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AUTOMATION OF AGRICULTURAL TOOLS: AGRITECH

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Abstract - *Agriculture is the worldwide prime occupation of human being. But there are some challenges that are faced by the farmer. The aim of this project is to reduce the farmer's efforts to access the agricultural tools. The project aims at developing a system that can control the operation of the agricultural tool and monitor the tools via the appropriate graphs using Raspberry Pi and Android application. This system will be a substitute to traditional farming method. We will develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world. This design is a smart agricultural technology in low cost which is usable by farmers. The mobile app provides user interface that gives access to control the agricultural tools and also shows the efficiency graphs of particular device. It also gives all round performance graph of the system. The database takes care of all the changes to the system. Raspberry Pi is the main heart of the whole system. It regularly checks for the updates made in the database and controls the corresponding devices via relay board. This project will be helpful to the farmers by reducing the human interaction towards the agricultural tools and also controls the expenditure towards maintenance.*

Key Words*: *Agriculture, Raspberry PI, Android Application, Efficiency Graph, Relay Board

1. INTRODUCTION

Agriculture is the worldwide prime occupation of human being. But there are some challenges that are faced by the farmer. The aim of this project is to reduce the farmer's efforts to access the agricultural tools. The project aims at developing a system that can control the operation of the agricultural tool and monitor the tools via the appropriate graphs using Raspberry Pi and Android application. This system will be a substitute to traditional farming method. We will develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world.

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1.1 Purpose

As our world is digitizing every day and India is known for its agricultural heritage in the world. Agriculture contributes large amount of revenue to Indian economy and exports variety of agricultural products. We see our farmers still hardworking in their fields watching their crops, irrigation, etc. Since the demand for agricultural products are increasing, Indian agricultural sector must adopt modern technology to produce maximum products and optimize the process with limited usage of resources.

In spite of the large-scale mechanization of agriculture in some parts of the country, most of the agricultural operations in larger parts are carried on by human hand using simple and conventional tools and implements like wooden plough, sickle, etc. There is urgent need to mechanize the agricultural operations so that wastage of labour force is avoided, and farming is made convenient and efficient.

Agricultural implements and machinery are a crucial input for efficient and timely agricultural operations, facilitating multiple cropping and thereby increasing production. By the introduction of modern technology in farming we would like to build an optimized sustainable agricultural practice. This smart automated agricultural tool helps farmers to reduce their time on field and can keep an eye on their field using this product. Our project would also help farmers to concentrate more on other important tasks such as planting seeds etc.

1.2 Related Work

[1] **Paper Name:** Drip Irrigation System using Wireless Sensor Networks

Authors: Bennis, H. Fouchal, O. Zytoune, D. Aboutajdine

Method Used: Nowadays, adopting an optimized irrigation system has become a necessity due to the lack of the world water resource. Moreover, many researchers have treated this issue to improve the irrigation system by coupling the novel technologies from the information and communication field with the agricultural practices. The Wireless Sensor and Actuators Networks (WSANs) present a great example of this fusion. In this paper, we present model architecture for a drip irrigation system using the WSANs. Our model includes the soil moisture, temperature and pressure sensors to monitor the irrigation operations. Specifically, we take into account the case where a system malfunction occurs, as when the pipes burst or the emitters block. Also, we differentiate two main traffic levels for the information transmitted by the WSAN, and we use an adequate priority-based routing protocol to achieve high QoS performance. Simulations conducted over the NS-2 simulator show promising results in terms of delay and Packet Delivery Ratio (PDR), mainly for the priority traffic.

Results: This paper provides solution which gives better performances in terms of delay, PDR for the priority traffic.

[2] **Paper Name:** IOT Based Smart Agriculture Monitoring System

Authors: Dr. N. Suma, Sandra Rhea Samson, S. Saranya, G. Shanmugapriya, R. Subhashri

Method Used: Agriculture is the primary occupation in our country for ages. But now due to migration of people from rural to urban there is hindrance in agriculture. So to overcome this problem we go for smart agriculture techniques using IoT. This project includes various features like GPS based remote controlled monitoring, moisture & temperature sensing, intruders scaring, security, leaf wetness and proper irrigation facilities. It makes use of wireless sensor networks for noting the soil properties and environmental factors continuously. Various sensor nodes are deployed at different locations in the farm. Controlling these parameters are through any remote device or internet services and the operations are performed by interfacing sensors, Wi-Fi, camera with microcontroller. This concept is created as a product and given to the farmer's welfare.

Results: Implementation of such a system in the field can definitely help to improve the yield of the crops and overall production.

[3] **Paper Name:** IoT Based Smart Home Garden Watering System Using Raspberry Pi 3

Authors: Sandhya B. R, Pallavi. M, Chandrashekar M

Method Used: In today's world automatic systems are more preferred than manual system. This paper propounds a design for garden watering system based on android application using Raspberry Pi 3. Home automation is the automatic control and monitoring of house hold appliances and also for garden watering. The system used Android application is used to control and monitor the appliances and Wi-Fi technology as a communication protocol to connect system components. Depending upon the moisture level of garden land and daylight intensity, the system can detect the appropriate time of water supply to the plants and trees in the garden. The analog data received from the sensor are transmitted as digital signal via Wi-Fi module to the Raspberry Pi 3.The system is able to notify the user that the water shortage arises in the main water supply and an user can also communicate with the system by sending SMS or email. Nowadays, adopting an optimized garden watering system has become a necessity due to the lack of the world water resource.

Results: The automated irrigation system is feasible and cost effective for optimizing water resources for agricultural production. The system would provide feedback control system which will monitor and control all activities of plant growth and irrigation system.

2. HIGH LEVEL DESIGN

2.1 Design

In this section, various sensors are deployed in the field like temperature sensor, moisture sensor and PIR sensor. The data collected from these sensors are connected to the microcontroller through Raspberry PI 3 Model B. In control section, the received data is verified with the threshold values. If the data exceeds the threshold value, notification is generated. This notification is sent as an alert to the farmer and automatically the power is switched OFF after sensing. The values are generated in the web page and the farmer gets the detailed description of the values.

In manual mode, the user has to switch ON and OFF the microcontroller by pressing the button in the Android Application developed. This is done with the help of GSM Module. In automatic mode, the microcontroller gets switched ON and OFF automatically if the value exceeds the threshold point. Soon after the microcontroller is started, automatically an alert must be sent to the user. This is achieved by sending a message to the user through the GSM module. Other parameters like the temperature, humidity and moisture sensors shows the threshold value and the water level sensor is used just to indicate the level of water inside a tank or the water resource.

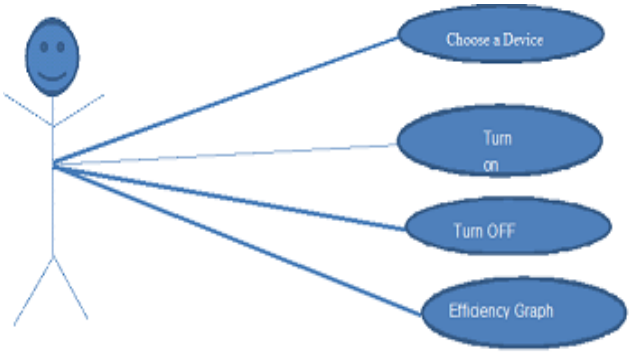

Fig 1: Use-Case Diagram

2.2 Description of Concept

Automation in agricultural tools: Agritech is regarded as IoT gadget focusing on Live Monitoring of Environmental data in terms of Temperature, Moisture and other types depending on the sensors integrated with it. Agritech provides the concept of "Plug & Sense" in which farmers can directly implement smart farming by as such putting the sensors on the field and getting Live Data feeds on various devices like Smart Phones, Tablets etc. and the data generated via sensors can be easily shared and viewed by agriculture consultants anywhere remotely via Cloud Computing technology integration.

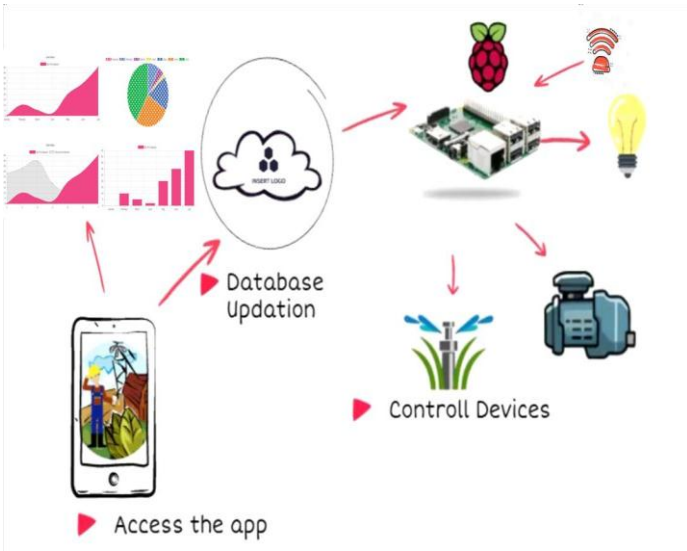

Fig 2: Design of Concept

2.3 System Flow Diagram

A System flow Diagram shows the complete path of the input and output through the system, specifies the type if input given to the system and indicates the type of output generated.

Application:

Once the application starts, user can add the device along with status, if the device is already added, then user turn on or off the required device. This application has an option to perform operation like generate or plotting efficiency graph. If the device is not in use or not needed any more, then user has an option to delete the device.

Server:

The server receives the data from the android application and updates the previous value and then sends the requested data to the application. If the user sends any of the signals of the device like turn on or off, the server forwards the signal to the Raspberry Pi. Server also gets the status of the device from the Raspberry Pi and sends it to the application.

Raspberry Pi:

The Raspberry Pi is a series of small single-board computers developed for promotion of teaching of basic computer science in schools and in developing countries. It receives signals from the server and processes it. The processed signal is then used to perform the operation indicated by the signal. Then it reverts back with the status of the device to the server.

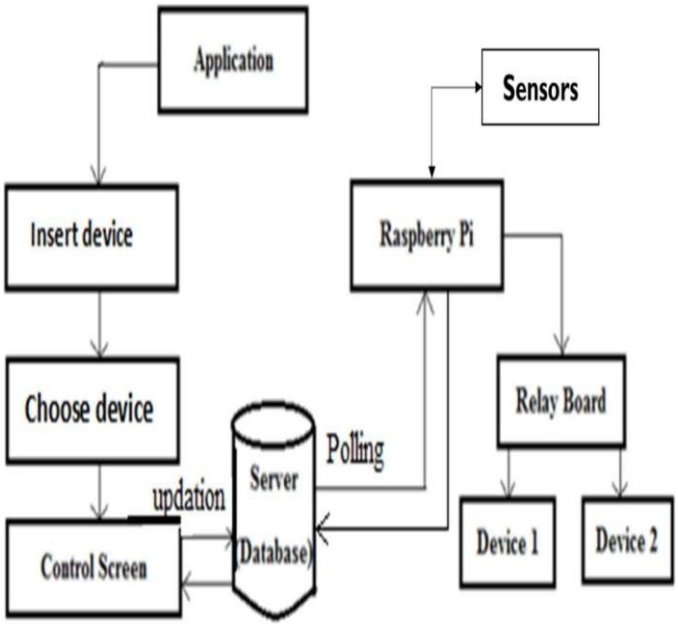

Fig 3: System Flow Diagram

3. IMPLEMENTATION

Software Requirements

Blynk Application

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, and it can store data, visualize it and do many other cool things.

There are three major components in the platform:

Blynk App - allows to you create amazing interfaces for your projects using various widgets we provide.

Blynk Server - responsible for all the communications between the smartphone and hardware. You can use our Blynk Cloud or run your private Blynk server locally.
Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and out coming commands.

Now imagine: every time you press a Button in the Blynk app, the message travels to the Blynk Cloud, where it magically finds its way to your hardware.
It works the same in the opposite direction and everything happens in a blynk of an eye.

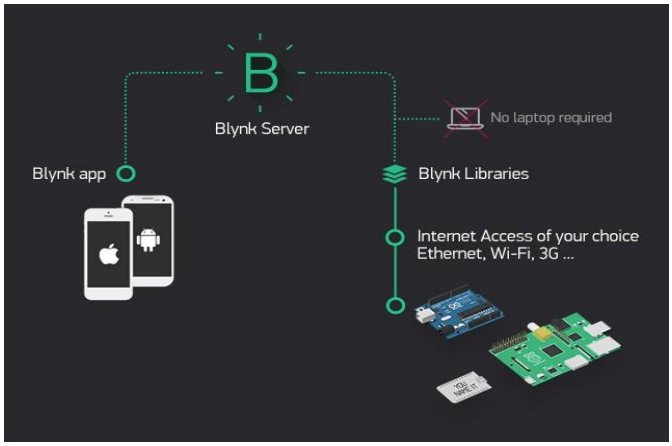

Fig 4: Blynk Application

Hardware Requirements

Raspberry Pi 3 B

The Raspberry Pi 3's four built-in USB ports provide enough connectivity for a mouse, keyboard, or anything else that you feel the Raspberry Pi needs, but if you want to add even more you can still use a USB hub. Keep in mind, it is recommended that you use a powered hub so as not to overtax the on-board voltage regulator.

Powering the Raspberry Pi 3 is easy; just plug any USB power supply into the micro-USB port. There's no power button so the Pi will begin to boot as soon as power is applied, to turn it off simply remove power.

The four built- in USB ports can even output up to 1.2A enabling you to connect more power hungry USB devices (This does require a 2Amp micro USB Power Supply) On top of all that, the low- level peripherals on the Pi make it great for hardware hacking. The 0.1" spaced 40-pin GPIO header on the Pi gives you access to 27 GPIO, UART, I2C, SPI as well as 3.3 and 5V sources. Each pin on the GPIO header is identical to its predecessor the Model B+.

Ultrasonic Ranging Module HC - SR04

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit.

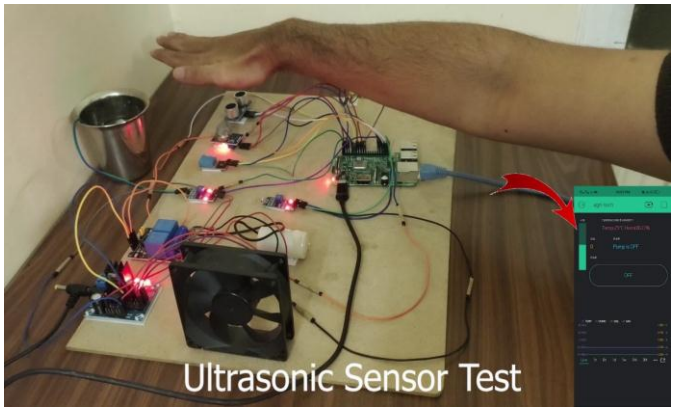

Fig 5: Ultrasonic Sensor

MQ-2 Gas Sensor

Sensitive material of MQ-2 gas sensor is SnO_2, with lower conductivity in clean air. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising. MQ-2 gas sensor has high sensitity to LPG, Propane and Hydrogen, also could be used to Methane and other combustible steam, it is with low cost and suitable for different application.

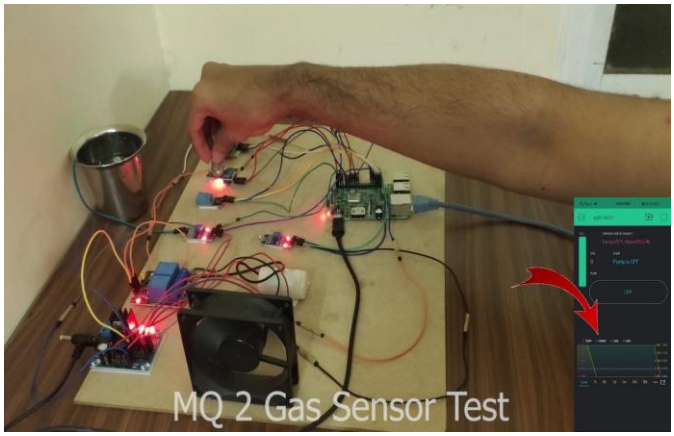

Fig 6: MQ-2 Gas Sensor

Soil Moisture Sensor

This sensor can be used to test the moisture of soil, when the soil is having water shortage, the module output is at high level, else the output is at low level. By using this sensor one can automatically water the plant, or crops requiring automatic watering technique. This module has triple output mode, digital output is simple, analog output more accurate, serial output gives exact readings.

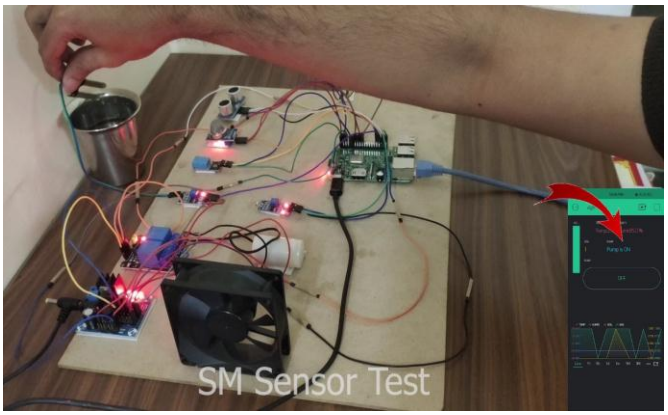

Fig 7: Soil Moisture Sensor

LDR Sensor

Light Dependent Resistor or Light sensor consists of two cadmium sulphide (CdS) photoconductive cells with spectral responses like that of the human eye. The cell resistance falls with increasing light intensity. Applications include automatic lighting control, batch counting and burglar alarm systems. The sensitivity of a photo detector is the relationship between the light falling on the device and the resulting output signal.

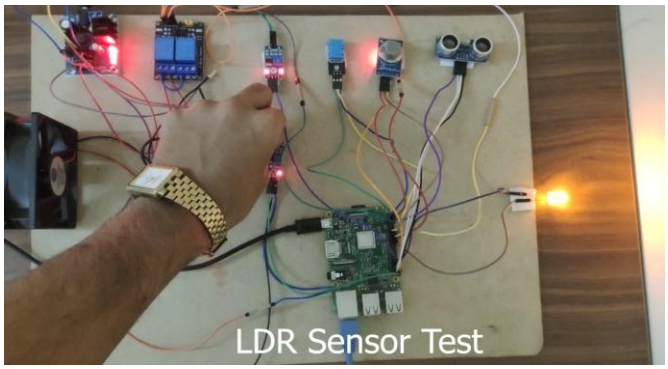

Fig 8: Light Sensor

DHT11 Temperature & Humidity Sensor

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability.

This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high- performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

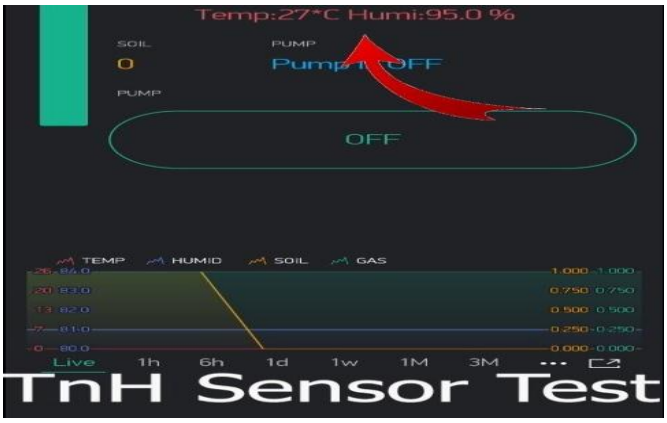

Fig 9: Temperature and Humidity Sensor

4. METHODOLOGY

Automation can be defined as the technology by which a process or procedure is performed without or minimal human assistance. In other words, Automation or automatic control is the use of various control systems for operating equipment such as machinery, sensors, home appliances, switching on/off networks, and other applications.

Internet of Things is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators and connectivity which enables these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but can inter-operate within the existing Internet infrastructure.

The Raspberry pi is a series of small single board computers developed to promote the teaching of basic computer science in schools and in developing countries.

It is the open hardware, with exception of the primary chip on the raspberry pi, the (system on a chip), which runs many of the main components of the board CPU, graphics, memory, the USB controller, etc.

Perform authentication of the interface, which indicates the server to use the set of devices to operate. Once the authentication of the interface is done the server connects to the database. The database stores all the history of the devices data.

Retrieving of the data is done by the raspberry pi. Raspberry pi is the main heart of the whole system. It regularly checks for the updation made in the database and controls the corresponding devices via relay board.

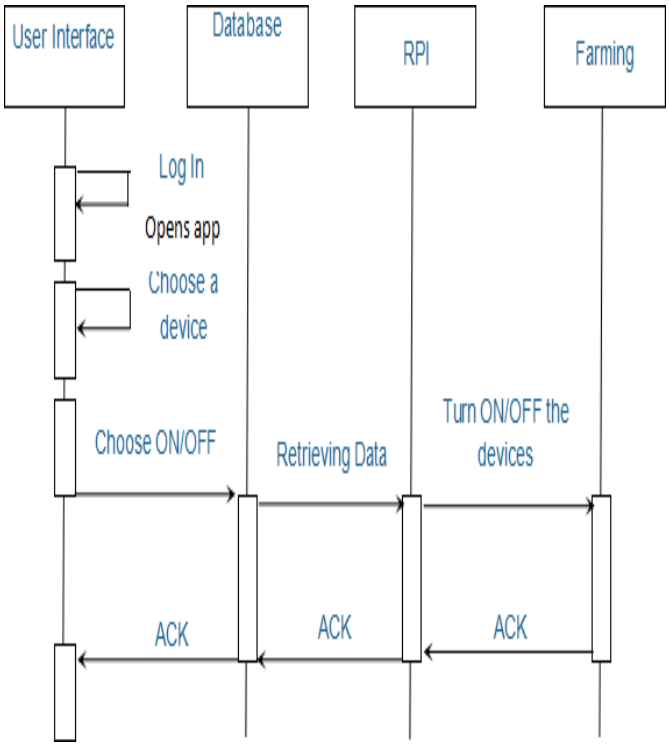

Fig 10: Methodology

5. RESULT

The figure below shows efficiency graph for the devices implemented using the RPi. The RPi is powered by a 5V adapter.

Fig 11: Efficiency Graph

Figure below shows the current status of the sensors and other devices like, soil Moisture sensor, temperature and humidity sensor, pump, ultrasonic Sensor.

Fig 12: Status of Devices

6. CONCLUSION

In this paper we have explained how the designed model successfully accomplishes switching the state of agricultural tools using smart android phone. We are able to generate power consumed graph with respect to time. Over all power consumption chart is been shown in the menu option. The designed models helps the farmer to grow financially by reducing the replacement of corrupted devices, help them during thunderstorms and excessive power consumption and reduces the manual work by saving their time.

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