

Solar Powered Intelligent Reservoir for Farming and Security against Animal Attacks using IOT

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Abstract—In the field of agriculture, the use of proper irrigation method is very important because of the following reasons: lack of rains and scarcity of land reservoir water, damage of motor due to dry run, due to animal attack, another very important reason is the unplanned usage of water due to which significant amount of water goes waste. Agriculture is an occupation that is concerned of breeding plants, raising livestock and it deserves security. In this paper its been focused on solar powered intelligent reservoir water tank for future usage of water, protecting motor from getting damaged due to dry run and to provide protection from animal attacks. This paper is based on a methods in providing solutions like using solar energy to operate the pump in reservoir tank, identify the level of water in tank and to decide whether to turn on/off motor and identifying the animals getting near to the fields, if so then delivers real time operation without the presence of any humans. The status of operation will be informed to the user with the help of IOT technique.

Index Terms— Irrigation, Solar Power, Sensor, Dry run, Internet of Things(IOT).

I. INTRODUCTION

Agriculture is an important business that would hold human life and around 80% of available fresh water resources will be used in Agriculture sector worldwide, this percentage of water consumption will be continued so on because of food demands as population growth increases.

The technology which allows things for communicating between each other is called as “internet of things” IOT. It had changed the processes and patterns in agricultural field at greater efficiency. Recently IOT Technology has been widely involved in people’s day-today activities to interconnect the people throughout the world, device to devices or people to devices. it actually refers to an uniquely identifiable “thing” which have digital presence. The main two categories of these things are: identified things and the connected devices, those things or objects can be interconnected with another object and also to the internet. Hence the connection of millions of devices through internet is called as Internet of Things (IOT).

This paper proposes intelligent solar powered reservoir water tank(Fig 1) which make use of solar energy. It is free and most abundant source of energy and the most efficient approach to use this solar energy is by Photovoltaic generation. Nowadays an solar panels which is nothing but an array of photovoltaic cells are used in streetlights, to meet domestic loads and in solar water heaters. This technology can also be used in

irrigation system. The advantage of this kind of water pumping system is we can store water in reservoir tank when sunlight is available thereby eliminating usage of batteries which make our system simpler and thereby reduce the cost effective. The solar photovoltaicity make use of solar converter or photovoltaic inverter to convert direct output current into an feasible frequency alternating current which can be used by any local, off-grid electrical network or by commercial electrical grid network.

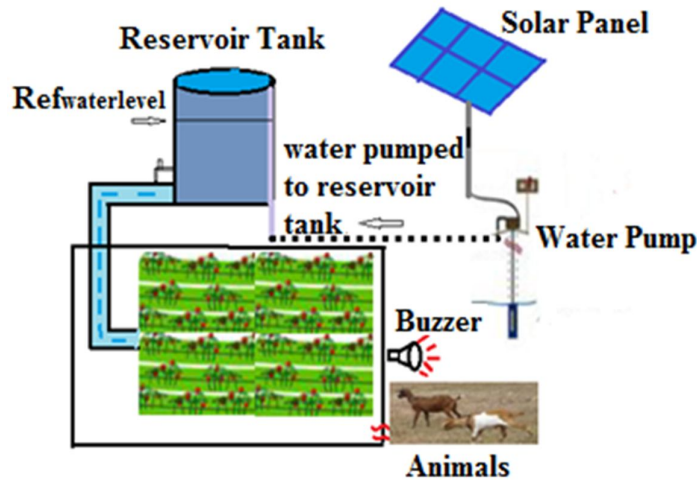


Figure 1: Proposed system

Because of no animal detection system, it has bought an massive loss for an farmer as animal attacks would destroy crops or crops will be eaten away by animals and sometimes there is a possibility of farmers losing their life due to animal attacks. Because of this improper safety measures most of the farmers are left helpless. Hence an proper animal detection system would help those farmers to preserve their crops.

Many times we see that farmer turns on the motor to water the crops and proceed with their work but forgets to turn off when there is no water in the tank, in such cases there is an possibility of motor getting damaged due to dry run so an proper monitoring is required.

II. RELATED WORK

S. S Wandre and V. B. Shinde[1] have considered that the Photovoltaic water pumping system is an best method for irrigation purpose. The variation of temporal and spatial distribution of available water for farming brings an big demand for water harvesting techniques. So the solar powered automated irrigation system would give the best solution for enhancing proper and efficient usage of water in agriculture sector and using this renewable energy system reduces workmapship. The use of photo irrigation system will also help in contributing a socioeconomic development.

Dr. M. Damodar Reddy[2] and V. RaviKiran have considered the concept of solar driven automatic water level controller along with dry run protection (SDWLC). The main purpose of SDWLC is develop an idea for proper usage of water, to stop the motor when there is no water in tank to avoid the motor from getting damage due to dry run and make use of solar energy effectively which is available abundantly.

Savio Raj Philip and Mriganka Gogoi[3] have proposed an system in which its been considered the need of analyzing the detection of animals particularly to protect paddy fields and farm land from getting attacked by animals. this system includes object detection and segmentation process. In segmentation process, the frame differencing is been used which is followed by “thresholding” and in frame differencing process two consecutive frames are subtracted which gives only the moving object and the segmentation process will be followed by the object detection.

H.T.Ingale and N.N.Kasat[4] have proposed and system which is based on sensing the changing condition of humidity and aware humans for proper usage of water for irrigation purpose.

Rich Gabrielson, Eric Spaulding and Robert Maccurdy[5] have proposed an real time automatic animal detecting and tracking system using GPS in which the system allows simultaneous detection of animals with compactable transmitters.

Surabhi Agarwal and Chandrika Chandra[6] have proposed an wireless design system for low cost animal detection using GSM technology in which it has been considered four sector area and controlling water pumps at their respective sector area.

S. Harishankar, Sudharsan K.P, R. Sathish Kumar, T. Viveknath and U. Vignesh[7] proposed an cost effective solar powered smart irrigation system consisting of solar powered water pump and an automated control of water flow based moisture sensed information which helped in energy crisis for farmers.

H.T.Ingale and N.N.Kasat[8] introduced an system in which it has been considered the proper scheduling of supplying water for irrigation based on humidity condition, avoiding wastage of water and give the proper knowledge for an farmer about plants growing specification with proper water supply to them.

III. PROPOSED METHODOLOGY

The main scenario is to develop an intelligent solar powered Reservoir for Farming and Security against Animal attack control system to analyze data and updates status to the user over network. In this system a solar panel (array of photovoltaic cells) and IR sensor will be connected to an controller board named as Raspberry Pi board.

Fig 2 shows the proposed system.The solar Panel is used to store the solar energy during day time, this energy will be further utilized for pumping water from the underground/borewell to an reservoir water tank(storage of water). Whereas to detect dry run condition of the motor an controlling subsystem is been introduced which consists of an IR sensor and will be placed inside the tank, this IR sensor will sense the level of water in reservoir tank and based on the condition of water level with respective to reference water level ($Ref_{waterlevel}$) the motor will be turned ON, the condition become true only if water level becomes lower than the reference water level (refer Fig 3) and an PIR sensor will be placed at the boundary of the field and it keep on sensing the arrival of animals near the fields and based on the analyzed condition (refer Fig 4)the buzzer turns ON automatically due to which animals may get panic and move away from fields.

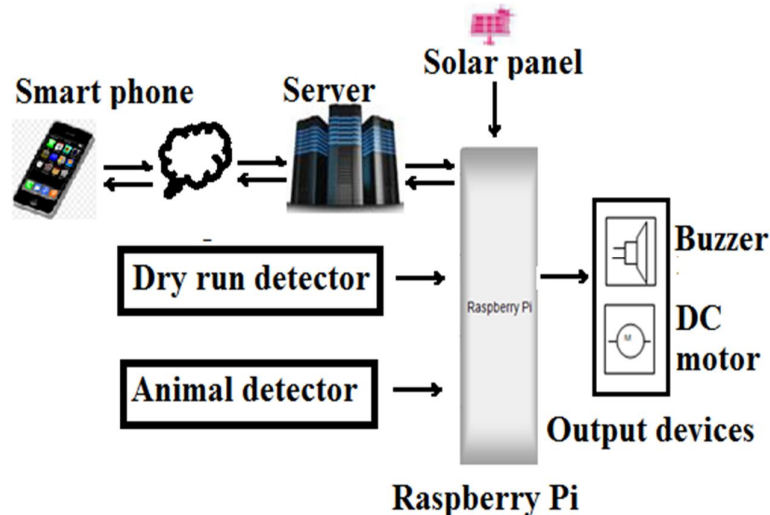


Figure 2: Design Methodology

Meanwhile the status of sensing data will be updated to the server using Wi-Fi module which is inbuilt in Raspberry Pi board. The sensed information will be analyzed to activate the controlling devices and controller will be used as an server to interact with user.

Components used :

- A. Raspberry Pi 3 Model B
- B. Solar Panel

- C. IR Sensor
- D. PIR Sensor
- E. DC Motor

A. Raspberry Pi 3

Raspberry Pi 3 Model B is an third generation Pi model, it is an powerful credit card sized small computer which can be used for agricultural application also, this is most powerful processer and faster. In addition it has inbuilt Wi-Fi module and Bluetooth which will be used for better connectivity. It has an inbuilt 1GB RAM,40 GPIO pins, Micro SD port which can store data.

B. IR Sensor

IR Sensor is used for sensing the water level in the tank, it will be placed inside the tank, it has to detect the water level or target by reflection of infrared beam. It should detect the level of water without contact with water. The range of device should vary with small distance in terms of cm, example of 60cm, but this range can slightly vary depending upon the IR transmitter and receiver LEDs and the range is also affected by the reflecting surface color

C. PIR Sensor

PIR Sensor is used for sensing the movable objects, it does not generate any energy or radiate energy to detect moving object instead it detects object by taking energy given off by the other moving objects in other terms it detects the infrared radiation emitted to the moving object or by infrared radiation reflected from the moving object. The range of PIR sensor will be upto 10 meters with +15° to -15°.

D. Solar Panel

Solar panel is an array of Photovoltaic cells/modules that are connected electrically and mounted on a flat structure. Photovoltaic module is a packet of array of solar cells which will convert sunlight into an electric current using photovoltaic effect (which means when an photon of light hits the semiconductor in panels, it causes an electrons to reach to its highest energy level), the job of solar panel is it pass all these electrons in one direction which leads to production of Electric current, hence solar panels are used to generate energy and to supply electricity to agricultural applications.

Language and Platform used are:

- A. Embedded c or Python
- B. Raspbian OS

A. Making a Decision for Motor

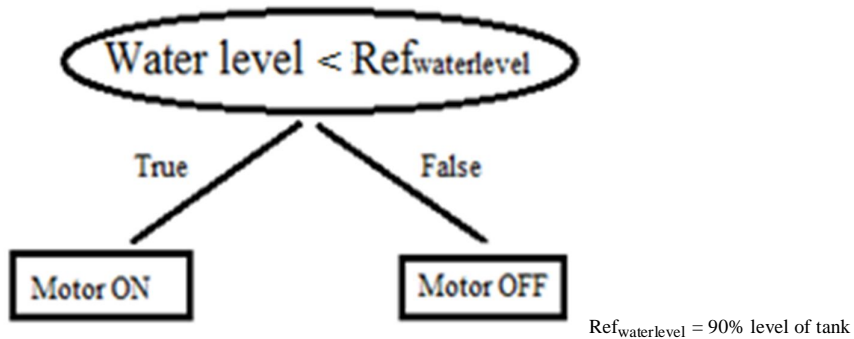


Fig 3: motor decision flow for motor

Fig 3 shows the decision making flow for controlling motor, once water get flowing out of the reservoir tank the sensor keep checking the water level if Water level goes below the Ref_{waterlevel} then the condition becomes true hence motor turns ON else OFF.

Making a Decision for Buzzer: Fig 4 shows the decision making flow on detecting animals, if Range<=1 means there is no obstacle, if the condition Range>=1 is true it indicates the arrival of animals within the specified range of PIR sensor hence the Buzzer will be ON else OFF on failure condition.

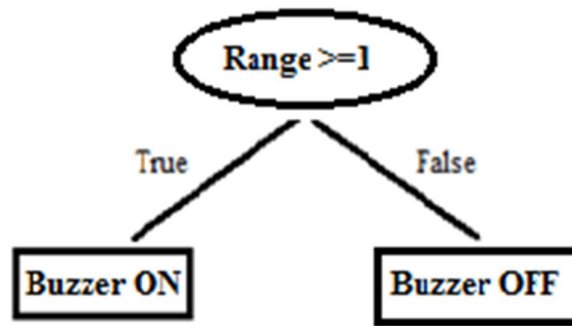


Figure 4: condition checking for animal detection

IV. CONCLUSION

The proposed system will help the farmers from protecting their fields from animal attacks, easily pump water to reservoir tank with the help of free solar energy source and also protect the motor from getting damaged due to dry run this system is comparably best and cost effective than using power supply for pumping water to tanks and may reduce human intervention. The energy obtained by solar panels can also be used for village Improvement purpose like street lights, supply electricity to their homes. This system is simple, friendly environment with good performance, even though the initial investment is high the advantages are high and needs less maintainability, and same system can be used for long period without fuel or electricity supply hence this proposed system will be more economic.

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