Implementation of GSM based data transfer and automaticControl systems in precision agriculture

K.Aravindhan*, R.CharathSwaminathan
Electrical and Electronics Engineering, MisrimalNavajeeMunoth Jain Engineering College, Thoraipakkam, Chennai-600097.

*Corresponding author: skaravindhan@gmail.com

ABSTRACT

To implement automatic control of pumps, motors and other necessary things to be controlled in the farm using GSM technology and also using the same GSM modem to implement data transfer system in agriculture system. So, by combining data transfer and control by using GSM technology one can easily manage agriculture and it will also make agriculture more effective. In agricultural land, there are data sensors or data loggers to collect the various field data such as moisture content and pH content etc., these data can be processed and sent to farmer or to central computer of the agriculture company using GSM technology at high speed. So when data transfer is enabled in high speed, lot of time and money is saved.And another advantage is that the farmer needs not to visit his field to know the conditions of his farm. As he receives data from field sensors through GSM technology, next control by using GSM technology is implemented by using microcontroller which is acting as interface between things to be controlled and GSM system. The control using GSM technology makes job of farmer very simple because during heavy rain or storm it is difficult for farmer to visit his land, so by using this technology he can easily control the pumps, motors etc. and also receive necessary data from the field. Another important advantage in this project is time management, as it enables fast data transfer and control, which is key factor in agriculture. Also, this project aim to modernize Agriculture and make the younger generation of our country to take Agriculture as their career.

INTRODUCTION

Agriculture has been backbone of our country for several years, 70% of our population is involved in the agriculture either directly or indirectly, and agriculture sector contribution to the GDP is significant , so agriculture is constantly evolving as newly developed technology offer new perspectives. The main drawback in the existing agriculture system is there is lack of automation and no proper way to use the data collected from the field using the field sensor. So because of this, the efficiency of agriculture is reduced and as a consequence end result also affected. There is a need for a system to be developed so that efficient use of field data can be achieved. And in another important perspective, it is our duty to design a cost effective system, so that it can be implemented in the agriculture field. It is the purpose of the paper to present data transfer and automatic control system using GSM technology. The global system of mobile communication is extremely useful in transporting the data in faster way and it can also transfer the data to many users who need these data ,apart from this we can interface the GSM modem with the microcontroller so that we can control the motor, pump and other necessary things in the farm. During the situation where the farmer cannot visit his land he can control the farm using mobile phone. The farmer will be receiving the data from the field to his mobile phone, based on that data he can do the necessary control in the farm by giving command from his mobile phone. In the farm land the surveillance camera is attached which will be sending the photograph of the farm, it ensures that farmer also can monitor his farm. And with help of GSM technology the data can be transferred to the agriculture research agencies they can analyze the data and give suitable tips and solutions to farmers, the farmer can implement it on his farm and improve the yield. Efficient data transfer and control means time is saved. If time is saved money is also saved and will be very useful for the farmers and others who involved in the agriculture. The efficient agriculture means that it will also encourage young generation to take agriculture as the career and make it develop even further.

EXISTING METHOD OF RETRIVING DATA

Previously there are many research attempts to compensate the aspect of operational management by using wireless and wired network which can monitor, collect and transport data to the managing entity [2]. The proposed GIS based monitoring networks usually rely on storing field sensor data on devices called data-loggers and then retrieving the data to the CPU (Central Processing Unit) of the managing entity.

Generally there are three ways of retrieving the field sensor data. The data can be transferred by any of the

following ways (1) wired 2) wirelessly –data logger with spread spectrum radio the data, or the 3) operator physically travels to the monitored field and retrieves the sensor data by using an adjacent device like a hard disk, pen drive, flash USB memory stick or a PDA (Palm Digital Assistant). This paper presents a concept of an integrated system for data transfer and automatic control and applies in the agriculture. The system combines modern internet and mobile communication systems with GIS and remote sensing tools for enhanced farming [2]. In the rural agriculture, the data collected from the various field sensors are present for collection of the field data, the data may be originated from different location and data from the different field sensors may be of different format. So it is necessary to store all the data in one common system first. So that it can be accessed any time by the authorized person. Another difficulty faced is that huge amount of memory is needed for saving this data, which is also another difficulty faced in the existing crop management system. In most of the cased the farmer who is performing the agriculture mot owing the land, it is owned by wither land lord or other Business man. They are not getting any data from his field. And current methods also not ensure that the data is transferred to farmer, which means that the farmer cannot implement the automatic control in his farm.

PROPOSED METHOD

Exploitation of the GSM technology in agriculture for data transfer and control is meant to shorten the time between the data acquisition and data processing. So with help of the data the landlords/research agencies can analyze the data for further process, the farmer who also will be receiving the data can implement the automatic control of (motor, pump, weed removing machines), Using his mobile phone.
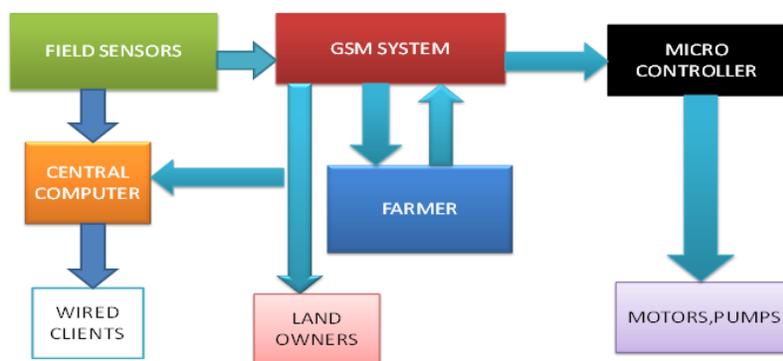

Figure.1

The block diagram shows in the agriculture land there are various kinds of field sensors such as Electro Chemical sensor- These are used to find the amount of chemical compounds of pesticides. Remote spectral sensing biosensors- These are used to capture images of farms which gives us the details of Spectrum wavelengths of the light absorbed from the farm. Soil and moisture sensor- These are used to detect the type of soils and amount of moisture in the farm. Water, ion sensor- These are used to detect the amount of water and its level with amount of potassium ions sensors- These are used to detect the volatile organic compounds produced in the agricultural farm. These measuring sensors collect various data's from the agriculture field, these data is stored and it is fed to the GSM system, and the GSM system will transmit these data to various technology such as farmers land owners government etc. The main advantage of GSM technology than other data transfer system is the GSM data transfer is faster among the all other data transfer data transfer system. So we have presented this. The microcontroller is connected to motors, other necessary things to be controlled through relay. For this kind of application any suitable microcontroller PIC, ARM, AVR varieties can be used. Based on our need any microcontroller can be used. After performing suitable operation, microcontroller will send message to farmer that motor has controlled successfully. In this system we also have implemented that if suppose a data has exceeded critical value, it will be processed and necessary control is automatically performed by microcontroller itself, this ensures that more reliable system. And automatic regulation is obtained.

Here in the below steps the process is explained

- Each modem has a unique number
- SMS is sent to this number from the mobile
- SMS received by modem is transferred to microcontroller with help of AT COMMAND
- SMS is transferred along with sender mobile number

- And after verification, the microcontroller performs control of agriculture equipment
- The farmer receives the reply that necessary action is performed and again he also receives the new field data from data sensors.

Features of GSM technology

- Mobile Frequency Range Rx : 925-960;
- Tx : 880-915
- Multiple Access Method : TDMA/FDM
- Modulation: GMSK (0.3 Gauss-Ian Filter)
- Channel Bit Rate: 270.833Kb

VALUES FROM VARIOUS SENSORS

Table.1.Data collected through electrochemical sensors

Pesticide Product	Status	Comments
aluminum phosphide	40 CFR 185.200	Residues not to exceed 0.01 parts per million (ppm) on vegetables, 0.1 ppm on other crops
aluminum tris (Oethylphosphonate)	40 CFR 180.176	For example, 3 ppm on tomatoes and 0.5 ppm on citrus
basic copper carbonate in pears	40 CFR 185.136	Tolerance of 3 ppm in pears
basic zinc sulfate	40 CFR 180.244	Tolerance of 30 ppm on peaches
coordination product of zinc ion and maneb	40 CFR 180.176	tolerances set on commodities such as apples

Table.2.Multiple nutrient fertilizers (IN %)

	N	P_2O_5	K_2O
N-P-K	14.5	11.5	13.9
N-P	16.0	27.4	0.0
N-K	17.1	0.0	19.3
P-K	0.0	16.0	29.9

Data through pH sensor:
Measuring Range: 0 to 14.00 pH
Sensitivity: 0.002 pH
Stability: 0.02 pH per 24 hours, non-cumulative
Wetted Materials: PEEK, ceramic, titanium, glass, Viton, EDPM (optional: 316 stainless steel with 316SS body)
Temperature Compensation: Pt1000 RTD
Sensor Cable 6 Conductor: (5 are used) plus 2 shields, 15 feet (4.6 meters) length standard
Temperature Range:-5 to +95 °C (23 to 203 °F)
Strength and other important aspects: It is very much essential to analyze the newly developed technology on various aspects such as strength, opportunity, environmental, and social aspect. On basis of these analysis, whether the newly developed crop management by using data transfer and control using GSM technology is feasible to replace existing crop management system.

Strengths: High speed upload/download of field data ,and automatic control system means that workload of the farmer is reduced and efficiency of agriculture is increased and another main advantage of the system is that it is highly reliable, and utilization of this system by farmer is simple because most of the people using cell phone in current era.

Opportunities: The newly developed technology will always have a great scope in the Indian, especially agriculture oriented country like India, if correct marketing strategy is followed.

Environmental aspect: In agriculture if excess fertilizer or pesticide is used it is harmful for the crops and affects the quality of vegetation, which means that we the people who consume those will also will be affected. If this system is implemented the above difficulty will be removed because, we can keep control of amount of these chemicals used. So by implementing this system it will have good environmental impact. And another important advantage is with help of GSM technology the data can be transferred to the agriculture research agencies they can analyze the data and give suitable tips

and solutions to farmers, the farmer can implement it on his farm and improve the yield. So better crop yield is obtained which is good for all.

Economic and social aspect: In current agriculture system there is lack of people for agriculture, if this system is implemented even less number of people can manage the agriculture easily. This system is not too high so it can be affordable and number of labor working also reduced which also reduces the cost. The maintenance of this system is also easy so it can be easily used by the people, and electricity consumption is also low for this system, which also another important advantage of this system

CONCLUSION

The GSM based data transfer and control technology allows for faster, more reliable data transfer between the data logger which contain the collected field data. And also the workload of farmer is reduced as automatic control is implemented. Certainly automation is the field which is having great impact on many fields, so it will also have great impact on the agriculture and it will also inspire the younger generation of our country to take agriculture as their career. And with the system overall efficiency and quality of agriculture will be improved and it will have good outcome as agriculture is the key sector in our country

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