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CONTROL AND MONITORING WATER IN AQUAPONICS USING IOT

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ABSTRACT: Modern aquaponics systems can be highly successful, but they require intensive monitoring, control, and management. IoT-enabled aquaponics systems on the other hand can provide the opportunity to improve the quality of the produce grown with minimal effort and automation of processes. The systems use Internet of things (IoT) technology to configure and deploy smart water-quality sensors that provide remote, continuous, and real-time information of related to water quality, on a graphical user interface (GUI). Continuous monitoring of this data, and making necessary adjustments, will facilitate the maintenance of a healthy ecosystem that is conductive to the growth of fish and plants, while utilizing about 90 percent less water than traditional farming. As using this technique water is reused, it requires less space, user gets natural food. Aquaponics can be automatically managed and controlled by making use of IOT technology with the help of sensors like pH, temperature and humidity, dissolved solvents, water level sensors.

KEYWORDS: Internet of things, graphical user interface, Wi-Fi module, cayenne application.

I.INTRODUCTION

There are many studies underway to hunt out various ways to understand this objective, one of which is Aquaponics. The term "aquaponics" is named a mixture of hydroponics and aquaculture. In aquaponics systems, the soil isn't used, but farming is administered without using soil, but nutrients are utilized in a solution. Plants only need water, sunlight is used for photosynthesis and nutrients grow, but they're going to also grow without soil, and therefore the rootage can grow better in water. one of the most problems within the world is providing food due to the huge increase in population, and on the opposite hand, the agriculture there's very crowded. Nowadays, people pay more attention to health, so they should ensure that the food they eat is healthy, so that they can use the Aquaponics system that helps to grow organic food to make sure this. Global climate change within the environment is no impact on the system, so it can increase any quiet vegetation. The system provides a farming method with minimal risk and high profit that consumers or people all over the world expect. Besides, this kind of co-cultivation farm requires complete maintenance and investment. Once fully established, chemical, viable, weed-free, low-cost, and reliable farming solutions can be obtained for free [1]. Traditional agriculture requires routine monitoring, while aquaponics systems are automated systems that require less monitoring. The survey shows that with the recycling of water by the system itself, the content of freshwater required for co-infiltration does not exceed 10%. In this document, the main objective is to propose an automated aquaponics system that requires small requirements to provide the greatest technical assistance. In this paper, we compared various existing systems in the literature survey section and proposed system and benefits of the proposed system.

II. INTERNET OF THINGS

The Internet of Things (IoT) is a system of connected things. The things generally comprise of an embedded operating system and an ability to communicate with the internet or with the neighbouring things. One of the key elements of a generic IoT system that bridges the various ‘things’ is an IoT service. An interesting implication from the ‘things’ comprising the IoT systems is that the things by themselves cannot do anything. At a bare minimum, they should have an ability to connect to other ‘things. But the real power of IoT is harnessed when the things connect to a ‘service’ either directly or via other ‘things. In such systems, the service plays the role of an invisible manager by providing capabilities ranging from simple data collection and monitoring to complex data analytics. The below diagram illustrates where an IoT service fits in an IoT eco-system: One such IoT application platform that offers a wide variety of analysis, monitoring and counter-action capabilities is Think speak.

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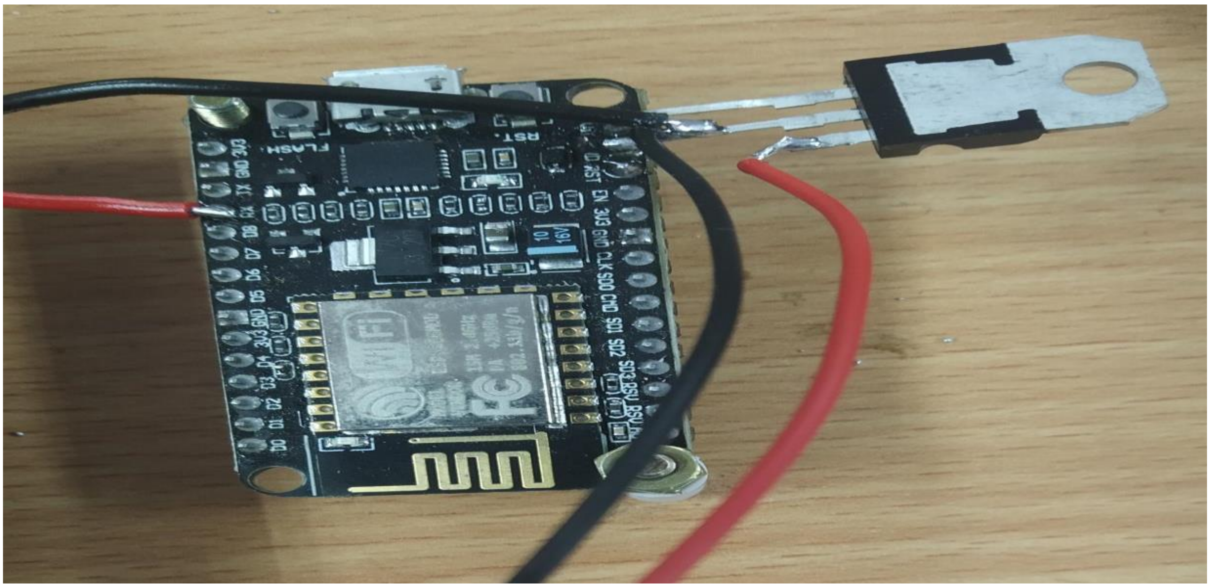
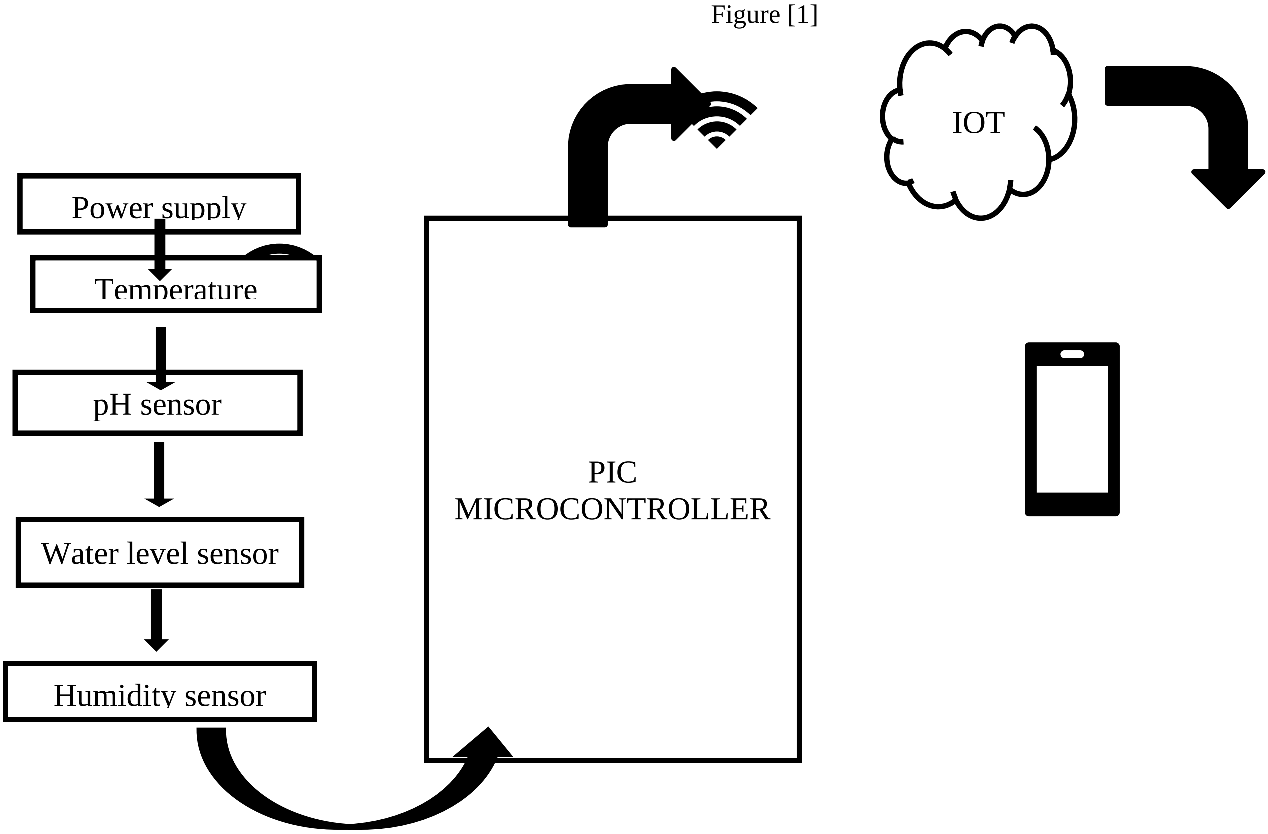


Figure [1]



III. BENEFITS OF IOT

The benefits of using a combination of IoT and aquaponics include

- Digitization of environmental parameters into an easily readable output.
- Maintenance of stable conditions in the system with the help of IoT devices and sensors for controlling temperature & humidity, pH, light intensity, ammonia, water and temperature.
- Continuous monitoring of data and issuance of trigger alerts allowing farmers to make necessary adjustments from remote locations.
- Automating repetitive tasks like regulating the flow of water when certain parameters are reached by using intelligent algorithms to control switches.

- Analysis of the sensor's feedback by data visualization and analytics platforms that measure KPIs and offer recommendations for higher yield and sustainability.
- Predictive analysis of the data sets which can help generate insights into future events through machine learning modules and indicate specific actions to be taken to avoid event occurrence (part replacement, maintenance activities run etc.).

Automation of aquaponic systems with IoT facilitates the maintenance of a healthy ecosystem that is conducive to the growth of fish and plants while pushing the real-time parameters, notifications and insights to key stakeholders for swift actions. We can safely say that IoT in aquaponics has the potential to evolve as a game-changer in the future of sustainable food production.

IV. pH sensor

pH meter, electric device used to measure Hydrogen ion activity (acidity or alkalinity) in solution. Fundamentally, a pH metres consists of voltmeter attached to a pH-responsive electrode and a reference (unvarying) electrode.

V. Humidity sensor

DHT11 is a low- relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc.., to measure humidity and temperature instantaneously. DHT11 humidity and temperature sensor is available as a sensor and as a module.

VI. Temperature sensor

LM35 Sensor does not require any external calibration or trimming to provide typical accuracies. The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easyLM35 is an integrated analog temperature sensor whose electrical output is proportional to Degree Centigrade.

VII. Water level sensor

Sensor is an electrical ON/OFF Switch, which operates automatically when liquid level goes up or down with respect to specified level. The Signal thus available from the Float Sensor can be utilized for control of a Motor Pump or an allied electrical element like Solenoid, Lamps, and Relays etc. Float Sensors contain hermetical sealed Reed Switch in the stem and a permanent Magnet in the Float. As the Float rises or falls with the level of liquid the Reed Switch is activated by Magnet in the Float.

VIII. Communication mode

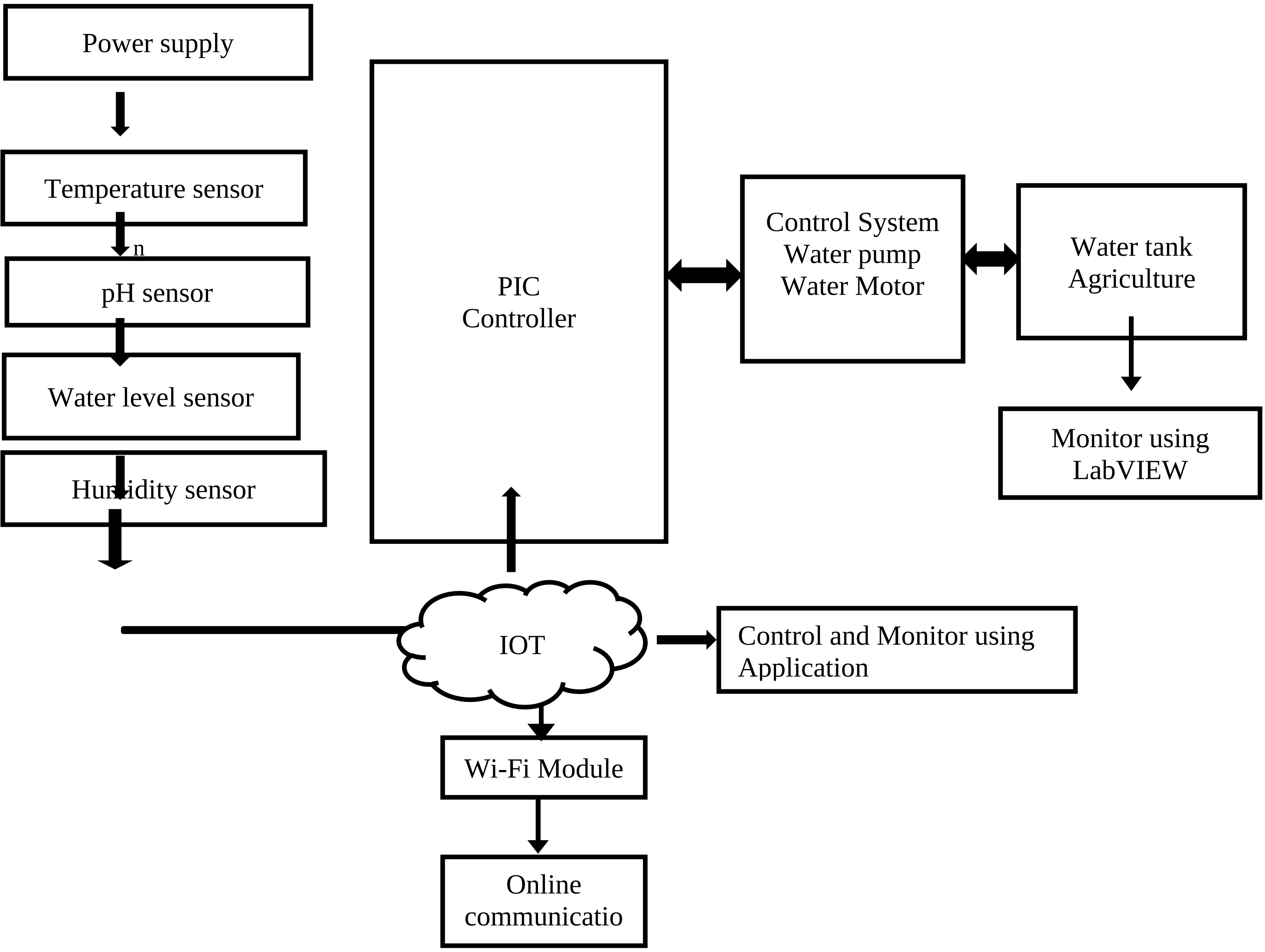
Online mode

Temperature, humidity, water level, pH Values will be displayed in the application using internet of things. we can control the pump and motor using the mobile application. Wi-Fi modules in it connects the database through which the sensor takes place. This can be easily monitored using the android application created.

Offline mode

Temperature, humidity, water level, pH Values will be displayed in the led display using LabVIEW. Respective coding for each sensor will be coded in the pic microcontroller that will display the value. LabVIEW will store the values in excel sheet for future reference and analysis.

XI. Block diagram



X. OPERATION

The main objective of an automated aquaponics system is to maintain and control various parameters of an aquaponics system by interconnecting various sensors and actuators to increase productivity. Automatic aquaponics that supervises the pH level of the water, temperature and humidity of the land and also the water level. This technique claims to have water efficiency, does not use pesticides and reduce the use of fertilizers, which make these technology green and sustainable. Water is conserved, and the nutrients are refused. Enables continuous and sustainable production. The system is simple, reliable and robust.

In our project we use temperature and humidity sensor to monitor the lands parameter in IOT. Water level sensor is used to check the level of water in the land, if the level is decreased then the motor turned on automatically. In case of high-level water then using water pump the water is pumped out automatically. We use PH sensor to know the PH level of the water, if the water in the land is more Acidic or base then the water is pumped out automatically. These all-sensor Parameters will be displayed in the application developed using IoT. Cayenne is the application developed by IoT. Using, cayenne application we can monitor the parameters in the aquaponics system.

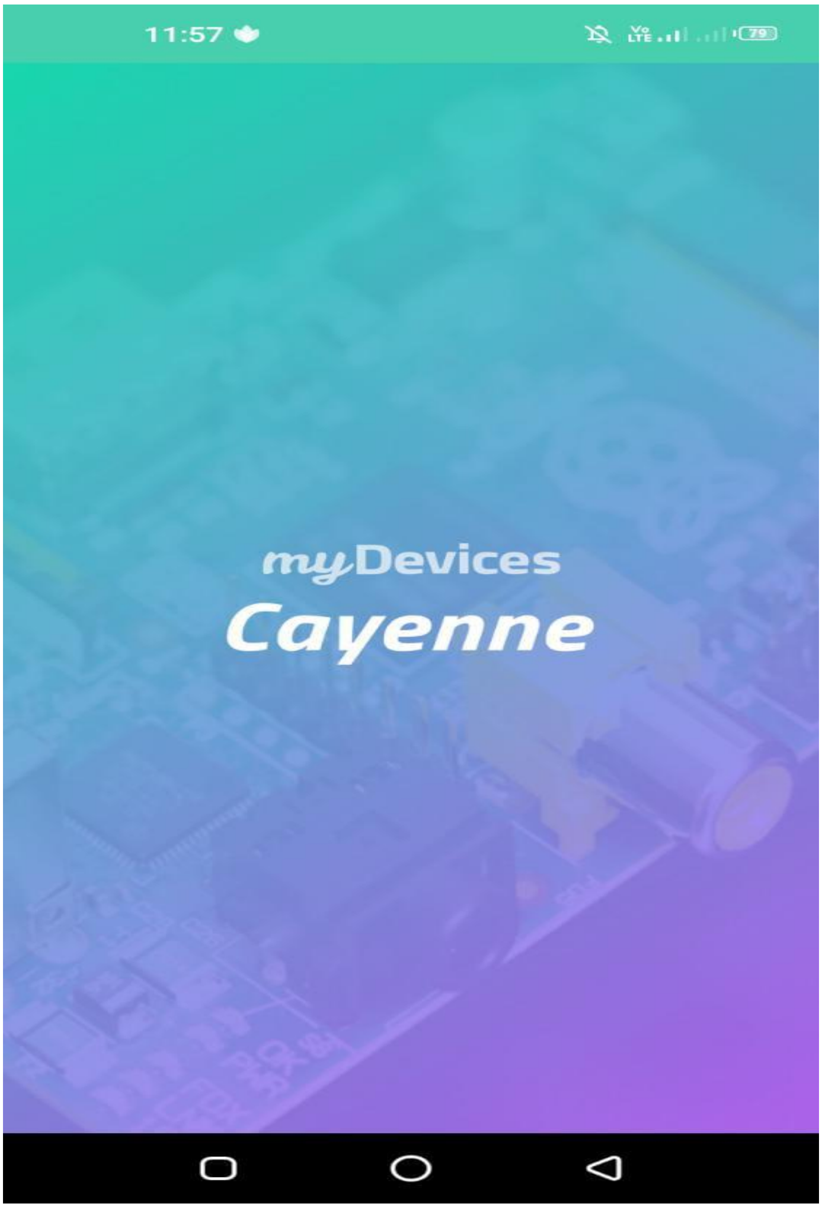


Figure [4] Application used for monito

XI. RESULT

The output of the conservation of water using IOT System is:

- Using IOT,Humidity,pH,Water level in the fish tank and Temperature in the atomosphere are measured using sensors and displayed in the application devloped in android mobile phone.
- Daily changes in the Humidity,pH,Water level and Temperature will save in the cloud for future reference
- Iot can be use in everywhere from the android mobile phone far away from the aquaphonic setup and we can control and monitor the aquaculture.
- Digitization of environmental parameters into an easily readable output.
- Maintenance of stable conditions in the system with the help of IoT devices and sensors for controlling temperature & humidity, pH and water temperature.

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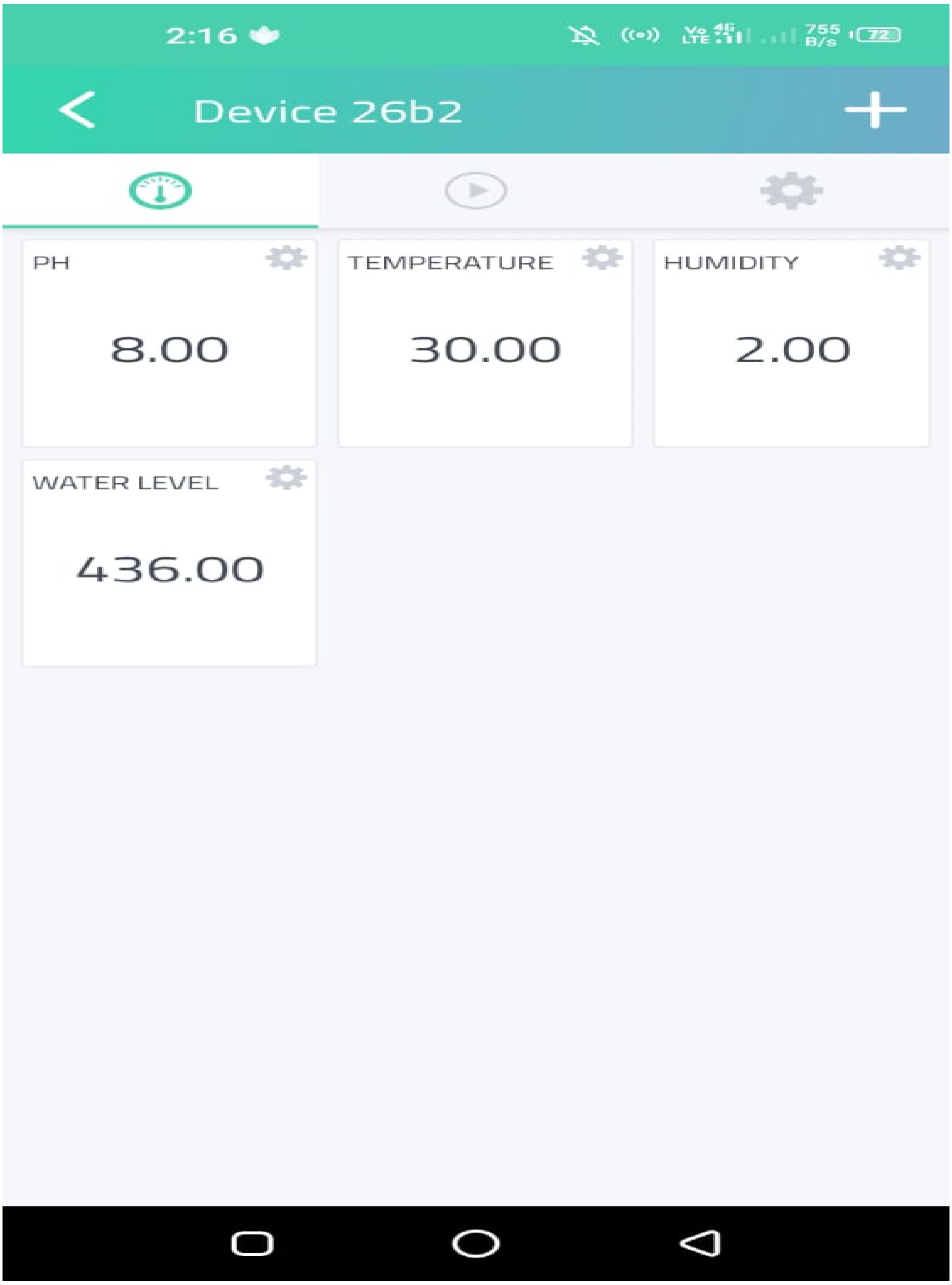

Figure [5] Display the parameters value

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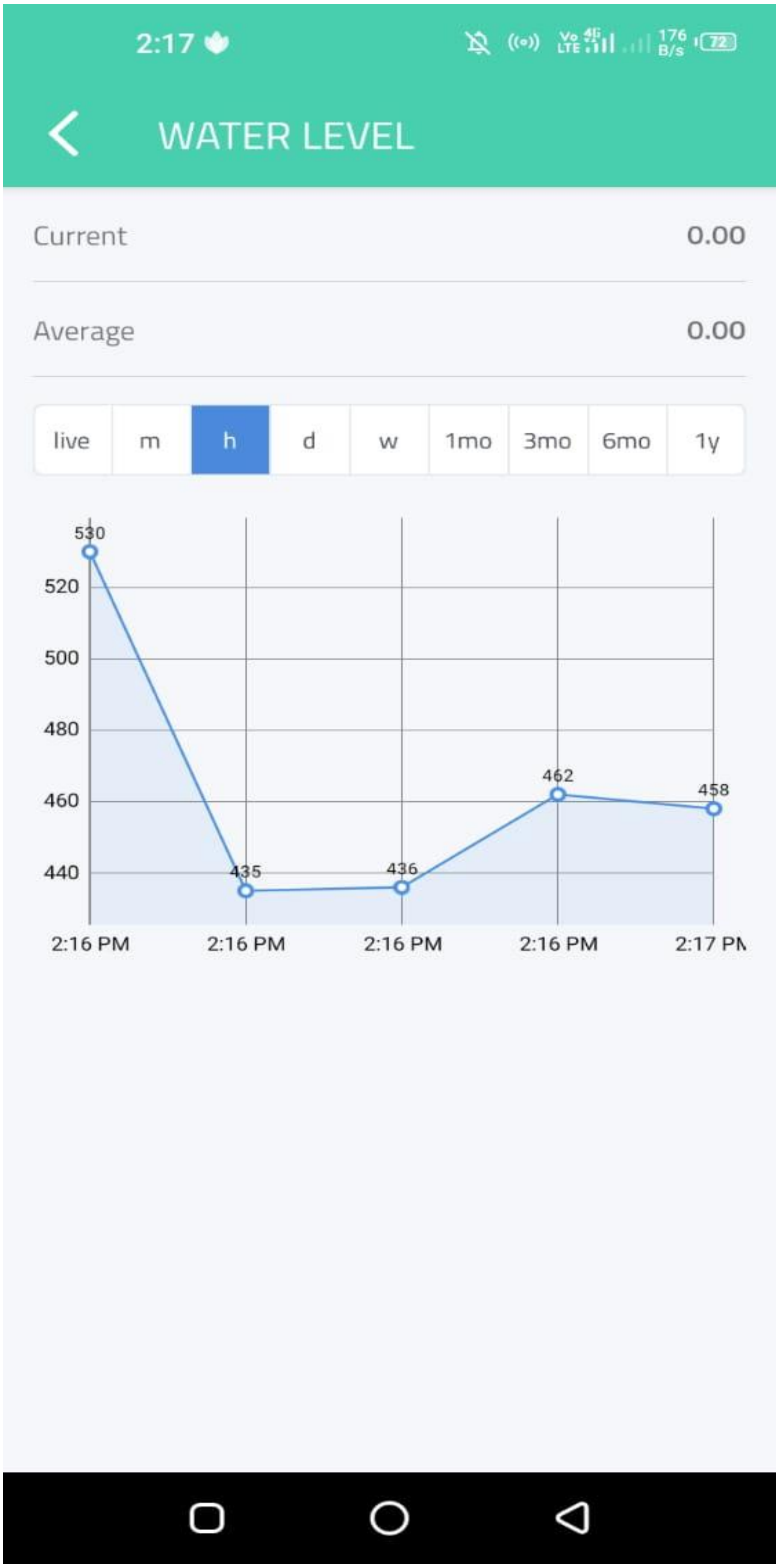

Figure [6] Water level in tank

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XII. CONCLUSION

Traditional method of aquaponics is replaced using the aquaponics using IoT. It is important to have a good water quality in the aquaculture for producing good yield of fish. If the water quality is not maintained properly the fishes will die. Hence, in this work a system has been designed using Microcontroller and different sensors like Temperature sensor, pH sensor. These sensors measure the corresponding value in the water and the values are sent to the microcontroller for processing. If the values measured are not in the desired level, then corresponding relay is activated to turn on motor. Also, the measured values are sent to the Google firebase cloud and display on application to inform the present situation. The measured values are continuously monitored through IoT.

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