VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELAGAVI – 590018

A Project Report on

"DEVELOPMENT OF SERICULTURE FARM AUTOMATION SYSTEM USING SENSOR NETWORK"

Project report Submitted in partial fulfilment of the requirements for the

Award of degree of

BACHELOR OF ENGINEERING IN INFORMATION SCIENCE AND ENGINEERING

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JYOTHY INSTITUTE OF TECHNOLOGY, BENGALURU-560082
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CERTIFICATE

Certified that the project work entitled "Development of sericulture farm automation system" carried out by **Ms. R Vinoditha,** USN: **1JT16S035, Ms. Rachana VM,** USN: **1JT16S036, Ms. Shreya D,** USN: **1JT16IS047,** who are bonafide students of Jyothy Institute of Technology, submitted in partial fulfillment for the award of **Bachelor of Engineering** in Information Science and Engineering department of the **Visvesvaraya Technological University**, Belagavi during the year 2019-2020. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

Signature of the Guide	Signature of the HOD	Signature of the Principal
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DECLARATION

We, **R Vinoditha, Rachana VM, Shreya D, s**tudents of Eighth semester BE, in the Department of Information Science and Engineering, Jyothy Institute Of Technology, Bengaluru, declare that the project work entitled **"Development of sericulture farm automation system"** which is being submitted by us in the partial fulfillment for the award of the degree of **Bachelor of Engineering in Information Science and Engineering, from Visvesvaraya Technological University, Belagavi** carried out during the academic year 2019-2020, under the guidance of **Pruthvi Kumar K.R,** Assistant Professor, Department of Information Science & Engineering, Jyothy Institute Of Technology, Bengaluru. The matter embodied in the project report has not been submitted previously for the award of any degree or diploma by us to any other university or institution.

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ABSTRACT

Sericulture is a branch of agriculture which comprises of cultivation of mulberry, silkworm rearing, and post cocoon technologies to develop silk cloth. Silkworm is a poikilothermic animal. Indian silk yarn is of poor quality and hence there is a need to maintain requisite temperature and relative humidity during the course of rearing.

The existing method of silkworm rearing requires more development. This project provides a complete protection to the farm and every process has undergone development with the help of electrical and electronics components. It facilitates farmers by adoption of automation in temperature and humidity control.Main motive of the project is to help the farmers economically and also, the owner can monitor the farm from wherever he is.

To improvise the current scenario, there is need to automate the sericulture farm which can lead production of good quality of silk. The model aims at usage of sensors such as temperature, humidity, fire, moisture, UV light, GSM module for communication, camera photographic system for maintaining the system at remote locations. This also uses the SST controller that stores the persistent data and regulates the process. Whenever the defected inputs exceed the ambient conditions, then this is immediately notified to the receiver. This information can be received in 3 ways. First being the SMS, the information can be sent via SMS form. If the phone is switched off or in silent mode, then the message is sent with the voice note. The SMS also contains the location where the fault has occurred. A picture of the system is sent through the text message. The location where the fault has occurred can be known. If the user wants to take necessary measures, he can click the nearby information button in the app, and can view the details. User then takes appropriate measures to make the condition suitable for silkworm's growth.

This project could be carried out both automatically and manually. This project will help farmers economically so that that they may not spend more time in the sericulture farm.

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INTRODUCTION

1.1. Overview

Silk is popularly known due its shiny texture, elegance and long lasting nature. Sericulture is the production of silk by rearing of silkworm. It was introduced in china between 2600 and 2700 BC. There are several stages in silkworm rearing. They are, egg stage, larval stage, pupal stage, moth stage. Larval stage is about 27-28 days out of which starting 10 days is chawki rearing. The next 18 days i.e from 10^{th} day to 28^{th} day is the main phase for our project. The shimmery appearance of silk gives a royal look and is cherished fabric. India holds 2^{nd} position in production of silk in the world. Sericulture is carried out in equatorial regions such as Karnataka, Tamil Nadu and Andhra Pradesh. This fabric is created from the spew of an insect and obtained from cocoon spun by larvae known as silkworms. Silkworms requires very nominal temperature and humidity for producing good yield of cocoons. The changes in the environmental conditions during the past few years, accentuated the need of management of climatic factors for continuous cocoon production.

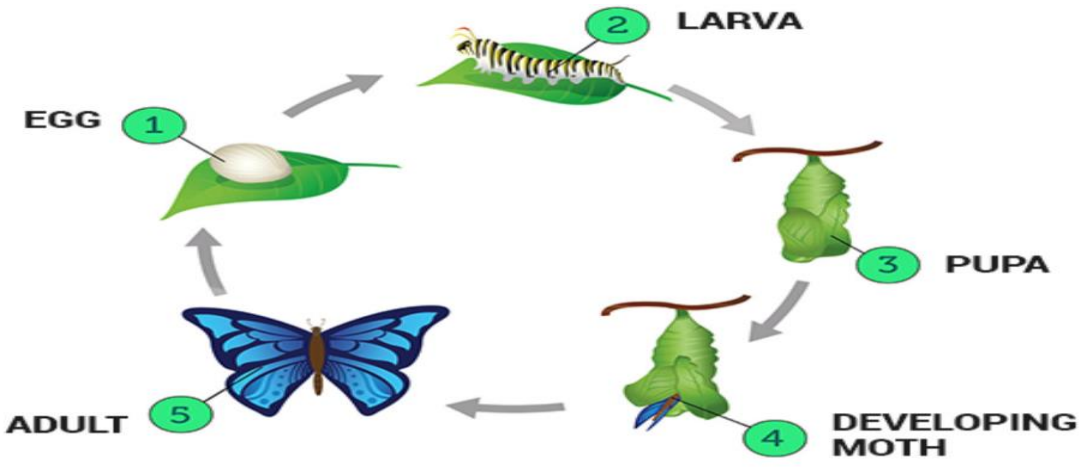

Fig 1.1: Lifecycle of a silkworm

Rearing of Silkworm: In the beginning, the female silk moth lays hundreds of eggs. These eggs are stored over a clean paper or piece of cloth. These eggs are then sold to the silkworm farmers. The farmers then keep the eggs under the accurate temperature and humidity at a clean place. They are warmed to the most appropriate temperature to hatch eggs to produce larvae or caterpillar. This process is done when the mulberry trees have fresh crop of leaves. The caterpillar eats this mulberry leaves day and night and it grows in size.

Bamboo trays are used to keep these caterpillars and some freshly chopped mulberry leaves are kept in the tray. After 30-40 days approximately the caterpillars stop eating the leaves and then it moves inside the small chambers in the bamboo trays to spin cocoons. These are produce by the secretion of liquid protein from their salivary glands. Small racks are given in the trays so that the cocoons get attached to those racks. Silk moths are developed inside the cocoons.

Processing Silk from Cocoons: These cocoons are used to obtain silk threads. When the cocoons are exposed to the sun or steam or boiled, the silk fib gets separated. This process of getting silk threads from the cocoons to use it as a silk fabric is known as reeling of the silk. Reeling of the silk is carried out by special machines. These machines unwind the fibers of silk or threads from the cocoon..

Fig:1.2: The rearing house of silkworms

1.2. Objective

The main objective is to improve the production and quality of silk thread, by usage of automation in sericulture.

To provide a complete protection to the farm and every process has undergone development with the help of electrical and electronics components. By automating , the process becomes fast and hence, farmer can perform multiple other operations in the mean time. Sericulture not only has rearing, but several other processes like food cultivation, post cocoon technologies like twisting, weaving etc.

Hence, farmer can work on these instead of spending major time on rearing. This device helps to control the numerous environmental factors such as temperature, humidity, and light intensity throughout the lifespan of the silk-worm and promises enhancement in the silk quality and quantity.

1.3 Motivation

The main motive of the project is to is to help the farmers in producing the silk with much ease and without spending much time in the sericulture farm.

Farmers are basically not aware of the new technologies that can be implemented into sericulture. Also, most farmers in Ramnagara work in sericulture farm. Using one such device for the large scale production woud help them produce large amount of cocoons with better quality and with ease.

Chapter-2

LITERATURE SURVEY

The current technique and one of the oldest methods in sericulture is the labor-intensive way of checking the factors. In this technique the agriculturalists they themselves authenticate each and every factors and compute the required values. It emphases on emerging devices and tools to achieve, display and aware the operators via the benefits of a wireless sensor network scheme.

It goals at building sericulture smart by applying automation and IoT technologies. The cloud computing devices that can make a whole computing system from sensors to tools, that observe data from sericulture field and precisely load the records into the sources. This system suggests an innovative methodology for smart farming by connecting a smart sensing devices and smart controlling system through wireless communication technology.

1.TITLE: IOT BASED AUTOMATION SERICULTURE SYSTEM

AUTHORS: Srinivas B, Khushi Kumari, Goverdhan Reddy H, Niranjan N, Hariprasad S A, Sunil M P

Sericulture denotes to the rearing of silkworm to produce silk. Parameters like Temperature, Humidity and Light intensity are the important factors in the progression of silkworms and suitable encouraging must to be done according to the requisites in every stage. Environmental variations assume as the important part in the growth and development of silkworm. Sericulture is the important occupation in India and the techniques used by the agriculturists are yet outdated.

Observing environmental parameters of the silkworm rearing house is the most important aspect to improve vintage of the silk. The specialty of this model comprises enhancement of a system which can observe temperature, humidity, light power through sensors using NodeMCU and in case of any variations in the parameters send a notification on the user mobile application using internet connection.

2. TITLE: AUTOMATION IN SERICULTURE FARM

AUTHORS: S. Vijayanand, E. Immanuvel Bright, L. Vijay Anand

Agriculture is the backbone of India. Nowadays, farmers are facing many economic problems. Hence there is a solution for our farmers to come out of their economic crisis. Sericulture is one of the best ways to earn more money and it can provide self-employment and remunerative returns.

The existing method of silkworm rearing requires more development. This project provides a complete protection to the farm and every process has undergone development with the help of electrical and electronics components. It facilitates farmers by adoption of automation in temperature and moisture control, feed supplement. The growth of silkworm involves three stages. These stages require different temperature and moisture level.

This is established with the help of temperature and moisture sensors and PIC16F877A micro controller, since the total process is controlled. Various processes like feed supplement, protection and medical safety for silkworm are provided by automation through this project. Power splitter is used and is driven by motordriveL2930. With the help of input keys, inputs are given. This project could be carried out both automatically and manually. This project will help farmers economically so that that they may not spend more time in the sericulture farm.

3. IMPLEMENTATION OF SERICULTURE FARM AUTOMATION USING SENSOR NETWORKAND GSM TECHNOLOGY

AUTHORS: Gunasheela T J, Renuka V Tali , Prathiba S N ,Shilpa A P

Sericulture basically refers to the production of silk by the rearing of the silk producing organisms.The system finally implemented is a futuristic set-up that reacts to any climatic changes that occur inside and the system suitably responds to the stimuli effectively. The implemented system had a flaw, where the user was restricted from receiving the message from the system when the mobile was turned off and there is a possibility of low signal power strength that creates disturbances in the GSM network between the system and user. The system eradicates these drawbacks by automating the farm such that the operations will

be carried out in timely manner and the concept of call forwarding is applied where the system can send the message to the alternative number as specified and placing the GSM module in an area where full signal strength is available for the communication.

4. TITLE:ARDUINO BASED AUTOMATED SERICULTURE SYSTEM

AUTHORS: Manjunatha, Mr. Mahesh B. Neelagar

Sericulture alludes to the raising of silkworm to deliver silk. India is the second biggest maker of silk by delivering 15% of the aggregate silk creation alongside China. Temperature, Relative Humidity, Light force and Atmospheric air assumes an imperative part in the advancement of sound silkworms and legitimate encouraging ought to be done according to the prerequisites in each stage. Occasional varieties assume an imperative part in the development and advancement of silkworm.

Sericulture is the significant occupation in country side of India and techniques utilized by the agriculturists are as yet obsolete. Henceforth there exists the need of utilizing innovation in sericulture cultivate. This venture gives a thought regarding giving automation in sericulture cultivate. This model faculties and controls the natural variables like temperature, relative humidity, CO2 and light power. Food feeder and solution sprayers are additionally mounted over the homestead. It likewise suggest the agriculturists about the conditions kept up in the farm and essential moves to make put if there is any conditions infringement. This is about to give automated control the agriculturists utilizing wireless sensors, microcontroller and GSM.

5. TITLE: AUTOMATED SMARTSERICULTURE SYSTEM BASED ON 6LoWPAN AND IMAGE PROCESSING TECHNIQUE

AUTHORS: Divya Darshini B, Adarsh BU, Navya KN

Sericulture is the root of social, economic, cultural and political progress of India. In this paper, we present an 6LoWPAN (IPv6 over Low power Wireless Personal Area Network) enabled IoT (Internet of Things) based approach to design a real time sericulture monitoring and disinfection actuating system with an inclusion of image processing technology to identify the stages of silk worm life cycle.

The complete system is designed and implemented using Contiki OS to control the atmospheric condition inside the sericulture system as per the requirements in each stage of sericulture life cycle. This complete prototype was built using the TelosB motes running 6LoWPAN stack interfaced to temperature and humidity sensors with an disinfection actuation system and a serial camera to auto capture the pictures and to analyze it using an image processing method to check the status on sericulture process.

2.1. EXISTING SYSTEM

The major activities involved in current sericulture industries are cultivation of silkworm food plants, rearing of silkworms for the production of raw silk, reeling the cocoons for unwinding the silk filament and other post cocoon process such as twisting, weaving printing and finishing.

In the existing system a traditional wooden carpet stand is maintained for avoiding termites and ants. Existing system does not maintain a normal temperature. It does not have facilities for maintaining humidity. We do not have an information system for farms. There is no A.I, photographic system to maintain at remote locations. There is no fire detection.

2.1.1. DISADVANTAGES

- Not economical: The existing system is not economical since most of the times, there is a possibility that the expected financial goal is not reached due to lack of automation.
- Not feasible: The existing system sometimes is not feasible because there may be a situation where in the humidity is not always accurate for the silkworms growth.
- Not scalable: When the system has to be implemented in a large place like ramnagara, it will not be scalable because the existing system is cornered only to some of the particular places.
- Does not have facilities to stop rodents: As of now, the system controls the rodents by using a safety net. Rodents can easily come over the net and eat the worms easily.

2.2. PROPOSED SYSTEM

The proposed system is implemented with the help of both software and hardware tools, that will carefully observe as well as control the variations in the environmental factors of silkworm raising house on the consistent basis. The proposed system does the following-

- Testing and Validation of sensor.
- Signal conditioning.
- Receiving signal with the help of Internet of Things (IoT)
- Interfacing sensors to microcontroller to achieve the desired result.

To maintain a normal temperature we use a temperature sensor in the rearing house. For maintaining of humidity we use the humidity sensor. Usage of GSM helps in remote network connectivity. We use the camera setup for capturing of the on going events in the rearing house in case of an emergency.

2.2.1. ADVANTAGES

- Easy to use and feasible: This system is easy to use since everything is automated and everything can be controlled by using mobile phone.
- Reliable product and scalable: The product developed is suitable for large scale industries and is reliable for farmers
- Can be used in various weather conditions: This model tends to notify the users at any temperature or humidity. Hence, this can be used at any weather conditions.
- This will the increases the cocoon production: When the temperature and humidity are accurate, then the silkworms will be able to produce good quality of silk as well as cocoons
- Initial investments are high but large scale destruction can be avoided. Once the system is established, it can be used forever. Hence this a one time investment.
- It helps farmers come out of their economic crisis. Since this model gives accurate output, farmers will hence be able to produce fine quality of silk and hence, they will be able to get money as well. Hence, it is economically feasible.

Chapter-3

METHODOLOGY

The proposed system is an embedded system which will closely monitor and control the environmental parameters of rearing house on regular basis. The dissection of a system into its component pieces to study how these component pieces interact and work. System design is the process of defining the architecture, components, modules interfaces and data for a system to satisfy specified requirements.

3.1 Modules:

- Android
- Mobile Data
- Sericulture system

3.1.1 Android:

Android is a free, open source mobile platform. It is a Linux-based, multiprocess, multithreaded Operating System. It is a software stack for mobile devices that include an operating system, middleware and key applications. By providing an open development platform, Android offers developers the ability to build extremely rich and innovative applications. Android offers a unified approach to application development for mobile devices which means developers need only develop for Android, and their applications should be able to run on different devices powered by Android.

The first beta version of the Android Software Development Kit (SDK) was released by Google in 2007.On June 27, 2012, at the Google I/O conference, Google announced the next Android version, 4.1 Jelly Bean.

Beginning with Android 4.1 "Jelly Bean", "expandable notifications" allow the user to tap an icon on the notification in order for it to expand and display more information and possible app actions right from the notification.

The source code has been used to develop variants of Android on a range of other electronics, such as game consoles, digital cameras, PCs and others, each with a specialized user interface.

The Android SDK provides the tools and APIs necessary to begin developing applications on the android platform using the java programming language.

API Level is an integer value that uniquely identifies the framework API revision offered by a version of the Android platform.

Android operating system is a stack of software components which is roughly divided into five sections and four main layers as shown below in the architecture diagram in figure 4.1.1

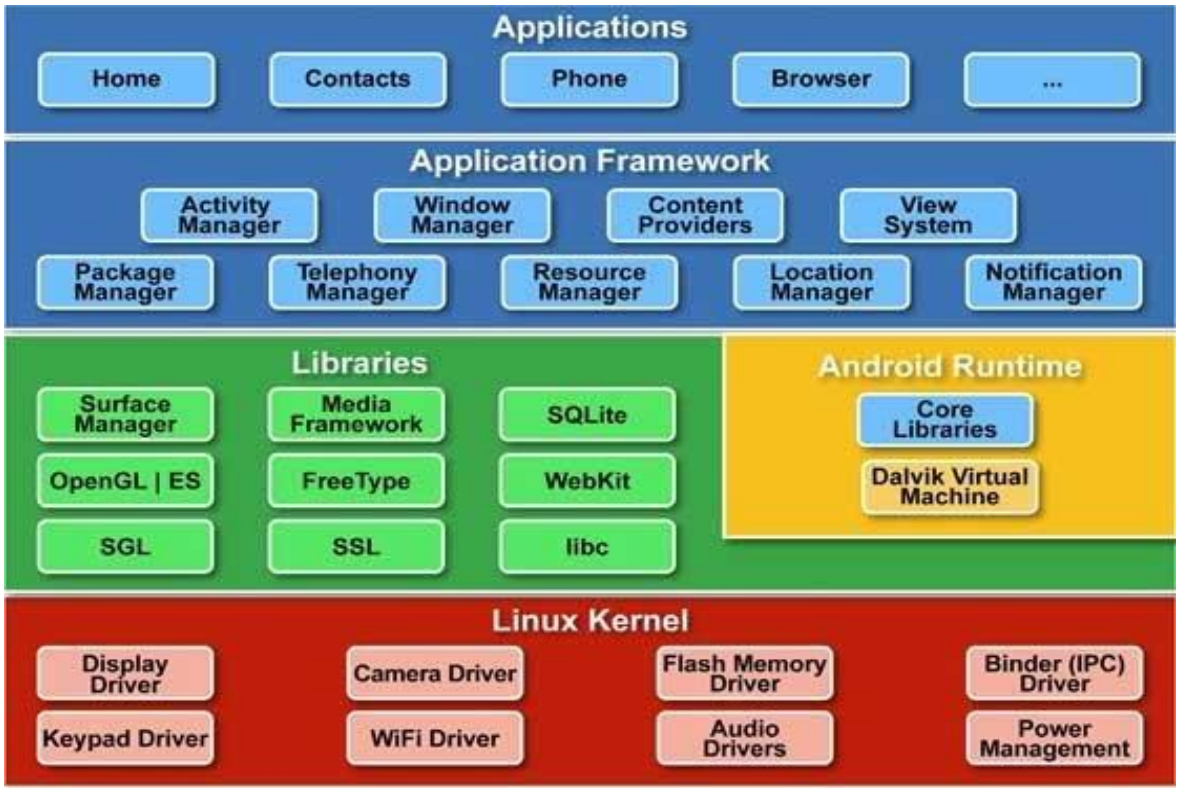

Fig 3.1: Android Architecture

Applications: These are applications written in Java. Some of the basic applications include calendar, email client, SMS program, maps, making phone calls, accessing the web browser, accessing contact list and others. This is the layer which an average user uses the most, rest of the layers are used by programmers, developers and hardware manufacturers.

Application Framework: This is the skeleton or framework which all android developers have to follow. The developers can access all framework APIs and manage phone's basic

functions like resource allocation, switching between processes or programs, telephone applications, and keeping track of the phone's physical location.

Libraries: This layer consists of Android libraries written in C, C++,and used by various systems. These libraries tell the device how to handle different kinds of data and are exposed to Android developers via Android application framework. Some of these libraries include media, 3D graphics, SQLite, Web browser library etc. The android runtime layer which includes set of core java libraries and DVM (Dalvik Virtual Machine) is also located in same layer.

Runtime Android: This layer includes set of base libraries that are required for java libraries. Every Android application gets its own instance of Dalvik Virtual Machine. Dalvik has been written so that a device can run multiple VMs efficiently and it executes files in executable (.Dex) optimized for minimum memory.

Kernel-Linux: Android relies on Linux version. This layer includes Android's memory management programs, security settings, power management software and several drivers for hardware, file system access, networking and inter- process communication. The kernel also acts as an abstraction layer between hardware and the rest of the software stack.

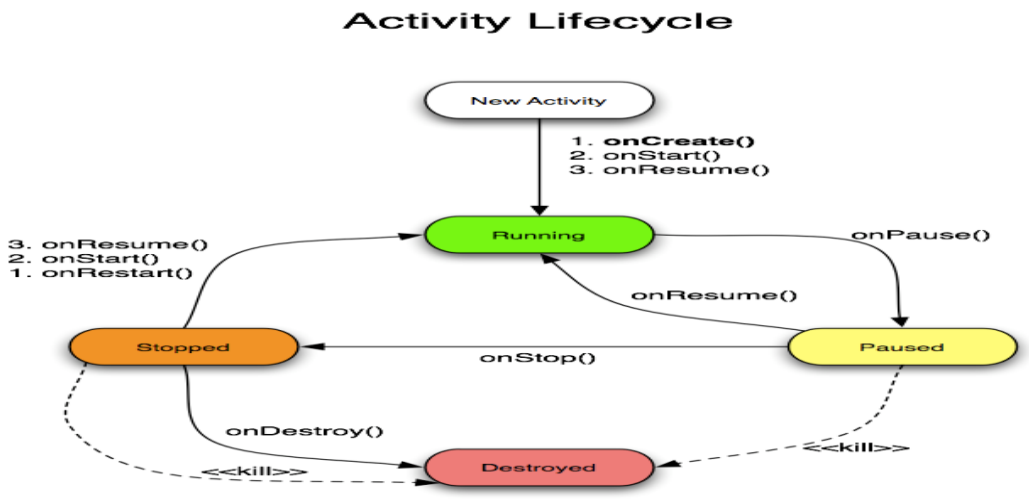

Fig 3.2: Activity Life Cycle Of Android

The set of functions are explained below :

- onCreate(Bundle): This is called when the activity first starts up . You can use it to perform one-time initialization such as creating the user interface. onCreate() takes one parameter that is either equal to null or some state information previously saved by the onSaveInstance() method.
- onStart( ): This indicates that the activity is about to br displayed to the user .
- onResume( ): This is called when your activity can start interacting with the user . This is a good place to start animations and music
- onPause( ): This runs when the activity is about to go into the background, usually because another activity has been launched in front of it . This is where you should save your programs persistent state , such as a database record being edited .
- onStop( ): This is called when your activity is no longer visible to the user and it wont be needed for a while. If the memory is tight , onStop() may never be called (the system may simply terminate your process).
- onRestart(): If this method is called , it indicates that your activity is being redisplayed to the user from a stop state.
- onDestroy(): This is called right before your activity is destroyed . if the memory is tight , onDestroy() may never be called (the system may simply terminate your process).
- onSaveInstanceState(Bundle) : Android will call this method to allow the activity to save per instance state such as a cursor position within a text field .usually you won't need to overwrite it because the default implementation saves the state for all user interface controls automatically.
- onRestoreInstanceState(Bundle) : This is called when the activity is being reinitialized from a state previously saved by the onSaveInstanceState ( ). The default implementation restores the state of your user interface .

3.1.2 Mobile Data:

Fig 3.3: Mobile Data

Mobile data is Internet content delivered to mobile devices such as smartphones and tablets over a wireless cellular connection. Mobile data is what allows your phone to get online when you're away from Wi-Fi. Mobile-enabled devices can send and receive information over a wireless cellular connection. As long as you have a cellular connection, you can use the Internet. Mobile data allows your phone to access the Internet even when you're not on Wi-Fi.

Mobile data gives you an Internet connection anywhere as long as you're connected to a cellular network. The mobile data can be used to your Internet browser, email and syncing to the cloud. Mobile data usage is measured in megabytes (MB) and gigabytes (GB). There are 1,000 MB in 1 GB of data. Everything you send to (upload) or receive from (download) the Internet will require some amount of data. Smartphones give you the option of turning mobile data on or off altogether. This can be a helpful trick if you're used to using data wherever you are and want to try a more conscious method of consumption.

3.1.3. Sericulture System:

The system has the following major components:-

1. **SST 89E516RD2 MICROCONTROLLER**

Fig 3.4: SST 89E516RD2 Microcontroller

Description:

The main centre part of the project is the microcontroller. Here we are using the 8051 based Philips SST 89E516RD2 microcontroller.

The 89E516RD2 are 80C51 microcontrollers with 64kB flash and 1024 B of data RAM. A key feature of the 89E516RD2 is its X2 mode option. The design engineer can choose to run the application with the conventional 80C51 clock rate (12 clocks per machine cycle) or select the X2 mode (six clocks per machine cycle) to achieve twice the throughput at the same clock frequency.

Features:

- 80C51 CPU with 5V operating voltage from 0 to 40 MHz
- 64 kB of on-chip flash user code memory with ISP and IAP.
- SPI and enhanced UART.
- Four 8-bit I/O ports with three high-current port 1 pins.
- Three 16-bit timers/counters.
- Programmable watchdog timer.
- Eight interrupt sources with four priority levels.
- Second DPTR register
- Low EMI mode (ALE inhibit)
- Low power mode

Pin configuration:

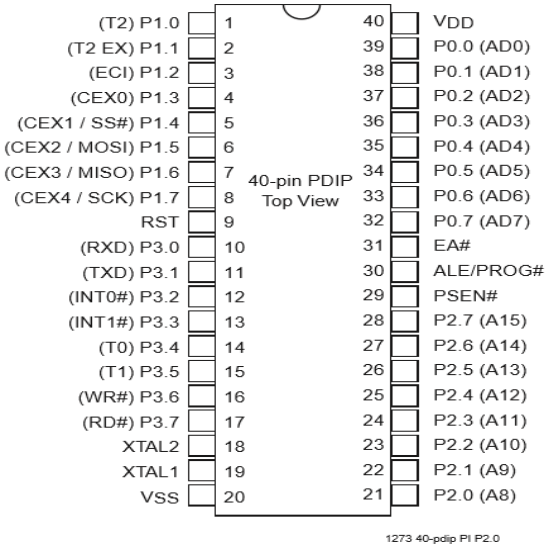

Fig 3.5: Pin configuration of SST 89E516RD2

- ALE/PROG: Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory. ALE is emitted at a constant rate of 1/6 of the oscillator frequency, for external timing or clocking purposes, even when there are no accesses to external memory. (However, one ALE pulse is skipped during each accesses to external Data Memory). This pin is also the program pulse input (PROG) during EPROM programming.
- PSEN: Program Store Enable is the read store be to external Program Memory. When the device is executing out of external Program Memory, PSEN is activated twice each machine cycle (except that two PSEN activations are skipped during accesses to external Data Memory). PSEN is not activated when the device is executing out of internal Program Memory.
- EA: External Access Enable: EA must be driven to VIL in order to enable the device to fetch code from the External Program Memory. EA must be driven to VIH for internal program execution. However, Security lock level 4 will disable EA, and program execution is only possible from internal program memory. The EA pin can tolerate a high voltage2 of 12V.

- XTAL1: Input to the inverting oscillator amplifier.
- XTAL2: Output from the inverting oscillator amplifier.
- Port0: Port0 is an 8-bit open drain bi-directional I/O Port. As output Port, each pin can sink eight TTL inputs. When are written to Port0 pins, the pins can be used as high impedance inputs.Port0 can also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode, P0 has internal pull-ups. Port0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.
- Port1: Port1 is an 8-bit bi-directional I/O port with internal pull-ups. The Port1 output buffers can sink/source four TTL inputs. When logic 1s are written to Port1 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port1 pins that are externally being pulled low will source current because of the internal pull-ups. PORT1 also receives the lower order address bytes during flash programming and verification. In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX).
- Port2: Port2 can also be used as an 8-bit bi-directional I/O Port with internal pull-ups. The Port2 output buffers can sink/source four TTL inputs. When ones are written to Port2 pins, they are pulled high the internal pull-ups and can be used as inputs. As inputs, Port2 pins that are externally being pulled low will source current because of the internal pull-ups.The alternate use of Port 2 is to supply a high order address byte in conjunction with the Port0 low order byte to address external memory. It uses strong internal pull-ups when emitting ones.It also receives the higher order address bytes and some control signals during flash programming and verification.

- Port3: Port3 is an 8-bit bi-directional I/O Port with internal pull-ups The Port3 output buffers can sink/source four TTL inputs. When ones are written to Port3 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port3 pins that are externally being pulled low will source current because of the pull-ups.

2. ALARM SYSTEM

An alarm system is a system designed to detect intrusion – unauthorized entry – into a building or other area such as a home or school. Security alarms are used in residential, commercial, industrial, and military properties for protection against rodents, pests or property damage, as well as personal protection against intruders like rats, lizards etc. Some alarm systems serve a single purpose of insects protection; combination systems provide both fire and intrusion protection. Intrusion alarm systems may also be combined with closed-circuit television surveillance systems to automatically record the activities of intruders, The most basic alarm consists of an alerting device to detect intruders, These indicate an alarm condition. Most commonly, these are bells, sirens, and/or flashing lights. Alerting devices serve the dual purposes of warning occupants of intrusion, and potentially scaring off burglars. These devices may also be used to warn occupants of a fire or smoke condition. In addition to the system itself, security alarms are often coupled with a monitoring service. In the event of an alarm, the premises control unit contacts a central monitoring station.

3. EMBEDDED C

C is the most widely used programming language for **embedded** processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements.

As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requiretments.

Initially C was developed by Kernighan and Ritchie to fit into the space of 8K and to write(portable) operating systems. Originally it was implemented on UNIX operating systems. As it was intended for operating systems development, it can manipulate memory addresses. Also, it allowed programmers to write very compact codes. This has given it the reputation as the language of choice for hackers too.

Chapter-4

SYSTEM REQUIREMENTS SPECIFICATIONS

System requirements specifications (SRS) is a text written to specify in detail the system components, both hardware and software, which are needed for the system implementation.

4.1 Hardware Specification

This section gives details of the hardware components required for the system implementation and deployment. Sericulture system requires the following components:-

1. **SST 89E516RD2 Microcontroller**

   The SST stands for silicon storage technology. A microcontroller plays a crucial role when it comes to project. This system uses the 8051 based Philips SST 89E516RD2 Microcontroller. It has a RAM of 1kb,ROM of 64kb and three timers t1,t2,t3 for feature purpose.8051 CPU with 5V operating voltage from 0 to 40MHz.SST 89E516RD2 is the 40 pins microcontroller with 4 ports as P0,P1,P2 and P3 of 8 bit each and also 32 pins of I/O ports. Three 16 bit clocks/counter and a programmable watch dog timer which is used in case of a hardware timers where the device can reset if some failure occurs.

1. **Temperature Sensor**

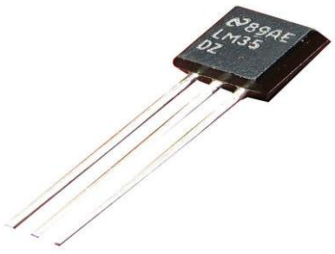

Fig 4.0: Temperature Sensor

LM35 is a temperature measuring devices which provides output voltage in centigrade. It does not require any external calibrations to give accuracies of ± ¼ °C at room temperature and ± ¾°C over a full -55 to +150 C temperature range. It can be used with solo power supplies with both positive and negative supplies. It reassures a low cost for any external calibrations. LM35 provides output which is more accurate

than thermistor output. It has a low impedance output of 0.1Ω for 1mA load and low self-heating, of 0.08 °C in still air.

2. Humidity sensor

Fig 4.1: Humidity Sensor

The module of HSM-20G is requisite for those applications where the relative humidity can be converted to standard output voltage. It includes various applications such as humidifiers and dehumidifiers, air-conditioner, humidity data loggers, automotive climate control and other applications. The characteristics of HSM-20G has got an input and output voltage range of DC 5.0 ±0.2V and DC 1.0 – 3.0V. This humidity sensor has a measurement accuracy of ±5% RH. It also has a storage RH ranging from 0 to 99% RH.

3. Fire sensor

Fig 4.2: Fire Sensor

Fire sensor works by detecting smoke or heat. The module makes use of fire sensor and comparator to catch fire up to a range of 1 meter. In this system when any fire

producing object is brought to the fire sensor within a range of 1M it produces fire alarm. The calibrations of the range adjustment is done beforehand.

The fire sensor is utilized as a basic and minimized gadget if there is an emergency. The presence of fire is seen through an LED with 3 pins which is a very easy interface controller.

4. MAX-232

Fig 4.3: Max 232

Max 232 is a dual driver/receiver to convert transistor transistor logic(TTL) voltage level to RS232 and vice-versa. It is an integrated circuit which comprises 16 pins and functions with single 5V power supply upto 120kbits. This is used as a hardware layer converter and typically consists of two transmitters and two receivers which can obtain ±30V input levels. Transmitters T1 and T2 receive the input from microcontroller and output is transferred to the receiver of RS232. The receiver on the author side accepts the input from the transmission pin of RS232 serial port and the output is given to receiver pin of microcontroller.

5. GSM

Fig 4.4: GSM

GSM stands for global system for mobile communication and is a mobile communication modem. It is a globally accepted standard used to communicate with a computer/processor over the network. It is a unique type of modem which acquires a sim card, and works over a subscription to a mobile operator similar to a mobile phone. GSM was developed as a digital system using time division multiple access. GSM network is categorized as switching system (SS), Base station(BSS), Operation support and system(OSS). The switching system is referred for executing functions related to calls. All functions that are pertaining to radio are performed in BSS and OSS is system that monitors and controls the activities inside the environment.

6. LCD

Fig 4.5: LCD

An LCD is a display of information that becomes visible when current is passed through them. It stands for liquid crystal display and consists of 32 characters in total with 16 coloumns and 2 rows. A constrict in the third pin of and LCD is used to adjust the brightness of LCD. LCD has got fixed commands for its operations. In the 4^{th} pin, this has got a register select RS which can be differentiated into two. They are the code register when RS=0 and data register when RS=1.

7. Relay

Fig 4.6: Relay

Electromagnetic waves operated switches are known as relays. This is a remote controlled switch capable of switching multiple circuits, either solely, together or in a series. It performs basic functions on galvanic separation of the primary and load circuits. A single input with multiple output capability is provided.

4.2 Software Specifications

This section gives of the software components required by the intended system under development. Sericulture system requires the following software components.

1. **Keil development tool**

Fig 4.7: Keil development tool

KEIL software gives the effortless writing code either in C or assembly level language. This software introduces a recently developed IDE called U-VISION 2 which has the capacity to merge program debugging, project management and source code editing into one single system for working. It acts as a cross compiler.

2. Flash Magic

Fig 4.8: Flash Magic

A flash magic is a computer side software which is executed that receives Intel HEX format file generated from compiler keil to be sent to target microcontroller. Flash magic notices the hardware connected to serial port. Flash microcontroller can be cleared and can be written again multiple times.

3. JDK

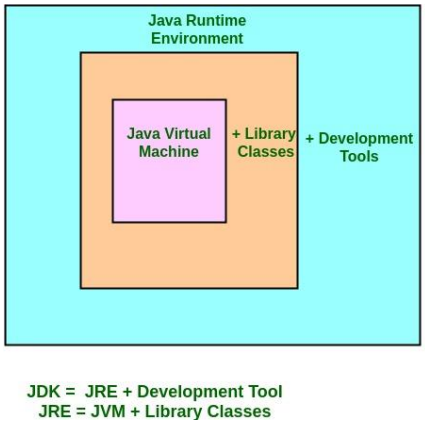

Fig 4.9: JDK

JDK stands for java development kit. It is a software development surrounding used for creating java applets and applications. A JDK incorporates JRE, an interpreter, a Javac, Jar, document generator known as Javadoc and various different tools necessary

4.3 Functional Requirements

This section describes the basic functionality of the system, as expected once the system is deployed. System meets the following functional requirements:

- **Sericulture activities must be performed with minimal effect:** In sericulture farm all the climatic variations must be normal for the growth of silkworms because silkworms are very sensitive creature which cannot survive extreme temperature for their survival.
- **The Application developed must be easily usable:**The minimum requirement for the user is to know how to operate the smart phone. The user should contain application before going to next step.
- **The farmer must be able to start or stop any activity effortlessly and with minimum time:** The farmer must have an android phone with an application and internet connection. The camera present in the rearing house can captures the activities taking place in the rear house and provides the information to the remote user in order for the farmer to know the status of the rear house situation.
- **The farmer before requesting the information of the rear house should have android phone and an app with him:** The remote user will have an IoT app through which he can request for any information needed. The user presses the photo button in the app, then the camera placed in the farm will automatically capture the image of the present situation at rearing house and sends to the user.
- **The activities of the sensor update all ready messages to the GSM module:** When their occurs any changes in the climatic conditions, when the sensors value exceeds the threshold values the sensors detect the changes and the messagedisplayed on the LCD screen. The gsm module will contain a sim through which the messages are sent to the destination immediately.
- **The farmer will be present at the remote location who receive the information:** the farmer or the remote user can be present anywhere around the world but he receive the necessary important messages and images of the rearing house as and when he wishes to look at it.
- **The usage of location:** first usage of the location comes into picture when the remote user can access the location of the salt region. The second place is when the location can be sent to nearby emergency services automatically in case of severe damage.

4.4 Non-Functional Requirements

This section describes additional performance criteria which the proposed system is aimed to meet. Some non-functional requirements are

- **Portability:** it is the degree to which software running on one platform can be easily converted to run on another. Portability is hard to quantify, because it is hard to predict on what other platforms will the software app be required to run. Portability for a given software app should be given priority for system that makes have to run on different platforms in the near future.

  In this system the software and hardware is portable. The software app can be put into use by just installing the app for any users and the hardware can be setup the any sericulture part
- **Reliability:** reliability of a software system is defined as the ability of the system to behave consistently in a user acceptable manner. When operating within the environment for which it was intended.

  Reliability can be defined in terms of an availability percentage say 99.999% for sensor, it should be reliable that is should not break down often. For a remote user he must be comfortable with the usage of app in his android phone.
- **Efficiency:**efficiency refers to the level of use of scars computational resources, storage space and communications channel. Efficiency can be categorized as capacity and degradation of service. A farmer should find it efficient in terms of both cost and computational efficiency. The system should be able to handle activity required by the user.
- **Safety:** Analysis or safety requirements often entails hazards analysis and fault occurrences, these are technique adopted from engineering principles. In this system safety is ensured by the fire detecting sensor which acts as a precautionary measure to avoid destructions. For example, when there is a fire in the rearing house, the fire sensor detects the fire and displays an alert message in the LCD as well as alerts the workers with a buzzer. Then, a message is notified to the remote user and the owner can take necessary actions from his app by dialing to nearby emergency services through the location fetching specialty

Chapter-5

SYSTEM DESIGN

5.1 Activity Diagram

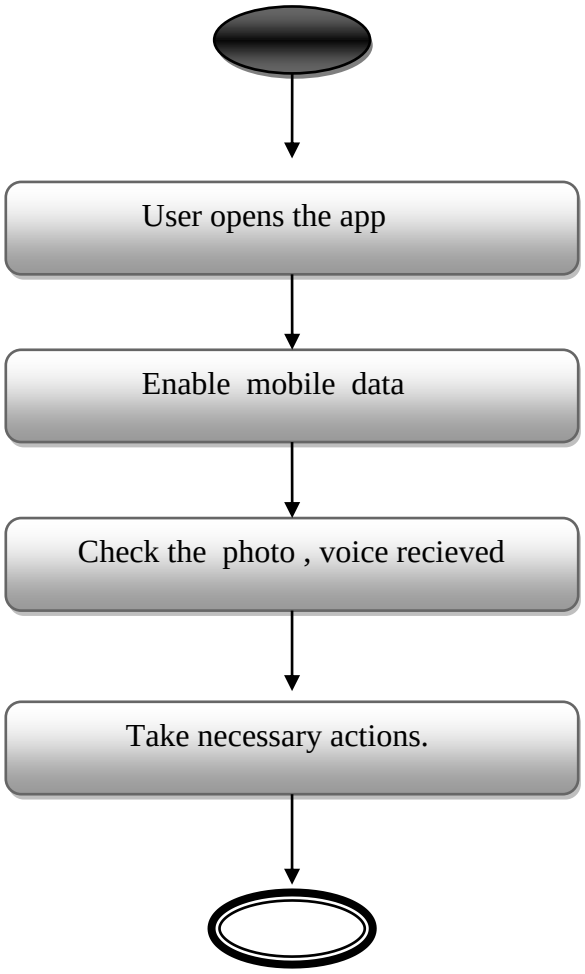

Fig 5.0: Activity diagram at User End

The figure 2.8 shows the activity diagram at user end. When the user opens the application in the phone , a text message requesting photo will be received. He opens the image, checks the image and gets to know the condition at the rearing house.

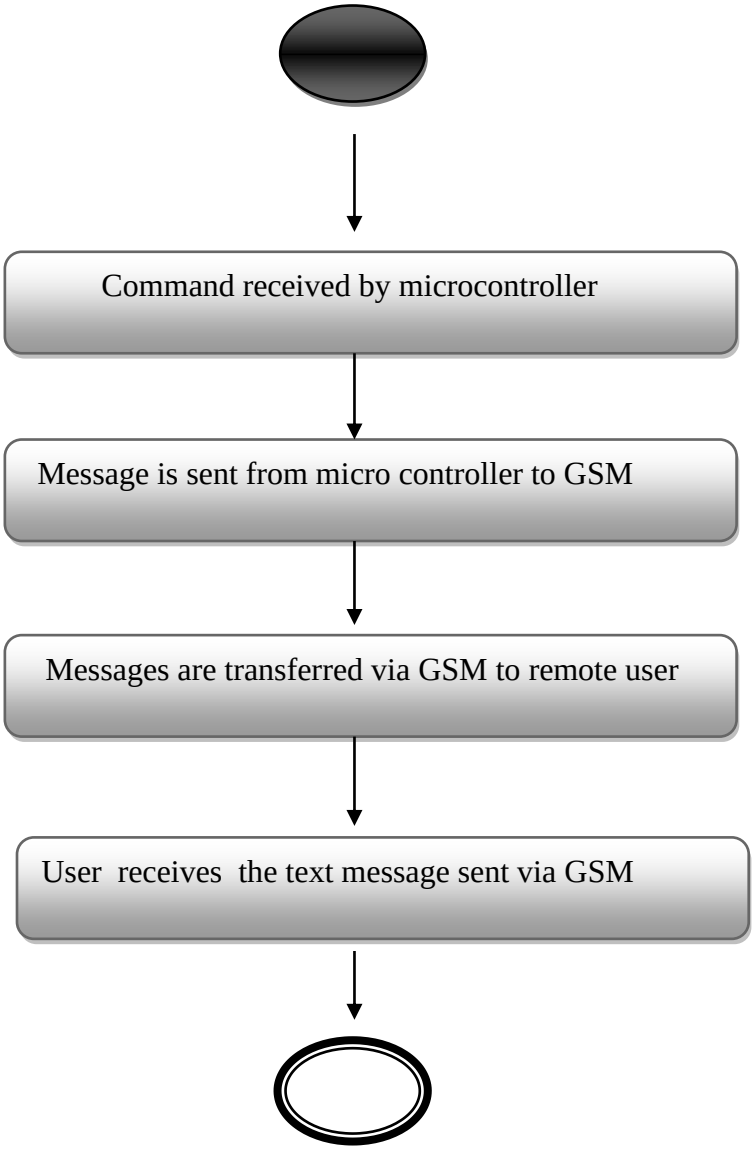

Fig 5.1: Activity diagram at sericulture farm

As illustrated in the figure 2.9, the microcontroller receives the commands from each sensor and is programmed in such a way that, when each sensor crosses a threshold value, the message is passed on to the GSM. Further, GSM sends a message , voice note, photo to the user . User then receives the information and takes necessary actions

5.2 Sequence diagram

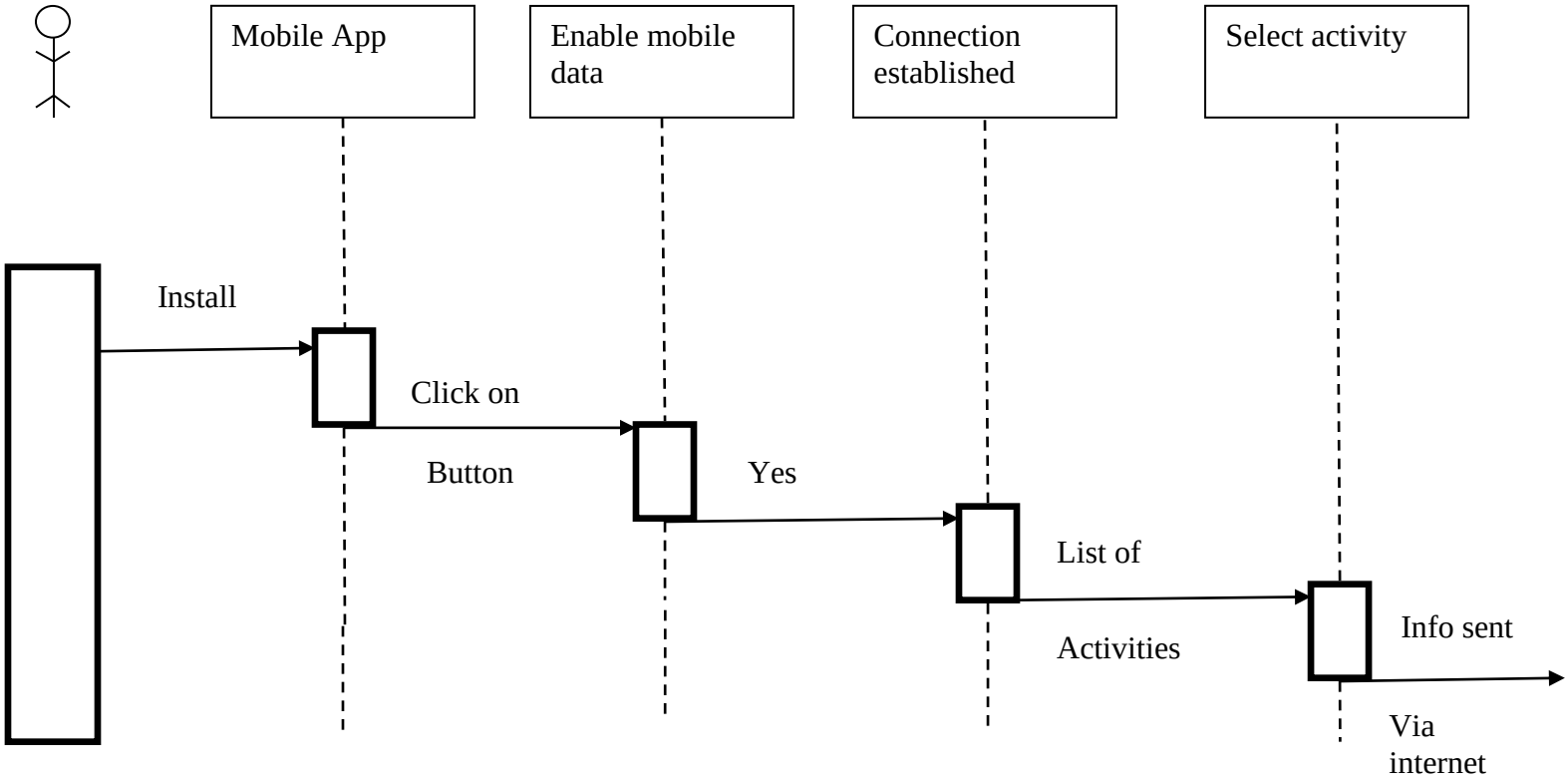

Fig 5.2: Sequence diagram at user end

The sequence diagram shown in fig 3.0 shows the flow of process occurred and in which order the activities are performed when user operates on the application.

When the user opens the application in the phone , a text message requesting photo will be received. He opens the image, checks the image and gets to know the condition at the rearing house.

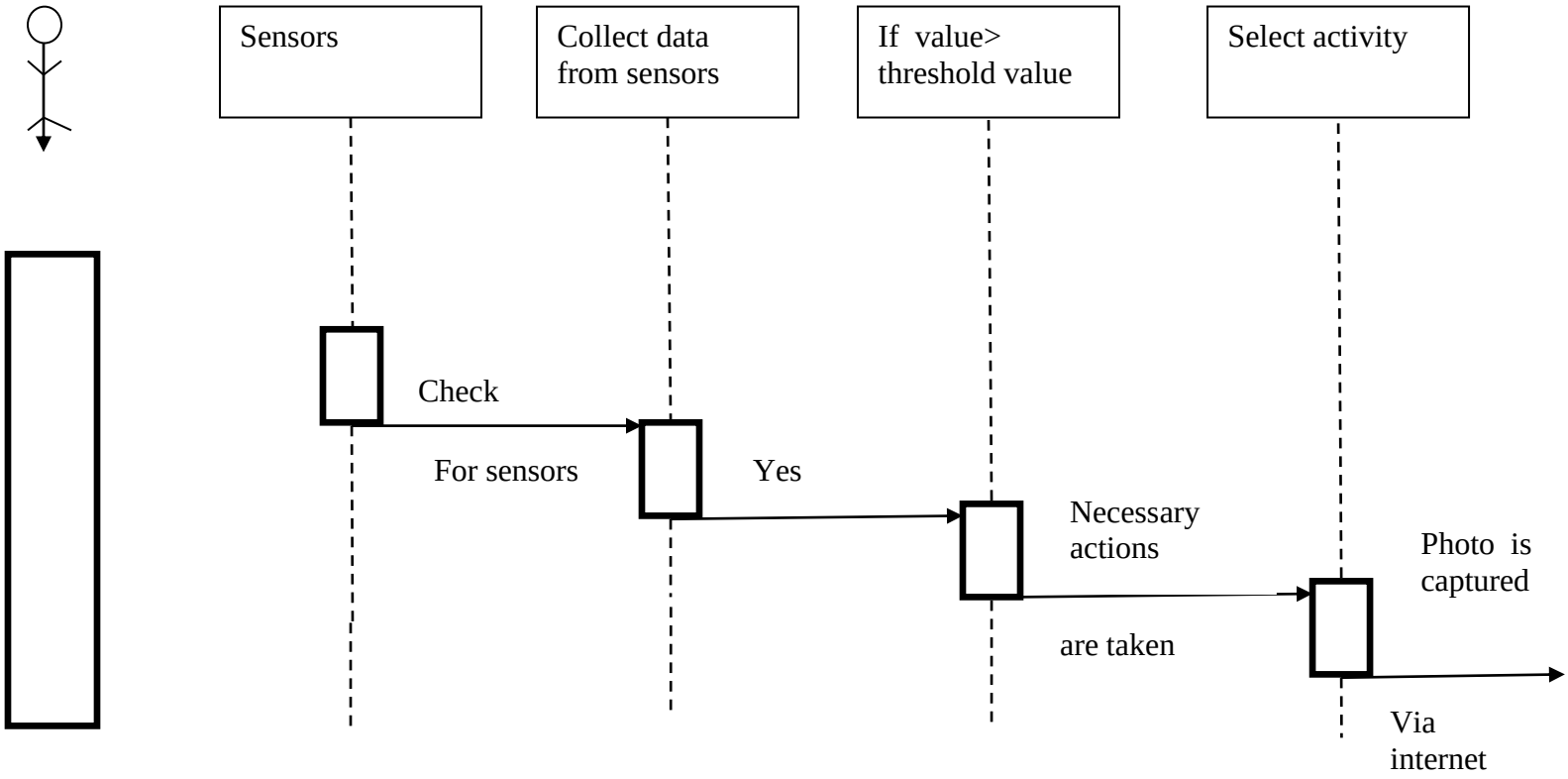

Fig 5.3: Sequence diagram at Sericulture farm

As shown in the figure 3.1, the sensors are inititalized and the values are read from the sensors. The values from temperature sensor, fire sensor, humidity sensor are collected. If these values are greater than threshold value, then the messages are sent to the intended person. Further, the necessary actions are taken by the farmer. By this method, the person at remote place gets the information.

5.3 System architecture

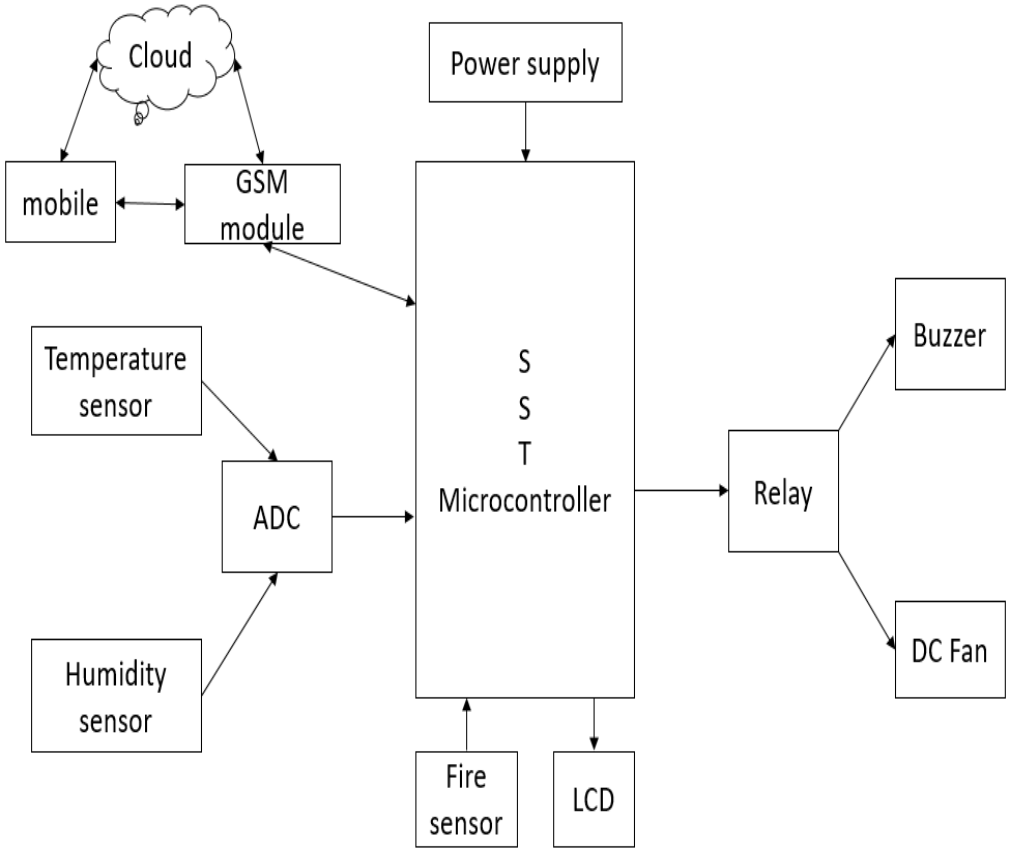

Fig 5.4: System architecture

The SST micro controller is used as a single task processor. Its RAM is 1KB and timer is 3. The sensors like temperature, humidity are connected to Analog to digital converter since these signals are in analog mode. After converting into digital signals, they are sent to micro controller. If the temperature is high, then the DC fan is switched on. If there is a fire, the buzzer is switched on. These statements are shown in LCD. This is the working of the figure

5.4 Flowchart of the overall system

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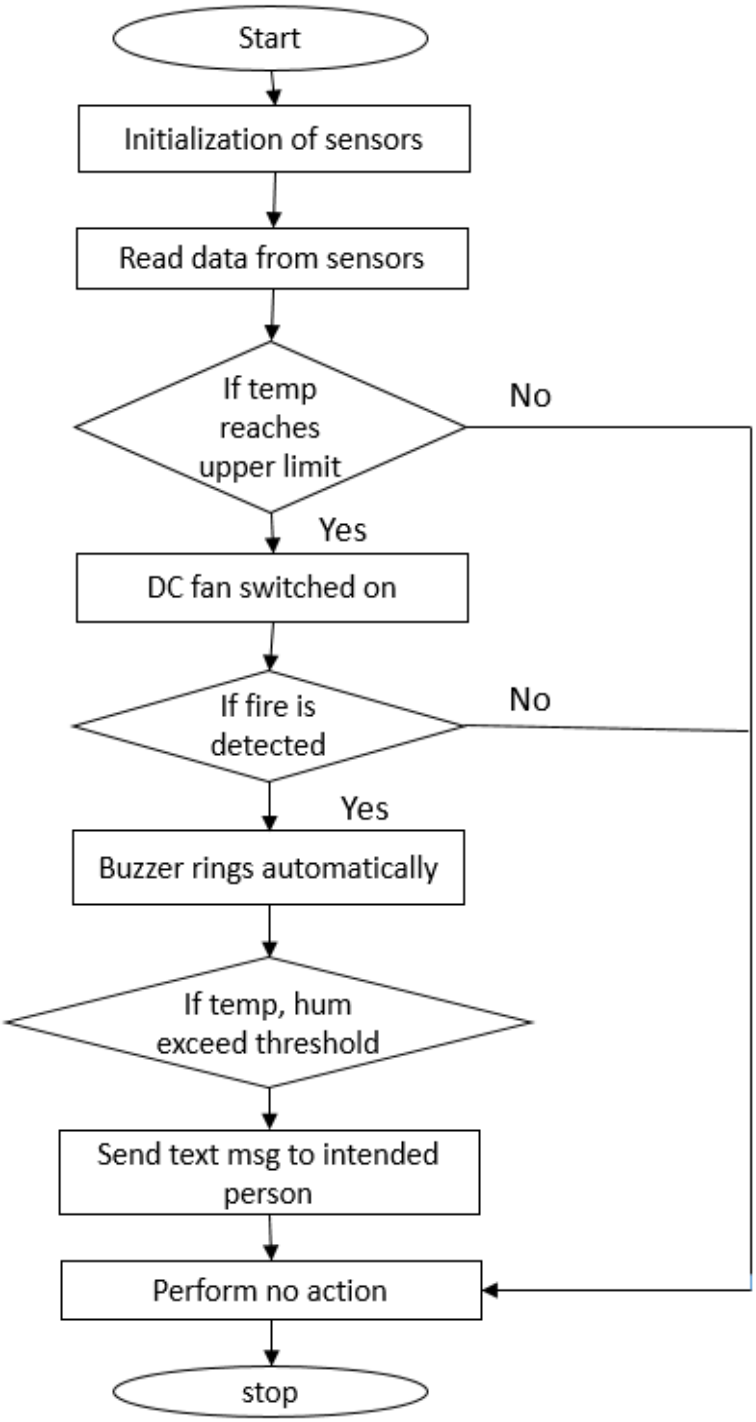

Fig 5.5: Flowchart of the overall system

Chapter- 6

SOFTWARE TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a product. It provides a way to check the functionality of components, sub-assemblies and a finished product. It is a process of exercising software with the intent of ensuring that the software system meets its requirements and user expectations and does not fail in an un acceptable manner,

The following are the design of the test cases that validate the functioning of the internal program logic and that the inputs produce valid outputs.

TEST CASE NO : 01	**TEST CASE NAME :** Temperature sensor
INPUT: If the temperature exceeds the threshold (50degree)	
OUTPUT: 1. Message is sent to the remote user. 1. DC fan is switched on automatically.	
RESULT: FAIL (Never reached 50 degree and hence changed it to 40 degree)	

Table 1.0 : Testcase 1

TEST CASE NO : 02	**TEST CASE NAME :** Fire sensor
INPUT: In case the fire is detected in rear house	
OUTPUT: 1. Message is sent to the remote user. 2. Buzzer is switched on automatically	
RESULT: PASS	

Table 1.1 : Testcase 2

TEST CASE NO : 04	**TEST CASE NAME :** GSM
INPUT: SIM is inserted and checked for network connection.	
OUTPUT: Text and voice messages are transferred to the user end.	
RESULT: PASS	

Table 1.3: Testcase 3

TEST CASE NO : 05	TEST CASE NAME : Sender access
INPUT: Captures the image in the farm and sends it to the user interface.	
OUTPUT: The receiver obtains the photo and knows the situation at the farm.	
RESULT: PASS	

Table 1.3: Testcase 4

TEST CASE NO : 06	TEST CASE NAME : Receiver access
INPUT: Requests for the photo to the person in the farm.	
OUTPUT: The intended request is obtained through text.	
RESULT: PASS	

Table 1.4: Testcase 5

Chapter-7

RESULTS AND SNAPSHOTS

Fig 7.0: Front view of the prototype kept in commercial rearing house.

Fig 7.1: Close up view of the prototype kept in commercial rearing house.

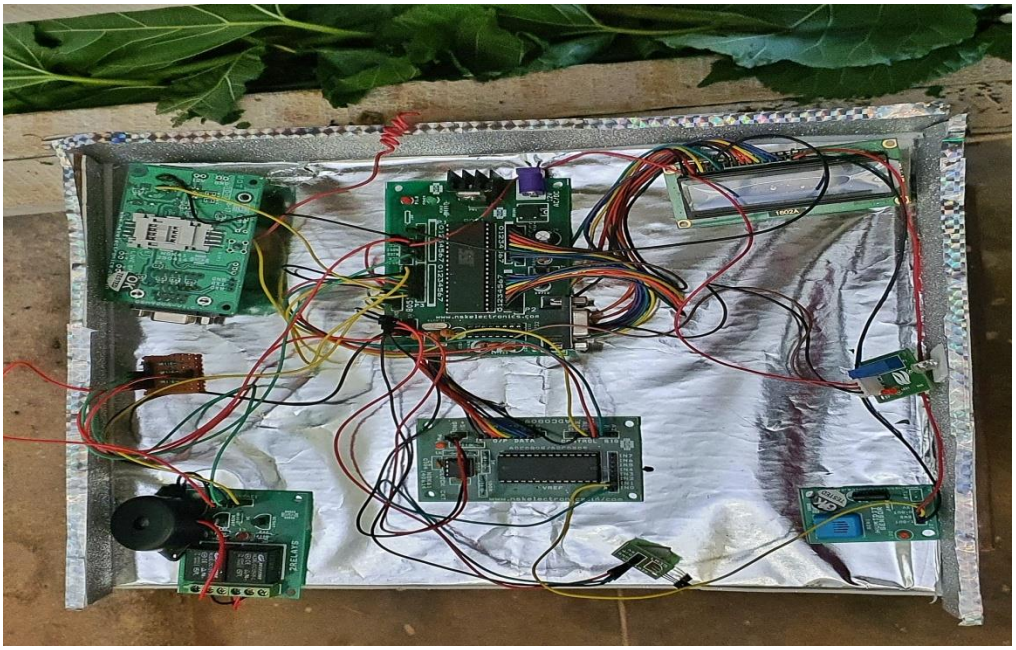

Fig 7.2: Top view of the prototype kept in commercial rearing house.

Fig 7.3: Screenshot showing the features of the application developed.

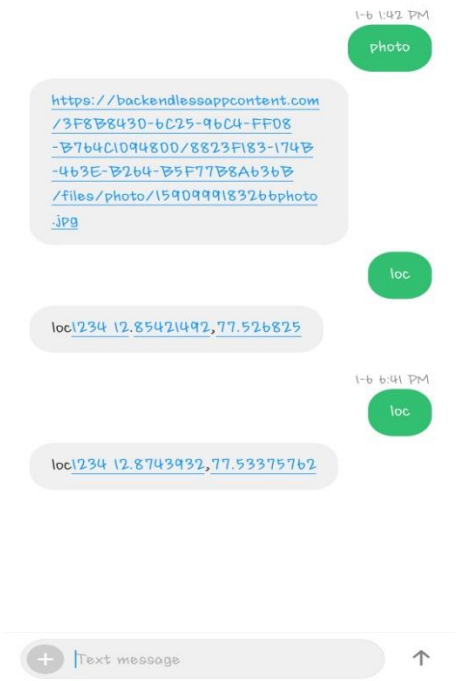

Fig 7.4: Screenshot showing the photo and location link that is received on requesting.

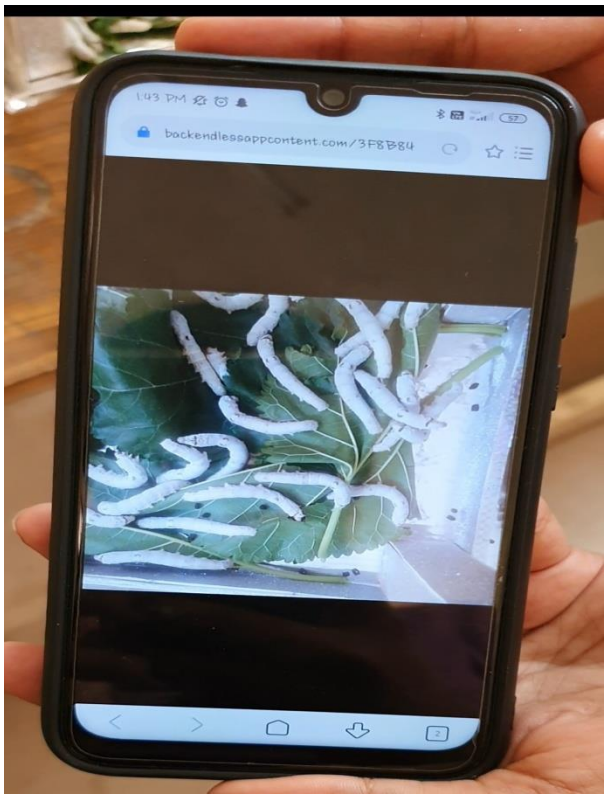

Fig 7.5: Image of the silkworms captured by the system at the farm

Fig 7.6: Screenshot of the details that is fetched on pressing the nearby info button

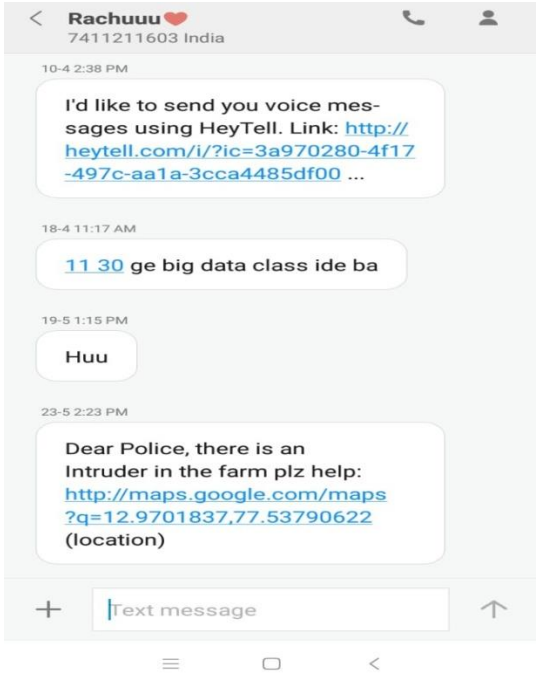

Fig 7.7: Screenshot showing the complaint received from the owner of the farm.

Chapter-8

CONCLUSION AND FUTURE ENHANCEMENT

As silk is regarded as a luxury item in India, its price is relatively higher than other fabrics. This “Development of sericulture farm automation using sensor network” is created using GSM/GPRS modem along with sensors which considers values of temperature, humidity, moisture and infrared sensors. The usage of SST microcontroller in this project offers significant cost and reliability benefits. This system records the ongoing process of the environmental conditions and notifies the user who may be at a remote location and can also take necessary actions for the same.

At the receiver IOT, the user is notified through an SMS, photographic messages via email and a voice over if the phone is in silent mode. Based on the need at raising place of silkworms, suitable measures are taken to solve the problems that\ have arisen. One of the drawbacks are the health hazards in sericulture where in the workers are required to work in units that are cramped, damp and poorly ventilated resulting in heart problems. And handling of dead worms with bare hands also cause an infection and illness.

On the whole this project reduces the fieldwork for the workers which prevents all health diseases and minimizes the faults. This sericulture is easily programmable and paves way for liability of the system

8.2: FUTURE ENHANCEMENT

The current system requires continuous internet connectivity. It is implemented using GSM module to send the notifications directly on the farmer’s mobile through the SMS without using the internet connectivity. In future, this can be overcome by using LoRa. LoRa is developed to provide IoT devices extended battery life in the range of several years at the same time a LoRa network has extended range and is cost effective to deploy.

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