Smart Farming Technology

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Abstract – Agriculture being backbone of the country contributes a major part to country's development, but degradation of resources resulted in the detoriation of agriculture in recent times. In order to improvise agriculture IoT has to be considered differently for implementation. The paper presents an idea for IoT based smart farming system to stabilize the agricultural productions and increase its yield. The only method to implement this is by modernizing the existing traditional methods the features in this system include GPS controlled robots, sensors, camera and Wi-Fi or ZigBee module.

Index Terms – IoT, automation, Wi-Fi, GPS, Smart Device.

1. INTRODUCTION

Agriculture is considered as the basis of life for the human species as it is the main source of food grains and other raw materials. It plays vital role in the growth of country's economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. Hence there is need to implement modern science and technology in the agriculture sector for increasing the yield. To meet this demand, farmers and agricultural companies are turning to the Internet of Things for analytics and greater production capabilities. The IoT is set to push the future of farming to the next level. Smart agriculture is already becoming more commonplace among farmers, and high tech farming is quickly becoming the standard thanks to agricultural drones and sensors. Farmers have already begun employing some high tech farming techniques and technologies in order to improve the efficiency of their day-to-day work. For example, sensors placed in fields allow farmers to obtain detailed maps of both the topography and resources in the area, as well as variables such as acidity and temperature of the soil. They can also access climate forecasts to predict weather patterns in the coming days and weeks. The Internet of Things (IoT) is transforming the agriculture industry and enabling farmers to contend with the enormous challenges they face. New innovative IoT applications are addressing these issues and increasing the quality, quantity, sustainability and cost effectiveness of agricultural production. Today's large and local farms can, for example, leverage IoT to remotely monitor sensors that can detect soil moisture, crop growth and livestock feed levels, remotely manage and control their smart connected harvesters and irrigation equipment, and utilize artificial intelligence based analytics to quickly analyse operational data combined with 3rd party information, such as weather services, to provide new insights and improve decision making. Monitoring environmental factors is not enough and complete solution to improve the yield of the crops. There are number of other factors that affect the productivity to great extent. These factors include attack of insects and pests, which can be controlled by spraying the crop with proper insecticide and pesticides. Secondly, attack of wild animals and birds when the crop grows up. There is also possibility of thefts when crop is at the stage of harvesting. Even after harvesting, farmers also face problems in storage of harvested crop. So, in order to provide solutions to all such problems, it is necessary to develop integrated system which will take care of all factors affecting the productivity in every stages like; cultivation, harvesting and post harvesting storage. This paper therefore proposes a system, which is useful in monitoring the field data as well as controlling the field operations, which provides the flexibility. Controlling of all these operations will be through any remote smart device or computer connected to Internet and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with micro-controller and raspberry pi.

2. PROPOSED MODELLING

The system consists of four sections 3 nodes and a mobile app for controlling the system. In the system, every node is integrated with sensors and is interconnected to a central system through wireless network. There are two modes of operation automatic and manual. Auto mode enables the system to take its own decision and in manual, the system is controlled by a mobile app.

3. HARDWARES USED

- Raspberry Pi
- Obstacle sensor
- ZigBee Module
- Temperature Sensor
- Moisture sensor
- Humidity sensor

- AVR Microcontroller

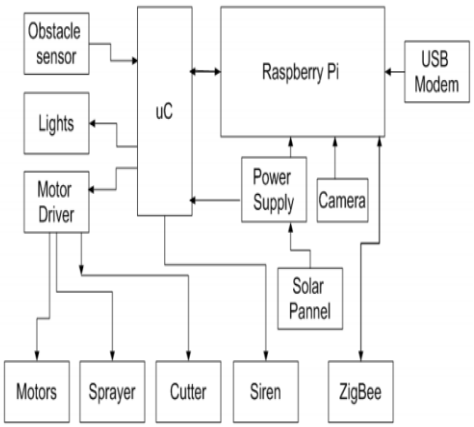
4. SOFTWARE USED

- AVR Studio Version 4
- Proteus 8 Simulator
- SinaProg
- Raspbian Operating System

5. SYSTEM ARCHITECTURE

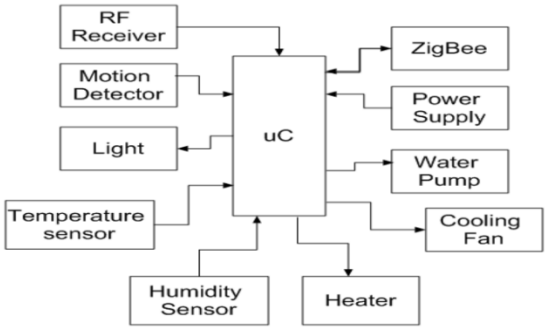
NODE1:

- Node1 is GPS based mobile robot which can be controlled remotely using computer as well as it can be programmed so as to navigate autonomously within the boundary of field using the co-ordinates given by GPS module.
- The Remote controlled robot have various sensors and devices like camera, obstacle sensor, siren, cutter, sprayer and using them it will perform tasks like; Keeping vigilance, Bird and animal scaring, Weeding, and Spraying



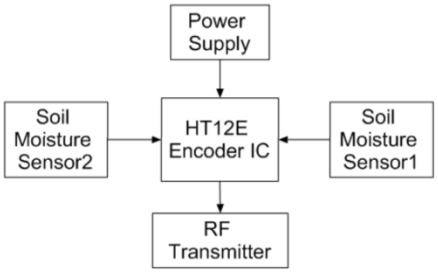
NODE2:

- It consists of motion detector, light sensor, humidity sensor, temperature sensor, room heater, cooling fan altogether interfaced with AVR microcontroller. Motion detector will detect the motion in the room when security mode will be ON and on detection of motion; it will send the alert signal to user via R-pi providing theft detection.
- Temperature sensor and Humidity sensor senses the temperature and humidity respectively and if the value crosses the threshold then room heater or cooling fan will be switched ON/OFF providing temperature and humidity.



NODE3:

- Node3 is a smart irrigation node with features like .
- Smart control of water pump based on real time field data i.e. automatically turning on/off the pump after attaining the required soil moisture level in auto mode, switching water pump on/off remotely via mobile or computer in manual mode, and continuous monitoring of soil moisture.
- In node3, moisture sensor transmits the data using HT12E Encoder IC and a RF transmitter. The transmitted data is received by node2 and there it is processed by microcontroller in order to control the operation of water pump.



6. RESULTS AND DISCUSSIONS

RESULT OF NODE1:

- NODE1 consists of mobile robot with central server, GPS module, camera and other sensors.
- All sensors are successfully interfaced with microcontroller and the microcontroller is interfaced with the raspberry pi.
- GPS and camera are also connected to raspberry pi.
- Test results shows that the robot can be controlled remotely using wireless transmission of PC commands to R-Pi.
- R-Pi forwards the commands to microcontroller and microcontroller gives signals to motor driver in order to drive the Robot.

- GPS module provides the co-ordinates for the location of the robot.

RESULT OF NODE2:

- Node2 consists of motion detector, temperature sensor, humidity senor, cooling fan, water pump, etc. connected to the microcontroller board.
- The sensors gives input to the controller and according to that microcontroller controls the devices in auto mode and also sends the value of sensors to R-Pi and R-Pi forwards it to user's smart device using internet.
- Test results shows that when temperature level increases above preset threshold level then cooling fan is started automatically in auto mode.
- The water pump also gets turned ON if moisture level goes below fixed threshold value.
- In manual mode, microcontroller receives the controlling signals from R-Pi through ZigBee and accordingly takes the control action.

RESULT OF NODE 3:

- Node3 consists of a moisture sensor connected to HT12E.
- Moisture sensor transmits the data using HT12E Encoder IC and a RF transmitter to the Node2 where it is processed by microcontroller and accordingly water pump is switched ON/OFF.

7. CONCLUSION

The sensors and microcontrollers of all three Nodes are successfully interfaced with raspberry pi and wireless communication is achieved between various Nodes. All observations and experimental tests proves that project is a complete solution to field activities, irrigation problems, and storage problems using remote controlled robot, smart irrigation system and a smart warehouse management system respectively. Implementation of such a system in the field can definitely help to improve the yield of the crops and overall production.

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