

Hydration Reminding Smart Bottle: IoT Experimentation

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ABSTRACT- This paper describes the experimentation architecture of Internet of Things (IoT) in real life. Objective of this work is to design water bottles which intimate a person to intake water on time to keep body temperature in stable. With busy schedules of humans and endless distractions, it's hard to remember to drink enough water by the humans. One of the health issues is not drinking sufficient amount of water properly in a human's daily life. Here the water float sensor can be used to sense the level of the water and it not only helps the users to measure the level of water, but also indicates the human to drink water when it's time to top up their body. This is a user- friendly project, that water bottle or flask can speaks with the person via passing commands as a message to drink sufficient water. The IoT experiment facility describes in this paper is conceived to provide a suitable platform for a large scale experimentation and evaluation of IoT concept under real life conditions.

Keywords- *IoT; water float sensor; hydration reminder*

I. INTRODUCTION

The internet of things (IoT) is the principle of working in a physical devices such as, vehicles, buildings and other things embedded with an electronics, software, sensors and enable these objects to collect and exchange information [1],[2],[3]. IoT is an eminent technology which make use of the existing wireless communication strategies to sense and control the objects by integrating the physical world with computer, thus improves the overall efficiency, accuracy and economic feasibilities.

A. Medical and healthcare:

IoT devices can be used to enable remote health monitoring and emergency notification systems. IoT opens a new pathway for doctors to remotely monitoring the health conditions of patients which may include blood pressure, heart beat rate, muscle movements, temperature by means of advanced devices such as pacemakers, pendant and wristwatches. Some hospitals have begun implementing smart bed, that can detect when they are occupied and when a patient is attempting to get up. It can also adjust itself to ensure appropriate pressure and support is applied to the patient without the manual interaction of nurses [4]. Specialized sensors can also be equipped within living spaces to monitor the health and also ensuring that proper treatment is taken and in assisting the people to regain the lost mobility by giving some therapy as well. Other consumer devices encourages healthy living by providing connected scales are wearable heart monitors, are also a possibility with the IoT [5],[6]. More end-to-end health monitoring IoT platforms are coming up for antenatal and

chronic patients, helping one to manage health vitals and recurring medication requirements. IoT combines the people and objects in physical world as well as data and virtual environment to interact with each other. IoT can be used in smart environment like: smart transport systems, smart cities, smart healthcare, etc. [7]. The busy schedules of human work lead to avoiding their regular necessary process. Even it is a small process it ends up in the larger affects to the human body. To avoid that kind of affects, smart health care system introduced many technologies. The proposed model uses the micro-controller based water level sensing and controlling in a wireless environment. A cellular based monitoring protocol which determines and senses water level.

As per study, a human body should contain minimum of 50-60% of water level. Water has numerous roles in the human body. It acts as a building material as a solvent, reaction medium and reactant as a carrier for nutrients and waste products. The regulation of water balance is very precise, as a loss of 1% of body water is usually compensated within 24 hr. An equalization of water inward to the human body and water outward from the human body can be termed as water balancing. The balancing of water content in the human body plays a prominent role for maintaining the health conditions. When age factors concern adults may regulate their water level by their own assumption and but infants and elder people doesn't show much importance on water balancing which may creates severe health issues in future. Dehydration can leads consciousness and other side affects [8]. Biologically an adult must intake 1.5 litre of water because water is the only essential liquid nutrient for the human body.

The proposed smart water bottle also comes under the one of the smart health care system to maintain the human health. In busy schedule of human works it's hard to remember to drink enough liquid. One of the most important issues are not drinking sufficient amount of water properly. This water bottle or flask that not only measures how much amount of water the user is drinking, but also indicates when it's time to top up by sending a messages to the smart phone. This is a user- friendly project, that water bottle can speak with the person via passing commands as a message to fill the bottle as well as to drink the sufficient water through low and high command.

II. RELATED WORKS:

From the study, there are many existing systems are available for human hydration. This section discusses about various human hydration.

A. E.Jequier

As the world contain 3/4 th of water, the human body also made up of 3/4 th of water. Water has enormous roles in the human body. It act as a building material, as a solvent, reaction, lubricants, etc.. The regulation of water balance is very important activity in a human body, as a loss of 1% of water in a human body it should be compensated within 24hr to avoid unnecessary causes. People are at greater risk of dehydration. Dehydration can affect consciousness and induce speech Incoherence, weakness, hypertension, etc. On minimum, an adult should drink 1.5l of water per day, as water is the only liquid nutrient essential for body dehydration [10]. Water is a vital nutrient and it has numerous critical roles in the human body. It acts as a building material as a solvent, reactant and reaction for nutrients and waste products. Consequently, the optimal functioning of our body requires a good hydration level. The regulation of water balance is very precise and it is essential for the maintenance of health and life. A better estimate of daily water requirements have been established owing to the knowledge of the main functions of water and the understand the mechanisms of water balance regulation. On an average, an adult should drink 1.5 l of water per day, as water is the only liquid nutrient that is really essential for body hydration [9].

B. S. Jatmiko

Water level detection system is used to facilitate human in collecting water levels data that can be performed in real-time. Ping sensor is used as a distance sensor for detecting the water level by calculating the distance between the sensor and water in the surfaces. The system consists of two modules; Transmitter module performs by detecting the level of the water and transmits it to the receiver as a data. Then the receiver module can be displays the data on the screen. This system can be used as a part of the system that need the detection of water level which can be collect remotely, such as, flood control system [11].

Prototype of Water Level Detection System has been tested and reasonably good performance is shown based on the test result. The main contribution of this performance is the ping sensor calibration by adjusting calculation of distance based on an actual data. Testing should be carried out for the real fluctuated water surface condition to retrieve the system performance in the real condition. The water level data is successfully displayed locally or remotely, therefore this prototype can be used as a part of the bigger system, such as, river flow management system which controls the stream to minimize the flood. The receiver acts as a water level data feeder that can be

transmit the data remotely to the server. Since computer is used as a part of receiver module, therefore more sophisticated system can be developed to display and analysis time series water level data, instead of only displaying the current water level data [10].

C. Nam Eui Lee

Smart Water bottle is used to intake of water which is important for health to keep the organs to function normally, especially among elder people. Since elders are unaware to take sufficient amount of water. This smart water bottle helps the users to drink water sufficiently by reminding them with the help of IoT technology to healthcare services [11]. Investigation of early seniors showed high level of interest in health and awareness of the importance of water intake but they are not accurate on human body water content level. Therefore, increase the improper intake of water. Individual management is particularly challenging because it is hard to accurately measure and record water intake. The proposed system is based on healthcare that aimed to develop highly efficient and effective strategy for water intake by providing diagnosis and notification based on the level of water intake by a particular person. Therefore, additional studies on Internet of Things' technology related to this services that can produce a prototypes and perform users tests are necessary to improve the user interface and experience of the users [12].

D. Arinobu Nijjima

Smart water bottle cap can be used here for controlling the amount of drinking water is important for healthy life. Controlling the volume of water that is needed for cooking. There are some ICT devices to inject liquid [13][14], but few people use them to control liquid flow in daily life. In this paper, the author has proposed Smart Bottle Cap, which can control liquid flow from a bottle with a smartphone. Smart water bottle cap is similar to normal water bottle caps and also allows user to replace smart water bottle caps instead of normal caps.

Smart Bottle Cap can be connected with a smartphone over Bluetooth Low Energy (BLE) so that it can work with many smartphone applications[15]. Smart water Bottle Cap can be used by the users to use it easily and widely, and it is important for the use in daily life. It controls liquid flow from a bottle with a smartphone. The replacement of the normal water bottle caps by smart water bottle caps, migrates the bottle as an IoT device and gets connected with the Internet with the help of a smartphone. The author proposed two applications one is to send sensor data to smartphone and another is to set the volume data automatically.

Smart Bottle Cap can free users from measuring the amount of liquid. Smart Bottle Cap can be used easily and it is one

of the products which can represent the era of an IoT [16].

E. Tae Hwa Lee

Individual management is challenging because it is hard to maintain the value accurately and record water intake. Precedent papers and studies have emphasized the importance of water intake, but few studies have addressed intake behaviour. If this service is introduced, enabling users to develop and manage proper intake of water, it will receive attention from members of the new senior generation who are interested supports health by flushing the waste from the body as well as increasing the metabolic of the respiratory organs to fight the diseases. In further, the smart water bottle can guide the user to drink the sufficient amount of water was addressed by applying the Internet of Things (IoT) technology of health care service [17].

III. HARDWARE SYSTEMS

In this section the details about the requirements used in this experimentation architecture of IoT test bed is elaborately explained.

A. Water Float Sensor

These float level sensor can be used to detect the level of h₂O. This sensor can act as a switch between two contacts. And it consists of retaining clip and plastic nut. And inside the sensor switch there is a metallic ring towards retaining clip. The main function of the sensor is only ON and OFF of the contacts [18].

B. PIC 40Pin- RS232

PIC Micro - controller is convenient to use, and it is easier to program. It has total number of 40pins and 33pins for input and output. Remaining 7pins are used for power supplies, master pin, and finally ground pin. EEPROM is also featured which makes it possible to store some information permanently like transmitter code and receiver frequencies. It is low cost and the advantage is it can be write- erase as many times with the use of FLASH memory technology in it. There is a 40pin micro controller and also 19there is a 20pin controller is available [2]. The main purpose of the 20pin controller is, it can choose what type of command should be passed as a SMS to the device by receiving certain input from the sensor that in contact with water.

C. GSM Modem

GSM modem is a communication device which can provide both voice and data related services. GSM modem can be easily programmed in order to communicate with physical world by making use of Embedded C programming languages. The purpose of using GSM modem is to communicate with the electronic device such as mobile phones and so on. This module helps to send information to the mobile as a message. A GSM modem is a specialized type of modem which accepts a SIM card. In the first image

the SIM slot will be shown. A GSM modem can be a dedicated modem device with a serial port, GSM modem is used to communicate over the mobile network which can be used for sending and receiving SMS. The 2.5G technologies GPRS and EDGE and 3G technologies WCDMA are used. The concern mobile users are charged for the messages that have been sent and its directly managed by mobile service providers. To perform these tasks, a GSM modem should support an "extended AT command set" to send/receive a SMS [20].

D. RS232 Cable

The RS232 cable is used for transmission of data from one to another device. This cable is a multi-purpose cable. It is not only used between Pc and PIC16F877A for transmission it also used between GSM modem and PIC16F877A micro-controller [21].

Here, other chips, it named as PIC16F788A and RS232. The PIC16F788A is a 40 pin chip where the 33 pins will be for main connection and remaining 7 pins are for power supply and ground connections, whereas the chip RS232 was used for the output designation. The output will be transformed to the mobile through the connection of RS232 cable from Micro controller and GSM modem.

E. RS232 Chip

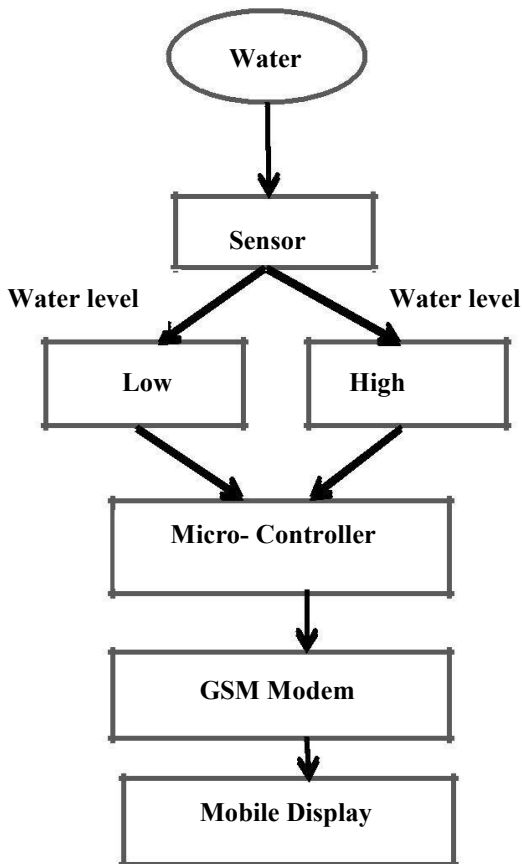
The RS232 chip is one of the controllers; it works from a micro-controller. The role of RS232 chip is to decide what type of message wants to send to the user's smart phone. It will be decided by receiving the different values as output from the sensors. It fixes what type message want to send for each and every value received from the sensors. After receiving the values it allows the GSM modem to send some type of text for indication as water level is low and high [22].

IV. DESIGN OF PROPOSED SYSTEM

The sensors had been connected to micro controller and to the GSM. The micro-controller has 10 pins for getting input and execution of the output. But the sensor cables can be connected with two main pins of named RA0 and RA1 among these 10 pins. These two pins have been used for setting low level and high level indication. When the sensor has been connected to the micro-controller the supplying power of 5V is provided to the sensors. Other than two main pins in the Micro-controller it has been available with two other chips, it named as PIC16F788A and RS232. The PIC16F788A is a 40 pin chip where the 33 pins will be for main connection and remaining 7 pins are for power supply and ground connections, whereas the chip RS232 was used for low/high output designation. The module sensors uses 5v power supply will be transformed to the mobile through the connection of RS232 cable from Micro controller and GSM modem. From the below given block diagram, it

explains that the sensors can be fixed into the water bottle or flasks to sense the water and measure the level of water as LOW and HIGH. The measured level should be passed to the micro-controller and from there the message should be decided with the help of RS232 chip. The message can be passed to the GSM modem with the help of using Sim card in it. It can be helped for sending the water levels to the mobile phone display as SMS.

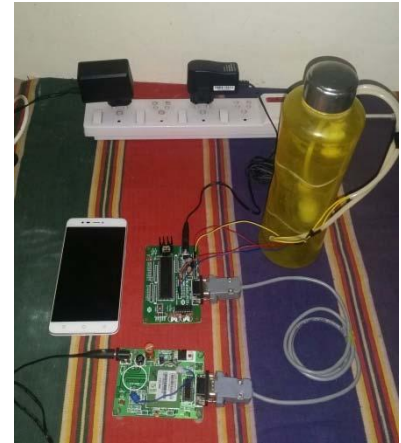
A. BLOCK DIAGRAM



B. OVERALL SETUP RESULTS



Fig 1.(a) Overall setup



(b) Mobile phone for monitoring levels of water

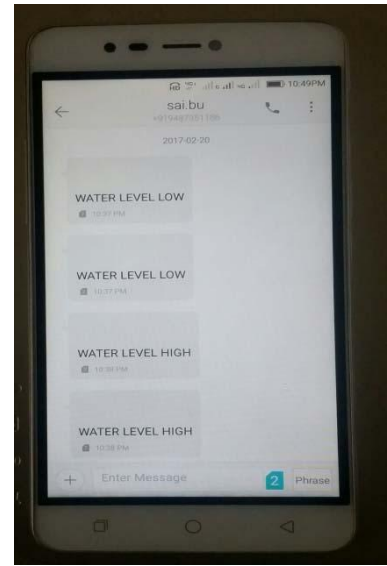
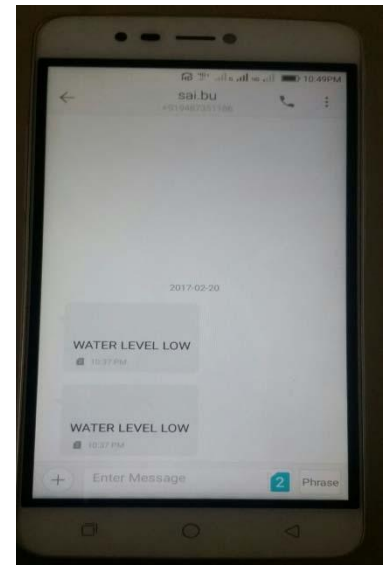


Fig 2.(a) Output displayed in mobile (HIGH)



(b) Output displayed in mobile (LOW)

Fig.1 shows the overall setup and connectivity of proposed system. Sensor fixed with a water bottle and the sensors are connected to keep in contact with water for sensing the different levels of water. Fig.2 displays the output in a mobile phone that indicating the level of the water in a smart bottle is LOW and HIGH. As like this, the different water levels in a smart bottle can be displayed in the smart phone.

V. CONCLUSION AND FUTURE WORK

In this paper, the proposed model of smart bottle architecture for hydration reminder to remind the humans to intake the sufficient water on time to keep the body stable is successfully implemented. The maximum power consumption used in this proposed system is 5v. Not only smart phones but also the basic mobile phones can also been used for verification and getting execution successfully. Further some possibilities for maintaining the record of daily usage of human sipping h2o are kept as future works and can also use it in another fields.

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