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Design of Farmer Friendly Intelligent System to Monitor and Control the Parameters in Precision Agriculture

Santhosh B Panjagal, V.Harinath, G.N.Kodanda Ramaiah, R Karthik

Abstract*: The principle objective of the proposed framework is to outline a convenient, versatile and low cost farmer friendly intelligent system to accomplish efficient use of water supply and motor control. It senses on field data like climate temperature and soil moisture level, rainfall, with the assistance of sensors used in the system. And also check for 3-ϕ supply availability, no load condition of water pump, intruder detection (humans, animals etc.). farmer receives all the parameters data sensed on field, for further decision making about the need for watering. Also need for motor Turn ON/OFF based on sensing rain fall and the same will be sent to the farmer, who might be away from the field. If any intruder is detected alarm gets enabled and the same is notified to the farmer via SMS.

In the proposed system "SMS on demand service" is provided to get the status of all parameters like water resource availability, soil's moisture content, 3-ϕ power supply availability and the intruder detection. The system helps the farmer in switching the motor according to his need i.e., whether the water is required for the crop or not. A user friendly mobile application and normal SMS service will enable the farmer to monitor and control the land parameters from the remote place efficiently. Hence the proposed method shows satisfactory performance to measure and monitor the land parameters and moreover 3- ϕ supply availability based motor operation saves from motor failure.

***Index Terms*: Ultra-Low power MSP430, 3-Phase system, GSM, Sensors, Intruder detector, Motor etc..**

I. INTRODUCTION

Indian economy firmly dependent on agriculture, over 70% of geographical area constituted by rural villages, and also around 58% of rural people's primary income is based agricultural production [4]. Indian water system framework for agriculture incorporates a system of major and minor waterways from streams, groundwater, tanks, and other water reaping. Of these, the groundwater framework is the largest[5] Of the 160 million hectares of developed land in India, around 39 million hectare can be flooded by groundwater wells and an extra 22 million hectares by water system canals.[6] In 2010, just around 35% of agrarian land in India was dependably irrigated[7].

The water is a most critical component of agricultural practices. Existing techniques for watering crops in land requires water in amount as well as level of water wastage is likewise high [3]. All-inclusive water is turning into a rare asset that inducing the need of controlled harvest water system. Because of uneven normal circulation of rain water it is exceptionally essential for agriculturists to screen and control the equivalent routing of water to all harvests in the entire homestead or according to the prerequisite of the yield.

In existing system switching off motor [2] is done manually/automatically by the farmer without considering input phase supply, which may sometimes result in motor failure, Along with these farmers are unaware of the requirement of water to the field at right time resulting in poor water management in turn reduced crop yield. Apart from these an adverse effect on crop yield is observed due to intruders (Human beings, Wild animals) which are to be identified and controlled.

In our proposed work various sensors are installed to measure the parameters of the crop land such as, humidity/temperature, rainfall, moisture level, intruder detection, 3-φ supply availability and motor failure notification. Sensed data shall be processed and sent to the farmer via GSM for further action, like based on moisture levels and/or rainfall status motor can be turned ON/OFF. Even the motor theft proof option is incorporated to avoid unauthorized persons. The intruders can detected by using laser technology, in which laser beam is routed around the field. Thus the designed prototype enables a farmer to receive text messages on his/her cell phone [1], if any animal or person enters into the land. Further the siren is activated to avert the intruders.

II. SYSTEM DESIGN

A. System Overview

The overview of the presented work is as shown in Fig 2.1, which represents real-time working of the all the systems installed at the agricultural land. Various sensors detects the changes in the parameter ranges, ultra-low power processor measures and analyses the sensor data and takes the decision based on condition and command decided by the farmer. An SMS service used by the farmer can control the motor remotely and know the status of land parameters with "SMS on Demand Service".

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***** Correspondence Author
Santhosh B Panjagal, Dept. of ECE, Kuppam Engineering College, Kuppam, India.
V harinath, Dept. of ECE, Kuppam Engineering College, Kuppam, India.
G.N Kodanda Ramaiah, Dept. of ECE, Kuppam Engineering College, Kuppam, India.
R Karthik, Department of Electronics and Communiaction Engineering, MLR Institute of Technology, Hyderabad, India .

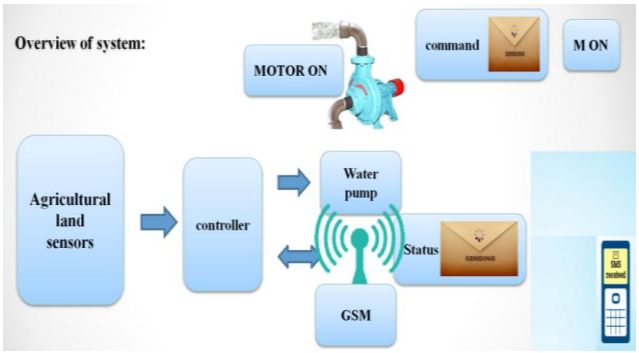

Fig 2.1: Overview of the overall system

B. SYSTEM BLOCK DIAGRAM

From fig 2.2, it is clear that the controller collects all the land parameter information, the collected information is processed and sends to the farmer in the form of text message using GSM. By checking the status of the field parameters, a farmer can turn on/off the motor on his/her need by a message with valid text.

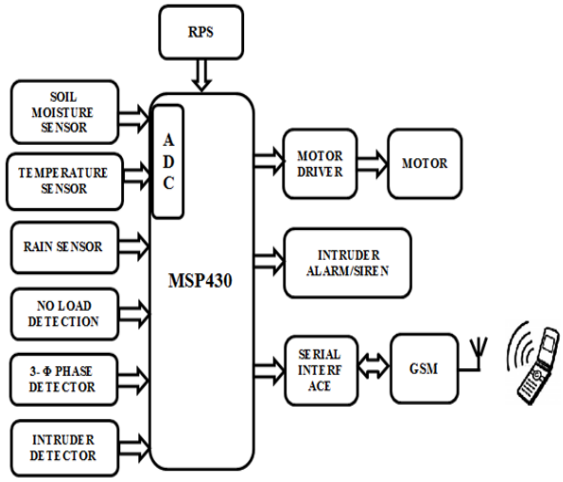

Fig 2.2: Proposed system block diagram

MSP430: A mixed signal RISC processor especially designed for Ultra-Low power applications [8]. The MSP430 is unique platform, which has many ultra-low power modes, flexible clocking system; more over every port pin/GPIO is interruptible. These features makes the processor consumes very little power such as, it can operate for many years on just a single coin cell battery. This processor is very much suited for remote applications, where the tiny sensors operate on battery. It uses Von-Neumann memory architecture, making both RAM and ROM to co-exist in the same memory bank. Provides both 10-bit and 12-bit ADC's which can be operated independently without the processor intervention. It has two powerful 16-bit timers with various capture and compare registers making this feature to be used to achieve ultra-low power consumption [8].

III. RAL-TIME SOFTWARE DESIGN

In order to design a complete working intelligent module, a real-time software program needs to be installed on the processing/controlling unit, which coordinates the functions of all the subsystems connected to it. As shown in figure 2.3, the first step in programming is to initialize the COM ports, sensors, display device etc., then calibrate the analog sensors to their optimal levels, and then measure the soil moisture content, rain fall status, 3-Phase power availability, intruder trespassing before sending temporal data to the farmers at the regular intervals. If any intruders like human beings or animals trying to access the land then an alert SMS will be sent to the farmer and a gentle alarm gets activated.

Apart from regular notification to the farmer, the system enables the "SMS on Demand" Service to be accessed by the farmer to know the land parameter status and control the water pump from remote place.

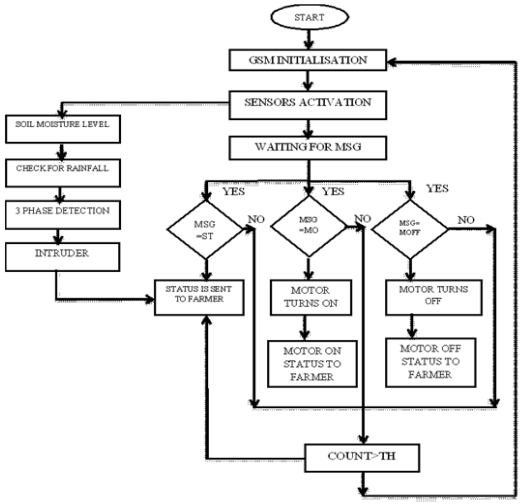

Fig 3.1: Software Design Flowchart

IV. RESULTS & DISCUSSION

To bring the idea into reality, we designed a prototype module, which demonstrates the real-time working of the entire system in the agricultural land. The present agriculture monitoring and control system is more advantageous when the agriculture land is far away or the farmer is in remote places. Figure 4.1 shows the prototype module of the proposed system.

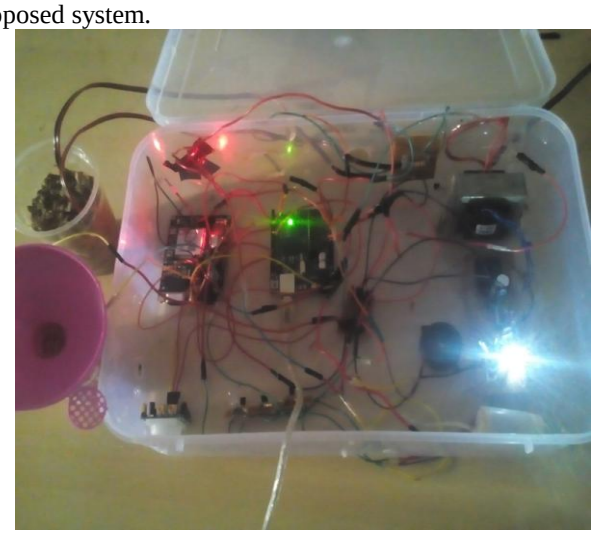

Fig 4.1 Proposed System Prototype Module

In order to switch ON the motor, firstly, the farmer should know the land parameters and 3-Phase supply availability; this is done by sending a valid text "STS" to the system.

After sensing the moisture content, temperature, rainfall, available load, intruder, the status information will be sent to the farmer.

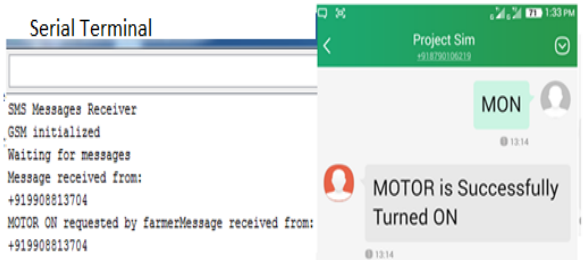

Fig 4.3 Acknowledgement message for Motor ON Command

If the land parameters are normal then, the farmer can switch off the motor by sending "MOFF" command to the system, in return he will receive acknowledgement stating motor is turned off successfully, as shown in figure 4.4.

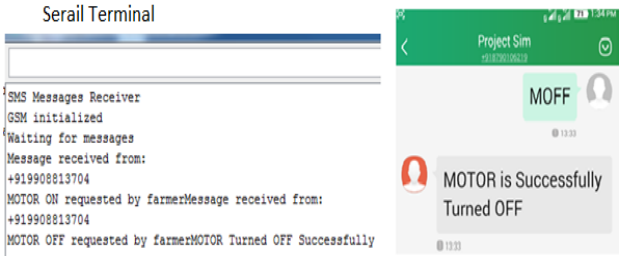

Fig 4.4 Acknowledgement message for Motor OFF Command

If there is any Intruder in the farm/land, the buzzer gets automatically turned ON. After a certain count even if the farmer does not request the status, the system will send the land status message automatically to the farmer [17-19].

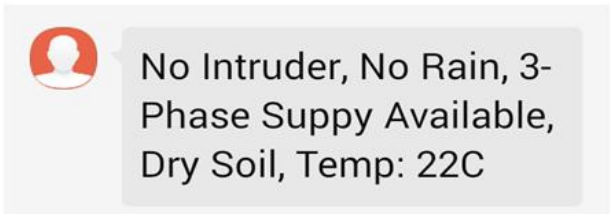

Fig 4.5 Status information at regular intervals

V. CONCLUSION AND FUTURE SCOPE

This paper describes about the design of a farmer friendly intelligent system to monitor and manage different parameters in the agricultural land. Remote monitoring and controlling facility enables the farmer to enter into a new virtual reality platform. The famer can able check all the parameters of the land and makes the decision accordingly. if the crop needs some watering he/she can put ON the water pump if there is no rain around or put OFF the pump if adequate watering to the crops is reached. Through the SMS service, the farmer can get complete information of the land parameters and also sends control signal for triggering certain actions. So the proposed system makes the farmer to monitor and control the situations around and/or in the land without being physically present in the land.

Future Scope: Our system can further be scaled up by incorporating biosensors to detect deficiency of NPK mineral levels in the land and suggesting the suitable fertilizers to improve the land fertility, intern increasing the crop production. Even the camera shall be installed to know the kind of disease the plants have been affected and there by suggesting suitable pesticides.

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AUTHORS PROFILE

Mr.Santhosh B Panjagal,M.Tech, (PhD) currently working as an Associate Professor, ECE-Department, KEC-Kuppam, A.P, INDIA. He pursued his B.E in 2006 from PDACE-Gulbarga affiliated to VTU-Belagavi. M.Tech in 2014 from SVCET-Chittoor, JNTU-Ananthapur and currently pursuing Ph.D in VTU-Belagavi. Published more than 10 research papers in many international journals, presented papers in a national & international conferences. He is a life member of IEI, ISRD & IAENG. His research interests are embedded systems, Wireless Sensor Networks, mobile communications and software development

Mr.V Harinath, M.Tech. (Ph.D) Currently working as an Associate Professor, ECE-Department, KEC-Kuppam, A.P, INDIA. He pursued his B.Tech in 2002 from JNTU-Anantapur. M.Tech in DE&CS 2012 from SVCET-Chittoor, JNTU-Ananthapur and currently pursuing Ph.D in VTU-Belagavi. Published more than 6 research papers in many international journals, presented papers in a national & international conferences.He is currently life member of MISTE & IEI. His research interests are embedded systems, Wireless Sensor Networks, mobile communications and Precision Agriculture.

Dr.G.N Kodanda Ramaiah, M.Tech. Ph.D Director R&D, Professor & Head, ECE-Department, KEC-Kuppam, A.P, INDIA. pursued his M.Tech degree from SJC Mysore, affiliated to VTU-Belagavi. Doctorate in 2012, JNTU-Ananthapur Published more than 40 research papers in international journals, presented 10 papers inboth national & international conferences. Currently he is life member of ISTE, MISTE, IEI. His research interests are embedded systems, Wireless Sensor Networks, mobile communications and Signal Processing & Speech Processing.

R. Karthik received M. Tech degree from the Visvesvaraya Technological University, India and Ph.D degree from VIT University, India. He is currently the Professor at Department of Electronics and Communication, MLR Institute of Technology, Hyderabad. Earlier, he was working as a faculty member at VIT University, Vellore. His Ph. D thesis research work was carried out at one of the labs of Center for Nanoelectronics, Indian Institute of Technology – Bombay, India. He received best researcher award from VIT University for his contribution to Nanodielectrics in 2013 and 2014. His current area of research includes Fabrication and Modeling of Nanoelectronic or Optoelectronic material based devices, Microwave Antennas, Medical Image Processing, Transformation in engineering education etc. At present, he is guiding 1 PhD research scholars. He has published more than 65 research papers in reputed journals and conferences. He is one of the co-designer for developing a nano-size high performance capacitor in 2013.