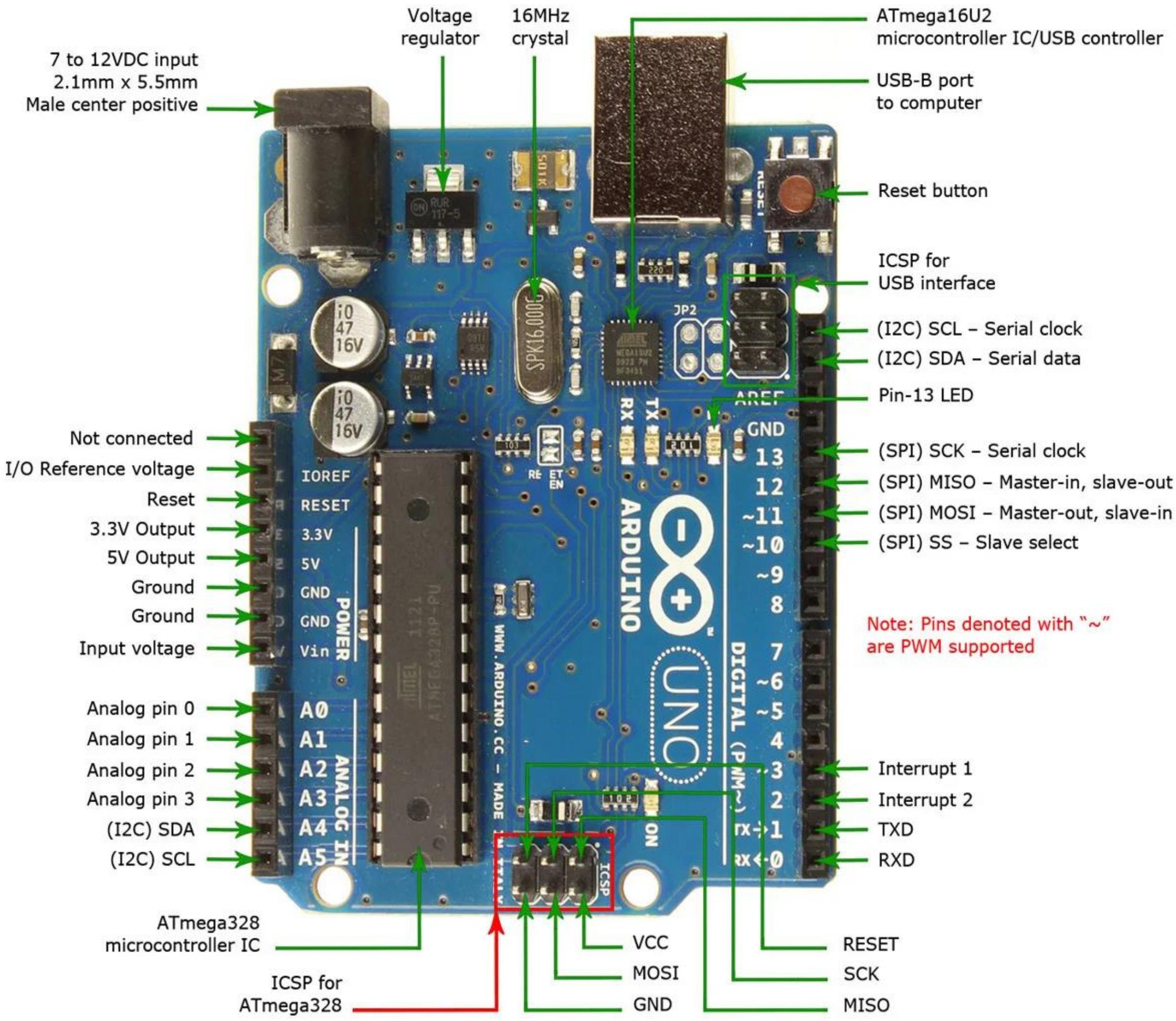


Figure 2.1.1

The Arduino is a open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery**.**

General pin functions

- **LED**: There is a built-in LED driven by digital pin 13. When the pin is high value, the LED is on, when the pin is low, it is off.
- **VIN**: The input voltage to the Arduino/Genuino board when it is using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V**: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3**: A 3.3-volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND**: Ground pins.
- **IOREF**: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source, or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset**: Typically used to add a reset button to shields that block the one on the board.

Special pin functions

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control (using pinMode (), digitalWrite (), and digitalRead () functions). They operate at 5 volts. Each pin can provide or receive 20 mA as the recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50K ohm. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e., 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analogReference () function.

In addition, some pins have specialized functions:

- **Serial / UART:** Pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL serial chip.
- **External interrupts**: Pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM** (pulse-width modulation): Pins 3, 5, 6, 9, 10, and 11. Can provide 8-bit PWM output with the analogWrite () function.
- **SPI** (Serial Peripheral Interface): Pins 10 (SS), 11 (MOSI), 12 (MISO), and 13 (SCK). These pins support SPI communication using the SPI library.
- **TWI** (two-wire interface) / I²C: Pin SDA (A4) and pin SCL (A5). Support TWI communication using the Wire library.
- **AREF** (analog reference): Reference voltage for the analog inputs.

2.1.2 NON-INVASIVE SENSOR

An intelligent non-contact liquid level sensor adopts advanced signal processing technology and a high-speed signal processing chip and it won't be influenced by container wall thickness when detecting the liquid level in an airtight container. The liquid level sensor is installed under the container (high level and low level). No need to bore a non-metallic container, easy to install. It can detect liquid levels of various toxic substances, acid, alkali, and all kinds of liquid in high-pressure airtight containers. It can be widely used and has no special requirement for the liquid medium and material of the container.

This Module has 4 wires:

- **VCC**: Module power supply – 5V to 24V
- **OUT:** Sensor Output
- **GND**: Ground
- **Mode**: Mode pin (If it is Low, the output will be Active Low and if it is High, output will be Active High. If it is not connected, the output remains Active High)

Applications:

1. Water tower
2. Sewage treatment
3. Drone irrigation
4. Medical equipment
5. Aquarium
6. Smart Appliances

Figure 2.1.2

Features:

1. The non-contact liquid level sensor is applicable to non-metallic containers without direct contact with the liquid, not affected by scale or other impurities.
2. High stability, high sensitivity.
3. Compatible with most 5 ~ 12V power adapters.

2.1.3 POTENTIOMETER

Figure 2.1.3

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.

Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

2.1.4 BUZZER

Figure 2.1.4

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke**.**

Electromechanical

Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz (the contacts buzz at line frequency if powered by alternating current) Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made.

Mechanical

A joy buzzer is an example of a purely mechanical buzzer and they require drivers. Other examples of them are doorbells.

Piezoelectric

A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep. A piezoelectric buzzer/beeper also depends on acoustic cavity resonance or Helmholtz resonance to produce an audible beep.

2.1.5 LED (FOUR-PIN COMMON ANODE)

Figure 2.1.5

The popular RGB, 4-pin, LED allows generation of colors across the visible spectrum. The 4-pin package is most commonly seen on RGB (red-green-blue) LEDs. Common cathode and common anode versions are available. To light up a common anode RGB LED, you have to connect its common terminal to the positive terminal of the power source. Then to light up the RED color, connect the RED color terminal to the negative terminal of the power source.

Common anode means that the anode (positive) side of all of the LEDs are electrically connected at one pin, and each LED cathode has its own pin. So turning on any particular segment will involve running a current from this common anode (positive) pin to the particular cathode (negative) pin for the desired segment.

Common Anode displays have all the LED Anodes connected together and need a display driver with outputs which become low to turn each segment on. Common Cathode displays have all the LED cathodes connected together and need a driver with outputs that become high to turn each segment.

2.1.6 GYRO SENSOR

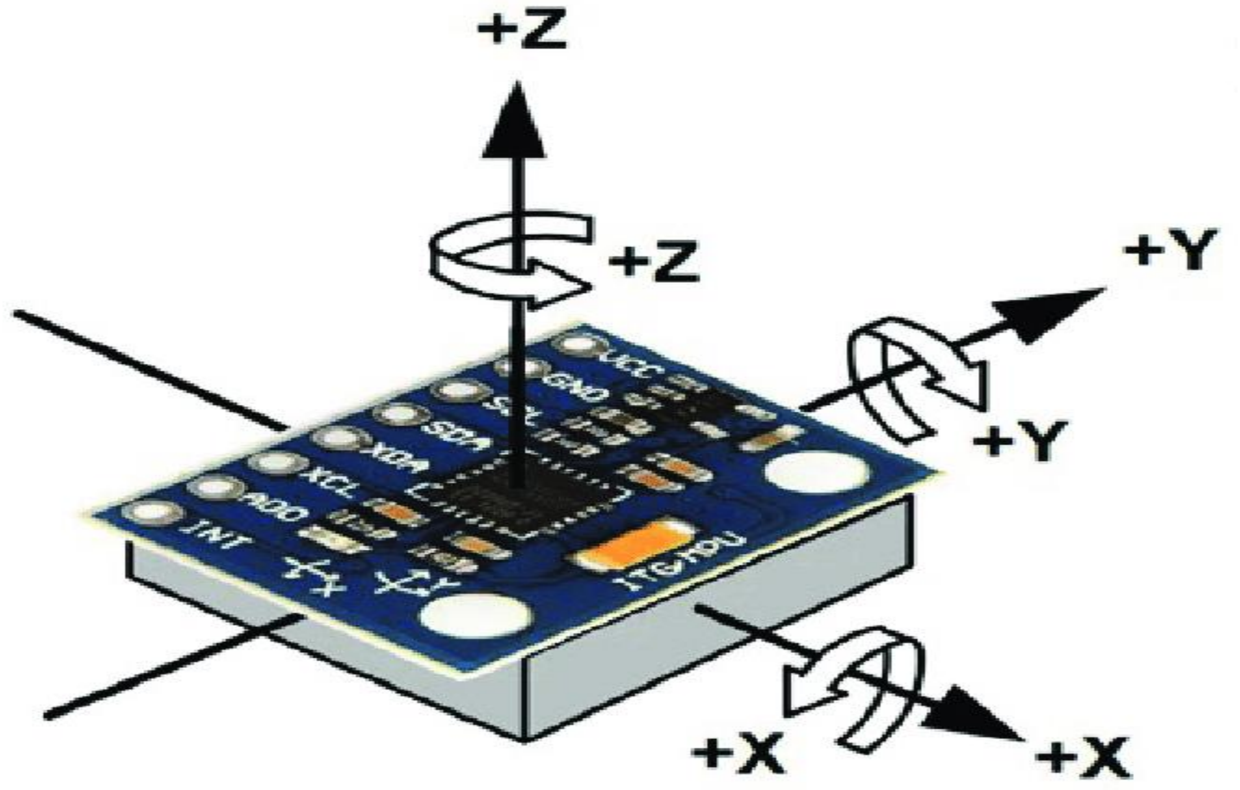


Figure 2.1.6

A gyroscope (from Ancient Greek γῦρος *gûros*, "circle" and σκοπέω *skopéō*, "to look") is a device used for measuring or maintaining orientation and angular velocity. It is a spinning wheel or disc in which the axis of rotation (spin axis) is free to assume any orientation by itself. When rotating, the orientation of this axis is unaffected by tilting or rotation of the mounting, according to the conservation of angular momentum.

Gyroscopes based on other operating principles also exist, such as the microchip-packaged MEMS gyroscopes found in electronic devices (sometimes called gyrometers), solid-state ring lasers, fibre optic gyroscopes, and the extremely sensitive quantum gyroscope.

Applications of gyroscopes include inertial navigation systems, such as in the Hubble Space Telescope, or inside the steel hull of a submerged submarine. Due to their precision, gyroscopes are also used in gyrotheodolites to maintain direction in tunnel mining. Gyroscopes can be used to construct gyrocompasses, which complement or replace magnetic compasses (in ships, aircraft and spacecraft, vehicles in general), to assist in stability (bicycles, motorcycles, and ships) or be used as part of an inertial guidance system.

2.1.7 FLEX SENSOR

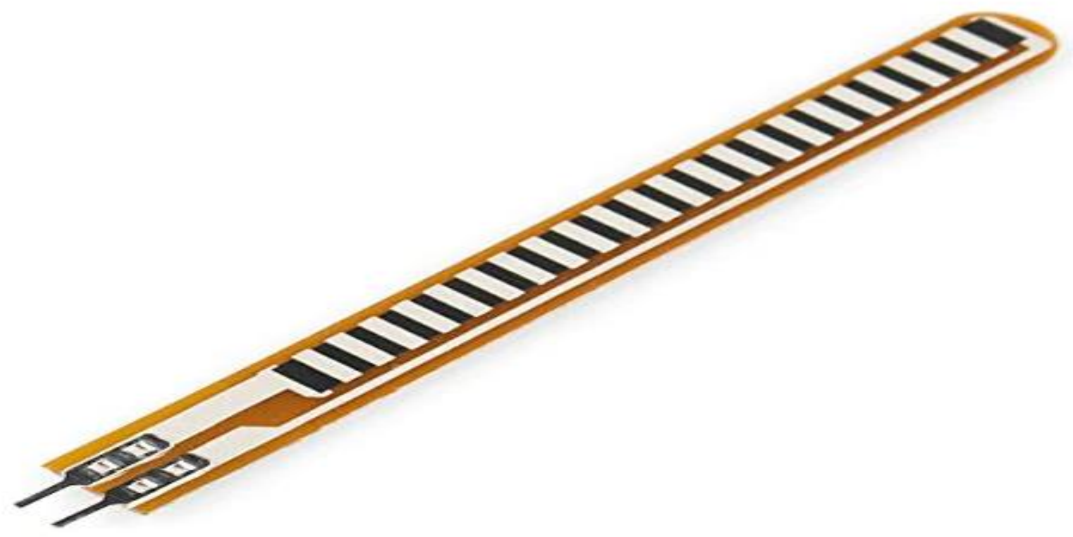


Figure 2.1.7

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface. Since the resistance is directly proportional to the amount of bend it is used as goniometer, and often called flexible potentiometer.

Flex sensors are used in wide areas of research from computer interfaces, rehabilitation, security systems and even music interfaces. It is also famous among students and hobbyists.

Human Machine Interface devices

A dataglove is human-computer interaction device that is made possible by flex sensors. Deflections of a dataglove are measured is via flex sensors embedded in the glove.

Rehabilitation Research

In rehabilitation research, wired gloves or datagloves are used to record joint movement.

Security Systems

Movement of doors is monitored by placing the sensor at the hinge. Also, damage to metal structures can be identified using the sensor.

2.2 SOFTWARE COMPONENTS

2.2.1 ARDUINO IDE SOFTWARE

The Arduino IDE is an open-source software. 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 hardware to upload programs and communicate with them.

The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++.

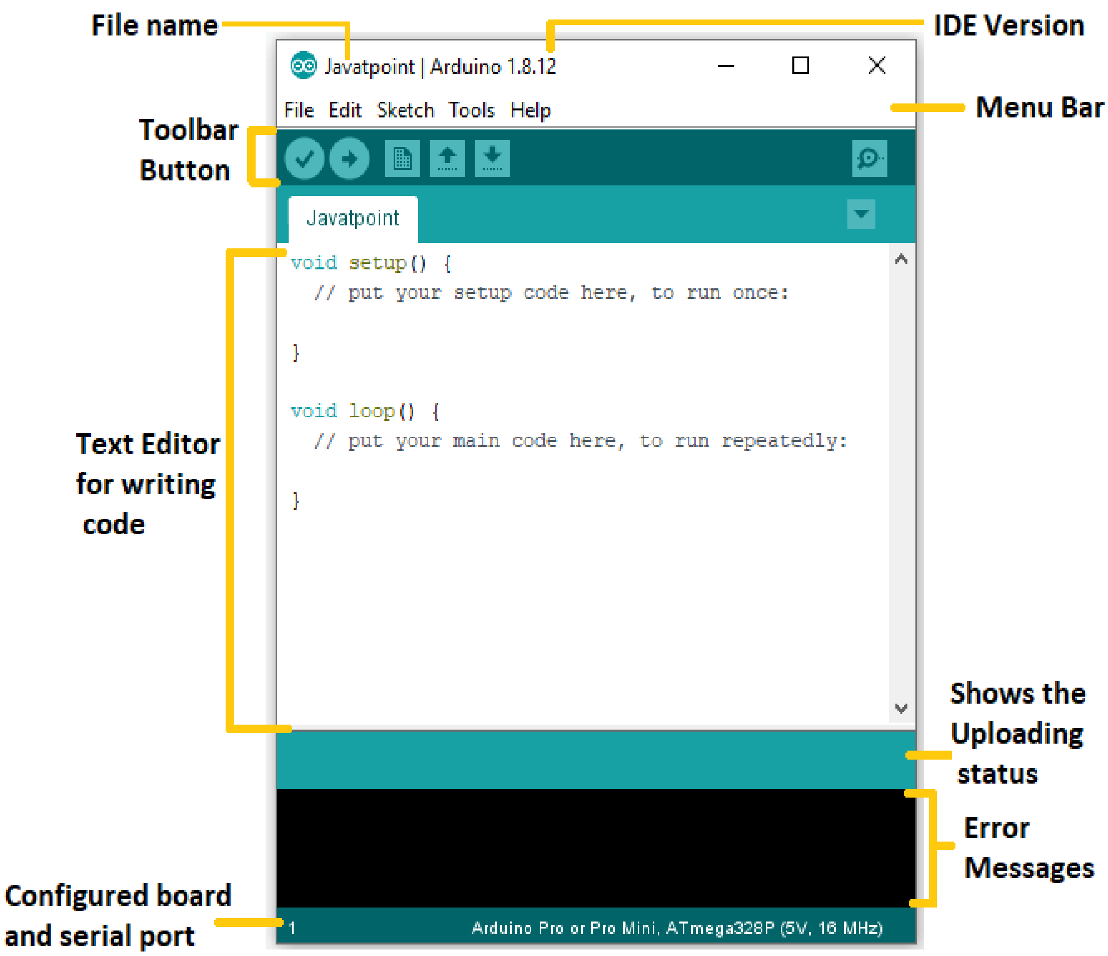


Figure 2.2.1

CHAPTER 3

WORKING

3.1 NON-INVASIVE SENSOR WITH ARDUINO

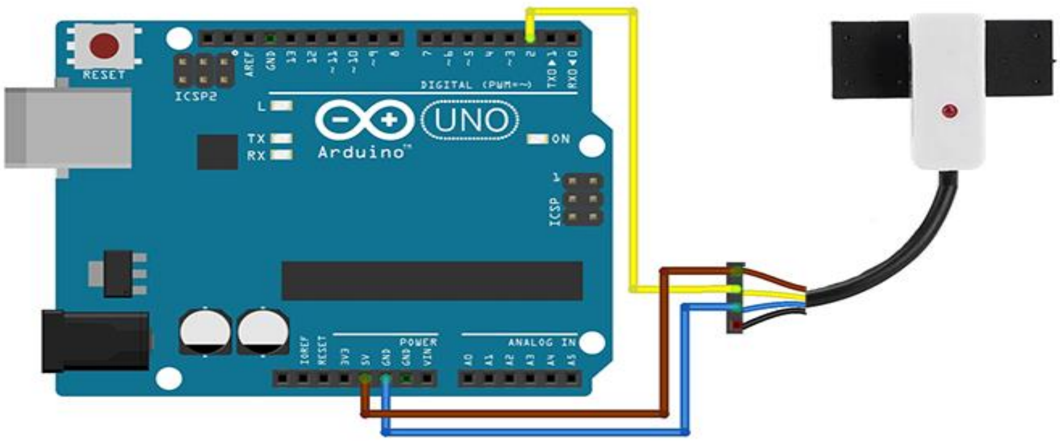


Figure 3.1

Connections were made according to the circuit diagram

- **VCC**: Module power supply – 5V to 24V – Brown
- **OUT:** Sensor Output – Yellow
- **GND**: Ground – Blue
- **Mode**: Mode pin (If it is Low, the output will be Active Low and if it is High, output will be Active High. If it is not connected, the output remains Active High.

3.2 FLEX SENSOR WITH ARDUINO

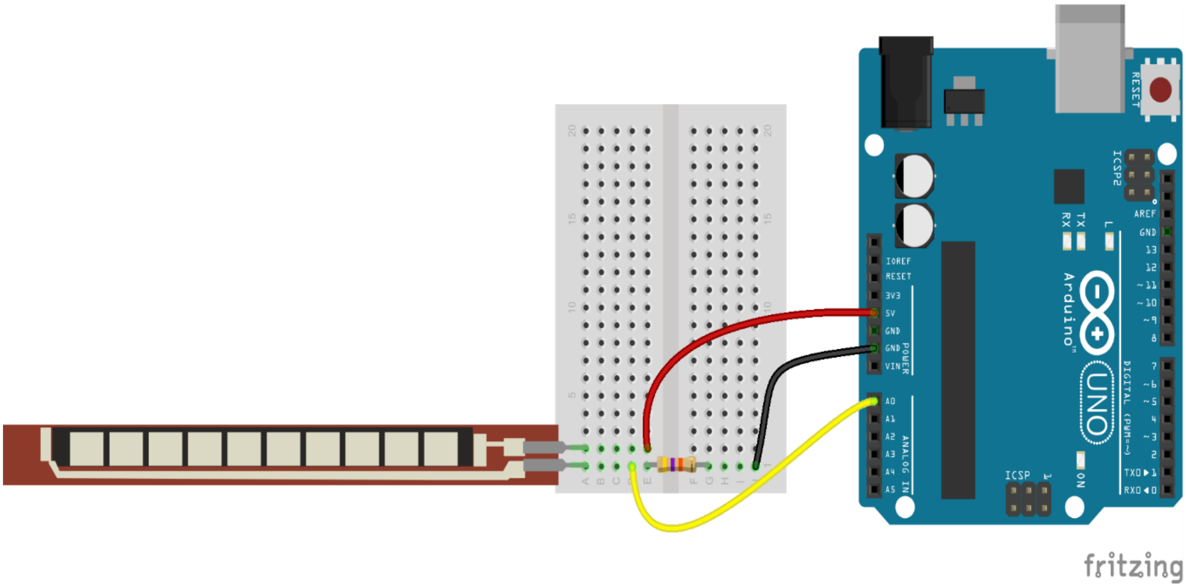


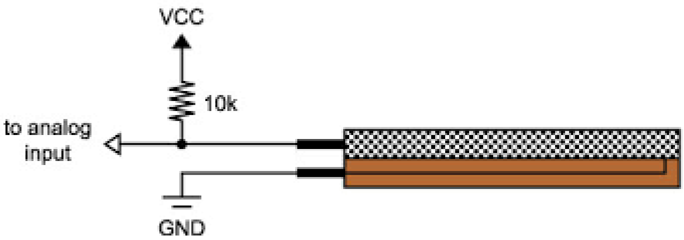
Figure 3.2

Connecting Flex Sensor with Arduino

As the flex sensor is a variable resistor, we cannot connect it directly to Arduino. We need a voltage divider circuit. The first resistor will be fixed one. The value of the resistor must be equal to the max resistance value of flex sensor.

Pin Configuration

Basically Flex sensor is a two terminal resistor type. So, it is not a polarized terminals like diode.



PIN-1: Connected to positive of power supply.

PIN-2: Connected to ground.

Application

A. Automotive controls.

B. Medical devices.

C. Industrial controls.

D. Computer peripherals.

E. Fitness products.

F. Musical instruments.

G. Measuring devices.

H. Virtual reality games.

I. Consumer products.

J. Physical therapy.

3.3 GYRO SENSOR WITH ARDUINO

MPU-6050 is an 8 pin 6 axis gyro and accelerometer in a single chip. This module works on I2C serial communication by default but it can be configured for SPI interface by configuring it register. For I2C this has SDA and SCL lines. Almost all the pins are multifunctioning but here we are proceeding only with I2C mode pins.

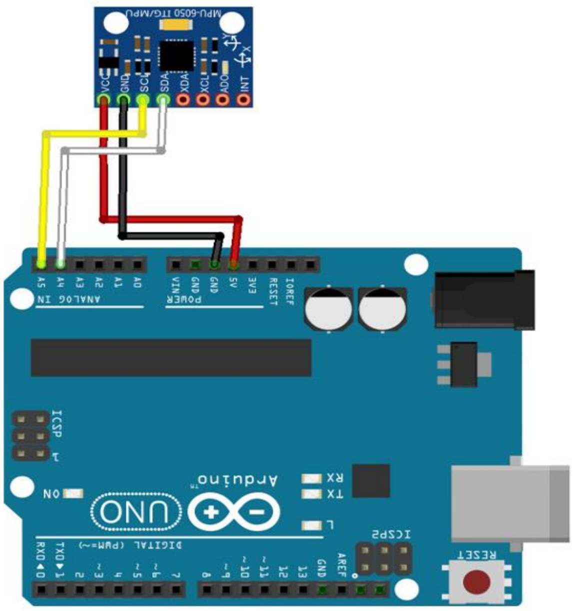


Figure 3.3

Pin Configuration:

Vcc:- this pin is used for powering the MPU6050 module with respect to ground

GND:- this is ground pin

SDA: -SDA pin is used for data between controller and mpu6050 module

SCL: - SCL pin is used for clock input

XDA: - This is sensor I2C SDA Data line for configuring and reading from external sensors ((optional) not used in our case)

XCL: - This is sensor I2C SCL clock line for configuring and reading from external sensors ((optional) not used in our case)

ADO: - I2C Slave Address LSB (not applicable in our case)

INT: - Interrupt pin for indication of data ready.

3.4 POTENTIOMETER WITH ARDUINO

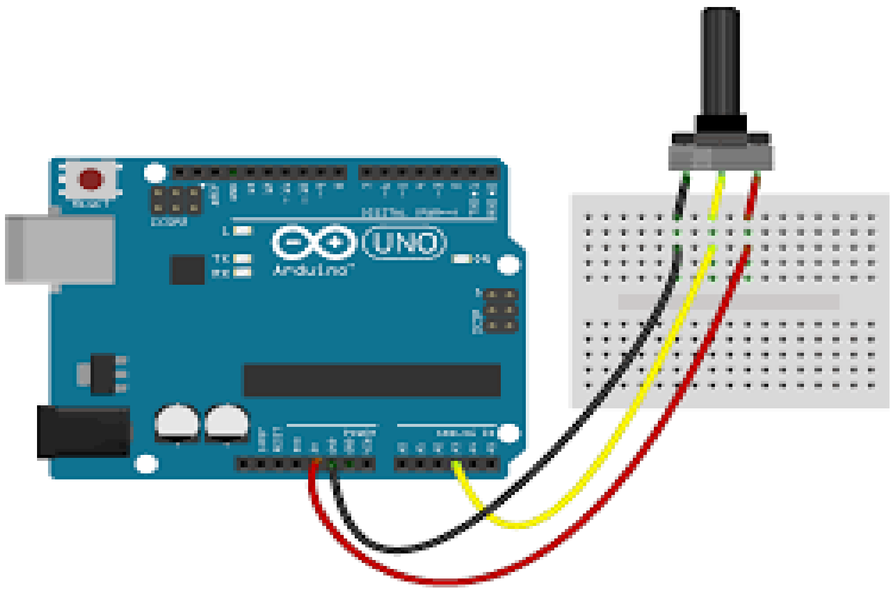


Figure 3.4

The potentiometer is a device that is used to measure the voltage or electric potential. It provides a variable resistance when the shaft of the device is turned. Here, we will measure the amount of resistance as an analog value produced by the potentiometer.

Pin Configuration

1.VCC

2.Output

3.Ground

CHAPTER 4

RESULT

4.1 HARDWARE:

Water bottle without water:

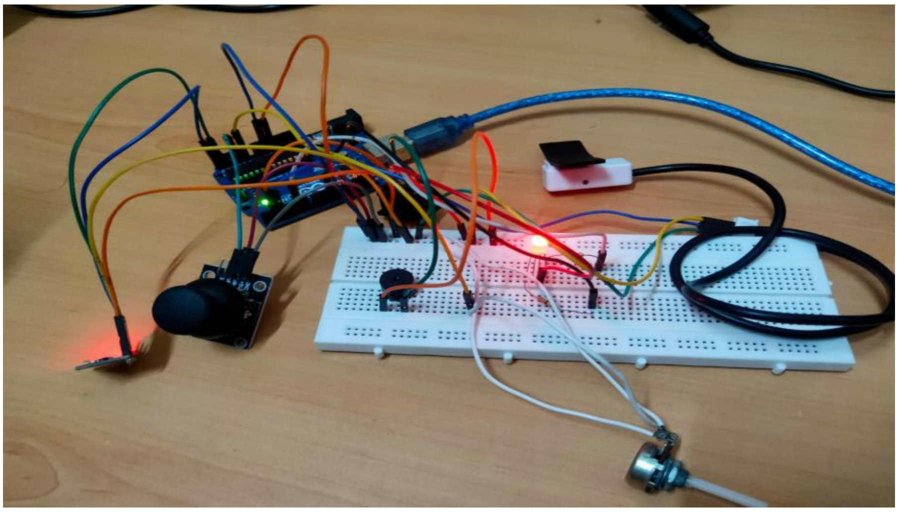


Figure 4.1

Water bottle indicate to drink water:

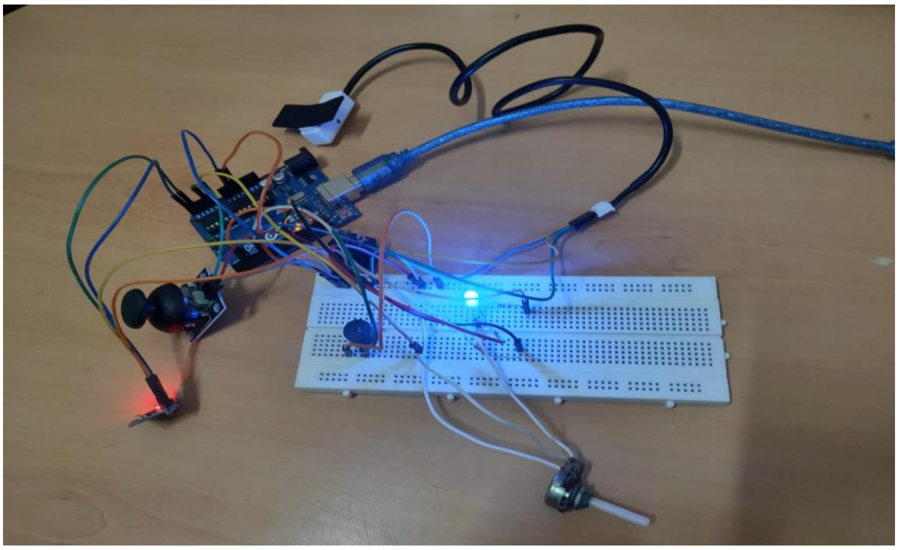


Figure 4.2

4.2 SOFTWARE:

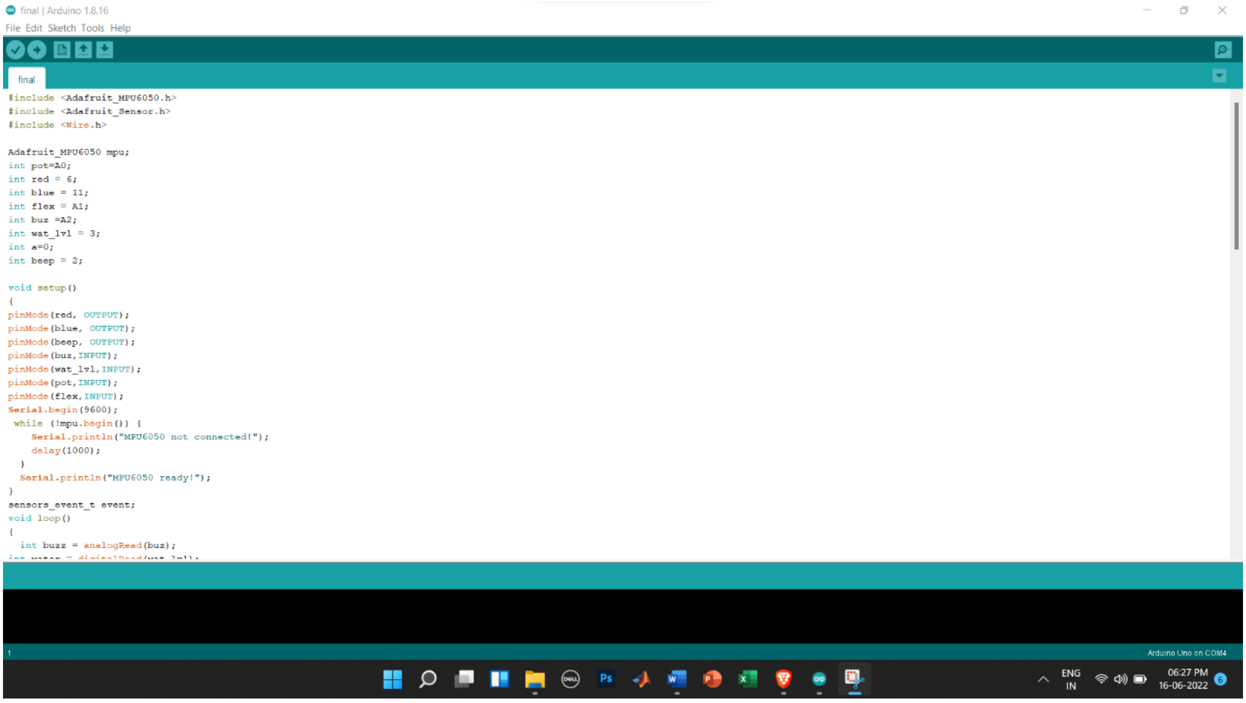


Figure 4.3

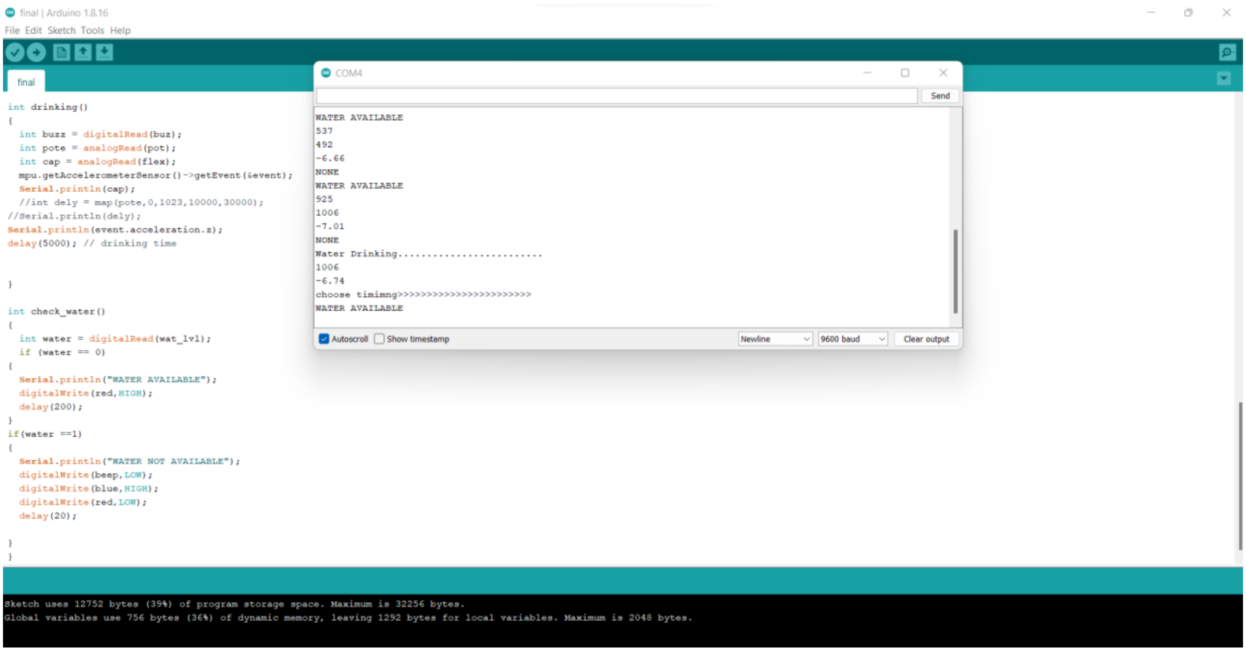


Figure 4.4

CHAPTER 5

CONCLUSION

Right amount of water is needed for every human to live a healthy life. Adults consume the water their body needs but in case of kids its essential for kids to be reminded . Our system will be helpful in intimating the kids to drink water at right interval of time. Hardware components like non invasive water level sensor, gyro sensor, flex sensor, potentiometer with led and buzzer are used to achieve the proposed system. Inadequate hydration is a prevalent and understudied health problem among children and adolescents, particularly boys, non-Hispanic Blacks, and Hispanics. Drinking watercan reduce the risk of inadequate hydration. Future research should explore strategies to improve overall levels of hydration among children and adolescents, determine the potential reasons for observed disparities, and focus on strategies to reduce gender and ethnic disparities. More information is needed on other predictors of hydration status, such as diet, that may also be modified to improve hydration.

CHAPTER 6

REFERENCE

1. E. Jovanov, V. R. Nallathimmareddygari and J. E. Pryor, "SmartStuff: A case study of a smart water bottle," *2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2016, pp. 6307-6310, doi: 10.1109/EMBC.2016.7592170.

2. Cohen, R.; Fernie, G.; Roshan Fekr, A. Fluid Intake Monitoring Systems for the Elderly: A Review of the Literature. *Nutrients* **2021**, *13*, 2092. https://doi.org/10.3390/nu13062092

3. Mentes, Janet C. and Kennith R. Culp. "Reducing Hydration-Linked Events in Nursing Home Residents." *Clinical Nursing Research* 12 (2003): 210 - 225.

4. Lee, Nameui, Tae Hwa Lee, Dong Heui Seo and Sung Yeon Kim. "A Smart Water Bottle for New Seniors: Internet of Things (IoT) and Health Care Services." *BSBT 2015* (2015).

5. Kaner, Gül & Genç, Uğur & Dinçer, Salih Berk & Erdoğan, Deniz & Coskun, Aykut. (2018). GROW: A Smart Bottle that Uses its Surface as an Ambient Display to Motivate Daily Water Intake. 10.1145/3170427.3188521.

6. Lessel, Pascal & Altmeyer, Maximilian & Kerber, Frederic & Barz, Michael & Leidinger, Cornelius & Krüger, Antonio. (2016). WaterCoaster: A Device to Encourage People in a Playful Fashion to Reach Their Daily Water Intake Level. 1813-1820. 10.1145/2851581.2892498.