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IoT based Agricultural System for Smart Farming

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***Abstract*— In the proposed model of Smart Agriculture/farming, five different smart features are created combining IoT technology, microntroller boards, electronic components, Bluetooth and WiFi modules which includes smart irrigation, to manage proper watering of crops to increase crop quality. IoT based smart fire sensor are implemented to protect crops from fire damage, animal repellent to prevent animals and insects from eating away and damaging crops. Motorized Sunroof is used for shielding the crops from extreme solar radiation. Artificial Basking provides light to the crops in the absence of sunlight due to cloudy sky. As light is important for photosynthesis.**

Keywords—IoT, sensors, Bluetooth, WiFi, motorized, artificial basking, smart agriculture

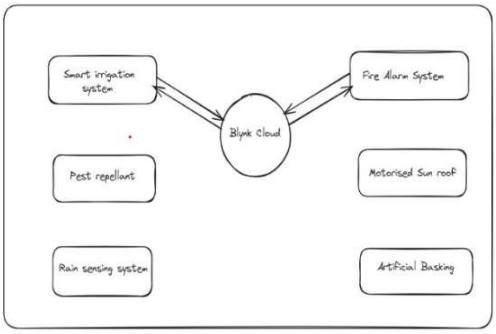
I. INTRODUCTION

Agriculture is an important aspect of human civilization, especially in India where a large part of our economy depends on agricultural sector. But due to various reasons the quality and quantity of our produce often deteriorates. It can include lack of proper irrigation, flooding due to excessive rain, pests and animals or fire outbreak. This leads to loss of billions every year. To mitigate this problem our model provides the solution to all of the above problems using modern technologies as given below. Smart Farming is a smart system that is implemented with the objective to eliminate or reduce human intervention in agricultural activities. It is implementation is achieved using electronic technologies like microcontrollers, Wifi [1] and Bluetooth modules, electronic sensors[2], IoT [3] – [9], software coding and various electrical and electronic devices like resistors, capacitors transistors and diodes. Some of the related literatures are discussed in [10] - [14]. Embedding of smart technologies in the proposed model has led to more efficiency and effectiveness of agriculture. The principle of smart agriculture revolves around leveraging advanced technologies and data-driven insights to optimize agricultural production while ensuring sustainability and efficiency. In essence, the principle of smart agriculture is rooted in harnessing innovation and data to create sustainable and efficient farming systems that meet the challenges of feeding a growing global population while safeguarding the environment and natural resources for future generations. The following section of the paper deals with the methodology, results and discussion about the novelty of the proposed design.

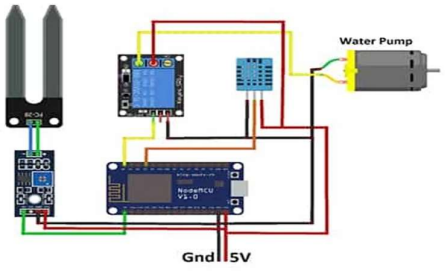
II. METHODOLOGY

The working principle is discussed in details in this section. The photodiode which conducts electric current when light falls on it works as a sensor of the proposed system. When a fire starts, light from the fire reaches the photo diode which generates electric signals passing through the device. The electric signal reaches the ESP 8266 microcontroller which process the signal and activate the buzzer connected to it. The wifi module of ESP 8266 enables the device of the user to receive fire alert notification in email via blynk app. Hence, buzzer based sound alert and notification in users device (mobile/laptop) is sent in real time so that the owner can take immediate necessary actions. There are various animals and insects (including mosquitos) that could hear the ultrasound. The Buzzer at the output (PIN 3) of the 555 timer IC so that a sound of desired frequency can be generated. A HIGH frequency Piezo buzzer is required, so that a high frequency sound can be generated. Humans might not be able to hear the sound, generated by the circuit as it is beyond our

audible range. Block diagram along with its circuit diagram is shown in Fig. 1(a) and Fig 1(b) respectively.



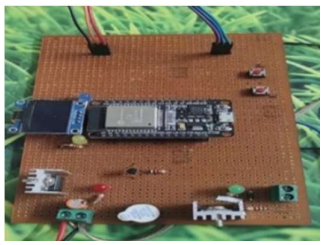
(a)



(b)

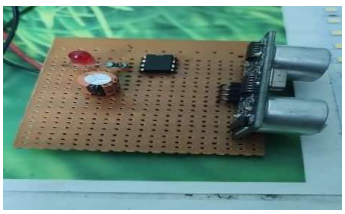
Fig.1. (a) Block diagram representation (b) Circuit Diagram of the proposed model

(a) Complete model (Top View)

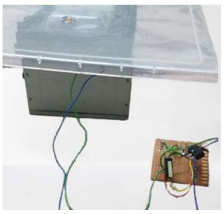


(b) Smart Irrigation Unit

(c) IoT based Fire Alarm

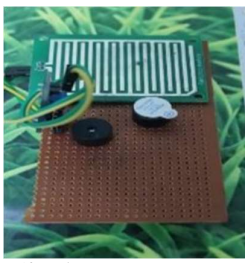


(c) Animal/Insect Repellent



(d) Motorised Sunroof

(e) Artificial Basking

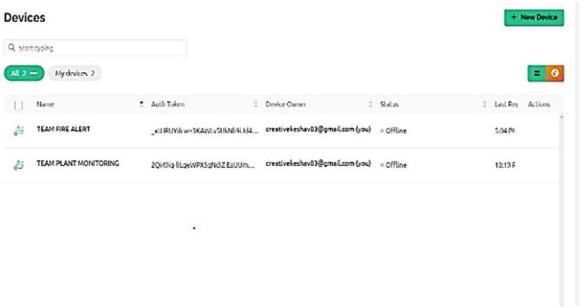


(f) Rain Sensor

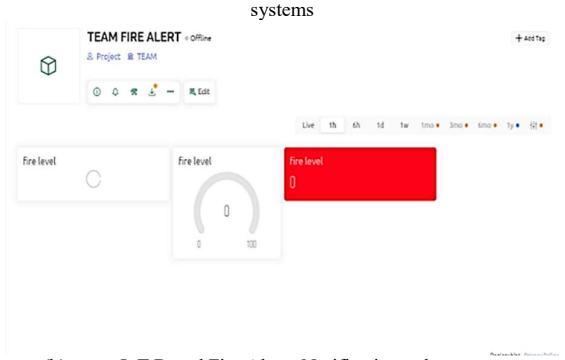
Fig.2 Complete model description along with each component shown

III. Results and Discussions

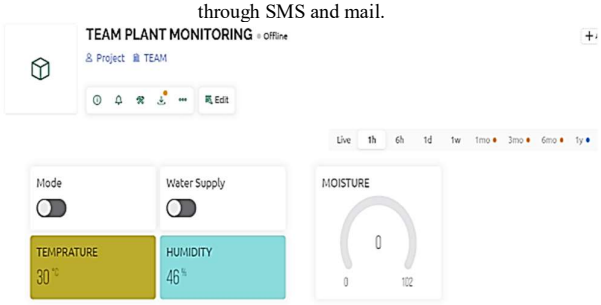
The results for each section of the proposed model is shown in the figure below. When light of fire is detected by the photo diode, both the LEDs turn on and the message "Fire Alert" is sent to the owners mobile via Blynk application (sms and mail) as shown in Fig. 3. Figure 3(a) shows the UI of the Blynk Web Application displaying the two smart systems while Figure 3(b) shows the smart alarm system which will notify the user about the fire through SMS and mail. The Smart Irrigation system shown in Fig. 3(c) is in auto mode. In the auto mode, when moisture detected by the soil moisture sensor falls below a certain threshold, the pump becomes on and water flows into the field. When moisture reaches the required level, the pump automatically turns off. In manual mode, pumping can be done anytime under any circumstances regardless of the temperature, humidity, moisture sensed by the system. The temperature and humidity levels change according to the sensors, thereby controlling the water pump hence, creating a smart system. The fire alarm notifications will be sent to the concerned owner as shown in Fig. 3(d).Artificial basking is also provided to aid the growth of crops. Finally, a system of artificial sunroof is provided to protect certain special crops from rain / excess sunlight.



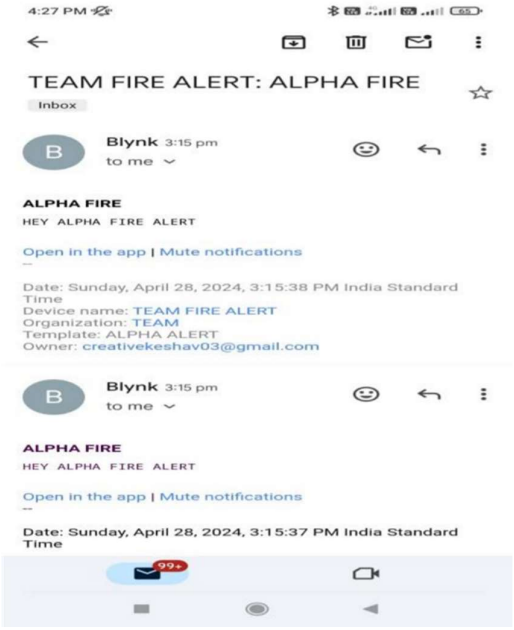
(a) UI of the Blynk web application displaying two smart systems



(b) IoT Based Fire Alarm Notification to be sent to user through SMS and mail.



(c) Smart Irrigation System in auto mode and manual mode.



(d) Screenshot of the mail sent to warn the user of an impending fire

IV. CONCLUSION

Smart agriculture represents a significant advancement in the agricultural sector, offering solutions to challenges such as climate change, population growth, and food security. By harnessing the power of technology and data, farmers can achieve higher yields, reduce costs, and contribute to a more sustainable future for agriculture. As these technologies continue to evolve, their widespread adoption has the potential to revolutionize global food production, making it more efficient, resilient, and environmentally friendly.

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