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# Smart Agriculture using IoT Powered by ARM Microcontroller

**Sourabh V Bhat[1], Rainak Sharma[1], Kavya U P[1] , Pooja M P[1], Pavithra G S[2]**

*[1]Student, Department of Electronics and Communication Engineering,*
*Sai Vidya Institute of Technology, Bangalore*
*[2]Assistant Professor, Department of Electronics and Communication Engineering,*
*Sai Vidya Institute of Technology, Bangalore*

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**Abstract -** *In this paper, we have showcased an idea to monitor and control various factors related to a farm using the Internet of Things and ARM Micro-Controller(LPC1768). In the country like India we have to associate agricultural science which engineering talent in order to build an infrastructure which can immensely enhance the produce of the agricultural domain. Especially in the developing countries like India, the fields like agriculture fail in inculcating the technological developments related to them due to various factors.*

***Keywords:*** **Advanced RISC Machine(LPC-1768), Agriculture, Sensors, GSM SIM908 module**

## 1. INTRODUCTION

Agriculture is one of the oldest Sciences which has progressed along with human civilization right from the period of Mohenjo-Daro and other ancient civilization[1]. The initial practices of trade were because of the agricultural production itself. Even though hunting provided food, a large portion of the human community relied on agriculture for their occupation and food. Agriculture involves a variety of activities right from ploughing the field to harvesting the crops. This is also dependent on various parameters among which few are in the control of humans whereas few others in the control of nature. This makes it a field with a lot of surprises and mysteries which are yet to be unearthed. The various factors include rain, humidity, soil fertility, and various other climatic conditions and soil properties[2]. These climatic conditions play a very vital role in the quality and quantity of the produce. An agriculturist needs to make the right decision at the right time concerning the quantity of the supplements which should be supplied to the farm. This not only requires the proper monitoring of various factors but also the experience in the agricultural field. The requirements differ from crops to crops. Along with the care and attention towards the quality of the product even the fertility of the farm also must be retained as if the fertility of the farm is ignored then it can lead to a Barren land over a certain duration.

The transistors, which opened doors to the wide range of opportunities in the electronics industry play a key role directly or indirectly in every other domain associated with various other fields as well. Though the invention of transistors created a scope for development, the integration of functionalities and miniaturization of the circuits and its components was the key. This was followed by the interconnection of the components through wired or wireless medium and thereby exchange the data and utilize the data for various useful purposes[3]. This brought the components are the circuits more closer to humans as this is enabled interactions easily. Two decades ago at Massachusetts Institute of Technology a researcher named Kevin Ashton who is a Co-founder of Auto-ID Lab, coined the term internet of things when he was presenting to the fellow researchers named Procter and Gamble. By this term, human to connect the mechanical components and also the electronic circuits and thereby generate a mechanism which could ease the human life. Sensors form a very important part of the IoT system. Those circuits which sense the physical stimulus and generate the appropriate electrical signal which can be used in proper interpretation using appropriate platform or a microcontroller. In the current scenario we would be using the ARM LPC 1768.

ARM microcontroller was the brainchild of a poor scientist point which is the abbreviation of Advanced RISC machine not only uses reduced instruction set computing for its operations but also executes instructions within a single machine cycle which makes it an efficient microcontroller over others. The Acorn computers are the name of the company which was started by the inventor of ARM initially. ARM is performance-oriented with a 32-bit data bus and 32 Bit microcontroller. It has three data patterns namely a byte which is an 8-bit word which is 32 bit and also the half-word which is 16 bit. arm follows the Harvard architecture that means it has separate memory space for data and program. the growth of arm has been documented as different versions in which each version is the progress achieved over a period of 6 months[4].

**Fig -1**: ARM v7 Controller Kit LPC 1768

## 2. WORKING PRINCIPLE

The task includes the ARM processor, GSM modem. It shows the after-effects of sensors in the horticultural field utilizing the processor. The framework for the most part achieves the significance in modernizing

the horticultural condition to defeat customary farming. The field is observed utilizing, various sensors that sense the field parameters like temperature, moistness, soil dampness, water level of wells on the farm[1]. All these field conditions are checked and SMS is sent to farmer portable number. The sensors sense the parameters and send them to processors after which it is sent to the agriculturist portable utilizing the GSM SIM908 module.

The framework comprises of the principal unit, equivalent to a versatile base station, comprising of the supporter number. This structures the correspondence connection between the farmer and the gadget. The entire framework works in the structure organize being associated with the focal unit as a Node. The focal unit is associated with numerous such hubs from which it gets or transmits the information. The client collaborates with the concentrated unit through SMS. The unified unit collaborates with the framework through SMS which will be gotten by the GSM with the assistance of the SIM card. The GSM sends this information to the ARM processor. The processor additionally constantly gets the information from sensors as AT orders. Subsequent to preparing, this information is put away on the processor[7]. The correspondence between different gadgets happens through RS232. In this way in short at whatever point the framework gets the enactment order from the supporter it checks all the field conditions and gives nitty-gritty criticism to the client and hangs tight for another initiation order to turn over the engine. The engine is constrained by a simple control in the interior structure of the starter. The starter loop is by implication initiated by methods for a transistorized transfer circuit. When the engine is turned over, steady observing on soil dampness and the water level is done and once the dirt dampness is reached to an adequate level the engine is consequently killed and a message is sent to the endorser that the engine is killed.

## 3. COMPONENTS

### 3.1 TO SCREEN LEVEL OF WATER IN WELL OR TANK

The need for checking the water level is very much important as it not only consumes lot of man power to monitor but also there are high chances of water wastage. This can also be integrated with a functionality to check if water is present in the source or not before it is pumped to the reservoir. So to avoid these issues we can monitor the level of water by our project. We propose to place the sensors in the tank at different heights which help us in detecting the water level at real time and then turn off the water pump set and notify the agriculturist about the activity. Now when the level of water reaches low it will indicate the farmer that water is low and start pumping the water i.e. motor is running and at this time device acts as open circuit[1]. This is how the system works and we have shown the device working in figure 2.

**Fig -3**: Water Level Sensor

### 3.2 TO SCREEN TEMPARATURE OF ENVIRONMENT

It is necessary to monitor the temperature of the surrounding for not only healthy growth of the crop but also to avoid self-destroy of the crop. This system facilitates the farmer to have the full detail of his farm on his phone. And he can also know many more details needed for his farm. Here we will be using LM35 as temperature sensor to measure temperature[1].

### 3.3 TO SCREEN SOIL MOISTURE

It is necessary to check the moisture of soil or the content of water that is present in soil[5]. Here when the voltage drops occurred it will be for dry soil condition and wet soil condition it is considered and both the values are compared, where now we take difference of these two condition if the difference is low then it say the water level in the soil is low or else if it is high the water level content is high in the soil[1].

### 3.4 ARM PROCESSOR LPC1768

LPC1768 is a microcontroller that is useful for the many applications in embedded system like we can have less power rating or consumption and also very good integrity. This ARM cortex M3 is having very good features. In this the drawback of other system is reduced we can easily debug the error and we have good support block so we can say it provides enhancement for the system, this can be operated at the frequency of 100Mhz, it has three stages of pipeline and uses Harvard structure with divided instruction and data buses, the peripheral component has up to 512Kb of flash memory and many more importance[1].

### 3.5 SIM908 and GSM

This is integrated with GSM/GPSR and also GPS engine. Here GSM/GPSR works with the frequency of GSM up to 850Mhz where it is GSM/GPSR is quad-band. EGSM is having frequency range of 900Mhz and DCS is having 1800Mhz. Here we have configuration which is least and it can be 50mm*33mm*8.8mm. SIM908-C it can reach the space requirements in user application. Here in M2M is also one of the application, tracker and other mobile requirements. We use GSM here which can find the position anywhere on the earth.

### 3.6 LM35

It is a temperature sensor that provides the values in degree Celsius to the ARM processor. Here we can do sensing of temperature directly or controlled by remote [6]. This IC of temperature sensor is using the temperature range of nominal IC i.e. -50 degree Celsius to +150 degree Celsius. These are precision IC where the output is linear i.e. the voltage at the output is proportional to Celsius temperature. We will interface this IC to ARM processor at ADCI present in ARM.

### 3.7 UART

We here have considered LPC1768 which has in built 4 UART where it has data lines which are standard. UART1 provides very good full interface (modem control). Here we are using standard board which is rating up to 115200 Bd where if this should be successful we need to make frequency of crystal as above 2MHZ.IrDA mode is included here to interface and they support DMA[2].

## 4. FLOW DIGRAM OF THESE PROCESSES

Mechanism of the system would start by initializing the variables present in the memory of the ARM LPC 1768 microcontroller with the output of sensors like temperature sensor, water level sensor, moisture sensor and also the humidity sensor. The real-time monitoring of temperature, water level in the reservoir, and also the moisture and humidity content in the environment of the farm is done in order to ensure the availability of most favourable conditions necessary for the respective crop. If the temperature is found to be high then the sprinklers installed in the farm are turned on automatically and the agriculturist is notified about the activity. if the water is found to be overflowing from the reservoir then the water pump which pumps the water to that reservoir is turned off and the agriculturist is notified again. Similarly the moisture and humidity as well. If they are found undesirable then the agriculturist is notified so that the suitable action can be taken. The mechanism of notifying the agriculturist is done through sending an SMS through the GSM module. Various other components which are explained about would be a part of the system. By bringing the proposed Idea into reality, it would be possible to reduce significant amount of efforts being put by the agriculturist.

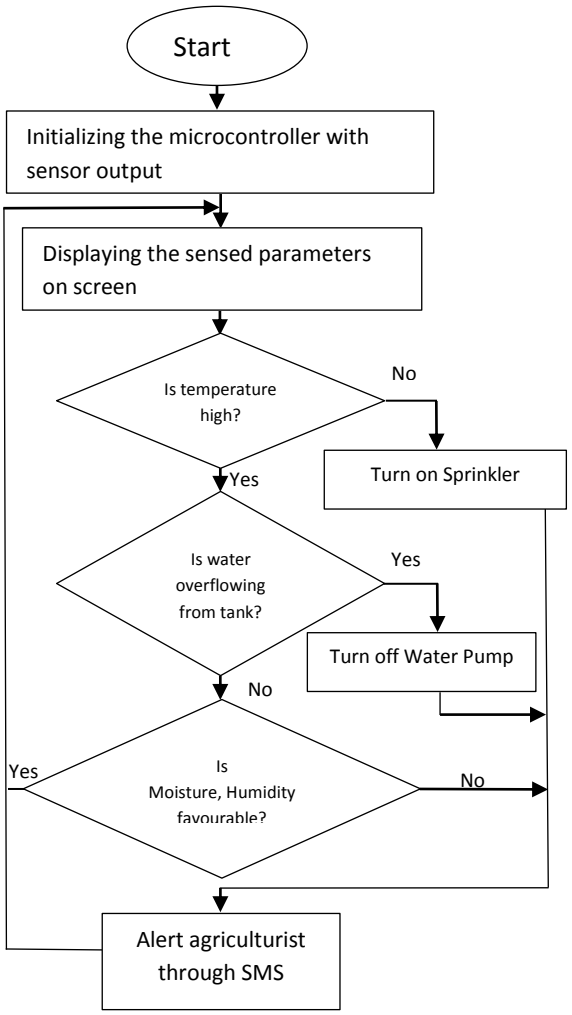


**Fig -3-:** Working of the system

## 5. CONCLUSION AND FUTURE WORK

Since most of the system is automated, it would not only reduce the manpower necessary but also help in overcoming the unavailability of labour. It can also reduce the overhead costs involved in growing the crops. It can also contribute to adequate usage of the resources like water and many more. Further, it can be enhanced by including few other functionalities like intruder detection, detection of the diseases which affect the quality of the produce, suggestions about the crop to be grown based on the projected environmental condition and also the soil fertility.

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