Greenhouse Automation Using CAN Bus

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ABSTRACT

The main objective of this project work is to design an automated greenhouse which is purely sensor based system. Greenhouse is a particular kind of agricultural environment in which the rate of plant growth can be changed, by creating optimum conditions. It can communicates with various sensor modules in real-time in order to control the light, humidity, soil moisture, temperature efficiently inside green house by actuating cooler, heater, dripper and lights respectively according to the necessary condition of the crops. This paper mainly reviews the present Greenhouse Monitoring and control systems. It proposes a generic architecture which can be applied for many other automation applications.

Keywords — Greenhouse, Sensors, CAN Bus, PIC Microcontroller, Actuators**.**

1. INTRODUCTION

The increase in demand for a lot of agricultural products has created awareness for the farmers to increase their production by implementing the latest technology in the field. Greenhouse is a particular kind of agricultural environment in which the rate of plant growth can be changed, by creating optimum conditions and the influence of an atrocious weather can be kept out. Unlike open farming, where nature's control takes the upper hand, green houses present a closed environment that can be strictly controlled by humans in order to provide optimal conditions for the growth of the crops [1].

The proposed embedded system is about monitoring as well as controlling the Greenhouse environment using CAN communication. The system is established using PIC Microcontroller having inbuilt CAN bus & ADC. Sensors are applied to retrieve the greenhouse parameters on real time basis. These parameters are processed using inbuilt ADC, and transmitted to Controller using CAN communication bus. All plants require optimum conditions to grow correctly hence in my project providing optimum condition under control in order to make those conditions as close to the ideal as possible. An automated management of a greenhouse provides the most proper conditions of plant growth.

2. EXISTING SYSTEM

In our entire previous concept which i analyzed have some disadvantages. In one existing system , automatic controlling process takes place by fully based on ARM microcontroller based circuit. In other case, it is done by zigbee wireless network. Where zigbee wireless network is used here for transferring information to the control room which is far away from environment. There the person can control according to their wish and transfer the information via zigbee connected to controller and according to that performance will takes place. Major Drawbacks [5]

1. In ARM microcontroller based circuit-The actions which we need to perform at any time cannot be done in any case. [3]

2. In zigbee wireless network based controlling process the all information stored in microcontroller is send

To PC which is far away in control room through zigbee transceiver. The person in control room will perform control action .According to that microcontroller will actuate the actuators.[2]

3. PROPOSED SYSTEM

An attractive thing of proposed system is that, it has extension in its concepts in a successful way. Here we have combined our all previous concepts for an effective and good productivity of plants. It has been identified that the rate of photosynthesis depends on the amount of light energy falling on to the leaves as light intensity reduces the photosynthesis rate reduce and respiration rate increases therefore to get the maximum out of the plants food production the photosynthesis rate needs to be kept high in day time but it is impossible to control if the plant is grown outside a greenhouse .Here even I m trying to connect the automotive industry with agriculture by using the present technology in the project . CAN bus which is mainly known for automotive industry , here in my project I m going to use that bus.This will make industry and agriculture again closer in terms of technology . CAN bus by using this we can be more reliable and safety at the output side.

3.1. Software Tools MPLAB X:

MPLAB X IDE is a software program that is used to develop applications for Microchip microcontrollers and digital signal controllers. This development tool is called an Integrated Development Environment, or IDE, because it provides a single integrated “environment” to develop code for embedded microcontrollers. Here coding will be similar to Embedded C code, here we can use same compiler for simulation and debugging code i.e. programming on the IC. In my project I m using MPLABX IDE V2.3.

4. SYSTEM ARCHITECTURE

The system model consists of sensors, microcontroller, interface such as relay and actuators. Actuators such as ventilation fan, sprayer, heater, water pump, artificial lights are used. The proposed system aim is to design a PIC microcontroller-based circuit to monitor and record the values of temperature, humidity, soil moisture level and sunlight of the natural environment that are continuously modified and it is get controlled in order optimize them to achieve maximum plant growth and yield**.** Controlling process takes place effectively by automatically**.** Depending upon the application, we will set particular threshold level for each climatic parameter. When any of parameters level cross a safety threshold then PIC microcontroller will perform the needed action by employing relay (motor driver) until the strayed-out parameter has been brought back to its optimum level.

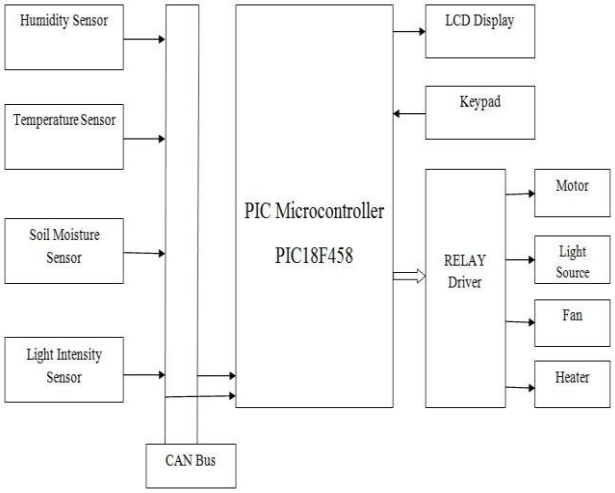


Fig:1.1 Block Diagram

5. HARDWARE DESCRIPTION

5.1 Sensors

Sensor is a device which is used to convert physical quantity into electrical signal. A sensor is a device, which responds to an input quantity by generating a functionally related output usually in the form of an electrical or optical signal[2]. A sensor's sensitivity indicates how much the sensor's output changes when the measured quantity changes. Sensors that measure very small changes must have very high sensitivities. Sensors measure for instance, a room temperature

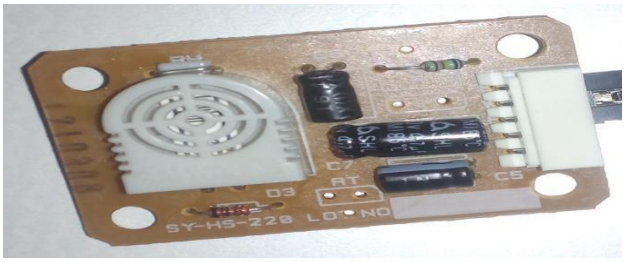
- Sensors used to measure environmental parameter in my project
- Temperature sensor(LM-35)

Temperature sensor converts temperature into voltage, which is relatively proportional to the increasing temperature.It’s a three terminal sensor namely +Vs , Vout

and Gnd.

- Humidity sensor(SY-HS-220)

Humidity sensor which measures the presence of water vapour in air . Humidity also plays an important role in plant growth because the amount of water vapour in air can affect the growth of plants. It's a three terminal sensor namely +Vs ,Vout and Gnd



- Soil moisture sensor:

This sensor measure the conductivity of the soil .In my project we only designed this sensor by PCB design technique. We just created four copper electrodes and applying voltage at both end of electrode .It will be just like current loop and again measuring voltage difference between the middle two electrodes.

- Light dependent resistor:

An LDR component that has variable resistance that changes with light intensity that falls upon it.

- **PIC Microcontroller**

The microcontroller board is based on the use of an 8 bit PIC18F458 microcontroller from Microchip. A microcontroller (MUC) is a small computer with all peripherals such as i/o, memory all mostly in build. Microcontrollers are used in automatically controlled devices. For Greenhouse effective management, here in my paper i m using PIC 18F458.A PIC Microcontroller Controller is an RISC machine (Reduced Instruction Set Computing). This microcontroller contains several resources:

- An 8 bit CPU.
- A flash memory where the program can be stored.
- A RAM Memory which can be used to store the variables used by the program.
- Several I/O lines. Some of them are digital and some are analog. Through this lines it is
- Possible to provide a analog/digital data acquisition which can expand the capabilities of the PIC. Several auxiliary devices (clock generators, counters, timers, etc.) which can be used for driving external devices.
- A digital I/O line, compliant with the CAN data MAC Protocol.
- ADC 8ch, 10-bit.

5.2 Relay

A **relay** is an electrical switch. This electrical switch is operated by an electromagnet that opens and closes under the control of another electrical circuit .It is able to control an output circuit of higher power than the input circuit.

5.3 Actuator

An actuator is an piece of equipment which will produce an movement when signal is given. Actuators are used in the computer control of an environment, industrial automation and in robotics or, more generally, actuators are the machines used for output in control applications. For the situation in a computer controlled greenhouse, the actuators receive their control signal from the microcontroller to control the inside climate variables of the greenhouse. The designed system includes the following actuators:

A ventilation fan, its speed determines the Exchange between inside and outside air, thus causing natural ventilation. The system consists of a number of heaters distributed along the greenhouse. As an artificial light LED (light emitting diode) is used.

5.4 Liquid Crystal Display

The LCD (Liquid Crystal Display) is used to display the measured parameters and the set parameters.in my project LCD is used to display the environment parameters which are collected from the sensors. Here I am using 16*2 LCD displays which operate on 5v.

5.5 CAN Bus

The Controller Area Network (CAN) is a communication protocol for real time applications. CAN bus is a differential bus terminated by 120Ω resistors at both the terminals. CAN defines in only the physical and data-link layers of ISO layer. The CAN physical layer connects the CAN controller to the physical bus wires. A CAN network is made up of group of nodes. Each node can communicate with other nodes using predefined messages called CAN Objects (COB). In a CAN network, higher priority is given to the lower COB-ID[3]. All the nodes that want to acquire the bus will be continuously monitoring the bus. When the bus becomes free all the nodes which were requesting the bus start transmitting their messages, starting with the COB-ID. Only the device with the lower COB ID will acquire the bus for the transmission. All other nodes withdraw transmission. As a result one of the messages will be transmitted without collision. This is in contrast to the situation on Ethernet where all the messages are lost in the case of a collision. This improves the performance on a slow network.

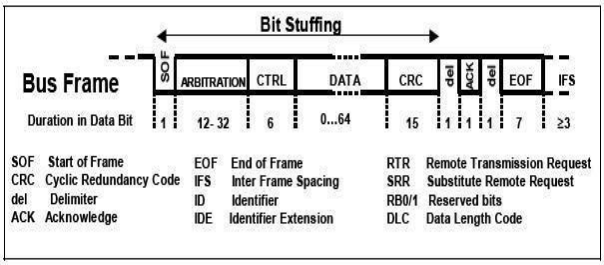
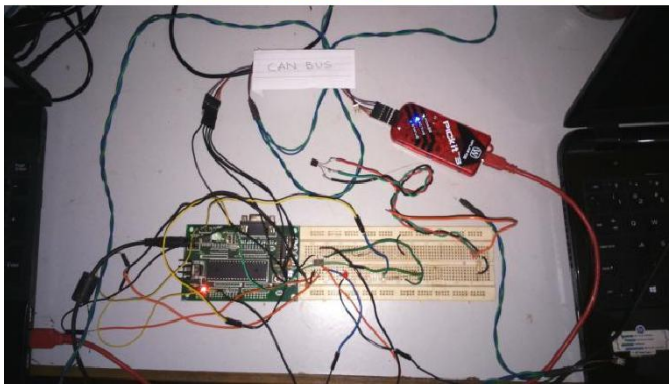


Fig 1.2: CAN Bus Format

6. RESULTS



7. CONCLUSION

A novel approach of greenhouse automation using PIC Microcontroller based system is designed and monitored the various parameters of greenhouse using CAN Bus.

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