Automatic Irrigation on Sensing Soil Moisture Content

A Rajendran, S Ezhilnirai Kavinila, J Harini, V.O.Sangeethaa

Abstract: ***This paper proposes automatic irrigation system for sensing soil moisture content using pic (16F887) microcontroller, which was automatically programmed for on and off the motor when the soil moisture content reaches a defined threshold level. Since our proposed system is automatic, human involvement is totally prevented for irrigation purpose. The entire system was programmed using pic simulator IDE setup and fused into pic microcontroller. This proposed frame work was tested for moisture level of various soils. By comparing our system with required soil moisture content table taken from agriculture database, the result shows that 99% accuracy in average of all the sample soils taken for test. Here we tested with three soil types.***

I. INTRODUCTION

In unmistakable nursery vegetable speedy improvement in the sustenance creation technology, the steady expansion of sustenance solicitation requires control [1]. For a country like India, where the economy is generally subject to water frameworks, it is a clear, definite technique in an age. It also helps in proficient, removing human agriculture and isotropic climatic conditions, still bumble in changing available levels of soil clamminess and we are not prepared to make full use of agrarian resources. Extend their net benefits. The main reason for this is the non-attendance of deluges and the lack of land Irrigation is the fake use of water to water in the soil store [2]. The generally reliable extraction of water to help generate yields. In yield age earth decreases the water level[3] as a result of which part of the earth is usually used in dry zones and during precipitation that continues to occur in unimmersed areas. Another deficiency, yet notwithstanding secure plants against frost [4]. Critical reason for this is the direct result of the unconstrained use of Irrigation Water Types, as a result of which a lot of water goes into the waste surface water framework. The most enormous Drip Irrigation advantage is that water is given in close proximity to the root zone of the sprinkler water frame. As a result, the plants spill by stream, saving a huge amount of water.

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A Rajendran, Professor, Department of Electronics and Communication Engineering, Karpagam College of Engineering – Coimbatore

S Ezhilnirai Kavinila, Student, Department of Electronics and Communication Engineering, Karpagam College of Engineering – Coimbatore

J Harini, Student, Department of Electronics and Communication Engineering, Karpagam College of Engineering – Coimbatore

V.O.Sangeethaa, Student, Department of Electronics and Communication Engineering, Karpagam College of Engineering – Coimbatore

Currently, farmers have been the usual water framework procedures such as overhead using Indian water framework techniques through manual control sprinklers [6], continuing flood type systems. The in which farmers plunge the land into the normal breaks is usually wet. Lower plant leaves and stem. The entire soil consumes more water or surface throughout this methodology is drenched and normally stays wet long after the water frame throughout the water reaches late in view of which crops are made. Such condition causes diseases to be dried by the leaf. Water insufficiency can be awkward to plants structure life forms. In spite of what may be normal the spill or stream water framework is before perceptible wilting occurs. Obstructed advancement rate, lighter a kind of present-day water framework system that step by step applies weight characteristic item seeks after slight water inadequacy [5]. This issues small amounts of water to part of the root zone of the plant. Water can be radiantly revised if we use customized small scale generally consistently to maintain a positive soil controller-based structure[7] in which the condition of suddenness and the stress of sogginess in the plant water framework occurs exactly when it is exceptional with authentic usage of water resources.

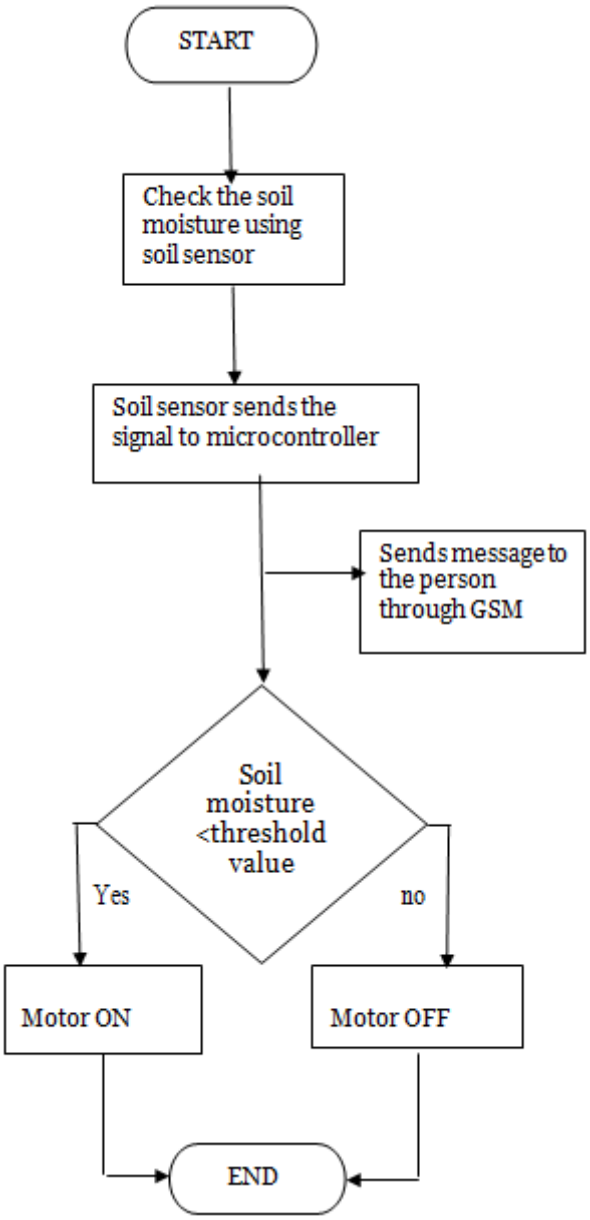
II. EXISTING MODEL

The endeavor is planned to develop a modified water framework structure which switches the siphon motor ON/OFF on recognizing the sogginess substance of the soil. The use of real water framework procedure in the field of agribusiness is fundamental. The upside of using this methodology is to diminish human intercession and still assurance proper water framework.

The endeavor uses a PIC(16F887) plan microcontroller which is altered to get the data banner of fluctuating sogginess condition of the soil through the distinguishing game-plan. This is cultivated by using an activity amp as a comparator between the action identifier and the microcontroller as an interface.

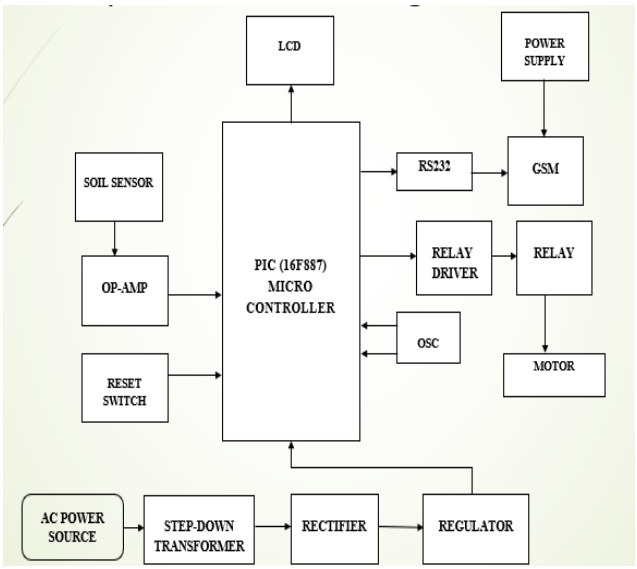
It makes a yield when the controller gets this banner, which drives a hand-off for the water siphon to work. An LCD show is moreover interfaced to the microcontroller to indicate status of the earth and water siphon. The recognizing strategy is made by using two firm metallic shafts installed into the field at a division. Relationship from the metallic shafts are interfaced to the control unit.

III. FLOW CHART



IV. PROPOSED MODEL

A. Block Diagram



Microcontroller pic (16F887), Op - Amp, Relay, Water Siphon, Diodes, Voltage Regulator, Capacitors, Resistors, Led, Crystal, Transistor are the required parts. The power supply consists of a downstage transformer that ventures down to 12VAC voltage. This AC is changed to DC by using an extension rectifier, at that point it is directed to 5v using a voltage controller that is used for microcontroller activity. The square outline of Automatic Irrigation System on Sensing Soil Moisture Content undertaking involves three primary segments in particular a pic (16F887) microcontroller, comparator and hand-off. This undertaking utilizes a pic (16F887) microcontroller which is modified in inserted C programming. When the sensor plan detects the dirt's dampness, by using a comparator, it sends the flag to the microcontroller. Here, the comparator is used as an interface between the action detection course and the microcontroller. Detecting course of action is accomplished by using two hardened metal bars set in a separate field. Once the microcontroller gets the flag, it creates the yield that drives a hand-off and encourages the engine to siphon the plants with water. The water siphon and soil status is displayed on the microcontroller interfaced LCD.

The idea we improved by incorporating GSM innovation, with the end goal that at whatever point the water siphon switches ON/OFF, a SMS is conveyed to the concerned individual in regards to the status of the siphon. We can likewise control the siphon through SMS.

B. Soil Moisture

Sensors of soil dampness measure the volumetric content of soil water. Because the direct gravimetric estimation of free soil dampness requires an example to be expelled, dried, and weighed, soil dampness sensors directly measure the volumetric water content by using some other dirt properties, such as electrical opposition, dielectric consistent, or neutron connection, as an intermediary for the dampness content.

V. PIC MICROCONTROLLER

PIC microcontrollers are a group of specific microcontroller chips created by microcontroller Technology in chandler Arizona. The abbreviation PIC represents peripheral interface controller despite the fact that that term is seldom utilized now a days. A normal microcontroller incorporates processor and memory and peripherals.

Here we use6 PIC microcontroller, it is quick a direct result of utilizing RISC engineering. when contrasting with different microcontrollers, control utilization is extremely less and writing computer programs is additionally simple.

A. Venture Down Transformer

A transformer that expansion voltage from primary to optional (more auxiliary twisting turns than essential winding turns) is known as a stage up transformer. On the other hand, a transformer intended to do the exact inverse is known as a stage down transformer.

The power supply in the Automatic Water System Framework consists of a stage down transformer that ventures down the voltage to 12VAC. By using a bridge rectifier this AC is switched to DC, then it is controlled to 5V using a voltage controller that is used for the microcontroller's activity.

D. Hand-Off

A hand-off is a switch that works electrically. Many transfers use an electromagnet to work a switch precisely, yet other working standards are also used, such as strong state relay. By utilizing a hand-off, we can control a machine which utilizes high voltage and possibly perilous, it is utilized to detect unusual condition and electrical switch can work naturally at the season of blame.

E. Controller

An electronic circuit used to keep up a dimension measure of voltage in an electrical line. It disposes of intensity floods, spikes and brownouts, which can make hurt delicate electrical. The microcontroller utilizes this data to manage water system by killing on or a water supply.

F.LCD

LCD (fluid precious stone display)is the innovation utilized for presentation in scratch pad and another littler PC. Like light - transmitting diode (LED) and gas-plasma advancements, LCDs permit presentations to be a lot slenderer than cathode beam tube(CRT) technology. An LCD show is interfaced to the microcontroller to show the status of the dirt dampness level and the engine on/off warning that was given by GSM

G. Rectifier

The electrical gadgets which changes over an exchanging flow into an immediate one by enabling a flow to move through it one way. In this we use connect arrangement that gives a similar extremity of yield voltage for either extremity of info voltage. At the point when utilized in its most regular application, for change of substituting current (AC) contribution to coordinate current (DC) yield, it is known as a scaffold rectifier. An extension rectifier gives full-wave correction from a two-wire AC input, bringing about lower cost and weight when contrasted with a middle-tapped transformer structure.

H. RS232

RS232 is a standard convention utilized for sequential correspondence, it is utilized for associating PC and its peripherals gadgets to permit sequential information trade between them. As it acquires the voltage for the way utilized for the information trade between the gadgets. It is utilized to interface the GSM with the microcontroller for correspondence to convey message to the worry individual.

I. Comparator

A comparator is a gadget that thinks about two voltage or current and yields a computerized flag demonstrating which is bigger. It has two simple info terminals and one paired computerized output.in this we have utilized Op-Amp as comparator. It detects motion from the dirt sensor and contrast it and the information esteem given to it and send the flag to microcontroller that whether the motor is to ON or OFF.

J. Sensor

A sensor is a gadget that distinguishes and reacts to some kind of contribution from the physical environment. We used sensors for soil dampness to measure the volumetric content of soil water. Soil dampness sensors measure roundabout volumetric water content by using other dirt properties, such as electrical opposition, dielectric steady or neutron connection, as an intermediary for the dampness content.

K. GSM

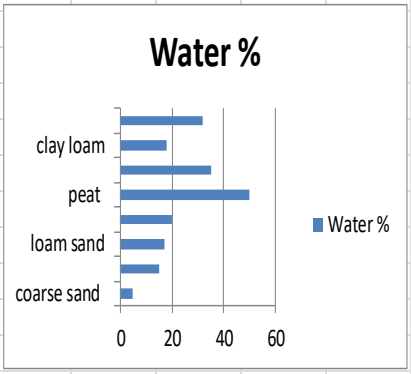
GSM (Global System for Mobile correspondence) is an advanced versatile system that is broadly utilized in Europe and others parts of the world. GSM utilizes a variety of time division different access (TDMA) and is the most broadly utilized of the three computerized remote. Its utilized for correspondence reason for sending messages to individual.

L. Engine

A gadget that changes over any type of vitality into mechanical vitality, particularly an inward ignition motor or a plan of curls and magnets that changes over electric flow into mechanical power. We have utilized DC engine to siphon water.

VI. SOIL MOISTURE LEVEL TABLE AND GRAPH

Soil Type	Water %
coarse sand	5
fine sand	15
loam sand	17
clay	20
peat	50
silt loam	35
clay loam	18
loam	32



A. Topsoil

Soil included meet sand and residue measures and somewhat less mud. Sand particles are the largest of the three segments. Sand does not clutch humidity, but it gives great circulation of air. On the contrary end, dirt particles are a lot littler and effectively conservative. That makes earth an extraordinary material for blocks of structure, but not very good to allow water, air, and roots of plants through. (Field Capacity: 0.74 in)

B. Mud

Mud soil consists of small particles that are hard and willing to be compacted effectively. This compaction makes it difficult to plant or even scoop inside the soil. While mud soil can be difficult to work with, the development of specific plants can very well be helpful. It can clutch the underlying foundations of plants better and give a steadier condition than numerous different kinds of soil. (Field Capacity: 0.54 in)

C. Mud Loam

A finished soil that breaks into hard when dry hunks or knots. When the clammy soil is squeezed between the thumb and the finger, a dainty strip will be framed that breaks promptly, supporting scarcely its own weight. (Field Capacity: 4.2 in)

D. Silty Clay

Sediment has larger particles than dirt and in nature is essentially inorganic. A silty earth soil has a higher level of mud than residue. (Field Capacity: 0.61 in)

E. Sandy Loam

Sandy topsoil soils have a high sand convergence that gives them an abrasive atmosphere. In greenhouses and gardens, sandy topsoil soils are capable of rapidly depleting excess water, yet they are unable to hold notable water or supplement measures for your plants. Plants developed in this kind of soil will require the water system and treatment to be visited gradually. (Field Capacity: 0.45 in)

F. Loamy Sand

Typically, this kind of dirt consists of sand mixed with a larger portion of sediment and mud. Numerous individuals lean for their planting towards loamy sand soil as this type of soil regularly takes into consideration great flow. (Field Capacity: 0.35 in)

G. Sand

This type of soil is anything but difficult to develop at the same time, as it takes into account more flow than required, watering it normally is essential, especially in the middle of summer days. Since sandy soils do not allow water to pool around the roots, plants that tend to experience the root rot's ill effects are a decent decision. (Field Capacity: 0.22 in)

VII. SOIL INTAKE RATE AND FIELD CAPACITY

Despite the preset soils, to depict your dirt piece, you can enter your own "Custom" factors:

A. Admission Rate (Inch/Mm Every Hour)

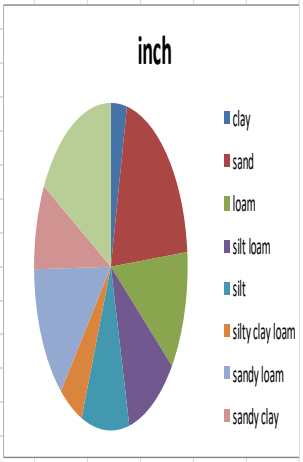
Identifies the time it takes to invade a given amount of water in a specific type of soil. When all is said in done, the lighter - finished (sandy) soil admission rate is higher than the heavier-finished (mud) soil. Be that as it may, sprinkler water system with an exceptionally high amount of water can prompt surface overflow even on sandy soils. Numerous elements, such as soil texture, soil structure, compaction, organic matter, stratified soils, salts in the dirt, water quality, sediments in water system water, and so on, influence the admission rate of dirt under water system.

B. Field Capacity (%)

Identifies the measurement of soil dampness or water content in the dirt after water abundance has depleted and the rate of decreasing development has decreased. This usually happens in past soils of uniform structure and surface 2–3 days after downpour or water system. The picture below (from Natural Resources Conservation Service) depicts the dirt textural division percentage of earth, sediment, and sand. The Intake Rate and Field Capacity contrast from one kind of dirt to another in light of this division.

C. Table of Soil Moisture in Inch and Millimeter

soil Texture	inch	milimeters
clay	0.1	2.54
sand	0.6	15.24
loam	0.35	8.89
silt loam	0.32	8.128
silt	0.3	7.62
silty clay loam	0.15	3.81
sandy loam	0.4	10.6
sandy clay	0.25	6.35
loamy sand	0.5	12.7

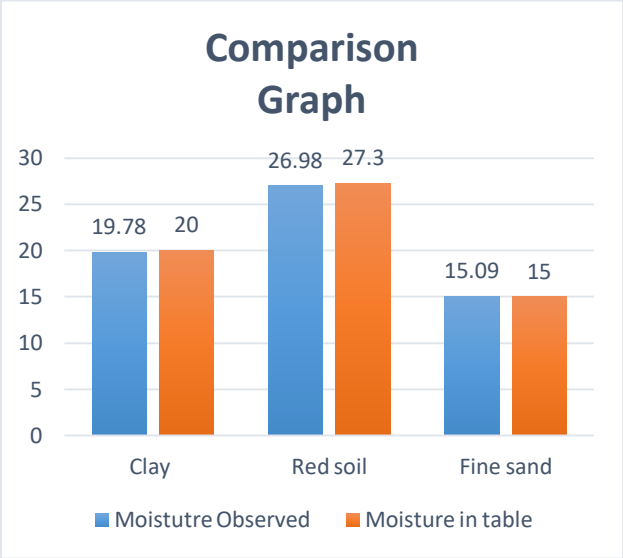


VIII. RESULT

Comparison Table

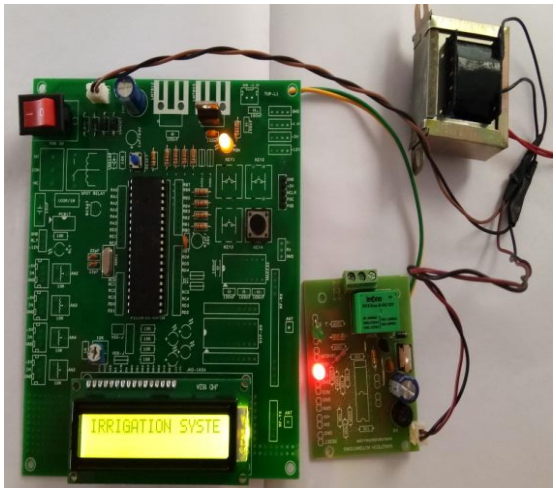
Soil Type	Observed Moisture level (%)	Required moisture as per soil moisture dataTable (v)	Accuracy (%)
Clay	19.75	20.00	99
Red soil	26.98	27.3	99
Fine sand	15.074	15.00	100

The above table shows the comparison of various soil type with soil moisture table database.It shows that our observed moisture values for soil types such as clay, red soil and sand almost matched with values in the soil moisture table as shown in comparison table.. When comparing our system with required soil moisture content table taken from agriculture database, the result shows that 99% accuracy in average of all the sample soils taken for test. Here we tested with three soil types.

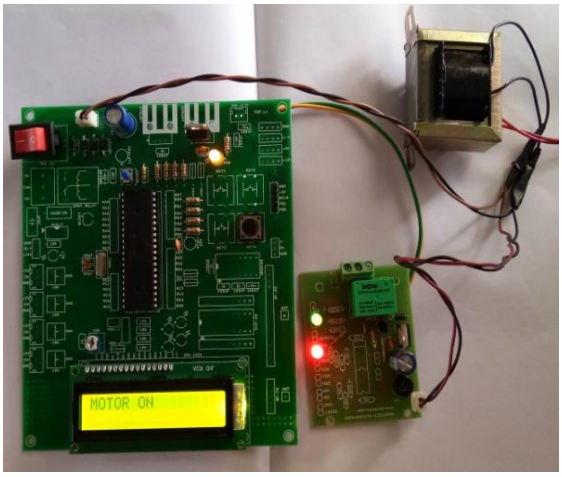


The comparison table shows the reading for the soils such as clay, redsoil, finesand.

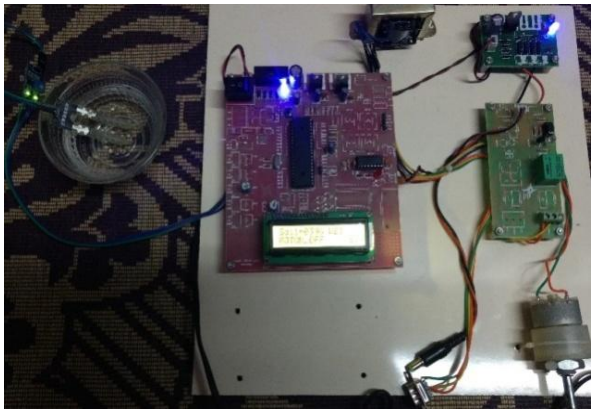
Output



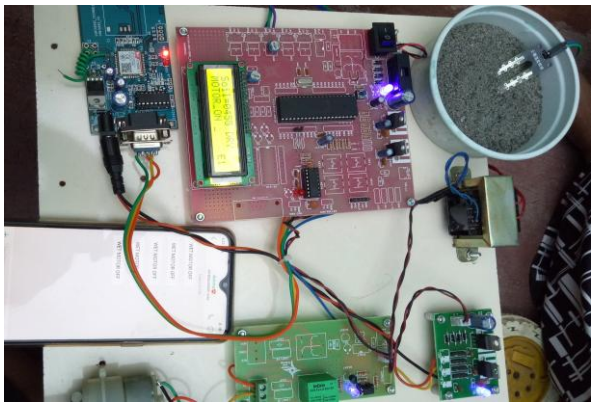
This output shows that power supply is given to the transformer and the message is display in the LCD.



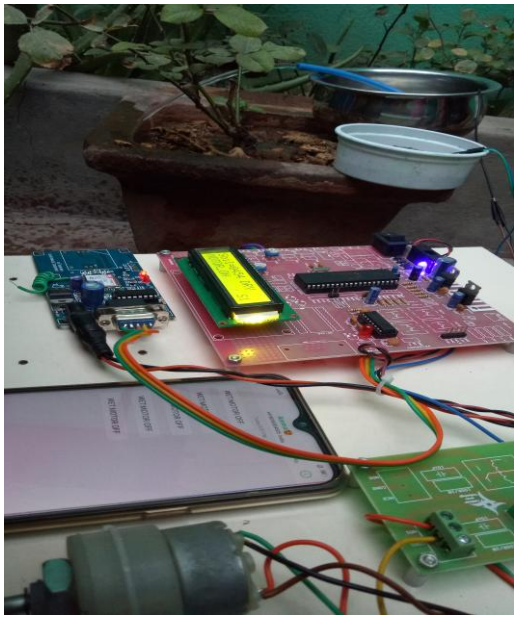
This output shows that, when the power is turn ON, motor starts to run the, in the initial condition relay act as a motor, and the LCD display the message as motor on.



This output is to test the soil sensor when the motor is ON.



This output shows that GSM is connected to the microcontroller when the soil sensor senses the moisture level it sends a message to the mobile phone.



This output shows the result as when the soil is dry the motor on and the water is pumps out to the soil. The message will be sent to the phone.

IX. CONCLUSION

This paper proposing the system for soil moisture content level testing with PIC microcontroller. In order to validate our proposed system, the soil moisture level database values were compared with our observed moisture level values. For example, from the comparison table for the soil type clay value is 19.75 and reading from the soil moisture table value is 20.Its show that our observed values is almost equal to the values in soil moisture table. Hence, our proposed system can be applied to any type of soil to measure the moisture content to help the farmers in irrigation purpose.

X. FUTURE USES

We enhanced by implementing a GSM technology that intimate a message to the concern person whether the motor is ON or OFF. It can be further enhanced by controlling the motor through the mobile.

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