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# Irrigation Pump Operation using IoT

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**ABSTRACT—** IoT means Internet of Things. Actually, it means the operation of systems remotely with a user handy approach. With the growing economy and population the Irrigation itself is an industry now. To be specific it has also remote operation, smart machines and apparatus. In this course pump is a very crucial thing to supply water to the fields. But majority of world still operates it manually even though systems are available. But due to their high prices third world countries majorly can't afford .So, services related to that is not that much available. But here in this paper casts an approach with which pumps can be made smarter as well. The module which has been introduced here works on different sensors and their data used to automate operation using threshold values. Even the modeling contains a monitoring using web services and a backup service of manual operation with the automatic one which is not only available but also user friendly.

**Keywords—** API, IoT, Module, Sensors, Cloud Services, Web Server, Operation, Automation, Microcontroller, Graph, Location, Threshold Values.

## I. INTRODUCTION

Internet of Things (IoT) is the concept of connecting different devices to each other and to the internet to transmit thousands of bits of data and information. IoT is changing a great part of the world relevant; from the manner in which we drive to how we make buys and even how we get vitality to our homes. Complex sensors and chips are embedded around us. How these devices share data and information and how we make use of them(Dawood,2020).Human beings quest for making a comfortable life is due to their inquisitiveness about the technical arena. Over the last few decades, mankind has experienced a technical transformational journey with the inventions of new technology frontiers. These frontiers have interacted with human beings and performed every possible work in a shorter period of time and with much greater accuracy. With the advent of 'Smart Concepts', the world is now becoming more connected. Precisely termed as hyper-connected world. The smart concepts include smart phones, smart devices, smart applications and smart cities. These smarter concepts form an ecosystem of devices whose basic work is to connect various devices to send and receive data. The Internet of Things is one the dominating technology that keeps eye on the connected smart devices. The Internet of Things has brought applications from fiction to fact enabling the fourth industrial revolution. It has laid an incredible impact on the technical, social, economic and on the lives of humans and machines. Scientists claim that the potential benefit derived from this technology will sprout a foreseeable future where the smart objects sense, think and act. Internet of Things is the trending technology and embodies various concepts such as fog computing, edge computing, communication protocols, electronic devices, sensors, geo-location etc. (Neha et.al.,2019).

Now, the world is changing. Specially after calamities like COVID-19.So,the market is also changing rapidly. Now, the COVID era left us in a doorway where everything seems remotely accessible .This happens same for the farming sectors. In this sector the water supply which means Irrigation is a one of the most important among all. So ,as the trend is there for automatic pump systems where the process is been automated using multidisciplinary approaches(Naseer,2019).

But, everything is related with cost of that product . So, operating these pumps and setups has been avoided in majority of the world specifically countries of the third world. Moreover, those setups are not that much user friendly for a tier of people for those who are lacking of formal or any technical education(Sakib et.al.,2016). So ,this type of problems have always been an obstacle for an adoption of technology like IoT.

## II. SYSTEM DESIGNING AND ARCHITECTURE

A item that has the requisite sensors, actuators, and a communication interface is needed to create an IoT system. In order to transfer data to the cloud or to a distant workstation for monitoring and analytics purposes, the device must be connected to the internet and have a communication interface.

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Moreover, the device has the ability to receive control information based on analytics and make actuating decisions (Verma et. al.,2020).

By linking people, systems, services, devices, and objects, Internet of Things (IoT)-based systems facilitate computations at any time or location, enabling autonomous systems to build digital societies. In order to effectively and efficiently construct complex IoT-driven systems, software architecture, the blueprint for software-intensive systems, abstracts the intricacies of modeling, design, development, and evolution phases of a software. Goals and Approach—In order to build and construct IoT systems that go beyond the current state-of-the-art for IoT, research and development activities are necessary to leverage architectural concepts and practices (Aakash et.al.,2019).

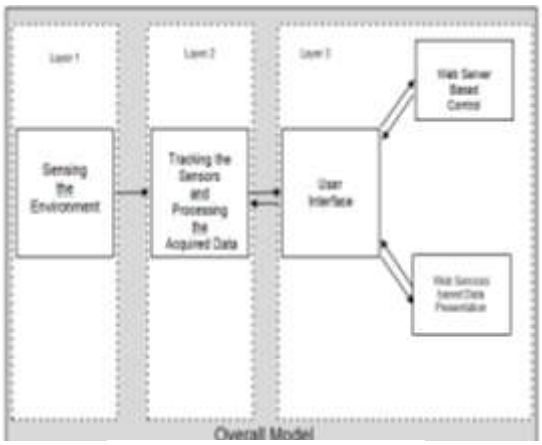


Figure 1: Layers of the model

According to Figure 1 the designing of the system involves three layers of interfacing which are;

1. Layer1: It's about the sensors and its interfacing with environment parameters under consideration. This layer sends information in the microcontroller block.
2. Layer2: This layer contains a microcontroller to trace the sensor data and process it for further operation. After this conversion the acquired data is sent to the user interface layer.
3. Layer 3:This layer is entirely designed keeping in mind the user friendly approach there are two sections of this layer that is;

A. Web Server Based Control

This will be enabled using wifi network connectivity and using an url. It can be accessible irrespective of different location, devices. This is actually to control the pump manually. This will be working in parallel with the automatic control.

B. Web Services based Data Presentation

The data gathered from the sensors continuously will be shown to a web screen based on a web service which will be accessed from the API Request.

## III. PROTOTYPING

The creation and implementation of web applications utilizing open-source hardware and software is both fascinating and difficult. The adoption of IoT is hampered by difficulties including privacy invasion, governance, security, regulatory issues, migration to IPv6, and standardization challenges, according to authors. Also, authors suggested areas for Internet of Things study in the future. IoT, architectural design decisions, internet and mobile applications, IPv6 standardization issues, invasion of privacy, and regulatory issues are some of the key terms(Paolo et.al.,2013).

As per the requirement of this model, here the hardware components were selected form the online advisories. It consists of two sensors which are;

a. DHT-11: It is an atmospheric pressure and humidity sensor. This module will be used to analyze the air based parameters.
b. Soil Humidity Sensor: This will measure the humidity and will show the results in percentage.
c. 5V Relay: It's a switch which will control the pump by its logic gates and that will be performed based on the PWM signal from the microcontroller.
d. ESP8266-NodeMCU: It's the microcontroller with high end operation capability with an inbuilt wifi module to work on WIFI supported projects.

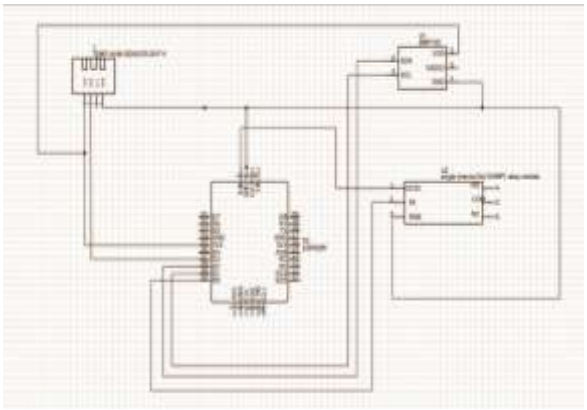

Figure 2: Schematic of the Circuit Connection.

*A.* Connection

The Schematic in Figure 2 is showing the connections here. This implies the module which is shown in the hardware in Figure 3 is very mobile as the sensors are connected with common ground and the live line of the connection will be connected with

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the relay line as that is the main connection for a pump.

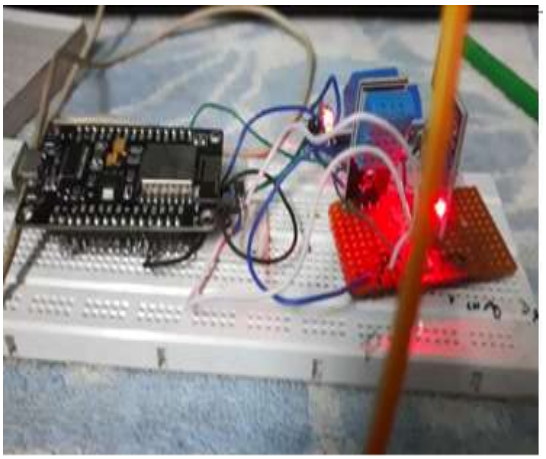

Figure 3: Hardware Setup

*B.* Block Diagram

As the connections from Figure 2 and Figure 4 the DHT-11 and Soil Sensor send the data to the ESP now if the value is lesser than the threshold then it sends signal through the PWM Pin to the relay and it changes the open circuit combination to a closed circuit and turns on the pump. On the contrary; the manual module works in parallel with this. If the user sends a request using that the pump can be made as per the need and the data will be plotted in Thing Speak Server. According to its creators, is an open source Internet of Things (IOT) application and API that stores and retrieves data from objects using the HTTP protocol across a local area network or the Internet. Application development for location tracking, sensor logging, and a social network of things with status updates are all made possible by Thing Speak.

The mathematical computer programme MATLAB from Math Works provides incorporated support for Things Talk, enabling users to analyze and visualize uploaded data using Matlab without having to buy a Matlab license from Math Works(Girija et.al.,2018).

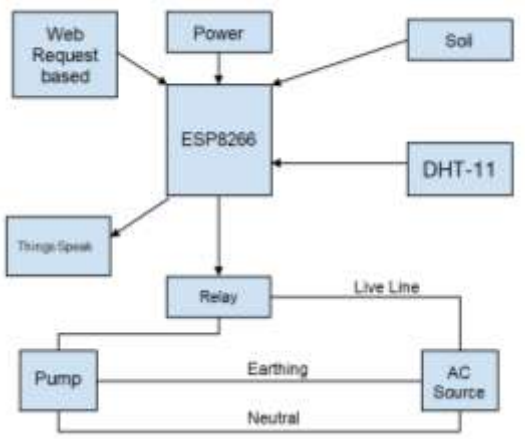


Figure 4: Block Diagram

## IV. RESULTS AND INFERENCES

Now by retaining embedded devices in the environment for monitoring, the ecosystem may protect itself (creating a smart environment). In order to achieve this, sensor devices must be placed in the environment for data collection and processing. We can make the environment more realistic by placing sensor devices there, allowing the environment to communicate with other things across a network. The user will then have access to the gathered data and the analysis' findings over Wi-Fi(Rawal,2017).

As per different approaches and ideas it's clear that this module has efficiently worked as per the planning which can be known by observing the result analysis and the main point is reminding the cost effectiveness and ease of use, this model shows the extraordinary results in terms of live simulation.

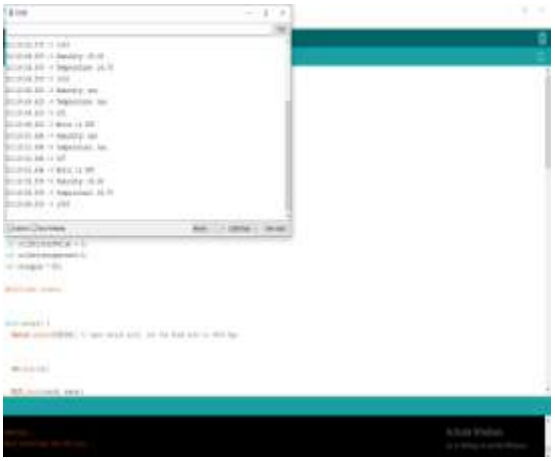

Figure 5: Motor condition tracking in Serial Monitor

Here the serial monitor in Figure 5 states about the motor's current condition and when the

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humidity is sufficient then motor off message can be seen in the serial monitor of Arduino IDE.


Figure 6 : Thing Speak Plot

Figure 6 is the live plot regarding the current condition of humidity. Here the peak shows the time when the water supply was on which means the motor has been turned on. Then it reached the maximum threshold and it stopped then again when it's below the level it turns on the pump.

For the manual operation the user can control the request window by a default set API which will be shown in the early stages of the connection with WIFI in serial window of the IDE.

## V. CONCLUSION

Nowadays, the Internet has spread to practically every country around the world and is having unprecedented effects on people's lives. The Internet of Things (IoT) is getting more popular and has a high level of interest in both practitioners and academicians in the age of wireless communication due to its diverse applications. The IoT is a technology that enables everyday things to become savvier, everyday computation towards becoming intellectual, and everyday communication to become a little more insightful. In this paper, the most common and popular IoT device capabilities, architectures, and protocols are demonstrated in brief to provide a clear overview of the IoT technology to the researchers in this area(Fakhri et.al.,2022).

In this module the inscribed things are considered to be the user friendly and less cost of operation. Although it has shown efficient results in terms of hardware implementation and specifically it's dual mode of operation, automatic and manual is defining it's uniqueness as a prototype module.

## VI. SCOPE OF WORK

The Internet of Things (IoT) is fostering a convergent environment in society. Now personal and professional lives are undergoing a paradigm shift as a result of technology. IoT increases consumer value and loyalty as a linked environment. IoT is now being used everywhere that affects people, including smart cities, smart environments, security, smart business processes, smart agriculture, home automation, and healthcare.

So ,as an application in agriculture and its prototyping it can be made more sophisticated by applying machine learning by using the sensor data derived from the module and can be used for the same process to predict the weather and possible calamities to prevent the losses in the sector.

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