

GREENLAND:A SECURE LAND REISTRATION SCHEME FOR BLOCK CHAIN AND AI-ENABLED AGRICULTURE INDUSTRY

¹JAMPANA GOPAL VARMA, ²K.RAJA RAJESWARI

¹Students, Department of MCA, B V Raju College, Bhimavaram Ap

²Assistant Professor, Department of MCA, B V Raju College, Bhimavaram Ap

ABSTRACT

Land registration systems are critical for maintaining ownership records, but traditional centralized systems are vulnerable to tampering and unauthorized modifications. This project proposes a secure and decentralized land registration system using blockchain and artificial intelligence (AI) technologies. Blockchain ensures tamper-proof, transparent, and decentralized storage of land records, while AI techniques are used to detect fraudulent transactions. In the proposed system, land transaction data is stored in the InterPlanetary File System (IPFS), and the corresponding hash is recorded on the blockchain using smart contracts developed in Solidity. Machine learning algorithms such as Logistic Regression, Support Vector Machine (SVM), Random Forest, XGBoost, and LightGBM are used to detect fraudulent transactions based on historical data. Among these, LightGBM achieves the highest accuracy. The system is implemented using Ethereum blockchain, IPFS, and Python-based machine learning models. Experimental results demonstrate improved security, transparency, and fraud detection capability. This approach provides a reliable and scalable solution for

secure land registration in Agriculture Industry 5.0.

Keywords :*Blockchain, Land Registration, IPFS, Smart Contracts, Fraud Detection, Machine Learning, LightGBM, Agriculture 5.0*

I.INTRODUCTION

Land registration is a fundamental component of property management and agricultural development. Traditional land registration systems rely on centralized databases, which are prone to data manipulation, unauthorized access, and corruption. These vulnerabilities can lead to disputes, fraud, and loss of ownership records. Therefore, there is a need for a secure and transparent system that ensures data integrity and trust.

Blockchain technology offers a decentralized and immutable platform for storing data securely. By recording land transactions on a blockchain, it becomes nearly impossible to alter or tamper with ownership records. Additionally, the use of smart contracts automates the process of storing and retrieving

data, ensuring transparency and eliminating the need for intermediaries. IPFS is used for storing large transaction data, while only the hash is stored on the blockchain to ensure efficiency.

In addition to secure storage, fraud detection is a critical aspect of land registration systems. Machine learning algorithms can analyze transaction patterns and identify suspicious activities. In this project, various algorithms such as Logistic Regression, SVM, Random Forest, XGBoost, and LightGBM are used for fraud detection. The integration of blockchain and AI provides a comprehensive solution for secure, transparent, and intelligent land registration, supporting the vision of Agriculture Industry 5.0.

II SURVEY OF RESEARCH

[1] The study by Satoshi Nakamoto (2008) introduced blockchain as a decentralized and immutable ledger system. The methodology uses cryptographic hashing and distributed consensus to ensure data integrity and transparency. Results showed that blockchain eliminates reliance on centralized authorities and prevents data tampering. However, scalability and latency issues remain challenges. This research forms the foundation for secure land registration systems. In the proposed work, blockchain is used to store land ownership records securely and prevent unauthorized modifications.

[2] The research by Juan Benet (2014) introduced the InterPlanetary File System (IPFS), a distributed file storage system. The methodology uses content-based addressing to store and retrieve files efficiently. Results demonstrated improved data availability and reduced dependency on centralized servers. However, managing large-scale networks can be complex. In the proposed system, IPFS is used to store land transaction data, while only hash values are stored on the blockchain to ensure efficiency and security.

[3] The study by Gavin Wood (2014) introduced smart contracts for automating processes on blockchain platforms. The methodology involves writing programmable contracts that execute automatically when predefined conditions are met. Results showed improved efficiency and transparency in decentralized applications. However, smart contract vulnerabilities can pose security risks. In the proposed system, smart contracts are used to manage buyer and seller transactions securely.

[4] The research by Jerome Friedman (2001) introduced boosting algorithms that improve prediction accuracy by combining multiple weak learners. The methodology focuses on minimizing prediction errors iteratively. Results demonstrated high accuracy in classification tasks. However, boosting models require careful parameter tuning. This research

supports the use of advanced algorithms like XGBoost and LightGBM in fraud detection.

[5] The study by Tianqi Chen and Carlos Guestrin (2016) introduced XGBoost, an optimized gradient boosting algorithm. The methodology includes regularization and parallel processing for improved performance. Results showed that XGBoost achieves high accuracy in predictive tasks. However, it may require computational resources. In the proposed system, XGBoost is used for fraud detection and achieves high performance.

[6] The research by Guolin Ke et al. (2017) introduced LightGBM, a fast and efficient gradient boosting framework. The methodology uses histogram-based learning and leaf-wise tree growth for faster training and higher accuracy. Results demonstrated superior performance compared to other boosting algorithms. However, it may overfit if not properly tuned. In the proposed system, LightGBM achieves the highest accuracy in fraud detection, making it the best-performing model.

III. WORKING METHODOLOGY

The proposed Greenland system integrates blockchain, IPFS, and machine learning to provide a secure and intelligent land registration platform. Initially, users such as buyers and sellers register in the system using a web interface. Each user is authenticated and

assigned a unique identity stored on the blockchain. When a buyer initiates a land transaction request, the raw transaction data—including sender details, receiver details, and transaction type—is uploaded to the system. This data is stored in the InterPlanetary File System (IPFS), which generates a unique hash value. This hash is then recorded on the blockchain using smart contracts developed in Solidity, ensuring tamper-proof and decentralized storage.

In the next phase, machine learning models are trained to detect fraudulent transactions. The dataset, such as the Ethereum fraud detection dataset, is preprocessed by converting non-numeric data into numeric format using label encoding and handling missing values. Feature selection techniques like ANOVA are applied to identify the most relevant features. The dataset is then split into training and testing sets, typically in an 80:20 ratio. Various machine learning algorithms, including Logistic Regression, Support Vector Machine (SVM), Random Forest, XGBoost, and LightGBM, are trained and evaluated using performance metrics such as accuracy, precision, recall, F1-score, and ROC curves. Among these, LightGBM achieves the highest accuracy and is selected as the final model.

Finally, the system integrates blockchain and machine learning for real-time transaction processing. When a buyer submits a land

request, the machine learning model analyzes the transaction data and predicts whether it is fraudulent or legitimate. The prediction result is displayed to the seller along with transaction details and IPFS hash. Based on this information, the seller can accept or reject the request. All transactions, including decisions, are recorded on the blockchain, ensuring transparency and auditability. The system is implemented using Ethereum blockchain, IPFS, Python for machine learning, and web technologies for user interaction, providing a secure, scalable, and intelligent land registration solution.

IV RESULTS EXPLANATIONS

In propose work author employing AI and Blockchain technologies in Land Registration as existing techniques were using centralized servers whose database can be easily tamper by server database administrator without getting detected. Blockchain has inbuilt support for decentralized storage, secured encrypted data storage and tamper proof data storage. In Blockchain based land registration ownership of registration will not be tamper any manner. AI algorithms employed to detect fraud transaction from Blockchain Raw data which contains land details such as Sender information, receiver information, transaction type and many other raw data. AI algorithms will get trained on raw data and then trained

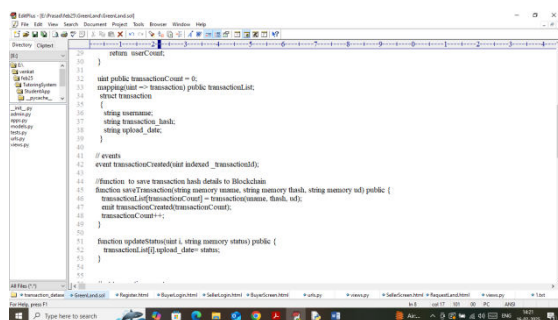
model can be applied to detect frauds from future Blockchain raw data.

For accurate detection author has experimented with various ML algorithms such as Logistic Regression, Random Forest, SVM, XGBOOST and LIGHTGBM. Each algorithm performance was tuned using various hyper parameters and then evaluation done using various metrics such as Accuracy, Precision, Recall, FSCORE and ROC graph. Among all algorithms LIGHTGBM giving highest accuracy.

To train above algorithms author has used Ethereum dataset which can be download from below URL

<https://www.kaggle.com/datasets/vagifa/ethereum-frauddetection-dataset/data>

Land Transaction Raw data will get saved in IPFS (interplanetary file system) server whose storage hashcode will get saved in Blockchain for future retrieval. Blockchain can store or retrieve data using Smart Contracts which can be designed using Solidity Programming. This contract contains functions which can be called using any programming language to store and retrieve data. To manage Land transaction data we have designed following contract



```

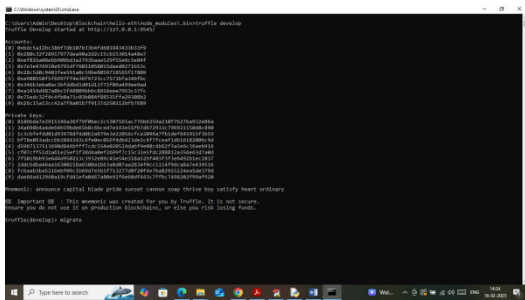
10 }
11
12 uint userCount;
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

```

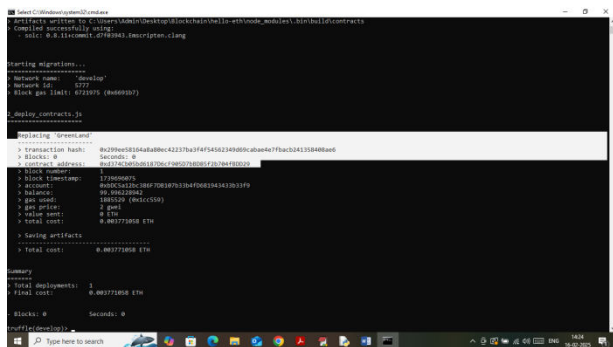
In above smart contract screen we have designed function to manage buyer, seller and

IPFS storage hashcode details. Now we need to deployed above contract in Blockchain Ethereum using below steps

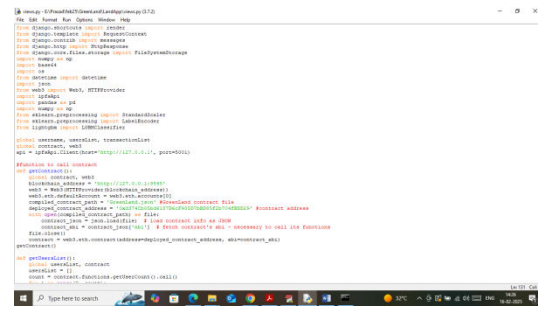
First go inside ‘hello-eth/node-modules/bin’ folder and then look and double click on ‘runBlockchain.bat’ file to get below screen



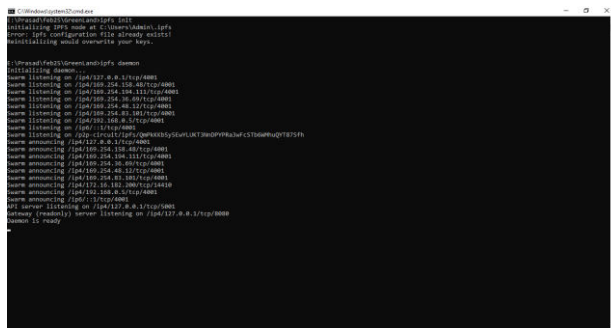
In above screen Ethereum started with default accounts and private keys and now type command as ‘migrate’ and then press enter key to get below page



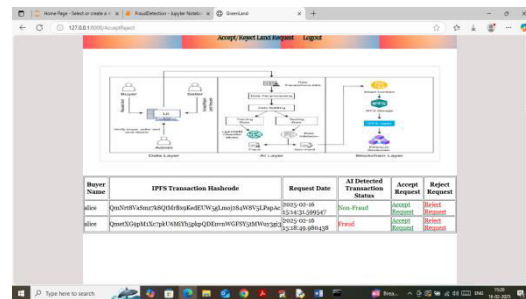
In above screen in white colour text can see ‘Greenland’ contract deployed and running successfully and let it run till you execute code. Now copy above contract address showing white text and then paste in python code to call above contract. In below screen showing python code calling above contract using address



In above screen read red colour comments to know about contract calling using address. In above screen Blockchain running successfully and now double click on ‘Start_IPFS.bat’ file to start IPFS server and get below page



In above screen IPFS server started and let it run till you execute code.



In above screen seller can view list of land request with details like buyer name, IPFS storage hashcode of raw transaction and then can ML predicted status and then Seller can click on either accept or reject link to get below page

Buyer Name	IPFS Transaction Hashcode	Request Date	AI Detected Transaction Status	Seller Decision
Buyer	QmYwS... (IPFS Hashcode)	2024-02-08	Non-Fraud	Accepted
Buyer	QmYwS... (IPFS Hashcode)	2024-02-08	Fraud	Rejected

In above screen buyer can view all transaction raw data hashcode and then can ML predicted output along with seller decision as “Accepted or Rejected”.

V. CONCLUSION

The proposed Greenland system presents a secure and intelligent solution for land registration by integrating blockchain, IPFS, and machine learning technologies. By utilizing blockchain, the system ensures decentralized, tamper-proof, and transparent storage of land ownership records, eliminating the risks associated with centralized databases. The use of IPFS enables efficient storage of large transaction data, while only hash values are stored on the blockchain to maintain performance and scalability. Additionally, the integration of machine learning algorithms enhances the system by detecting fraudulent transactions in real time. Among the evaluated models, LightGBM achieved the highest accuracy, making it the most suitable for fraud detection. The web-based interface further improves usability by allowing buyers and sellers to interact seamlessly. Overall, the system provides a reliable, scalable, and secure framework for land registration, supporting the

vision of Agriculture Industry 5.0 and reducing fraud and disputes in property transactions.

RE.FERENCES

- [1] S. Nakamoto, “Bitcoin: A Peer-to-Peer Electronic Cash System,” 2008.
- [2] J. Benet, “IPFS – Content Addressed, Versioned, P2P File System,” 2014.
- [3] G. Wood, “Ethereum: A Secure Decentralised Generalised Transaction Ledger,” 2014.
- [4] T. Chen and C. Guestrin, “XGBoost: A Scalable Tree Boosting System,” *Proc. ACM SIGKDD*, 2016.
- [5] G. Ke et al., “LightGBM: A Highly Efficient Gradient Boosting Decision Tree,” *Advances in Neural Information Processing Systems*, 2017.
- [6] J. H. Friedman, “Greedy Function Approximation: A Gradient Boosting Machine,” *Annals of Statistics*, 2001.
- [7] L. Breiman, “Random Forests,” *Machine Learning*, vol. 45, no. 1, pp. 5–32, 2001.
- [8] C. Cortes and V. Vapnik, “Support Vector Machines,” *Machine Learning*, 1995.
- [9] D. W. Hosmer and S. Lemeshow, *Applied Logistic Regression*. Wiley, 2000.

- [10] I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. MIT Press, 2016.
- [11] C. M. Bishop, *Pattern Recognition and Machine Learning*. Springer, 2006.
- [12] K. P. Murphy, *Machine Learning: A Probabilistic Perspective*. MIT Press, 2012.
- [13] F. Chollet, *Deep Learning with Python*. Manning Publications, 2017.
- [14] J. Brownlee, *Machine Learning Mastery with Python*. 2016.
- [15] M. Swan, *Blockchain: Blueprint for a New Economy*. O'Reilly Media, 2015.
- [16] A. Antonopoulos, *Mastering Bitcoin*. O'Reilly Media, 2014.
- [17] N. Szabo, "Smart Contracts: Building Blocks for Digital Markets," 1996.
- [18] D. Boneh and M. Franklin, "Identity-Based Encryption," *SIAM Journal on Computing*, 2003.
- [19] R. Rivest, A. Shamir, and L. Adleman, "RSA Algorithm," *Communications of the ACM*, 1978.
- [20] W. Diffie and M. Hellman, "New Directions in Cryptography," *IEEE Transactions on Information Theory*, 1976.
- [21] K. Christidis and M. Devetsikiotis, "Blockchains and Smart Contracts for IoT," *IEEE Access*, 2016.
- [22] Q. Yang et al., "Federated Machine Learning: Concept and Applications," *ACM TIST*, 2019.
- [23] H. Greenspan et al., "Deep Learning in Medical Imaging," *IEEE Transactions on Medical Imaging*, 2016.
- [24] M. Abadi et al., "TensorFlow: Large-Scale Machine Learning," 2016.
- [25] A. Géron, *Hands-On Machine Learning with Scikit-Learn and TensorFlow*. O'Reilly Media, 2017.